**REPORT**

# Groundwater Mitigation System Design Report

## *CBM Caledon Pit and Quarry*

Submitted to:

**CBM Aggregates - a Division of St. Marys Cement Inc. (Canada)**

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Submitted by:

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CA-GLD-19129150

May 2025

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# Table of Contents

**TABLES**

## FIGURES

## APPENDICES

**APPENDIX A**
DESKTOP REVIEW OF INFILTRATION TRENCH SYSTEM TECHNOLOGIES

**APPENDIX B**
FIELD INVESTIGATION

**APPENDIX C**
NUMERICAL MODELLING SIMULATIONS

**APPENDIX D**
UPDATED WATER MANAGEMENT PLAN

# 1.0 INTRODUCTION

## 1.1 Background

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada), has applied to the Ministry of Natural Resources (MNR) for a Class A License (Pit and Quarry Below Water) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation for the proposed CBM Caledon Pit / Quarry.

CBM controls approximately 323 hectares of land located at the northwest, northeast and southwest intersection of Regional Road 24 (Charleston Sideroad) and Regional Road 136 (Main Street). Of these lands, approximately 261.2 hectares are proposed to be licenced under the Aggregate Resources Act and designated / zoned under the Planning Act to permit the proposed CBM Caledon Pit / Quarry. The lands proposed to be licenced under the Aggregate Resources Act are referred to herein as the “Subject Site” (or “Site”) and are legally described as Part of Lots 15-18, Concession 4 WSCR and Part of Lot 16, Concession 3 WSCR (former Geographic Township of Caledon). The area located to the northwest of the intersection of Regional Road 24 and 136 is referred to as the “Main Area”. The area to the northeast of the intersection of Regional Road 24 and 136 is referred to as the “North Area”, and the area located to the southwest of the intersection of Regional Road 24 and 136 is referred to as the “South Area” (Figure 1).

Groundwater-surface water model simulations using HydroGeoSphere (HGS) undertaken as part of the revised Level 1 / 2 Water Report (Golder 2022, revised July 2023), indicated that pit / quarry dewatering during the later stages of operations (Phases 4 to 7) could result in a decline in groundwater levels in the water table aquifer that would extend southward and to the southwest of the licence area.

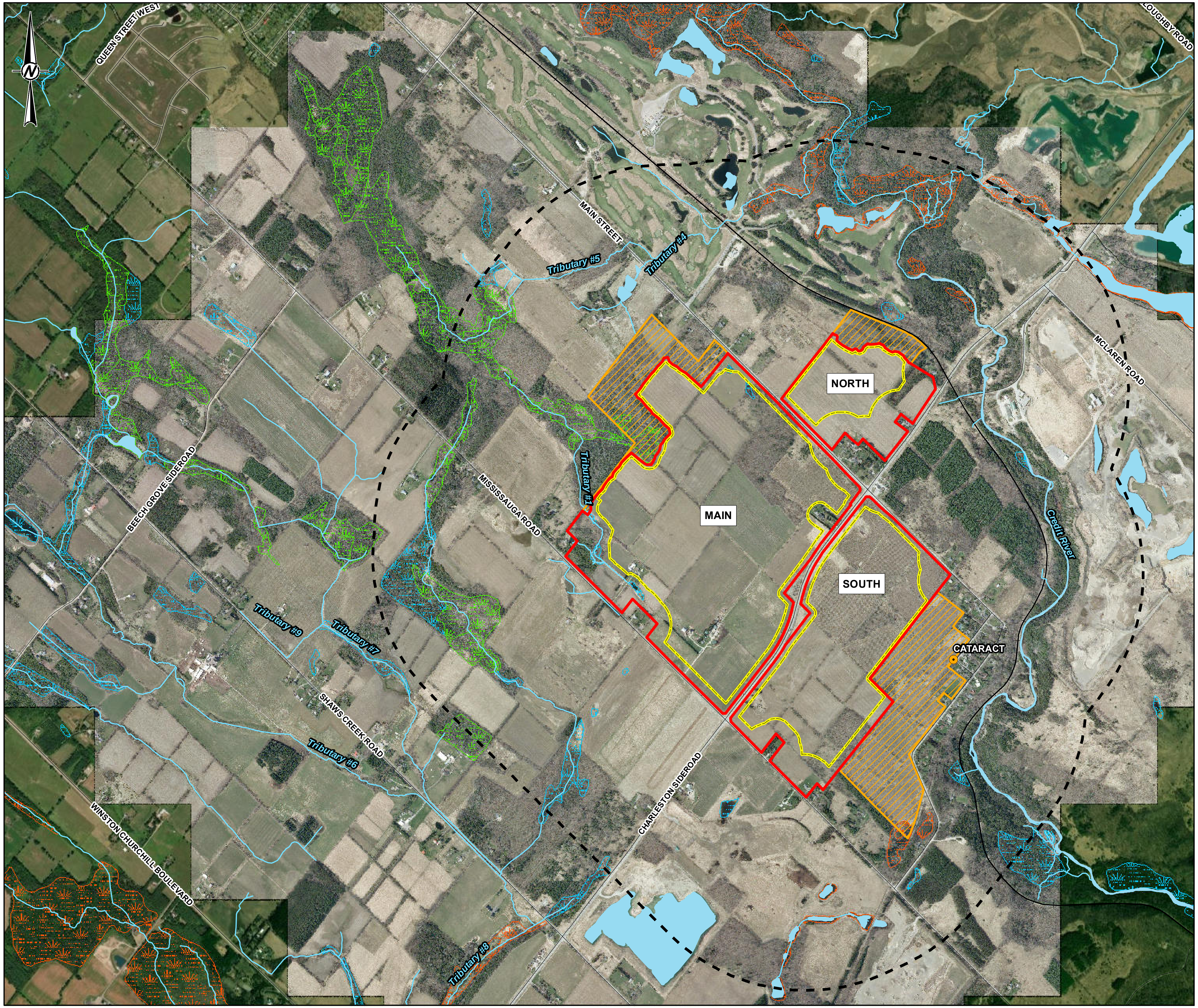
In order to mitigate the potential effects on natural features and groundwater users to the south of the proposed CBM Caledon Pit / Quarry during the operational phases, mitigation measures were developed by WSP (formerly Golder) to maintain groundwater levels within the range of their natural pre-extraction seasonal variations. The mitigations were then implemented in HGS modelling simulations of Operational Phase 3 to 7, to assess their effectiveness. These proposed mitigation measures are described in the Level 1 / 2 Water Report (Appendix S1), which presented a conceptual design and proposed implementation phasing of a groundwater mitigation system.

Some of the technical comments related to the Level 1/2 Water Report received from various agency / stakeholder groups between the fall of 2023 and the spring of 2024 requested additional study and further development of the mitigation system design, in order to demonstrate proof of concept, and to provide assurance to those agencies and stakeholder groups that the proposed infiltration trench system would perform as predicted.

In the spring of 2024, WSP was retained by CBM to undertake additional technical studies and advance the design for the groundwater mitigation system proposed for the CBM Caledon Pit and quarry project.

## 1.2 Objectives

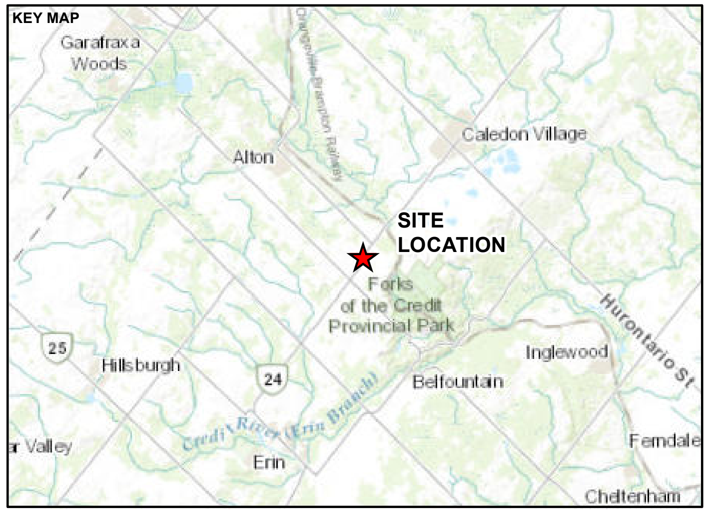
As noted above, this report presents the results of the additional technical studies undertaken by WSP to advance the design for the groundwater mitigation system proposed for the CBM Caledon Pit and quarry project, in order to demonstrate proof of concept, and to provide assurance to those agencies and stakeholder groups that the proposed infiltration trench system would perform as predicted.



**LEGEND**

- ● TOWN/VILLAGE
- ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- UNEVALUATED WETLAND
- OTHER EVALUATED WETLAND
- PROVINCIALLY SIGNIFICANT WETLAND
- 1 km LICENCE BOUNDARY BUFFER
- LIMIT OF EXTRACTION
- LICENCE BOUNDARY
- ADDITIONAL LANDS OWNED / CONTROLLED BY CBM

**KEY MAP**



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**REFERENCE(S)**

1. BASEDATA MNRF LIO OBTAINED APRIL 2020
2. WATERCOURSES OBTAINED FROM CREDIT VALLEY CONSERVATION AUTHORITY OPEN DATA PORTAL, NOVEMBER 2022 IN COMBINATION WITH SITE WATERCOURSE SURVEY PROVIDED BY FIRST BASE SOLUTIONS NOVEMBER 2021.
3. IMAGERY FIRSTBASE SOLUTIONS SPRING 2019 (15CM RESOLUTION) AND SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. LICENCE AND LIMIT OF EXTRACTION PROVIDED BY MHBC JUNE 2023
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
CALEDON PIT / QUARRY

TITLE
## STUDY AREA

CONSULTANT
wsp

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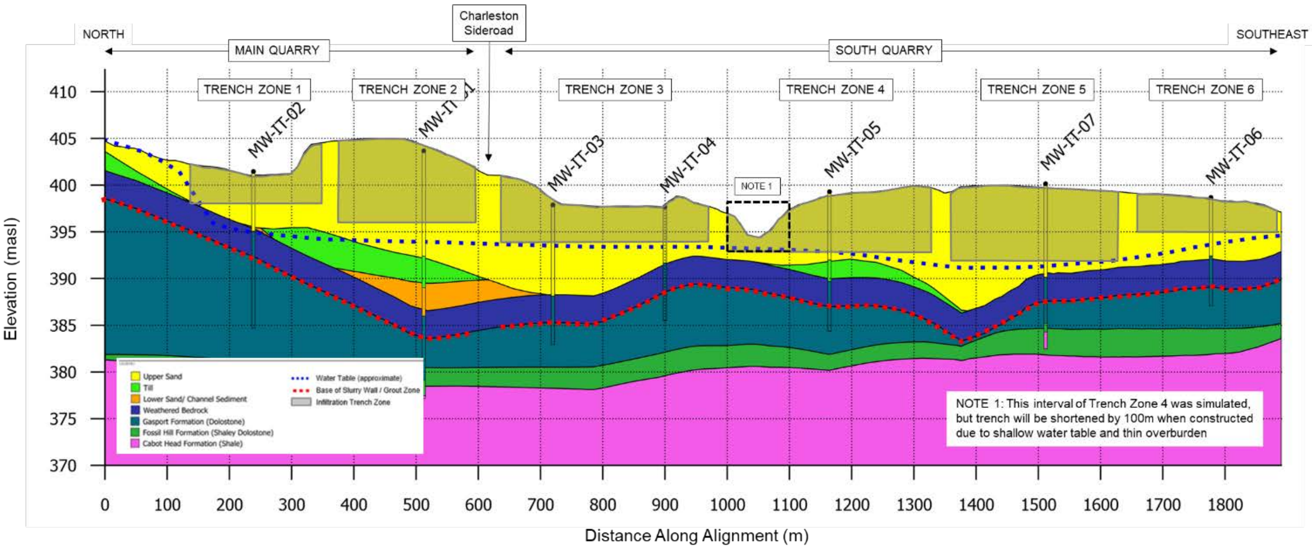
## 1.3 Groundwater Mitigation System

The proposed groundwater mitigation system will utilize a portion of the water collected during Phases 4 to 7 of operations, and direct it to a series of six infiltration trench zones along a 1,900 m alignment along the west side of the Main Area and the west and south side of the South Area, in the setback area between the licence limit and the limit of extraction (Figure 2).

Water collected in the pit / quarry from dewatering will be reintroduced into the groundwater system through these infiltration trench zones to maintain the groundwater levels west and south of the licence area to levels within their current typical range. Additionally, two hydraulic barrier zones will be installed between the infiltration trenches and the extraction limit, in order to minimize the flow of groundwater back into the pit / quarry from the infiltration trenches. The hydraulic barrier will primarily consist of two slurry wall zones in the overburden, noting that the upper bedrock zone along the slurry wall alignments may also be grouted to reduce the permeability of this zone and further reduce the inflow of groundwater into the pit / quarry and help sustain existing groundwater levels outside of the licence area.



NOTE 1: This interval of Trench Zone 4 was simulated, but trench will be shortened by 100m when constructed due to shallow water table and thin overburden

**Figure 2: Proposed Groundwater Mitigation System consisting of six Infiltration Trench Zones and two Hydraulic Barrier Zones**

## 1.4 Scope of Work

The work was carried out by WSP from April 2024 to March 2025, and was comprised of the following main activities.

**Desktop Review** – A desktop review of infiltration trench system technologies was completed by WSP, with a focus on reviewing recent studies / examples in the Greater Toronto Area (GTA), Ontario and other Canadian jurisdictions, to help ensure the design incorporates current industry best practices and lessons learned from other projects. The results of infiltration system technology review are presented in Appendix A and summarized in Section 2.

**Field Investigation** – A hydrogeological field investigation was carried out by WSP in the spring and summer of 2024 along the proposed infiltration trench alignment, which included continuous coring of boreholes through the overburden and bedrock, laboratory testing of soil cores, and the installation and testing of 7 new monitoring well nests, in order to obtain detailed site-specific information on stratigraphy, groundwater levels, groundwater gradient and hydraulic properties of the various aquifer and aquitard units. The field investigation results are presented in Appendix B and summarized in Section 3.

**Numerical Modelling Simulations** - The results of the field investigation along the proposed infiltration trench system were used to update the conceptual site model and the HGS numerical model in this area. The updated numerical model was then recalibrated to current conditions and used to update the various mitigation system simulations utilizing the refined numerical model. The numerical modelling results are presented in Appendix C and summarized in Section 4.

**Water Management Plan Update** - The updated numerical modelling simulation results were also used to update the Water Management Plan for the proposed pit and quarry operation, which is presented in Appendix D and summarised in Section 5.

**Mitigation System Design Update** – The mitigation system design was then updated, based on the desktop review, field investigation, and updated numerical modelling simulations. The updated mitigation system design is presented in Section 7. The updated design demonstrates "proof of concept" and provides assurances to CBM, agencies, stakeholder groups, that the proposed GW mitigation system will perform as predicted.

# 2.0 DESKTOP REVIEW

A desktop review of infiltration trench system technologies was completed by WSP to help ensure the mitigation system design update incorporates current industry best practices and lessons learned from other projects. The full review is presented in Appendix A, and key findings are summarized below. Guidance documents and case studies are unanimous in their consensus that infiltration systems are a beneficial management practice to mitigate the impacts of development. The technology is well known and supported by a body of literature, design guidance, and successful examples.

The best practices in the design and operation of infiltration systems are summarized in the following categories: site characterization, design, construction, operation and maintenance, and water quality, as presented in the following sections. References cited are provided in Appendix A.

## 2.1 Site Characterization

Site characterization is essential in the design of infiltration systems.

- Soil permeability is a critical design criterion for infiltration systems. In soils which are not sufficiently permeable, the system will be ineffective at discharging water, and soils which are too permeable may not provide sufficient treatment. It is recommended that the field measured infiltration rates are between 13 to 76 mm/hr (USEPA, 2021), however circumstantially, rates as low as 7 mm/hour (TRCA, 2013) and rates up to 210 mm/hr (Schueler, 1987) may be considered depending on the design priorities and risk to receptors.

- Lithological heterogeneities beneath infiltration systems can be potential preferential pathways for rapid recharge and therefore an elevated risk of groundwater contamination compared to an assumed homogenous aquifer. Continuous subsurface imaging, such as ground penetrating radar (GPR) in combination with boreholes, test pits, and sedimentological insight, can improve the characterization of hydrostratigraphic units in the subsurface (Chouteau and Giroux, 2008).

- Where infiltration systems are constructed above carbonate rocks, enhanced dissolution should be considered in the design of the system. Case studies used detailed site characterization and GPR to search for pre-existing karst prior to construction, and designed systems to avoid rapid localized recharge to the bedrock by ensuring sufficient overburden travel time (PDEP, 2006).

## 2.2 Infiltration System Design

**System Design** – Most resources recommend an infiltration system to be fully enclosed with a non-woven filter fabric to prevent the infiltration of fine materials from the surrounding soils, the majority of the backfill be a large diameter clear stone (often 20 to 50 mm) (MOE, 2003) (TRCA, 2013), with a vegetated topsoil cover to prevent erosion, and a filter layer 0.15 to 0.30 m thick be placed at the base of the system.

- The purpose of the filter layer is to provide filtration for fine particles, pathogens, metals, and organic compounds that will be partially removed by the filter layer. Depending on the water quality parameters of concern, the filter layer maybe composed of fine sand or peat (MOE, 2003).
- Permeable filter fabric is recommended on the base and side walls of the infiltration system, and less permeable filter fabric on top, to mitigate infiltration of fines from above the system (Schueler, 1987).

**System Sizing** – Most system sizing discussions for stormwater applications are based on a design storage volume, assuming a 40% void ratio in the backfilled volume. Infiltration systems are generally sized such that void space can accommodate the require level of water storage. Saturated depth is specified based on the infiltration rate measurement and designed to fully discharge in 48 to 72 hours (Chahar, Graillot, & Gaur, 2012). Area of the system is then calculated to achieve the required volume (MOE, 2003) (Rowe, 2019).

**Infiltration into the Unsaturated Zone** – Infiltrating water into the unsaturated zone is generally recommended to allow for some degree of aerobic water treatment to take place before the water reaches the water table and more variable conditions (MOE, 2003) (BCMOE, 2014). Recommended offsets vary from 1.5 to 7.5 m based on soil type and potential to improve water quality (MOE, 2003) (USDOT, 2024) (MPCA, 2022) (BCMOE, 2014) (USEPA, 2021). However, where source water quality is of little concern, there are successful examples of infiltration systems sited at the water table elevation (TRCA, 2013) (GHD, 2021).

The design and construction of the infiltration system should consider the primary causes of failure for infiltration systems: poor construction practices, inadequate field testing (in particular in situ testing), and lack of sediment control (Schueler, 1987).

## 2.3 Construction

Construction practices recommended to optimize infiltration system operation include (Schueler, 1987):

- Prevent heavy machinery from compacting subsoils;
- The edges of the infiltration system should be bermed and erosion of the sidewalls stabilized to prevent sediment migration into the infiltration system during construction;
- The infiltration system should be constructed using an excavator or trencher, equipped with tracks or oversized tires to avoid soil compaction. Use of bulldozers and front-end loaders within the infiltration system alignment should be avoided; and

- Clean stone should be placed in lightly compacted lifts. Unwashed stone contains enough sediment to risk clogging.

## 2.4 Operation and Maintenance

A primary concern in the operation and maintenance of infiltration systems is clogging. Clogging has several possible causes including (Dillon et al., 2024):

- Physical Clogging: Caused by the filtration of suspended solids present in the recharge water or the swelling/mobilization of clays;
- Biological Clogging: Resulting from bacterial growth due to dissolved nutrients in the source water;
- Mechanical Clogging: Caused by air entrainment, gas binding, or formation failure; and
- Chemical Clogging: Due to the precipitation of minerals (for example calcium carbonate).

Physical clogging of control structures, distribution pipes, and pore spaces caused by suspended solids in the source water is among the most commonly reported problems for infiltration systems. The primary mitigation measures are the selection of waters to infiltrate and pre-treatment (USDOT, 2024) (TRCA, 2013).

- Where there is opportunity to select water with low initial TSS to be infiltrated, this has proven to be an effective approach to designing an infiltration system. In some cases, systems have sourced very clear water, operated an infiltration system with no pre-treatment, and observed no long term clogging. Systems that received water with very low levels of suspended solids generally continued to perform well and required little maintenance (Schueler, 1987) (TRCA, 2013).
- Various pre-treatment methods to settle or otherwise attenuate suspended solids are recommended, including, use of sumps in injection control structures, oil and grit separators, prefiltration of water through filter sand, fabric, or organic material, prior to it entering the infiltration system, and reduction of suspended sediment by allowing water to gently flow through a grassy swale or filter strip prior to entering the infiltration system (Schueler, 1987) (MOE, 2003) (TRCA, 2013) (BCMOE, 2014).
- Where additional protection from clogging is needed in the design, the perforated distribution pipe can be oversized and wrapped in filter fabric to act as an additional layer of sediment control in the system (Schueler, 1987).

Maintenance activities should include (BCMOE, 2014) (USEPA, 2021) (USDOT, 2024):

- Regular inspections for sediment accumulation or other clogging, any structural problems, such as cracking or settlement, animal activity, or undesirable vegetation growth;
- Minor sediment removal from easily accessed areas of the system;
- Major sediment removal with the use of flushing and vac trucks to remove sediment from subsurface facilities; and
- Documentation standards for all maintenance activities.

## 2.5 Water Quality

Water quality parameters potentially applicable to quarry water management and the design of infiltration systems include the following (BCMOE, 2014) (Dillon et al., 2022).

- Suspended solids from aggregate extraction and atmospheric deposition. Suspended solids are a concern because they can clog infiltration facilities, diminishing their performance.
- Inorganics (e.g. iron and manganese). These are common constituents in bedrock-derived groundwater in southern Ontario.
- Nutrients, primarily nitrogen, from blasting residuals.
- Salt from de-icing and dust suppression activities.
- Petroleum hydrocarbons, associated with vehicles and other human activities.
- Pathogens and pathogen indicators, primarily associated with natural watershed sources.
- Temperature: groundwater temperature changes may cause changes in geochemical conditions and gas release. However, thermal effects are buffered to some extent within an infiltration system due to the passage of water through the unsaturated zone.

Water quality risk and mitigation in the design of infiltration systems can be considered in the following categories: source water quality, water treatment prior to infiltration (pre-treatment), water quality improvement in the infiltration system and subsurface (intrinsic reduction), the sensitivity of the receptor, and post-treatment before use at the receptor (Dillon et al., 2022).

**Source Water Quality** - Source water quality is evaluated by consideration of known risk factors (proximity to refueling, industrial operations, etc.) and typical water quality for the source (storm water, groundwater, etc.). Source water quality monitoring is not generally conducted where the source water is considered low risk. However, source water monitoring is recommended where either the source of water is at risk of contamination or if there are sensitive receptors to the infiltrated water (BCMOE, 2014).

**Pre-Treatment** – Pre-treatment of waters for some parameters prior to infiltration (e.g. suspended solids) has a significant impact on the effectiveness and longevity of the system and its potential to have impacts on groundwater receptors.

- Pre-treatment of water to be infiltrated with an oil and grease separator has been implemented where these are risk factors in the source water (Schueler, 1987) (TRCA, 2013).
- Depending on source water quality and risk to receptors, treatment of waters for pathogens may be required (Dillon et al., 2022). For example, the Mannheim ASR system is used store water for Municipal drinking water supply, Grand River water is treated using a UV system for primary disinfection prior to entering the injection well and is chlorinated at the extraction well following recovery. In cases where there is limited risk to receptors, or there is sufficient intrinsic reduction in the system, no pre-treatment other than treatment for suspended solids is required, such as the Milton Quarry (GHD, 2021) or most stormwater applications (TRCA, 2013) (USDOT, 2024).

**Intrinsic Reduction** – Water quality has generally been found to improve between where it enters the infiltration system and when it is observed downgradient in the groundwater system, due to soil interaction, including sorption, precipitation, trapping, filtering, and bacterial degradation. The effectiveness of these processes in improving water quality are dependent on soil type and site specific conditions. Typical water quality improvements include the following.

- The USDOT states typical reduction of contaminant levels by infiltration systems include: 60% in nutrient loads, 85% in metals, 90% in total suspended solids, and 90% in bacteria (2024).
- Similarly, the MPCA (2022) states that infiltration systems have a high capacity to treat (65 to 100% improvement) of TSS, metals, oils and grease, and pathogens, a medium capacity to treat dissolved nutrients (~65% reduction), and a low capacity to treat chloride (<30%).
- Potential contaminants (such as metals and oils) with low solubility generally pose a lower risk to aquifers, because they will tend to adsorb to sediments or will degrade and breakdown over time. For example, many metals may only be transported a few centimetres beneath surface infiltration facilities (BCMOE, 2014).
- To achieve water quality improvements in the infiltration system, the retention time should be less than the maximum retention time (48 to 72 hours, to allow aerobic conditions suitable for bacterial growth in the subsoil) and greater than the minimum retention time (6 hours, to allow filtration and sorption processes time to take place) (Schueler, 1987) (Chahar, Graillot, & Gaur, 2012).
- In general, where risk to water quality receptors is high and water quality enhancement in the subsurface is relied upon to mitigate risks, sampling of groundwater downgradient of the infiltration system is used to validate the effectiveness of the system in enhancing water quality (Dillon et al., 2022).
- Aquifer residence time can effectively remove pollutants, such as pathogens. An application of this principle is a California system which infiltrates wastewater into a drinking water aquifer. A standard for removal of pathogens before arrival at the drinking water receptor was established and aquifer residence time was accounted for as one order of magnitude removal per month of residence time in the aquifer (Dillon et al., 2022).

**Post-treatment** – If required, adverse water quality can be mitigated by treatment at the receptor, particularly for drinking water receptors (Dillon et al., 2022). An example of this is the Mannheim ASR system, which uses chlorination post-treatment at its extraction wells to manage pathogen risks to drinking water supplies (Stantec, 2015).

**Proximity to Receptors** - Where possible, infiltration systems should be cited at least 30 m (CalTrans, 2020) to 60 m (BCMOE, 2014) upgradient from a water supply well. Detailed characterization along the full alignment of the infiltration system, including lithology and groundwater levels with particular caution exercised in the presence of possible karst conditions (BCMOE, 2014) (USEPA, 2021).

# 3.0 FIELD INVESTIGATIONS

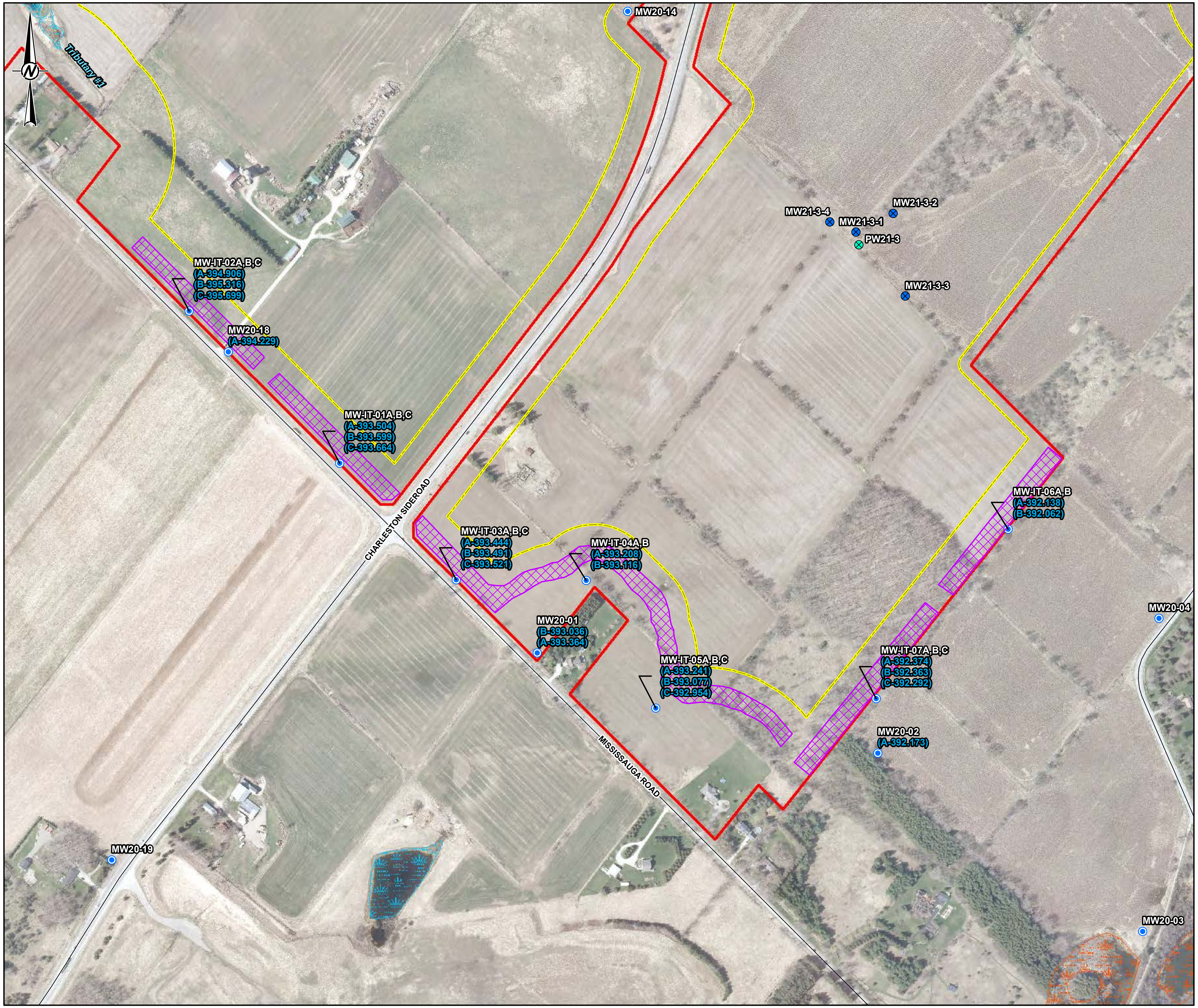
WSP was retained by CBM to undertake field investigations along the proposed infiltration trench alignment, to inform the design of the proposed groundwater mitigation system, install the well nests needed to establish baseline conditions and eventually monitor system performance, and at the same time respond to agency / stakeholder requests for additional information.

These investigations were carried out from April to June 2024 and were comprised mainly of the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 3).

The field investigations were comprised of the following main activities:

- Borehole drilling and monitoring well nest installation;
- Laboratory testing of overburden soils;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

The investigation results are presented in Appendix B, and key findings are summarized below.



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| ⊗ | TEST PUMPING WELL WELL (2021 PUMPING TEST) |
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| — | ROAD |
| ▨ | PROPOSED GROUNDWATER INFILTRATION TRENCH |
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| ▨ | PROVINCIALLY SIGNIFICANT WETLAND |
| 🟥 | PROPOSED LICENCE LIMIT |
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**REFERENCE(S)**

1. BASE DATA MNRF LIO OBTAINED 2020
2. WATERCOURSES OBTAINED FROM CREDIT VALLEY CONSERVATION AUTHORITY OPEN DATA PORTAL, NOVEMBER 2022 IN COMBINATION WITH SITE WATERCOURSE SURVEY PROVIDED BY FIRST BASE SOLUTIONS NOVEMBER 2021..
3. IMAGERY FIRSTBASE SOLUTIONS SPRING 2019 (15CM RESOLUTION) AND SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
4. LICENSE AND EXTRACTION LIMIT PROVIDED BY MHBC IN JUNE 2023.
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA).

PROJECT
CBM CALEDON PIT / QUARRY

TITLE
**LOCATION OF INFILTRATION TRENCH MONITORING WELL NESTS MW-IT-01 TO MW-IT-07**

CONSULTANT
wsp

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## 3.1 Drilling and Monitoring Well Installation

The borehole drilling and monitoring well installation was carried out over a three-week period during April 2024.

- A total of 19 monitoring wells were installed at seven well nest locations MW-IT-01 to MW-IT-07.
- Boreholes were advanced through the overburden and bedrock to the required depth with the rotasonic method, obtaining a continuous core (Figure 4).
- The overburden and rock core samples were logged, photographed, and bagged for laboratory testing.
- Each well nest generally consisted of a well installed in the bedrock, contact aquifer and overburden, where possible, with each well installed in its own borehole.
- The wells were subsequently used for groundwater level monitoring, single well response tests, and groundwater quality sampling.

**Figure 4: Continuous Core at MW-IT-01 within Proposed Infiltration Trench Zone 2**

## 3.2 Laboratory Testing

A total 171 soil samples were collected, and of those, 34 representative samples were selected for grainsize analysis (sieve).

- Four to six representative soil samples were selected for analysis from the deepest borehole at each well nest location.

- A variety of soil samples were chosen to confirm the soil descriptions prepared in the field during borehole logging.
- In addition to sieve analysis, Fineness Modulus (FM), % Wash Loss, % Crushable Stone and Stone-to-Sand Ratio was calculated for sand and gravel samples.
- The grainsize results were used to refine the field descriptions of soil types, prepare final borehole logs and subsequently used to revise the hydrostratigraphy and HGS numerical model for the site.

## 3.3 Groundwater Level Monitoring

The groundwater monitoring data to date from well nests MW-IT-01 to MW-IT-07 has helped refine hydrogeologic conditions along the proposed mitigation system alignment, including groundwater levels, flow direction and vertical hydraulic gradients.

Hydrographs from well nest MW-IT-02 are presented on Figure 5 as a representative example; a complete set of hydrographs is provided in Appendix B.

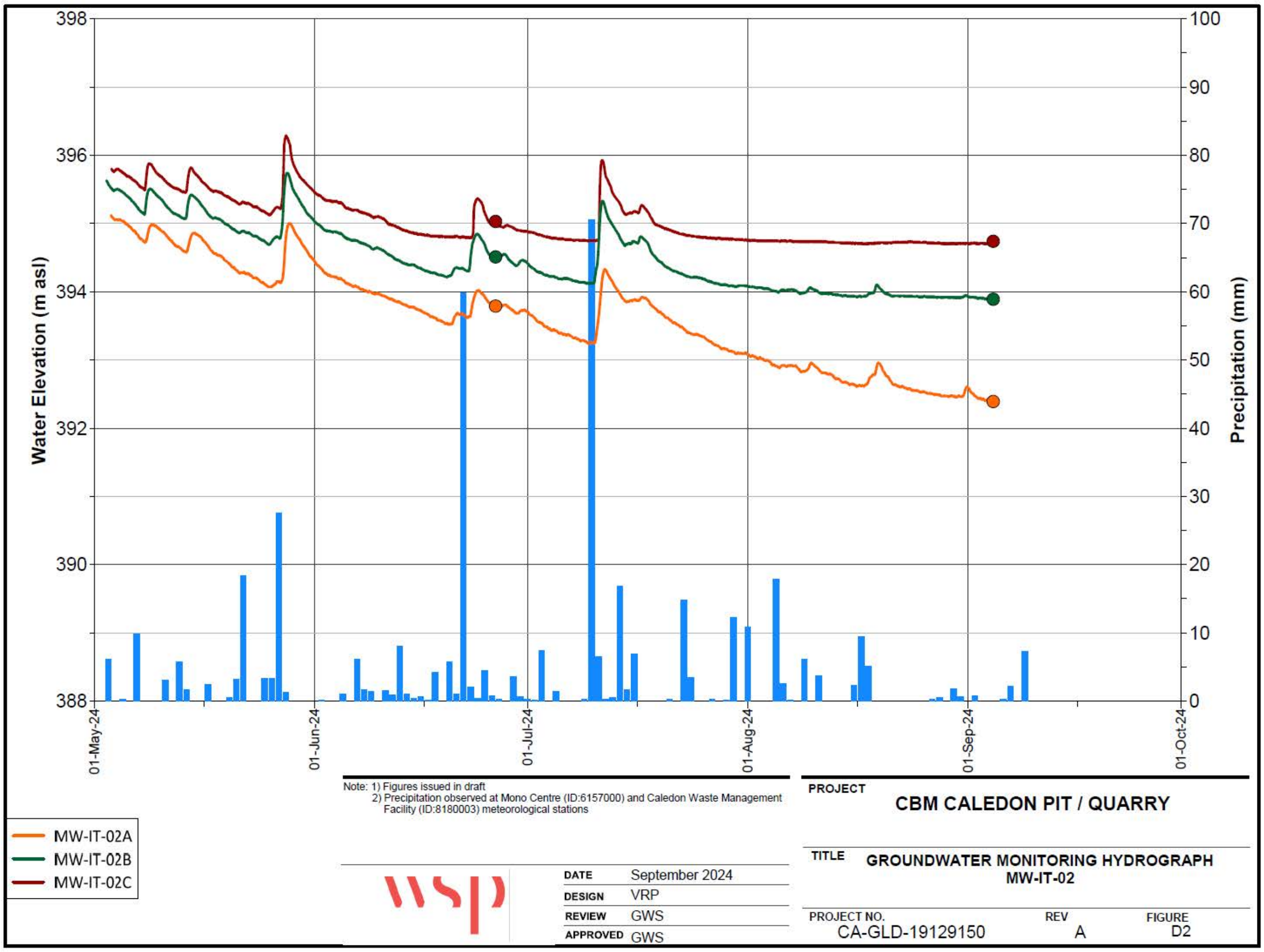


Figure 5: Hydrographs at Well Nest MW-IT-02 (A=bedrock, B=contact aquifer, C=overburden)

The hydrographs generally show the following.

- All monitoring wells show a trend of decreasing water elevation from May to September 2024, concurrent with warm weather and active plant growth. This is consistent with seasonal trends observed on the Site since 2021.
- Rapid increases in groundwater levels were observed in response to significant precipitation events at MW-IT-01A/B/C, similar to the response observed where conditions are similar.
- The vertical hydraulic gradients between the wells installed in the Gasport formation and the bedrock contact were generally upward at locations MW-IT-01, MW-IT-04, MW-IT-05 and MW-IT-06, and neutral at locations MW-IT-03 and MW-IT-07. At MW-IT-02, there was a notable downward hydraulic gradient throughout the monitoring period.
- At location MW-IT-02, two wells (-A and -B) were installed within the Gasport Formation. There was a downward hydraulic gradient between these wells throughout the monitoring period, which was observed to be increasing in magnitude over time (June and September hydraulic gradients of -0.14 and -0.30, respectively).
- The vertical hydraulic gradients between the wells installed in the bedrock contact and the overburden were generally upward at MW-IT-05, neutral at MW-IT-03 and MW-IT-07, and downward at MW-IT-01. All of the overburden wells, with the exception of MW-IT-03C, have gone dry over the course of the monitoring period.

## 3.4 Hydraulic Testing – Single Well Response Tests (SWRTs)

Single well response tests (SWRTs) were conducted in all 19 of the newly installed monitoring wells in April and May 2024, following monitoring well development. The SWRTs were analyzed to estimate the hydraulic conductivity of each subsurface interval tested. The single well response tests and results are presented in Appendix B.

A summary of results by aquifer unit is presented in the table below.

**Table 1: Single Well Response Test Hydraulic Conductivity by Aquifer Unit**

| Formation / Rock Unit | Number of Observations | Minimum K (m/s) | Maximum K (m/s) | Geometric Mean K (m/s) |
|---|---|---|---|---|
| Overburden | 4 | $8x10^{-6}$ | $2x10^{-3}$ | $1x10^{-4}$ |
| Bedrock Contact | 7 | $1x10^{-5}$ | $8x10^{-4}$ | $2x10^{-4}$ |
| Gasport | 7 | $6x10^{-7}$ | $6x10^{-4}$ | $2x10^{-5}$ |
| Gasport / Shaley Dolostone | 1 | $2x10^{-4}$ | | |

The following observations are made with respect to the results of the SWRTs:

- The SWRTs performed on wells screened in the Gasport Formation ranged from $6x10^{-7}$ m/s to $6x10^{-4}$ m/s, which is typical of lithologies ranging from a middle value for unfractured dolostone to a middle value of weathered dolostone (Freeze and Cherry 1979). This is consistent with the lithological observations at the Site and previously reported hydraulic conductivity ranges in the revised Water Report Level 1/2.

- The SWRT performed on the well screened in both the Gasport Formation and Shaley Dolostone fell within the range of values observed for the wells that were entirely screened within the Gasport Formation. This value is approximately an order of magnitude greater than the maximum observed in the revised Water Report.
- The results of SWRTs in the overburden were generally consistent with published hydraulic conductivities for the soil materials observed during drilling at those locations.

## 3.5 Groundwater Quality

Water quality sampling was carried out between April 26 to May 1, 2024, at the monitoring well nests MW-IT-01 to MW-IT-07. Water quality results are presented in Appendix B.

In general, water quality was in the typical range for groundwater in this hydrogeologic setting, which was similar to the results found in other monitoring wells within the study area.

- There were some exceedances of ODWS and MECP Table 2 parameters, including total dissolved solids (TDS), hardness, chloride, cobalt, manganese, sodium and PHC F3 hydrocarbons. There were also a number of occasional exceedances of PWQO parameters, notably for cobalt and BTEX (toluene).
- Several locations that exhibited one or more detections of parameters presumed to be related to anthropogenic activities, including elevated chloride and sodium (MW-IT-01C), PHC detections and detections of one or more BTEX parameters. The PHC and BTEX detections may be due to PVC cement used during well installation to extend the riser pipe at ground surface.
- The elevated sodium and chloride detections in groundwater are localized in extent and likely the result of salt application on nearby roads, and potentially from snow storage on adjacent municipal lands. Ditches along the roadsides that drain away from the proposed pit / quarry areas, and berms around the pit / quarry will help to minimize surface water run-off from entering the pit / quarry operation.

# 4.0 NUMERICAL MODELLING SIMULATIONS

Utilizing the new data collected during the 2024 field investigations at the seven new monitoring well nests MW-IT-01 to MW-IT-07, the Site conceptual understanding / hydrostratigraphic understanding / HGS numerical model for the proposed pit / quarry were updated along the proposed infiltration trench / hydraulic barrier alignment.

The updated HGS flow model was calibrated to updated current hydrogeologic conditions and then used to update predictive simulations for all operational phases and the rehabilitation phase of the proposed pit / quarry. The HGS model updates are described in Appendix D and the results are summarized below.

## 4.1 HGS Model Revisions

The HGS model domain, surface water flow, and boundary conditions were not modified. The hydrostratigraphy and the hydraulic properties of the hydrostratigraphic units were updated based on the new IT wells and the HGS model was then re-calibrated to reproduce the observed water levels at the new IT wells measured in 2024.

### 4.1.1 Hydrostratigraphy

The new IT wells provided additional hydrostratigraphic information along the proposed mitigation system alignment. The updated hydrostratigraphy is illustrated on Figure 2, along with groundwater levels under current (baseline) conditions. The horizontal discretization of the HGS model mesh remained consistent with the original HGS model but the vertical thickness of the hydrostratigraphic layers in the HGS numerical model were updated to coincide with the updated hydrostratigraphy.

### 4.1.2 Hydraulic Conductivity Parameterization

Hydraulic conductivity measurements at the IT wells were used to supplement the previously compiled hydraulic conductivity measurements. These were applied to the HGS numerical model as initial parameters for model calibration and used as references throughout the calibration process. To improve refinement within the Site Area and better fit hydraulic conductivity observations, hydraulic conductivity zonation was reevaluated. Weathered Bedrock Zone 4 was sub-divided into three new sub-zones of weathered bedrock hydraulic conductivity and each of these three sub-zones were assigned an independent, calibrated hydraulic conductivity. These sub-zones were calibrated separately from the regional hydrostratigraphic units (see Figure 2, Appendix D).

## 4.2 Model Calibration

### 4.2.1 Calibration Approach

The numerical modelling tool PEST (Doherty 2018) was again used to calibrate the hydraulic conductivity so that the simulation could reproduce current observed groundwater elevations and stream flows. PEST was run for 6 iterations before being terminated. The calibrated hydraulic conductivity values are shown on Figure 2 (Appendix D); noting that the hydraulic conductivity was refined for the following hydrostratigraphic units:

- Weathered Bedrock Zones 4A, 4B, and 4C;
- Gasport Zone 4;
- Upper Sand; and
- Local Till.

All other parameters remained unchanged from their previous values used in Golder (2023) simulations. All calibrated hydraulic conductivity values were within the range observed in the field or conceptually consistent with the observed site conditions.

### 4.2.2 Calibration Assessment

The simulated calibrated model results are presented in Appendix D. Overall, the updated HGS numerical model is considered fit for purpose based on the calibration fit, the consistency of the calibrated parameters with the hydrostratigraphic conceptualization, and the consistency of the simulation groundwater flow patterns with the conceptual groundwater flow model.

## 4.3 Updated Predictive Simulations

A total of eight model forecast simulations were completed, each representing a different phase of pit / quarry development (including rehabilitation) as shown in Appendix D. The forecast simulations were completed under steady state conditions to provide a conservative estimate of the extent of drawdown for each development phase (i.e. highest drawdown during that phase).

### 4.3.1 Updated Base of Grout Zones and Infiltration Trenches

The new hydrogeologic information obtained from the new well nests MW-IT-01 to MW-IT-07 indicates that the water table is 2 to 3 metres lower along some portions of Zones 1, 2 and 3 than was previously indicated from groundwater level data available at that time. As such, base elevation of the infiltration trenches and hydraulic barrier in Zones 1, 2, and 3 in the forecast simulations were lowered to reflect the updated water table from the updated calibrated HGS model. Trench and hydraulic barrier base elevations in Zones 4, 5, and 6 remain substantially the same in the revised forecast simulations, since predicted groundwater levels along those trenches did not substantially change as a result of the new hydrogeologic information in those areas.

### 4.3.2 Updated Mitigation of Quarry Inflows

The new hydrogeologic information (i.e. stratigraphy, water levels and hydraulic conductivity measurements) along with the updated HGS numerical model calibration to current conditions indicated that aquifer transmissivity along portions of the proposed groundwater mitigation system alignment was higher than previously inferred, particularly along Zones 1, 2 and 3, which would result in higher predicted inflows during the operational periods.

Modelling simulations were iteratively used to evaluate options to minimize higher potential inflows to optimize portion of water infiltrated which contributes to increasing aquifer levels (as opposed to re-entering the quarry). It was determined that by placing and compacting low permeability silt till backfill along the pit / quarry walls adjacent to the high transmissivity zone during Phases 5 and 6 as part of progressive rehabilitation, pit / quarry inflows could be minimized and actually reduced relative to the original (Golder 2023) predicted inflows. The timing of the progressive placement of silt till backfill in the other phases of operation otherwise remained the same in the updated forecast simulations. Note that the hydraulic conductivity of the silt till backfill was assigned as $1x10^{-6}$ m/s, which was consistent with previous simulations (Golder 2023).

The mitigation of Phase 5 required higher heads in Trench Zones 1 and 2. Trench Zones 1 and 2 are active from Phase 4 through Phase 7 but these higher heads were only required in Phase 5.

### 4.3.3 Updated Backfill Removal Area Post- Rehabilitation

The zone of silt till backfill removal upon rehabilitation in the main pit / quarry remains in the same location and has the same planned extent as previous simulations (Golder 2023). The area of backfill removal is now represented as restoring 98% of the effective hydraulic conductivity of this portion of the original pit / quarry wall prior to backfill placement, as residual silt till material is expected remain in place.

## 4.4 Results

### 4.4.1 Simulated Head and Drawdown

The general simulated groundwater flow direction across the Site in each unit remained consistent with the current conditions; groundwater flow is southeast across the Site toward the Credit River and bedrock valley.

The simulated water level drawdown is consistent with the head change in the Gasport Formation south and southwest of the Site. As in Golder 2023, in the northwest and north of the Site where fine grained material is present, the water table drawdown is less than the head change in the Gasport Formation. There is also drawdown observed in the Whirlpool / Manitoulin Formations, but this is relatively small in magnitude relative to the available drawdown in this aquifer given its depth and typical static water level. Upon rehabilitation, the residual change in groundwater heads within all aquifer units is typically less than +/- 1 m.

### 4.4.2 Surface Water Flows

Surface water stations SW5, SW11, SW13, SW14, and SW16 experience some simulated reduction in flows relative to current conditions. Rehabilitation, SW14, SW13, and SW5 experience some long-term reductions relative to the current conditions. SW16 experiences an increase in long-term flow upon rehabilitation.

### 4.4.3 Quarry Inflows

Overall, the total simulated inflow to all areas of the pit / quarry during operation ranges from 14.7 L/s to 50.9 L/s, a narrower range than the 14.3 L/s to 133.6 L/s simulated in Golder 2023. The majority of the simulated inflow is in the Main Area of the pit / quarry, with inflows up to 47.9 L/s during Phase 5 of the operation. The simulated pit / quarry inflows have decreased in Phase 5 and 6 relative to Golder 2023, primarily due to the progressive silt till backfill placement, but other changes in conductivity and model updates have resulted in changes between the other phases as well.

### 4.4.4 Final Pond Water Levels

Upon rehabilitation, the maximum water level in the Main Pond will be controlled by an outflow to the North Pond at an approximate elevation of 400 masl, and the maximum water level in the North Pond will be controlled by an outflow and pipe to the Osprey Valley Golf Course irrigation system at an approximate elevation of 399 masl. The simulated elevation of the South Pond is estimated to be 393.5 masl and will be internally contained, with no surface outflow. The simulated steady state outflow from the combined Main and North Ponds to the golf course irrigation system is estimated to be approximately 10 L/s, a decrease of 2 L/s from the estimation presented in Golder (2023).

### 4.4.5 Trench Flow Rates

Simulated infiltration trench flow rates peak in Phase 5 at 51.6 L/s. Total trench flow as a percentage of total sump inflow peaks in Phase 5 at 77% assuming the target heads are maintained in Trench Zones 1 to 6.

## 4.5 Summary

The HGS numerical model for the proposed Caledon pit / quarry has been updated and calibrated to our improved hydrostratigraphic characterization for the Site, and the updated HGS model has been used to update the assessment of potential impacts to groundwater and surface water due to the proposed pit / quarry operations.

The HGS model simulations demonstrate that the proposed mitigation system can maintain groundwater levels within their current typical range during the later stages of pit / quarry operations, and that proactive rehabilitation during Phases 5 and 6 of the pit / quarry operations can reduce groundwater inflows into the pit / quarry relative to earlier simulations, thereby optimizing water management during future operations.

# 5.0 WATER MANAGEMENT PLAN

An updated year-by-year Water Management Plan has been prepared for the site (see Appendix D) and is summarized below.

## 5.1 Off-Site Discharge

A single point of discharge has been identified for water collected from the combined land assemblages of the proposed Caledon Pit / Quarry to the Osprey Valley Golf Course irrigation system infrastructure (Figure 6), where water will be used for irrigation when needed, with excess water stored in the golf course's existing pond system which ultimately discharges to the Credit River.

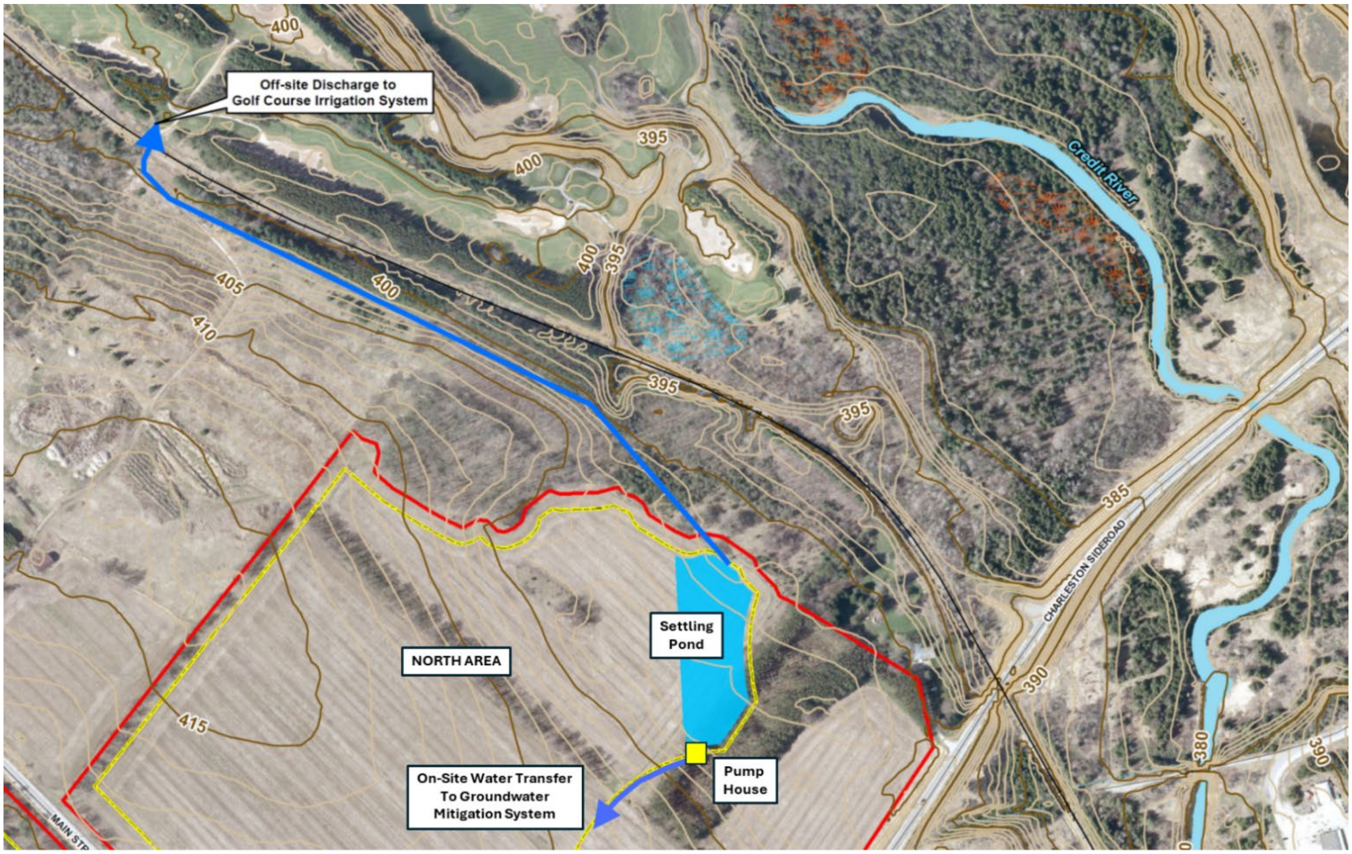


Figure 6: Proposed Water Discharge from the Pit / Quarry Settling Pond to the Osprey Valley Golf Course

## 5.2 Pit / Quarry Discharges and Flows

With reference to Table 2, discharges of surplus water to the Osprey Valley Golf Course irrigation system are anticipated to begin during Operational Year 1 with an annual discharge of approximately 10,000 $m^3$ that year. The rate of discharge is expected to increase annually to a maximum of approximately 587,000 $m^3$ / year in operational Year 13, and then stabilize and decline in future years.

It should be noted that additional HGS water model simulations indicated the groundwater mitigation system could be used to re-infiltrate additional groundwater, in the range of 200,000 to 400,000 $m^3$ / year, without adversely affecting groundwater levels. As such there is an option to re-infiltrate additional groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of downgradient natural heritage features.

Because no water will be discharged from the proposed pit / quarry directly to the Credit River, there are no significant changes expected to flow or thermal characteristics of the Credit River.

### Table 2: Water Consumption and Discharge Scenarios

| Year | Scenario 1 | Water Consumed | | Water Stored | | | | | Water Infiltrated by Trench | | | | | | | Water Discharged / Infiltrated | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Annual Water Generated | Agg Prod-uction | Water for Agg Washing | Main Sump Storage | Wash Plant Storage | North Sump Storage | North Quarry Allowed to Fill | South Sump Storage | Trench Zone 1 | Trench Zone 2 | Trench Zone 3 | Trench Zone 4 | Trench Zone 5 | Trench Zone 6 | Total Infiltration Trench Zones 1-6 | Total Water to Manage | Off Site Water Discharge to OVGC | Water Transferred to Trench Zones 1-2 | Water Transferred to Trench Zones 3-6 |
| | | | 0.05 | | | | | | | | | | | | | | | | |
| | m3 | T | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | | m3 | m3 | m3 | m3 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 | 0 |
| 1 | 84,251 | 250,000 | 12,500 | 1,000 | 20,000 | 40,000 | 0 | 0 | | | | | | | 0 | 10,751 | 10,751 | 0 | 0 |
| 2 | 120,746 | 500,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 95,746 | 95,746 | 0 | 0 |
| 3 | 173,517 | 750,000 | 37,500 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 136,017 | 136,017 | 0 | 0 |
| 4 | 229,708 | 1,000,000 | 50,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 179,708 | 179,708 | 0 | 0 |
| 5 | 275,220 | 1,500,000 | 75,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 200,220 | 200,220 | 0 | 0 |
| 6 | 338,310 | 2,000,000 | 100,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 238,310 | 238,310 | 0 | 0 |
| 7 | 399,855 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 274,855 | 274,855 | 0 | 0 |
| 8 | 467,414 | 2,500,000 | 125,000 | 0 | 150,000 | 0 | 0 | 0 | | | | | | | 0 | 192,414 | 192,414 | 0 | 0 |
| 9 | 533,807 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 408,807 | 408,807 | 0 | 0 |
| 10 | 586,684 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 461,684 | 461,684 | 0 | 0 |
| 11 | 629,412 | 2,500,000 | 125,000 | 0 | 0 | 1,000 | 0 | 0 | | | | | | | 0 | 503,412 | 503,412 | 0 | 0 |
| 12 | 678,977 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 553,977 | 553,977 | 0 | 0 |
| 13 | 712,714 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 587,714 | 587,714 | 0 | 0 |
| 14 | 703,493 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 578,493 | 578,493 | 0 | 0 |
| 15 | 694,359 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 569,359 | 569,359 | 0 | 0 |
| 16 | 685,290 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 560,290 | 560,290 | 0 | 0 |
| 17 | 681,178 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 556,178 | 556,178 | 0 | 0 |
| 18 | 724,436 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 76,948 | 8,830 | | | | | 85,778 | 599,436 | 513,658 | 85,778 | 0 |
| 19 | 763,373 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 153,896 | 17,660 | | | | | 171,556 | 638,373 | 466,818 | 171,556 | 0 |
| 20 | 803,666 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 230,844 | 26,490 | | | | | 257,334 | 678,666 | 421,332 | 257,334 | 0 |
| 21 | 836,766 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 307,791 | 35,320 | | | | | 343,112 | 711,766 | 368,654 | 343,112 | 0 |
| 22 | 873,547 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 384,739 | 44,150 | | | | | 428,890 | 748,547 | 319,658 | 428,890 | 0 |
| 23 | 1,180,746 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 506,153 | 222,329 | | | | | 728,482 | 1,055,746 | 327,265 | 728,482 | 0 |
| 24 | 1,504,204 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 627,566 | 400,507 | | | | | 1,028,074 | 1,379,204 | 351,131 | 1,028,074 | 0 |
| 25 | 1,804,207 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 748,980 | 578,686 | | | | | 1,327,666 | 1,679,207 | 351,541 | 1,327,666 | 0 |
| 26 | 2,109,758 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 870,394 | 756,864 | 0 | 0 | 0 | 0 | 1,627,258 | 1,984,758 | 357,501 | 1,627,258 | 0 |
| 27 | 1,981,351 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 1,000 | 782,093 | 632,822 | 27,331 | 14,717 | 22,075 | 15,242 | 1,494,281 | 1,855,351 | 361,070 | 1,414,915 | 79,366 |
| 28 | 1,837,035 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 693,792 | 508,781 | 54,662 | 29,434 | 44,150 | 30,485 | 1,361,304 | 1,712,035 | 350,731 | 1,202,573 | 158,731 |
| 29 | 1,675,534 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 605,491 | 384,739 | 81,994 | 44,150 | 66,226 | 45,727 | 1,228,327 | 1,550,534 | 322,207 | 990,230 | 238,097 |
| 30 | 1,527,862 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 20,000 | 517,190 | 260,698 | 109,325 | 58,867 | 88,301 | 60,970 | 1,095,350 | 1,382,862 | 287,511 | 777,888 | 317,462 |
| 31 | 1,381,639 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 428,890 | 136,656 | 136,656 | 73,584 | 110,376 | 76,212 | 962,374 | 1,256,639 | 294,265 | 565,546 | 396,828 |
| 32 | 1,235,580 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 340,589 | 12,614 | 163,987 | 88,301 | 132,451 | 91,454 | 829,397 | 1,110,580 | 281,184 | 353,203 | 476,194 |
| 33 | 1,298,865 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 342,166 | 14,191 | 177,653 | 102,492 | 142,438 | 103,543 | 882,482 | 1,173,865 | 291,383 | 356,357 | 526,126 |
| 34 | 1,374,664 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 343,742 | 15,768 | 191,318 | 116,683 | 152,424 | 115,632 | 935,568 | 1,249,664 | 314,096 | 359,510 | 576,058 |
| 35 | 1,446,686 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 345,319 | 17,345 | 204,984 | 130,874 | 162,410 | 127,721 | 988,654 | 1,321,686 | 333,033 | 362,664 | 625,990 |
| 36 | 1,502,123 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 346,896 | 18,922 | 218,650 | 145,066 | 172,397 | 139,810 | 1,041,739 | 1,377,123 | 335,384 | 365,818 | 675,922 |
| 37 | 1,539,750 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 348,473 | 20,498 | 232,315 | 159,257 | 182,383 | 151,898 | 1,094,825 | 1,414,750 | 319,925 | 368,971 | 725,854 |
| 38 | 1,576,800 | 500,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | 350,050 | 22,075 | 245,981 | 173,448 | 192,370 | 163,987 | 1,147,910 | 1,551,800 | 403,890 | 372,125 | 775,786 |

| | | |
|---|---|---|
| Max annual discharge to the Golf Course Irrigation Ponds: | 587,714 | m3 |
| Avg discharge flow rate to the Golf Course Irrigation Ponds (max year): | 18.6 | L/s |
| Average annual discharge to the Golf Course Irrigation Ponds: | 345,645 | m3 |
| Avg discharge flow rate to the Golf Course Irrigation Ponds: | 11.0 | L/s |

## 5.3 Summary

The following key points are noted with respect to water management at the proposed Caledon Pit / Quarry.

- The Operational Plan for the pit / quarry plans for the construction of a 40,000 m$^3$ settling pond / holding pond for managing discharge water in the North Area during Year 1, in order provide “immediate” water storage capacity.
- Based on water inflow predictions and mitigation water needs from numerical simulations during operations, enough water will be generated during Years 17 to 38 of operation to supply the water needed for the proposed groundwater mitigation system.
- Additional water storage to operate the groundwater mitigation system, if needed, could be accommodated in the Main Area or the North Area (preferred). If needed, the North Area could be used to store additional water, as there is in excess of 300,000 m$^3$ of capacity in that area once extraction has been completed at the end of Operational Year 14.
- The maximum annual average rate of discharge throughout pit / quarry operations to the Osprey Valley Golf Course irrigation pond system is approximately 587,000 m$^3$ / year in Operational Year 13. The peak average annual water discharge rate (in Year 13) is expected to be approximately 18.6 L/s.

- There is an option to re-infiltrate an additional 200,000 to 400,000 $m^3$ / year in Phases 4 to 7 of operations of groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of downgradient natural heritage features.
- Upon rehabilitation, the combined outflow from the Main and North Ponds to the Osprey Valley Golf Course irrigation pond system is expected to be 10.0 L/s on average.

# 6.0 UPDATED MITIGATION SYSTEM DESIGN

The proposed groundwater mitigation system design presented in Golder (2023) has been updated based on the infiltration technology review, 2024 field investigations along the proposed infiltration trench and hydraulic barrier alignment, updated HGS numerical modelling simulations, and the updated water management plan. The updated system design is presented in the following subsections:

- General Configuration;
- Mitigation System Zones;
- Phasing of Implementation;
- Estimated Pit / Quarry Inflows and Trench Infiltration Rates;
- Sensitivity to Hydraulic Barrier Performance;
- Infiltration Trench Details;
- Hydraulic Barrier Details;
- Water Storage and Distribution System;
- Supply to Gravity Reservoirs;
- Supply to Infiltration Vaults; and
- Water Quality Considerations.

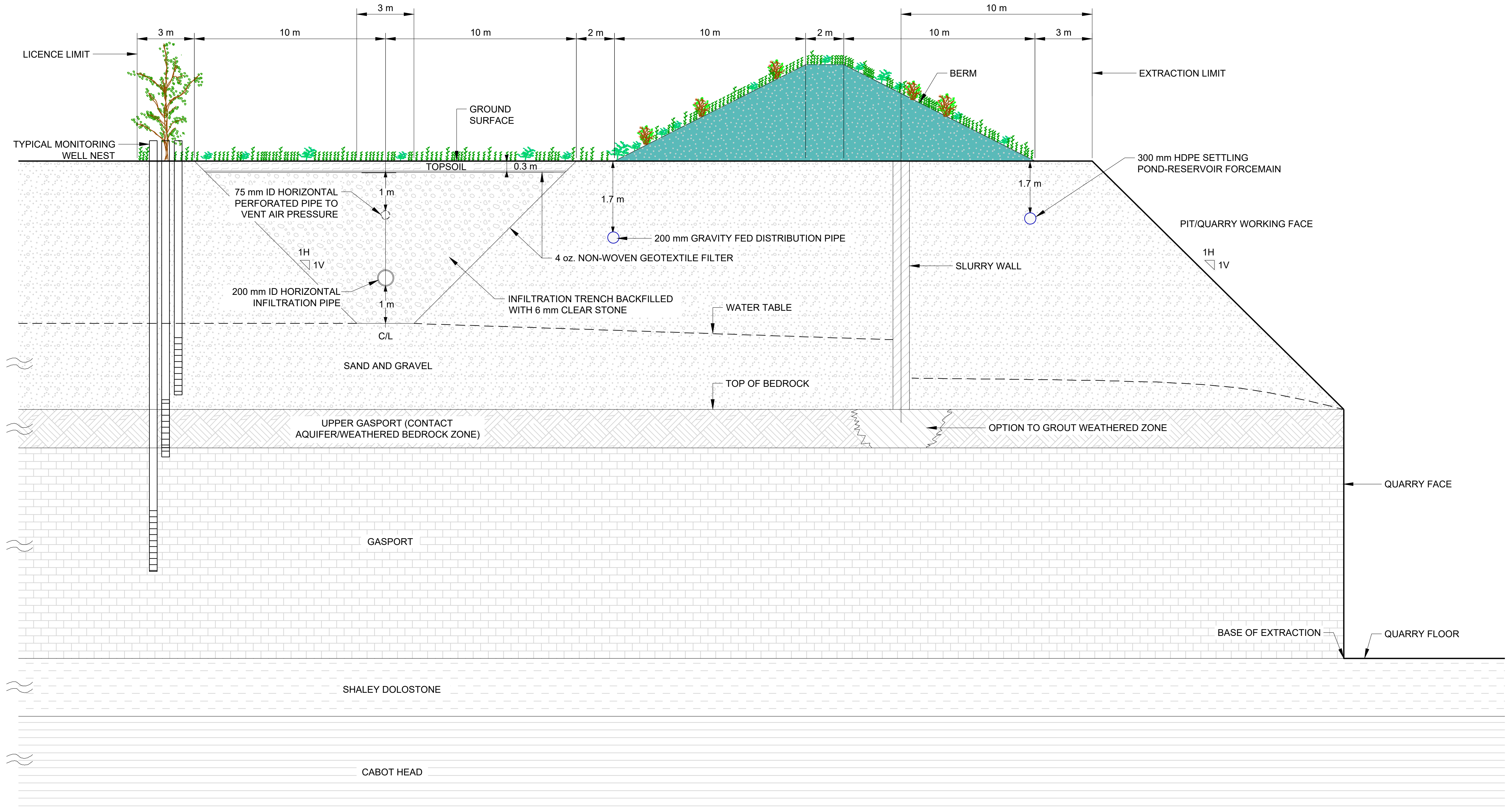
Supplemental design information is provided in Appendix E.

## 6.1 General Configuration

The proposed mitigation system generally consists of a groundwater infiltration trench and slurry wall / grout zone, as shown conceptually on Figure 7, which will be implemented within a 50 m wide zone of the pit / quarry setback, where it is required to sustain groundwater levels during operations.

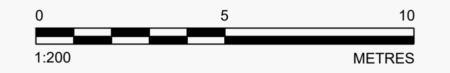
- The infiltration trench would be constructed within the setback, parallel and a minimum of 3 m from the licence limit. The trench will be excavated through the sand and gravel overburden to design depth using 1:1 sloping with a typical minimum width at the base of 3 m.
- The design depth of the trench is the shallowest of the depth to the annual average water table, top of bedrock, or a maximum depth of 8.5 m. Therefore, the trench has a maximum width of 20 m at surface. The detailed design of the Mitigation System will consider water level monitoring up to that point in the selection of design depths.
- A perforated 200 mm horizontal infiltration pipe would be placed 1 m above the base of the trench, and the trench would then be backfilled with 6 mm clear stone material, covered with a 4 oz non-woven geotextile and capped with a topsoil layer at surface, a minimum of 0.3 m thick, and up to a maximum of 0.9 m thick where the total depth of the trench permits a greater root zone.

  - It is noted that many infiltration systems which receive variable inflows (such as storm water surges) conservatively select the backfill to be a large diameter clear stone (often 20 to 50 mm) to accommodate dynamic filling. In this case inflow rates are managed by the design of the system so a smaller diameter backfill material can be selected. This has the additional benefit, that in the event of a penetration of the geotextile a smaller diameter backfill may develop a natural filter pack and reduce the infiltration of fines into the trench compared to a larger backfill material.
  - A thin (4 oz) non-woven geotextile is selected to reduce the risk of the geotextile becoming clogged over time and therefore improve the longevity of the system. As the material is thinner, care will be taken during construction to ensure that geotextile will not be damaged.
- The infiltration pipe would have 1.8 mm sluice perforations and have suitable strength to be buried up to design depths. It is anticipated that the sluice openings will provide sufficiently large openings to avoid chemical clogging of the infiltration pipe by the formation of precipitates (Dillon et al., 2024).
- All connections would be completed using soil tight connectors to ensure backfill materials do not clog pipes.
- Several vertical air release vent pipes to surface will be installed along the horizontal infiltration pipe to allow any entrapped air in the infiltration pipe to vent. A secondary function of the vertical vent pipes is to allow monitoring of water levels within the infiltration trench, with manual observations or with electronic water level monitoring devices. Vertical vent pipes will be placed at the end of each infiltration pipe and at the midpoint between vaults where there are multiple vaults in a zone.
- Horizontal air vents would be constructed using nominal 75 mm perforated pipe installed along the trench alignment at a depth of 1 m below the top of the backfill to vent air displaced in the backfill when water levels rise (TRCA, 2013).
- The vertical and horizontal air vents would alleviate mechanical clogging (or “back pressure”) due to air entrapment and ensure that water flows freely into the vault to the pipe to the granular material (Dillon et al., 2022).
- Water collected during pit / quarry operations would be stored and used to supply water to the infiltration trench via an infiltration vault, as may be needed to help maintain groundwater levels in the areas of potential concern at their current typical range during pit / quarry operations.
- An infiltration vault (Figure 8) would consist of prefabricated concrete “box culvert” segments, placed vertically on a prefabricated end cap with a gasket on the base of the trench, and extending to ground surface. The infiltration vault would be supplied with water via piping from the Settling Pond. Piping for the water distribution system would be installed below the frost line, where required, to facilitate year-round operation.



**GENERAL**

1. Max trench width 20 m and depth 8.5 m will vary depending on the design depth.
2. Infiltration piping will be sized to meet required infiltration rate.
3. Minimum setback of 50 m needed.
4. Construct slurry wall/grout 10 m from extraction limit.
5. Construct infiltration trench centerline 13 m from licence limit.
6. Construct berm in setback.
7. Design features are schematic and Not to Scale.



CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA).

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

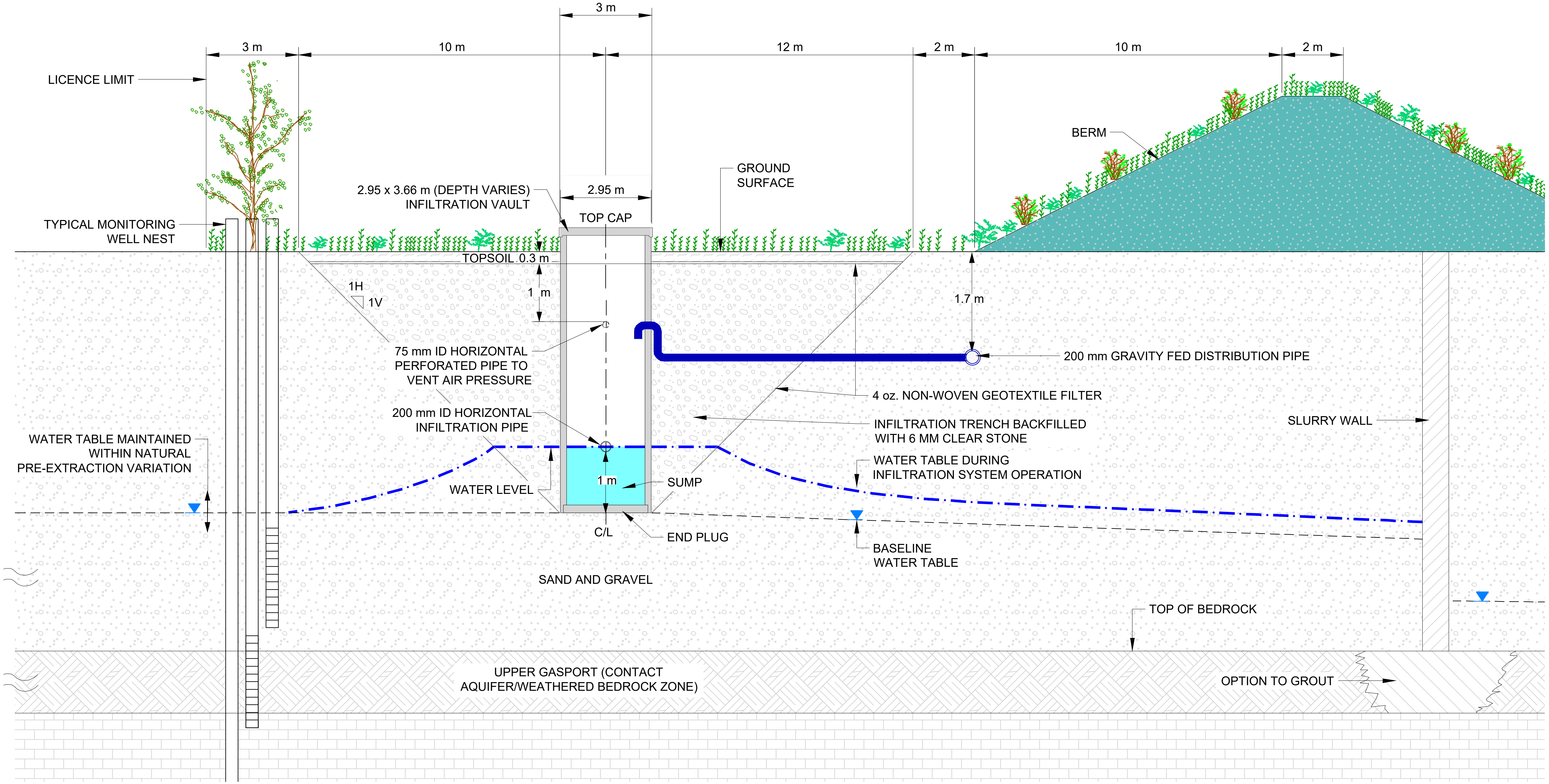
CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2025-05-07 |
| DESIGNED | GWS |
| PREPARED | JPR |
| REVIEWED | PM |
| APPROVED | GWS |

TITLE
**CROSS-SECTION SHOWING GENERAL CONFIGURATION OF PROPOSED GROUNDWATER INFILTRATION TENCH AND SLURRY WALL**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 19129150 | 0071 | 1 | 7 |

- The infiltration vaults will extend from above ground surface to the base of the infiltration trench, with the infiltration pipe positioned 1 m above the bottom of the sump. This placement will create an approximately 1 m sump at the base of the vault, which will provide redundant settling for particles and further reduce the likelihood of physical clogging (Dillon et al., 2024) (TRCA, 2013).
- A hydraulic barrier will also be constructed in the setback area, through the sand and gravel overburden and into the upper weather zone of the bedrock, between the infiltration trench alignment and the extraction limit, approximately 10 m from the extraction limit. The hydraulic barrier will consist of two components: grouting of fractures in the upper 3 to 5 m of the bedrock (i.e. weathered zone, if present) to reduce groundwater flow through any fractures, followed by the construction of a low permeability ~1m thick slurry wall in the overburden, keyed into the top of competent bedrock to ground surface on the same alignment.
- The target hydraulic conductivity (k) of the hydraulic barrier created by the slurry wall and grout zone within the overburden and weathered bedrock is $1x10^{-7}$ m/s, and this k value was used as the base case in the HGS numerical simulations to represent these zones in the scenarios with the mitigation system in place. It is noted that a soil slurry wall may need to be amended
- Grouting of the more permeable upper weathered bedrock zone would be performed, typically by means of pressurized injection grouting, where is it required to help create a hydraulic barrier. The slurry wall would extend from ground surface down to the top of bedrock. Given its proposed location within the setback, this hydraulic barrier would be constructed prior to the installation of the berm in that part of the setback area.
- Lastly, monitoring well nests (seven in total) have been installed in the spring of 2023 at key locations in the setback along the proposed mitigation system between the infiltration trench and the licence limit, as described in Section 0. In general, each well nest includes of a deep piezometer in the Gasport Formation, a piezometer screened across the Contact Aquifer zone, and a shallow piezometer in the overburden. Where groundwater levels were near the bedrock contact, an overburden monitoring well was omitted from the well nest. These monitoring well nests are currently being monitored to establish baseline groundwater levels along the proposed mitigation system, and will be used later to provide “feedback” on groundwater levels, to “inform” the injection rate needed to sustain groundwater levels, and to monitor the performance of the mitigation system.
- When operational, the mitigation system would be used to maintain groundwater levels within the range of their natural pre-extraction variations, as illustrated on Figure 8 (proximal to the trench vault) and Figure 9 (along other parts of the trench).



**GENERAL**

1. Max trench width 20 m and depth 8.5 m will vary depending on the design depth.
2. Infiltration piping will be sized to meet required infiltration rate.
3. Minimum setback of 50 m needed.
4. Construct slurry wall/grout 10 m from extraction limit.
5. Construct infiltration trench centerline 13 m from licence limit.
6. Construct berm in setback.
7. Design features are schematic and Not to Scale.

0 2.5 5
1:125 METRES

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA).

CONSULTANT
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| APPROVED | GWS |

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

TITLE
**CROSS-SECTION SHOWING PROPOSED INFILTRATION VAULT DETAIL**

| PROJECT NO. | CONTROL | REV. | FIGURE |
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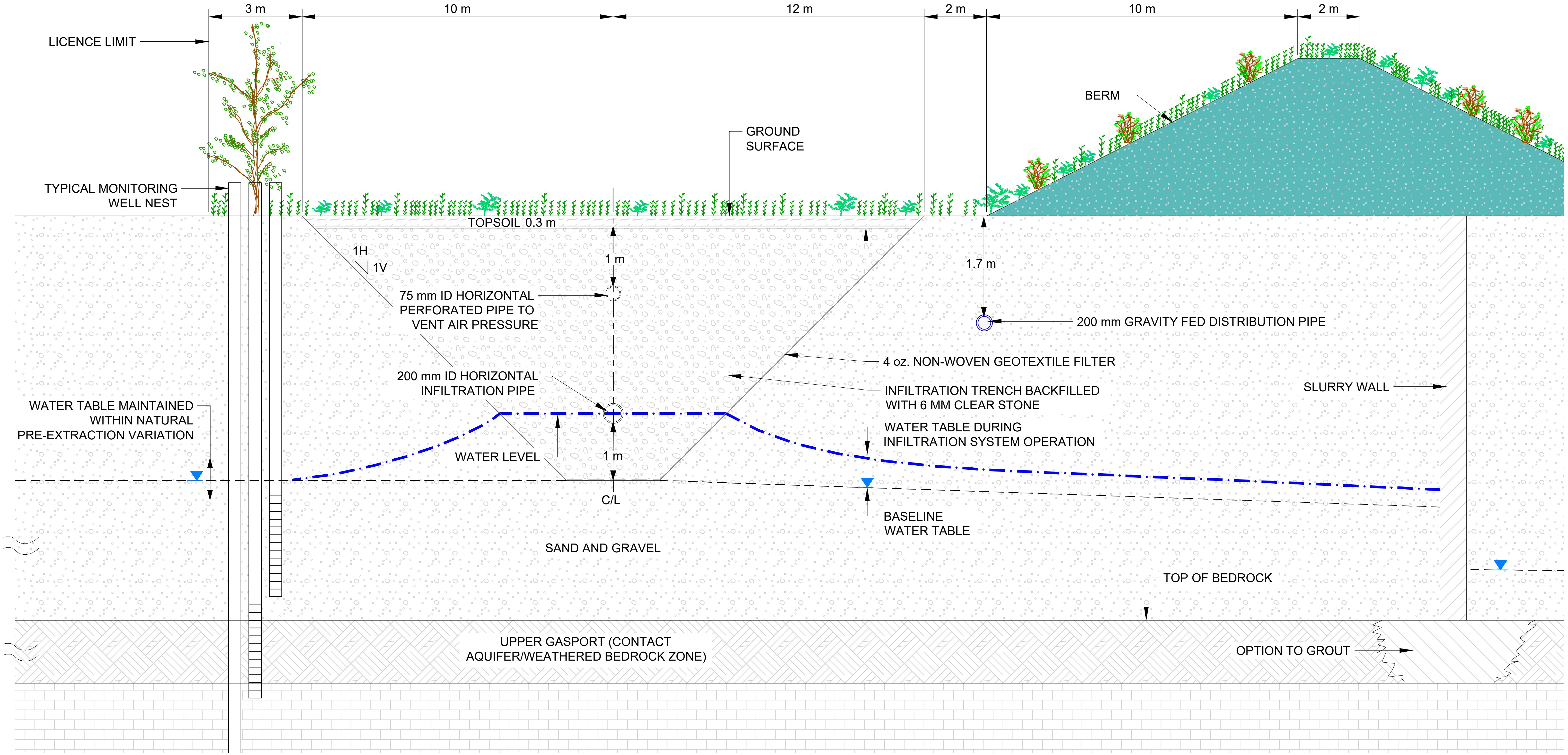

**GENERAL**

1. Max trench width 20 m and depth 8.5 m will vary depending on the design depth.
2. Infiltration piping will be sized to meet required infiltration rate.
3. Minimum setback of 50 m needed.
4. Construct slurry wall/grout 10 m from extraction limit.
5. Construct infiltration trench centerline 13 m from licence limit.
6. Construct berm in setback.
7. Design features are schematic and Not to Scale.

0 2.5 5
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CLIENT
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| YYYY-MM-DD | 2025-05-07 |
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| PREPARED | JPR |
| REVIEWED | PM |
| APPROVED | GWS |

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

TITLE
**CROSS-SECTION SHOWING PROPOSED TYPICAL INFILTRATION TRENCH DETAIL**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 19129150 | 0071 | 1 | 9 |

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## 6.2 Mitigation System Zones

To mitigate the potential decline in groundwater levels during later the stages of operations (Phases 4 to 7) due to dewatering, the proposed mitigation system would consist of six infiltration trench zones and two slurry wall / grout zones constructed along a 1,900 m alignment, as summarized in Table 3.

- North of Charleston Sideroad in the Main Area, two trench zones (Zones 1 and 2) and a 600 m long slurry wall / grout zone are proposed.
- South of Charleston Sideroad in the South Area, four trench zones (Zones 3 to 6) and a 1,250 m long slurry wall / grout zone are proposed.
- The six individual trench zones would range in length from ~220 to ~335 m and are typically separated from one another by a “gap” of 30 m, except Trenches 2 and 3, which are separated by a gap of ~43 m as they straddle Charleston Sideroad and Trenches 3 and 4 which are separated by 125 m where a topographic low area where the water table is close to ground surface, making trench operation impractical.
- Each trench zone would be assigned a “target” water level to be maintained during mitigation. For the purposes of the design and testing the feasibility of this mitigation, the steady state current condition water table from the calibrated HGS model was assumed to be the “target” water level in numerical simulations.
- The monitoring wells installed along the mitigation system alignment will observe the natural pre-extraction water table fluctuations and can be used to establish the maximum and minimum water level range associated with each trench zone.

**Table 3: Proposed Groundwater Mitigation Zones**

| Mitigation | | Start (m) | End (m) | Length (m) | Target Trench Water Level (masl) |
|---|---|---|---|---|---|
| Main Area | Slurry Wall | 0.0 | 128.6 | 128.6 | N/A |
| | Trench Zone 1 / Slurry Wall | 128.6 | 348.7 | 220.1 | 396.0 - 398.0 |
| | Trench Zone 2 / Slurry Wall | 378.7 | 596.7 | 218.0 | 394.0 - 398.0 |
| South Area | Trench Zone 3 / Slurry Wall | 640.1 | 974.8 | 334.7 | 393.5 |
| | Trench Zone 4 / Slurry Wall | 1100.0 | 1334.9 | 234.9 | 393.0 |
| | Trench Zone 5 / Slurry Wall | 1365.8 | 1634.5 | 268.7 | 392.0 |
| | Trench Zone 6 / Slurry Wall | 1664.5 | 1890.5 | 226.0 | 394.0 |

- With reference to Table 3 the “average” current condition groundwater table assigned to each trench segment in the HGS model simulation varied along the alignment, from 396.0 masl at the north end in Trench Zone 1 in the Main Area, to as low as 393.0, 392.0 and 394.0 masl at the southernmost trench Zones 4, 5 and 6 in the South Area.
- Trench Zones 1 and 2 will be assigned higher target heads (398.0 masl) during Phase 5 of operation to help maintain groundwater levels in that area, and will otherwise be assigned target groundwater levels based on average current condition groundwater levels (396.0 and 394.0 masl, respectively).

- When the system is implemented, the range of operational water levels for each trench zone will be determined from baseline water level monitoring data at the monitoring well nest or nests corresponding to that trench zone. Using natural variations observed in baseline groundwater levels, the target water levels can be varied to account for observed seasonal changes in groundwater levels.
- Target water levels will be determined for each trench zone from baseline monitoring at the infiltration trench monitoring well nests, acquired for a minimum period of 2 years prior to the start of below water table extraction. Based on the water level variability observed at existing site monitoring wells MW20-01, MW20-02 and MW20-18 for the 2021 period, it is expected that target water levels for the proposed infiltration trench system will vary seasonally by 1.5 to 2 m. It is expected that it will also be necessary to periodically adjust the range of target water levels in the event that longer term changes in groundwater levels occur as a result of future climate trends.
- Because the mitigation system reinfiltrates a large portion of the total pit / quarry inflows into the southwestern portion of the Site, the proposed system will mitigate the impact of dewatering to the west of the Main Area and the south and west of the South Area of the proposed pit / quarry operation.
- In the event that baseline aquifer water levels are established during typical conditions, then abnormally dry conditions occur during operations, aquifer water levels to naturally decline below established target levels, through no impact of the quarry. Therefore, it is suggested that during the detailed design a maximum portion of quarry inflows (for example 90%) be required for use of the mitigation system in the event of abnormally dry conditions.

## 6.3 Phasing of Implementation

Based on numerical simulations for Operational Phases 3 to 7 as described in Section 8 and Appendix Q of the Water Report (Golder, 2023), the groundwater mitigation system elements would be implemented in the following operational sequence.

- Phase 3 – Implementation of the slurry wall / grouting of the weathered bedrock zone on the west side of the Main Area prior to the start of Phase 3 extraction.
- Phases 4 and 5 – Implementation of the infiltration trench system (Trench Zones 1 and 2) on the west side of the Main Area prior to the start of Phase 4 and 5 extraction.
- Phase 6 and 7 – Implementation of the second slurry wall / grouting of the weathered bedrock zone and the second phase of the infiltration trench system (Trench Zones 4 to 6) prior to the start of Phase 6 and 7 extraction.

The Rehabilitation scenario includes the removal of the slurry wall in the overburden in the southwest corner of the South Area (adjacent to Trench Zones 4 and 5), in order to help restore the original hydraulic connection between the South Area and the lands to the south and southwest of the Site. The other slurry walls and the infiltration trenches would remain in place. The infiltration trench vaults would be decommissioned in place, but the water distribution piping would be removed.

A summary of the mitigation system elements that were simulated and are proposed to be implemented during pit / quarry operations is presented in Table 4.

**Table 4: Implementation Sequence of Groundwater Mitigation System Elements**

| Phase | Operational Year | Slurry Wall / Grout Zone | Infiltration Trench Zone / Constant Head (masl) |
|---|---|---|---|
| Phase 1 | 1 to 8 | N/A | N/A |
| Phase 2 | 9 to 13 | N/A | N/A |
| Phase 3 | 14 to 17 | West side of Main Area | N/A |
| Phase 4 | 18 to 22 | West side of Main Area | Trench Zone 1: 396.0<br>Trench Zone 2: 394.0 |
| Phase 5 | 23 to 26 | West side of Main Area | Trench Zone 1: 398.0<br>Trench Zone 2: 398.0 |
| Phase 6 | 27 to 32 | West side of Main Area<br>West and South side of South Area | Trench Zone 1: 396.0<br>Trench Zone 2: 394.0<br>Trench Zone 3: 393.5<br>Trench Zone 4: 393.0<br>Trench Zone 5: 392.0<br>Trench Zone 6: 394.0 |
| Phase 7 | 33 to 38 | West side of Main Area<br>West and South side of South Area | Trench Zone 1: 396.0<br>Trench Zone 2: 394.0<br>Trench Zone 3: 393.5<br>Trench Zone 4: 393.0<br>Trench Zone 5: 392.0<br>Trench Zone 6: 394.0 |
| Rehabilitation | Year 39+ | Slurry wall removed along Trench Zones 4 and 5 | N/A |

## 6.4 Estimated Pit / Quarry Inflows and Trench Infiltration Rates

Numerical simulations in HGS for each phase of pit / quarry operations with the proposed mitigation system elements in place (inflows presented in Table 5), in accordance with the implementation sequence noted above (Table 4). The estimated inflows by phase are also shown graphically on Figure 10.

**Table 5: Estimated Pit / Quarry Inflows**

| Phase | Period (years) | Forecast Year | Pit / Quarry Inflow – With Mitigation Trench (L/s) | | | |
|---|---|---|---|---|---|---|
| | | | Main Area | North Area | South Area | Total Inflow |
| 1 | 1 to 8 | 8 | 14.7 | 0.0 | n/a | 14.7 |
| 2 | 9 to 13 | 13 | 19.6 | 3.0 | n/a | 22.6 |
| 3 | 14 to 17 | 17 | 18.5 | 3.1 | n/a | 21.6 |
| 4 | 18 to 22 | 22 | 24.6 | 3.1 | n/a | 27.7 |
| 5 | 23 to 26 | 26 | 63.8 | 3.1 | n/a | 66.9 |
| 6 | 27 to 32 | 32 | 28.2 | 3.0 | 7.9 | 39.1 |
| 7 | 33 to 38 | 38 | 29.5 | 2.5 | 18.0 | 50.0 |

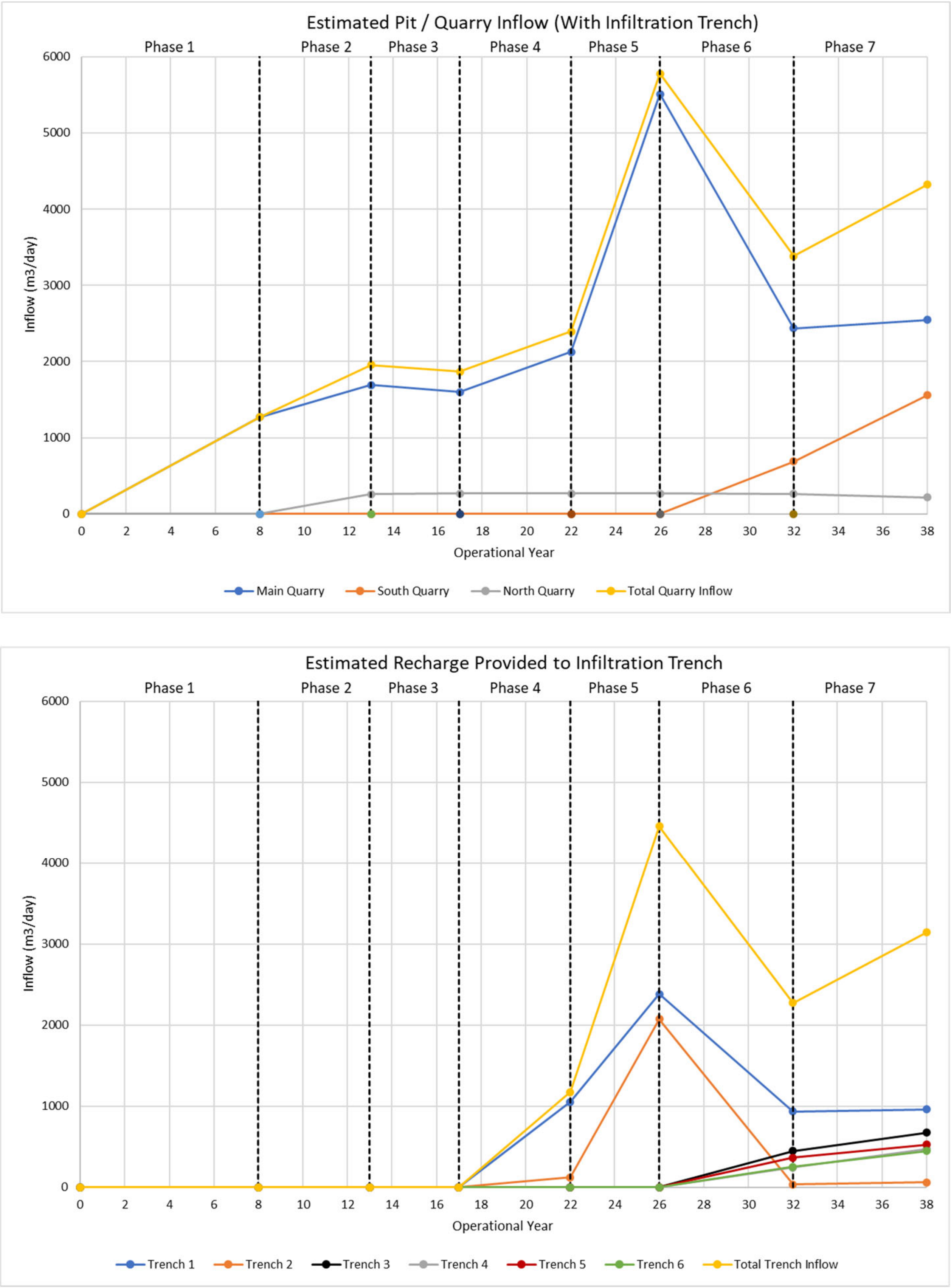
The HGS model simulations were also used to estimate the quantity of water required to maintain the groundwater tables at the target trench water levels, as summarized in Table 5, and shown graphically on Figure 10.

The simulations demonstrate that the volume of water required for the implementation of the groundwater mitigation system is less than the corresponding quarry inflows on an annual basis and the water balance presented in Appendix A of the Water Report Addendum (WSP 2025) shows that sufficient water throughout the year to operate the system, indicating that there will be sufficient water available from dewatering to operate the mitigation system throughout all phases of the pit / quarry.

Hydraulic conductivity estimates from field observations and HGS numerical simulations demonstrate that the weathered bedrock is sufficiently permeable (ranging from k = $1x10^{-3}$ m/s to k = 8 $x10^{-3}$ m/s), overlain by sand and gravel (k = 1 $x10^{-4}$ m/s) to receive the proposed groundwater inflow rates, given the size of the contact area within the trench that is available for infiltration.

**Table 6: Estimated Recharge Required to Infiltration Trench**

| Phase | Forecast Year | Recharge Required to Infiltration Trench (L/s) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Trench Zone 1 | Trench Zone 2 | Trench Zone 3 | Trench Zone 4 | Trench Zone 5 | Trench Zone 6 | Total Trench Recharge | Trench Flow Portion of Sump Inflow (%) |
| 1 | 8 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 2 | 13 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 3 | 17 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 4 | 22 | 12.2 | 1.4 | n/a | n/a | n/a | n/a | 13.6 | 49% |
| 5 | 26 | 27.6 | 24.0 | n/a | n/a | n/a | n/a | 51.6 | 77% |
| 6 | 32 | 10.8 | 0.4 | 5.2 | 2.8 | 4.2 | 2.9 | 26.3 | 67% |
| 7 | 38 | 11.1 | 0.7 | 7.8 | 5.5 | 6.1 | 5.2 | 36.4 | 73% |
| Max. infiltration rate (L/s): | | 26.7 | 24.0 | 7.8 | 5.5 | 6.1 | 5.2 | 51.6 | |



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CBM Aggregates, a division of St. Marys Cement Inc. (Canada)

PROJECT
**Caledon Pit / Quarry**
Groundwater Mitigation Design Report

CONSULTANT

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| PREPARED | PGM |
| DESIGN | PGM |
| REVIEW | GWS |
| APPROVED | GWS |

TITLE
**ESTIMATED PIT / QUARRY INFLOWS AND INFILTRATION RATES FOR PROPOSED MITIGATION SYSTEM**

| PROJECT No. | Rev. | FIG. |
|---|---|---|
| **19129150** | **A** | **10** |

## 6.5 Sensitivity to Hydraulic Barrier Performance

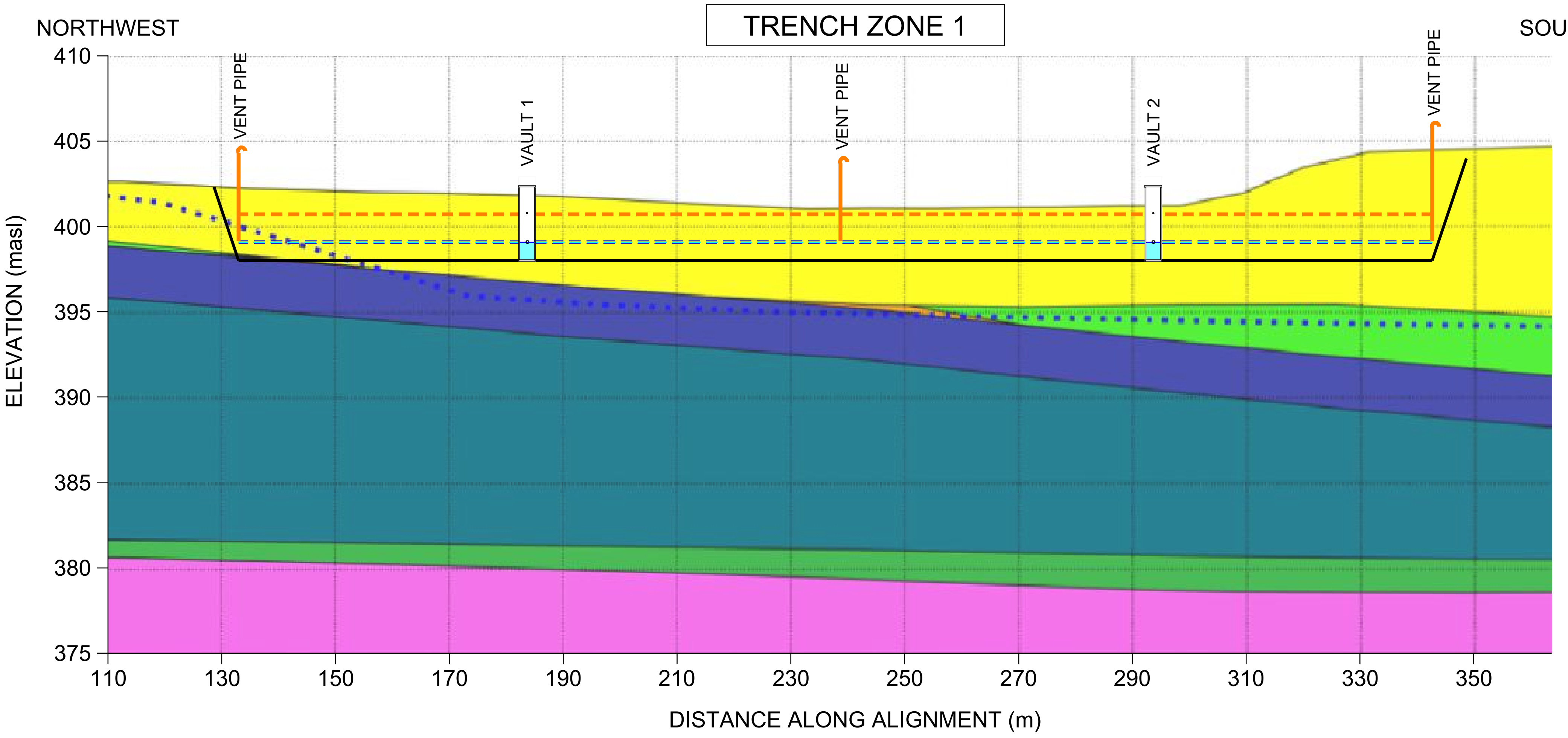
A sensitivity analysis was performed on predicted pit / quarry inflows by varying the hydraulic conductivity of the proposed hydraulic barrier by increasing and decreasing it by one order of magnitude for each of the operational phases (Appendix S, Golder 2023). The analysis showed that quarry inflows varied by <10% in response to the effective hydraulic conductivity of the barrier. With the inclusion of progressive rehabilitation in addition to the hydraulic barrier in the groundwater mitigation system, it is expected quarry inflows will be less sensitive to the performance of the hydraulic barrier.

## 6.6 Infiltration Trench Details

The details of the design of each zone of the infiltration trench are summarized in Table 7 and presented in Figure 11 to Figure 16. The trench zone bottom elevations are designed by selecting the highest elevation of highest point on the typical water table elevation, top of bedrock elevation, or 8.5 m below the highest topographic point in the trench footprint, as described in Section 6.1.

**Table 7: Infiltration Trench Zone Details**

| Trench Zone # | Chainage (m) | Base of Trench Design Elevation (masl) | Rationale | Trench Depth Range Below Ground Surface (m) | Trench Width Range (m) | Number of Vaults |
|---|---|---|---|---|---|---|
| 1 | 128.6 to 348.7 | 398 | Water Table and Top of Bedrock Elevation | 4 to 6 | 11 to 15 | 2 |
| 2 | 378.7 to 596.7 | 396.5 | Maximum Trench Depth | 5.5 to 8.5 | 14 to 20 | 1 |
| 3 | 640.1 to 974.8 | 394 | Water Table Elevation | 3 to 6 | 9 to 15 | 1 |
| 4 | 1100.0 to 1334.9 | 393 | Water Table Elevation | 4 to 7 | 11 to 17 | 1 |
| 5 | 1365.8 to 1634.5 | 392 | Water Table Elevation | 7 to 8 | 17 to 19 | 1 |
| 6 | 1664.5 to 1890.5 | 395 | Water Table Elevation | 3 to 4 | 9 to 11 | 1 |



APPROXIMATE DESIGN ELEVATIONS:

HORIZONTAL VENT 400.7
INFILTRATION PIPE 399.0
TRENCH BOTTOM 398.0

**GENERAL**

| | |
|---|---|
| 🟨 | Upper Sand |
| 🟩 | Till |
| 🟧 | Lower Sand / Channel Sediment |
| 🟦 | Weathered Bedrock |
| 🟦 | Gasport Formation (Dolostone) |
| 🟩 | Fossil Hill Formation (Shaley Dolostone) |
| 🟪 | Cabot Head Formation (Shale) |

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.
(CANADA).

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

CONSULTANT

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| YYYY-MM-DD | 2025-03-07 |
| DESIGNED | GWS |
| PREPARED | JPR |
| REVIEWED | PM |
| APPROVED | GWS |

TITLE
**TRENCH ZONE1**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
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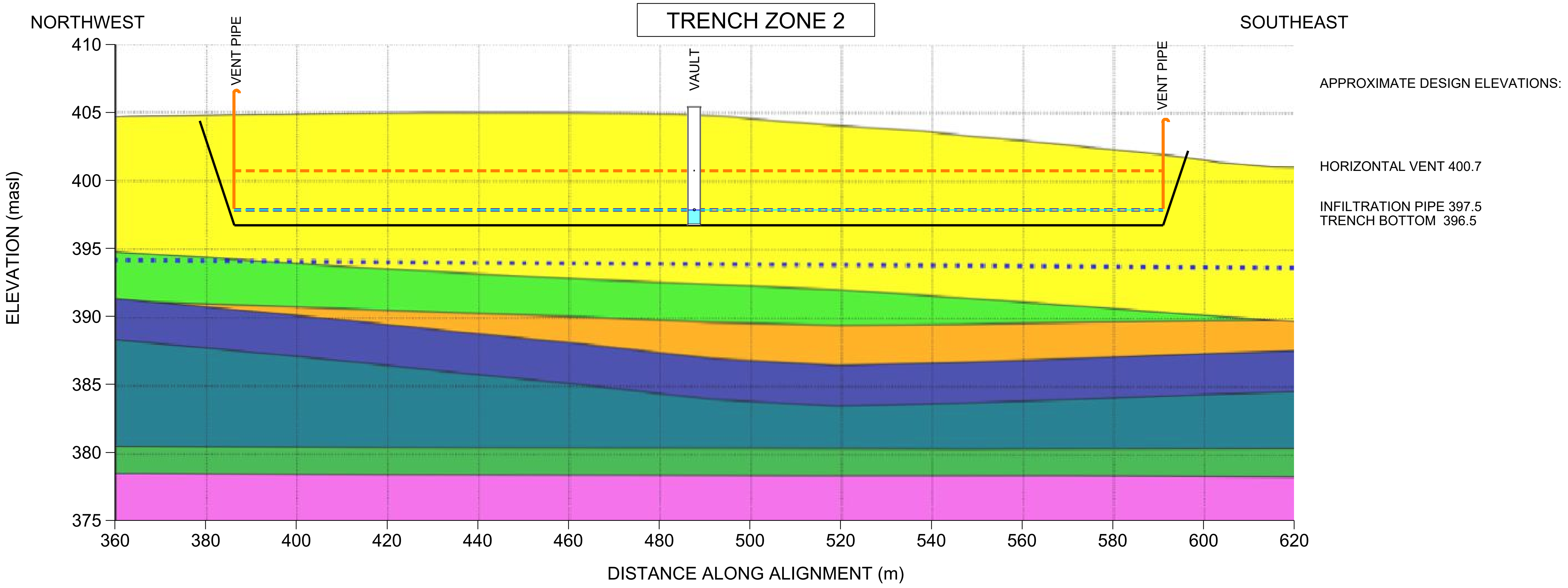

**GENERAL**

🟨 Upper Sand
🟩 Till
🟧 Lower Sand / Channel Sediment
🟦 Weathered Bedrock
🟦 Gasport Formation (Dolostone)
🟩 Fossil Hill Formation (Shaley Dolostone)
🟪 Cabot Head Formation (Shale)

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| PREPARED | JPR |
| REVIEWED | PM |
| APPROVED | GWS |

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

TITLE
**TRENCH ZONE2**

| PROJECT NO. | CONTROL | REV. | FIGURE |
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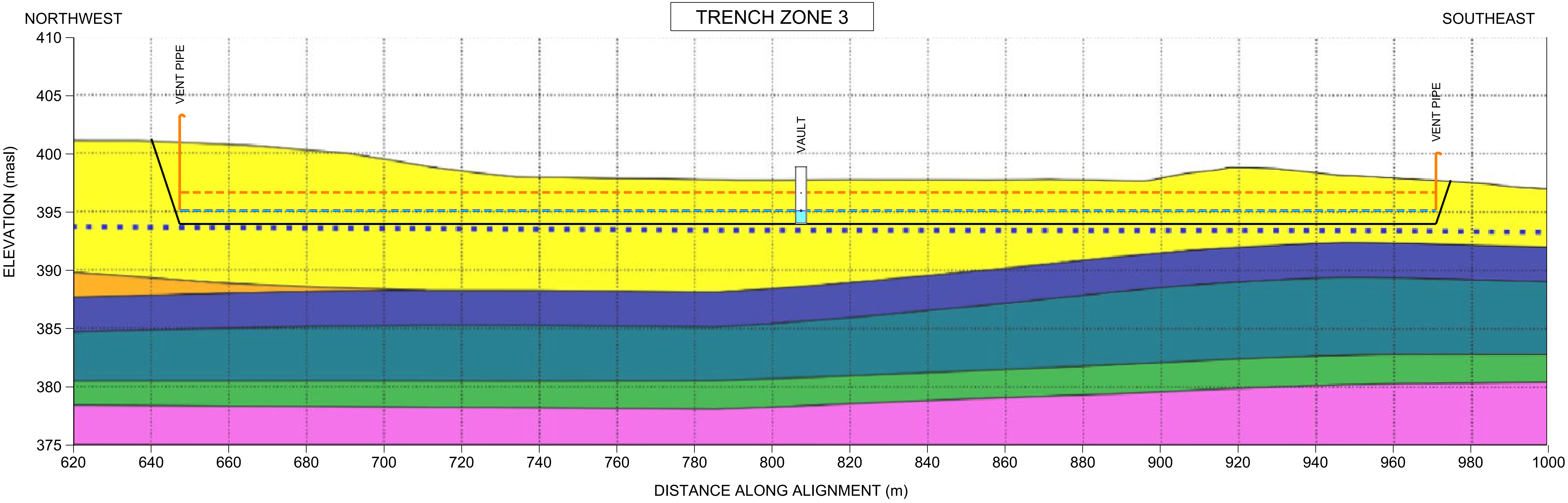
# TRENCH ZONE 3



APPROXIMATE DESIGN ELEVATIONS:

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|---|---|
| - - - - | HORIZONTAL VENT 396.7 |
| = = = = | INFILTRATION PIPE 395.0 |
| ——— | TRENCH BOTTOM 394.0 |

**GENERAL**

| | |
|---|---|
| 🟨 | Upper Sand |
| 🟩 | Till |
| 🟧 | Lower Sand / Channel Sediment |
| 🟦 | Weathered Bedrock |
| 🟦 | Gasport Formation (Dolostone) |
| 🟩 | Fossil Hill Formation (Shaley Dolostone) |
| 🟪 | Cabot Head Formation (Shale) |

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PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

CONSULTANT

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| YYYY-MM-DD | 2025-03-07 |
| DESIGNED | GWS |
| PREPARED | JPR |
| REVIEWED | PM |
| APPROVED | GWS |

TITLE
**TRENCH ZONE3**

| PROJECT NO. | CONTROL | REV. | FIGURE |
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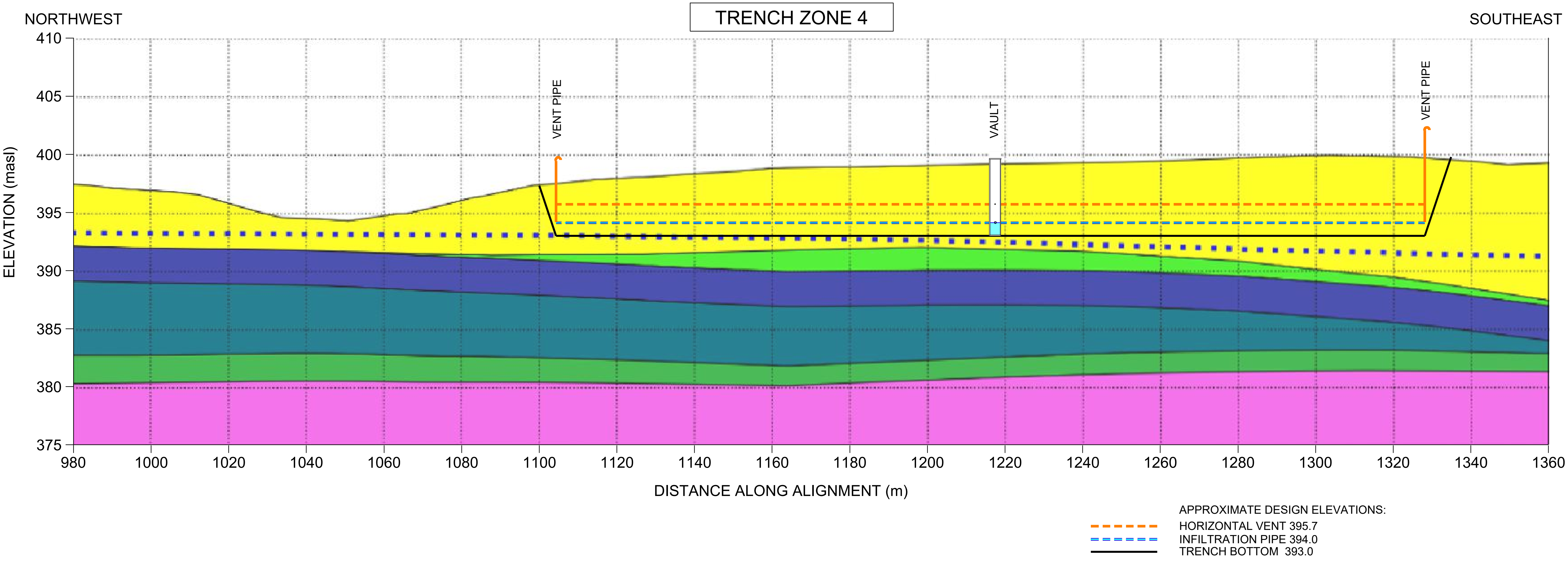

**GENERAL**

| | |
|---|---|
| 🟨 | Upper Sand |
| 🟩 | Till |
| 🟧 | Lower Sand / Channel Sediment |
| 🟦 | Weathered Bedrock |
| 🟦 | Gasport Formation (Dolostone) |
| 🟩 | Fossil Hill Formation (Shaley Dolostone) |
| 🟪 | Cabot Head Formation (Shale) |

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CONSULTANT
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| DESIGNED | GWS |
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| REVIEWED | PM |
| APPROVED | GWS |

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

TITLE
**TRENCH ZONE4**

| PROJECT NO. | CONTROL | REV. | FIGURE |
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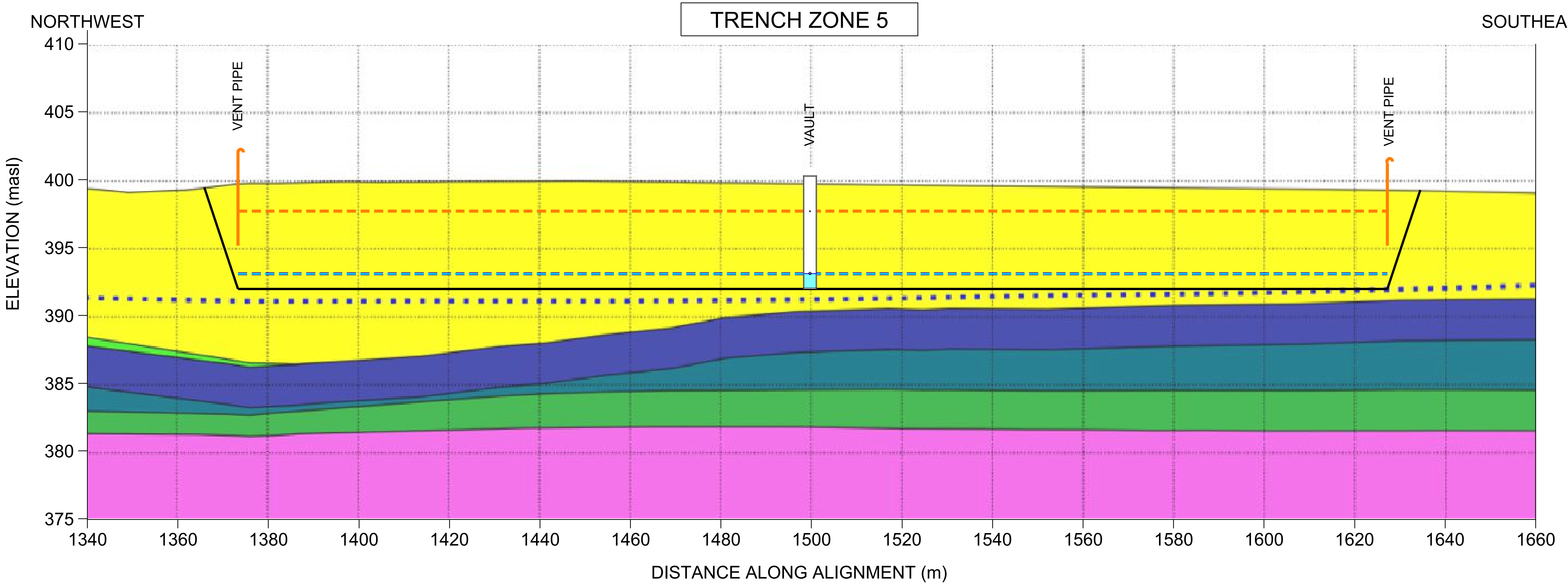
# TRENCH ZONE 5



APPROXIMATE DESIGN ELEVATIONS:
HORIZONTAL VENT 397.7
INFILTRATION PIPE 393.0
TRENCH BOTTOM 392.0

**GENERAL**

| | |
|---|---|
| 🟨 | Upper Sand |
| 🟩 | Till |
| 🟧 | Lower Sand / Channel Sediment |
| 🟦 | Weathered Bedrock |
| 🟦 | Gasport Formation (Dolostone) |
| 🟩 | Fossil Hill Formation (Shaley Dolostone) |
| 🟪 | Cabot Head Formation (Shale) |

0 25 50
1:1,000 METRES

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| APPROVED | GWS |

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

TITLE
**TRENCH ZONE5**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 19129150 | 0071 | | 15 |

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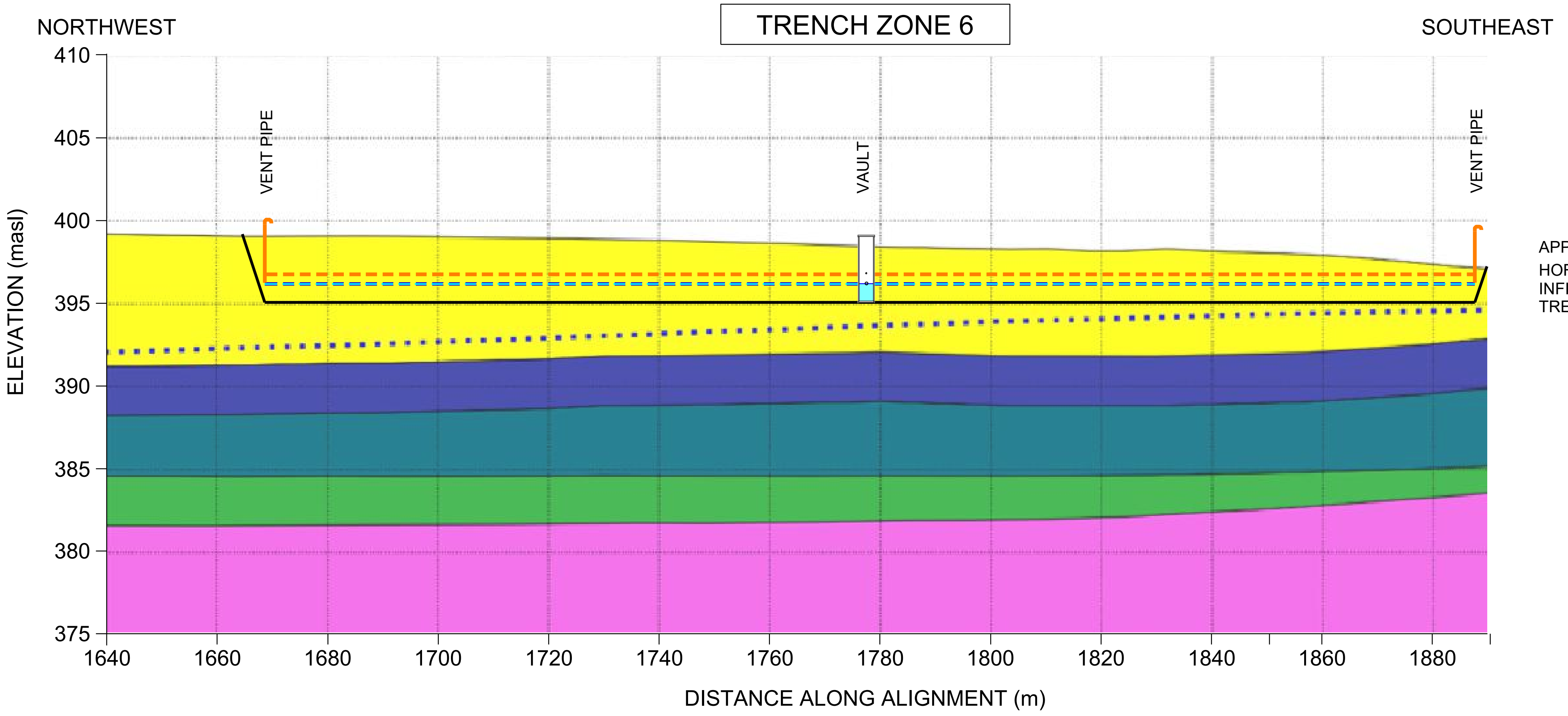

APPROXIMATE DESIGN ELEVATIONS:
HORIZONTAL VENT 396.7
INFILTRATION PIPE 396.0
TRENCH BOTTOM 395.0

**GENERAL**

🟨 Upper Sand
🟩 Till
🟧 Lower Sand / Channel Sediment
🟦 Weathered Bedrock
🟦 Gasport Formation (Dolostone)
🟩 Fossil Hill Formation (Shaley Dolostone)
🟪 Cabot Head Formation (Shale)

0 25 50
1:1,000 METRES

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CONSULTANT

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| YYYY-MM-DD | 2025-03-07 |
| DESIGNED | GWS |
| PREPARED | JPR |
| REVIEWED | PM |
| APPROVED | GWS |

PROJECT
CBM CALEDON PIT / QUARRY
GROUNDWATER MITIGATION DESIGN REPORT

TITLE
**TRENCH ZONE6**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 19129150 | 0071 | | 16 |

Trench zones vary in length from 220 m (Zone 1) to 335 m (Zone 3), in bottom depth below ground surface from 3.0 m (Zone 6) to 8.5 m (Zone 2), and correspondingly in top width from 9 to 20 m in width. Bottom elevations range from 393 masl (Zone 4) to 398 masl (Zone 1), based on the typical water table elevation (as predicted by the HGS model), except for Zone 2 where the maximum excavation depth (8.5 mbgs) was used to design the bottom elevation of the trench. The only exception to this design method occurs at the northern extent of Zone 1, where the predicted water table dips steeply (Figure 11). For Zone 1 a representative water table elevation (instead of the maximum water table elevation), which coincides with the expected top of bedrock, was selected as the designed bottom elevation of the trench zone.

Following the collection of detailed baseline groundwater level monitoring data along the mitigation system alignment, final design elevations will be established for each zone, following the same method described in Section 6.1.

Each trench zone is supplied by one Infiltration Vault placed in the center of the alignment, except for Zone 1 which is supplied by two Infiltration Vaults, due to the higher expected infiltration rates in this trench zone. As shown in Figure 11 to Figure 16, air vents are installed in the trench vertically, at the greatest distances from the infiltration vaults and horizontally at 1 m below the top of the backfill material.

## 6.7 Hydraulic Barrier Details

As initially described in Golder (2023) Appendix S, a hydraulic barrier will be constructed in the setback area through the sand and gravel overburden and into the upper weathered zone of the bedrock. The barrier will be constructed between the infiltration trench alignment and the extraction limit, approximately 10 m from the extraction limit, and approximately 27 m from the centerline of the infiltration trench, as shown on Figure 7. The hydraulic barrier will consist of two components: constructing a slurry wall through the overburden and keyed into competent bedrock and (if required) grouting the weathered zone in the upper bedrock on the same alignment.

The target hydraulic conductivity (k) of the hydraulic barrier created by the slurry wall and grout zone within the overburden and weathered bedrock is $1\text{x}10^{-7}$ m/s. This k value was used for HGS numerical simulations to represent the hydraulic barrier zones in operational scenarios with the groundwater mitigation system in place.

A number of construction methods were initially evaluated and from that, two slurry wall construction technologies emerged as the most suitable for the proposed hydraulic barrier at the site: in-situ soil mixing by one-pass trenching (OPT) to create a soil-bentonite (SB) barrier; and a self-hardening cement-bentonite (CB) slurry wall constructed by traditional excavation methods.

### 6.7.1 Soil Mixing by One-Pass Trenching (OPT)

One-Pass Trenching (OPT) technology is an in-situ soil mixing technique (DeWind, 2025). OPT soil mixing implements a high-speed, high-torque mixing chain to homogenize in-situ soils with a prescribed proportion of bentonite (Figure 17). The resultant soil-bentonite barrier wall can be constructed to meet the hydraulic conductivity objective of the project.

If this approach is selected, the hydraulic barrier wall would be installed with a DeWind MT1600 One-Pass Trencher, capable of reaching a maximum 22 m depth and operating with 2,000 horsepower. This trencher produces 800,000 lb-ft of torque and has digging chain speeds of up to 4 m/s. The process typically uses a maximum operational vertical boom stroke of 3 m, depending on the length of the boom and the amount of leverage the trencher exerts on the boom (DeWind, 2025).

**Figure 17: One-Pass Trenching Method a) Digging box. b) Stick (pivot) cylinders. c) Lift (stroke) cylinders. d) Boom. e) Water supply line. f) Digging/mixing chain. g) Drag Box. h) Cab. i) Tracks. j) Counterweight (DeWind, 2025).**

The OPT method also has the potential to reduce the permeability of the weathered upper bedrock zone without the need for additional grouting of the bedrock. Because it does not require the use of slurry to hold the trench walls open, an in-situ soil-bentonite mixture is constantly maintained within a 10 to 20 cm “slump”. This low-slump mixture enables slurry loss into bedrock fractures to be gradual, allowing time to place more trenching spoils on the working pad to “top off” the trench volume as soil-bentonite mixture slowly fills in top-of-rock fracture pathways. The soil-bentonite mixture will typically fill in fractures due to the weight/pressure of the 6 to 18 m of soil-bentonite mixture above them, which is an intrinsic benefit of selecting the barrier wall installation method in these circumstances.

### 6.7.2 Self-Hardening Cement-Bentonite (CB) Slurry Wall

First constructed in the 1970’s, self-hardening CB (Cement-bentonite) slurry walls are a common barrier wall choice in North America, Europe and other international locales (Geo-Solutions, 2025). In this method, the wall is excavated through a slurry that typically consists of water, bentonite, cement, and occasionally other additives (Figure 18). The trench slurry hardens in place, normally overnight. The hardened CB slurry serves as the final barrier wall. Cement-bentonite installations do not require a separate backfilling operation and it’s for this reason that this technique is sometimes referred to as one-step slurry wall construction.

**Figure 18: Self-Hardening CB (Cement-Bentonite) Slurry Wall Method (Geo-Solutions, 2025)**

The CB wall method is advantageous over conventional slurry walls where there is limited access or narrow work zones because of the smaller equipment footprint. Since CB slurry is heavier than bentonite slurry and self-hardens, this method can provide improved trench stability and more easily overcome weaker ground conditions, and variable topography. Since the slurry sets after ~1 day, overlapping segments can be constructed in any direction or order to form a continuous barrier. Segments can be used to traverse up or down moderate slopes (5 to 15%) with minimal earthwork construction. Cement-bentonite walls can also be readily constructed through relatively permeable ground.

The CB walls are excavated using a hydraulic excavator and/or clamshell excavation equipment, the same equipment used for other slurry walls. At the slurry plant, cement, or some other setting agent, is added to the bentonite slurry. The viscosity of the mixed slurry is designed to be in the fluid range during the excavation process. The slurry is then pumped from the mix plant to the excavation. Once the excavation is to full depth, the bottom is “cleaned”, and the process moves on. The slurry stays in the trench and is allowed to set. Typical CB slurry will attain a butter-like consistency overnight and a clay-like consistency after fully curing.

Cement-bentonite walls typically pair well with underlying bedrock grouting from an installation standpoint. With a CB wall approach, the slurry wall can be installed first, which allows for a full profiling along the entire trench of the bedrock interface so when bedrock grouting begins, the start and stop depths are already defined. Secondly, if the CB wall is already in place prior to grouting, when the grouting holes are drilled, it’s possible to drill them uncased through the CB wall, which saves significant grouting costs. Most importantly, the CB wall installation may also eliminate the need for additional grouting, as a portion of the CB slurry is expected to enter into and seal some fractures in the upper bedrock zone when it is initially emplaced in the excavation.

### 6.7.3 Grouting the Upper Weathered Bedrock Zone

Based on the hydrogeologic and geologic data obtained in the spring of 2024, the results of previous site investigations along the proposed hydraulic barrier alignment, and opinions provided by expert contractors (DeWinde 2025; Geo-Solutions, 2025), grouting of the upper weathered bedrock zone, while practical, is a costly approach to treating a relatively small zone of weathered rock.

As noted above, both the OPT SB slurry wall and the traditional CB slurry wall can be constructed in a manner that inherently reduces the permeability of the upper bedrock and both are likely to achieve the intended result of reducing water inflows, without the need for additional grouting. It is therefore recommended that the decision to perform additional grouting of the bedrock be made once the slurry walls have been constructed, as the slurry wall construction in itself will provide additional information on subsurface conditions and further inform the decision-making process. If ground conditions are conducive to the hydraulic barrier being keyed into competent bedrock, grouting can be omitted from the construction of the mitigation system. If grouting is selected, it would typically be carried out in the following general steps.

- Drilling through the completed SB or CB wall (2 m min, 16 m max, 8.4 m average), through the "weathered" rock (about 3 m in thickness) and into the underlying bedrock about 1.5 m.
- Drill primary and secondary boring pairs on a 3 m spacing for a final spacing of 1.5 m. A 25% allowance should be made for higher-order borings, to be located based on observed grout takes in the field (to provide additional treatment to "problem" areas).
- Upstage grouting with traditional balanced / stable cementitious grouts. Grouts can be varied in viscosity to suit the rock condition and observed takes.
- Packer grout in ~3 m stages. Grout each stage to effective refusal.
- Option to conduct water pressure testing and / or coring to verify grouting placement / performance.

### 6.7.4 Summary

The hydrogeologic and geologic data obtained in the spring of 2024 from the drilling and testing of monitoring wells nests MW-IT-01 to MW-IT-07 and the results of previous site investigations along the proposed hydraulic barrier alignment, indicates that both the OPT SB wall and one-step CB wall construction methods are viable for the slurry wall / hydraulic barrier at the proposed pit / quarry, and are also both likely to reduce the permeability of the weathered upper bedrock zone sufficiently to negate the need for additional grouting.

## 6.8 Water Storage and Distribution System

Water collected from pit / quarry sumps during operational Phases 1 to 7 will be conveyed to the Settling Pond (described in Section 6.8.1) located in the North Area, where it will be stored until it is needed to supply the proposed groundwater mitigation system or surplus water is discharged off-site to the Golf Course irrigation system. The mitigation system will distribute water in two main phases: supplying water from the Settling Pond to the Gravity Reservoirs (described in Section 6.8.2) and from the Gravity Reservoirs to the Infiltration Vaults (described in Section 6.8.3).

### 6.8.1 Settling Pond, Intake, and Outlets

The proposed Settling Pond (Figure 6) is approximately 8,900 $m^2$ in size and rectangular in shape (180 m x 540 m) with an average depth of 4.5 m, and a planned water storage capacity of approximately 40,000 $m^3$. Run-off and groundwater seepage collected in the pit / quarry sumps will be collected and discharged to the Settling Pond via an inlet structure located on the west side of the pond. Both a submerged and non-submerged inlet structure will be evaluated at the detailed design stage, and the preferred intake option selected for implementation. Suspended particles will be allowed to settle in the forebay of the pond, before exiting the forebay via conveyance pipes and entering the main area of the pond. The main area of the pond comprises a permanent pool (lower portion of the water column) and an active storage zone (upper portion of the water column).

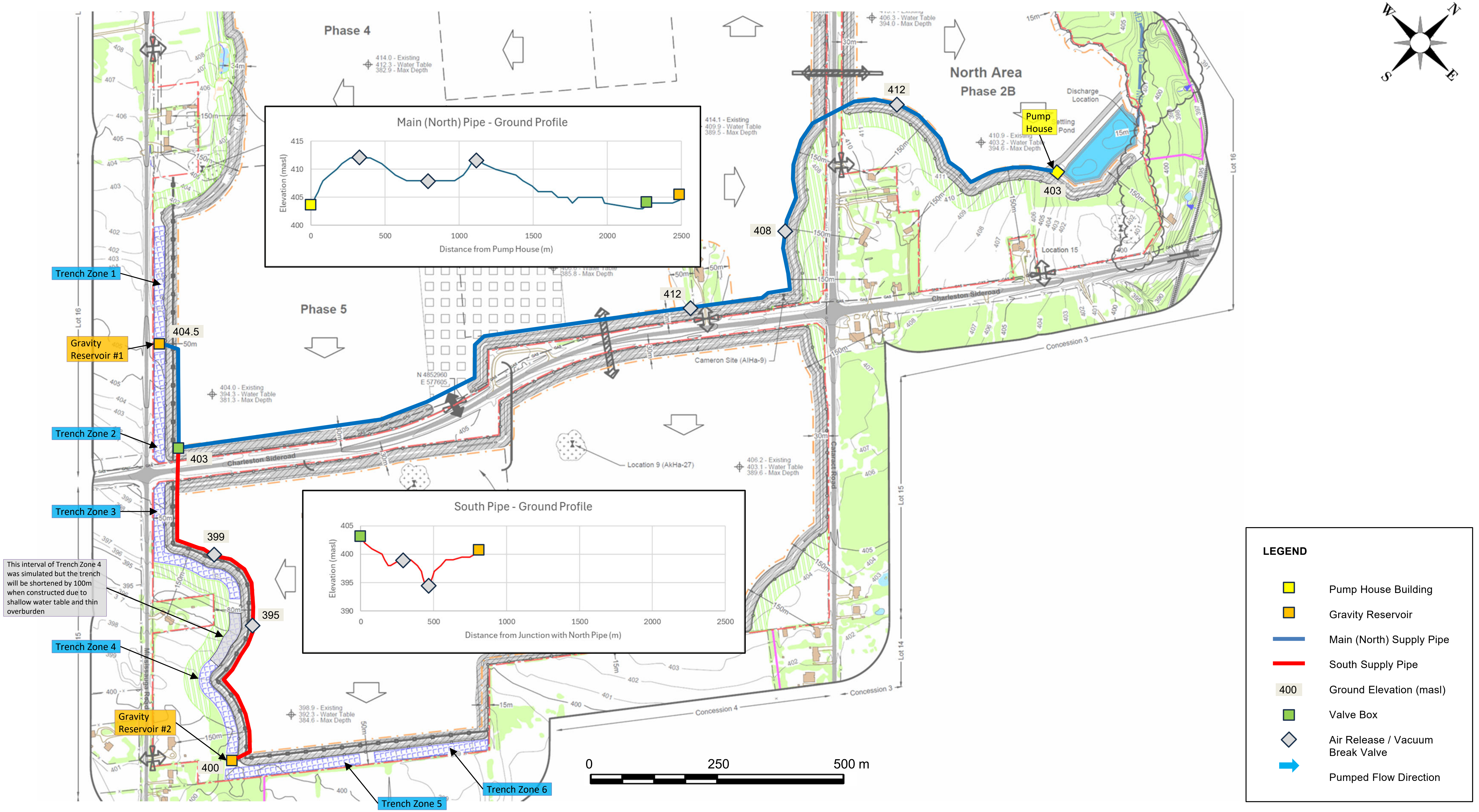
The design of the Settling Pond will be consistent in the approach recommended in the Stormwater Management Planning and Design Manual (MOE, 2003). The forebay's length-to-width ratio will be optimized to maximize the settling of particles, the forebay will be sized to ensure non-erosive velocities exit the forebay, and the forebay's size will not exceed 33% of the size and 20% of the volume of the permanent pool. If required, the main area of the pond may be constructed with low flow berming to extend the flow path of the water through the pond. The large size and volume of the settling pond, together with the use of berming (if needed) in its detailed design will ensure that a minimum detention time of at least 24 hours can be met for inflow rates that will readily accommodate anticipated maximum steady flows rates predicted for Phase 5 of operation (i.e. 66.9 L/s, Table 5), as well as higher short term peak inflows associated with spring melt and storm events.

Water to supply the groundwater mitigation system will be drawn from an outlet at the south end of the pond through a submerged woven wire mesh screen into a pipe connected to a concrete chamber beneath the pump house, from which it will be pumped to the mitigation system as needed. The screen area and outlet pipe diameter will be sized to meet the maximum inflow rate needed to supply water to the pump house for distribution to the groundwater mitigation system.

Water to be directed off-site to the golf course will be drawn from a second outlet at the north end of the pond using a reverse sloped pipe outlet configuration, passing through a submerged woven wire mesh screen into a pipe which will convey water to a concrete chamber and then by gravity through a buried pipeline to the golf course. The screen area and outlet pipe diameter will be sized to ensure the unfettered flow of water by gravity to the golf course irrigation system both during pit / quarry operation, and upon rehabilitation. As this outlet will remain operational upon rehabilitation when the settling pond will be naturalized, the screen will be sized to meet Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO, 1995).

### 6.8.2 Supply to Gravity Reservoirs

Water to supply the proposed groundwater mitigation system, when needed, will be pumped from the Settling Pond via buried pipelines to two reservoirs (Gravity Reservoir #1 in the Main Area and Gravity Reservoir #2 in the South Area) located proximal to the infiltration trench system (Trench Zones 1 – 2 in the Main Area and Trench Zones 3 – 6 in the South Area). The overall distance of conveyance from the Pump House to each gravity reservoir is approximately 2,500 m and 3,300 m, respectively, as shown on Figure 19.



NOTES

1. This figure is to be read in conjunction with the accompanying report.
2. Base drawing prepared by MHBC Planning [8816AF – Site Plan.dwg].
3. Ground elevations and locations are approximate.
4. Road crossings of the supply pipe will be constructed by directional drilling.

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| YYYY-MM-DD | 2025-03-08 |
| PREPARED | GWS |
| DESIGN | PGM / LS / GWS |
| REVIEW | LS |
| APPROVED | FSB |

PROJECT
**Caledon Pit / Quarry**
Groundwater Mitigation System Design Report

TITLE
**LAYOUT OF WATER DISTRIBUTION SYSTEM TO SUPPLY PROPOSED GRAVITY RESERVOIRS**

PROJECT No. 19129150
Rev. A
FIG. 19

#### 6.8.2.1 Flows

The anticipated flows to be pumped from the settling pond to each of the gravity reservoirs are summarized below in Table 8. Flows from the Settling Pond to Gravity Reservoir 1 peak during Phase 5 of operations, with an average anticipated flow of 4,458 $m^3$, prior to the construction of Gravity Reservoir 2. Peak flow from the Settling Pond to Gravity Reservoir 2 occurs during Phase 7, with an anticipated average rate of 2,125 $m^3$ in a 24-hour period, while Gravity Reservoir 1 simultaneously receives 1,020 $m^3$. Design calculations considered operational flexibility and seasonal variations to estimate the maximum flow rates that may be required, as high as 6,687 $m^3$ per 24-hour period, for Gravity Reservoir 1 and 3,188 $m^3$ per 24-hour period, for Gravity Reservoir 2.

**Table 8: Anticipated Flows to the Gravity Reservoirs**

| Flow Consideration | Gravity Reservoir #1 ($m^3$/24 hrs) | Gravity Reservoir #2 ($m^3$/24 hrs) |
|---|---|---|
| Average | 1,905 | 1,715 |
| Maximum | 6,687 | 3,188 |
| Minimum | 484 | 652 |

#### 6.8.2.2 System Description

Overall, the system will include the following main components:

- Pumping station;
- Piping; and
- Gravity reservoir.

Each of the above is described separately in the sections that follow.

### Pumping Station

The pumping station is envisioned to be a small building (~10 x 10 m in size) which houses the mechanical, electrical and instrumentation equipment required to transfer water from the settling pond and direct it through the conveyance pipe.

The pump station is anticipated to include:

- Intake piping with screen;
- Pump system and controls; and
- Pre-treatment as may be required.

Intake pipe with screen

The intake pipe will draw water from the settling pond. The pipe will project into the pond and be supported through its length. The pipe will be sized to ensure peak flows can reach the pipes with minimal pressure loss through the pipe. At the intake to the pipe a mechanical screening system will be provided to ensure large debris is not directed to the pumps.

Pump system and controls

Two pumps with Variable Frequency Drives (VFDs) will be provided. The pumps will be operated in a duty/standby configuration and will alternate which pump is duty. The VFDs will allow flow discharged to the gravity reservoirs to vary as needed by operations. The discharge from the pumps will be monitored using a magnetic flow meter. Pressure indicator and pressure transmitter on the pump discharge will be provided to monitor the pressure and provide alarms should the pressure be higher (blockage) or lower (line leak) than typical.

Pre-treatment as required

Depending on water quality results from the settling pond, additional treatment may be provided prior to or following the pump system. Treatment systems may include particulate removal and/or disinfection. This is discussed further in Section 6.9.

### *Piping*

The force main to supply the Gravity Reservoirs will be composed of 300 mm HDPE, as depicted in Figure 7. The piping to Gravity Reservoir #1 and Gravity Reservoir #2 will have a main common pipe (North Pipe) for approximately 2,300 m and then a valve box will be provided where flow can be directed to one or both of the gravity reservoirs. The distance of pipe from the valve box to Gravity Reservoir #1 is approximately 200m and the distance from the valve box to Gravity Reservoir #2 (South Pipe) is approximately 800m.

The pipe will be buried below the frost depth (typically 1.7 mbgs) and hence no piping insulation will be required. To minimize pressure losses through the pipe, all bends will use as large a radius as possible. At two points along the piping route, directional drilling will be used to have the pipe go under public roads. With the exception of these two locations, the pipe will be buried at the toe of the berm on the inside property slope of the berm. A permitter access road will allow for pipe installation and maintenance.

Figure 19 provides a surface elevation profile for the Main (North) pipe to Gravity Reservoir #1 and the South pipe to Gravity Reservoir #2. The profile can be flattened to a certain degree based on how the pipe is placed in the ground; however, it is noted that there will still be high and low points within the piping layout. To prevent air pockets from inhibiting flow and potentially siphoning of water to occur at the discharge, air release and/or vacuum break valves will be provided as required. A number of potential locations for these valves and hence the chambers in which they will be contained are indicated in Figure 19. The perimeter access road will be used for the monitoring and maintaining of these valves. The number and exact location of the valves will be determined when transient analysis is done on the pumping and piping system. A transient analysis is a modelling exercise that can determine and then minimize the pressure waves (water hammer) generated by pumping starting/stopping, valves opening/closing and where air or vacuums may be generated.

The valve box located at the junction of Main pipe and South pipe will include electrically actuated valves that will direct flow to one or both of the gravity reservoirs.

### *Gravity Reservoirs*

Discharge from the piping system into the gravity reservoirs will be through an open discharge pipe. To optimize the number of pump cycles and the duration of pump cycles, Gravity Reservoir 1 will be a minimum of 100 $m^3$ and Gravity Reservoir 2 will be minimum of 50 $m^3$. To prevent siphoning of water from pipe when the pumps are turned off, the reservoirs will be raised and/or discharges into the reservoirs will be elevated. Floats within the reservoirs will be used to indicate low and high levels and will provide indications to the control system when flow to the reservoir can begin and when it should stop.

#### 6.8.2.3 Process Control

A control system is required to determine when:

- The duty pump should start and stop;
- The duty pump should switch to standby;
- The pump VFD setting should change; and
- Which valve(s) in the valve box should be open.

It is noted that the control system will permit the above features be done manually or done automatically using a control logic program.

In addition to the above, the control system will provide operators an indication of when a system has gone into a warning or alarm state and attention is needed.

In general, pumping will start, when:

- One or both of the Gravity Reservoirs low level floats indicate water should be directed to the reservoir; and
- The appropriate valves in the valve box are open.

The duration of the pumping cycle is controlled by either:

- High level float position in the reservoir (filled / not filled); or
- Volume of water directed to the reservoir(s).

Typically, the high level float in the reservoir will stop the pump; however, should the volume to the reservoir be higher than anticipated as calculated by the pump discharge flow meter, the pump may turn off. This would be a safety feature in the case of float failure.

By changing the speed of the pump motor, the VFD can trim flows to account for the difference in pumping to Gravity Reservoir #1 versus pumping to Gravity Reservoir #2 and to accommodate the flow requirements during minimum flow and maximum flow conditions. In addition, through the use of the VFD, it will ensure that the number of pump starts and stops per hour do not exceed pump specifications.

