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HYDROGEOLOGICAL ASSESSMENT & MAXIMUM PREDICTED GROUNDWATER REPORT

JEDBURGH PLAINS
1830 WRIGLEY ROAD, AYR
REGIONAL MUNICIPALITY OF WATERLOO

PROJECT NO. SC-02093

JULY 7, 2025

Submitted to:

J-AAR MATERIALS LIMITED

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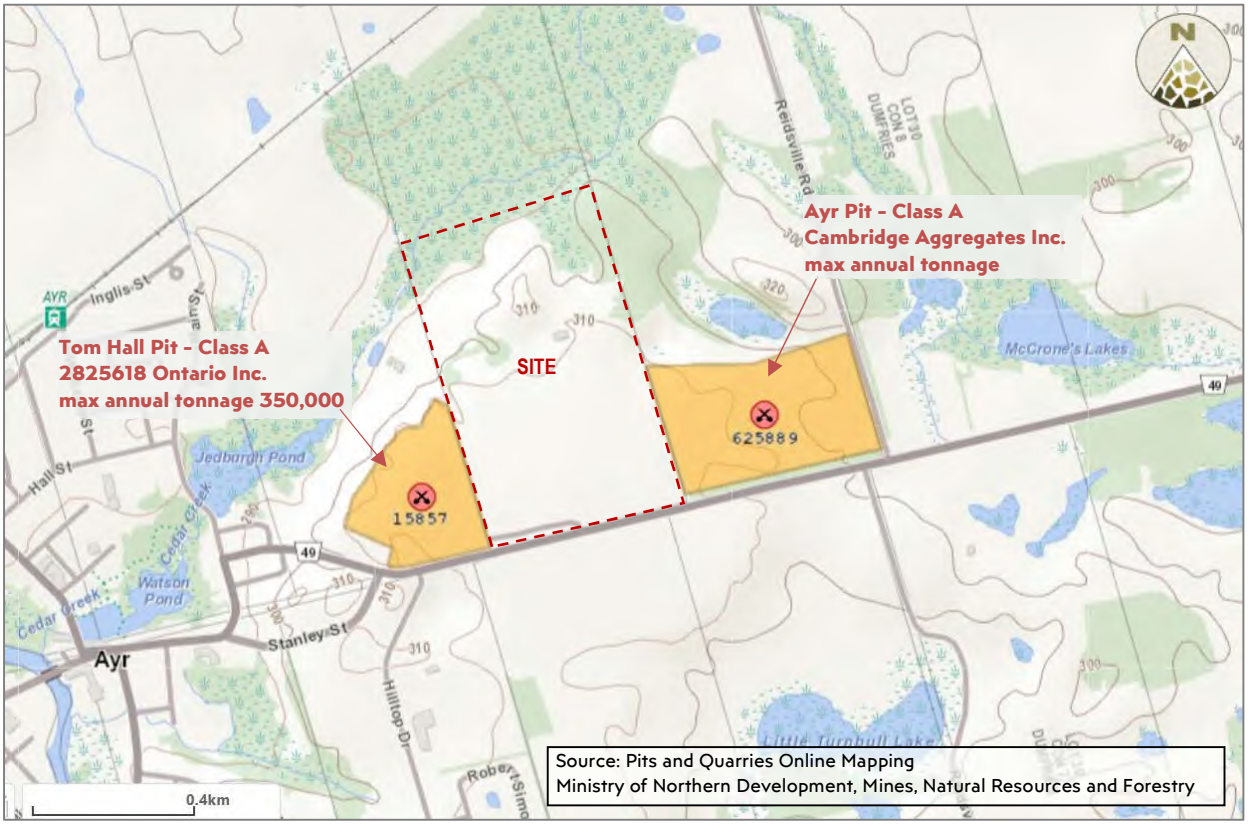
1. INTRODUCTION

Stonecairn Consulting Inc. (Stonecairn) has been retained by J-AAR Materials Ltd. to conduct a Hydrogeological Assessment for a proposed aggregate pit, located along Wrigley Road (Regional Road 49), east of the community of Ayr, in the Township of North Dumfries, in the Regional Municipality of Waterloo. The legal description of the property is as follows: Part Lot 32, Concession 8, Geographic Township of North Dumfries, Regional Municipality of Waterloo. A Key Plan showing the site location is provided on Figure 1, below.

Figure 1: Key Plan



The subject lands are approximately 38 hectares in size, and an aggregate extraction operation is proposed for a portion of the property. The properties immediately to the east and west contain existing gravel pit operations (identified as the Ayr Pit and Tom Hall Pit) which immediately border the subject property and both operate under Class A License, as noted in Figure 1.

Preparation of this report relies on information collected by LDS Consultants Inc. [LDS], which closed in September 2024. This report was prepared by the supervising engineer who oversaw the original hydrogeological assessment work at LDS, and provides updated information to satisfy current requirements.

1.1 Terms of Reference

The scope of work for the Hydrogeological Assessment was authorized on January 26, 2024 on behalf of J-AAR Materials Ltd. This Report has been prepared for the purposes of examining hydrogeological characteristics of the site. Based on the hydrogeological conditions, groundwater use in the area, the amount of collected field data, and subsequent interpretation. According to the Ontario Provincial Standards, this report includes the requirements for Class A license for a pit which intends to extract aggregate material from above the stabilized groundwater table.

The Level 1 Hydrogeological Assessment included in this report provides a preliminary evaluation to determine the final extraction depth relative to the established groundwater table(s) and the potential for adverse effects to groundwater and surface water resources and their uses. As such, the following information has been incorporated into this report:

- Summary of borehole and shallow groundwater information based on drilling program and monitoring wells which have been installed at the site – monitoring commenced in May 2023, and continued on a monthly basis at the site;
- Characteristics of the shallow groundwater conditions, including stabilized water level, flow direction, gradient;
- Information compiled from a review of available publications and geological mapping for the area, including adjacent land uses, site topography, surface drainage and site features;
- Information compiled from a review of MECP Well Records, and supplemental data collected for the area through a well survey delivered to nearby properties;
- Discussion on potential adverse impacts which could result from the proposed gravel pit operation.

This report also expands on the discussion of potential adverse impacts, with discussion of mitigation measures and contingency measures to address potential concerns with contamination which could occur as a result of typical operations and aggregate extraction activities. Baseline groundwater chemistry has been documented with analytical testing on water samples collected from onsite monitoring wells.

This report is provided on the basis of the terms noted above, and is expected to form part of a submission to the Ministry of Natural Resources and Forestry (MNRF) to comply with the requirements of the Aggregate Resources Act.

The format and content of this report has been guided to address specific client needs. Stonecairn has provided engineering guidelines for the geotechnical design and construction at the site. Laboratory testing, where applicable, follows ASTM or CSA Standards. The information in this report in no way reflects on the environmental aspects of the soil.

2. SITE PHYSICAL FEATURES

2.1 Site Location and Description

The subject property is located along the north side of Wrigley Road (Regional Road 49), east of the community of Ayr, in The Region of Waterloo. The northeast end of the property is occupied by a residential dwelling, which fronts onto Regional Road 49 (and addressed as Wrigley Road, Ayr). The property is rectangular in shape, and occupies a total area of approximately 38 hectares.

A review of aerial photographs dating from 2006 to 2023 indicates site has remained with a residence and farm buildings fronting onto Wrigley Road (Regional Road 49), and cultivated fields occupying the remaining area. Since 2023, the residence and buildings have been demolished, with only partial foundations remaining. The site includes an established woodlot along the northeast and northwest portions of the site, and extending beyond the property limits (associated with Cedar Creek). There are existing aggregate operations immediately adjacent: Ayr Pit, and Tom Hall Pit (to the east and west respectively). Refer to Drawing 2, below. The proposed extraction limits are expected to be within the south and central part of the site.

Figure 2: Existing Operations

2.2 Topography and Surface Drainage

The overall topographic fall across the property is relatively flat in the south end, and steepened through the north end, with a topographic relief of approximately 25 m from north to south, ranging from elevation 290 to 315 m above sea level (ASL). This is consistent with the Topographic Mapping for the area (which is provided on Drawing 1, in Appendix A). The proposed aggregate extraction area is located across the southerly extent of the property, to a proposed elevation of 294.0m ASL.

It is noted that there are no obvious surficial flow paths or channels for stormwater runoff leaving the site, indicating that where surface water ponding occurs, that it generally sheet flows from the site, or is infiltrated into the shallow subgrade soils.

2.3 Natural Heritage Features

Cedar Creek is located along the north edge of the property boundary, and conveys flows to the west. The bulk of the property is occupied by arable, agricultural land which is cultivated in row crops. Agricultural activities generally extend close to the channel bank of the Cedar Creek. The edge of the agricultural lands is bordered by a wooded area.

In the north half of the property, there is a mixed meadow area located along the topographic relief zone separating a small section of agriculture lands in the north from the bulk in the south. A farm path connects the two fields along the easterly limit of the property.

The wooded area is described as having a mix of poplar, maple and willow trees. The lands to the north are occupied with woodlot which extends across the Cedar Creek valley slope, and into the floodplain area along the base of the slope. A small wooded area extends from the lands to the east, beyond the east limits of the proposed extraction area.

2.4 Adjacent Land Use

The general area is characterized by agricultural lands, which are generally maintained in row crops. Rural residential properties are located in the area, fronting onto Wrigley Road. Immediately east of the property, a portion of the adjacent property is occupied by the Ayr Pit, an existing aggregate extraction operation, which operates under a Class A license, allowing above water aggregate extraction. Immediately west of the property, a portion of the adjacent property is occupied by the Tom Hall Pit, an existing aggregate extraction operation, which operates under a Class A license, allowing above water aggregate extraction. The Tom Hall Pit is accessed via a temporary road allowance along the southern border of the subject property which fronts onto Wrigley Road. It is anticipated that the existing entrance from Wrigley Road in the southeast corner of the site will be utilized as the primary access for the proposed operation on the subject property.

2.5 Extraction Plan

Primary site access is expected to be from Wrigley Road (Regional Road 49), at the southeast corner of the site. The existing access on the south side which is currently utilized by the Tom Hall Pit on the lands to the west, may serve as a secondary access. It is understood that the applicant is considering a Class A above-water aggregate license for the property. The proposed aggregate extraction area is expected to be located across the southerly extent of the property, to a proposed elevation of 294.0m ASL.

Existing topsoil and overburden soils are expected to be stockpiled onsite, with the expectation that this material will be used in the site restoration works. It is anticipated that the aggregate extraction operation will maintain a minimum 15 m setback from the property limits (except where a 0 m setback is proposed adjacent to the existing operations, and supported with a common boundary agreement), and a 30 m setback from Cedar Creek watercourse along the north side of the property. It is understood that this setback is measured from the bank-full width. No disturbance or site alteration associated with pit operations (e.g., storage berms, acoustic berms) is should be within the 30 m setback from Cedar Creek.

The above water aggregate extraction is expected to utilize conventional construction equipment, including loaders, excavators, backhoes, bulldozers, and conveyors. Portable processing equipment will be utilized at the site, and the location will be shifted to accommodate the aggregate extraction operation. It is understood that existing vegetation within the licensed area will be maintained until sequential stripping begins or until the rehabilitation is completed.

3. STUDY METHODOLOGY

3.1 Document & Publication Review

3.1.1 Review of Geologic Mapping

Physiography & Quaternary Geology

In Southwestern Ontario, the last continental scale glaciation was during the Wisconsinan Time. The glaciers extended south of Southwestern Ontario. When the glaciers began to retreat during the Late Wisconsinan, this resulted in the deposition of material contained in the glaciers. Lakes, rivers, and spillways created by the meltwater from the retreating glaciers deposited massive amounts of glacial debris and shaped the landscape of Southwestern Ontario.

Physiographic mapping for Southwestern Ontario (Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release-Data 228), identifies that the site is located within the physiographic region known as the Horseshoe Moraines. More specifically, the site is set within the northern limit of a till moraine, bordering a glacial spillway along the north, associated with the Cedar Creek valley lands. Soil conditions are expected to be comprised of clay, silt, sand, and gravel soils, as well as silt till.

Quaternary geology mapping for the Cambridge area (Quaternary Geology, Ontario Geological Survey Map P2604, Cambridge Area, Scale 1:50,000, 1983) indicates that the study area consists of outwash deposits comprised of predominantly gravel. An excerpt from the aforementioned mapping is provided on Drawing 3, in Appendix A.

Bedrock Geology

Bedrock geology mapping for Southwestern Ontario (Ontario Geological Survey. 1:250 000 scale, Bedrock Geology of Ontario. Ontario Geological Survey, Miscellaneous Release Data 126, Revised 2006) indicates that bedrock in the general area consists of limestone, dolostone, and shale with sandstone, gypsum and salt inclusions from the Salina formation, from the Late Silurian Period. Geological publications describe the limestone as grey – brown medium to thickly bedded limestone and; dolostone, containing fossils, bituminous partings and microstylolites.

Bedrock was not encountered during the fieldwork for this investigation, but is expected to be at approximately Elevation 221 m (~69-94 m depth), based on the following Bedrock Topography mapping: Bedrock Topography Series, Cambridge area, southern Ontario, Ontario Geological Survey, Preliminary Map P1985, scale 1:50,000, published 1979. This is documented on Drawing 3, in Appendix A.

3.1.2 Source Water Protection

Where proposed developments are being planned, it is important to determine the presence of Significant Groundwater Recharge Areas and High Vulnerability Aquifers in the area. These areas are protected under the Clean Water Act (2006). In general, Significant Groundwater Recharge Areas are defined as areas where water seeps into an aquifer from rain and melting snow, supplying water to the underlying aquifer. A highly vulnerable aquifer occurs where the subsurface material offers limited protection from contamination resulting from surface activities.

The Grand River Source Protection Plan (approved September 2024) presents the framework for assessing lands within the Kitchener-Waterloo, Guelph, Cambridge and surrounding areas. The Source Protection Plan also presents the assessment work which has been done by the Grand River Source Protection Committee. A more detailed discussion is provided below. Mapping from the MECP Source Water Protection online database (current to October 8, 2024) is included on Drawing 4.

Significant Groundwater Recharge Areas (SGRA)

Groundwater recharge is largely controlled by soil conditions, and typically occurs in upland areas. As discussed previously, regional groundwater flow directions identified in the Grand River Information Network for overburden and bedrock aquifers are typically indicated to be in a southerly or south-easterly direction.

As defined in the Clean Water Act (2006), an area is a significant groundwater recharge area if, the area annually recharges water to the underlying aquifer at a rate that is greater than the rate of recharge across the whole of the related groundwater recharge area by a factor of 1.15 or more; or, the area annually recharges a volume of water to the underlying aquifer that is 55% or more of the volume determined by subtracting the annual evapotranspiration for the whole of the related groundwater recharge area from the annual precipitation for the whole of the related groundwater recharge area.

The Property is located within a Significant Groundwater Recharge Area with no rating/score.

High Vulnerability Aquifers (HVA)

The susceptibility of an aquifer to contamination is a function of the susceptibility of its recharge area to the infiltration of contaminants. In the Grand River region, HVA's were mapped using the Intrinsic susceptibility index (ISI) method, which is an indexing approach using existing provincial Water Well Information System (WWIS) database. The Grand River Source Protection Committee has determined, that the Site is not located within a Highly Vulnerable Aquifer. In general terms, a highly vulnerable aquifer occurs where the subsurface material offers limited protection from contamination resulting from surface activities. The susceptibility of an aquifer to contamination is a function of the

susceptibility of its recharge area to the infiltration of contaminants. The pink overlay in Drawing 4 shows the subject property being outside the identified Highly Vulnerable Aquifer zone.

Wellhead Protection Area (WHPA)

The Grand River Source Protection Plan outlines that Wellhead Protection Areas (WHPA's) are defined as the vulnerable areas around groundwater sources that have been delineated using three-dimensional groundwater flow models. The WHPA for each well field (or well) is based on an estimate of the groundwater travel time to the well, with defined zones extending out to a period of 25-years for groundwater travel to the well. The subject lands are located within two separate WHPA zones:

- WHPA-C (with a score of 4) in the west third; and,
- WHPA-D (with a score of 2) in the east two-thirds.

It is noted that the Township of North Dumfries Official Plan also includes mapping which shows the approximate limits of Wellhead Protection Sensitivity Areas, which fall within a scale of WPSA1 through to WPSA8. This classification allows for varying degrees of management relative to the vulnerability of the underlying groundwater to contamination, the importance of the well to the capacity of the municipal drinking-water supply systems, and the length of time groundwater within the area will take to reach the municipal drinking-water supply well. Based on this mapping, the site falls within a Wellhead Protection Sensitivity Area WPSA6.

The proposed aggregate extraction is not considered a threat to drinking water (quality or quantity) since the extraction activities are not expected to require active dewatering or groundwater pumping, and best management practices for equipment fuelling and maintenance are expected to be implemented under the terms and conditions of the license. This report includes further additional discussion (Section 6) regarding the potential impacts to water quality as a result of aggregate extraction and processing activities at the site, and provides recommended to help reduce potential impacts, and mitigation measures which can be implemented at the site, if required.

Summary Comments

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

3.1.3 Review of GRCA Regulation Limits

In April 2024, Ontario Regulation 41/24 came into effect in the Grand River Conservation Authority (GRCA) watershed area, which implements the Generic Regulation (Development, Interference with Wetlands and Alterations to Shoreline and Watercourses). This regulation is intended to ensure public safety, prevent property damage and social disruption due to natural hazards such as flooding and erosion; and is implemented by the local Conservation Authority, through the Section 28 Permit process.

GRCA Regulated lands extend along the boundaries of Cedar Creek, and mixed meadow lands located along the topographic relief. Property owners must obtain permission from GRCA before beginning any development, site alteration, construction, or placement of fill within the regulated area. Proposed development within the study area will be subject to the above referenced Regulation. The proposed aggregate extraction operation within the study area is expected to be subject to the above referenced Regulation within the north and northeast part of the site. Consultation with the local Conservation Authority for review of site-specific development plans is recommended in this regard.

Based on best practice, it is recommended that the Conservation Authority be consulted on the sediment and erosion control requirements while active gravel extraction and site rehabilitation activities are occurring, stormwater management, and flood controls.

3.1.4 MECP Well Record Review

A review of local well records available through the Ministry of Environment, Conservation, and Parks (MECP) for this area was carried out to review the water levels recorded in the nearby wells. Drawings C1 and C2 in Appendix C shows the location of the wells (with corresponding Well Registration No.) which are in close proximity to the site.

The following table summarizes the water supply wells which are located within 500 m of the site. Appendix C expands on this information, and identifies observation wells, test holes and well abandonment records included in the MECP well records which are in proximity to the site.

The water supply wells noted in the records are generally set in intermediate (>15m) and deep (>30m) overburden deposits of sand and gravel. Static water levels in these water supply wells are generally reported at depths ranging from 13 to 19 m. Pump rates indicate strong yield capacities in the deep overburden aquifer. The well abandonment records which are documented in the well records indicate that some of the water supply wells have been decommissioned, following access to municipal water supply which is now available in the area.

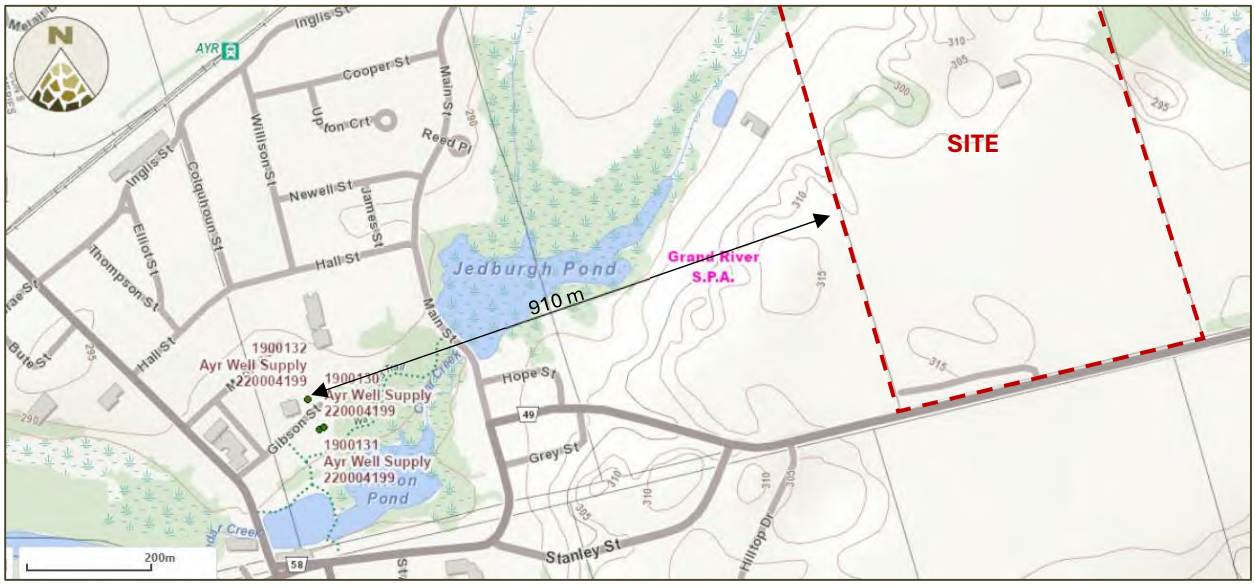
The remaining well records are recorded as observation wells or test holes, as shown in Appendix C, and are primarily set in the shallow to intermediate overburden aquifers.

Table 1: MECP Water Supply Wells

MECP Well ID	Registration Year	Well Type	Depth of Well (m)	Depth Water Found (m)	Static Water Level (m)	Pump Rate (L/min)
6500401	1958-04-18	Domestic	24.4	21.3	17.7	*NR*
6500404	1962-08-10	Livestock	26.5	26.5	15.8	41.6
6500405	1961-10-18	Livestock	32.0	28.0	18.6	45.4
6500406	1963-09-20	Domestic	46.0	41.1	18.3	37.9
6503024	1969-03-10	Domestic	24.4	21.3	19.8	15.1
6503572	1972-02-29	Domestic	58.2	44.2	19.8	*NR*
6503680	1972-10-19	Domestic	33.5	33.5	13.7	18.9
6504605	1976-11-25	Domestic	29.6	29.6	14.3	30.3
6506440	1988-10-25	Domestic	8.5	8.5	3.4	75.7
6506567	1988-09-20	Domestic	13.7	13.4	10.1	18.9
NR: Not recorded						

Although not included within the 500 m boundary reviewed by Stonecairn, it is noted that there are three municipal water supply wells (located ~910 m west of the site, proximal to Cedar Creek) which are set in the shallow to intermediate overburden aquifer, as shown in Figure 3, below. Static water levels in these water supply wells are generally reported at depths ranging from 3.4 to 10.1 m.

Figure 3: Municipal Water Supply Wells



A well survey was not conducted for the area, since the water supply wells for the residential and agricultural properties near by are all set into the deep overburden aquifer. The proposed aggregate extraction activities are not expected to adversely impact water supply with this aquifer, since the aquifer is set well below the proposed extraction depth, and active construction dewatering is not proposed as part of the aggregate extraction methodology.

3.2 Field Program

A field program consisting of a series of boreholes was carried out by others (MTE), drilled on April 26, 2023. The boreholes were advanced at the site by a local drilling-contractor, using a track-mounted drill-rig. Four boreholes (denoted as MW101-23 through MW104-23) were advanced to depths ranging from 11.1 m (36.5 feet) to 28 m (92 feet) below existing grade. Stonecairn oversaw the drilling of three additional boreholes – denoted as BH201, BH202 and BH203 in June 2025, to obtain some supplemental groundwater information at the site.

Ground surface elevations at the borehole locations were surveyed using a Trimble R12 GPS rover. The location of the boreholes is summarized below, and illustrated on Drawing 5, in Appendix A.

Table 2: Borehole Locations

Location	Northing, m N	Easting, m E	Ground Surface Elevation (m ASL)
MW101-23	4793646.39	545470.02	289.69
MW102-23	4793369.45	545527.01	308.26
MW103-23	4793489.86	545666.98	302.05
MW104-23	4793010.21	545783.02	313.95
BH201	4793114.38	546025.64	312.83
BH202	4793599.62	545742.27	298.59
BH203	4793216.82	545487.92	312.71

Monitoring wells were installed in each of the boreholes to allow for monitoring the stabilized groundwater level at the site. Wells are comprised of a 50 mm diameter CPVC pipe, with a slotted and filtered screen. Details of monitoring well construction are provided on the attached borehole logs. The screens on each well are mill-slotted, with a slot spacing of 0.5 mm, and were backfilled with Type 2 Silica Sand. Above the screened depth, the annular space was backfilled with a bentonite slurry, up to ground surface. The wells have been equipped with lockable caps. The monitoring wells have been registered with the Ministry of Environment, Conservation, and Parks (MECP), in accordance with Ontario Regulation (O.Reg.) 903. Table 2 (below) summarizes the well construction details.