### 6.8.3 Supply to Infiltration Vaults

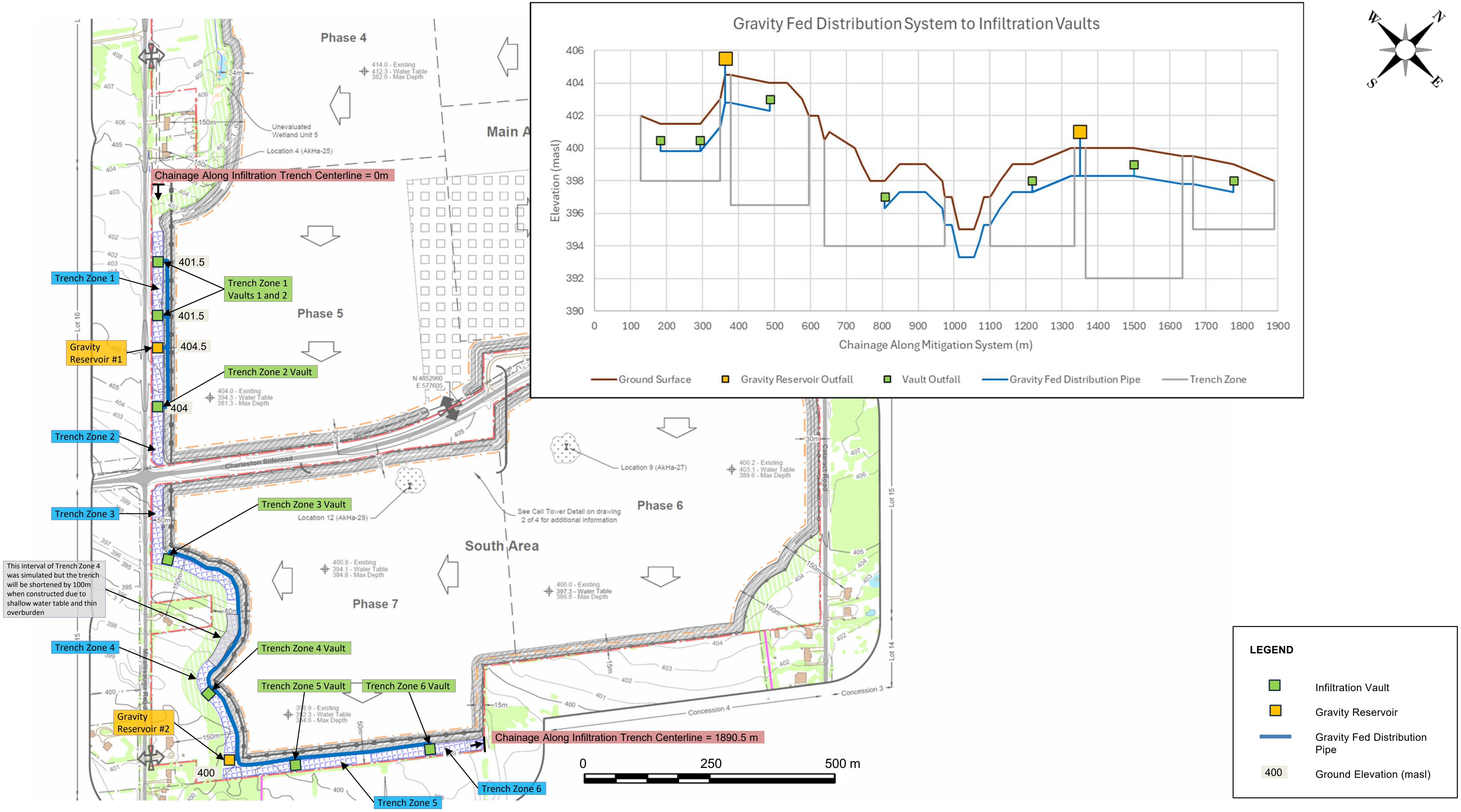
A distribution system will supply the infiltration vaults from the gravity reservoirs, as shown on Figure 20.

#### 6.8.3.1 Flows

Flows directed to each infiltration trench zone during each operational phase are described in Section 6.4 and summarized in Table 5. Table 9 includes a summary of the flow rates to each infiltration vault. The typical flows to each infiltration vault are designed based on these estimates averaged over the service life of each vault. To design the water supply system (principally pipe sizing) a flow equal to 150% of the maximum flow rate (for any operational phase described in Section 6.4) was considered to ensure operational flexibility of the system. (For example, if more water than anticipated is required the distribution system will be capable of meeting the requirement.)

**Table 9: Infiltration Vault Flow Rate Summary**

| Trench # | Vault # | Ground Surface (masl) | Vault Chainage (m) | Typical Designed Flow ($m^3$/24 hrs) | Max Designed Flow ($m^3$/24 hrs) | Supplied by Gravity Reservoir # |
|---|---|---|---|---|---|---|
| 1 | 1 | 401.5 | 184 | 666 | 1,788 | 1 |
| 1 | 2 | 401.5 | 294 | 666 | 1,788 | 1 |
| 2 | 1 | 404 | 488 | 572 | 3,110 | 1 |
| 3 | 1 | 398 | 807 | 562 | 1,011 | 2 |
| 4 | 1 | 399 | 1,217 | 359 | 713 | 2 |
| 5 | 1 | 400 | 1,500 | 445 | 791 | 2 |
| 6 | 1 | 399 | 1,778 | 350 | 674 | 2 |



NOTES

1. This figure is to be read in conjunction with the accompanying report.
2. Base drawing prepared by MHBC Planning [8816AF – Site Plan.dwg].
3. Ground elevations and locations are approximate.
4. Road crossings of the supply pipe will be constructed by directional drilling.

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PROJECT
**Caledon Pit / Quarry**
Groundwater Mitigation System Design Report

CONSULTANT
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| YYYY-MM-DD | 2025-03-08 |
| PREPARED | GWS |
| DESIGN | PGM / LS / GWS |
| REVIEW | LS |
| APPROVED | FSB |

TITLE
**LAYOUT OF WATER DISTRIBUTION SYSTEM TO SUPPLY PROPOSED INFILTRATION VAULTS AND INFILTRATION TRENCH ZONES**

| PROJECT No. | Rev. | FIG. |
|---|---|---|
| 19129150 | A | 20 |

### 6.8.3.2 System Description

#### Gravity Reservoirs

Gravity reservoirs, as described in Section 6.8.2.2, receive and store water pumped from the Settling Pond and supply it to the infiltration vaults. The gravity reservoirs will have dedicated outlets for each supply pipe to each infiltration vault approximately 1 m above ground surface at each location (Gravity Reservoir 1 at 405.5 masl and Gravity Reservoir 2 at 401 masl). The hydraulic head at the gravity reservoirs will pressurize the system when operating to distribute water without pumping from the gravity reservoirs to the infiltration vaults.

#### Piping

The gravity fed distribution system will include a dedicated 200 mm HDPE pipe for each infiltration vault from a gravity reservoir. The pipe to supply the infiltration vault will be buried below the frost depth (typically 1.7 mbgs) and hence no piping insulation will be required. To minimize pressure losses through the pipe, all bends will use as large a radius as practical. The distribution pipe will be constructed with appropriately spaced clean-outs and pressure flushing ports to allow maintenance on the pipe, as needed. The elevation head at each end of the pipe and the length of pipe to supply each infiltration vault are summarized in Table 10.

**Table 10: Infiltration Vault Supply Pipe Length Summary**

| Supplied by Gravity Reservoir # | Gravity Reservoir Outlet Elevation (masl) | Trench # | Vault # | Outfall Elevation (masl) | Pipe Length (m) |
|---|---|---|---|---|---|
| 1 | 405.5 | 1 | 1 | 400.5 | 204 |
| 1 | 405.5 | 1 | 2 | 400.5 | 94 |
| 1 | 405.5 | 2 | 1 | 403.0 | 148 |
| 2 | 401.0 | 3 | 1 | 397.0 | 567 |
| 2 | 401.0 | 4 | 1 | 398.0 | 157 |
| 2 | 401.0 | 5 | 1 | 399.0 | 174 |
| 2 | 401.0 | 6 | 1 | 398.0 | 451 |

#### Infiltration Vaults

The water discharged to the infiltration vaults would be supplied by the distribution pipe, enter the infiltration vault, and free fall to the sump in the vault, as shown in Figure 8. When water levels in the sump reach the level of infiltration pipes, water then flows out into the infiltration pipe, out of the perforations in the pipe and into the infiltration trench.

### 6.8.3.3 Process Control

A control system is required to:

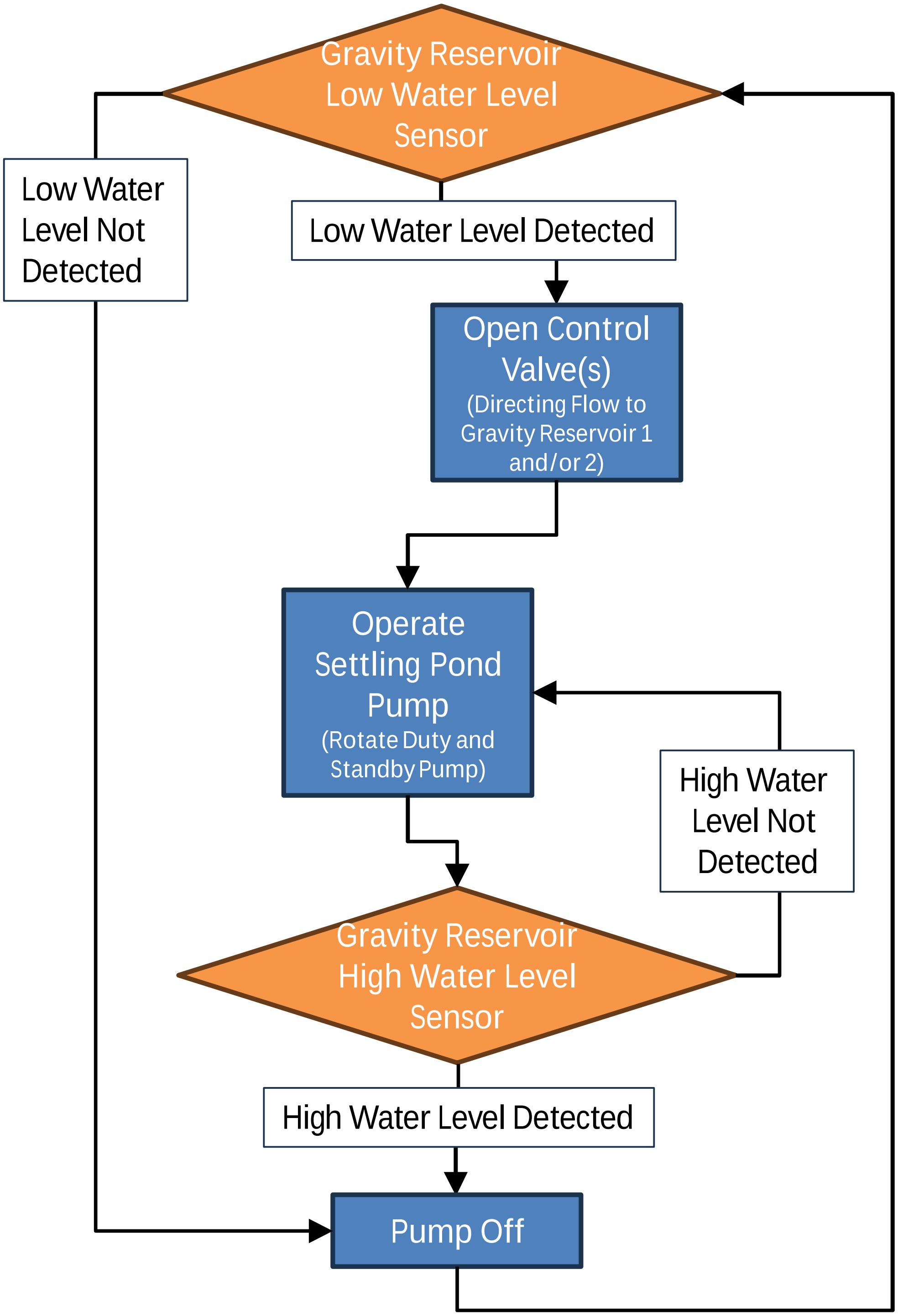
- Document volume of water supplied to each infiltration vault;
- Ensure maximum elevations are not exceeded in each infiltration vault; and

- Operate which valve(s) should be open.

Schematics flow charts of the process controls for supply to the gravity reservoirs is shown on Figure 21 and for supply to the infiltration vaults on Figure 22. In general, the gravity reservoirs will be supplied from the pump station at the settling pond, when a low water level is observed in a gravity reservoir and stopped when a high level is detected. The gravity distribution system will operate using inline flow meters installed in each pipe feeding an infiltration vault to provide a specified quantity of water to each infiltration vault each day with a high-water level sensor to ensure vaults are not overfilled. Once the specified volume of water has been supplied to the infiltration vault, the isolation gate will remain closed until the following day.

The quantity of water will initially be specified based on the expected amount of recharge required to maintain groundwater levels within their natural pre-extraction variations and adjusted based on observed water levels in the monitoring wells. These adjustments can be made using manual water level measurements and logger downloads at the monitoring wells or using a real-time water level monitoring system to inform system operation. Each infiltration vault will be equipped with a high-level float to indicate water supply to the infiltration vault should be stopped.

It is noted that the control system will permit the above features be done manually or done automatically using a control logic program (e.g. SCADA system). In addition to the above, the control system will provide operators an indication of when the system has gone into a warning or alarm state and attention is needed.



Notes:
Figure to be read with accompanying report.
Control logic presented is applied simultaneously at Gravity Reservoir 1 and 2 and at 7 infiltration vaults.
Control system to evaluate Gravity Reservoir Low Water Level Float and Infiltration Vault Flow Totalizer Volume at specified frequency to initiate control logic.

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PROJECT
**Caledon Pit / Quarry**
Groundwater Mitigation Design Report

CONSULTANT

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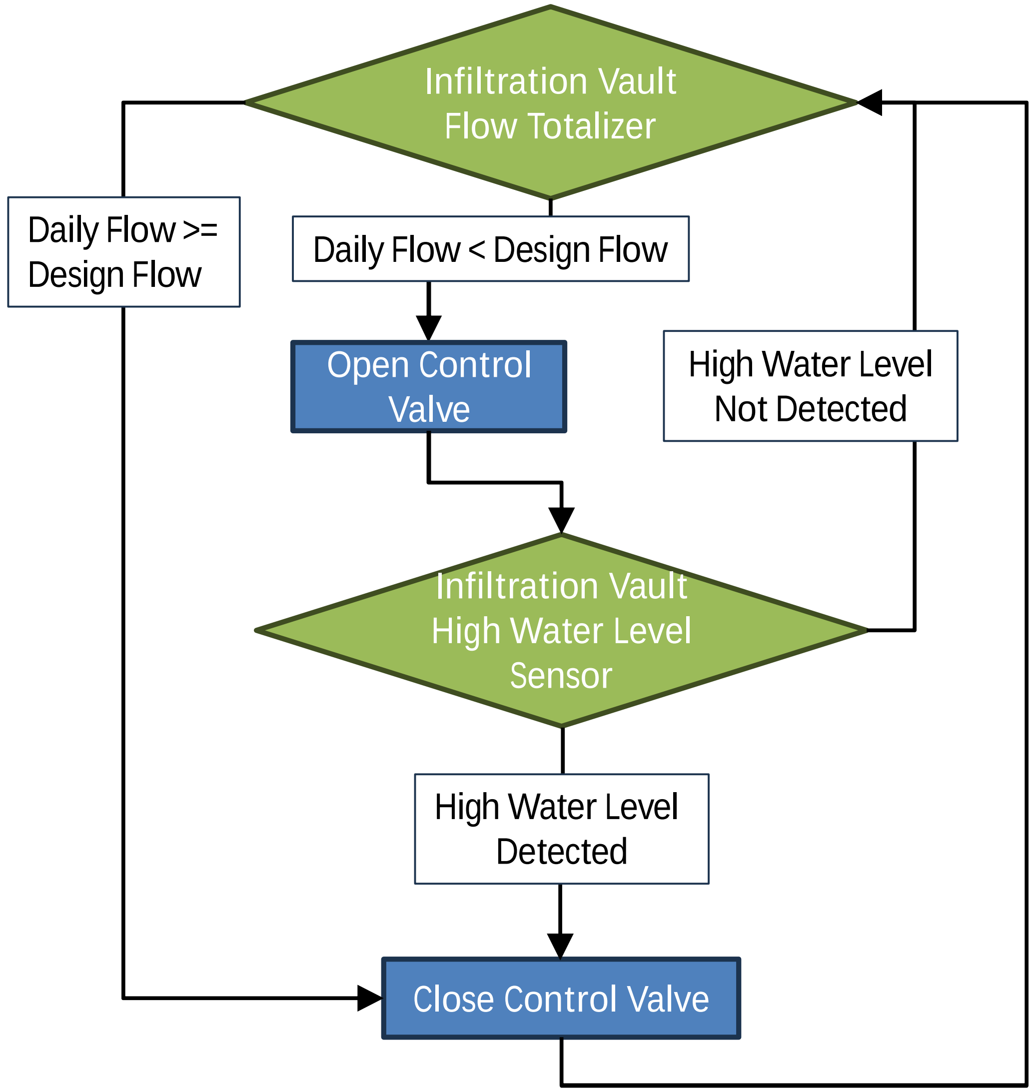
| YYYY-MM-DD | 2025-05-08 |
| PREPARED | PGM |
| DESIGN | PGM |
| REVIEW | GWS |
| APPROVED | GWS |

TITLE
**Process Control Flow Chart – Water Supply to Gravity Reservoirs from Settling Pond**

PROJECT No.
**19129150**

Rev.
**A**

FIG.
**21**



Notes:
Figure to be read with accompanying report.
Control logic presented is applied simultaneously at Gravity Reservoir 1 and 2 and at 7 infiltration vaults.
Control system to evaluate Gravity Reservoir Low Water Level Float and Infiltration Vault Flow Totalizer Volume at specified frequency to initiate control logic.

CLIENT
CBM Aggregates, a division of St. Marys Cement Inc. (Canada)

PROJECT
**Caledon Pit / Quarry**
Groundwater Mitigation Design Report

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2025-05-08 |
| PREPARED | PGM |
| DESIGN | PGM |
| REVIEW | GWS |
| APPROVED | GWS |

TITLE
**Process Control Flow Chart – Water Supply from Gravity Reservoir to Infiltration Vaults**

PROJECT No.
**19129150**

Rev.
**A**

FIG.
**22**

## 6.9 Water Quality Considerations

As noted in the Water Report (Golder, revised July 2023), any water discharged from the Settling Pond must first meet all necessary water quality discharge criteria specified in the PTTW and ECA, which will be obtained by CBM prior to any off-Site water discharge. This condition will ensure that all water discharged from the Site will meet water quality criteria before it is re-infiltrated into the ground through the mitigation system (or be discharged off-Site for use in golf course irrigation).

Groundwater quality at the Site is generally good and within the typical range expected for groundwater in this hydrogeologic setting for most parameters tested (Golder, revised July 2023) and (WSP, 2025). These reports and the desktop review of infiltration systems (Appendix A) identified the following potential contaminants of concern that may be present in future at the proposed pit / quarry during operations:

- Suspended solids;
- Petroleum hydrocarbons (PHC);
- Road salt;
- Nitrogen-based residuals from blasting activities; and
- Pathogens

The issue of suspended solids in the source water can be readily addressed by allowing adequate resident time in the Settling Pond, positioning of the water intake for the mitigation system at an appropriate level in the water column, and filtration at the pump intake. The sumps located at the base of each infiltration trench vaults also provide an opportunity for particles to settle before entering the groundwater system, and there is additional filtering provided by the filter fabric at the infiltration trench / soil interface.

Additional pre-treatment of the source water at the Settling Pond prior to conveyance of water into the mitigation may be required to meet water quality regulatory requirements for some parameters (e.g. pathogens), if present. To address this issue, water quality in the Settling Pond will need to be monitored and assessed to determine if treatment is needed prior to operation of the mitigation system.

As there will be approximately 10 to 15 years between the commissioning of the Settling Pond and the operation of the Groundwater Mitigation system, there will be adequate time to assess in situ water quality and develop suitable treatment options, if treatment is required. Additionally, treatment technologies will continue to evolve beyond the technologies of today, such that any future treatment method proposed will utilize the best available technology of the day. Depending on the potential contaminants of concern, intrinsic treatment with validation (e.g. nitrogen) and post-treatment (e.g. pathogens) approaches can also be considered, where they are applicable.

Overall, it is expected that the proposed pit / quarry will not have any impact on water quality receptors, as aggregate operations will follow all applicable environmental standards, employ current industry best practices, implement mitigations discussed above as needed, and confirm water quality with sampling.

# 7.0 DETAILED DESIGN, PERMITTING, AND CONSTRUCTION AND OPERATION

## 7.1 Detailed Design

This report provides an updated design for the proposed groundwater mitigation system at the Caledon Pit / Quarry for the purposes of supporting this ARA licence application, and in response to review comments provided by various agency / stakeholder groups.

The additional studies and updated system design presented in this report demonstrate “proof of concept” and provides a technical basis from which a Detailed Design and Associated Refinements can be prepared at an appropriate time in the life-cycle of the Project.

## 7.2 Permitting

Prior to implementation of the proposed groundwater mitigation system, CBM would be required to obtain and operate in accordance with a Permit To Take Water and Industrial Sewage Works (ISW) Environmental Compliance Approval (ECA) under the Ontario Water Resources Act to permit the water management activities needed to operate this system.

The PTTW and ECA Permit would be a part of the overall approvals required to operate the pit / quarry, which would include:

- Pumping, collection, storage and discharge of pit / quarry water;
- Operation of the groundwater mitigation system (i.e., infiltration trench system); and
- Construction and operation of an aggregate wash plant.

Regarding the operation of the proposed groundwater mitigation system, the PTTW and ECA Permit would typically need to specifically include and/or address the following key elements (many of which have already been addressed by technical studies to date):

- A description of the groundwater mitigation system, including a functional (process flow) diagram of the system;
- Target groundwater levels (see Note 1 below);
- Water handling requirements (i.e., water collection, temporary storage, settling, filtration, pumping and re-infiltration);
- Water level and water quality monitoring requirements;
- System operation and maintenance requirements; and
- Reporting requirements.

Note 1: The target water level for each trench zone will be determined from baseline water level monitoring data at the monitoring wells nest or nests corresponding to that zone, and will account for seasonal variability and climate variability, as much as possible.

## 7.3 Construction and Operation

Construction of the various elements of the proposed groundwater mitigation system would be integrated into the overall planned schedule for pit / quarry operations, generally as follows:

- Phase 3 – Implementation of the slurry wall / grouting of the weathered bedrock zone on the west side of the Main Area prior to the start of Phase 3 extraction.
- Phases 4 and 5 – Implementation of the infiltration trench system (Trench Zones 1 and 2) on the west side of the Main Area, including pilot-scale testing, prior to the start of Phase 4 and 5 extraction. This stage of implementation would include pilot test of the system prior to its full implementation
- Phase 6 and 7 – Implementation of the second slurry wall / grouting of the weathered bedrock zone and the second phase of the infiltration trench system (Trench Zones 4 to 6), including pilot-scale testing, prior to the start of Phase 6 and 7 extraction.

The construction of the proposed mitigation system would be carried out concurrently with other operation activities in a manner that would not adversely impact the overall operational schedule. Further recommendations on construction methods and operational practices are discussed in Sections 2.3 and 2.4.

# 8.0 SUMMARY AND CONCLUSIONS

This report presents the results of additional technical studies and provides an updated design for the groundwater mitigation system proposed for the CBM Caledon Pit and quarry project.

## 8.1 General Overview

The proposed groundwater mitigation system will utilize a portion of the water collected during Phases 4 to 7 of operations, and direct it to a series of six infiltration trench zones along a 1,900 m alignment along the west side of the Main Area and the west and south side of the South Area, in the setback area between the licence limit and the limit of extraction (Figure 2).

Water collected in the pit / quarry from dewatering will be reintroduced into the groundwater system through these infiltration trench zones to maintain the groundwater levels west and south of the licence area to levels within their current typical range. Additionally, two hydraulic barrier zones will be installed between the infiltration trenches and the extraction limit, in order to minimize the flow of groundwater back into the pit / quarry from the infiltration trenches. The hydraulic barrier will primarily consist of two slurry wall zones in the overburden, with the option to grout the upper bedrock zone if required.

## 8.2 Scope of Work

The scope of work undertaken and presented in this report includes the following:

**Desktop Review** – A desktop review of infiltration trench system technologies to help ensure the updated trench design incorporates current industry best practices and lessons learned from other projects.

**Field Investigation** – A hydrogeological field investigation along the proposed mitigation system alignment to obtain detailed site-specific information.

**Numerical Modelling Simulations** - The results of the field investigation were used to update the conceptual site model and the HGS numerical model in this area, which was used to update mitigation system simulations.

**Water Management Plan Update** - The updated numerical modelling simulation results were also used to update the Water Management Plan for the proposed pit and quarry operation.

**Mitigation System Design Update** – The mitigation system design was then updated, based on the desktop review, field investigations, updated numerical modelling simulations, and the updated water management plan.

## 8.3 Infiltration Technology Review

A desktop review of infiltration trench system technologies was completed to help ensure the mitigation system design update incorporates current industry best practices and lessons learned from other projects. Guidance documents and case studies are unanimous in their consensus that infiltration systems are a beneficial management practice to mitigate the impacts of development. The technology is well known and supported by a body of literature, design guidance, and successful examples.

Best practices reaffirmed the importance of obtaining detailed site data and were used to update key aspects of the proposed mitigation system including trench design, construction, operation and maintenance, and identified potential water quality issues for future design consideration.

## 8.4 Field Investigations

Extensive hydrogeological field investigations were carried out from April to June 2024, comprising the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 3). The field investigations included the following main activities:

- Borehole drilling and monitoring well nest installation;
- Laboratory testing of overburden soils;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

The investigation results provided additional detailed site-specific information on stratigraphy, groundwater levels, groundwater gradients and hydraulic properties of the various aquifer and aquitard units.

## 8.5 Updated HGS Numerical Modelling

The HGS numerical model for the proposed Caledon pit / quarry has been updated and calibrated to the refined hydrostratigraphy for the Site, and the updated HGS model has been used to update the assessment of potential impacts to groundwater and surface water due to the proposed pit / quarry operations.

The HGS model simulations demonstrate that the proposed mitigation system can maintain groundwater levels within their current typical range during the later stages of pit / quarry operations, and that proactive rehabilitation during Phases 5 and 6 of the pit / quarry operations can reduce groundwater inflows into the pit / quarry relative to earlier simulations, thereby optimizing water management during future operations.

## 8.6 Updated Water Management Plan

The Water Management Plan for the site has been updated to incorporate new hydrogeologic data and inflow predictions for the pit / quarry, noting the following.

- The construction of a 40,000 m$^3$ settling pond / holding pond is planned for Year 1 in the North Area in order to provide "immediate" on-site water storage capacity.

- Based on water inflow predictions and mitigation water needs from numerical simulations during operations, enough water will be generated during Years 17 to 38 of operation to supply the water needed for the proposed groundwater mitigation system.

- Additional water storage to operate the groundwater mitigation system, if needed, could be accommodated in the Main Area or the North Area (preferred). If needed, the North Area could be used to store additional water, as there is in excess of 300,000 m$^3$ of capacity in that area once extraction has been completed at the end of Operational Year 14.

- The maximum annual average rate of discharge throughout pit / quarry operations is approximately 587,000 m$^3$ / year in Operational Year 13. The peak average annual water discharge rate (in Year 13) is expected to be approximately 18.6 L/s.

- There is an option to re-infiltrate an additional 200,000 to 400,000 m$^3$ / year of groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of the natural heritage features to the southwest.

## 8.7 Updated Mitigation System Design

The proposed groundwater mitigation system design presented in Golder (2023) has been updated based on the infiltration technology review, 2024 field investigations along the proposed infiltration trench and hydraulic barrier alignment, updated HGS numerical modelling simulations, and the updated water management plan.

The updated system design included a review of and update to the following key system elements, where required.

- General configuration of the groundwater mitigation system has been updated to reflect more detailed subsurface stratigraphy and refined groundwater levels along the alignment.
- Mitigation system zones were unchanged from the initial design concept.
- Phasing of implementation was unchanged from the initial design concept.
- Estimated pit / quarry inflows and trench infiltration rates have been updated based on new HGS modelling.
- Infiltration trench design details have been refined to incorporate best practice features wherever possible and provide additional specific design details.
- The hydraulic barrier design concept has been updated, and two viable construction technologies have been identified that fit the needs of this project.
- A general design has been developed for the water storage and distribution system to supply water to the infiltration trenches, including the conveyance of water from the Settling Pond to Gravity Reservoirs, and ultimately to the Infiltration Vaults and Infiltration Trenches.
- The potential for water quality issues have been identified and options to ensure mitigation have been discussed.

## 8.8 Conclusions and Recommendations

The additional technical studies and groundwater mitigation system design presented in this report for the proposed CBM Caledon Pit / Quarry project demonstrates proof of concept, and provides assurance to CBM, as well as agencies and stakeholder groups, that the proposed groundwater mitigation system will perform as predicted to protect groundwater and surface water resources.

WSP recommends that the ARA Site Plan for the proposed pit /quarry be updated (Sheets 2 and 3) to show a minor change to the proposed groundwater infiltration trench system. The northern end of Infiltration Trench 4 as originally proposed will be truncated by 100 m, as shown in the cross-section presented on Figure 14. This reduction in the length of the trench will not affect its ability to maintain groundwater levels in this area during operations.

WSP also recommends that the ARA Site Plan be updated (Sheet 3) to include the revised “typical infiltration trench detail” shown on Figure 9 of this report.

# Signature Page

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https://wsponline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/45 mitigation system design 2025/11 final report may2025/07 final version r2d 27may2025/cbm caledon - mitigation system design report 27may2025.docx

## APPENDIX A

# DESKTOP REVIEW OF INFILTRATION TRENCH SYSTEM TECHNOLOGIES

## TECHNICAL MEMORANDUM

**DATE** March 10, 2025 **Project No.** 19129150

**TO** David Hanratty, Mike LeBreton
CBM Aggregates

**CC** George Schneider, Frank Barone, Greg Padusenko - WSP

**FROM** Paul Menkveld **EMAIL paul.menkveld@wsp.com**

# INFILTRATION SYSTEM TECHNOLOGY REVIEW - PROPOSED CBM CALEDON PIT / QUARRY

## 1.0 INTRODUCTION

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada), submitted an application in 2022 to the Ministry of Natural Resources and Forestry (MNRF) for a Class A License (Pit and Quarry Below Water) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation for the proposed CBM Caledon Pit / Quarry.CBM controls approximately 323 hectares of land located at the northwest, northeast and southwest intersection of Regional Road 24 (Charleston Sideroad) and Regional Road 136 (Main Street). Of these lands, approximately 261.2 hectares are proposed to be licenced under the Aggregate Resources Act referred to as the “Site”.

### 1.1 Background

Initial review of the HydroGeoSphere (HGS) groundwater-surface water model simulations undertaken as part of the Water Report (Golder, 2023) indicated that pit / quarry dewatering during later the stages of operations (Phases 4 to 7) would likely result in a decline in groundwater levels in the water table aquifer that would extend southward and to the southwest of the licence area. If so, these predicted changes in groundwater levels could potentially effect natural features, groundwater users, and influence groundwater levels beneath existing aggregate pit #6525 (Lafarge Pit #3) that is currently licenced to extract sand and gravel above the water table.

In order to mitigate the potential effects of these predicted changes in groundwater levels during the operational phases of the proposed CBM Caledon Pit / Quarry, groundwater mitigation measures, including a series of infiltration trenches and a hydraulic barrier (i.e. slurry wall / optional bedrock grouting), were developed by Golder and then implemented in the HGS modelling simulations for Operational Phase 3 to 7, to assess their effectiveness, as described in the Water Report (Golder, 2023). The Water Report presented the conceptual design of the mitigation system and recommended the completion of detailed design following licencing.

Technical comments related to the Level 1/2 Water Report have been received from agency and stakeholder groups, which requested additional study and further development of the mitigation system design, in order to demonstrate proof of concept, and to provide assurance to those agencies and stakeholder groups that the proposed infiltration trench system will perform as predicted.

## 1.2 Objectives

The objective of this Technical Memorandum is to review existing infiltration system guidance, best management practices (BMP), (Section 2.0) and case studies (Section 3.0), and summarize findings (Section 4.0),.

# 2.0 REVIEW OF DESIGN GUIDANCE AND BMP

To assess and refine the conceptual design of the proposed CBM Caledon Pit / Quarry infiltration trench system, a review of 21 relevant papers, design guides, and other publications is summarized in this section. The design guidelines are grouped by region, Ontario (and other selected Canadian guidance documents), the United States, and International.

## 2.1 Ontario (and selected Canadian Guidance)

### Evaluation of Underground Stormwater Infiltration Systems - Toronto Region Conservation Authority (2013)

- Infiltration systems are well suited to clean water, such as roof run-off. However, when pre-treatment is provided through hydrodynamic separators (i.e., oil and grit separators), in-line filters or grassed swales they may also be applied successfully to treat run-off from parking lots and low traffic roads, which typically generate higher loads of sediment and other pollutants than roofs.
- The document summarizes eight infiltration system case studies (with detailed descriptions of three) including their design, context, and monitored performance.
- Two residential neighborhoods constructed in 1993 in Nepean, Ontario, were equipped with perforated pipe systems to manage storm water run-off volumes. The two systems infiltrated 70% and 94% of the water received, with little reduction in performance in the 20 year monitoring period.
- Two perforated pipe systems in Etobicoke and North York, Ontario, that receive roof and road run-off were also examined as an infiltration system to manage storm water. The systems were observed to infiltrate 89% and 95% of all run-off from storms greater than 5 millimetres (mm), over the two years of monitoring.
- An infiltration trench installed on the campus of Villanova University in Pennsylvania, received untreated run-off from a heavily used parking lot. Infiltration rates were observed to decrease exponentially during the first and second years after installation, with the decreased infiltration rate attributed to high loads of suspended sediments.
- The Elgin Mills Cross Infiltration System is designed to receive stormwater from the roofs of a large commercial plaza. The infiltration system was constructed near the water table to take advantage of a sand lens within the silty sand aquifer and maintain groundwater discharge to a nearby surface water feature. The infiltration system was generally effective and durable.
- The Mayfield Industrial Park Infiltration Trench System, constructed in Bolton Ontario, is designed to infiltrate roof run-off using a system of four infiltration trenches. Water levels are managed using manholes with weir plates, connecting to perforated pipes at the top and bottom of the infiltration trench, backfilled with gravel, and wrapped in filter fabric. Pre-treatment occurs in a manhole equipped with a Goss trap to remove floating debris. During operations, silt infiltrating the system clogged several distribution pipes, accumulated in

manholes, and reduced the effective storage capacity of one of the trenches by 30%. Recommendations included cautious management of suspended solids, consideration of maintenance, and the inclusion of sumps in manholes as a silt management contingency.

- The Bamport Infiltration System in Brampton, Ontario, receives roof, road, and parking lot run-off which is directed to a system of infiltration chambers in a gravel bed, controlled with a series of orifices. Water quality concerns, including suspended solids, were addressed using a sump in the control manhole and an inline oil and grit separator. The design relied on a permeability estimate derived from grain size distributions for the sandy silty clay till. Operational monitoring showed “very little or no infiltration” into the till, due to an overestimate in the hydraulic conductivity of the material during design.

## Stormwater Management Planning and Design Manual – Ministry of the Environment (2003)

- Infiltration is a preferred method of stormwater control, as compared to direct surface water discharge, because it maintains groundwater levels, and therefore protects baseflow, aquifer filtration mitigates surface water quality and temperature impacts.
- Design recommendations for infiltration systems includes:
    - Use of 50 mm clear stone and filter fabric, fully enclosing the subsurface infiltration system;
    - Depth of design should consider freezing conditions and potential for frost heave;
    - Inclusion of a 150 to 300 mm thick filter layer at the base of the infiltration system to enhance infiltrated water quality. Recommended sands for a filter layer include 0.25 mm and a coefficient of uniformity less than or equal to 3.5 or an effective size of 2.5 mm and a coefficient of uniformity less than or equal to 1.5;
    - Alternatively, peat can be mixed into the filter layer to improve removal of metals, hydrocarbons, and nutrients;
    - To permit aerobic processes to improve water quality in the subsurface, the infiltration system should be sited more than 1 m above the water table or bedrock surface;
    - To improve storage characteristics of the storage media (generally gravel), compaction during construction should be minimized; and
    - To improve infiltration rates, smearing of excavation faces during construction should be minimized.

## Proper Sizing of Infiltration Trenches and Bioretention Cells for Urban Stormwater Management Purposes – Rowe (2019)

- Rowe (2019) summarized typical sizing approaches in Canadian stormwater management. The depth is determined by use of a site measured or literature value infiltration rates to determine and sizing the system to fully discharge in 48 hours. The volume (and therefore area) of the system is determined based on the design storm, typically a 100-year storm.
- The publication argues that in many marginally economical cases this is too onerous and leads to overdesign. A probabilistic approach is developed to optimize the sizing of the system relative to annual run-off volumes.

## Underground Stormwater Infiltration: Best Practices for the Protection of Groundwater in British Columbia – BCMOE (2014)

- The design of an infiltration system should rely on a detailed hydrogeological assessment including lithology, groundwater levels, groundwater flow system, infiltration capacity, seasonal variability, source water analysis, and impact assessment.
- Common water quality considerations in the design of an infiltration system include:
  - Total suspended sediments or solids (TSS);
  - Trace metals, primarily copper, lead, zinc, and cadmium;
  - Nutrients, primarily total nitrogen (TN) and total phosphorus (TP);
  - Petroleum hydrocarbons (PHC) associated with vehicles and other human activities;
  - Pesticides, herbicides and fungicides;
  - Salts used for roadway de-icing;
  - Pathogens and pathogen indicators associated with human waste, animal waste, and natural watershed sources. Pathogen transport in the subsurface varies significantly depending on the capacity of the soil to absorb them and therefore the risks posed can be difficult to assess;
  - Many pollutants (such as metals and oils) have low solubility in water. Such pollutants will tend to adsorb to sediments or will degrade and breakdown over time. Consequently, they tend to be filtered and attenuate to varying levels as infiltrating water percolates through the soil pores. For example, many metals may only be transported a few centimetres beneath infiltration facilities. Pollutants with low solubility generally pose a lower risk to aquifers; and
  - Depending on the risk associated with the operation of the system, source water monitoring or sampling may be necessary.
- Where a drinking water aquifer receives water from an infiltration system, it is recommended that:
  - Any facility specifically designed to convey water to the saturated zone of a drinking water aquifer requires a high level of design, regulatory approval, and ongoing oversight;
  - The drinking water well is set back 60 m or more from the infiltration system;
  - The vulnerability assessment considers groundwater flow direction, flow speed, and aquifer vulnerability; and
  - A private well survey be conducted.
- Design recommendations include:
  - To achieve some aerobic water quality enhancement, different offsets distances between the infiltration system and the maximum water table elevation are recommended, ranging from 1.5 m in fine grained materials (such as sandy silt), to 3.0 m in medium grained materials (such as sand), to 7.5 m in coarse grained materials (such as gravel);

  - An access road to support maintenance and serviceability, in particular to allow vac trucks to access all manholes for sediment removal;
  - Manholes should be a minimum of 0.75 m in diameter to allow for maintenance activities; and
  - Monitoring wells and observation ports should be included in the installation to allow for monitoring of system performance.
- Maintenance activities should include:
  - Regular inspections for sediment accumulation or other clogging, any structural problems, such as cracking or settlement, and animal activity;
  - Minor sediment removal from easily accessed areas of the system;
  - Major sediment removal with the use of flushing and vac trucks to remove sediment from subsurface facilities; and
  - Documentation standards for all maintenance activities.
- Monitoring of the performance of an infiltration system includes monitoring of groundwater levels, water levels in the system, and, ideally, flow rate monitoring, although this is often difficult to measure accurately depending on system design. Monitoring should include a start up phase, where monitoring is performed more frequently until the system's performance is better understood.

## 2.2 United States of America

Infiltration systems are a familiar and widely adopted technology in the United States, with many recommendations and guidelines for their design and implementation.

### Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring – United States Department of Transportation (2024)

- Infiltration systems are beneficial for maintaining groundwater levels where development has increased impervious surface area and enhance surface water quantity, however their costs generally limit application to stormwater management to ultra-urban high density situations.
- Pre-treatment of infiltration water to mitigate suspended solids is essential to effective performance and longevity of infiltration systems. Common pre-treatments include vegetated filter strips and grassed swales.
- Soil interaction with the infiltrating water includes sorption, precipitation, trapping, filtering, and bacterial degradation. The effectiveness of these processes in improving water quality are dependent on soil type and site specific conditions. Typical reduction of contaminant levels by infiltration systems include: 60% in nutrient loads, 85% in metals, 90% in total suspended solids, and 90% in bacteria.
- Infiltration systems should be designed using site specific in situ testing to determine hydraulic properties of subsurface materials and be sited in materials with a minimum infiltration rate of 7 mm/hour.
- To allow for aerobic water quality improvement processes, infiltration systems should be constructed at a minimum 1.22 m above bedrock and the seasonally high water table.

- For systems with inadequate suspended sediment removal, major sediment removal may be required within five years, while systems with effective pre-treatment may last as long as 10 to 15 years without major maintenance.

## Best Management Practices for Stormwater Infiltration - Minnesota Pollution Control Agency (2022)

- Infiltration systems are a valuable tool in water management to minimize the impacts of development on the hydrological system.
- Various infiltration system configurations are considered including: infiltration trenches, infiltration basins, dry wells, permeable pavements, bio infiltration systems, and dry swales with check dams.
- For infiltration trench systems, the following design features are recommended:
  - The bottom of the trench be constructed a minimum of 0.9 m above the water table;
  - Consider maintenance methods explicitly in the design; and
  - Conduct a source water risk assessment.
- For infiltration trench systems, the improvement to water quality is characterized by high capacity to treat (65 to 100% improvement) of TSS, metals, oils and grease, and pathogens, a medium capacity to treat dissolved nutrients (~65% reduction), and a low capacity to treat chloride (<30%).

## The American Society of Civil Engineers / Environmental and Water Resource Institute Standard Guidelines for Managed Aquifer Recharge – McCurry et al. (2023)

- These conference proceedings provide an overview of the standards for managed aquifer recharge (MAR) systems, highlight the environmental benefits of maintaining predevelopment levels of recharge to support to environment features and overviews cases studies of MAR.
- The guideline includes a scoring system to evaluate potential MAR sites, which considers factors including hydrogeological suitability, environmental considerations (benefits and potential of adverse impacts), and implementation considerations.
- Several design recommendations are featured, including use of pilot testing in system design, high frequency start up monitoring, and detailed design of electrical, control, and sensor systems.

## Best Management Practices for Infiltration Trenches – USEPA (2021)

- Soil permeability is a “strongly limited factor” in the siting of infiltration systems. In soils which are not sufficiently permeable, the system will be ineffective at discharging water, and soils which are too permeable may not provide sufficient treatment. It is recommended that the field measured infiltration rates are between 13 to 76 mm/hr.
- Other design recommendations include:
  - Pre-treatment including use of settling basins to reduce clogging;
  - Maintain a 1.2 m offset from the seasonally high water table;

  - Not using infiltration systems in areas with karst topography due to the potential for sinkhole formation and the risk of rapid groundwater contamination, should the source water quality be compromised; and
  - Design in cold climates should consider minimum depths to saturated materials to avoid frost heave.
- Regular inspections, pre-treatment, control structures and maintenance to remove sediment.
- Typical water quality improvements attributed to infiltration systems include 90% reduction in TSS, 60% reduction in TP, due to soil adsorption, and 10 to 55% reduction in TN, due to inorganic soils generally do not filtering or absorbing nitrogen well.

## Infiltration Trench Design Guidance – CalTrans (2020)

- Design recommendations include: design of vertical or slopes side walls of infiltration trenches, lined with filter fabric, pre-treatment to remove sediment (such as forebays, bioswales, or vegetation strips), and consideration of sensitive receptors (requiring infiltration systems to be set back a minimum of 30 m upgradient of a private well).
- Alternative trench backfill materials are considered, including either a sand or a mixture of perlite, dolomite, gypsum, and crushed rock, to provided treatment via filtering, adsorption, and ion exchange within the trench.

## Pennsylvania Stormwater Best Management Practices Manual - Pennsylvania Department of Environmental Protection (2006)

- Pennsylvania (PA) Department of Environmental Protection (PDEP) presents two case studies of the design of infiltration systems and highlights design considerations.
- At the Flying J. Truck Plaza for Welsh Oil of Indiana Truck Refueling Terminal, Cumberland County, PA (constructed in 1993) stormwater from a large parking area is managed using extensive pre-treatment, including a vegetated settling unit, filtration system, and in line sand filter (within the control manholes) and subsurface infiltration beds. The risk of dissolution of carbonate rock beneath the infiltration beds, and the possible formation of sink holes, was evaluated using ground penetrating radar, to establish that the rock mass did not contain any large solution enhanced features prior to construction.
- Infiltration systems were designed as part of the construction of the Penn State University - Centre County Visitor Center, Centre County, PA. The lithology of the site is characterized by a thin layer of overburden (approximately 2 m) over weathered carbonate bedrock, which are the drinking water aquifer for several supply wells 800 m downgradient of the infiltration system. The system was designed based on detailed site characterization and percolation testing in test pits. Moderate clay content in the overburden was observed to prevent rapid infiltration into the bedrock and is expected to enhance water quality through soil absorption. Sinkhole risk was assessed to be low based on the detailed investigation and further mitigated by carefully maintaining an offset from the top of weathered bedrock.

## Effects of Stormwater Infiltration on Quality of Groundwater Beneath Retention and Detention Basins - Fischer, Emmanuel, and Baehr (2003)

- This study performed sampling of groundwater in wells designed to monitor the performance of storm water infiltration systems and wells observing background groundwater conditions. In general, facilities with poorly controlled source water quality varied in performance, and showed variable groundwater quality with elevated levels of contaminants commonly found in surface water, such as elevated benzene or toluene.

- In areas where background groundwater quality contained some contamination, such as chlorinated solvents, increased recharge diluted the undesirable water quality and enhanced groundwater quality.

## Sizing Stormwater Infiltration Structures - Aken (2002)

- This paper presents a mathematical approach, simultaneously solving the Green-Ampt equation and the equation for storage in an infiltration structure, to predicting capacity of a system and its time to fully discharge based on known hydrogeological parameters and the time and flow rate the system receives.

## Controlling Urban Run-off - Schueler (1987)

- Infiltration systems are generally seen as a beneficial development practice as they maintain natural recharge patterns, groundwater levels, and mitigate water quality risks.
- Design and site selection should consider factors such as infiltration rates greater than 13 mm/hr (and up to 210 mm/hr), a minimum of 0.6 m above the seasonally high water table, 1.2 m above top of rock, and at least 30 m upgradient of drinking water supplies and foundations.
- Primary causes of failure for infiltration systems are poor construction practices, inadequate field testing, and lack of sediment control.
- Detailed design guidance includes:
  - In general, infiltration systems should be graded to have a flat bottom of excavation, with permeable filter fabric and/or a layer of filter sand at the base (0.15 to 0.30 m), permeable filter fabric side walls, and impermeable filter fabric on top (to mitigate infiltration of fines from above the system), with seams in the fabric overlapped generously, perforated distribution pipes, backfilled with washed clear stone (25 to 76 mm), and with at least one observation well per infiltration trench;
  - Schueler describes several configurations of pre-treatment chambers and intakes to reduce sediment, oil and grease, and floating debris, in source water before directing it to the infiltration system; and
  - Where pre-treatment is expected to remove a high level of sediment, perforated pipe can be used to distribute water in the infiltration system. Where additional protection from clogging is needed in the design, the perforated pipe can be oversized and wrapped in filter fabric to act as an additional layer of sediment control in the system.
- Recommended construction practices to optimize infiltration systems include:
  - Prevent heavy machinery from compacting subsoils;
  - The edges of the trench should be bermed and erosion of the trench walls stabilized to prevent sediment migration into the trench during construction;
  - Trench should be constructed using a backhoe or trencher, equipped with tracks or oversized tires to avoid soil compaction. Use of bulldozers and front-end loaders within the trench alignment should be avoided; and
  - Clean stone should be placed in lightly compacted in lifts. Unwashed stone contains enough sediment to risk clogging.

- Infiltration systems are noted to provide significant enhancement to water quality, removing 80 to 100% TSS, 60 to 100% biological oxygen demand (BOD) and bacteria, 40 to 80% TP and TN, when operated as recommended.
- To provide effective water quality treatment in the infiltration system, a minimum and maximum drainage time are established:
  - Maximum drainage time: the system should fully drain in 48 hours or less to maintain aerobic conditions in the underlying soil, which favor bacteria which aid in pollutant removal.
  - Minimum drainage time: poor pollutant removal was observed in systems which hold water for less than 6 hours.

### A study of Infiltration Trenches in Unsaturated Soils – Kim (1986)

- This paper developed a numerical solution to solve Fok’s model of unsaturated groundwater flow using a finite difference method. The numerical simulations showed that infiltration rates were predominantly a function of hydraulic conductivity of the subsoils, with little impact from porosity, capillary potential, or surface infiltration.
- The study also showed that long narrow infiltration trenches were more effective than near square infiltration systems.

## 2.3 International

### Managed Aquifer Recharge: Overview and Governance – Dillon et al. (2022)

- The International Association of Hydrogeologists Commission on Managed Aquifer Recharge (MAR) prepared this publication to support the development of standards and applications of MAR, including guidance on design, management, and monitoring of infiltration systems.
- Risks associated with water quality can be considered based on source water quality, water treatment prior to infiltration, the sensitivity of the receptor, and post treatment before use at the receptor. Dillon et al. provide generalized guidance is included for each stage of MAR, for example, generally water sourced from another aquifer needs little or no pre-treatment before being recharged and infiltrated water with the end use of drinking water, requires disinfection post treatment.
  - It is recommended that sampling criteria and frequency be developed based on an assessment of risk of the source, the receptor, and treatment.
- Water quality hazards include:
  - Pathogens: Preventative measures to manage pathogen hazards include natural treatment in the aquifer (which requires validation), source control, pre-treatment of source water prior to recharge or on recovery (e.g., disinfection), and measures to reduce exposure during use of the recovered water. An example of a regulation to mitigate pathogen risks to drinking water supplies is a standard developed in California, which requires log 12 removal of viruses from waste water to be indirectly reused as drinking water, assuming 1 log removal per month retained in the aquifer, and any additional required removal being achieved with pre-treatment methods (FYI: Ontario requires log 4 removal of viruses for SW and GUDI sources, and higher removal may be needed in the presence of sewage);

  - Inorganic chemicals: including iron, manganese, arsenic, and trace metals. Where geochemical changes result from the infiltration system, it is possible to mobilize inorganic substances in the subsurface, such as arsenic. A geochemical assessment is recommended to evaluate these risks;
  - Salinity: either as a result of source water quality, or as a result of mixing stratified water qualities within the aquifer;
  - Nutrients: nitrogen, phosphorus and organic carbon, can impact human health but are usually of greater concern in relation to the environment. Preventative measures to manage nutrient hazards include natural treatment in the subsurface (which requires validation), source control, selective recharge/diversion of continuously monitored source water that is outside specified water quality criteria (e.g., color) and pre- or post-treatment;
  - Organic chemicals: include contaminants of emerging concern (e.g., per- and polyfluoroalkyl substances) as well as herbicides, pesticides, hydrocarbons, industrial chemicals, algal toxins, pharmaceuticals, personal care products and disinfection byproducts;
  - Radionuclides: In general, elevated radionuclide concentrations can be found in granitic, fractured rock aquifers; and
  - Temperature: in well-based MAR systems groundwater temperature can be affected, leading changes in geochemical conditions and gas release, however, in infiltration systems thermal effects are buffered to some extent during the passage of water through the unsaturated zone.
- Clogging has several possible causes including:
  - Physical Clogging: Caused by the filtration of suspended solids present in the recharge water or the swelling/mobilization of clays;

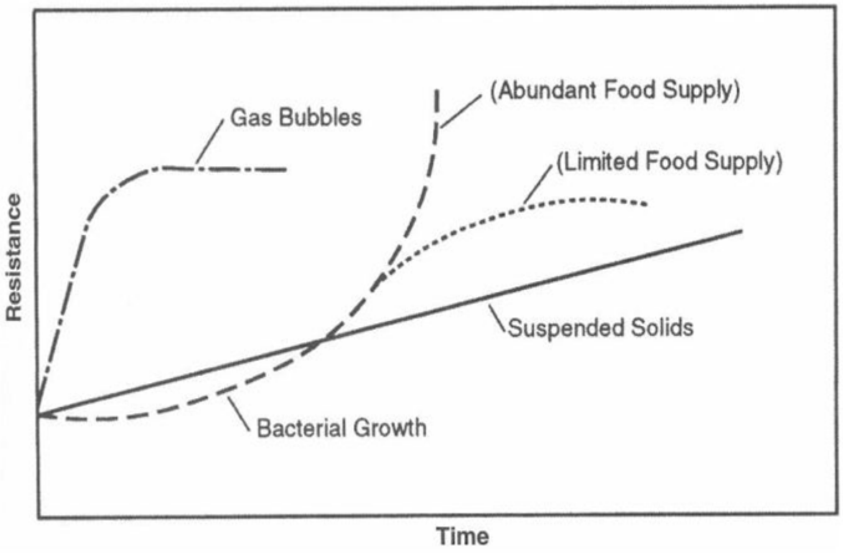

**Figure 1: Typical Resistance to Infiltration for Different Clogging Mechanisms (Dillon et al., 2022)**

  - Biological Clogging: Resulting from bacterial growth due to dissolved nutrients in the source water;

  - Mechanical Clogging: Caused by air entrainment, gas binding, or formation failure;
  - Chemical Clogging: Due to the precipitation of minerals (for example calcium carbonate);
  - Preventative measures to reduce the impact of clogging include source control, selective recharge (for example diverting water which fails a to meet a continuously measured water quality parameter, such as turbidity), and treatment of source water prior to recharge; and
  - Figure 1 shows generalized trends in resistance to infiltration over time, due to different clogging mechanisms.

## Artificial Recharge of Groundwater – Malu (2017)

- Infiltration systems generally improve groundwater quantity and quality. Siting considerations include: source water quantity and quality, aquifer properties, where groundwater levels are in decline due to overuse, and where groundwater quality is poor. In this context infiltration systems are generally seen as a mitigation for adversely affected groundwater quantity and quality by anthropogenic activity.
- Recommended studies include, source water studies (water quality and hydrometeorological as applicable), hydrogeological, and geophysical (as applicable).
- Design guidance emphasizes effective groundwater recharge in large quantities, including use of percolation tanks and spreading basins, where “highly fractured and weathered” rock formations can be exposed, injection of source water into dug wells, and the construction of vertical and horizontal shafts into aquifer materials to inject source water.

## Influence of Applying Infiltration and Retention Objects to the Rainwater Run-off on a Plot and Catchment Scale – Case Study of Służewiecki Stream Subcatchment in Warsaw - Barszcz (2015)

- This study simulated the impacts of different low impact development (LID) strategies, including infiltration systems, on plot and subwatershed scale. The study showed that infiltration systems provided meaningful reductions in run-off from impervious areas and in peak storm responses. Infiltration systems were the most effective LID for recharging groundwater in the study.

## Storm-water management through Infiltration trenches - Chahar, Graillot, & Gaur (2012)

- This study develops a numerical approach to simulate 2D groundwater flow beneath infiltration systems, with an emphasis on the calculation of infiltration rates, effects of multiple soil layers, and lateral effects of the trench above the water table, to support decisions on spacing of multiple trenches.
- To examine the applicability of the numerical method to physical installations, the approximately 100 infiltration systems in Lyon, France, were considered. Many of these systems have been operated for 10 to 21 years and continue to perform well, which is generally attributed to the highly permeable fluvial and glaciofluvial strata beneath them.
- The Django-Reinhardt infiltration basin was compared in detail by comparison to the numerical approach. That system pretreats with a large subsurface settling facility, then water is pumped to a trapezoidal infiltration

trench 1 m deep. The subsoil has variable hydraulic conductivity, overlying a permeable layer at 10 m below ground surface (bgs) and the water table at 18 m bgs. Numerical and field studies found that:

- The trench effectively saturates the soils beneath it;
- Infiltration can be considered 2D where the length of a trench is ten times its width;
- Clogging and groundwater contamination must be considered in the design of infiltration systems; and
- Drainage time should be limited to 72 hours to maintain aerobic conditions for microbes beneath the infiltration system.

## Hydrostratigraphic Characterization of Glaciofluvial Deposits Underlying an Infiltration Basin Using Ground Penetrating Radar - Chouteau (2008)

- This study focuses on heterogeneities beneath infiltration systems in fluvial and glaciofluvial sedimentary environments as a potential preferential pathway for rapid recharge and an elevated risk of groundwater contamination compared to an assumed homogenous aquifer.
- These heterogeneities are too small in scale for widely spaced boreholes to observe and too small for pumping tests to directly observe. Geophysics, and ground penetrating radar (GPR) in particular, offers an opportunity to collect continuous 2D and 3D data for comparison to boreholes, test pits, and sedimentological insight. In combination, these data sets offer the opportunity to map hydrogeological units in the subsurface.
- The study applied these methods to characterize the Django-Reinhardt Infiltration Basin in Lyon, France, to map and predict subsurface conditions with a very high degree of accuracy.
- The study installed time domain reflectometry (TDR) probes below the infiltration trench to measure in situ water content and monitor the effect of the overlying silty sand above a gravel unit in the vadose zone. The gravel unit allowed rapid recharge when the infiltration basin was operating and acted as a capillary barrier in dry conditions.

## Case study: design, operation, maintenance and water quality management of sustainable storm water ponds for roof run-off – Scholz (2005)

- Evaluated the performance of a stormwater pond with a silt trap, which receives roof run-off coupled to a dry pond intended to infiltrate water following settling in the stormwater pond. While the system achieved some of its water quality objectives, the infiltration basin failed due to inadequate site characterization.

## A Review of Sustainable Drainage Systems: A Soft Option for Hard Drainage Questions? - Charlesworth, Harker & Rickard (2003)

- This publication highlights the importance of LID practices in development, including infiltration systems. It is argued that successful infiltration systems including infiltration trenches, basins, and soakaways, have been applied widely including in the Sweden, Australia, the United States, and the United Kingdom, and should be broadly accepted and applied in the interests of sustainable development.

# 3.0 CASE HISTORIES

Managed aquifer recharge (MAR) systems operated in Ontario provide a valuable opportunity to review their design, performance, and impacts, to inform the detailed design of the CBM Caledon Pit / Quarry infiltration trench system.

## 3.1 Milton Quarry East Extension

The Milton Quarry, in the Region of Halton, has operated since 1962, near the brow of the Niagara Escarpment (MHBC, 2021). As the quarry expanded, a MAR system was proposed to mitigate the impacts of quarry dewatering below the water table. In 2007 the Milton Quarry commissioned a system of recharge wells to mitigate groundwater level reductions. The system includes the following key elements (GHD, 2021):

- A pumping station from the flooded Main Quarry reservoir. As the primary receptors are wetland features, no supplemental treatment of the water is required:

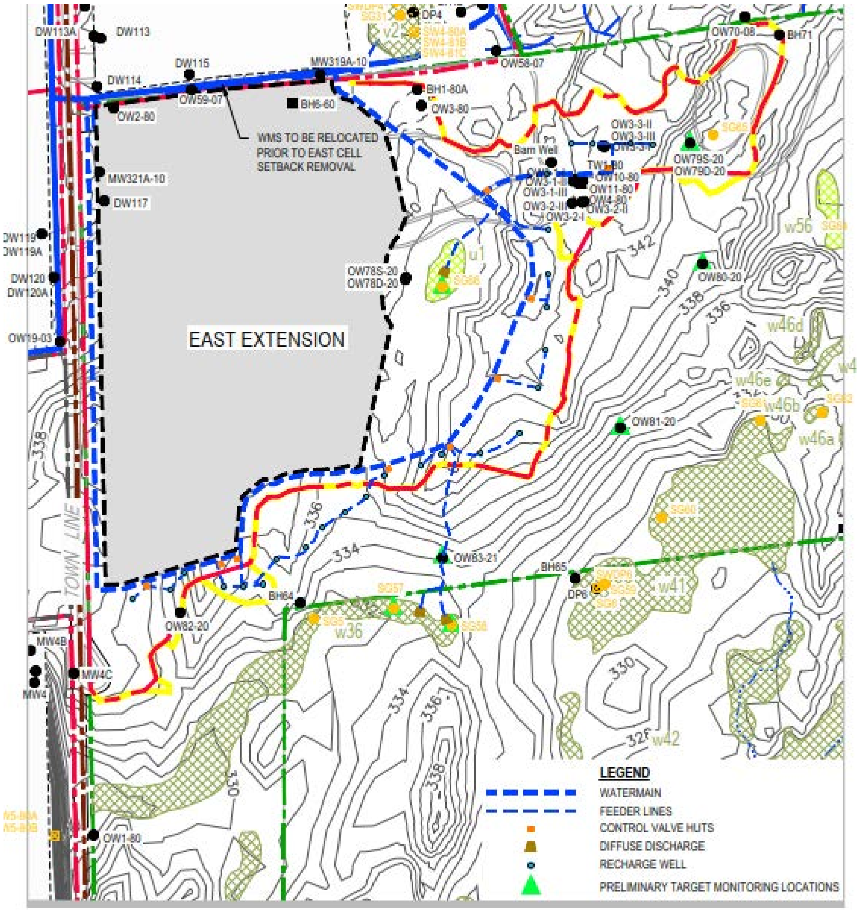

**Figure 2: Milton Quary East Extension Managed Aquifer Recharge System**

- Water mains service the perimeter of the quarry and distribute water supply through control huts and feeder lines to recharge wells. Control huts are small structures which control the supply to four or more groundwater recharge or surface water discharge points. Flow rate and pressure are monitored in each recharge water supply;

- The recharge wells are completed by casing through the overburden and advancing open holes through the Lockport Formation. Recharge wells are supplied with water a rate to maintain groundwater levels at or slightly above baseline conditions; and
- Monitoring wells, identified as “Target Monitoring Locations”, are placed at receptors to monitor water levels and identify any adverse impact. If water levels decline below specified levels at Target Monitoring Locations, injection rates in nearby wells can be adjusted to mitigate the impact.

In 2021, Dufferin Aggregates applied for an extension to the East Quarry and proposed an extension of the MAR system to mitigate potential impacts. The configuration of 15 recharge wells, water mains, and seven Target Monitoring Locations, are presented on Figure 2, and water level changes in the Lockport Formation associated with the quarry extension and recharge system is presented on Figure 3.

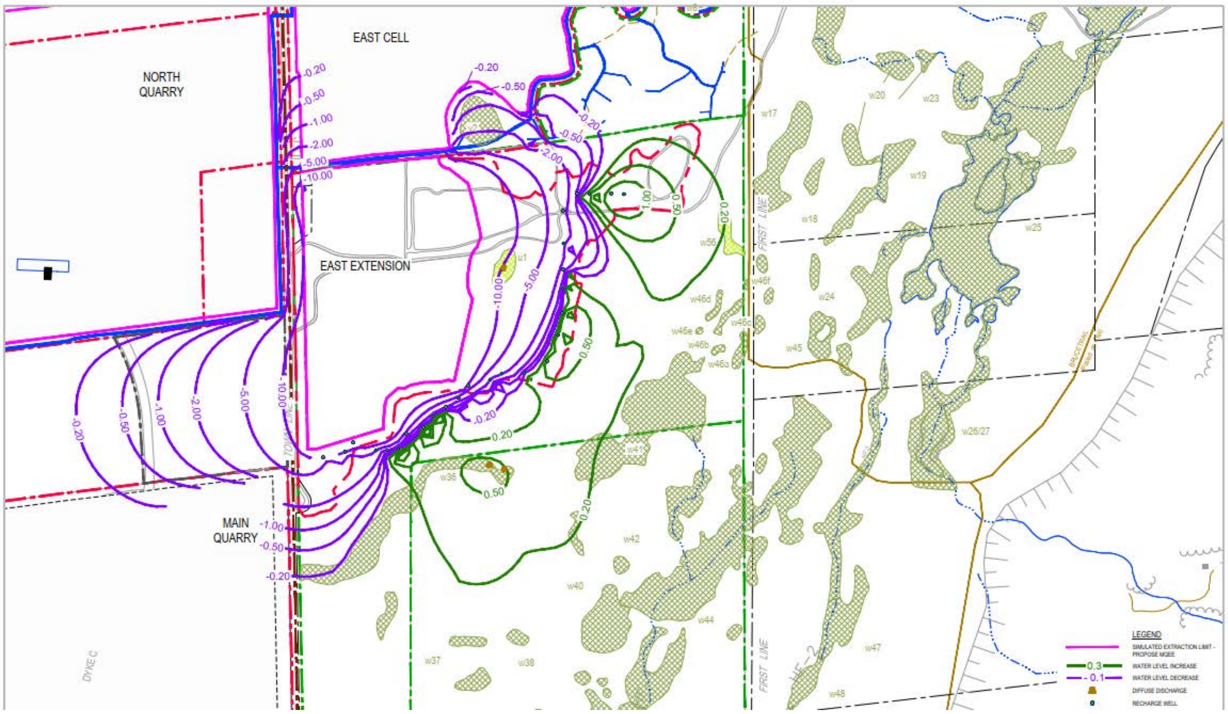

**Figure 3: Milton Quary East Extension Groundwater Level Change in the Lockport Formation**

The water management plan indicates recharge wells will be operated continuously throughout the life of the quarry to maintain water levels at or slightly above the established baseline level. Upon rehabilitation, the MAR system will continue during the filling of the quarry and will be decommissioned when the quarry lakes have reached their final levels (GHD and GEC, 2021).

The Milton Quarry East Extension demonstrates that MAR can effectively mitigated impacts of aggregate extraction on groundwater levels and downgradient groundwater users.

## 3.2 Elgin Mills Stormwater Infiltration System

In Richmond Hill, Ontario, an infiltration system was constructed in 2008 at a commercial plaza as a part of a stormwater management system. Its design, operation, and medium-term operation are described the TRCA's report entitled: "Evaluation of Underground Stormwater Infiltration Systems" (2013).

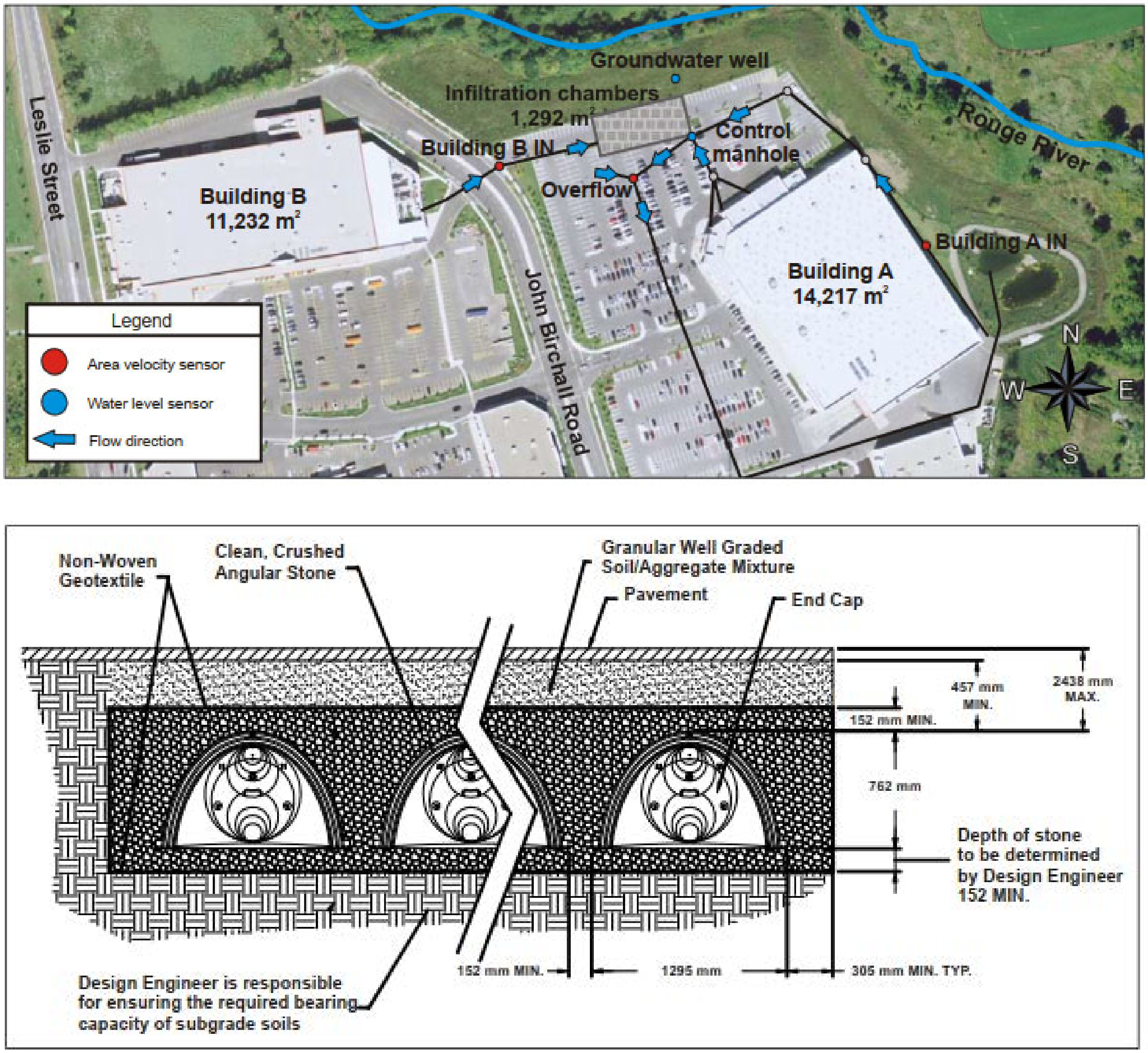

**Figure 4: Elgin Mills Stormwater Infiltration System Plan and Cross Section**

Source water for the infiltration system is obtained from the roofs of two large commercial buildings. The source water was assessed to pose little risk to groundwater quality and was likely to contain very low levels of suspended sediments. Based on these assessments, no pre-treatment or source water sampling was required.

The infiltration system is 1,292 m$^2$ and approximately 1 m deep. It uses infiltration chambers, 20 to 50 mm crushed clear stone backfill, and a control manhole with weir plates to manage inflows. The system was designed to accommodate up to 840 m$^3$ and expected to discharge fully in 62 hours, based on an infiltration rate of 11 mm/hr, and therefore a system discharge rate of 3.8 L/s. The infiltration system layout and a cross section are presented in Figure 4.

This site is located immediately to the south of the Rouge River, which is a cold-water aquatic habitat. Groundwater discharge rate, quality, and temperature are important factors in maintaining predevelopment habitat functions in the river. By infiltrating a portion of the water captured on impervious surfaces in the development, ecological functions are maintained.

The hydrogeological characterization of the site showed a shallow unconfined aquifer in a sandy silt material, which flows to the north and discharges to the Rouge River immediately north of the site. The water table is typically located 2 to 3 m below ground surface and with a seasonally high water table of 230.6 masl. A sand lens, believed to be connected the Rouge River, was observed between elevations of 230 and 231 masl in boreholes near the infiltration system. A bottom depth of 230.50 masl was selected for the infiltration system to connect to the sand lens, infiltrate water more quickly, and maintain groundwater discharge to the river. This design decision means that during seasonally high conditions, the water table will be at or near the base of the infiltration system and that the sand lens has the potential to transport infiltrating water quickly into the subsurface and to the receptor.

Operational monitoring was conducted following completion of the system in September 2008 to July 2011. Precipitation, water levels in the system, and groundwater were monitored during this period, with the following key findings:

- Performance of the system varied between observed infiltration rates of 1.0 to 13.5 mm/hour depending on if a recent storm event had partially filled the storage system and increased the water table elevation;
- No decline in performance was noted over the first three years of operation. A contributing factor in this reliable performance is the low levels of suspended solids;
- Groundwater elevations downgradient of the infiltration system increased in response to the operation of the system; and
- Observed infiltration rates were generally less than those estimated in the design of the system, based on literature values, highlighting the value of site specific, in situ testing.

Overall, the Elgin Mills Crossing Site serves as a successful example of how underground stormwater infiltration systems can be implemented to promote sustainable water management and mitigate the impacts on local hydrology.

## 3.3 Mannheim ASR

In 2005 the Region of Waterloo commissioned a managed aquifer recharge (MAR) system to take advantage of flows in the Grand River significantly exceeding demand from water users in the fall, winter, and spring, to address periods in the summer when flows in the Grand River are lower and water demand is high (Camilleri, 2019). To this end, water from the Grand River is used in an aquifer storage and recovery system (ASR). Injection wells directly recharge a sand and gravel aquifer in the Waterloo Moraine throughout the year, then recover the water during periods of low flow and high demand, as shown on Figure 5 (Stantec, 2015).

The ASR system contains four wells used for both injection and recovery and two recovery wells to the east and west of the injection of the system. The system has operated effectively and provides 231 L/s in sustainable peaking capacity to the Region of Waterloo's water supply system, which corresponds to 10% of the Region's peak day water demand in 2010 (Stantec, 2015).

Water quality in the system is managed using water treatment prior to injection and following recovery (Grand River Watershed Water Management Plan, 2014). Prior to injection, water is treated using an ultraviolet (UV) system to provide primary disinfection. Following recovery, the water is chlorinated prior to distribution (Stantec, 2015).

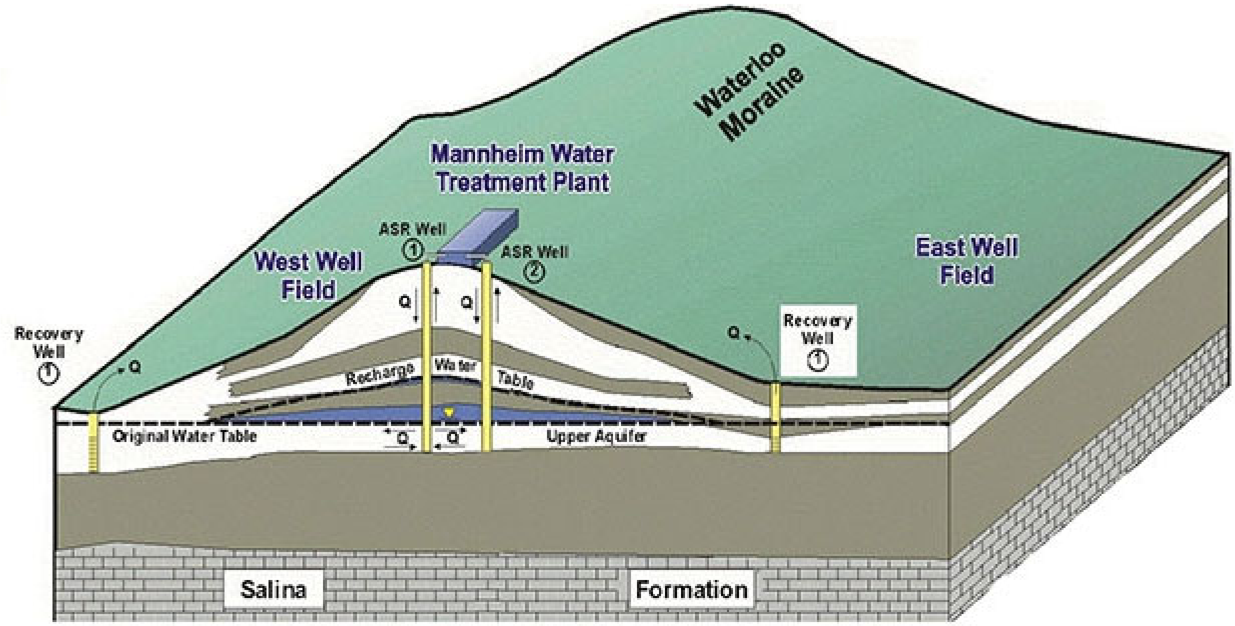

**Figure 5: Mannheim Aquifer Storage and Recovery System Conceptual Configuration (Camilleri, 2019)**

The Mannheim ASR serves as an example of a well managed ASR system to meet the needs of the Region of Waterloo as it grows and to limit environmental impact of water use.

## 4.0 SUMMARY OF BEST PRACTICES

Guidance documents and case studies are unanimous in their consensus that, in general, infiltration systems are a beneficial management practice to mitigate the impacts of development. The technology is well known and supported by a body of literature, design guidance, and successful examples. The best practices in the design and operation of infiltration systems are summarized in the following categories: site characterization, design, construction, operation and maintenance, and water quality.

## 4.1 Site Characterization

Site characterization is essential in the design of infiltration systems.

- Soil permeability is a critical design criterion for infiltration systems. In soils which are not sufficiently permeable, the system will be ineffective at discharging water, and soils which are too permeable may not provide sufficient treatment. It is recommended that the field measured infiltration rates are between 13 to 76 mm/hr (USEPA, 2021), however circumstantially, rates as low as 7 mm/hour (TRCA, 2013) and rates up to 210 mm/hr (Schueler, 1987) may be considered depending on the design priorities and risk to receptors.
- Lithological heterogeneities beneath infiltration systems can be potential preferential pathways for rapid recharge and therefore an elevated risk of groundwater contamination compared to an assumed homogenous aquifer. Continuous subsurface imaging, such as ground penetrating radar (GPR) in combination with boreholes, test pits, and sedimentological insight, can improve the characterization of hydrostratigraphic units in the subsurface (Chouteau and Giroux, 2008).
- Where infiltration systems are constructed above carbonate rocks, enhanced dissolution should be considered in the design of the system. Case studies used detailed site characterization and GPR to search for pre-existing karst prior to construction, and designed systems to avoid rapid localized recharge to the bedrock by ensuring sufficient overburden travel time (PDEP, 2006).

## 4.2 Infiltration System Design

**System Design** – Most resources recommend an infiltration system to be full enclosed with a non-woven filter fabric to prevent the infiltration of fine materials from the surrounding soils, the majority of the backfill be a large diameter clear stone (often 20 to 50 mm) (MOE, 2003) (TRCA, 2013), with a vegetated topsoil cover to prevent erosion, and a filter layer 0.15 to 0.30 m thick be placed at the base of the system.

  - The purpose of the filter layer is to provide filtration for fine particles, pathogens, metals, and organic compounds that will be partially removed by the filter layer. Depending on the water quality parameters of concern, the filter layer maybe composed of fine sand or peat (MOE, 2003).
  - Permeable filter fabric is recommended on the base and side walls of the infiltration system, and less permeable filter fabric on top, to mitigate infiltration of fines from above the system (Schueler, 1987).

**System Sizing** – Most system sizing discussions for stormwater applications are based on a design storage volume, assuming a 40% void ratio in the backfilled volume. Infiltration systems are generally sized such that void space can accommodate the require level of water storage. Saturated depth is specified based on the infiltration rate measurement and designed to fully discharge in 48 to 72 hours (Chahar, Graillot, & Gaur, 2012). Area of the system is then calculated to achieve the required volume (MOE, 2003) (Rowe, 2019).

**Infiltration into the Unsaturated Zone** – Infiltrating water into the unsaturated zone is generally recommended to allow for some degree of aerobic water treatment to take place before the water reaches the water table and more variable conditions (MOE, 2003) (BCMOE, 2014). Recommended offsets vary from 1.5 to 7.5 m based on soil type and potential to improve water quality (MOE, 2003) (USDOT, 2024) (MPCA, 2022) (BCMOE, 2014) (USEPA, 2021). However, where source water quality is of little concern, there are successful examples of infiltration systems sited at the water table elevation (TRCA, 2013) (GHD, 2021).

The design and construction of the infiltration system should consider the primary causes of failure for infiltration systems: poor construction practices, inadequate field testing (in particular in situ testing), and lack of sediment control (through measures discussed in Section 4.4) (Schueler, 1987).

## 4.3 Construction

Construction practices recommended to optimize infiltration system operation include (Schueler, 1987):

- Prevent heavy machinery from compacting subsoils;
- The edges of the infiltration system should be bermed and erosion of the sidewalls stabilized to prevent sediment migration into the infiltration system during construction;
- The infiltration system should be constructed using a backhoe or trencher, equipped with tracks or oversized tires to avoid soil compaction. Use of bulldozers and front-end loaders within the infiltration system alignment should be avoided; and
- Clean stone should be placed in lightly compacted lifts. Unwashed stone contains enough sediment to risk clogging.

## 4.4 Operation and Maintenance

A primary concern in the operation and maintenance of infiltration systems is clogging. Clogging has several possible causes including (Dillon et al., 2024):

- Physical Clogging: Caused by the filtration of suspended solids present in the recharge water or the swelling/mobilization of clays;
- Biological Clogging: Resulting from bacterial growth due to dissolved nutrients in the source water;
- Mechanical Clogging: Caused by air entrainment, gas binding, or formation failure; and
- Chemical Clogging: Due to the precipitation of minerals (for example calcium carbonate).

Physical clogging of control structures, distribution pipes, and pore spaces caused by suspended solids in the source water is among the most commonly reported problems for infiltration systems. The primary mitigation measures are the selection of waters to infiltrate and pre-treatment (USDOT, 2024) (TRCA, 2013).

- Where there is opportunity to select water with low initial TSS to be infiltrated, this has proven to be an effective approach to designing an infiltration system. In some cases, systems have sourced very clear water, operated an infiltration system with no pre-treatment, and observed no long term clogging. Systems that received water with very low levels of suspended solids generally continued to perform well and required little maintenance (Schueler, 1987) (TRCA, 2013).
- Various pre-treatment methods to settle or otherwise attenuate suspended solids are recommended, including, use of sumps in injection control structures, oil and grit separators, prefiltration of water through filter sand, fabric, or organic material, prior to it entering the infiltration system, and reduction of suspended sediment by allowing water to gently flow through a grassy swale or filter strip prior to entering the infiltration system (Schueler, 1987) (MOE, 2003) (TRCA, 2013) (BCMOE, 2014).

- Where additional protection from clogging is needed in the design, the perforated distribution pipe can be oversized and wrapped in filter fabric to act as an additional layer of sediment control in the system (Schueler, 1987).

Maintenance activities should include (BCMOE, 2014) (USEPA, 2021) (USDOT, 2024):

- Regular inspections for sediment accumulation or other clogging, any structural problems, such as cracking or settlement, animal activity, or undesirable vegetation growth;
- Minor sediment removal from easily accessed areas of the system;
- Major sediment removal with the use of flushing and vac trucks to remove sediment from subsurface facilities; and
- Documentation standards for all maintenance activities.

## 4.5 Water Quality

Water quality parameters often considered in the design of infiltration systems include the following (BCMOE, 2014) (Dillon et al., 2022).

- Suspended solids from numerous sources including un-stabilized soils, human activities and atmospheric deposition. Suspended sediments are a concern for all sites, because other pollutants can adhere to particulates, and because they can clog infiltration facilities, diminishing their performance.
- Inorganics including iron, manganese, arsenic, and trace metals (primarily copper, lead, zinc, and cadmium). Where geochemical conditions are affected by the infiltration system, it is possible to mobilize inorganic substances in the subsurface. Where this risk is identified a geochemical assessment is recommended.
- Organics including contaminants of emerging concern (e.g., per- and polyfluoroalkyl substances) as well as herbicides, pesticides, hydrocarbons, industrial chemicals, algal toxins, pharmaceuticals, personal care products and disinfection byproducts.
- Nutrients, primarily nitrogen and phosphorus, from landscaping activities, automobile exhaust and atmospheric fallout.
- A wide variety of petroleum hydrocarbons associated with vehicles and other human activities.
- Salts used for roadway de-icing.
- Pathogens and pathogen indicators associated with human waste, animal waste, and natural watershed sources. Preventative measures to manage pathogen hazards include natural treatment in the aquifer (which requires validation), source control, pre-treatment of source water prior to recharge, and treatment on recovered water (e.g., disinfection).
- Radionuclides: elevated radionuclide concentrations may be found in granitic, fractured rock aquifers.
- Temperature: groundwater temperature changes may cause changes in geochemical conditions and gas release, however, in infiltration systems thermal effects are buffered to some extent during the passage of water through the unsaturated zone.

Water quality risk and mitigation in the design of infiltration systems can be considered in the following categories: source water quality, water treatment prior to infiltration (pre-treatment), water quality improvement in the infiltration system and subsurface (intrinsic reduction), the sensitivity of the receptor, and post-treatment before use at the receptor (Dillon et al., 2022).

**Source Water Quality** - Source water quality is evaluated by consideration of known risk factors (proximity to refueling, industrial operations, etc.) and typical water quality for the source (storm water, groundwater, etc.). Source water quality monitoring is not generally conducted where the source water is considered low risk. However, source water monitoring is recommended where either the source of water is at risk of contamination or if there are sensitive receptors to the infiltrated water (BCMOE, 2014).

**Pre-Treatment** – Pre-treatment of waters for some parameters prior to infiltration (e.g. suspended solids) has a significant impact on the effectiveness and longevity of the system and its potential to have impacts on groundwater receptors.

- Pre-treatment of water to be infiltrated with an oil and grease separator has been implemented where these are risk factors in the source water (Schueler, 1987) (TRCA, 2013).
- Depending on source water quality and risk to receptors, treatment of waters for pathogens may be required (Dillon et al., 2022). For example, the Mannheim ASR system is used store water for Municipal drinking water supply, Grand River water is treated using a UV system for primary disinfection prior to entering the injection well and is chlorinated at the extraction well following recovery. In cases where there is limited risk to receptors, or there is sufficient intrinsic reduction in the system, no pre-treatment other than treatment for suspended solids is required, such as the Milton Quarry (GHD, 2021) or most stormwater applications (TRCA, 2013) (USDOT, 2024).

**Intrinsic Reduction** – Water quality has generally bee found to improve between where it enters the infiltration system and when it is observed downgradient in the groundwater system, due to soil interaction, including sorption, precipitation, trapping, filtering, and bacterial degradation. The effectiveness of these processes in improving water quality are dependent on soil type and site specific conditions. Typical water quality improvements include the following.

- The USDOT states typical reduction of contaminant levels by infiltration systems include: 60% in nutrient loads, 85% in metals, 90% in total suspended solids, and 90% in bacteria (2024).
- Similarly, the MPCA states that infiltration systems have a high capacity to treat (65 to 100% improvement) of TSS, metals, oils and grease, and pathogens, a medium capacity to treat dissolved nutrients (~65% reduction), and a low capacity to treat chloride (<30%) (2022).
- Potential contaminants (such as metals and oils) with low solubility generally pose a lower risk to aquifers, because they will tend to adsorb to sediments or will degrade and breakdown over time. For example, many metals may only be transported a few centimetres beneath surface infiltration facilities (BCMOE, 2014).
- To achieve water quality improvements in the infiltration system, the retention time should be less than the maximum retention time (48 to 72 hours, to allow aerobic conditions suitable for bacterial growth in the subsoil) and greater than the minimum retention time (6 hours, to allow filtration and sorption processes time to take place) (Schueler, 1987) (Chahar, Graillot, & Gaur, 2012).

- In general, where risk to water quality receptors is high and water quality enhancement in the subsurface is relied upon to mitigate risks, sampling of groundwater downgradient of the infiltration system is used to validate the effectiveness of the system in enhancing groundwater quality (Dillon et al., 2022).
- Alternative infiltration system backfill materials can be considered to provided enhanced treatment via filtering, adsorption, and ion exchange within the infiltration system, including either a sand or a mixture of perlite, dolomite, gypsum, and crushed rock (CalTrans, 2020).
- Aquifer residence time can effectively remove pollutants, such as pathogens. An application of this principle is a California system which infiltrates wastewater into a drinking water aquifer. A standard for log removal of pathogens before arrival at the drinking water receptor was established and aquifer residence time was accounted for as one log removal per month of residence time in the aquifer (Dillon et al., 2022).

**Post-treatment** – If required, adverse water quality can be mitigated by treatment at the receptor, particularly for drinking water receptors (Dillon et al., 2022). An example of this is the Mannheim ASR system, which uses chlorination post-treatment at its extraction wells to manage pathogen risks to drinking water supplies (Stantec, 2015).

- **Proximity to Receptors** - Where possible, infiltration systems should be cited at least 30 m (CalTrans, 2020) to 60 m (BCMOE, 2014) upgradient from a water supply well. Detailed characterization along the full alignment of the infiltration system, including lithology and groundwater levels with particular caution exercised in the presence of possible karst conditions (BCMOE, 2014) (USEPA, 2021).

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## CLOSURE

We trust that this Technical Memorandum meets your current needs. If you have any questions or require clarification, please contact WSP at your earliest convenience.

**WSP Canada Inc.**

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Attachments: None

https://wsponline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/45 mitigation system design 2025/02 mitigation desktop review (see technical work 40)/19129150 caledon trench technology review mar2025 r1.docx

## APPENDIX B

# FIELD INVESTIGATION

# TECHNICAL MEMORANDUM

**DATE** November 20, 2024 **Project No.** CA-GLD-19129150

**TO** David Hanratty; Mike Le Breton
CBM Aggregates

**CC** Paul Menkveld; Greg Padusenko; Heather Melcher

**FROM** George Schneider; Victoria Propp **EMAIL george.schneider@wsp.com**

# FIELD INVESTIGATION RESULTS - GROUNDWATER MITIGATION SYSTEM FOR THE PROPOSED CBM CALEDON PIT / QUARRY

## 1.0 INTRODUCTION

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada) has applied to the Ministry of Natural Resources (MNR) for a Class A Licence (Pit and Quarry Below Water) under the Aggregate Resources Act (ARA) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation. To support the application process, WSP Canada Inc. (WSP), formerly Golder Associates Ltd. (Golder), was retained by CBM beginning in 2019 to carry out technical studies and prepare a Level 1/2 Water Report (Golder December 2022, revised July 2023).

In order to maintain groundwater levels on the west and south sides of the Main and South Quarry areas, the revised Water Report proposed that a groundwater mitigation system, consisting mainly of a series of infiltration trenches (Figure 1) be constructed during pit / quarry operations, to help maintain groundwater levels west and south of the site within their normal seasonal range, and thereby mitigate the temporary effects of pit / quarry dewatering on water users and ecological features.

As part of the application process, CBM received review comments on the revised Water Report from nine agency / stakeholder groups. Five of the nine agencies / groups requested additional information regarding the proposed groundwater mitigation system, in order demonstrate that the system will perform as predicted and mitigate potential impacts to groundwater during the operation of the pit / quarry.

The investigation results are being used to update the Hydrogeosphere (HGS) groundwater-surface water numerical model for the site, update hydrogeologic predictions during pit / quarry operations, and help advance the detailed design of the mitigation system, building on the conceptual design initially presented in the revised Water Report (Golder July 2023).

## 2.0 FIELD INVESTIGATIONS

In the spring of 2024, WSP was retained by CBM to undertake field investigations along the proposed infiltration trench alignment, to inform the design of the proposed groundwater mitigation system, install the well nests needed to establish baseline conditions and eventually monitor system performance, and at the same time respond to agency / stakeholder requests for additional information. This technical memorandum presents the results of these field investigations, which were carried out by WSP from April to June 2024 and were comprised mainly of the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 1).

The field investigations were comprised of the following main activities:

- Borehole drilling and monitoring well nest installation;
- Laboratory testing of overburden soils;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

These investigations are described in the sections below.

## 2.1 Drilling and Monitoring Well Installation

The borehole drilling and monitoring well installation was carried out by Choice Sonic Drilling Ltd. (CSD) of Brighton, Ontario under WSP supervision over a three-week period during April 2024. Monitoring well locations are shown on Figure 1.

A total of 19 monitoring wells were installed at seven well nest locations MW-IT-01 to MW-IT-07, generally as follows.

- All locations were cleared for underground utilities using public and private locating services, prior to the start of drilling.
- The boreholes were drilled using a track-mounted Sonic SDC 550 drill rig and support equipment including 4x4 pickup trucks, a skid-steer, and a utility trailer equipped with low-impact tires.
- The borehole was advanced through the overburden and bedrock to the required depth with the rotasonic method, obtaining a continuous 114 mm diameter (4 ½”) soil rock core and leaving a 124 mm (4-7/8”) open borehole in the rock.
- The overburden and rock core samples were logged, photographed, and bagged for future laboratory testing.
- The well installation was completed using 51 mm (2”) SCH40 PVC well screen and riser pipe. Each well nest generally consisted of a well installed in the bedrock, contact aquifer and overburden, where possible, with each well installed in its own borehole. Well screens were backfilled with a sand pack and then sealed up to surface using bentonite pellets.
- Each well nest installation was then completed at surface with a lockable protective well casing.
- The monitoring wells were later developed by purging, using a 13 mm inner diameter Waterra tubing with an inertial foot valve. Development was considered complete based on one of the following conditions being met: ten times the volume of water in the monitoring well had been pumped or the well was pumped dry, allowed to recover (fully or partially depending on recovery speed) and pumped dry again.

All boreholes and monitoring wells were later surveyed by Delph and Jenkins North Ltd. of Aurora, Ontario and the results provided to WSP via CBM.

All monitoring and pumping wells were tagged and registered with the MECP Water Well Information System. The well records were submitted to the MECP by CSD on behalf of CBM, the owner of the wells.

A summary of the borehole observations and monitoring well installation details are provided in Table 1. Record of Borehole and Monitoring Well Logs are provided in Appendix A. Core photographs of the deepest borehole at each well nest location are provided in Appendix B. The wells were subsequently used for groundwater level monitoring, single well response tests, and groundwater quality sampling, as discussed in later subsections.

## 2.2 Laboratory Testing

Of the 19 wells drilled on or proximal to the Site, a total 171 soil samples were collected, and of those, 34 representative samples were selected for grainsize analysis (sieve only). Four to six representative soil samples were selected for analysis from the deepest borehole at each well nest location. A variety of soil samples were chosen to confirm the soil descriptions prepared in the field during borehole logging.

The soil core samples were transported to WSP’s Materials Testing Laboratory in Cambridge, which is accredited for Aggregate Testing by the Canadian Council of Independent Laboratories (CCIL) and the Ministry of Transportation Ontario (MTO). In addition to sieve analysis, Fineness Modulus (FM), % Wash Loss, % Crushable Stone and Stone-to-Sand Ratio was calculated for sand and gravel samples.

The grainsize distribution curves are presented in Appendix C and the results are summarized in Table 2. The grainsize results were used to refine the field descriptions of soil types, prepare the final borehole logs presented in Appendix A, and were subsequently used to revise the hydrostratigraphy and HGS numerical model for the site.

## 2.3 Groundwater Level Monitoring

The newly installed groundwater monitoring well nests MW-IT-01 to MW-IT-07 will be added to the groundwater monitoring program at the proposed Caledon Pit / Quarry. These new well nests will help establish baseline groundwater conditions, including groundwater flow direction and vertical hydraulic gradients, and later to monitor groundwater levels adjacent to the proposed infiltration trench system during future pit / quarry operations.

Each monitoring well was equipped with a Van Essen TD-Diver pressure transducer / logger following well development. The loggers were generally installed in the screened interval, each with a range suitable for the range of water levels that may be encountered and programmed to record water levels on a 15-minute interval.

Manual water levels were also measured on May 6, June 26, and September 4, 2024, using an electric water level measuring tape. Groundwater levels were converted to elevations using the surveyed elevation (Delph and Jenkins North Ltd. of Aurora, Ontario) of the ground surface at each monument and the field measured stickup.

The groundwater head elevations monitored as part of this investigation are presented as hydrographs in Appendix D. The figures present data collected between the start of May 2024 up to September 5, 2024. A hydrograph showing the seasonal fluctuation in groundwater head elevations for nearby previously installed monitoring wells (MW20-01A/B, MW20-02 and MW20-18) is also presented in Figure D8. Figure D8 presents data collected between April 2023 up to September 5, 2024. Precipitation data included on these figures was measured at Environment Canada Meteorology Mono Centre Station (Station ID: 6157000).

With reference to the above noted hydrographs presented in Appendix D, the following is noted:

- All monitoring wells show a trend of decreasing water elevation from May to September 2024, concurrent with warm weather and active plant growth, which presumably reduces the water available for infiltration and recharge. This is consistent with seasonal trends observed on the Site since 2021.
- Rapid increases in groundwater levels were observed in response to significant precipitation events at MW-IT-02A/B/C, similar to the response observed at MW20-18.
- The vertical hydraulic gradients between the wells installed in the Gasport formation and the bedrock contact were generally upward at locations MW-IT-01, MW-IT-04, MW-IT-05 and MW-IT-06, and neutral at locations MW-IT-03 and MW-IT-07. At MW-IT-02, there was a notable downward hydraulic gradient throughout the monitoring period.
- At location MW-IT-02, two wells (-A and -B) were installed within the Gasport Formation. There was a downward hydraulic gradient between these wells throughout the monitoring period, which was observed to be increasing in magnitude over time (June and September hydraulic gradients of -0.14 and -0.30, respectively).
- The vertical hydraulic gradients between the wells installed in the bedrock contact and the overburden were generally upward at MW-IT-05, neutral at MW-IT-03 and MW-IT-07, and downward at MW-IT-01. All of the overburden wells, with the exception of MW-IT-03C, have gone dry over the course of the monitoring period.

## 2.4 Hydraulic Testing – Single Well Response Tests (SWRTs)

Single well response tests (SWRTs) were conducted by WSP in all 19 of the newly installed monitoring wells in April and May 2024, following monitoring well development. The SWRTs were analyzed to estimate the hydraulic conductivity of each subsurface interval tested.

### SWRT Methodology

Single well response testing method selection was informed by speed of water level recovery during well development. In monitoring wells with an intermediate recovery speed, a Waterra purge rising head test, bailer test, or a physical slug test were performed as described below.

- Waterra purge rising head test: The monitoring well was allowed to recover following development. Static water levels were confirmed prior the test by measuring manual water levels until the water level had stabilized for 5 minutes. A logger was then placed below the water level and set to a high recording frequency, to optimize the collection of data for a period of minutes or hours. The static water level was monitored for several minutes to observe any minor water level trends. The Waterra pump was then used to rapidly purge the well. The volume purged from the well was measured in a graduated bucket. The Waterra pump was then removed from the monitoring well and recovery was monitored using the logger and manual water levels. The logger was downloaded, and the test considered completed when recovery exceeded 95%.
- Bailer test: The monitoring well was allowed to recover following development. Static water levels were confirmed prior the test by measuring manual water levels until the water level had stabilized for 5 minutes. A logger was then placed below the water level and set to a high reading frequency, to allow for the collection of data for a period of minutes or hours. The static water level was monitored for several minutes to observe any minor water level trends. A bailer was then lowered into the well and allowed to fill with water. The bailer was then rapidly removed from the well and the volume of water removed was recorded. A rising head test was

monitored using the logger and manual water level measurements until 95% recovery was exceeded. Where there was uncertainty if the logger had shifted during the insertion and removal of the bailer, the test was repeated.

- Physical slug test: The monitoring well was allowed to recover following development. Static water levels were confirmed prior the test by measuring manual water levels until the water level had stabilized for 5 minutes. A logger was then placed below the water level and set to a high reading frequency, to allow for the collection of data for a period of minutes or hours. The static water level was monitored for several minutes to observe any minor water level trends. A slug of known volume was then lowered quickly to displace the water in the well and a falling head test was monitored using the logger and manual water level measurements. Typically, when recovery exceeded 95%, the slug was rapidly removed from the well and recovery was monitored until 95% was exceeded. Where there was uncertainty if the logger had shifted during the insertion and removal of the slug, the test was repeated.

Where rapid recovery from well development was identified, a pneumatic displacement rising head test was performed.

- A pneumatic displacement rising head test was conducted by sealing the top of the riser pipe off with the test apparatus, and then using air pressure to displace groundwater in the riser pipe out through the well screen.
- The pressure in the system is monitored using pressure transducers at two locations in the riser pipe: in the water column at a known depth, and in the air space above the water column.
- Typically, pressure in the riser pipe was allowed to equilibrate for 5 minutes. Air pressure is then suddenly released, and the transient response is observed as a rising head test.

This test method provided more instantaneous displacement and a better fit with theoretical displacement than traditional tests using a physical slug to displace the water in fast recovering wells. Implementing a pneumatic method is consistent with the Butler’s recommendation for testing high k aquifers (1998).

In some cases, where the monitoring well recovered rapidly, the well head geometry or a water level in the well screen made it impossible complete a pneumatic rising head test. In these cases, a physical slug test, bailer test, or a Waterra purge rising head test were conducted.

## SWRT Analysis

Analysis of the single well response tests was performed using the following methodology.

- Monitoring well details were confirmed based construction details to establish the screen length, well diameter, borehole diameter, sand pack length, stick up, and materials used in well construction.
- Field notes and logger files were reviewed, and a test hydrograph was plotted.
- A conceptual model of the well was developed, including identifying if the well was confined or unconfined, determining aquifer thickness, and estimating well penetration, based on a review of the borehole log and downhole geophysical data.
- It was assumed that the tested interval was homogenous, isotropic, and no borehole skin affected the test.

- An effective radius correction was applied if the water level entered the sand pack during the test and if the water level was in the well screen interval during the majority of the test.
- These parameters were entered into AQTESOLV (Version 4.50) and an analytical solution was applied to calculate a hydraulic conductivity for the test.
  - Where test results were overdamped (displacement consistently fell toward the static level), the Bouwer Rice (1976) (confined or unconfined, depending on well model) solution was applied.
  - Where test results were underdamped (displacement oscillated around the static level), Springer-Gelhar (1991) solution was applied for unconfined wells and the Butler (1998) solution for confined wells.

### SWRT Results

The single well response tests and results are presented in Table 3 and Appendix E (Figures E1 to E19). A summary of results by aquifer unit is presented below.

**Single Well Response Test Hydraulic Conductivity by Aquifer Unit**

| Formation / Rock Unit | Number of Observations | Minimum K (m/s) | Maximum K (m/s) | Geometric Mean K (m/s) |
|---|---|---|---|---|
| Overburden | 4 | $8x10^{-06}$ | $2x10^{-03}$ | $1x10^{-04}$ |
| Bedrock Contact | 7 | $1x10^{-05}$ | $8\ x10^{-04}$ | $2\ x10^{-04}$ |
| Gasport | 7 | $6x10^{-07}$ | $6\ x10^{-04}$ | $2\ x10^{-05}$ |
| Gasport / Shaley Dolostone | 1 | $2\ x10^{-04}$ | | |

The following observations are made with respect to the results of the SWRTs:

- The SWRTs performed on wells screened in the Gasport Formation ranged from $6x10^{-07}$ m/s to $6\ x10^{-04}$ m/s, which is typical of lithologies ranging from a middle value for unfractured dolostone to a middle value of weathered dolostone (Freeze and Cherry 1979). This is consistent with the lithological observations at the Site and previously reported hydraulic conductivity ranges in the revised Water Report Level 1/2.
- The SWRT performed on the well screened in both the Gasport Formation and Shaley Dolostone fell within the range of values observed for the wells that were entirely screened within the Gasport Formation. This value is approximately an order of magnitude greater than the maximum observed in the revised Water Report.
- The results of SWRTs in the overburden were generally consistent with published hydraulic conductivities for the soil materials observed during drilling at those locations.

## 2.5 Groundwater Quality

Water quality sampling was carried out by WSP field personnel between April 26 to May 1, 2024, at the monitoring well nests MW-IT-01 to MW-IT-07 shown on Figure 1. The sampling methodology was generally as follows.

- All monitoring wells installed were developed and completed with dedicated groundwater water sampling equipment (tubing and Waterra foot-valves).
- Each well was purged and then sampled. Field parameters (including pH, electrical conductivity, and temperature) were recorded after each purge volume, to ensure water chemistry had stabilized prior to sampling.
- The water samples were collected in pre-supplied laboratory bottles, placed in ice-packed coolers, and delivered to the Bureau Veritas (BV) Labs in Mississauga following standard Chain of Custody protocols.
- The samples were analyzed at BV Labs for the RCAP groundwater suite (which includes general chemistry, nutrients, inorganics and metals), as well as benzene, toluene, ethylbenzene and xylene (BTEX) and petroleum hydrocarbons (PHC) F1 to F4.
- Analytical results were compared to:
  - Table 2: Full Depth Generic Site Condition Standards [SCS] in a Potable Groundwater Condition - Coarse Grained Sediments - Residential / Parkland / Institutional Use from the MECP *Soil, ground water and sediment standards for use under Part XV.1 of the Environmental Protection Act*, dated July 1, 2011;
  - Ontario Drinking Water Quality Standards (ODWS) from the MECP *Safe Drinking Water Act*, dated January 1, 2020; and
  - Provincial Water Quality Objectives (PWQO) from *Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy*, reprinted February, 1999.

Water quality results are summarized in Table 4 and are presented with MECP Table 2, ODWS and PWQO criteria presented alongside the data for comparison purposes. A full set of analytical results from the laboratory, including chain of custody and certificates of analysis, are provided in Appendix F. The groundwater samples were analyzed for dissolved metals (not total metals) for comparison to MECP Table 2 and ODWS, and as such, the groundwater samples for metals were field filtered. It should be noted that the PWQO are intended to be compared to total metal concentrations, which may be higher than dissolved metal concentrations. The comparison to the PWQO is nonetheless considered to be helpful in understanding the potential quality of excess water collected during pit / quarry operations that may be discharged from the Site to the Osprey Valley Golf Course irrigation pond system.

In general, the water quality was in the typical range for groundwater in this hydrogeologic setting.

There were some exceedances of ODWS and MECP Table 2 parameters, including total dissolved solids (TDS), hardness, chloride, cobalt, manganese, sodium and PHC F3 hydrocarbons. There were also a number of occasional exceedances of PWQO parameters, notably for cobalt and BTEX (toluene).

Several locations that exhibited one or more detections of parameters presumed to be related to anthropogenic activities, including elevated chloride and sodium (MW-IT-01C), elevated PHCs and detections of one or more BTEX parameters. Elevated PHC and BTEX concentrations may be due to the PVC cement used during well installation to extend the riser pipe at ground surface.

# 3.0 CLOSURE

We trust that this memorandum meets your current needs. If you have any questions or require clarification, please contact the undersigned at your earliest convenience.

**WSP Canada Inc.**

Victoria Propp

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Attachments: Table 1 – Borehole and Monitoring Well Details for MW-IT Wells
Table 2 – Summary of Grainsize Results for MW-IT Wells
Table 3 – Summary of Single Well Response Tests for MW-IT Wells
Table 4 – Summary of Water Quality Results for MW-IT Wells
Figure 1 – Location of Infiltration Trench Monitoring Well Nests MW-IT-01 to MW-IT-07
Appendix A – Borehole Logs and Well Installation Details
Appendix B – Core Photographs
Appendix C – Grainsize Test Results
Appendix D – Hydrographs
Appendix E – Single Well Response Tests
Appendix F – Water Quality Results

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# Table 1
## Borehole and Monitoring Well Details for MW-IT Wells
## CBM Caledon Pit / Quarry

| Well ID | Date Drilled | Easting (m) UTM 17T | Northing (m) UTM 17T | Ground Surface Elevation (masl) | Standpipe | Total Hole Depth (mbgs) | Depth to Bedrock (mbgs) | Stick Up (m) | Formation Screened | Screen from (m) | Screen to (m) | Screen length (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-IT-01A | April 15, 2024 | 577201 | 4852516 | 403.67 | 2" PVC | 26.52 | 17.68 | 0.930 | Gasport Fm | 21.64 | 23.16 | 1.52 |
| MW-IT-01B | April 16, 2024 | 577202 | 4852514 | 403.63 | 2" PVC | 19.51 | 17.98 | 0.830 | Contact Aquifer | 16.71 | 18.84 | 2.13 |
| MW-IT-01C | April 16, 2024 | 577204 | 4852513 | 403.58 | 2" PVC | 11.96 | - | 0.896 | Overburden | 10.44 | 11.96 | 1.52 |
| MW-IT-02A | April 16, 2024 | 577009 | 4852710 | 401.46 | 2" PVC | 16.76 | 6.1 | 0.861 | Gasport Fm | 14.64 | 16.16 | 1.52 |
| MW-IT-02B | April 17, 2024 | 577007 | 4852712 | 401.49 | 2" PVC | 12.50 | 6.4 | 0.912 | Gasport Fm | 8.84 | 11.89 | 3.05 |
| MW-IT-02C | April 17, 2024 | 577006 | 4852713 | 401.47 | 2" PVC | 7.01 | - | 0.822 | Contact Aquifer | 5.18 | 6.71 | 1.52 |
| MW-IT-03A | April 18, 2024 | 577352 | 4852364 | 397.88 | 2" PVC | 14.94 | 9.75 | 0.895 | Gasport Fm | 13.29 | 14.81 | 1.52 |
| MW-IT-03B | April 18, 2024 | 577354 | 4852363 | 397.76 | 2" PVC | 12.04 | 9.75 | 0.929 | Contact Aquifer | 9.60 | 11.43 | 1.83 |
| MW-IT-03C | April 18, 2024 | 577355 | 4852362 | 397.74 | 2" PVC | 7.92 | - | 0.910 | Overburden | 5.79 | 7.32 | 1.52 |
| MW-IT-04A | April 19, 2024 | 577521 | 4852364 | 397.68 | 2" PVC | 12.19 | 6.55 | 0.837 | Gasport Fm | 10.21 | 11.73 | 1.52 |
| MW-IT-04B | April 22, 2024 | 577522 | 4852363 | 397.69 | 2" PVC | 9.14 | 5.49 | 0.869 | Contact Aquifer | 5.33 | 8.38 | 3.05 |
| MW-IT-05A | April 22, 2024 | 577614 | 4852195 | 399.30 | 2" PVC | 14.94 | 9.14 | 0.871 | Gasport Fm | 11.39 | 14.44 | 3.05 |
| MW-IT-05B | April 23, 2024 | 577612 | 4852197 | 399.23 | 2" PVC | 10.36 | 10.06 | 0.865 | Contact Aquifer | 8.71 | 10.23 | 1.52 |
| MW-IT-05C | April 23, 2024 | 577611 | 4852199 | 399.18 | 2" PVC | 7.62 | - | 0.888 | Overburden | 5.79 | 7.32 | 1.52 |
| MW-IT-06A | April 24, 2024 | 578068 | 4852428 | 398.67 | 2" PVC | 11.58 | 6.25 | 0.861 | Gasport Fm | 9.75 | 11.28 | 1.52 |
| MW-IT-06B | April 25, 2024 | 578069 | 4852429 | 398.62 | 2" PVC | 9.14 | 6.10 | 0.834 | Contact Aquifer | 6.00 | 9.04 | 3.05 |
| MW-IT-07A | April 26, 2024 | 577897 | 4852208 | 400.14 | 2" PVC | 17.68 | 10.21 | 0.946 | Gasport Fm and Shaley Dolostone | 13.72 | 15.24 | 1.52 |
| MW-IT-07B | April 29, 2024 | 577898 | 4852209 | 400.19 | 2" PVC | 12.95 | 9.75 | 0.901 | Contact Aquifer | 9.61 | 12.66 | 3.05 |
| MW-IT-07C | April 29, 2024 | 577899 | 4852211 | 400.14 | 2" PVC | 9.30 | - | 1.003 | Overburden | 7.48 | 9.00 | 1.52 |

# Table 2
# Summary of Grainsize Results for MW-IT Wells
# CBM Caledon Pit / Quarry

| Well ID | Sample ID | Run Depth (ft) | | | | Percent Gravel (%) | Percent Sand (%) | Percent Silt (%) | Full FM Value | Sand Portion FM Value | Wash Loss (%) | Crushable Stone (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Top | | Bottom | | | | | | | | |
| | | (ft) | (m) | (ft) | (m) | | | | | | | |
| MW-IT-01A | 7 | 12.5 | 3.81 | 17.5 | 5.33 | 42 | 39 | 19 | 5.43 | 3.92 | 18.7 | 20.37 |
| MW-IT-01A | 9 | 22.0 | 6.71 | 26.0 | 7.92 | 46 | 39 | 15 | 5.62 | 4.32 | 15.0 | 17.44 |
| MW-IT-01A | 12 | 32.0 | 9.75 | 36.0 | 10.97 | 55 | 35 | 10 | 6.64 | 4.88 | 10.4 | 25.44 |
| MW-IT-01A | 13 | 38.0 | 11.58 | 43.0 | 13.11 | 0 | 10 | 90 | 0.04 | 0.04 | 90.4 | 0.00 |
| MW-IT-01A | 17 | 51.5 | 15.70 | 56.0 | 17.07 | 67 | 28 | 5 | 7.47 | 5.65 | 4.5 | 30.99 |
| MW-IT-02A | 3 | 3.5 | 1.07 | 8.0 | 2.44 | 21 | 62 | 17 | 3.23 | 3.02 | 16.8 | 0.51 |
| MW-IT-02A | 5 | 10.0 | 3.05 | 11.5 | 3.51 | 30 | 40 | 30 | 3.59 | 3.06 | 30.2 | 8.12 |
| MW-IT-02A | 6 | 11.5 | 3.51 | 14.0 | 4.27 | 64 | 27 | 9 | 7.54 | 5.28 | 9.3 | 32.65 |
| MW-IT-02A | 7 | 16.5 | 5.03 | 18.0 | 5.49 | 56 | 27 | 17 | 6.17 | 4.59 | 16.8 | 25.14 |
| MW-IT-03A | 3 | 4.0 | 1.22 | 8.0 | 2.44 | 49 | 40 | 11 | 5.56 | 4.48 | 11.1 | 16.25 |
| MW-IT-03A | 4 | 9.0 | 2.74 | 11.5 | 3.51 | 2 | 22 | 76 | 0.38 | 0.38 | 75.9 | 0.00 |
| MW-IT-03A | 7 | 15.0 | 4.57 | 17.5 | 5.33 | 63 | 24 | 13 | 7.32 | 5.11 | 13.4 | 35.21 |
| MW-IT-03A | 9 | 21.0 | 6.40 | 25.5 | 7.77 | 70 | 20 | 10 | 8.39 | 5.43 | 9.6 | 42.10 |
| MW-IT-03A | 10 | 29.0 | 8.84 | 31.0 | 9.45 | 57 | 20 | 23 | 6.30 | 4.51 | 22.7 | 29.28 |
| MW-IT-04A | 2 | 6.0 | 1.83 | 9.0 | 2.74 | 47 | 40 | 13 | 5.59 | 4.47 | 12.6 | 18.79 |
| MW-IT-04A | 4 | 9.0 | 2.74 | 10.0 | 3.05 | 59 | 22 | 19 | 4.39 | 3.78 | 18.8 | 8.22 |
| MW-IT-04A | 6 | 13.0 | 3.96 | 15.5 | 4.72 | 0 | 65 | 35 | 0.28 | 0.28 | 34.8 | 0.00 |
| MW-IT-04A | 7 | 15.5 | 4.72 | 17.0 | 5.18 | 0 | 30 | 70 | 0.03 | 0.03 | 70.4 | 0.00 |
| MW-IT-04A | 9 | 19.0 | 5.79 | 21.5 | 6.55 | 52 | 27 | 21 | 6.13 | 4.36 | 20.7 | 26.28 |
| MW-IT-05A | 2 | 3.0 | 0.91 | 8.0 | 2.44 | 47 | 38 | 15 | 5.85 | 4.26 | 14.6 | 20.14 |
| MW-IT-05A | 3 | 8.0 | 2.44 | 13.0 | 3.96 | 46 | 41 | 13 | 5.57 | 4.33 | 12.7 | 18.04 |
| MW-IT-05A | 4 | 13.0 | 3.96 | 18.0 | 5.49 | 40 | 43 | 17 | 4.65 | 3.77 | 16.6 | 14.75 |
| MW-IT-05A | 5 | 18.0 | 5.49 | 23.0 | 7.01 | 0 | 87 | 13 | 1.19 | 1.19 | 13.0 | 0.00 |
| MW-IT-05A | 6 | 23.0 | 7.01 | 28.0 | 8.53 | 0 | 33 | 67 | 0.08 | 0.08 | 67.0 | 0.00 |
| MW-IT-06A | 1 | 0.0 | 0.00 | 3.0 | 0.91 | 38 | 38 | 24 | 4.85 | 3.67 | 23.5 | 18.54 |
| MW-IT-06A | 2 | 3.0 | 0.91 | 8.0 | 2.44 | 44 | 40 | 16 | 5.40 | 4.21 | 15.9 | 17.72 |
| MW-IT-06A | 3 | 8.0 | 2.44 | 13.0 | 3.96 | 60 | 29 | 11 | 7.39 | 5.01 | 10.8 | 33.95 |
| MW-IT-06A | 4 | 13.0 | 3.96 | 18.0 | 5.49 | 44 | 42 | 14 | 5.43 | 4.28 | 14.2 | 14.30 |
| MW-IT-06A | 5 | 18.0 | 5.49 | 23.0 | 7.01 | 68 | 21 | 11 | 7.57 | 5.41 | 10.7 | 32.68 |
| MW-IT-07A | 2 | 4.0 | 1.22 | 8.0 | 2.44 | 35 | 48 | 17 | 4.40 | 3.85 | 17.1 | 6.76 |
| MW-IT-07A | 3 | 8.0 | 2.44 | 11.0 | 3.35 | 53 | 40 | 7 | 6.25 | 4.99 | 7.2 | 19.71 |
| MW-IT-07A | 5 | 18.0 | 5.49 | 21.0 | 6.40 | 40 | 56 | 4 | 5.61 | 4.60 | 4.1 | 12.55 |
| MW-IT-07A | 6 | 21.0 | 6.40 | 28.0 | 8.53 | 44 | 49 | 7 | 5.56 | 4.68 | 6.8 | 11.85 |
| MW-IT-07A | 7 | 28.0 | 8.53 | 33.0 | 10.06 | 30 | 58 | 12 | 3.87 | 3.37 | 12.4 | 6.10 |

# Table 3
## Summary of Single Well Response Tests for MW-IT Wells
## CBM Caledon Pit / Quarry

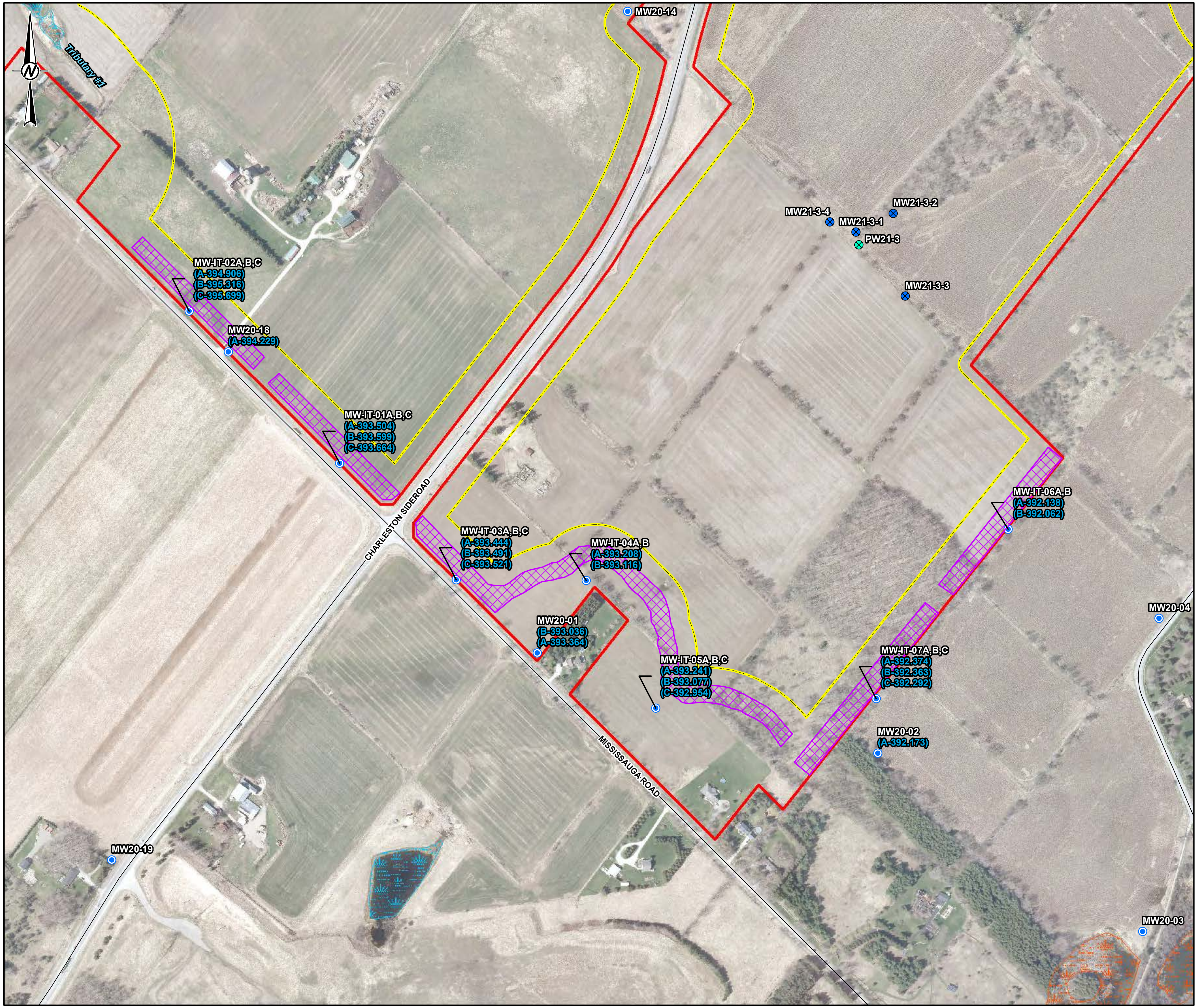
| MW ID | Figure Number | Top of test interval (mbgs) | Bottom of test interval (mbgs) | Depth of Test (center point mbgs) | Ground Surface Elevation (masl) | Depth of Test (center point masl) | Aquifer Model | Screened Formation | Final k (m/s) |
|---|---|---|---|---|---|---|---|---|---|
| MW-IT-01A | D01 | 21.64 | 23.16 | 22.40 | 403.67 | 381.27 | Confined | Gasport Fm | 9.E-05 |
| MW-IT-01B | D02 | 16.71 | 18.84 | 17.78 | 403.63 | 385.85 | Confined | BR Contact | 8.E-04 |
| MW-IT-01C | D03 | 10.44 | 11.96 | 11.20 | 403.58 | 392.38 | Unconfined | Overburden | 5.E-05 |
| MW-IT-02A | D04 | 14.64 | 16.16 | 15.40 | 401.46 | 386.06 | Unconfined | Gasport Fm | 6.E-07 |
| MW-IT-02B | D05 | 8.84 | 11.89 | 10.37 | 401.49 | 391.12 | Unconfined | Gasport Fm | 3.E-06 |
| MW-IT-02C | D06 | 5.18 | 6.71 | 5.95 | 401.47 | 395.53 | Unconfined | BR Contact | 2.E-05 |
| MW-IT-03A | D07 | 13.29 | 14.81 | 14.05 | 397.88 | 383.83 | Unconfined | Gasport Fm | 1.E-06 |
| MW-IT-03B | D08 | 9.6 | 11.43 | 10.52 | 397.76 | 387.25 | Unconfined | BR Contact | 1.E-04 |
| MW-IT-03C | D09 | 5.79 | 7.32 | 6.56 | 397.74 | 391.18 | Unconfined | Overburden | 2.E-03 |
| MW-IT-04A | D10 | 10.21 | 11.73 | 10.97 | 397.68 | 386.71 | Unconfined | Gasport Fm | 1.E-04 |
| MW-IT-04B | D11 | 5.33 | 8.38 | 6.86 | 397.69 | 390.83 | Unconfined | BR Contact | 7.E-04 |
| MW-IT-05A | D12 | 11.39 | 14.44 | 12.92 | 399.30 | 386.38 | Confined | Gasport Fm | 6.E-04 |
| MW-IT-05B | D13 | 8.71 | 10.23 | 9.47 | 399.23 | 389.76 | Confined | BR Contact | 1.E-05 |
| MW-IT-05C | D14 | 5.79 | 7.32 | 6.56 | 399.18 | 392.62 | Unconfined | Overburden | 8.E-06 |
| MW-IT-06A | D15 | 9.75 | 11.28 | 10.52 | 398.67 | 388.16 | Unconfined | Gasport Fm | 1.E-04 |
| MW-IT-06B | D16 | 6 | 9.04 | 7.52 | 398.62 | 391.10 | Unconfined | BR Contact | 6.E-04 |
| MW-IT-07A | D17 | 13.72 | 15.24 | 14.48 | 400.14 | 385.66 | Unconfined | Gasport Fm and Shaley Dolostone | 2.E-04 |
| MW-IT-07B | D18 | 9.61 | 12.66 | 11.14 | 400.19 | 389.05 | Unconfined | BR Contact | 8.E-04 |
| MW-IT-07C | D19 | 7.48 | 9 | 8.24 | 400.14 | 391.90 | Unconfined | Overburden | 3.E-04 |

## Table 4
## Summary of Water Quality Results for MW-IT Wells
## CBM Caledon Pit / Quarry

| | Units | PWQO | Criteria, ODWS | | | | MECP Table 2 | MW-IT-01A | MW-IT-01B | MW-IT-01C | MW-IT-02A | MW-IT-02B | DUP2 | MW-IT-02C | MW-IT-03A | MW-IT-03B | MW-IT-03C | MW-IT-04A | MW-IT-04B | DUP1 | MW-IT-05A | MW-IT-05B | MW-IT-05C | MW-IT-06A | MW-IT-06B | MW-IT-07A | MW-IT-07B | MW-IT-07C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MAC | IMAC | AO | OG | | 30-Apr-24 | 30-Apr-24 | 30-Apr-24 | 30-Apr-24 | 30-Apr-24 | 30-Apr-24 | 30-Apr-24 | 29-Apr-24 | 29-Apr-24 | 29-Apr-24 | 26-Apr-24 | 26-Apr-24 | 26-Apr-24 | 26-Apr-24 | 26-Apr-24 | 26-Apr-24 | 29-Apr-24 | 29-Apr-24 | 1-May-24 | 1-May-24 | 1-May-24 |
| | | | | | | | | Gasport Fm | Gasport Fm / Overburden | Overburden | Gasport Fm | Gasport Fm | Gasport Fm | Gasport Fm / Overburden | Gasport Fm | Gasport Fm / Overburden | Overburden | Gasport Fm | Gasport Fm / Overburden | Gasport Fm / Overburden | Gasport Fm | Gasport Fm / Overburden | Overburden | Gasport Fm | Gasport Fm / Overburden | Gasport Fm / Shaley Dolostone or Cabot Head Fm | Gasport Fm / Overburden | Overburden |
| **Physical Tests (Water)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Anion Sum | me/L | | | | | | | 6.18 | 6.85 | 17.4 | 5.92 | 5.48 | 5.53 | 5.3 | 4.51 | 6.03 | 6.23 | 6.55 | 6.95 | 6.97 | 6.15 | 6.35 | 5.21 | 5.76 | 6.02 | 6.35 | 6.2 | 5.63 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | | | | | | | 220 | 210 | 250 | 230 | 210 | 220 | 220 | 170 | 220 | 210 | 220 | 220 | 220 | 210 | 210 | 170 | 170 | 180 | 210 | 210 | 220 |
| Calculated TDS | mg/L | | | | 500 | | | 330 | 370 | 1000 | 310 | 280 | 280 | 270 | 260 | 320 | 340 | 350 | 380 | 380 | 330 | 340 | 300 | 340 | 350 | 350 | 340 | 310 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | | | | | | | 3.1 | 2.3 | 1.5 | 2.6 | 3.6 | 3 | 3.9 | 2.3 | 3.3 | 1.9 | 2 | 2.7 | 2.5 | 2.8 | 2.4 | 1.7 | 1.9 | 2 | 2.7 | 2.6 | 2.2 |
| Cation Sum | me/L | | | | | | | 6.18 | 7.37 | 19.7 | 5.86 | 5.31 | 5.54 | 5.31 | 5.48 | 6.35 | 6.81 | 6.82 | 7.48 | 7.38 | 6.45 | 6.53 | 5.73 | 6.67 | 6.59 | 6.74 | 6.63 | 6.45 |
| Hardness (CaCO3) | mg/L | | | | | 80-100 | | 280 | 280 | 470 | 280 | 230 | 240 | 240 | 260 | 260 | 260 | 250 | 280 | 280 | 260 | 260 | 260 | 290 | 280 | 270 | 270 | 290 |
| Ion Balance (% Difference) | % | | | | | | | 0.06 | 3.71 | 6.19 | 0.5 | 1.57 | 0.08 | 0.1 | 9.72 | 2.6 | 4.45 | 1.98 | 3.65 | 2.84 | 2.42 | 1.39 | 4.67 | 7.3 | 4.5 | 2.91 | 3.38 | 6.76 |
| Langelier Index (@ 20C) | N/A | | | | | | | 0.964 | 0.855 | 0.827 | 0.883 | 0.996 | 0.931 | 1.05 | 0.814 | 0.967 | 0.757 | 0.779 | 0.942 | 0.895 | 0.919 | 0.837 | 0.775 | 0.804 | 0.821 | 0.913 | 0.898 | 0.896 |
| Langelier Index (@ 4C) | N/A | | | | | | | 0.715 | 0.606 | 0.581 | 0.634 | 0.746 | 0.682 | 0.799 | 0.564 | 0.718 | 0.508 | 0.53 | 0.693 | 0.647 | 0.67 | 0.588 | 0.526 | 0.555 | 0.572 | 0.665 | 0.65 | 0.647 |
| Saturation pH (@ 20C) | N/A | | | | | | | 7.21 | 7.21 | 6.98 | 7.2 | 7.27 | 7.24 | 7.23 | 7.33 | 7.24 | 7.23 | 7.22 | 7.17 | 7.18 | 7.23 | 7.24 | 7.26 | 7.28 | 7.24 | 7.22 | 7.22 | 7.12 |
| Saturation pH (@ 4C) | N/A | | | | | | | 7.45 | 7.46 | 7.22 | 7.45 | 7.52 | 7.49 | 7.48 | 7.58 | 7.49 | 7.48 | 7.47 | 7.42 | 7.42 | 7.48 | 7.49 | 7.51 | 7.53 | 7.49 | 7.46 | 7.46 | 7.37 |
| **Inorganics** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Ammonia-N | mg/L | | | | | | | 0.051 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Unionized Ammonia | mg/L | 0.02 | | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Conductivity | umho/cm | | | | | | | 590 | 720 | 2000 | 540 | 530 | 530 | 500 | 420 | 590 | 640 | 660 | 710 | 710 | 600 | 620 | 510 | 570 | 600 | 630 | 610 | 540 |
| Dissolved Organic Carbon | mg/L | | | | 5 | | | 1.3 | 2.1 | 1.4 | 3.7 | 3.8 | 3.8 | 4 | 0.45 | 2 | 2.2 | 1.7 | 1.8 | 1.8 | 1.8 | 2.8 | 2.2 | 0.99 | 1.1 | 1.6 | 1.7 | 2.5 |
| Orthophosphate (P) | mg/L | | | | | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| pH | pH | 6.5-8.5 | | | | 6.5-8.5 | | 8.17 | 8.07 | 7.8 | 8.08 | 8.26 | 8.17 | 8.28 | 8.14 | 8.21 | 7.99 | 8 | 8.11 | 8.07 | 8.15 | 8.08 | 8.03 | 8.08 | 8.06 | 8.13 | 8.11 | 8.01 |
| Dissolved Sulphate (SO4) | mg/L | | | | 500 | | | 41 | 13 | 19 | 49 | 13 | 12 | 8.6 | 43 | 15 | 14 | 15 | 16 | 16 | 13 | 17 | 33 | 17 | 13 | 14 | 14 | 10 |
| Alkalinity (Total as CaCO3) | mg/L | not decreased by >25% of natural concentration | | | | 30-500 | | 220 | 210 | 250 | 240 | 210 | 220 | 220 | 170 | 220 | 210 | 220 | 230 | 230 | 210 | 210 | 170 | 170 | 190 | 210 | 210 | 230 |
| Dissolved Chloride (Cl-) | mg/L | | | | 250 | | 790 | 28 | 78 | 410 | 7 | 31 | 30 | 24 | 5 | 43 | 57 | 60 | 67 | 67 | 54 | 56 | 29 | 44 | 45 | 54 | 49 | 25 |
| Nitrite (N) | mg/L | | 1.0 | | | | | <0.010 | <0.010 | 0.06 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Nitrate (N) | mg/L | | 10.0 | | | | | 1.17 | 1.8 | 5.29 | <0.10 | 0.95 | 0.94 | 0.59 | <0.10 | 1.65 | 1.73 | 2.44 | 2.74 | 2.75 | 2.66 | 2.73 | 4.54 | 10.5 | 10.6 | 3.75 | 4.11 | 2.32 |
| Nitrate + Nitrite (N) | mg/L | | | | | | | 1.17 | 1.8 | 5.35 | <0.10 | 0.95 | 0.94 | 0.59 | <0.10 | 1.65 | 1.73 | 2.44 | 2.74 | 2.75 | 2.66 | 2.73 | 4.54 | 10.5 | 10.6 | 3.75 | 4.11 | 2.32 |
| **Metals** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | 75 | | | | 100 | | 6 | <4.9 | <4.9 | 5.2 | 9.9 | 5.1 | 7 | 69 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | <4.9 | 11 |
| Dissolved Antimony (Sb) | ug/L | 20 | | 6 | | | 6 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Dissolved Arsenic (As) | ug/L | 100 | | 10 | | | 25 | <1.0 | <1.0 | <1.0 | 5.6 | <1.0 | <1.0 | <1.0 | 3.7 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Dissolved Barium (Ba) | ug/L | | 1000 | | | | 1000 | 29 | 51 | 330 | 91 | 35 | 37 | 17 | 84 | 41 | 30 | 38 | 39 | 38 | 35 | 48 | 39 | 22 | 28 | 38 | 36 | 72 |
| Dissolved Beryllium (Be) | ug/L | 1100 | | | | | 4 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 |
| Dissolved Boron (B) | ug/L | 200 | | 5000 | | | 5000 | 31 | <10 | 14 | 17 | 12 | <10 | 11 | 17 | 12 | <10 | <10 | <10 | <10 | <10 | 15 | 16 | <10 | <10 | <10 | <10 | 12 |
| Dissolved Cadmium (Cd) | ug/L | 0 | 5 | | | | 3 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 |
| Dissolved Calcium (Ca) | ug/L | | | | | | | 75000 | 79000 | 150000 | 71000 | 65000 | 69000 | 68000 | 68000 | 70000 | 75000 | 75000 | 82000 | 81000 | 75000 | 73000 | 86000 | 83000 | 83000 | 77000 | 77000 | 89000 |
| Dissolved Chromium (Cr) | ug/L | 1 CrVI or 8.9 CrIII | 50 | | | | 50 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Dissolved Cobalt (Co) | ug/L | 1 | | | | | 4 | 0.74 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | 0.77 | **10** | **2.4** | **1.8** | 0.69 | 0.65 | **3** |
| Dissolved Copper (Cu) | ug/L | 5 | | | 1000 | | 87 | <0.90 | 0.95 | <0.90 | <0.90 | 1.4 | 1.2 | 1.6 | 0.91 | 1.1 | 0.97 | <0.90 | <0.90 | <0.90 | <0.90 | <0.90 | <0.90 | <0.90 | <0.90 | <0.90 | 0.92 | 1 |
| Dissolved Iron (Fe) | ug/L | 300 | | | 300 | | | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 |
| Dissolved Lead (Pb) | ug/L | 5 | 10 | | | | 10 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Dissolved Magnesium (Mg) | ug/L | | | | | | | 22000 | 19000 | 22000 | 25000 | 17000 | 18000 | 16000 | 23000 | 20000 | 17000 | 16000 | 18000 | 18000 | 17000 | 18000 | 11000 | 19000 | 17000 | 18000 | 18000 | 16000 |
| Dissolved Manganese (Mn) | ug/L | | | | 50 | | | 9.1 | 26 | 66 | 47 | 6.4 | 6.4 | 14 | 29 | 10 | <2.0 | <2.0 | 2.2 | 2.3 | <2.0 | 65 | 210 | 5.9 | 15 | 5.8 | <2.0 | 51 |
| Dissolved Molybdenum (Mo) | ug/L | 40 | | | | | 70 | 1.4 | <0.50 | 1.2 | 3.1 | <0.50 | <0.50 | <0.50 | 2.1 | 5.8 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | 4.2 | 5.9 | <0.50 | <0.50 | <0.50 | <0.50 | 1 |
| Dissolved Nickel (Ni) | ug/L | 25 | | | | | 100 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.7 | 9.5 | 2.6 | 1.7 | <1.0 | <1.0 | 5.8 |
| Dissolved Phosphorus (P) | ug/L | 30 | | | | | | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 |
| Dissolved Potassium (K) | ug/L | | | | | | | 2000 | 1400 | 2800 | 780 | 1100 | 1200 | 1300 | 1100 | 1300 | 1300 | 1200 | 1400 | 1300 | 1300 | 1500 | 1000 | 1000 | 940 | 2100 | 2200 | 1700 |
| Dissolved Selenium (Se) | ug/L | 100 | 50 | | | | 10 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Dissolved Silicon (Si) | ug/L | | | | | | | 2500 | 2500 | 3800 | 3100 | 2200 | 2200 | 2300 | 3900 | 2600 | 2600 | 2600 | 2900 | 2800 | 2600 | 3100 | 3300 | 2500 | 2500 | 2900 | 2800 | 3600 |
| Dissolved Silver (Ag) | ug/L | 0.1 | | | | | 2 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 | <0.090 |
| Dissolved Sodium (Na) | ug/L | | | | 200000 | | | 14000 | 42000 | 240000 | 5000 | 15000 | 15000 | 12000 | 3600 | 28000 | 38000 | 39000 | 43000 | 42000 | 29000 | 31000 | 12000 | 22000 | 23000 | 30000 | 28000 | 16000 |
| Dissolved Strontium (Sr) | ug/L | | | | | | | 1300 | 140 | 310 | 310 | 120 | 120 | 110 | 690 | 140 | 140 | 130 | 140 | 140 | 130 | 150 | 190 | 130 | 120 | 130 | 120 | 160 |
| Dissolved Thallium (Tl) | ug/L | 0.3 | | | | | 2 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Dissolved Titanium (Ti) | ug/L | | | | | | | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Dissolved Uranium (U) | ug/L | 5 | 20 | | | | 20 | 0.3 | 0.34 | 0.26 | 0.15 | 0.45 | 0.42 | 0.32 | 0.57 | 0.47 | 0.27 | 0.27 | 0.24 | 0.24 | 0.24 | 0.33 | 0.47 | 0.15 | 0.17 | 0.24 | 0.24 | 0.28 |
| Dissolved Vanadium (V) | ug/L | 6 | | | | | 6.2 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Dissolved Zinc (Zn) | ug/L | 20 | | | 5000 | | 1100 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| **BTEX & F1 Hydrocarbons** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Benzene | ug/L | 100.00 | 1 | | | | 5 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | 0.21 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| Toluene | ug/L | 0.80 | 60 | | 24 | | 24 | <0.20 | <0.20 | 0.37 | **1.3** | <0.20 | <0.20 | <0.20 | **8.1** | <0.20 | <0.20 | <0.20 | 0.27 | 0.24 | <0.20 | **2.7** | **1.5** | **0.97** | <0.20 | 0.32 | <0.20 | **1.9** |
| Ethylbenzene | ug/L | 8 | 140 | | 1.6 | | 2.4 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | 0.35 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| o-Xylene | ug/L | 40 | | | | | | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | 0.56 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| p+m-Xylene | ug/L | 2-m and 30-p | | | | | | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | 1.2 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 |
| Total Xylenes | ug/L | | 90 | | 20 | | 300 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | 1.8 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 |
| F1 (C6-C10) | ug/L | | | | | | 750 | <25 | <25 | 47 | 200 | <25 | <25 | <25 | 25 | <25 | <25 | <25 | <25 | <25 | <25 | 100 | 85 | <25 | <25 | <25 | <25 | 110 |
| F1 (C6-C10) - BTEX | ug/L | | | | | | | <25 | <25 | 47 | 200 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | <25 | 95 | 84 | <25 | <25 | <25 | <25 | 100 |
| **F2-F4 Hydrocarbons** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | | | | | | 150 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 |
| F3 (C16-C34 Hydrocarbons) | ug/L | | | | | | 500 | <200 | <200 | <200 | 600 | <200 | <200 | 320 | <200 | <200 | <200 | 380 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | 390 |
| F4 (C34-C50 Hydrocarbons) | ug/L | | | | | | 500 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

Notes:
1) PWQO metals standards apply to unfiltered surface water samples. Included here for comparison to filtered groundwater samples.
2) PWQO exceedances bolded.
3) ODWS exceedance highlighted yellow
4) MECP Table 2 exceednaces highlighted blue

Prepared by: MY
Checked by: VRP



**LEGEND**

| | |
|---|---|
| ● | MONITORING WELL |
| ⊗ | MONITORING WELL (2021 PUMPING TEST) |
| ⊗ | TEST PUMPING WELL WELL (2021 PUMPING TEST) |
| 393.504 | GROUNDWATER ELEVATION, mASL |
| — | ROAD |
| ▨ | PROPOSED GROUNDWATER INFILTRATION TRENCH |
| ▨ | UNEVALUATED WETLAND |
| ▨ | PROVINCIALLY SIGNIFICANT WETLAND |
| ☐ | PROPOSED LICENCE LIMIT |
| ☐ | PROPOSED LIMIT OF EXTRACTION |

0 100 200

1:5,000 METRES

**REFERENCE(S)**

1. BASE DATA MNRF LIO OBTAINED 2020
2. WATERCOURSES OBTAINED FROM CREDIT VALLEY CONSERVATION AUTHORITY OPEN DATA PORTAL, NOVEMBER 2022 IN COMBINATION WITH SITE WATERCOURSE SURVEY PROVIDED BY FIRST BASE SOLUTIONS NOVEMBER 2021..
3. IMAGERY FIRSTBASE SOLUTIONS SPRING 2019 (15CM RESOLUTION) AND SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
4. LICENSE AND EXTRACTION LIMIT PROVIDED BY MHBC IN JUNE 2023.
5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA).

PROJECT

CBM CALEDON PIT / QUARRY

TITLE

## LOCATION OF INFILTRATION TRENCH MONITORING WELL NESTS MW-IT-01 TO MW-IT-07

CONSULTANT

wsp

| | |
|---|---|
| YYYY-MM-DD | 2024-06-07 |
| DESIGNED | CGE |
| PREPARED | SA |
| REVIEWED | PGM |
| APPROVED | GWS |

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 19129150 | 0065 | 0.0 | 1 |

PATH: S:\Clients\Votorantim_Cimentos\Long_Par_5_Caledon\99_PROJ\19129150\40_PROD\0065_Hydrogeology\19129150-0065-CH-0002.mxd PRINTED ON: 2024-06-07 AT: 11:07:39 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm 0

APPENDIX A

# Borehole Logs and Well Installation Details

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-01A (CAL)

SHEET 1 OF 1

LOCATION: N 4852515.7 ;E 577201.0

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 15, 2024

DRILL RIG: Sonic

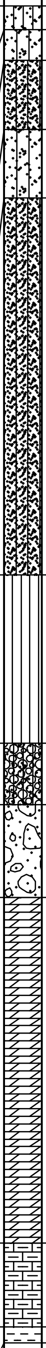
DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

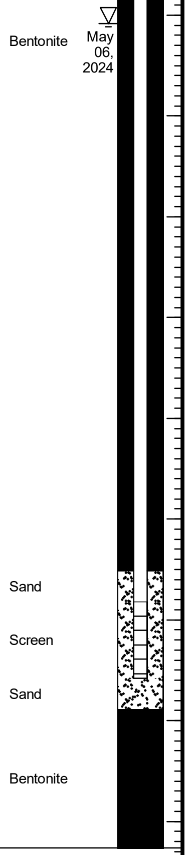
| | | | | |
|---|---|---|---|---|
| JN - Joint<br>FLT - Fault<br>SHR- Shear<br>VN - Vein<br>CJ - Conjugate | BD- Bedding<br>FO- Foliation<br>CO- Contact<br>OR- Orthogonal<br>CL - Cleavage | PL - Planar<br>CU- Curved<br>UN- Undulating<br>ST - Stepped<br>IR - Irregular | PO- Polished<br>K - Slickensided<br>SM- Smooth<br>Ro - Rough<br>MB- Mechanical Break | BR - Broken Rock<br>**NOTE:** For additional abbreviations refer to list of abbreviations & symbols. |

Column headings: DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | FLUSH | COLOUR % RETURN | RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20) | R.Q.D. % (80 60 40 20) | FRACT. INDEX PER 0.25 m (5 10 15 20) | DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn | HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | Diametral Point Load Index (MPa) (2 4 6) | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION

Drilling record: Sonic



| DESCRIPTION | ELEV. / DEPTH (m) |
|---|---|
| GROUND SURFACE | 403.67 / 0.00 |
| (ML) SANDY SILT, some clay; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 402.60 / 1.07 (0.46) |
| (SM) SILTY SAND, trace gravel; few cobbles, sub-rounded to sub-angular, brown, gravel grey, pinkish and white, no odors, no staining, non-cohesive, dry | 401.23 / 2.44 |
| (SM/GP) SILTY SAND and GRAVEL; rounded to sub-angular, brown, grey gravel, no odors, no staining, non-cohesive, dry | 399.86 / 3.81 |
| (SM) SILTY SAND, some gravel; few cobbles, rounded to sub-angular, brown, gravel grey, no odors, no staining, non-cohesive, dry | |
| (SM/GP) SILTY SAND and GRAVEL; rounded to sub-angular, brown, grey gravel, no odors, no staining, non-cohesive, dry | 392.39 / 11.28 |
| (ML) SILT, some sand; light brown, no odors, no staining, cohesive, w~PL | 389.04 / 14.63 |
| (GM) sandy SILTY GRAVEL; sub-rounded to sub-angular, light brown, grey gravel, non-cohesive, wet | 387.82 / 15.85 |
| (GP) SANDY GRAVEL, trace silt; sub-rounded to sub-angular, light brown, grey gravel, no odors, no staining, non-cohesive, wet | 385.99 / 17.68 |
| DOLOSTONE, moderately weathered to fresh, bedded dolostone, grey (GASPORT FORMATION)<br>-weathered fractures from 17.68 to 20.73 m<br>-weathered fractures from 22.25 to 23.77 m | 379.13 / 24.54 |
| SHALEY DOLOSTONE, bedded shaley dolostone, cream to grey, pyrite crystallization | 377.46 / 26.21 |
| SHALE, bedded, shale, blue green (CABOT HEAD FORMATION) | 26.52 |
| BOTTOM OF HOLE | |



DEPTH SCALE

1 : 150

LOGGED: VRP

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-01B (CAL)

SHEET 1 OF 1

LOCATION: N 4852514.4 ;E 577202.4
INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 16, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

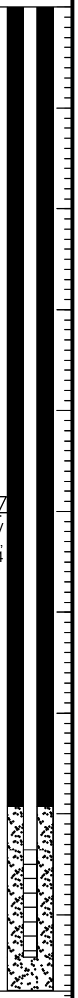
JN - Joint
FLT - Fault
SHR - Shear
VN - Vein
CJ - Conjugate
BD - Bedding
FO - Foliation
CO - Contact
OR - Orthogonal
CL - Cleavage
PL - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular
PO - Polished
K - Slickensided
SM - Smooth
Ro - Rough
MB - Mechanical Break
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
| | | GROUND SURFACE | 403.63 | |
| 0 | Sonic | (ML) SANDY SILT, some clay; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00<br>0.46 | |
| | | (SM) SILTY SAND, trace gravel; few cobbles, sub-rounded to sub-angular, brown, gravel grey, pinkish and white, no odors, no staining, non-cohesive, dry | 402.56<br>1.07 | |
| 2 | | (SM/GP) SILTY SAND and GRAVEL; rounded to sub-angular, brown, grey gravel, no odors, no staining, non-cohesive, dry | 401.19<br>2.44 | |
| 4 | | (SM) SILTY SAND, some gravel; few cobbles, rounded to sub-angular, brown, gravel grey, no odors, no staining, non-cohesive, dry | 399.82<br>3.81 | |
| 6 – 10 | | (SM/GP) SILTY SAND and GRAVEL; rounded to sub-angular, brown, grey gravel, no odors, no staining, non-cohesive, dry | | Bentonite<br>▽ May 06, 2024 |
| 12 | | (ML) SILT, some sand; light brown, no odors, no staining, cohesive, w~PL | 392.35<br>11.28 | |
| 14 | | (GM) sandy SILTY GRAVEL; sub-rounded to sub-angular, light brown, grey gravel, non-cohesive, wet | 389.00<br>14.63 | |
| 16 | | (GP) SANDY GRAVEL, trace silt; sub-rounded to sub-angular, light brown, grey gravel, no odors, no staining, non-cohesive, wet | 387.78<br>15.85 | Sand<br>Screen |
| 18 | | DOLOSTONE, moderately weathered to fresh, bedded dolostone, grey (GASPORT FORMATION) | 385.65<br>17.98 | Sand |
| 20 | | BOTTOM OF HOLE | 384.12<br>19.51 | |

Depth scale marks: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30

Other columns (no entries): SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); FLUSH; COLOUR % RETURN; RECOVERY (TOTAL CORE %, SOLID CORE % 80 60 40 20); R.Q.D. % 80 60 40 20; FRACT. INDEX PER 0.25 m 5 10 15 20; DISCONTINUITY DATA (B Angle 0 90 180 270; DIP w.r.t. CORE AXIS 0 30 60 90; TYPE AND SURFACE DESCRIPTION; Jr; Ja; Jn); HYDRAULIC CONDUCTIVITY K, cm/sec $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$; Diametral Point Load Index (MPa) 2 4 6; RMC -Q' AVG.



GTA-RCK 004 S:\CLIENTS\VOTORANTIM_CIMENTOS\LONG_PAR_5_CALEDON\02_DATA\GINT\LONG_PAR_5_CALEDON.GPJ GAL-MISS.GDT 6/13/24

DEPTH SCALE
1 : 150

LOGGED: VRP
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-01C (CAL)

SHEET 1 OF 1

LOCATION: N 4852513.2 ;E 577203.7

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 16, 2024

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

JN - Joint
FLT - Fault
SHR - Shear
VN - Vein
CJ - Conjugate

BD - Bedding
FO - Foliation
CO - Contact
OR - Orthogonal
CL - Cleavage

PL - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

PO - Polished
K - Slickensided
SM - Smooth
Ro - Rough
MB - Mechanical Break

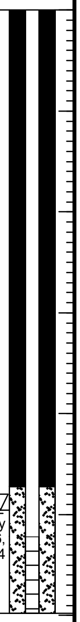
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
| | | GROUND SURFACE | 403.58 | |
| 0 | Sonic | (ML) SANDY SILT, some clay; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00<br>0.46 | |
| | | (SM) SILTY SAND, trace gravel; few cobbles, sub-rounded to sub-angular, brown, gravel grey, pinkish and white, no odors, no staining, non-cohesive, dry | 402.51<br>1.07 | |
| 2 | | (SM/GP) SILTY SAND and GRAVEL; rounded to sub-angular, brown, grey gravel, no odors, no staining, non-cohesive, dry | 401.14<br>2.44 | |
| 4 | | (SM) SILTY SAND, some gravel; few cobbles, rounded to sub-angular, brown, gravel grey, no odors, no staining, non-cohesive, dry | 399.16<br>4.42 | Bentonite |
| 6 | | (SM/GP) SILTY SAND and GRAVEL; rounded to sub-angular, brown, grey gravel, no odors, no staining, non-cohesive, dry | | |
| 10 | | | | Sand<br>May 06, 2024<br>Screen |
| 12 | | BOTTOM OF HOLE | 391.62<br>11.96 | |

Column headings of the empty columns: SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); COLOUR % RETURN; FLUSH; RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 0.25 m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn; HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.

Depth scale: 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30



DEPTH SCALE

1 : 150

LOGGED: VRP

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-02A (CAL)

SHEET 1 OF 1

LOCATION: N 4852710.5 ;E 577008.7

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 16, 2024

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

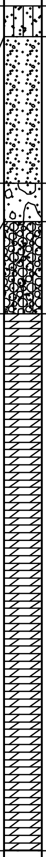
DATUM: Geodetic

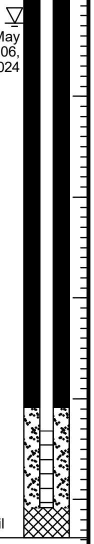
JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

SYMBOLIC LOG | RUN No. | PENETRATION RATE min/(m) | FLUSH | COLOUR / % RETURN | RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20) | R.Q.D. % (80 60 40 20) | FRACT. INDEX PER 0.25 m (5 10 15 20) | DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn | HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | Diametral Point Load Index (MPa) (2 4 6) | RMC -Q' AVG.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
|  |  | GROUND SURFACE | 401.46 |  |
| 0 | Sonic | (ML) SANDY SILT, some gravel; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00<br>400.85<br>0.61 |  |
| 2 |  | (SM) GRAVELLY SILTY SAND; few cobbles, sub-rounded to sub-angular, brown, gravel grey, pinkish and white, no odors, no staining, non-cohesive, dry<br>-colour change to reddish brown, moist | 397.95<br>3.51 |  |
| 4 |  | (GP) SANDY GRAVEL, some silt and cobbles; light brown, grey gravel, no odors, no staining, non-cohesive, moist | 397.19<br>4.27 |  |
|  |  | (GM) sandy SILTY GRAVEL, few cobbles; light brown, grey gravel, non-cohesive, wet | 395.36<br>6.10 |  |
| 6 |  | DOLOSTONE, moderately weathered to fresh, bedded dolostone, grey (GASPORT FORMATION) |  | Bentonite<br>May 06, 2024 |
| 8 |  | -weathered fractures from 8.53 to 12.50 m, with a highly fractures zone at 8.84 to 9.30 m |  |  |
| 10 |  |  |  |  |
| 12 |  | -fewer fractures, few vugs up to 5 cm, some coral features |  |  |
| 14 |  |  |  | Sand<br>Screen |
| 16 |  |  | 384.70 | Natural Backfil |
|  |  | BOTTOM OF HOLE | 16.76 |  |
| 18 |  |  |  |  |
| 20 |  |  |  |  |
| 22 |  |  |  |  |
| 24 |  |  |  |  |
| 26 |  |  |  |  |
| 28 |  |  |  |  |
| 30 |  |  |  |  |





DEPTH SCALE

1 : 150

LOGGED: VRP

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-02B (CAL)

SHEET 1 OF 1

LOCATION: N 4852711.8 ;E 577007.4

DRILLING DATE: April 17, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

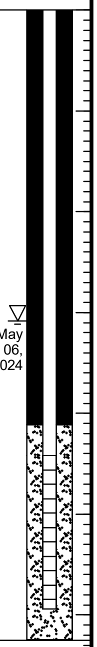
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | COLOUR % RETURN FLUSH | RECOVERY TOTAL CORE % 80 60 40 20 | RECOVERY SOLID CORE % 80 60 40 20 | R.Q.D. % 80 60 40 20 | FRACT. INDEX PER 0.25 m 5 10 15 20 | DISCONTINUITY DATA B Angle 0 90 180 270 | DIP w.r.t. CORE AXIS 0 30 60 90 | TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | HYDRAULIC CONDUCTIVITY K, cm/sec $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$ | Diametral Point Load Index (MPa) 2 4 6 | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 401.49 | | | | | | | | | | | | | | | | | |
| 0 | Sonic | (ML) SANDY SILT, some gravel; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | | 0.00<br>400.88<br>0.61 | | | | | | | | | | | | | | | | | |
| 2 | | (SM) gravelly SILTY SAND; few cobbles, sub-rounded to sub-angular, brown, gravel grey, pinkish and white, no odors, no staining, non-cohesive, dry<br>-colour change to reddish brown, moist | | 397.98<br>3.51 | | | | | | | | | | | | | | | | | |
| 4 | | (GP) SANDY GRAVEL, some silt and cobbles; light brown, grey gravel, no odors, no staining, non-cohesive, moist | | 397.22<br>4.27 | | | | | | | | | | | | | | | | | Bentonite |
| | | (GM) sandy SILTY GRAVEL, few cobbles; light brown, grey gravel, non-cohesive, wet | | 395.09<br>6.40 | | | | | | | | | | | | | | | | | May 06, 2024 |
| 6–12 | | DOLOSTONE, moderately weathered to fresh, bedded dolostone, grey (GASPORT FORMATION)<br>-weathered fractures from 8.84 to 12.50 m | | 388.99<br>12.50 | | | | | | | | | | | | | | | | | Sand<br>Screen<br>Sand |
| | | BOTTOM OF HOLE | | | | | | | | | | | | | | | | | | | |



Depth scale: 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

GTA-RCK 004 S:\CLIENTS\VOTORANTIM_CIMENTOS\LONG_PAR_5_CALEDON\02_DATA\GINT\LONG_PAR_5_CALEDON.GPJ GAL-MISS.GDT 6/13/24

DEPTH SCALE

1 : 150

LOGGED: VRP

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-02C (CAL)

SHEET 1 OF 1

LOCATION: N 4852712.8 ;E 577005.9

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 17, 2024

DRILL RIG: Sonic

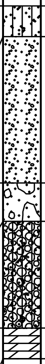
DRILLING CONTRACTOR: Choice Sonic Drilling

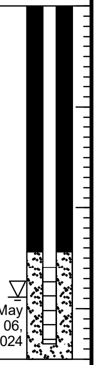
DATUM: Geodetic

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | FLUSH COLOUR % RETURN | RECOVERY TOTAL CORE % | RECOVERY SOLID CORE % | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA B Angle | DIP w.r.t. CORE AXIS | TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | GROUND SURFACE |  | 401.47 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | Sonic | (ML) SANDY SILT, some gravel; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) |  | 0.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Bentonite |
|  |  | (SM) gravelly SILTY SAND; few cobbles, sub-rounded to sub-angular, brown, gravel grey, pinkish and white, no odors, no staining, non-cohesive, dry<br>-colour change to reddish brown, moist |  | 400.86<br>0.61 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | (GP) SANDY GRAVEL, some silt and cobbles; light brown, grey gravel, no odors, no staining, non-cohesive, moist |  | 397.96<br>3.51 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | (GM) sandy SILTY GRAVEL, few cobbles; light brown, grey gravel, non-cohesive, wet |  | 397.20<br>4.27 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Sand<br>Screen<br>May 06, 2024 |
|  |  | DOLOSTONE, moderately weathered to fresh, bedded dolostone, grey (GASPORT FORMATION) |  | 395.07<br>6.40 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Sand |
|  |  | BOTTOM OF HOLE |  | 394.46<br>7.01 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |





DEPTH SCALE

1 : 150

LOGGED: VRP

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-03A (CAL)

SHEET 1 OF 1

LOCATION: N 4852364.4 ;E 577352.1

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 18, 2024

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

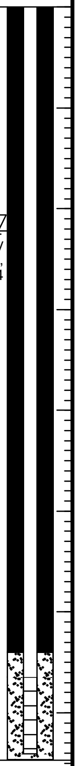
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
| | | GROUND SURFACE | 397.88 | |
| 0 | Sonic | (SM) SILTY SAND, trace gravel; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00<br>0.30 | |
| | | (CL) SILTY CLAY, some sand, trace gravel; sub-rounded to sub-angular, brown, grey gravel, no odor, no staining, cohesive, w~PL | 396.66<br>1.22 | |
| | | (GP/SP) GRAVEL and SAND; some silt and cobbles, brown, grey gravel, no odors, no staining, non-cohesive, moist | 395.14<br>2.74 | |
| | | (ML) SANDY SILT, trace gravel and clay; brown, no odors, no staining, cohesive, w~PL | 394.37<br>3.51 | ▽ May 06, 2024 |
| | | (GM) sandy SILTY GRAVEL, few cobbles; sub-rounded to sub-angular, brown, grey gravel, non-cohesive, moist -wet | | Bentonite |
| | | (GP) GRAVEL, some silt and sand; sub-angular to angular, brown and grey, non-cohesive, crushed dolostone | 388.43<br>9.45 | |
| | | DOLOSTONE, moderately weathered to fresh, bedded dolostone, grey, fossils and coral features, many vugs up to 1 cm (GASPORT FORMATION)<br>-weathered fracture with oxidation staining<br>-weathered fracture<br>-increased fractures from 14.41 to 14.94 m | 9.75 | Sand<br>Screen<br>Sand |
| | | BOTTOM OF HOLE | 382.94<br>14.94 | |

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30

Column headings (no data entered): SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); COLOUR % RETURN; FLUSH; RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 0.25 m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn; HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.



DEPTH SCALE
1 : 150

LOGGED: VRP
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-03B (CAL)

SHEET 1 OF 1

LOCATION: N 4852363.3 ;E 577353.6

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 18, 2024

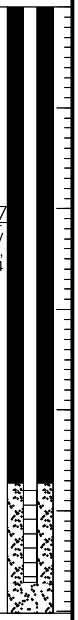
DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

| | | | | |
|---|---|---|---|---|
| JN - Joint | BD - Bedding | PL - Planar | PO - Polished | BR - Broken Rock |
| FLT - Fault | FO - Foliation | CU - Curved | K - Slickensided | **NOTE:** For additional abbreviations refer to list of abbreviations & symbols. |
| SHR - Shear | CO - Contact | UN - Undulating | SM - Smooth | |
| VN - Vein | OR - Orthogonal | ST - Stepped | Ro - Rough | |
| CJ - Conjugate | CL - Cleavage | IR - Irregular | MB - Mechanical Break | |

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. / DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
| | | GROUND SURFACE | 397.76 | |
| 0 | Sonic | (SM) SILTY SAND, trace gravel; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00<br>0.30 | Bentonite |
| | | (CL) SILTY CLAY, some sand, trace gravel; sub-rounded to sub-angular, brown, grey gravel, no odor, no staining, cohesive, w~PL | 396.54<br>1.22 | |
| | | (GP/SP) GRAVEL and SAND, some silt and cobbles; brown, grey gravel, no odors, no staining, non-cohesive, moist | 395.02<br>2.74 | |
| | | (ML) SANDY SILT, trace gravel and clay; brown, no odors, no staining, cohesive, w~PL | 394.25<br>3.51 | ▽ May 06, 2024 |
| | | (GM) sandy SILTY GRAVEL, few cobbles; sub-rounded to sub-angular, brown, grey gravel, non-cohesive, moist -wet | | |
| | | (GP) GRAVEL, some silt and sand; sub-angular to angular, brown and grey, non-cohesive, dry, crushed dolostone | 388.31<br>9.45 | Sand |
| | | DOLOSTONE, moderately weathered to fresh, bedded dolostone, grey, fossils and coral features, many vugs up to 1 cm (GASPORT FORMATION)<br>-weathered fracture with oxidation staining | 9.75 | Screen<br>Sand |
| 12 | | BOTTOM OF HOLE | 385.72<br>12.04 | |



| SYMBOLIC LOG | RUN No. | PENETRATION RATE min/(m) | FLUSH | COLOUR / % RETURN |
|---|---|---|---|---|

| RECOVERY | | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA | | | | | | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC -Q' AVG. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL CORE % | SOLID CORE % | | | B Angle | DIP w.r.t. CORE AXIS | TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | | | |
| 80 60 40 20 | 80 60 40 20 | 80 60 40 20 | 5 10 15 20 | 0 90 180 270 | 0 30 60 90 | | | | | $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$ | 2 4 6 | |

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

GTA-RCK 004 S:\CLIENTS\VOTORANTIM_CIMENTOS\LONG_PAR_5_CALEDON\02_DATA\GINT\LONG_PAR_5_CALEDON.GPJ GAL-MISS.GDT 6/13/24

DEPTH SCALE

1 : 150

LOGGED: VRP

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-03C (CAL)

SHEET 1 OF 1

LOCATION: N 4852362.3 ;E 577355.1

INCLINATION: -90° AZIMUTH: ---

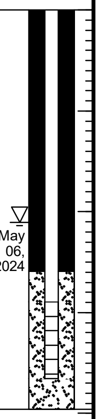
DRILLING DATE: April 18, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

| | | | | |
|---|---|---|---|---|
| JN - Joint | BD- Bedding | PL - Planar | PO- Polished | BR - Broken Rock |
| FLT - Fault | FO- Foliation | CU- Curved | K - Slickensided | **NOTE:** For additional abbreviations refer to list of abbreviations & symbols. |
| SHR- Shear | CO- Contact | UN- Undulating | SM- Smooth | |
| VN - Vein | OR- Orthogonal | ST - Stepped | Ro - Rough | |
| CJ - Conjugate | CL - Cleavage | IR - Irregular | MB- Mechanical Break | |

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. / DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
| | | GROUND SURFACE | 397.74 | |
| 0 | Sonic | (SM) SILTY SAND,trace gravel; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00 | |
| | | (CL) SILTY CLAY, some sand, trace gravel; sub-rounded to sub-angular, brown, grey gravel, no odor, no staining, cohesive, w~PL | 0.30<br>396.52<br>1.22 | Bentonite |
| 2 | | (GP/SP) GRAVEL and SAND; some silt and cobbles, brown, grey gravel, no odors, no staining, non-cohesive, moist | 395.00<br>2.74 | |
| 4 | | (ML) SANDY SILT, trace gravel and clay; brown, no odors, no staining, cohesive, w~PL | 394.08<br>3.66 | May 06, 2024 |
| 6 | | (GM) sandy SILTY GRAVEL, few cobbles; sub-rounded to sub-angular, brown, grey gravel, non-cohesive, moist -wet | | Sand<br>Screen<br>Sand |
| 8 | | BOTTOM OF HOLE | 389.82<br>7.92 | |
| 10 | | | | |
| 12 | | | | |
| 14 | | | | |
| 16 | | | | |
| 18 | | | | |
| 20 | | | | |
| 22 | | | | |
| 24 | | | | |
| 26 | | | | |
| 28 | | | | |
| 30 | | | | |

Column headings: SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); COLOUR / % RETURN; FLUSH; RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 0.25 m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn; HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.



DEPTH SCALE
1 : 150

LOGGED: VRP
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-04A (CAL)

SHEET 1 OF 1

LOCATION: N 4852363.9 ;E 577521.0
INCLINATION: -90° AZIMUTH: ---
DRILLING DATE: April 19, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling
DATUM: Geodetic

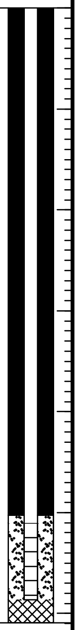
JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

Other column headings on the form (no data entered): SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); FLUSH: COLOUR, % RETURN; RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 0.25 m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn; HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.

DEPTH SCALE METRES: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30

| DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|
| | GROUND SURFACE | 397.68 | |
| Sonic | (ML) SANDY SILT, some clay; dark brown, organic matter, no odors, no staining, cohesive, w<PL (TOPSOIL) | 0.00 | |
| | (CL) SILTY CLAY, trace gravel; rounded, brown, grey gravel, no odor, no staining, cohesive, w~PL | 0.30 | |
| | (SM/GP) SILTY SAND and GRAVEL; some cobbles, rounded, brown, grey gravel, no odors, no staining, non-cohesive, dry | 395.85<br>1.83 | |
| | (SM) SILTY SAND; brown, no odors, no staining, non-cohesive, moist | 394.63<br>3.05 | |
| | (ML) SANDY SILT; brown, no odors, no staining, cohesive, w~PL | 392.96<br>4.72 | Bentonite |
| | (GM) sandy SILTY GRAVEL; sub-rounded to sub-angular, reddish brown, grey gravel, non-cohesive, wet, gravel % increases with depth | 5.18 | |
| | DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION)<br>-highly weathered, gravel and cobble sized pieces of dolostone, beige to grey, coral features from 7.47 to 8.84 m<br>-weathered fracture<br>-weathered fracture | 391.13<br>6.55 | Sand<br>Screen<br>Natural Backfil |
| | BOTTOM OF HOLE | 385.49<br>12.19 | |



DEPTH SCALE
1 : 150

wsp

LOGGED: VRP
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-04B (CAL)

SHEET 1 OF 1

LOCATION: N 4852362.5 ;E 577522.1
INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 22, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | FLUSH COLOUR % RETURN | RECOVERY TOTAL CORE % 80 60 40 20 | RECOVERY SOLID CORE % 80 60 40 20 | R.Q.D. % 80 60 40 20 | FRACT. INDEX PER 0.25 m 5 10 15 20 | DISCONTINUITY DATA B Angle 0 90 180 270 | DISCONTINUITY DATA DIP w.r.t. CORE AXIS 0 30 60 90 | DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | HYDRAULIC CONDUCTIVITY K, cm/sec $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$ | Diametral Point Load Index (MPa) 2 4 6 | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 397.69 | | | | | | | | | | | | | | | | | |
| 0 | Sonic | (ML) SANDY SILT, some clay; dark brown, organic matter, no odors, no staining, cohesive, w<PL (TOPSOIL) | | 0.00 | | | | | | | | | | | | | | | | | |
| | | (CL) SILTY CLAY, trace gravel; rounded, brown, grey gravel, no odor, no staining, cohesive, w~PL | | 0.30 | | | | | | | | | | | | | | | | | |
| 2 | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, rounded, brown, grey gravel, no odors, no staining, non-cohesive, dry | | 395.86<br>1.83 | | | | | | | | | | | | | | | | | Bentonite |
| | | (SM) SILTY SAND; brown, no odors, no staining, non-cohesive, moist | | 394.64<br>3.05 | | | | | | | | | | | | | | | | | |
| 4 | | (ML) SANDY SILT; brown, no odors, no staining, cohesive, w~PL | | 393.42<br>4.27 | | | | | | | | | | | | | | | | | May 06, 2024 |
| | | (GM) sandy SILTY GRAVEL; sub-rounded to sub-angular, reddish brown, grey gravel, non-cohesive, wet, gravel % increases with depth | | 392.51<br>5.18 | | | | | | | | | | | | | | | | | Sand |
| 6 | | DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION)<br>-highly weathered, gravel and cobble sized pieces of dolostone, beige to grey, coral features from 6.71 to 8.38 m | | 5.49 | | | | | | | | | | | | | | | | | Screen |
| 8 | | | | | | | | | | | | | | | | | | | | | Natural Backfil |
| | | BOTTOM OF HOLE | | 388.55<br>9.14 | | | | | | | | | | | | | | | | | |

10

12

14

16

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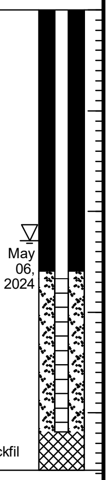


DEPTH SCALE
1 : 150

LOGGED: VRP
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-05A (CAL)

SHEET 1 OF 1

LOCATION: N 4852195.3 ;E 577613.7

DRILLING DATE: April 22, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

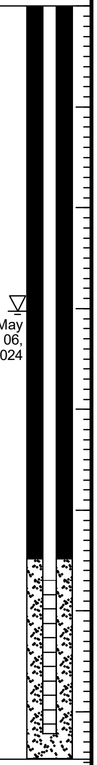
DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | FLUSH COLOUR % RETURN | RECOVERY TOTAL CORE % 80 60 40 20 | RECOVERY SOLID CORE % 80 60 40 20 | R.Q.D. % 80 60 40 20 | FRACT. INDEX PER 0.25 m 5 10 15 20 | DISCONTINUITY DATA B Angle 0 90 180 270 | DIP w.r.t. CORE AXIS 0 30 60 90 | TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | HYDRAULIC CONDUCTIVITY K, cm/sec $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$ | Diametral Point Load Index (MPa) 2 4 6 | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 399.30 | | | | | | | | | | | | | | | | | |
| 0 | Sonic | (SM) SILTY SAND, some clay; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | | 0.00 | | | | | | | | | | | | | | | | | |
| | | (SM/GP) SILTY SAND and GRAVEL; trace cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | | 0.30 | | | | | | | | | | | | | | | | | |
| 5 | | (SM) SILTY SAND; reddish brown, no odors, no staining, non-cohesive, dry -wet | | 394.12<br>5.18 | | | | | | | | | | | | | | | | | Bentonite<br>May 06, 2024 |
| | | (ML) SANDY SILT; brown, no odors, no staining, cohesive, w~PL | | 391.98<br>7.32 | | | | | | | | | | | | | | | | | |
| | | DOLOSTONE, highly weathered to fresh, bedded dolostone, grey (GASPORT FORMATION)<br>-gravel-sized pieces of dolostone, fossils and coral features, highly fractured from approximately 11.58 to 13.11 m | | 390.16<br>9.14 | | | | | | | | | | | | | | | | | Sand<br>Screen<br>Sand |
| | | BOTTOM OF HOLE | | 384.36<br>14.94 | | | | | | | | | | | | | | | | | |



DEPTH SCALE
1 : 150

LOGGED: RN
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-05B (CAL)

SHEET 1 OF 1

LOCATION: N 4852196.9 ;E 577612.3
INCLINATION: -90° AZIMUTH: ---
DRILLING DATE: April 23, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling
DATUM: Geodetic

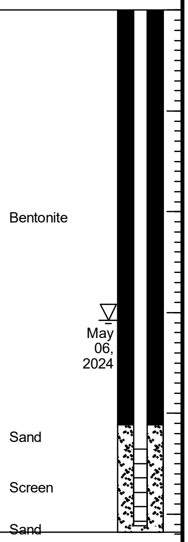
JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
| | | GROUND SURFACE | 399.23 | |
| 0 | Sonic | (SM) SILTY SAND, some clay; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00 | |
| | | (SM/GP) SILTY SAND and GRAVEL; trace cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 0.30 | Bentonite |
| 5.18 | | (SM) SILTY SAND; reddish brown, no odors, no staining, non-cohesive, dry -wet | 394.05<br>5.18 | May 06, 2024 |
| 8.53 | | (ML) SANDY SILT; brown, no odors, no staining, cohesive, w~PL | 390.70<br>8.53 | Sand<br>Screen |
| 10.06 | | DOLOSTONE, highly weathered to fresh, bedded dolostone, grey (GASPORT FORMATION) | 389.17<br>10.06 | Sand |
| | | BOTTOM OF HOLE | 10.36 | |

Column headings: SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); COLOUR % RETURN; FLUSH; RECOVERY (TOTAL CORE %, SOLID CORE %) 80 60 40 20; R.Q.D. % 80 60 40 20; FRACT. INDEX PER 0.25 m 5 10 15 20; DISCONTINUITY DATA (B Angle 0 90 180 270; DIP w.r.t. CORE AXIS 0 30 60 90; TYPE AND SURFACE DESCRIPTION; Jr; Ja; Jn); HYDRAULIC CONDUCTIVITY K, cm/sec $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$; Diametral Point Load Index (MPa) 2 4 6; RMC -Q' AVG.

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30



DEPTH SCALE
1 : 150

LOGGED: RN
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-05C (CAL)

SHEET 1 OF 1

LOCATION: N 4852198.7 ;E 577610.6

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 23, 2024

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

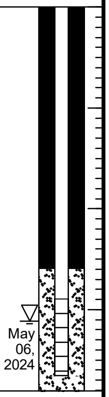
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | COLOUR % RETURN | FLUSH | RECOVERY TOTAL CORE % 80 60 40 20 | RECOVERY SOLID CORE % 80 60 40 20 | R.Q.D. % 80 60 40 20 | FRACT. INDEX PER 0.25 m 5 10 15 20 | DISCONTINUITY DATA B Angle 0 90 180 270 | DISCONTINUITY DATA DIP w.r.t. CORE AXIS 0 30 60 90 | DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | HYDRAULIC CONDUCTIVITY K, cm/sec $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$ | Diametral Point Load Index (MPa) 2 4 6 | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | GROUND SURFACE |  | 399.18 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | Sonic | (SM) SILTY SAND, some clay; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) |  | 0.00<br>398.57 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2<br>4 |  | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry |  | 0.61<br>394.00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Bentonite |
| 6 |  | (SM) SILTY SAND; reddish brown to brown, no odors, no staining, non-cohesive, wet |  | 5.18<br>391.56 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Sand<br>Screen<br>May 06, 2024<br>Sand |
| 8<br>10<br>12<br>14<br>16<br>18<br>20<br>22<br>24<br>26<br>28<br>30 |  | BOTTOM OF HOLE |  | 7.62 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



DEPTH SCALE

1 : 150

LOGGED: RN

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-06A (CAL)

SHEET 1 OF 1

LOCATION: N 4852427.6 ;E 578067.9
INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 24, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling

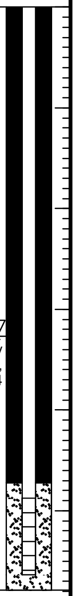
DATUM: Geodetic

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | COLOUR % RETURN / FLUSH | RECOVERY TOTAL CORE % (80 60 40 20) | RECOVERY SOLID CORE % (80 60 40 20) | R.Q.D. % (80 60 40 20) | FRACT. INDEX PER 0.25 m (5 10 15 20) | DISCONTINUITY DATA B Angle (0 90 180 270) | DIP w.r.t. CORE AXIS (0 30 60 90) | TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | Diametral Point Load Index (MPa) (2 4 6) | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | 398.67 | | | | | | | | | | | | | | | | | |
| 0 | Sonic | (ML) CLAYEY SILT, some sand; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00 | | | | | | | | | | | | | | | | | |
| | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 397.91<br>0.76 | | | | | | | | | | | | | | | | | |
| 2 | | (GP) SANDY GRAVEL, some silt; cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 396.23<br>2.44 | | | | | | | | | | | | | | | | | |
| 4 | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 394.71<br>3.96 | | | | | | | | | | | | | | | | | Bentonite |
| | | (GM) sandy SILTY GRAVEL; cobbles, brown, grey gravel, non-cohesive, wet | 393.18<br>5.49 | | | | | | | | | | | | | | | | | |
| 6 | | DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION)<br>-highly weathered, gravel-sized pieces of dolostone from 6.25 to 8.23 m<br>-competent rock starting at approximately 8.23 m. Weathered fractures with oxidation staining | 392.42<br>6.25 | | | | | | | | | | | | | | | | | ∇ May 06, 2024<br>Sand<br>Screen<br>Sand |
| 12 | | BOTTOM OF HOLE | 387.09<br>11.58 | | | | | | | | | | | | | | | | | |

DEPTH SCALE: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30



DEPTH SCALE
1 : 150

LOGGED: RN
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-06B (CAL)

SHEET 1 OF 1

LOCATION: N 4852429.0 ;E 578069.2

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 25, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

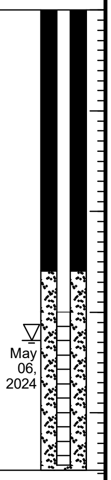
PL - Planar
CU- Curved
UN - Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

BR - Broken Rock

**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE min/(m) | COLOUR / % RETURN | FLUSH | RECOVERY TOTAL CORE % 80 60 40 20 | RECOVERY SOLID CORE % 80 60 40 20 | R.Q.D. % 80 60 40 20 | FRACT. INDEX PER 0.25 m 5 10 15 20 | DISCONTINUITY DATA B Angle 0 90 180 270 | DISCONTINUITY DATA DIP w.r.t. CORE AXIS 0 30 60 90 | DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION | Jr | Ja | Jn | HYDRAULIC CONDUCTIVITY K, cm/sec $10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$ | Diametral Point Load Index (MPa) 2 4 6 | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | 398.62 | | | | | | | | | | | | | | | | | | |
| 0 | Sonic | (ML) CLAYEY SILT, some sand; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00 | | | | | | | | | | | | | | | | | | |
| | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 397.86<br>0.76 | | | | | | | | | | | | | | | | | | Bentonite |
| | | -wet | | | | | | | | | | | | | | | | | | | Sand |
| 6 | | DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION) | 392.52<br>6.10 | | | | | | | | | | | | | | | | | | May 06, 2024<br>Screen |
| | | BOTTOM OF HOLE | 389.48<br>9.14 | | | | | | | | | | | | | | | | | | Sand |



DEPTH SCALE 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

DEPTH SCALE
1 : 150

LOGGED: RN
CHECKED: GWS

GTA-RCK 004 S:\CLIENTS\VOTORANTIM_CIMENTOS\LONG_PAR_5_CALEDON\02_DATA\GINT\LONG_PAR_5_CALEDON.GPJ GAL-MISS.GDT 6/13/24

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-07A (CAL)

SHEET 1 OF 1

LOCATION: N 4852207.9 ;E 577897.1

DRILLING DATE: April 26, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

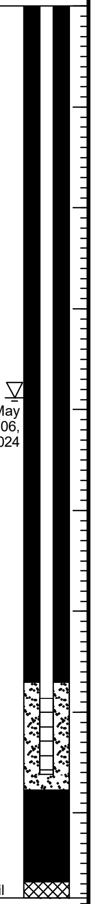
DRILLING CONTRACTOR: Choice Sonic Drilling

| | | | | | |
|---|---|---|---|---|---|
| JN - Joint | BD - Bedding | PL - Planar | PO - Polished | BR - Broken Rock | |
| FLT - Fault | FO - Foliation | CU - Curved | K - Slickensided | **NOTE:** For additional abbreviations refer to list of abbreviations & symbols. | |
| SHR - Shear | CO - Contact | UN - Undulating | SM - Smooth | | |
| VN - Vein | OR - Orthogonal | ST - Stepped | Ro - Rough | | |
| CJ - Conjugate | CL - Cleavage | IR - Irregular | MB - Mechanical Break | | |

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) | NOTES WATER LEVELS INSTRUMENTATION |
|---|---|---|---|---|
| | | GROUND SURFACE | 400.14 | |
| 0 | Sonic | (ML) CLAYEY SILT, some sand; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00<br>399.53<br>0.61 | |
| | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 397.70<br>2.44 | |
| 2 | | (GP/SP) GRAVEL and SAND; some silt and cobbles, brown, grey gravel, no odors, no staining, non-cohesive, moist<br>-wet | 391.61<br>8.53 | Bentonite<br>May 06, 2024 |
| 8 | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 389.93<br>10.21 | |
| 10 | | DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION) | 385.20<br>14.94 | Sand<br>Screen |
| 14 | | SHALEY DOLOSTONE, bedded shaley dolostone, cream to grey | 384.29<br>15.85 | Sand |
| 16 | | SHALE, bedded, shale, blueish grey (CABOT HEAD FORMATION) | 382.46<br>17.68 | Bentonite<br>Natural Backfil |
| 18 | | BOTTOM OF HOLE | | |

Column headings: SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); FLUSH; COLOUR % RETURN; RECOVERY (TOTAL CORE %, SOLID CORE %); R.Q.D. %; FRACT. INDEX PER 0.25 m; DISCONTINUITY DATA (B Angle, DIP w.r.t. CORE AXIS, TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn); HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$, $10^{-5}$, $10^{-4}$, $10^{-3}$); Diametral Point Load Index (MPa); RMC -Q' AVG.

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30



DEPTH SCALE

1 : 150

wsp

LOGGED: RN

CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-07B (CAL)

SHEET 1 OF 1

LOCATION: N 4852209.1 ;E 577898.0

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 29, 2024
DRILL RIG: Sonic
DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

JN - Joint
FLT - Fault
SHR - Shear
VN - Vein
CJ - Conjugate
BD - Bedding
FO - Foliation
CO - Contact
OR - Orthogonal
CL - Cleavage
PL - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular
PO - Polished
K - Slickensided
SM - Smooth
Ro - Rough
MB - Mechanical Break
BR - Broken Rock

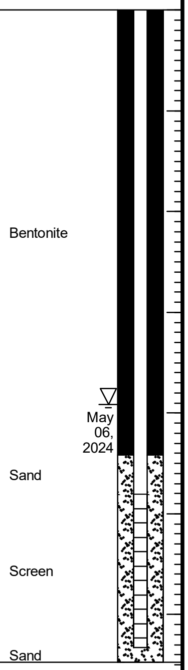
**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) |
|---|---|---|---|
| | | GROUND SURFACE | 400.19 |
| 0 | Sonic | (ML) CLAYEY SILT, some sand; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00 |
| | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 399.58<br>0.61 |
| 2 | | (GP/SP) GRAVEL and SAND; some silt and cobbles, brown, grey gravel, no odors, no staining, non-cohesive, moist<br>-wet | 397.75<br>2.44 |
| 8 | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 391.66<br>8.53 |
| | | (CL) CLAY, trace silt, brown, no odors, no staining, cohesive, w~PL | 390.59<br>9.75 |
| 10 | | DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION) | |
| | | BOTTOM OF HOLE | 387.24<br>12.95 |

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30

Column headings: SYMBOLIC LOG; RUN No.; PENETRATION RATE min/(m); COLOUR % RETURN; FLUSH; RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 0.25 m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn; HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.

NOTES
WATER LEVELS
INSTRUMENTATION



DEPTH SCALE
1 : 150

LOGGED: RN
CHECKED: GWS

PROJECT: 19129150

# RECORD OF DRILLHOLE: MW-IT-07C (CAL)

SHEET 1 OF 1

LOCATION: N 4852210.9 ;E 577899.2

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: April 29, 2024

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

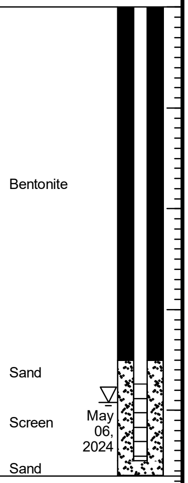
DATUM: Geodetic

| | | | | |
|---|---|---|---|---|
| JN - Joint | BD - Bedding | PL - Planar | PO - Polished | BR - Broken Rock |
| FLT - Fault | FO - Foliation | CU - Curved | K - Slickensided | **NOTE:** For additional abbreviations refer to list of abbreviations & symbols. |
| SHR - Shear | CO - Contact | UN - Undulating | SM - Smooth | |
| VN - Vein | OR - Orthogonal | ST - Stepped | Ro - Rough | |
| CJ - Conjugate | CL - Cleavage | IR - Irregular | MB - Mechanical Break | |

RUN No. | PENETRATION RATE min/(m) | COLOUR % RETURN | FLUSH | RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20) | R.Q.D. % (80 60 40 20) | FRACT. INDEX PER 0.25 m (5 10 15 20) | DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION, Jr, Ja, Jn | HYDRAULIC CONDUCTIVITY K, cm/sec ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | Diametral Point Load Index (MPa) (2 4 6) | RMC -Q' AVG.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | ELEV. DEPTH (m) |
|---|---|---|---|
| | | GROUND SURFACE | 400.14 |
| 0 | Sonic | (ML) CLAYEY SILT, some sand; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL) | 0.00 |
| | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 399.53<br>0.61 |
| 2 | | (GP/SP) GRAVEL and SAND; some silt and cobbles, brown, grey gravel, no odors, no staining, non-cohesive, moist | 397.70<br>2.44 |
| 4 | | | |
| 6 | | | |
| | | -wet | |
| 8 | | (SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry | 391.61<br>8.53 |
| | | BOTTOM OF HOLE | 390.84<br>9.30 |
| 10 | | | |
| 12 | | | |
| 14 | | | |
| 16 | | | |
| 18 | | | |
| 20 | | | |
| 22 | | | |
| 24 | | | |
| 26 | | | |
| 28 | | | |
| 30 | | | |

NOTES
WATER LEVELS
INSTRUMENTATION



DEPTH SCALE
1 : 150

LOGGED: RN
CHECKED: GWS

**APPENDIX B**

# Core Photographs


19129150
CBM Caledon
Run #1
0'-8'
MW-IT-01


18
19129150
CBM Caledon
Run 2 (8'-18')
MW-IT-01


19129150
CBM Caledon
Run #3 (18-28')
MW-IT-01


19129150
CBM Caledon
MW-IT-01
Run #4 (28-38')


19129150
04/15/24
CBM Caledon
MW-IT-01
Run #5 (38-48')


19129150
04/15/24
CBM Caledon
MW-IT-01
Run 6 (48-58')


58
19129150
CBM Caledon
MW-IT-01
Run 7 (58-68')
04/15/24


FIELD BOREHOLE LOG
19129150
CBM Caledon
MW-IT-01
Run7 (58-68')
SA19 (62-~~63~~ 64.5')
04/15/24
ESTWING


19129150
CBM Caledon
MW-IT-01
Run 7 (58-68')
SA 20 (64.5-67')
R8


19129150
CBM Caledon
MW-IT-01
Run 8 (68-78')
SA 21 (68-75')
04/15/2024


19129150
CBM Caledon
MW-IT-01
Run 8
SA22 (73-75.5')
04/15/24


19129150
CBM CALEDON
MW-IT-01
Run 8
SA23 (75.5-78')
04/15/24
FIELD BOREHOLE LOG
Golder Associates


19/29/50
CBM Caledon
MW-IT-01
Run 9 (78-87')
04/15/24
HUSKY


04-16-2024
19129150
CBM Caledon
MW-IT-02
Run 1 0-9'


14
19
04/16/24
19129150
CBM Caledon
MW-IT-02
Run 2 (9-19')


04/16/2024
19129150
CBM Caledon
MW-IT-02
Run 3 19-29'


MW-IT-02
Run 3
SA 9
20-24'


04/15/2024
19129150
CBM Caledon
MW-IT-02
Run 4 (29'-39')


04/16/24
19129150
CBM Caledon
MW-IT-02
Run 5 (39'-49')


04/16/24
19129150
CBM Caledon
MW-IT-02
Run 6 (49-55')


04/18/24
19129150
CBM Caledon
MW-IT-03
Run 1 (0-9')


04/18/24
19129150
CBM Caledon
MW-IT-03
Run 2 (9-14')


04/ 8/24
19129150
CBM Caledon
MW-IT-03
Run 3
(19-29')
HUSKY


19129
MW-IT-03
Run 4 (29-34')
HUSKY


04/18/2024
19129150
CBM Caledon
MW-IT-03
Run 5 (34-39')
HUSKY


04/18/2024
19129150
CBM Caledon
MW-IT-03
Run 6 (39-49')
HUSKY
Sharpie


04/19/24
19129150
CBM Caledon
MW-IT-04
Run #1 0-9'


04/19/24
19129150
CBM Caledon
MW-IT-04
Run 2 (9-19')

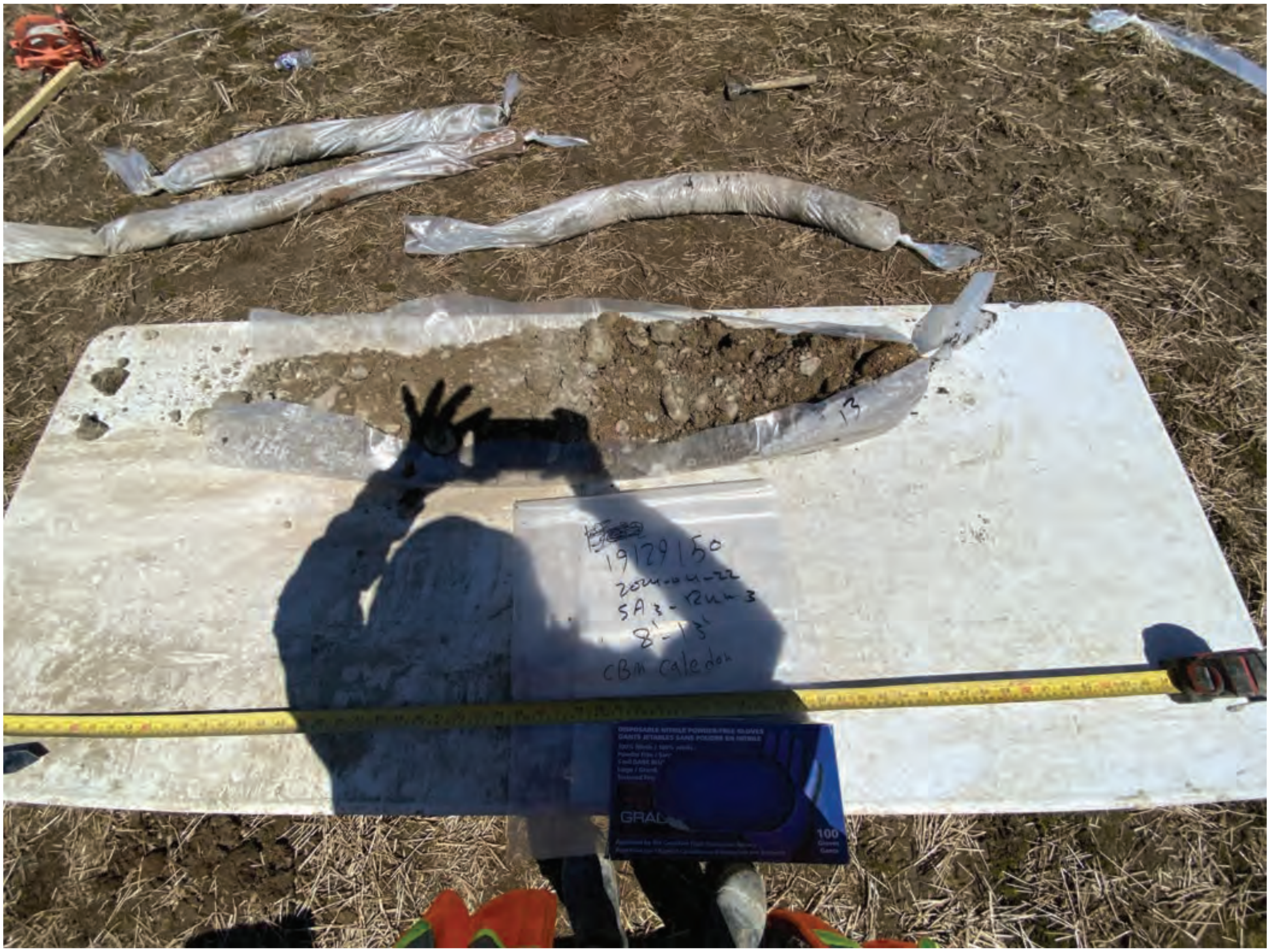

MW-IT-04
Run 3
19-29'

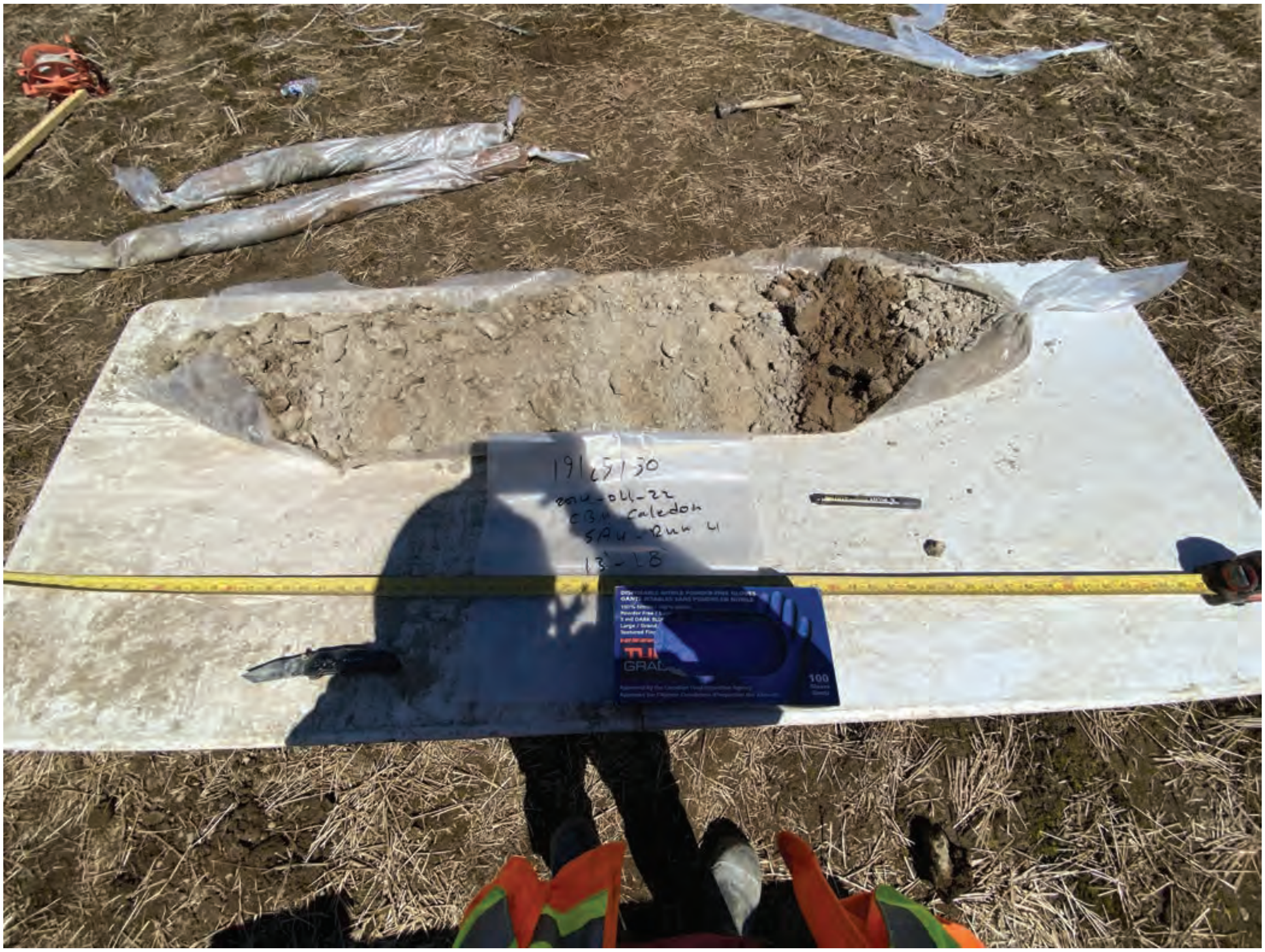

04/19/24
1912915
MW-IT-04
Run 3 (19-29')


04/19/24
19129150
CBM Caledon
MW-IT-04


CA-GLD-19129150
2024-04-22
CBM Caledon
MW-IT-05A
0'-3'


19129150
2024-04-22
CBM Caledon
SA2 - Run 2
3'-8'


13
19129150
2024-04-22
SA3 - Run 3
8'-13'
CBM Caledon
100


19125130
2024-04-22
CBM Caledon
SA4 - Run 4
13'-18
100


MW-IT-05-A
19129150
CBM Caledon
2021-04-22
Run 6 - SA6
23'-28'

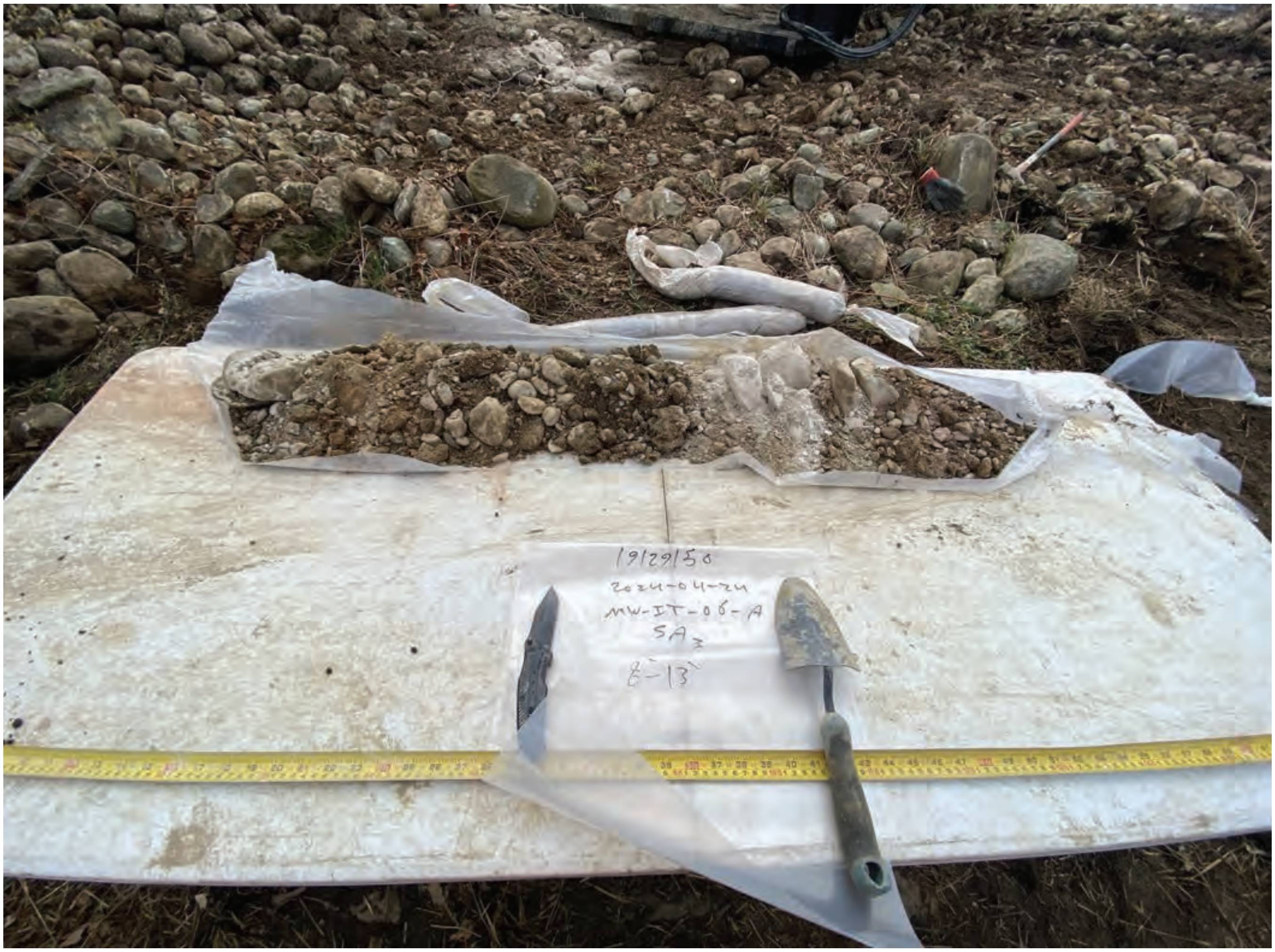

MW-IT-05-A
19129150
CBM Caledon
2021-04-22
Run 7 - SA67


19129150
2024-04-22
MW-II-05-A
SA8-Run 8
33'-38'


19129150
2024-04-22
MW-II-05-A
SA9-Run 9
38'-48'


19129150
2024-04-24
MW-IT-06-A
SA1
0'-3'


19129150
2024-04-24
MW-IT-06-A
SA2
3'-8'


19129150
2024-04-24
MW-IT-06-A
SA3
8'-13'


19129150
2024-04-24
MW-IT-06-A
SA4
13'-18'


19129150
2024-04-24
MW-IT-06-A
SA5
18`-23`


19129150
2024-04-24
MW-IT-06-A
SA6
23`-28`


19129150
2024-04-24
MW-IT-06-A
SA7
28-33'


19129150
2024-04-24
MW-IT-06-A
SA8
33-38'


191291 50
2021-04-26
MW-IT-07-A
SA1
0-4'


191291 50
2021-04-26
MW-IT-07-A
SA2
4-8'

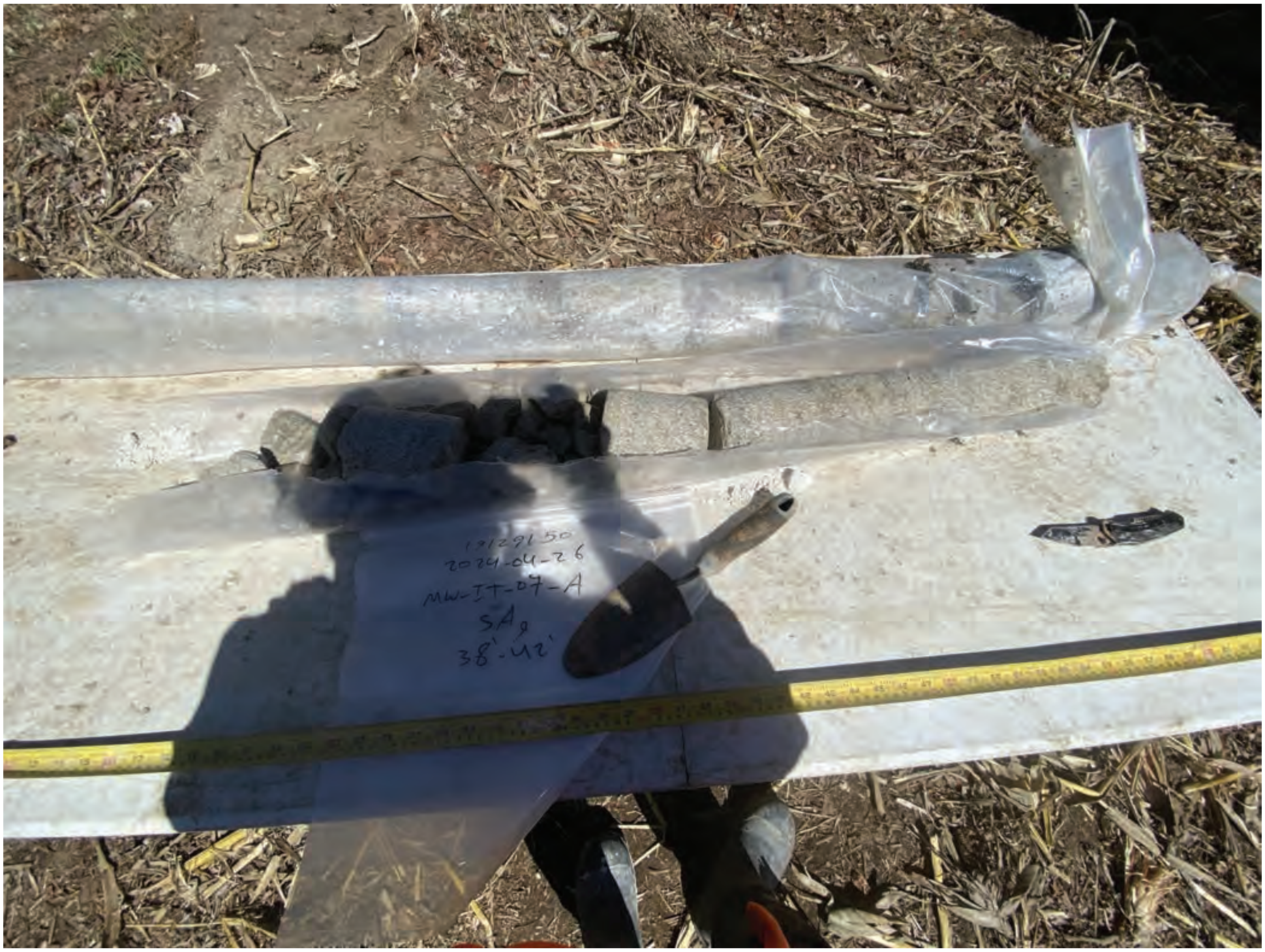

19129150
2024-04-26
MW-IT-07-A
SA3
8'-11'


19129150
2024-04-26
MW-IT-07-A
SA4
11'-18'


2024-04-26
SA5
18'-21'


13:27:50
2024-04-26
SA7
28'-33'


19129150
MW-IT-07-A


19129150
2024-04-26
MW-IT-07-A
SA9
38'-42'


MW-IT-07-A

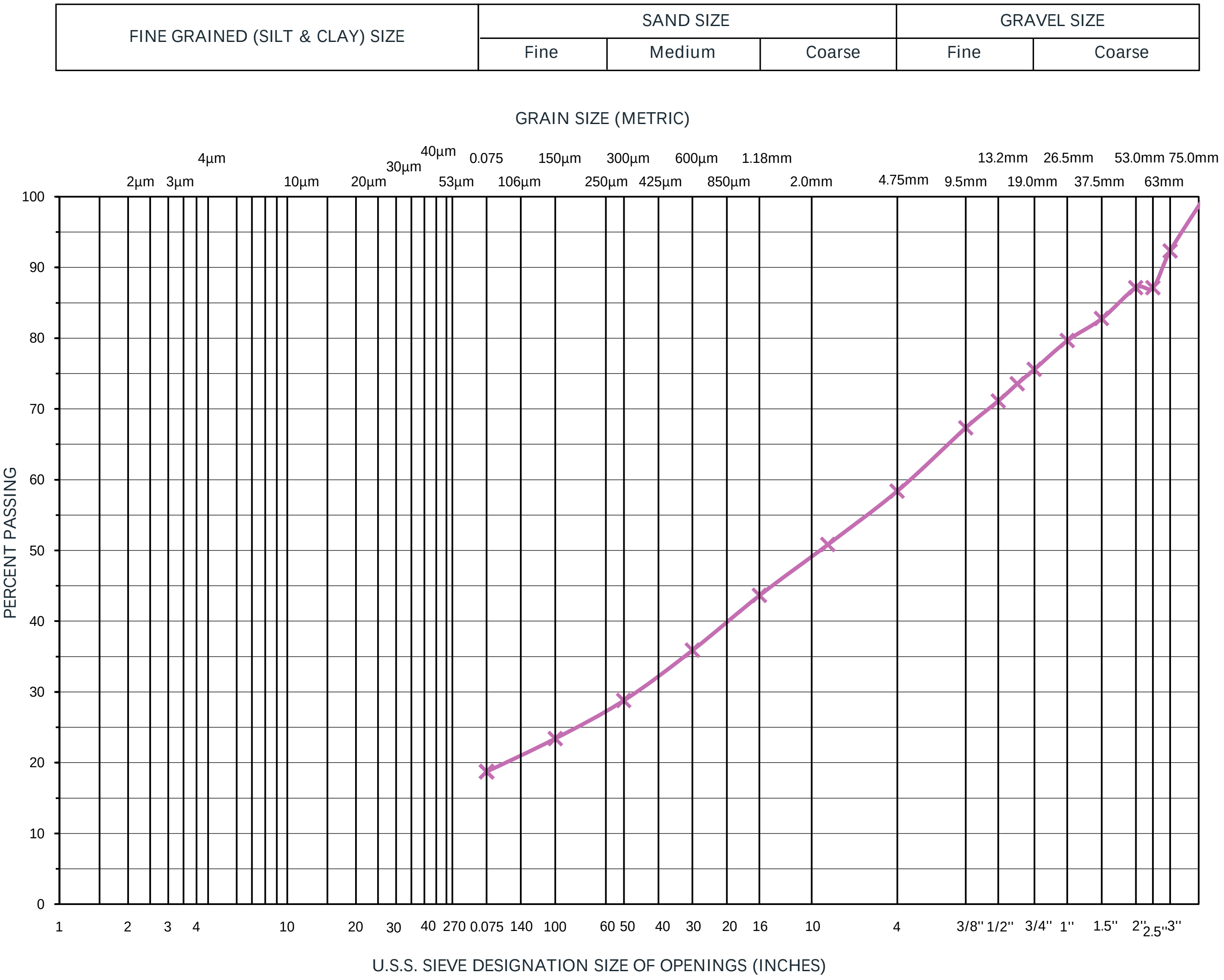

MW-IT-07A
5All
48-58'

## APPENDIX C

# Grainsize Test Results

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-01A | SA7 | 3.81-5.33 | 42 | 39 | 19 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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GRAIN SIZE DISTRIBUTION

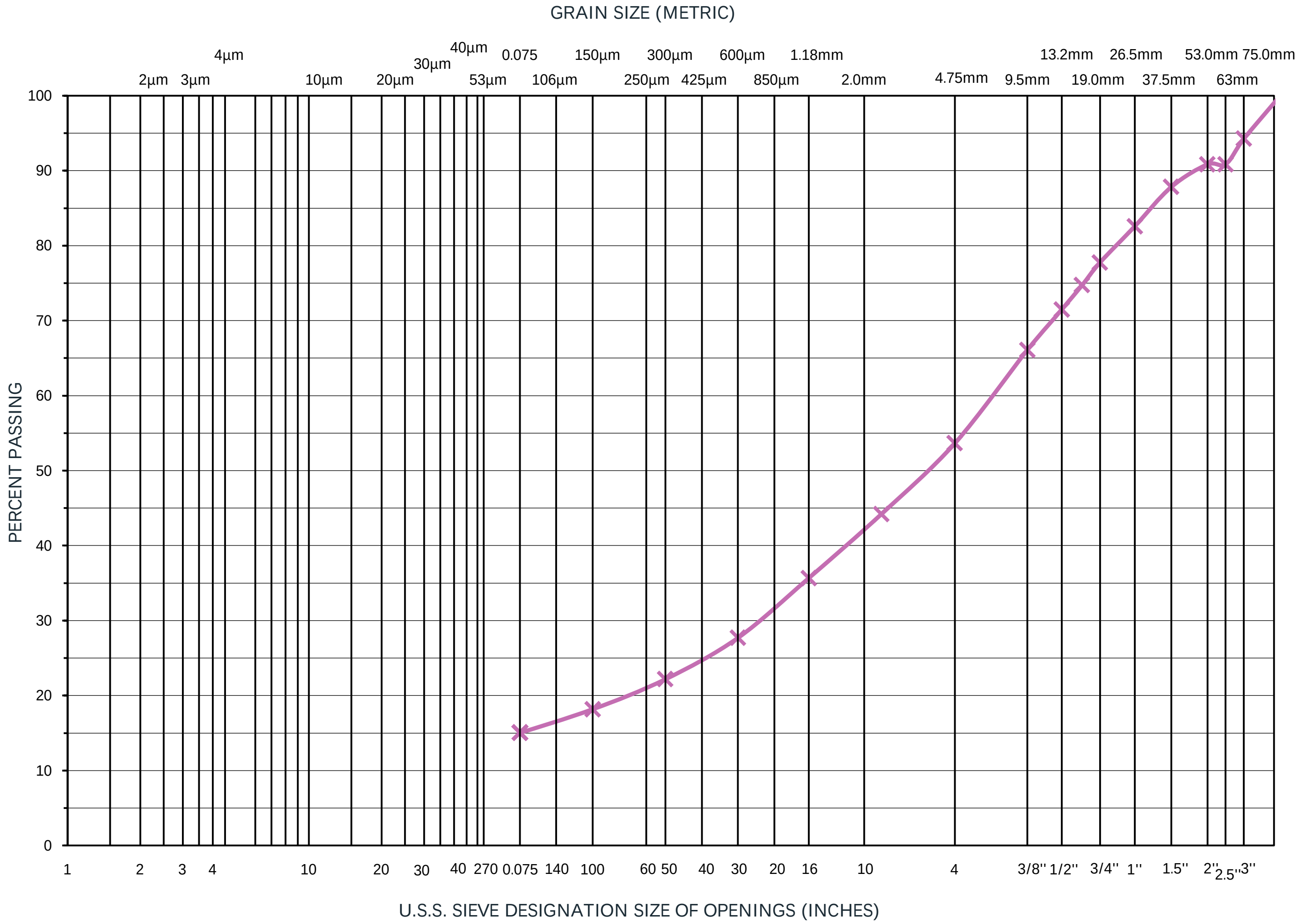
MW-IT-01A SA7

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 16, 2024 | Tested By: | D. Dion |
| Report Date: | Apr 20, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-01A | SA9 | 6.71-7.92 | 46 | 39 | 15 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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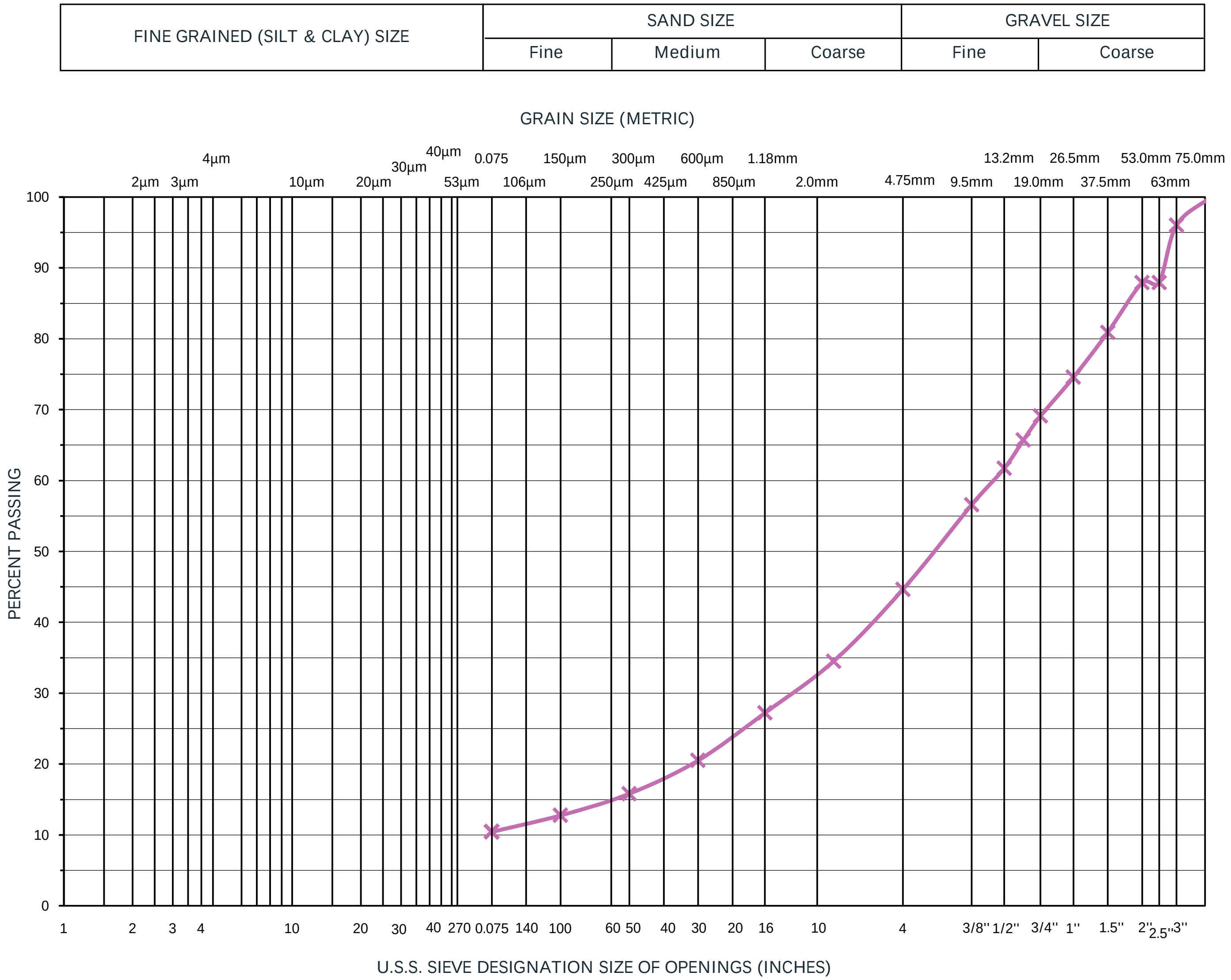
GRAIN SIZE DISTRIBUTION

MW-IT-01A SA9
Project No.: CA-GLD-19129150
Date Rec'd: Apr 16, 2024 Tested By: D. Dion
Report Date: Apr 20, 2024

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-01A | SA12 | 9.75-10.97 | 55 | 35 | 10 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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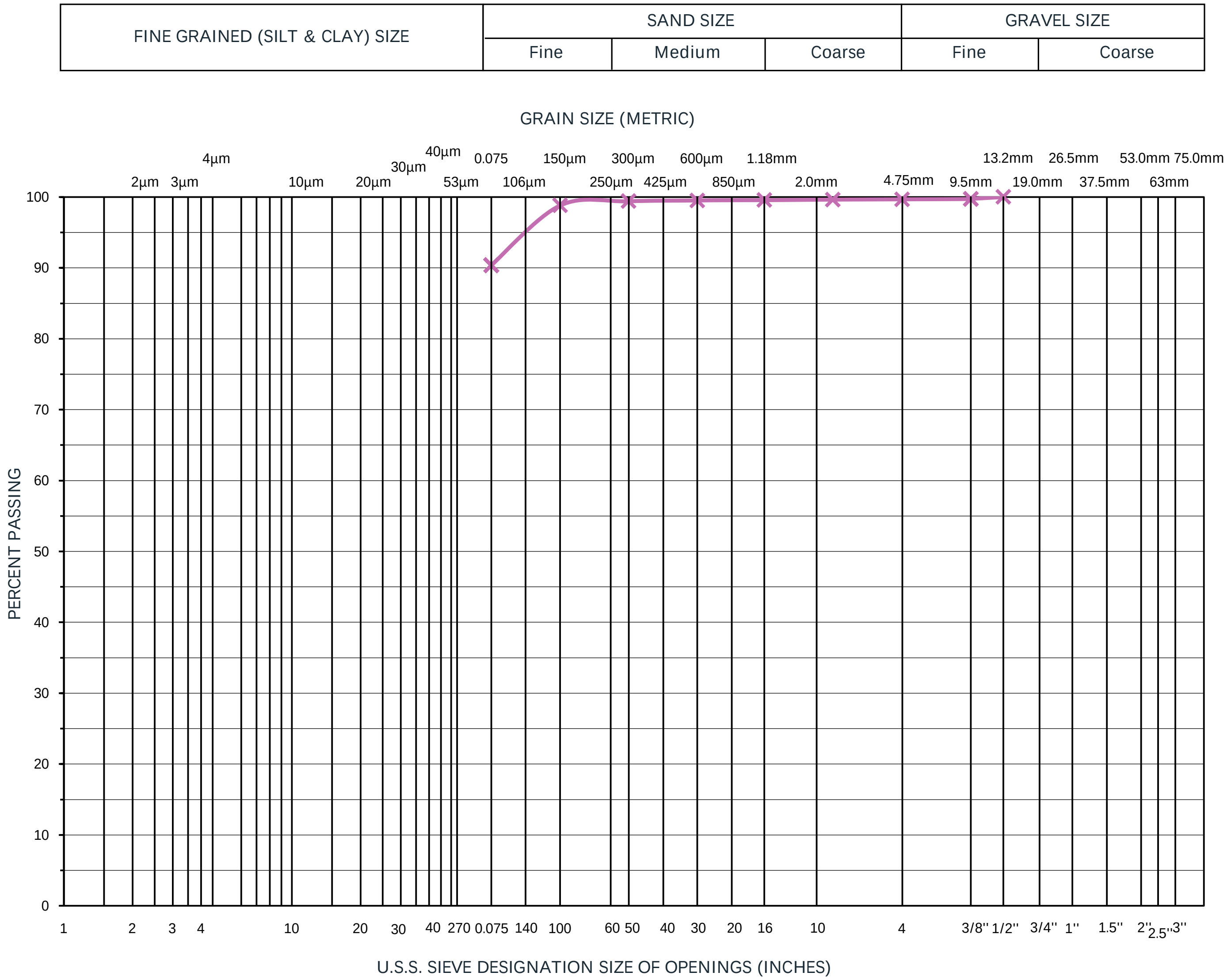
GRAIN SIZE DISTRIBUTION

MW-IT-01A SA12

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 16, 2024 | Tested By: | D. Dion |
| Report Date: | Apr 20, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-01A | SA13 | 11.58-13.11 | 0 | 10 | 90 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

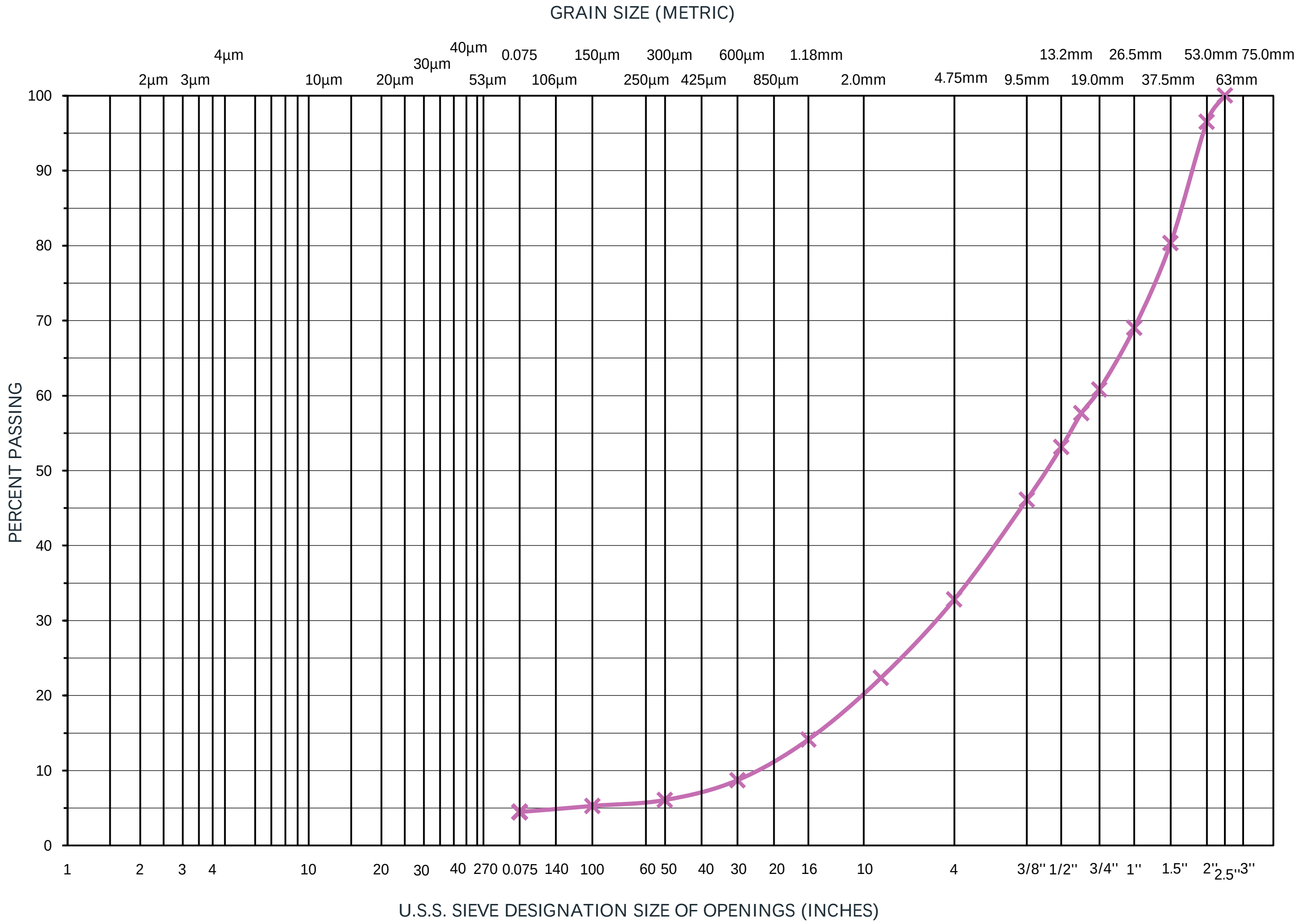
MW-IT-01A SA13

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 2, 2024 | Tested By: | D. Dion |
| Report Date: | Apr 20, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | W-IT-01A | SA17 | 15.7-17.07 | 67 | 28 | 5 |
| | | | | | | |
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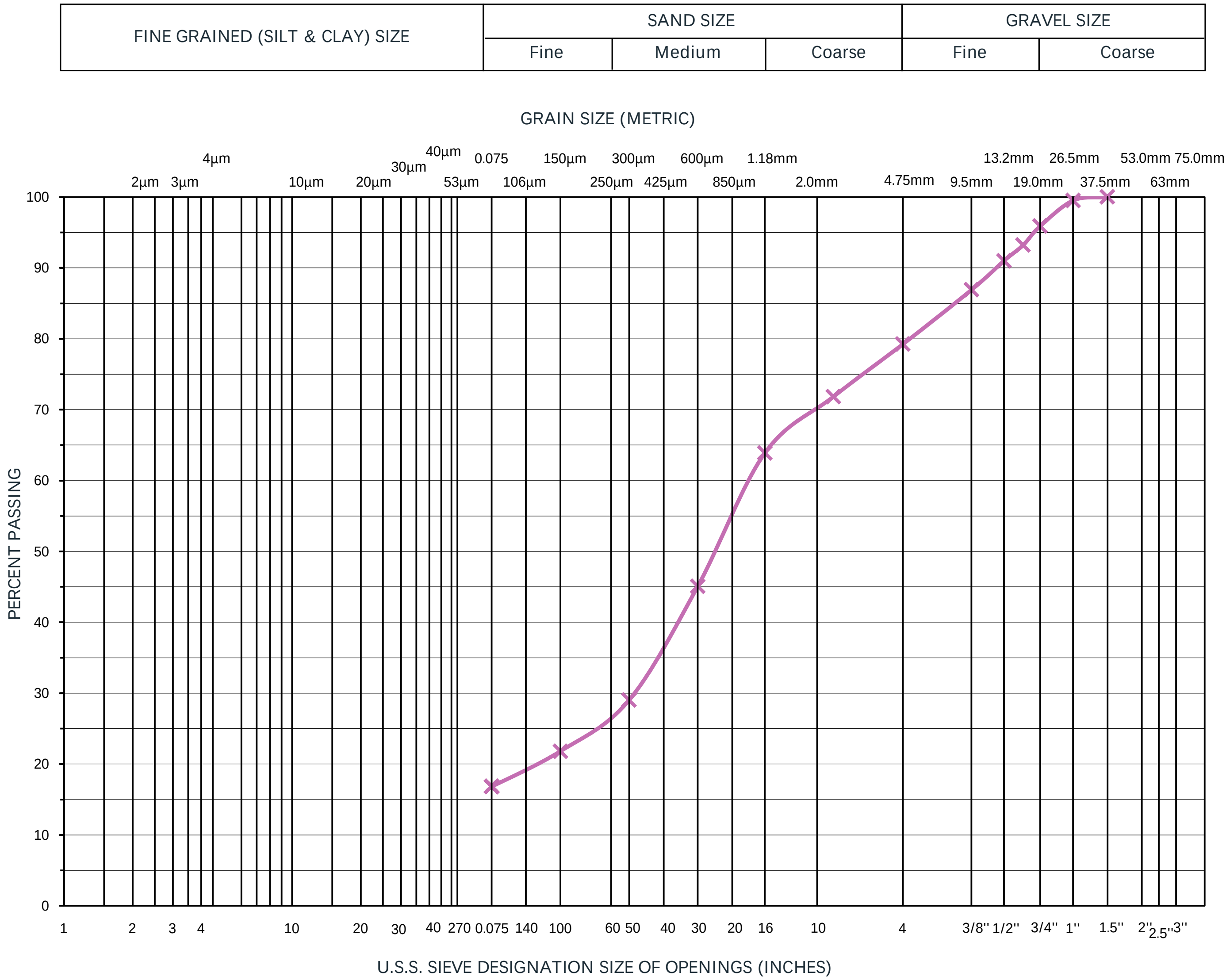
GRAIN SIZE DISTRIBUTION

MW-IT-01A SA17

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 16, 2024 | Tested By: | D. Dion |
| Report Date: | Apr 20, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-02A | SA3 | 1.07-2.44 | 21 | 62 | 17 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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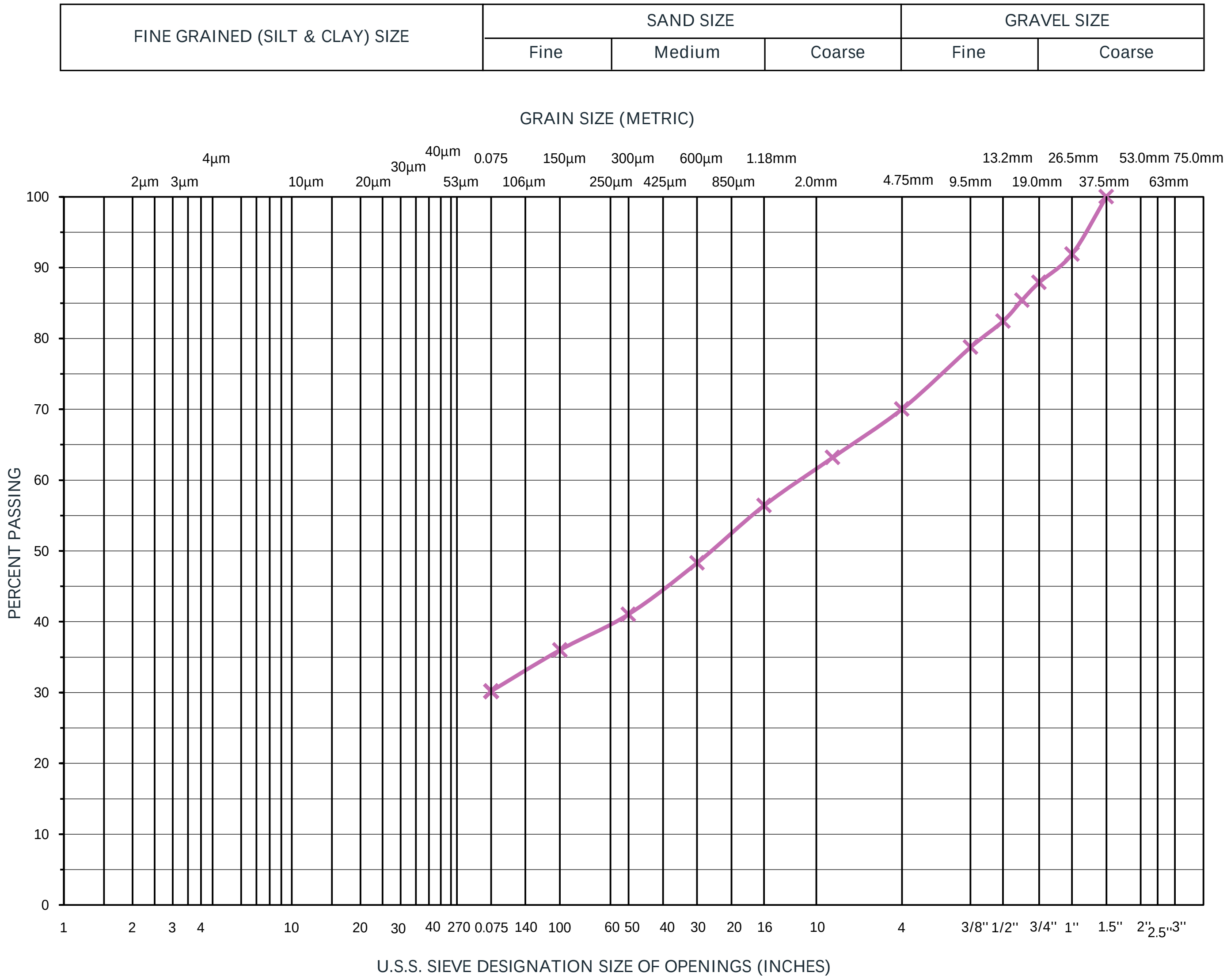
GRAIN SIZE DISTRIBUTION

MW-IT-02A SA3

Project No.: CA-GLD-19129150
Date Rec'd: Apr 16, 2024 Tested By: D. Dion
Report Date: Apr 20, 2024

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-02A | SA5 | 3.05-3.51 | 30 | 40 | 30 |
| | | | | | | |
| | | | | | | |
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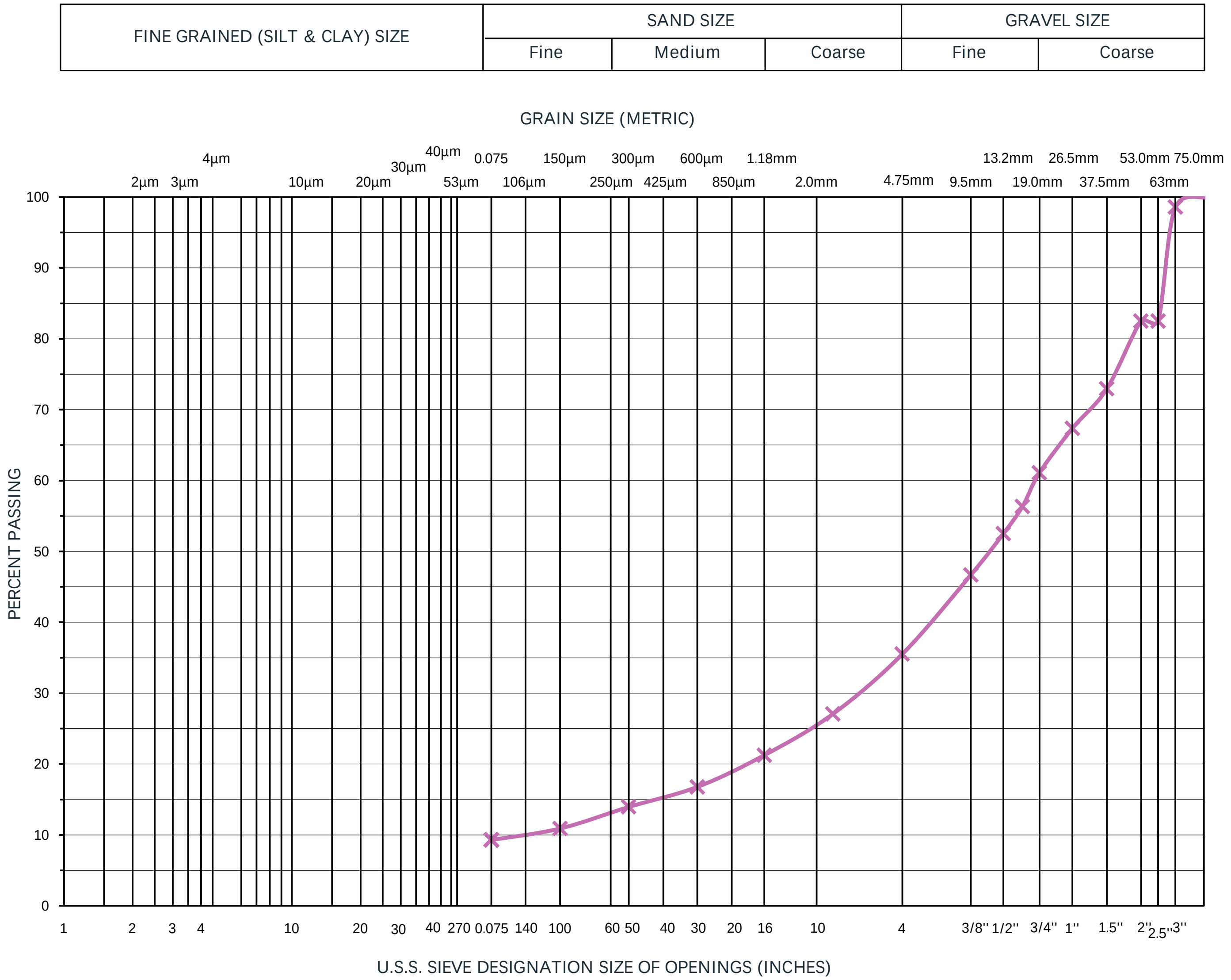
GRAIN SIZE DISTRIBUTION

| | | | |
|---|---|---|---|
| MW-IT-02A SA5 | | | |
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 16, 2024 | Tested By: | D. Dion |
| Report Date: | Apr 20, 2024 | | |

# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | W-IT-02A | SA6 | 3.51-4.27 | 64 | 27 | 9 |
| | | | | | | |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

MW-IT-02A SA6

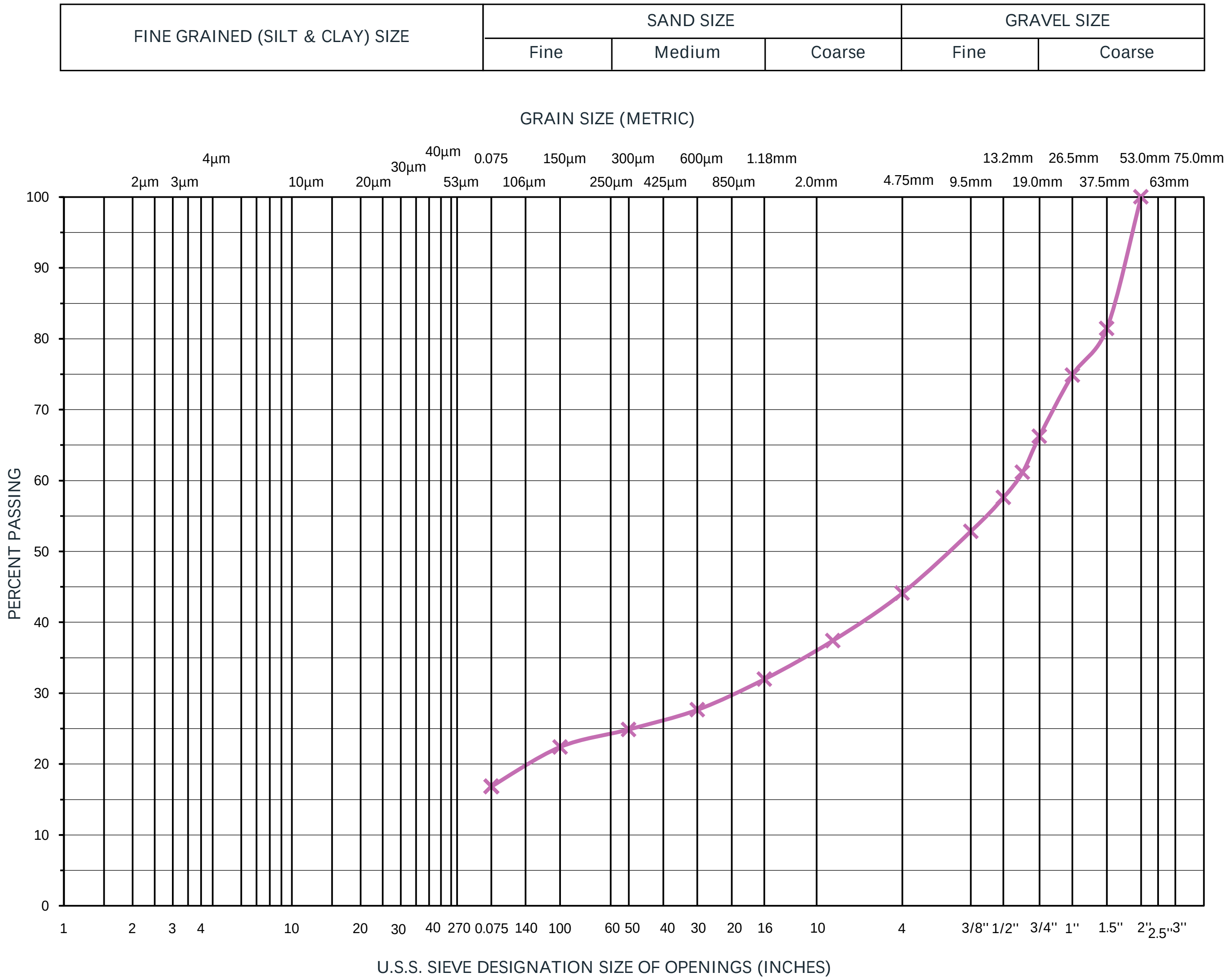
Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

Report Date: Apr 20, 2024

# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-02A | SA7 | 4.42-5.49 | 56 | 27 | 17 |
| | | | | | | |
| | | | | | | |
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| | | | | | | |

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GRAIN SIZE DISTRIBUTION

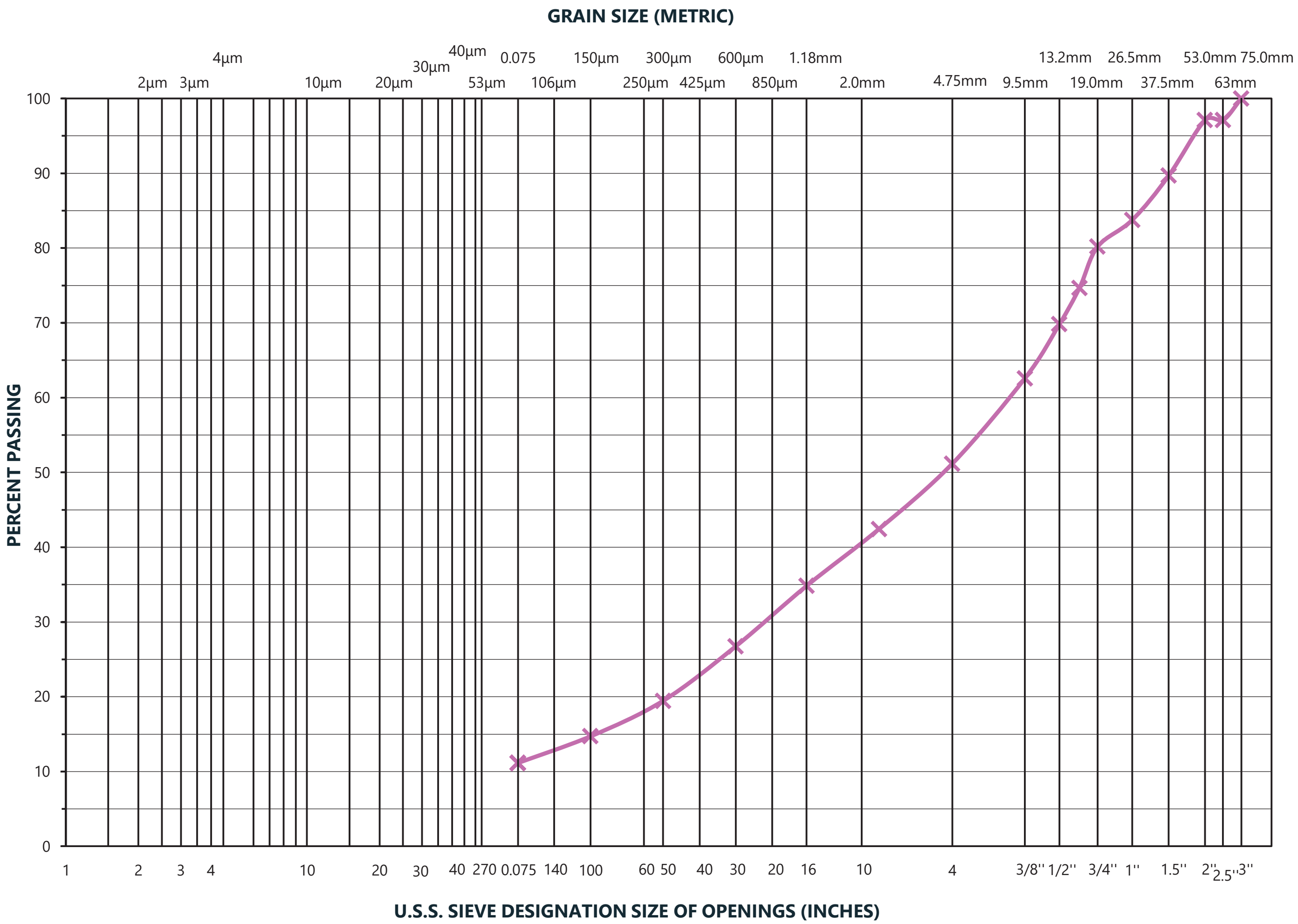
MW-IT-02A SA7

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 16, 2024 | Tested By: | D. Dion |
| Report Date: | Apr 20, 2024 | | |

# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-03 | SA3 RUN 1 | | 49 | 40 | 11 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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**GRAIN SIZE DISTRIBUTION**

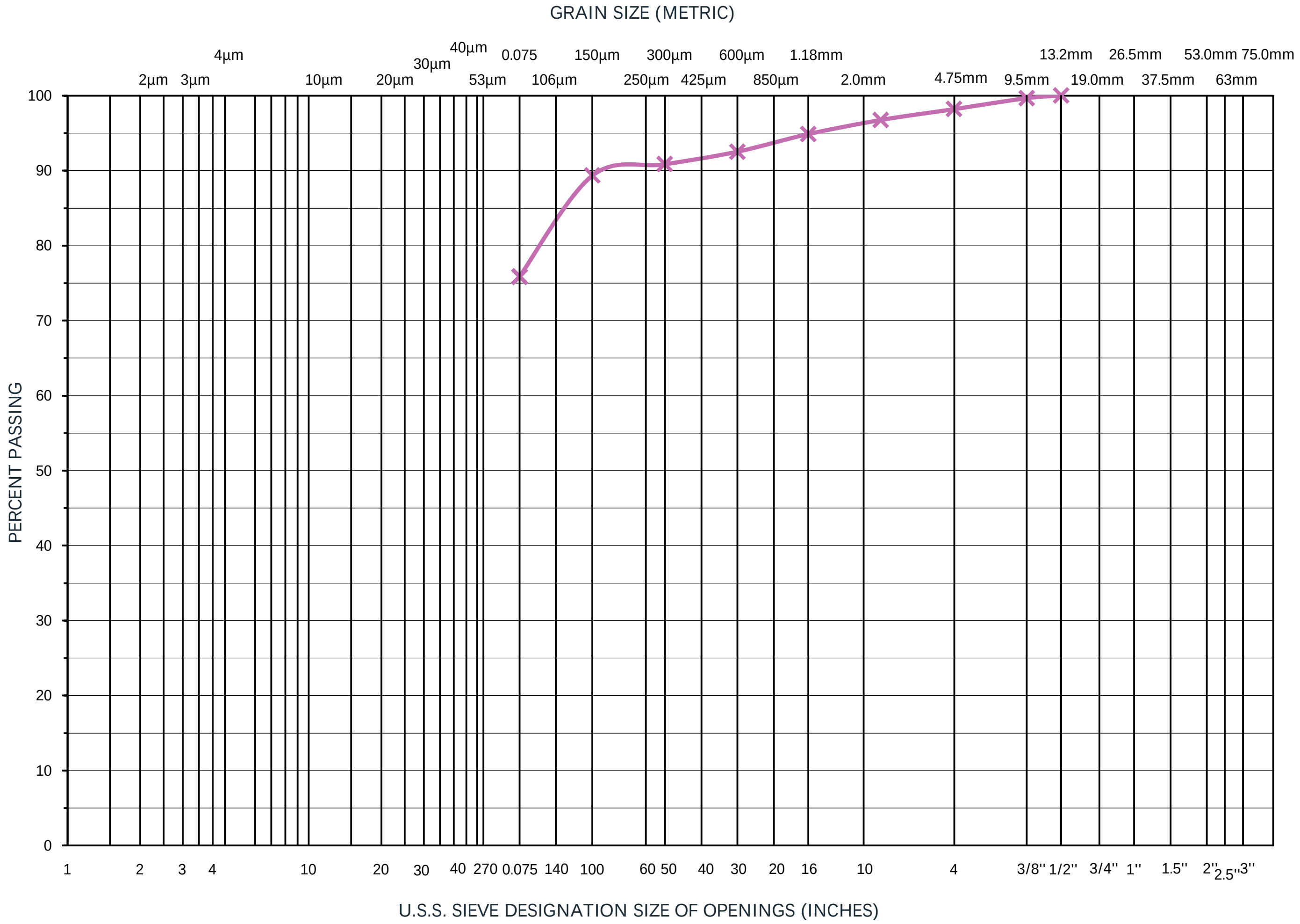
**MW-IT-03 SA3 RUN 1**

| | | | |
|---|---|---|---|
| **Project No.:** | **CA-GLD-19129150** | | |
| **Date Rec'd:** | **Apr 19, 2024** | **Tested By:** | **D. Dion** |
| **Report Date:** | **May 16, 2024** | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



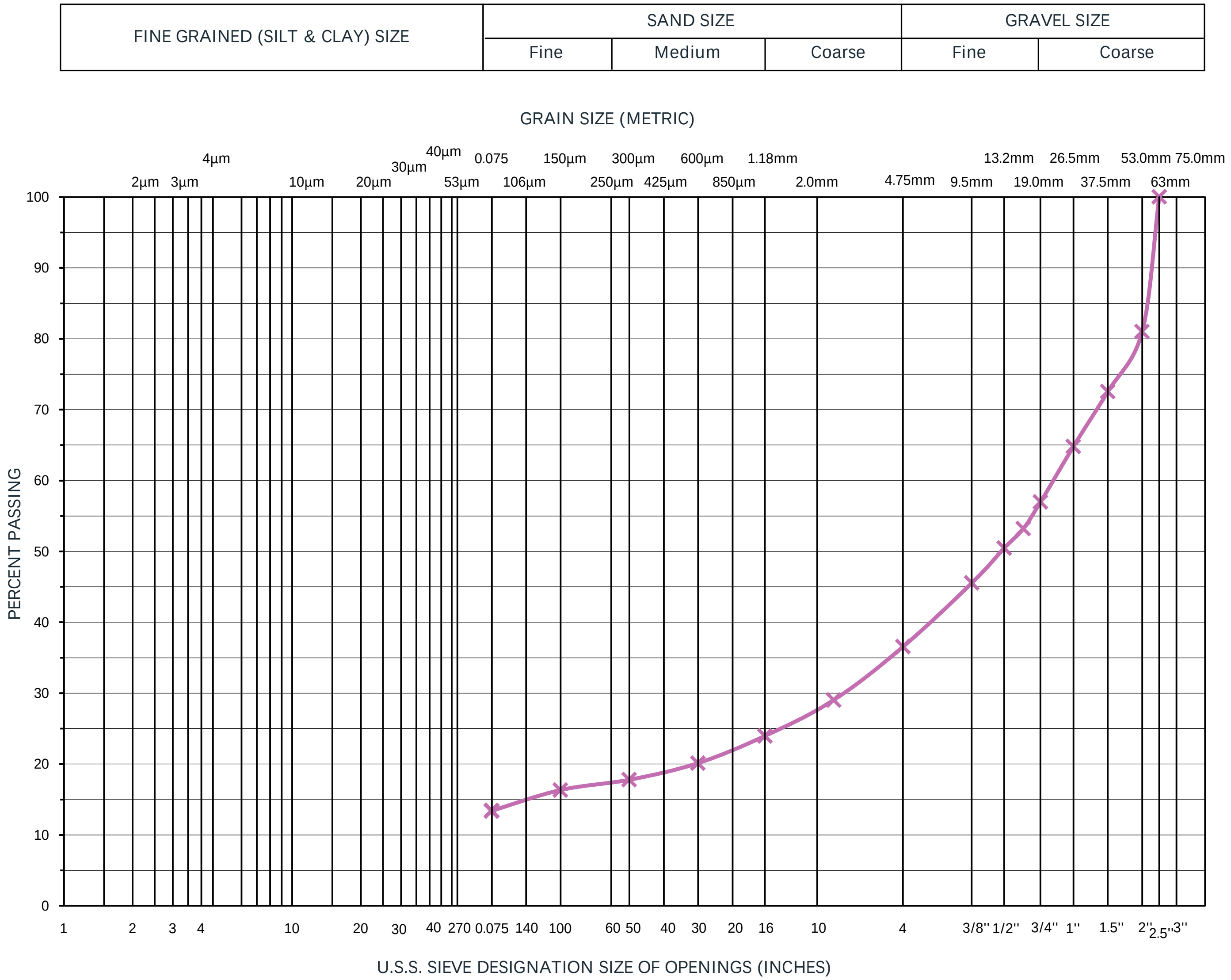
LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-03 | SA4 RUN 2 | | 2 | 22 | 76 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| | | |
|---|---|---|
| WSP Canada Inc<br>900 Maple Grove Road, Unit 10<br>Cambridge, ON  N3H 4R7<br>www.wsp.com | GRAIN SIZE DISTRIBUTION | MW-IT-03 SA4 RUN 2 |
| | | Project No.: CA-GLD-19129150 |
| | | Date Rec'd: Apr 19, 2024 · Tested By: D. Dion |
| | | Report Date: |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-03 | SA7 RUN 2 | | 63 | 24 | 13 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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GRAIN SIZE DISTRIBUTION

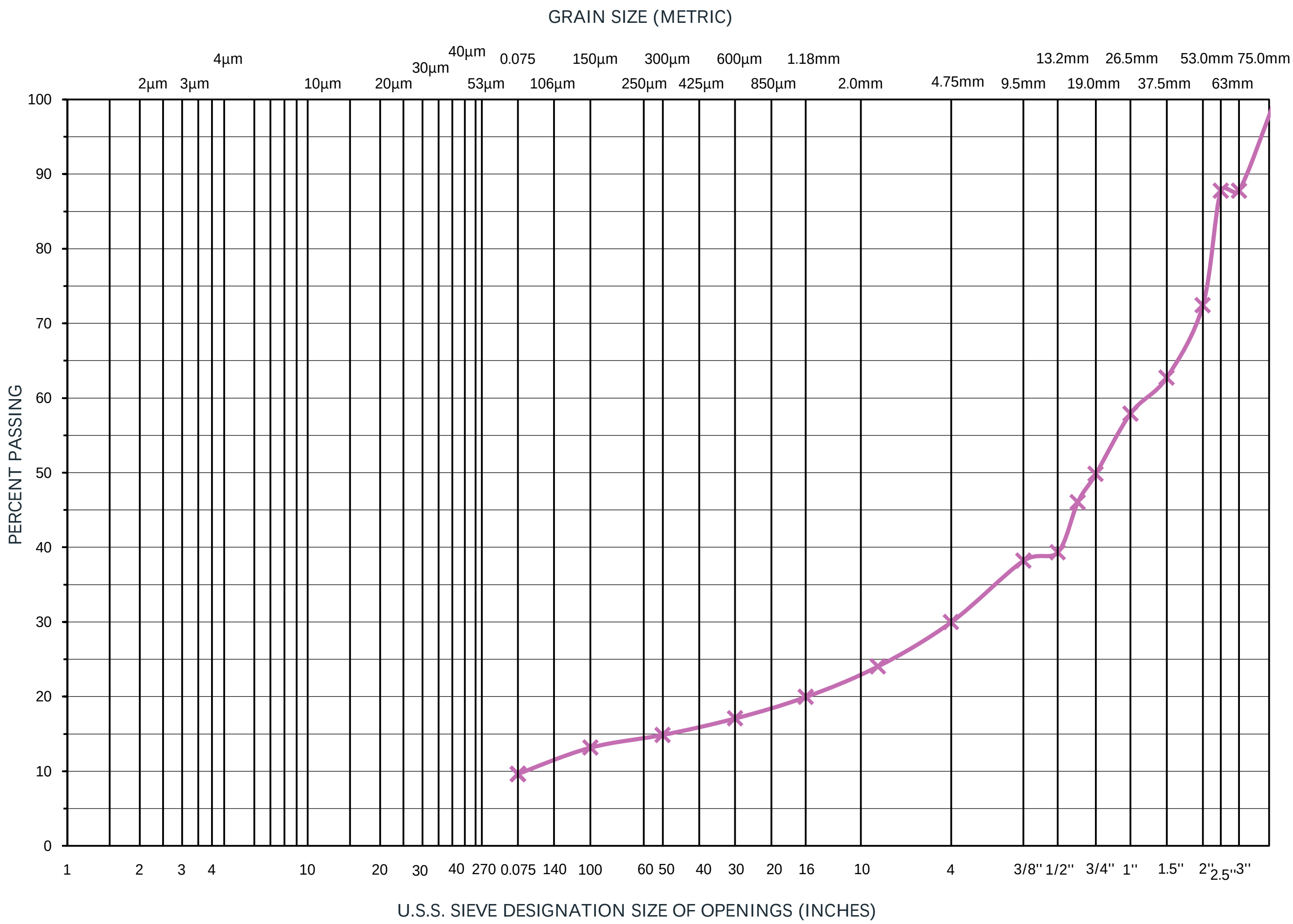
MW-IT-03 SA7 RUN 2

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 19, 2024 | Tested By: | D. Dion |
| Report Date: | | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-03 | SA9 RUN 3 | | 70 | 20 | 10 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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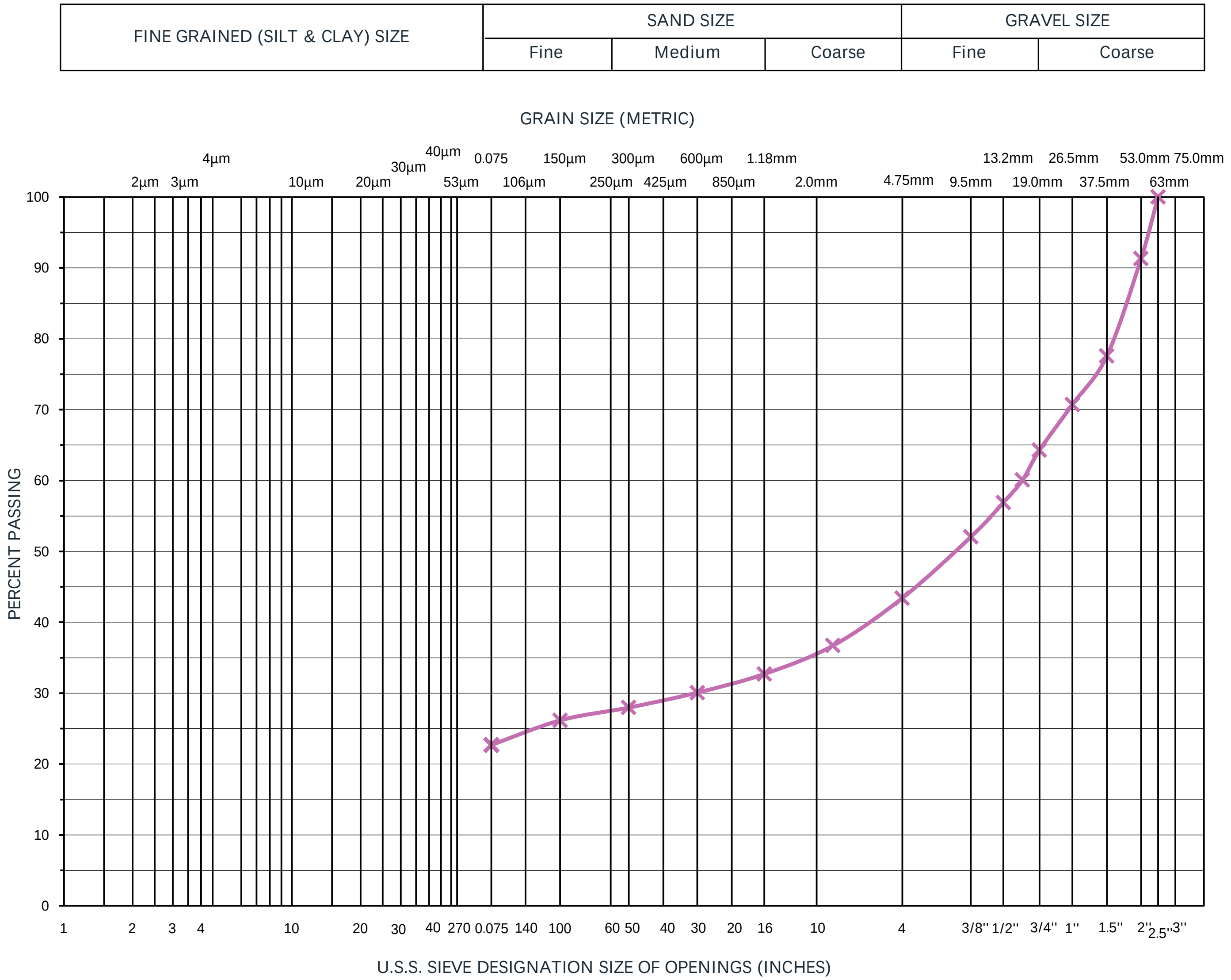
GRAIN SIZE DISTRIBUTION

| MW-IT-03 SA9 RUN 3 | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 19, 2024 | Tested By: | D. Dion |
| Report Date: | | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-03 | SA10 RUN 4 | | 57 | 20 | 23 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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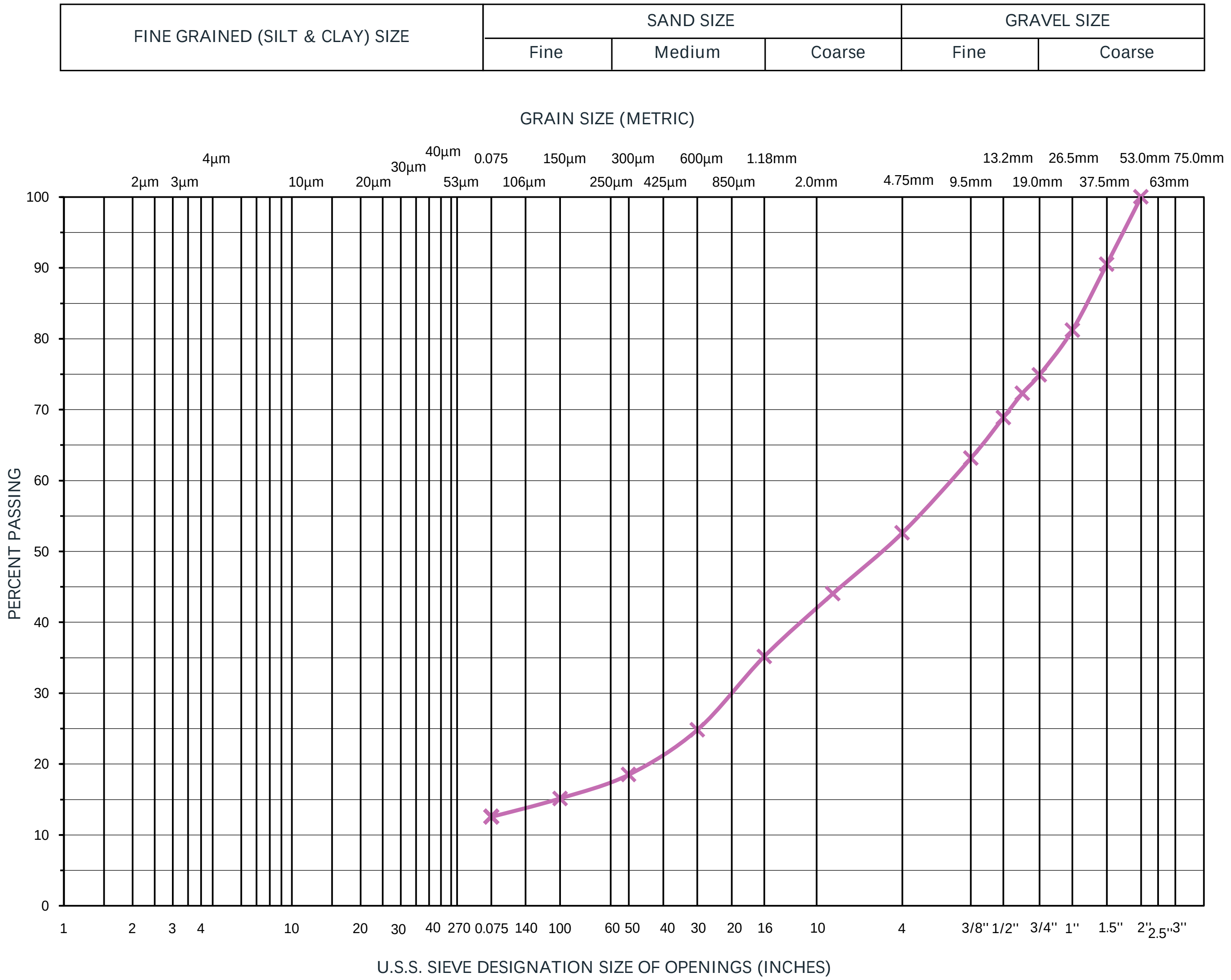
GRAIN SIZE DISTRIBUTION

MW-IT-03 SA10 RUN 4

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 19, 2024 | Tested By: | D. Dion |
| Report Date: | | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-04 | SA2 RUN 1 | | 47 | 40 | 13 |
| | | | | | | |
| | | | | | | |
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WSP Canada Inc
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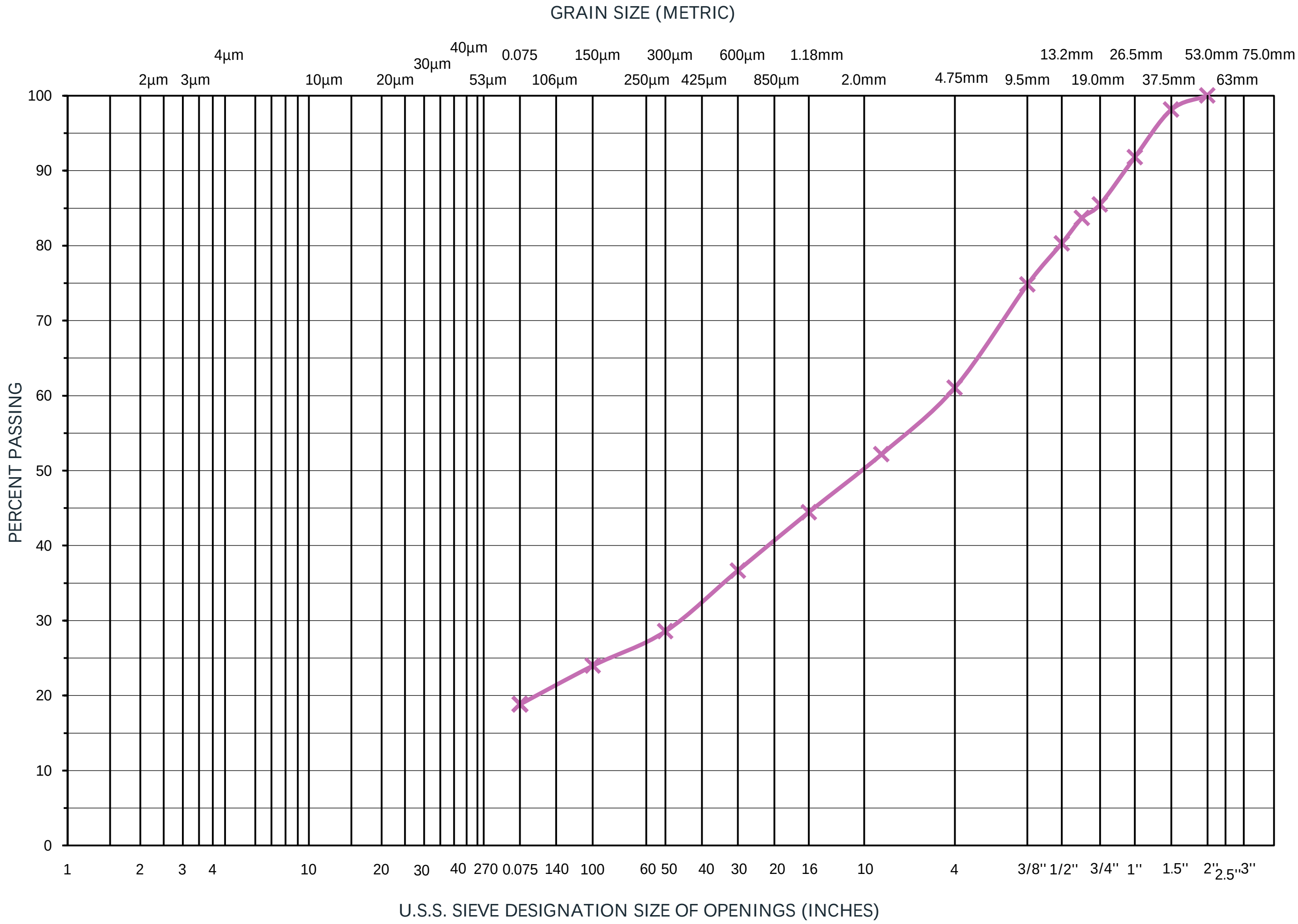
GRAIN SIZE DISTRIBUTION

| | | | |
|---|---|---|---|
| MW-IT-04 SA2 RUN 1 | | | |
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 19, 2024 | Tested By: | D. Dion |
| Report Date: | | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-04 | SA4 RUN 2 | | 59 | 22 | 19 |
| | | | | | | |
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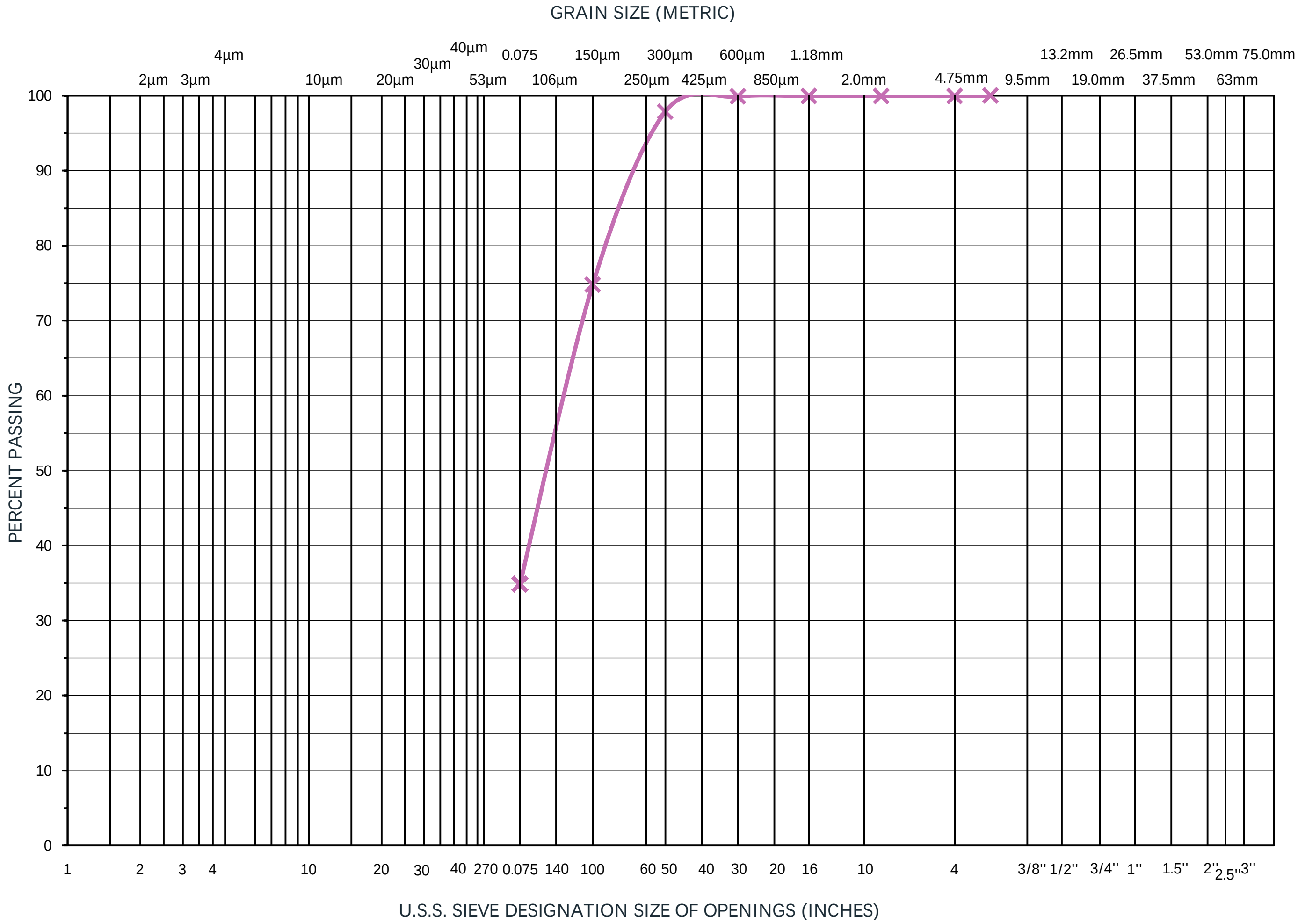
GRAIN SIZE DISTRIBUTION

MW-IT-04 SA4 RUN 2
Project No.: CA-GLD-19129150
Date Rec'd: Apr 2, 2024
Tested By: D. Dion
Report Date: May 16, 2024

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-04 | SA6 RUN 2 | | 0 | 65 | 35 |
| | | | | | | |
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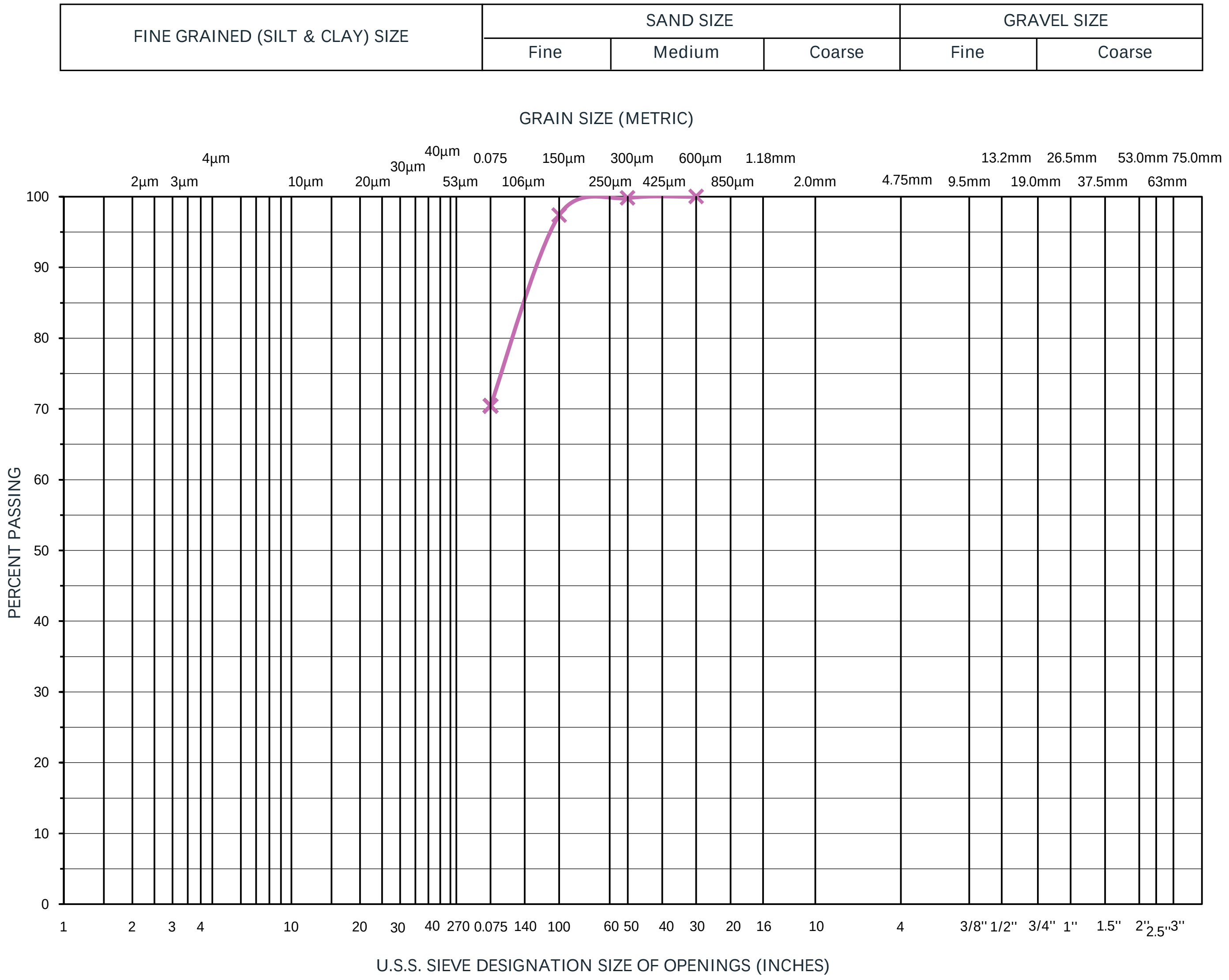
GRAIN SIZE DISTRIBUTION

MW-IT-04 SA6 RUN 2

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 19, 2024 | Tested By: | D. Dion |
| Report Date: | | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-04 | SA7 RUN 2 | | 0 | 30 | 70 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

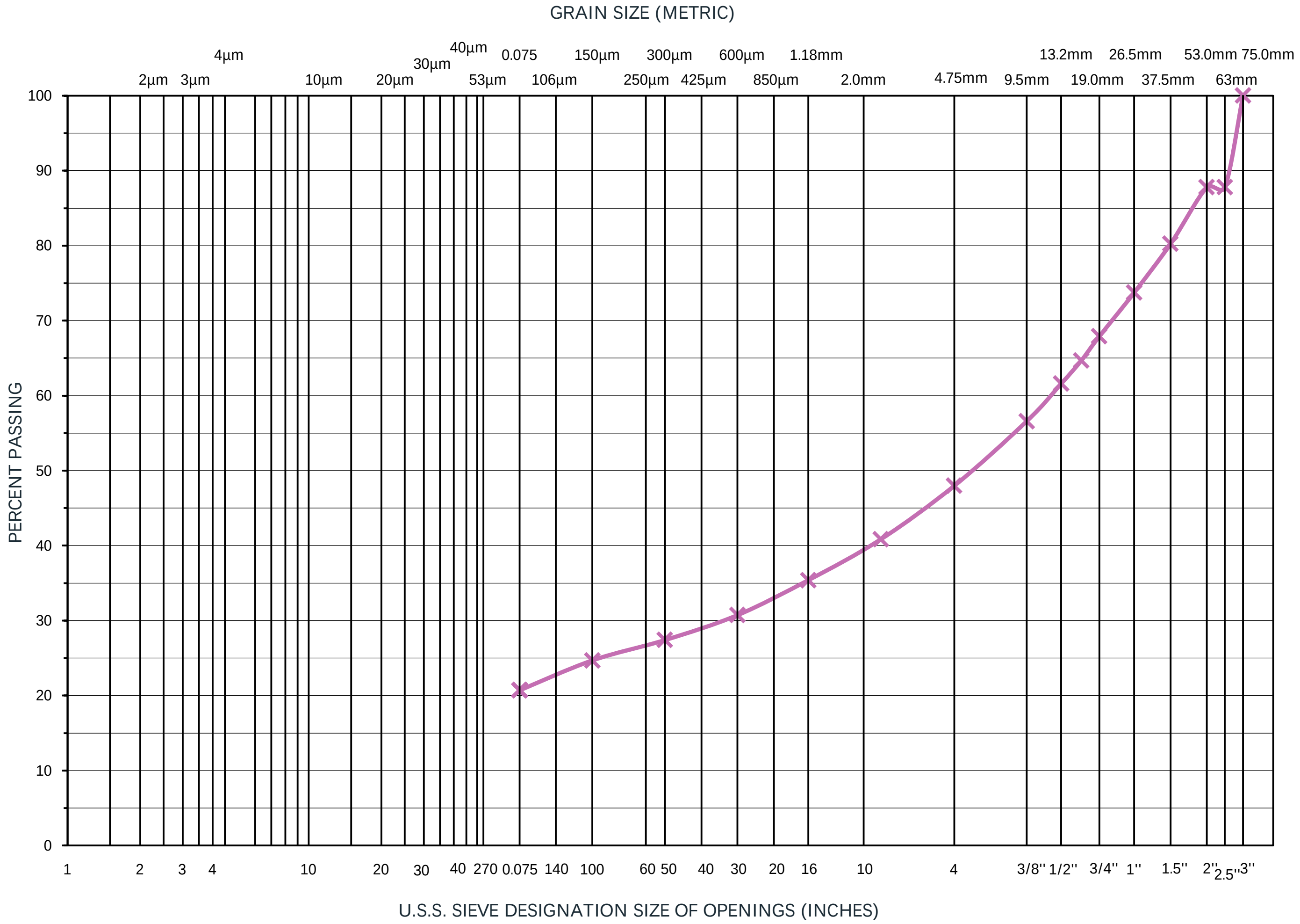
MW-IT-04 SA7 RUN 2

Project No.: CA-GLD-19129150
Date Rec'd: Apr 19, 2024 Tested By: D. Dion
Report Date:

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-04 | SA9 RUN 3 | | 52 | 27 | 21 |
| | | | | | | |
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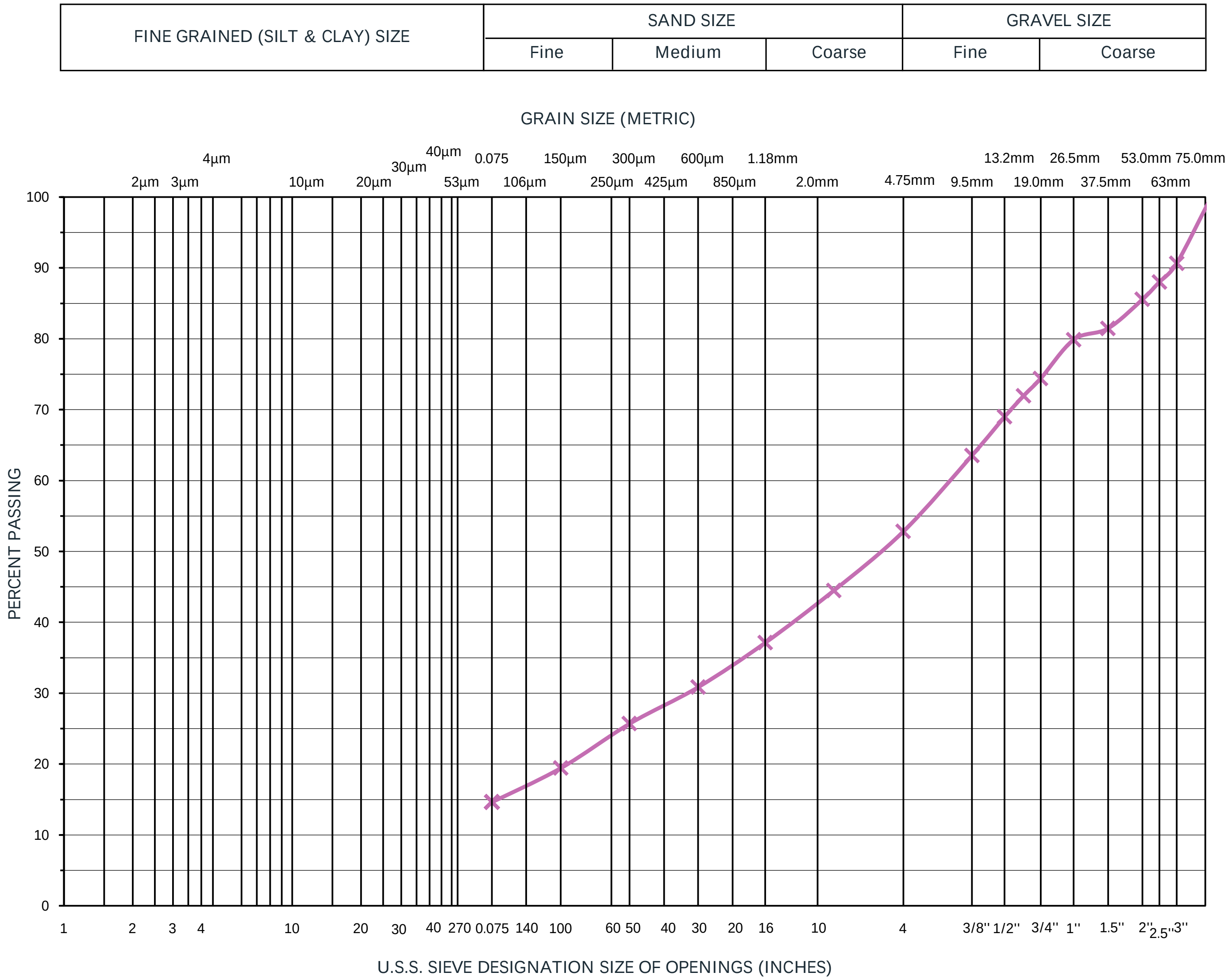
GRAIN SIZE DISTRIBUTION

MW-IT-04 SA9 RUN 3

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 19, 2024 | Tested By: | D. Dion |
| Report Date: | | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-05A | SA2 | | 47 | 38 | 15 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA2

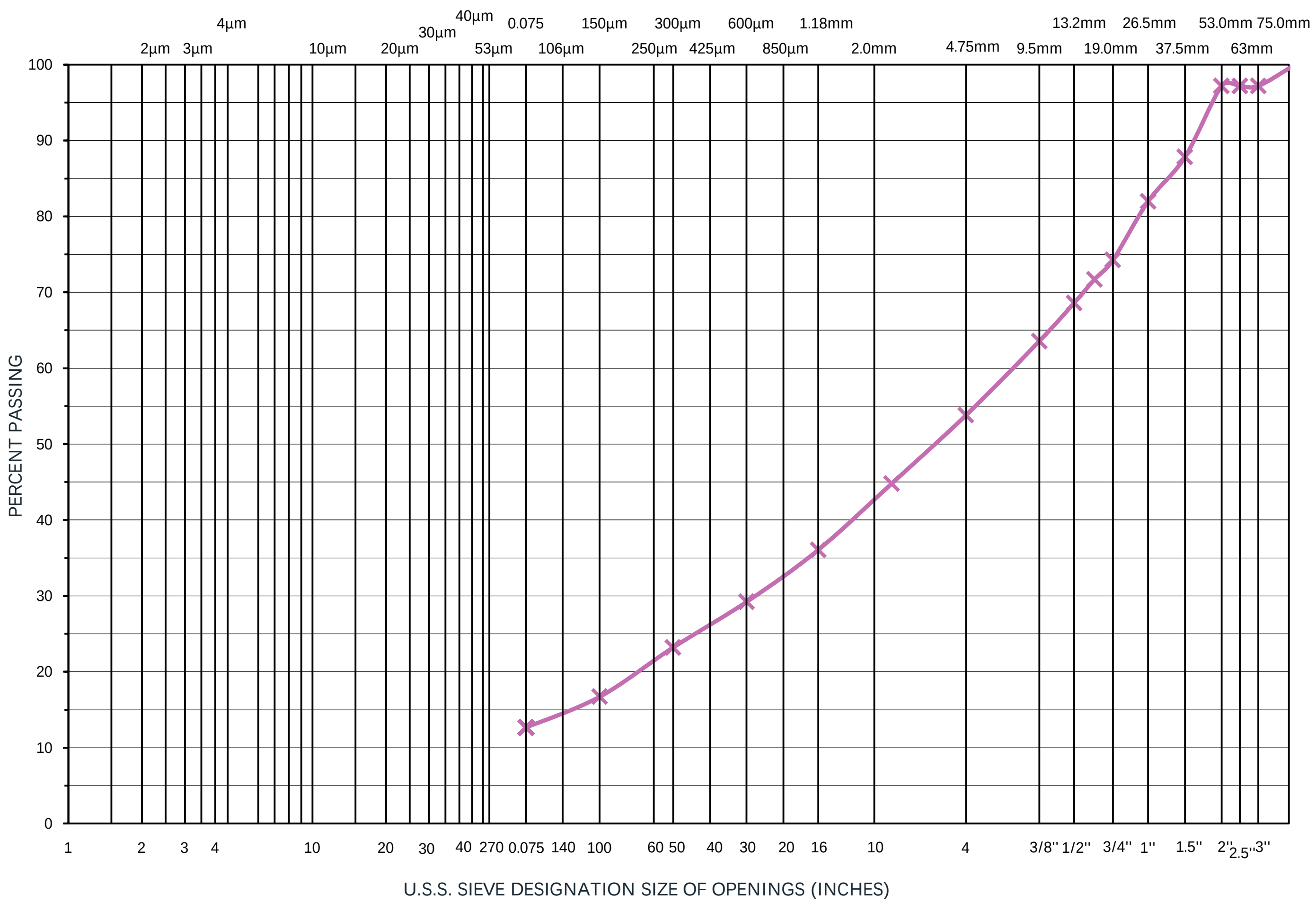
| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | D. Dion |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |

GRAIN SIZE (METRIC)



U.S.S. SIEVE DESIGNATION SIZE OF OPENINGS (INCHES)

## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-05A | SA3 | | 46 | 41 | 13 |
| | | | | | | |
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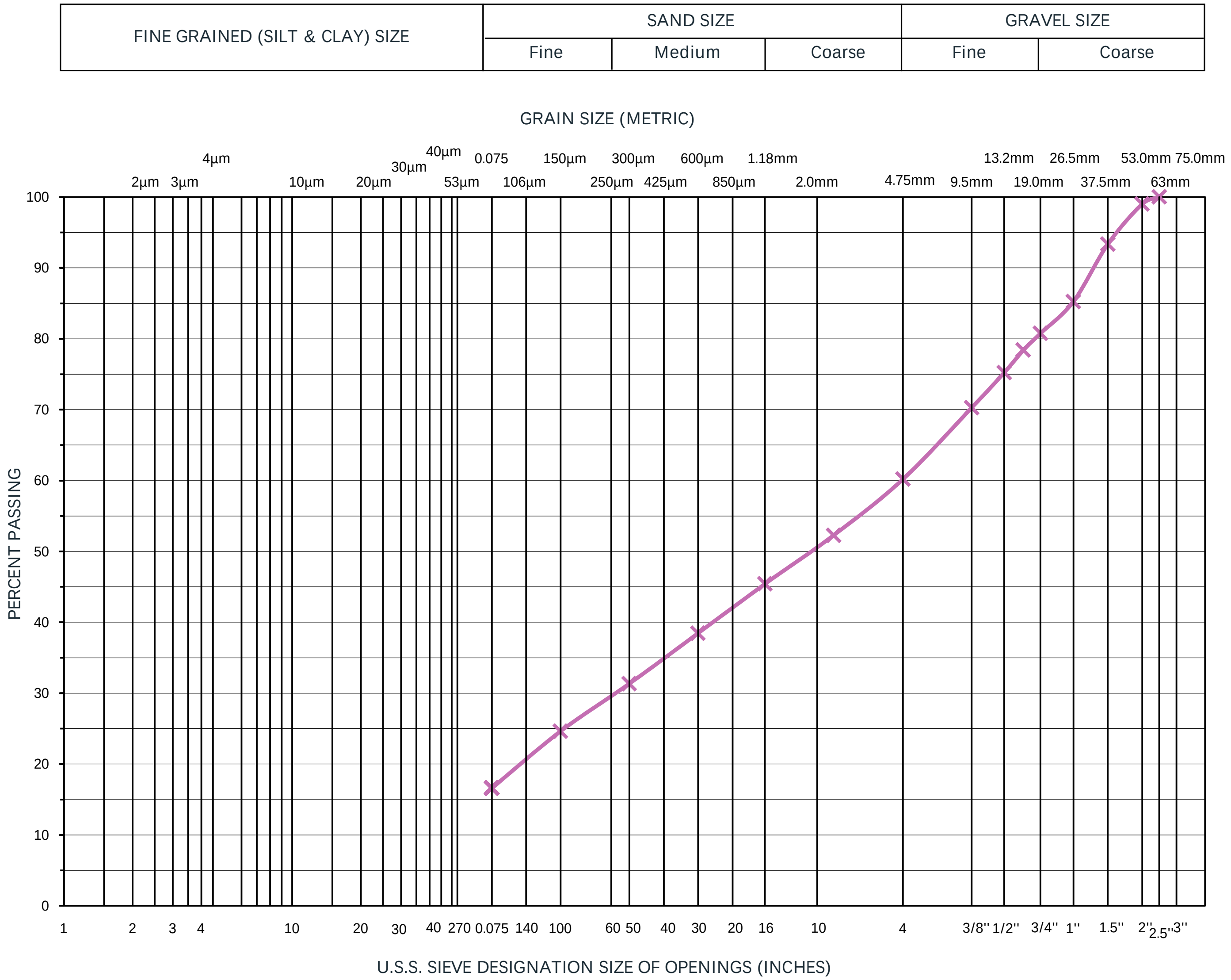
GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA3