Table 3: Well Construction Details

Borehole	Ground Surface Elevation, m ASL	Well Installation Depth, m BGS	Screened Length, m	Screened Strata
MW101-23	289.69	10.6	1.52	Gravelly Sand
MW102-23	308.26	23.0	3.05	Sand
MW103-23	302.05	15.6	1.52	Sand
MW104-23	313.95	27.8	1.52	Sand
BH202	298.59	10.7	3.05	Sand
BH203	312.71	10.7	3.05	Sand

3.3 Laboratory Testing

3.3.1 Geotechnical Lab Testing

All samples recovered from the site were returned to MTE for detailed examination and selective testing. Select samples were collected from the boreholes for further review and laboratory testing. Four grain size analyses were carried out on select samples of the predominant subgrade soils (sand, and sand and gravel soils), where shallow groundwater conditions were identified. Routine moisture content determinations were also carried out on select samples from each borehole.

3.3.2 Analytical Water Quality Testing

One surface water and two groundwater samples were collected at the site on October 3, 2023. The sampled monitoring wells at MW101-23 and MW104-23 were developed 24 hours in advance of the testing, including the removal of the equivalent of three water-columns of water. The water samples were collected using designated bailer tubes.

The laboratory was contacted in advance to order sufficient soil and groundwater pre-cleaned (and pre-preserved, where applicable) sample containers for the desired analyses, pre-labelled with the project number and project location. All water samples collected at the site were secured and transported to Paracel Laboratories in designated lab-supplies containers, and stored in a chilled cooler for transport. The water samples were submitted for general chemistry analyses, which included pH, inorganics and dissolved metals, as well as calculated parameters for anion and cation summaries, hardness and total dissolved solids.

The Certificate of Analysis provided by the laboratory is provided in Appendix D.

4. BOREHOLE FINDINGS

4.1 Soil Conditions

A series of four boreholes were advanced at the site to examine soil and shallow groundwater conditions. The borehole locations are shown on Drawing 5, appended. In general, soils observed in the boreholes consisted of topsoil/fill overlying silt, sand and gravel, and sand soils. General descriptions of subsurface conditions are summarized in the following sections. Borehole logs are provided in Appendix B, for reference.

It should be noted that boundaries of soil indicated in the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change.

Topsoil and Fill

Each borehole was surfaced with a layer of topsoil. The topsoil described as black and silty with thicknesses ranging from 120 to 400 mm across the site. The topsoil was in a moist state at the time of the fieldwork, based on visual and tactile examination. Some mixed soil was observed in the underlying subgrade soils, likely as a result of the cultivation of the field. It should be noted that topsoil quantities noted above are based on information provided at the borehole locations only, and may vary in areas with existing vegetation and tree cover. If required, a more detailed analysis (involving additional shallow test pits) is recommended to accurately quantify the amount of topsoil to be removed for construction purposes.

A layer of fill was encountered underlying the topsoil within boreholes MW103-23 and MW104-23, and extended to 1.6 to 1.9 m below ground surface. The fill was described as greyish black in colour, and the composition of the fill generally consisted of sandy silt mixed with organics. The fill is described as being in a loose state, based on a Standard Penetration Test (SPT) N-value of 12 blows per 0.3 m of split-spoon sampler penetration. The fill was described as being in a damp state at the time of the fieldwork.

Sand and Gravel

Underlying the topsoil and fill, each borehole encountered sand and gravel deposits extending to exploration depths at each location. The primary component of these deposits was sand with highly variable gravel content. The sand and gravel deposits were described as brown in colour, with a medium to coarse grained texture containing trace silt.

Four samples of the sand and gravel were submitted for gradation analyses, and the following table shows the grain size distribution. It is noted that the split-spoon sampling method doesn't allow for sampling of cobble-sized stone (> 75 mm diameter), therefore the presence of cobbles may be anticipated, even though it is not included in the gradation summary noted below. The results are also shown graphically in Appendix B.

Table 4: Gradation Summary, Sand and Gravel

Sample ID	Depth (m bgs)	Unified Soil Classification			
		% Fines (Silt & Clay)	% Sand	% Gravel	% Cobbles
MW101-23, SS-5	10.7-11.1	4.0	70.0	26.0	0.0
MW102-23, SS-12	21.3-21.8	11.0	89.0	0.0	0.0
MW103-23, SS-8	13.7-14.2	25.0	73.0	2.0	0.0
MW104-23, SS-14	24.4-24.8	7.0	91.0	2.0	0.0

The sand and gravel is in a variable compact to dense state, based on SPT N-values in the range of 14 to 52 blows per 0.3 m of split-spoon sampler penetration. Moisture content determinations conducted on recovered samples of the sand and gravel generally range between 3 to 24 percent, generally indicative of damp conditions above the stabilized groundwater table, and saturated conditions below the groundwater table

4.2 Soil Permeability

The hydraulic conductivity of a soil depends on a number of factors, including particle size distribution, degree of saturation, compactness, adsorbed water (which depends on clay content). The heterogeneous nature of glacial deposits can also contribute to variations in soil permeability where the soil composition may include localized areas with increased fine material or sandy material which can influence soil permeability at different points within the soil strata.

The soil permeability of select sand samples was assessed by correlation of hydraulic conductivity and factored infiltration rates based on the results of gradation analyses on collected samples.

Based on the gradation results presented in Section 4.1, the following values for saturated hydraulic conductivity have been calculated. Hazen's method was used to correlate the grain size analysis to the hydraulic conductivity of the sand soils. This correlation is based on the following relationship:

$\mathbf{k\ (cm/s) = C(d_{10})^2}$ where, d_{10} is the diameter (size measured in mm) at which 10% passes; and,
C is an empirical coefficient (average value of 1.0).

Table 6: Hydraulic Conductivity & Factored Infiltration Rates

Sample ID	Sample Composition			Parameter		
	% Silt	% Sand	% Gravel	D_{10} (mm)	Saturated Hydraulic Conductivity (m/sec)	Factored Infiltration Rate (mm/hr)
Sand and Gravel						
MW101-23, SS-5	4.0	70.0	26.0	0.160	$2.56x10^{-4}$	100
MW102-23, SS-12	11.0	89.0	0.0	0.075	$5.63\ x10^{-5}$	67
MW103-23, SS-8	25.0	73.0	2.0	0.080	$6.40\ x10^{-5}$	70
MW104-23, SS-14	7.0	91.0	2.0	0.013	$1.69\ x10^{-6}$	27

The natural water-bearing sand, and sand and gravel soils have a saturated hydraulic conductivity in the range of 10^{-4} to 10^{-6} m/s, based on the above results. The above infiltration rates have been calculated using correlation from TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guide protocol which references the 2024 Ontario Building Code - Supplementary Guidelines, SG-6: Percolation Time and Soil Descriptions. A Factor of Safety of 2.0 has been applied to determine the factored infiltration rate.

4.3 Cross Sections

Two geologic cross sections have been created for the site, with the cross-section locations shown on Drawing 6, and the cross sections presented on Drawings 7A and 7B, in Appendix A. Results of the onsite drilling indicates that a surficial topsoil layer covers much of the Site, which in turn is underlain by discontinuous deposits of silt, sand and/or sand and gravel.

5. HYDROGEOLOGICAL SETTING

5.1 Regional Setting

Within the broad, regional setting, three aquifers have been identified, and are characterized below:

- Shallow to intermediate unconfined overburden aquifer, typically contained within surficial deposits of outwash sand and gravel soils, generally encountered at relatively shallow depth; and,
- Bedrock aquifer contained within the shale or limestone bedrock.

For the purposes of this study, the focus is on the shallow unconfined aquifer, contacted in the boreholes and monitoring wells installed at the site. This shallow aquifer is not identified as being a high vulnerability aquifer.

The regional predominant groundwater flow direction within the shallow aquifer is generally expected to follow the surface topography, with water flow towards the Cedar Creek, located to the northwest of the site.

In general, source water for the shallow overburden aquifer is relatively local, being precipitation falling within the local subcatchment area. Local topography defines the general subcatchment area for the unconfined shallow aquifer.

5.2 Shallow Groundwater Conditions

The wells installed into the MTE boreholes were advanced using 6-inch (152.4 mm) outer diameter hollow stem augers. The monitoring wells were constructed with 2-inch (50.8 mm) diameter CPVC pipe. The screens on each well are mill-slotted, with a slot spacing of 0.5 mm, and were backfilled with Type 2 Silica Sand. Above the screened depth, the annular space was backfilled with a Bentonite slurry, up to ground surface.

Manual water level readings were collected from the monitoring wells to document the stabilized groundwater levels, on a regular basis for the period from May 2023, through to July 2024. Seasonal measurements have been recorded through the fall and winter of 2024 up to current. Water level measurements are summarized in the Table 7, with the seasonal fluctuations summarized in Table 8.

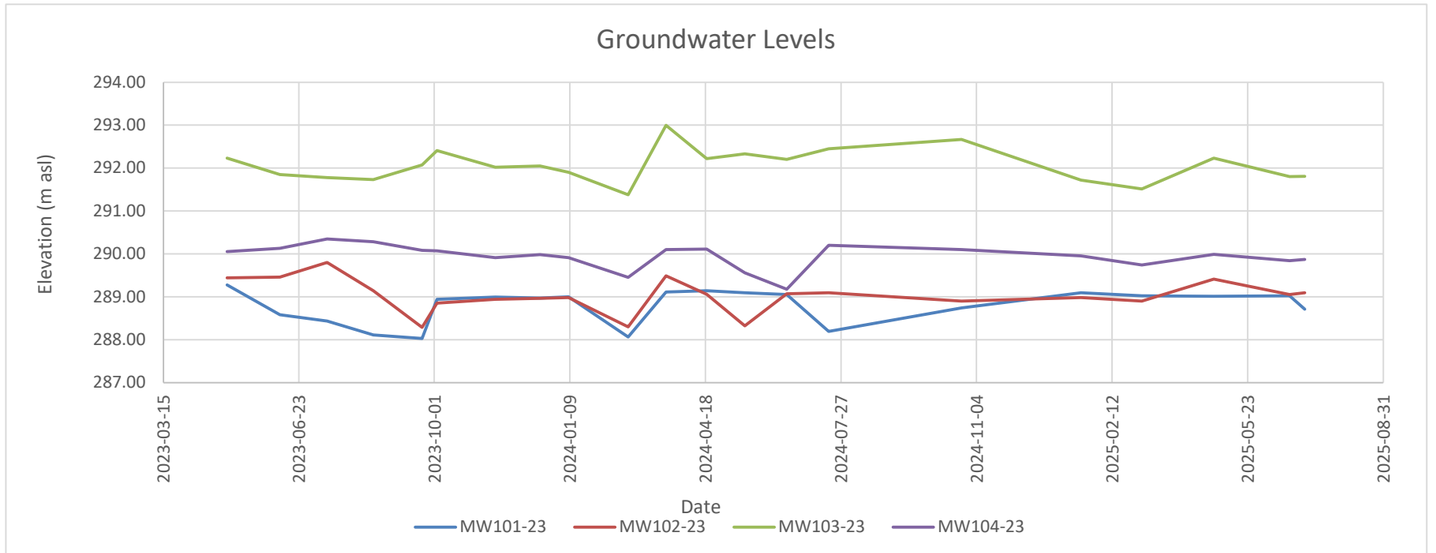
Table 7: Stabilized Groundwater Measurements

Location	Ground Surface Elevation (m, asl)	Depth to Groundwater (m, bgs) / *Groundwater Elevation (m, asl)*																			
		01-May-2023	09-Jun-2023	14-Jul-2023	17-Aug-2023	22-Sep-2023	03-Oct-2023	15-Nov-2023	18-Dec-2023	08-Jan-2024	21-Feb-2024	20-Mar-2024	19-Apr-2024	17-May-2024	17-Jun-2024	18-Jul-2024	24-Oct-2024	20-Jan-2025	06-Mar 2025	28-Apr-2025	23-Jun-2025	04-July-2025
MW101-23	289.69	0.41	1.11	1.26	1.58	1.66	0.75	0.70	0.72	0.69	1.63	0.58	0.55	0.60	0.64	1.50	0.95	0.60	0.67	0.68	0.67	0.98
		289.28	*288.58*	*288.43*	*288.11*	*288.03*	*288.94*	*288.99*	*288.97*	*289.00*	*288.06*	*289.11*	*289.14*	*289.09*	*289.05*	*288.19*	*288.74*	*289.09*	*289.02*	*289.01*	*289.02*	*288.71*
MW102-23	308.26	18.82	18.80	18.46	19.12	19.97	19.41	19.32	19.30	19.28	19.96	18.77	19.2	19.94	19.19	19.17	19.36	19.28	19.36	18.85	19.21	19.17
		289.44	*289.46*	*289.80*	*289.14*	*288.29*	*288.85*	*288.94*	*288.96*	*288.98*	*288.30*	*289.49*	*289.06*	*288.32*	*289.07*	*289.09*	*288.90*	*288.98*	*288.90*	*289.41*	*289.05*	*289.09*
MW103-23	302.05	9.82	10.20	10.27	10.32	*N/R*	9.64	10.03	10.00	10.15	10.67	9.05	9.83	9.72	9.85	9.60	9.83	10.33	10.54	9.82	10.25	10.24
		292.23	*291.85*	*291.78*	*291.73*	--	*292.41*	*292.02*	*292.05*	*291.90*	*291.38*	*293.00*	*292.22*	*292.33*	*292.20*	*292.45*	*292.67*	*291.72*	*291.51*	*292.23*	*291.80*	*291.81*
MW104-23	313.95	23.90	23.82	23.60	23.67	23.87	23.88	24.04	23.97	24.04	24.50	23.85	23.84	24.39	24.77	23.75	23.85	24.00	24.21	23.96	24.11	24.08
		290.05	*290.13*	*290.35*	*290.28*	*290.08*	*290.07*	*289.91*	*289.98*	*289.91*	*289.45*	*290.10*	*290.11*	*289.56*	*289.18*	*290.20*	*290.10*	*289.95*	*289.74*	*289.99*	*289.84*	*289.87*
BH202	298.59																				*8.86*	*8.99*
																					289.73	*289.60*
BH203	312.71																				*Dry to 10.7 m*	*Dry to 10.7 m*
																					Below 302.01	*Below 302.01*

Table 8: Seasonal Fluctuations in Stabilized Water Levels

Location	Ground Surface Elevation (m, asl)	Depth to Groundwater (m, bgs) *Groundwater Elevation (m, asl)*		Total Fluctuation (m)
		High Water Levels	Low Water Levels	
MW101-23	289.69	0.41	1.66	1.25
		289.28	*288.03*	
MW102-23	308.26	15.77	19.97	4.20
		292.49	*288.85*	
MW103-23	302.05	9.05	10.54	1.62
		293.00	*291.51*	
MW104-23	313.95	23.60	24.77	1.17
		290.35	*289.18*	

Figure 4: Groundwater Levels (May 2023 – July 2025)



As demonstrated by the manual groundwater level measurements recorded at the site, the shallow groundwater varies in response to climatic and/or seasonal conditions. High water levels were typically recorded in the spring of 2023 and 2024, and the low water levels were generally noted in September 2023.

Within the limits of the area to be licensed, the data from Boreholes MW102-23, MW103-23, and MW104-23 for the monitoring periods between May 2023 through to July 2025 indicates a typical a seasonal range in water levels between 288.85 (lowest reading) to 293.00 (highest reading).

5.3 Groundwater Flow Direction and Hydraulic Gradients

The groundwater flow direction interpreted from the water level measurements collected onsite indicates groundwater flows in a north-westerly / westerly direction, towards the Cedar Creek. This is demonstrated on the Groundwater Contour Plans provided on Drawings 8, 9 and 10 in Appendix A, which shows the groundwater contours and general flow direction, based on the manual groundwater measurements recorded at the site in the Fall 2023, Spring 2024 and Summer 2025, respectively. Monitoring wells have been maintained for the purpose of collecting seasonal groundwater measurements.

The relatively small change in groundwater elevation in the north half of the Site is attributed to the proximity of the Cedar Creek to the north, and the relatively high permeability of sand/sand and gravel deposits. Sand and gravel deposits are highly transmissive and therefore do not support high hydraulic gradients, as noted in the table below, which identifies the gradients identified in the proposed licensed area.

Table 9: Hydraulic Gradient

Seasonal Condition	Gradient, m/m		
	Maximum	Minimum	Average
Fall Conditions – Sept 2023	0.023	0.005	0.012
Spring Conditions – March 2024	0.027	0.001	0.010
Spring Conditions – April 2025	0.028	0.001	0.010

Groundwater flow generally follows site topography, and generally corresponds with the presence of wet sand soils observed within the boreholes advanced at the site.

It is noted that the water levels recorded in MW103-23 may be artificially high, due to the placement of the monitoring well on an elevated part of the site where the former buildings and structures were located (and where partial foundations remain), receiving stormwater run-off from these former built-up areas. As aggregate is removed from the central part of the site, the groundwater mounding effect which is identified in the groundwater contour plans in this area are expected to be lessened, with water levels becoming more aligned with the water levels recorded at MW102-23 and BH202.

5.4 Groundwater and Surface Water Interaction

Shallow groundwater throughout the proposed pit location is contained within the near-surface sand or sand and gravel soils, within an unconfined shallow groundwater aquifer. The shallow groundwater flow direction is in a north-westerly / westerly direction towards the Cedar Creek. Water levels in proximity to the Cedar Creek are directly influenced by changes in the water level in the Creek, as documented during flooding events, and drier summer months. As such, there is a direct connection through the shallow subgrade soils, which connect shallow groundwater conditions, to the surface water within the Cedar Creek.

Similar to the interconnected nature of the shallow groundwater and the Cedar Creek, the surface water which is present within the wetland feature north and northeast of the site is also connected to the shallow groundwater table. During low flow periods, and in the absence of rainfall, the presence of water in the wetland features is sustained with shallow groundwater contributions. This is supplemented with surface water contributions from precipitation, stormwater run-off and snow melt events. Surface water temperatures are more variable and more strongly influenced by seasonal conditions. Compared to surface water contributions, the thermal profile of the shallow groundwater is more consistent.

5.5 Groundwater Quality

Groundwater samples were collected from select monitoring wells at the site on October 3, 2023. The rationale for selecting the sampling locations was that one sample (taken from MW101-23) would be from the north limit of the work area in the floodplain area next to Cedar Creek, and that the second sample (taken from MW104-23) would be taken from the south limit of the work area. One surface water sample was also collected from Cedar Creek at a location due west of borehole MW101-23. The surface water sample location is shown on Drawing 5, in Appendix A.

The sampled monitoring wells were developed 24 hours in advance of the testing, including the removal of the equivalent of three water-columns of water, using a jet pump. Each well was fitted with a dedicated bailer to allow sampling of the well and avoid cross-contamination.

The analytical testing included the following sampling parameters.

- Nutrients: Nitrate, Nitrite, total ammonia;
- Dissolved Metals: Standard Metals Package for General Chemistry;
- General Inorganic Parameters and Calculated Parameters: pH, Total Dissolved Solids, Electrical Conductivity, Hardness, Anion and Cation Sums.

Samples were collected by a technician wearing disposable Nitrile gloves, and samples were placed in laboratory-supplied sample bottles, labelled with a unique sample number, dated, and recorded on the laboratory chain of custody form. Samples were immediately placed in a cooler with ice for delivery

to an accredited laboratory (Paracel Laboratories depot in London, Ontario) under the chain of custody (No. 71660).

A copy of the Certificate of Analysis is provided in Appendix D, and results are summarized in the following table (Table 12 – page 20).

5.6 Groundwater Temperature Profiles

Temperature profiles were recorded in the monitoring wells in February 21 2024. A submersible pressure transducer with a data logger (Onset Hobo U20L unit) was used to record water temperatures at variable depths within each monitoring well. The temperature data points relative to depth in the water column for each location is shown graphically in Figure 3 (refer to page 21). Measurements were typically recorded at 0.5 m depth intervals, and the top of the water columns at the time of the readings is denoted in the upper most reading in each monitoring well.

Shallow groundwater exhibits relatively wide temperature differences, while deeper groundwater has a much narrower range of temperature fluctuations. As the air and ground surface cools off, the colder air temperatures progressively move into the subsurface, resulting in water temperatures in the shallow groundwater being more significantly influenced by the ambient air and ground temperatures near surface since there is less ground cover to act as insulation for the groundwater. At greater depths, this effect is less pronounced.

As the depth to the saturated zone increases, the temperature spread becomes significantly narrower, which is demonstrated particularly well in boreholes MW102-23, MW103-23 and MW104-23.

Throughout the warmer times of the year (April through to October), the warmest groundwater temperatures typically occur in the period from July to October. The thermal variance in the groundwater is less significant through the summer months. As the air temperature and groundwater surface cools off in the fall, the colder temperatures progressively move into the subsurface, resulting in the temperature profile cooling ahead of the winter months. This continues until the spring snowmelt in March or early April, when a large pulse of cold water infiltrates into the ground. As the air and ground begin to warm, a slow- moving warm temperature wave moves into the subsurface and the cycle repeats.

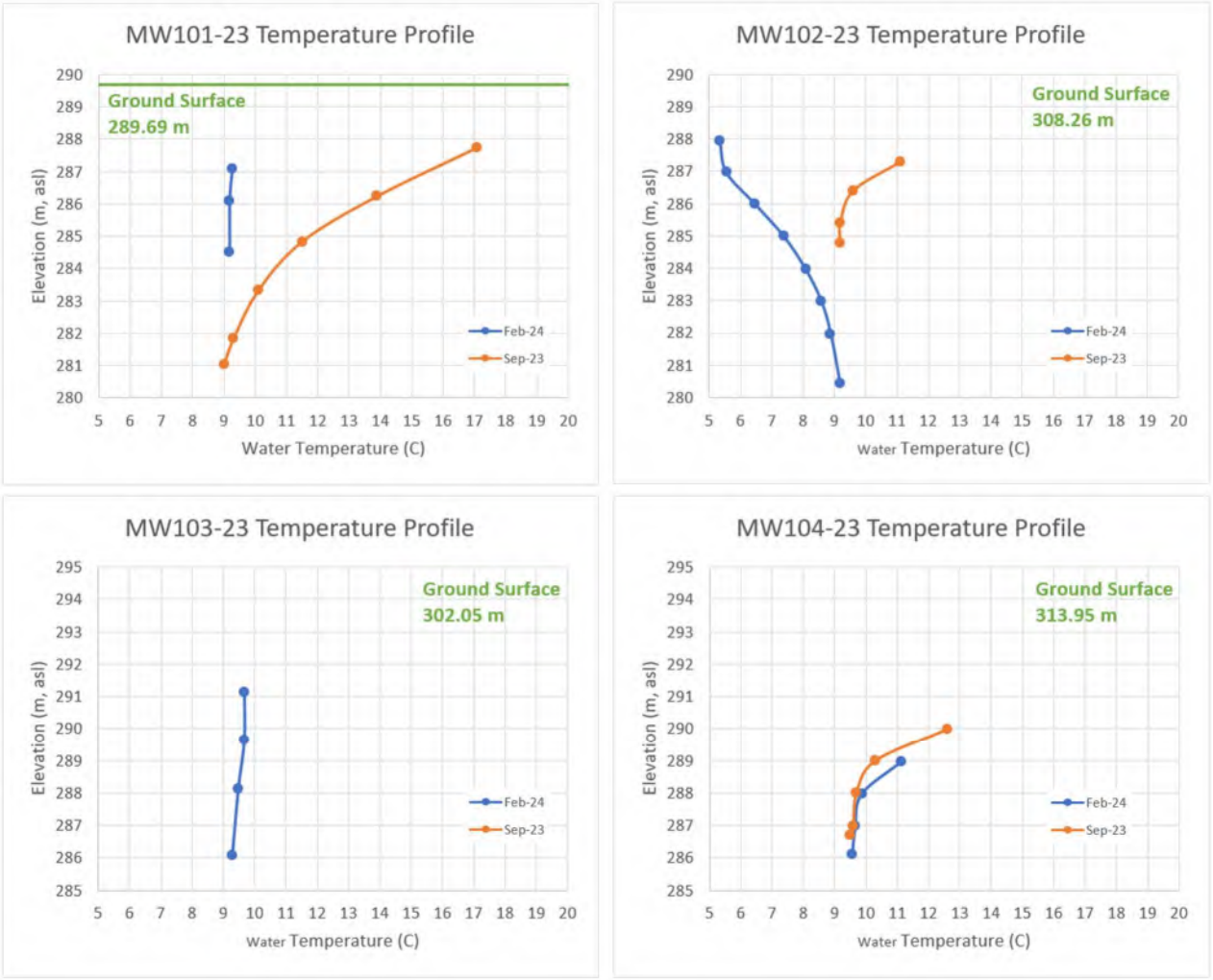
Table 12: Analytical Test Results

PARAMETER	UNITS	Sample		
		MW104	MW101	Surface
Calculated Parameters				
Anion Sum	mEq/L	14.1	3.17	9.14
Cation Sum	mEq/L	13.6	4.08	9.34
Ion Balance	%	-2.02	12.5	1.1
Solids, total dissolved - calc.	mg/L	748	195	481
Langlier Index	S.I.	0.83	-0.28	1.14
Saturation pH	pH Units	7.17	7.78	7.06
General Inorganics				
Alkalinity, total	mg/L	308	112	266
Alkalinity, bicarbonate	mg/L	306	111	262
Alkalinity, carbonate	mg/L	ND (5)	ND (5)	ND (5)
Ammonia as N	mg/L	0.02	0.15	0.02
Dissolved Organic Carbon	mg/L	3.2	37.7	3.5
Colour	TCU	ND (2)	306	12
Conductivity	uS/cm	1430	333	858
Hardness	mg/L	280	116	381
pH	pH Units	8.0	7.5	8.2
Phosphorus, total	mg/L	0.02	0.07	0.02
Phosphorus, total dissolved	mg/L	ND (0.01)	0.03	ND (0.01)
Total Dissolved Solids	mg/L	744	258	496
Total Suspended Solids	mg/L	ND (2)	11	5
Tannin & Lignin	mg/L	ND (0.1)	6.1	0.2
Total Kjeldahl Nitrogen	mg/L	0.3	2.5	0.3
Turbidity	NTU	0.8	8.4	2.1
Anions				
Bromide	mg/L	ND (0.1)	ND (0.1)	ND (0.1)
Chloride	mg/L	255	4	74
Fluoride	mg/L	ND (0.1)	ND (0.1)	ND (0.1)
Nitrate as N	mg/L	4.8	0.2	3.4
Nitrite as N	mg/L	ND (0.05)	ND (0.05)	ND (0.05)
Nitrate + Nitrite as N	mg/L	4.81	0.223	3.44
Phosphate as P	mg/L	0.6	ND (0.5)	ND (0.5)
Sulphate	mg/L	20	38	72