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | D. Dion |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-05A | SA4 | | 40 | 43 | 17 |
| | | | | | | |
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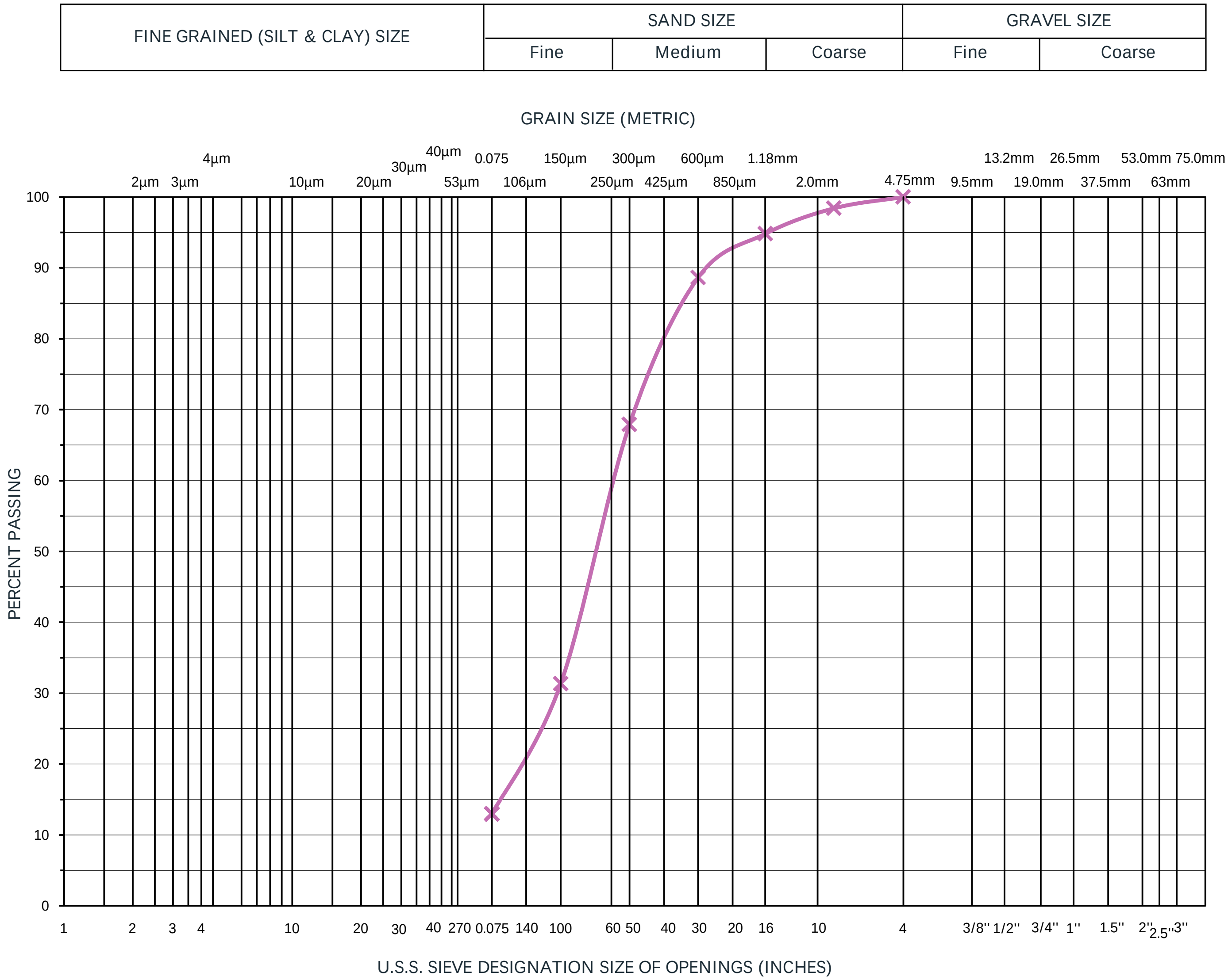
GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA4

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | D. Dion |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-05A | SA5 | | 0 | 87 | 13 |
| | | | | | | |
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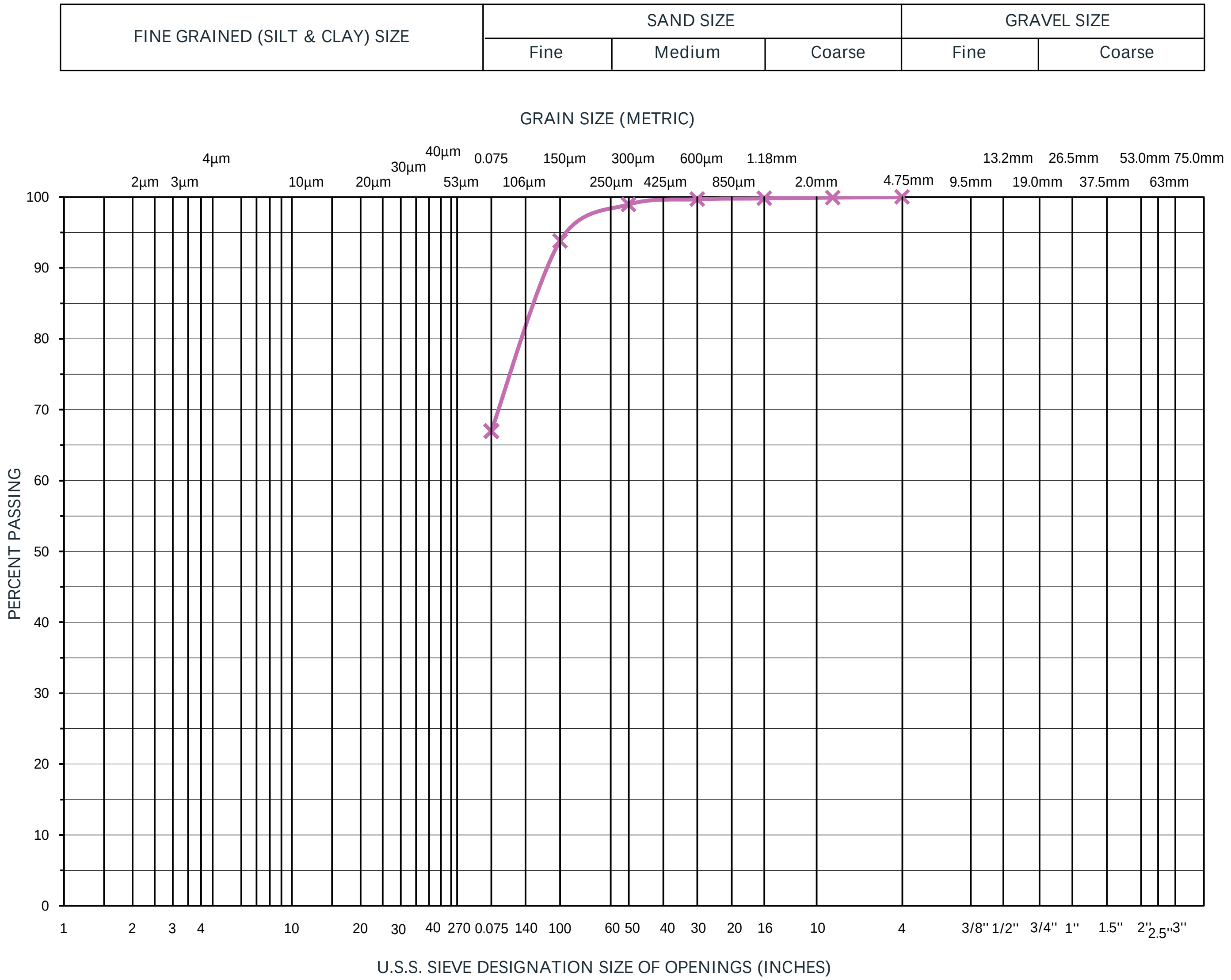
GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA5

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | D. Dion |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-05A | SA6 | | 0 | 33 | 67 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA6

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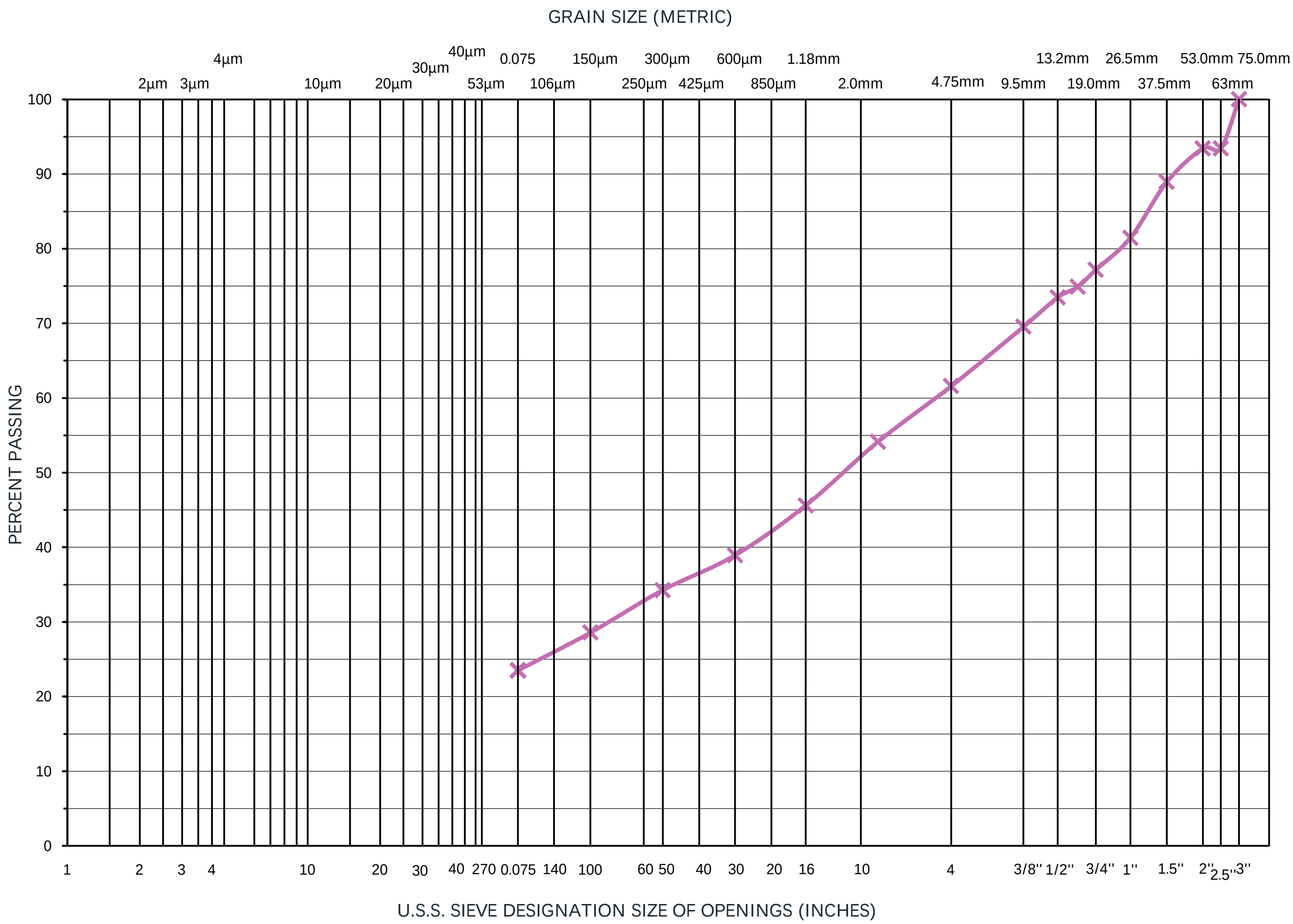
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | D. Dion |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-06A | SA1 | | 38 | 38 | 24 |
| | | | | | | |
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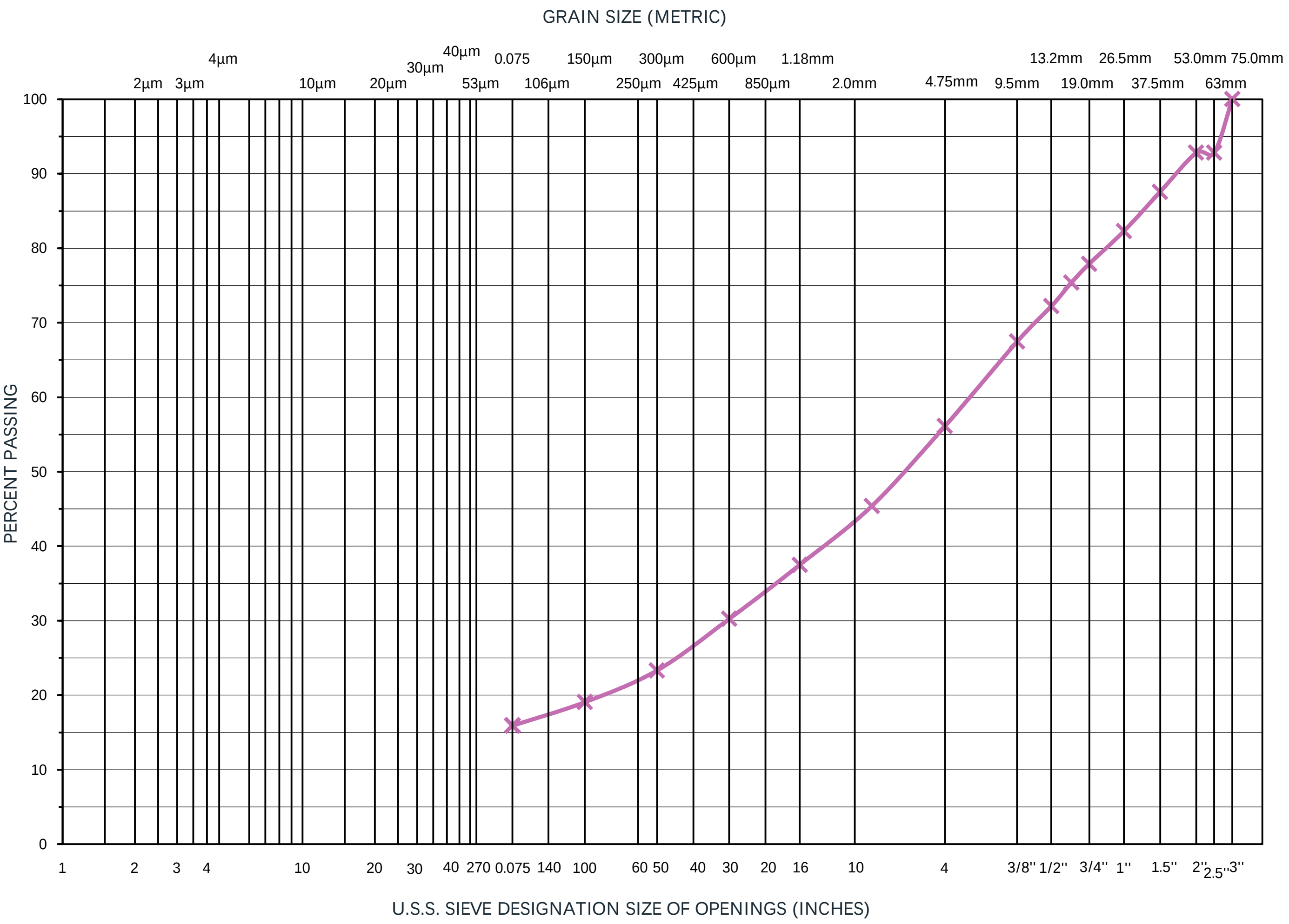
|---|---|---|
| WSP Canada Inc<br>900 Maple Grove Road, Unit 10<br>Cambridge, ON N3H 4R7<br>www.wsp.com | GRAIN SIZE DISTRIBUTION | MW-IT-06A SA1<br>Project No.: CA-GLD-19129150<br>Date Rec'd: Apr 26, 2024 Tested By: H. Desai<br>Report Date: May 4, 2024 |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-06A | SA2 | | 44 | 40 | 16 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

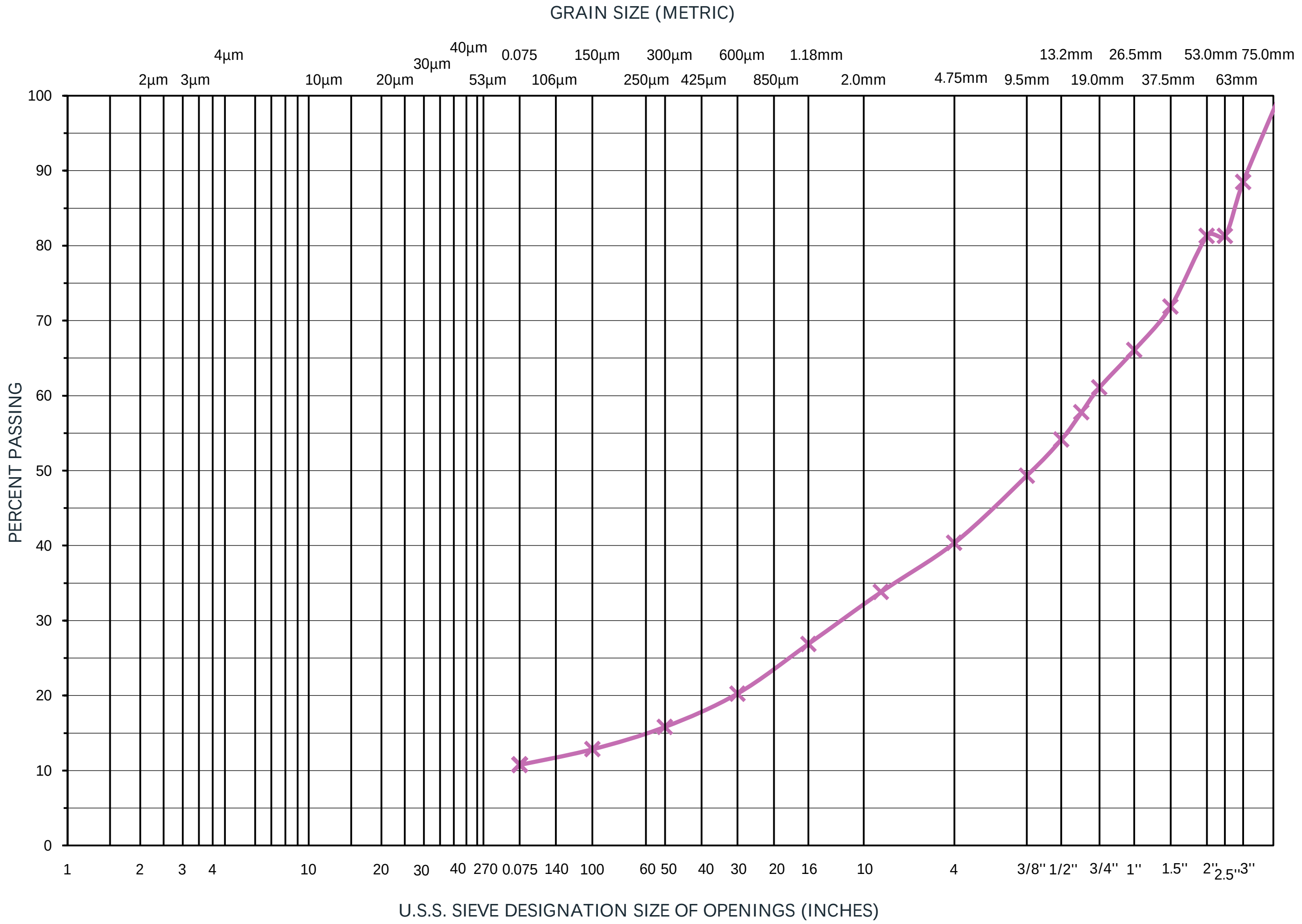
MW-IT-06A SA2

Project No.: CA-GLD-19129150
Date Rec'd: Apr 26, 2024
Tested By: H. Desai
Report Date: May 4, 2024

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-06A | SA3 | | 60 | 29 | 11 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

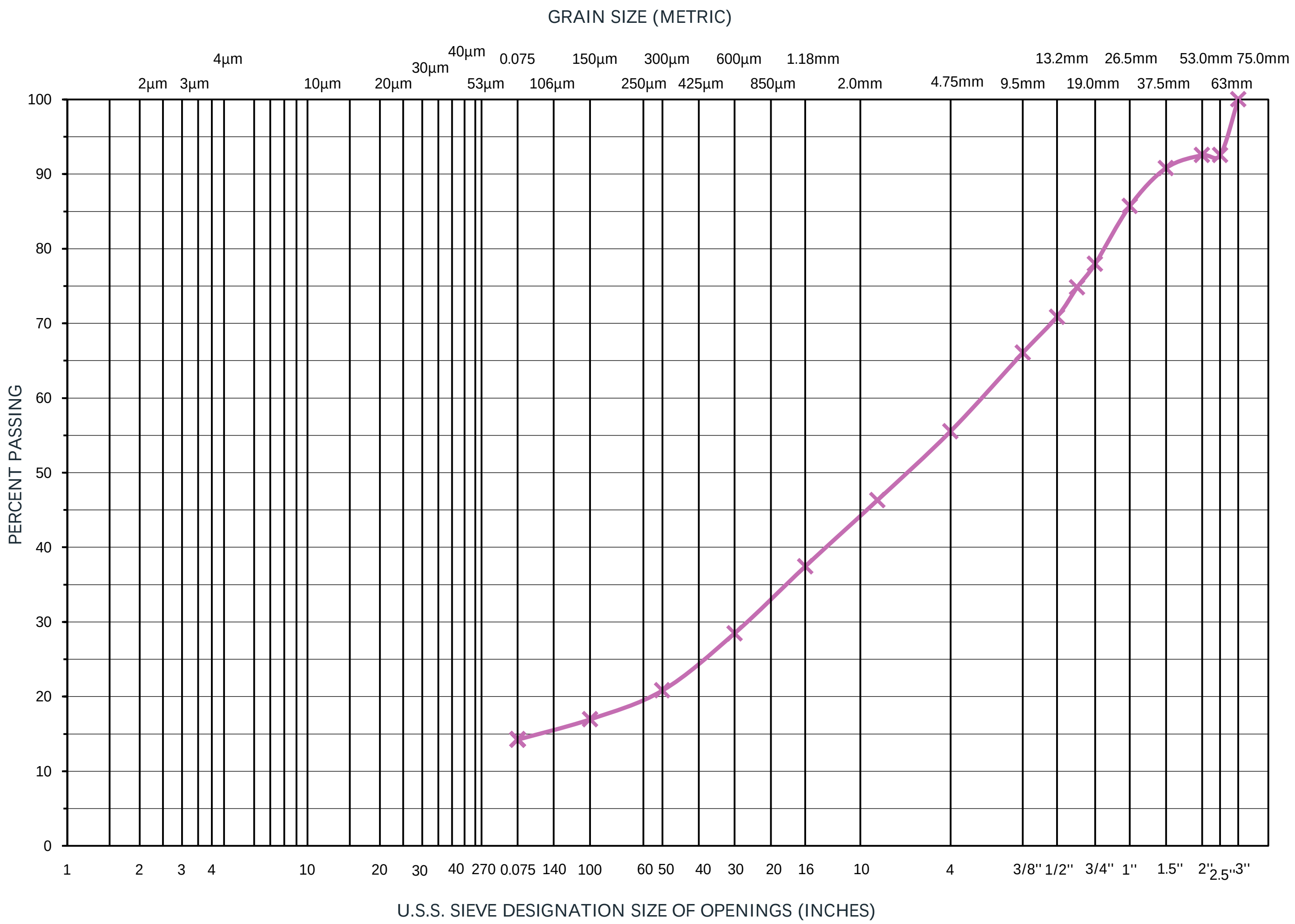
MW-IT-06A SA3

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | H. Desai |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-06A | SA4 | | 44 | 42 | 14 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

MW-IT-06A SA4

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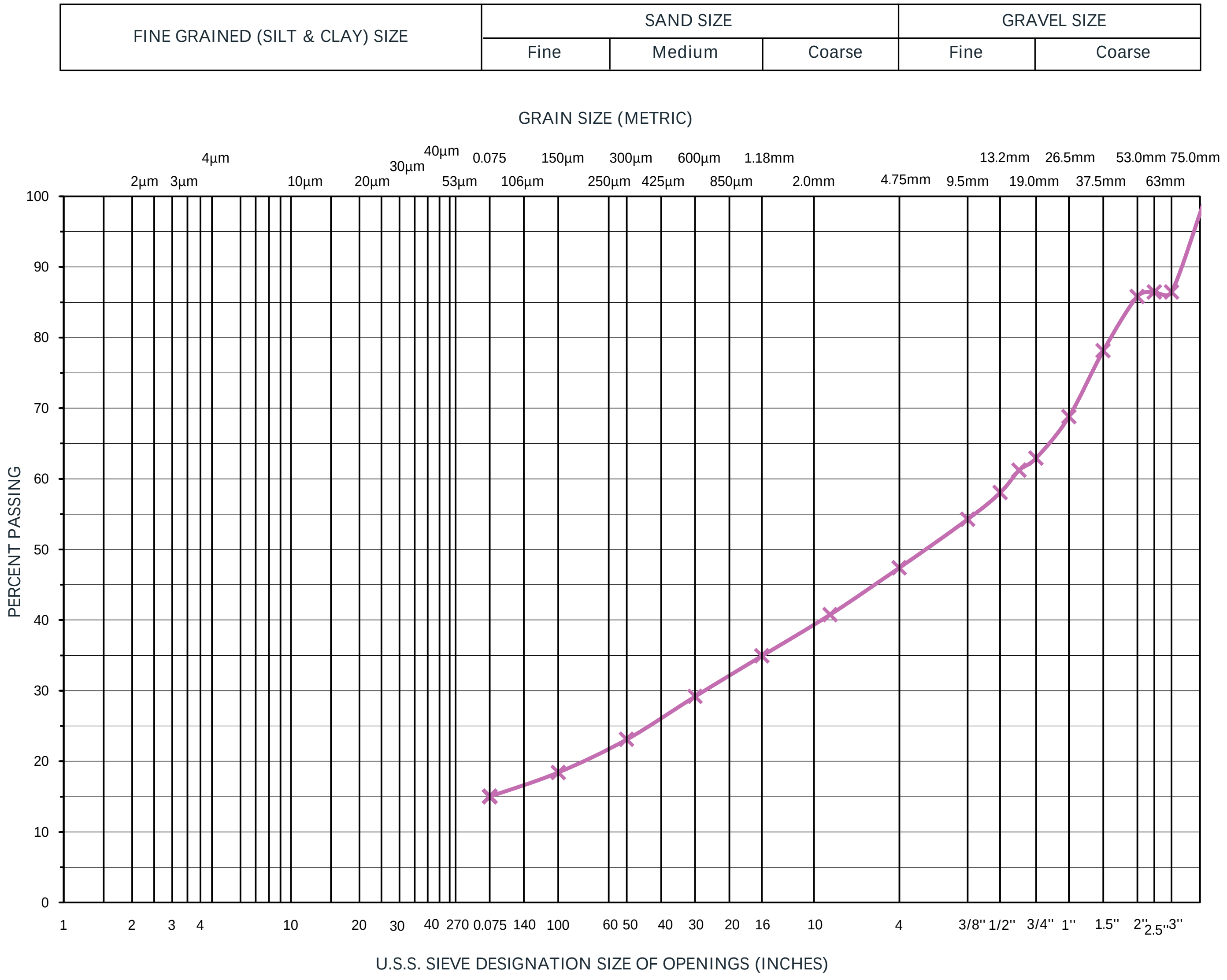
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | H. Desai |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-06A | SA5 | | 53 | 29 | 18 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

MW-IT-06A SA5

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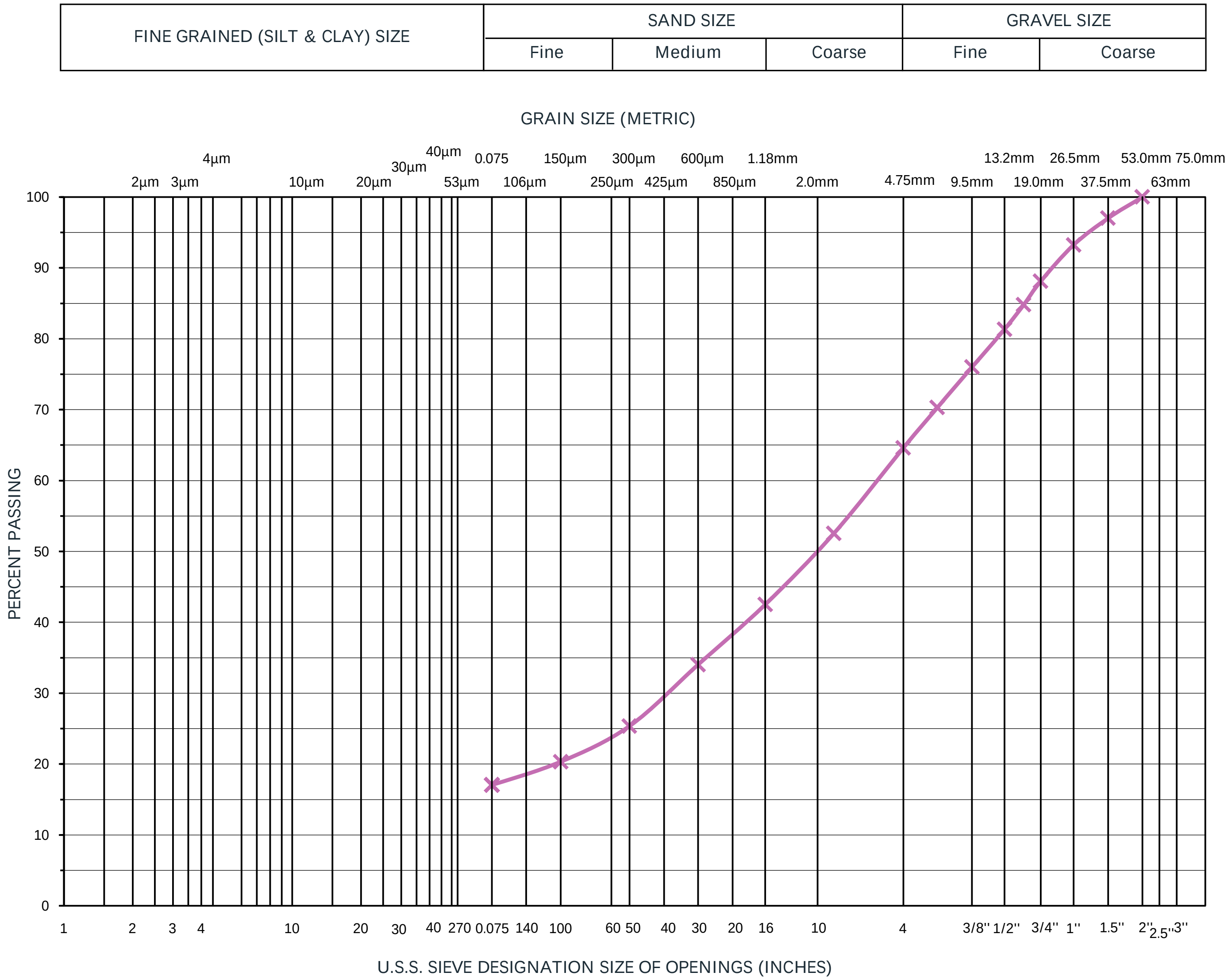
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | H. Desai |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-07A | SA2 | | 35 | 48 | 17 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

MW-IT-07A, SA2

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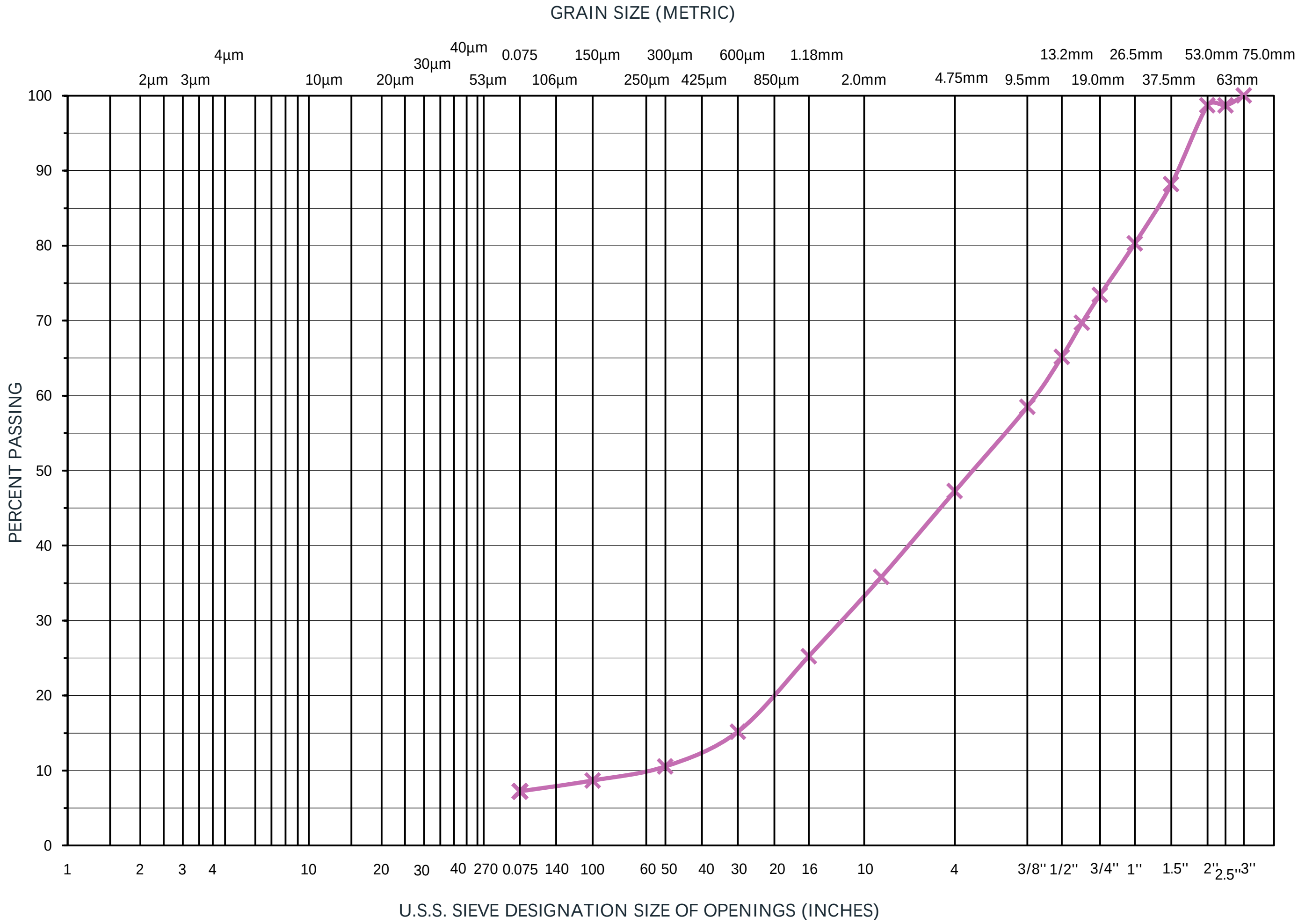
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 29, 2024 | Tested By: | H. Desai |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-07A | SA3 | | 53 | 40 | 7 |
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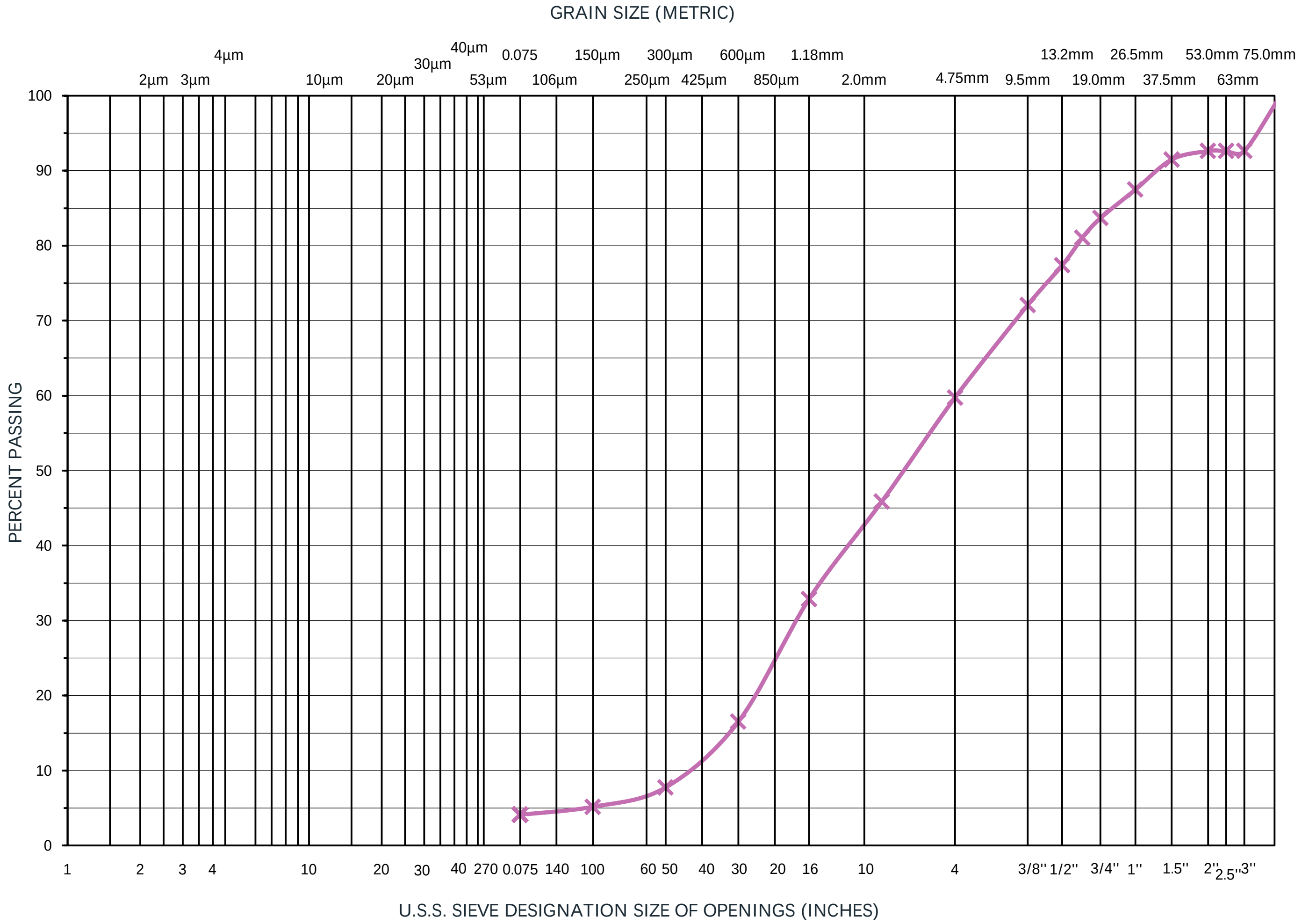
| | | Project No.: CA-GLD-19129150 | |
| | | Date Rec'd: Apr 26, 2024 | Tested By: H. Desai |
| | | Report Date: May 4, 2024 | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-07A | SA5 | | 40 | 56 | 4 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

MW-IT-07A, SA5

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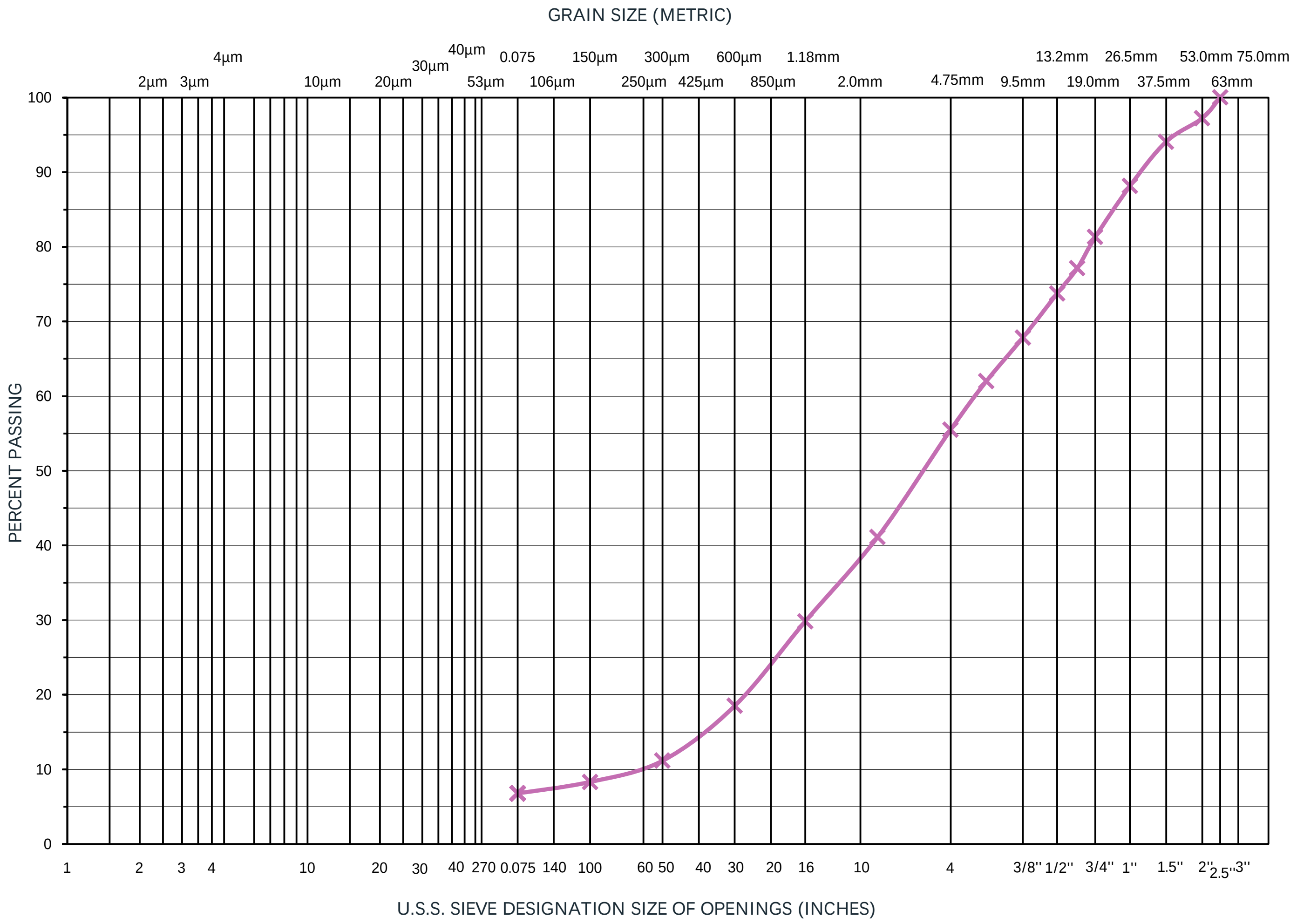
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | H. Desai |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



## LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-07A | SA6 | | 44 | 49 | 7 |
| | | | | | | |
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GRAIN SIZE DISTRIBUTION

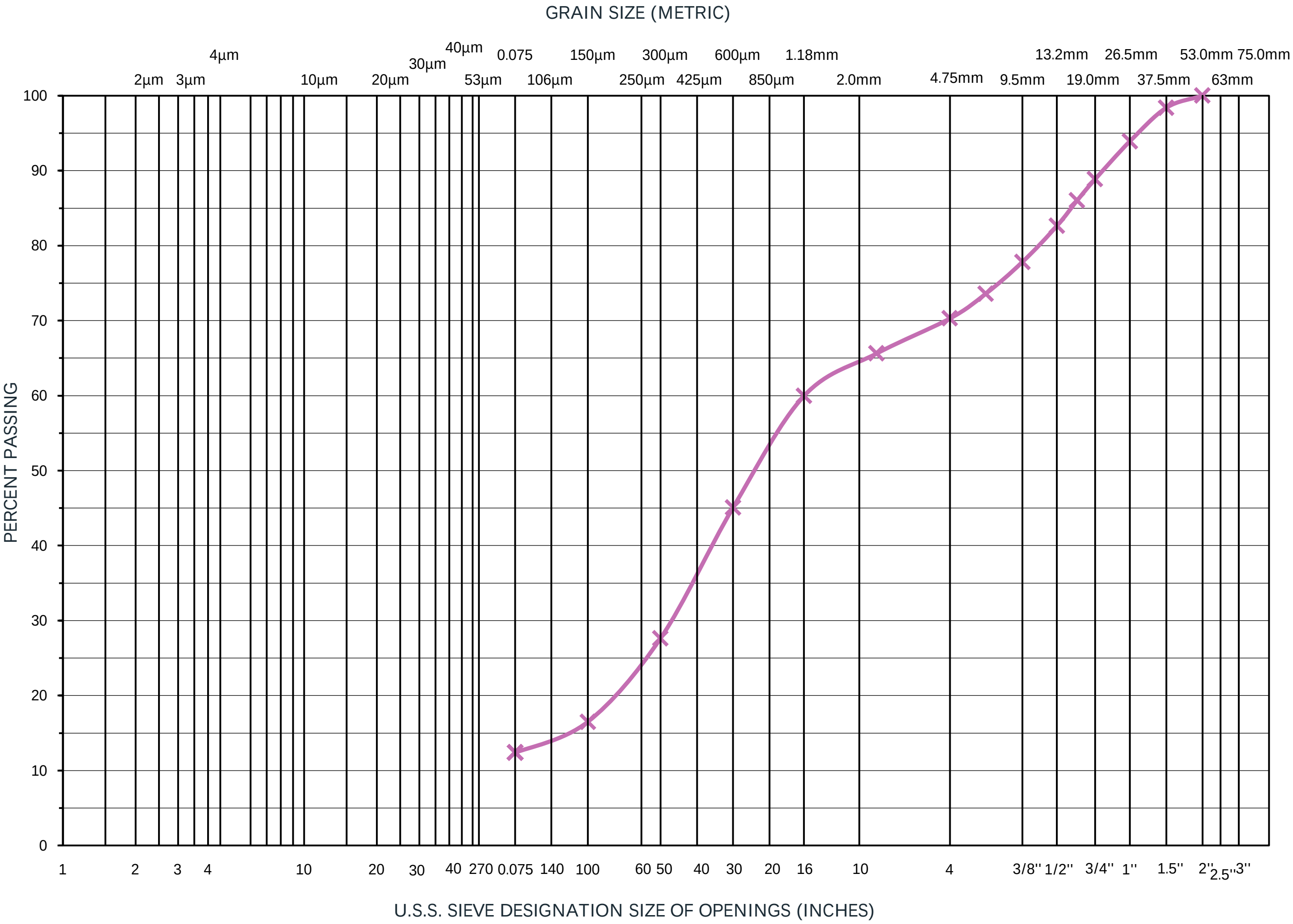
MW-IT-07A, SA6

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | H. Desai |
| Report Date: | May 4, 2024 | | |

# GRAIN SIZE DISTRUBUTION

## CBM Caledon Pit Laboratory Testing

| FINE GRAINED (SILT & CLAY) SIZE | SAND SIZE | | | GRAVEL SIZE | |
|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse |



LEGEND

| SYMBOL | BOREHOLE | SAMPLE | DEPTH (m) | GRAVEL (%) | SAND (%) | SILT (%) |
|---|---|---|---|---|---|---|
| X | MW-IT-07A | SA7 | | 30 | 58 | 12 |
| | | | | | | |
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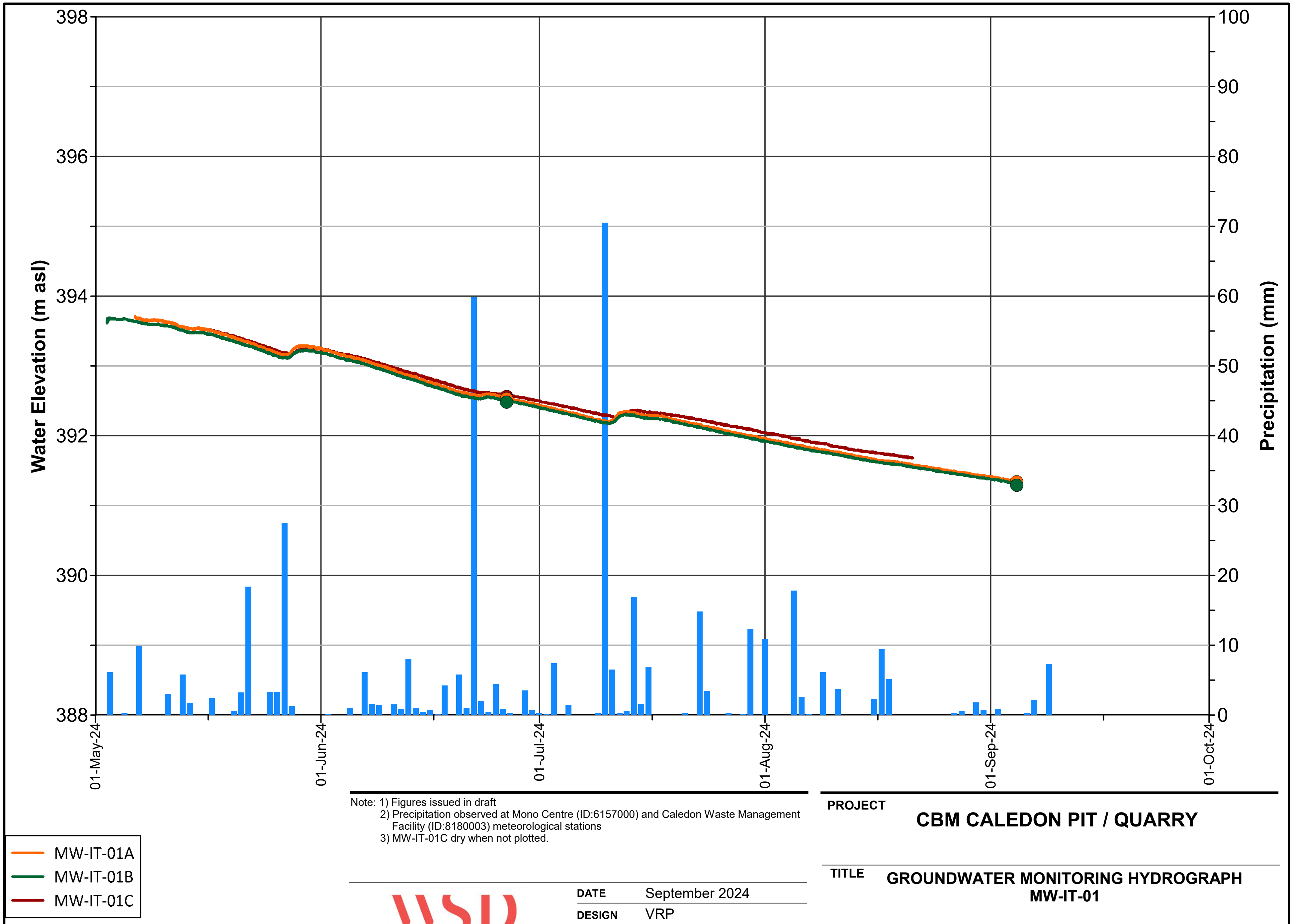
GRAIN SIZE DISTRIBUTION

MW-IT-07A, SA7

| | | | |
|---|---|---|---|
| Project No.: | CA-GLD-19129150 | | |
| Date Rec'd: | Apr 26, 2024 | Tested By: | H. Desai |
| Report Date: | May 4, 2024 | | |

## APPENDIX D

# Hydrographs



Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations
3) MW-IT-01C dry when not plotted.

| | |
|---|---|
| DATE | September 2024 |
| DESIGN | VRP |
| REVIEW | GWS |
| APPROVED | GWS |

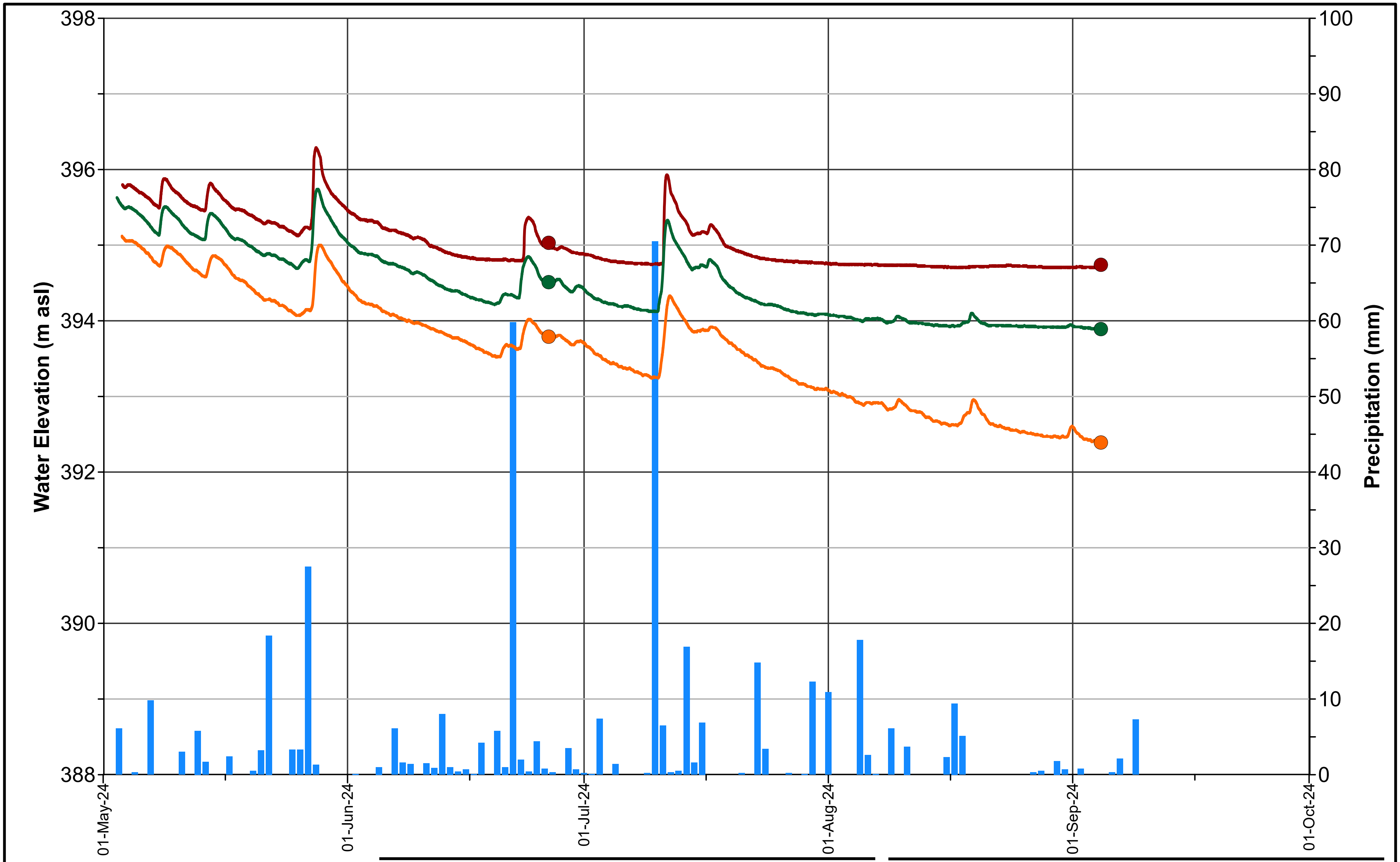
**PROJECT**

**CBM CALEDON PIT / QUARRY**

**TITLE**

**GROUNDWATER MONITORING HYDROGRAPH**
**MW-IT-01**

| PROJECT NO. | REV | FIGURE |
|---|---|---|
| CA-GLD-19129150 | A | D1 |



Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

| | |
|---|---|
| **DATE** | September 2024 |
| **DESIGN** | VRP |
| **REVIEW** | GWS |
| **APPROVED** | GWS |

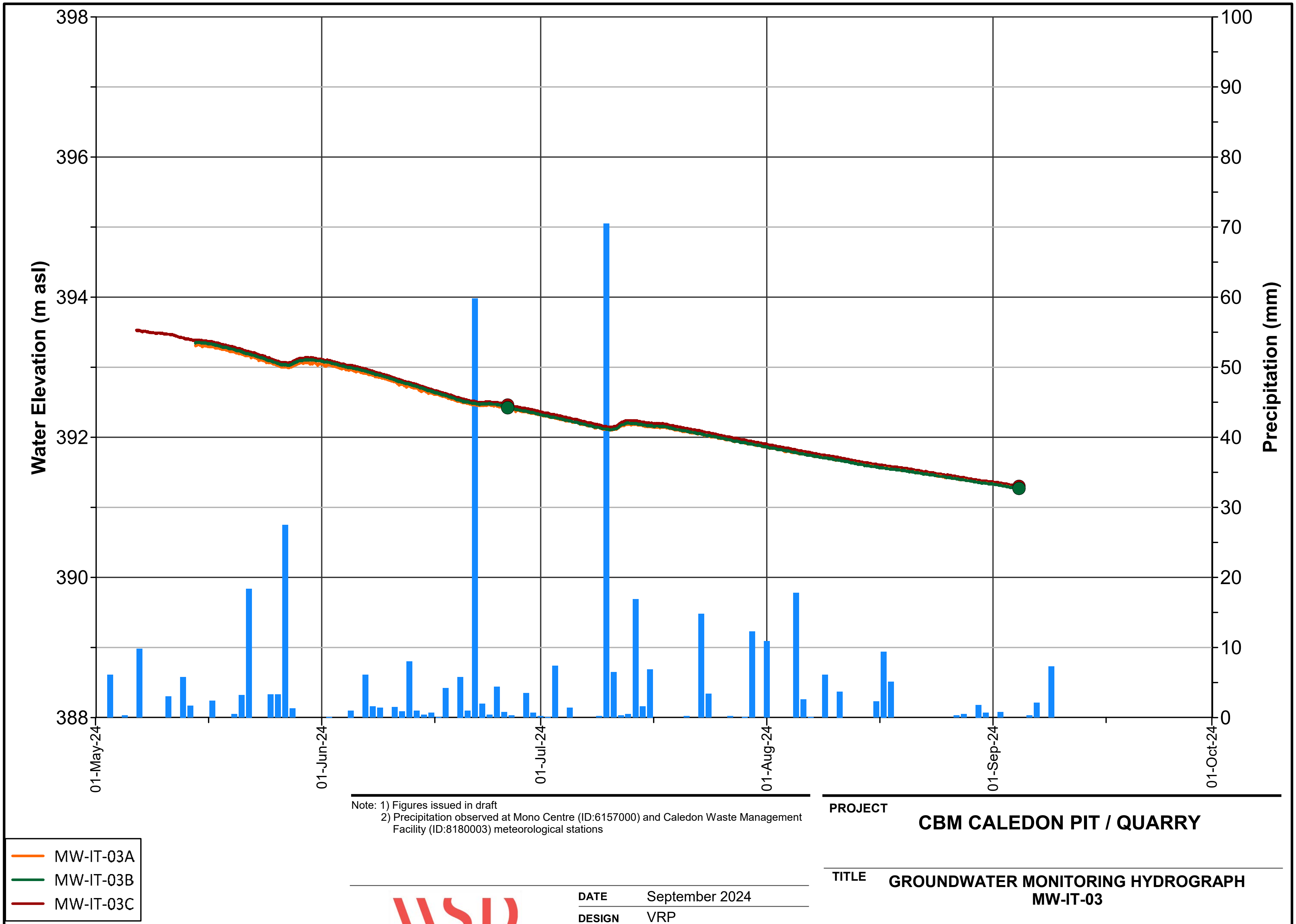
**PROJECT**

**CBM CALEDON PIT / QUARRY**

**TITLE**

**GROUNDWATER MONITORING HYDROGRAPH**
**MW-IT-02**

| **PROJECT NO.** | **REV** | **FIGURE** |
|---|---|---|
| CA-GLD-19129150 | A | D2 |



Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

| | |
|---|---|
| **DATE** | September 2024 |
| **DESIGN** | VRP |
| **REVIEW** | GWS |
| **APPROVED** | GWS |

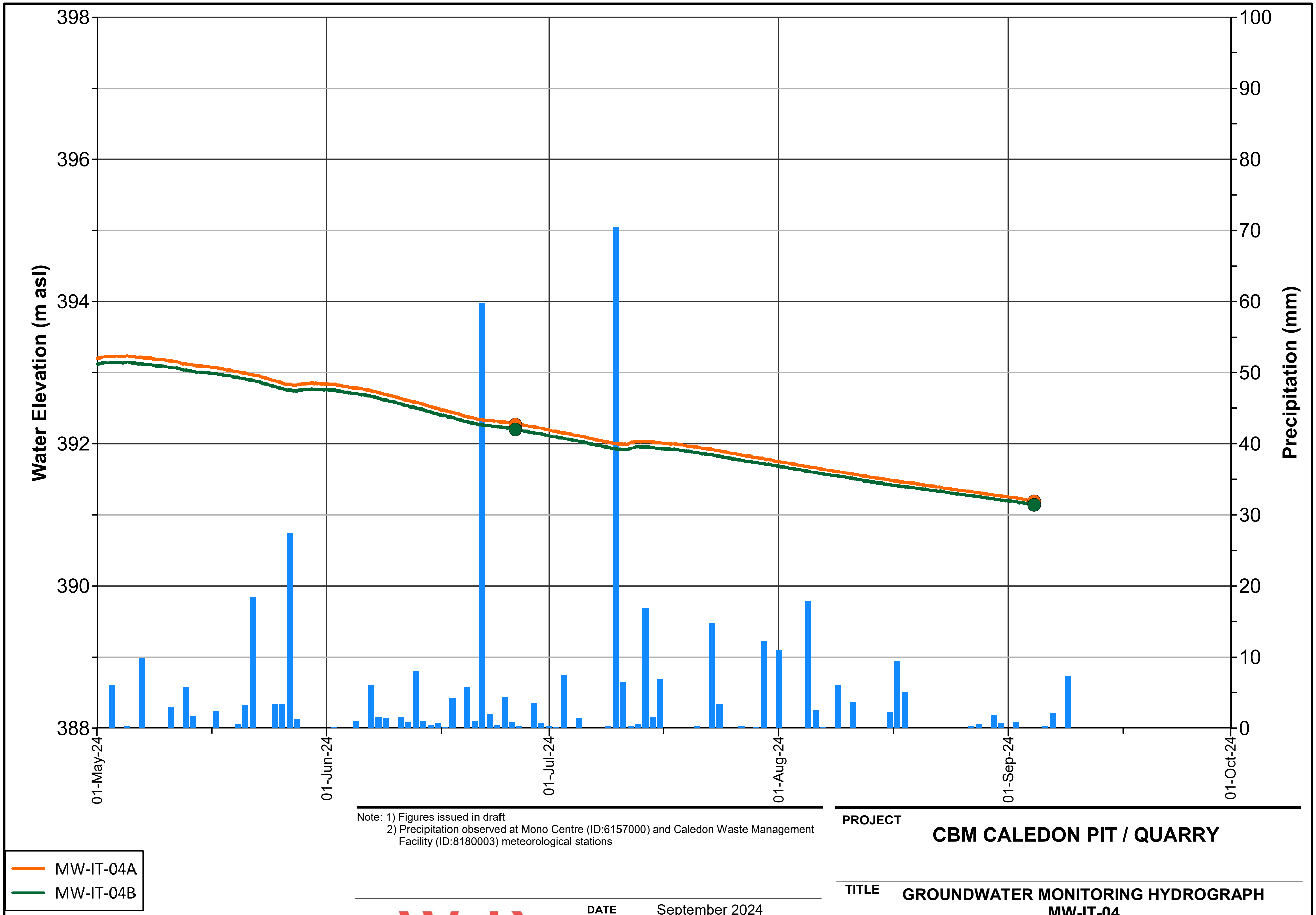
**PROJECT**

**CBM CALEDON PIT / QUARRY**

**TITLE**

**GROUNDWATER MONITORING HYDROGRAPH**
**MW-IT-03**

| **PROJECT NO.** | **REV** | **FIGURE** |
|---|---|---|
| CA-GLD-19129150 | A | D3 |



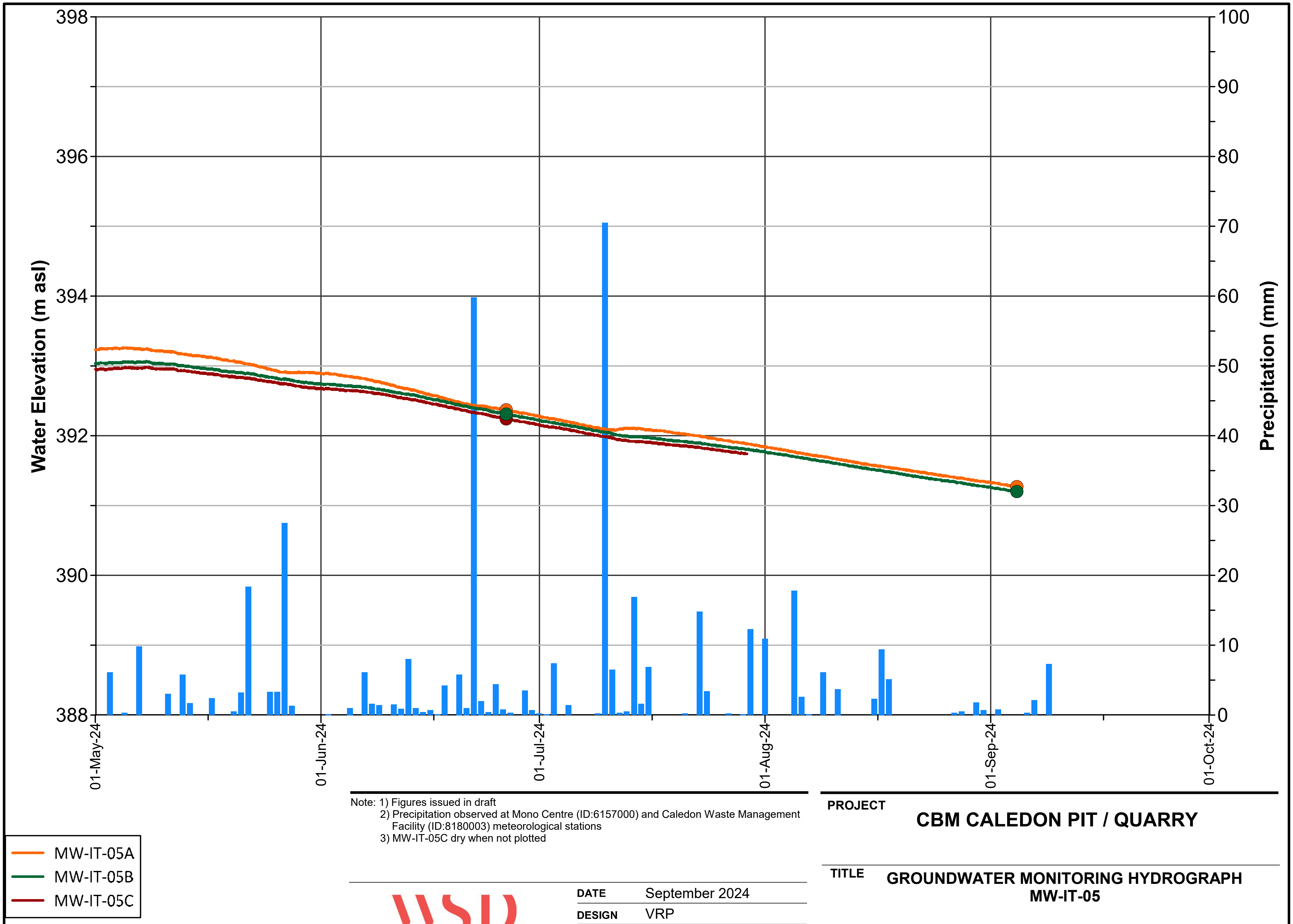
Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

| | |
|---|---|
| **DATE** | September 2024 |
| **DESIGN** | VRP |
| **REVIEW** | GWS |
| **APPROVED** | GWS |

**PROJECT**
**CBM CALEDON PIT / QUARRY**

**TITLE**
**GROUNDWATER MONITORING HYDROGRAPH**
**MW-IT-04**

| **PROJECT NO.** | **REV** | **FIGURE** |
|---|---|---|
| CA-GLD-19129150 | A | D4 |



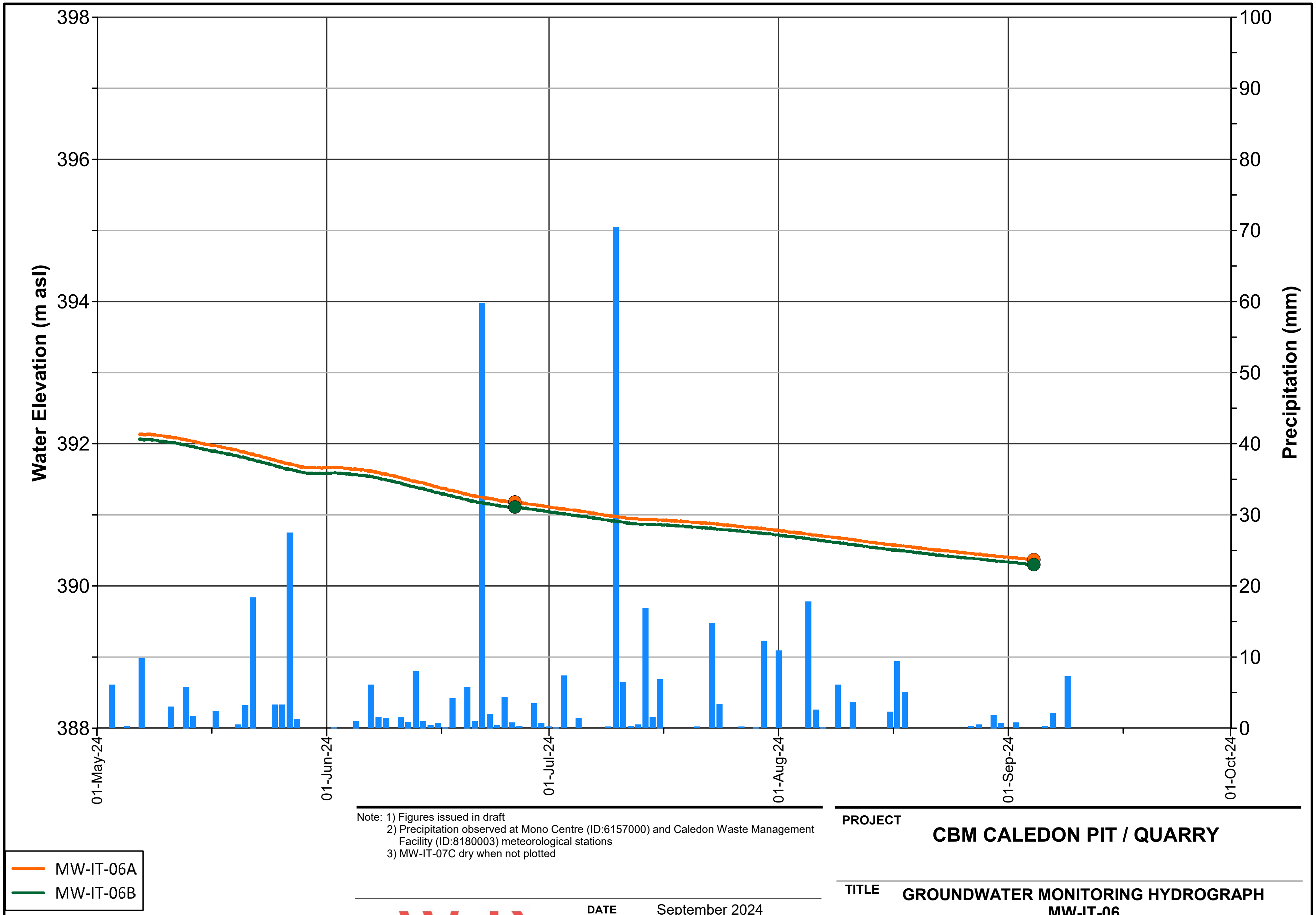
Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations
3) MW-IT-05C dry when not plotted

| | |
|---|---|
| DATE | September 2024 |
| DESIGN | VRP |
| REVIEW | GWS |
| APPROVED | GWS |

**PROJECT**
**CBM CALEDON PIT / QUARRY**

**TITLE**
**GROUNDWATER MONITORING HYDROGRAPH**
**MW-IT-05**

| PROJECT NO. | REV | FIGURE |
|---|---|---|
| CA-GLD-19129150 | A | D5 |



Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations
3) MW-IT-07C dry when not plotted

wsp

| | |
|---|---|
| **DATE** | September 2024 |
| **DESIGN** | VRP |
| **REVIEW** | GWS |
| **APPROVED** | GWS |

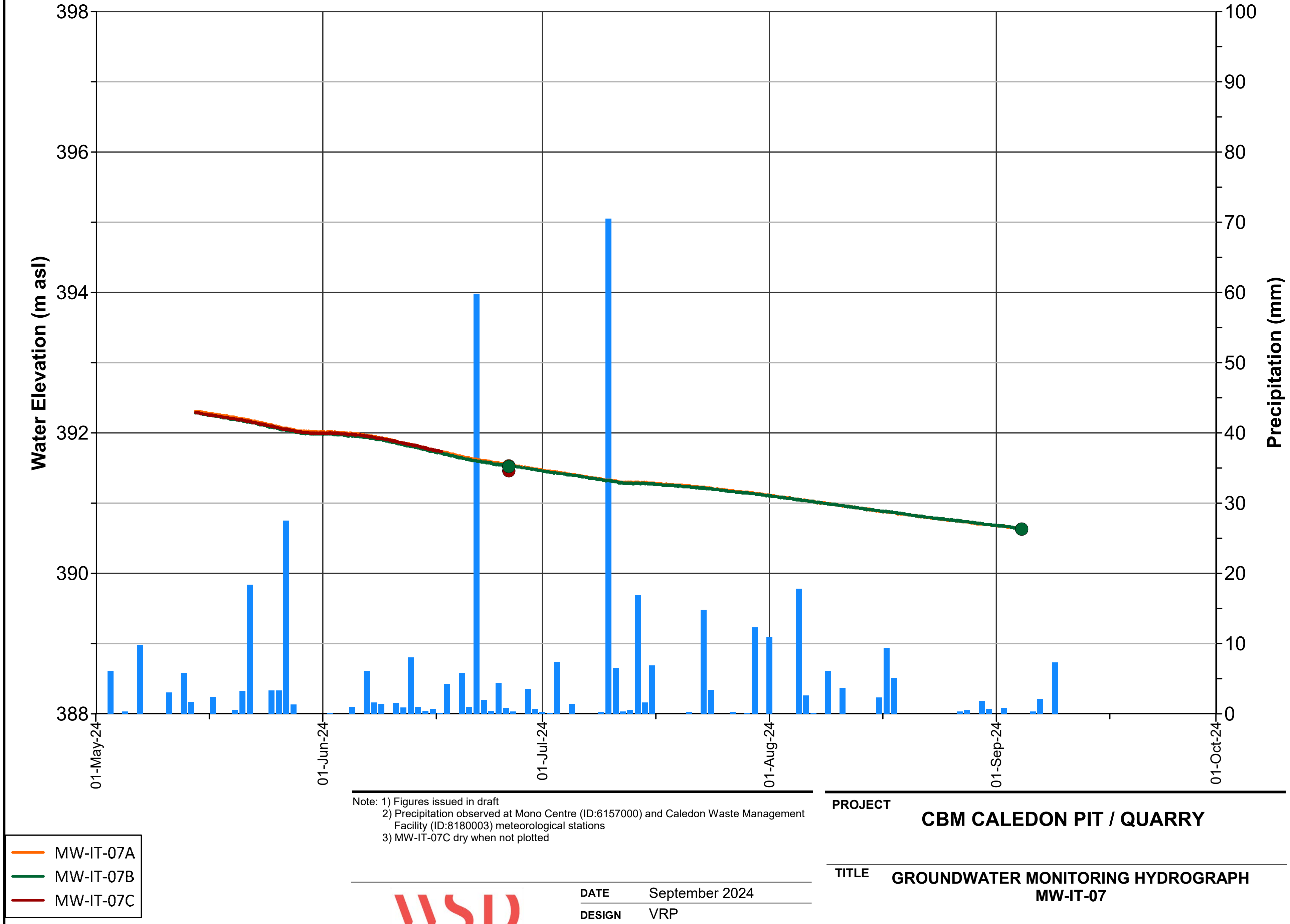
**PROJECT**

**CBM CALEDON PIT / QUARRY**

**TITLE**

**GROUNDWATER MONITORING HYDROGRAPH**
**MW-IT-06**

| PROJECT NO. | REV | FIGURE |
|---|---|---|
| CA-GLD-19129150 | A | D6 |



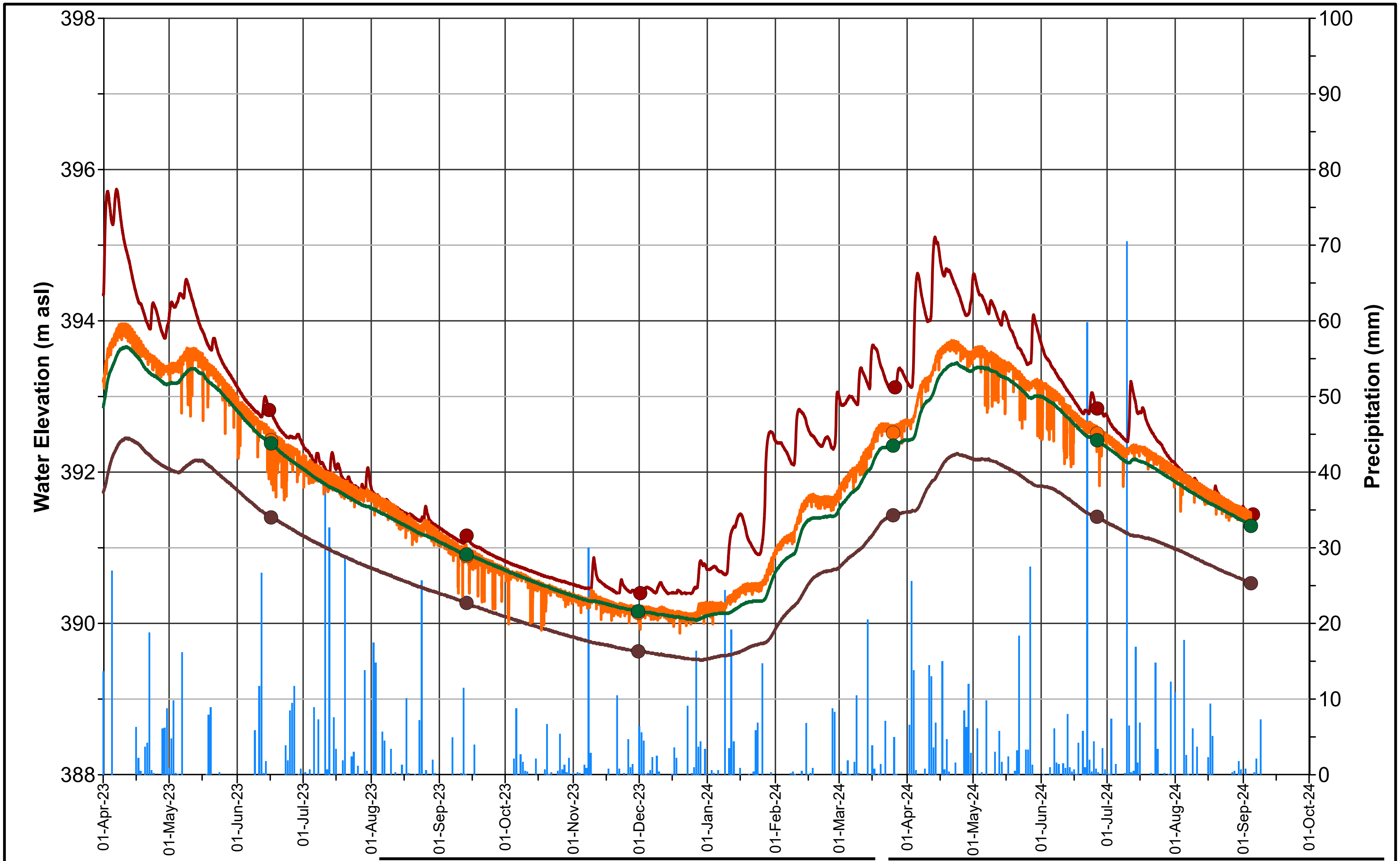
Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations
3) MW-IT-07C dry when not plotted

**PROJECT**
**CBM CALEDON PIT / QUARRY**

**TITLE**
**GROUNDWATER MONITORING HYDROGRAPH**
**MW-IT-07**

| | |
|---|---|
| **DATE** | September 2024 |
| **DESIGN** | VRP |
| **REVIEW** | GWS |
| **APPROVED** | GWS |

| **PROJECT NO.** | **REV** | **FIGURE** |
|---|---|---|
| CA-GLD-19129150 | A | D7 |



MW20-01A
MW20-01B
MW20-02
MW20-18

Note: 1) Figures issued in draft
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

**PROJECT** **CBM CALEDON PIT / QUARRY**

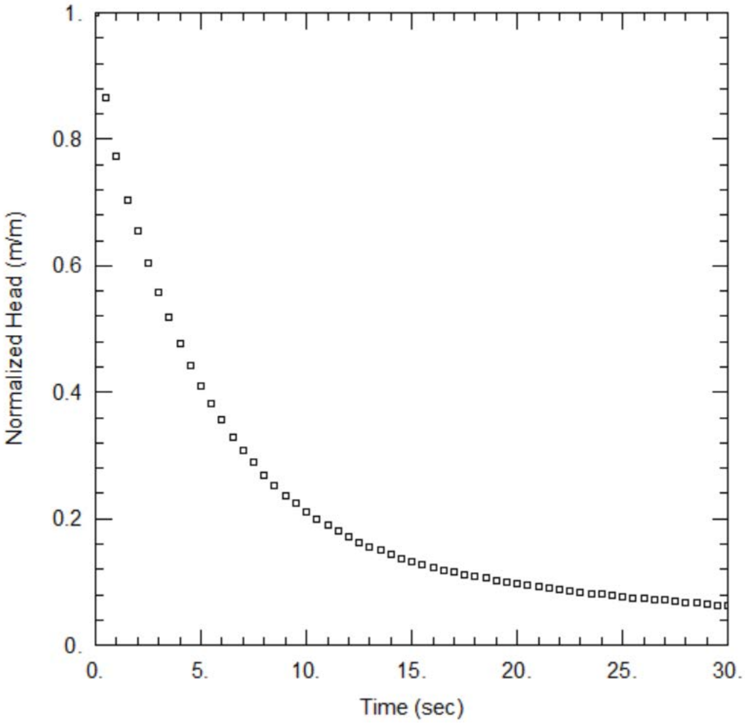
**TITLE** **GROUNDWATER MONITORING HYDROGRAPH**
**MW20-01A/B, MW20-02 AND MW20-18**

| | |
|---|---|
| **DATE** | September 2024 |
| **DESIGN** | VRP |
| **REVIEW** | PGM |
| **APPROVED** | GWS |

| **PROJECT NO.** | **REV** | **FIGURE** |
|---|---|---|
| CA-GLD-19129150 | A | D8 |

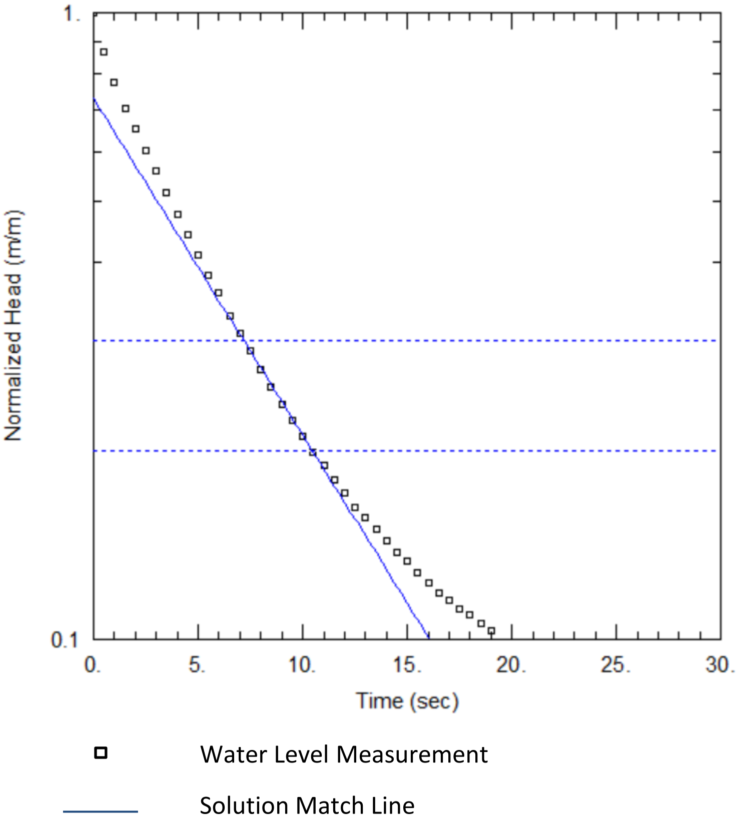
**APPENDIX E**

# Single Well Response Tests



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-01A |
| Date of Test: | May 02, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Pneumatic Rising Head Test |
| Static Water Level: | 9.92 mbgs |
| Initial Displacement: | 3.47 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 21.64 m to 23.16 m |
| Geology: | Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Confined |

**Hydraulic Conductivity (K) =**

**$9 \times 10^{-5}$ m/s**

CLIENT
**CBM Aggregates**

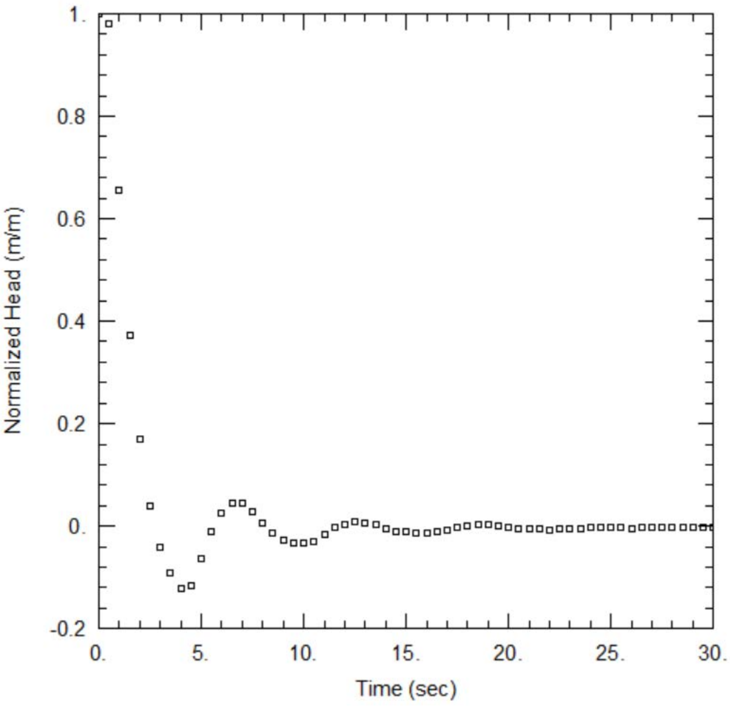
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

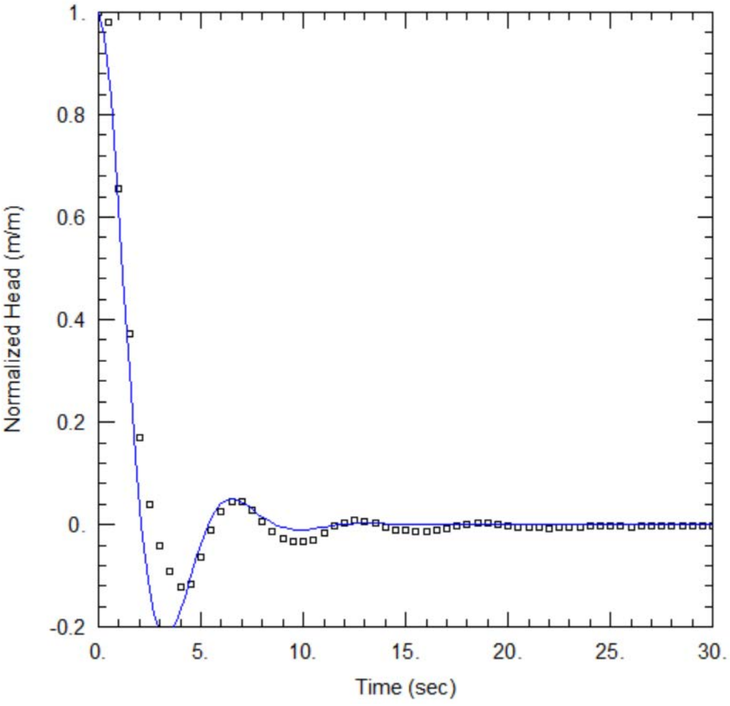
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-01A**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E01** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-01B |
| Date of Test: | May 02, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Pneumatic Rising Head Test |
| Static Water Level: | 9.97 mbgs |
| Initial Displacement: | 1.23 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 16.71 m to 18.84 m |
| Geology: | (GP/GM) – SANDY SILTY GRAVEL<br>& Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Butler |
| Solution Type: | Inertial |
| Aquifer Model: | Confined |

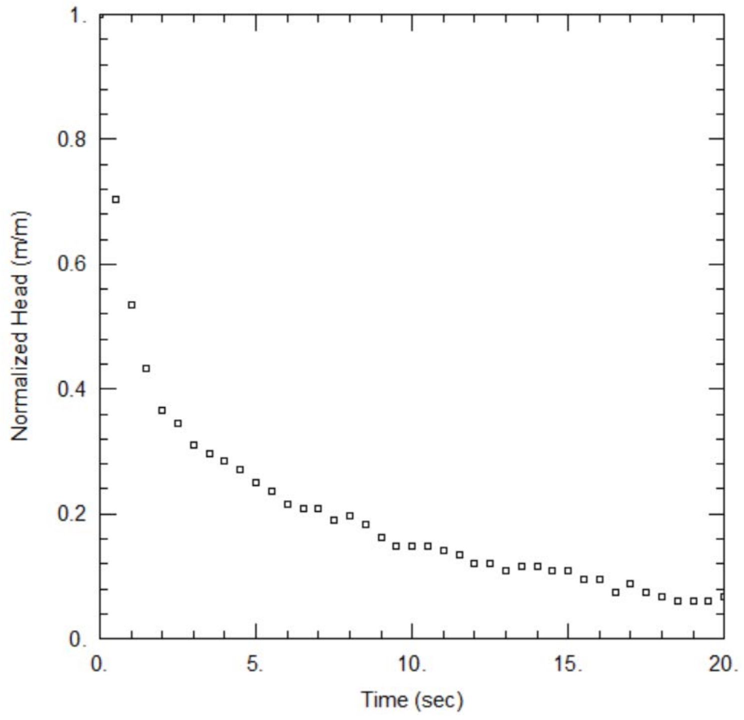
**Hydraulic Conductivity (K) =**

**$8 \times 10^{-4}$ m/s**

| | |
|---|---|
| □ | Water Level Measurement |
| — | Solution Match Line |

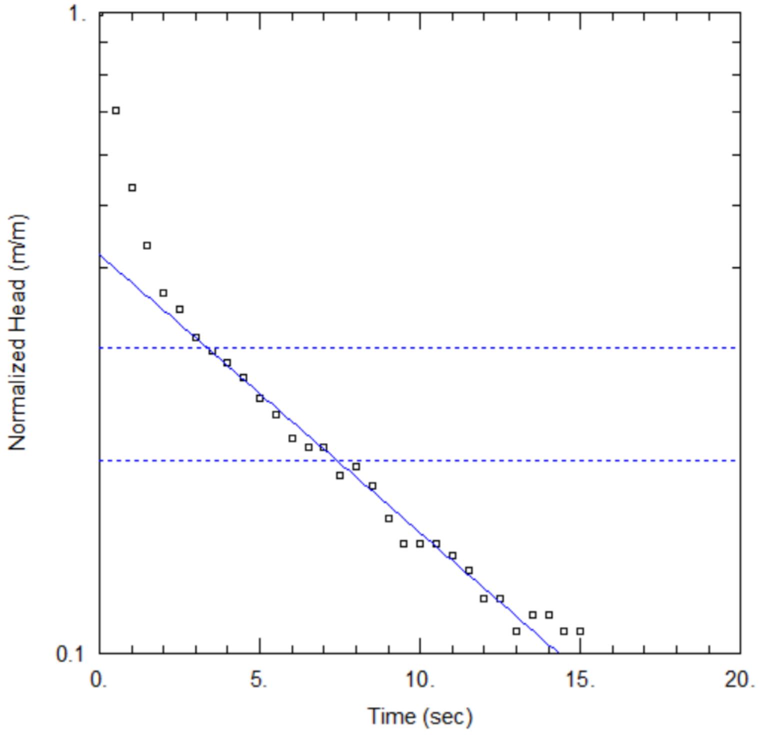
| | | | |
|---|---|---|---|
| CLIENT<br>**CBM Aggregates** | | PROJECT<br>**CALEDON PIT / QUARRY** | |
| CONSULTANT | YYYY-MM-DD | 2024-06-05 | TITLE<br>**SINGLE WELL RESPONSE TEST ANALYSIS<br>MONITORING WELL MW-IT-01B** |
| | PREPARED | VRP | |
| | DESIGN | VRP | |
| | REVIEW | PM/MY | |
| | APPROVED | GWS | |

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E02** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-01C |
| Date of Test: | May 14, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Waterra Purge |
| Static Water Level: | 10.07 mbgs |
| Initial Displacement: | 0.15 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.089 m |
| Well Screen Interval: | 10.44 m to 11.96 m |
| Geology: | (SM/GP) SILTY SAND and GRAVEL |



□ Water Level Measurement

— Solution Match Line

## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$5 \times 10^{-5}$ m/s**

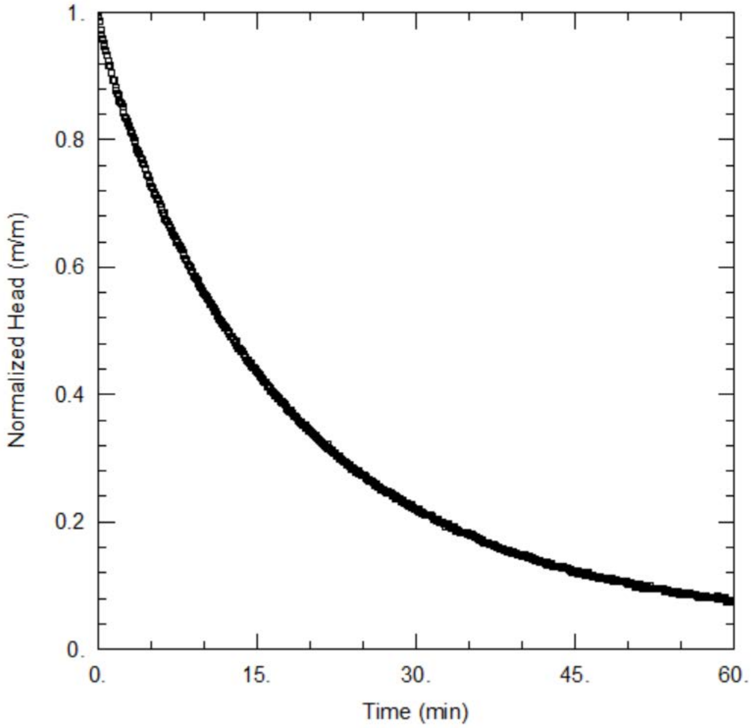
| | |
|---|---|
| CLIENT | PROJECT |
| **CBM Aggregates** | **CALEDON PIT / QUARRY** |

| | | |
|---|---|---|
| CONSULTANT | YYYY-MM-DD | 2024-06-05 |
| | PREPARED | VRP |
| | DESIGN | VRP |
| | REVIEW | PM/MY |
| | APPROVED | GWS |

TITLE

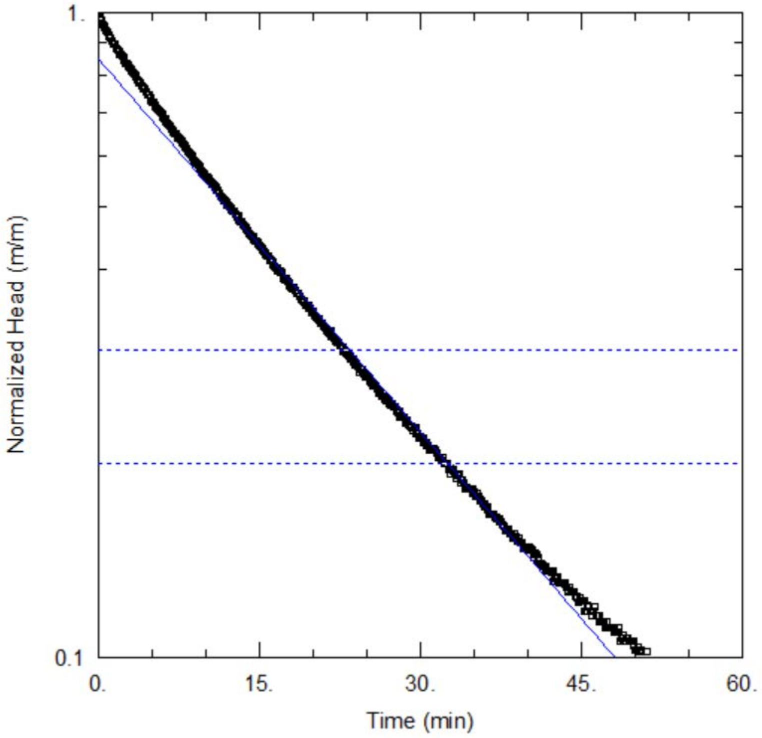
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-01C**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E03** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-02A |
| Date of Test: | May 02, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Bailer |
| Static Water Level: | 6.21 mbgs |
| Initial Displacement: | 1.23 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 14.64 m to 16.16 m |
| Geology: | Dolostone, Gasport Fm |



□ Water Level Measurement

— Solution Match Line

## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$6 \times 10^{-7}$ m/s**

CLIENT
**CBM Aggregates**

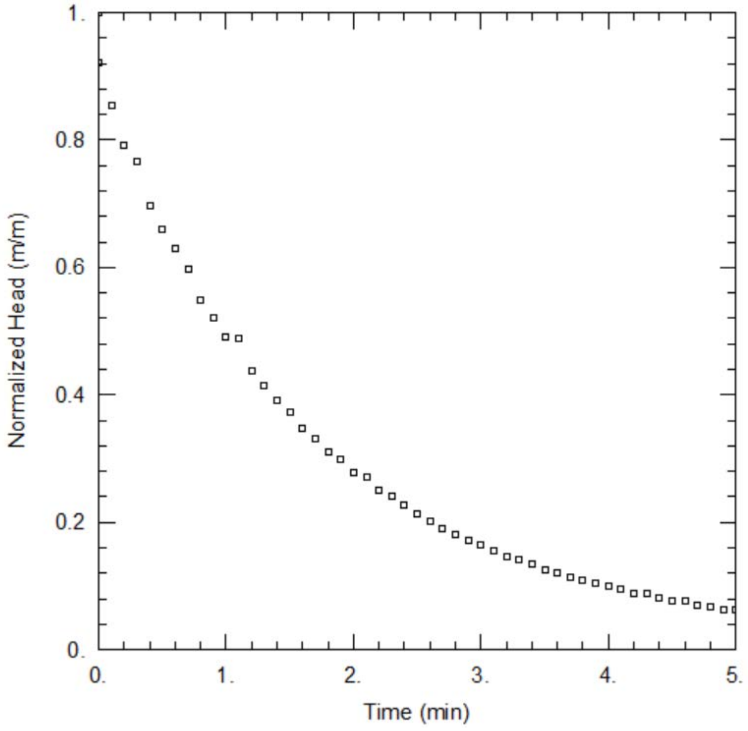
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

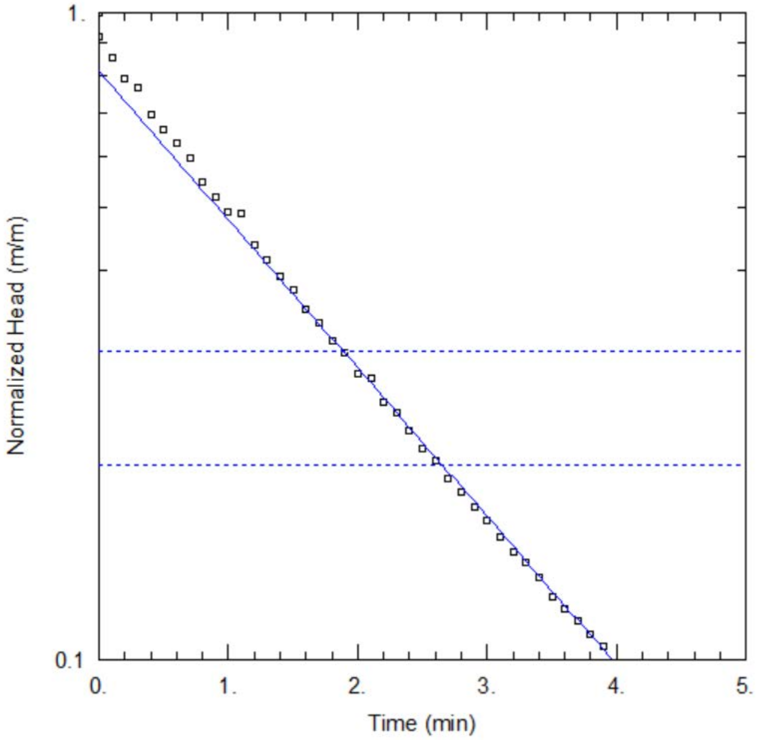
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-02A**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E04** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-02B |
| Date of Test: | May 02, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Bailer |
| Static Water Level: | 5.85 mbgs |
| Initial Displacement: | 0.94 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 8.84 m to 11.89 m |
| Geology: | Dolostone, Gasport Fm |



□ Water Level Measurement

— Solution Match Line

## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$3 \times 10^{-6}$ m/s**

CLIENT
**CBM Aggregates**

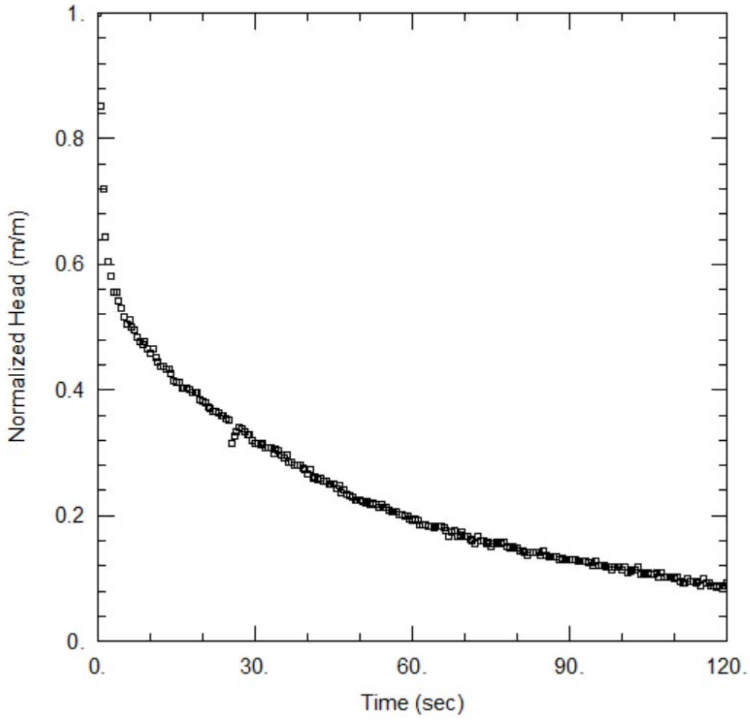
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

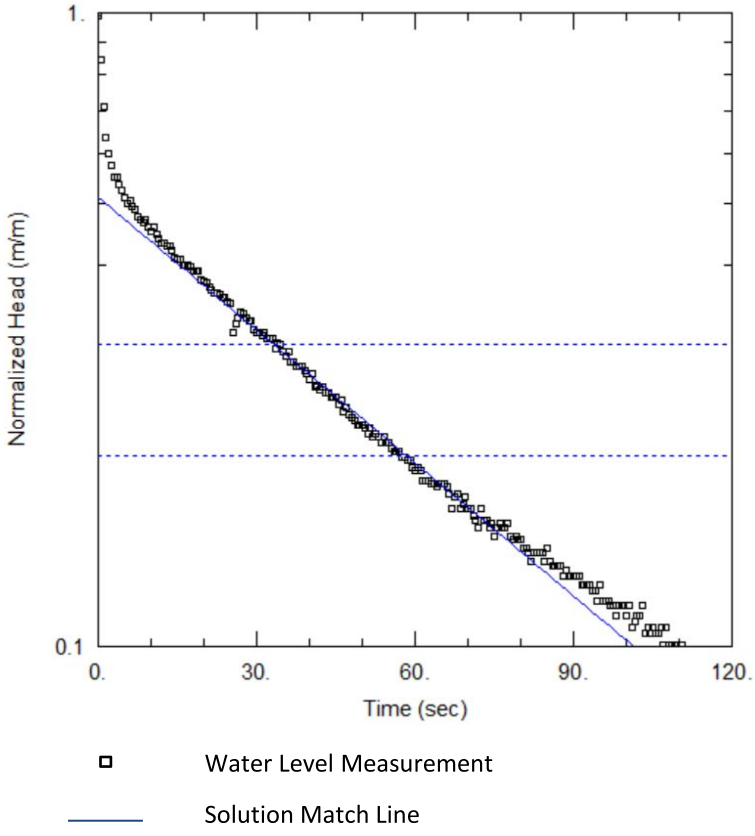
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-02B**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 19129150 | 2300 | A | E05 |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-02C |
| Date of Test: | May 03, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Bailer |
| Static Water Level: | 5.60 mbgs |
| Initial Displacement: | 0.44 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.089 m |
| Well Screen Interval: | 5.18 m to 6.71 m |
| Geology: | (GP/GM) – SANDY SILTY GRAVEL<br>& Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$2 \times 10^{-5}$ m/s**

CLIENT
**CBM Aggregates**

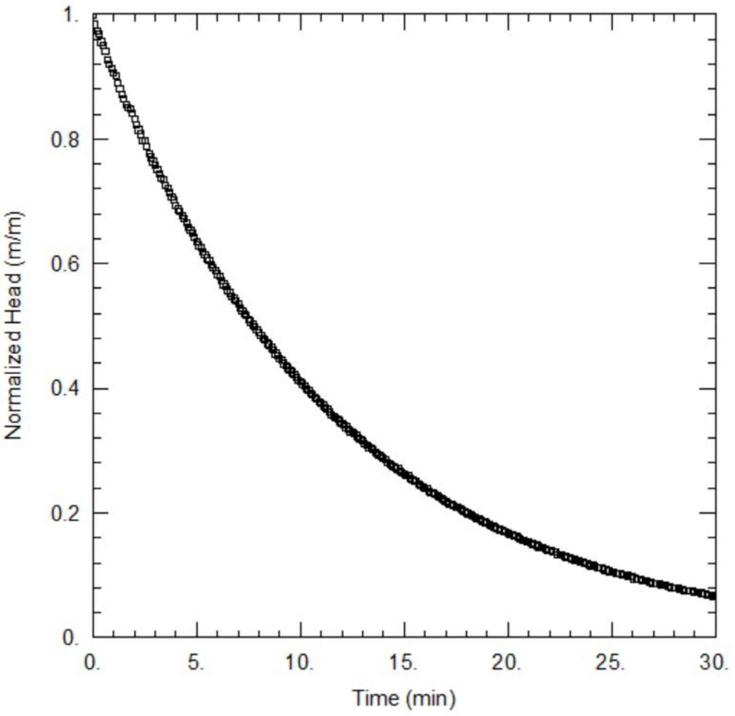
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

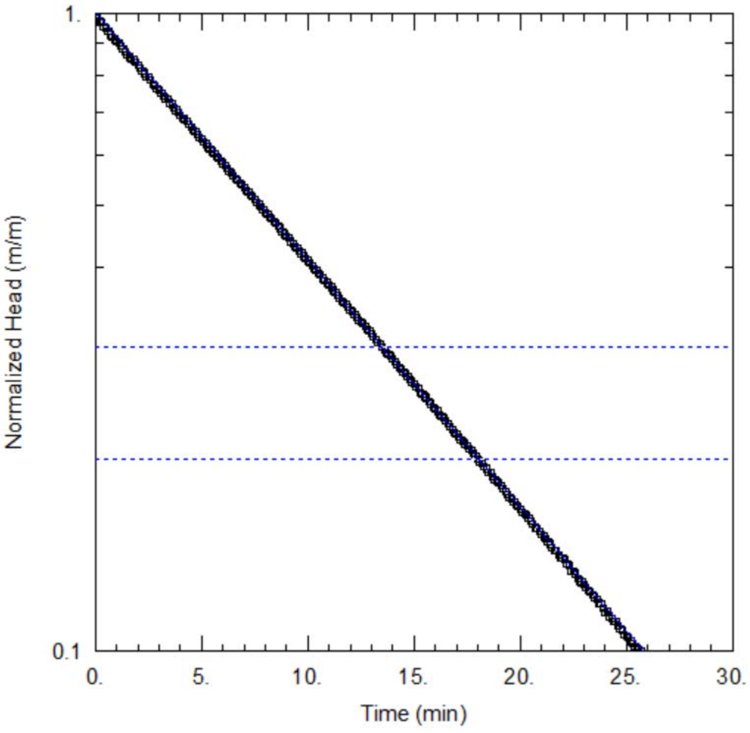
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-02C**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E06** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-03A |
| Date of Test: | May 14, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Waterra Purge |
| | |
| Static Water Level: | 4.59 mbgs |
| Initial Displacement: | 3.04 m |
| | |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 13.29 m to 14.81 m |
| Geology: | Dolostone, Gasport Fm |



□ Water Level Measurement

— Solution Match Line

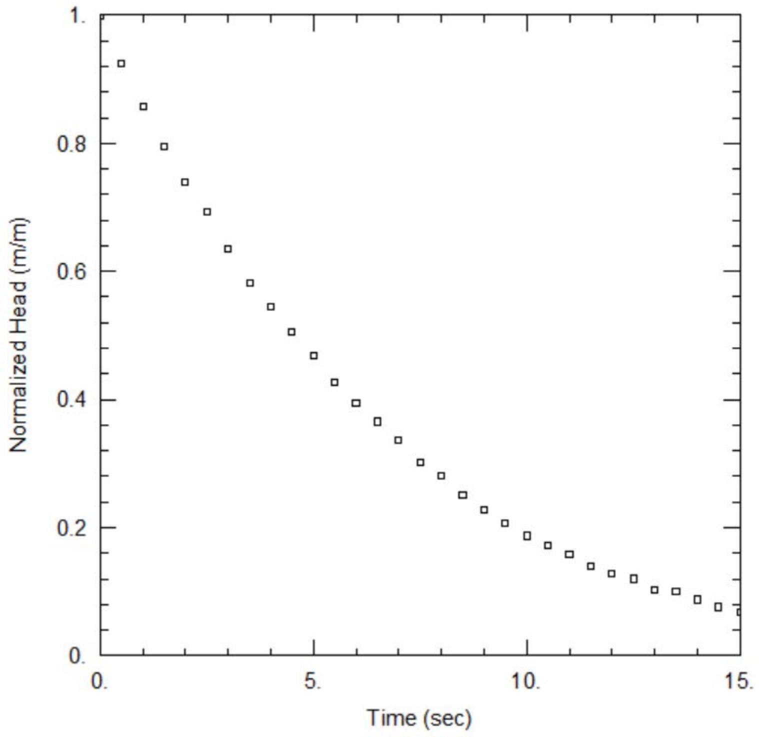
## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

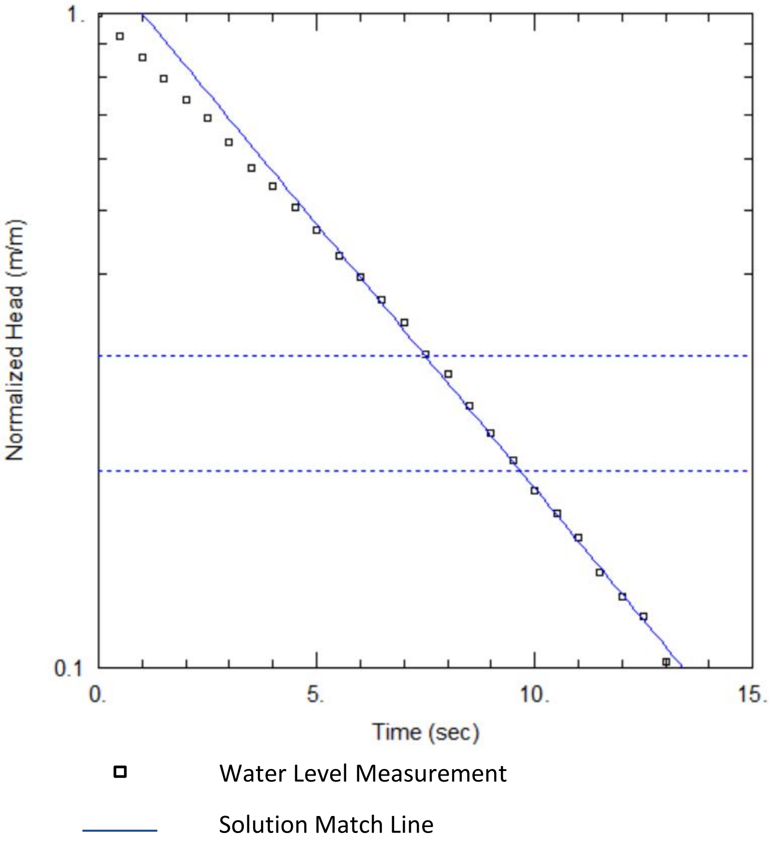
**1 x $10^{-6}$ m/s**

| | | | |
|---|---|---|---|
| CLIENT<br>**CBM Aggregates** | | | PROJECT<br>**CALEDON PIT / QUARRY** |
| CONSULTANT | YYYY-MM-DD | 2024-06-05 | TITLE<br>**SINGLE WELL RESPONSE TEST ANALYSIS**<br>**MONITORING WELL MW-IT-03A** |
| | PREPARED | VRP | |
| | DESIGN | VRP | |
| | REVIEW | PM/MY | PROJECT No. **19129150** PHASE **2300** Rev. **A** FIGURE **E07** |
| | APPROVED | GWS | |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-03B |
| Date of Test: | May 06, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Physical Slug |
| Static Water Level: | 4.27 mbgs |
| Initial Displacement: | 0.34 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 9.60 m to 11.43 m |
| Geology: | (GP) – GRAVEL & Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**1 x $10^{-4}$ m/s**

CLIENT
**CBM Aggregates**

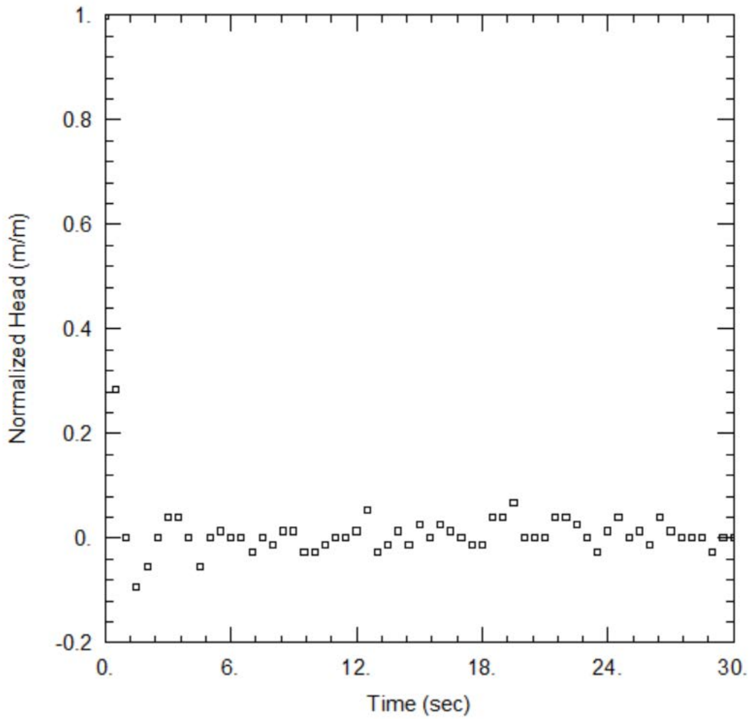
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

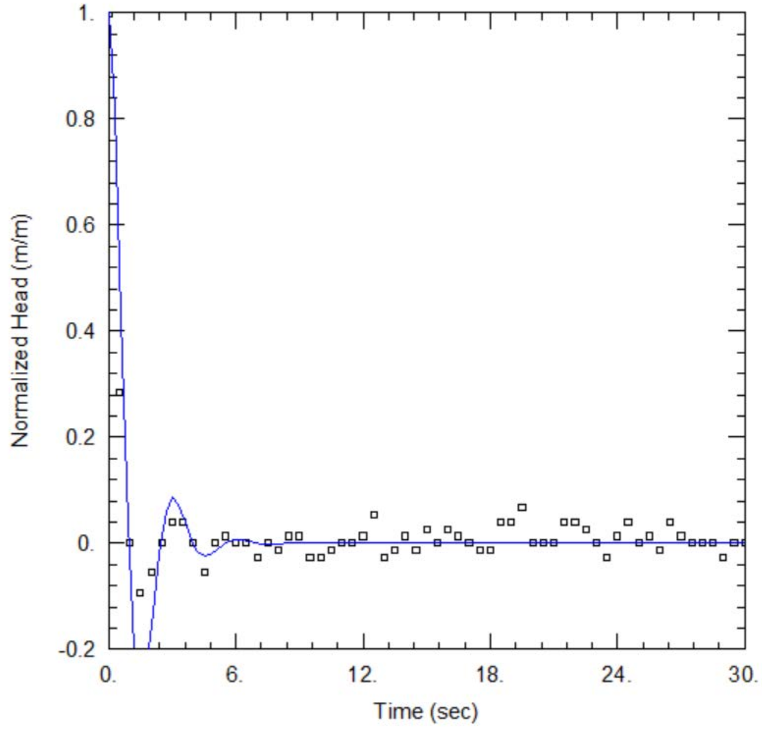
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-03B**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E08** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-03C |
| Date of Test: | May 06, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Physical Slug |
| Static Water Level: | 4.21 mbgs |
| Initial Displacement: | 0.07 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.089 m |
| Well Screen Interval: | 5.79 m to 7.32 m |
| Geology: | (GP/GM) – SANDY SILTY GRAVEL |



□ Water Level Measurement

— Solution Match Line

## SOLUTION:

| | |
|---|---|
| Solution Method: | Springer-Gelhar |
| Solution Type: | Inertial |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**2 x $10^{-3}$ m/s**

CLIENT
**CBM Aggregates**

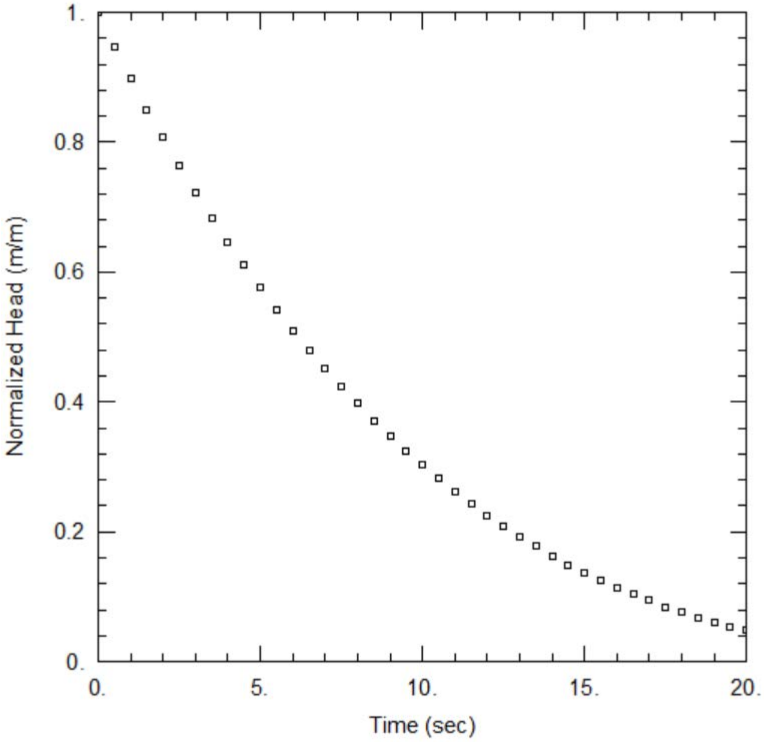
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

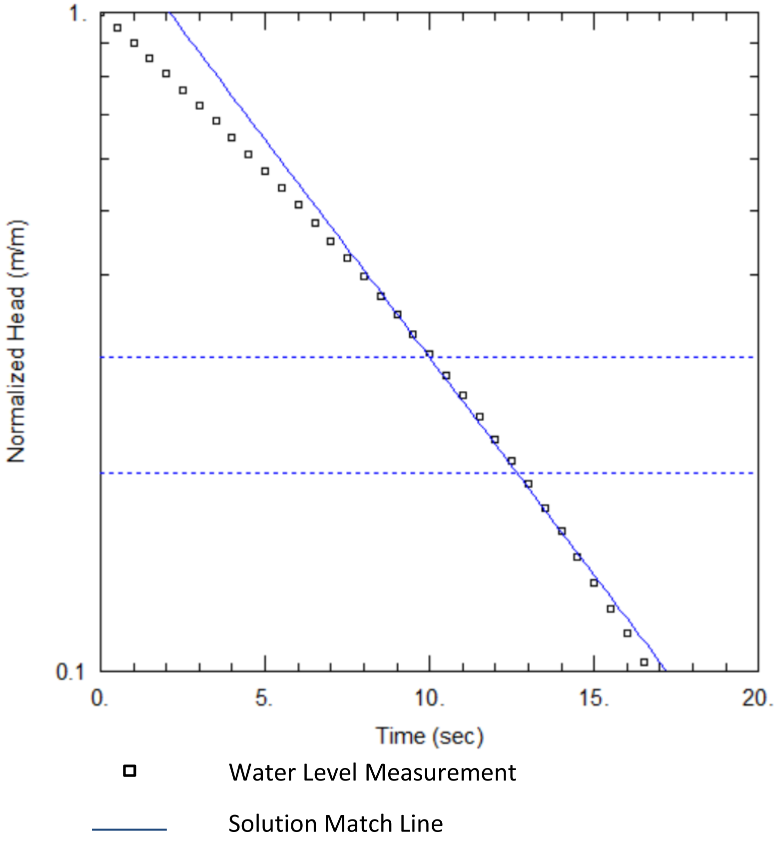
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-03C**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E09** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-04A |
| Date of Test: | April 29, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Pneumatic Rising Head Test |
| Static Water Level: | 4.49 mbgs |
| Initial Displacement: | 3.58 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 10.21 m to 11.73 m |
| Geology: | Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$1 \times 10^{-4}$ m/s**

CLIENT
**CBM Aggregates**

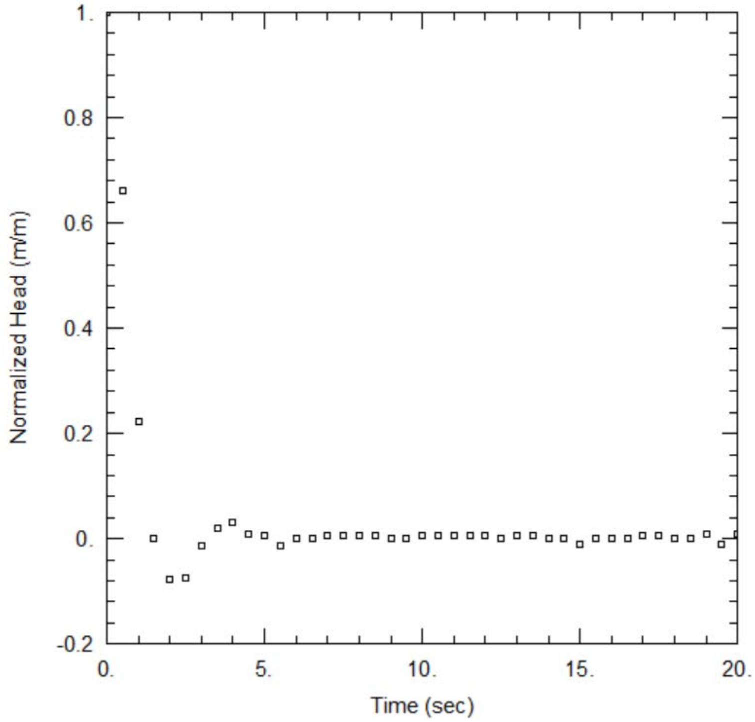
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

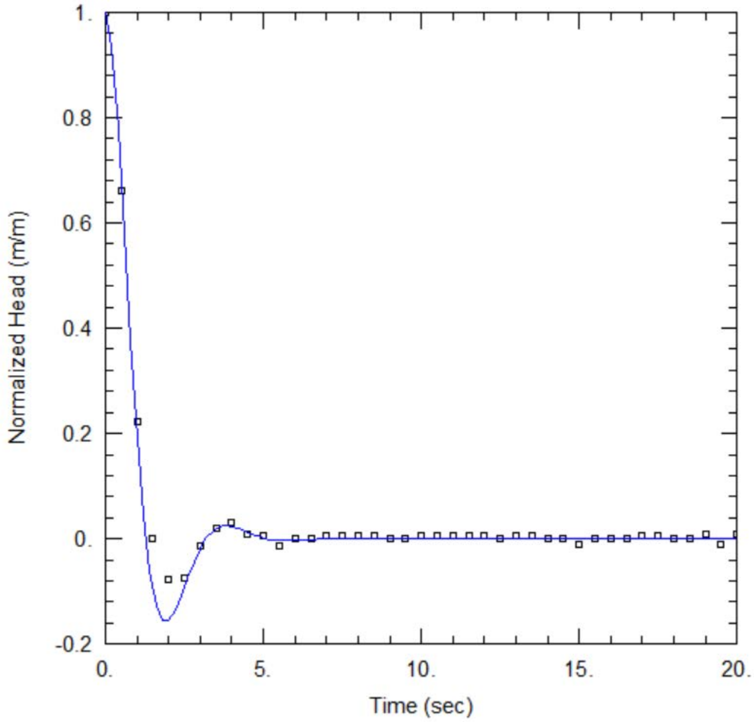
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-04A**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E10** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-04B |
| Date of Test: | April 29, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Pneumatic Rising Head Test |
| Static Water Level: | 4.58 mbgs |
| Initial Displacement: | 0.20 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 5.33 m to 8.38 m |
| Geology: | (GP/GM) – SANDY SILTY GRAVEL & Dolostone, Gasport Fm |



□ Water Level Measurement

— Solution Match Line

## SOLUTION:

| | |
|---|---|
| Solution Method: | Springer-Gelhar |
| Solution Type: | Inertial |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$7 \times 10^{-4}$ m/s**

CLIENT
**CBM Aggregates**

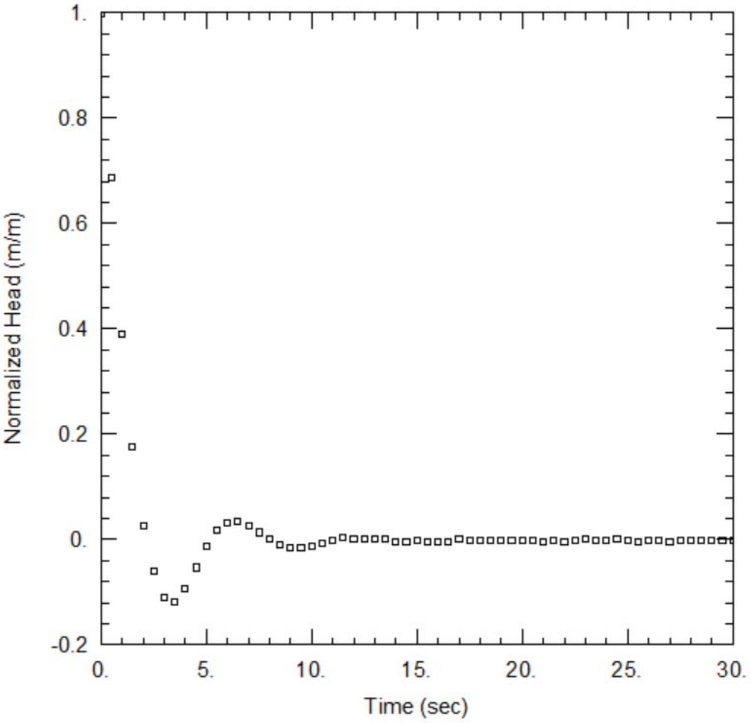
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

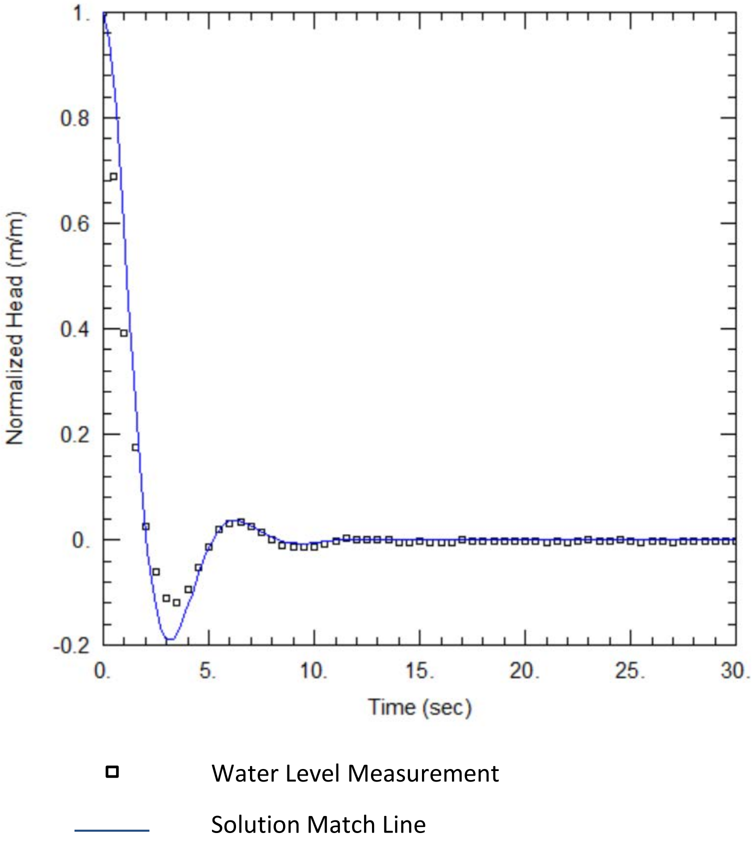
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-04B**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 19129150 | 2300 | A | E11 |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-05A |
| Date of Test: | April 30, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Pneumatic Rising Head Test |
| Static Water Level: | 6.06 mbgs |
| Initial Displacement: | 1.02 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 11.39 m to 14.44 m |
| Geology: | Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Butler |
| Solution Type: | Inertial |
| Aquifer Model: | Confined |

**Hydraulic Conductivity (K) =**

**$6 \times 10^{-4}$ m/s**

CLIENT
**CBM Aggregates**

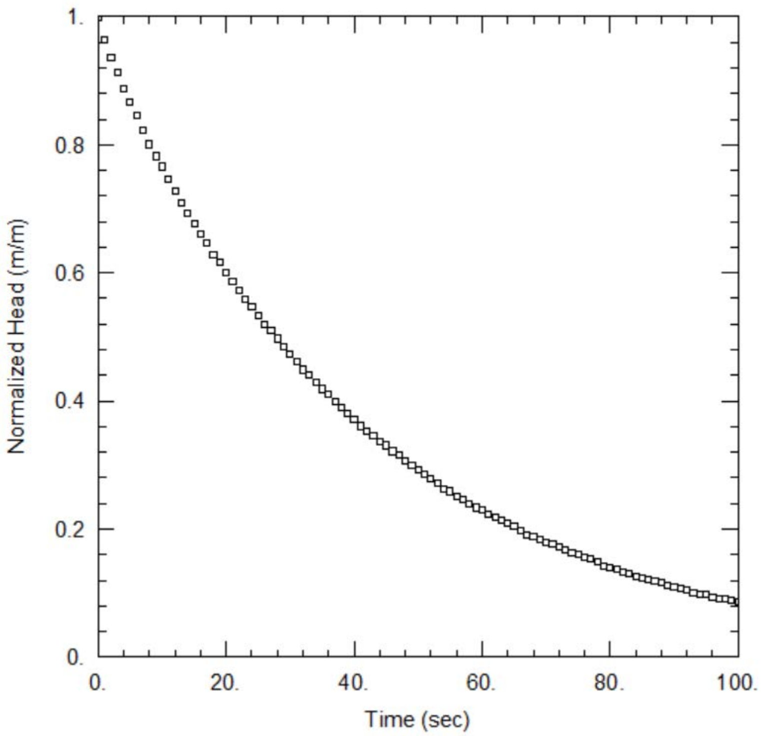
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

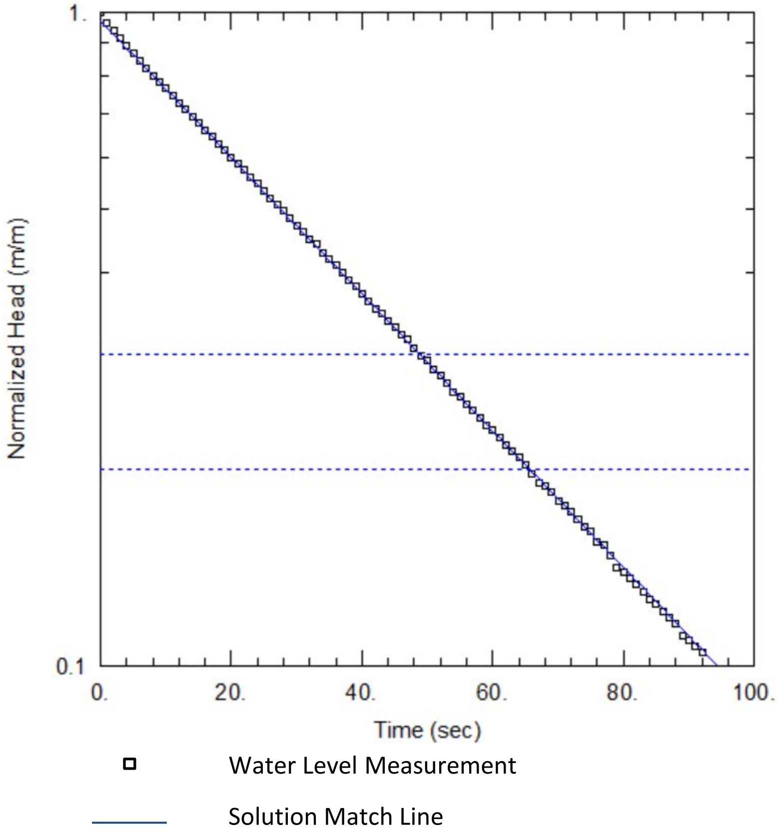
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-05A**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E12** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-05B |
| Date of Test: | April 30, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Pneumatic Rising Head Test |
| Static Water Level: | 6.20 mbgs |
| Initial Displacement: | 1.40 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.089 m |
| Well Screen Interval: | 8.71 m to 10.23 m |
| Geology: | (ML) SANDY SILT & Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Confined |

**Hydraulic Conductivity (K) =**

**1 x $10^{-5}$ m/s**

CLIENT

**CBM Aggregates**

PROJECT

**CALEDON PIT / QUARRY**

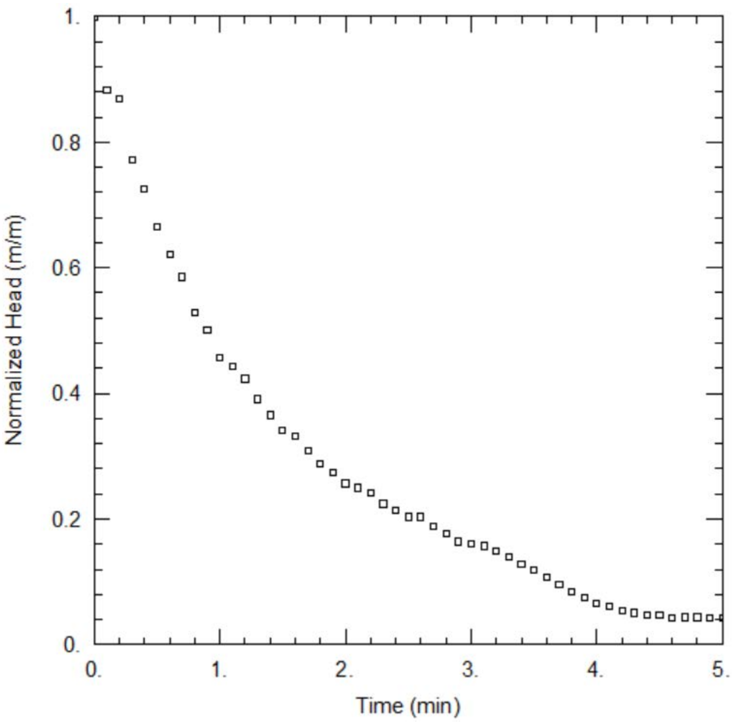
CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

TITLE

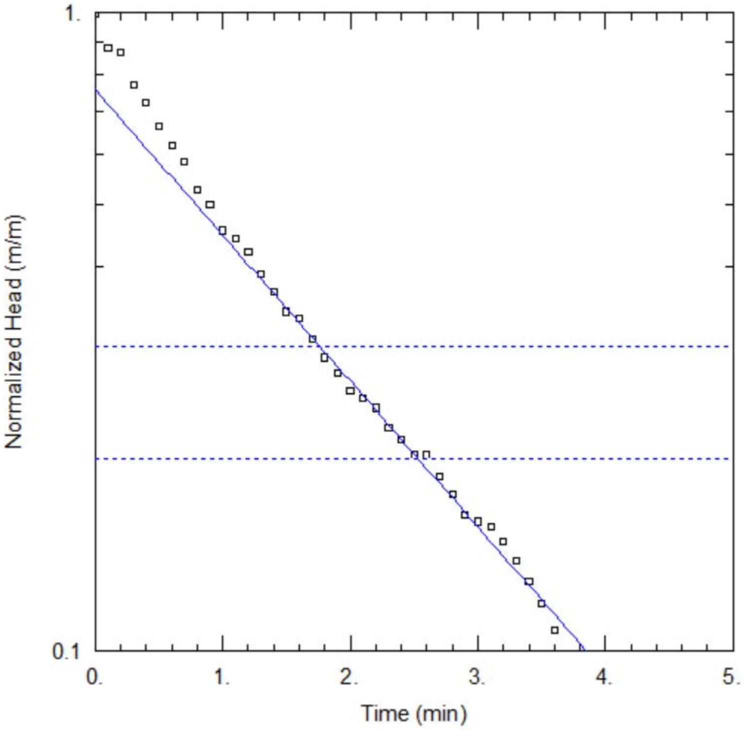
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-05B**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E13** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-05C |
| Date of Test: | April 30, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Waterra Purge |
| Static Water Level: | 6.23 mbgs |
| Initial Displacement: | 0.71 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.089 m |
| Well Screen Interval: | 5.79 m to 7.32 m |
| Geology: | (SM) SILTY SAND |



□ Water Level Measurement

— Solution Match Line

## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**8 x $10^{-6}$ m/s**

CLIENT
**CBM Aggregates**

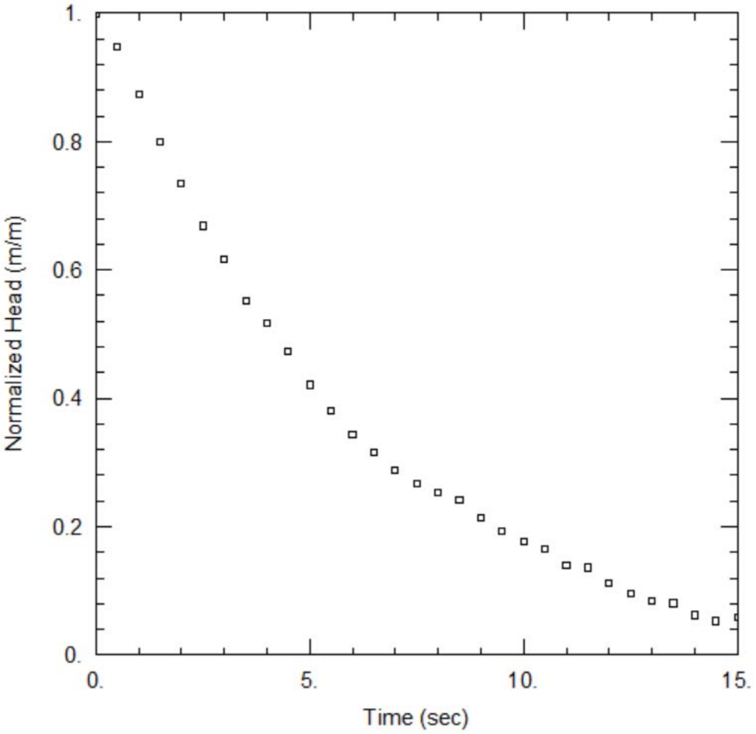
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

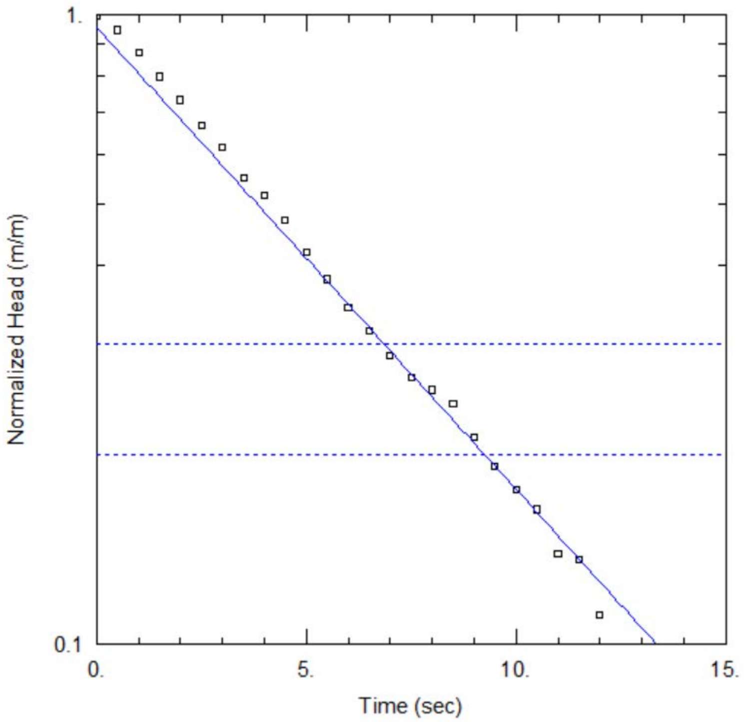
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-05C**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E14** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-06A |
| Date of Test: | May 06, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Physical Slug |
| Static Water Level: | 6.54 mbgs |
| Initial Displacement: | 0.32 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 9.75 m to 11.28 m |
| Geology: | Dolostone, Gasport Fm |



□ Water Level Measurement

Solution Match Line

## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**1 x $10^{-4}$ m/s**

CLIENT

**CBM Aggregates**

PROJECT

**CALEDON PIT / QUARRY**

CONSULTANT

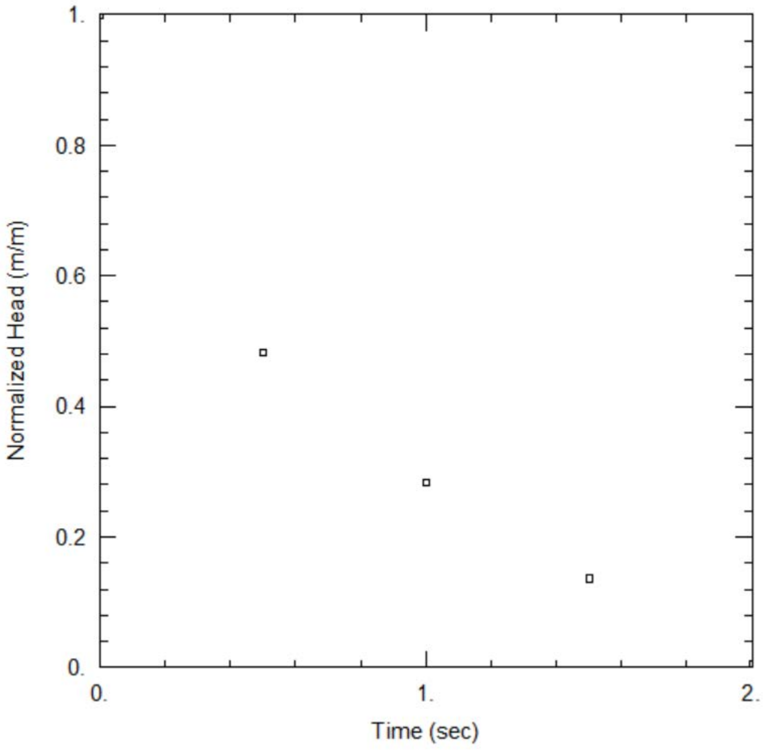
wsp

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

TITLE

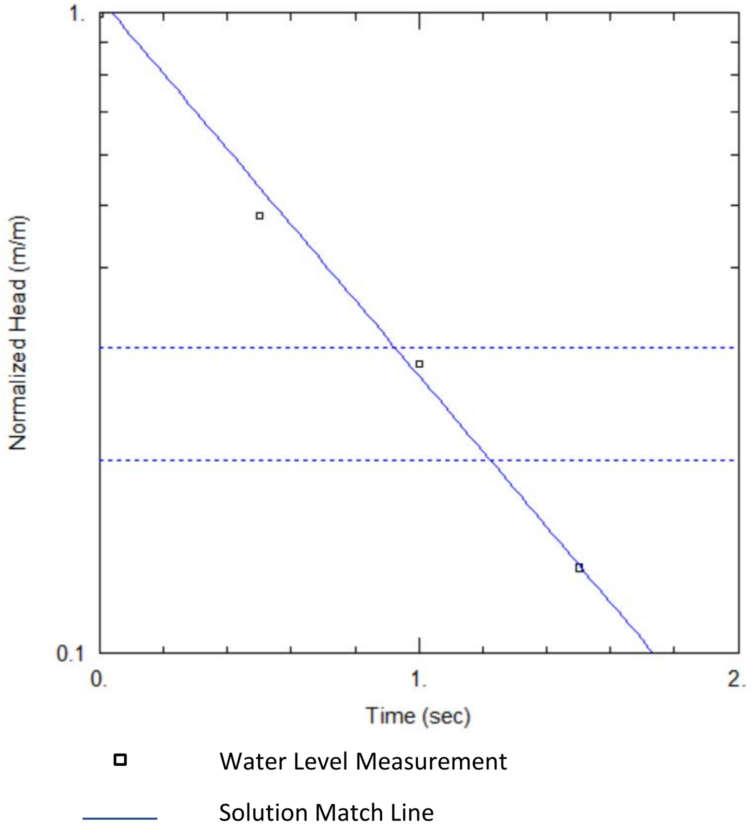
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-06A**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E15** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-06B |
| Date of Test: | May 06, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Physical Slug |
| Static Water Level: | 6.55 mbgs |
| Initial Displacement: | 0.19 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 6.00 m to 9.04 m |
| Geology: | (SM/GP) SILTY SAND and GRAVEL & Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**6 x $10^{-4}$ m/s**

CLIENT
**CBM Aggregates**

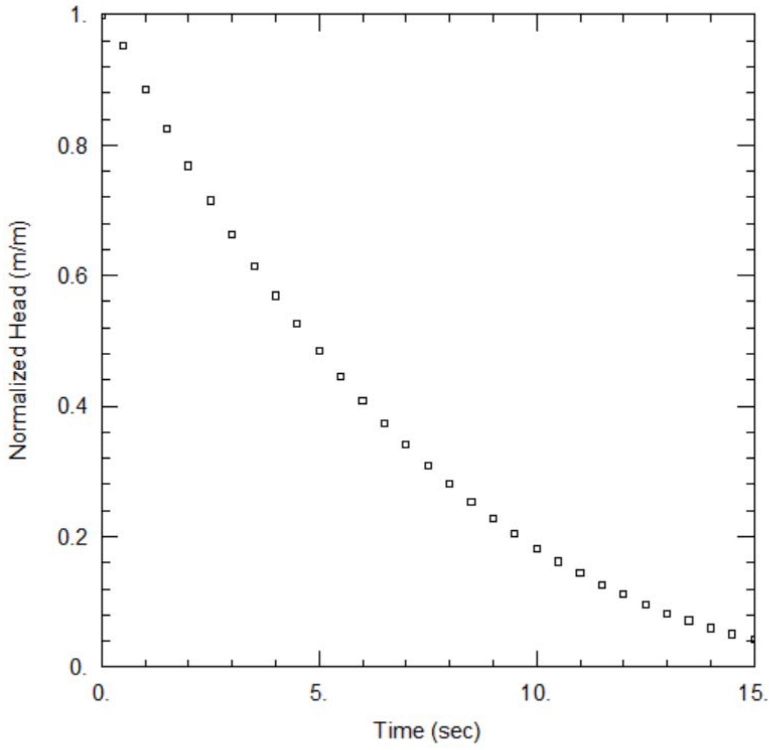
PROJECT
**CALEDON PIT / QUARRY**

CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

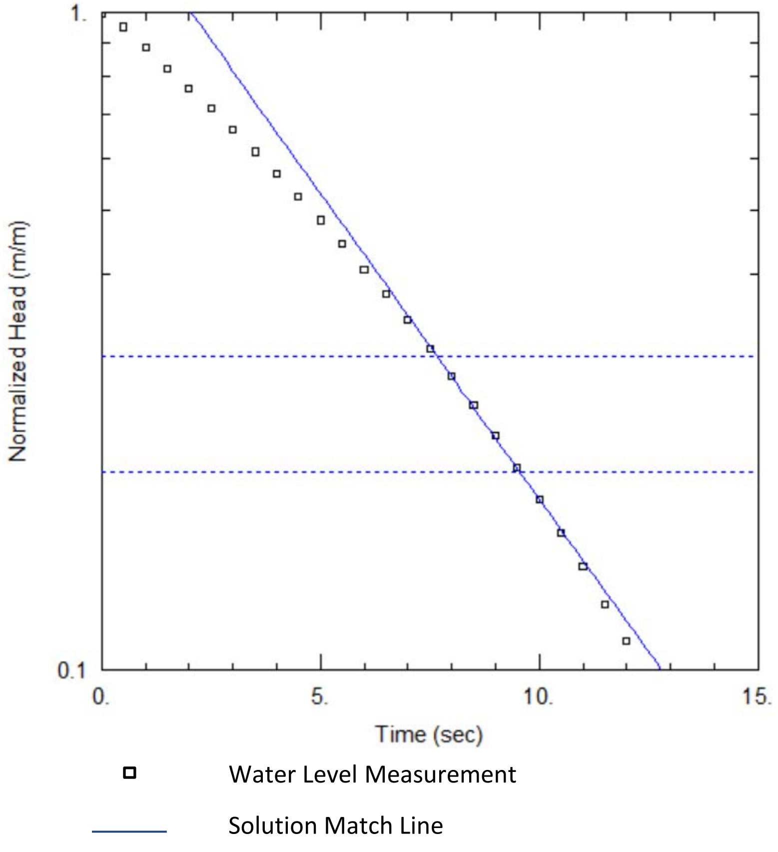
TITLE
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-06B**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 19129150 | 2300 | A | E16 |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-07A |
| Date of Test: | May 14, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Pneumatic Rising Head Test |
| Static Water Level: | 7.86 mbgs |
| Initial Displacement: | 2.39 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 13.72 m to 15.24 m |
| Geology: | Dolostone, Gasport Fm & Shaley Dolostone |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$2 \times 10^{-4}$ m/s**

CLIENT

**CBM Aggregates**

PROJECT

**CALEDON PIT / QUARRY**

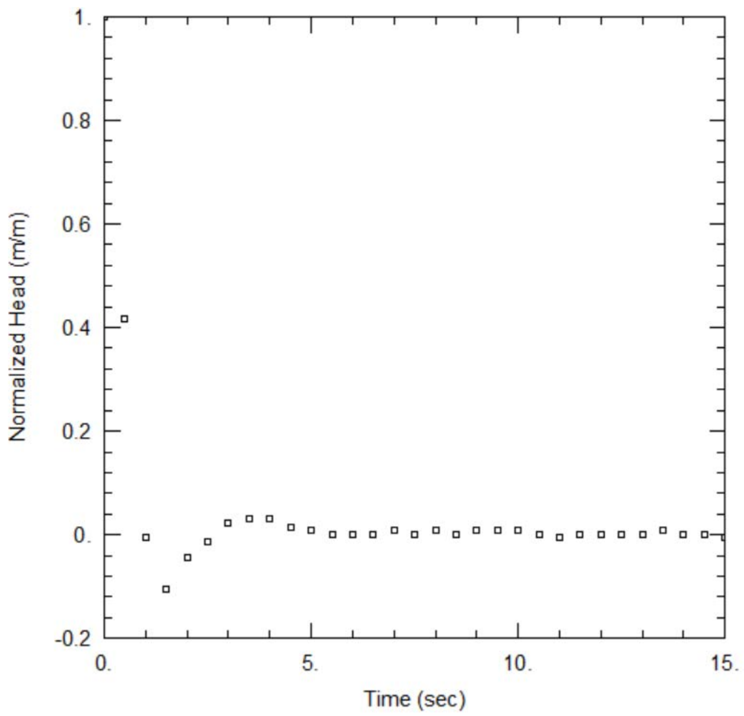
CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

TITLE

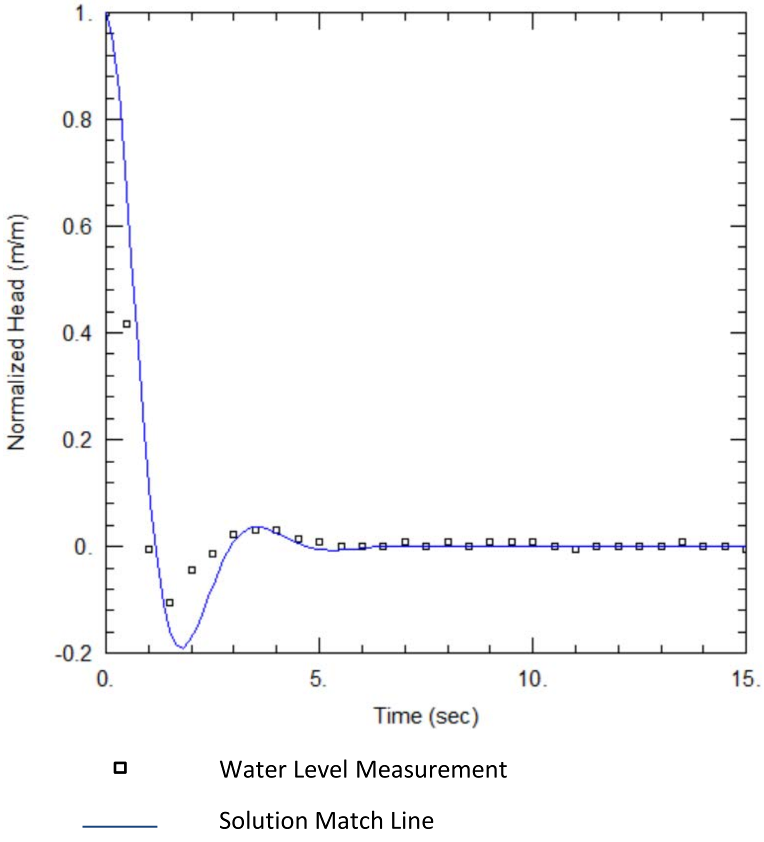
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-07A**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E17** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-07B |
| Date of Test: | May 06, 2024 |
| Test Type: | Falling Head Test |
| Test Method: | Physical Slug |
| Static Water Level: | 7.82 mbgs |
| Initial Displacement: | 0.23 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.062 m |
| Well Screen Interval: | 9.61 m to 12.66 m |
| Geology: | (CL) CLAY & Dolostone, Gasport Fm |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Springer-Gelhar |
| Solution Type: | Inertial |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$8 \times 10^{-4}$ m/s**

CLIENT

**CBM Aggregates**

PROJECT

**CALEDON PIT / QUARRY**

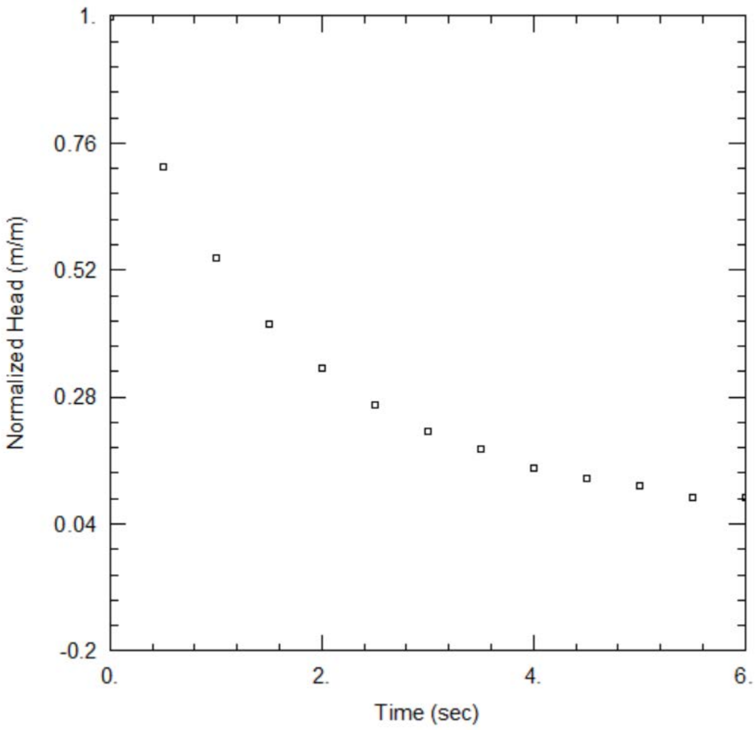
CONSULTANT

| | |
|---|---|
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |

TITLE

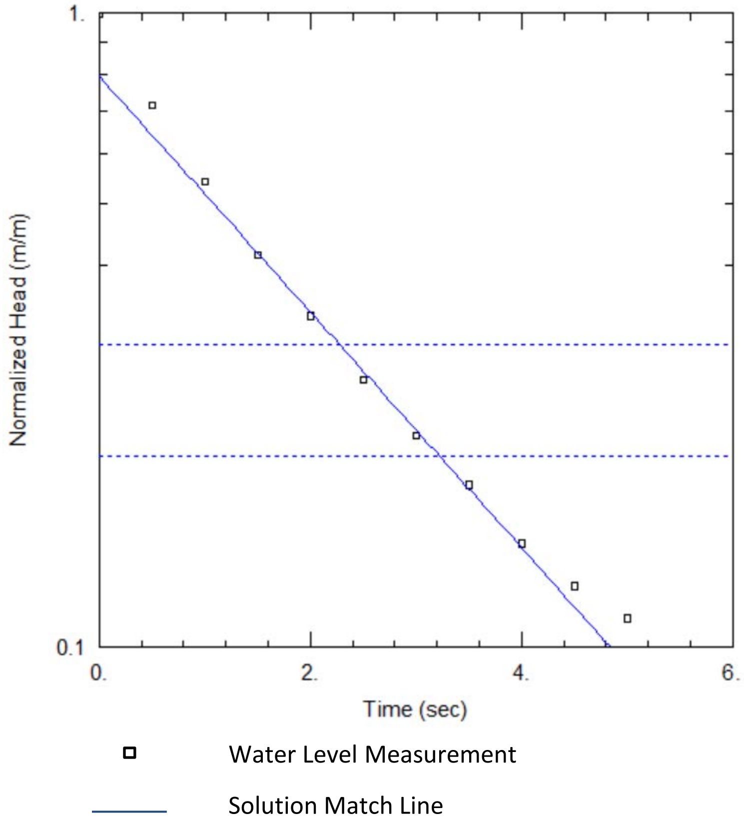
**SINGLE WELL RESPONSE TEST ANALYSIS**
**MONITORING WELL MW-IT-07B**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| **19129150** | **2300** | **A** | **E18** |



## TEST INFORMATION:

| | |
|---|---|
| Test Well: | MW-IT-07C |
| Date of Test: | May 01, 2024 |
| Test Type: | Rising Head Test |
| Test Method: | Physical Slug |
| Static Water Level: | 7.85 mbgs |
| Initial Displacement: | 0.14 m |
| Casing Radius: | 0.026 m |
| Borehole Radius: | 0.089 m |
| Well Screen Interval: | 7.48 m to 9.00 m |
| Geology: | (GP/SP) GRAVEL and SAND &<br>(SM/GP) SILTY SAND and GRAVEL |



## SOLUTION:

| | |
|---|---|
| Solution Method: | Bouwer-Rice |
| Solution Type: | Zero Storage |
| Aquifer Model: | Unconfined |

**Hydraulic Conductivity (K) =**

**$3 \times 10^{-4}$ m/s**

| | |
|---|---|
| CLIENT | **CBM Aggregates** |
| PROJECT | **CALEDON PIT / QUARRY** |
| CONSULTANT | wsp |
| YYYY-MM-DD | 2024-06-05 |
| PREPARED | VRP |
| DESIGN | VRP |
| REVIEW | PM/MY |
| APPROVED | GWS |
| TITLE | **SINGLE WELL RESPONSE TEST ANALYSIS<br>MONITORING WELL MW-IT-07C** |
| PROJECT No. | **19129150** |
| PHASE | **2300** |
| Rev. | **A** |
| FIGURE | **E19** |

**APPENDIX F**

# Water Quality Results

Your Project #: CA-GLD-19129150 (2300)
Site Location: CBM CALEDON QUARRY
Your C.O.C. #: C#987335-02-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/06**
Report #: R8137184
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4C5873**
**Received: 2024/04/26, 19:08**

Sample Matrix: Water
# Samples Received: 7

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Alkalinity | 1 | N/A | 2024/04/30 | CAM SOP-00448 | SM 24 2320 B m |
| Alkalinity | 5 | N/A | 2024/05/04 | CAM SOP-00448 | SM 24 2320 B m |
| Carbonate, Bicarbonate and Hydroxide | 1 | N/A | 2024/05/01 | CAM SOP-00102 | APHA 4500-CO2 D |
| Carbonate, Bicarbonate and Hydroxide | 5 | N/A | 2024/05/04 | CAM SOP-00102 | APHA 4500-CO2 D |
| Chloride by Automated Colourimetry | 6 | N/A | 2024/05/01 | CAM SOP-00463 | SM 24 4500-Cl E m |
| Conductivity | 1 | N/A | 2024/04/30 | CAM SOP-00414 | SM 24 2510 m |
| Conductivity | 5 | N/A | 2024/05/04 | CAM SOP-00414 | SM 24 2510 m |
| Dissolved Organic Carbon (DOC) (1) | 6 | N/A | 2024/04/29 | CAM SOP-00446 | SM 24 5310 B m |
| Petroleum Hydro. CCME F1 & BTEX in Water | 3 | N/A | 2024/04/29 | CAM SOP-00315 | CCME PHC-CWS m |
| Petroleum Hydro. CCME F1 & BTEX in Water | 4 | N/A | 2024/04/30 | CAM SOP-00315 | CCME PHC-CWS m |
| Petroleum Hydrocarbons F2-F4 in Water (2) | 6 | 2024/04/29 | 2024/04/30 | CAM SOP-00316 | CCME PHC-CWS m |
| Hardness (calculated as CaCO3) | 6 | N/A | 2024/05/01 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Dissolved Metals by ICPMS | 6 | N/A | 2024/04/30 | CAM SOP-00447 | EPA 6020B m |
| Ion Balance (% Difference) | 1 | N/A | 2024/05/01 | | |
| Ion Balance (% Difference) | 2 | N/A | 2024/05/04 | | |
| Ion Balance (% Difference) | 3 | N/A | 2024/05/06 | | |
| Anion and Cation Sum | 1 | N/A | 2024/05/01 | | |
| Anion and Cation Sum | 5 | N/A | 2024/05/04 | | |
| Total Ammonia-N | 6 | N/A | 2024/05/02 | CAM SOP-00441 | USGS I-2522-90 m |
| Nitrate & Nitrite as Nitrogen in Water (3) | 6 | N/A | 2024/05/01 | CAM SOP-00440 | SM 24 4500-NO3I/NO2B |
| pH (4) | 5 | 2024/04/29 | 2024/05/04 | CAM SOP-00413 | SM 24th - 4500H+ B |
| pH (4) | 1 | 2024/04/30 | 2024/04/30 | CAM SOP-00413 | SM 24th - 4500H+ B |
| Orthophosphate | 6 | N/A | 2024/05/01 | CAM SOP-00461 | SM 24 4500-P E |
| Sat. pH and Langelier Index (@ 20C) | 1 | N/A | 2024/05/01 | | Auto Calc |
| Sat. pH and Langelier Index (@ 20C) | 2 | N/A | 2024/05/04 | | Auto Calc |
| Sat. pH and Langelier Index (@ 20C) | 3 | N/A | 2024/05/06 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 1 | N/A | 2024/05/01 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 2 | N/A | 2024/05/04 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 3 | N/A | 2024/05/06 | | Auto Calc |
| Sulphate by Automated Turbidimetry | 6 | N/A | 2024/05/01 | CAM SOP-00464 | SM 24 4500-SO42- E m |

Your Project #: CA-GLD-19129150 (2300)
Site Location: CBM CALEDON QUARRY
Your C.O.C. #: C#987335-02-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/06**
Report #: R8137184
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4C5873**
**Received: 2024/04/26, 19:08**

Sample Matrix: Water
# Samples Received: 7

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Total Dissolved Solids (TDS calc) | 1 | N/A | 2024/05/01 | | Auto Calc |
| Total Dissolved Solids (TDS calc) | 2 | N/A | 2024/05/04 | | Auto Calc |
| Total Dissolved Solids (TDS calc) | 3 | N/A | 2024/05/06 | | 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, EPA, APHA or the Quebec Ministry of Environment.

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) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Your Project #: CA-GLD-19129150 (2300)
Site Location: CBM CALEDON QUARRY
Your C.O.C. #: C#987335-02-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/06**
Report #: R8137184
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4C5873**
**Received: 2024/04/26, 19:08**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Ankita Bhalla, Project Manager
Email: Ankita.Bhalla@bureauveritas.com
Phone# (905) 817-5700
====================================================================
This report has been generated and distributed using a secure automated process.
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 Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Total Cover Pages : 3

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAC561 | | ZAC562 | ZAC563 | | |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26 13:00 | | 2024/04/26 15:00 | 2024/04/26 16:00 | | |
| **COC Number** | | C#987335-02-01 | | C#987335-02-01 | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-04B** | **RDL** | **MW-IT-05A** | **MW-IT-05B** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Anion Sum | me/L | 6.95 | N/A | 6.15 | 6.35 | N/A | 9360238 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 220 | 1.0 | 210 | 210 | 1.0 | 9360243 |
| Calculated TDS | mg/L | 380 | 1.0 | 330 | 340 | 1.0 | 9360236 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 2.7 | 1.0 | 2.8 | 2.4 | 1.0 | 9360243 |
| Cation Sum | me/L | 7.48 | N/A | 6.45 | 6.53 | N/A | 9360238 |
| Hardness (CaCO3) | mg/L | 280 | 1.0 | 260 | 260 | 1.0 | 9360155 |
| Ion Balance (% Difference) | % | 3.65 | N/A | 2.42 | 1.39 | N/A | 9360237 |
| Langelier Index (@ 20C) | N/A | 0.942 | | 0.919 | 0.837 | | 9360233 |
| Langelier Index (@ 4C) | N/A | 0.693 | | 0.670 | 0.588 | | 9360234 |
| Saturation pH (@ 20C) | N/A | 7.17 | | 7.23 | 7.24 | | 9360233 |
| Saturation pH (@ 4C) | N/A | 7.42 | | 7.48 | 7.49 | | 9360234 |
| **Inorganics** | | | | | | | |
| Total Ammonia-N | mg/L | <0.050 | 0.050 | <0.050 | <0.050 | 0.050 | 9366492 |
| Conductivity | umho/cm | 710 | 1.0 | 600 | 620 | 1.0 | 9362336 |
| Dissolved Organic Carbon | mg/L | 1.8 | 0.40 | 1.8 | 2.8 | 0.40 | 9362351 |
| Orthophosphate (P) | mg/L | <0.010 | 0.010 | <0.010 | <0.010 | 0.010 | 9362439 |
| pH | pH | 8.11 | | 8.15 | 8.08 | | 9362332 |
| Dissolved Sulphate (SO4) | mg/L | 16 | 1.0 | 13 | 17 | 1.0 | 9362440 |
| Alkalinity (Total as CaCO3) | mg/L | 230 | 1.0 | 210 | 210 | 1.0 | 9362320 |
| Dissolved Chloride (Cl-) | mg/L | 67 | 1.0 | 54 | 56 | 2.0 | 9362431 |
| Nitrite (N) | mg/L | <0.010 | 0.010 | <0.010 | <0.010 | 0.010 | 9363815 |
| Nitrate (N) | mg/L | 2.74 | 0.10 | 2.66 | 2.73 | 0.10 | 9363815 |
| Nitrate + Nitrite (N) | mg/L | 2.74 | 0.10 | 2.66 | 2.73 | 0.10 | 9363815 |
| **Metals** | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | <4.9 | 4.9 | <4.9 | <4.9 | 4.9 | 9362177 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 0.50 | <0.50 | <0.50 | 0.50 | 9362177 |
| Dissolved Arsenic (As) | ug/L | <1.0 | 1.0 | <1.0 | <1.0 | 1.0 | 9362177 |
| Dissolved Barium (Ba) | ug/L | 39 | 2.0 | 35 | 48 | 2.0 | 9362177 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 0.40 | <0.40 | <0.40 | 0.40 | 9362177 |
| Dissolved Boron (B) | ug/L | <10 | 10 | <10 | 15 | 10 | 9362177 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAC561 | | ZAC562 | ZAC563 | | |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26<br>13:00 | | 2024/04/26<br>15:00 | 2024/04/26<br>16:00 | | |
| **COC Number** | | C#987335-02-01 | | C#987335-02-01 | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-04B** | **RDL** | **MW-IT-05A** | **MW-IT-05B** | **RDL** | **QC Batch** |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 0.090 | <0.090 | <0.090 | 0.090 | 9362177 |
| Dissolved Calcium (Ca) | ug/L | 82000 | 200 | 75000 | 73000 | 200 | 9362177 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 5.0 | <5.0 | <5.0 | 5.0 | 9362177 |
| Dissolved Cobalt (Co) | ug/L | <0.50 | 0.50 | <0.50 | 0.77 | 0.50 | 9362177 |
| Dissolved Copper (Cu) | ug/L | <0.90 | 0.90 | <0.90 | <0.90 | 0.90 | 9362177 |
| Dissolved Iron (Fe) | ug/L | <100 | 100 | <100 | <100 | 100 | 9362177 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 0.50 | <0.50 | <0.50 | 0.50 | 9362177 |
| Dissolved Magnesium (Mg) | ug/L | 18000 | 50 | 17000 | 18000 | 50 | 9362177 |
| Dissolved Manganese (Mn) | ug/L | 2.2 | 2.0 | <2.0 | 65 | 2.0 | 9362177 |
| Dissolved Molybdenum (Mo) | ug/L | <0.50 | 0.50 | <0.50 | 4.2 | 0.50 | 9362177 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | 1.0 | <1.0 | 1.7 | 1.0 | 9362177 |
| Dissolved Phosphorus (P) | ug/L | <100 | 100 | <100 | <100 | 100 | 9362177 |
| Dissolved Potassium (K) | ug/L | 1400 | 200 | 1300 | 1500 | 200 | 9362177 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 2.0 | <2.0 | <2.0 | 2.0 | 9362177 |
| Dissolved Silicon (Si) | ug/L | 2900 | 50 | 2600 | 3100 | 50 | 9362177 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 0.090 | <0.090 | <0.090 | 0.090 | 9362177 |
| Dissolved Sodium (Na) | ug/L | 43000 | 100 | 29000 | 31000 | 100 | 9362177 |
| Dissolved Strontium (Sr) | ug/L | 140 | 1.0 | 130 | 150 | 1.0 | 9362177 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 0.050 | <0.050 | <0.050 | 0.050 | 9362177 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 5.0 | <5.0 | <5.0 | 5.0 | 9362177 |
| Dissolved Uranium (U) | ug/L | 0.24 | 0.10 | 0.24 | 0.33 | 0.10 | 9362177 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 0.50 | <0.50 | <0.50 | 0.50 | 9362177 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | 5.0 | <5.0 | <5.0 | 5.0 | 9362177 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAC563 | | | ZAC564 | | ZAC565 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26 16:00 | | | 2024/04/26 16:30 | | 2024/04/26 12:00 | | |
| **COC Number** | | C#987335-02-01 | | | C#987335-02-01 | | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-05B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-05C** | **QC Batch** | **MW-IT-04A** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | |
| Anion Sum | me/L | | | | 5.21 | 9360238 | 6.55 | N/A | 9360238 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | | | | 170 | 9360243 | 220 | 1.0 | 9360243 |
| Calculated TDS | mg/L | | | | 300 | 9360236 | 350 | 1.0 | 9360236 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | | | | 1.7 | 9360243 | 2.0 | 1.0 | 9360243 |
| Cation Sum | me/L | | | | 5.73 | 9360238 | 6.82 | N/A | 9360238 |
| Hardness (CaCO3) | mg/L | | | | 260 | 9360155 | 250 | 1.0 | 9360155 |
| Ion Balance (% Difference) | % | | | | 4.67 | 9360237 | 1.98 | N/A | 9360237 |
| Langelier Index (@ 20C) | N/A | | | | 0.775 | 9360233 | 0.779 | | 9360233 |
| Langelier Index (@ 4C) | N/A | | | | 0.526 | 9360234 | 0.530 | | 9360234 |
| Saturation pH (@ 20C) | N/A | | | | 7.26 | 9360233 | 7.22 | | 9360233 |
| Saturation pH (@ 4C) | N/A | | | | 7.51 | 9360234 | 7.47 | | 9360234 |
| **Inorganics** | | | | | | | | | |
| Total Ammonia-N | mg/L | | | | <0.050 | 9366492 | <0.050 | 0.050 | 9366492 |
| Conductivity | umho/cm | | | | 510 | 9362336 | 660 | 1.0 | 9363678 |
| Dissolved Organic Carbon | mg/L | | | | 2.2 | 9362351 | 1.7 | 0.40 | 9362351 |
| Orthophosphate (P) | mg/L | <0.010 | 0.010 | 9362439 | <0.010 | 9362439 | <0.010 | 0.010 | 9362439 |
| pH | pH | | | | 8.03 | 9362332 | 8.00 | | 9363674 |
| Dissolved Sulphate (SO4) | mg/L | 17 | 1.0 | 9362440 | 33 | 9362440 | 15 | 1.0 | 9362440 |
| Alkalinity (Total as CaCO3) | mg/L | | | | 170 | 9362320 | 220 | 1.0 | 9363644 |
| Dissolved Chloride (Cl-) | mg/L | 56 | 2.0 | 9362431 | 29 | 9362431 | 60 | 1.0 | 9362431 |
| Nitrite (N) | mg/L | | | | <0.010 | 9363815 | <0.010 | 0.010 | 9363815 |
| Nitrate (N) | mg/L | | | | 4.54 | 9363815 | 2.44 | 0.10 | 9363815 |
| Nitrate + Nitrite (N) | mg/L | | | | 4.54 | 9363815 | 2.44 | 0.10 | 9363815 |
| **Metals** | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | | | | <4.9 | 9362177 | <4.9 | 4.9 | 9362177 |
| Dissolved Antimony (Sb) | ug/L | | | | <0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Arsenic (As) | ug/L | | | | <1.0 | 9362177 | <1.0 | 1.0 | 9362177 |
| Dissolved Barium (Ba) | ug/L | | | | 39 | 9362177 | 38 | 2.0 | 9362177 |
| Dissolved Beryllium (Be) | ug/L | | | | <0.40 | 9362177 | <0.40 | 0.40 | 9362177 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAC563 | | | ZAC564 | | ZAC565 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26<br>16:00 | | | 2024/04/26<br>16:30 | | 2024/04/26<br>12:00 | | |
| **COC Number** | | C#987335-02-01 | | | C#987335-02-01 | | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-05B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-05C** | **QC Batch** | **MW-IT-04A** | **RDL** | **QC Batch** |
| Dissolved Boron (B) | ug/L | | | | 16 | 9362177 | <10 | 10 | 9362177 |
| Dissolved Cadmium (Cd) | ug/L | | | | <0.090 | 9362177 | <0.090 | 0.090 | 9362177 |
| Dissolved Calcium (Ca) | ug/L | | | | 86000 | 9362177 | 75000 | 200 | 9362177 |
| Dissolved Chromium (Cr) | ug/L | | | | <5.0 | 9362177 | <5.0 | 5.0 | 9362177 |
| Dissolved Cobalt (Co) | ug/L | | | | 10 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Copper (Cu) | ug/L | | | | <0.90 | 9362177 | <0.90 | 0.90 | 9362177 |
| Dissolved Iron (Fe) | ug/L | | | | <100 | 9362177 | <100 | 100 | 9362177 |
| Dissolved Lead (Pb) | ug/L | | | | <0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Magnesium (Mg) | ug/L | | | | 11000 | 9362177 | 16000 | 50 | 9362177 |
| Dissolved Manganese (Mn) | ug/L | | | | 210 | 9362177 | <2.0 | 2.0 | 9362177 |
| Dissolved Molybdenum (Mo) | ug/L | | | | 5.9 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Nickel (Ni) | ug/L | | | | 9.5 | 9362177 | <1.0 | 1.0 | 9362177 |
| Dissolved Phosphorus (P) | ug/L | | | | <100 | 9362177 | <100 | 100 | 9362177 |
| Dissolved Potassium (K) | ug/L | | | | 1000 | 9362177 | 1200 | 200 | 9362177 |
| Dissolved Selenium (Se) | ug/L | | | | <2.0 | 9362177 | <2.0 | 2.0 | 9362177 |
| Dissolved Silicon (Si) | ug/L | | | | 3300 | 9362177 | 2600 | 50 | 9362177 |
| Dissolved Silver (Ag) | ug/L | | | | <0.090 | 9362177 | <0.090 | 0.090 | 9362177 |
| Dissolved Sodium (Na) | ug/L | | | | 12000 | 9362177 | 39000 | 100 | 9362177 |
| Dissolved Strontium (Sr) | ug/L | | | | 190 | 9362177 | 130 | 1.0 | 9362177 |
| Dissolved Thallium (Tl) | ug/L | | | | <0.050 | 9362177 | <0.050 | 0.050 | 9362177 |
| Dissolved Titanium (Ti) | ug/L | | | | <5.0 | 9362177 | <5.0 | 5.0 | 9362177 |
| Dissolved Uranium (U) | ug/L | | | | 0.47 | 9362177 | 0.27 | 0.10 | 9362177 |
| Dissolved Vanadium (V) | ug/L | | | | <0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Zinc (Zn) | ug/L | | | | <5.0 | 9362177 | <5.0 | 5.0 | 9362177 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAC565 | | | ZAC566 | | |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26 12:00 | | | 2024/04/26 | | |
| **COC Number** | | C#987335-02-01 | | | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-04A Lab-Dup** | **RDL** | **QC Batch** | **DUP1** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Anion Sum | me/L | | | | 6.97 | N/A | 9360238 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | | | | 220 | 1.0 | 9360243 |
| Calculated TDS | mg/L | | | | 380 | 1.0 | 9360236 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | | | | 2.5 | 1.0 | 9360243 |
| Cation Sum | me/L | | | | 7.38 | N/A | 9360238 |
| Hardness (CaCO3) | mg/L | | | | 280 | 1.0 | 9360155 |
| Ion Balance (% Difference) | % | | | | 2.84 | N/A | 9360237 |
| Langelier Index (@ 20C) | N/A | | | | 0.895 | | 9360233 |
| Langelier Index (@ 4C) | N/A | | | | 0.647 | | 9360234 |
| Saturation pH (@ 20C) | N/A | | | | 7.18 | | 9360233 |
| Saturation pH (@ 4C) | N/A | | | | 7.42 | | 9360234 |
| **Inorganics** | | | | | | | |
| Total Ammonia-N | mg/L | | | | <0.050 | 0.050 | 9366492 |
| Conductivity | umho/cm | | | | 710 | 1.0 | 9362336 |
| Dissolved Organic Carbon | mg/L | | | | 1.8 | 0.40 | 9362351 |
| Orthophosphate (P) | mg/L | | | | <0.010 | 0.010 | 9362439 |
| pH | pH | | | | 8.07 | | 9362332 |
| Dissolved Sulphate (SO4) | mg/L | | | | 16 | 1.0 | 9362440 |
| Alkalinity (Total as CaCO3) | mg/L | | | | 230 | 1.0 | 9362320 |
| Dissolved Chloride (Cl-) | mg/L | | | | 67 | 1.0 | 9362431 |
| Nitrite (N) | mg/L | | | | <0.010 | 0.010 | 9363815 |
| Nitrate (N) | mg/L | | | | 2.75 | 0.10 | 9363815 |
| Nitrate + Nitrite (N) | mg/L | | | | 2.75 | 0.10 | 9363815 |
| **Metals** | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | <4.9 | 4.9 | 9362177 | <4.9 | 4.9 | 9362177 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Arsenic (As) | ug/L | <1.0 | 1.0 | 9362177 | <1.0 | 1.0 | 9362177 |
| Dissolved Barium (Ba) | ug/L | 38 | 2.0 | 9362177 | 38 | 2.0 | 9362177 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 0.40 | 9362177 | <0.40 | 0.40 | 9362177 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAC565 | | | ZAC566 | | |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26 12:00 | | | 2024/04/26 | | |
| **COC Number** | | C#987335-02-01 | | | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-04A Lab-Dup** | **RDL** | **QC Batch** | **DUP1** | **RDL** | **QC Batch** |
| Dissolved Boron (B) | ug/L | <10 | 10 | 9362177 | <10 | 10 | 9362177 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 0.090 | 9362177 | <0.090 | 0.090 | 9362177 |
| Dissolved Calcium (Ca) | ug/L | 77000 | 200 | 9362177 | 81000 | 200 | 9362177 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 5.0 | 9362177 | <5.0 | 5.0 | 9362177 |
| Dissolved Cobalt (Co) | ug/L | <0.50 | 0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Copper (Cu) | ug/L | <0.90 | 0.90 | 9362177 | <0.90 | 0.90 | 9362177 |
| Dissolved Iron (Fe) | ug/L | <100 | 100 | 9362177 | <100 | 100 | 9362177 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Magnesium (Mg) | ug/L | 16000 | 50 | 9362177 | 18000 | 50 | 9362177 |
| Dissolved Manganese (Mn) | ug/L | <2.0 | 2.0 | 9362177 | 2.3 | 2.0 | 9362177 |
| Dissolved Molybdenum (Mo) | ug/L | <0.50 | 0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | 1.0 | 9362177 | <1.0 | 1.0 | 9362177 |
| Dissolved Phosphorus (P) | ug/L | <100 | 100 | 9362177 | <100 | 100 | 9362177 |
| Dissolved Potassium (K) | ug/L | 1200 | 200 | 9362177 | 1300 | 200 | 9362177 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 2.0 | 9362177 | <2.0 | 2.0 | 9362177 |
| Dissolved Silicon (Si) | ug/L | 2600 | 50 | 9362177 | 2800 | 50 | 9362177 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 0.090 | 9362177 | <0.090 | 0.090 | 9362177 |
| Dissolved Sodium (Na) | ug/L | 39000 | 100 | 9362177 | 42000 | 100 | 9362177 |
| Dissolved Strontium (Sr) | ug/L | 130 | 1.0 | 9362177 | 140 | 1.0 | 9362177 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 0.050 | 9362177 | <0.050 | 0.050 | 9362177 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 5.0 | 9362177 | <5.0 | 5.0 | 9362177 |
| Dissolved Uranium (U) | ug/L | 0.27 | 0.10 | 9362177 | 0.24 | 0.10 | 9362177 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 0.50 | 9362177 | <0.50 | 0.50 | 9362177 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | 5.0 | 9362177 | <5.0 | 5.0 | 9362177 |

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

## PETROLEUM HYDROCARBONS (CCME)

| **Bureau Veritas ID** | | ZAC567 | | |
|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26 | | |
| **COC Number** | | C#987335-02-01 | | |
| | **UNITS** | **TRIPBLANK** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | |
| Benzene | ug/L | <0.20 | 0.20 | 9362790 |
| Toluene | ug/L | <0.20 | 0.20 | 9362790 |
| Ethylbenzene | ug/L | <0.20 | 0.20 | 9362790 |
| o-Xylene | ug/L | <0.20 | 0.20 | 9362790 |
| p+m-Xylene | ug/L | <0.40 | 0.40 | 9362790 |
| Total Xylenes | ug/L | <0.40 | 0.40 | 9362790 |
| F1 (C6-C10) | ug/L | <25 | 25 | 9362790 |
| F1 (C6-C10) - BTEX | ug/L | <25 | 25 | 9362790 |
| **Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene | % | 92 | | 9362790 |
| 4-Bromofluorobenzene | % | 100 | | 9362790 |
| D10-o-Xylene | % | 91 | | 9362790 |
| D4-1,2-Dichloroethane | % | 92 | | 9362790 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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

| **Bureau Veritas ID** | | ZAC561 | | | ZAC561 | | | ZAC562 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26<br>13:00 | | | 2024/04/26<br>13:00 | | | 2024/04/26<br>15:00 | | |
| **COC Number** | | C#987335-02-01 | | | C#987335-02-01 | | | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-04B** | **RDL** | **QC Batch** | **MW-IT-04B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-05A** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | | | | | | | |
| Benzene | ug/L | <0.20 | 0.20 | 9362790 | <0.20 | 0.20 | 9362790 | <0.20 | 0.20 | 9362790 |
| Toluene | ug/L | 0.27 | 0.20 | 9362790 | 0.22 | 0.20 | 9362790 | <0.20 | 0.20 | 9362790 |
| Ethylbenzene | ug/L | <0.20 | 0.20 | 9362790 | <0.20 | 0.20 | 9362790 | <0.20 | 0.20 | 9362790 |
| o-Xylene | ug/L | <0.20 | 0.20 | 9362790 | <0.20 | 0.20 | 9362790 | <0.20 | 0.20 | 9362790 |
| p+m-Xylene | ug/L | <0.40 | 0.40 | 9362790 | <0.40 | 0.40 | 9362790 | <0.40 | 0.40 | 9362790 |
| Total Xylenes | ug/L | <0.40 | 0.40 | 9362790 | <0.40 | 0.40 | 9362790 | <0.40 | 0.40 | 9362790 |
| F1 (C6-C10) | ug/L | <25 | 25 | 9362790 | <25 | 25 | 9362790 | <25 | 25 | 9362790 |
| F1 (C6-C10) - BTEX | ug/L | <25 | 25 | 9362790 | <25 | 25 | 9362790 | <25 | 25 | 9362790 |
| **F2-F4 Hydrocarbons** | | | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | <100 | 100 | 9362318 | | | | <100 | 100 | 9362318 |
| F3 (C16-C34 Hydrocarbons) | ug/L | <200 | 200 | 9362318 | | | | <200 | 200 | 9362318 |
| F4 (C34-C50 Hydrocarbons) | ug/L | <200 | 200 | 9362318 | | | | <200 | 200 | 9362318 |
| Reached Baseline at C50 | ug/L | Yes | | 9362318 | | | | Yes | | 9362318 |
| **Surrogate Recovery (%)** | | | | | | | | | | |
| 1,4-Difluorobenzene | % | 96 | | 9362790 | 91 | | 9362790 | 95 | | 9362790 |
| 4-Bromofluorobenzene | % | 99 | | 9362790 | 102 | | 9362790 | 99 | | 9362790 |
| D10-o-Xylene | % | 102 | | 9362790 | 86 | | 9362790 | 91 | | 9362790 |
| D4-1,2-Dichloroethane | % | 95 | | 9362790 | 101 | | 9362790 | 90 | | 9362790 |
| o-Terphenyl | % | 98 | | 9362318 | | | | 95 | | 9362318 |

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

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

| **Bureau Veritas ID** | | ZAC563 | ZAC564 | ZAC565 | ZAC566 | | |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/26 16:00 | 2024/04/26 16:30 | 2024/04/26 12:00 | 2024/04/26 | | |
| **COC Number** | | C#987335-02-01 | C#987335-02-01 | C#987335-02-01 | C#987335-02-01 | | |
| | **UNITS** | **MW-IT-05B** | **MW-IT-05C** | **MW-IT-04A** | **DUP1** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | | | | |
| Benzene | ug/L | 0.21 | <0.20 | <0.20 | <0.20 | 0.20 | 9362790 |
| Toluene | ug/L | 2.7 | 1.5 | <0.20 | 0.24 | 0.20 | 9362790 |
| Ethylbenzene | ug/L | 0.35 | <0.20 | <0.20 | <0.20 | 0.20 | 9362790 |
| o-Xylene | ug/L | 0.56 | <0.20 | <0.20 | <0.20 | 0.20 | 9362790 |
| p+m-Xylene | ug/L | 1.2 | <0.40 | <0.40 | <0.40 | 0.40 | 9362790 |
| Total Xylenes | ug/L | 1.8 | <0.40 | <0.40 | <0.40 | 0.40 | 9362790 |
| F1 (C6-C10) | ug/L | 100 | 85 | <25 | <25 | 25 | 9362790 |
| F1 (C6-C10) - BTEX | ug/L | 95 | 84 | <25 | <25 | 25 | 9362790 |
| **F2-F4 Hydrocarbons** | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | <100 | <100 | <100 | <100 | 100 | 9362318 |
| F3 (C16-C34 Hydrocarbons) | ug/L | <200 | <200 | 380 | <200 | 200 | 9362318 |
| F4 (C34-C50 Hydrocarbons) | ug/L | <200 | <200 | <200 | <200 | 200 | 9362318 |
| Reached Baseline at C50 | ug/L | Yes | Yes | Yes | Yes | | 9362318 |
| **Surrogate Recovery (%)** | | | | | | | |
| 1,4-Difluorobenzene | % | 92 | 92 | 93 | 92 | | 9362790 |
| 4-Bromofluorobenzene | % | 100 | 100 | 101 | 100 | | 9362790 |
| D10-o-Xylene | % | 94 | 90 | 87 | 91 | | 9362790 |
| D4-1,2-Dichloroethane | % | 92 | 95 | 93 | 87 | | 9362790 |
| o-Terphenyl | % | 94 | 98 | 95 | 99 | | 9362318 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

## TEST SUMMARY

**Bureau Veritas ID:** ZAC561
**Sample ID:** MW-IT-04B
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9362320 | N/A | 2024/05/04 | Nachiketa Gohil |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9360243 | N/A | 2024/05/04 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9362431 | N/A | 2024/05/01 | Massarat Jan |
| Conductivity | AT | 9362336 | N/A | 2024/05/04 | Nachiketa Gohil |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9362351 | N/A | 2024/04/29 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/30 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9362318 | 2024/04/29 | 2024/04/30 | Mohammed Abdul Nafay Shoeb |
| Hardness (calculated as CaCO3) |  | 9360155 | N/A | 2024/05/01 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9362177 | N/A | 2024/04/30 | Thuy Linh Nguyen |
| Ion Balance (% Difference) | CALC | 9360237 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9360238 | N/A | 2024/05/04 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9366492 | N/A | 2024/05/02 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9363815 | N/A | 2024/05/01 | Jinal Chavda |
| pH | AT | 9362332 | 2024/04/29 | 2024/05/04 | Nachiketa Gohil |
| Orthophosphate | KONE | 9362439 | N/A | 2024/05/01 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9360233 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9360234 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9362440 | N/A | 2024/05/01 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9360236 | N/A | 2024/05/06 | Automated Statchk |

**Bureau Veritas ID:** ZAC561 Dup
**Sample ID:** MW-IT-04B
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/30 | Georgeta Rusu |

**Bureau Veritas ID:** ZAC562
**Sample ID:** MW-IT-05A
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9362320 | N/A | 2024/05/04 | Nachiketa Gohil |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9360243 | N/A | 2024/05/04 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9362431 | N/A | 2024/05/01 | Massarat Jan |
| Conductivity | AT | 9362336 | N/A | 2024/05/04 | Nachiketa Gohil |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9362351 | N/A | 2024/04/29 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/29 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9362318 | 2024/04/29 | 2024/04/30 | Mohammed Abdul Nafay Shoeb |
| Hardness (calculated as CaCO3) |  | 9360155 | N/A | 2024/05/01 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9362177 | N/A | 2024/04/30 | Thuy Linh Nguyen |
| Ion Balance (% Difference) | CALC | 9360237 | N/A | 2024/05/04 | Automated Statchk |
| Anion and Cation Sum | CALC | 9360238 | N/A | 2024/05/04 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9366492 | N/A | 2024/05/02 | Yogesh Patel |

## TEST SUMMARY

**Bureau Veritas ID:** ZAC562
**Sample ID:** MW-IT-05A
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9363815 | N/A | 2024/05/01 | Jinal Chavda |
| pH | AT | 9362332 | 2024/04/29 | 2024/05/04 | Nachiketa Gohil |
| Orthophosphate | KONE | 9362439 | N/A | 2024/05/01 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9360233 | N/A | 2024/05/04 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9360234 | N/A | 2024/05/04 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9362440 | N/A | 2024/05/01 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9360236 | N/A | 2024/05/04 | Automated Statchk |

**Bureau Veritas ID:** ZAC563
**Sample ID:** MW-IT-05B
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9362320 | N/A | 2024/05/04 | Nachiketa Gohil |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9360243 | N/A | 2024/05/04 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9362431 | N/A | 2024/05/01 | Massarat Jan |
| Conductivity | AT | 9362336 | N/A | 2024/05/04 | Nachiketa Gohil |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9362351 | N/A | 2024/04/29 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/29 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9362318 | 2024/04/29 | 2024/04/30 | Mohammed Abdul Nafay Shoeb |
| Hardness (calculated as CaCO3) |  | 9360155 | N/A | 2024/05/01 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9362177 | N/A | 2024/04/30 | Thuy Linh Nguyen |
| Ion Balance (% Difference) | CALC | 9360237 | N/A | 2024/05/04 | Automated Statchk |
| Anion and Cation Sum | CALC | 9360238 | N/A | 2024/05/04 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9366492 | N/A | 2024/05/02 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9363815 | N/A | 2024/05/01 | Jinal Chavda |
| pH | AT | 9362332 | 2024/04/29 | 2024/05/04 | Nachiketa Gohil |
| Orthophosphate | KONE | 9362439 | N/A | 2024/05/01 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9360233 | N/A | 2024/05/04 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9360234 | N/A | 2024/05/04 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9362440 | N/A | 2024/05/01 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9360236 | N/A | 2024/05/04 | Automated Statchk |

**Bureau Veritas ID:** ZAC563 Dup
**Sample ID:** MW-IT-05B
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Chloride by Automated Colourimetry | SKAL | 9362431 | N/A | 2024/05/01 | Massarat Jan |
| Orthophosphate | KONE | 9362439 | N/A | 2024/05/01 | Massarat Jan |
| Sulphate by Automated Turbidimetry | SKAL | 9362440 | N/A | 2024/05/01 | Massarat Jan |

## TEST SUMMARY

**Bureau Veritas ID:** ZAC564
**Sample ID:** MW-IT-05C
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9362320 | N/A | 2024/05/04 | Nachiketa Gohil |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9360243 | N/A | 2024/05/04 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9362431 | N/A | 2024/05/01 | Massarat Jan |
| Conductivity | AT | 9362336 | N/A | 2024/05/04 | Nachiketa Gohil |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9362351 | N/A | 2024/04/29 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/30 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9362318 | 2024/04/29 | 2024/04/30 | Mohammed Abdul Nafay Shoeb |
| Hardness (calculated as CaCO3) |  | 9360155 | N/A | 2024/05/01 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9362177 | N/A | 2024/04/30 | Thuy Linh Nguyen |
| Ion Balance (% Difference) | CALC | 9360237 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9360238 | N/A | 2024/05/04 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9366492 | N/A | 2024/05/02 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9363815 | N/A | 2024/05/01 | Jinal Chavda |
| pH | AT | 9362332 | 2024/04/29 | 2024/05/04 | Nachiketa Gohil |
| Orthophosphate | KONE | 9362439 | N/A | 2024/05/01 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9360233 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9360234 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9362440 | N/A | 2024/05/01 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9360236 | N/A | 2024/05/06 | Automated Statchk |

**Bureau Veritas ID:** ZAC565
**Sample ID:** MW-IT-04A
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9363644 | N/A | 2024/04/30 | Nachiketa Gohil |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9360243 | N/A | 2024/05/01 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9362431 | N/A | 2024/05/01 | Massarat Jan |
| Conductivity | AT | 9363678 | N/A | 2024/04/30 | Nachiketa Gohil |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9362351 | N/A | 2024/04/29 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/30 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9362318 | 2024/04/29 | 2024/04/30 | Mohammed Abdul Nafay Shoeb |
| Hardness (calculated as CaCO3) |  | 9360155 | N/A | 2024/05/01 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9362177 | N/A | 2024/04/30 | Thuy Linh Nguyen |
| Ion Balance (% Difference) | CALC | 9360237 | N/A | 2024/05/01 | Automated Statchk |
| Anion and Cation Sum | CALC | 9360238 | N/A | 2024/05/01 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9366492 | N/A | 2024/05/02 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9363815 | N/A | 2024/05/01 | Jinal Chavda |
| pH | AT | 9363674 | 2024/04/30 | 2024/04/30 | Nachiketa Gohil |
| Orthophosphate | KONE | 9362439 | N/A | 2024/05/01 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9360233 | N/A | 2024/05/01 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9360234 | N/A | 2024/05/01 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9362440 | N/A | 2024/05/01 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9360236 | N/A | 2024/05/01 | Automated Statchk |

## TEST SUMMARY

**Bureau Veritas ID:** ZAC565 Dup
**Sample ID:** MW-IT-04A
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Dissolved Metals by ICPMS | ICP/MS | 9362177 | N/A | 2024/04/30 | Thuy Linh Nguyen |

**Bureau Veritas ID:** ZAC566
**Sample ID:** DUP1
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9362320 | N/A | 2024/05/04 | Nachiketa Gohil |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9360243 | N/A | 2024/05/04 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9362431 | N/A | 2024/05/01 | Massarat Jan |
| Conductivity | AT | 9362336 | N/A | 2024/05/04 | Nachiketa Gohil |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9362351 | N/A | 2024/04/29 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/30 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9362318 | 2024/04/29 | 2024/04/30 | Mohammed Abdul Nafay Shoeb |
| Hardness (calculated as CaCO3) |  | 9360155 | N/A | 2024/05/01 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9362177 | N/A | 2024/04/30 | Thuy Linh Nguyen |
| Ion Balance (% Difference) | CALC | 9360237 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9360238 | N/A | 2024/05/04 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9366492 | N/A | 2024/05/02 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9363815 | N/A | 2024/05/01 | Jinal Chavda |
| pH | AT | 9362332 | 2024/04/29 | 2024/05/04 | Nachiketa Gohil |
| Orthophosphate | KONE | 9362439 | N/A | 2024/05/01 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9360233 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9360234 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9362440 | N/A | 2024/05/01 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9360236 | N/A | 2024/05/06 | Automated Statchk |

**Bureau Veritas ID:** ZAC567
**Sample ID:** TRIPBLANK
**Matrix:** Water

**Collected:** 2024/04/26
**Shipped:**
**Received:** 2024/04/26

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9362790 | N/A | 2024/04/29 | Georgeta Rusu |

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 1.7°C |

**Results relate only to the items tested.**

# 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 |
| 9362318 | o-Terphenyl | 2024/04/29 | 103 | 60 - 130 | 104 | 60 - 130 | 101 | % | | |
| 9362790 | 1,4-Difluorobenzene | 2024/04/29 | 92 | 70 - 130 | 94 | 70 - 130 | 97 | % | | |
| 9362790 | 4-Bromofluorobenzene | 2024/04/29 | 105 | 70 - 130 | 105 | 70 - 130 | 103 | % | | |
| 9362790 | D10-o-Xylene | 2024/04/29 | 93 | 70 - 130 | 102 | 70 - 130 | 90 | % | | |
| 9362790 | D4-1,2-Dichloroethane | 2024/04/29 | 94 | 70 - 130 | 94 | 70 - 130 | 107 | % | | |
| 9362177 | Dissolved Aluminum (Al) | 2024/04/30 | 103 | 80 - 120 | 97 | 80 - 120 | <4.9 | ug/L | NC | 20 |
| 9362177 | Dissolved Antimony (Sb) | 2024/04/30 | 113 | 80 - 120 | 105 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9362177 | Dissolved Arsenic (As) | 2024/04/30 | 104 | 80 - 120 | 101 | 80 - 120 | <1.0 | ug/L | NC | 20 |
| 9362177 | Dissolved Barium (Ba) | 2024/04/30 | 104 | 80 - 120 | 99 | 80 - 120 | <2.0 | ug/L | 1.2 | 20 |
| 9362177 | Dissolved Beryllium (Be) | 2024/04/30 | 109 | 80 - 120 | 104 | 80 - 120 | <0.40 | ug/L | NC | 20 |
| 9362177 | Dissolved Boron (B) | 2024/04/30 | 101 | 80 - 120 | 98 | 80 - 120 | <10 | ug/L | NC | 20 |
| 9362177 | Dissolved Cadmium (Cd) | 2024/04/30 | 104 | 80 - 120 | 99 | 80 - 120 | <0.090 | ug/L | NC | 20 |
| 9362177 | Dissolved Calcium (Ca) | 2024/04/30 | NC | 80 - 120 | 101 | 80 - 120 | <200 | ug/L | 1.7 | 20 |
| 9362177 | Dissolved Chromium (Cr) | 2024/04/30 | 105 | 80 - 120 | 99 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9362177 | Dissolved Cobalt (Co) | 2024/04/30 | 103 | 80 - 120 | 101 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9362177 | Dissolved Copper (Cu) | 2024/04/30 | 105 | 80 - 120 | 104 | 80 - 120 | <0.90 | ug/L | NC | 20 |
| 9362177 | Dissolved Iron (Fe) | 2024/04/30 | 104 | 80 - 120 | 102 | 80 - 120 | <100 | ug/L | NC | 20 |
| 9362177 | Dissolved Lead (Pb) | 2024/04/30 | 104 | 80 - 120 | 101 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9362177 | Dissolved Magnesium (Mg) | 2024/04/30 | 100 | 80 - 120 | 101 | 80 - 120 | <50 | ug/L | 0.20 | 20 |
| 9362177 | Dissolved Manganese (Mn) | 2024/04/30 | 101 | 80 - 120 | 99 | 80 - 120 | <2.0 | ug/L | NC | 20 |
| 9362177 | Dissolved Molybdenum (Mo) | 2024/04/30 | 110 | 80 - 120 | 104 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9362177 | Dissolved Nickel (Ni) | 2024/04/30 | 97 | 80 - 120 | 96 | 80 - 120 | <1.0 | ug/L | NC | 20 |
| 9362177 | Dissolved Phosphorus (P) | 2024/04/30 | 108 | 80 - 120 | 101 | 80 - 120 | <100 | ug/L | NC | 20 |
| 9362177 | Dissolved Potassium (K) | 2024/04/30 | 109 | 80 - 120 | 106 | 80 - 120 | <200 | ug/L | 0.35 | 20 |
| 9362177 | Dissolved Selenium (Se) | 2024/04/30 | 102 | 80 - 120 | 97 | 80 - 120 | <2.0 | ug/L | NC | 20 |
| 9362177 | Dissolved Silicon (Si) | 2024/04/30 | 106 | 80 - 120 | 100 | 80 - 120 | <50 | ug/L | 2.0 | 20 |
| 9362177 | Dissolved Silver (Ag) | 2024/04/30 | 106 | 80 - 120 | 102 | 80 - 120 | <0.090 | ug/L | NC | 20 |
| 9362177 | Dissolved Sodium (Na) | 2024/04/30 | NC | 80 - 120 | 102 | 80 - 120 | <100 | ug/L | 0.17 | 20 |
| 9362177 | Dissolved Strontium (Sr) | 2024/04/30 | 101 | 80 - 120 | 99 | 80 - 120 | <1.0 | ug/L | 1.1 | 20 |
| 9362177 | Dissolved Thallium (Tl) | 2024/04/30 | 103 | 80 - 120 | 102 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| 9362177 | Dissolved Titanium (Ti) | 2024/04/30 | 106 | 80 - 120 | 100 | 80 - 120 | <5.0 | ug/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** |
| 9362177 | Dissolved Uranium (U) | 2024/04/30 | 103 | 80 - 120 | 99 | 80 - 120 | <0.10 | ug/L | 1.1 | 20 |
| 9362177 | Dissolved Vanadium (V) | 2024/04/30 | 104 | 80 - 120 | 99 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9362177 | Dissolved Zinc (Zn) | 2024/04/30 | 100 | 80 - 120 | 99 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9362318 | F2 (C10-C16 Hydrocarbons) | 2024/04/30 | 96 | 60 - 130 | 98 | 60 - 130 | <100 | ug/L | 16 | 30 |
| 9362318 | F3 (C16-C34 Hydrocarbons) | 2024/04/30 | 105 | 60 - 130 | 108 | 60 - 130 | <200 | ug/L | 9.5 | 30 |
| 9362318 | F4 (C34-C50 Hydrocarbons) | 2024/04/30 | 99 | 60 - 130 | 103 | 60 - 130 | <200 | ug/L | NC | 30 |
| 9362320 | Alkalinity (Total as CaCO3) | 2024/05/04 | | | 100 | 85 - 115 | <1.0 | mg/L | 1.5 | 20 |
| 9362332 | pH | 2024/05/04 | | | 101 | 98 - 103 | | | 2.0 | N/A |
| 9362336 | Conductivity | 2024/05/04 | | | 102 | 85 - 115 | <1.0 | umho/cm | 0.95 | 10 |
| 9362351 | Dissolved Organic Carbon | 2024/04/29 | 94 | 80 - 120 | 95 | 80 - 120 | <0.40 | mg/L | 0.63 | 20 |
| 9362431 | Dissolved Chloride (Cl-) | 2024/05/01 | NC | 80 - 120 | 99 | 80 - 120 | <1.0 | mg/L | 0.85 | 20 |
| 9362439 | Orthophosphate (P) | 2024/05/01 | 92 | 75 - 125 | 91 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 9362440 | Dissolved Sulphate (SO4) | 2024/05/01 | 97 | 75 - 125 | 96 | 80 - 120 | <1.0 | mg/L | 0.36 | 20 |
| 9362790 | Benzene | 2024/04/30 | 90 | 50 - 140 | 91 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9362790 | Ethylbenzene | 2024/04/30 | 93 | 50 - 140 | 96 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9362790 | F1 (C6-C10) - BTEX | 2024/04/30 | | | | | <25 | ug/L | NC | 30 |
| 9362790 | F1 (C6-C10) | 2024/04/30 | 97 | 60 - 140 | 99 | 60 - 140 | <25 | ug/L | NC | 30 |
| 9362790 | o-Xylene | 2024/04/30 | 92 | 50 - 140 | 93 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9362790 | p+m-Xylene | 2024/04/30 | 89 | 50 - 140 | 91 | 50 - 140 | <0.40 | ug/L | NC | 30 |
| 9362790 | Toluene | 2024/04/30 | 86 | 50 - 140 | 88 | 50 - 140 | <0.20 | ug/L | 20 | 30 |
| 9362790 | Total Xylenes | 2024/04/30 | | | | | <0.40 | ug/L | NC | 30 |
| 9363644 | Alkalinity (Total as CaCO3) | 2024/04/30 | | | 101 | 85 - 115 | <1.0 | mg/L | 1.9 | 20 |
| 9363674 | pH | 2024/04/30 | | | 102 | 98 - 103 | | | 0.27 | N/A |
| 9363678 | Conductivity | 2024/04/30 | | | 102 | 85 - 115 | <1.0 | umho/cm | 0.16 | 10 |
| 9363815 | Nitrate (N) | 2024/05/01 | 89 | 80 - 120 | 97 | 80 - 120 | <0.10 | mg/L | NC | 20 |
| 9363815 | Nitrite (N) | 2024/05/01 | 97 | 80 - 120 | 102 | 80 - 120 | <0.010 | mg/L | 3.4 | 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** |
| 9366492 | Total Ammonia-N | 2024/05/02 | NC | 75 - 125 | 98 | 80 - 120 | <0.050 | mg/L | 0.57 | 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).

# VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Senior Scientific Specialist

---

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

CH NONT-2024-04-2749

~~Page 2 of 3~~ 1 of 1

ttle Order #: 987335

**INVOICE TO:**

Company Name: #21375 WSP Canada Inc.
Attention: George Schneider
Address: 210 Sheldon Drive
Cambridge ON N1T 1A8
Tel: (519) 620-8182 Fax:
Email: George_Schneider@golder.com

**REPORT TO:**

Company Name:
Attention: Paul Menkveld
Address:
Tel: Fax:
Email: paul.menkveld@wsp.com

**PROJECT INFORMATION:**

Quotation #: C41059
P.O. #:
Project: CA-GLD-19129150 (2300)
Project Name: CBM Caledon Quarry
Site #:
Sampled By: Victoria Propp

COC #: C#987335-02-01

Project Manager: Ankita Bhalla

**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 ___

**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, BTEX/F1-F4 | | | | | | | | | # of Bottles | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | MW-IT-04B | 24/04/26 | 13:00 | GW | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 2 | | ~~MW-IT-04C~~ | | | | ~~✓~~ | ~~✓~~ | ~~✓~~ | | | | | | | | | ~~8~~ | |
| 3 | | MW-IT-05A | | 15:00 | | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 4 | | MW-IT-05B | | 16:00 | | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 5 | | MW-IT-05C | | 16:30 | | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 6 | | MW-IT-~~06A~~ 04A | | 12:00 | | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 7 | | ~~MW-IT-06B~~ DUP1 | ↓ | — | ↓ | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 8 | | ~~MW-IT-06C~~ TRIP BLANK | — | — | — | — | | ✓ | | | | | | | | | 2 | |
| 9 | | ~~MW-IT-07A~~ | | | | | | | | | | | | | | | | |
| 10 | | ~~MW-IT-07B~~ | | | | | | | | | | | | | | | | |

| * RELINQUISHED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | RECEIVED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | # jars used and not submitted |
|---|---|---|---|---|---|---|
| V. Propp | 24/04/26 | 19:00 | Ashitha Sukumar<br>ASHITHA SUKUMAR | 2024/04/26 | 19:08 | |

**Laboratory Use Only**

| Time Sensitive | Temperature (°C) on Recei | Custody Seal | Yes | No |
|---|---|---|---|---|
| | 1/1/3 | 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.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-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.

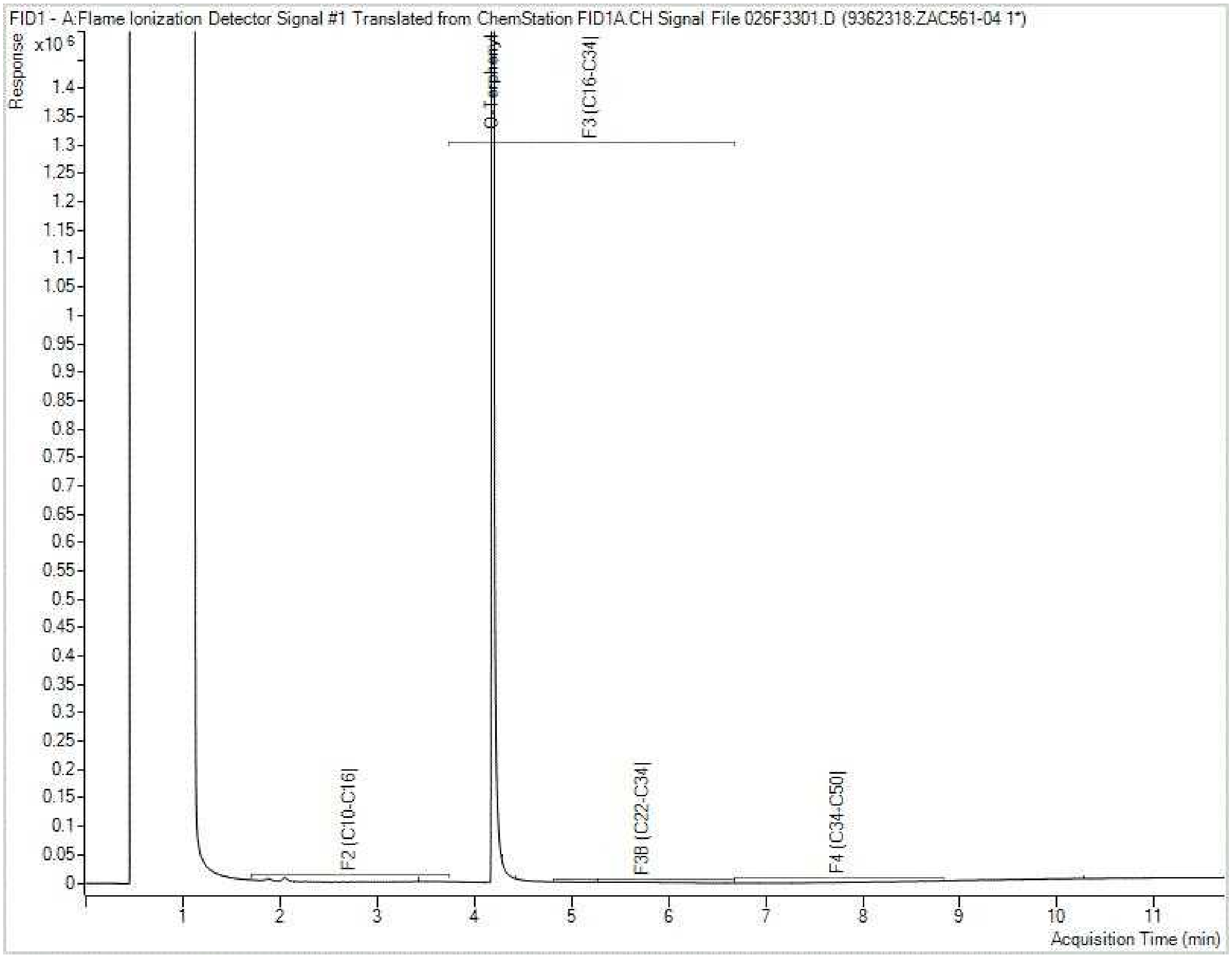
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.

**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.

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

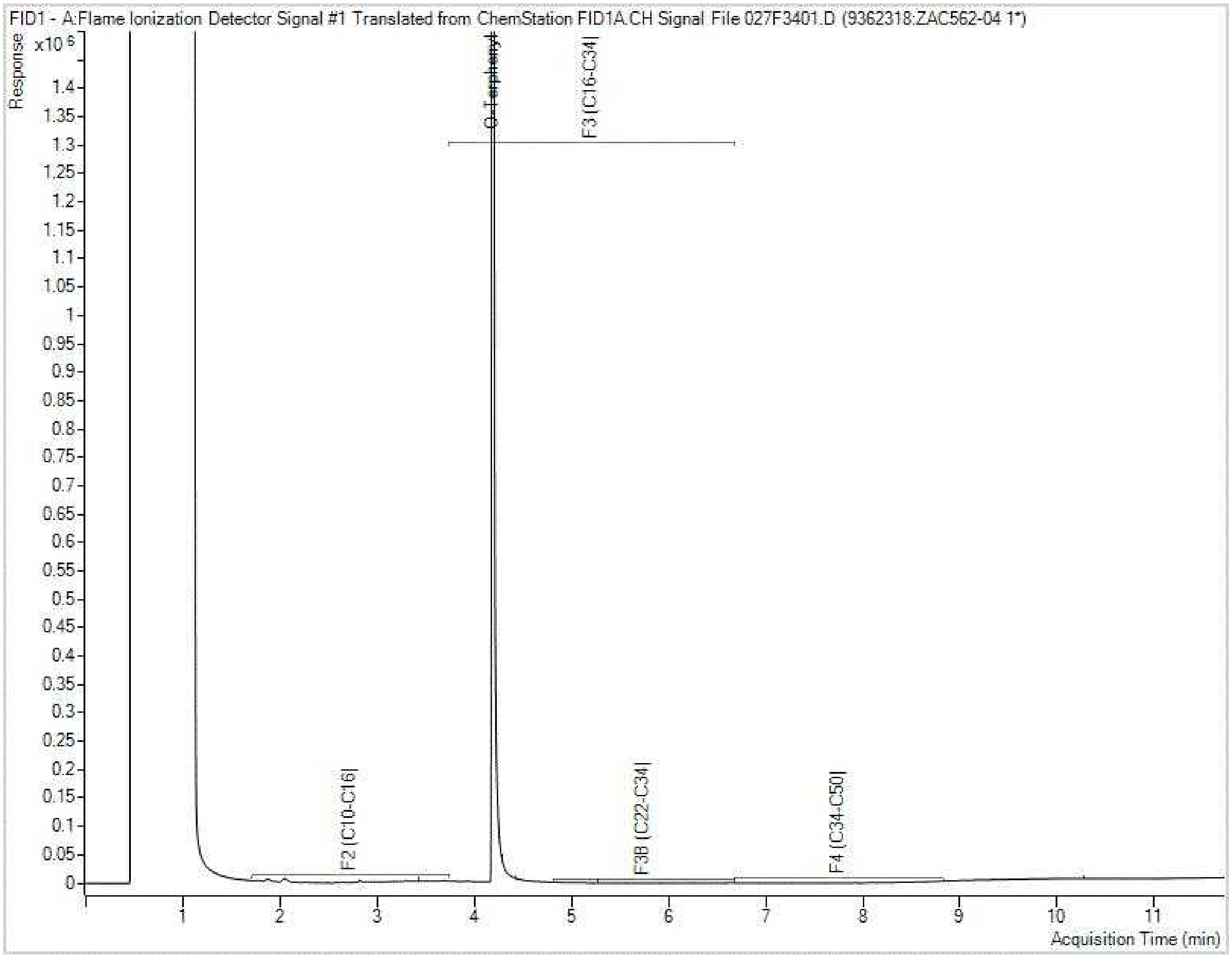


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C5873
Report Date: 2024/05/06
Bureau Veritas Sample: ZAC562

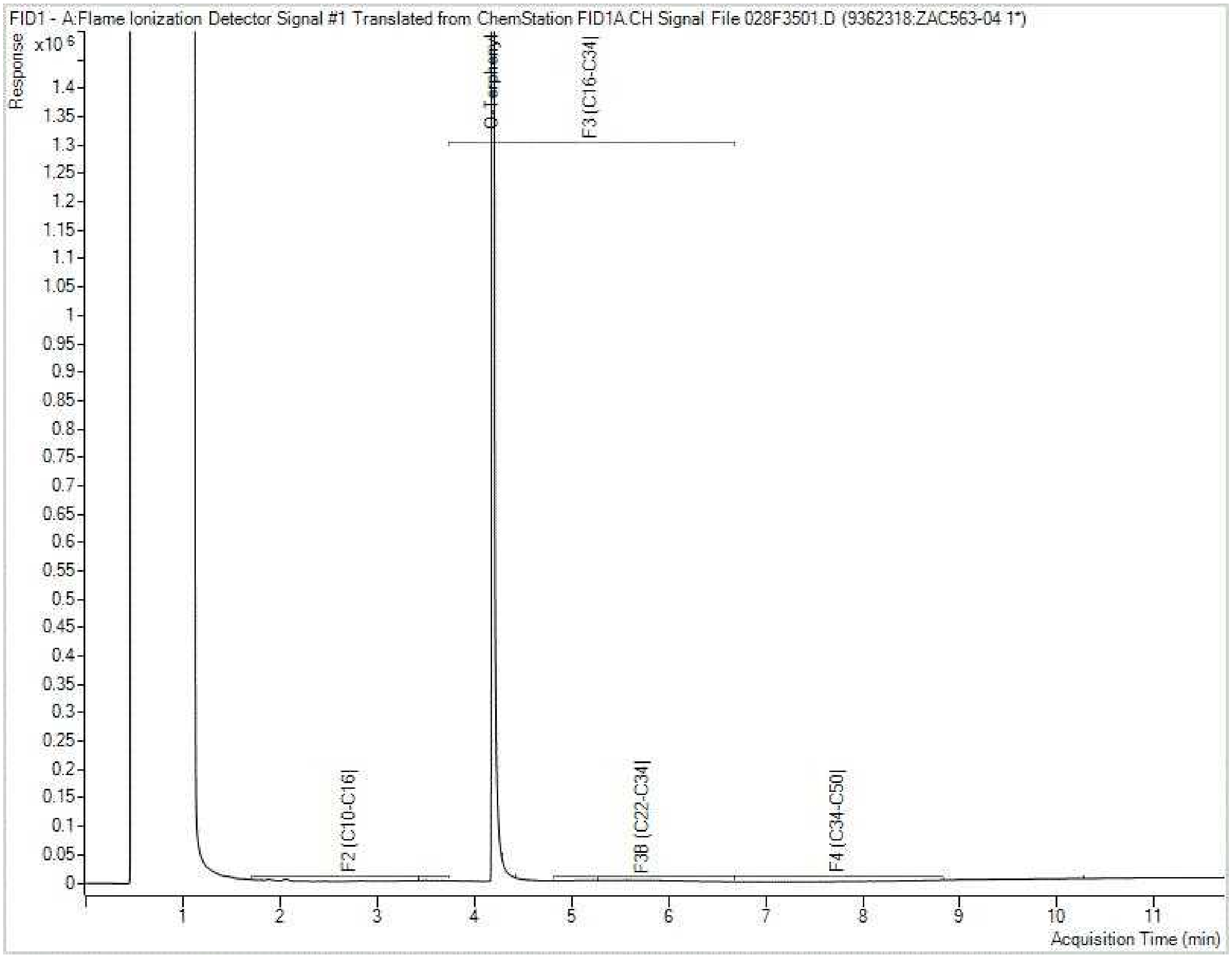
WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON QUARRY
Client ID: MW-IT-05A

**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**

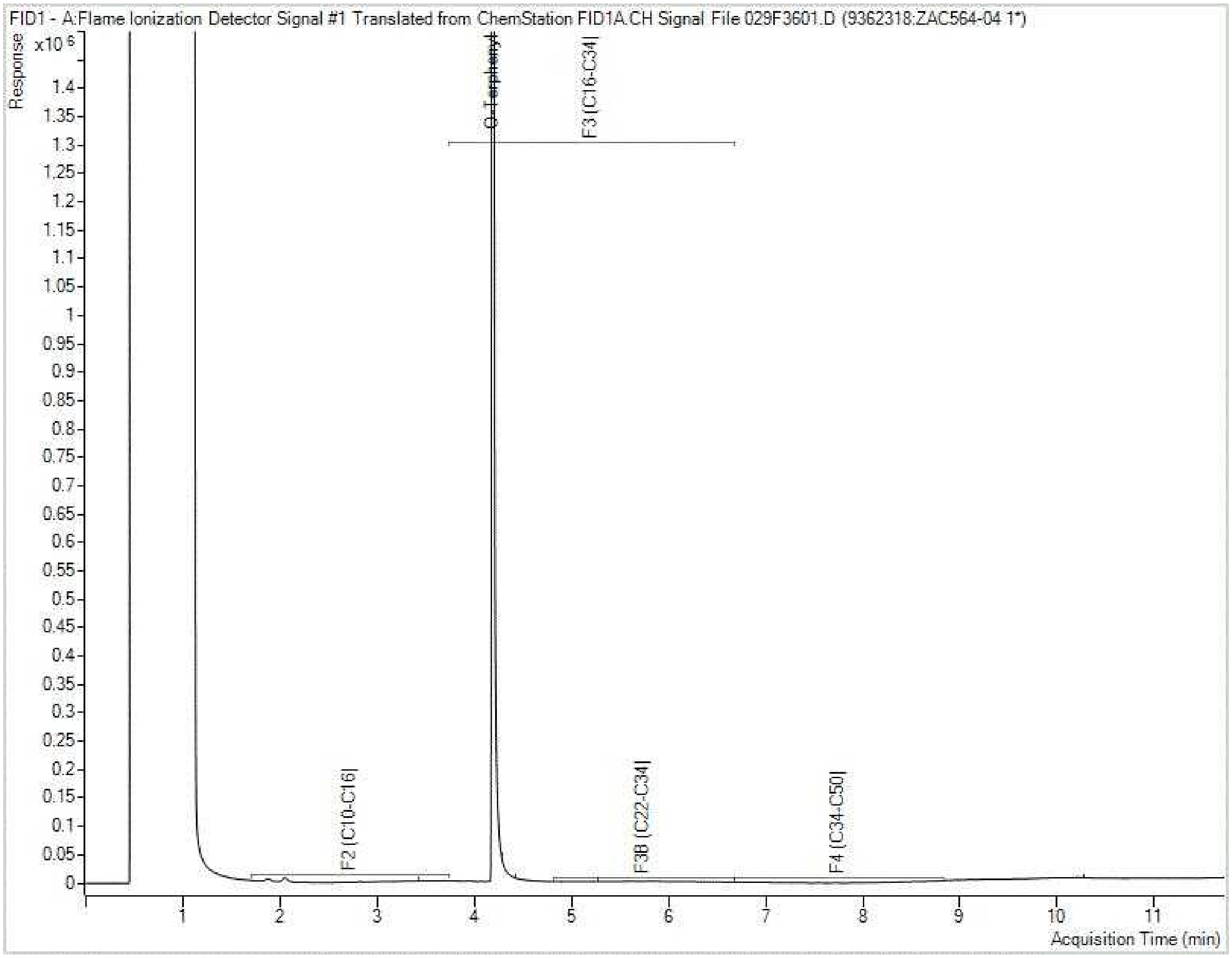


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C5873
Report Date: 2024/05/06
Bureau Veritas Sample: ZAC564

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON QUARRY
Client ID: MW-IT-05C

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

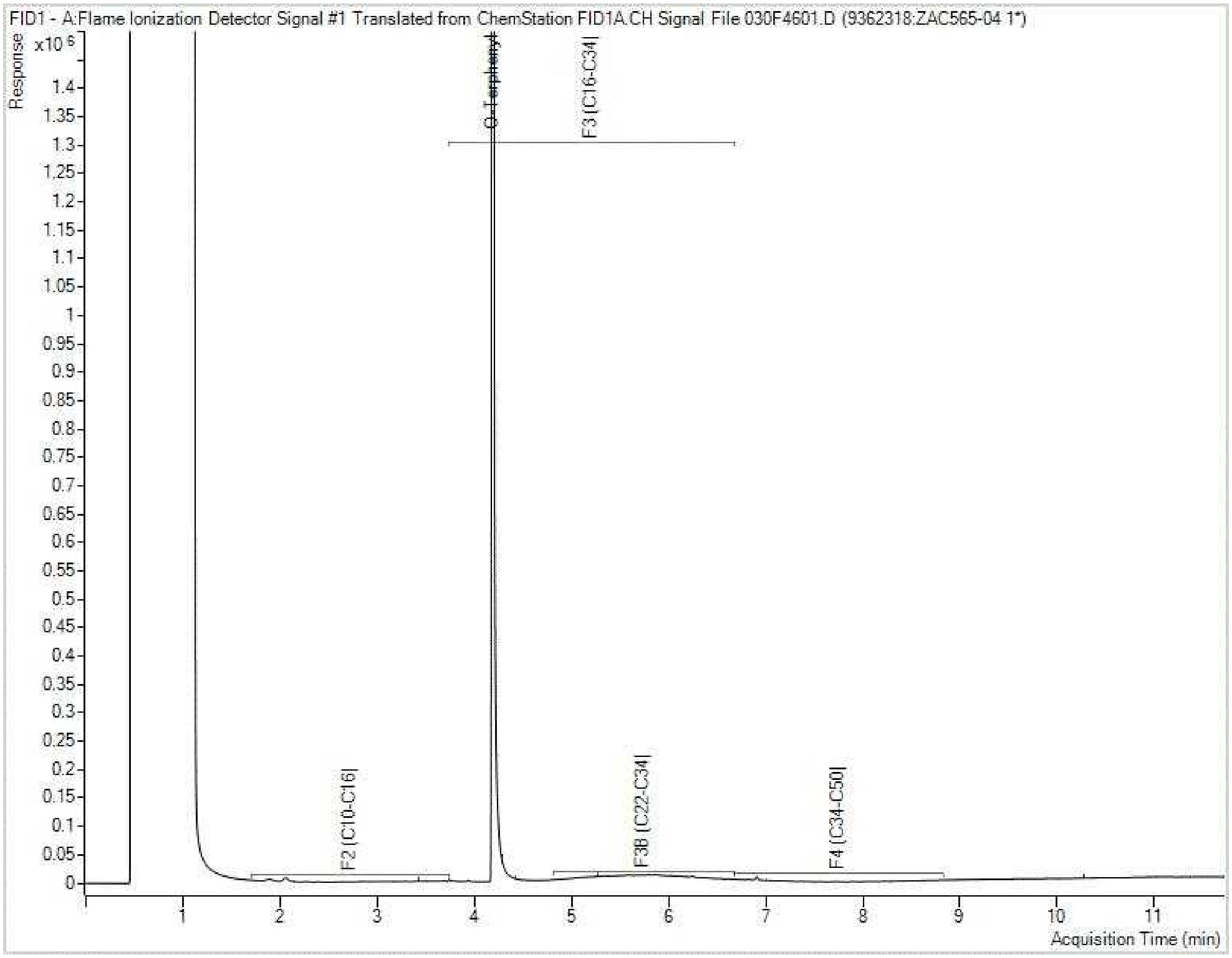


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C5873
Report Date: 2024/05/06
Bureau Veritas Sample: ZAC565

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON QUARRY
Client ID: MW-IT-04A

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

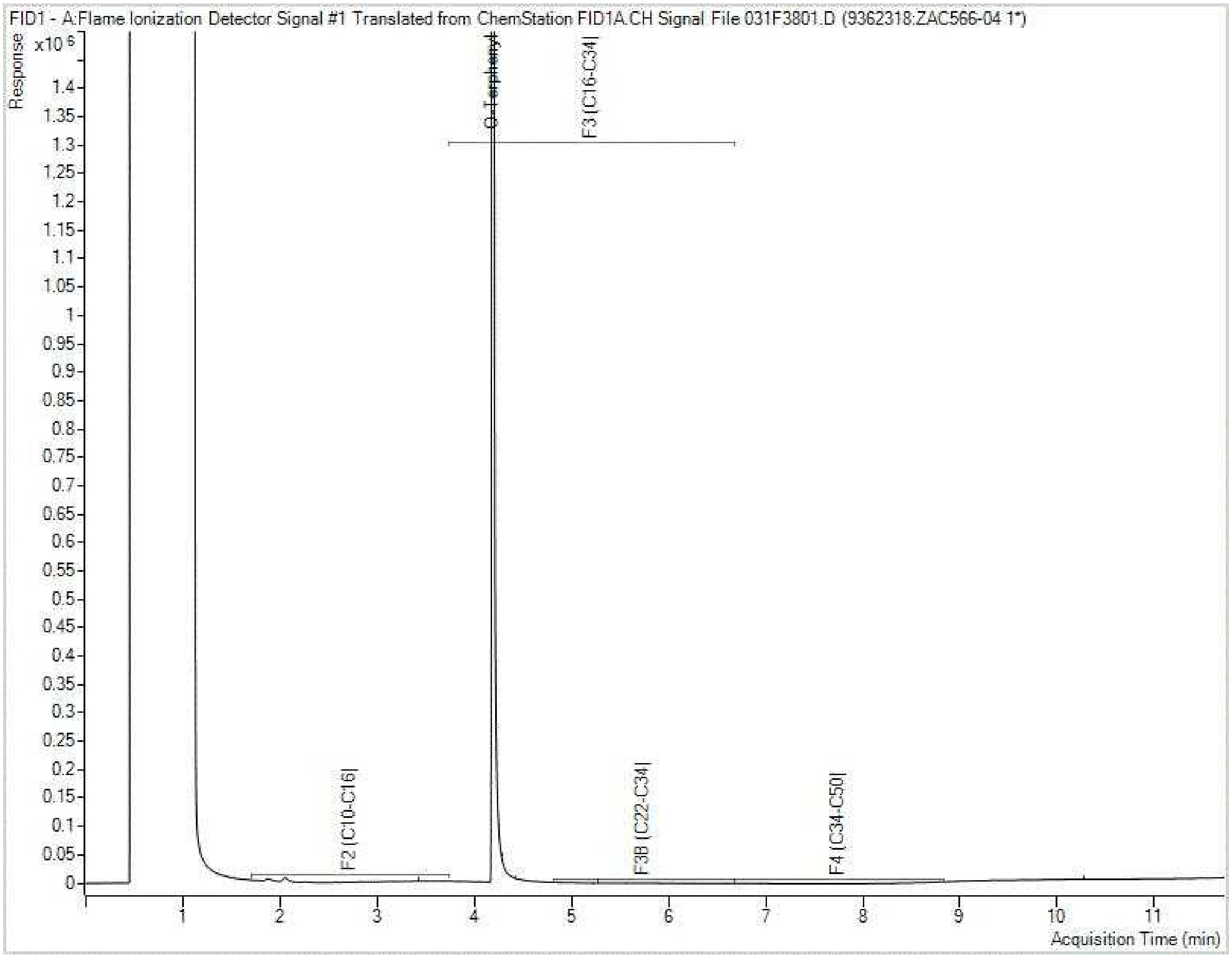


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C5873
Report Date: 2024/05/06
Bureau Veritas Sample: ZAC566

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON QUARRY
Client ID: 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.**

Your Project #: CA-GLD-19129150 (2300)
Site Location: CBM CALEDON
Your C.O.C. #: 987335-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/06**
Report #: R8137528
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4C8240**
**Received: 2024/04/29, 18:30**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Alkalinity | 1 | N/A | 2024/05/05 | CAM SOP-00448 | SM 24 2320 B m |
| Alkalinity | 4 | N/A | 2024/05/06 | CAM SOP-00448 | SM 24 2320 B m |
| Carbonate, Bicarbonate and Hydroxide | 5 | N/A | 2024/05/06 | CAM SOP-00102 | APHA 4500-CO2 D |
| Chloride by Automated Colourimetry | 5 | N/A | 2024/05/02 | CAM SOP-00463 | SM 24 4500-Cl E m |
| Conductivity | 1 | N/A | 2024/05/05 | CAM SOP-00414 | SM 24 2510 m |
| Conductivity | 4 | N/A | 2024/05/06 | CAM SOP-00414 | SM 24 2510 m |
| Dissolved Organic Carbon (DOC) (1) | 5 | N/A | 2024/05/02 | CAM SOP-00446 | SM 24 5310 B m |
| Petroleum Hydro. CCME F1 & BTEX in Water | 5 | N/A | 2024/05/01 | CAM SOP-00315 | CCME PHC-CWS m |
| Petroleum Hydrocarbons F2-F4 in Water (2) | 5 | 2024/05/01 | 2024/05/01 | CAM SOP-00316 | CCME PHC-CWS m |
| Hardness (calculated as CaCO3) | 5 | N/A | 2024/05/03 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Dissolved Metals by ICPMS | 5 | N/A | 2024/05/03 | CAM SOP-00447 | EPA 6020B m |
| Ion Balance (% Difference) | 5 | N/A | 2024/05/06 | | |
| Anion and Cation Sum | 5 | N/A | 2024/05/06 | | |
| Total Ammonia-N | 5 | N/A | 2024/05/05 | CAM SOP-00441 | USGS I-2522-90 m |
| Nitrate & Nitrite as Nitrogen in Water (3) | 5 | N/A | 2024/05/01 | CAM SOP-00440 | SM 24 4500-NO3I/NO2B |
| pH (4) | 1 | 2024/05/01 | 2024/05/05 | CAM SOP-00413 | SM 24th - 4500H+ B |
| pH (4) | 4 | 2024/05/01 | 2024/05/06 | CAM SOP-00413 | SM 24th - 4500H+ B |
| Orthophosphate | 5 | N/A | 2024/05/02 | CAM SOP-00461 | SM 24 4500-P E |
| Sat. pH and Langelier Index (@ 20C) | 5 | N/A | 2024/05/06 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 5 | N/A | 2024/05/06 | | Auto Calc |
| Sulphate by Automated Turbidimetry | 5 | N/A | 2024/05/02 | CAM SOP-00464 | SM 24 4500-SO42- E m |
| Total Dissolved Solids (TDS calc) | 5 | N/A | 2024/05/06 | | 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, EPA, APHA or the Quebec Ministry of Environment.

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

Your Project #: CA-GLD-19129150 (2300)
Site Location: CBM CALEDON
Your C.O.C. #: 987335-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/06**
Report #: R8137528
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4C8240**
**Received: 2024/04/29, 18:30**

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) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Ankita Bhalla, Project Manager
Email: Ankita.Bhalla@bureauveritas.com
Phone# (905) 817-5700
====================================================================
This report has been generated and distributed using a secure automated process.
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 Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Total Cover Pages : 2

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAP561 | | | ZAP561 | | | ZAP562 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/29 14:00 | | | 2024/04/29 14:00 | | | 2024/04/29 15:00 | | |
| **COC Number** | | 987335-01-01 | | | 987335-01-01 | | | 987335-01-01 | | |
| | **UNITS** | **MW-IT-06A** | **RDL** | **QC Batch** | **MW-IT-06A Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-06B** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Anion Sum | me/L | 5.76 | N/A | 9364795 | | | | 6.02 | N/A | 9364796 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 170 | 1.0 | 9364792 | | | | 180 | 1.0 | 9364792 |
| Calculated TDS | mg/L | 340 | 1.0 | 9364802 | | | | 350 | 1.0 | 9364802 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 1.9 | 1.0 | 9364792 | | | | 2.0 | 1.0 | 9364792 |
| Cation Sum | me/L | 6.67 | N/A | 9364795 | | | | 6.59 | N/A | 9364796 |
| Hardness (CaCO3) | mg/L | 290 | 1.0 | 9363516 | | | | 280 | 1.0 | 9363516 |
| Ion Balance (% Difference) | % | 7.30 | N/A | 9364794 | | | | 4.50 | N/A | 9364794 |
| Langelier Index (@ 20C) | N/A | 0.804 | | 9364797 | | | | 0.821 | | 9364797 |
| Langelier Index (@ 4C) | N/A | 0.555 | | 9364799 | | | | 0.572 | | 9364800 |
| Saturation pH (@ 20C) | N/A | 7.28 | | 9364797 | | | | 7.24 | | 9364797 |
| Saturation pH (@ 4C) | N/A | 7.53 | | 9364799 | | | | 7.49 | | 9364800 |
| **Inorganics** | | | | | | | | | | |
| Total Ammonia-N | mg/L | <0.050 | 0.050 | 9368749 | | | | <0.050 | 0.050 | 9368749 |
| Conductivity | umho/cm | 570 | 1.0 | 9367304 | | | | 600 | 1.0 | 9367304 |
| Dissolved Organic Carbon | mg/L | 0.99 | 0.40 | 9367022 | | | | 1.1 | 0.40 | 9367022 |
| Orthophosphate (P) | mg/L | <0.010 | 0.010 | 9367923 | | | | <0.010 | 0.010 | 9367923 |
| pH | pH | 8.08 | | 9367314 | | | | 8.06 | | 9367314 |
| Dissolved Sulphate (SO4) | mg/L | 17 | 1.0 | 9367913 | | | | 13 | 1.0 | 9367913 |
| Alkalinity (Total as CaCO3) | mg/L | 170 | 1.0 | 9367272 | | | | 190 | 1.0 | 9367272 |
| Dissolved Chloride (Cl-) | mg/L | 44 | 1.0 | 9367906 | | | | 45 | 1.0 | 9367906 |
| Nitrite (N) | mg/L | <0.010 | 0.010 | 9366685 | | | | <0.010 | 0.010 | 9366685 |
| Nitrate (N) | mg/L | 10.5 | 0.10 | 9366685 | | | | 10.6 | 0.10 | 9366685 |
| Nitrate + Nitrite (N) | mg/L | 10.5 | 0.10 | 9366685 | | | | 10.6 | 0.10 | 9366685 |
| **Metals** | | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | <4.9 | 4.9 | 9371442 | <4.9 | 4.9 | 9371442 | <4.9 | 4.9 | 9371442 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Arsenic (As) | ug/L | <1.0 | 1.0 | 9371442 | <1.0 | 1.0 | 9371442 | <1.0 | 1.0 | 9371442 |
| Dissolved Barium (Ba) | ug/L | 22 | 2.0 | 9371442 | 22 | 2.0 | 9371442 | 28 | 2.0 | 9371442 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 0.40 | 9371442 | <0.40 | 0.40 | 9371442 | <0.40 | 0.40 | 9371442 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAP561 | | | ZAP561 | | | ZAP562 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/29 14:00 | | | 2024/04/29 14:00 | | | 2024/04/29 15:00 | | |
| **COC Number** | | 987335-01-01 | | | 987335-01-01 | | | 987335-01-01 | | |
| | **UNITS** | **MW-IT-06A** | **RDL** | **QC Batch** | **MW-IT-06A Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-06B** | **RDL** | **QC Batch** |
| Dissolved Boron (B) | ug/L | <10 | 10 | 9371442 | <10 | 10 | 9371442 | <10 | 10 | 9371442 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 0.090 | 9371442 | <0.090 | 0.090 | 9371442 | <0.090 | 0.090 | 9371442 |
| Dissolved Calcium (Ca) | ug/L | 83000 | 200 | 9371442 | 80000 | 200 | 9371442 | 83000 | 200 | 9371442 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 5.0 | 9371442 | <5.0 | 5.0 | 9371442 | <5.0 | 5.0 | 9371442 |
| Dissolved Cobalt (Co) | ug/L | 2.4 | 0.50 | 9371442 | 2.3 | 0.50 | 9371442 | 1.8 | 0.50 | 9371442 |
| Dissolved Copper (Cu) | ug/L | <0.90 | 0.90 | 9371442 | <0.90 | 0.90 | 9371442 | <0.90 | 0.90 | 9371442 |
| Dissolved Iron (Fe) | ug/L | <100 | 100 | 9371442 | <100 | 100 | 9371442 | <100 | 100 | 9371442 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Magnesium (Mg) | ug/L | 19000 | 50 | 9371442 | 19000 | 50 | 9371442 | 17000 | 50 | 9371442 |
| Dissolved Manganese (Mn) | ug/L | 5.9 | 2.0 | 9371442 | 5.8 | 2.0 | 9371442 | 15 | 2.0 | 9371442 |
| Dissolved Molybdenum (Mo) | ug/L | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Nickel (Ni) | ug/L | 2.6 | 1.0 | 9371442 | 2.6 | 1.0 | 9371442 | 1.7 | 1.0 | 9371442 |
| Dissolved Phosphorus (P) | ug/L | <100 | 100 | 9371442 | <100 | 100 | 9371442 | <100 | 100 | 9371442 |
| Dissolved Potassium (K) | ug/L | 1000 | 200 | 9371442 | 1000 | 200 | 9371442 | 940 | 200 | 9371442 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 2.0 | 9371442 | <2.0 | 2.0 | 9371442 | <2.0 | 2.0 | 9371442 |
| Dissolved Silicon (Si) | ug/L | 2500 | 50 | 9371442 | 2400 | 50 | 9371442 | 2500 | 50 | 9371442 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 0.090 | 9371442 | <0.090 | 0.090 | 9371442 | <0.090 | 0.090 | 9371442 |
| Dissolved Sodium (Na) | ug/L | 22000 | 100 | 9371442 | 22000 | 100 | 9371442 | 23000 | 100 | 9371442 |
| Dissolved Strontium (Sr) | ug/L | 130 | 1.0 | 9371442 | 130 | 1.0 | 9371442 | 120 | 1.0 | 9371442 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 0.050 | 9371442 | <0.050 | 0.050 | 9371442 | <0.050 | 0.050 | 9371442 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 5.0 | 9371442 | <5.0 | 5.0 | 9371442 | <5.0 | 5.0 | 9371442 |
| Dissolved Uranium (U) | ug/L | 0.15 | 0.10 | 9371442 | 0.14 | 0.10 | 9371442 | 0.17 | 0.10 | 9371442 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | 5.0 | 9371442 | <5.0 | 5.0 | 9371442 | <5.0 | 5.0 | 9371442 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAP563 | | ZAP564 | | ZAP565 | | |
|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/29 11:15 | | 2024/04/29 12:00 | | 2024/04/29 12:30 | | |
| **COC Number** | | 987335-01-01 | | 987335-01-01 | | 987335-01-01 | | |
| | **UNITS** | **MW-IT-03A** | **QC Batch** | **MW-IT-03B** | **QC Batch** | **MW-IT-03C** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | |
| Anion Sum | me/L | 4.51 | 9364795 | 6.03 | 9364796 | 6.23 | N/A | 9364796 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 170 | 9364792 | 220 | 9364792 | 210 | 1.0 | 9364792 |
| Calculated TDS | mg/L | 260 | 9364802 | 320 | 9364802 | 340 | 1.0 | 9364802 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 2.3 | 9364792 | 3.3 | 9364792 | 1.9 | 1.0 | 9364792 |
| Cation Sum | me/L | 5.48 | 9364795 | 6.35 | 9364796 | 6.81 | N/A | 9364796 |
| Hardness (CaCO3) | mg/L | 260 | 9363516 | 260 | 9363516 | 260 | 1.0 | 9363516 |
| Ion Balance (% Difference) | % | 9.72 | 9364794 | 2.60 | 9364794 | 4.45 | N/A | 9364794 |
| Langelier Index (@ 20C) | N/A | 0.814 | 9364797 | 0.967 | 9364797 | 0.757 | | 9364797 |
| Langelier Index (@ 4C) | N/A | 0.564 | 9364800 | 0.718 | 9364800 | 0.508 | | 9364800 |
| Saturation pH (@ 20C) | N/A | 7.33 | 9364797 | 7.24 | 9364797 | 7.23 | | 9364797 |
| Saturation pH (@ 4C) | N/A | 7.58 | 9364800 | 7.49 | 9364800 | 7.48 | | 9364800 |
| **Inorganics** | | | | | | | | |
| Total Ammonia-N | mg/L | <0.050 | 9368749 | <0.050 | 9368749 | <0.050 | 0.050 | 9368749 |
| Conductivity | umho/cm | 420 | 9367304 | 590 | 9367304 | 640 | 1.0 | 9367187 |
| Dissolved Organic Carbon | mg/L | 0.45 | 9367022 | 2.0 | 9367022 | 2.2 | 0.40 | 9367022 |
| Orthophosphate (P) | mg/L | <0.010 | 9367923 | <0.010 | 9367923 | <0.010 | 0.010 | 9367923 |
| pH | pH | 8.14 | 9367314 | 8.21 | 9367314 | 7.99 | | 9367182 |
| Dissolved Sulphate (SO4) | mg/L | 43 | 9367913 | 15 | 9367913 | 14 | 1.0 | 9367913 |
| Alkalinity (Total as CaCO3) | mg/L | 170 | 9367272 | 220 | 9367272 | 210 | 1.0 | 9367165 |
| Dissolved Chloride (Cl-) | mg/L | 5.0 | 9367906 | 43 | 9367906 | 57 | 1.0 | 9367906 |
| Nitrite (N) | mg/L | <0.010 | 9366685 | <0.010 | 9366685 | <0.010 | 0.010 | 9366685 |
| Nitrate (N) | mg/L | <0.10 | 9366685 | 1.65 | 9366685 | 1.73 | 0.10 | 9366685 |
| Nitrate + Nitrite (N) | mg/L | <0.10 | 9366685 | 1.65 | 9366685 | 1.73 | 0.10 | 9366685 |
| **Metals** | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | 69 | 9371442 | <4.9 | 9371442 | <4.9 | 4.9 | 9371442 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 9371442 | <0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Arsenic (As) | ug/L | 3.7 | 9371442 | <1.0 | 9371442 | <1.0 | 1.0 | 9371442 |
| Dissolved Barium (Ba) | ug/L | 84 | 9371442 | 41 | 9371442 | 30 | 2.0 | 9371442 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 9371442 | <0.40 | 9371442 | <0.40 | 0.40 | 9371442 |
| Dissolved Boron (B) | ug/L | 17 | 9371442 | 12 | 9371442 | <10 | 10 | 9371442 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAP563 | | ZAP564 | | ZAP565 | | |
|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/29 11:15 | | 2024/04/29 12:00 | | 2024/04/29 12:30 | | |
| **COC Number** | | 987335-01-01 | | 987335-01-01 | | 987335-01-01 | | |
| | **UNITS** | **MW-IT-03A** | **QC Batch** | **MW-IT-03B** | **QC Batch** | **MW-IT-03C** | **RDL** | **QC Batch** |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 9371442 | <0.090 | 9371442 | <0.090 | 0.090 | 9371442 |
| Dissolved Calcium (Ca) | ug/L | 68000 | 9371442 | 70000 | 9371442 | 75000 | 200 | 9371442 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 9371442 | <5.0 | 9371442 | <5.0 | 5.0 | 9371442 |
| Dissolved Cobalt (Co) | ug/L | <0.50 | 9371442 | <0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Copper (Cu) | ug/L | 0.91 | 9371442 | 1.1 | 9371442 | 0.97 | 0.90 | 9371442 |
| Dissolved Iron (Fe) | ug/L | <100 | 9371442 | <100 | 9371442 | <100 | 100 | 9371442 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 9371442 | <0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Magnesium (Mg) | ug/L | 23000 | 9371442 | 20000 | 9371442 | 17000 | 50 | 9371442 |
| Dissolved Manganese (Mn) | ug/L | 29 | 9371442 | 10 | 9371442 | <2.0 | 2.0 | 9371442 |
| Dissolved Molybdenum (Mo) | ug/L | 2.1 | 9371442 | 5.8 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Nickel (Ni) | ug/L | 1.4 | 9371442 | <1.0 | 9371442 | <1.0 | 1.0 | 9371442 |
| Dissolved Phosphorus (P) | ug/L | <100 | 9371442 | <100 | 9371442 | <100 | 100 | 9371442 |
| Dissolved Potassium (K) | ug/L | 1100 | 9371442 | 1300 | 9371442 | 1300 | 200 | 9371442 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 9371442 | <2.0 | 9371442 | <2.0 | 2.0 | 9371442 |
| Dissolved Silicon (Si) | ug/L | 3900 | 9371442 | 2600 | 9371442 | 2600 | 50 | 9371442 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 9371442 | <0.090 | 9371442 | <0.090 | 0.090 | 9371442 |
| Dissolved Sodium (Na) | ug/L | 3600 | 9371442 | 28000 | 9371442 | 38000 | 100 | 9371442 |
| Dissolved Strontium (Sr) | ug/L | 690 | 9371442 | 140 | 9371442 | 140 | 1.0 | 9371442 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 9371442 | <0.050 | 9371442 | <0.050 | 0.050 | 9371442 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 9371442 | <5.0 | 9371442 | <5.0 | 5.0 | 9371442 |
| Dissolved Uranium (U) | ug/L | 0.57 | 9371442 | 0.47 | 9371442 | 0.27 | 0.10 | 9371442 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 9371442 | <0.50 | 9371442 | <0.50 | 0.50 | 9371442 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | 9371442 | <5.0 | 9371442 | <5.0 | 5.0 | 9371442 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAP565 | | |
|---|---|---|---|---|
| **Sampling Date** | | 2024/04/29 12:30 | | |
| **COC Number** | | 987335-01-01 | | |
| | **UNITS** | **MW-IT-03C Lab-Dup** | **RDL** | **QC Batch** |
| **Inorganics** | | | | |
| Conductivity | umho/cm | 640 | 1.0 | 9367187 |
| Orthophosphate (P) | mg/L | <0.010 | 0.010 | 9367923 |
| pH | pH | 8.11 | | 9367182 |
| Dissolved Sulphate (SO4) | mg/L | 14 | 1.0 | 9367913 |
| Alkalinity (Total as CaCO3) | mg/L | 210 | 1.0 | 9367165 |
| Dissolved Chloride (Cl-) | mg/L | 56 | 1.0 | 9367906 |

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

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

| **Bureau Veritas ID** | | ZAP561 | ZAP562 | | | ZAP562 | | | ZAP563 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/29 14:00 | 2024/04/29 15:00 | | | 2024/04/29 15:00 | | | 2024/04/29 11:15 | | |
| **COC Number** | | 987335-01-01 | 987335-01-01 | | | 987335-01-01 | | | 987335-01-01 | | |
| | **UNITS** | **MW-IT-06A** | **MW-IT-06B** | **RDL** | **QC Batch** | **MW-IT-06B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-03A** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | | | | | | | | |
| Benzene | ug/L | <0.20 | <0.20 | 0.20 | 9365952 | <0.20 | 0.20 | 9365952 | <0.20 | 0.20 | 9365952 |
| Toluene | ug/L | 0.97 | <0.20 | 0.20 | 9365952 | <0.20 | 0.20 | 9365952 | 8.1 | 0.20 | 9365952 |
| Ethylbenzene | ug/L | <0.20 | <0.20 | 0.20 | 9365952 | <0.20 | 0.20 | 9365952 | <0.20 | 0.20 | 9365952 |
| o-Xylene | ug/L | <0.20 | <0.20 | 0.20 | 9365952 | <0.20 | 0.20 | 9365952 | <0.20 | 0.20 | 9365952 |
| p+m-Xylene | ug/L | <0.40 | <0.40 | 0.40 | 9365952 | <0.40 | 0.40 | 9365952 | <0.40 | 0.40 | 9365952 |
| Total Xylenes | ug/L | <0.40 | <0.40 | 0.40 | 9365952 | <0.40 | 0.40 | 9365952 | <0.40 | 0.40 | 9365952 |
| F1 (C6-C10) | ug/L | <25 | <25 | 25 | 9365952 | <25 | 25 | 9365952 | 25 | 25 | 9365952 |
| F1 (C6-C10) - BTEX | ug/L | <25 | <25 | 25 | 9365952 | <25 | 25 | 9365952 | <25 | 25 | 9365952 |
| **F2-F4 Hydrocarbons** | | | | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | <100 | <100 | 100 | 9365911 | | | | <100 | 100 | 9365911 |
| F3 (C16-C34 Hydrocarbons) | ug/L | <200 | <200 | 200 | 9365911 | | | | <200 | 200 | 9365911 |
| F4 (C34-C50 Hydrocarbons) | ug/L | <200 | <200 | 200 | 9365911 | | | | <200 | 200 | 9365911 |
| Reached Baseline at C50 | ug/L | Yes | Yes | | 9365911 | | | | Yes | | 9365911 |
| **Surrogate Recovery (%)** | | | | | | | | | | | |
| 1,4-Difluorobenzene | % | 102 | 104 | | 9365952 | 104 | | 9365952 | 103 | | 9365952 |
| 4-Bromofluorobenzene | % | 96 | 100 | | 9365952 | 100 | | 9365952 | 96 | | 9365952 |
| D10-o-Xylene | % | 99 | 102 | | 9365952 | 104 | | 9365952 | 103 | | 9365952 |
| D4-1,2-Dichloroethane | % | 114 | 112 | | 9365952 | 113 | | 9365952 | 114 | | 9365952 |
| o-Terphenyl | % | 95 | 93 | | 9365911 | | | | 98 | | 9365911 |

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

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

| **Bureau Veritas ID** | | ZAP564 | ZAP565 | | |
|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/29 12:00 | 2024/04/29 12:30 | | |
| **COC Number** | | 987335-01-01 | 987335-01-01 | | |
| | **UNITS** | **MW-IT-03B** | **MW-IT-03C** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | | |
| Benzene | ug/L | <0.20 | <0.20 | 0.20 | 9365952 |
| Toluene | ug/L | <0.20 | <0.20 | 0.20 | 9365952 |
| Ethylbenzene | ug/L | <0.20 | <0.20 | 0.20 | 9365952 |
| o-Xylene | ug/L | <0.20 | <0.20 | 0.20 | 9365952 |
| p+m-Xylene | ug/L | <0.40 | <0.40 | 0.40 | 9365952 |
| Total Xylenes | ug/L | <0.40 | <0.40 | 0.40 | 9365952 |
| F1 (C6-C10) | ug/L | <25 | <25 | 25 | 9365952 |
| F1 (C6-C10) - BTEX | ug/L | <25 | <25 | 25 | 9365952 |
| **F2-F4 Hydrocarbons** | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | <100 | <100 | 100 | 9365911 |
| F3 (C16-C34 Hydrocarbons) | ug/L | <200 | <200 | 200 | 9365911 |
| F4 (C34-C50 Hydrocarbons) | ug/L | <200 | <200 | 200 | 9365911 |
| Reached Baseline at C50 | ug/L | Yes | Yes | | 9365911 |
| **Surrogate Recovery (%)** | | | | | |
| 1,4-Difluorobenzene | % | 103 | 104 | | 9365952 |
| 4-Bromofluorobenzene | % | 96 | 99 | | 9365952 |
| D10-o-Xylene | % | 100 | 102 | | 9365952 |
| D4-1,2-Dichloroethane | % | 115 | 111 | | 9365952 |
| o-Terphenyl | % | 94 | 96 | | 9365911 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

## TEST SUMMARY

**Bureau Veritas ID:** ZAP561
**Sample ID:** MW-IT-06A
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9367272 | N/A | 2024/05/06 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9364792 | N/A | 2024/05/06 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9367906 | N/A | 2024/05/02 | Massarat Jan |
| Conductivity | AT | 9367304 | N/A | 2024/05/06 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9367022 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9365952 | N/A | 2024/05/01 | Haibin Wu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9365911 | 2024/05/01 | 2024/05/01 | Jeevaraj Jeevaratrnam |
| Hardness (calculated as CaCO3) | | 9363516 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9364794 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9364795 | N/A | 2024/05/06 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9368749 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9366685 | N/A | 2024/05/01 | Samuel Law |
| pH | AT | 9367314 | 2024/05/01 | 2024/05/06 | Surinder Rai |
| Orthophosphate | KONE | 9367923 | N/A | 2024/05/02 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9364797 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9364799 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9367913 | N/A | 2024/05/02 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9364802 | N/A | 2024/05/06 | Automated Statchk |

**Bureau Veritas ID:** ZAP561 Dup
**Sample ID:** MW-IT-06A
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |

**Bureau Veritas ID:** ZAP562
**Sample ID:** MW-IT-06B
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9367272 | N/A | 2024/05/06 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9364792 | N/A | 2024/05/06 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9367906 | N/A | 2024/05/02 | Massarat Jan |
| Conductivity | AT | 9367304 | N/A | 2024/05/06 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9367022 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9365952 | N/A | 2024/05/01 | Haibin Wu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9365911 | 2024/05/01 | 2024/05/01 | Jeevaraj Jeevaratrnam |
| Hardness (calculated as CaCO3) | | 9363516 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9364794 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9364796 | N/A | 2024/05/06 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9368749 | N/A | 2024/05/05 | Yogesh Patel |

## TEST SUMMARY

**Bureau Veritas ID:** ZAP562
**Sample ID:** MW-IT-06B
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9366685 | N/A | 2024/05/01 | Samuel Law |
| pH | AT | 9367314 | 2024/05/01 | 2024/05/06 | Surinder Rai |
| Orthophosphate | KONE | 9367923 | N/A | 2024/05/02 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9364797 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9364800 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9367913 | N/A | 2024/05/02 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9364802 | N/A | 2024/05/06 | Automated Statchk |

**Bureau Veritas ID:** ZAP562 Dup
**Sample ID:** MW-IT-06B
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9365952 | N/A | 2024/05/01 | Haibin Wu |

**Bureau Veritas ID:** ZAP563
**Sample ID:** MW-IT-03A
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9367272 | N/A | 2024/05/06 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9364792 | N/A | 2024/05/06 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9367906 | N/A | 2024/05/02 | Massarat Jan |
| Conductivity | AT | 9367304 | N/A | 2024/05/06 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9367022 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9365952 | N/A | 2024/05/01 | Haibin Wu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9365911 | 2024/05/01 | 2024/05/01 | Jeevaraj Jeevaratrnam |
| Hardness (calculated as CaCO3) |  | 9363516 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9364794 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9364795 | N/A | 2024/05/06 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9368749 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9366685 | N/A | 2024/05/01 | Samuel Law |
| pH | AT | 9367314 | 2024/05/01 | 2024/05/06 | Surinder Rai |
| Orthophosphate | KONE | 9367923 | N/A | 2024/05/02 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9364797 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9364800 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9367913 | N/A | 2024/05/02 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9364802 | N/A | 2024/05/06 | Automated Statchk |

## TEST SUMMARY

**Bureau Veritas ID:** ZAP564
**Sample ID:** MW-IT-03B
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9367272 | N/A | 2024/05/06 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9364792 | N/A | 2024/05/06 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9367906 | N/A | 2024/05/02 | Massarat Jan |
| Conductivity | AT | 9367304 | N/A | 2024/05/06 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9367022 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9365952 | N/A | 2024/05/01 | Haibin Wu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9365911 | 2024/05/01 | 2024/05/01 | Jeevaraj Jeevaratrnam |
| Hardness (calculated as CaCO3) | | 9363516 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9364794 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9364796 | N/A | 2024/05/06 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9368749 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9366685 | N/A | 2024/05/01 | Samuel Law |
| pH | AT | 9367314 | 2024/05/01 | 2024/05/06 | Surinder Rai |
| Orthophosphate | KONE | 9367923 | N/A | 2024/05/02 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9364797 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9364800 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9367913 | N/A | 2024/05/02 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9364802 | N/A | 2024/05/06 | Automated Statchk |

**Bureau Veritas ID:** ZAP565
**Sample ID:** MW-IT-03C
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9367165 | N/A | 2024/05/05 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9364792 | N/A | 2024/05/06 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9367906 | N/A | 2024/05/02 | Massarat Jan |
| Conductivity | AT | 9367187 | N/A | 2024/05/05 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9367022 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9365952 | N/A | 2024/05/01 | Haibin Wu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9365911 | 2024/05/01 | 2024/05/01 | Jeevaraj Jeevaratrnam |
| Hardness (calculated as CaCO3) | | 9363516 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9364794 | N/A | 2024/05/06 | Automated Statchk |
| Anion and Cation Sum | CALC | 9364796 | N/A | 2024/05/06 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9368749 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9366685 | N/A | 2024/05/01 | Samuel Law |
| pH | AT | 9367182 | 2024/05/01 | 2024/05/05 | Surinder Rai |
| Orthophosphate | KONE | 9367923 | N/A | 2024/05/02 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9364797 | N/A | 2024/05/06 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9364800 | N/A | 2024/05/06 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9367913 | N/A | 2024/05/02 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9364802 | N/A | 2024/05/06 | Automated Statchk |

## TEST SUMMARY

**Bureau Veritas ID:** ZAP565 Dup
**Sample ID:** MW-IT-03C
**Matrix:** Water

**Collected:** 2024/04/29
**Shipped:**
**Received:** 2024/04/29

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9367165 | N/A | 2024/05/05 | Surinder Rai |
| Chloride by Automated Colourimetry | SKAL | 9367906 | N/A | 2024/05/02 | Massarat Jan |
| Conductivity | AT | 9367187 | N/A | 2024/05/05 | Surinder Rai |
| pH | AT | 9367182 | 2024/05/01 | 2024/05/05 | Surinder Rai |
| Orthophosphate | KONE | 9367923 | N/A | 2024/05/02 | Massarat Jan |
| Sulphate by Automated Turbidimetry | SKAL | 9367913 | N/A | 2024/05/02 | Massarat Jan |

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 5.3°C |

**Results relate only to the items tested.**

# 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 |
| 9365911 | o-Terphenyl | 2024/05/01 | 98 | 60 - 130 | 98 | 60 - 130 | 101 | % | | |
| 9365952 | 1,4-Difluorobenzene | 2024/05/01 | 98 | 70 - 130 | 100 | 70 - 130 | 102 | % | | |
| 9365952 | 4-Bromofluorobenzene | 2024/05/01 | 105 | 70 - 130 | 103 | 70 - 130 | 100 | % | | |
| 9365952 | D10-o-Xylene | 2024/05/01 | 101 | 70 - 130 | 111 | 70 - 130 | 101 | % | | |
| 9365952 | D4-1,2-Dichloroethane | 2024/05/01 | 110 | 70 - 130 | 109 | 70 - 130 | 113 | % | | |
| 9365911 | F2 (C10-C16 Hydrocarbons) | 2024/05/01 | 95 | 60 - 130 | 93 | 60 - 130 | <100 | ug/L | NC | 30 |
| 9365911 | F3 (C16-C34 Hydrocarbons) | 2024/05/01 | 96 | 60 - 130 | 98 | 60 - 130 | <200 | ug/L | NC | 30 |
| 9365911 | F4 (C34-C50 Hydrocarbons) | 2024/05/01 | 89 | 60 - 130 | 89 | 60 - 130 | <200 | ug/L | NC | 30 |
| 9365952 | Benzene | 2024/05/01 | 94 | 50 - 140 | 104 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9365952 | Ethylbenzene | 2024/05/01 | 89 | 50 - 140 | 99 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9365952 | F1 (C6-C10) - BTEX | 2024/05/01 | | | | | <25 | ug/L | NC | 30 |
| 9365952 | F1 (C6-C10) | 2024/05/01 | 100 | 60 - 140 | 112 | 60 - 140 | <25 | ug/L | NC | 30 |
| 9365952 | o-Xylene | 2024/05/01 | 92 | 50 - 140 | 101 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9365952 | p+m-Xylene | 2024/05/01 | 87 | 50 - 140 | 96 | 50 - 140 | <0.40 | ug/L | NC | 30 |
| 9365952 | Toluene | 2024/05/01 | 85 | 50 - 140 | 93 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9365952 | Total Xylenes | 2024/05/01 | | | | | <0.40 | ug/L | NC | 30 |
| 9366685 | Nitrate (N) | 2024/05/01 | NC | 80 - 120 | 98 | 80 - 120 | <0.10 | mg/L | 2.6 | 20 |
| 9366685 | Nitrite (N) | 2024/05/01 | NC | 80 - 120 | 102 | 80 - 120 | <0.010 | mg/L | 0.075 | 20 |
| 9367022 | Dissolved Organic Carbon | 2024/05/02 | 96 | 80 - 120 | 100 | 80 - 120 | <0.40 | mg/L | 1.4 | 20 |
| 9367165 | Alkalinity (Total as CaCO3) | 2024/05/05 | | | 100 | 85 - 115 | <1.0 | mg/L | 1.8 | 20 |
| 9367182 | pH | 2024/05/05 | | | 102 | 98 - 103 | | | 1.6 | N/A |
| 9367187 | Conductivity | 2024/05/05 | | | 101 | 85 - 115 | <1.0 | umho/cm | 0.49 | 10 |
| 9367272 | Alkalinity (Total as CaCO3) | 2024/05/06 | | | 103 | 85 - 115 | <1.0 | mg/L | 1.5 | 20 |
| 9367304 | Conductivity | 2024/05/06 | | | 101 | 85 - 115 | <1.0 | umho/cm | 0.95 | 10 |
| 9367314 | pH | 2024/05/06 | | | 102 | 98 - 103 | | | 1.3 | N/A |
| 9367906 | Dissolved Chloride (Cl-) | 2024/05/02 | NC | 80 - 120 | 100 | 80 - 120 | <1.0 | mg/L | 1.3 | 20 |
| 9367913 | Dissolved Sulphate (SO4) | 2024/05/02 | 96 | 75 - 125 | 99 | 80 - 120 | <1.0 | mg/L | 0.37 | 20 |
| 9367923 | Orthophosphate (P) | 2024/05/02 | 97 | 75 - 125 | 98 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 9368749 | Total Ammonia-N | 2024/05/05 | NC | 75 - 125 | 103 | 80 - 120 | <0.050 | mg/L | 0.75 | 20 |
| 9371442 | Dissolved Aluminum (Al) | 2024/05/03 | 105 | 80 - 120 | 101 | 80 - 120 | <4.9 | ug/L | NC | 20 |
| 9371442 | Dissolved Antimony (Sb) | 2024/05/03 | 110 | 80 - 120 | 105 | 80 - 120 | <0.50 | ug/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 |
| 9371442 | Dissolved Arsenic (As) | 2024/05/03 | 106 | 80 - 120 | 100 | 80 - 120 | <1.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Barium (Ba) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <2.0 | ug/L | 0.43 | 20 |
| 9371442 | Dissolved Beryllium (Be) | 2024/05/03 | 107 | 80 - 120 | 99 | 80 - 120 | <0.40 | ug/L | NC | 20 |
| 9371442 | Dissolved Boron (B) | 2024/05/03 | 104 | 80 - 120 | 96 | 80 - 120 | <10 | ug/L | NC | 20 |
| 9371442 | Dissolved Cadmium (Cd) | 2024/05/03 | 106 | 80 - 120 | 101 | 80 - 120 | <0.090 | ug/L | NC | 20 |
| 9371442 | Dissolved Calcium (Ca) | 2024/05/03 | NC | 80 - 120 | 103 | 80 - 120 | <200 | ug/L | 3.5 | 20 |
| 9371442 | Dissolved Chromium (Cr) | 2024/05/03 | 105 | 80 - 120 | 100 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Cobalt (Co) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <0.50 | ug/L | 2.6 | 20 |
| 9371442 | Dissolved Copper (Cu) | 2024/05/03 | 107 | 80 - 120 | 103 | 80 - 120 | <0.90 | ug/L | NC | 20 |
| 9371442 | Dissolved Iron (Fe) | 2024/05/03 | 107 | 80 - 120 | 103 | 80 - 120 | <100 | ug/L | NC | 20 |
| 9371442 | Dissolved Lead (Pb) | 2024/05/03 | 104 | 80 - 120 | 101 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9371442 | Dissolved Magnesium (Mg) | 2024/05/03 | 104 | 80 - 120 | 101 | 80 - 120 | <50 | ug/L | 1.0 | 20 |
| 9371442 | Dissolved Manganese (Mn) | 2024/05/03 | 105 | 80 - 120 | 100 | 80 - 120 | <2.0 | ug/L | 1.8 | 20 |
| 9371442 | Dissolved Molybdenum (Mo) | 2024/05/03 | 111 | 80 - 120 | 106 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9371442 | Dissolved Nickel (Ni) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <1.0 | ug/L | 0.11 | 20 |
| 9371442 | Dissolved Phosphorus (P) | 2024/05/03 | 110 | 80 - 120 | 101 | 80 - 120 | <100 | ug/L | NC | 20 |
| 9371442 | Dissolved Potassium (K) | 2024/05/03 | 108 | 80 - 120 | 103 | 80 - 120 | <200 | ug/L | 0.45 | 20 |
| 9371442 | Dissolved Selenium (Se) | 2024/05/03 | 106 | 80 - 120 | 102 | 80 - 120 | <2.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Silicon (Si) | 2024/05/03 | 106 | 80 - 120 | 102 | 80 - 120 | <50 | ug/L | 2.6 | 20 |
| 9371442 | Dissolved Silver (Ag) | 2024/05/03 | 107 | 80 - 120 | 104 | 80 - 120 | <0.090 | ug/L | NC | 20 |
| 9371442 | Dissolved Sodium (Na) | 2024/05/03 | 105 | 80 - 120 | 102 | 80 - 120 | <100 | ug/L | 0.47 | 20 |
| 9371442 | Dissolved Strontium (Sr) | 2024/05/03 | 106 | 80 - 120 | 101 | 80 - 120 | <1.0 | ug/L | 0.51 | 20 |
| 9371442 | Dissolved Thallium (Tl) | 2024/05/03 | 105 | 80 - 120 | 102 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| 9371442 | Dissolved Titanium (Ti) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Uranium (U) | 2024/05/03 | 105 | 80 - 120 | 102 | 80 - 120 | <0.10 | ug/L | 5.6 | 20 |
| 9371442 | Dissolved Vanadium (V) | 2024/05/03 | 107 | 80 - 120 | 101 | 80 - 120 | <0.50 | ug/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** |
| 9371442 | Dissolved Zinc (Zn) | 2024/05/03 | 106 | 80 - 120 | 101 | 80 - 120 | <5.0 | ug/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).

## VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Senior Scientific Specialist

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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 Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

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

NONT-2024-04-2918

Page 1 of 3

**INVOICE TO:**

Company Name: #21375 WSP Canada Inc.
Attention: George Schneider
Address: 210 Sheldon Drive
Cambridge ON N1T 1A8
Tel: (519) 620-8182 Fax:
Email: George_Schneider@golder.com

**REPORT TO:**

Company Name:
Attention: Paul Menkveld
Address:
Tel: Fax:
Email: paul.menkveld@wsp.com

**PROJECT INFORMATION:**

Quotation #: C41059
P.O. #:
Project: CA-GLD-19129150 (2300)
Project Name: CBM Caledon
Site #:
Sampled By: VP / RN

**Bottle Order #:** 987335

**COC #:** C#987335-01-01

**Project Manager:** Ankita Bhalla

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 ______

**Special Instructions**

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

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, BTEX/F1-F4 | # of Bottles | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | ~~MW-IT-01A~~ MW-IT-06A | 24/04/29 | 14:00 | GW | ✓ | ✓ | ✓ | 8 | |
| 2 | | ~~MW-IT-01B~~ MW-IT-06B | 24/04/29 | 15:00 | GW | ✓ | ✓ | ✓ | 8 | * All dissolved metals (Red) Field Filtered * |
| 3 | | ~~MW-IT-01C~~ | | | | | | | | |
| 4 | | ~~MW-IT-02A~~ | | | | | | | | |
| 5 | | ~~MW-IT-02B~~ | | | | | | | | |
| 6 | | ~~MW-IT-02C~~ | | | | | | | | |
| 7 | | MW-IT-03A | 24/04/29 | 11:15 | GW | ✓ | ✓ | ✓ | 8 | |
| 8 | | MW-IT-03B | 24/04/29 | 12:00 | GW | ✓ | ✓ | ✓ | 8 | |
| 9 | | MW-IT-03C | 24/04/29 | 12:30 | GW | ✓ | ✓ | ✓ | 8 | |
| 10 | | ~~MW-IT-04A~~ | | | | | | | | |

| * RELINQUISHED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | RECEIVED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | # jars used and not submitted |
|---|---|---|---|---|---|---|
| Ramin Vikram | 24/4/29 | 18:30 | SUGAR SALVANI | 2024/04/29 | 18:30 | |
| | | | | | | |

**Laboratory Use Only**

| Time Sensitive | Temperature (°C) on Recei | Custody Seal | Yes | No |
|---|---|---|---|---|
| | 4 / 5 / 7 | 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.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-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.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.

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

White: Bureau Veritas Yellow: Client

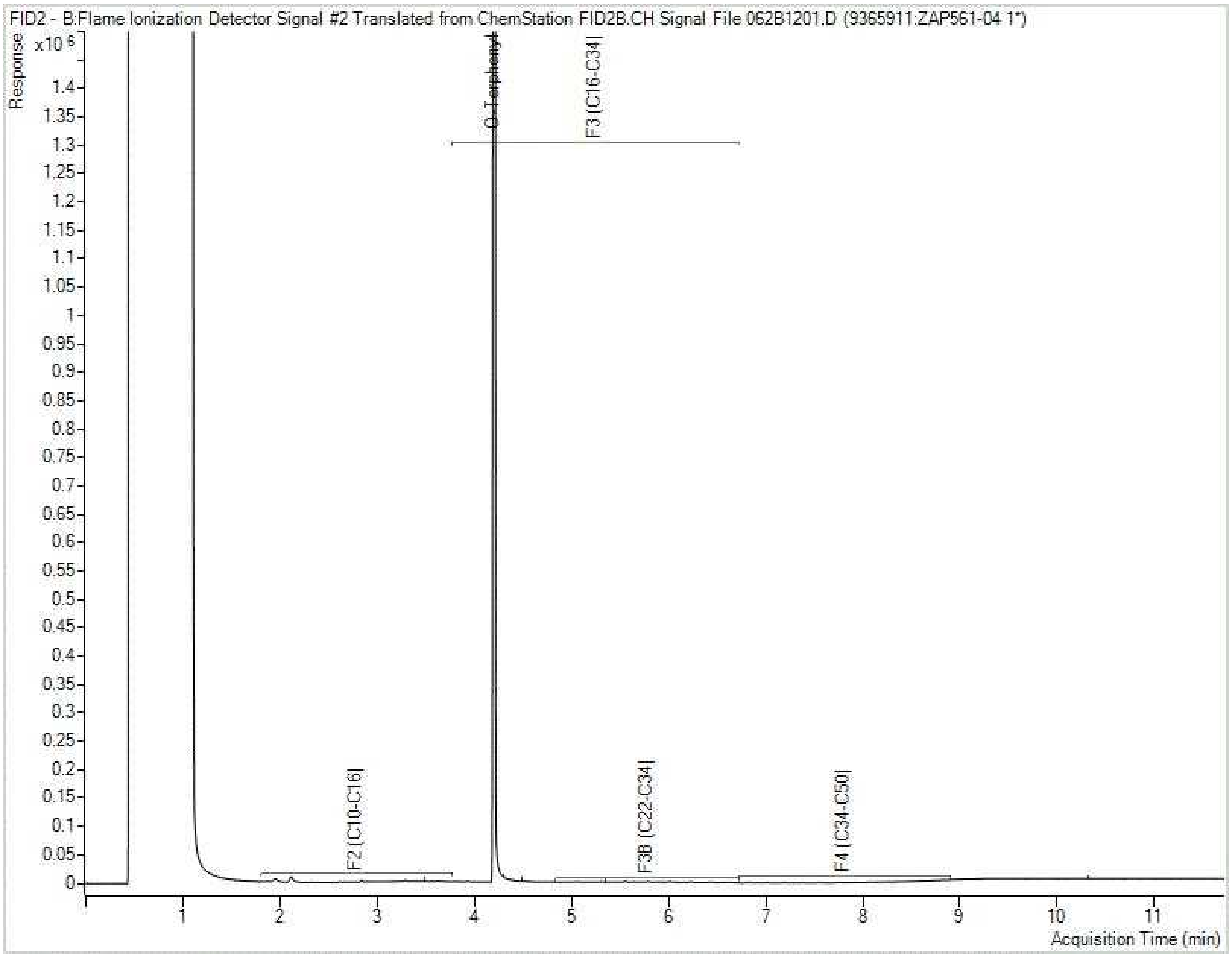
ON ICE

Bureau Veritas Canada (2019) Inc.

Bureau Veritas Job #: C4C8240
Report Date: 2024/05/06
Bureau Veritas Sample: ZAP561

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON
Client ID: MW-IT-06A

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

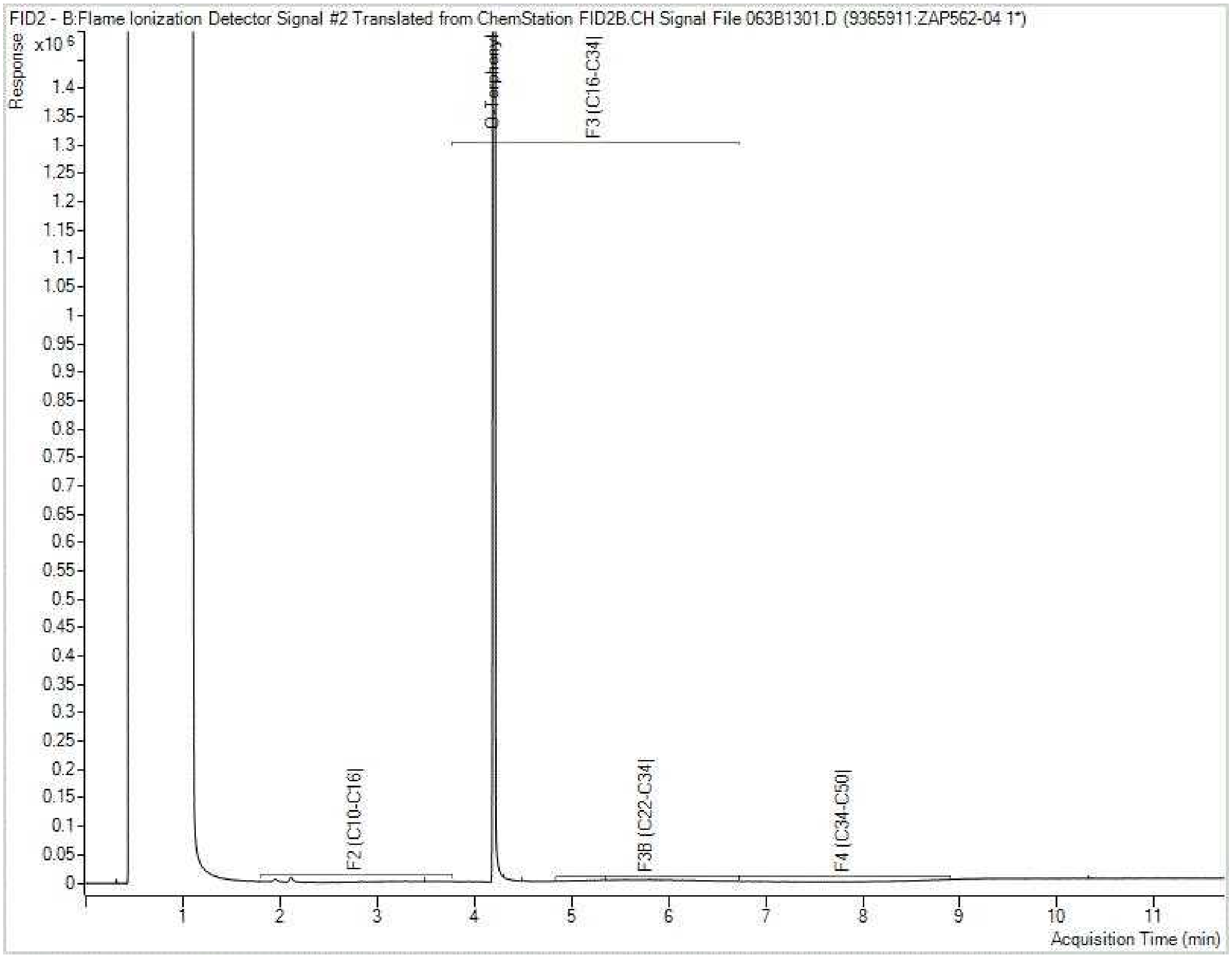


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C8240
Report Date: 2024/05/06
Bureau Veritas Sample: ZAP562

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON
Client ID: MW-IT-06B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

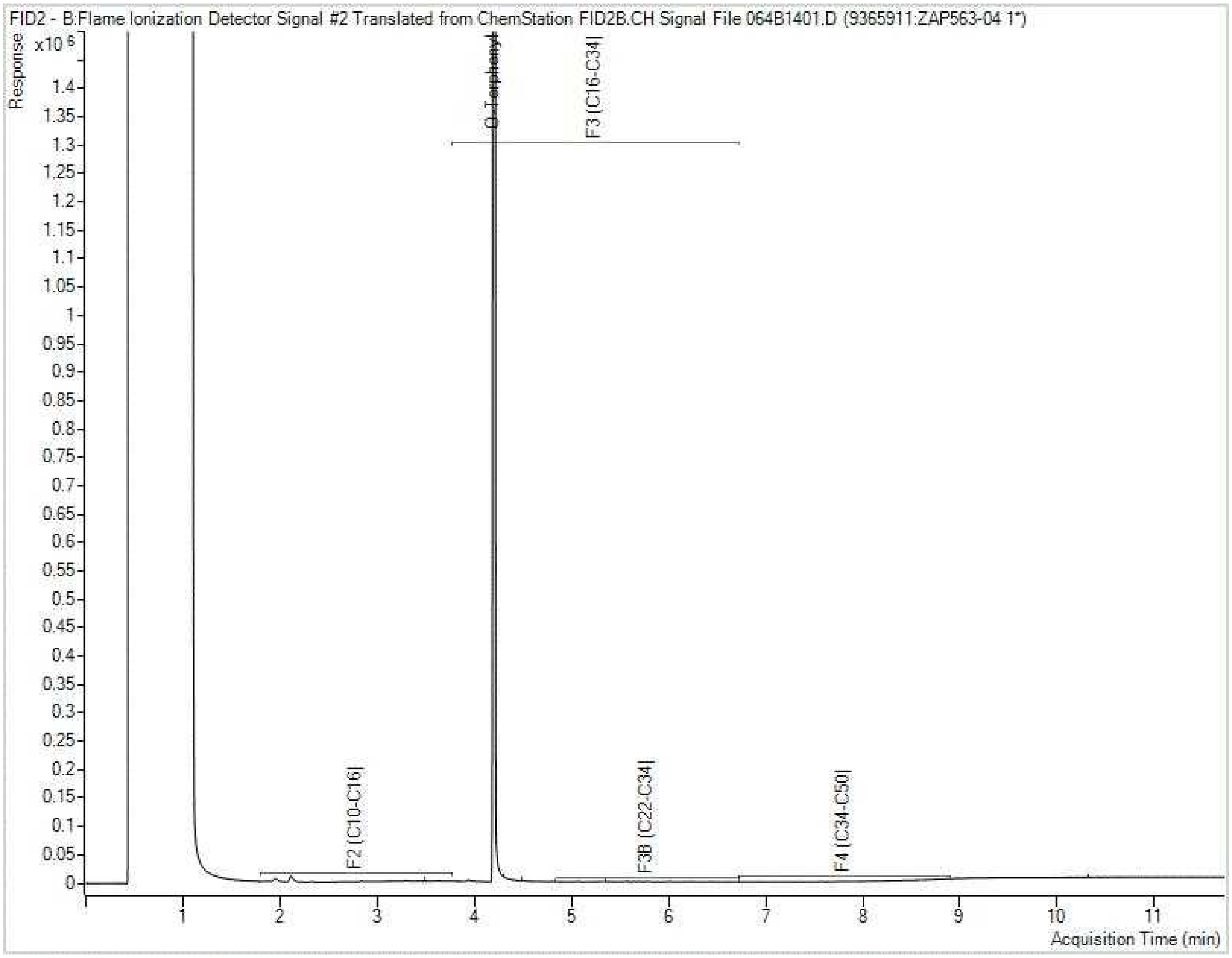


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C8240
Report Date: 2024/05/06
Bureau Veritas Sample: ZAP563

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON
Client ID: MW-IT-03A

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

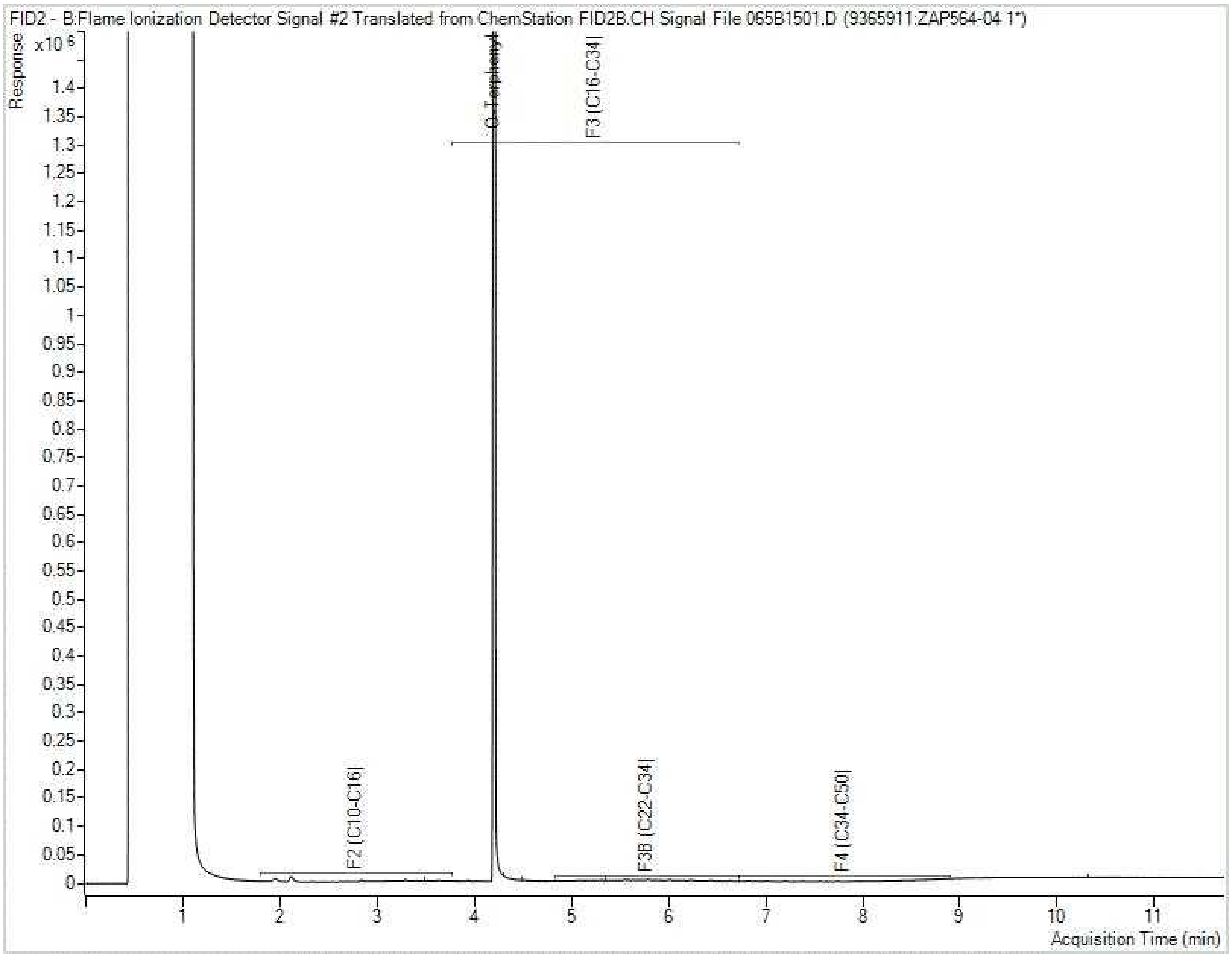


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C8240
Report Date: 2024/05/06
Bureau Veritas Sample: ZAP564

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON
Client ID: MW-IT-03B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

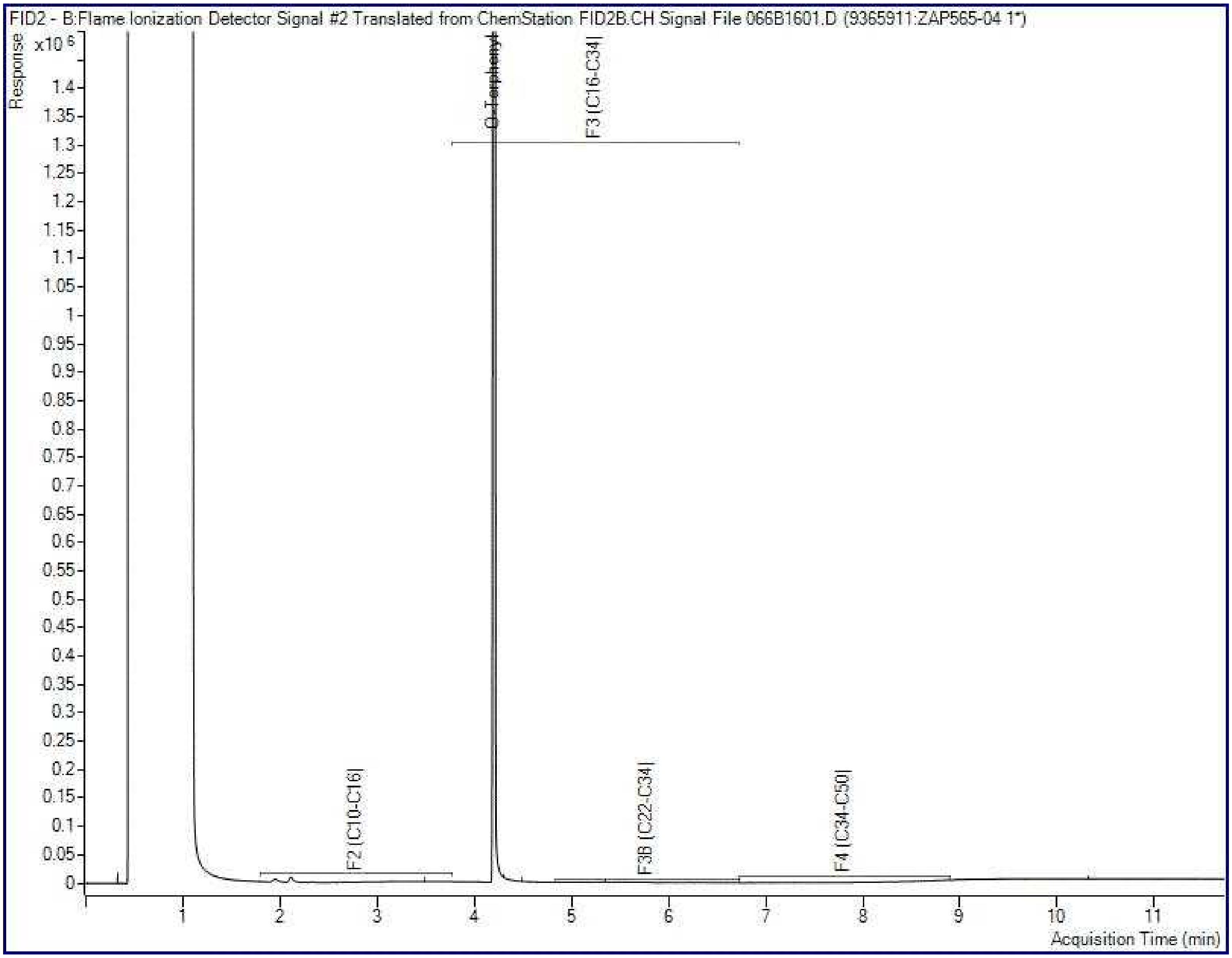


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C8240
Report Date: 2024/05/06
Bureau Veritas Sample: ZAP565

WSP Canada Inc.
Client Project #: CA-GLD-19129150 (2300)
Project name: CBM CALEDON
Client ID: MW-IT-03C

**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 #: CA-GLD-19129150
Site Location: CBM CALEDON
Your C.O.C. #: C#984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/07**
Report #: R8138664
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4C9366**
**Received: 2024/04/30, 19:05**

Sample Matrix: Water
# Samples Received: 8

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Alkalinity | 1 | N/A | 2024/05/06 | CAM SOP-00448 | SM 24 2320 B m |
| Alkalinity | 6 | N/A | 2024/05/07 | CAM SOP-00448 | SM 24 2320 B m |
| Carbonate, Bicarbonate and Hydroxide | 7 | N/A | 2024/05/07 | CAM SOP-00102 | APHA 4500-CO2 D |
| Chloride by Automated Colourimetry | 7 | N/A | 2024/05/03 | CAM SOP-00463 | SM 24 4500-Cl E m |
| Conductivity | 1 | N/A | 2024/05/06 | CAM SOP-00414 | SM 24 2510 m |
| Conductivity | 6 | N/A | 2024/05/07 | CAM SOP-00414 | SM 24 2510 m |
| Dissolved Organic Carbon (DOC) (1) | 5 | N/A | 2024/05/02 | CAM SOP-00446 | SM 24 5310 B m |
| Dissolved Organic Carbon (DOC) (1) | 2 | N/A | 2024/05/03 | CAM SOP-00446 | SM 24 5310 B m |
| Petroleum Hydro. CCME F1 & BTEX in Water | 8 | N/A | 2024/05/02 | CAM SOP-00315 | CCME PHC-CWS m |
| Petroleum Hydrocarbons F2-F4 in Water (2) | 7 | 2024/05/03 | 2024/05/03 | CAM SOP-00316 | CCME PHC-CWS m |
| Hardness (calculated as CaCO3) | 7 | N/A | 2024/05/02 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Dissolved Metals by ICPMS | 7 | N/A | 2024/05/02 | CAM SOP-00447 | EPA 6020B m |
| Ion Balance (% Difference) | 7 | N/A | 2024/05/07 | | |
| Anion and Cation Sum | 7 | N/A | 2024/05/07 | | |
| Total Ammonia-N | 7 | N/A | 2024/05/05 | CAM SOP-00441 | USGS I-2522-90 m |
| Nitrate & Nitrite as Nitrogen in Water (3) | 7 | N/A | 2024/05/03 | CAM SOP-00440 | SM 24 4500-NO3I/NO2B |
| pH (4) | 1 | 2024/05/02 | 2024/05/06 | CAM SOP-00413 | SM 24th - 4500H+ B |
| pH (4) | 6 | 2024/05/02 | 2024/05/07 | CAM SOP-00413 | SM 24th - 4500H+ B |
| Orthophosphate | 7 | N/A | 2024/05/03 | CAM SOP-00461 | SM 24 4500-P E |
| Sat. pH and Langelier Index (@ 20C) | 7 | N/A | 2024/05/07 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 7 | N/A | 2024/05/07 | | Auto Calc |
| Sulphate by Automated Turbidimetry | 7 | N/A | 2024/05/03 | CAM SOP-00464 | SM 24 4500-SO42- E m |
| Total Dissolved Solids (TDS calc) | 7 | N/A | 2024/05/07 | | 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, EPA, APHA or the Quebec Ministry of Environment.