PARAMETER	UNITS	Sample		
		MW104	MW101	Surface
Metals				
Aluminum	ug/L	48	138	12
Antimony	ug/L	ND (0.5)	0.6	ND (0.5)
Arsenic	ug/L	ND (1)	1	ND (1)
Barium	ug/L	145	21	94
Beryllium	ug/L	ND (0.5)	ND (0.5)	ND (0.5)
Boron	ug/L	11	434	18
Cadmium	ug/L	ND (0.1)	ND (0.1)	ND (0.1)
Calcium	ug/L	77500	36900	101000
Chromium	ug/L	9	3	ND (1)
Cobalt	ug/L	ND (0.5)	0.5	ND (0.5)
Copper	ug/L	2.7	14.2	1.6
Iron	ug/L	111	658	ND (100)
Lead	ug/L	0.5	2.1	0.3
Magnesium	ug/L	21000	5700	31200
Manganese	ug/L	17	64	24
Molybdenum	ug/L	ND (0.5)	3.2	0.9
Nickel	ug/L	6	6	ND (1)
Potassium	ug/L	1750	4000	2480
Selenium	ug/L	ND (1)	ND (1)	ND (1)
Silicon	ug/L	4500	902	4540
Silver	ug/L	ND (0.1)	ND (0.1)	ND (0.1)
Sodium	ug/L	182000	38300	38500
Strontium	ug/L	341	113	712
Thallium	ug/L	ND (0.1)	ND (0.1)	ND (0.1)
Tin	ug/L	ND (5)	8	ND (5)
Titanium	ug/L	ND (5)	ND (5)	ND (5)
Tungsten	ug/L	ND (10)	ND (10)	ND (10)
Uranium	ug/L	0.5	0.7	0.8
Vanadium	ug/L	ND (0.5)	0.6	ND (0.5)
Zinc	ug/L	7	47	8

Note: ND(x) denotes concentration below the minimum detection limit x.

Figure 3: Groundwater Temperature Profiles



6. IMPACTS OF PROPOSED OPERATIONS

6.1 Proposed Aggregate Extraction

The findings of this report confirm the presence of granular materials which have commercial value to the owner. The natural sand and gravel soils encountered at the site extend below the shallow groundwater table.

It is understood that aggregate extraction operations at the site will involve the excavation of sand, and sand and gravel soils above the water table. Within the proposed licensed area, the thickness of the granular deposits extends below the borehole exploration depth of 28.0 m in Borehole MW104-23. Based on the borehole data, the natural sand and gravel soils extend to about Elevation 289.0 m, with some sandy soils extending to exploration depths, as shown on the cross-section drawings and borehole logs. The overall extraction depths expected to be in the range of Elevation 294 m ASL.

6.2 Impacts to the Shallow Groundwater and Surface Water Features

The depth of excavation is expected to extend to about Elevation 294 m ASL to effectively extract and utilize the aggregate. Throughout most of the site (as documented in the monitoring wells), this remains above the seasonal high groundwater levels recorded at the site.

Since the proposed aggregate extraction activities are not expected to extend below the water table, direct impacts to the water quality and water levels are not anticipated. However, removal of aggregate from above the water table may result in a reduction of the protective overburden cover, which can result in potential impacts to shallow groundwater temperatures, since there is less soil cover to attenuate warm water conditions which may occur from stormwater runoff. This is discussed in more detail below.

The Groundwater Contour Plans provided on Drawings 8, 9 and 10 show a shallow groundwater flow direction to the northwest, towards Cedar Creek. It is noted that the water levels recorded in MW103-23 may be artificially high, due to the placement of the monitoring well on an elevated part of the site. As aggregate is removed from the central part of the site, the groundwater mounding effect which is identified in the groundwater contour plans in this area are expected to be lessened, with water levels becoming more aligned with the water levels recorded at MW102-23 and BH202.

Reductions in the soil cover above the shallow groundwater at the site may result in a seasonal warming during warm summer months. The available space between the proposed extraction limits and Cedar Creek, will help to attenuate the effects of changes in the water temperature, as the water permeates through the subgrade soils through the shallow aquifer, along with the lateral and vertical

migration of infiltrated water which will provide time for water temperatures to adjust to levels similar to those within the shallow groundwater in the undisturbed areas of the site.

Maintaining shading and vegetative cover around the wetland feature can also help to regulate surface water temperatures and shallow groundwater temperatures which provide base flow to the wetland area. As such, the effects of localized warming of surface water at the site can be mitigated to limit any detrimental effect to nearby downgradient natural features which may be sensitive to changes in the thermal regime.

6.3 Soil Erosion Considerations

Soil erosion concerns during rehabilitation are not anticipated to be as significant as the extraction stage. Most activities resulting in soil erosion occur during the initial construction phase when berms are being constructed, and through the extraction process due to the progressive nature of the extraction activities. Since extraction and progressive rehabilitation are undertaken simultaneously, considerations for reducing erosion during this phase should be considered.

As a best practice, consideration of the following measures are recommended to mitigate adverse impacts arising from soil erosion:

- Erosion arising from wind is largely addressed by dust control and mitigation measures.
- The operator should prevent uncontrolled runoff of sediment-laden stormwater from the site. Onsite containment with interceptor swales and drainage swales, and utilizing temporary ponding areas may be helpful in this regard.
- Disturbance to the vegetative cover in proximity to Cedar Creek and other natural features which are being maintained should be strictly controlled, by ensuring that the work area is clearly delineated.
- If topsoil stripping and overburden removal are likely to occur during periods of intensive rainfall, care should be given to implementing temporary measures to contain and treat surface runoff from disturbed areas or recently backfilled areas which have not yet been protected with vegetative cover.

7. CONTINGENCY PLAN AND MITIGATION MEASURES

7.1 Construction Equipment

The proposed aggregate extraction operation is expected to involve excavation of sand, and sand and gravel materials. The use of equipment for site operations may pose a potential risk of petroleum hydrocarbons such as fuels, oil and grease to enter the exposed groundwater system unless the proper operation and refuelling procedures are followed.

There are best management and good construction practices that should be followed to reduce the potential and mitigate risks associated with the equipment operation. The following recommendations are provided for consideration:

- Onsite fuel storage tanks will be installed and maintained in accordance with the Gasoline Handling Act;
- Designated fuelling and equipment maintenance area, located at least 30 m away from surface water features, where possible;
- Crushers, stackers and screening plants shall be re-fuelled and maintained on the pit floor during daylight hours. Any minor drips or spills shall be immediately cleaned up and properly disposed of; and,
- Implement spill contingency measures and spill action response plans for construction equipment.

7.2 Sediment and Erosion Control Measures

It is anticipated that surficial topsoil and overburden soils will be stripped as part of the site preparation works, and stored onsite for reuse during the site restoration. It is recommended that stockpiled materials which have been stripped during the site preparation be stored in areas where stormwater run-off will not drain directly into roadside drainage ditches, or into Cedar Creek to the north.

Earthen berms constructed at the site should be vegetated as soon as possible after placement, to help stabilize the berm side slopes.

7.3 Potable Water Supply Interference

Although not anticipated for this project, the following water well interference complaint protocol is recommended to address water supply interference to domestic and farm water supplies for properties located in proximity (within 150 m) to the site.

The following parameters will be utilized to determine what is considered to be 'significant disruption' or 'significant adverse effect' to the water supply for potable (domestic or livestock) water supply wells. The following complaints will be assessed by the licensee's consulting team:

- Any visual (colour, clarity), olfactory impact (unusual smell) or change in taste which is reported by the owner of the well, and where the owner has expressed a concern about a change in the water quality;
- Unexpected drop in water level which is not typically associated with seasonal variations; and,
- Unexpected periods of the well going 'dry', within insufficient water supply to meet typical residential or livestock usage.

All reasonable complaints will be reviewed to determine if pit operations have contributed to the perceived change in the water quality or quantity, and the Licensee will respond in accordance with the protocol outlined in the report.

Well Interference Complaint Protocol:

1. Nearby and neighbouring properties shall be provided with 24-hour emergency contact information for the Licensee, to facilitate reporting of perceived water supply impacts.
2. Nearby and neighbouring properties which experience disruption or quality problems shall notify the Licensee, who will be responsible to report the well interference complain to MNRF and MECP.
3. In the event that the well owner experiences a significant disruption in their water supply, or experience significant adverse effects upon their water quality; and if the operation of the pit cannot obviously and definitively be excluded as the cause, the licensee shall provide a temporary water supply within 24 hours and thereafter until such time as the cause of the disturbance can be determined and the situation addressed.
4. The Licensee shall investigate the cause of the water supply disturbance and shall report to the MNRF, MECP and the well owner.
5. If it is determined that the aggregate extraction at the pit has been found to have caused a domestic or farm water supply to be adversely affected, the Licensee shall, at the Licensees expense, either restore or replace the water supply to ensure that historic water supply and quality are restored for such a resident. If it is determined that the operation of the pit has not caused any domestic or farm water supply to be adversely affected, the temporary water supply will be maintained for an additional 24 hours to allow the resident to make alternate water supply arrangements.

8. MONITORING PROGRAM

There is no proposed dewatering of the gravel pit, and aggregate extraction is expected to remain above the stabilized groundwater level.

The existing monitoring wells which are located around the perimeter of the site may be suitable for continued use for monitoring water levels. A site plan showing all wells to be maintained and protected at the site should be provided to the Licensee and/or operator working at the site, to ensure that monitoring wells are not inadvertently damaged during site preparation works and removal of overburden materials. An additional monitoring well on the east side of the site would be helpful to address the data gap for stabilized water levels in that part of the site. Vertical extensions or risers for the monitoring wells may be required to accommodate changes in site grades or the construction of earthen berms around the perimeter of the site. The use of a datalogger would provide continuous monitoring of both water levels and water temperatures at the site.

In the event that there is a perceived impact identified through environmental monitoring at the site, or in the event that interference or disturbance is reported for nearby water supply wells, interim water quality testing measurements from the established monitoring wells should be carried out within 24 hours of the reported incident, to document the onsite stabilized groundwater levels.

In the event that perceived impacts to the groundwater quality are reported, a water quality sampling program could also be implemented onsite, in consultation with the hydrogeologist to determine if there is a change from the established baseline water quality data, as presented in Section 5.4.

Manual water level measurements should be carried out on a quarterly basis once the site is licensed and continue until extraction is completed and the site has been rehabilitated. Timing of the quarterly reporting should coincide with annual regulatory compliance reporting requirements which are required to be submitted on September 30 of each year, to ensure that data submitted to the Ministry of Natural Resources is as current as possible.

When the monitoring wells are determined to be no longer required, the wells should be properly decommissioned in accordance with Ontario Regulation 903. This regulation identifies that only certified and qualified well drilling technicians are permitted to direct the decommissioning work for existing wells. Decommissioning a well which is no longer in use helps to ensure the safety of those in the vicinity of the well, prevents surface water infiltration into an aquifer via the well, prevents the vertical movement of water within a well, conserves aquifer yield and hydraulic head and can potentially remove a physical hazard.