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

Your Project #: CA-GLD-19129150
Site Location: CBM CALEDON
Your C.O.C. #: C#984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/07**
Report #: R8138664
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4C9366**
**Received: 2024/04/30, 19:05**

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) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Ankita Bhalla, Project Manager
Email: Ankita.Bhalla@bureauveritas.com
Phone# (905) 817-5700
====================================================================
This report has been generated and distributed using a secure automated process.
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 Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Total Cover Pages : 2

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAW282 | | | ZAW282 | | | ZAW283 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30<br>11:45 | | | 2024/04/30<br>11:45 | | | 2024/04/30<br>12:45 | | |
| **COC Number** | | C#984504-01-01 | | | C#984504-01-01 | | | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-01 A** | **RDL** | **QC Batch** | **MW-IT-01 A Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-01 B** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Anion Sum | me/L | 6.18 | N/A | 9366859 | | | | 6.85 | N/A | 9366859 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 220 | 1.0 | 9366736 | | | | 210 | 1.0 | 9366736 |
| Calculated TDS | mg/L | 330 | 1.0 | 9366865 | | | | 370 | 1.0 | 9366865 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 3.1 | 1.0 | 9366736 | | | | 2.3 | 1.0 | 9366736 |
| Cation Sum | me/L | 6.18 | N/A | 9366859 | | | | 7.37 | N/A | 9366859 |
| Hardness (CaCO3) | mg/L | 280 | 1.0 | 9366619 | | | | 280 | 1.0 | 9366619 |
| Ion Balance (% Difference) | % | 0.0600 | N/A | 9366858 | | | | 3.71 | N/A | 9366858 |
| Langelier Index (@ 20C) | N/A | 0.964 | | 9366860 | | | | 0.855 | | 9366861 |
| Langelier Index (@ 4C) | N/A | 0.715 | | 9366863 | | | | 0.606 | | 9366864 |
| Saturation pH (@ 20C) | N/A | 7.21 | | 9366860 | | | | 7.21 | | 9366861 |
| Saturation pH (@ 4C) | N/A | 7.45 | | 9366863 | | | | 7.46 | | 9366864 |
| **Inorganics** | | | | | | | | | | |
| Total Ammonia-N | mg/L | 0.051 | 0.050 | 9369317 | | | | <0.050 | 0.050 | 9369317 |
| Conductivity | umho/cm | 590 | 1.0 | 9369695 | | | | 720 | 1.0 | 9370043 |
| Dissolved Organic Carbon | mg/L | 1.3 | 0.40 | 9370893 | | | | 2.1 | 0.40 | 9369779 |
| Orthophosphate (P) | mg/L | <0.010 | 0.010 | 9370991 | <0.010 | 0.010 | 9370991 | <0.010 | 0.010 | 9370991 |
| pH | pH | 8.17 | | 9369696 | | | | 8.07 | | 9370055 |
| Dissolved Sulphate (SO4) | mg/L | 41 | 1.0 | 9370990 | 41 | 1.0 | 9370990 | 13 | 1.0 | 9370990 |
| Alkalinity (Total as CaCO3) | mg/L | 220 | 1.0 | 9369684 | | | | 210 | 1.0 | 9370036 |
| Dissolved Chloride (Cl-) | mg/L | 28 | 1.0 | 9370984 | 28 | 1.0 | 9370984 | 78 | 1.0 | 9370984 |
| Nitrite (N) | mg/L | <0.010 | 0.010 | 9369705 | | | | <0.010 | 0.010 | 9369705 |
| Nitrate (N) | mg/L | 1.17 | 0.10 | 9369705 | | | | 1.80 | 0.10 | 9369705 |
| Nitrate + Nitrite (N) | mg/L | 1.17 | 0.10 | 9369705 | | | | 1.80 | 0.10 | 9369705 |
| **Metals** | | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | 6.0 | 4.9 | 9369366 | | | | <4.9 | 4.9 | 9369366 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 0.50 | 9369366 | | | | <0.50 | 0.50 | 9369366 |
| Dissolved Arsenic (As) | ug/L | <1.0 | 1.0 | 9369366 | | | | <1.0 | 1.0 | 9369366 |
| Dissolved Barium (Ba) | ug/L | 29 | 2.0 | 9369366 | | | | 51 | 2.0 | 9369366 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAW282 | | | ZAW282 | | | ZAW283 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30 11:45 | | | 2024/04/30 11:45 | | | 2024/04/30 12:45 | | |
| **COC Number** | | C#984504-01-01 | | | C#984504-01-01 | | | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-01 A** | **RDL** | **QC Batch** | **MW-IT-01 A Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-01 B** | **RDL** | **QC Batch** |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 0.40 | 9369366 | | | | <0.40 | 0.40 | 9369366 |
| Dissolved Boron (B) | ug/L | 31 | 10 | 9369366 | | | | <10 | 10 | 9369366 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 0.090 | 9369366 | | | | <0.090 | 0.090 | 9369366 |
| Dissolved Calcium (Ca) | ug/L | 75000 | 200 | 9369366 | | | | 79000 | 200 | 9369366 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 5.0 | 9369366 | | | | <5.0 | 5.0 | 9369366 |
| Dissolved Cobalt (Co) | ug/L | 0.74 | 0.50 | 9369366 | | | | <0.50 | 0.50 | 9369366 |
| Dissolved Copper (Cu) | ug/L | <0.90 | 0.90 | 9369366 | | | | 0.95 | 0.90 | 9369366 |
| Dissolved Iron (Fe) | ug/L | <100 | 100 | 9369366 | | | | <100 | 100 | 9369366 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 0.50 | 9369366 | | | | <0.50 | 0.50 | 9369366 |
| Dissolved Magnesium (Mg) | ug/L | 22000 | 50 | 9369366 | | | | 19000 | 50 | 9369366 |
| Dissolved Manganese (Mn) | ug/L | 9.1 | 2.0 | 9369366 | | | | 26 | 2.0 | 9369366 |
| Dissolved Molybdenum (Mo) | ug/L | 1.4 | 0.50 | 9369366 | | | | <0.50 | 0.50 | 9369366 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | 1.0 | 9369366 | | | | <1.0 | 1.0 | 9369366 |
| Dissolved Phosphorus (P) | ug/L | <100 | 100 | 9369366 | | | | <100 | 100 | 9369366 |
| Dissolved Potassium (K) | ug/L | 2000 | 200 | 9369366 | | | | 1400 | 200 | 9369366 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 2.0 | 9369366 | | | | <2.0 | 2.0 | 9369366 |
| Dissolved Silicon (Si) | ug/L | 2500 | 50 | 9369366 | | | | 2500 | 50 | 9369366 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 0.090 | 9369366 | | | | <0.090 | 0.090 | 9369366 |
| Dissolved Sodium (Na) | ug/L | 14000 | 100 | 9369366 | | | | 42000 | 100 | 9369366 |
| Dissolved Strontium (Sr) | ug/L | 1300 | 1.0 | 9369366 | | | | 140 | 1.0 | 9369366 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 0.050 | 9369366 | | | | <0.050 | 0.050 | 9369366 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 5.0 | 9369366 | | | | <5.0 | 5.0 | 9369366 |
| Dissolved Uranium (U) | ug/L | 0.30 | 0.10 | 9369366 | | | | 0.34 | 0.10 | 9369366 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 0.50 | 9369366 | | | | <0.50 | 0.50 | 9369366 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | 5.0 | 9369366 | | | | <5.0 | 5.0 | 9369366 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAW283 | | | ZAW284 | | | ZAW285 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30<br>12:45 | | | 2024/04/30<br>11:30 | | | 2024/04/30<br>17:00 | | |
| **COC Number** | | C#984504-01-01 | | | C#984504-01-01 | | | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-01 B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-01 C** | **RDL** | **QC Batch** | **MW-IT-02A** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Anion Sum | me/L | | | | 17.4 | N/A | 9366859 | 5.92 | N/A | 9366859 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | | | | 250 | 1.0 | 9366736 | 230 | 1.0 | 9366736 |
| Calculated TDS | mg/L | | | | 1000 | 1.0 | 9366865 | 310 | 1.0 | 9366865 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | | | | 1.5 | 1.0 | 9366736 | 2.6 | 1.0 | 9366736 |
| Cation Sum | me/L | | | | 19.7 | N/A | 9366859 | 5.86 | N/A | 9366859 |
| Hardness (CaCO3) | mg/L | | | | 470 | 1.0 | 9366619 | 280 | 1.0 | 9366619 |
| Ion Balance (% Difference) | % | | | | 6.19 | N/A | 9366858 | 0.500 | N/A | 9366858 |
| Langelier Index (@ 20C) | N/A | | | | 0.827 | | 9366861 | 0.883 | | 9366861 |
| Langelier Index (@ 4C) | N/A | | | | 0.581 | | 9366864 | 0.634 | | 9366864 |
| Saturation pH (@ 20C) | N/A | | | | 6.98 | | 9366861 | 7.20 | | 9366861 |
| Saturation pH (@ 4C) | N/A | | | | 7.22 | | 9366864 | 7.45 | | 9366864 |
| **Inorganics** | | | | | | | | | | |
| Total Ammonia-N | mg/L | | | | <0.050 | 0.050 | 9369317 | <0.050 | 0.050 | 9369317 |
| Conductivity | umho/cm | 720 | 1.0 | 9370043 | 2000 | 1.0 | 9369695 | 540 | 1.0 | 9370043 |
| Dissolved Organic Carbon | mg/L | | | | 1.4 | 0.40 | 9370893 | 3.7 | 0.40 | 9369779 |
| Orthophosphate (P) | mg/L | | | | <0.010 | 0.010 | 9370991 | <0.010 | 0.010 | 9370991 |
| pH | pH | 8.03 | | 9370055 | 7.80 | | 9369696 | 8.08 | | 9370055 |
| Dissolved Sulphate (SO4) | mg/L | | | | 19 | 1.0 | 9370990 | 49 | 1.0 | 9370990 |
| Alkalinity (Total as CaCO3) | mg/L | 210 | 1.0 | 9370036 | 250 | 1.0 | 9369684 | 240 | 1.0 | 9370036 |
| Dissolved Chloride (Cl-) | mg/L | | | | 410 | 5.0 | 9370984 | 7.0 | 1.0 | 9370984 |
| Nitrite (N) | mg/L | | | | 0.060 | 0.010 | 9369708 | <0.010 | 0.010 | 9369705 |
| Nitrate (N) | mg/L | | | | 5.29 | 0.10 | 9369708 | <0.10 | 0.10 | 9369705 |
| Nitrate + Nitrite (N) | mg/L | | | | 5.35 | 0.10 | 9369708 | <0.10 | 0.10 | 9369705 |
| **Metals** | | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | | | | <4.9 | 4.9 | 9369366 | 5.2 | 4.9 | 9369366 |
| Dissolved Antimony (Sb) | ug/L | | | | <0.50 | 0.50 | 9369366 | <0.50 | 0.50 | 9369366 |
| Dissolved Arsenic (As) | ug/L | | | | <1.0 | 1.0 | 9369366 | 5.6 | 1.0 | 9369366 |
| Dissolved Barium (Ba) | ug/L | | | | 330 | 2.0 | 9369366 | 91 | 2.0 | 9369366 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAW283 | | | ZAW284 | | | ZAW285 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30 12:45 | | | 2024/04/30 11:30 | | | 2024/04/30 17:00 | | |
| **COC Number** | | C#984504-01-01 | | | C#984504-01-01 | | | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-01 B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-01 C** | **RDL** | **QC Batch** | **MW-IT-02A** | **RDL** | **QC Batch** |
| Dissolved Beryllium (Be) | ug/L | | | | <0.40 | 0.40 | 9369366 | <0.40 | 0.40 | 9369366 |
| Dissolved Boron (B) | ug/L | | | | 14 | 10 | 9369366 | 17 | 10 | 9369366 |
| Dissolved Cadmium (Cd) | ug/L | | | | <0.090 | 0.090 | 9369366 | <0.090 | 0.090 | 9369366 |
| Dissolved Calcium (Ca) | ug/L | | | | 150000 | 200 | 9369366 | 71000 | 200 | 9369366 |
| Dissolved Chromium (Cr) | ug/L | | | | <5.0 | 5.0 | 9369366 | <5.0 | 5.0 | 9369366 |
| Dissolved Cobalt (Co) | ug/L | | | | <0.50 | 0.50 | 9369366 | <0.50 | 0.50 | 9369366 |
| Dissolved Copper (Cu) | ug/L | | | | <0.90 | 0.90 | 9369366 | <0.90 | 0.90 | 9369366 |
| Dissolved Iron (Fe) | ug/L | | | | <100 | 100 | 9369366 | <100 | 100 | 9369366 |
| Dissolved Lead (Pb) | ug/L | | | | <0.50 | 0.50 | 9369366 | <0.50 | 0.50 | 9369366 |
| Dissolved Magnesium (Mg) | ug/L | | | | 22000 | 50 | 9369366 | 25000 | 50 | 9369366 |
| Dissolved Manganese (Mn) | ug/L | | | | 66 | 2.0 | 9369366 | 47 | 2.0 | 9369366 |
| Dissolved Molybdenum (Mo) | ug/L | | | | 1.2 | 0.50 | 9369366 | 3.1 | 0.50 | 9369366 |
| Dissolved Nickel (Ni) | ug/L | | | | <1.0 | 1.0 | 9369366 | <1.0 | 1.0 | 9369366 |
| Dissolved Phosphorus (P) | ug/L | | | | <100 | 100 | 9369366 | <100 | 100 | 9369366 |
| Dissolved Potassium (K) | ug/L | | | | 2800 | 200 | 9369366 | 780 | 200 | 9369366 |
| Dissolved Selenium (Se) | ug/L | | | | <2.0 | 2.0 | 9369366 | <2.0 | 2.0 | 9369366 |
| Dissolved Silicon (Si) | ug/L | | | | 3800 | 50 | 9369366 | 3100 | 50 | 9369366 |
| Dissolved Silver (Ag) | ug/L | | | | <0.090 | 0.090 | 9369366 | <0.090 | 0.090 | 9369366 |
| Dissolved Sodium (Na) | ug/L | | | | 240000 | 100 | 9369366 | 5000 | 100 | 9369366 |
| Dissolved Strontium (Sr) | ug/L | | | | 310 | 1.0 | 9369366 | 310 | 1.0 | 9369366 |
| Dissolved Thallium (Tl) | ug/L | | | | <0.050 | 0.050 | 9369366 | <0.050 | 0.050 | 9369366 |
| Dissolved Titanium (Ti) | ug/L | | | | <5.0 | 5.0 | 9369366 | <5.0 | 5.0 | 9369366 |
| Dissolved Uranium (U) | ug/L | | | | 0.26 | 0.10 | 9369366 | 0.15 | 0.10 | 9369366 |
| Dissolved Vanadium (V) | ug/L | | | | <0.50 | 0.50 | 9369366 | <0.50 | 0.50 | 9369366 |
| Dissolved Zinc (Zn) | ug/L | | | | <5.0 | 5.0 | 9369366 | <5.0 | 5.0 | 9369366 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAW286 | ZAW287 | ZAW288 | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30 17:30 | 2024/04/30 16:15 | 2024/04/30 | | |
| **COC Number** | | C#984504-01-01 | C#984504-01-01 | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-02B** | **MW-IT-02C** | **DUP2** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | |
| Anion Sum | me/L | 5.48 | 5.30 | 5.53 | N/A | 9366859 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 210 | 220 | 220 | 1.0 | 9366736 |
| Calculated TDS | mg/L | 280 | 270 | 280 | 1.0 | 9366865 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 3.6 | 3.9 | 3.0 | 1.0 | 9366736 |
| Cation Sum | me/L | 5.31 | 5.31 | 5.54 | N/A | 9366859 |
| Hardness (CaCO3) | mg/L | 230 | 240 | 240 | 1.0 | 9366619 |
| Ion Balance (% Difference) | % | 1.57 | 0.100 | 0.0800 | N/A | 9366858 |
| Langelier Index (@ 20C) | N/A | 0.996 | 1.05 | 0.931 | | 9366861 |
| Langelier Index (@ 4C) | N/A | 0.746 | 0.799 | 0.682 | | 9366864 |
| Saturation pH (@ 20C) | N/A | 7.27 | 7.23 | 7.24 | | 9366861 |
| Saturation pH (@ 4C) | N/A | 7.52 | 7.48 | 7.49 | | 9366864 |
| **Inorganics** | | | | | | |
| Total Ammonia-N | mg/L | <0.050 | <0.050 | <0.050 | 0.050 | 9369317 |
| Conductivity | umho/cm | 530 | 500 | 530 | 1.0 | 9369695 |
| Dissolved Organic Carbon | mg/L | 3.8 | 4.0 | 3.8 | 0.40 | 9369779 |
| Orthophosphate (P) | mg/L | <0.010 | <0.010 | <0.010 | 0.010 | 9370991 |
| pH | pH | 8.26 | 8.28 | 8.17 | | 9369696 |
| Dissolved Sulphate (SO4) | mg/L | 13 | 8.6 | 12 | 1.0 | 9370990 |
| Alkalinity (Total as CaCO3) | mg/L | 210 | 220 | 220 | 1.0 | 9369684 |
| Dissolved Chloride (Cl-) | mg/L | 31 | 24 | 30 | 1.0 | 9370984 |
| Nitrite (N) | mg/L | <0.010 | <0.010 | <0.010 | 0.010 | 9369708 |
| Nitrate (N) | mg/L | 0.95 | 0.59 | 0.94 | 0.10 | 9369708 |
| Nitrate + Nitrite (N) | mg/L | 0.95 | 0.59 | 0.94 | 0.10 | 9369708 |
| **Metals** | | | | | | |
| Dissolved Aluminum (Al) | ug/L | 9.9 | 7.0 | 5.1 | 4.9 | 9369366 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | <0.50 | <0.50 | 0.50 | 9369366 |
| Dissolved Arsenic (As) | ug/L | <1.0 | <1.0 | <1.0 | 1.0 | 9369366 |
| Dissolved Barium (Ba) | ug/L | 35 | 17 | 37 | 2.0 | 9369366 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | <0.40 | <0.40 | 0.40 | 9369366 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZAW286 | ZAW287 | ZAW288 | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30 17:30 | 2024/04/30 16:15 | 2024/04/30 | | |
| **COC Number** | | C#984504-01-01 | C#984504-01-01 | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-02B** | **MW-IT-02C** | **DUP2** | **RDL** | **QC Batch** |
| Dissolved Boron (B) | ug/L | 12 | 11 | <10 | 10 | 9369366 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | <0.090 | <0.090 | 0.090 | 9369366 |
| Dissolved Calcium (Ca) | ug/L | 65000 | 68000 | 69000 | 200 | 9369366 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | <5.0 | <5.0 | 5.0 | 9369366 |
| Dissolved Cobalt (Co) | ug/L | <0.50 | <0.50 | <0.50 | 0.50 | 9369366 |
| Dissolved Copper (Cu) | ug/L | 1.4 | 1.6 | 1.2 | 0.90 | 9369366 |
| Dissolved Iron (Fe) | ug/L | <100 | <100 | <100 | 100 | 9369366 |
| Dissolved Lead (Pb) | ug/L | <0.50 | <0.50 | <0.50 | 0.50 | 9369366 |
| Dissolved Magnesium (Mg) | ug/L | 17000 | 16000 | 18000 | 50 | 9369366 |
| Dissolved Manganese (Mn) | ug/L | 6.4 | 14 | 6.4 | 2.0 | 9369366 |
| Dissolved Molybdenum (Mo) | ug/L | <0.50 | <0.50 | <0.50 | 0.50 | 9369366 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | <1.0 | <1.0 | 1.0 | 9369366 |
| Dissolved Phosphorus (P) | ug/L | <100 | <100 | <100 | 100 | 9369366 |
| Dissolved Potassium (K) | ug/L | 1100 | 1300 | 1200 | 200 | 9369366 |
| Dissolved Selenium (Se) | ug/L | <2.0 | <2.0 | <2.0 | 2.0 | 9369366 |
| Dissolved Silicon (Si) | ug/L | 2200 | 2300 | 2200 | 50 | 9369366 |
| Dissolved Silver (Ag) | ug/L | <0.090 | <0.090 | <0.090 | 0.090 | 9369366 |
| Dissolved Sodium (Na) | ug/L | 15000 | 12000 | 15000 | 100 | 9369366 |
| Dissolved Strontium (Sr) | ug/L | 120 | 110 | 120 | 1.0 | 9369366 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | <0.050 | <0.050 | 0.050 | 9369366 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | <5.0 | <5.0 | 5.0 | 9369366 |
| Dissolved Uranium (U) | ug/L | 0.45 | 0.32 | 0.42 | 0.10 | 9369366 |
| Dissolved Vanadium (V) | ug/L | <0.50 | <0.50 | <0.50 | 0.50 | 9369366 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | <5.0 | <5.0 | 5.0 | 9369366 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

## PETROLEUM HYDROCARBONS (CCME)

| **Bureau Veritas ID** | | ZAW289 | | |
|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30 | | |
| **COC Number** | | C#984504-01-01 | | |
| | **UNITS** | **TRIP BLANK** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | |
| Benzene | ug/L | <0.20 | 0.20 | 9367992 |
| Toluene | ug/L | <0.20 | 0.20 | 9367992 |
| Ethylbenzene | ug/L | <0.20 | 0.20 | 9367992 |
| o-Xylene | ug/L | <0.20 | 0.20 | 9367992 |
| p+m-Xylene | ug/L | <0.40 | 0.40 | 9367992 |
| Total Xylenes | ug/L | <0.40 | 0.40 | 9367992 |
| F1 (C6-C10) | ug/L | <25 | 25 | 9367992 |
| F1 (C6-C10) - BTEX | ug/L | <25 | 25 | 9367992 |
| **Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene | % | 106 | | 9367992 |
| 4-Bromofluorobenzene | % | 93 | | 9367992 |
| D10-o-Xylene | % | 86 | | 9367992 |
| D4-1,2-Dichloroethane | % | 102 | | 9367992 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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

| **Bureau Veritas ID** | | ZAW282 | ZAW283 | ZAW283 | ZAW284 | ZAW285 | | |
|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30 11:45 | 2024/04/30 12:45 | 2024/04/30 12:45 | 2024/04/30 11:30 | 2024/04/30 17:00 | | |
| **COC Number** | | C#984504-01-01 | C#984504-01-01 | C#984504-01-01 | C#984504-01-01 | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-01 A** | **MW-IT-01 B** | **MW-IT-01 B Lab-Dup** | **MW-IT-01 C** | **MW-IT-02A** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | | | | | |
| Benzene | ug/L | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | 0.20 | 9367992 |
| Toluene | ug/L | <0.20 | <0.20 | <0.20 | 0.37 | 1.3 | 0.20 | 9367992 |
| Ethylbenzene | ug/L | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | 0.20 | 9367992 |
| o-Xylene | ug/L | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | 0.20 | 9367992 |
| p+m-Xylene | ug/L | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | 0.40 | 9367992 |
| Total Xylenes | ug/L | <0.40 | <0.40 | <0.40 | <0.40 | <0.40 | 0.40 | 9367992 |
| F1 (C6-C10) | ug/L | <25 | <25 | <25 | 47 | 200 | 25 | 9367992 |
| F1 (C6-C10) - BTEX | ug/L | <25 | <25 | <25 | 47 | 200 | 25 | 9367992 |
| **F2-F4 Hydrocarbons** | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | <100 | <100 | <100 | <100 | <100 | 100 | 9371300 |
| F3 (C16-C34 Hydrocarbons) | ug/L | <200 | <200 | <200 | <200 | 600 | 200 | 9371300 |
| F4 (C34-C50 Hydrocarbons) | ug/L | <200 | <200 | <200 | <200 | <200 | 200 | 9371300 |
| Reached Baseline at C50 | ug/L | Yes | Yes | Yes | Yes | Yes | | 9371300 |
| **Surrogate Recovery (%)** | | | | | | | | |
| 1,4-Difluorobenzene | % | 105 | 104 | 102 | 104 | 104 | | 9367992 |
| 4-Bromofluorobenzene | % | 92 | 91 | 89 | 94 | 91 | | 9367992 |
| D10-o-Xylene | % | 86 | 91 | 84 | 87 | 87 | | 9367992 |
| D4-1,2-Dichloroethane | % | 104 | 107 | 104 | 105 | 104 | | 9367992 |
| o-Terphenyl | % | 99 | 98 | 99 | 98 | 99 | | 9371300 |

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

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

| **Bureau Veritas ID** | | ZAW286 | ZAW287 | ZAW288 | | |
|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/04/30 17:30 | 2024/04/30 16:15 | 2024/04/30 | | |
| **COC Number** | | C#984504-01-01 | C#984504-01-01 | C#984504-01-01 | | |
| | **UNITS** | **MW-IT-02B** | **MW-IT-02C** | **DUP2** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | | | |
| Benzene | ug/L | <0.20 | <0.20 | <0.20 | 0.20 | 9367992 |
| Toluene | ug/L | <0.20 | <0.20 | <0.20 | 0.20 | 9367992 |
| Ethylbenzene | ug/L | <0.20 | <0.20 | <0.20 | 0.20 | 9367992 |
| o-Xylene | ug/L | <0.20 | <0.20 | <0.20 | 0.20 | 9367992 |
| p+m-Xylene | ug/L | <0.40 | <0.40 | <0.40 | 0.40 | 9367992 |
| Total Xylenes | ug/L | <0.40 | <0.40 | <0.40 | 0.40 | 9367992 |
| F1 (C6-C10) | ug/L | <25 | <25 | <25 | 25 | 9367992 |
| F1 (C6-C10) - BTEX | ug/L | <25 | <25 | <25 | 25 | 9367992 |
| **F2-F4 Hydrocarbons** | | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | <100 | <100 | <100 | 100 | 9371300 |
| F3 (C16-C34 Hydrocarbons) | ug/L | <200 | 320 | <200 | 200 | 9371300 |
| F4 (C34-C50 Hydrocarbons) | ug/L | <200 | <200 | <200 | 200 | 9371300 |
| Reached Baseline at C50 | ug/L | Yes | Yes | Yes | | 9371300 |
| **Surrogate Recovery (%)** | | | | | | |
| 1,4-Difluorobenzene | % | 105 | 103 | 104 | | 9367992 |
| 4-Bromofluorobenzene | % | 93 | 92 | 94 | | 9367992 |
| D10-o-Xylene | % | 84 | 86 | 88 | | 9367992 |
| D4-1,2-Dichloroethane | % | 103 | 107 | 107 | | 9367992 |
| o-Terphenyl | % | 98 | 100 | 99 | | 9371300 |

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

## TEST SUMMARY

**Bureau Veritas ID:** ZAW282
**Sample ID:** MW-IT-01 A
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9369684 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9366736 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9369695 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9370893 | N/A | 2024/05/03 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| Hardness (calculated as CaCO3) | | 9366619 | N/A | 2024/05/02 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9369366 | N/A | 2024/05/02 | Indira HarryPaul |
| Ion Balance (% Difference) | CALC | 9366858 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9366859 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9369317 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9369705 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9369696 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9366860 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9366863 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9366865 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZAW282 Dup
**Sample ID:** MW-IT-01 A
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |

**Bureau Veritas ID:** ZAW283
**Sample ID:** MW-IT-01 B
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9370036 | N/A | 2024/05/06 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9366736 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9370043 | N/A | 2024/05/06 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9369779 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| Hardness (calculated as CaCO3) | | 9366619 | N/A | 2024/05/02 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9369366 | N/A | 2024/05/02 | Indira HarryPaul |
| Ion Balance (% Difference) | CALC | 9366858 | N/A | 2024/05/07 | Automated Statchk |

## TEST SUMMARY

**Bureau Veritas ID:** ZAW283
**Sample ID:** MW-IT-01 B
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Anion and Cation Sum | CALC | 9366859 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9369317 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9369705 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9370055 | 2024/05/02 | 2024/05/06 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9366861 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9366864 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9366865 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZAW283 Dup
**Sample ID:** MW-IT-01 B
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9370036 | N/A | 2024/05/06 | Surinder Rai |
| Conductivity | AT | 9370043 | N/A | 2024/05/06 | Surinder Rai |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| pH | AT | 9370055 | 2024/05/02 | 2024/05/06 | Surinder Rai |

**Bureau Veritas ID:** ZAW284
**Sample ID:** MW-IT-01 C
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9369684 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9366736 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9369695 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9370893 | N/A | 2024/05/03 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| Hardness (calculated as CaCO3) |  | 9366619 | N/A | 2024/05/02 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9369366 | N/A | 2024/05/02 | Indira HarryPaul |
| Ion Balance (% Difference) | CALC | 9366858 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9366859 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9369317 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9369708 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9369696 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9366861 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9366864 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |

## TEST SUMMARY

**Bureau Veritas ID:** ZAW284
**Sample ID:** MW-IT-01 C
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Total Dissolved Solids (TDS calc) | CALC | 9366865 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZAW285
**Sample ID:** MW-IT-02A
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9370036 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9366736 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9370043 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9369779 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| Hardness (calculated as CaCO3) | | 9366619 | N/A | 2024/05/02 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9369366 | N/A | 2024/05/02 | Indira HarryPaul |
| Ion Balance (% Difference) | CALC | 9366858 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9366859 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9369317 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9369705 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9370055 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9366861 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9366864 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9366865 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZAW286
**Sample ID:** MW-IT-02B
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9369684 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9366736 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9369695 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9369779 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| Hardness (calculated as CaCO3) | | 9366619 | N/A | 2024/05/02 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9369366 | N/A | 2024/05/02 | Indira HarryPaul |
| Ion Balance (% Difference) | CALC | 9366858 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9366859 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9369317 | N/A | 2024/05/05 | Yogesh Patel |

# TEST SUMMARY

**Bureau Veritas ID:** ZAW286
**Sample ID:** MW-IT-02B
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9369708 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9369696 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9366861 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9366864 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9366865 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZAW287
**Sample ID:** MW-IT-02C
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9369684 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9366736 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9369695 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9369779 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| Hardness (calculated as CaCO3) | | 9366619 | N/A | 2024/05/02 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9369366 | N/A | 2024/05/02 | Indira HarryPaul |
| Ion Balance (% Difference) | CALC | 9366858 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9366859 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9369317 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9369708 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9369696 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9366861 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9366864 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9366865 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZAW288
**Sample ID:** DUP2
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9369684 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9366736 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9369695 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9369779 | N/A | 2024/05/02 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |

# TEST SUMMARY

**Bureau Veritas ID:** ZAW288
**Sample ID:** DUP2
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9371300 | 2024/05/03 | 2024/05/03 | (Kent) Maolin Li |
| Hardness (calculated as CaCO3) |  | 9366619 | N/A | 2024/05/02 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9369366 | N/A | 2024/05/02 | Indira HarryPaul |
| Ion Balance (% Difference) | CALC | 9366858 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9366859 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9369317 | N/A | 2024/05/05 | Yogesh Patel |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9369708 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9369696 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9366861 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9366864 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9366865 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZAW289
**Sample ID:** TRIP BLANK
**Matrix:** Water

**Collected:** 2024/04/30
**Shipped:**
**Received:** 2024/04/30

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9367992 | N/A | 2024/05/02 | Ravinder Gaidhu |

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 8.7°C |

**Results relate only to the items tested.**

| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch** | **Parameter** | **Date** | **% Recovery** | **QC Limits** | **% Recovery** | **QC Limits** | **Value** | **UNITS** | **Value (%)** | **QC Limits** |
| 9367992 | 1,4-Difluorobenzene | 2024/05/02 | 97 | 70 - 130 | 97 | 70 - 130 | 102 | % | | |
| 9367992 | 4-Bromofluorobenzene | 2024/05/02 | 98 | 70 - 130 | 98 | 70 - 130 | 95 | % | | |
| 9367992 | D10-o-Xylene | 2024/05/02 | 95 | 70 - 130 | 90 | 70 - 130 | 84 | % | | |
| 9367992 | D4-1,2-Dichloroethane | 2024/05/02 | 98 | 70 - 130 | 98 | 70 - 130 | 102 | % | | |
| 9371300 | o-Terphenyl | 2024/05/03 | 103 | 60 - 130 | 99 | 60 - 130 | 100 | % | | |
| 9367992 | Benzene | 2024/05/02 | 92 | 50 - 140 | 89 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9367992 | Ethylbenzene | 2024/05/02 | 93 | 50 - 140 | 93 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9367992 | F1 (C6-C10) - BTEX | 2024/05/02 | | | | | <25 | ug/L | NC | 30 |
| 9367992 | F1 (C6-C10) | 2024/05/02 | 99 | 60 - 140 | 104 | 60 - 140 | <25 | ug/L | NC | 30 |
| 9367992 | o-Xylene | 2024/05/02 | 94 | 50 - 140 | 91 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9367992 | p+m-Xylene | 2024/05/02 | 90 | 50 - 140 | 87 | 50 - 140 | <0.40 | ug/L | NC | 30 |
| 9367992 | Toluene | 2024/05/02 | 89 | 50 - 140 | 86 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9367992 | Total Xylenes | 2024/05/02 | | | | | <0.40 | ug/L | NC | 30 |
| 9369317 | Total Ammonia-N | 2024/05/05 | 95 | 75 - 125 | 104 | 80 - 120 | <0.050 | mg/L | 1.7 | 20 |
| 9369366 | Dissolved Aluminum (Al) | 2024/05/02 | 101 | 80 - 120 | 94 | 80 - 120 | <4.9 | ug/L | NC | 20 |
| 9369366 | Dissolved Antimony (Sb) | 2024/05/02 | 107 | 80 - 120 | 98 | 80 - 120 | <0.50 | ug/L | | |
| 9369366 | Dissolved Arsenic (As) | 2024/05/02 | 103 | 80 - 120 | 98 | 80 - 120 | <1.0 | ug/L | NC | 20 |
| 9369366 | Dissolved Barium (Ba) | 2024/05/02 | 99 | 80 - 120 | 97 | 80 - 120 | <2.0 | ug/L | 0.32 | 20 |
| 9369366 | Dissolved Beryllium (Be) | 2024/05/02 | 98 | 80 - 120 | 95 | 80 - 120 | <0.40 | ug/L | NC | 20 |
| 9369366 | Dissolved Boron (B) | 2024/05/02 | NC | 80 - 120 | 96 | 80 - 120 | <10 | ug/L | 4.3 | 20 |
| 9369366 | Dissolved Cadmium (Cd) | 2024/05/02 | 102 | 80 - 120 | 95 | 80 - 120 | <0.090 | ug/L | 7.4 | 20 |
| 9369366 | Dissolved Calcium (Ca) | 2024/05/02 | NC | 80 - 120 | 96 | 80 - 120 | <200 | ug/L | 4.6 | 20 |
| 9369366 | Dissolved Chromium (Cr) | 2024/05/02 | 96 | 80 - 120 | 93 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9369366 | Dissolved Cobalt (Co) | 2024/05/02 | 97 | 80 - 120 | 95 | 80 - 120 | <0.50 | ug/L | 0.062 | 20 |
| 9369366 | Dissolved Copper (Cu) | 2024/05/02 | 104 | 80 - 120 | 96 | 80 - 120 | <0.90 | ug/L | 1.3 | 20 |
| 9369366 | Dissolved Iron (Fe) | 2024/05/02 | 101 | 80 - 120 | 97 | 80 - 120 | <100 | ug/L | NC | 20 |
| 9369366 | Dissolved Lead (Pb) | 2024/05/02 | 100 | 80 - 120 | 94 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9369366 | Dissolved Magnesium (Mg) | 2024/05/02 | NC | 80 - 120 | 99 | 80 - 120 | <50 | ug/L | 3.2 | 20 |
| 9369366 | Dissolved Manganese (Mn) | 2024/05/02 | NC | 80 - 120 | 95 | 80 - 120 | <2.0 | ug/L | 0.74 | 20 |
| 9369366 | Dissolved Molybdenum (Mo) | 2024/05/02 | 104 | 80 - 120 | 98 | 80 - 120 | <0.50 | ug/L | 0.43 | 20 |
| 9369366 | Dissolved Nickel (Ni) | 2024/05/02 | 95 | 80 - 120 | 93 | 80 - 120 | <1.0 | ug/L | 2.5 | 20 |

| | | | Matrix Spike | | SPIKED BLANK | | Method Blank | | RPD | |
|---|---|---|---|---|---|---|---|---|---|---|
| QC Batch | Parameter | Date | % Recovery | QC Limits | % Recovery | QC Limits | Value | UNITS | Value (%) | QC Limits |
| 9369366 | Dissolved Phosphorus (P) | 2024/05/02 | 109 | 80 - 120 | 98 | 80 - 120 | <100 | ug/L | | |
| 9369366 | Dissolved Potassium (K) | 2024/05/02 | NC | 80 - 120 | 102 | 80 - 120 | <200 | ug/L | 1.4 | 20 |
| 9369366 | Dissolved Selenium (Se) | 2024/05/02 | 103 | 80 - 120 | 97 | 80 - 120 | <2.0 | ug/L | | |
| 9369366 | Dissolved Silicon (Si) | 2024/05/02 | 98 | 80 - 120 | 93 | 80 - 120 | <50 | ug/L | 3.8 | 20 |
| 9369366 | Dissolved Silver (Ag) | 2024/05/02 | 62 (1) | 80 - 120 | 93 | 80 - 120 | <0.090 | ug/L | NC | 20 |
| 9369366 | Dissolved Sodium (Na) | 2024/05/02 | NC | 80 - 120 | 98 | 80 - 120 | <100 | ug/L | 3.5 | 20 |
| 9369366 | Dissolved Strontium (Sr) | 2024/05/02 | NC | 80 - 120 | 95 | 80 - 120 | <1.0 | ug/L | 1.7 | 20 |
| 9369366 | Dissolved Thallium (Tl) | 2024/05/02 | 103 | 80 - 120 | 98 | 80 - 120 | <0.050 | ug/L | 2.1 | 20 |
| 9369366 | Dissolved Titanium (Ti) | 2024/05/02 | 101 | 80 - 120 | 96 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9369366 | Dissolved Uranium (U) | 2024/05/02 | 96 | 80 - 120 | 92 | 80 - 120 | <0.10 | ug/L | | |
| 9369366 | Dissolved Vanadium (V) | 2024/05/02 | 102 | 80 - 120 | 95 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9369366 | Dissolved Zinc (Zn) | 2024/05/02 | 98 | 80 - 120 | 96 | 80 - 120 | <5.0 | ug/L | 1.6 | 20 |
| 9369684 | Alkalinity (Total as CaCO3) | 2024/05/07 | | | 102 | 85 - 115 | <1.0 | mg/L | 0.15 | 20 |
| 9369695 | Conductivity | 2024/05/07 | | | 102 | 85 - 115 | <1.0 | umho/cm | 0.58 | 10 |
| 9369696 | pH | 2024/05/07 | | | 102 | 98 - 103 | | | 0.83 | N/A |
| 9369705 | Nitrate (N) | 2024/05/03 | NC | 80 - 120 | 98 | 80 - 120 | <0.10 | mg/L | 0.79 | 20 |
| 9369705 | Nitrite (N) | 2024/05/03 | 93 | 80 - 120 | 94 | 80 - 120 | <0.010 | mg/L | 1.7 | 20 |
| 9369708 | Nitrate (N) | 2024/05/03 | 92 | 80 - 120 | 94 | 80 - 120 | <0.10 | mg/L | 1.8 | 20 |
| 9369708 | Nitrite (N) | 2024/05/03 | 95 | 80 - 120 | 92 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 9369779 | Dissolved Organic Carbon | 2024/05/02 | 93 | 80 - 120 | 97 | 80 - 120 | <0.40 | mg/L | 3.4 | 20 |
| 9370036 | Alkalinity (Total as CaCO3) | 2024/05/06 | | | 102 | 85 - 115 | <1.0 | mg/L | 1.4 | 20 |
| 9370043 | Conductivity | 2024/05/06 | | | 101 | 85 - 115 | <1.0 | umho/cm | 0.29 | 10 |
| 9370055 | pH | 2024/05/06 | | | 102 | 98 - 103 | | | 0.51 | N/A |
| 9370893 | Dissolved Organic Carbon | 2024/05/03 | 96 | 80 - 120 | 98 | 80 - 120 | <0.40 | mg/L | 1.5 | 20 |
| 9370984 | Dissolved Chloride (Cl-) | 2024/05/03 | NC | 80 - 120 | 99 | 80 - 120 | <1.0 | mg/L | 0.36 | 20 |
| 9370990 | Dissolved Sulphate (SO4) | 2024/05/03 | NC | 75 - 125 | 97 | 80 - 120 | <1.0 | mg/L | 0.77 | 20 |
| 9370991 | Orthophosphate (P) | 2024/05/03 | 95 | 75 - 125 | 95 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 9371300 | F2 (C10-C16 Hydrocarbons) | 2024/05/03 | 97 | 60 - 130 | 91 | 60 - 130 | <100 | ug/L | NC | 30 |
| 9371300 | F3 (C16-C34 Hydrocarbons) | 2024/05/03 | 104 | 60 - 130 | 101 | 60 - 130 | <200 | ug/L | NC | 30 |

## 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 |
| 9371300 | F4 (C34-C50 Hydrocarbons) | 2024/05/03 | 97 | 60 - 130 | 94 | 60 - 130 | <200 | 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).

(1) Matrix Spike exceeds acceptance limits, probable matrix interference

# VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Senior 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 Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

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

NONT-2024-04-3020

Page of

| INVOICE TO: | |
|---|---|
| Company Name: | #21375 WSP Canada Inc. |
| Attention: | George Schneider |
| Address: | 210 Sheldon Drive<br>Cambridge ON N1T 1A8 |
| Tel: | (519) 620-8182 Fax: |
| Email: | George_Schneider@golder.com |

| REPORT TO: | |
|---|---|
| Company Name: | |
| Attention: | Paul Menkveld |
| Address: | |
| Tel: | Fax: |
| Email: | paul.menkveld@wsp.com |

| PROJECT INFORMATION: | |
|---|---|
| Quotation #: | C41059 |
| P.O. #: | |
| Project: | CA-GLD-19129150 |
| Project Name: | CBM Caledon |
| Site #: | |
| Sampled By: | VP/AN |

Only:

| Bottle Order #: | COC #: | Project Manager: |
|---|---|---|
| 984504 | C#984504-01-01 | Ankita Bhalla |

**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 ______

**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, BTEX/F1-F4 | | | | | | | | | # of Bottles | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | MW-IT-01 A | 24/04/30 | 11:45 | GW | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 2 | | MW-IT-01 B | \| | 12:45 | \| | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 3 | | MW-IT-01 C | \| | 11:30 | \| | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 4 | | MW-IT-02A | \| | 17:00 | \| | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 5 | | MW-IT-02B | \| | 17:30 | \| | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 6 | | MW-IT-02C | \| | 16:15 | \| | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 7 | | DUP2 | ↓ | — | ↓ | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 8 | | Trip Blank | — | — | — | | | ✓ | | | | | | | | | 2 | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

| * RELINQUISHED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | RECEIVED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | # jars used and not submitted |
|---|---|---|---|---|---|---|
| V Propp | 24/04/30 | 19:00 | | 2024/04/30 | 19:05 | |
| | | | | | | |

**Laboratory Use Only**

| Time Sensitive | Temperature (°C) on Recei | Custody Seal | Yes | No |
|---|---|---|---|---|
| | 12/7/7 | 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.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-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.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.

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

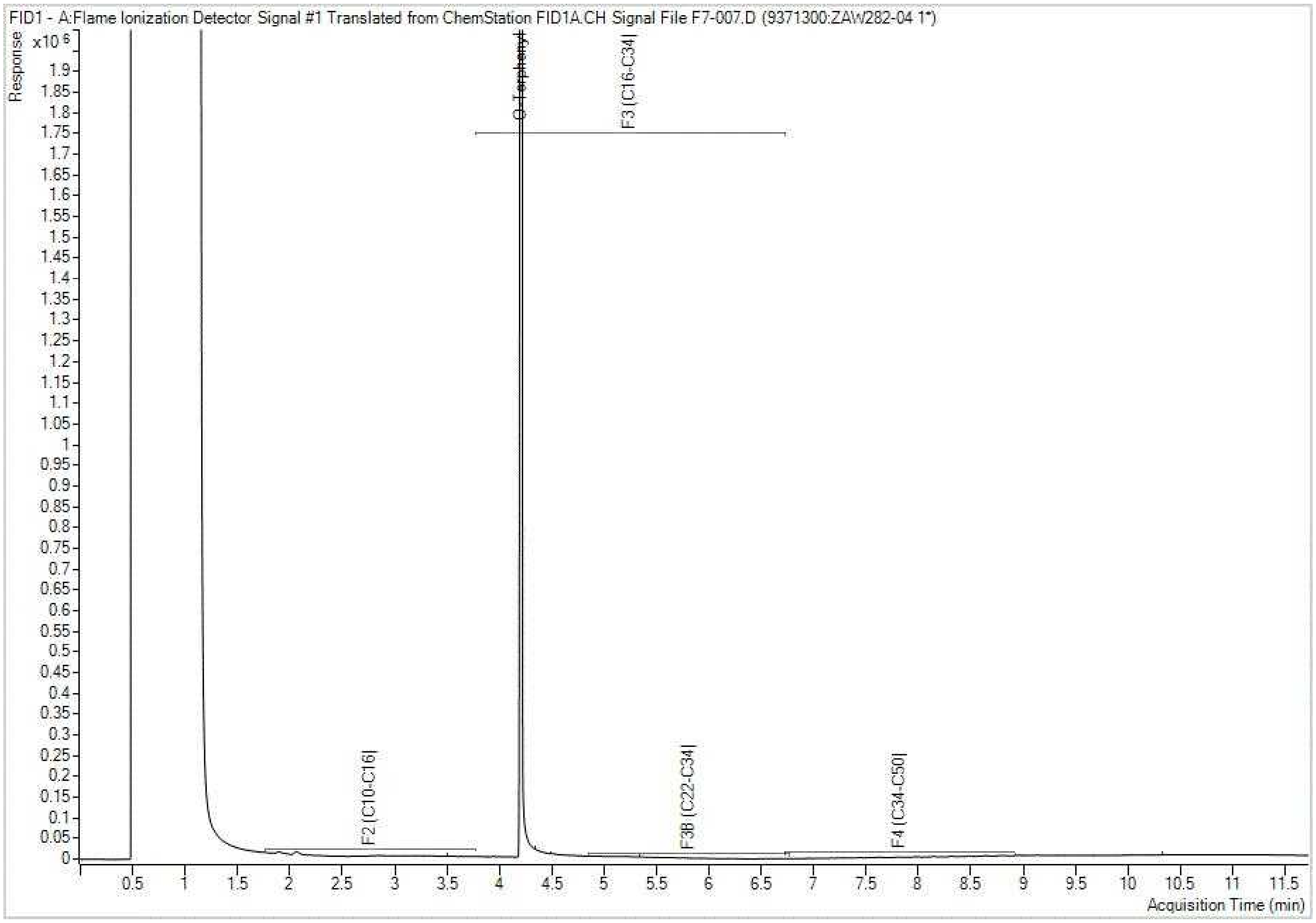
White: Bureau Veritas Yellow: Client

ICF

Bureau Veritas Job #: C4C9366
Report Date: 2024/05/07
Bureau Veritas Sample: ZAW282

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-01 A

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

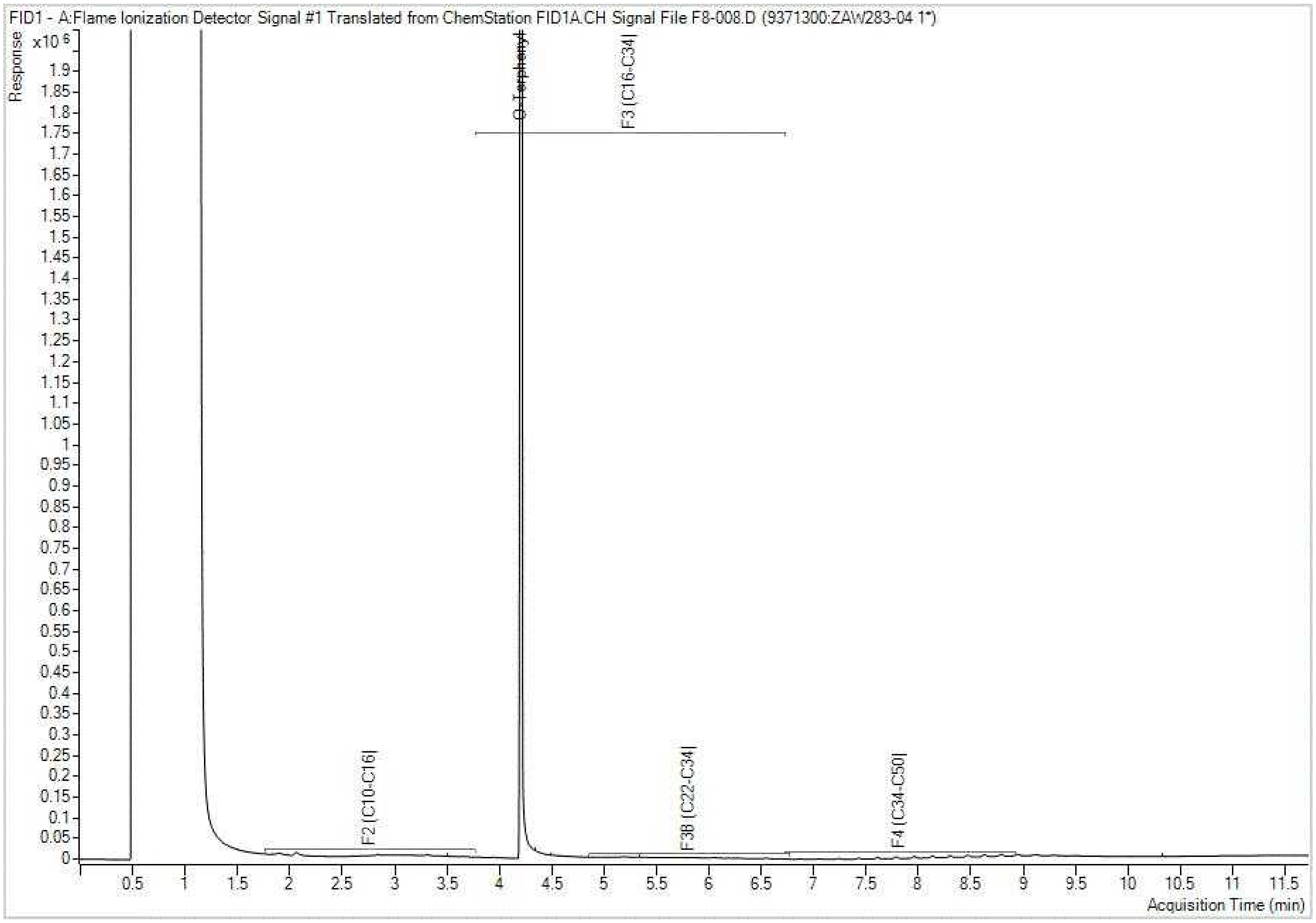


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C9366
Report Date: 2024/05/07
Bureau Veritas Sample: ZAW283

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-01 B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

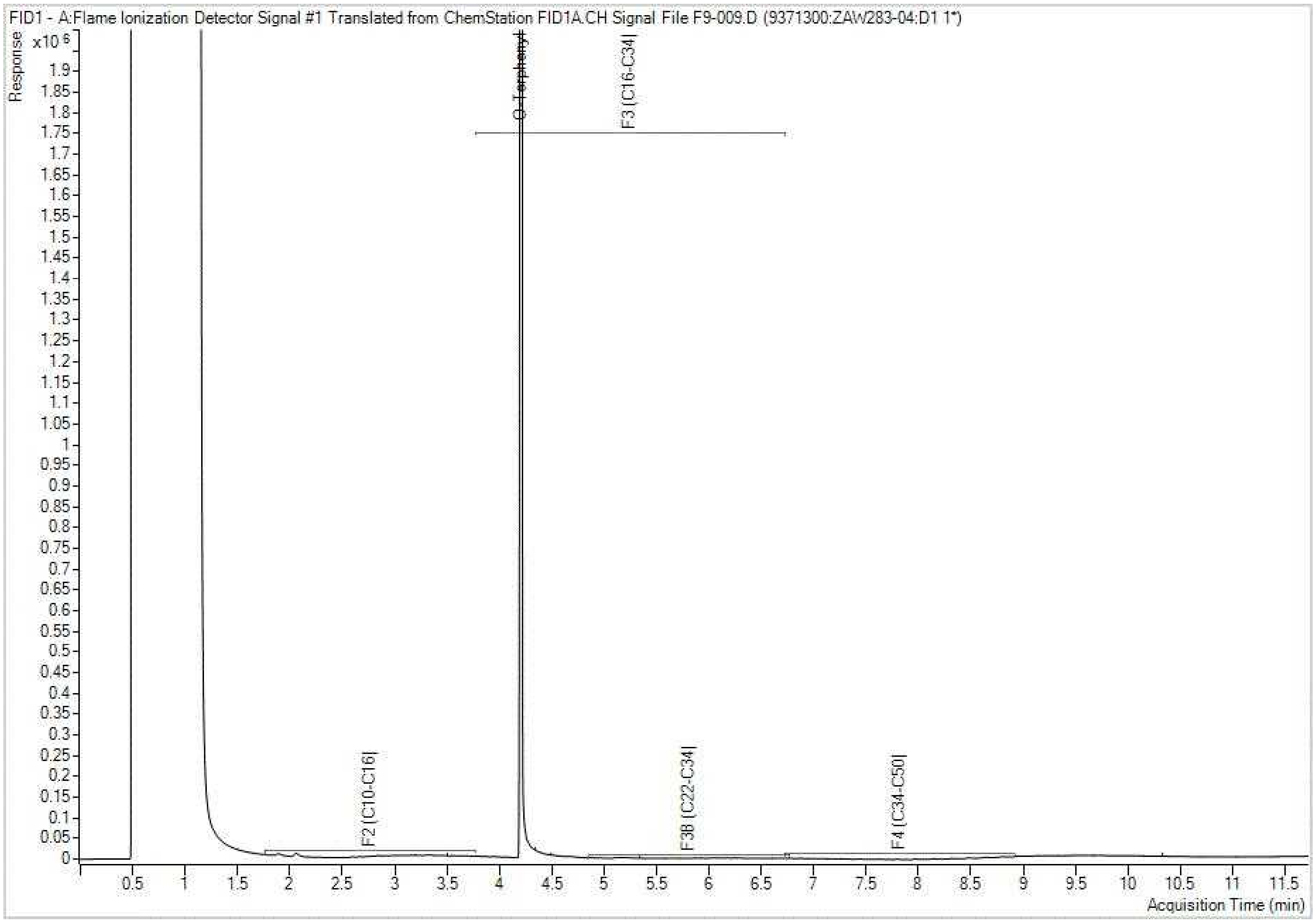


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C9366
Report Date: 2024/05/07
Bureau Veritas Sample: ZAW283 Lab-Dup

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-01 B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

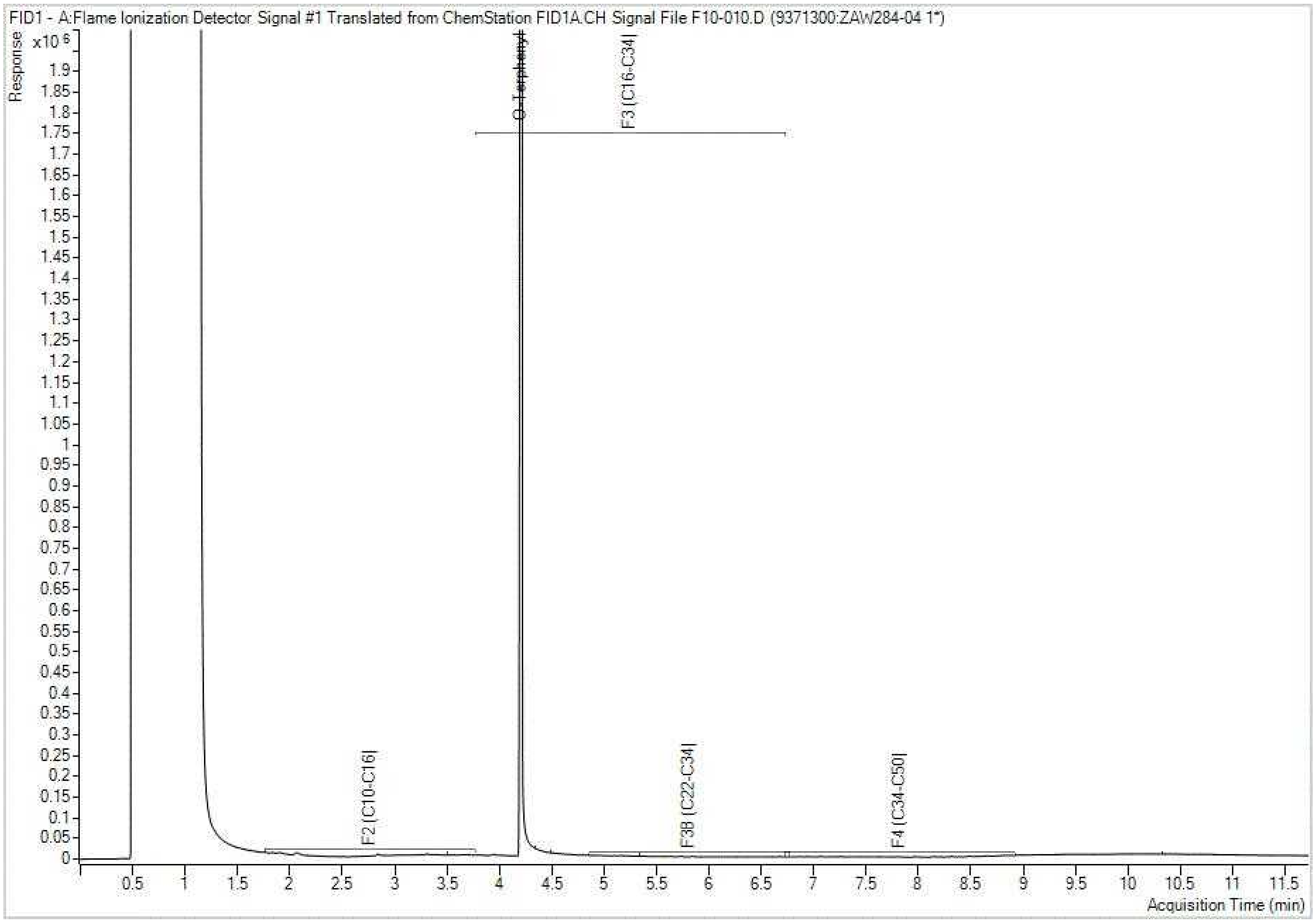


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C9366
Report Date: 2024/05/07
Bureau Veritas Sample: ZAW284

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-01 C

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

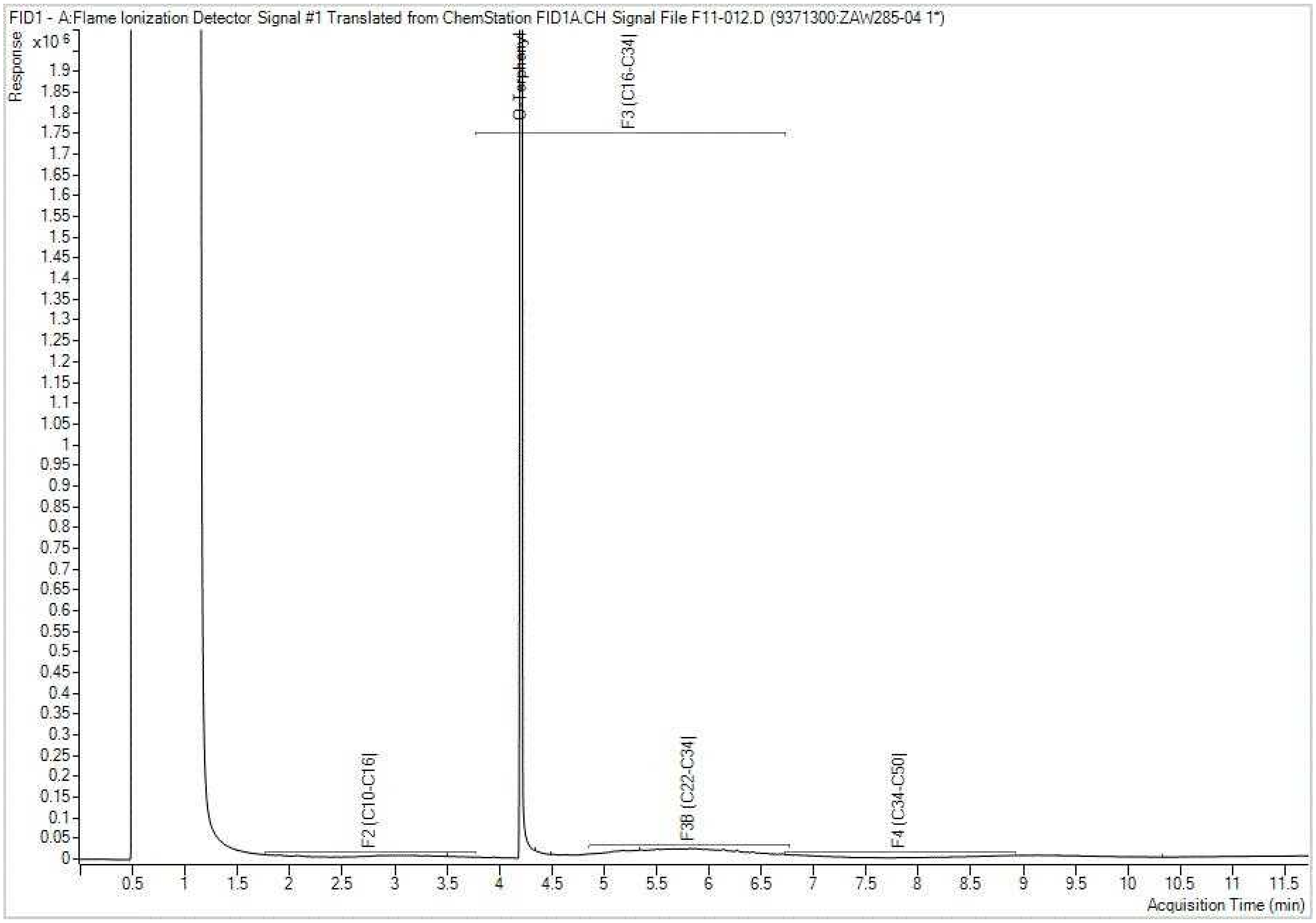


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C9366
Report Date: 2024/05/07
Bureau Veritas Sample: ZAW285

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-02A

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

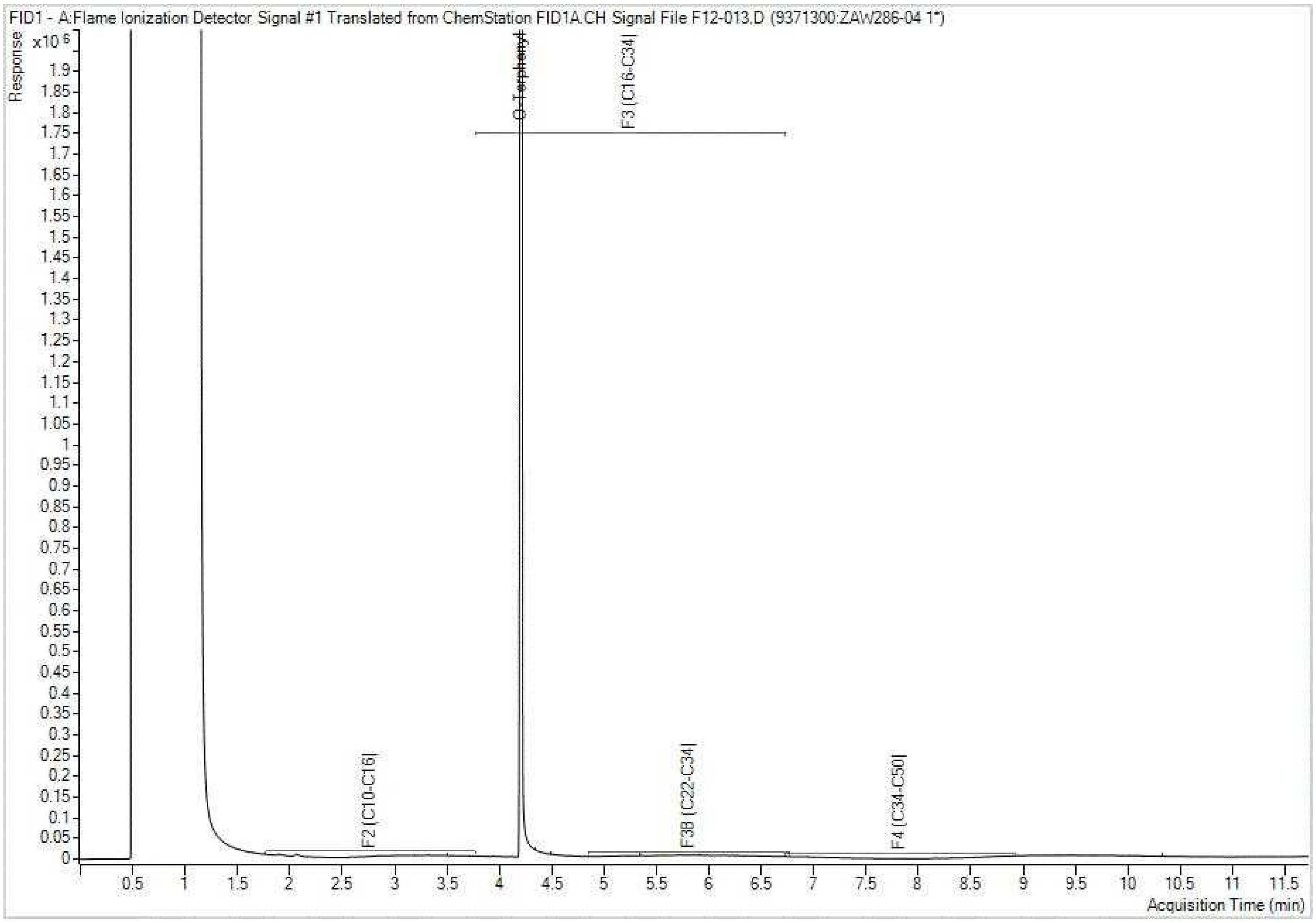


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C9366
Report Date: 2024/05/07
Bureau Veritas Sample: ZAW286

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-02B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

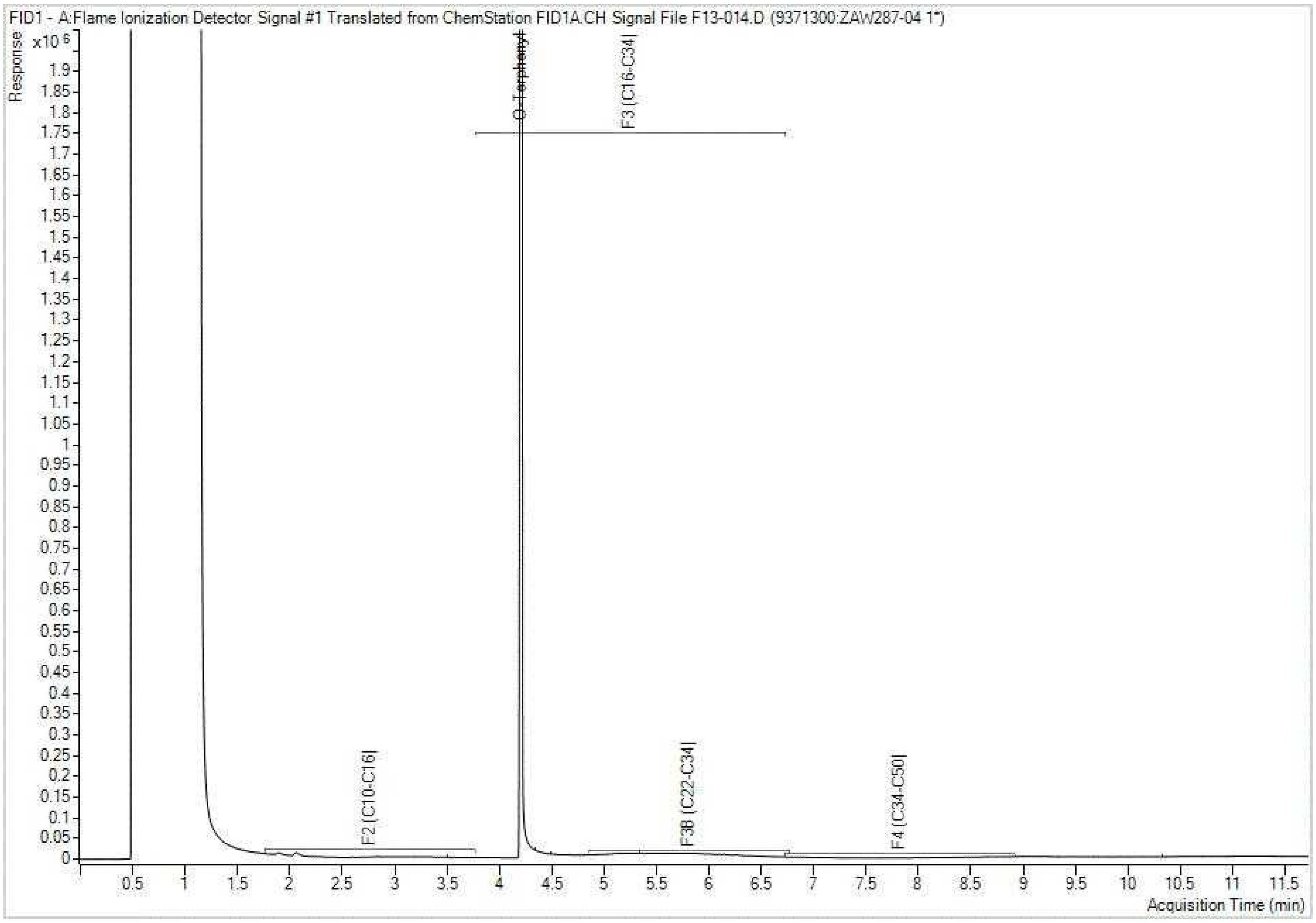


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4C9366
Report Date: 2024/05/07
Bureau Veritas Sample: ZAW287

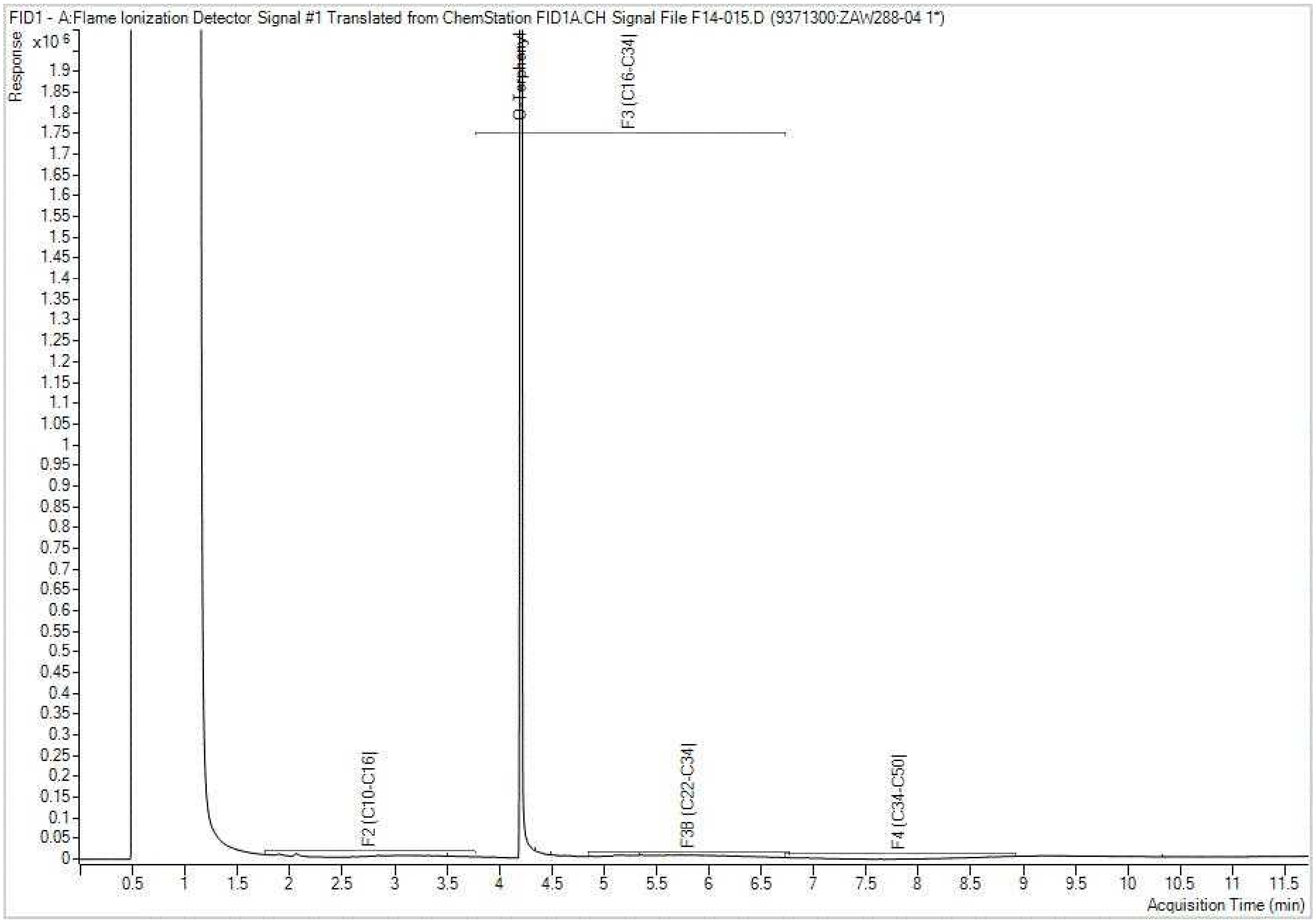
WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-02C

**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 #: CA-GLD-19129150
Site Location: CBM CALEDON
Your C.O.C. #: 984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/07**
Report #: R8138514
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4D0350**
**Received: 2024/05/01, 15:31**

Sample Matrix: Water
# Samples Received: 3

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Alkalinity | 3 | N/A | 2024/05/07 | CAM SOP-00448 | SM 24 2320 B m |
| Carbonate, Bicarbonate and Hydroxide | 3 | N/A | 2024/05/07 | CAM SOP-00102 | APHA 4500-CO2 D |
| Chloride by Automated Colourimetry | 3 | N/A | 2024/05/03 | CAM SOP-00463 | SM 24 4500-Cl E m |
| Conductivity | 3 | N/A | 2024/05/07 | CAM SOP-00414 | SM 24 2510 m |
| Dissolved Organic Carbon (DOC) (1) | 3 | N/A | 2024/05/03 | CAM SOP-00446 | SM 24 5310 B m |
| Petroleum Hydro. CCME F1 & BTEX in Water | 3 | N/A | 2024/05/02 | CAM SOP-00315 | CCME PHC-CWS m |
| Petroleum Hydrocarbons F2-F4 in Water (2) | 3 | 2024/05/03 | 2024/05/04 | CAM SOP-00316 | CCME PHC-CWS m |
| Hardness (calculated as CaCO3) | 3 | N/A | 2024/05/03 | CAM SOP 00102/00408/00447 | SM 2340 B |
| Dissolved Metals by ICPMS | 3 | N/A | 2024/05/03 | CAM SOP-00447 | EPA 6020B m |
| Ion Balance (% Difference) | 3 | N/A | 2024/05/07 | | |
| Anion and Cation Sum | 3 | N/A | 2024/05/07 | | |
| Total Ammonia-N | 3 | N/A | 2024/05/03 | CAM SOP-00441 | USGS I-2522-90 m |
| Nitrate & Nitrite as Nitrogen in Water (3) | 3 | N/A | 2024/05/03 | CAM SOP-00440 | SM 24 4500-NO3I/NO2B |
| pH (4) | 3 | 2024/05/02 | 2024/05/07 | CAM SOP-00413 | SM 24th - 4500H+ B |
| Orthophosphate | 3 | N/A | 2024/05/03 | CAM SOP-00461 | SM 24 4500-P E |
| Sat. pH and Langelier Index (@ 20C) | 3 | N/A | 2024/05/07 | | Auto Calc |
| Sat. pH and Langelier Index (@ 4C) | 3 | N/A | 2024/05/07 | | Auto Calc |
| Sulphate by Automated Turbidimetry | 3 | N/A | 2024/05/03 | CAM SOP-00464 | SM 24 4500-SO42- E m |
| Total Dissolved Solids (TDS calc) | 3 | N/A | 2024/05/07 | | 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, EPA, APHA or the Quebec Ministry of Environment.

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

Your Project #: CA-GLD-19129150
Site Location: CBM CALEDON
Your C.O.C. #: 984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.
210 Sheldon Drive
Cambridge, ON
CANADA N1T 1A8

**Report Date: 2024/05/07**
Report #: R8138514
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**BUREAU VERITAS JOB #: C4D0350**
**Received: 2024/05/01, 15:31**

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) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Ankita Bhalla, Project Manager
Email: Ankita.Bhalla@bureauveritas.com
Phone# (905) 817-5700
==================================================================
This report has been generated and distributed using a secure automated process.
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 Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Total Cover Pages : 2

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZBB544 | | | ZBB544 | | | ZBB545 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/05/01 10:35 | | | 2024/05/01 10:35 | | | 2024/05/01 11:40 | | |
| **COC Number** | | 984504-01-01 | | | 984504-01-01 | | | 984504-01-01 | | |
| | **UNITS** | **MW-IT-07-A** | **RDL** | **QC Batch** | **MW-IT-07-A Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-07-B** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Anion Sum | me/L | 6.35 | N/A | 9369503 | | | | 6.20 | N/A | 9369503 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | 210 | 1.0 | 9369498 | | | | 210 | 1.0 | 9369498 |
| Calculated TDS | mg/L | 350 | 1.0 | 9369497 | | | | 340 | 1.0 | 9369497 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | 2.7 | 1.0 | 9369498 | | | | 2.6 | 1.0 | 9369498 |
| Cation Sum | me/L | 6.74 | N/A | 9369503 | | | | 6.63 | N/A | 9369503 |
| Hardness (CaCO3) | mg/L | 270 | 1.0 | 9369500 | | | | 270 | 1.0 | 9369500 |
| Ion Balance (% Difference) | % | 2.91 | N/A | 9369502 | | | | 3.38 | N/A | 9369502 |
| Langelier Index (@ 20C) | N/A | 0.913 | | 9369505 | | | | 0.898 | | 9369505 |
| Langelier Index (@ 4C) | N/A | 0.665 | | 9369506 | | | | 0.650 | | 9369506 |
| Saturation pH (@ 20C) | N/A | 7.22 | | 9369505 | | | | 7.22 | | 9369505 |
| Saturation pH (@ 4C) | N/A | 7.46 | | 9369506 | | | | 7.46 | | 9369506 |
| **Inorganics** | | | | | | | | | | |
| Total Ammonia-N | mg/L | <0.050 | 0.050 | 9370616 | <0.050 | 0.050 | 9370616 | <0.050 | 0.050 | 9370616 |
| Conductivity | umho/cm | 630 | 1.0 | 9370043 | | | | 610 | 1.0 | 9370043 |
| Dissolved Organic Carbon | mg/L | 1.6 | 0.40 | 9371968 | | | | 1.7 | 0.40 | 9371968 |
| Orthophosphate (P) | mg/L | <0.010 | 0.010 | 9370991 | | | | <0.010 | 0.010 | 9370991 |
| pH | pH | 8.13 | | 9370055 | | | | 8.11 | | 9370055 |
| Dissolved Sulphate (SO4) | mg/L | 14 | 1.0 | 9370990 | | | | 14 | 1.0 | 9370990 |
| Alkalinity (Total as CaCO3) | mg/L | 210 | 1.0 | 9370036 | | | | 210 | 1.0 | 9370036 |
| Dissolved Chloride (Cl-) | mg/L | 54 | 2.0 | 9370984 | | | | 49 | 1.0 | 9370984 |
| Nitrite (N) | mg/L | <0.010 | 0.010 | 9371000 | | | | <0.010 | 0.010 | 9371000 |
| Nitrate (N) | mg/L | 3.75 | 0.10 | 9371000 | | | | 4.11 | 0.10 | 9371000 |
| Nitrate + Nitrite (N) | mg/L | 3.75 | 0.10 | 9371000 | | | | 4.11 | 0.10 | 9371000 |
| **Metals** | | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | <4.9 | 4.9 | 9371442 | | | | <4.9 | 4.9 | 9371442 |
| Dissolved Antimony (Sb) | ug/L | <0.50 | 0.50 | 9371442 | | | | <0.50 | 0.50 | 9371442 |
| Dissolved Arsenic (As) | ug/L | <1.0 | 1.0 | 9371442 | | | | <1.0 | 1.0 | 9371442 |
| Dissolved Barium (Ba) | ug/L | 38 | 2.0 | 9371442 | | | | 36 | 2.0 | 9371442 |
| Dissolved Beryllium (Be) | ug/L | <0.40 | 0.40 | 9371442 | | | | <0.40 | 0.40 | 9371442 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZBB544 | | | ZBB544 | | | ZBB545 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/05/01 10:35 | | | 2024/05/01 10:35 | | | 2024/05/01 11:40 | | |
| **COC Number** | | 984504-01-01 | | | 984504-01-01 | | | 984504-01-01 | | |
| | **UNITS** | **MW-IT-07-A** | **RDL** | **QC Batch** | **MW-IT-07-A Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-07-B** | **RDL** | **QC Batch** |
| Dissolved Boron (B) | ug/L | <10 | 10 | 9371442 | | | | <10 | 10 | 9371442 |
| Dissolved Cadmium (Cd) | ug/L | <0.090 | 0.090 | 9371442 | | | | <0.090 | 0.090 | 9371442 |
| Dissolved Calcium (Ca) | ug/L | 77000 | 200 | 9371442 | | | | 77000 | 200 | 9371442 |
| Dissolved Chromium (Cr) | ug/L | <5.0 | 5.0 | 9371442 | | | | <5.0 | 5.0 | 9371442 |
| Dissolved Cobalt (Co) | ug/L | 0.69 | 0.50 | 9371442 | | | | 0.65 | 0.50 | 9371442 |
| Dissolved Copper (Cu) | ug/L | <0.90 | 0.90 | 9371442 | | | | 0.92 | 0.90 | 9371442 |
| Dissolved Iron (Fe) | ug/L | <100 | 100 | 9371442 | | | | <100 | 100 | 9371442 |
| Dissolved Lead (Pb) | ug/L | <0.50 | 0.50 | 9371442 | | | | <0.50 | 0.50 | 9371442 |
| Dissolved Magnesium (Mg) | ug/L | 18000 | 50 | 9371442 | | | | 18000 | 50 | 9371442 |
| Dissolved Manganese (Mn) | ug/L | 5.8 | 2.0 | 9371442 | | | | <2.0 | 2.0 | 9371442 |
| Dissolved Molybdenum (Mo) | ug/L | <0.50 | 0.50 | 9371442 | | | | <0.50 | 0.50 | 9371442 |
| Dissolved Nickel (Ni) | ug/L | <1.0 | 1.0 | 9371442 | | | | <1.0 | 1.0 | 9371442 |
| Dissolved Phosphorus (P) | ug/L | <100 | 100 | 9371442 | | | | <100 | 100 | 9371442 |
| Dissolved Potassium (K) | ug/L | 2100 | 200 | 9371442 | | | | 2200 | 200 | 9371442 |
| Dissolved Selenium (Se) | ug/L | <2.0 | 2.0 | 9371442 | | | | <2.0 | 2.0 | 9371442 |
| Dissolved Silicon (Si) | ug/L | 2900 | 50 | 9371442 | | | | 2800 | 50 | 9371442 |
| Dissolved Silver (Ag) | ug/L | <0.090 | 0.090 | 9371442 | | | | <0.090 | 0.090 | 9371442 |
| Dissolved Sodium (Na) | ug/L | 30000 | 100 | 9371442 | | | | 28000 | 100 | 9371442 |
| Dissolved Strontium (Sr) | ug/L | 130 | 1.0 | 9371442 | | | | 120 | 1.0 | 9371442 |
| Dissolved Thallium (Tl) | ug/L | <0.050 | 0.050 | 9371442 | | | | <0.050 | 0.050 | 9371442 |
| Dissolved Titanium (Ti) | ug/L | <5.0 | 5.0 | 9371442 | | | | <5.0 | 5.0 | 9371442 |
| Dissolved Uranium (U) | ug/L | 0.24 | 0.10 | 9371442 | | | | 0.24 | 0.10 | 9371442 |
| Dissolved Vanadium (V) | ug/L | <0.50 | 0.50 | 9371442 | | | | <0.50 | 0.50 | 9371442 |
| Dissolved Zinc (Zn) | ug/L | <5.0 | 5.0 | 9371442 | | | | <5.0 | 5.0 | 9371442 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZBB545 | | | ZBB546 | | |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/05/01<br>11:40 | | | 2024/05/01<br>10:15 | | |
| **COC Number** | | 984504-01-01 | | | 984504-01-01 | | |
| | **UNITS** | **MW-IT-07-B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-07-C** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Anion Sum | me/L | | | | 5.63 | N/A | 9369503 |
| Bicarb. Alkalinity (calc. as CaCO3) | mg/L | | | | 220 | 1.0 | 9369498 |
| Calculated TDS | mg/L | | | | 310 | 1.0 | 9369497 |
| Carb. Alkalinity (calc. as CaCO3) | mg/L | | | | 2.2 | 1.0 | 9369498 |
| Cation Sum | me/L | | | | 6.45 | N/A | 9369503 |
| Hardness (CaCO3) | mg/L | | | | 290 | 1.0 | 9369500 |
| Ion Balance (% Difference) | % | | | | 6.76 | N/A | 9369502 |
| Langelier Index (@ 20C) | N/A | | | | 0.896 | | 9369505 |
| Langelier Index (@ 4C) | N/A | | | | 0.647 | | 9369506 |
| Saturation pH (@ 20C) | N/A | | | | 7.12 | | 9369505 |
| Saturation pH (@ 4C) | N/A | | | | 7.37 | | 9369506 |
| **Inorganics** | | | | | | | |
| Total Ammonia-N | mg/L | | | | <0.050 | 0.050 | 9370616 |
| Conductivity | umho/cm | | | | 540 | 1.0 | 9370043 |
| Dissolved Organic Carbon | mg/L | 1.6 | 0.40 | 9371968 | 2.5 | 0.40 | 9370893 |
| Orthophosphate (P) | mg/L | | | | <0.010 | 0.010 | 9370991 |
| pH | pH | | | | 8.01 | | 9370055 |
| Dissolved Sulphate (SO4) | mg/L | | | | 10 | 1.0 | 9370990 |
| Alkalinity (Total as CaCO3) | mg/L | | | | 230 | 1.0 | 9370036 |
| Dissolved Chloride (Cl-) | mg/L | | | | 25 | 1.0 | 9370984 |
| Nitrite (N) | mg/L | | | | <0.010 | 0.010 | 9371000 |
| Nitrate (N) | mg/L | | | | 2.32 | 0.10 | 9371000 |
| Nitrate + Nitrite (N) | mg/L | | | | 2.32 | 0.10 | 9371000 |
| **Metals** | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | | | | 11 | 4.9 | 9371442 |
| Dissolved Antimony (Sb) | ug/L | | | | <0.50 | 0.50 | 9371442 |
| Dissolved Arsenic (As) | ug/L | | | | <1.0 | 1.0 | 9371442 |
| Dissolved Barium (Ba) | ug/L | | | | 72 | 2.0 | 9371442 |
| Dissolved Beryllium (Be) | ug/L | | | | <0.40 | 0.40 | 9371442 |

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

## RCAP - COMPREHENSIVE (WATER)

| **Bureau Veritas ID** | | ZBB545 | | | ZBB546 | | |
|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/05/01 11:40 | | | 2024/05/01 10:15 | | |
| **COC Number** | | 984504-01-01 | | | 984504-01-01 | | |
| | **UNITS** | **MW-IT-07-B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-07-C** | **RDL** | **QC Batch** |
| Dissolved Boron (B) | ug/L | | | | 12 | 10 | 9371442 |
| Dissolved Cadmium (Cd) | ug/L | | | | <0.090 | 0.090 | 9371442 |
| Dissolved Calcium (Ca) | ug/L | | | | 89000 | 200 | 9371442 |
| Dissolved Chromium (Cr) | ug/L | | | | <5.0 | 5.0 | 9371442 |
| Dissolved Cobalt (Co) | ug/L | | | | 3.0 | 0.50 | 9371442 |
| Dissolved Copper (Cu) | ug/L | | | | 1.0 | 0.90 | 9371442 |
| Dissolved Iron (Fe) | ug/L | | | | <100 | 100 | 9371442 |
| Dissolved Lead (Pb) | ug/L | | | | <0.50 | 0.50 | 9371442 |
| Dissolved Magnesium (Mg) | ug/L | | | | 16000 | 50 | 9371442 |
| Dissolved Manganese (Mn) | ug/L | | | | 51 | 2.0 | 9371442 |
| Dissolved Molybdenum (Mo) | ug/L | | | | 1.0 | 0.50 | 9371442 |
| Dissolved Nickel (Ni) | ug/L | | | | 5.8 | 1.0 | 9371442 |
| Dissolved Phosphorus (P) | ug/L | | | | <100 | 100 | 9371442 |
| Dissolved Potassium (K) | ug/L | | | | 1700 | 200 | 9371442 |
| Dissolved Selenium (Se) | ug/L | | | | <2.0 | 2.0 | 9371442 |
| Dissolved Silicon (Si) | ug/L | | | | 3600 | 50 | 9371442 |
| Dissolved Silver (Ag) | ug/L | | | | <0.090 | 0.090 | 9371442 |
| Dissolved Sodium (Na) | ug/L | | | | 16000 | 100 | 9371442 |
| Dissolved Strontium (Sr) | ug/L | | | | 160 | 1.0 | 9371442 |
| Dissolved Thallium (Tl) | ug/L | | | | <0.050 | 0.050 | 9371442 |
| Dissolved Titanium (Ti) | ug/L | | | | <5.0 | 5.0 | 9371442 |
| Dissolved Uranium (U) | ug/L | | | | 0.28 | 0.10 | 9371442 |
| Dissolved Vanadium (V) | ug/L | | | | <0.50 | 0.50 | 9371442 |
| Dissolved Zinc (Zn) | ug/L | | | | <5.0 | 5.0 | 9371442 |

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

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

| **Bureau Veritas ID** | | ZBB544 | ZBB545 | | | ZBB545 | | | ZBB546 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sampling Date** | | 2024/05/01<br>10:35 | 2024/05/01<br>11:40 | | | 2024/05/01<br>11:40 | | | 2024/05/01<br>10:15 | | |
| **COC Number** | | 984504-01-01 | 984504-01-01 | | | 984504-01-01 | | | 984504-01-01 | | |
| | **UNITS** | **MW-IT-07-A** | **MW-IT-07-B** | **RDL** | **QC Batch** | **MW-IT-07-B Lab-Dup** | **RDL** | **QC Batch** | **MW-IT-07-C** | **RDL** | **QC Batch** |
| **BTEX & F1 Hydrocarbons** | | | | | | | | | | | |
| Benzene | ug/L | <0.20 | <0.20 | 0.20 | 9370734 | | | | <0.20 | 0.20 | 9370734 |
| Toluene | ug/L | 0.32 | <0.20 | 0.20 | 9370734 | | | | 1.9 | 0.20 | 9370734 |
| Ethylbenzene | ug/L | <0.20 | <0.20 | 0.20 | 9370734 | | | | <0.20 | 0.20 | 9370734 |
| o-Xylene | ug/L | <0.20 | <0.20 | 0.20 | 9370734 | | | | <0.20 | 0.20 | 9370734 |
| p+m-Xylene | ug/L | <0.40 | <0.40 | 0.40 | 9370734 | | | | <0.40 | 0.40 | 9370734 |
| Total Xylenes | ug/L | <0.40 | <0.40 | 0.40 | 9370734 | | | | <0.40 | 0.40 | 9370734 |
| F1 (C6-C10) | ug/L | <25 | <25 | 25 | 9370734 | | | | 110 | 25 | 9370734 |
| F1 (C6-C10) - BTEX | ug/L | <25 | <25 | 25 | 9370734 | | | | 100 | 25 | 9370734 |
| **F2-F4 Hydrocarbons** | | | | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | ug/L | <100 | <100 | 100 | 9372441 | <100 | 100 | 9372441 | <100 | 100 | 9372441 |
| F3 (C16-C34 Hydrocarbons) | ug/L | <200 | <200 | 200 | 9372441 | <200 | 200 | 9372441 | 390 | 200 | 9372441 |
| F4 (C34-C50 Hydrocarbons) | ug/L | <200 | <200 | 200 | 9372441 | <200 | 200 | 9372441 | <200 | 200 | 9372441 |
| Reached Baseline at C50 | ug/L | Yes | Yes | | 9372441 | Yes | | 9372441 | Yes | | 9372441 |
| **Surrogate Recovery (%)** | | | | | | | | | | | |
| 1,4-Difluorobenzene | % | 99 | 100 | | 9370734 | | | | 99 | | 9370734 |
| 4-Bromofluorobenzene | % | 99 | 99 | | 9370734 | | | | 100 | | 9370734 |
| D10-o-Xylene | % | 90 | 90 | | 9370734 | | | | 94 | | 9370734 |
| D4-1,2-Dichloroethane | % | 100 | 99 | | 9370734 | | | | 100 | | 9370734 |
| o-Terphenyl | % | 99 | 101 | | 9372441 | 100 | | 9372441 | 102 | | 9372441 |

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

## TEST SUMMARY

**Bureau Veritas ID:** ZBB544
**Sample ID:** MW-IT-07-A
**Matrix:** Water

**Collected:** 2024/05/01
**Shipped:**
**Received:** 2024/05/01

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9370036 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9369498 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9370043 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9371968 | N/A | 2024/05/03 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9370734 | N/A | 2024/05/02 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9372441 | 2024/05/03 | 2024/05/04 | Dennis Ngondu |
| Hardness (calculated as CaCO3) | | 9369500 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9369502 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9369503 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9370616 | N/A | 2024/05/03 | Massarat Jan |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9371000 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9370055 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9369505 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9369506 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9369497 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZBB544 Dup
**Sample ID:** MW-IT-07-A
**Matrix:** Water

**Collected:** 2024/05/01
**Shipped:**
**Received:** 2024/05/01

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Total Ammonia-N | LACH/NH4 | 9370616 | N/A | 2024/05/03 | Massarat Jan |

**Bureau Veritas ID:** ZBB545
**Sample ID:** MW-IT-07-B
**Matrix:** Water

**Collected:** 2024/05/01
**Shipped:**
**Received:** 2024/05/01

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9370036 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9369498 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9370043 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9371968 | N/A | 2024/05/03 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9370734 | N/A | 2024/05/02 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9372441 | 2024/05/03 | 2024/05/04 | Dennis Ngondu |
| Hardness (calculated as CaCO3) | | 9369500 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9369502 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9369503 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9370616 | N/A | 2024/05/03 | Massarat Jan |

# TEST SUMMARY

**Bureau Veritas ID:** ZBB545
**Sample ID:** MW-IT-07-B
**Matrix:** Water

**Collected:** 2024/05/01
**Shipped:**
**Received:** 2024/05/01

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9371000 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9370055 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9369505 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9369506 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9369497 | N/A | 2024/05/07 | Automated Statchk |

**Bureau Veritas ID:** ZBB545 Dup
**Sample ID:** MW-IT-07-B
**Matrix:** Water

**Collected:** 2024/05/01
**Shipped:**
**Received:** 2024/05/01

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9371968 | N/A | 2024/05/03 | Gyulshen Idriz |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9372441 | 2024/05/03 | 2024/05/04 | Dennis Ngondu |

**Bureau Veritas ID:** ZBB546
**Sample ID:** MW-IT-07-C
**Matrix:** Water

**Collected:** 2024/05/01
**Shipped:**
**Received:** 2024/05/01

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity | AT | 9370036 | N/A | 2024/05/07 | Surinder Rai |
| Carbonate, Bicarbonate and Hydroxide | CALC | 9369498 | N/A | 2024/05/07 | Automated Statchk |
| Chloride by Automated Colourimetry | SKAL | 9370984 | N/A | 2024/05/03 | Massarat Jan |
| Conductivity | AT | 9370043 | N/A | 2024/05/07 | Surinder Rai |
| Dissolved Organic Carbon (DOC) | TOCV/NDIR | 9370893 | N/A | 2024/05/03 | Gyulshen Idriz |
| Petroleum Hydro. CCME F1 & BTEX in Water | HSGC/MSFD | 9370734 | N/A | 2024/05/02 | Georgeta Rusu |
| Petroleum Hydrocarbons F2-F4 in Water | GC/FID | 9372441 | 2024/05/03 | 2024/05/04 | Dennis Ngondu |
| Hardness (calculated as CaCO3) |  | 9369500 | N/A | 2024/05/03 | Automated Statchk |
| Dissolved Metals by ICPMS | ICP/MS | 9371442 | N/A | 2024/05/03 | Prempal Bhatti |
| Ion Balance (% Difference) | CALC | 9369502 | N/A | 2024/05/07 | Automated Statchk |
| Anion and Cation Sum | CALC | 9369503 | N/A | 2024/05/07 | Automated Statchk |
| Total Ammonia-N | LACH/NH4 | 9370616 | N/A | 2024/05/03 | Massarat Jan |
| Nitrate & Nitrite as Nitrogen in Water | LACH | 9371000 | N/A | 2024/05/03 | Jinal Chavda |
| pH | AT | 9370055 | 2024/05/02 | 2024/05/07 | Surinder Rai |
| Orthophosphate | KONE | 9370991 | N/A | 2024/05/03 | Massarat Jan |
| Sat. pH and Langelier Index (@ 20C) | CALC | 9369505 | N/A | 2024/05/07 | Automated Statchk |
| Sat. pH and Langelier Index (@ 4C) | CALC | 9369506 | N/A | 2024/05/07 | Automated Statchk |
| Sulphate by Automated Turbidimetry | SKAL | 9370990 | N/A | 2024/05/03 | Massarat Jan |
| Total Dissolved Solids (TDS calc) | CALC | 9369497 | N/A | 2024/05/07 | Automated Statchk |

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 15.0°C |

**Results relate only to the items tested.**

# 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 |
| 9370734 | 1,4-Difluorobenzene | 2024/05/02 | 96 | 70 - 130 | 97 | 70 - 130 | 102 | % | | |
| 9370734 | 4-Bromofluorobenzene | 2024/05/02 | 101 | 70 - 130 | 102 | 70 - 130 | 97 | % | | |
| 9370734 | D10-o-Xylene | 2024/05/02 | 103 | 70 - 130 | 102 | 70 - 130 | 87 | % | | |
| 9370734 | D4-1,2-Dichloroethane | 2024/05/02 | 97 | 70 - 130 | 96 | 70 - 130 | 103 | % | | |
| 9372441 | o-Terphenyl | 2024/05/04 | 102 | 60 - 130 | 102 | 60 - 130 | 105 | % | | |
| 9370036 | Alkalinity (Total as CaCO3) | 2024/05/06 | | | 102 | 85 - 115 | <1.0 | mg/L | 1.4 | 20 |
| 9370043 | Conductivity | 2024/05/06 | | | 101 | 85 - 115 | <1.0 | umho/cm | 0.29 | 10 |
| 9370055 | pH | 2024/05/06 | | | 102 | 98 - 103 | | | 0.51 | N/A |
| 9370616 | Total Ammonia-N | 2024/05/03 | 93 | 75 - 125 | 98 | 80 - 120 | <0.050 | mg/L | NC | 20 |
| 9370734 | Benzene | 2024/05/02 | 85 | 50 - 140 | 86 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9370734 | Ethylbenzene | 2024/05/02 | 92 | 50 - 140 | 89 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9370734 | F1 (C6-C10) - BTEX | 2024/05/02 | | | | | <25 | ug/L | NC | 30 |
| 9370734 | F1 (C6-C10) | 2024/05/02 | 96 | 60 - 140 | 96 | 60 - 140 | <25 | ug/L | NC | 30 |
| 9370734 | o-Xylene | 2024/05/02 | 91 | 50 - 140 | 94 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9370734 | p+m-Xylene | 2024/05/02 | 86 | 50 - 140 | 88 | 50 - 140 | <0.40 | ug/L | NC | 30 |
| 9370734 | Toluene | 2024/05/02 | 83 | 50 - 140 | 85 | 50 - 140 | <0.20 | ug/L | NC | 30 |
| 9370734 | Total Xylenes | 2024/05/02 | | | | | <0.40 | ug/L | NC | 30 |
| 9370893 | Dissolved Organic Carbon | 2024/05/03 | 96 | 80 - 120 | 98 | 80 - 120 | <0.40 | mg/L | 1.5 | 20 |
| 9370984 | Dissolved Chloride (Cl-) | 2024/05/03 | NC | 80 - 120 | 99 | 80 - 120 | <1.0 | mg/L | 0.36 | 20 |
| 9370990 | Dissolved Sulphate (SO4) | 2024/05/03 | NC | 75 - 125 | 97 | 80 - 120 | <1.0 | mg/L | 0.77 | 20 |
| 9370991 | Orthophosphate (P) | 2024/05/03 | 95 | 75 - 125 | 95 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 9371000 | Nitrate (N) | 2024/05/03 | 93 | 80 - 120 | 94 | 80 - 120 | <0.10 | mg/L | NC | 20 |
| 9371000 | Nitrite (N) | 2024/05/03 | 97 | 80 - 120 | 96 | 80 - 120 | <0.010 | mg/L | NC | 20 |
| 9371442 | Dissolved Aluminum (Al) | 2024/05/03 | 105 | 80 - 120 | 101 | 80 - 120 | <4.9 | ug/L | NC | 20 |
| 9371442 | Dissolved Antimony (Sb) | 2024/05/03 | 110 | 80 - 120 | 105 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9371442 | Dissolved Arsenic (As) | 2024/05/03 | 106 | 80 - 120 | 100 | 80 - 120 | <1.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Barium (Ba) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <2.0 | ug/L | 0.43 | 20 |
| 9371442 | Dissolved Beryllium (Be) | 2024/05/03 | 107 | 80 - 120 | 99 | 80 - 120 | <0.40 | ug/L | NC | 20 |
| 9371442 | Dissolved Boron (B) | 2024/05/03 | 104 | 80 - 120 | 96 | 80 - 120 | <10 | ug/L | NC | 20 |
| 9371442 | Dissolved Cadmium (Cd) | 2024/05/03 | 106 | 80 - 120 | 101 | 80 - 120 | <0.090 | ug/L | NC | 20 |
| 9371442 | Dissolved Calcium (Ca) | 2024/05/03 | NC | 80 - 120 | 103 | 80 - 120 | <200 | ug/L | 3.5 | 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 |
| 9371442 | Dissolved Chromium (Cr) | 2024/05/03 | 105 | 80 - 120 | 100 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Cobalt (Co) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <0.50 | ug/L | 2.6 | 20 |
| 9371442 | Dissolved Copper (Cu) | 2024/05/03 | 107 | 80 - 120 | 103 | 80 - 120 | <0.90 | ug/L | NC | 20 |
| 9371442 | Dissolved Iron (Fe) | 2024/05/03 | 107 | 80 - 120 | 103 | 80 - 120 | <100 | ug/L | NC | 20 |
| 9371442 | Dissolved Lead (Pb) | 2024/05/03 | 104 | 80 - 120 | 101 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9371442 | Dissolved Magnesium (Mg) | 2024/05/03 | 104 | 80 - 120 | 101 | 80 - 120 | <50 | ug/L | 1.0 | 20 |
| 9371442 | Dissolved Manganese (Mn) | 2024/05/03 | 105 | 80 - 120 | 100 | 80 - 120 | <2.0 | ug/L | 1.8 | 20 |
| 9371442 | Dissolved Molybdenum (Mo) | 2024/05/03 | 111 | 80 - 120 | 106 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9371442 | Dissolved Nickel (Ni) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <1.0 | ug/L | 0.11 | 20 |
| 9371442 | Dissolved Phosphorus (P) | 2024/05/03 | 110 | 80 - 120 | 101 | 80 - 120 | <100 | ug/L | NC | 20 |
| 9371442 | Dissolved Potassium (K) | 2024/05/03 | 108 | 80 - 120 | 103 | 80 - 120 | <200 | ug/L | 0.45 | 20 |
| 9371442 | Dissolved Selenium (Se) | 2024/05/03 | 106 | 80 - 120 | 102 | 80 - 120 | <2.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Silicon (Si) | 2024/05/03 | 106 | 80 - 120 | 102 | 80 - 120 | <50 | ug/L | 2.6 | 20 |
| 9371442 | Dissolved Silver (Ag) | 2024/05/03 | 107 | 80 - 120 | 104 | 80 - 120 | <0.090 | ug/L | NC | 20 |
| 9371442 | Dissolved Sodium (Na) | 2024/05/03 | 105 | 80 - 120 | 102 | 80 - 120 | <100 | ug/L | 0.47 | 20 |
| 9371442 | Dissolved Strontium (Sr) | 2024/05/03 | 106 | 80 - 120 | 101 | 80 - 120 | <1.0 | ug/L | 0.51 | 20 |
| 9371442 | Dissolved Thallium (Tl) | 2024/05/03 | 105 | 80 - 120 | 102 | 80 - 120 | <0.050 | ug/L | NC | 20 |
| 9371442 | Dissolved Titanium (Ti) | 2024/05/03 | 104 | 80 - 120 | 100 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9371442 | Dissolved Uranium (U) | 2024/05/03 | 105 | 80 - 120 | 102 | 80 - 120 | <0.10 | ug/L | 5.6 | 20 |
| 9371442 | Dissolved Vanadium (V) | 2024/05/03 | 107 | 80 - 120 | 101 | 80 - 120 | <0.50 | ug/L | NC | 20 |
| 9371442 | Dissolved Zinc (Zn) | 2024/05/03 | 106 | 80 - 120 | 101 | 80 - 120 | <5.0 | ug/L | NC | 20 |
| 9371968 | Dissolved Organic Carbon | 2024/05/03 | 96 | 80 - 120 | 98 | 80 - 120 | <0.40 | mg/L | 0.79 | 20 |
| 9372441 | F2 (C10-C16 Hydrocarbons) | 2024/05/04 | 94 | 60 - 130 | 96 | 60 - 130 | <100 | ug/L | NC | 30 |
| 9372441 | F3 (C16-C34 Hydrocarbons) | 2024/05/04 | 104 | 60 - 130 | 108 | 60 - 130 | <200 | ug/L | NC | 30 |

## 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 |
| 9372441 | F4 (C34-C50 Hydrocarbons) | 2024/05/04 | 100 | 60 - 130 | 106 | 60 - 130 | <200 | 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).

# VALIDATION SIGNATURE PAGE

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

Cristina Carriere

Cristina Carriere, Senior 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 Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

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

NONT-2024-05-151

Page of

**INVOICE TO:**

Company Name: #21375 WSP Canada Inc.
Attention: George Schneider
Address: 210 Sheldon Drive
Cambridge ON N1T 1A8
Tel: (519) 620-8182 Fax:
Email: George_Schneider@golder.com

**REPORT TO:**

Company Name: WSP
Attention: Paul Menkveld
Address:
Tel: Fax:
Email: paul.menkveld@wsp.com

**PROJECT INFORMATION:**

Quotation #: C41059
P.O. #:
Project: CA-GLD-19129150
Project Name: CBM Caledon
Site #:
Sampled By: Raman Ta10

**Bottle Order #:** 984504

**COC #:** C#984504-01-01

**Project Manager:** Ankita Bhalla

**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 ___

**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, BTEX/F1-F4 | | | | | | | | | # of Bottles | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | MW-IT-07-A | 2024-05-01 | 10:35 | GW | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 2 | | MW-IT-07-B | ↓ | 11:40 | ↓ | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 3 | | MW-IT-07-C | ↓ | 10:15 | ↓ | ✓ | ✓ | ✓ | | | | | | | | | 8 | |
| 4 | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

| * RELINQUISHED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | RECEIVED BY: (Signature/Print) | Date: (YY/MM/DD) | Time | # jars used and not submitted |
|---|---|---|---|---|---|---|
| Raman Ta10 | 2024-05-01 | 3:32 PM | | 2024/05/01 | 1521 | |
| | | | | | | |

**Laboratory Use Only**

| Time Sensitive | Temperature (°C) on Recei | Custody Seal | Yes | No |
|---|---|---|---|---|
| | 14/15/16 | 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.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-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.

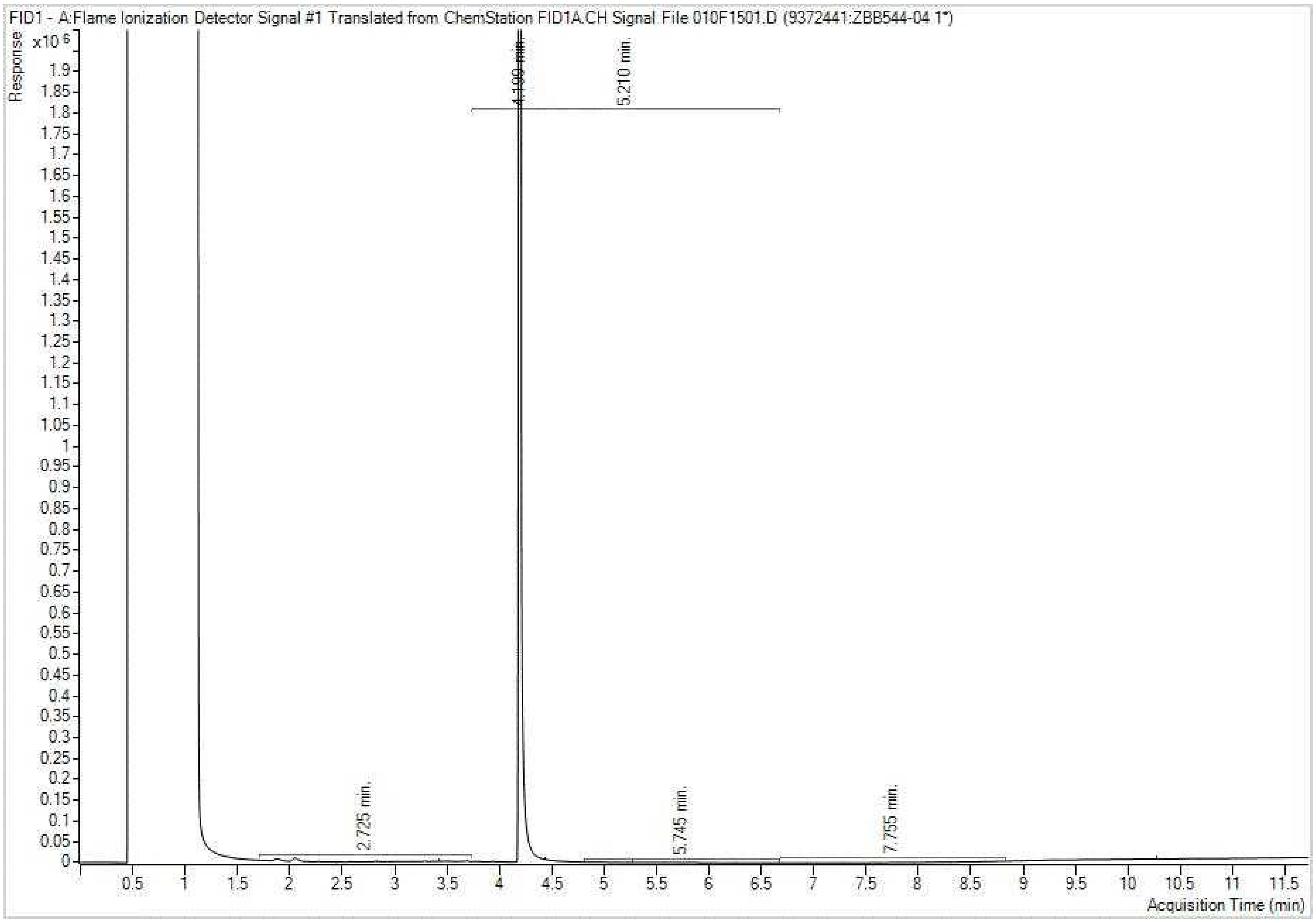
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.

**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.

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

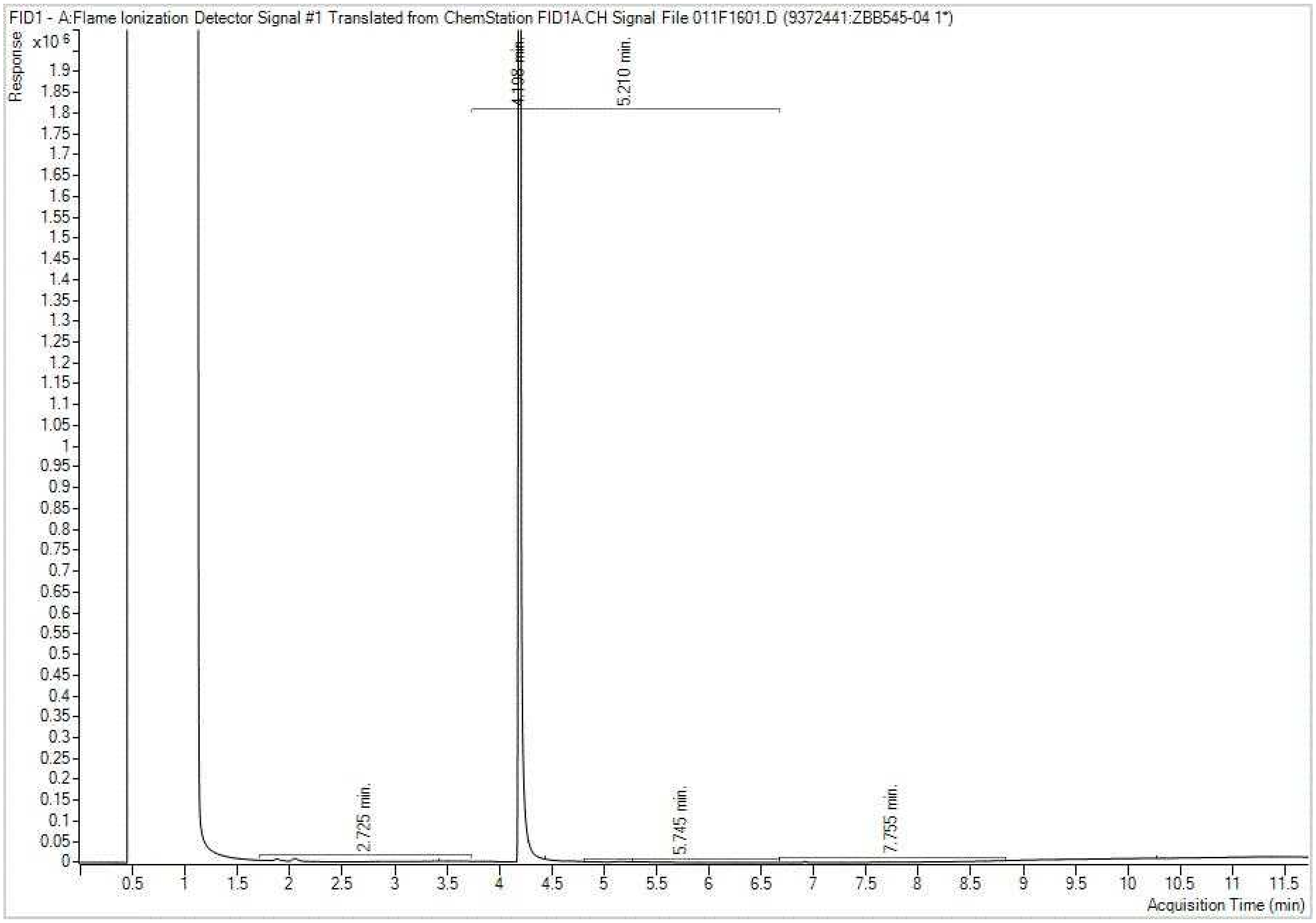


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4D0350
Report Date: 2024/05/07
Bureau Veritas Sample: ZBB545

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-07-B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

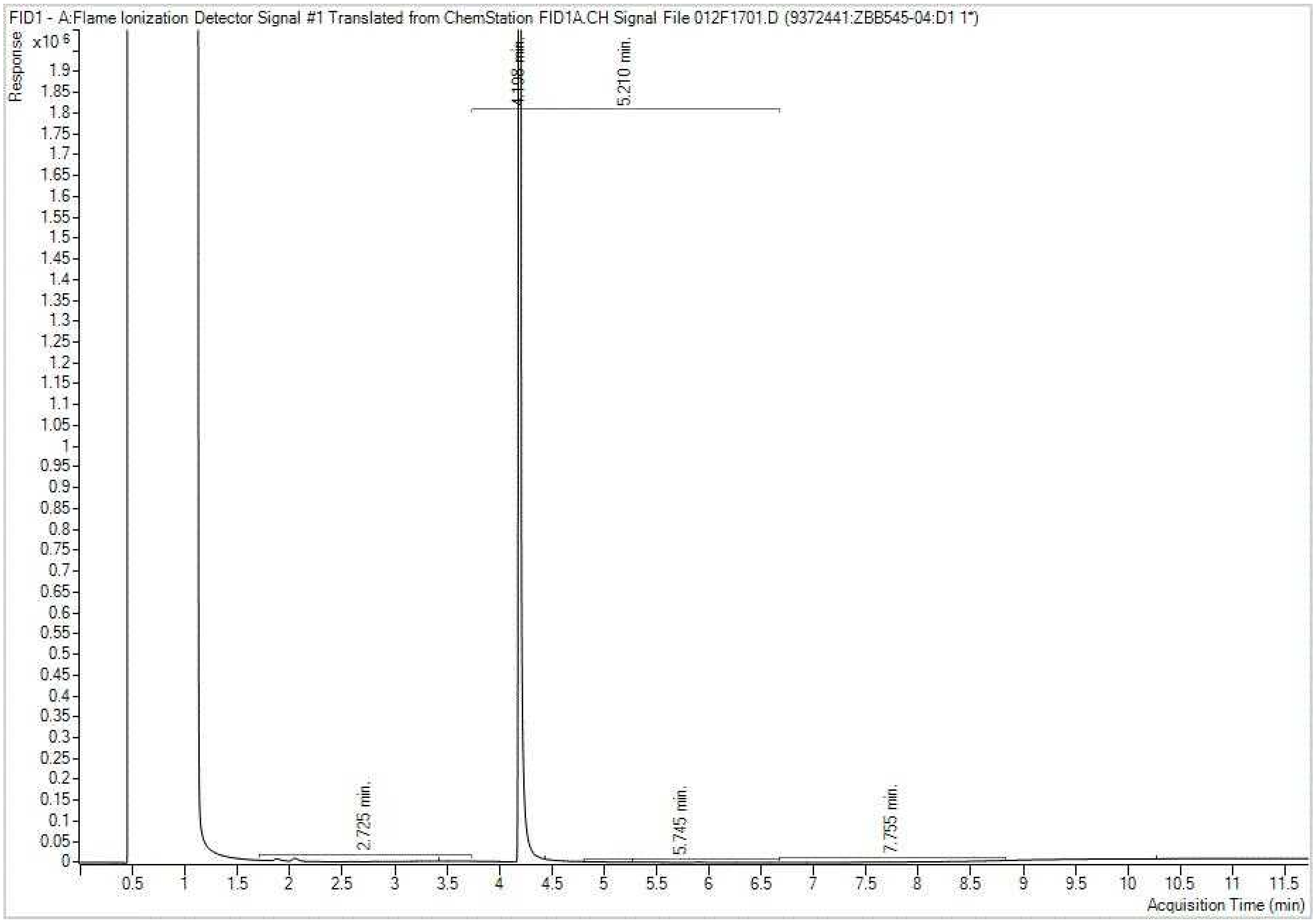


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4D0350
Report Date: 2024/05/07
Bureau Veritas Sample: ZBB545 Lab-Dup

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-07-B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**

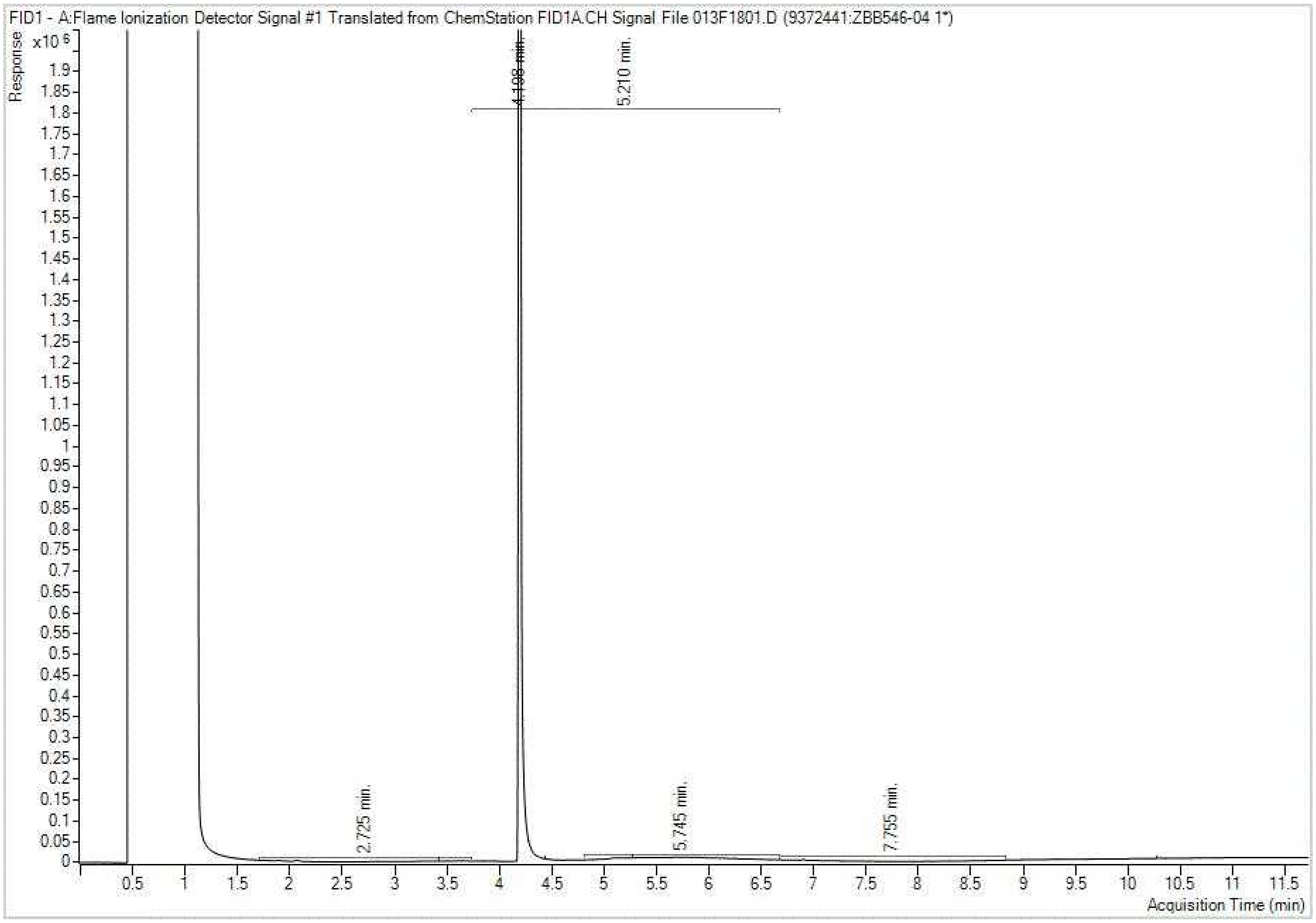


**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Bureau Veritas Job #: C4D0350
Report Date: 2024/05/07
Bureau Veritas Sample: ZBB546

WSP Canada Inc.
Client Project #: CA-GLD-19129150
Project name: CBM CALEDON
Client ID: MW-IT-07-C

**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 C**

# NUMERICAL MODELLING SIMULATIONS

# TECHNICAL MEMORANDUM

**DATE** May 9, 2025 **Project No.** CA-GLD-19129150

**TO** Mike LeBreton; Bill Marquardt
CBM Aggregates

**CC** Paul Menkveld; Greg Padusenko; Daniel Eusebi

**FROM** George Schneider; Richard Simms; Tori Grootjen **EMAIL george.schneider@wsp.com**

## GROUNDWATER MITIGATION SYSTEM NUMERICAL MODELLING – PROPOSED CBM CALEDON PIT / QUARRY

## 1.0 INTRODUCTION

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada) applied to the Ministry of Natural Resources (MNR) for a Class A Licence (Pit and Quarry Below Water) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation. Previously, WSP Canada Inc. (WSP, formerly Golder Associates) completed numerical modelling of the groundwater mitigation system for the proposed CBM Caledon Pit / Quarry presented in the revised Water Report Level 1/2 dated July 2023 (Golder 2023).

Technical comments related to the Level 1/2 Water Report have been received from agency / stakeholder groups in 2023 and 2024. A number of these groups requested additional studies be undertaken to further the development of the mitigation system design, to demonstrate proof of concept, and to provide further assurance to those agencies and stakeholder groups that the proposed infiltration trench system will perform as predicted. In response to these comments, WSP developed a work plan comprised of the following tasks, which was approved by CBM and initiated by WSP in April of 2024:

- Desktop Review – Undertake a desktop review of infiltration systems, with a focus on reviewing recent studies / examples in the Greater Toronto Area (GTA), Ontario and other Canadian jurisdictions.
- Field Investigations – Conduct geotechnical / hydrogeological field investigations along the proposed infiltration trench alignment, including the installation of 7 monitoring well nests that will be used to establish background groundwater levels / gradients / water quality and monitor the future performance of the infiltration trench system.
- Numerical Modelling Update - Utilizing the new data collected during the field investigations, update the hydrostratigraphic model for the proposed Caledon Pit / quarry along the proposed infiltration trench, update and optimize calibration of the baseline HydroGeoSphere (HGS) numerical groundwater-surface water flow model, update the proposed trench configuration and target water levels (as required), and run updated HGS simulations for all Operational Phases and the post-rehabilitation phase of the proposed pit / quarry.

- Preliminary Mitigation System Design - Based on the results of the tasks described above, update the conceptual mitigation system design to a preliminary design level that is sufficiently advanced to demonstrate proof of concept.

This technical memorandum presents the results of the HGS numerical model updates for the proposed Caledon Pit / Quarry, utilizing the new hydrogeologic information collected during the field investigations carried out by WSP.

## 2.0 FIELD INVESTIGATION RESULTS

The 2024 field investigation along the proposed infiltration trench system alignment was comprised mainly of the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 1), and included the following tasks:

- Borehole drilling (continuous coring) and monitoring well nest installation;
- Laboratory testing of overburden soils for grainsize distribution;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

The field investigation results are presented in a Technical Memorandum dated November 20, 2024 (WSP 2024 - draft). Well installation details, groundwater levels and aquifer testing results are summarized in Table 1 and hydraulic conductivity (k) estimates from SWRTs are summarized by hydrostratigraphic unit in Table 2.

The new hydrogeologic information obtained during the field investigations was used to update the hydrostratigraphic model and the HGS numerical model in the vicinity of the proposed infiltration trench mitigation system (Figure 2 and Figure 3). The groundwater level and hydraulic conductivity data were used to update the HGS model calibration to current (baseline) conditions.

## Table 1: New Infiltration Trench Monitoring Wells

| Well ID | Easting (m) | Northing (m) | Ground Surface Elevation (masl) | Total Hole Depth (mbgs) | Depth to Bedrock (mbgs) | Stick Up (m) | Aquifer Unit Screened | Screen from (m) | Screen to (m) | Screen Length (m) | Static Water Level (masl) | Hydraulic Conductivity[1] (m/s) | SWRT Field Method | SWRT Solution Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-IT-01A | 577201 | 4852516 | 403.67 | 26.52 | 17.68 | 0.930 | Gasport Fm | 21.64 | 23.16 | 1.52 | 393.50 | 9E-05 | Pneumatic Rising Head Test | Bouwer-Rice |
| MW-IT-01B | 577202 | 4852514 | 403.63 | 19.51 | 17.98 | 0.830 | Contact Aquifer | 16.71 | 18.84 | 2.13 | 393.60 | 8E-04 | Pneumatic Rising Head Test | Butler |
| MW-IT-01C | 577204 | 4852513 | 403.58 | 11.96 | - | 0.896 | Overburden | 10.44 | 11.96 | 1.52 | 393.66 | 5E-05 | Waterra Purge | Bouwer-Rice |
| MW-IT-02A | 577009 | 4852710 | 401.46 | 16.76 | 6.1 | 0.861 | Gasport Fm | 14.64 | 16.16 | 1.52 | 394.91 | 6E-07 | Bailer | Bouwer-Rice |
| MW-IT-02B | 577007 | 4852712 | 401.49 | 12.50 | 6.4 | 0.912 | Gasport Fm | 8.84 | 11.89 | 3.05 | 395.32 | 3E-06 | Bailer | Bouwer-Rice |
| MW-IT-02C | 577006 | 4852713 | 401.47 | 7.01 | - | 0.822 | Contact Aquifer | 5.18 | 6.71 | 1.52 | 395.70 | 2E-05 | Bailer | Bouwer-Rice |
| MW-IT-03A | 577352 | 4852364 | 397.88 | 14.94 | 9.75 | 0.895 | Gasport Fm | 13.29 | 14.81 | 1.52 | 393.44 | 1E-06 | Waterra Purge | Bouwer-Rice |
| MW-IT-03B | 577354 | 4852363 | 397.76 | 12.04 | 9.75 | 0.929 | Contact Aquifer | 9.60 | 11.43 | 1.83 | 393.49 | 1E-04 | Physical Slug | Bouwer-Rice |
| MW-IT-03C | 577355 | 4852362 | 397.74 | 7.92 | - | 0.910 | Overburden | 5.79 | 7.32 | 1.52 | 393.52 | 2E-03 | Physical Slug | Springer-Gelhar |
| MW-IT-04A | 577521 | 4852364 | 397.68 | 12.19 | 6.55 | 0.837 | Gasport Fm | 10.21 | 11.73 | 1.52 | 393.21 | 1E-04 | Pneumatic Rising Head Test | Bouwer-Rice |
| MW-IT-04B | 577522 | 4852363 | 397.69 | 9.14 | 5.49 | 0.869 | Contact Aquifer | 5.33 | 8.38 | 3.05 | 393.12 | 7E-04 | Pneumatic Rising Head Test | Springer-Gelhar |
| MW-IT-05A | 577614 | 4852195 | 399.30 | 14.94 | 9.14 | 0.871 | Gasport Fm | 11.39 | 14.44 | 3.05 | 393.24 | 6E-04 | Pneumatic Rising Head Test | Butler |
| MW-IT-05B | 577612 | 4852197 | 399.23 | 10.36 | 10.06 | 0.865 | Contact Aquifer | 8.71 | 10.23 | 1.52 | 393.08 | 1E-05 | Pneumatic Rising Head Test | Bouwer-Rice |
| MW-IT-05C | 577611 | 4852199 | 399.18 | 7.62 | - | 0.888 | Overburden | 5.79 | 7.32 | 1.52 | 392.95 | 8E-06 | Waterra Purge | Bouwer-Rice |
| MW-IT-06A | 578068 | 4852428 | 398.67 | 11.58 | 6.25 | 0.861 | Gasport Fm | 9.75 | 11.28 | 1.52 | 392.14 | 1E-04 | Physical Slug | Bouwer-Rice |
| MW-IT-06B | 578069 | 4852429 | 398.62 | 9.14 | 6.10 | 0.834 | Contact Aquifer | 6.00 | 9.04 | 3.05 | 392.06 | 6E-04 | Physical Slug | Bouwer-Rice |
| MW-IT-07A | 577897 | 4852208 | 400.14 | 17.68 | 10.21 | 0.946 | Gasport Fm and Shaley Dolostone | 13.72 | 15.24 | 1.52 | 392.37 | 2E-04 | Pneumatic Rising Head Test | Bouwer-Rice |
| MW-IT-07B | 577898 | 4852209 | 400.19 | 12.95 | 9.75 | 0.901 | Contact Aquifer | 9.61 | 12.66 | 3.05 | 392.36 | 8E-04 | Physical Slug | Springer-Gelhar |
| MW-IT-07C | 577899 | 4852211 | 400.14 | 9.30 | - | 1.003 | Overburden | 7.48 | 9.00 | 1.52 | 392.29 | 3E-04 | Physical Slug | Bouwer-Rice |
| | | | | | | | | | | | | | | |

**Abbreviations and Notes:**

m – metres; masl - metres above sea level; mbgs - metres below ground surface; Fm – Formation; SWRT – Single Well Response Test; m/s – metres / second

1 - Water levels measured on May 6, 2024

**Table 2: Hydraulic Conductivity from SWRTs by Hydrostratigraphic Unit**

| Hydrostratigraphic Unit | Number of Observations | Minimum K (m/s) | Maximum K (m/s) | Geometric Mean K (m/s) |
|---|---|---|---|---|
| Overburden | 4 | 8E-06 | 2E-03 | 1E-04 |
| Bedrock Contact Aquifer | 7 | 1E-05 | 8E-04 | 2E-04 |
| Gasport Formation | 7 | 6E-07 | 6E-04 | 2E-05 |
| Gasport Formation and Shaley Dolostone | 1 | 2E-04 | - | - |

**Abbreviations:**

K – hydraulic conductivity; m/s – metres per second

# 3.0 HGS MODEL AND BASELINE CALIBRATION

## 3.1 Approach

The objective of the HGS hydrogeological modelling is to assess the potential impact of the proposed Caledon Pit / Quarry on local and regional groundwater and surface water conditions, and to help develop and evaluate the performance of the proposed groundwater (infiltration trench) mitigation system. This includes evaluating potential changes in water levels and flows in nearby surface water features relative to background conditions. Given the emphasis on both groundwater and surface water impacts, a coupled surface water/groundwater (SW/GW) modelling approach was applied. As part of the Water Report Level 1/2 (Golder 2023), a 3D numerical model of the proposed pit / quarry and surrounding regional groundwater flow system was constructed, with the addition of a 2D grid that represents the surface flow domain (which is coincident with the top of the 3D model domain) in HydroGeoSphere (HGS, Aquanty 2015) (Golder 2023).

The initial 3D model was constructed based on the hydrogeologic conceptual model presented in the Water Report Level 1/2 (Section 2.0 of Golder 2023), which has now been updated to include the new hydrogeologic data collected in 2024 along the proposed infiltration trench system. The HGS numerical model was re-calibrated to observed groundwater elevations and surface water flows under steady state conditions. This calibrated numerical model was then used as the basis for forecast simulations of the proposed pit / quarry development during operational phases and post-rehabilitation.

## 3.2 Model Revisions

The initial model was described in the Water Report Level 1/2 (Golder 2023). The model domain, surface water flow, and boundary conditions were not modified. The hydrostratigraphy and the hydraulic properties of the hydrostratigraphic units have been updated based on the new IT wells and the HGS model has been re-calibrated to reproduce the observed water levels at the new IT wells. Modifications to the HGS model are described below.

### 3.2.1 Hydrostratigraphy

The hydrostratigraphic units used in the HGS model are described in Section 2.4 of the Water Report Level 1/2 (Golder 2023). The new IT wells provided additional hydrostratigraphic information along the proposed mitigation system alignment, on the west side of the Main Area and along the west and southwest sides of the South Area of the proposed pit / quarry. The updated hydrostratigraphy along the proposed mitigation system alignment is illustrated on Figure 3, along with groundwater levels under current (baseline) conditions. Note that the cross-section follows the grout wall alignment, and the IT wells are projected onto that alignment. The horizontal discretization of the HGS model mesh remained consistent with the original HGS model but the vertical thickness of the hydrostratigraphic layers in the HGS numerical model were updated to coincide with the updated stratigraphy.

### 3.2.2 Hydraulic Conductivity Parameterization

The hydraulic conductivity measurements at the IT wells (Section 2) were used to supplement the previously compiled hydraulic conductivity measurements. These were applied to the HGS numerical model as initial parameters for model calibration and used as references throughout the calibration process. To improve refinement within the Site Area and better fit hydraulic conductivity observations, hydraulic conductivity zonation was reevaluated. Weathered Bedrock Zone 4 was sub-divided into three new sub-zones of weathered bedrock hydraulic conductivity and each of these three sub-zones were assigned an independent, calibrated hydraulic conductivity. These sub-zones were calibrated separately from the regional hydrostratigraphic units (Figure 2).

## 3.3 Model Calibration

### 3.3.1 Calibration Approach

Three additional Weathered Bedrock hydrostratigraphic units were added to account for greater heterogeneity of the top of bedrock representation and more flexibility with hydraulic conductivity assignment with the intention of improving calibration fit within the Site and Study Areas. As in Golder 2023, PEST (Doherty 2018) was used to calibrate the hydraulic conductivity so that the simulation could reproduce observed groundwater elevations and stream flows within the Site and Study Area. PEST (Doherty 2018) is a model-independent parameter estimation tool that automates the calibration process by adjusting model parameters to better match observed data. PEST was run for 6 iterations before being terminated. The calibrated hydraulic conductivity values are shown on Figure 2. The following calibration measures were used in the assessment:

- Average groundwater levels at 88 groundwater monitoring well locations across the Site Area, over the period of record for each location. The monitoring locations include 24 sets of nested monitoring wells. Average head differences between each nested pair of monitoring wells are also considered as part of the calibration process.
- Average streamflow measurements in 16 surface water monitoring stations in the Site Area, over the period of record for each location.
- Groundwater level measurements from 1,857 water well records in the MECP WWR database, located within the model domain (MECP, 2020).
- Single well response test results from the new IT wells (described in Section 2.0) provided additional information about the hydraulic conductivity along the proposed infiltration trench (Table 2). These new IT wells also provided additional water level data for calibration.

PEST was used to refine the hydraulic conductivity for the following hydrostratigraphic units:

- Weathered Bedrock Zones 4A, 4B, and 4C;
- Gasport Zone 4;
- Upper Sand; and
- Local Till.

All other parameters remained unchanged from their values used in Golder 2023. A comparison of the calibrated parameters to the previously used parameters in Golder 2023 is provided in Table 4. Note that all calibrated hydraulic conductivity values were within the range observed in the field or conceptually consistent with the observed site conditions.

### 3.3.2 Calibration Assessment

The simulated calibrated model results are shown on Figures 4 and 5 and in Table 3, and summarized as follows:

- Plan view maps of the simulated hydraulic head distribution and groundwater flow direction in the overburden, Gasport Formation, and Manitoulin / Whirlpool Formation (Figure 4) are generally consistent with the conceptual understanding of the groundwater flow system in the Credit River Watershed and remain mostly unchanged from Golder 2023. West of the Credit River Valley, shallow groundwater flow follows topographic relief, and generally flows from northwest to southeast, towards the valley. Closer to the Credit River Valley, the water table declines significantly, following the ground surface topography. The simulated hydraulic head distribution and groundwater flow direction in the Gasport Formation is consistent with observed data at the Site (Figures 5-2 to 5-6 of Golder 2023).
- A scatter plot of the regional simulated hydraulic head versus the average head for the target observation points (both MECP WWR measurements, additional water level information from consultant reports (CRA 1990, 1994, 2012, and Harden 2016) and Site monitoring wells, (2043 total water levels) shows the simulated points generally close to the 45-degree line and in reasonable agreement with the observed values (Figure 4). Regionally, the mean residual is calculated to be 3.1 m, while the normalized root mean square error (NRMSE) is 3.8%, which is the same NRMSE from Golder 2023. Looking at the Site data only (128 total average water level measurements), the mean residual is calculated to be 0.5 m (an increase from Golder 2023), while the NRMSE is 3.5% (a decrease from 3.8% in Golder 2023). Looking at the new IT wells only (19 wells at 7 locations), the mean residual is calculated to be 0.7 m.
- A plot of the observed and simulated head differences at nested monitoring locations (Figure 4) generally shows good agreement between the two datasets, with more upward gradients to the west of the Site transitioning to neutral / slight downward gradients to the east, and downward gradient to the north. The observed head difference values used for comparison represent the averages over the period of record, though it is recognized that there could be variability in the magnitude (and direction) of the gradient throughout the year.
- A plot of the unit yield for each surface water station (Figure 5) shows that the updated model results remain consistent with the conceptual hydrogeologic behaviour in the Site Area. These updated model results show that the model performance is comparable to those of the initial model (Golder 2023).
- In Golder 2023, the Weathered Bedrock Zone 4 (WB4) had a hydraulic conductivity of 1E-03 m/s (isotropic). In this assessment, WB4 was divided into sub-zones WB4A, WB4B, and WB4C. The sub-zones were calibrated independently and were assumed to have 10:1 horizontal to vertical anisotropy. The WB4A horizontal hydraulic conductivity is 8.15E-03 m/s, representing an 8.15x increase. The WB4B horizontal hydraulic conductivity is 1.91E-03 m/s, representing a 1.91x increase. The WB4C horizontal hydraulic conductivity is 1.34E-03 m/s, representing a 1.34x increase.
- This results in a higher transmissivity in the areas of the infiltration trenches. For example, at the midpoint of Trench Zone 3 the effective transmissivity is $2.6 \times 10^{-2}$ $m^2/s$ which is an increase from Golder 2023 that had a transmissivity $3.7 \times 10^{-3}$ $m^2/s$, an increase in transmissivity of 7x in this location.

Overall, the updated HGS numerical model is considered fit for purpose based on the calibration fit, the consistency of the calibrated parameters with the hydrostratigraphic conceptualization, and the consistency with the simulation groundwater flow patterns with the conceptual groundwater flow model.