9. CONCLUSIONS AND RECOMMENDATIONS

Based on the information collected in the field and analysis of available data, the following conclusions are made:

1. There is a substantial thickness of sand, and sand and gravel soils at the site, which has been deemed to be a financially viable aggregate extraction resource. Aggregate extraction is expected to include both above water operations.
2. Above water aggregate extraction is already occurring on an adjacent licensed aggregate pit (Ayr Pit and Tom Hill Pit), on the lands immediately east and west of the site.
3. The shallow unconfined groundwater aquifer is the most likely aquifer to have a risk of adverse impacts associated with the proposed site activities.
4. Groundwater flow direction has been identified to be in a northwesterly / westerly direction, with the predominant flow direction towards Cedar Creek.
5. Only a limited number of water supply wells are present in proximity to the site, and well records generally indicate that wells are set into deep overburden deposits.
6. Aggregate extraction operations are not expected to involve active dewatering efforts, therefore significant impacts to nearby water supply wells are expected to be negligible.
7. Provided that the contractor follows best management practices for equipment maintenance and fuelling activities, the risk of water quality impact is expected to be negligible.
8. The hydrogeological site assessment indicates that the proposed aggregate extraction will not have any adverse effect on local water resources, including domestic water wells, nor on any of the natural environment features in the area.

Based on the conclusions drawn from the work described herein, the following recommendations are made and should be incorporated into the site plans:

1. Fuel storage, equipment filling, and equipment maintenance shall be carried out in accordance with best management practices outlined in Section 7.1, including designated fuelling locations and implementation of spills management response plans, as appropriate to reduce the potential and mitigate risks associated with the equipment operation.
2. Groundwater level monitoring shall continue at the site on a quarterly basis after the pit is licensed, and continue until site rehabilitation is complete.
3. Groundwater monitoring shall include stabilized groundwater level measurements, and groundwater temperature profiles at each monitoring location.
4. Groundwater samples have been collected at the site to establish baseline water quality conditions for shallow groundwater within the unconfined aquifer which is expected to be encountered during the aggregate extraction operation. Future water quality testing can be compared to the background information presented in this report, if required.

5. If complaints are received from nearby or neighbouring property owners (within 120 m of the site), the Water Supply Interference Protocols outlined in Section 7.3 of this report shall be adhered to.

10. ASSESSOR QUALIFICATIONS

This assessment was prepared by Mrs. Rebecca Walker, P. Eng., QPESA, who has been thoroughly trained in conducting geotechnical and hydrogeological assessments. Mrs. Walker is a licensed professional engineer in the Province of Ontario. She obtained a Bachelor of Applied Science in Geological Engineering from Queen's University in 1998 and is a Qualified Person (QPESA) registered with MECP, under the requirements of Ontario Regulation 153. Rebecca provides geotechnical and geoscience services under the Guideline of Professional Engineers providing Geotechnical Engineering Services under the Professional Engineers Act in Ontario. Rebecca is qualified to provide geoscience (hydrogeological) services under the Professional Geoscientists Act as an exempted engineer, by virtue of her training and experience, as prescribed by the Professional Engineers Act.

Mrs. Walker has over 25 years of direct experience in the geotechnical and hydrogeological consulting industry. Over 4800 projects have been completed under her supervision. Mrs. Walker is also a recognized expert in the industry and has testified as an expert witness in Ontario Municipal Board and Local Planning Appeals Tribunal hearings, and Municipal Councils related to groundwater hydrogeology and geotechnical matters for land development, aggregate extraction and various types of construction projects. She has been retained for many projects, both directly and indirectly by local municipalities as a hydrogeological and geotechnical consultant.

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

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

Lake Erie Region Source Protection Committee, 2022. Lake Erie Region Source Protection Committee, Grand River Source Protection Area, Assessment Report, Approved February 9, 2022.

12. CLOSING

The information presented in this report is based on a scoped investigation designed to provide information to support an assessment of the hydrogeological setting at the subject property, for the project described in the text of the report.

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

No portion of this report may be used as a separate entity. It is intended to be read in its entirety. Stonecairn should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented.

We trust this satisfies your present requirements. If you have any questions or require anything further, please feel free to contact our office.

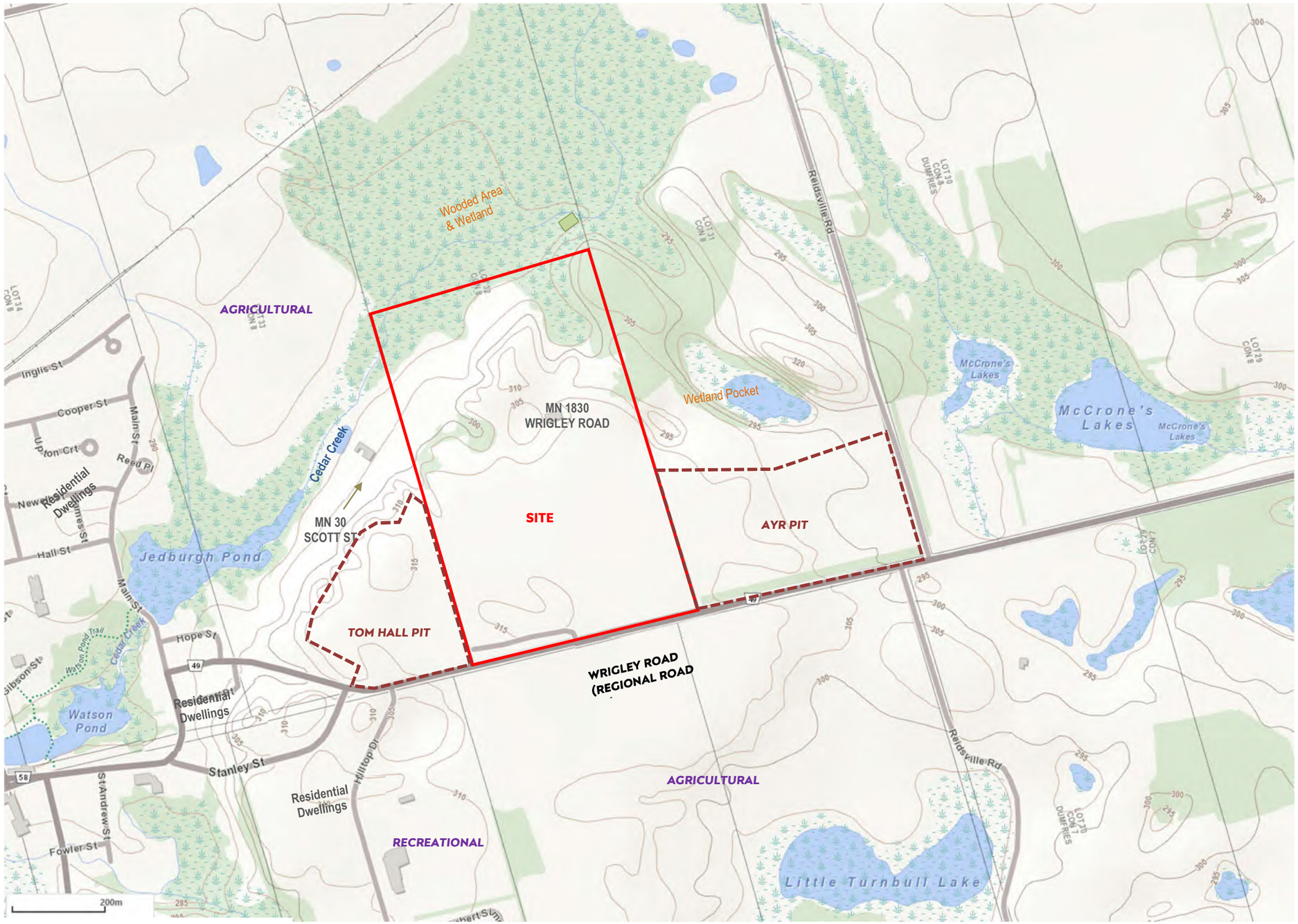
Respectfully Submitted,

STONECAIRN CONSULTING INC.

Rebecca A. Walker, P. Eng., QP$_{ESA}$
Principal, Geotechnical Services
rebecca.walker@stonecairn.ca

APPENDIX A

DRAWINGS



N

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STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP NORTH DUMFRIES

DRAWING NAME

SITE FEATURES & SURROUNDING LAND USE

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	1

2006 AERIAL PHOTOGRAPH

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 546400 m E, 4793534 m N,
Imagery date 04/26/2006

2024 AERIAL PHOTOGRAPH

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 546400 m E, 4793534 m N,
Imagery date 06/27/2023

N

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

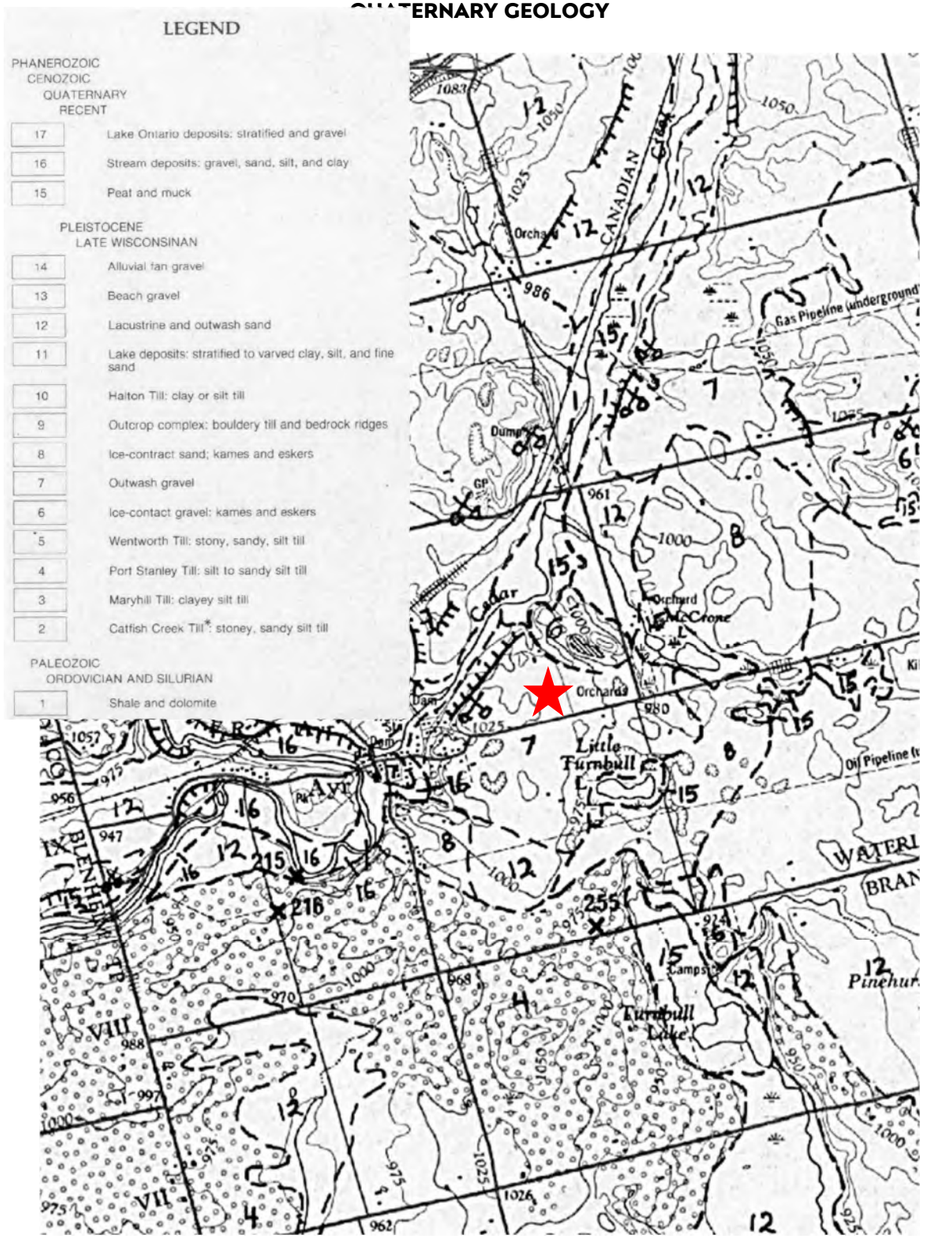
PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP NORTH DUMFRIES

DRAWING NAME

AERIAL PHOTOGRAPHS

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	2

QUATERNARY GEOLOGY



SOURCE: Quaternary Geology, Cambridge Area, Southern Ontario, Ontario Division of Mines, Preliminary Map P2604, scale 1:50,000, published 1983