## Table 3: Comparison of Steady State Simulated and Average Measured Groundwater Elevation at Site Well Locations

| Well ID | Average Measured Water Level (masl)[a] | Simulated Water Level (masl) | Residual (m)[b] |
|---|---|---|---|
| JHL_BH1 | 405.9 | 406.6 | 0.7 |
| JHL_BH16 | 400.7 | 399.3 | -1.4 |
| JHL_BH17 | 400.8 | 399.0 | -1.8 |
| JHL_BH18 | 396.7 | 394.7 | -2.0 |
| JHL_BH19 | 402.1 | 401.9 | -0.2 |
| JHL_BH2 | 411.3 | 410.6 | -0.6 |
| JHL_BH3 | 405.1 | 404.7 | -0.4 |
| JHL_BH7 | 402.7 | 402.2 | -0.5 |
| MW20-01A | 391.0 | 393.2 | 2.2 |
| MW20-01B | 390.9 | 393.2 | 2.4 |
| MW20-02 | 390.2 | 390.6 | 0.4 |
| MW20-03 | 384.9 | 387.1 | 2.2 |
| MW20-04 | 389.4 | 387.9 | -1.5 |
| MW20-05A | 393.2 | 395.3 | 2.0 |
| MW20-06A | 396.8 | 397.7 | 1.0 |
| MW20-06B | 397.0 | 397.7 | 0.8 |
| MW20-07A | 402.3 | 398.5 | -3.8 |
| MW20-07B | 402.4 | 399.4 | -2.9 |
| MW20-08A | 404.4 | 401.6 | -2.7 |
| MW20-08B | 404.4 | 402.0 | -2.4 |
| MW20-09 | 396.3 | 392.5 | -3.9 |
| MW20-10A | 400.6 | 397.2 | -3.4 |
| MW20-10B | 400.6 | 397.5 | -3.0 |
| MW20-11A | 405.7 | 404.6 | -1.1 |
| MW20-11B | 405.7 | 405.0 | -0.7 |
| MW20-12A | 406.5 | 405.7 | -0.8 |
| MW20-12B | 406.5 | 406.3 | -0.3 |
| MW20-13A | 411.1 | 410.8 | -0.3 |
| MW20-13B | 411.2 | 410.8 | -0.4 |
| MW20-13C | 412.8 | 411.2 | -1.7 |
| MW20-14A | 402.1 | 402.1 | 0.0 |
| MW20-14B | 402.1 | 402.1 | 0.0 |
| MW20-15A | 415.8 | 416.6 | 0.8 |
| MW20-15B | 415.7 | 417.1 | 1.4 |
| MW20-15C | 415.5 | 417.2 | 1.7 |
| MW20-16A | 419.6 | 418.6 | -1.0 |
| MW20-16B | 419.6 | 418.7 | -0.9 |
| MW20-17A | 402.7 | 406.4 | 3.7 |
| MW20-17B | 402.5 | 406.6 | 4.1 |
| MW20-18 | 391.6 | 394.4 | 2.8 |
| MW20-19A | 390.7 | 393.7 | 3.0 |
| MW20-19B | 390.7 | 393.7 | 3.0 |
| MW20-20A | 405.4 | 403.1 | -2.3 |
| MW20-20B | 405.5 | 403.1 | -2.4 |
| MW20-20C | 401.4 | 403.1 | 1.7 |
| MW20-21A | 413.9 | 414.5 | 0.6 |
| MW20-21B | 414.2 | 414.7 | 0.6 |
| MW20-22A | 396.4 | 400.2 | 3.8 |
| MW20-22B | 395.3 | 399.5 | 4.1 |
| MW20-23A | 391.8 | 395.3 | 3.5 |
| MW20-23B | 391.6 | 395.2 | 3.7 |
| MW20-23C | 391.5 | 395.2 | 3.7 |
| MW20-24A | 433.7 | 434.4 | 0.7 |
| MW20-24B | 434.1 | 435.3 | 1.2 |
| MW20-25A | 419.9 | 420.0 | 0.2 |
| MW20-25B | 419.2 | 419.5 | 0.3 |
| MW20-26A | 433.7 | 433.5 | -0.2 |
| MW20-26B | 433.9 | 433.5 | -0.4 |
| MW20-26C | 436.1 | 433.9 | -2.3 |
| MW20-27A | 423.7 | 423.7 | -0.1 |
| MW20-27B | 423.7 | 423.9 | 0.2 |
| MW20-28A | 418.4 | 416.4 | -2.0 |
| MW20-28B | 418.5 | 416.3 | -2.1 |
| MW22-01 | 418.8 | 418.9 | 0.1 |
| MW22-02A | 418.4 | 420.5 | 2.0 |
| OVG-MW18-20 | 389.6 | 390.2 | 0.7 |
| OVG-MW19-20 | 391.1 | 391.3 | 0.2 |
| OVG-MW24-20 | 400.3 | 396.9 | -3.4 |
| OVG-MW25-20 | 397.4 | 397.0 | -0.4 |
| OVG-MW5-20 | 387.1 | 388.7 | 1.6 |
| OVG-MW6-20 | 392.7 | 388.4 | -4.4 |
| OVG-MW7-20 | 387.0 | 388.5 | 1.5 |
| OVG-MW8-20 | 386.5 | 387.6 | 1.1 |
| OVG-MW9-20 | 388.8 | 393.6 | 4.8 |
| OW10B-90 | 388.3 | 388.3 | 0.1 |
| OW11B-90 | 388.7 | 389.7 | 1.0 |
| OW12-90 | 392.1 | 393.0 | 0.8 |
| OW13-90 | 390.3 | 391.6 | 1.3 |
| OW14-90 | 389.1 | 389.8 | 0.7 |
| OW15-90 | 388.4 | 388.2 | -0.2 |
| OW16-90 | 387.7 | 388.8 | 1.1 |
| OW17-90 | 392.6 | 393.4 | 0.8 |
| OW18-90 | 388.2 | 390.0 | 1.8 |
| OW19-94 | 389.2 | 391.1 | 1.9 |
| OW20-94 | 387.8 | 388.1 | 0.3 |
| OW21-94 | 388.4 | 390.1 | 1.7 |
| OW22-94 | 387.1 | 387.7 | 0.6 |
| OW23-94 | 385.1 | 386.8 | 1.7 |
| OW3B-90 | 391.5 | 392.5 | 1.0 |
| P-1 | 379.9 | 383.1 | 3.2 |
| P-2 | 386.5 | 387.2 | 0.7 |
| P-3 | 384.5 | 386.2 | 1.8 |
| P-4 | 385.3 | 386.5 | 1.2 |
| P-6 | 385.7 | 386.4 | 0.7 |
| P-7 | 385.7 | 385.7 | 0.0 |
| P-8 | 383.1 | 385.2 | 2.1 |
| P-9 | 386.7 | 387.2 | 0.5 |
| P-10 | 382.6 | 384.7 | 2.1 |
| P-12 | 378.8 | 384.1 | 5.2 |
| POND1 | 388.5 | 389.6 | 1.2 |
| POND2 | 388.6 | 389.4 | 0.8 |
| POND3 | 389.0 | 389.7 | 0.8 |
| POND4 | 388.3 | 388.4 | 0.1 |
| PW21-1 | 416.8 | 414.8 | -2.0 |
| PW21-2 | 407.8 | 407.6 | -0.2 |
| PW21-3 | 395.9 | 398.8 | 2.8 |
| PW21-4 | 402.7 | 402.3 | -0.4 |
| PW22-01 | 416.2 | 417.0 | 0.7 |
| TH1-89 | 388.8 | 389.3 | 0.5 |
| TH2-89 | 391.1 | 392.1 | 1.0 |
| TH3-89 | 391.5 | 392.5 | 1.0 |
| TH4-89 | 391.5 | 391.1 | -0.4 |
| TH5-89 | 387.7 | 388.1 | 0.5 |
| TH6-89 | 389.0 | 390.7 | 1.7 |
| TH7-89 | 388.2 | 391.8 | 3.6 |
| TH8-89 | 388.1 | 390.4 | 2.3 |
| TH9-89 | 389.6 | 391.1 | 1.5 |
| TH10-89 | 388.2 | 388.2 | 0.0 |
| TH11-89 | 388.6 | 389.6 | 1.0 |
| MW-IT-01A | 393.5 | 393.9 | 0.4 |
| MW-IT-01B | 393.6 | 393.9 | 0.3 |
| MW-IT-01C | 393.7 | 393.9 | 0.2 |
| MW-IT-02A | 394.9 | 394.9 | 0.0 |
| MW-IT-02B | 395.3 | 394.9 | -0.4 |
| MW-IT-02C | 395.7 | 395.0 | -0.8 |
| MW-IT-03A | 393.4 | 393.5 | 0.1 |
| MW-IT-03B | 393.5 | 393.5 | 0.0 |
| MW-IT-03C | 393.5 | 393.5 | 0.0 |
| MW-IT-04A | 393.2 | 393.3 | 0.1 |
| MW-IT-04B | 393.1 | 393.3 | 0.2 |

| Well ID | Average Measured Water Level (masl)[a] | Simulated Water Level (masl) | Residual (m)[b] |
|---|---|---|---|
| MW22-02B | 418.6 | 420.2 | 1.6 |
| MW22-02C | 418.3 | 420.1 | 1.8 |
| MW22-03A | 420.6 | 422.2 | 1.7 |
| MW22-03B | 419.8 | 421.8 | 2.1 |
| OVG-MW10-20 | 388.5 | 393.4 | 4.9 |
| OVG-MW11-20 | 392.1 | 392.9 | 0.8 |
| OVG-MW12-20 | 393.9 | 393.2 | -0.7 |
| OVG-MW13-20 | 394.7 | 392.7 | -2.0 |
| OVG-MW16-20 | 392.4 | 391.9 | -0.5 |

| Well ID | Average Measured Water Level (masl)[a] | Simulated Water Level (masl) | Residual (m)[b] |
|---|---|---|---|
| MW-IT-05A | 393.2 | 392.8 | -0.5 |
| MW-IT-05B | 393.1 | 392.8 | -0.3 |
| MW-IT-05C | 393.0 | 392.9 | 0.0 |
| MW-IT-06A | 392.1 | 393.4 | 1.2 |
| MW-IT-06B | 392.1 | 393.4 | 1.3 |
| MW-IT-07A | 392.4 | 391.1 | -1.3 |
| MW-IT-07B | 392.4 | 391.1 | -1.3 |
| MW-IT-07C | 392.3 | 391.1 | -1.2 |

**Abbreviations and Notes:**
m - metres, masl - metres above sea level
a. Average measured water level represents the average water level over the period of record for each location.
b. Residual is calculated by subtracting the measured water level from the simulated water level.

## Table 4: Comparison of Calibrated Parameters: 2023 (Revised) Model vs Updated 2024 Model

| Unit | Kh (m/s) | | Kv (m/s) | | Porosity[a] | | Specific Storage (1/m) | |
|---|---|---|---|---|---|---|---|---|
| | Golder 2023 | 2024 Update | Golder 2023 | 2024 Update | Golder 2023 | 2024 Update | Golder 2023 | 2024 Update |
| Regional Till | 1.E-06 | 1.E-06 | 1.E-06 | 1.E-06 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Local Till | 1.E-08 | 8.35E-09 | 5.E-09 | 8.35E-10 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Upper Sand | 1.E-04 | 1.44E-04 | 1.E-04 | 1.44E-05 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Lower Sand | 1.E-04 | 1.E-04 | 1.E-04 | 1.E-04 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Till (Valley Skin) Zone 1 | 4.E-06 | 4.E-06 | 4.E-06 | 4.E-06 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Till (Valley Skin) Zone 2 | 1.E-06 | 1.E-06 | 1.E-06 | 1.E-06 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Till (Valley Skin) Zone 3 | 5.E-06 | 5.E-06 | 5.E-06 | 5.E-06 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Till (Valley Skin) Zone 4 | 2.E-04 | 2.E-04 | 2.E-04 | 2.E-04 | 0.3 | 0.3 | 1.E-04 | 1.E-04 |
| Weathered Bedrock (Regional) | 2.E-04 | 2.E-04 | 5.E-06 | 5.E-06 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 1 | 5.E-06 | 5.E-06 | 5.E-07 | 5.E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 2 | 4.E-06 | 4.E-06 | 4.E-06 | 4.E-06 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 3 | 4.E-06 | 5.E-06 | 4.E-06 | 5.E-06 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 4A | 1.E-03 | 8.15E-03 | 1.E-03 | 8.15E-04 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 4B | 1.E-03 | 1.91E-03 | 1.E-03 | 1.91E-04 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 4C | 1.E-03 | 1.34E-03 | 1.E-03 | 1.34E-03 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 5 | 5.E-05 | 5.E-05 | 5.E-06 | 5.E-06 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 6 | 5.E-04 | 5.E-04 | 5.E-04 | 5.E-04 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Weathered Bedrock Zone 7 | 5.E-06 | 5.E-06 | 5.E-07 | 5.E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Guelph Formation | 5.E-05 | 5.E-05 | 5.E-06 | 5.E-06 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Eramosa Formation | 9.E-08 | 9.E-08 | 9.E-09 | 9.E-09 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Goat Island Formation | 1.E-06 | 1.E-06 | 1.E-07 | 1.E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Regional | 1.E-06 | 1.E-06 | 1.E-07 | 1.E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Zone 1 | 5.E-06 | 5.E-06 | 5.E-07 | 5.E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Zone 2 | 5.E-07 | 5.5E-07 | 5.E-08 | 5.5E-08 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Zone 3 | 1.E-06 | 1.E-06 | 1.E-07 | 1.E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Zone 4 | 1.E-05 | 8.67E-06 | 1.E-06 | 8.67E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Zone 5 | 1.E-05 | 1.E-05 | 1.E-06 | 1.E-06 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Zone 6 | 1.E-07 | 1.E-07 | 1.E-08 | 1.E-08 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Gasport Formation Zone 7 | 5.E-06 | 5.E-06 | 5.E-07 | 5.E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Shaley Dolostone Unit | 1.E-07 | 1.E-07 | 2.E-09 | 2.E-09 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Cabot Head Formation | 1.E-08 | 1.E-08 | 1.E-09 | 1.E-09 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Manitoulin Formation | 1.E-05 | 1.E-05 | 1.E-06 | 1.E-06 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Whirlpool Formation | 1.E-06 | 1.15E-06 | 1.E-07 | 1.15E-07 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |
| Queenston Formation | 1.E-08 | 1.E-08 | 1.E-09 | 1.E-09 | 0.01 | 0.01 | 5.E-06 | 5.E-06 |

**Abbreviations and Notes:**
m - metres, m/s - metres per second, n/a - new unit added to 2024 model, Kh – horizontal hydraulic conductivity, Kv – vertical hydraulic conductivity
a: porosity is equivalent to specific yield

# 4.0 FORECAST SIMULATIONS

## 4.1 Approach

The approach used for the forecast simulations in this HGS model update was consistent with Section 3.1 of Golder 2023. A total of eight model forecast simulations were completed, each representing a different phase of pit / quarry development (including post-rehabilitation) as shown in Figure 6. The forecast simulations were completed under steady state conditions to provide a conservative estimate of the extent of drawdown for each development phase (i.e. highest drawdown during that phase).

Model parameterization is described in Section 3.2 of Golder (2023). Due to a change in the hydrostratigraphy of the overburden and weathered bedrock, the depth of the infiltration trench and grout wall were updated to align with the updated hydrostratigraphy. As per the previous approach, the base of the infiltration trench will be aligned with the water table, were possible, and the grout wall will extend from ground surface, through the overburden and into the weathered bedrock zone.

Groundwater elevations, water level drawdown relative to current conditions, and reduction in surface water flows at surface water monitoring stations were again simulated through each phase.

### 4.1.1 Updated Base of Grout Zones and Infiltration Trenches

The new hydrogeologic information obtained from the new well nests MW-IT-01 to MW-IT-07 indicates that the water table is 2 to 3 metres lower along some portions of Zones 1, 2 and 3 than was previously indicated from groundwater level data. As such, base elevation of the infiltration trenches and grout wall in Zones 1, 2, and 3 in the forecast simulations were lowered to reflect the updated water table from the updated calibrated HGS model (see Figure 3 for trench and grout zone depths). Trench and grout wall base elevations in Zones 4, 5, and 6 remain substantially the same in the revised forecast simulations, since predicted groundwater levels along those trenches did not substantially change as a result of the new hydrogeologic information in those areas.

### 4.1.2 Updated Mitigation of Quarry Inflows

The new hydrogeologic information (i.e. stratigraphy, water levels and hydraulic conductivity measurements) along with the updated HGS numerical model calibration to current conditions indicated that aquifer transmissivity along portions of the proposed groundwater mitigation system alignment was higher than previously inferred, particularly along Zones 1, 2 and 3, which would result in higher predicted inflows during the operational periods.

Modelling simulations were iteratively used to evaluate options to minimize higher potential inflows to optimize portion of water infiltrated which contributes to increasing aquifer levels (as opposed to re-entering the quarry). It was determined that by placing and compacting low permeability silt till backfill along the pit / quarry walls adjacent to the high transmissivity zone during Phases 5 and 6 as part of progressive rehabilitation, pit / quarry inflows could be minimized and actually reduced relative to the original (Golder 2023) predicted inflows. The timing of the progressive placement of silt till backfill in the other phases of operation otherwise remained the same in the updated forecast simulations. Note that the hydraulic conductivity of the silt till backfill was assigned as $1x10^{-6}$ m/s, which was consistent with previous simulations (Golder 2023).

The mitigation of Phase 5 required higher heads in Trench Zones 1 and 2. Trench Zones 1 and 2 are active from Phase 4 through Phase 7 but these higher heads were only required in Phase 5. See Section 4.2.5 for a sensitivity assessment of Trench Zone 1 and 2 heads on Phase 5 drawdown propagation, which provided the basis for assigning higher target heads to Zones 1 and 2 during Phase 5 in the final simulations.

### 4.1.3 Updated Backfill Removal Area Post-Rehabilitation

The zone of silt till backfill removal upon rehabilitation in the main pit / quarry remains in the same location and has the same planned extent as previous simulations (Golder 2023). The area of backfill removal is now represented as restoring 98% of the effective hydraulic conductivity of this portion of the original pit / quarry wall prior to backfill placement, as residual silt till material is expected remain in place.

## 4.2 Results

### 4.2.1 Simulated Head and Drawdown

The simulated hydraulic head, drawdown of the water table, and head change within the Gasport Formation, and the Whirlpool / Manitoulin Formations for Phases 1 to 7 and the post-Rehabilitation phase are shown on Figures 7A-H (hydraulic head) and Figures 8A-H (drawdown and head change).

The general simulated groundwater flow direction across the Site in each unit remained consistent with the current conditions; groundwater flow is southeast across the Site toward the Credit River and bedrock valley.

The simulated water level drawdown is consistent with the head change in the Gasport Formation south and southwest of the Site. During operation, the extent of drawdown in this area is the largest during Phase 3, prior to the implementation of the infiltration trench mitigation system in the Main Area. Phase 5 is simulated to have less drawdown than in Golder 2023 due to the combination of the progressive silt till backfill placement and the implementation of the mitigation systems.

As in Golder 2023, in the northwest and north of the Site where fine grained material is present the water table drawdown is less than the head change in the Gasport Formation. The finer grained, lower hydraulic conductivity materials provide a significant degree of hydraulic isolation between the shallow overburden and the underlying Gasport Formation layers, where dewatering mainly occurs during operations. The progressive rehabilitation of the pit / quarry walls during operation provides further hydraulic isolation between the pit / quarry operation and the surrounding environment, helping to minimize drawdown and dewatering requirements.

There is also drawdown observed in the Whirlpool / Manitoulin Formations, but this is relatively small in magnitude relative to the available drawdown in this aquifer given its depth and typical static water level. The drawdown beyond the Site in these deep aquifers is predicted to reach a maximum of approximately 3 m, which represents a small fraction of the available water column in wells screened in that aquifer, as discussed in Section 9.3.1 of Golder (2023). Upon rehabilitation, the residual change in groundwater heads within all aquifer units is typically less than +/- 1 m.

### 4.2.2 Surface Water Flows

A summary of the simulated changes in surface water flow at the surface water monitoring stations SW1 to SW16 for Operational Phases 1 to 7 and post-Rehabilitation is presented on Figure 9. Surface water stations SW5, SW11, SW13, SW14, and SW16 experience some simulated reduction in flows relative to current conditions. Post-rehabilitation, SW14, SW13, and SW5 experience some long-term reductions relative to the current conditions. SW16 experiences an increase in long-term flow upon rehabilitation.

### 4.2.3 Quarry Inflows

The steady state simulated groundwater inflow during Operational Phases 1 to 7 for each area (Main, North, South) is summarized in Table 5 below. The forecast results from Golder (2023) are included for reference.

**Table 5: Simulated Quarry Inflow at Each Phase of Development**

| Phase | Main Area Simulated Inflow (L/s) | | | North Area Simulated Inflow (L/s) | | | South Area Simulated Inflow (L/s) | | | Total Inflow (L/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Golder 2023[a] | 2024 Update[a] | Net Surplus[b] | Golder 2023[a] | 2024 Update[a] | Net Surplus[b] | Golder 2023[a] | 2024 Update[a] | Net Surplus[b] | Golder 2023[a] | 2024 Update[a] | Net Surplus[b] |
| 1 | 14.3 | 14.7 | 4.5 | 0.0 | 0.0 | 0.1 | n/a | n/a | n/a | 14.3 | 14.7 | 4.7 |
| 2 | 18.0 | 19.6 | 6.9 | 2.8 | 3.0 | 1.7 | n/a | n/a | n/a | 20.8 | 22.6 | 8.7 |
| 3 | 17.4 | 18.5 | 8.6 | 2.9 | 3.1 | 1.7 | n/a | n/a | n/a | 20.3 | 21.6 | 10.4 |
| 4 | 25.3 | 24.6 | 11.2 | 2.9 | 3.1 | 1.7 | n/a | n/a | n/a | 28.2 | 27.7 | 12.9 |
| 5 | 70.8 | 63.8 | 13.7 | 2.9 | 3.1 | 1.7 | n/a | n/a | n/a | 73.7 | 66.9 | 15.5 |
| 6 | 81.3 | 28.2 | 14.4 | 2.9 | 3.0 | 1.7 | 7.7 | 7.9 | 3.5 | 91.9 | 39.2 | 19.6 |
| 7 | 53.6 | 29.5 | 14.5 | 2.5 | 2.5 | 1.8 | 77.5 | 18.0 | 6.7 | 133.6 | 50.0 | 22.9 |

**Abbreviations and Notes:**

n/a – no sump installed, L/s – litres per second

a. The inflows include the net surplus applied to the pit and quarry area.

b. Calculated based on the quarry area and a net surplus of 364 mm/year.

Overall, the total simulated inflow to all areas of the pit / quarry during operation ranges from 14.7 L/s to 66.9 L/s, a narrower range than the 14.3 L/s to 133.6 L/s simulated in Golder 2023 Appendix Q. The majority of the simulated inflow is in the Main Area of the pit / quarry, with inflows up to 66.9 L/s during Phase 5 of the operation. The simulated pit / quarry inflows have decreased in Phase 5 and 6 relative to Golder 2023, primarily due to the progressive silt till backfill placement, but other changes in conductivity and model updates have resulted in changes between the other phases as well.

Upon rehabilitation, the maximum water level in the Main Pond will be controlled by an outflow to the North Pond at an approximate elevation of 400 masl, and the maximum water level in the North Pond will be controlled by an outflow and pipe to the Osprey Valley Golf Course irrigation system at an approximate elevation of 399 masl. The simulated elevation of the South Pond is estimated to be 393.5 masl and will be internally contained, with no surface outflow. The simulated steady state outflow from the Main and North Ponds to the golf course irrigation system is estimated to be approximately 10 L/s, a decrease of 2 L/s from the estimation presented in Golder (2023).

### 4.2.4 Trench Flow Rates

Simulated infiltration trench flow rates are shown in Table 6. Total trench flow rates peak in Phase 5 at 51.6 L/s. Total trench flow as a percentage of total sump inflow peaks in Phase 5 at 77% assuming the target heads are maintained in Trench Zones 1 to 6.

**Table 6: Trench Flow Rates**

| Phase | Trench Zone 1 (L/s) | Trench Zone 2 (L/s) | Trench Zone 3 (L/s) | Trench Zone 4 (L/s) | Trench Zone 5 (L/s) | Trench Zone 6 (L/s) | Total Trench Flow (L/s) | Total Trench Flow as Percent of Total Sump Inflow (%) |
|---|---|---|---|---|---|---|---|---|
| 1 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 2 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 3 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 4 | 12.2 | 1.4 | n/a | n/a | n/a | n/a | 13.6 | 49% |
| 5 | 27.6 | 24.0 | n/a | n/a | n/a | n/a | 51.6 | 77% |
| 6 | 10.8 | 0.4 | 5.2 | 2.8 | 4.2 | 2.9 | 26.3 | 67% |
| 7 | 11.1 | 0.7 | 7.8 | 5.5 | 6.1 | 5.2 | 36.4 | 73% |

**Abbreviations and Notes:**
n/a – trench not installed, L/s – litres per second

### 4.2.5 Phase 5 Infiltration Head Sensitivity Check

Phase 5 sensitivity to infiltration trench heads in Trench Zones 1 and 2 was assessed and the results are presented on Figure 10. The planned operational case from this 2024 update was used as a base case and three scenarios where the infiltration trench heads are increased were simulated. When the heads were increased, the drawdown south of the Site property boundary was reduced. Increasing the infiltration trench heads also increased the net outflow to the surrounding aquifer. Note that head increases above the pre-development water table results in a slight rise in the water table proximal to the trench zones during Operational phases when the infiltration trench heads are maintained at a higher level (e.g., Scenario 5B in Figure 10).

## 4.3 Summary

The HGS numerical model for the proposed Caledon pit / quarry has been updated, utilizing new hydrogeologic information collected during the field investigations along the proposed mitigation system alignment along the west side of the Main Area and southwest sides of the South Area of the pit / quarry. This new hydrogeologic information has improved our understanding of the hydrostratigraphy of the Site, and the updated HGS model has been used to provide an updated assessment of potential impacts to groundwater and surface water due to the proposed pit / quarry operations.

The HGS model simulations demonstrate that the proposed mitigation system can maintain groundwater levels within their current typical range during the later stages of pit / quarry operations, and that proactive rehabilitation during Phases 5 and 6 of the pit / quarry operations can reduce groundwater inflows into the pit / quarry relative to earlier simulations, thereby optimizing water management during future operations.

# 5.0 LIMITATIONS

## 5.1 Use of This Report

This report has been prepared by WSP for use by CBM Aggregates (CBM) and its agents. The factual information, descriptions, interpretations, comments, results, conclusions and electronic files contained herein are specific to the project described in this report. Information used in this report should be restricted to that specified in the scope of work unless otherwise mutually agreed upon by CBM and WSP. This report should be read in its entirety as some sections could be falsely interpreted when taken individually or out-of-context. WSP is not responsible for any use of this report and its content by a third party, and/or for its use for purposes other than those intended.

WSP is not responsible for any damages that may result from unpredictable or unknown underground conditions, from erroneous information provided by and/or obtained from sources other than WSP, and from ulterior changes in the site conditions unless WSP has been notified of any occurrence, activity, information or discovery, past or future, susceptible of modifying the underground conditions described herein, and have had the opportunity of revising its interpretations. In addition, WSP is not responsible for any decrease of a property’s value or any failure to complete a transaction as a consequence of this report.

## 5.2 Groundwater Modelling General Limitations

Hydrogeological investigations and groundwater modelling are dynamic and inexact sciences. They are dynamic in the sense that the state of any hydrological system is changing with time and the science is continually developing new techniques to evaluate these systems. They are inexact in the sense that field data provides a fraction of information for the site or model domain; as such a truly complete, comprehensive characterization of the groundwater system is not possible. Therefore, every groundwater model is, by necessity, a simplification of a reality.

The professional groundwater modelling services described in this report are conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions. The results of previous or simultaneous work provided by sources other than WSP and quoted and/or used herein are considered as having been obtained according to recognized and accepted professional rules and practices, and therefore deemed valid.

The model presented herein provides a predictive scientific tool to evaluate the impacts of specified hydrological stressors on a real groundwater system and to compare various scenarios in support of a decision-making process. The model’s accuracy is bound to the normal uncertainty associated to groundwater modelling and no warranty, express or implied, is made.

# 6.0 REFERENCES

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WSP Canada Inc. (WSP), 2024. Field Investigation Results - Groundwater Mitigation System for the Proposed CBM Caledon Pit / Quarry. Draft Technical memorandum. November 20, 2024, 230 p.

## 7.0 CLOSURE

We trust that this memorandum meets your current needs. If you have any questions or require clarification, please contact the undersigned at your earliest convenience.

**WSP Canada Inc.**

TGrootjen

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*Groundwater Modeller*

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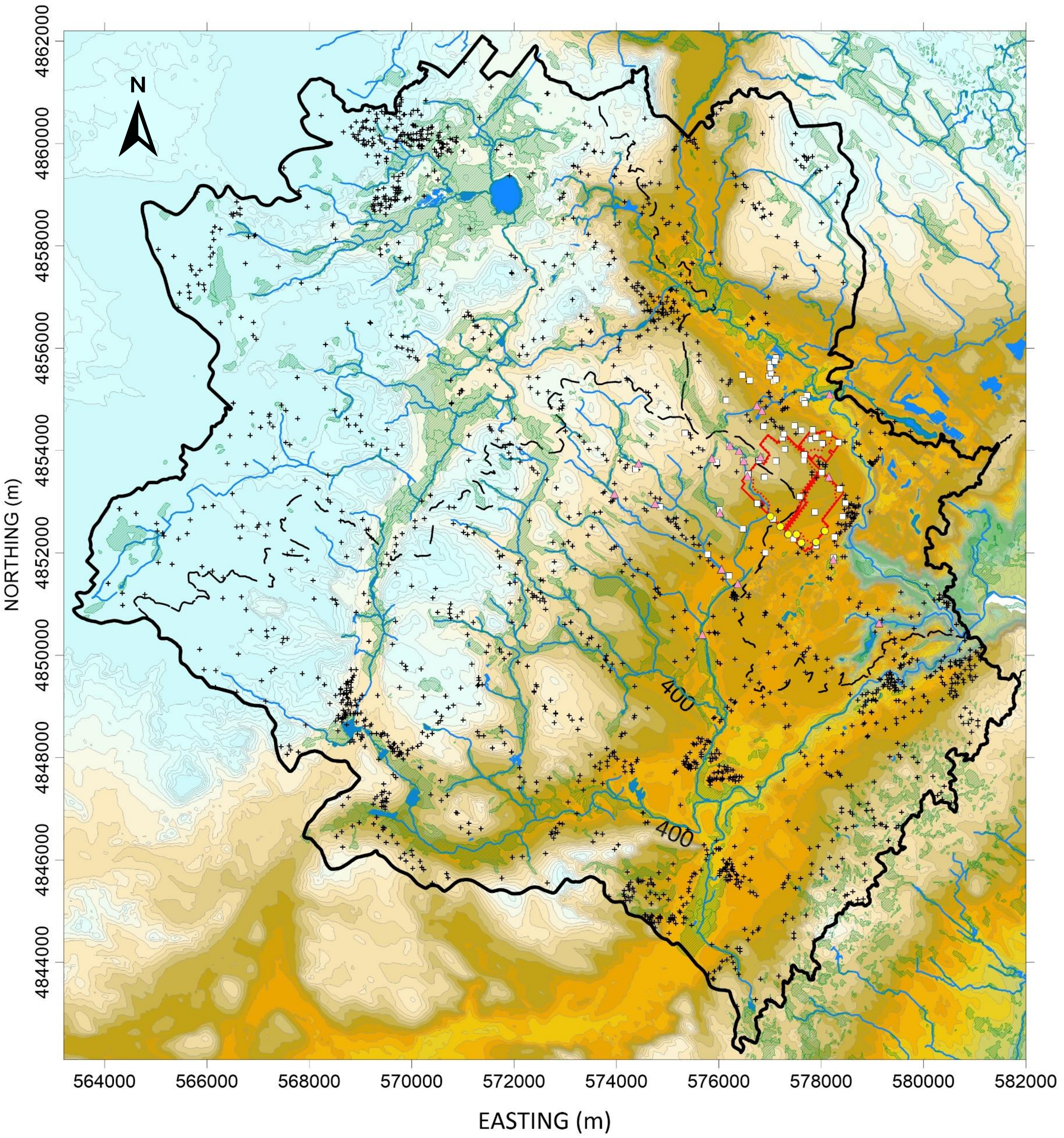
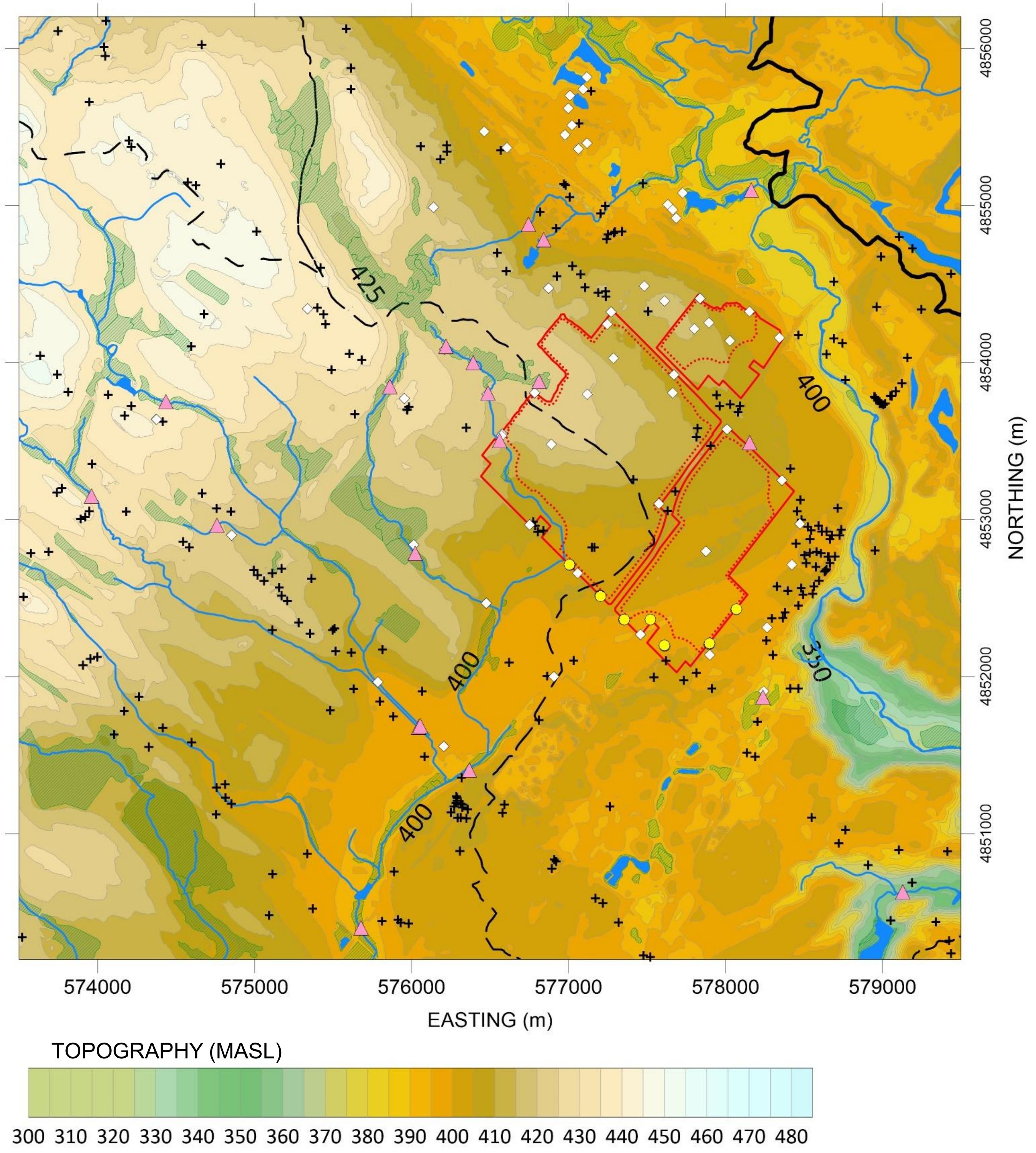
Attachments: Figures 1 to 10

https://wsponline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/11 hgs numerical model/16 june 2024 mitigation system design modelling/04_2025 final draft report may 2025/ca-gld-19129150-tm hgs update may2025.docx

# FIGURES





LEGEND

| | |
|---|---|
| 🟦 | LAKES |
| — | RIVERS/ STREAMS |
| ▨ | WETLAND |
| — | MODEL DOMAIN |
| - - | CVC SUBWATERSHED |
| — | SITE PROPERTY BOUNDARY |
| ····· | EXTRACTION EXTENTS |
| ✚ | MECP WWR WELL LOCATION |
| ◇ | SITE GROUNDWATER MONITORING LOCATION |
| △ | SITE SURFACE WATER MONITORING LOCATION |
| ● | NEW IT WELLS |

NOTES

1. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
2. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNRF) Southwestern Ontario Orthophotography (SWOOP) 2019
3. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
4. Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2020).
5. Quarry license and limit of extraction provided by MHBC (2022)

CLIENT
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

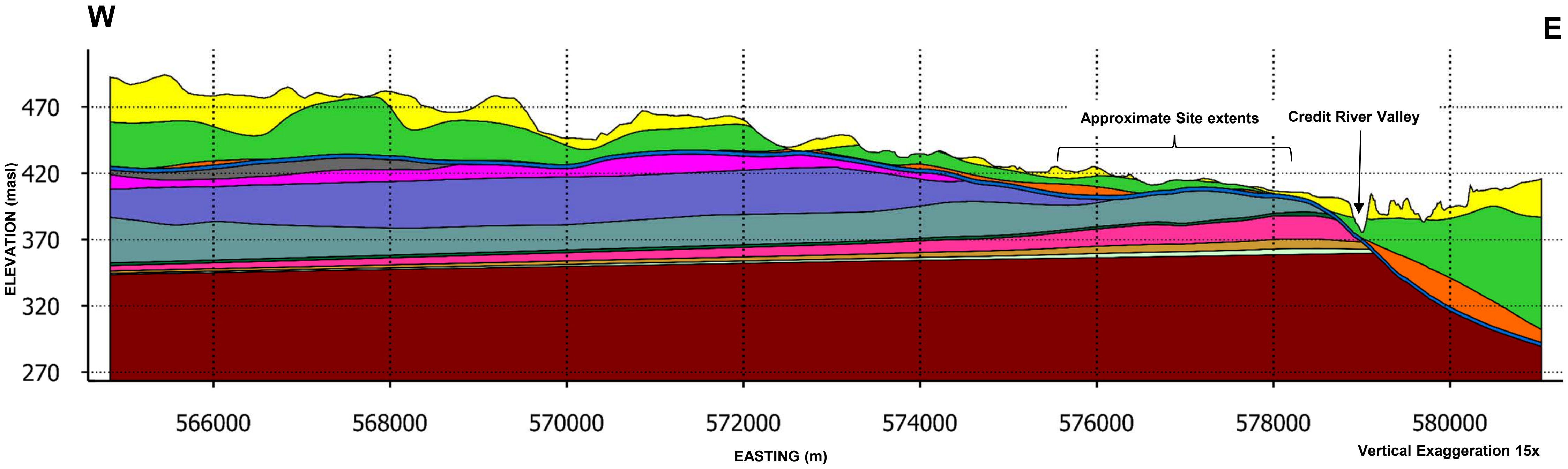
CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2024-10-25 |
| PREPARED | HW |
| DESIGN | WA |
| REVIEW | RS |
| APPROVED | GS |

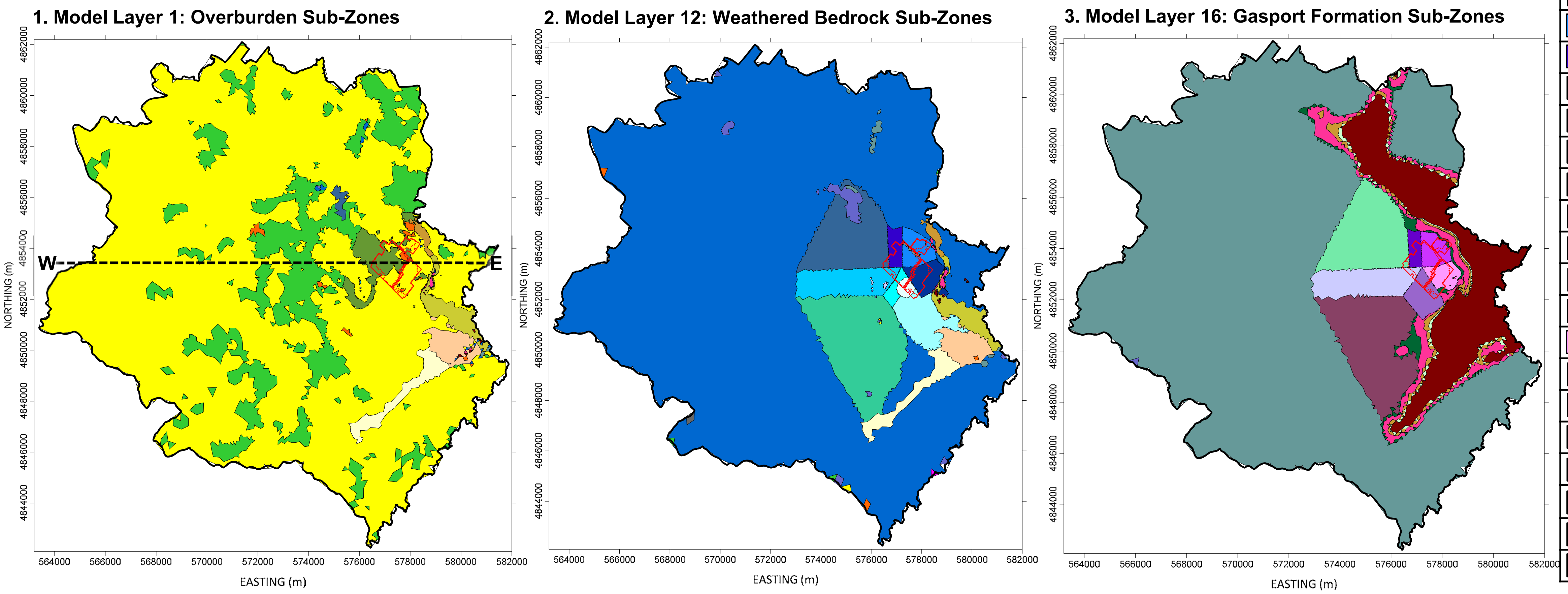
TITLE
**STUDY AREA AND MODEL DOMAIN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 1 |

## CROSS SECTION: GENERAL MODEL HYDROSTRATIGRAPHY



## PLAN VIEW: MODEL UNIT SUB-ZONES WITHIN PARENT UNITS


1. Model Layer 1: Overburden Sub-Zones

2. Model Layer 12: Weathered Bedrock Sub-Zones

3. Model Layer 16: Gasport Formation Sub-Zones

| | Unit | Kh (m/s) | Kv (m/s) | Porosity | Specific Storage (1/m) |
|---|---|---|---|---|---|
| 🟩 | Regional Till | 1.E-06 | 1.E-06 | 0.3 | 1.E-04 |
| 🟩 | Local Till | 8.4E-09 | 8.4E-10 | 0.3 | 1.E-04 |
| 🟨 | Upper Sand | 1.4E-04 | 1.4E-05 | 0.3 | 1.E-04 |
| 🟧 | Lower Sand | 1.E-04 | 1.E-05 | 0.3 | 1.E-04 |
| ⬜ | Till (Valley Skin) Zone 1 | 4.E-06 | 4.E-06 | 0.3 | 1.E-04 |
| 🟧 | Till (Valley Skin) Zone 2 | 1.E-06 | 1.E-06 | 0.3 | 1.E-04 |
| 🟨 | Till (Valley Skin) Zone 3 | 5.E-06 | 5.E-06 | 0.3 | 1.E-04 |
| 🟫 | Till (Valley Skin) Zone 4 | 2.E-04 | 2.E-04 | 0.3 | 1.E-04 |
| 🟦 | Weathered Bedrock (Regional) | 2.E-04 | 5.E-06 | 0.01 | 5.E-06 |
| 🟦 | Weathered Bedrock Zone 1 | 5.E-06 | 5.E-07 | 0.01 | 5.E-06 |
| 🟦 | Weathered Bedrock Zone 2 | 4.E-06 | 4.E-06 | 0.01 | 5.E-06 |
| 🟩 | Weathered Bedrock Zone 3 | 5.E-06 | 5.E-06 | 0.01 | 5.E-06 |
| ⬜ | Weathered Bedrock Zone 4A | 8.2E-03 | 8.2E-04 | 0.01 | 5.E-06 |
| 🟦 | Weathered Bedrock Zone 4B | 1.9E-03 | 1.9E-04 | 0.01 | 5.E-06 |
| 🟦 | Weathered Bedrock Zone 4C | 1.3E-03 | 1.3E-04 | 0.01 | 5.E-06 |
| 🟦 | Weathered Bedrock Zone 5 | 5.E-05 | 5.E-06 | 0.01 | 5.E-06 |
| 🟦 | Weathered Bedrock Zone 6 | 5.E-04 | 5.E-04 | 0.01 | 5.E-06 |
| 🟪 | Weathered Bedrock Zone 7 | 5.E-06 | 5.E-07 | 0.01 | 5.E-06 |
| ⬛ | Guelph Formation | 5.E-05 | 5.E-06 | 0.01 | 5.E-06 |
| 🟪 | Eramosa Formation | 9.E-08 | 9.E-09 | 0.01 | 5.E-06 |
| 🟪 | Goat Island Formation | 1.E-06 | 1.E-07 | 0.01 | 5.E-06 |
| 🟦 | Gasport Formation Regional | 1.E-06 | 1.E-07 | 0.01 | 5.E-06 |
| 🟩 | Gasport Formation Zone 1 | 5.E-06 | 5.E-07 | 0.01 | 5.E-06 |
| 🟪 | Gasport Formation Zone 2 | 5.E-07 | 5.E-08 | 0.01 | 5.E-06 |
| 🟫 | Gasport Formation Zone 3 | 1.E-06 | 1.E-07 | 0.01 | 5.E-06 |
| 🟪 | Gasport Formation Zone 4 | 8.7E-03 | 8.7E-04 | 0.01 | 5.E-06 |
| 🟪 | Gasport Formation Zone 5 | 1.E-05 | 1.E-06 | 0.01 | 5.E-06 |
| 🟪 | Gasport Formation Zone 6 | 1.E-07 | 1.E-08 | 0.01 | 5.E-06 |
| 🟪 | Gasport Formation Zone 7 | 5.E-06 | 5.E-07 | 0.01 | 5.E-06 |
| 🟩 | Shaley Dolostone Unit | 1.E-07 | 2.E-09 | 0.01 | 5.E-06 |
| 🟥 | Cabot Head Formation | 1.E-08 | 1.E-09 | 0.01 | 5.E-06 |
| 🟫 | Manitoulin Formation | 1.E-05 | 1.E-06 | 0.01 | 5.E-06 |
| 🟩 | Whirlpool Formation | 1.E-06 | 1.E-07 | 0.01 | 5.E-06 |
| 🟥 | Queenston Formation | 1.E-08 | 1.E-09 | 0.01 | 5.E-06 |

LEGEND

| | |
|---|---|
| ━ | SITE PROPERTY BOUNDARY |
| ┅ | EXTRACTION EXTENT |
| ━ | MODEL DOMAIN |

NOTES

1. Quarry license and limit of extraction provided by MHBC (2022)
2. Only parent units are shown in cross section view (not sub-zones)
3. Figure 1 shows the sub-zones within the modelled overburden layers, which are assigned form model layer 1-11. Layer 1 is shown as an example of the hydraulic conductivity distribution.
4. Figure 2 shows the weathered bedrock unit sub-zones, which are assigned primarily to model layer 12
5. Figure 3 shows the Gasport Formation sub-zones, which are assigned to model layers 16-21.

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PROJECT
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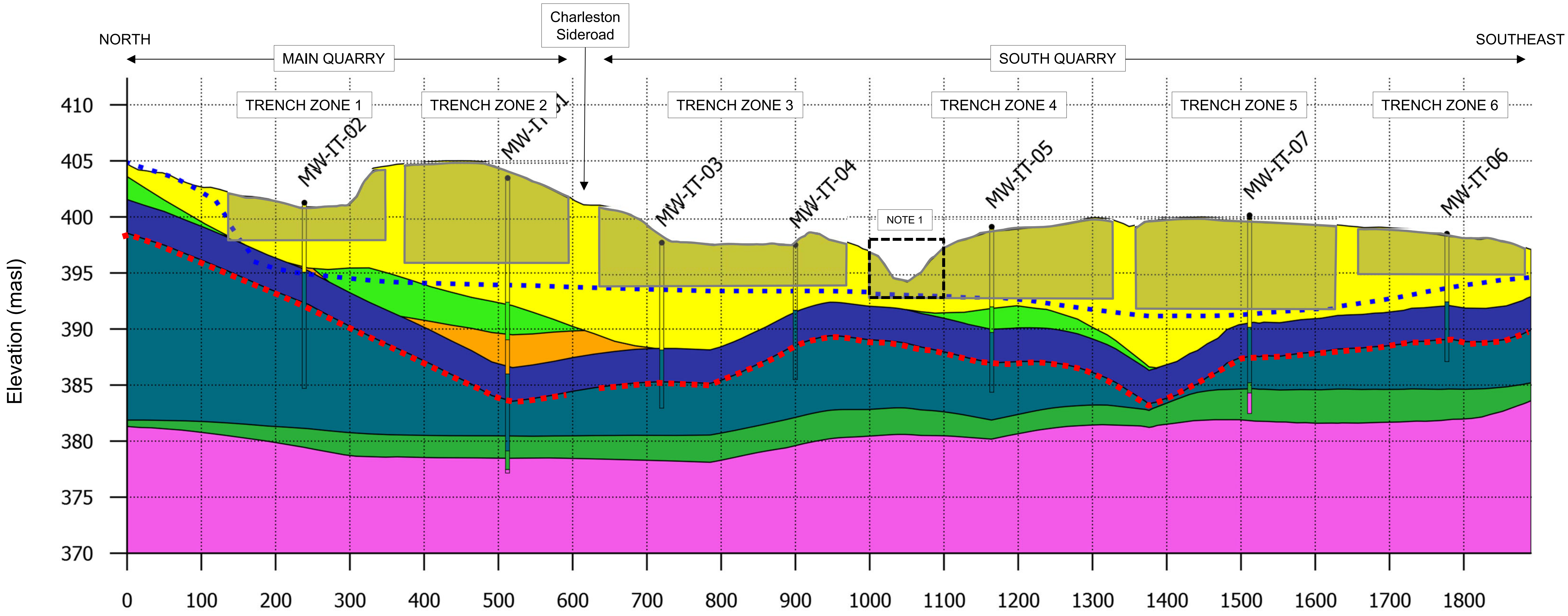
|---|---|
| YYYY-MM-DD | 2024-12-09 |
| PREPARED | HW |
| DESIGN | WA |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**MODEL PARAMETERIZATION**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 2 |

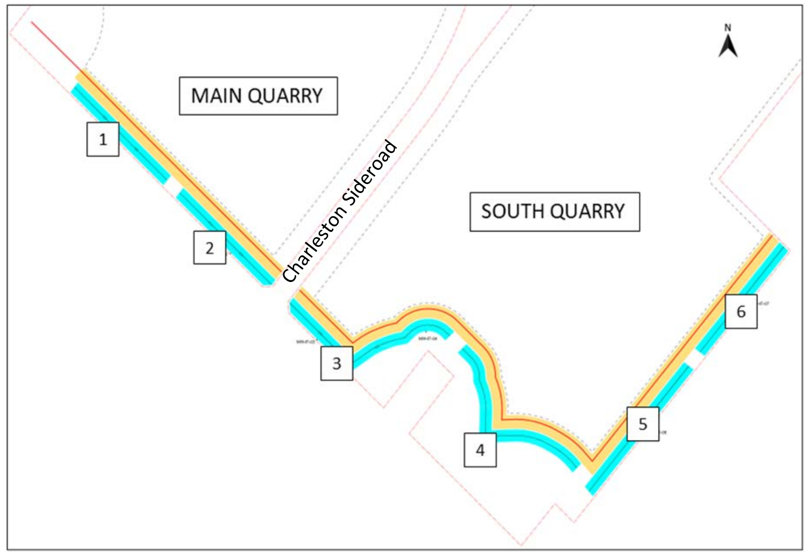


TRENCH AND SLURRY WALL CHAINAGES

| | Start (m) | End (m) | Trench Length (m) | Target WL (masl) |
|---|---|---|---|---|
| Slurry wall only | 0.0 | 128.6 | N/A | N/A |
| Trench Zone 1 | 128.6 | 348.7 | 220.1 | 396.0 (398.0ᵃ) |
| Trench Zone 2 | 378.7 | 596.7 | 218.0 | 394.0 (398.0ᵃ) |
| Trench Zone 3 | 640.1 | 974.8 | 334.7 | 393.5 |
| Trench Zone 4 | 1004.8 | 1334.9 | 330.2 | 393.0 |
| Trench Zone 5 | 1365.8 | 1634.5 | 268.7 | 392.0 |
| Trench Zone 6 | 1664.5 | 1890.5 | 226.0 | 394.0 |

a. Target WL during Phase 5 is 398.0 masl.

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |



LEGEND

- 🟨 Upper Sand
- 🟩 Till
- 🟧 Lower Sand/ Channel Sediment
- 🟦 Weathered Bedrock
- 🟦 Gasport Formation (Dolostone)
- 🟩 Fossil Hill Formation (Shaley Dolostone)
- 🟪 Cabot Head Formation (Shale)
- ▪▪▪▪ Water Table (approximate)
- ▪▪▪ Base of Slurry Wall / Grout Zone
- ▭ Infiltration Trench Zone

NOTES

1. This interval of Trench Zone 4 was simulated, but trench will be shortened by 100m when constructed due to shallow water table and thin overburden
2. m = metres, masl = metres above sea level
3. WL = water level, N/A = not applicable
4. Vertical exaggeration: 15x

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PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

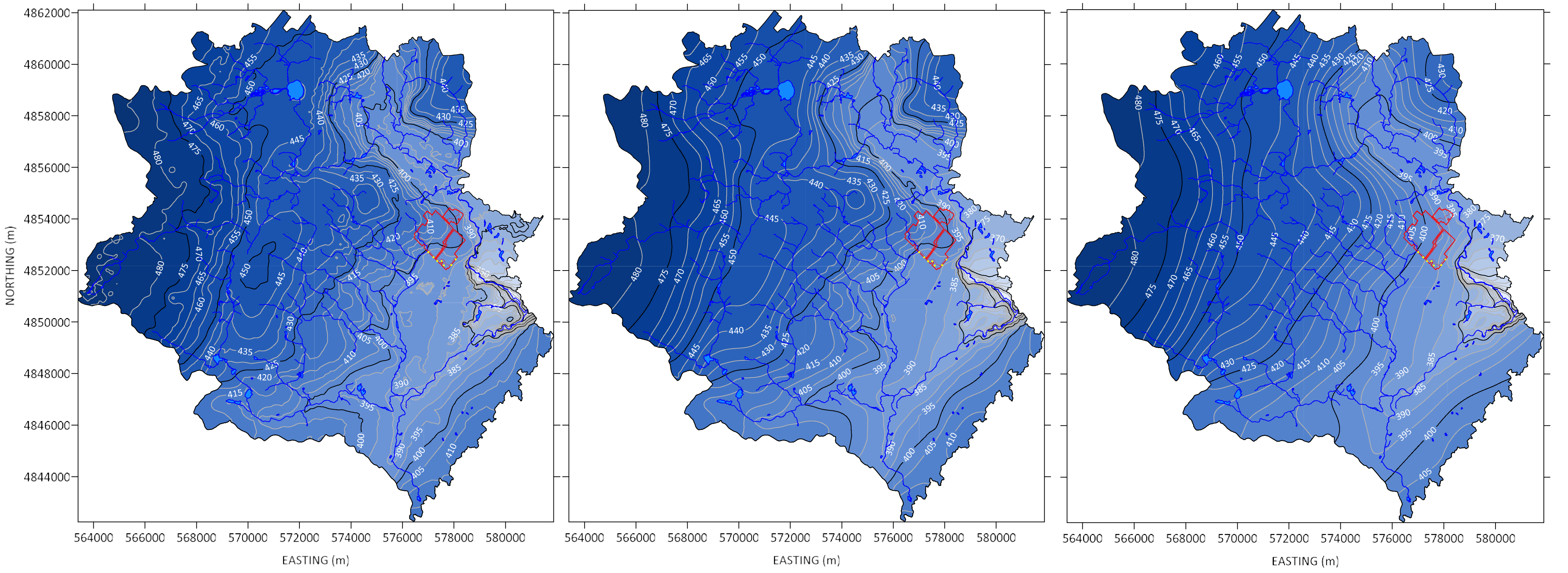
CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2025-03-11 |
| PREPARED | TG |
| DESIGN | HW/GWS |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**HYDROSTRATIGRAPHIC CROSS-SECTION ALONG SLURRY WALL ALIGNMENT**

PROJECT No. 19129150
Rev. 0
FIGURE 3

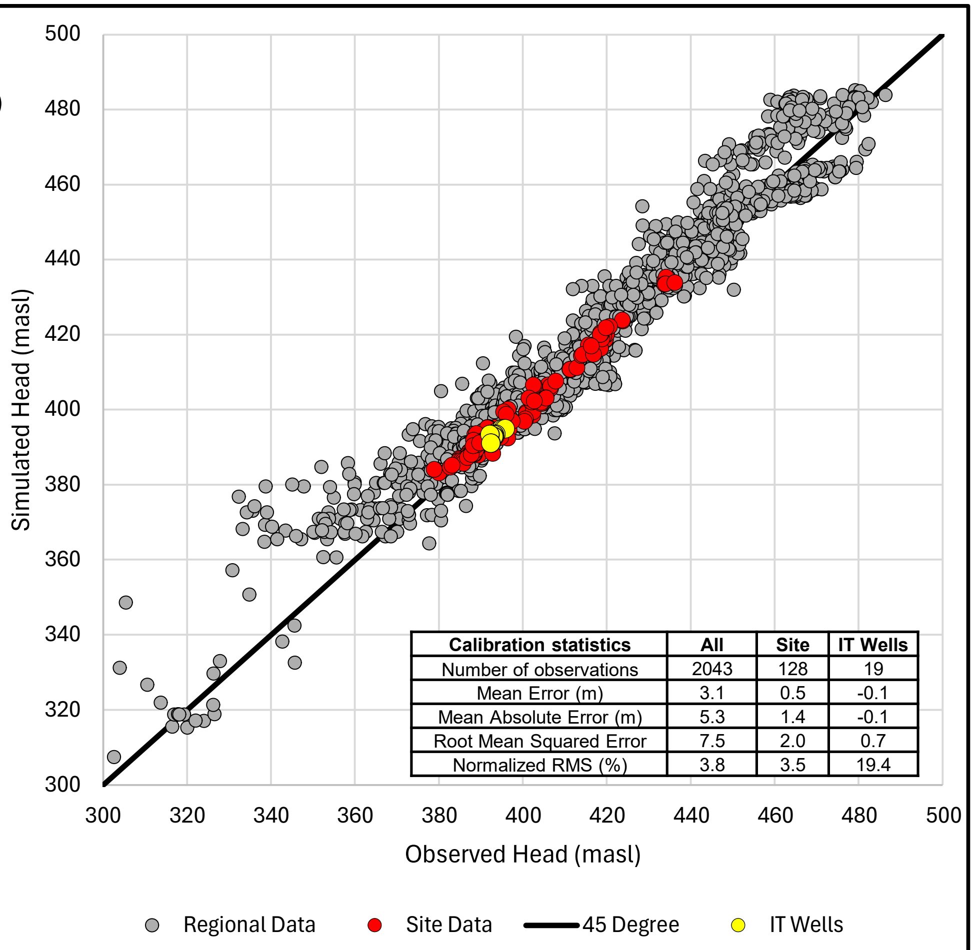
## SIMULATED HYDAULIC HEAD: REGIONAL (masl)



1. Simulated Water Table Elevation

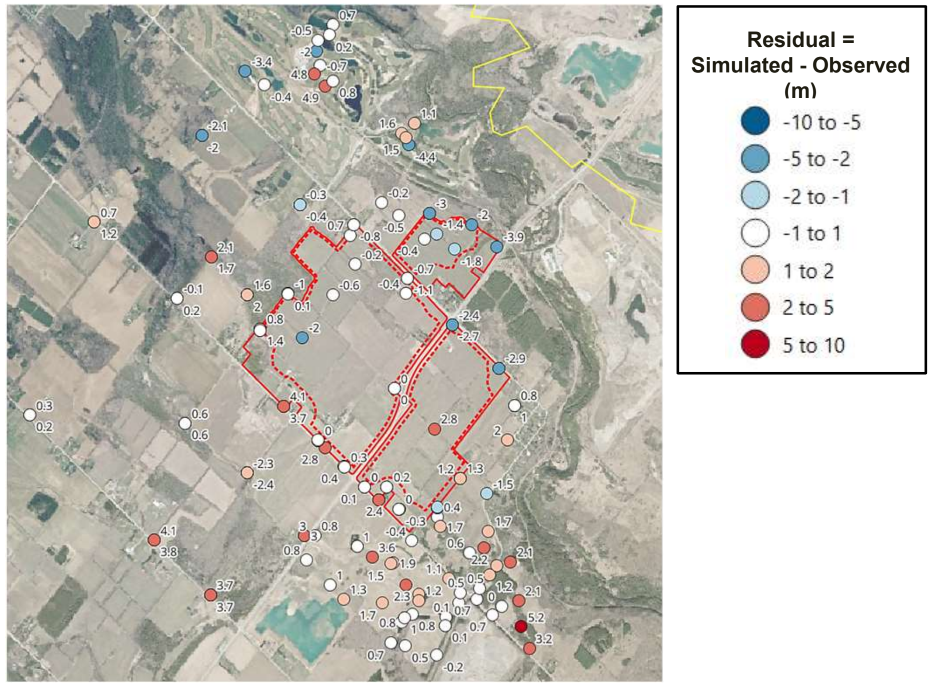
2. Gasport Formation (Model Slice 22)

3. Manitoulin/ Whirlpool Formation (Model Slice 25)

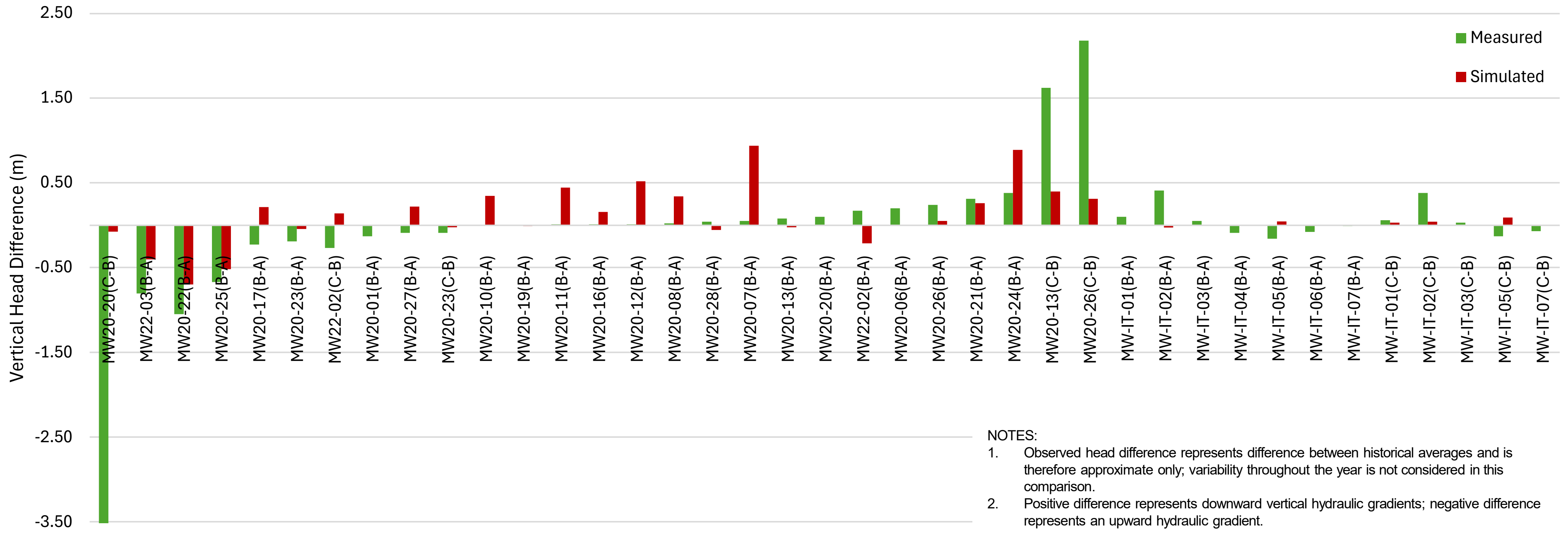


| Calibration statistics | All | Site | IT Wells |
|---|---|---|---|
| Number of observations | 2043 | 128 | 19 |
| Mean Error (m) | 3.1 | 0.5 | -0.1 |
| Mean Absolute Error (m) | 5.3 | 1.4 | -0.1 |
| Root Mean Squared Error | 7.5 | 2.0 | 0.7 |
| Normalized RMS (%) | 3.8 | 3.5 | 19.4 |

## SIMULATED VS. OBSERVED HYDAULIC HEAD: SITE



## SIMULATED VS. OBSERVED HYDRAULIC HEAD DIFFERENCE IN NESTED MONITORING WELLS



NOTES:

1. Observed head difference represents difference between historical averages and is therefore approximate only; variability throughout the year is not considered in this comparison.
2. Positive difference represents downward vertical hydraulic gradients; negative difference represents an upward hydraulic gradient.

LEGEND

- LAKES
- RIVERS/ STREAMS
- WETLAND
- MODEL DOMAIN
- NEW IT WELLS
- SITE PROPERTY BOUNDARY
- EXTRACTION EXTENTS
- ✚ MECP WWR WELL LOCATION
- ◇ SITE GROUNDWATER MONITORING LOCATION
- △ SITE SURFACE WATER MONITORING LOCATION

NOTES

3. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
4. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNRF) Southwestern Ontario Orthophotography (SWOOP) 2019
5. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
6. Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2020).
7. Quarry license and limit of extraction provided by MHBC (2022)

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PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

CONSULTANT

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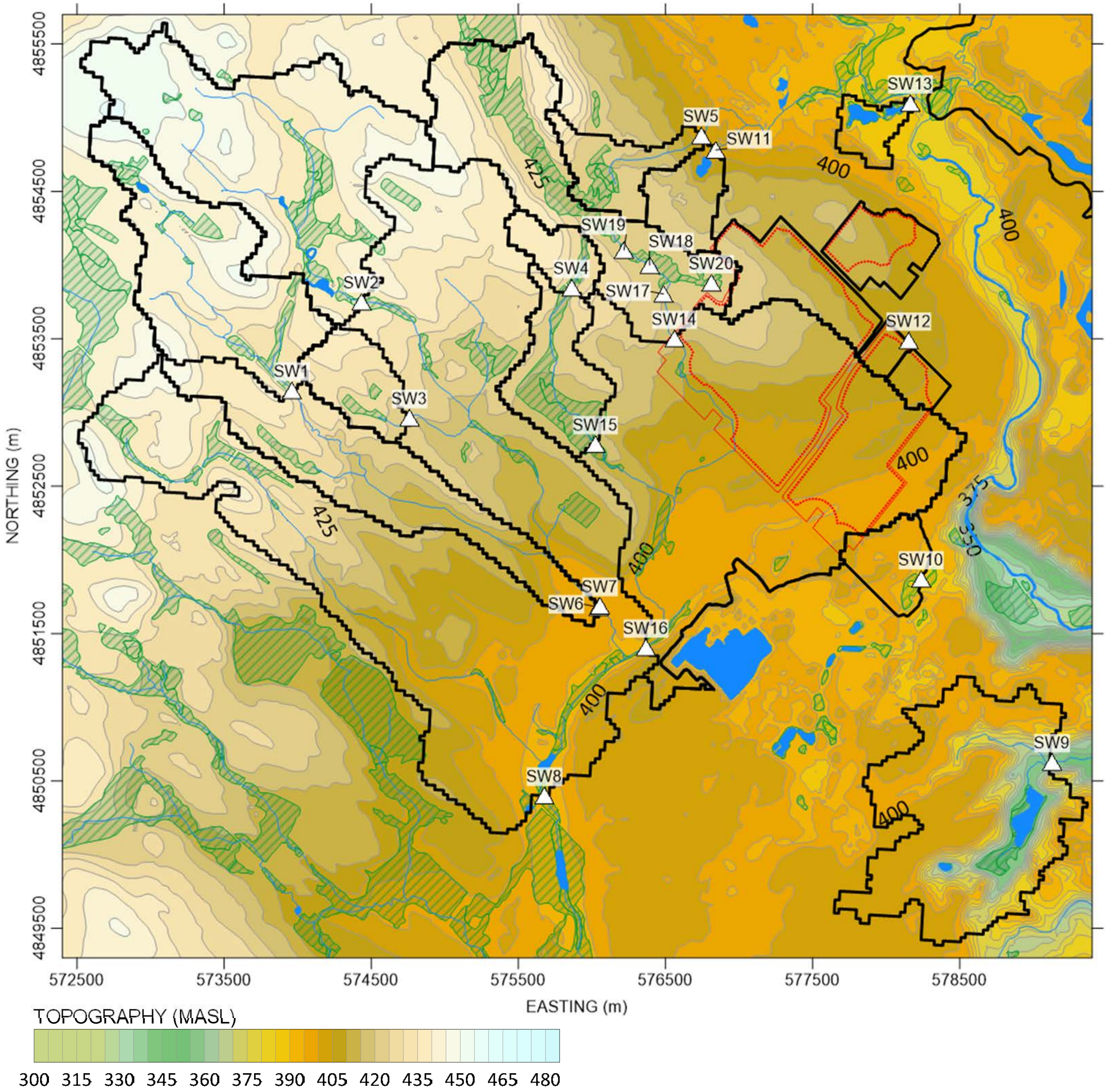
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | WA |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

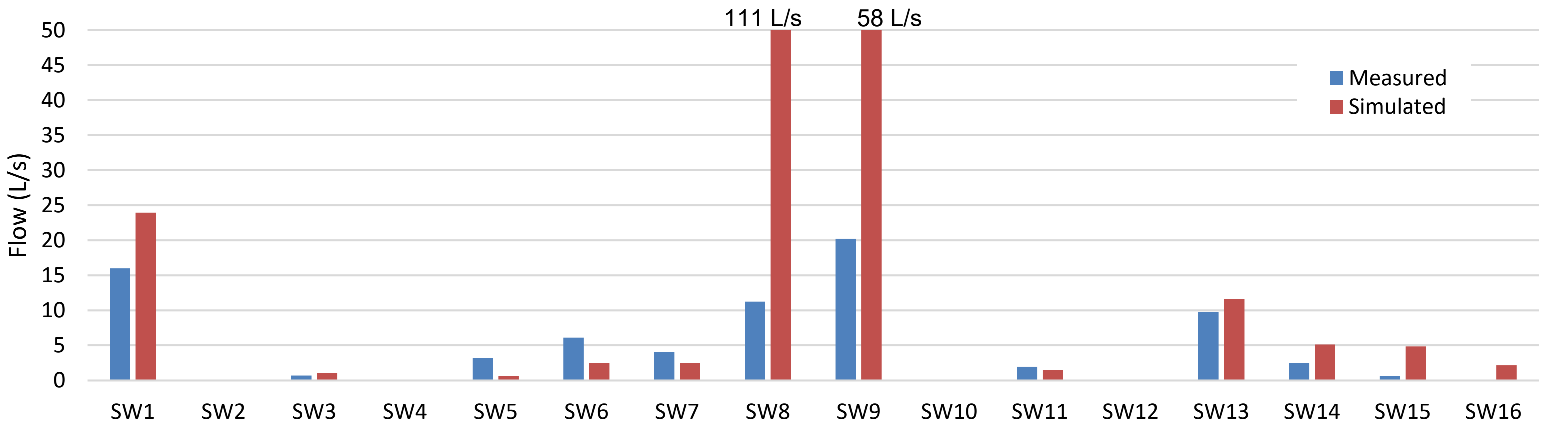
TITLE
**CURRENT CONDITIONS SIMULATED HYDRAULIC HEAD**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 4 |

## SURFACE WATER MONTIORING STATIONS AND CATCHMENT AREAS



## AVERAGE MEASURED AND SIMULATED FLOW (L/s)



## AVERAGE MEASURED AND SIMULATED UNIT YIELD (L/s/km²)

| Stations | Catchment Area ($km^2$) | Flow (L/s) | | Unit Yield (L/s/km²) | | |
|---|---|---|---|---|---|---|
| | | Average Measured | Model Simulated | Average Measured | Model Simulated | Surplus |
| SW1 | 1.32 | 16.00 | 23.95 | 12.12 | 18.14 | 11.54 |
| SW2 | 2.21 | 0.03 | 0.00 | 0.01 | 0.00 | 11.54 |
| SW3 | 0.35 | 0.68 | 1.09 | 1.98 | 3.15 | 11.54 |
| SW4 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 11.54 |
| SW5 | 0.35 | 3.20 | 0.59 | 9.20 | 1.71 | 11.54 |
| SW6/7 | 7.73 | 10.17 | 2.44 | 1.32 | 0.32 | 11.54 |
| SW8 | 17.40 | 11.25 | 110.69 | 0.65 | 6.36 | 11.54 |
| SW9 | 1.81 | 20.23 | 58.12 | 11.19 | 32.14 | 11.54 |
| SW10 | 0.26 | 0.00 | 0.00 | 0.00 | 0.00 | 11.54 |
| SW11 | 0.28 | 1.94 | 1.47 | 6.83 | 5.19 | 11.54 |
| SW12 | 0.06 | 0.00 | 0.00 | 0.02 | 0.00 | 11.54 |
| SW13 | 0.16 | 9.79 | 11.64 | 60.44 | 71.88 | 11.54 |
| SW14 | 1.41 | 2.50 | 5.12 | 1.77 | 3.62 | 11.54 |
| SW15 | 0.73 | 0.65 | 4.84 | 0.89 | 6.60 | 11.54 |
| SW16 | 5.94 | 0.00 | 2.15 | 0.00 | 0.36 | 11.54 |

NOTES:

1. Average measured surface water flows represent the average over the period of record for each station (approximately May 2020 to December 2021). There may be considerable variability in flows as a results of short-term climate events, which is shown in the hydrograph figures in the main report.
2. Several surface water stations have an average flow of 0.00 L/s (SW4, SW10, SW12, and SW16).
3. The 'unit yield' for both average measured and simulated surface water flow represents the average measured flow and model simulated flow for each surface water monitoring station divided by the catchment area.
4. The 'unit yield' surplus value represents the surplus value of 364 mm/yr applied to the top surface of the model (surface water domain), normalized by area.

LEGEND

| | | | |
|---|---|---|---|
| 🟦 | LAKES | — | SITE PROPERTY BOUNDARY |
| — | RIVERS/ STREAMS | ┅ | EXTRACTION EXTENTS |
| ▨ | WETLAND | △ | SURFACE WATER MONITORING STATION |
| — | CATCHMENT AREA | | |

ADDITIONAL MAP NOTES

5. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
6. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNRF) Southwestern Ontario Orthophotography (SWOOP) 2019
7. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
8. Quarry license and limit of extraction provided by MHBC (2022)

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CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

CONSULTANT
wsp

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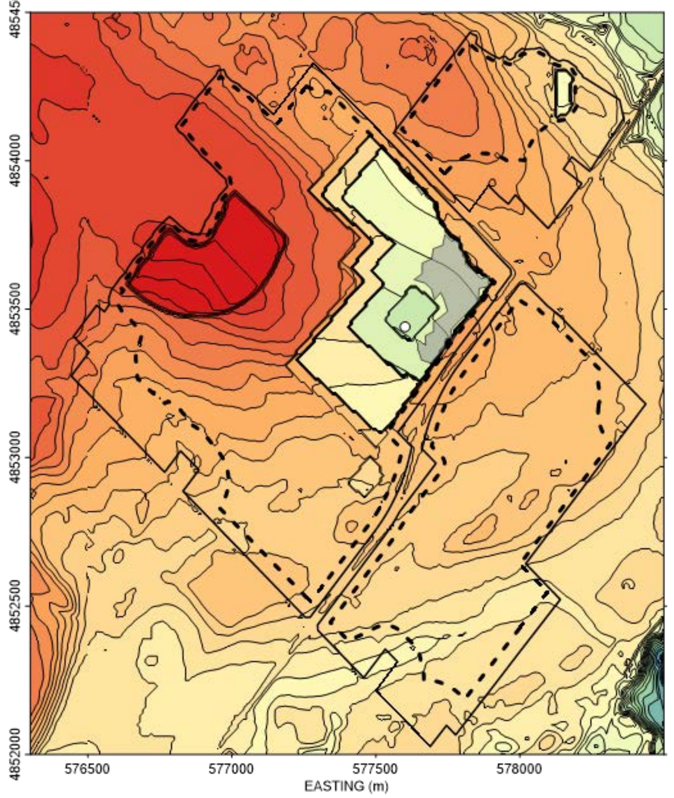
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | WA |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**CURRENT CONDITIONS SIMULATED SURFACE WATER FLOW**

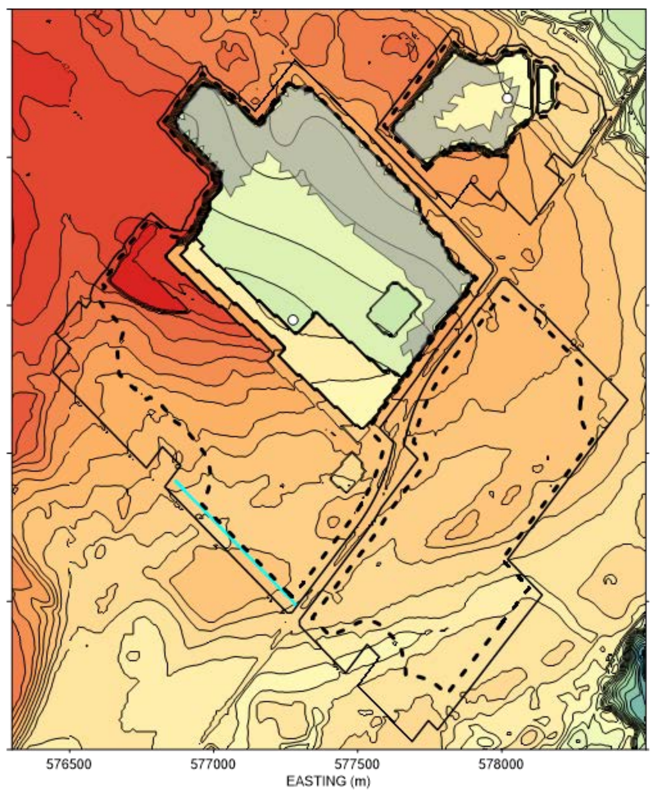
PROJECT No. 19129150
Rev. 0
FIGURE 5

## PHASE 1

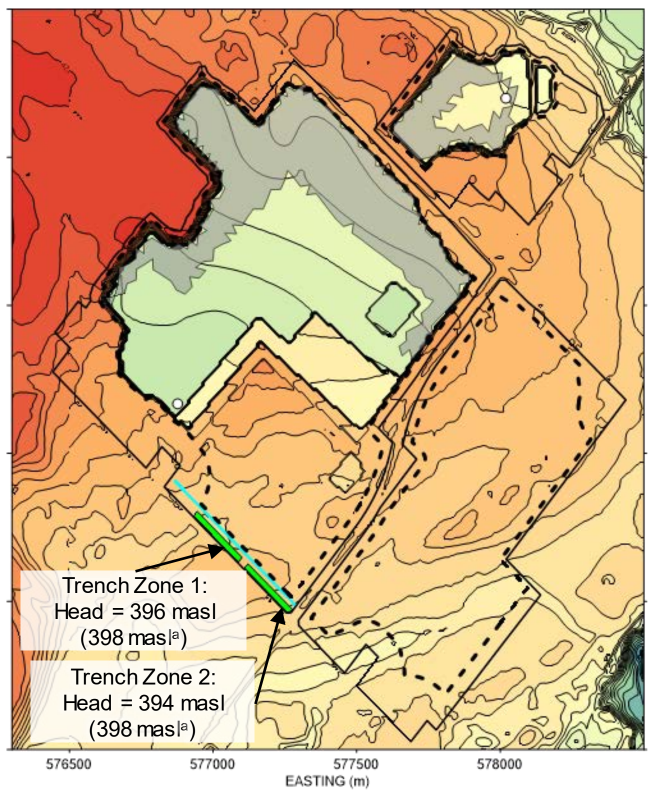


## PHASE 2

## PHASE 3



## PHASE 4



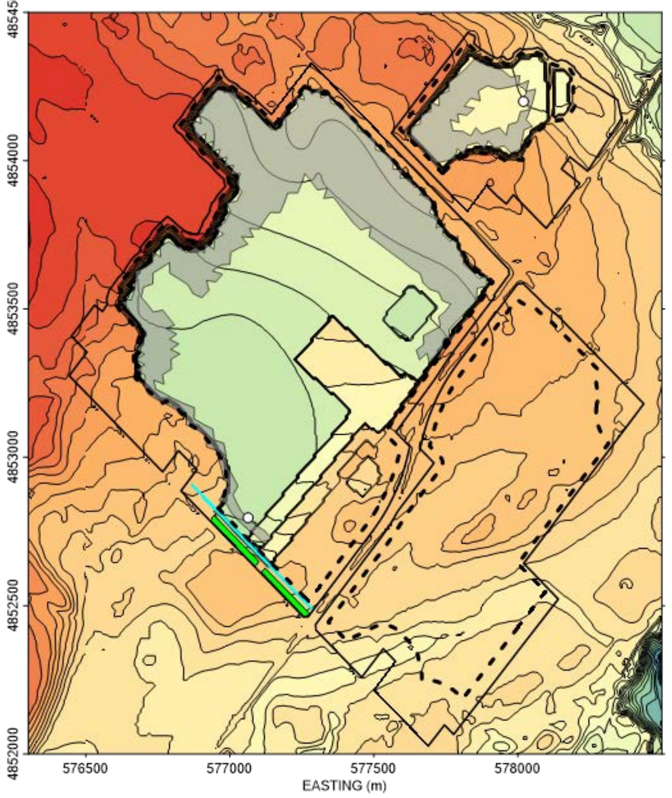
### TIMELINE OF QUARRY DEVELOPMENT

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

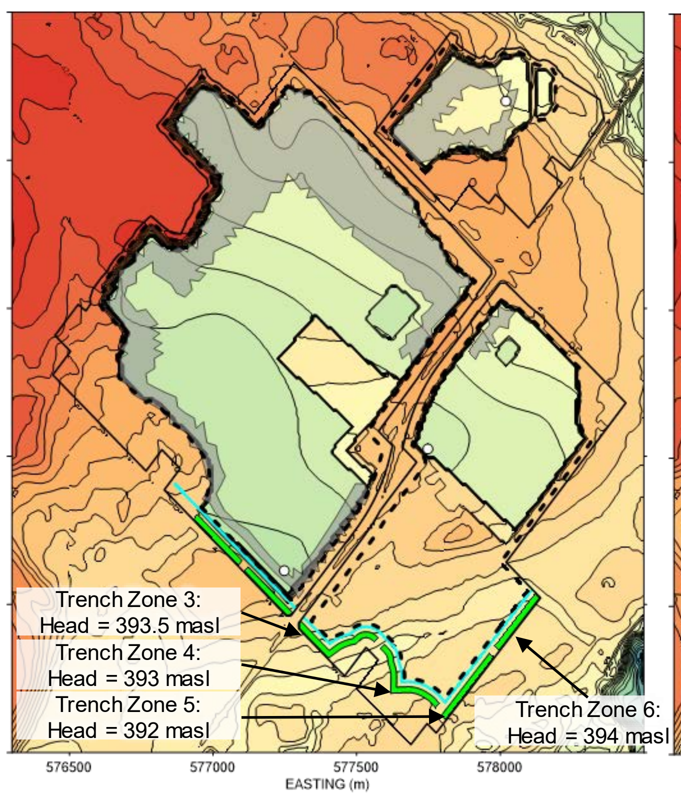
### QUARRY SUMP ELEVATIONS

| Phase of Operation | Main Area | North Area | South Area |
|---|---|---|---|
| 1 | 385.1 | - | - |
| 2 | 385.1 | 394.0 | - |
| 3 | 385.3 | 394.0 | - |
| 4 | 382.5 | 394.0 | - |
| 5 | 382.1 | 394.0 | - |
| 6 | 381.2 | 394.0 | 385.2 |
| 7 | 381.2 | 394.0 | 383.4 |

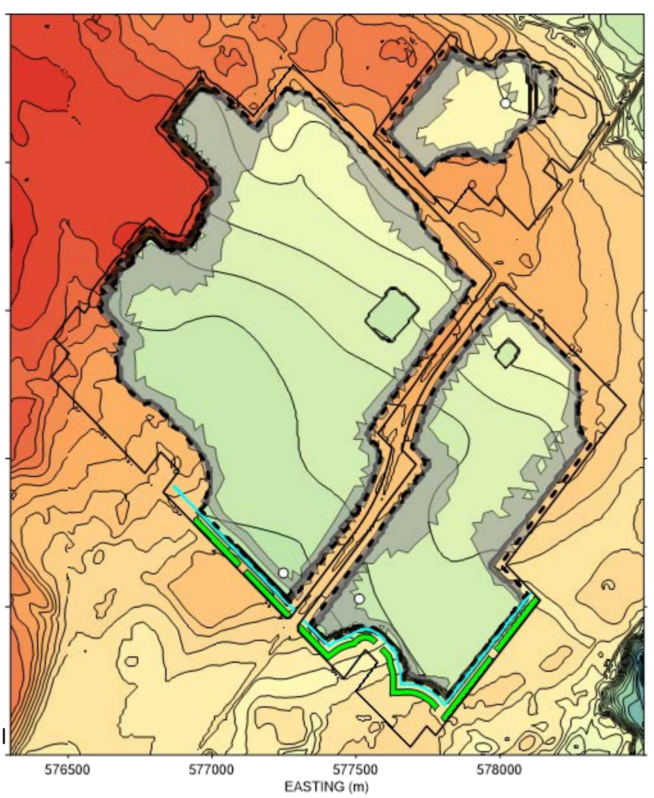
## PHASE 5



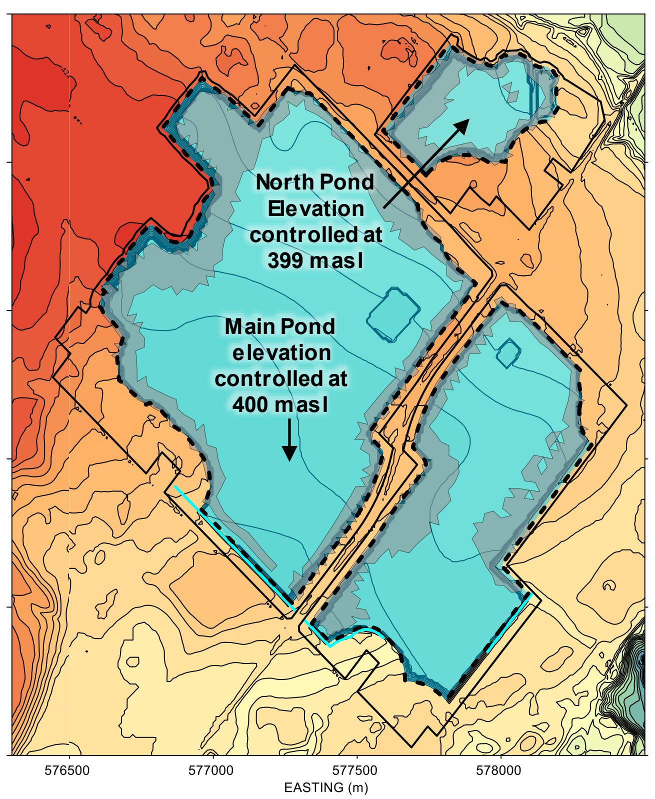
## PHASE 6



## PHASE 7



## REHABILITATION



### NOTES ON MODEL SETUP:

1. Quarry area is simulated as a high hydraulic conductivity zone (K = 1 m/s)
2. Till backfill has an assumed value of 1E-6 m/s. The till backfill is progressively placed to help limit quarry inflows. The modelled till backfill extents are shown for model layer 21.
3. Infiltration trench zones are simulated as constant head boundaries.
4. Slurry wall and grout alignment is modelled as a hydraulic conductivity zone with K = 1E-7 m/s. Slurry wall is removed along trench zones 4 and 5 during the rehabilitation phase.
5. Sump locations are set in the South Quarry, Main Quarry, and North Quarry as they are developed. These sump nodes discharge to the Credit River directly to the east of the Main Quarry.

LEGEND

| | |
|---|---|
| 🟦 | LAKES |
| ━ | RIVERS/ STREAMS |
| ━ | LICENSE LIMIT |
| ╍ | MODELLED EXTRACTION EXTENTS |
| ○ | QUARRY SUMP LOCATION |
| ▨ | TILL BACKFILL MATERIAL |
| ━ | SLURRY WALL/ GROUT ALIGNMENT |
| 🟩 | INFILTRATION TRENCH |

ELEVATION (masl)

360 364 368 372 376 380 384 388 392 396 400 404 408 412 416 420 424

ADDITIONAL MAP NOTES

1. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
2. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNRF) Southwestern Ontario Orthophotography (SWOOP) 2019
3. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
4. Quarry license and ultimate modelled limit of extraction provided by MHBC (May 2023)

a. Trench target head during Phase 5 is 398 masl.

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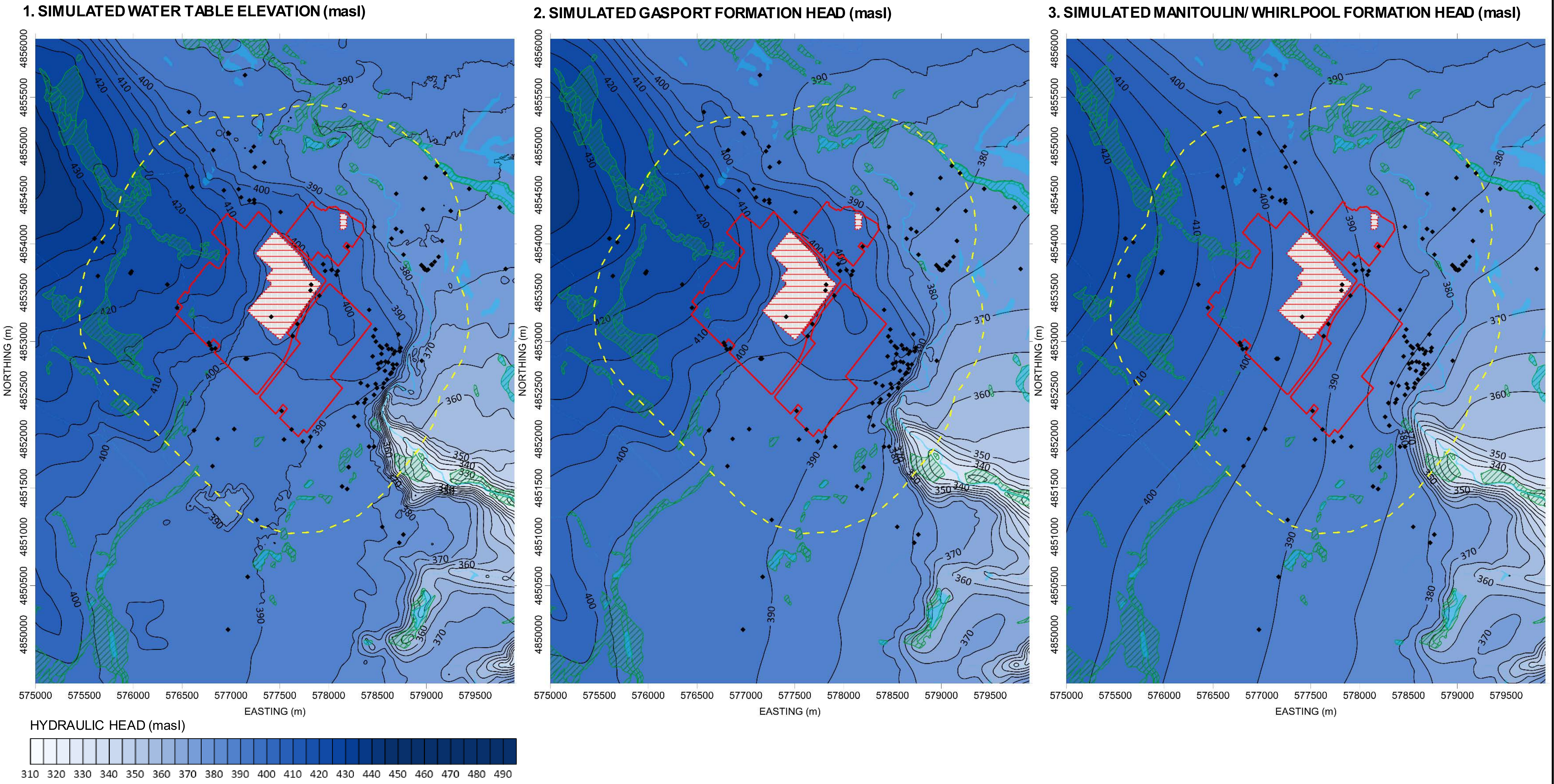
|---|---|
| YYYY-MM-DD | 2025-03-11 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**MODELLED QUARRY DEVELOPMENT PHASES AND MITIGATION**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 6 |


1. SIMULATED WATER TABLE ELEVATION (masl)

2. SIMULATED GASPORT FORMATION HEAD (masl)

3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)

LEGEND

- 🟦 LAKES
- ─ RIVERS/ STREAMS
- ─ SITE PROPERTY BOUNDARY
- ┅ EXTRACTION EXTENTS
- ▨ WETLAND
- ┅ 1KM BUFFER AROUND PROPERTY
- ◆ MECP PRIVATE WELL LOCATION

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
2. Gasport formation head extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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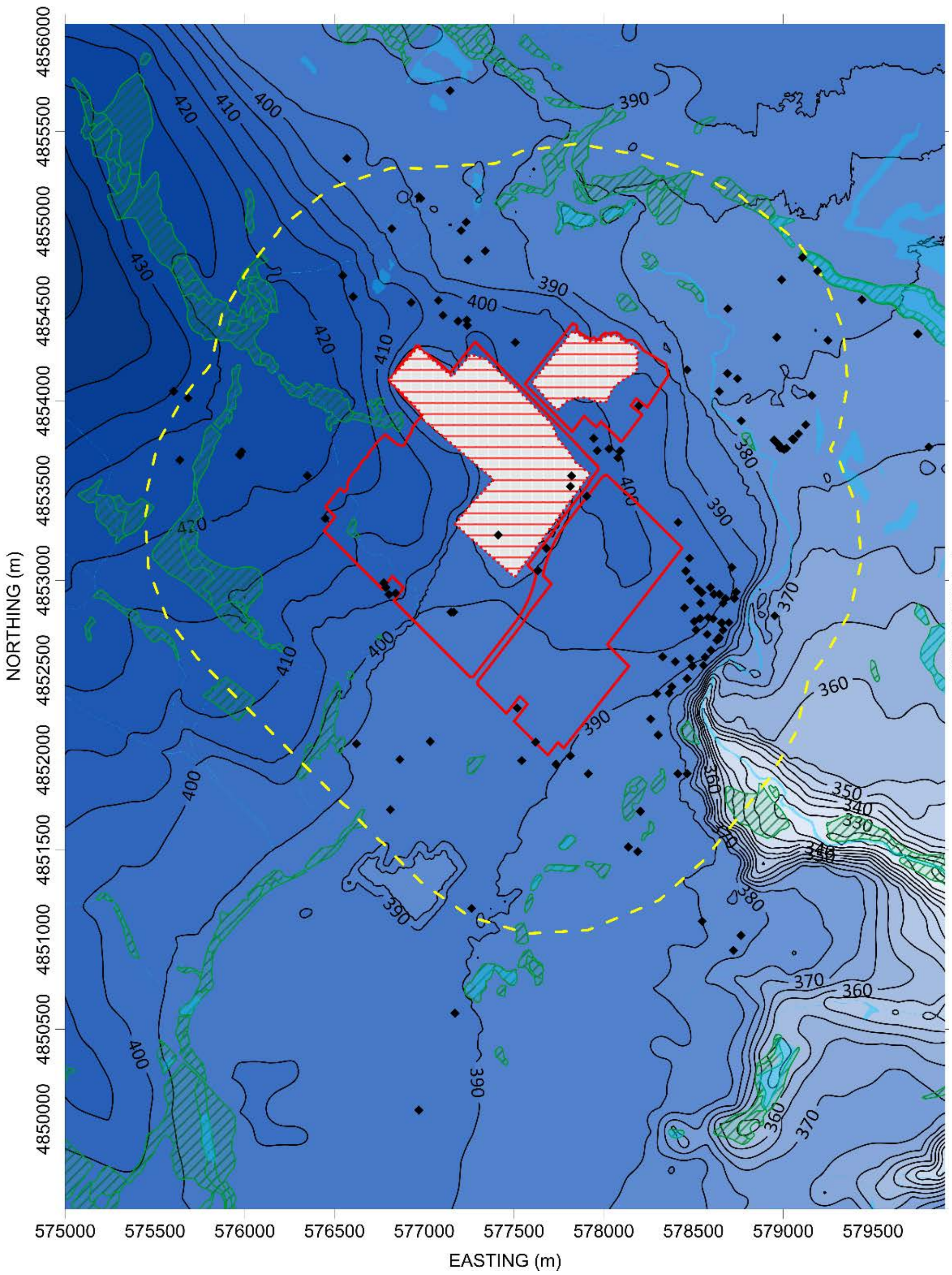
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

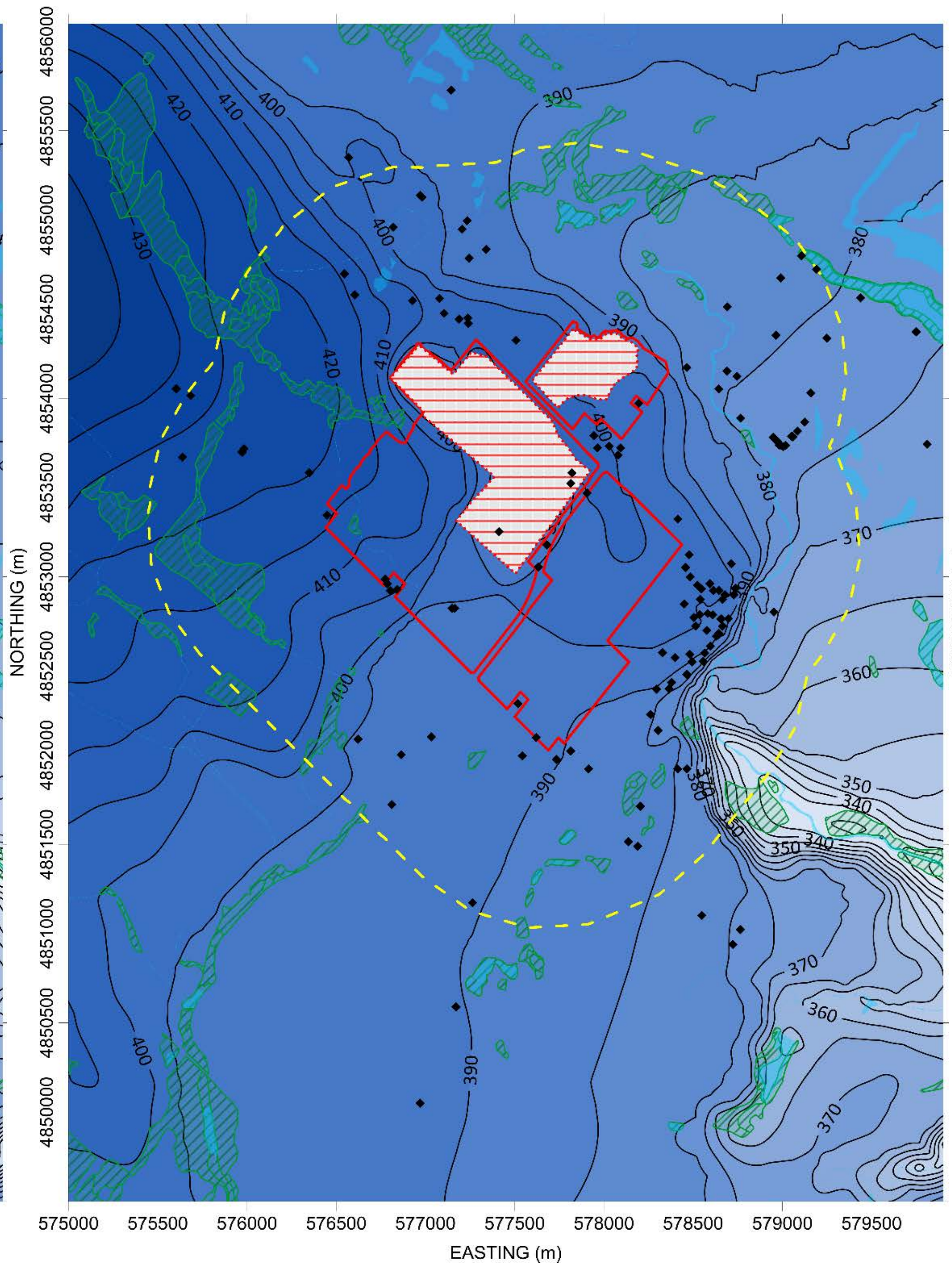
TITLE
PHASE 1 SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7A |

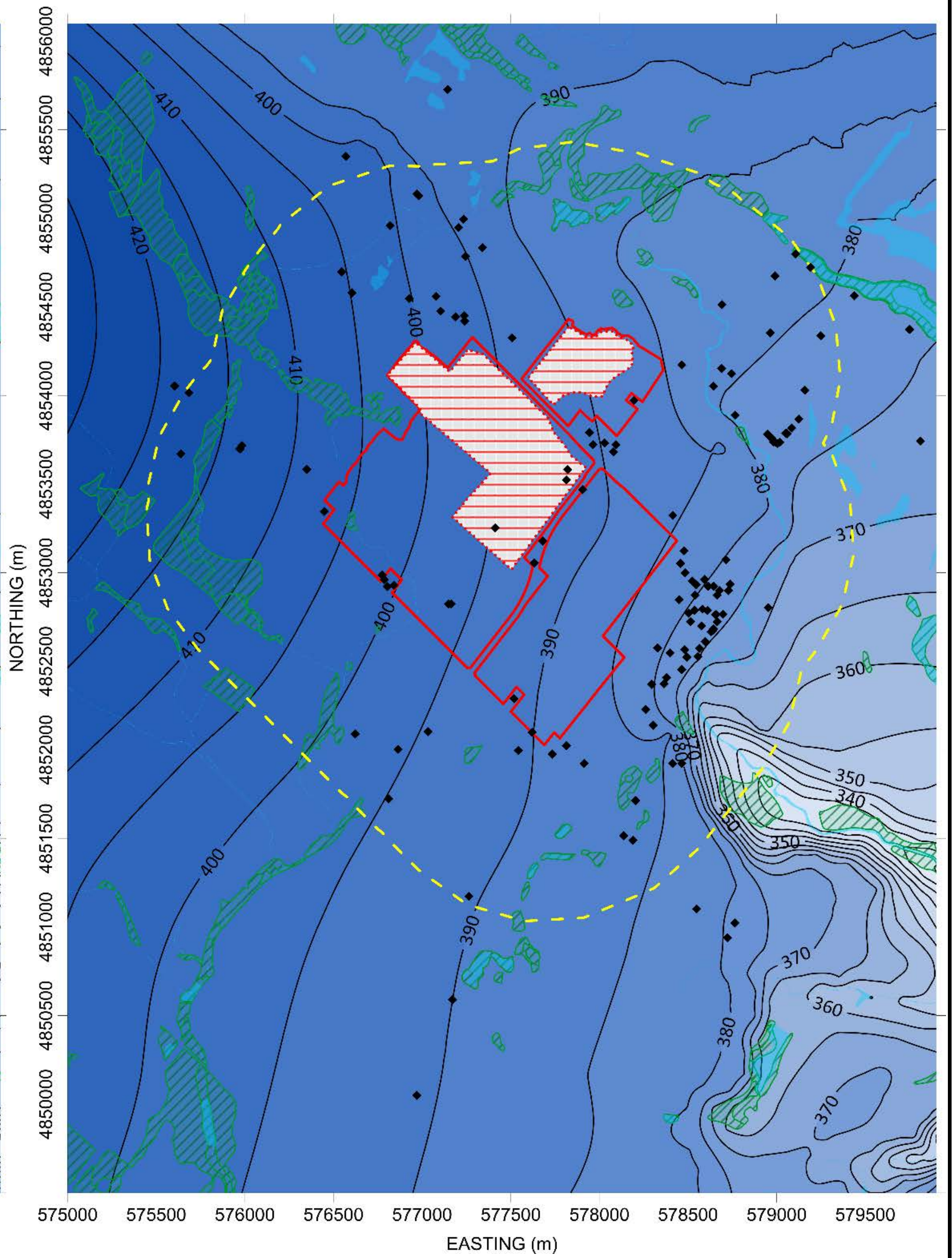
## 1. SIMULATED WATER TABLE ELEVATION (masl)



## 2. SIMULATED GASPORT FORMATION HEAD (masl)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



HYDRAULIC HEAD (masl)

310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490

LEGEND

- 🟦 LAKES
- ━ RIVERS/ STREAMS
- ━ SITE PROPERTY BOUNDARY
- ┅ EXTRACTION EXTENTS
- ▨ WETLAND
- ┅ 1KM BUFFER AROUND PROPERTY
- ◆ MECP PRIVATE WELL LOCATION

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

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4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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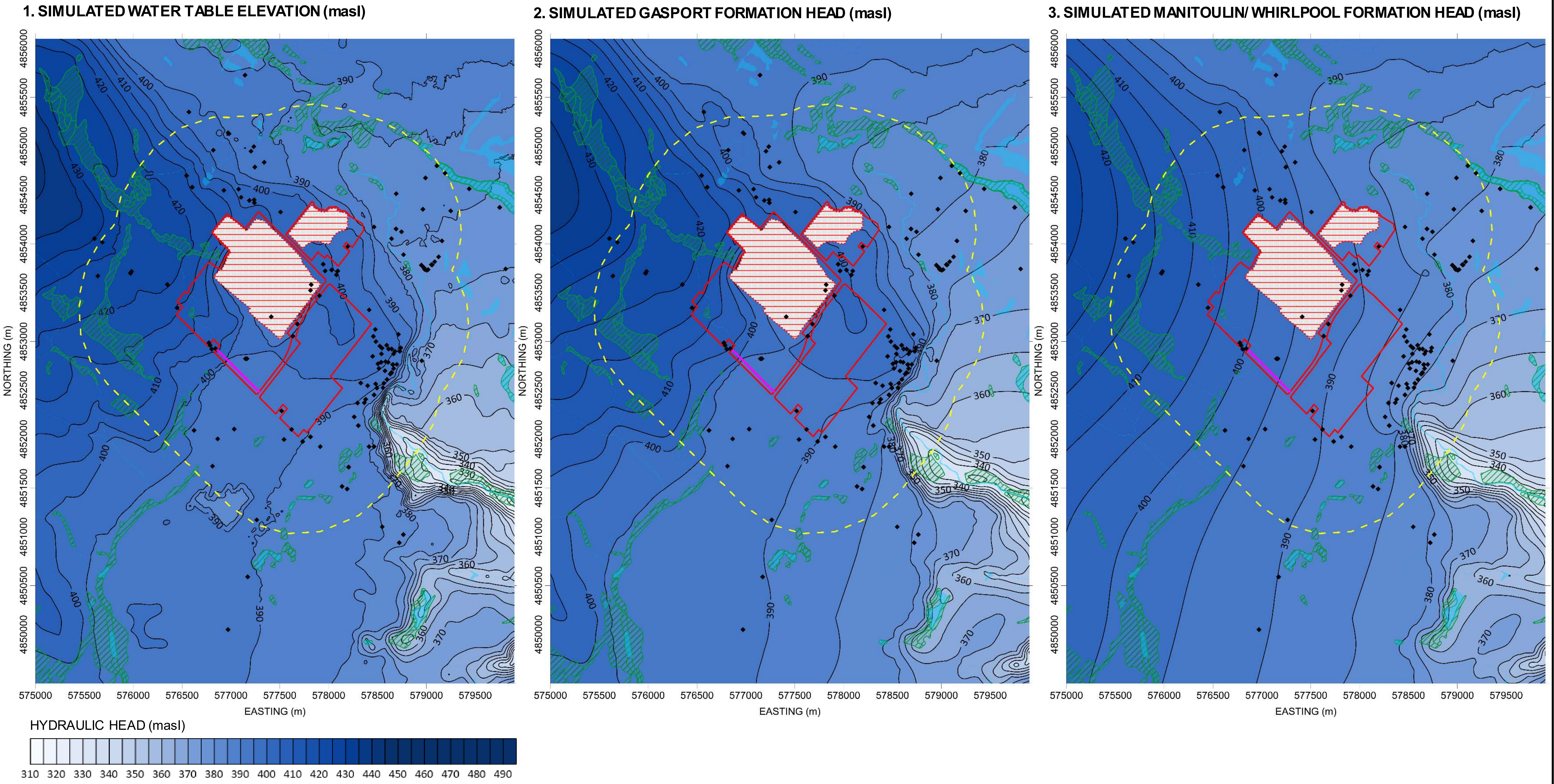
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE
PHASE 2 SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7B |


1. SIMULATED WATER TABLE ELEVATION (masl)

2. SIMULATED GASPORT FORMATION HEAD (masl)

3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)

LEGEND

- 🟦 LAKES
- — RIVERS/ STREAMS
- — SITE PROPERTY BOUNDARY
- ⋯ EXTRACTION EXTENTS
- ▨ WETLAND
- ⋯ 1KM BUFFER AROUND PROPERTY
- ◆ MECP PRIVATE WELL LOCATION
- — SLURRY WALL/ GROUT ALIGNMENT

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

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5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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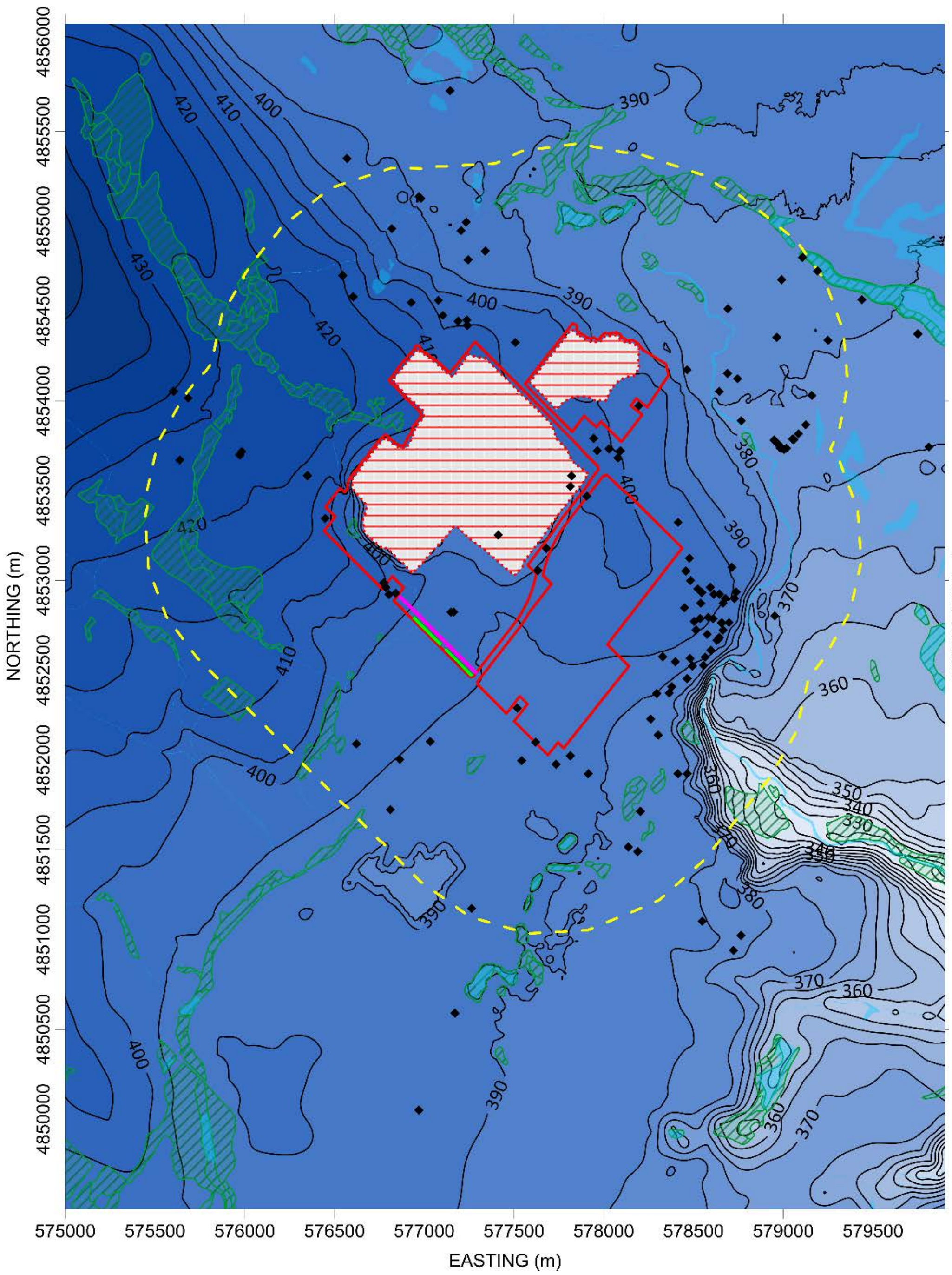
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

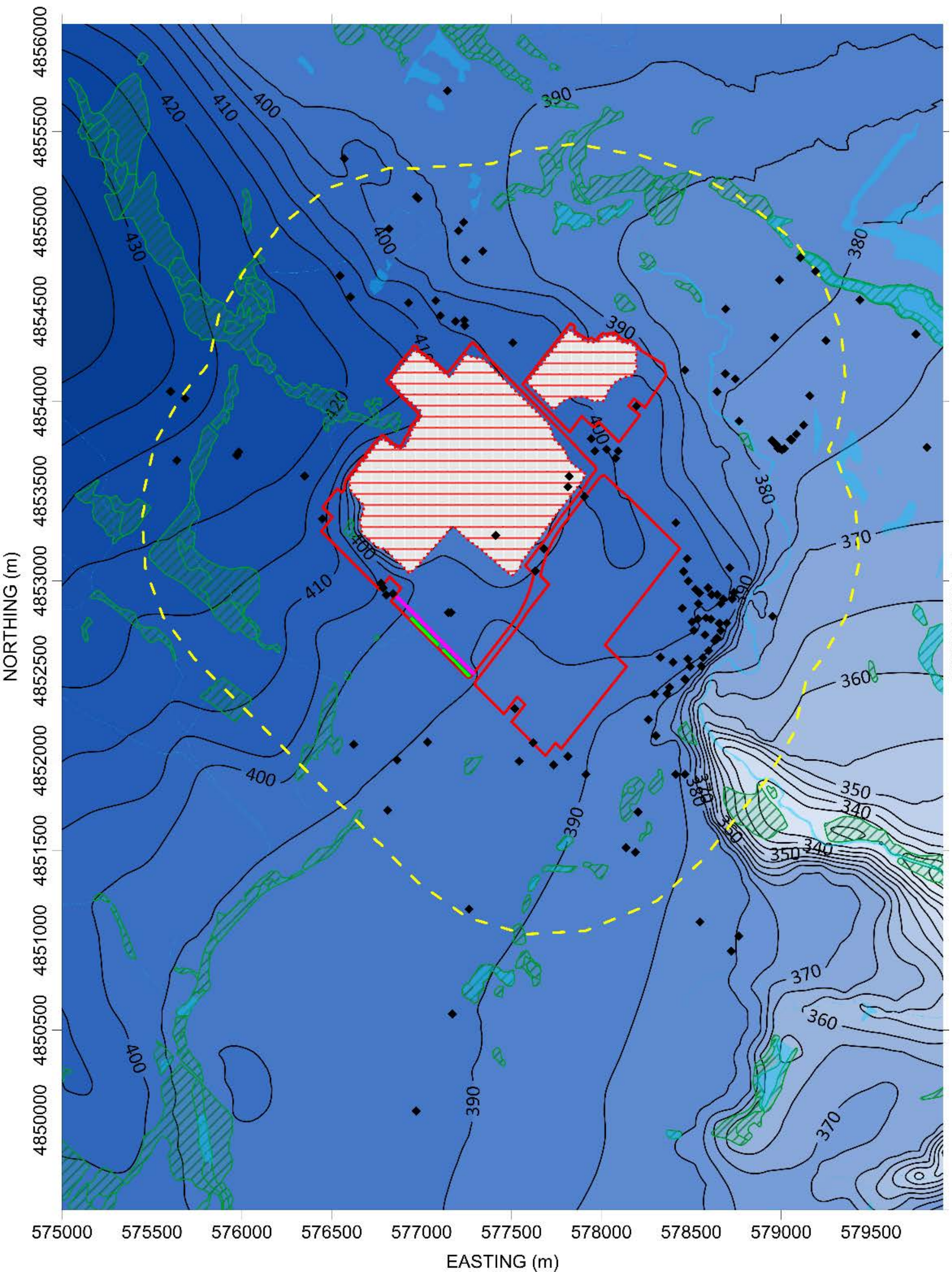
TITLE
PHASE 3 SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7C |

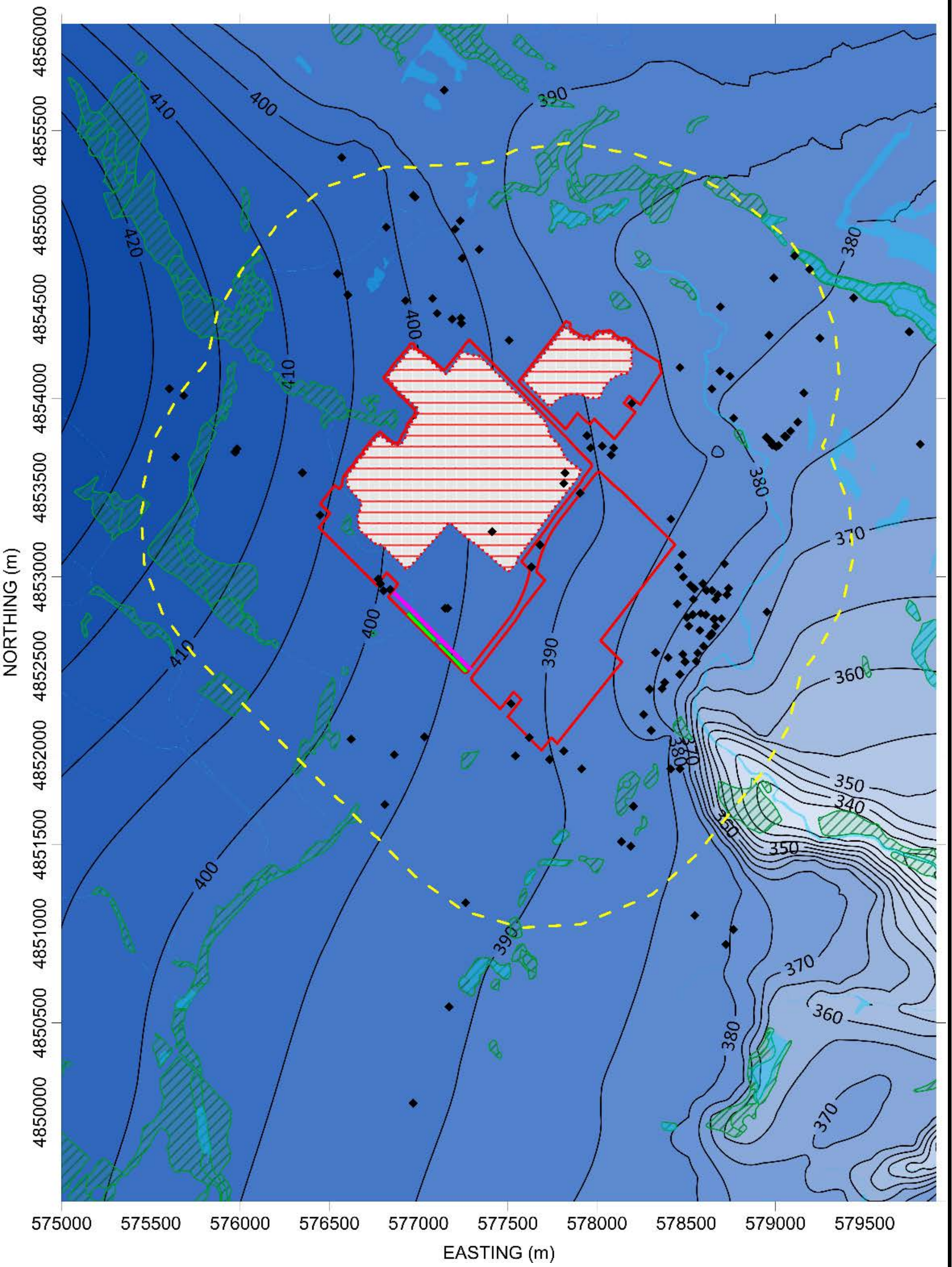
## 1. SIMULATED WATER TABLE ELEVATION (masl)



## 2. SIMULATED GASPORT FORMATION HEAD (masl)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



HYDRAULIC HEAD (masl)

310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490

LEGEND

| | |
|---|---|
| 🟦 | LAKES |
| — | RIVERS/ STREAMS |
| — | SITE PROPERTY BOUNDARY |
| ┈ | EXTRACTION EXTENTS |
| ▨ | WETLAND |
| ┈ | 1KM BUFFER AROUND PROPERTY |
| ◆ | MECP PRIVATE WELL LOCATION |
| — | SLURRY WALL/ GROUT ALIGNMENT |
| 🟩 | INFILTRATION TRENCH |

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
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3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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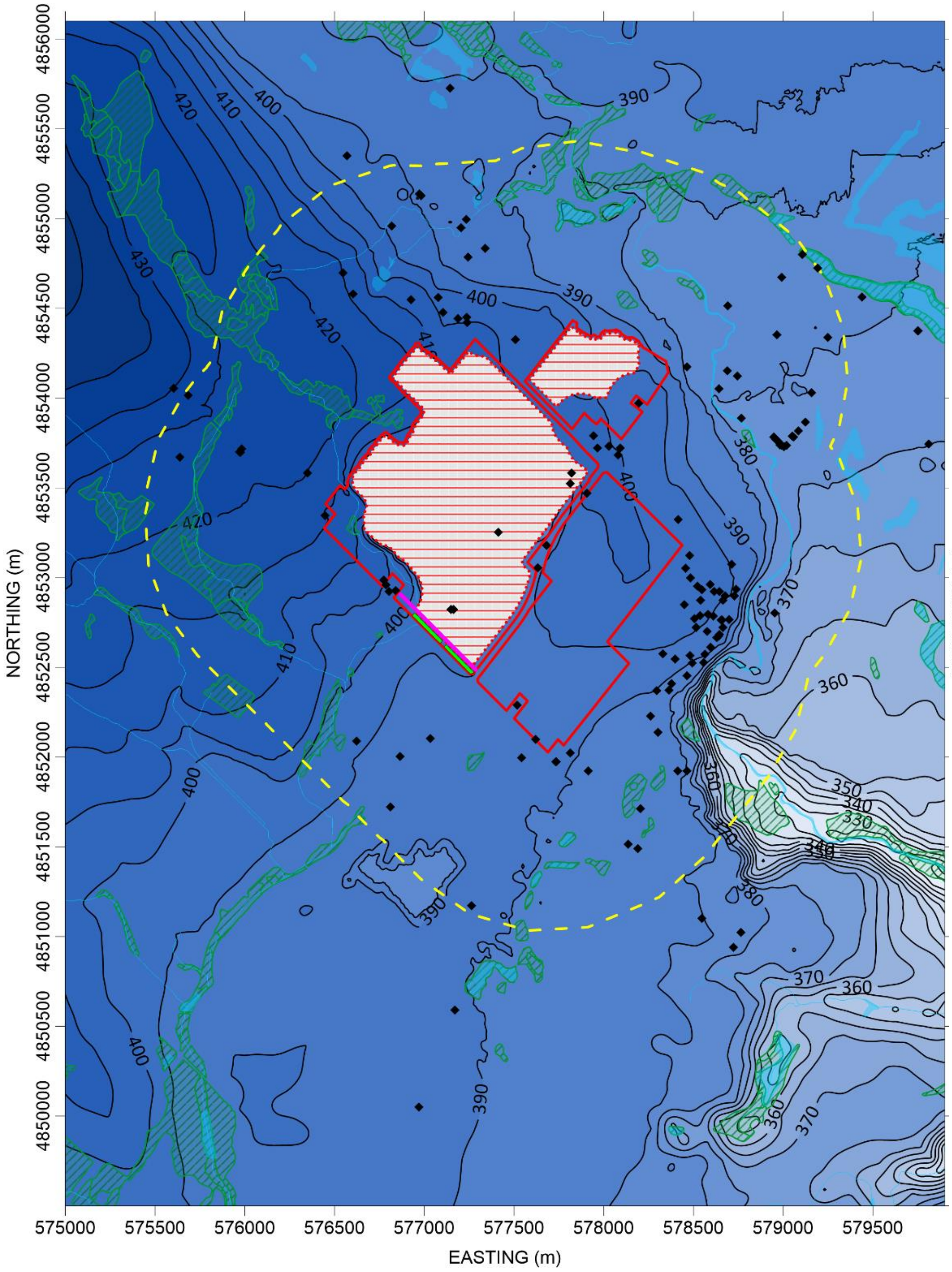
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

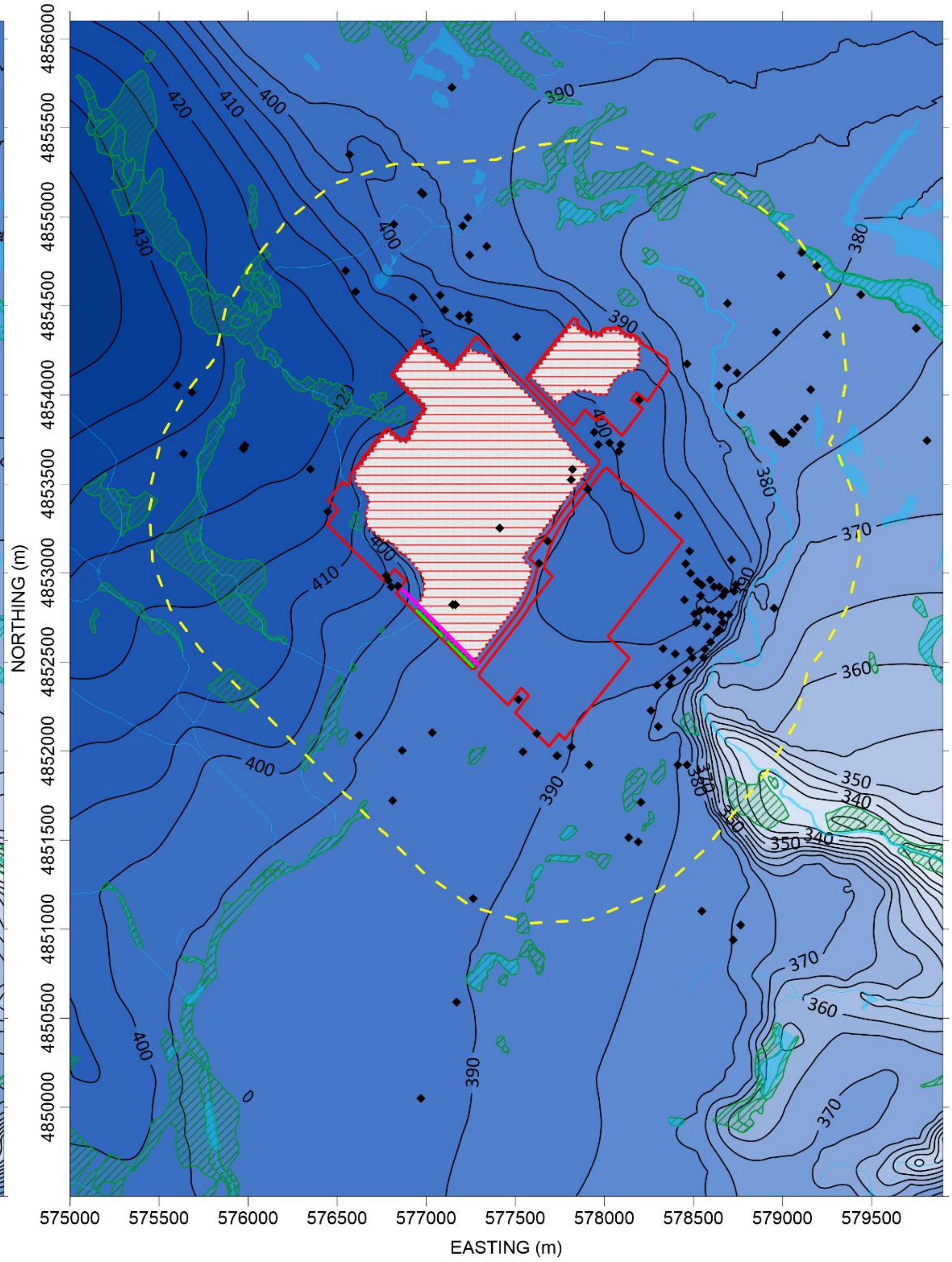
TITLE
PHASE 4 SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7D |

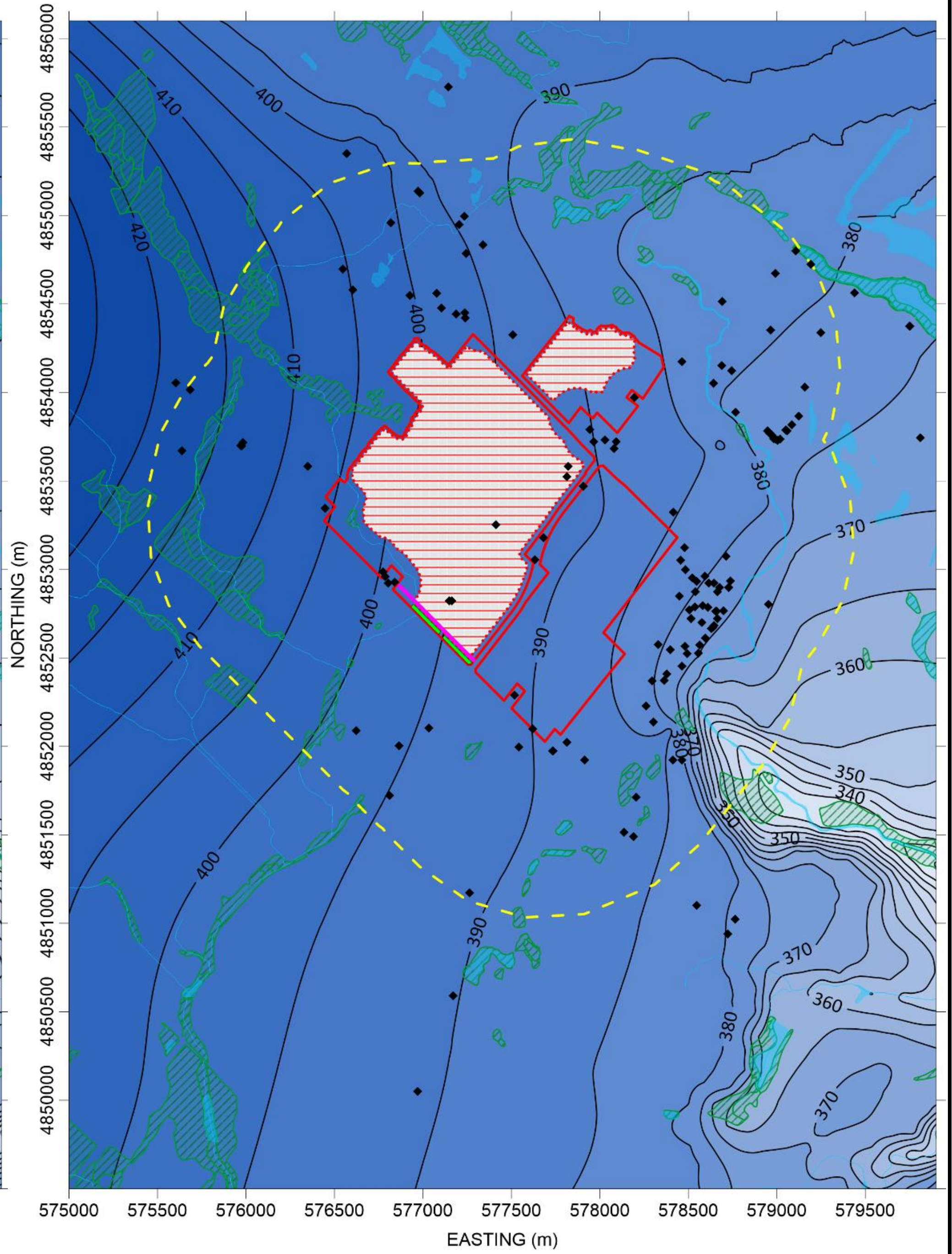
## 1. SIMULATED WATER TABLE ELEVATION (masl)



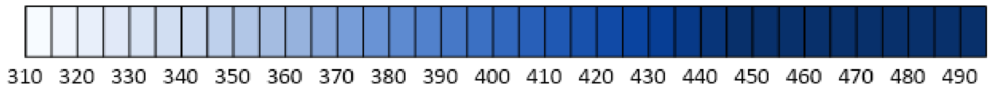
## 2. SIMULATED GASPORT FORMATION HEAD (masl)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



HYDRAULIC HEAD (masl)



LEGEND

🟦 LAKES

— RIVERS/ STREAMS

— SITE PROPERTY BOUNDARY

┅ EXTRACTION EXTENTS

▨ WETLAND

┅ 1KM BUFFER AROUND PROPERTY

◆ MECP PRIVATE WELL LOCATION

— SLURRY WALL/ GROUT ALIGNMENT

🟩 INFILTRATION TRENCH

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
2. Gasport formation head extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

CONSULTANT
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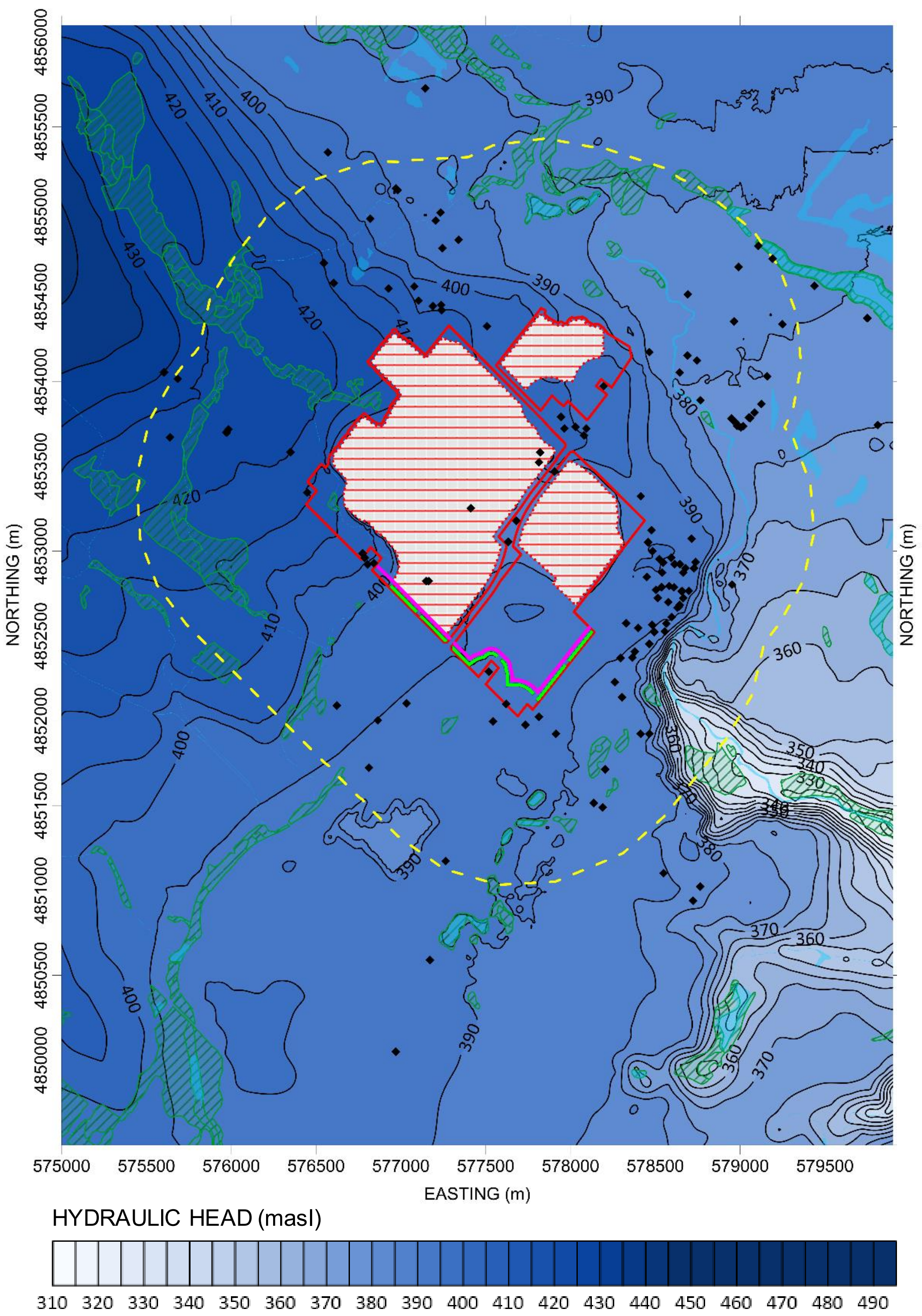
|---|---|
| YYYY-MM-DD | 2025-03-10 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

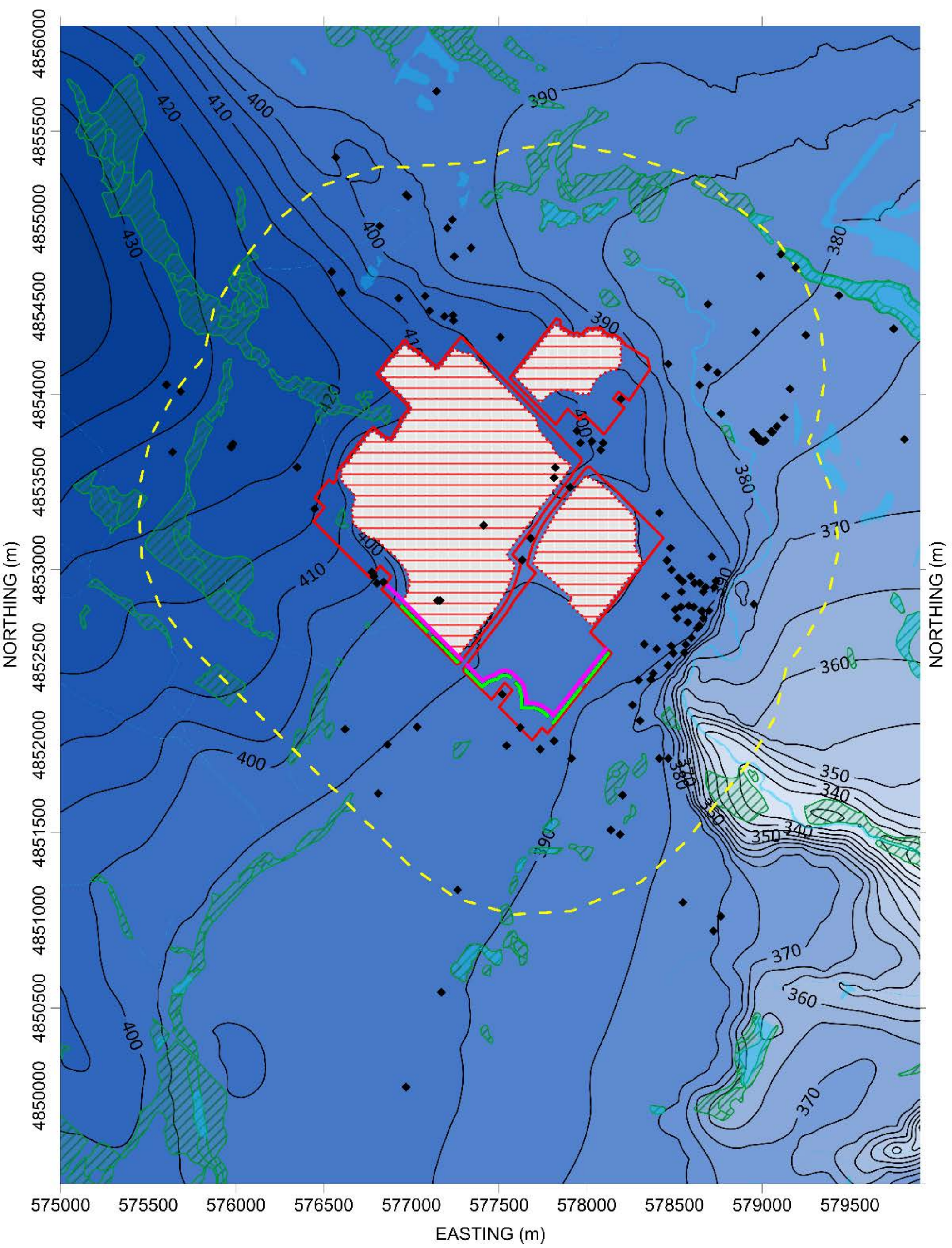
TITLE
PHASE 5 SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7E |

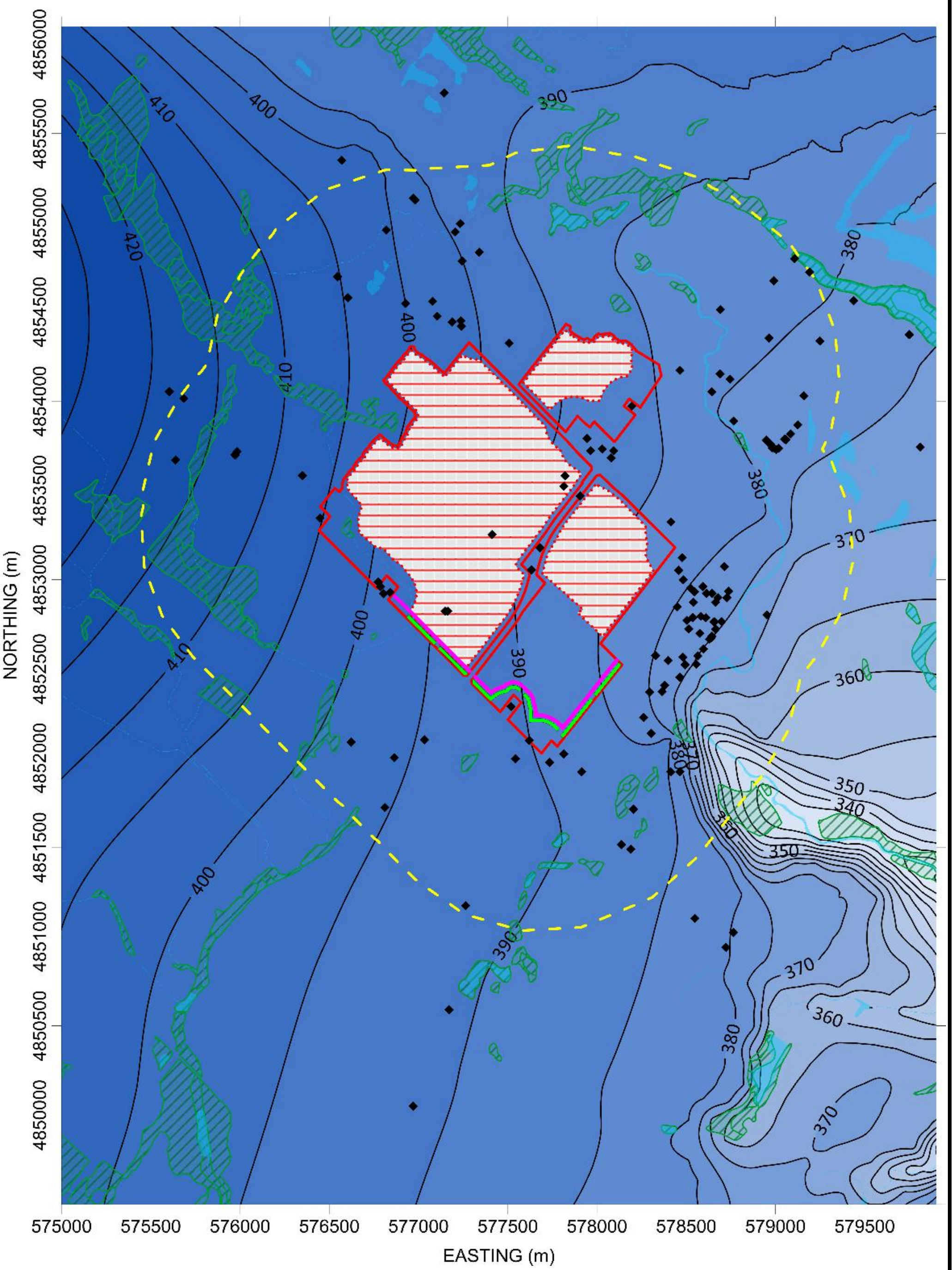
## 1. SIMULATED WATER TABLE ELEVATION (masl)