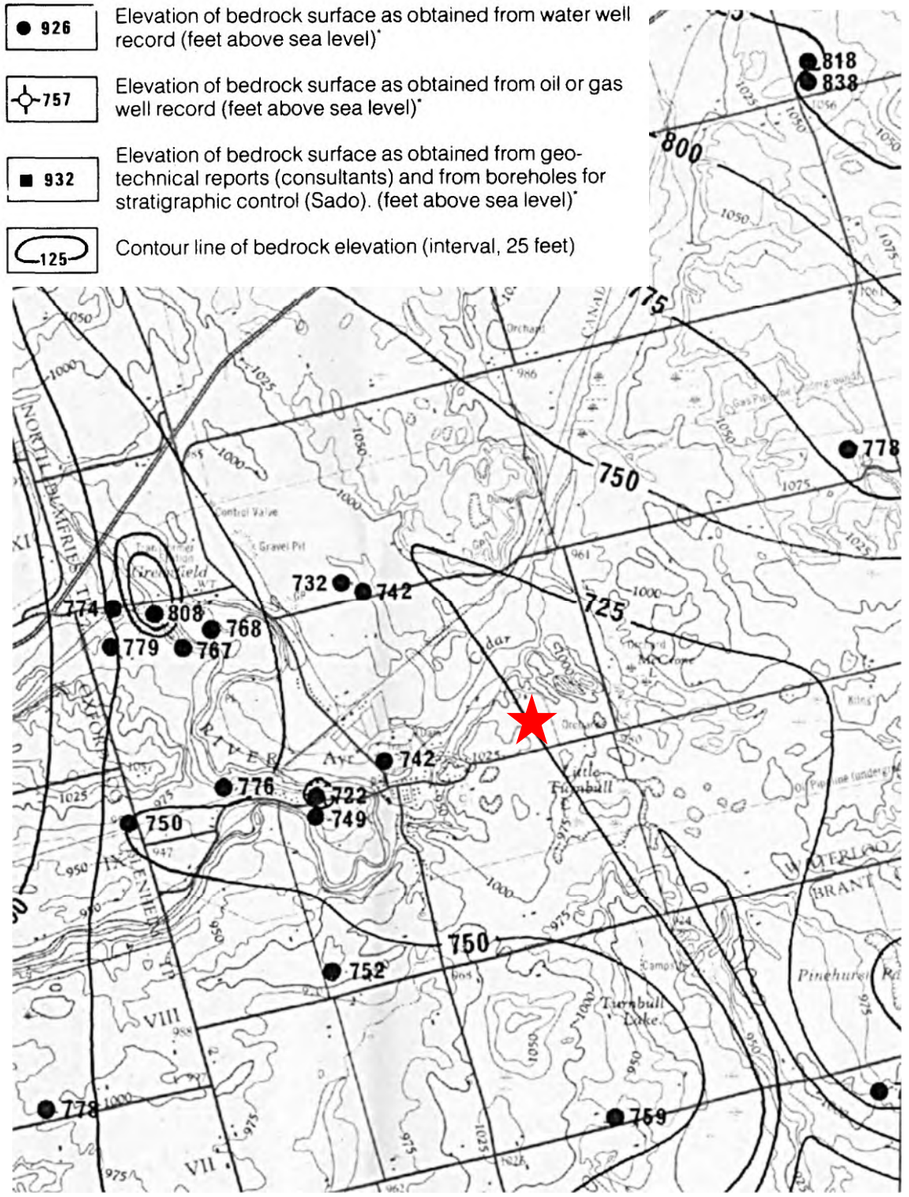
BEDROCK TOPOGRAPHY

● 926 Elevation of bedrock surface as obtained from water well record (feet above sea level)*

757 Elevation of bedrock surface as obtained from oil or gas well record (feet above sea level)*

■ 932 Elevation of bedrock surface as obtained from geo-technical reports (consultants) and from boreholes for stratigraphic control (Sado). (feet above sea level)*

125 Contour line of bedrock elevation (interval, 25 feet)



SOURCE: Bedrock Topography Series, Cambridge Area, southern Ontario, Ontario Geological Survey, Preliminary Map P1985, scale 1:50,000, Published 1979

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

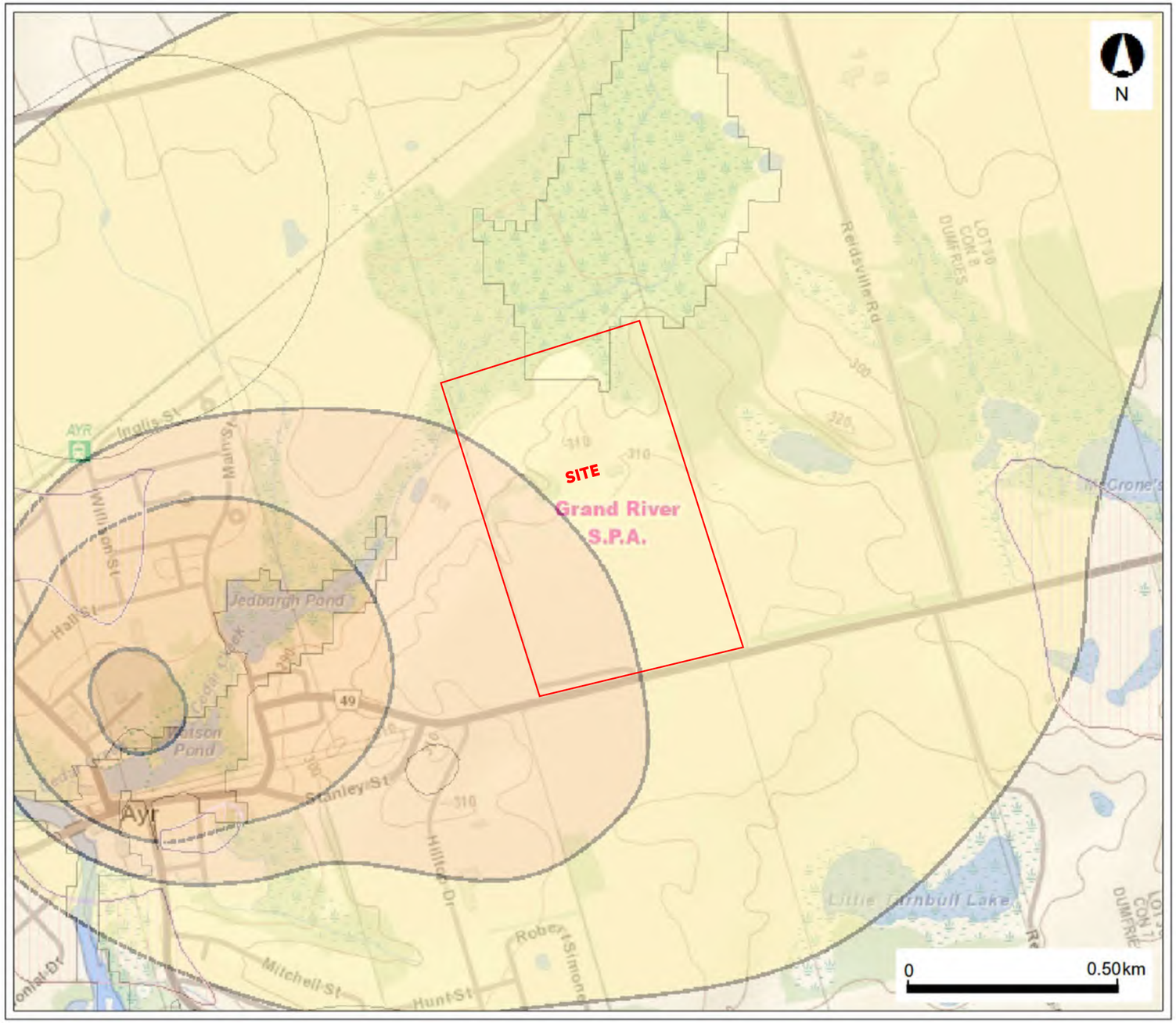
PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP NORTH DUMFRIES

DRAWING NAME

GEOLOGIC MAPPING

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	3



Legend

- Significant Groundwater Recharge Area
  - N/A
  - 0
  - 2
  - 4
  - 6
- Issue Contributing Areas
- Highly Vulnerable Aquifers
- WHPA-E
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Source Protection Areas

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

SOURCE

Ministry of Environment, Conservation and Parks, Source Protection Information Atlas, interactive mapping, current to December 12, 2024

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP NORTH DUMFRIES

DRAWING NAME

SOURCE PROTECTION INFORMATION ATLAS

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	4

Location	Northing, m N	Easting, m E	Ground Surface Elevation (m ASL)
MW101-23	4793646.39	545470.02	289.69
MW102-23	4793369.45	545527.01	308.26
MW103-23	4793489.86	545666.98	302.05
MW104-23	4793010.21	545783.02	313.95
BH201	4793114.38	546025.64	312.83
BH202	4793599.62	545742.27	298.59
BH203	4793216.82	545487.92	312.71

MW locations surveyed by Stonecairn staff

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 546400 m E, 4793534 m N,
Imagery date 06/27/2023

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

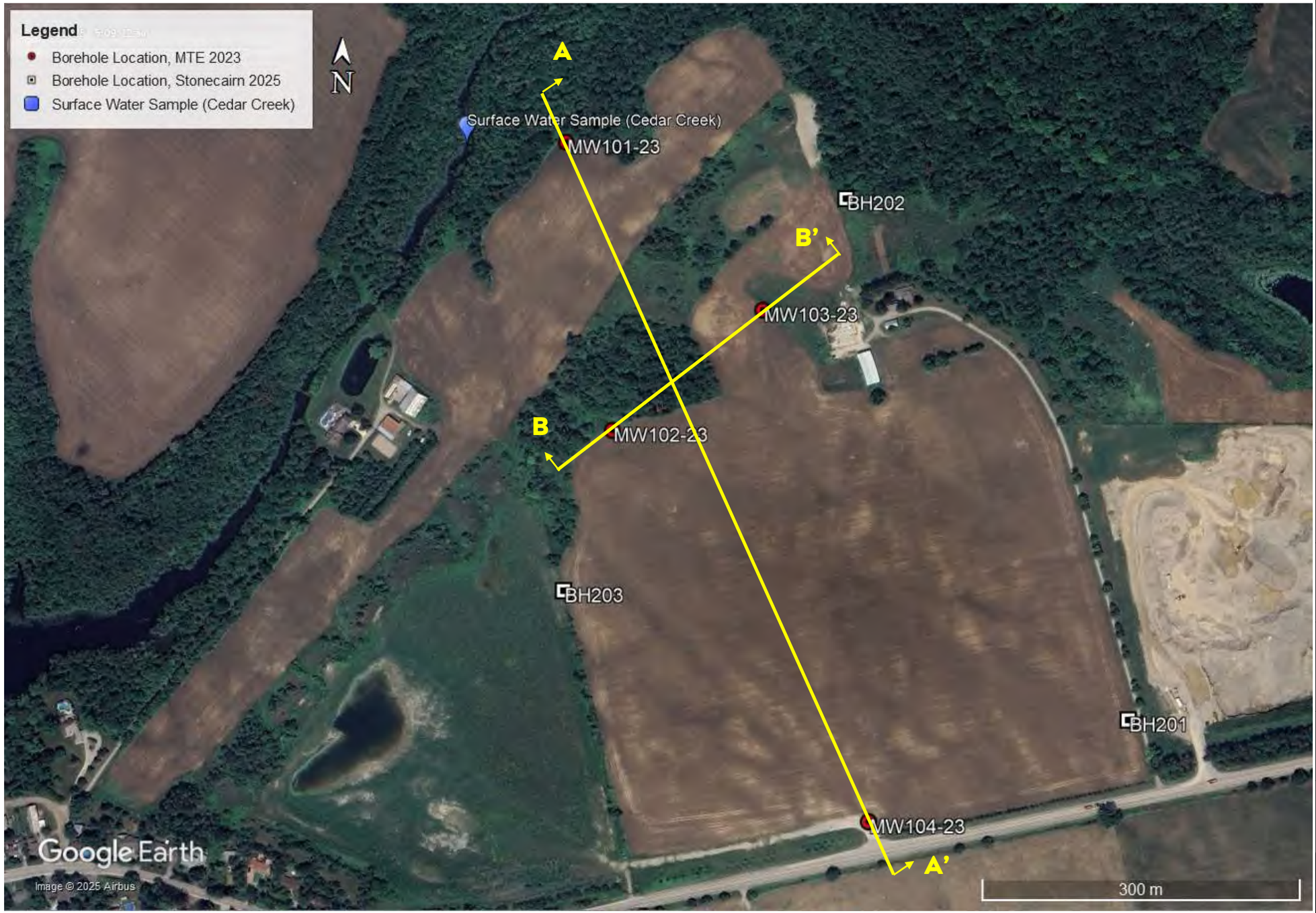
PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP NORTH DUMFRIES

DRAWING NAME

BOREHOLE LOCATION PLAN

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	5



NOTE:
Refer to Drawing 7A & 7B for Profiles

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 546400 m E, 4793534 m N,
Imagery date 06/27/2023