## 2. SIMULATED GASPORT FORMATION HEAD (masl)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

🟦 LAKES

— RIVERS/ STREAMS

— SITE PROPERTY BOUNDARY

······ EXTRACTION EXTENTS

▨ WETLAND

······ 1KM BUFFER AROUND PROPERTY

◆ MECP PRIVATE WELL LOCATION

— SLURRY WALL/ GROUT ALIGNMENT

🟩 INFILTRATION TRENCH

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
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3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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WSP

| | |
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

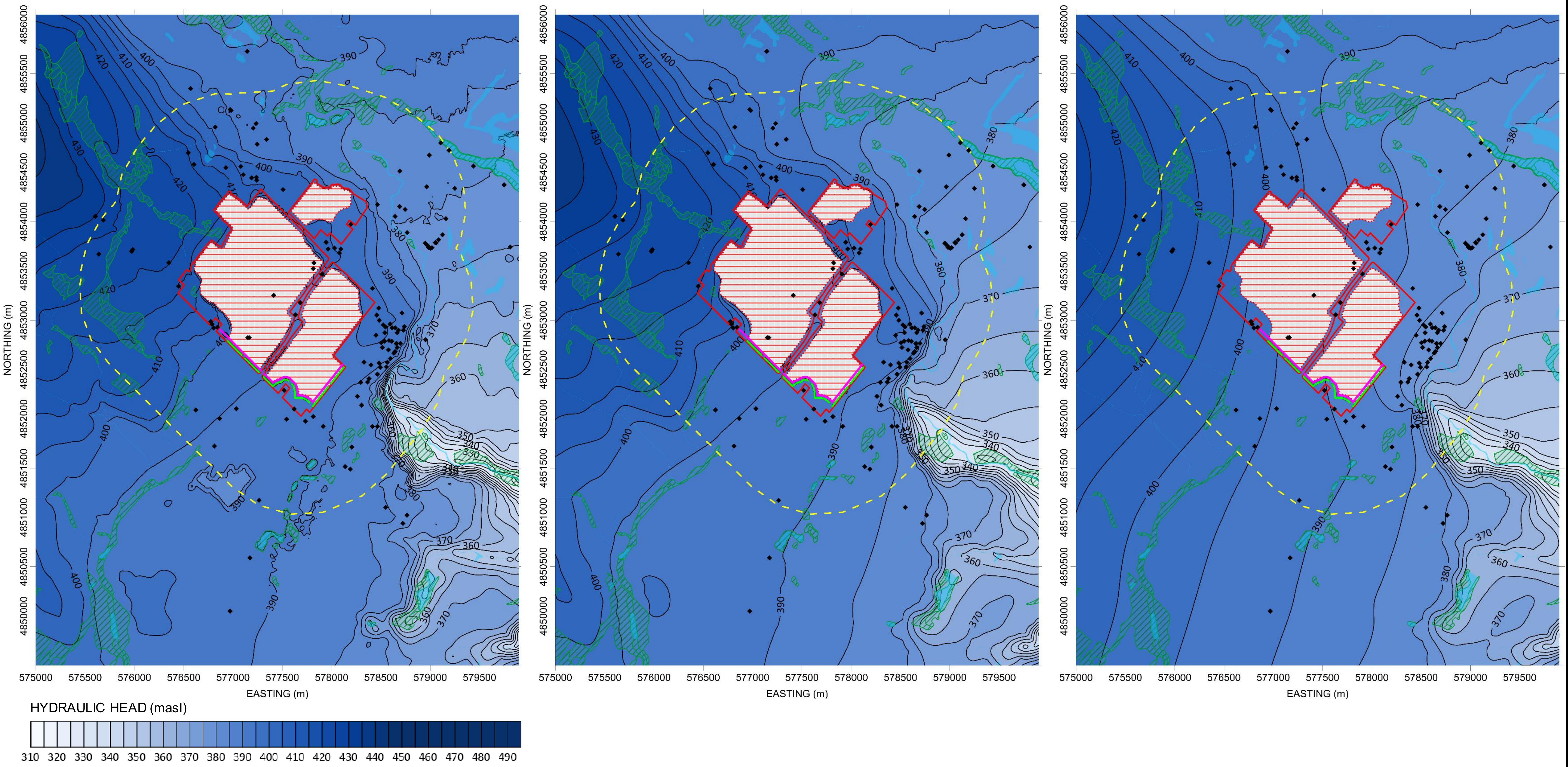
TITLE
PHASE 6 SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7F |

## 1. SIMULATED WATER TABLE ELEVATION (masl)

## 2. SIMULATED GASPORT FORMATION HEAD (masl)

## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

🟦 LAKES

— RIVERS/ STREAMS

— SITE PROPERTY BOUNDARY

┅ EXTRACTION EXTENTS

▨ WETLAND

┅ 1KM BUFFER AROUND PROPERTY

◆ MECP PRIVATE WELL LOCATION

— SLURRY WALL/ GROUT ALIGNMENT

🟩 INFILTRATION TRENCH

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
2. Gasport formation head extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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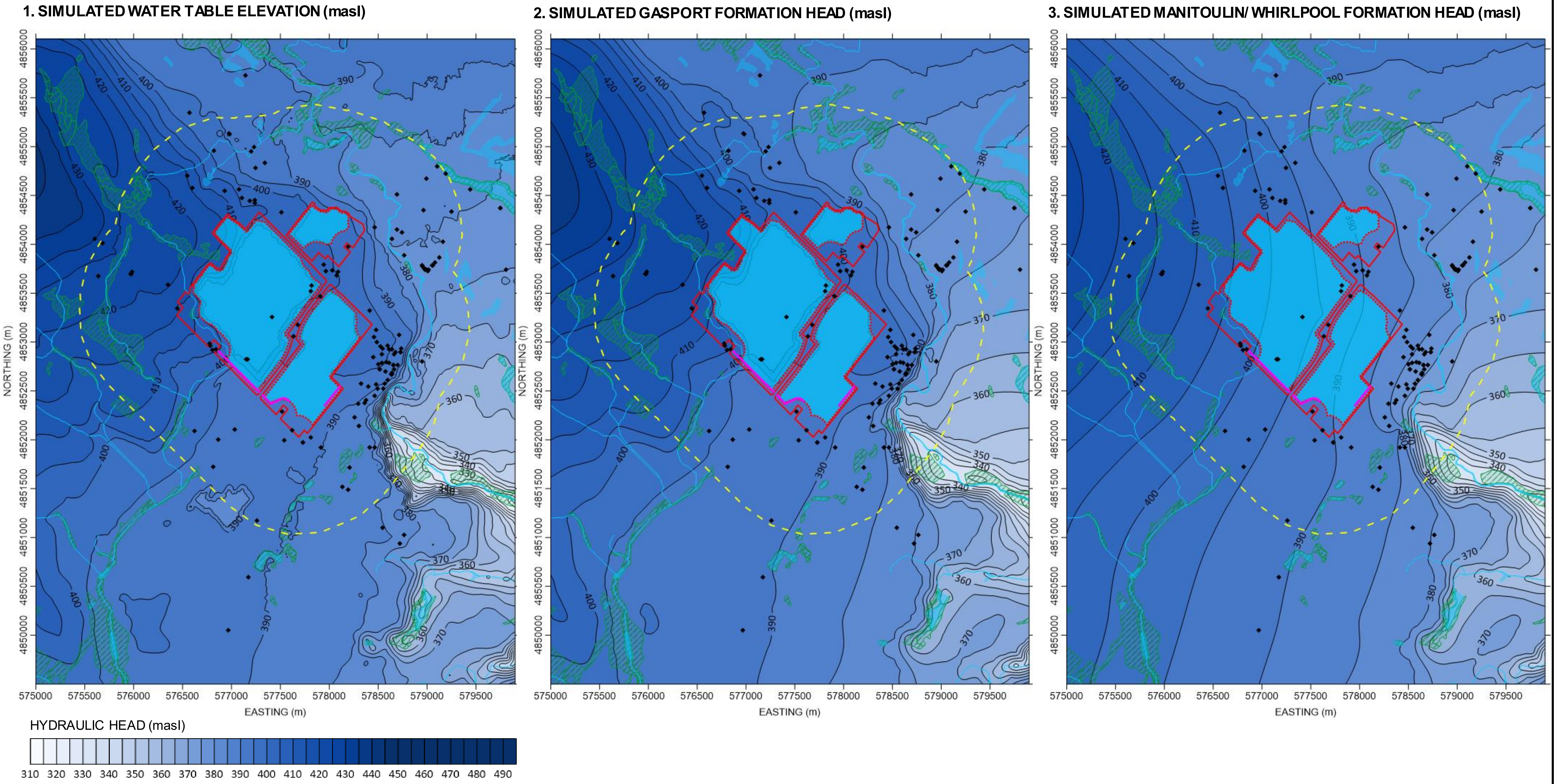
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE
PHASE 7 SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7G |



1. SIMULATED WATER TABLE ELEVATION (masl)

2. SIMULATED GASPORT FORMATION HEAD (masl)

3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)

LEGEND

| | | | |
|---|---|---|---|
| 🟦 | LAKES | ━ | SLURRY WALL/ GROUT ALIGNMENT |
| ━ | RIVERS/ STREAMS | 🟩 | INFILTRATION TRENCH |
| ━ | SITE PROPERTY BOUNDARY | | |
| ┅ | EXTRACTION EXTENTS | | |
| ▨ | WETLAND | | |
| ┅ | 1KM BUFFER AROUND PROPERTY | | |
| ◆ | MECP PRIVATE WELL LOCATION | | |

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

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5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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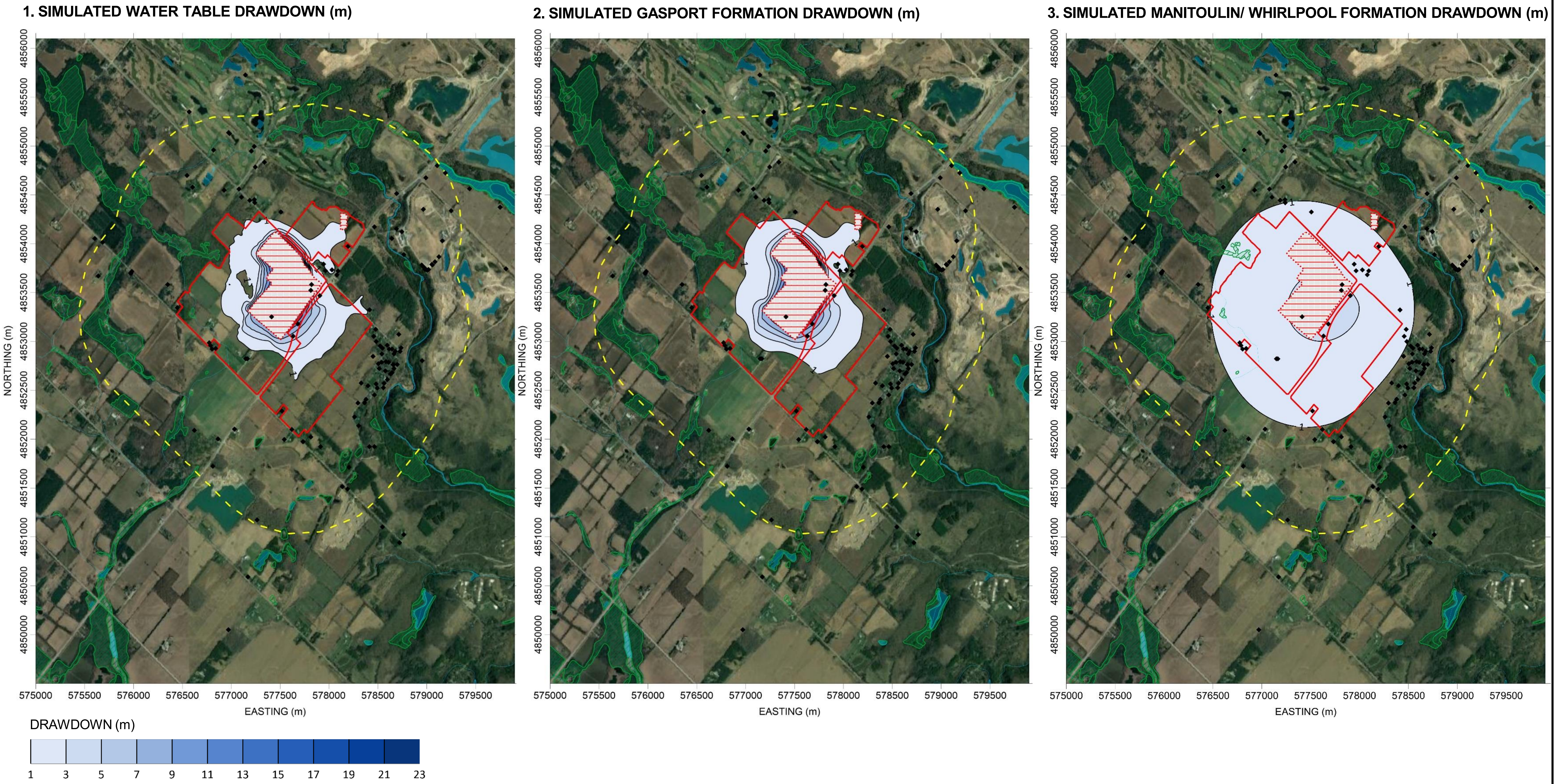
| YYYY-MM-DD | 2025-05-09 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE
REHABILITATION SIMULATED HYDRAULIC HEAD

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 7H |



LEGEND

| | |
|---|---|
| 🟦 | LAKES |
| — | RIVERS/ STREAMS |
| — | SITE PROPERTY BOUNDARY |
| ┅ | EXTRACTION EXTENTS |
| ▨ | WETLAND |
| ┅ | 1KM BUFFER AROUND PROPERTY |
| ◆ | MECP PRIVATE WELL LOCATION |

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

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5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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CALEDON PIT AND QUARRY NUMERICAL MODELLING

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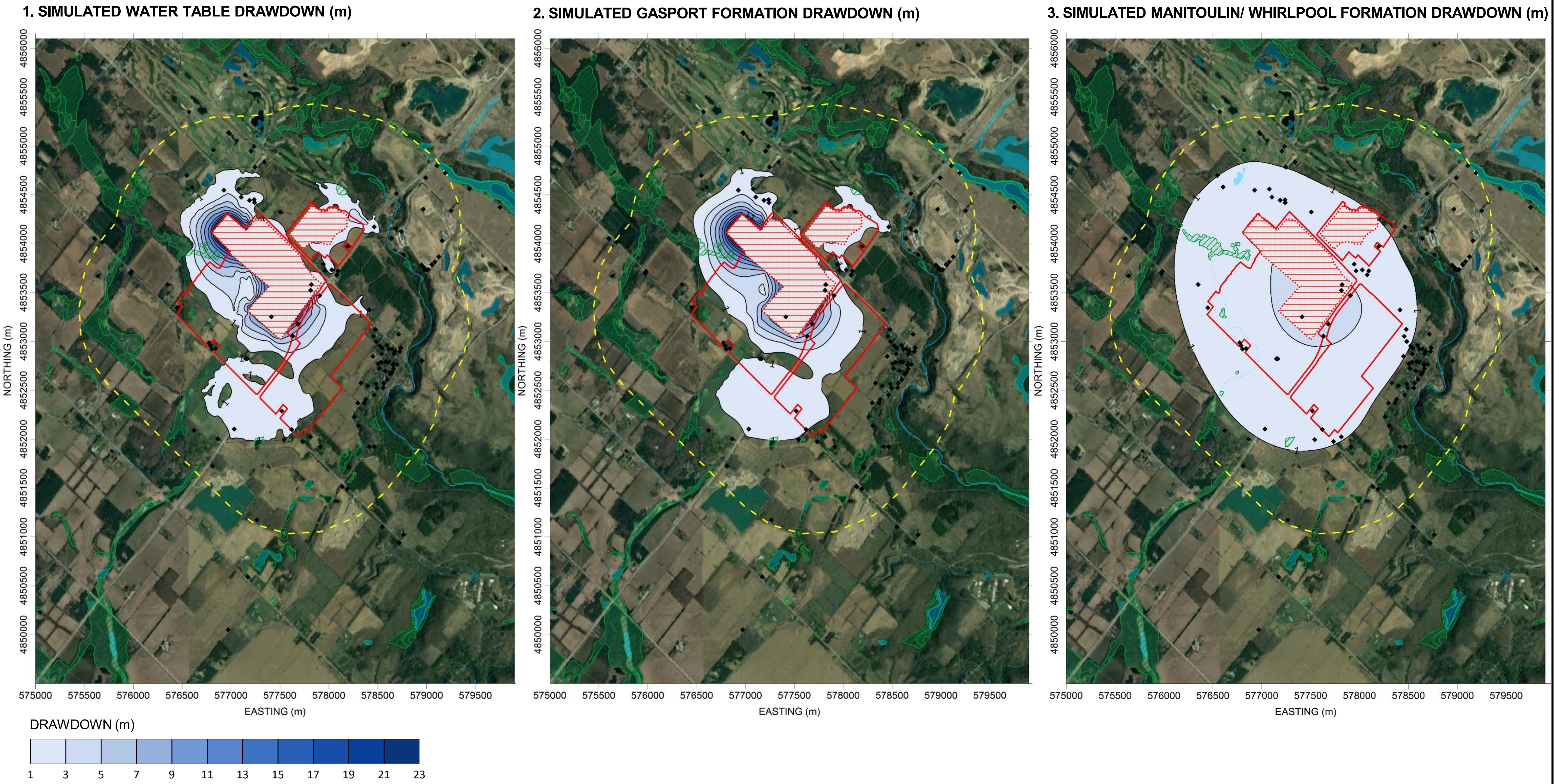
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**PHASE 1 SIMULATED DRAWDOWN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 8A |



LEGEND

🟦 LAKES

— RIVERS/ STREAMS

— SITE PROPERTY BOUNDARY

┅ EXTRACTION EXTENTS

▨ WETLAND

┅ 1KM BUFFER AROUND PROPERTY

◆ MECP PRIVATE WELL LOCATION

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

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3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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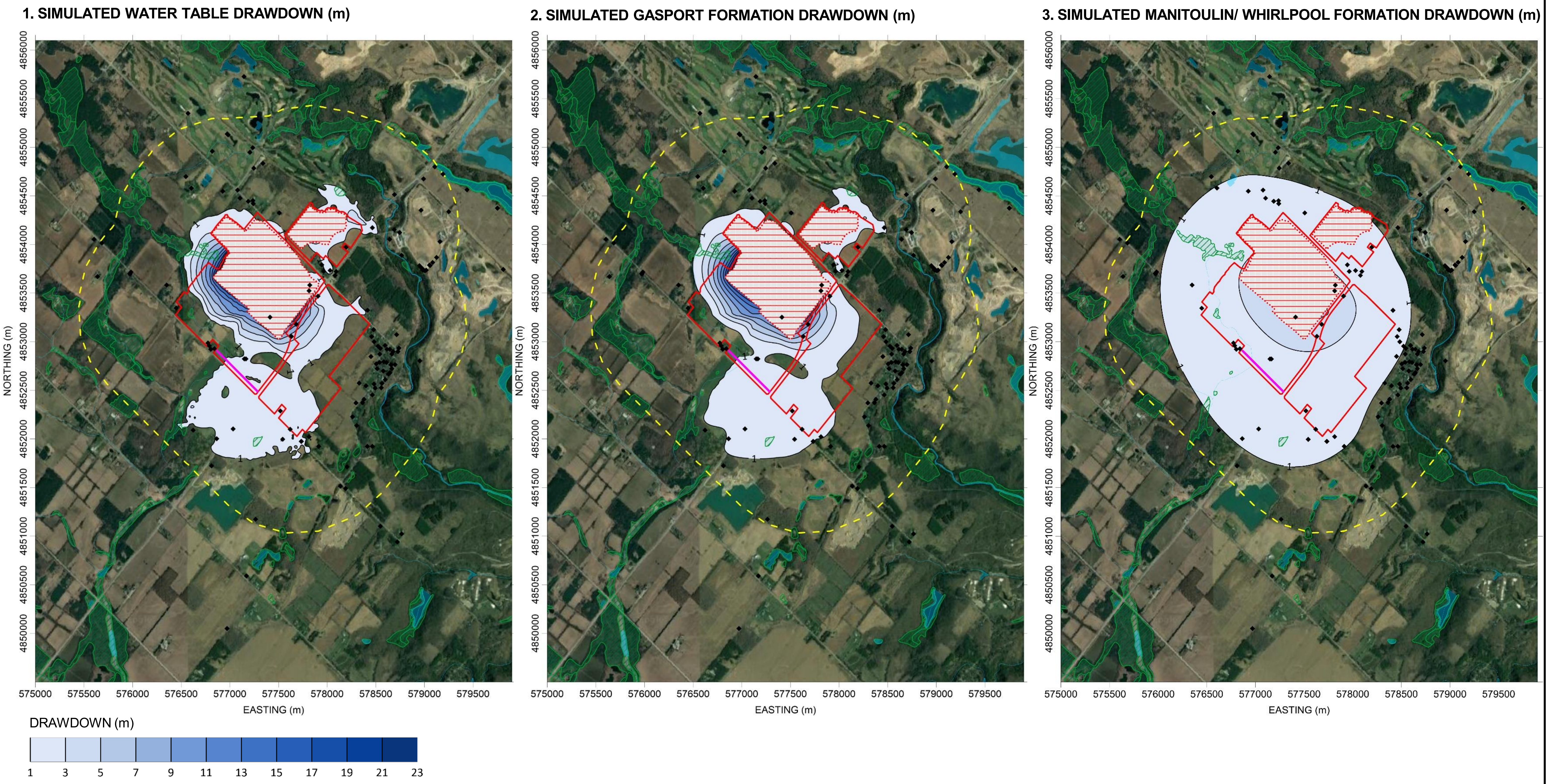
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**PHASE 2 SIMULATED DRAWDOWN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 8B |



1. SIMULATED WATER TABLE DRAWDOWN (m)

2. SIMULATED GASPORT FORMATION DRAWDOWN (m)

3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)

LEGEND

- 🟦 LAKES
- — RIVERS/ STREAMS
- — SITE PROPERTY BOUNDARY
- ┅ EXTRACTION EXTENTS
- ▨ WETLAND
- ┅ 1KM BUFFER AROUND PROPERTY
- ◆ MECP PRIVATE WELL LOCATION
- — SLURRY WALL/ GROUT ALIGNMENT

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated drawdown is shown at a contour interval of 2m
2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

CONSULTANT

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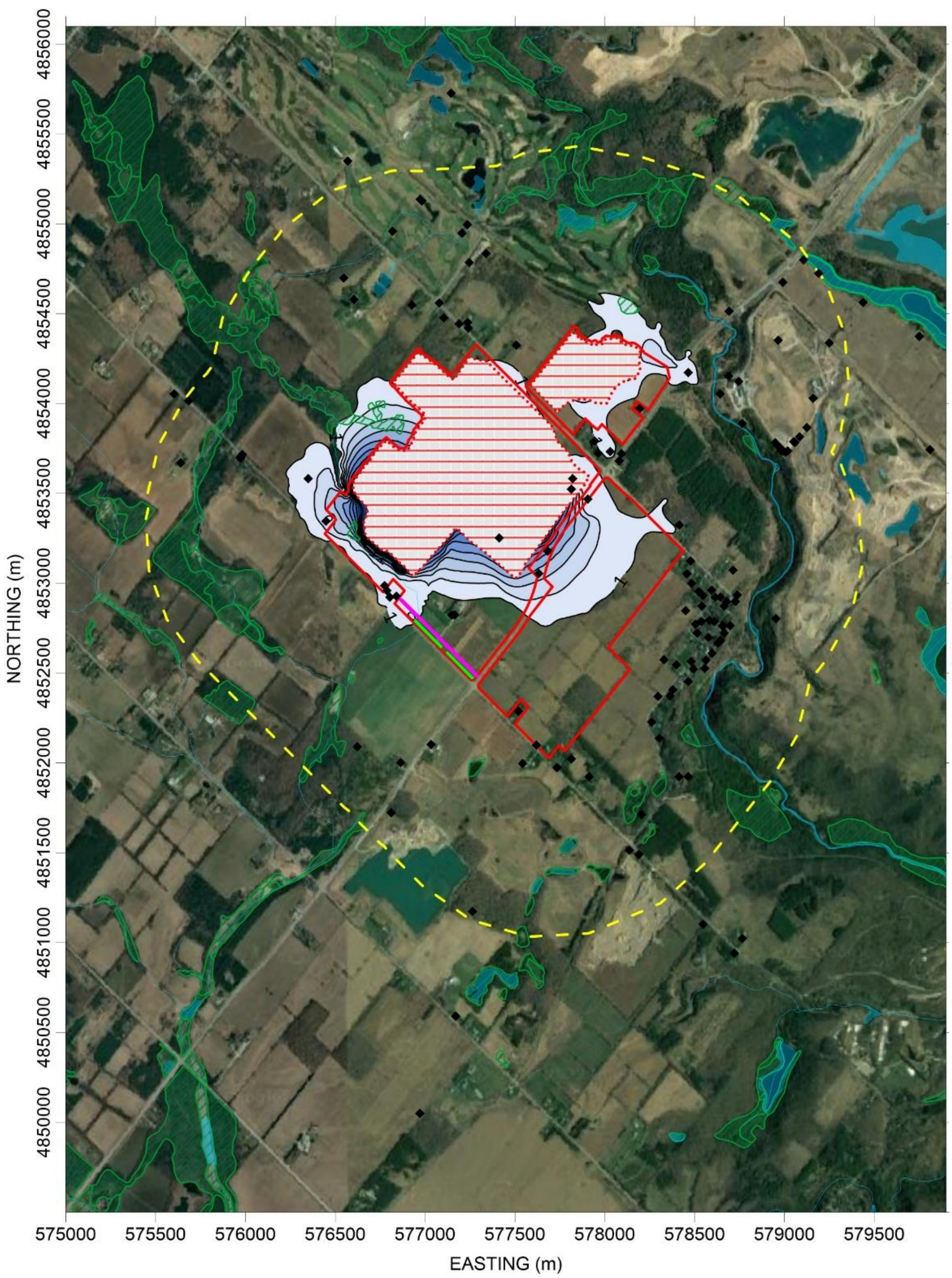
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

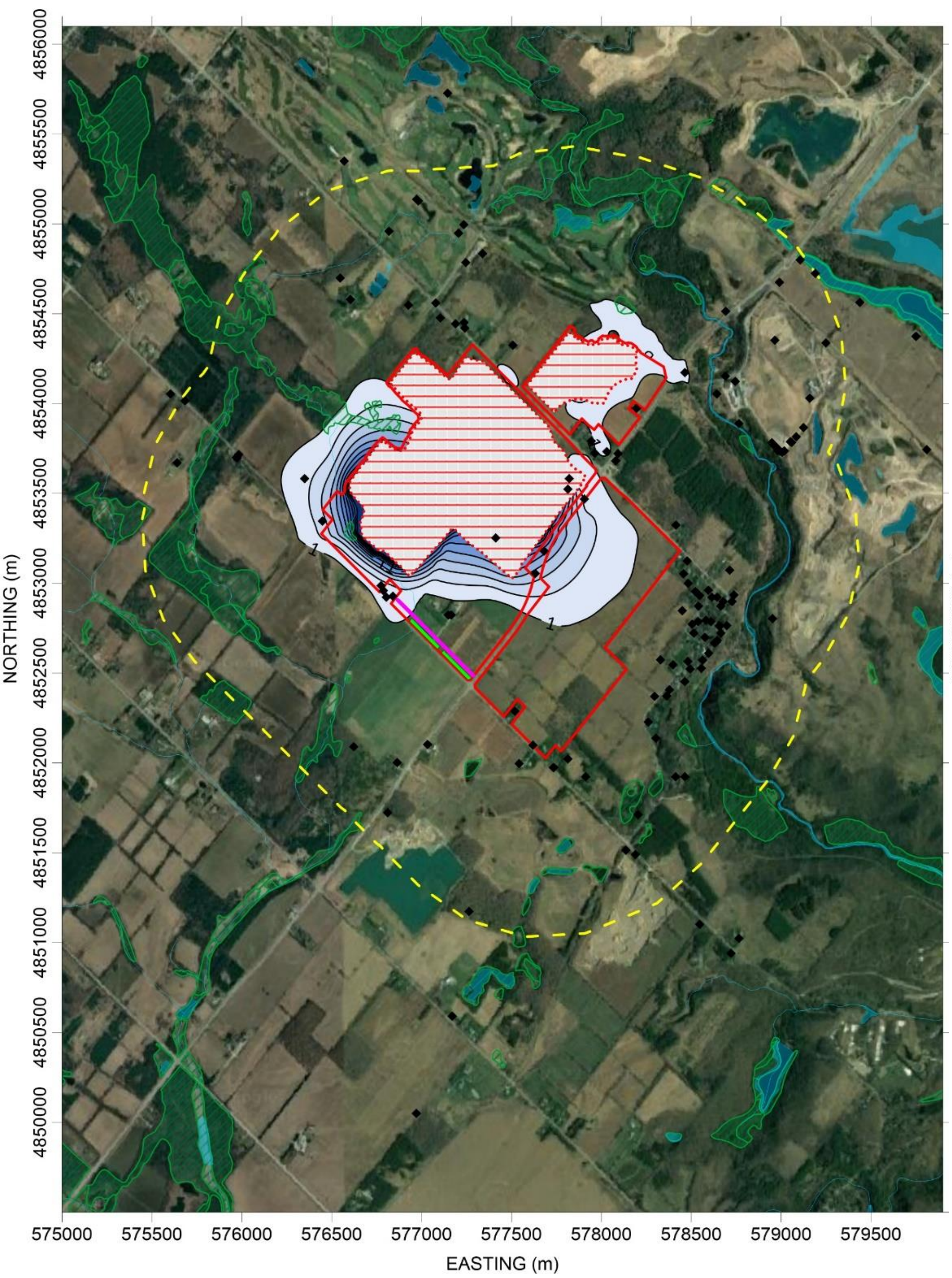
TITLE
**PHASE 3 SIMULATED DRAWDOWN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 8C |

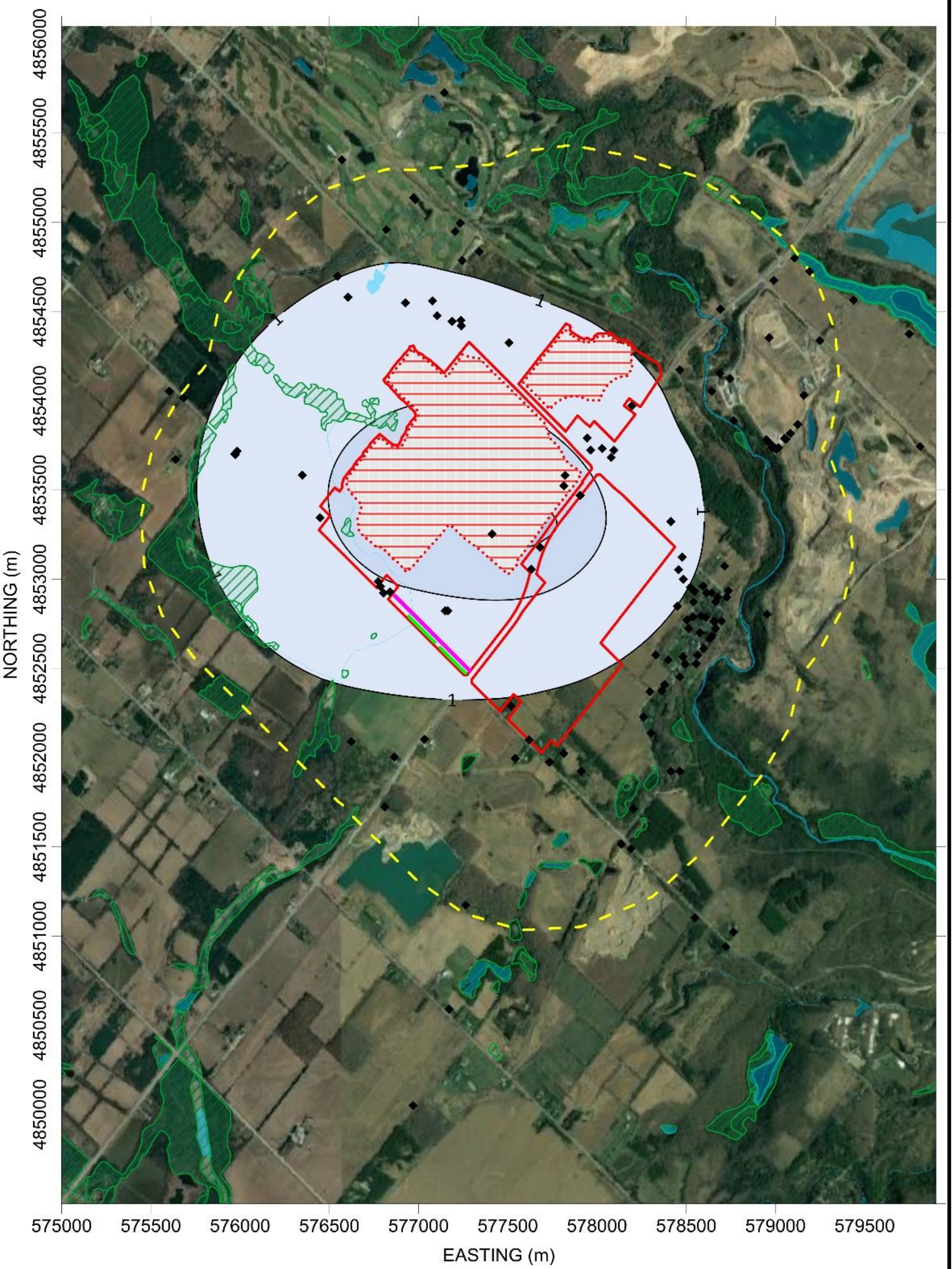
## 1. SIMULATED WATER TABLE DRAWDOWN (m)



## 2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



DRAWDOWN (m)

1 3 5 7 9 11 13 15 17 19 21 23

LEGEND

- 🟦 LAKES
- — RIVERS/ STREAMS
- — SITE PROPERTY BOUNDARY
- ┅ EXTRACTION EXTENTS
- ▨ WETLAND
- ┅ 1KM BUFFER AROUND PROPERTY
- ◆ MECP PRIVATE WELL LOCATION
- — SLURRY WALL/ GROUT ALIGNMENT
- 🟩 INFILTRATION TRENCH

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated drawdown is shown at a contour interval of 2m
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3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
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5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

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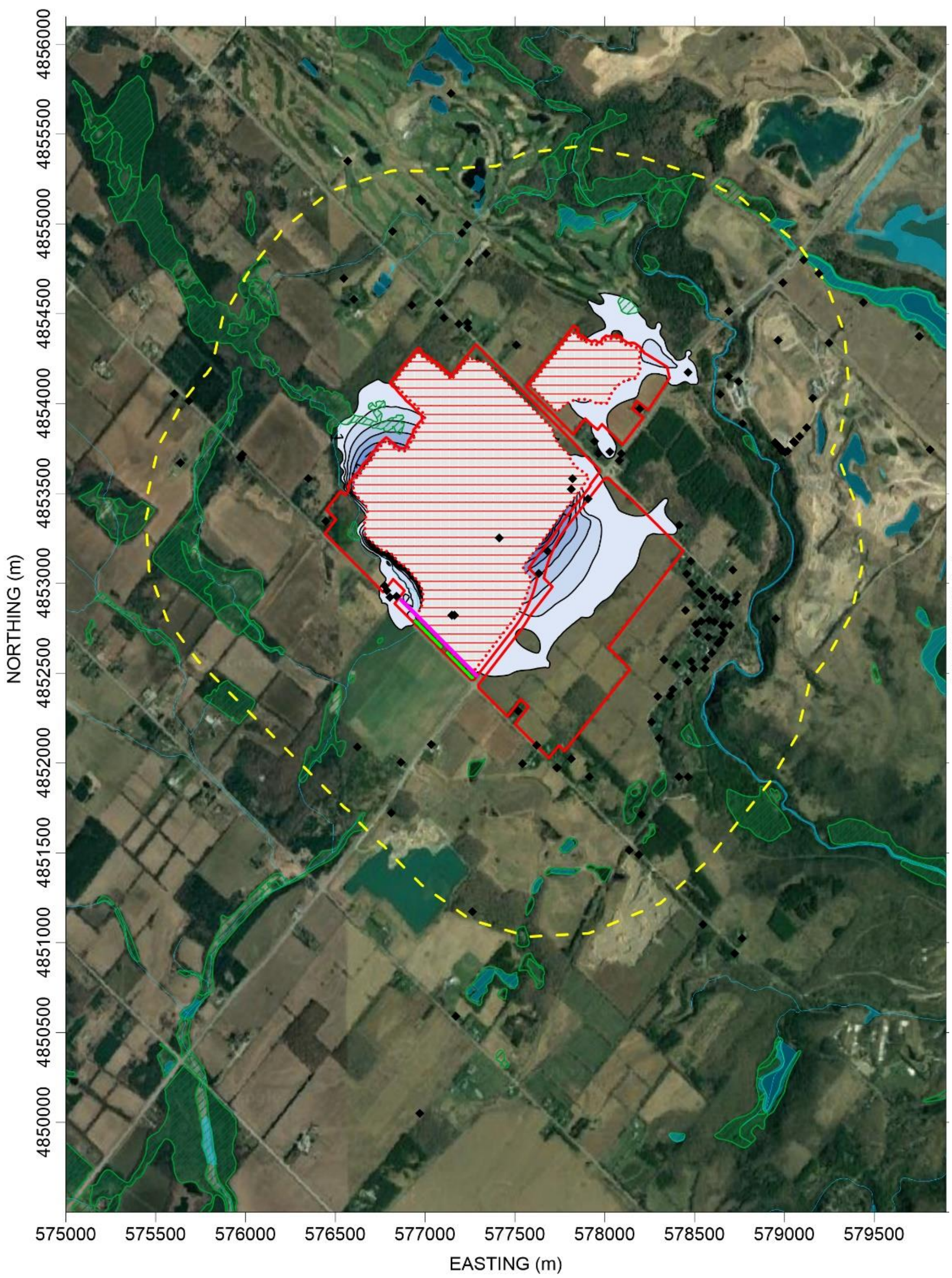
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

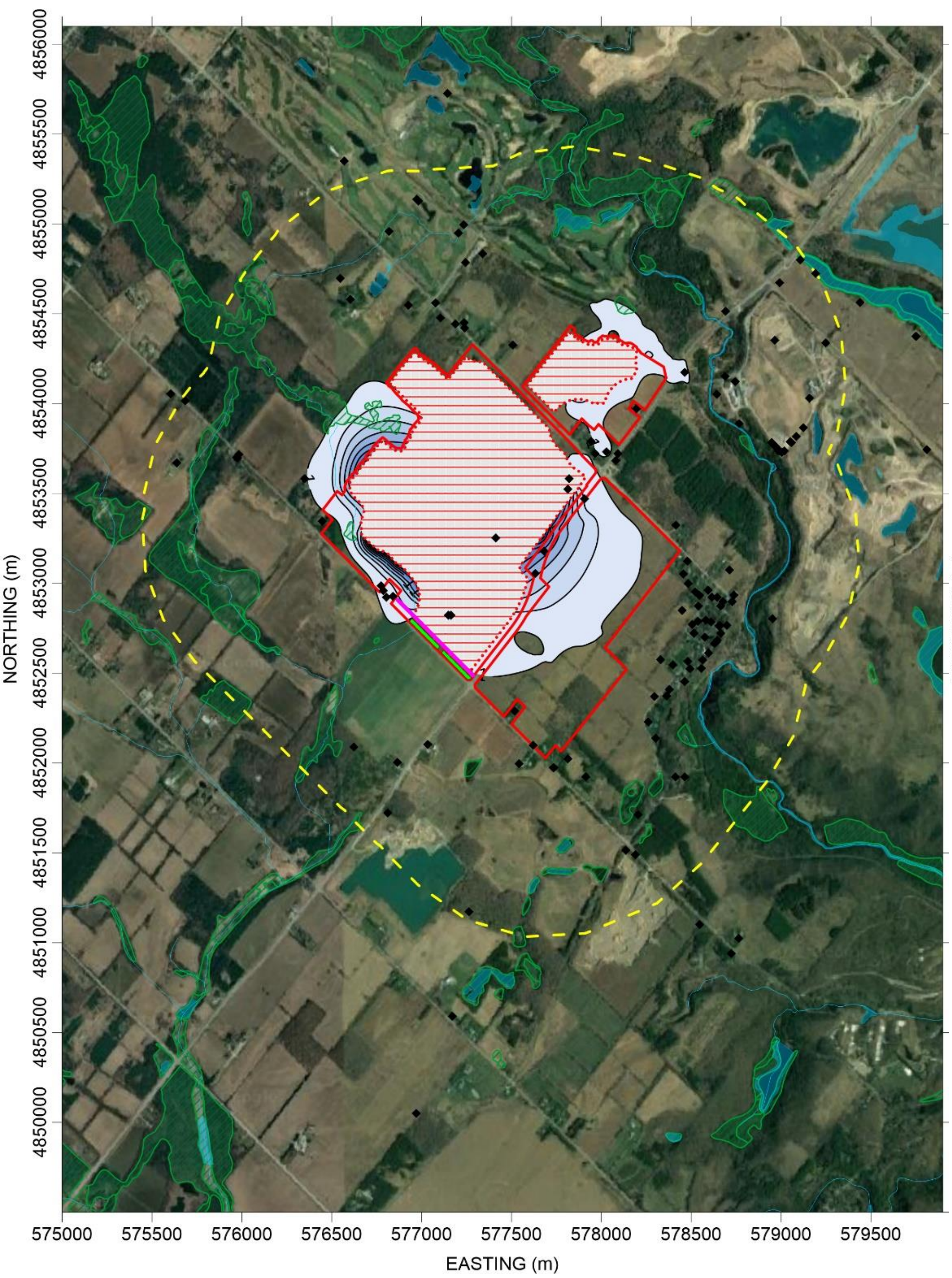
TITLE
**PHASE 4 SIMULATED DRAWDOWN**

PROJECT No. 19129150
Rev. 0
FIGURE 8D

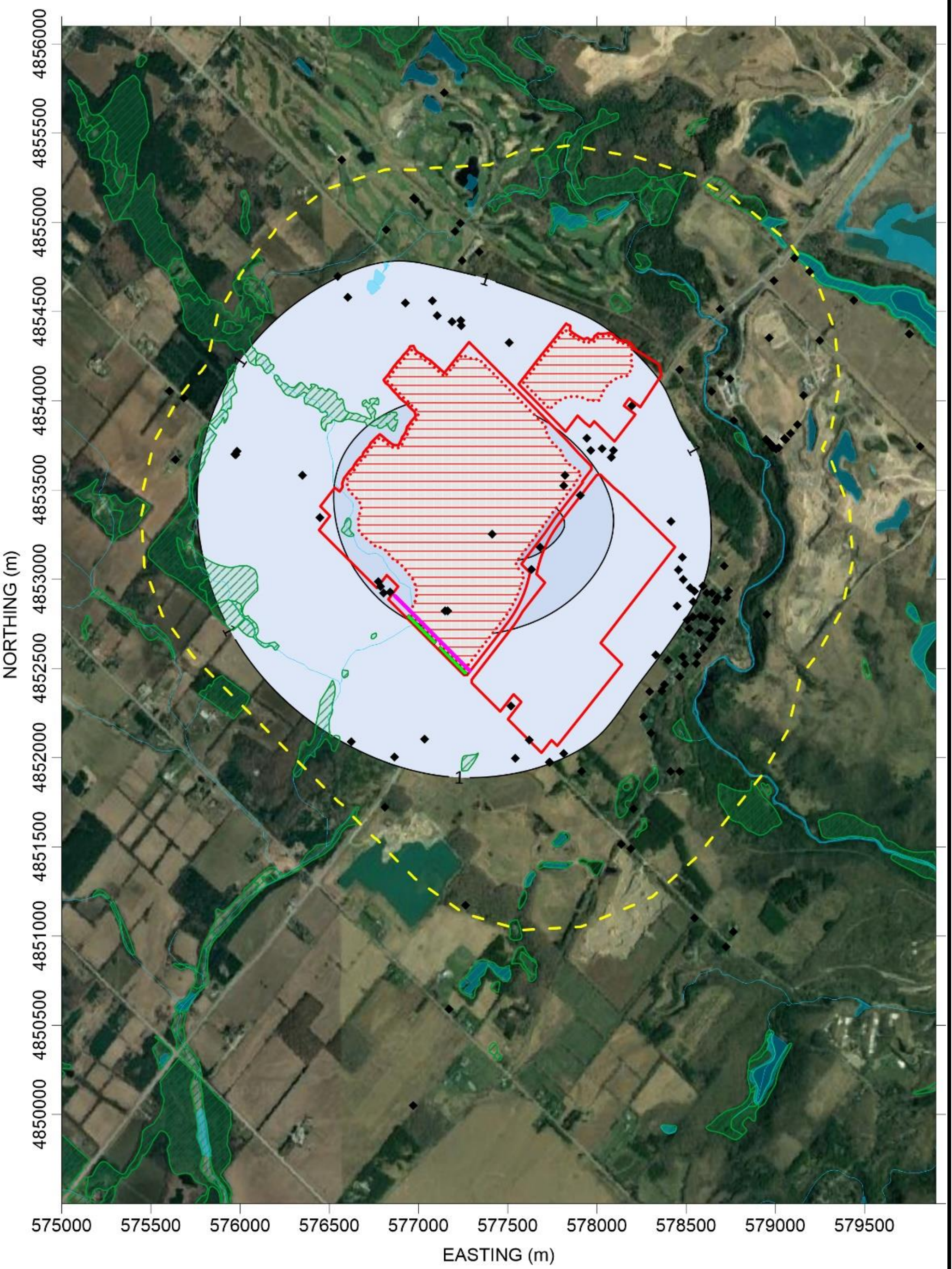
## 1. SIMULATED WATER TABLE DRAWDOWN (m)



## 2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



DRAWDOWN (m)

1 3 5 7 9 11 13 15 17 19 21 23

LEGEND

| | |
|---|---|
| 🟦 | LAKES |
| ─ | RIVERS/ STREAMS |
| ─ | SITE PROPERTY BOUNDARY |
| ┅ | EXTRACTION EXTENTS |
| ▨ | WETLAND |
| ┅ | 1KM BUFFER AROUND PROPERTY |
| ◆ | MECP PRIVATE WELL LOCATION |
| ─ | SLURRY WALL/ GROUT ALIGNMENT |
| 🟩 | INFILTRATION TRENCH |

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated drawdown is shown at a contour interval of 2m
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3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
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PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

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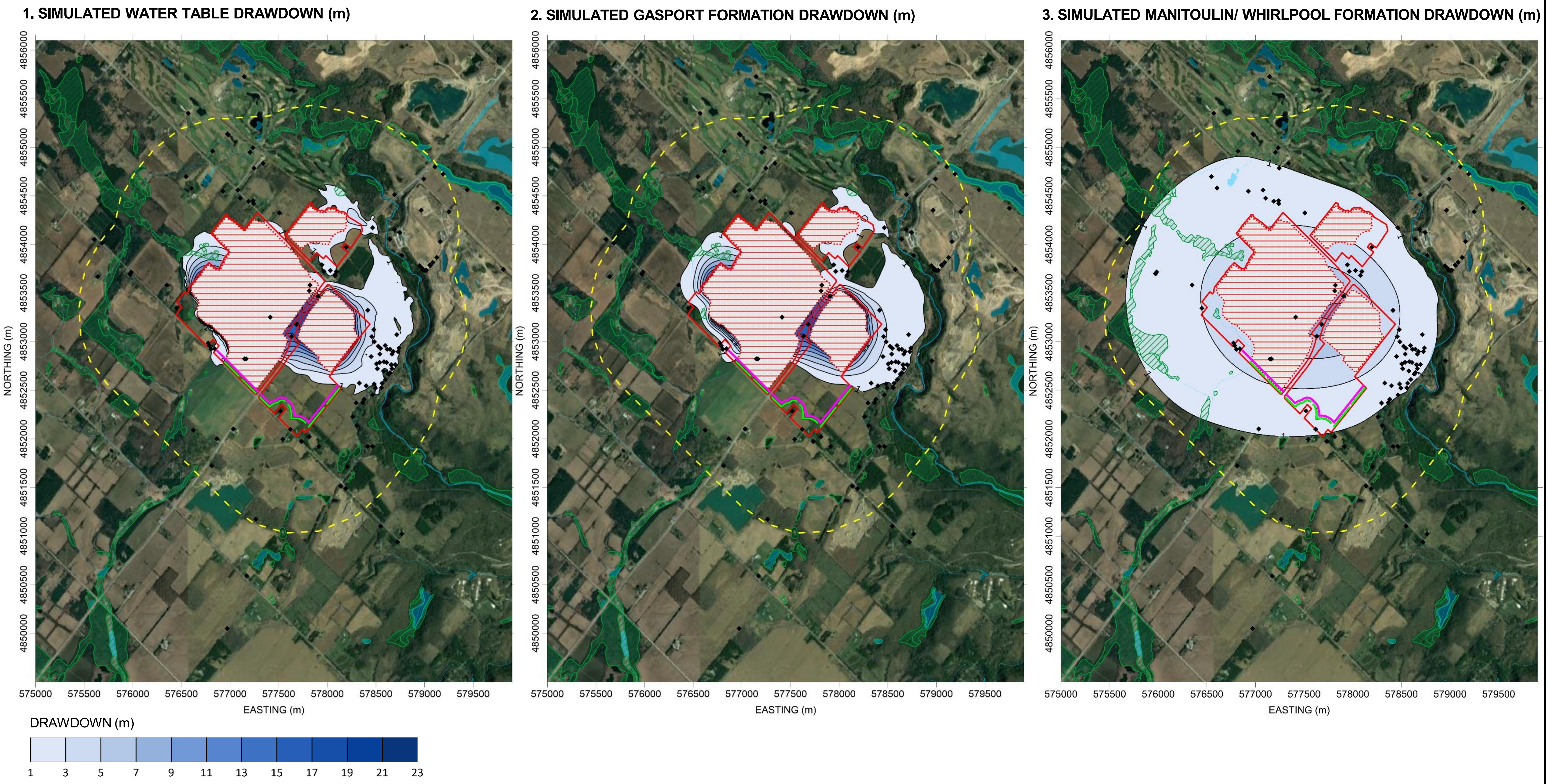
| YYYY-MM-DD | 2025-03-10 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**PHASE 5 SIMULATED DRAWDOWN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 8E |



1. SIMULATED WATER TABLE DRAWDOWN (m)

2. SIMULATED GASPORT FORMATION DRAWDOWN (m)

3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)

LEGEND

| | | | |
|---|---|---|---|
| 🟦 | LAKES | ▬ | SLURRY WALL/ GROUT ALIGNMENT |
| ▬ | RIVERS/ STREAMS | 🟩 | INFILTRATION TRENCH |
| ▬ | SITE PROPERTY BOUNDARY | | |
| ┅ | EXTRACTION EXTENTS | | |
| ▨ | WETLAND | | |
| ┅ | 1KM BUFFER AROUND PROPERTY | | |
| ◆ | MECP PRIVATE WELL LOCATION | | |

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

1. Simulated drawdown is shown at a contour interval of 2m
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3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

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PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

CONSULTANT
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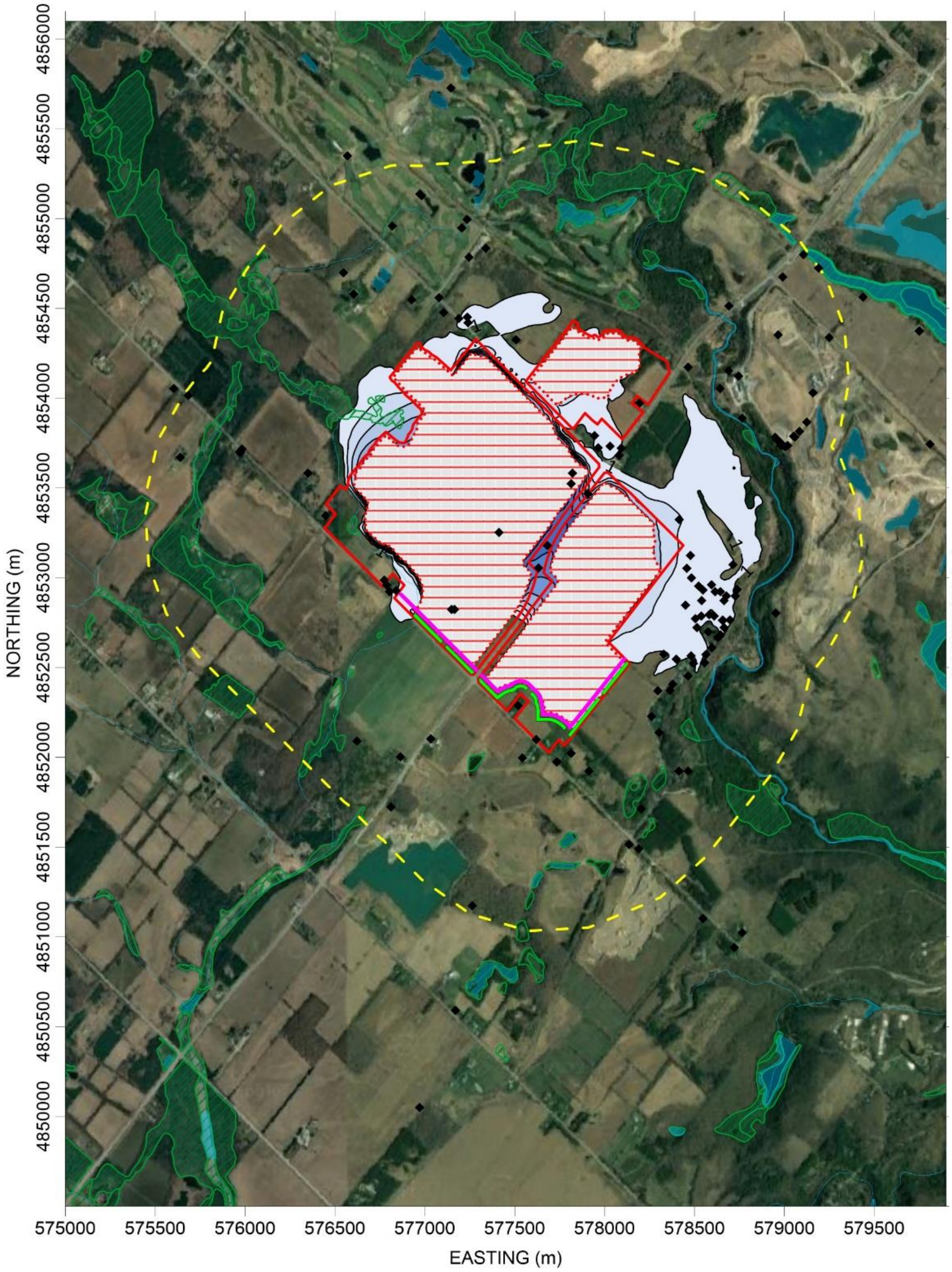
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

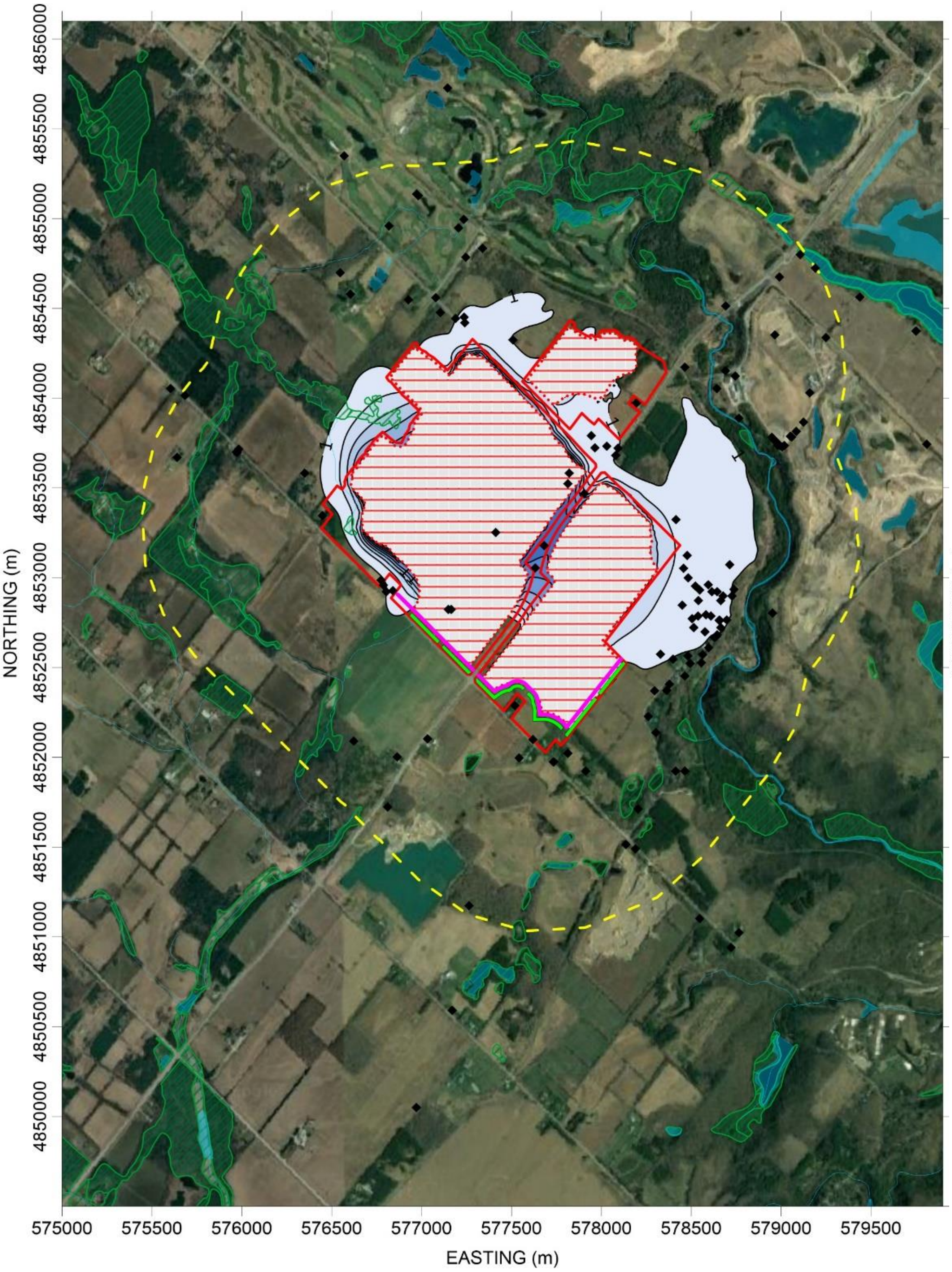
TITLE
**PHASE 6 SIMULATED DRAWDOWN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 8F |

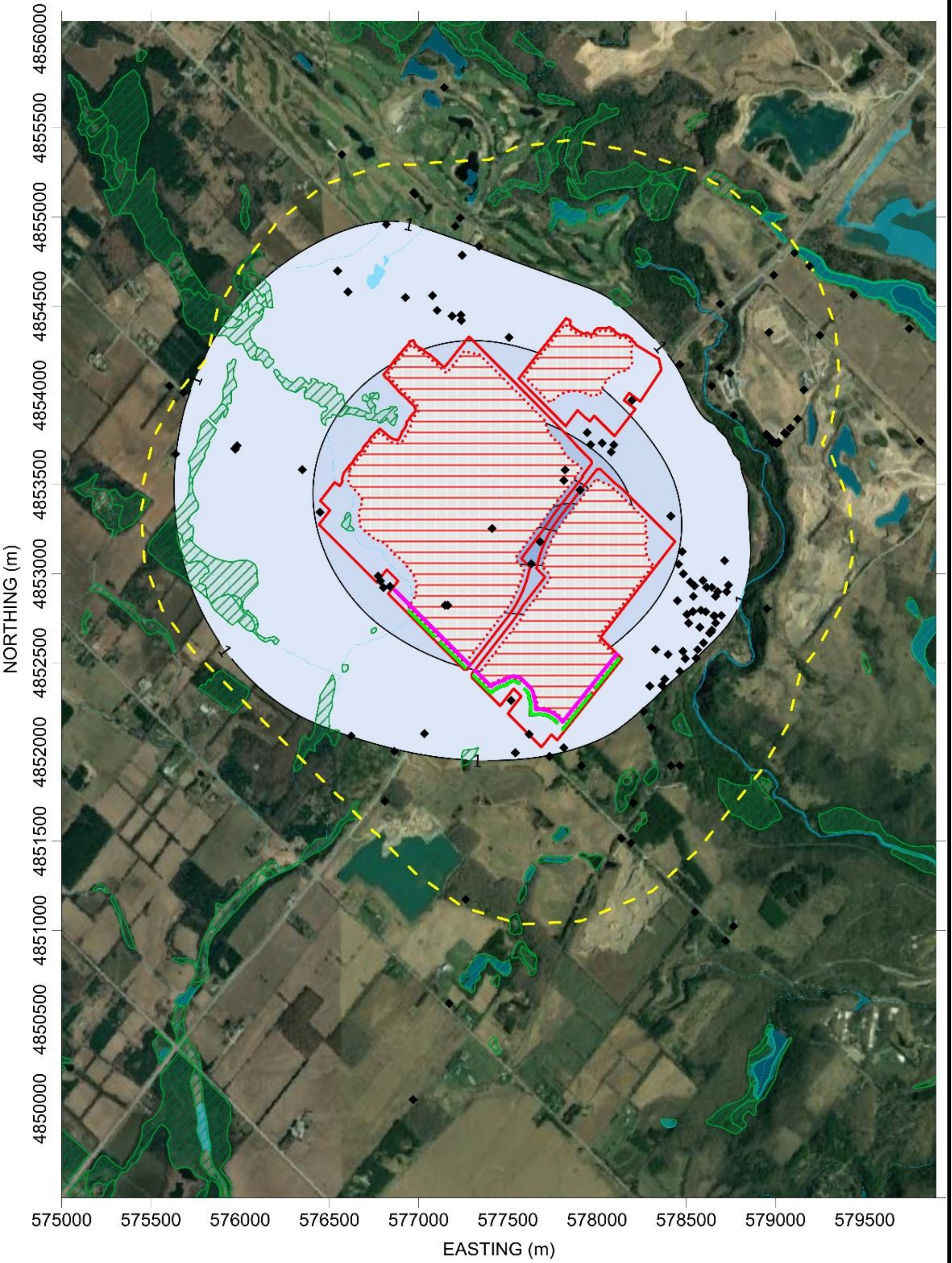
## 1. SIMULATED WATER TABLE DRAWDOWN (m)



## 2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



DRAWDOWN (m)

1 3 5 7 9 11 13 15 17 19 21 23

LEGEND

| | |
|---|---|
| 🟦 | LAKES |
| — | RIVERS/ STREAMS |
| — | SITE PROPERTY BOUNDARY |
| ┅ | EXTRACTION EXTENTS |
| ▨ | WETLAND |
| ┅ | 1KM BUFFER AROUND PROPERTY |
| ◆ | MECP PRIVATE WELL LOCATION |
| — | SLURRY WALL/ GROUT ALIGNMENT |
| 🟩 | INFILTRATION TRENCH |

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
| 6 | 27 to 32 |
| 7 | 33 to 38 |

NOTES

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PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

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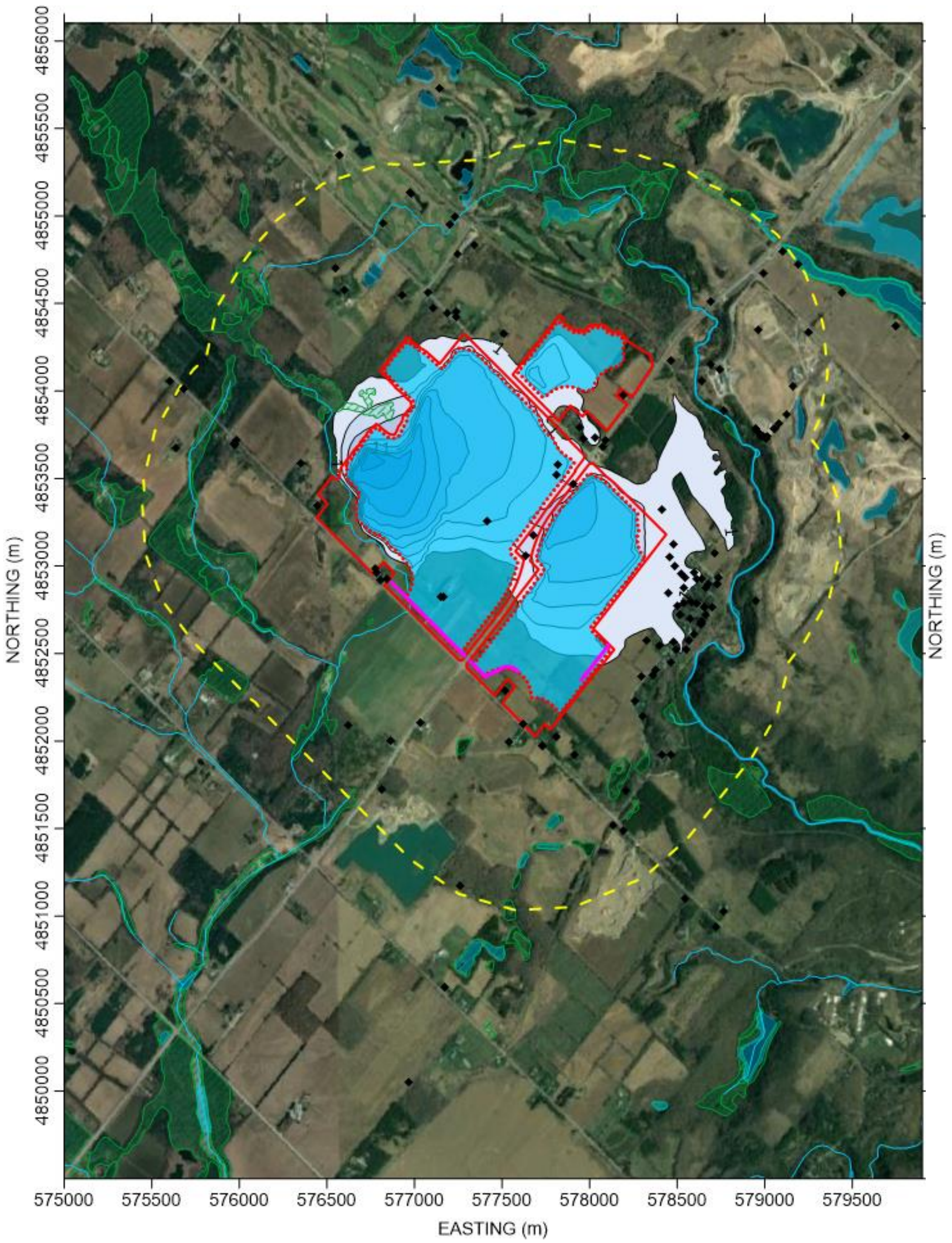
|---|---|
| YYYY-MM-DD | 2024-12-17 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

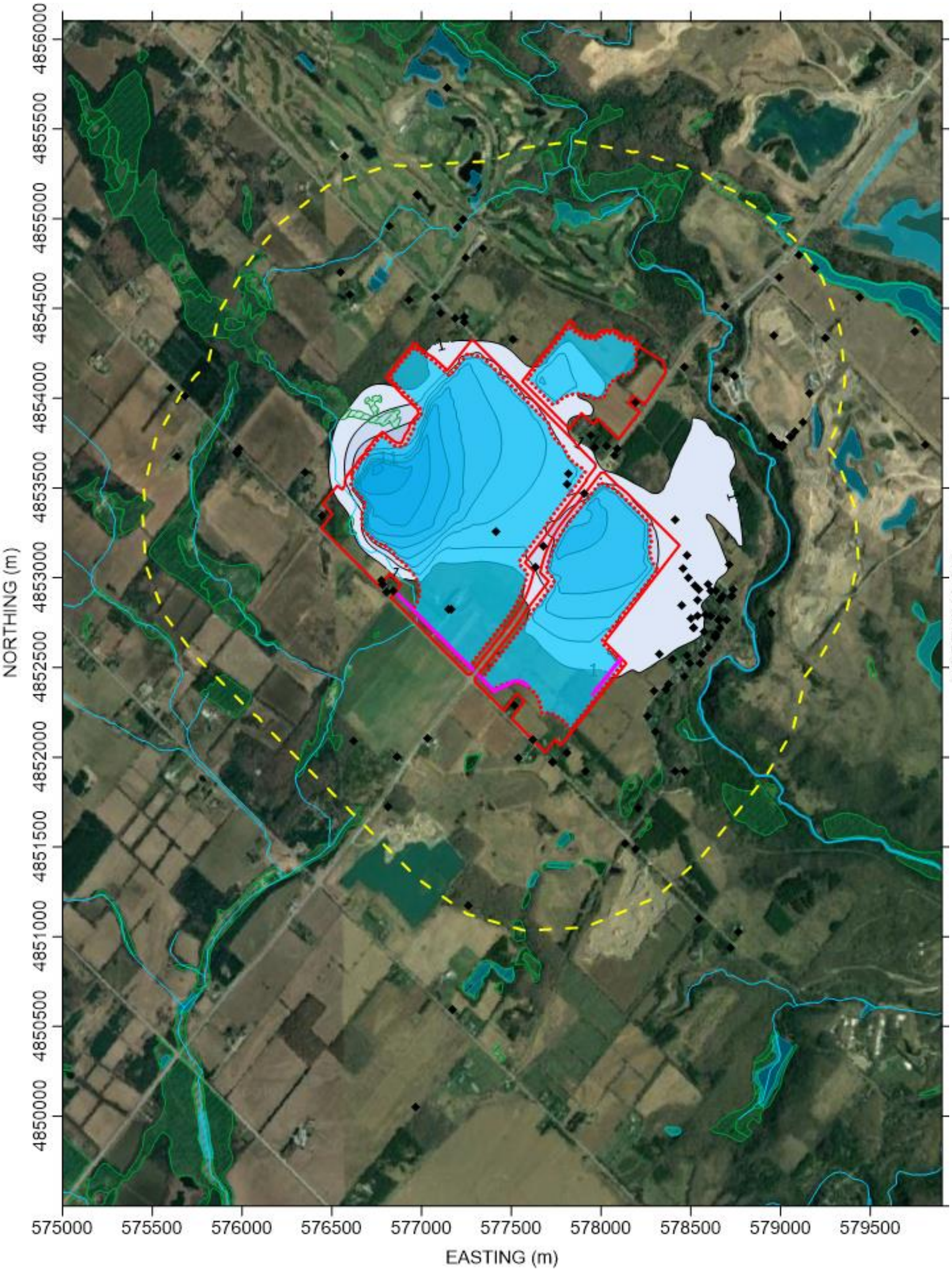
TITLE
**PHASE 7 SIMULATED DRAWDOWN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 8G |

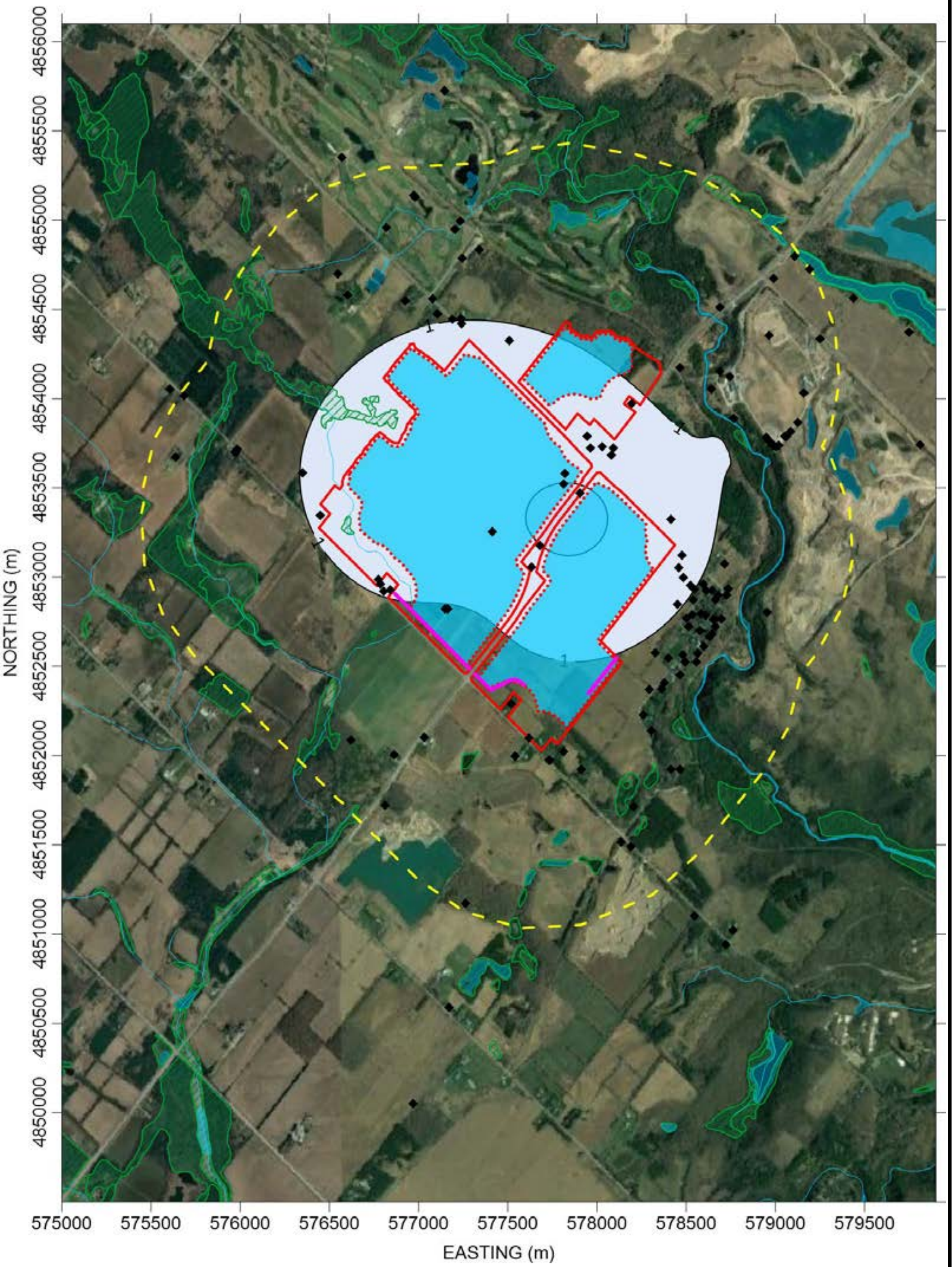
## 1. SIMULATED WATER TABLE DRAWDOWN (m)



## 2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



## 3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



DRAWDOWN (m)

LEGEND

- 🟦 LAKES
- — RIVERS/ STREAMS
- — SITE PROPERTY BOUNDARY
- ⋯ EXTRACTION EXTENTS
- ▨ WETLAND
- ⋯ 1KM BUFFER AROUND PROPERTY
- ◆ MECP PRIVATE WELL LOCATION
- — SLURRY WALL/ GROUT ALIGNMENT
- 🟩 INFILTRATION TRENCH

| Phase of Operation | Years |
|---|---|
| 1 | 1 to 8 |
| 2 | 9 to 13 |
| 3 | 14 to 17 |
| 4 | 18 to 22 |
| 5 | 23 to 26 |
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PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

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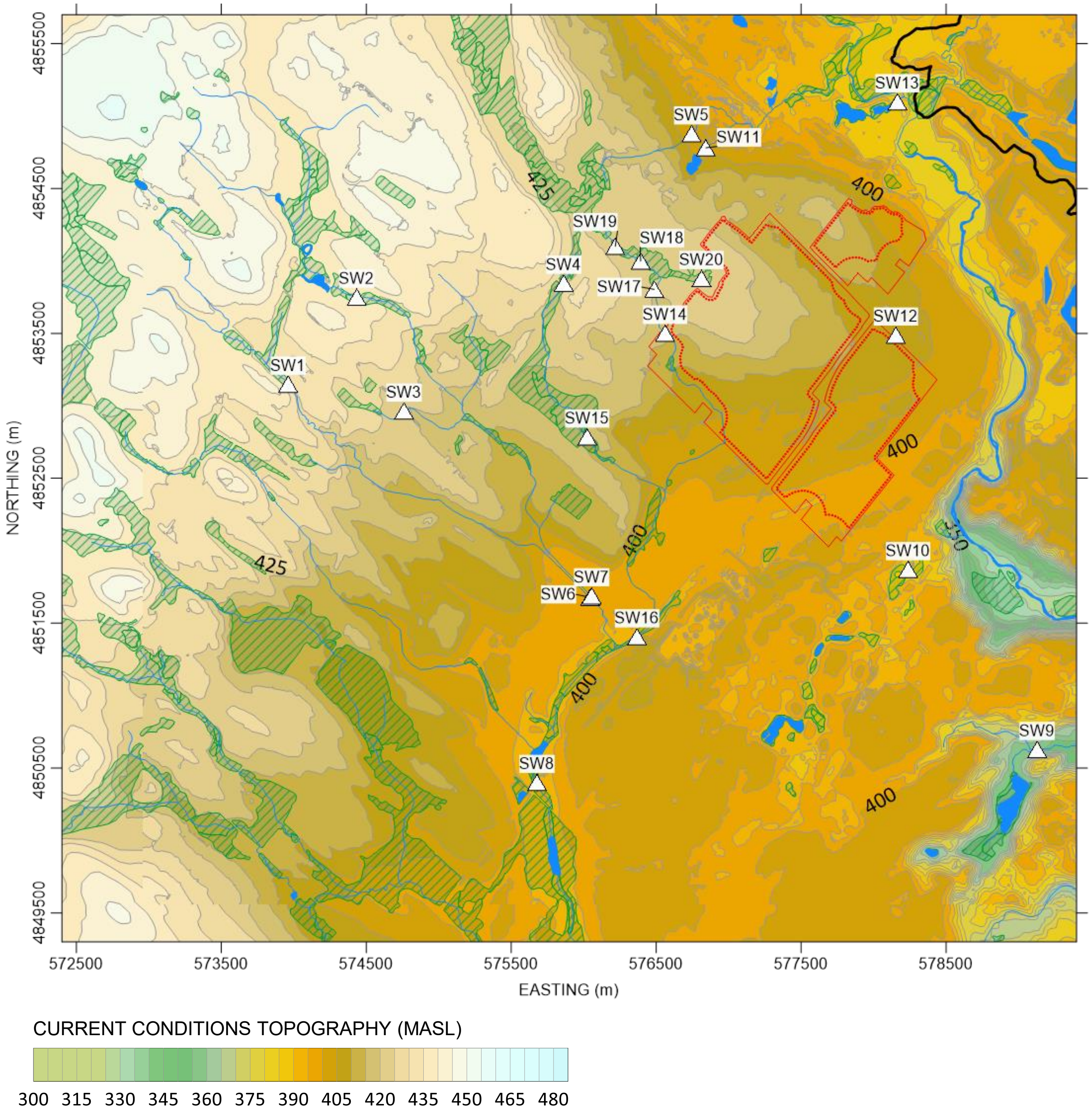
|---|---|
| YYYY-MM-DD | 2025-05-09 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

TITLE
**REHABILITATION SIMULATED DRAWDOWN**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 8H |

## SURFACE WATER MONITORING STATIONS



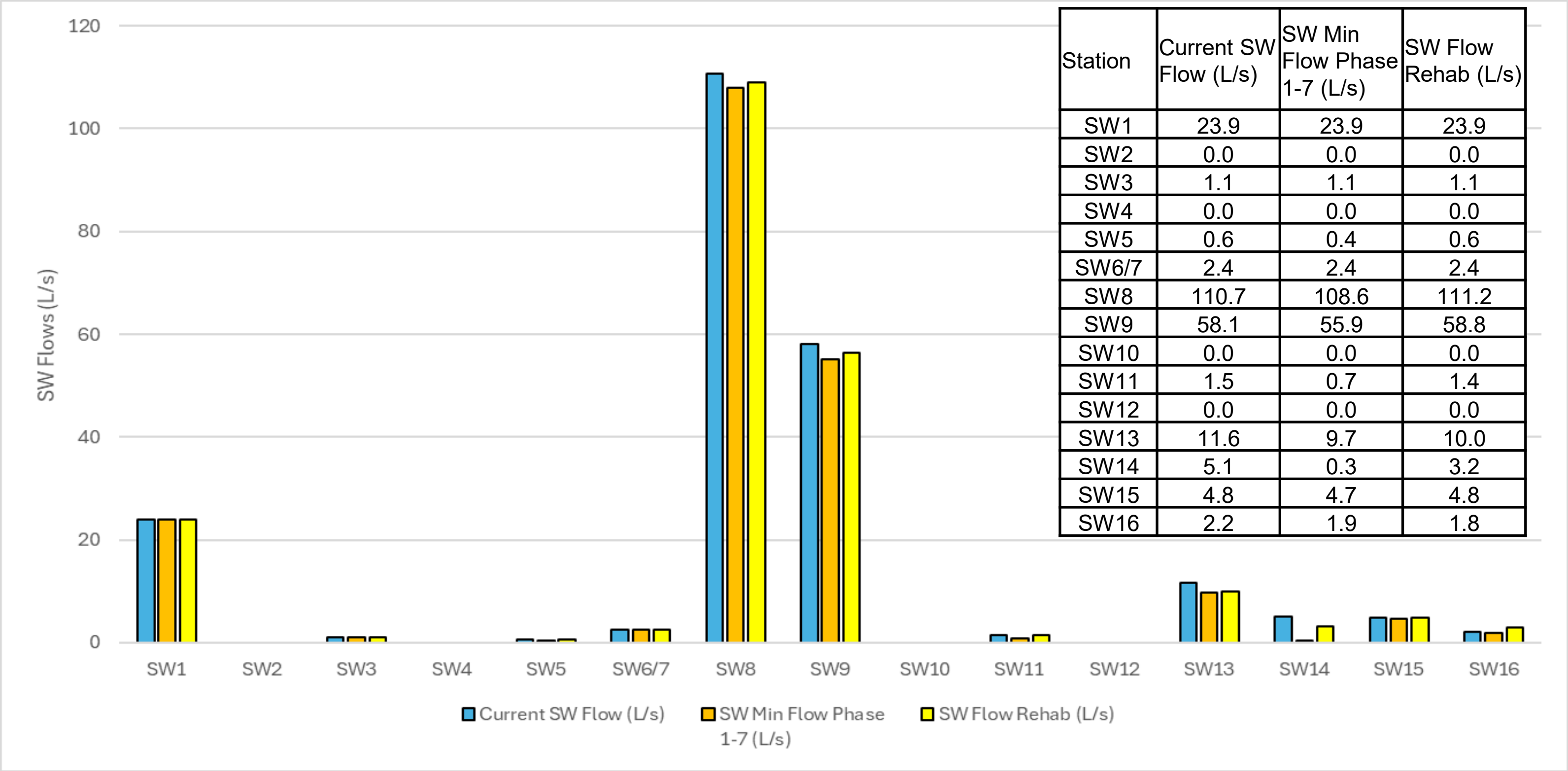
NOTES:

1. Simulated surface water flows for phases 1-7 and rehabilitation represent long term average (steady state) values
2. Several surface water stations have a current conditions simulated flow of 0.00 L/s (SW2, SW4, SW5, SW10, SW11, SW12, SW15 and SW16), and continue to have a simulated flow of 0.00 L/s throughout quarry operation and rehabilitation

## SIMULATED REDUCTION IN SURFACE WATER FLOW THROUGH QUARRY PHASES

| SW Station | Current Conditions (L/s) | Phase 1 (L/s) | | Phase 2 (L/s) | | Phase 3 (L/s) | | Phase 4 (L/s) | | Phase 5 (L/s) | | Phase 6 (L/s) | | Phase 7 (L/s) | | Rehab (L/s) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow | Flow | Reduc-tion | Flow | Reduc-tion | Flow | Reduc-tion | Flow | Reduc-tion | Flow | Reduc-tion | Flow | Reduc-tion | Flow | Reduc-tion | Flow | Reduc-tion |
| SW1 | 23.9 | 23.9 | 0.0 | 23.9 | 0.0 | 23.9 | 0.0 | 23.9 | 0.0 | 23.9 | 0.0 | 23.9 | 0.0 | 23.9 | 0.0 | 23.9 | 0.0 |
| SW2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SW3 | 1.1 | 1.1 | 0.0 | 1.1 | 0.0 | 1.1 | 0.0 | 1.1 | 0.0 | 1.1 | 0.0 | 1.1 | 0.0 | 1.1 | 0.0 | 1.1 | 0.0 |
| SW4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SW5 | 0.6 | 0.6 | 0.0 | 0.4 | 0.2 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.6 | 0.0 |
| SW6/7 | 2.4 | 2.4 | 0.0 | 2.4 | 0.0 | 2.4 | 0.0 | 2.4 | 0.0 | 2.4 | 0.0 | 2.4 | 0.0 | 2.4 | 0.0 | 2.4 | 0.0 |
| SW8 | 110.7 | 109.4 | 1.3 | 108.9 | 1.8 | 108.6 | 2.1 | 110.1 | 0.6 | 109.9 | 0.8 | 110.9 | -0.2 | 110.7 | 0.0 | 111.2 | -0.5 |
| SW9 | 58.1 | 56.7 | 1.4 | 56.2 | 2.0 | 55.9 | 2.3 | 57.6 | 0.5 | 57.2 | 0.9 | 58.7 | -0.6 | 58.5 | -0.4 | 58.8 | -0.7 |
| SW10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SW11 | 1.5 | 1.4 | 0.0 | 0.7 | 0.7 | 1.3 | 0.2 | 1.4 | 0.1 | 1.4 | 0.1 | 1.4 | 0.1 | 1.3 | 0.1 | 1.4 | 0.1 |
| SW12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SW13 | 11.6 | 10.4 | 1.3 | 9.7 | 2.0 | 10.1 | 1.6 | 10.2 | 1.4 | 10.2 | 1.4 | 10.2 | 1.4 | 9.7 | 2.0 | 10.0 | 1.7 |
| SW14 | 5.1 | 5.0 | 0.2 | 3.1 | 2.1 | 3.1 | 2.0 | 0.3 | 4.8 | 1.7 | 3.4 | 1.7 | 3.4 | 2.5 | 2.6 | 3.2 | 1.9 |
| SW15 | 4.8 | 4.8 | 0.0 | 4.8 | 0.0 | 4.8 | 0.0 | 4.7 | 0.2 | 4.8 | 0.1 | 4.8 | 0.1 | 4.8 | 0.1 | 4.8 | 0.0 |
| SW16 | 2.2 | 2.8 | -0.7 | 3.1 | -0.9 | 3.2 | -1.1 | 2.4 | -0.2 | 2.5 | -0.4 | 1.9 | 0.2 | 2.0 | 0.1 | 1.8 | 0.3 |

## SIMULATED SURFACE WATER FLOW: CURRENT CONDITIONS, MINIMUM DURING OPERATION, AND REHAB



| Station | Current SW Flow (L/s) | SW Min Flow Phase 1-7 (L/s) | SW Flow Rehab (L/s) |
|---|---|---|---|
| SW1 | 23.9 | 23.9 | 23.9 |
| SW2 | 0.0 | 0.0 | 0.0 |
| SW3 | 1.1 | 1.1 | 1.1 |
| SW4 | 0.0 | 0.0 | 0.0 |
| SW5 | 0.6 | 0.4 | 0.6 |
| SW6/7 | 2.4 | 2.4 | 2.4 |
| SW8 | 110.7 | 108.6 | 111.2 |
| SW9 | 58.1 | 55.9 | 58.8 |
| SW10 | 0.0 | 0.0 | 0.0 |
| SW11 | 1.5 | 0.7 | 1.4 |
| SW12 | 0.0 | 0.0 | 0.0 |
| SW13 | 11.6 | 9.7 | 10.0 |
| SW14 | 5.1 | 0.3 | 3.2 |
| SW15 | 4.8 | 4.7 | 4.8 |
| SW16 | 2.2 | 1.9 | 1.8 |

LEGEND

| | | | |
|---|---|---|---|
| 🟦 | LAKES | ━ | SITE PROPERTY BOUNDARY |
| ━ | RIVERS/ STREAMS | ┅ | EXTRACTION EXTENTS |
| ▨ | WETLAND | △ | SURFACE WATER MONITORING STATION |

ADDITIONAL MAP NOTES

3. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
4. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNRF) Southwestern Ontario Orthophotography (SWOOP) 2019
5. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
6. Quarry license and limit of extraction provided by MHBC (2022)

CLIENT
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
CALEDON PIT AND QUARRY

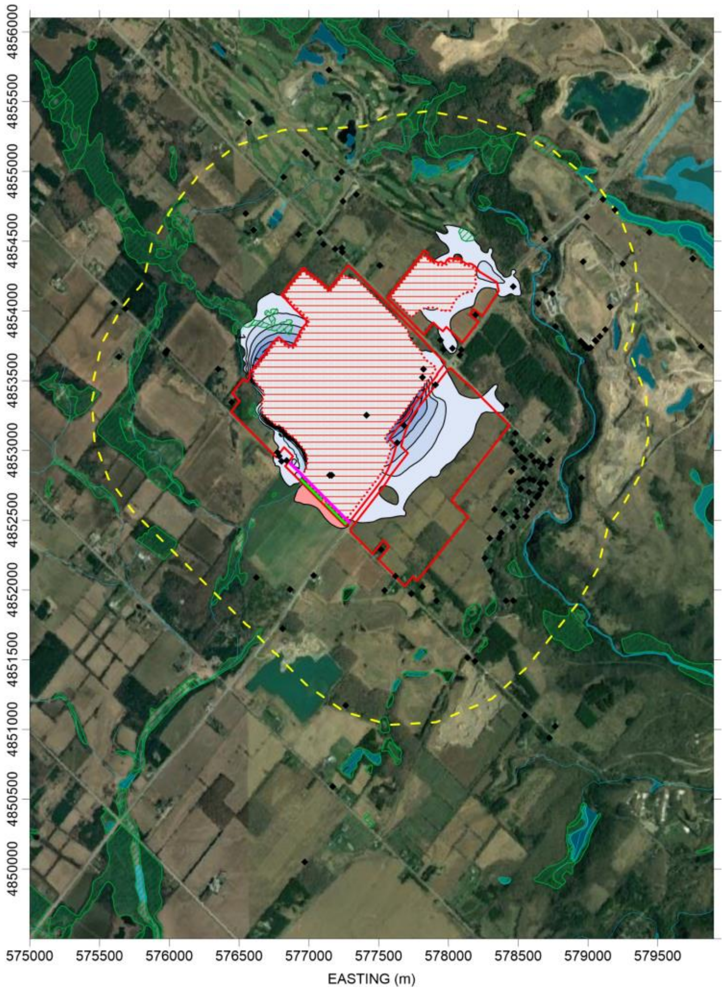
CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2025-05-09 |
| PREPARED | TG |
| DESIGN | HW |
| REVIEW | RS |
| APPROVED | GS |

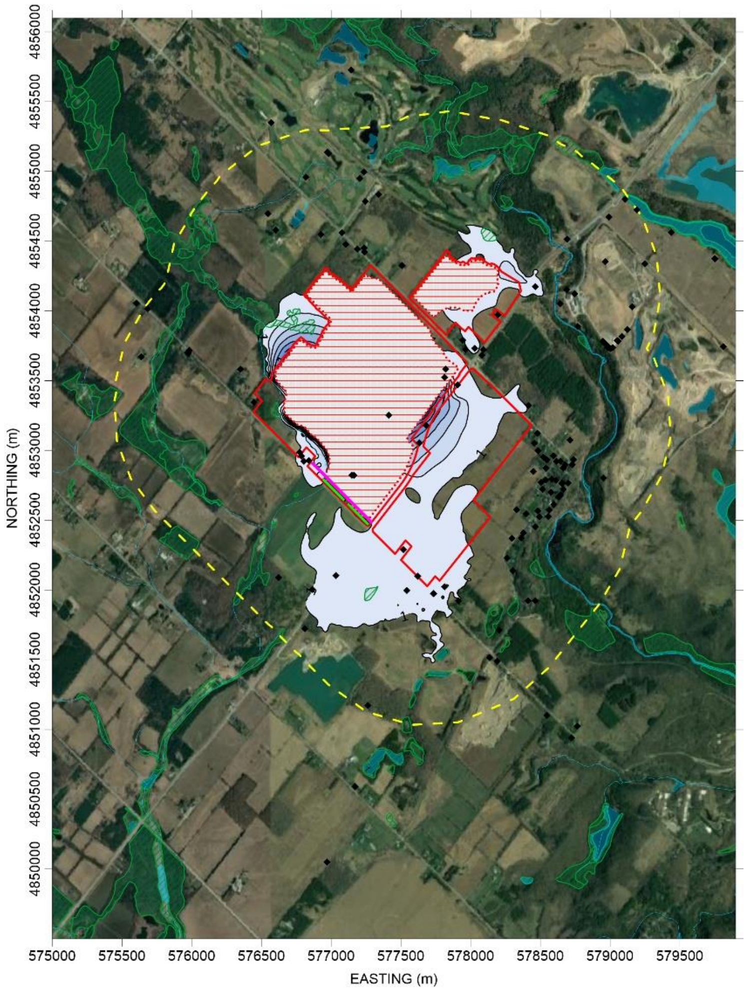
TITLE
**SIMULATED CHANGE IN SURFACE WATER FLOW AT MONITORING STATIONS**

| PROJECT No. | Rev. | FIGURE |
|---|---|---|
| 19129150 | 0 | 9 |

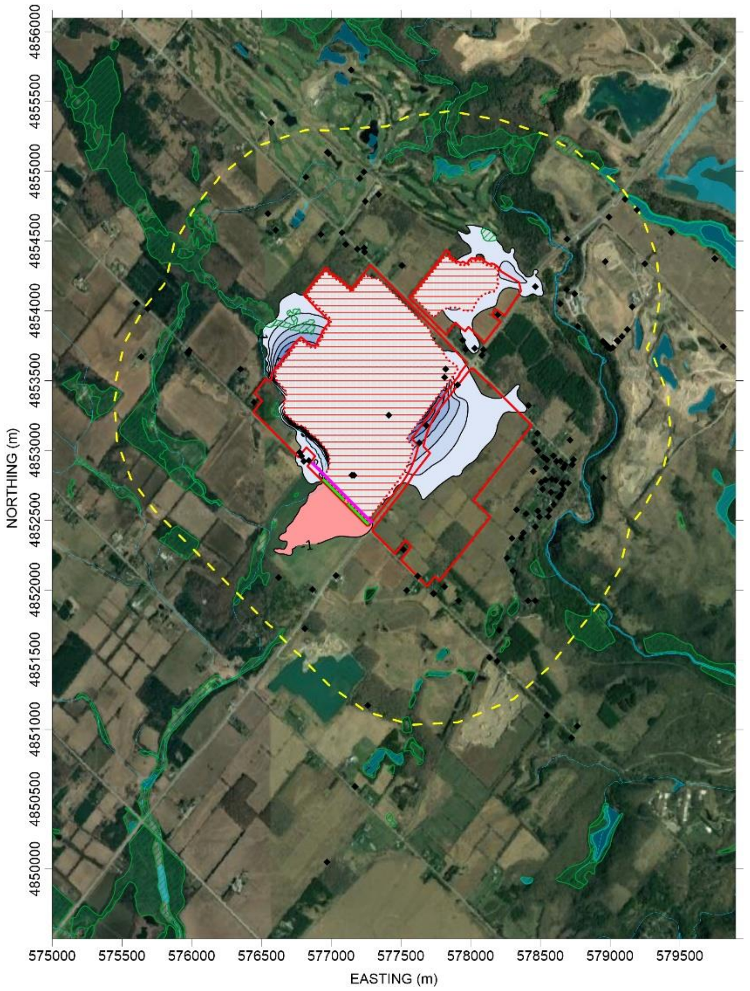
## 2024 UPDATE: WATER TABLE DRAWDOWN



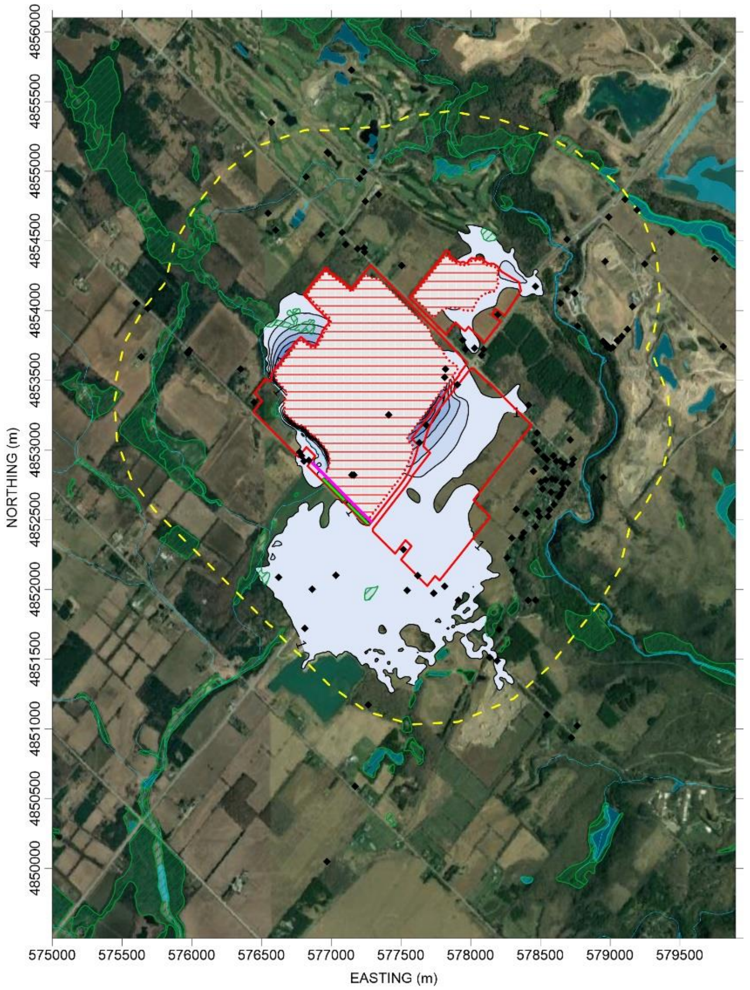
## SCENARIO 5A: WATER TABLE DRAWDOWN



## SCENARIO 5B: WATER TABLE DRAWDOWN



## SCENARIO 5C: WATER TABLE DRAWDOWN



DRAWDOWN (m)

-3 -1 1 3 5 7 9 11 13 15 17 19 21

transparent

| Phase - Scenario | Model Boundary Conditions – Phase 5 |  | Main Area Simulated Inflow (L/s) |  | North Area Simulated Inflow (L/s) |  | Total Inflow (L/s) |  | Trench Flow (L/s) |  |  | Total Trench Flow as Percent of Total Sump Inflow (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Trench Zone 1 Head (masl) | Trench Zone 2 Head (masl) | 2024 Update[a] | Net Surplus[b] | 2024 Update[a] | Net Surplus[b] | 2024 Update[a] | Net Surplus[b] | Trench Zone 1 | Trench Zone 2 | Total Trench |  |
| 5 – 2024 Update | 398 | 398 | 63.8 | 13.7 | 3.1 | 1.7 | 66.9 | 15.5 | 27.6 | 24.0 | 51.6 | 77% |
| 5 – Sc 5A | 396 | 396 | 52.6 | 13.7 | 3.1 | 1.7 | 55.7 | 15.5 | 17.7 | 16.4 | 34.1 | 61% |
| 5 – Sc 5B | 400 | 400 | 73.8 | 13.7 | 3.1 | 1.7 | 76.9 | 15.5 | 36.2 | 31.8 | 68.0 | 88% |
| 5 – Sc 5C | 396 | 394 | 47.9 | 13.7 | 3.1 | 1.7 | 50.9 | 15.5 | 20.0 | 6.4 | 26.3 | 52% |

LEGEND

- 🟦 LAKES
- ― RIVERS / STREAMS
- ― SITE PROPERTY BOUNDARY
- ┅ EXTRACTION EXTENTS
- ▨ WETLAND
- ┅ 1 KM BUFFER AROUND PROPERTY
- ◆ MECP PRIVATE WELL LOCATION
- ― SLURRY WALL / GROUT ALIGNMENT
- 🟩 INFILTRATION TRENCH

NOTES

1. Simulated drawdown is shown at a contour interval of 2 m
2. m = metres, masl = metres above sea level, L/s = litres per second, Sc = scenario
3. Water table drawdown extracted from model slice 1
4. South Area Sump is excluded from the table because it is inactive during Phase 5.
5. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
6. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

a. The inflows include the net surplus applied to the pit and quarry area.
b. Calculated based on the quarry area and a net surplus of 364 millimetres/year.

CLIENT
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
CALEDON PIT AND QUARRY NUMERICAL MODELLING

CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2025-03-11 |
| PREPARED | TG |
| DESIGN | TG |
| REVIEW | RS |
| APPROVED | GS |

TITLE
PHASE 5 SIMULATED DRAWDOWN - SENSITIVITY ASSESSMENT

PROJECT No.
19129150

Rev.
0

FIGURE
10

## APPENDIX D

# UPDATED WATER MANAGEMENT PLAN

# TECHNICAL MEMORANDUM

**DATE** May 9, 2025 **Project No.** 19129150

**TO** David Hanratty, Mike LeBreton
CBM Aggregates

**CC** Greg Padusenko, Dan Eusebi - WSP

**FROM** George Schneider, Craig DeVito, Richard Simms, Paul Menkveld **EMAIL george.schneider@wsp.com**

## WATER MANAGEMENT AND DISCHARGE PLAN – PROPOSED CBM CALEDON PIT / QUARRY

This technical memorandum provides an overview of the water management and discharge plan for the proposed CBM Caledon Pit / Quarry project.

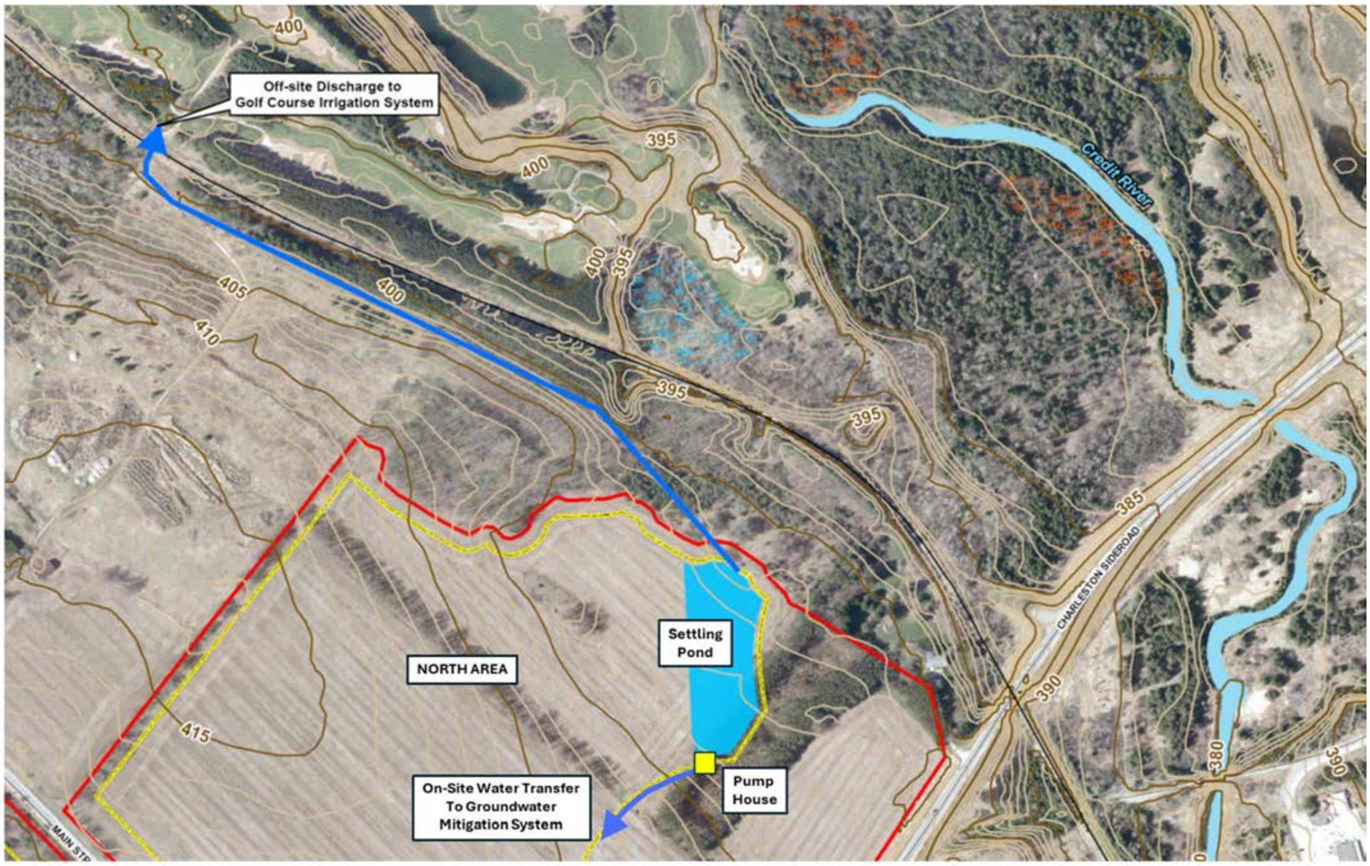


**Figure 1: Proposed Water Discharge from the Pit / Quarry Settling Pond to the Osprey Valley Golf Course**

**WSP Canada Inc.**
6925 Century Avenue, Suite #600, Mississauga, Ontario, L5N 7K2, Canada T: +1 905 567 4444 F: +1 905 567 6561

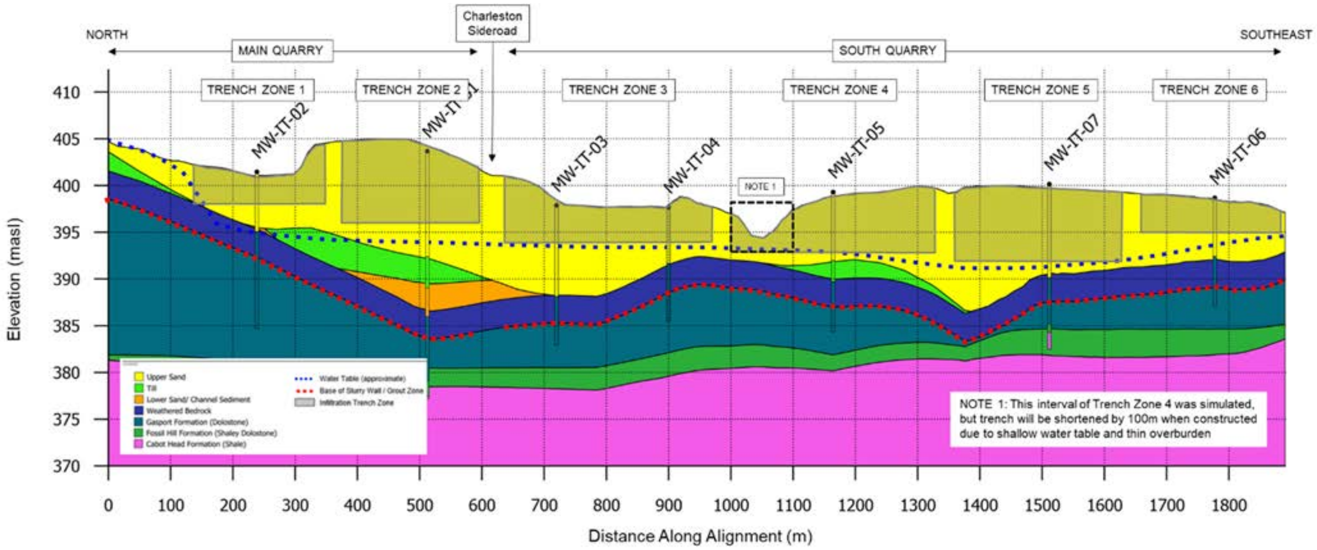
## OFF-SITE DISCHARGE

A single point of discharge has been identified for water collected from the combined land assemblages of the proposed Caledon Pit / Quarry to the Osprey Valley Golf Course irrigation system infrastructure (Figure 1), where water will be used for irrigation when needed, with excess water stored in the golf course's existing pond system which ultimately discharges to the Credit River.

## PROPOSED GROUNDWATER MITIGATION SYSTEM

A groundwater mitigation system is proposed for Phases 3 to 7 of pit / quarry operation, and a portion of the water collected during those phases of operations is expected to be directed to the infiltration trenches that form part of the mitigation system to mitigate impacts of pit / quarry dewatering (Figure 2). The mitigation measures consist of the installation and operation of six infiltration trench zones along a 1,900 m alignment along the west side of the Main Area and the west and south side of the South Area, in the setback area between the licence limit and the limit of extraction.

Water collected in the pit / quarry from dewatering will be reintroduced into the groundwater system through these infiltration trench zones to maintain the groundwater levels west and south of the licence area to levels within their current typical range. Additionally, two hydraulic barrier zones will be installed between the infiltration trenches and the extraction limit, in order to minimize the flow of groundwater back into the pit / quarry from the infiltration trenches. The hydraulic barrier will primarily consist of two slurry wall zones in the overburden, noting that the upper bedrock zone along the slurry wall alignments may also be grouted to reduce the permeability of this zone and further reduce the inflow of groundwater into the pit / quarry and help sustain existing groundwater levels outside of the licence area.



NOTE 1: This interval of Trench Zone 4 was simulated, but trench will be shortened by 100m when constructed due to shallow water table and thin overburden

**Figure 2: The Proposed Groundwater Mitigation System consisting of six Infiltration Trench Zones and two Hydraulic Barrier Zones**

If required, the proposed groundwater mitigation system would be implemented in the following stages of pit / quarry operation:

- Phase 3 – Implementation of the slurry wall / grouting of the weathered bedrock zone on the west side of the Main Area prior to the start of Phase 3 extraction.
- Phases 4 and 5 – Implementation of the infiltration trench system (Trench Zones 1 and 2) on the west side of the Main Area prior to the start of Phase 4 and 5 extraction.
- Phase 6 and 7 – Implementation of the second slurry wall / grouting of the weathered bedrock zone and the second phase of the infiltration trench system (Trench Zones 4 to 6) prior to the start of Phase 6 and 7 extraction.

The post-Rehabilitation scenario includes the removal of the slurry wall in the overburden in the southwest corner of the South Area (adjacent to Trench Zones 4 and 5) to partially reinstate the original hydraulic connection in the overburden between the South Area and the lands to the south and southwest of the Site.

## WATER INFLOW PREDICTIONS AND WATER MANAGEMENT STRATEGY

Water balance calculations were performed for the pit / quarry areas, at one-year increments, for each year of operation as proposed in the Caledon Pit / Quarry Mining Plan (Mining Plan) dated 12 December 2022, in order to help predict water inflows to the quarry and inform a water management strategy. The calculations estimated how much water will be generated by pit / quarry operations each year and evaluated options to best manage the water. The water balance calculation was performed as follows, with the calculations and results presented in Tables 1 and 2.

- The net annual water surplus was calculated for each of the pit / quarry areas, year by year, for each operational year, based on plan view “snapshots” presented in the Mining Plan.
- These annual snapshots were used to calculate the spatial size of vegetated, till, rock and open water areas, and along with water surplus factors unique to each of the land surface types, a net annual water surplus was calculated for each quarry parcel. It was assumed that the surplus water from exposed till, exposed rock and ponded water areas was captured within the quarry, while surplus water from the undisturbed vegetated areas was not.
- Groundwater seepage was inferred by subtracting the annual water surplus from the total water inflow predicted by recently updated HydroGeoSphere (HGS) simulations (WSP Modeling TM, March 2025) at key time steps during pit / quarry operations.
- The annual water surplus from each area including the estimated seepage contributions were summed to estimate the total water generated by quarry operation each year.
- A portion of the pit / quarry water generated each year will be used for aggregate washing, and while washing is largely non-consumptive, it is estimated that 0.05 $m^3$ of water would be lost for every tonne of aggregate washed.
- The net water surplus for each year was then allocated to storage, used in the proposed groundwater mitigation system or discharged to the Osprey Valley Golf Course irrigation pond system, depending on the operational needs for that year. Key water management milestones are highlighted in the table below.

# Table 1
## Water Generation Estimate - CBM Caledon Pit / Quarry

| Year | Main Quarry | | | | | | HGS Inflow Prediction | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total area | Veg area | Open Rock area | Till / Rehab area | Pond area | Site Surplus Inflow | Total Model Inflow | Total Model Inflow | GW Seepage (by HGS) | Annual Water Generated |
| | mm/yr | 342 | 446 | 365 | 234 | | | | | |
| | m2 | m2 | m2 | m2 | m2 | m3/yr | m3/d | m3/yr | m3/yr | m3 |
| 0 | 1,245,747 | 1,245,747 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1,245,747 | 1,130,547 | 70,475 | 44,725 | 0 | 47,756 | 159 | 57,947 | 36,495 | 84,251 |
| 2 | 1,245,747 | 1,130,547 | 70,475 | 44,725 | 0 | 47,756 | 318 | 115,895 | 72,989 | 120,746 |
| 3 | 1,245,747 | 1,093,797 | 105,825 | 46,125 | 0 | 64,034 | 476 | 173,842 | 109,484 | 173,517 |
| 4 | 1,245,747 | 1,047,647 | 141,025 | 57,075 | 0 | 83,730 | 635 | 231,790 | 145,978 | 229,708 |
| 5 | 1,245,747 | 1,026,847 | 158,625 | 60,275 | 0 | 92,747 | 794 | 289,737 | 182,473 | 275,220 |
| 6 | 1,245,747 | 966,372 | 214,450 | 64,925 | 0 | 119,342 | 953 | 347,684 | 218,968 | 338,310 |
| 7 | 1,245,747 | 907,172 | 256,950 | 81,625 | 0 | 144,393 | 1,111 | 405,632 | 255,462 | 399,855 |
| 8 | 1,245,747 | 835,072 | 298,950 | 92,725 | 19,000 | 171,622 | 1,270 | 463,579 | 291,957 | 463,579 |
| 9 | 1,245,747 | 776,672 | 317,500 | 132,575 | 19,000 | 194,441 | 1,355 | 494,484 | 303,006 | 497,447 |
| 10 | 1,245,747 | 769,972 | 318,900 | 137,875 | 19,000 | 197,000 | 1,439 | 525,390 | 314,055 | 511,055 |
| 11 | 1,245,747 | 708,797 | 378,500 | 139,450 | 19,000 | 224,156 | 1,524 | 556,295 | 325,104 | 549,260 |
| 12 | 1,245,747 | 626,447 | 395,975 | 204,325 | 19,000 | 255,629 | 1,609 | 587,200 | 336,153 | 591,782 |
| 13 | 1,245,747 | 589,572 | 418,382 | 218,792 | 19,000 | 270,904 | 1,693 | 618,106 | 347,202 | 618,106 |
| 14 | 1,245,747 | 550,872 | 427,161 | 248,714 | 19,000 | 285,740 | 1,670 | 609,433 | 322,356 | 608,097 |
| 15 | 1,245,747 | 514,122 | 445,796 | 266,829 | 19,000 | 300,664 | 1,646 | 600,761 | 297,511 | 598,174 |
| 16 | 1,245,747 | 476,072 | 459,375 | 291,300 | 19,000 | 315,652 | 1,622 | 592,088 | 272,665 | 588,317 |
| 17 | 1,245,747 | 426,072 | 480,300 | 320,375 | 19,000 | 335,597 | 1,598 | 583,416 | 247,819 | 583,416 |
| 18 | 1,245,747 | 369,297 | 509,800 | 347,650 | 19,000 | 358,709 | 1,704 | 621,890 | 267,965 | 626,674 |
| 19 | 1,245,747 | 323,772 | 536,660 | 366,315 | 19,000 | 377,501 | 1,809 | 660,364 | 288,110 | 665,612 |
| 20 | 1,245,747 | 276,697 | 573,262 | 376,788 | 19,000 | 397,648 | 1,915 | 698,838 | 308,256 | 705,904 |
| 21 | 1,245,747 | 248,497 | 606,117 | 372,133 | 19,000 | 410,603 | 2,020 | 737,312 | 328,402 | 739,004 |
| 22 | 1,245,747 | 208,397 | 630,800 | 387,550 | 19,000 | 427,239 | 2,125 | 775,786 | 348,547 | 775,786 |
| 23 | 1,245,747 | 170,597 | 654,100 | 402,050 | 19,000 | 442,923 | 2,972 | 1,084,838 | 640,062 | 1,082,985 |
| 24 | 1,245,747 | 94,447 | 705,313 | 426,987 | 19,000 | 474,866 | 3,819 | 1,393,891 | 931,577 | 1,406,443 |
| 25 | 1,245,747 | 74,147 | 718,620 | 433,980 | 19,000 | 483,353 | 4,666 | 1,702,944 | 1,223,092 | 1,706,445 |
| 26 | 1,245,747 | 41,622 | 745,352 | 439,773 | 19,000 | 497,390 | 5,512 | 2,011,997 | 1,514,607 | 2,011,997 |
| 27 | 1,245,747 | 3,722 | 775,925 | 447,100 | 19,000 | 513,700 | 5,000 | 1,824,883 | 1,324,110 | 1,837,810 |
| 28 | 1,245,747 | 0 | 799,950 | 426,797 | 19,000 | 517,005 | 4,487 | 1,637,770 | 1,133,613 | 1,650,617 |
| 29 | 1,245,747 | 0 | 811,650 | 415,097 | 19,000 | 517,952 | 3,974 | 1,450,656 | 943,116 | 1,461,068 |
| 30 | 1,245,747 | 0 | 808,419 | 418,328 | 19,000 | 517,691 | 3,462 | 1,263,542 | 752,619 | 1,270,309 |
| 31 | 1,245,747 | 0 | 808,419 | 418,328 | 19,000 | 517,691 | 2,949 | 1,076,429 | 562,122 | 1,079,812 |
| 32 | 1,245,747 | 0 | 808,419 | 418,328 | 19,000 | 517,691 | 2,436 | 889,315 | 371,625 | 889,315 |
| 33 | 1,245,747 | 0 | 808,419 | 418,328 | 19,000 | 517,691 | 2,455 | 896,148 | 378,384 | 896,075 |
| 34 | 1,245,747 | 0 | 808,419 | 418,328 | 19,000 | 517,691 | 2,474 | 902,981 | 385,144 | 902,835 |
| 35 | 1,245,747 | 0 | 808,419 | 418,328 | 19,000 | 517,691 | 2,493 | 909,814 | 391,904 | 909,595 |
| 36 | 1,245,747 | 0 | 808,419 | 418,328 | 19,000 | 517,691 | 2,511 | 916,646 | 398,664 | 916,355 |
| 37 | 1,245,747 | 0 | 813,819 | 412,928 | 19,000 | 518,128 | 2,530 | 923,479 | 405,424 | 923,552 |
| 38 | 1,245,747 | 0 | 813,819 | 412,928 | 19,000 | 518,128 | 2,549 | 930,312 | 412,184 | 930,312 |

## Table 1
## Water Generation Estimate - CBM Caledon Pit / Quarry

| Year | North Quarry - Scenario 1 - No Flooding Immediately Post-Rehab | | | | | | HGS Inflow Prediction | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total area | Veg area | Rock area | Till area | Pond area | Site Surplus | Total Model Inflow | Total Model Inflow | GW Seepage (by HGS) | Annual Water Generated |
| | m/yr | 342 | 446 | 365 | 234 | | | | | |
| | m2 | m2 | m2 | m2 | m2 | m3 | m3/d | m3/yr | m3/yr | m3 |
| 0 | 149,350 | 149,350 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 2 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 3 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 4 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 5 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 6 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 7 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 8 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | 0 | 0 | 0 | 3,835 |
| 9 | 149,350 | 77,950 | 50,025 | 12,475 | 8,900 | 28,947 | 52 | 18,922 | 7,413 | 36,360 |
| 10 | 149,350 | 0 | 92,056 | 48,394 | 8,900 | 60,803 | 104 | 37,843 | 14,826 | 75,630 |
| 11 | 149,350 | 0 | 56,369 | 84,081 | 8,900 | 57,913 | 156 | 56,765 | 22,239 | 80,152 |
| 12 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 207 | 75,686 | 29,652 | 87,195 |
| 13 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 259 | 94,608 | 37,065 | 94,608 |
| 14 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 261 | 95,396 | 37,854 | 95,396 |
| 15 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 264 | 96,185 | 38,642 | 96,185 |
| 16 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 266 | 96,973 | 39,431 | 96,973 |
| 17 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 18 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 19 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 20 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 21 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 22 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 23 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 24 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 25 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 26 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 268 | 97,762 | 40,219 | 97,762 |
| 27 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 267 | 97,446 | 39,904 | 97,446 |
| 28 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 266 | 97,131 | 39,588 | 97,131 |
| 29 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 265 | 96,816 | 39,273 | 96,816 |
| 30 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 264 | 96,500 | 38,958 | 96,500 |
| 31 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 264 | 96,185 | 38,642 | 96,185 |
| 32 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 263 | 95,869 | 38,327 | 95,869 |
| 33 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 255 | 93,031 | 35,489 | 93,031 |
| 34 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 247 | 90,193 | 32,650 | 90,193 |
| 35 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 239 | 87,355 | 29,812 | 87,355 |
| 36 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 232 | 84,516 | 26,974 | 84,516 |
| 37 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 224 | 81,678 | 24,136 | 81,678 |
| 38 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 216 | 78,840 | 21,297 | 78,840 |

# Table 1
## Water Generation Estimate - CBM Caledon Pit / Quarry

| Year | North Quarry - Scenario 2 - Flooding Immediately Post-Rehab | | | | | | HGS Inflow Prediction | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total area | Veg area | Rock area | Till area | Pond area | Site Surplus | Total Model Inflow | Total Model Inflow | GW Seepage (by HGS) | Annual Water Generated |
| | **m/yr** | **342** | **446** | **365** | **234** | | | | | |
| | m2 | m2 | m2 | m2 | m2 | m3 | m3/d | m3/yr | m3/yr | m3 |
| 0 | 149,350 | 149,350 | 0 | 0 | 0 | 0 | | | | |
| 1 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 2 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 3 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 4 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 5 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 6 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 7 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | | | | |
| 8 | 149,350 | 135,650 | 0 | 4,800 | 8,900 | 3,835 | 0 | 0 | 0 | 3,835 |
| 9 | 149,350 | 77,950 | 50,025 | 12,475 | 8,900 | 28,947 | 52 | 18,922 | 7,413 | 36,360 |
| 10 | 149,350 | 0 | 92,056 | 48,394 | 8,900 | 60,803 | 104 | 37,843 | 14,826 | 75,630 |
| 11 | 149,350 | 0 | 56,369 | 84,081 | 8,900 | 57,913 | 156 | 56,765 | 22,239 | 80,152 |
| 12 | 149,350 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 207 | 75,686 | 29,652 | 87,195 |
| 13 | 131,175 | 0 | 51,800 | 88,650 | 8,900 | 57,543 | 259 | 94,608 | 37,065 | 94,608 |
| 14 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 15 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 16 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 17 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 18 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 19 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 20 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 21 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 22 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 23 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 24 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 25 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 26 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 27 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 28 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 29 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 30 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 31 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 32 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 33 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 34 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 35 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 36 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 37 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |
| 38 | 131,175 | 0 | 0 | 0 | 131,175 | 30,695 | | | | 30,695 |

# Table 1
## Water Generation Estimate - CBM Caledon Pit / Quarry

| Year | South Quarry | | | | | | HGS Inflow Prediction | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total area | Veg area | Open Rock area | Till / Rehab area | Pond area | Site Surplus | Total Model Inflow | Total Model Inflow | GW Seepage (by HGS) | Annual Water Generated |
| | m/yr | 342 | 446 | 365 | 234 | | | | | |
| | m2 | m2 | m2 | m2 | m2 | m3 | m3/d | m3/yr | m3/yr | m3 |
| 0 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 1 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 2 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 3 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 4 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 5 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 6 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 7 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 8 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 9 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 10 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 11 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 12 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 13 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 14 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 15 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 16 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 17 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 18 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 19 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 20 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 21 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 22 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 23 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 24 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 25 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | | | | |
| 26 | 581,534 | 581,534 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 581,534 | 517,109 | 43,075 | 21,350 | 0 | 27,004 | 114 | 41,733 | 19,090 | 46,095 |
| 28 | 581,534 | 461,384 | 89,525 | 30,625 | 0 | 51,106 | 229 | 83,465 | 38,181 | 89,287 |
| 29 | 581,534 | 437,809 | 97,775 | 45,950 | 0 | 60,379 | 343 | 125,198 | 57,271 | 117,651 |
| 30 | 581,534 | 376,734 | 130,380 | 69,670 | 4,750 | 84,691 | 457 | 166,931 | 76,362 | 161,052 |
| 31 | 581,534 | 314,784 | 166,025 | 95,975 | 4,750 | 110,190 | 572 | 208,663 | 95,452 | 205,642 |
| 32 | 581,534 | 259,984 | 235,925 | 80,875 | 4,750 | 135,853 | 686 | 250,396 | 114,542 | 250,396 |
| 33 | 581,534 | 196,759 | 274,792 | 105,233 | 4,750 | 162,079 | 831 | 303,271 | 147,680 | 309,759 |
| 34 | 581,534 | 110,609 | 364,850 | 101,325 | 4,750 | 200,818 | 976 | 356,147 | 180,818 | 381,636 |
| 35 | 581,534 | 33,584 | 449,400 | 93,800 | 4,750 | 235,781 | 1,121 | 409,022 | 213,956 | 449,737 |
| 36 | 581,534 | 0 | 524,944 | 51,840 | 4,750 | 254,158 | 1,265 | 461,897 | 247,094 | 501,252 |
| 37 | 581,534 | 0 | 526,550 | 50,234 | 4,750 | 254,288 | 1,410 | 514,773 | 280,231 | 534,520 |
| 38 | 581,534 | 0 | 526,435 | 50,349 | 4,750 | 254,279 | 1,555 | 567,648 | 313,369 | 567,648 |

# Table 2
## Water Consumption and Discharge Scenarios - CBM Caledon Pit / Quarry

| Year | Scenario 1 | Water Consumed | | Water Stored | | | | | Water Infiltrated by Trench | | | | | | | Water Discharged / Infiltrated | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Annual Water Generated | Agg Prod-uction | Water for Agg Washing | Main Sump Storage | Wash Plant Storage | North Sump Storage | North Quarry Allowed to Fill | South Sump Storage | Trench Zone 1 | Trench Zone 2 | Trench Zone 3 | Trench Zone 4 | Trench Zone 5 | Trench Zone 6 | Total Infiltration Trench Zones 1-6 | Total Water to Manage | Off Site Water Discharge to OVGC | Water Transferred to Trench Zones 1-2 | Water Transferred to Trench Zones 3-6 |
| | | | 0.05 | | | | | | | | | | | | | | | | |
| | m3 | T | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | | m3 | m3 | m3 | m3 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 | 0 |
| 1 | 84,251 | 250,000 | 12,500 | 1,000 | 20,000 | 40,000 | 0 | 0 | | | | | | | 0 | 10,751 | 10,751 | 0 | 0 |
| 2 | 120,746 | 500,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 95,746 | 95,746 | 0 | 0 |
| 3 | 173,517 | 750,000 | 37,500 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 136,017 | 136,017 | 0 | 0 |
| 4 | 229,708 | 1,000,000 | 50,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 179,708 | 179,708 | 0 | 0 |
| 5 | 275,220 | 1,500,000 | 75,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 200,220 | 200,220 | 0 | 0 |
| 6 | 338,310 | 2,000,000 | 100,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 238,310 | 238,310 | 0 | 0 |
| 7 | 399,855 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 274,855 | 274,855 | 0 | 0 |
| 8 | 467,414 | 2,500,000 | 125,000 | 0 | 150,000 | 0 | 0 | 0 | | | | | | | 0 | 192,414 | 192,414 | 0 | 0 |
| 9 | 533,807 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 408,807 | 408,807 | 0 | 0 |
| 10 | 586,684 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 461,684 | 461,684 | 0 | 0 |
| 11 | 629,412 | 2,500,000 | 125,000 | 0 | 0 | 1,000 | 0 | 0 | | | | | | | 0 | 503,412 | 503,412 | 0 | 0 |
| 12 | 678,977 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 553,977 | 553,977 | 0 | 0 |
| 13 | 712,714 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 587,714 | 587,714 | 0 | 0 |
| 14 | 703,493 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 578,493 | 578,493 | 0 | 0 |
| 15 | 694,359 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 569,359 | 569,359 | 0 | 0 |
| 16 | 685,290 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 560,290 | 560,290 | 0 | 0 |
| 17 | 681,178 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 556,178 | 556,178 | 0 | 0 |
| 18 | 724,436 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 76,948 | 8,830 | | | | | 85,778 | 599,436 | 513,658 | 85,778 | 0 |
| 19 | 763,373 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 153,896 | 17,660 | | | | | 171,556 | 638,373 | 466,818 | 171,556 | 0 |
| 20 | 803,666 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 230,844 | 26,490 | | | | | 257,334 | 678,666 | 421,332 | 257,334 | 0 |
| 21 | 836,766 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 307,791 | 35,320 | | | | | 343,112 | 711,766 | 368,654 | 343,112 | 0 |
| 22 | 873,547 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 384,739 | 44,150 | | | | | 428,890 | 748,547 | 319,658 | 428,890 | 0 |
| 23 | 1,180,746 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 506,153 | 222,329 | | | | | 728,482 | 1,055,746 | 327,265 | 728,482 | 0 |
| 24 | 1,504,204 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 627,566 | 400,507 | | | | | 1,028,074 | 1,379,204 | 351,131 | 1,028,074 | 0 |
| 25 | 1,804,207 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 748,980 | 578,686 | | | | | 1,327,666 | 1,679,207 | 351,541 | 1,327,666 | 0 |
| 26 | 2,109,758 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 870,394 | 756,864 | 0 | 0 | 0 | 0 | 1,627,258 | 1,984,758 | 357,501 | 1,627,258 | 0 |
| 27 | 1,981,351 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 1,000 | 782,093 | 632,822 | 27,331 | 14,717 | 22,075 | 15,242 | 1,494,281 | 1,855,351 | 361,070 | 1,414,915 | 79,366 |
| 28 | 1,837,035 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 693,792 | 508,781 | 54,662 | 29,434 | 44,150 | 30,485 | 1,361,304 | 1,712,035 | 350,731 | 1,202,573 | 158,731 |
| 29 | 1,675,534 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 605,491 | 384,739 | 81,994 | 44,150 | 66,226 | 45,727 | 1,228,327 | 1,550,534 | 322,207 | 990,230 | 238,097 |
| 30 | 1,527,862 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 20,000 | 517,190 | 260,698 | 109,325 | 58,867 | 88,301 | 60,970 | 1,095,350 | 1,382,862 | 287,511 | 777,888 | 317,462 |
| 31 | 1,381,639 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 428,890 | 136,656 | 136,656 | 73,584 | 110,376 | 76,212 | 962,374 | 1,256,639 | 294,265 | 565,546 | 396,828 |
| 32 | 1,235,580 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 340,589 | 12,614 | 163,987 | 88,301 | 132,451 | 91,454 | 829,397 | 1,110,580 | 281,184 | 353,203 | 476,194 |
| 33 | 1,298,865 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 342,166 | 14,191 | 177,653 | 102,492 | 142,438 | 103,543 | 882,482 | 1,173,865 | 291,383 | 356,357 | 526,126 |
| 34 | 1,374,664 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 343,742 | 15,768 | 191,318 | 116,683 | 152,424 | 115,632 | 935,568 | 1,249,664 | 314,096 | 359,510 | 576,058 |
| 35 | 1,446,686 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 345,319 | 17,345 | 204,984 | 130,874 | 162,410 | 127,721 | 988,654 | 1,321,686 | 333,033 | 362,664 | 625,990 |
| 36 | 1,502,123 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 346,896 | 18,922 | 218,650 | 145,066 | 172,397 | 139,810 | 1,041,739 | 1,377,123 | 335,384 | 365,818 | 675,922 |
| 37 | 1,539,750 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 348,473 | 20,498 | 232,315 | 159,257 | 182,383 | 151,898 | 1,094,825 | 1,414,750 | 319,925 | 368,971 | 725,854 |
| 38 | 1,576,800 | 500,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | 350,050 | 22,075 | 245,981 | 173,448 | 192,370 | 163,987 | 1,147,910 | 1,551,800 | 403,890 | 372,125 | 775,786 |

| | | |
|---|---|---|
| Max annual discharge to the Golf Course Irrigation Ponds: | 587,714 | m3 |
| Avg discharge flow rate to the Golf Course Irrigation Ponds (max year): | 18.6 | L/s |
| Average annual discharge to the Golf Course Irrigation Ponds: | 345,645 | m3 |
| Avg discharge flow rate to the Golf Course Irrigation Ponds: | 11.0 | L/s |

## Table 2

## Water Consumption and Discharge Scenarios - CBM Caledon Pit / Quarry

| Year | Scenario 2 | Water Consumed | | Water Stored | | | | | Water Infiltrated by Trench | | | | | | | Water Discharged / Infiltrated | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Annual Water Generated | Agg Prod-uction | Water for Agg Washing | Main Sump Storage | Wash Plant Storage | North Sump Storage | North Quarry Allowed to Fill | South Sump Storage | Trench Zone 1 | Trench Zone 2 | Trench Zone 3 | Trench Zone 4 | Trench Zone 5 | Trench Zone 6 | Total Infiltration Trench Zones 1-6 | Total Water to Manage | Off Site Water Discharge to OVGC | Water Transferred to Trench Zones 1-2 | Water Transferred to Trench Zones 3-6 |
| | | | 0.05 | | | | | | | | | | | | | | | | |
| | m3 | T | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | m3 | | m3 | m3 | m3 | m3 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 | 0 |
| 1 | 84,251 | 250,000 | 12,500 | 1,000 | 20,000 | 40,000 | 0 | 0 | | | | | | | 0 | 10,751 | 10,751 | 0 | 0 |
| 2 | 120,746 | 500,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 95,746 | 95,746 | 0 | 0 |
| 3 | 173,517 | 750,000 | 37,500 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 136,017 | 136,017 | 0 | 0 |
| 4 | 229,708 | 1,000,000 | 50,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 179,708 | 179,708 | 0 | 0 |
| 5 | 275,220 | 1,500,000 | 75,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 200,220 | 200,220 | 0 | 0 |
| 6 | 338,310 | 2,000,000 | 100,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 238,310 | 238,310 | 0 | 0 |
| 7 | 399,855 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 274,855 | 274,855 | 0 | 0 |
| 8 | 467,414 | 2,500,000 | 125,000 | 0 | 150,000 | 0 | 0 | 0 | | | | | | | 0 | 192,414 | 192,414 | 0 | 0 |
| 9 | 533,807 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 408,807 | 408,807 | 0 | 0 |
| 10 | 586,684 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 461,684 | 461,684 | 0 | 0 |
| 11 | 629,412 | 2,500,000 | 125,000 | 0 | 0 | 1,000 | 0 | 0 | | | | | | | 0 | 503,412 | 503,412 | 0 | 0 |
| 12 | 678,977 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 553,977 | 553,977 | 0 | 0 |
| 13 | 712,714 | 2,500,000 | 125,000 | 0 | 0 | 0 | 376,000 | 0 | | | | | | | 0 | 211,714 | 211,714 | 0 | 0 |
| 14 | 638,791 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 513,791 | 513,791 | 0 | 0 |
| 15 | 628,869 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 503,869 | 503,869 | 0 | 0 |
| 16 | 619,012 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | | | | | | | 0 | 494,012 | 494,012 | 0 | 0 |
| 17 | 614,111 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 489,111 | 489,111 | 0 | 0 |
| 18 | 657,369 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 76,948 | 8,830 | | | | | 85,778 | 532,369 | 446,591 | 85,778 | 0 |
| 19 | 696,307 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 153,896 | 17,660 | | | | | 171,556 | 571,307 | 399,751 | 171,556 | 0 |
| 20 | 736,599 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 230,844 | 26,490 | | | | | 257,334 | 611,599 | 354,266 | 257,334 | 0 |
| 21 | 769,699 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 307,791 | 35,320 | | | | | 343,112 | 644,699 | 301,588 | 343,112 | 0 |
| 22 | 806,481 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 384,739 | 44,150 | | | | | 428,890 | 681,481 | 252,591 | 428,890 | 0 |
| 23 | 1,113,680 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 506,153 | 222,329 | | | | | 728,482 | 988,680 | 260,198 | 728,482 | 0 |
| 24 | 1,437,138 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 627,566 | 400,507 | | | | | 1,028,074 | 1,312,138 | 284,064 | 1,028,074 | 0 |
| 25 | 1,737,140 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 748,980 | 578,686 | | | | | 1,327,666 | 1,612,140 | 284,474 | 1,327,666 | 0 |
| 26 | 2,042,692 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 870,394 | 756,864 | 0 | 0 | 0 | 0 | 1,627,258 | 1,917,692 | 290,434 | 1,627,258 | 0 |
| 27 | 1,914,599 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 1,000 | 782,093 | 632,822 | 27,331 | 14,717 | 22,075 | 15,242 | 1,494,281 | 1,788,599 | 294,318 | 1,414,915 | 79,366 |
| 28 | 1,770,599 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 693,792 | 508,781 | 54,662 | 29,434 | 44,150 | 30,485 | 1,361,304 | 1,645,599 | 284,295 | 1,202,573 | 158,731 |
| 29 | 1,609,413 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 605,491 | 384,739 | 81,994 | 44,150 | 66,226 | 45,727 | 1,228,327 | 1,484,413 | 256,086 | 990,230 | 238,097 |
| 30 | 1,462,056 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 20,000 | 517,190 | 260,698 | 109,325 | 58,867 | 88,301 | 60,970 | 1,095,350 | 1,317,056 | 221,706 | 777,888 | 317,462 |
| 31 | 1,316,149 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 428,890 | 136,656 | 136,656 | 73,584 | 110,376 | 76,212 | 962,374 | 1,191,149 | 228,775 | 565,546 | 396,828 |
| 32 | 1,170,406 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 340,589 | 12,614 | 163,987 | 88,301 | 132,451 | 91,454 | 829,397 | 1,045,406 | 216,009 | 353,203 | 476,194 |
| 33 | 1,236,529 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 342,166 | 14,191 | 177,653 | 102,492 | 142,438 | 103,543 | 882,482 | 1,111,529 | 229,047 | 356,357 | 526,126 |
| 34 | 1,315,166 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 343,742 | 15,768 | 191,318 | 116,683 | 152,424 | 115,632 | 935,568 | 1,190,166 | 254,598 | 359,510 | 576,058 |
| 35 | 1,390,027 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 345,319 | 17,345 | 204,984 | 130,874 | 162,410 | 127,721 | 988,654 | 1,265,027 | 276,373 | 362,664 | 625,990 |
| 36 | 1,448,301 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 346,896 | 18,922 | 218,650 | 145,066 | 172,397 | 139,810 | 1,041,739 | 1,323,301 | 281,562 | 365,818 | 675,922 |
| 37 | 1,488,767 | 2,500,000 | 125,000 | 0 | 0 | 0 | 0 | 0 | 348,473 | 20,498 | 232,315 | 159,257 | 182,383 | 151,898 | 1,094,825 | 1,363,767 | 268,942 | 368,971 | 725,854 |
| 38 | 1,528,655 | 500,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | 350,050 | 22,075 | 245,981 | 173,448 | 192,370 | 163,987 | 1,147,910 | 1,503,655 | 355,745 | 372,125 | 775,786 |

| | | |
|---|---|---|
| Max annual discharge to the Golf Course Irrigation Ponds: | 553,977 | m3 |
| Avg discharge flow rate to the Golf Course Irrigation Ponds (max year): | 17.6 | L/s |
| Average annual discharge to the Golf Course Irrigation Ponds: | 295,123 | m3 |
| Avg discharge flow rate to the Golf Course Irrigation Ponds: | 9.4 | L/s |

The water balance calculation presented in this section differs from the site-wide surface water balance presented in Section 7 of the Water Report in the following notable ways.

- The site-wide surface water balance in the Water Report follows the Thornthwaite water balance accounting model.
- The water balance presented in this section includes additional water balance elements in comparison to the site-wide surface water balance, namely, quarry inflows due to dewatering, water used in aggregate washing operations and water used in the proposed groundwater mitigation system.
- The site-wide surface water balance presented in the Water Report was calculated for the final year of each operational phase and post-rehabilitation, whereas water balance was calculated for each year of operation.

## Water Management Milestones - Caledon Pit / Quarry

Key water management milestones during pit / quarry operations are summarized in the table below.

**Table 3: Water Management Milestones**

| Year | Milestone / Operational Note |
|---|---|
| 1 | Establish Main Area sump with 1,000 $m^3$ storage in low point.<br>Establish 0.5 Ha temporary wash pond with 20,000 $m^3$ storage.<br>Establish 0.89 Ha settling pond in North Area with 40,000 $m^3$ storage. |
| 8 | Establish permanent 1.9 Ha wash ponds in the Main Area with 150,000 $m^3$ storage. May decommission temporary wash pond. |
| 10 | Establish North Area sump with 1,000 $m^3$ storage in low point. |
| 13 | North Area extraction complete. Assume CBM will continue to dewater it, but CBM could possibly use it for additional water storage capacity, if needed. There is in excess of 300,000 $m^3$ of additional water storage capacity in the North Area. |
| 17 | **Initiate discharge to groundwater infiltration Trench Zones 1 and 2 in the Main Area.**<br>Additional water storage to operate the infiltration trench system, if needed, could be accommodated in the Main Area or the North Area (preferred). Storage of this water is not formally accounted, but there is sufficient water generated to supply the mitigation system. |
| 26 | Establish South Area sump with 1,000 $m^3$ storage in low point.<br>Establish 0.47 Ha sump in South Area with 20,000 $m^3$ storage.<br>**Initiate discharge to groundwater infiltration Trench Zones 3 to 6 in the South Area.** |
| 38 | Last year of scheduled dewatering / water discharge. Discharge of water will cease once the Site has been rehabilitated and the excavated and rehabbed areas are allowed to naturally flood. |

## QUARRY SUMP(S)

Figure 3 below shows elevation contours for the base of the Gasport Formation, which is the lower limit of extraction and approximately represents the pit / quarry floor surface. As extraction proceeds, it is assumed that at any given time the pit / quarry sump(s) will be located proximal to the low point of the excavation floor.

## TRANSFER OF WATER BETWEEN QUARRY PARCELS

During operational phases, it will be necessary to transfer excess pit / quarry water from the South and Main Areas to the North Area, in order to store and convey excess quarry water to the golf course irrigation system at the proposed point of discharge. This will require pumping, and piping would need to be constructed to cross the roadways, either by cut and fill, or directional drilling.

**Figure 3: Elevation of the Base of the Gasport Formation (masl)**

## QUARRY WATER DISCHARGE AND FLOWS

With reference to Table 2, discharges of surplus water to the Osprey Valley Golf Course irrigation system are anticipated to begin during Operational Year 1 with an annual discharge of approximately 10,000 m$^3$ that year. The rate of discharge is expected to increase annually to a maximum of approximately 587,000 m$^3$ / year in operational Year 13 and then stabilize and decline in future years. The highest annual average water discharge (Year 13) is expected to be approximately 18.6 L/s. Operational Scenario 2 (North Quarry allowed to fill in Year 13) has lower discharges and flows than Scenario 1 (North Quarry remains dry until rehab), owing to the additional water loss due to evaporation in the flooded North Quarry.

It should be noted that additional HGS water model simulations indicated the groundwater mitigation system could be used to re-infiltrate additional groundwater, in the range of 200,000 to 400,000 m$^3$ / year, without adversely affecting groundwater levels. As such there is an option to re-infiltrate additional groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of the natural heritage features to the southwest.

Because no water will be discharged from the proposed pit / quarry directly to the Credit River, there are no significant changes expected to flow or thermal characteristics of the Credit River.

## FINAL POND WATER LEVELS

Upon rehabilitation, the maximum water level in the Main Pond will be controlled by an outflow to the North Pond at an approximate elevation of 400 masl, and the maximum water level in the North Pond will be controlled by an outflow to the Osprey Valley Golf Course irrigation system at an approximate elevation of 399 masl. The simulated post-rehabilitation water level in the South Pond is predicted to be 393.5 masl and will be internally contained, with no outflow. Post-rehabilitation the simulated steady state outflow from the combined Main and North Ponds to the golf course irrigation system is estimated to be approximately 10 L/s.

**Table 4: Final Pond Capacities and Water Levels Post-Rehabilitation**

| Parameter | Units | Main | South | North (Scenario 1) |
|---|---|---|---|---|
| Base of Gasport (range) | masl | 381 - 392.5 | 383.5 - 390.5 | 394 - 395 |
| Base of Gasport (average) | masl | 386 | 386 | 394.5 |
| Pit Shell Area | m2 | 1,245,747 | 581,534 | 149,350 |
| Current High Water Table (range) | masl | 406 - 420 | 392 - 405 | 398 - 406 |
| **Final Pond Water Level** | **masl** | **400** | **393.5** | **399** |
| Pond Capacity Post-Rehab | m3 | 13,599,000 | 3,055,000 | 376,000 |
| Average post-rehab inflow rate (50% of initial post-rehab inflow rate) | m3/yr | 465,156 | 283,824 | 39,420 |
| Time required to fill ponds (average inflow rate) | yr | 29.2 | 10.8 | 9.5 |

Notes
1. Main Pond overflow would be directed via a culvert to the North Pond - invert at ~400 masl.
2. North Pond overflow would be directed via main outlet to the Osprey Valley Golf Course Irrigation System - invert at ~399 masl.
3. South Pond does not have an outlet.

With reference to Table 4, it is anticipated that it will require approximately 29.2, 10.8 and 9.5 years for the ponds in the Main, North and South Areas to reach their final water levels, assuming that 50% of the steady state inflow rate for the final operational year is maintained, on average, as the ponds fill post-rehabilitation.

## SUMMARY

In summary, we note the following key points with respect to water management at the proposed Caledon Pit / Quarry:

- The Operational Plan for the pit / quarry plans for the construction of a 40,000 $m^3$ settling pond / holding pond for managing discharge water in the North Area during Year 1, in order provide “immediate” water storage capacity.
- Based on water inflow predictions and mitigation water needs from numerical simulations during operations, enough water will be generated during Years 17 to 38 of operation to supply the water needed for the proposed groundwater mitigation system.
- Additional water storage to operate the groundwater mitigation system, if needed, could be accommodated in the Main Area or the North Area (preferred). If needed, the North Area could be used to store additional water, as there is in excess of 300,000 $m^3$ of capacity in that area once extraction has been completed at the end of Operational Year 14.
- The maximum annual average rate of discharge throughout pit / quarry operations is approximately 587,000 $m^3$ / year in Operational Year 13. The peak average annual water discharge rate (in Year 13) is expected to be approximately 18.6 L/s.
- There is an option to re-infiltrate an additional 200,000 to 400,000 $m^3$ / year of groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of the natural heritage features to the southwest.
- Because no water will be discharged from the proposed pit / quarry directly to the Credit River, there are no significant changes expected to flow or thermal characteristics of the Credit River.

## CLOSURE

We trust that this Technical Memorandum meets your current needs. If you have any questions or require clarification, please contact WSP at your earliest convenience.

**WSP Canada Inc.**

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Attachments: None

https://wsponline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/45 mitigation system design 2025/05a updated water management plan/19129150 caledon wmp update may2025 r3.docx wsp.com