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

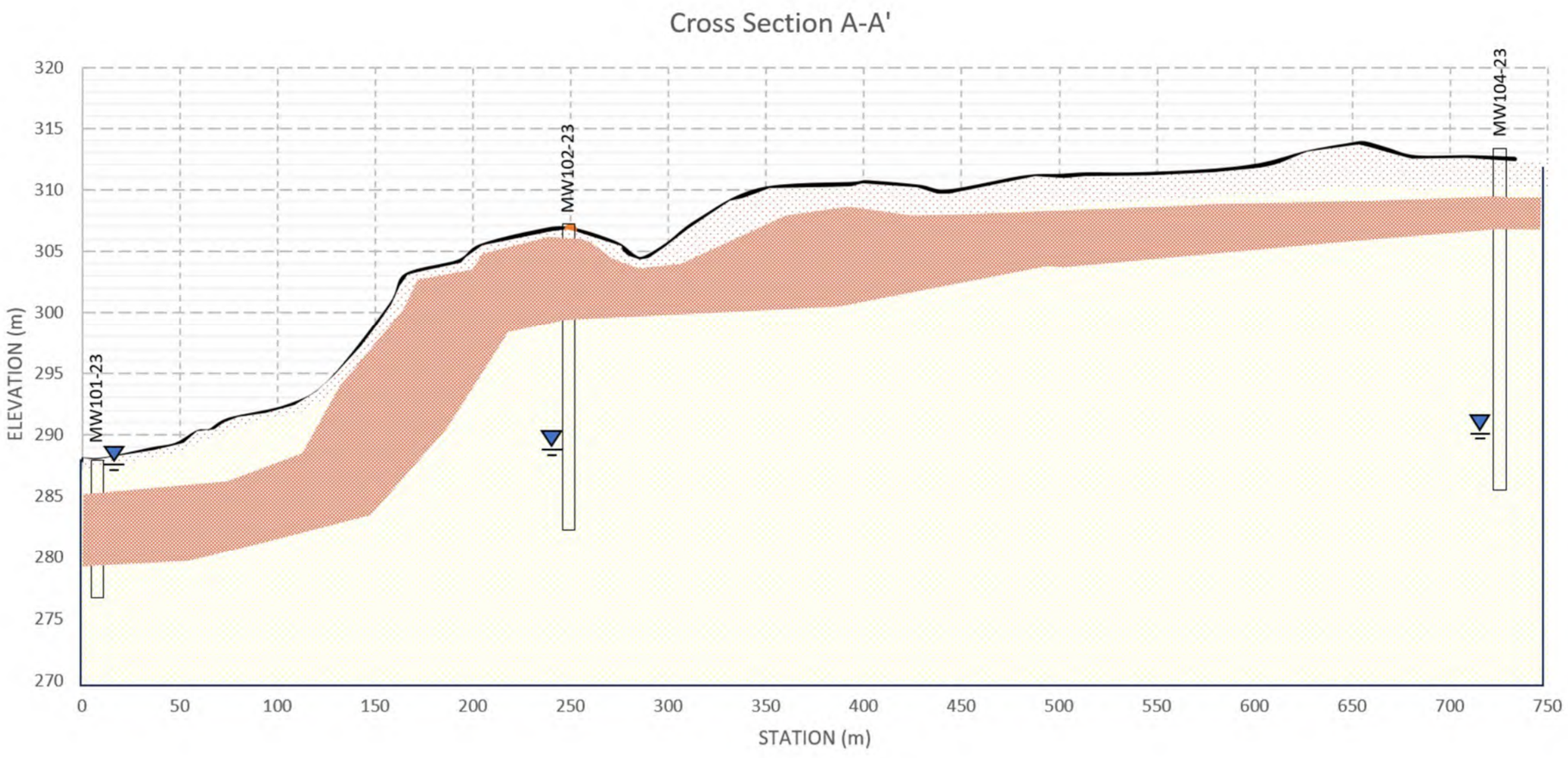
PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP NORTH DUMFRIES

DRAWING NAME

CROSS SECTION LOCATIONS

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	6



LEGEND

- Overburden
- Sandy Silt
- Sand and Gravel
- Sand
- Silt Till
- Stabilized Groundwater Level (March 2021)
- Inferred Groundwater Level

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

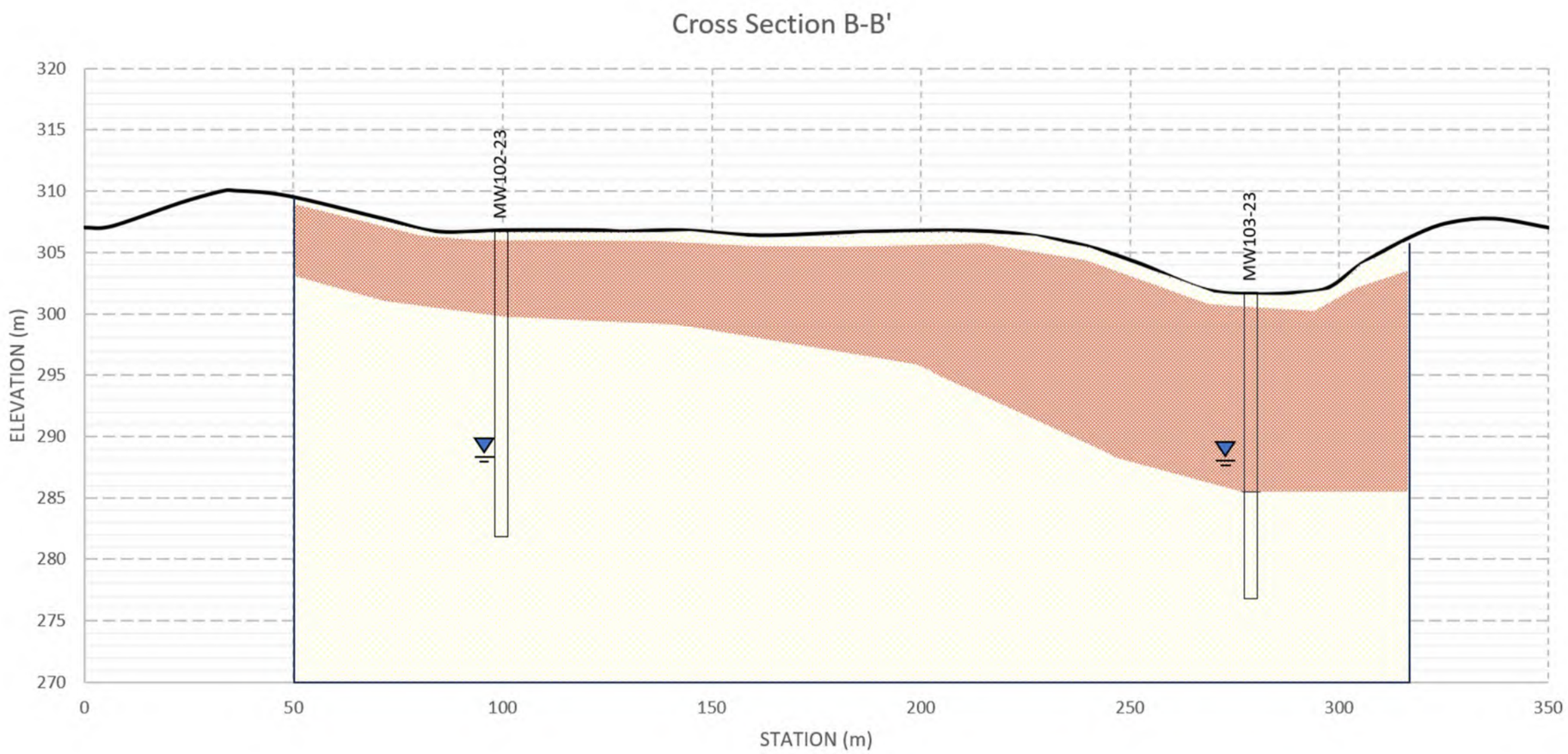
PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES

DRAWING NAME

CROSS SECTION A-A'

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	7A



LEGEND

- Overburden
- Sandy Silt
- Sand and Gravel
- Sand
- Silt Till
- Stabilized Groundwater Level (March 2021)
- Inferred Groundwater Level

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES

DRAWING NAME

CROSS SECTION B-B'

SCALE	**PROJECT NO.**
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	7B

LEGEND

WL-238.41 — Groundwater Elevation (m, asl) Measured September 22, 2023

Groundwater Contour (m, asl)

Inferred Groundwater Flow Direction

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 546400 m E, 4793534 m N,
Imagery date 06/27/2023

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES

DRAWING NAME

GROUNDWATER CONTOUR PLAN
(FALL 2023)

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	8

LEGEND

WL-238.41 — Groundwater Elevation (m, asl) Measured March, 2024

Groundwater Contour (m, asl)

Inferred Groundwater Flow Direction

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 546400 m E, 4793534 m N,
Imagery date 06/27/2023

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES

DRAWING NAME

GROUNDWATER CONTOUR PLAN
(SPRING 2024)

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	9

LEGEND

WL-238.41 — Groundwater Elevation (m, asl) Measured June 2025

Groundwater Contour (m, asl)

Inferred Groundwater Flow Direction

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 546400 m E, 4793534 m N,
Imagery date 06/27/2023

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES

DRAWING NAME

GROUNDWATER CONTOUR PLAN
(JUNE 2025)

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	10

APPENDIX B

BOREHOLE SUMMARY &

GRAIN SIZE ANALYSES

NOTES ON SAMPLE DESCRIPTIONS

1. All descriptions included in this report follow the Canadian Foundation Engineering Manual soil classification system, based on visual and tactile examination which are consistent with the field identification procedures. Soil descriptions and classifications are based on the Unified Soil Classification System (USCS), based on visual and tactile observations. Where grain size analyses have been specified, mechanical grain size distribution has been used to confirm the soil classification.

Soil Classification (based on particle diameter)
Clay: < 0.002 mm
Silt: 0.002 – 0.075 mm
Sand: 0.075 – 4.75 mm
Gravel: 4.75 mm – 75 mm
Cobbles: 75 – 200 mm
Boulders: > 200 mm

Terminology & Proportion
Trace: < 10%
Some: 10-20%
Adjective, sandy, gravelly, etc.: 20-35%
And, and gravel, and silt, etc.: > 35%
Noun, Sand, Gravel, Silt, etc.: > 35% and main fraction

2. The compactness condition of cohesionless soils is based on drilling resistance, and Standard Penetration Test (SPT) N-values where available. The Canadian Foundation Engineering Manual provides the following summary for reference.

Compactness of Cohesionless Soils	**SPT N-Value** (# blows per 0.3 m penetration of split-spoon sampler)
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	50+

3. Topsoil Thickness - It should be noted that topsoil quantities should not be established from information provided at the test hole locations only. If required, a more detailed analysis with additional test holes may be recommended to accurately quantify the amount of topsoil to be removed for construction purposes.

4. Fill material is heterogeneous in nature, and may vary significantly in composition, density and overall condition. Where uncontrolled fill is contacted, it is possible that large obstructions or pockets of otherwise unsuitable or unstable soils may be present beyond the test hole locations.

5. Where glacial till is referenced, this is indicative of material which originates from a geological process associated with glaciation. Because of this geological process, till must be considered heterogeneous in composition and as such, may contain pockets and / or seams of material such as sand, gravel, silt or clay. Till often contains cobbles or boulders and therefore, contractors may encounter them during excavation, even if they are not indicated on the test hole logs. Where soil samples have been collected using borehole sampling equipment, it should be understood that normal sampling equipment can not differentiate the size or type of obstruction. Because of horizontal and vertical variability of till, the sample description may be applicable to a very limited area; therefore, caution is essential when dealing with excavations in till material.

6. Consistency of cohesive soils is based on tactile examination and undrained shear strength where available. The Canadian Foundation Engineering Manual provides the following summary for field identification methods and classification by corresponding undrained shear strength.

Consistency of Cohesive Soils	**Field Identification**	**Undrained Shear Strength** (kPa)
Very Soft	Easily penetrated several cm by the fist	0 – 12
Soft	Easily penetrated several cm by the thumb	12 – 25
Firm	Can be penetrated several cm by the thumb with moderate effort	25 – 50
Stiff	Readily indented by the thumb, but penetrated only with great effort	50 – 100
Very Stiff	Readily indented by the thumb nail	100 – 200
Hard	Indented with difficulty by the thumbnail	200+

ID No.: MW101-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
0 ft / 0 m	Ground Surface	289.5						
	TOPSOIL black silty topsoil, moist (300 mm)	0.0						
2 ft	**SANDY SILT** compact brown sandy silt, trace gravel, with topsoil seams, saturated		1	SS	21		23	
6 ft / 2 m		287.4						
8 ft	**SAND** compact brown sand, trace gravel and silt, saturated	2.1						
10 ft		286.5						
12 ft	**SAND AND GRAVEL** compact brown coarse sand and gravel, trace silt, with boulders and cobbles, saturated	3.0	2	SS	14		17	
14 ft / 4 m								
16 ft		284.7	3	SS	16		16	
18 ft	**SILTY SAND** compact brown silty sand, moist	4.9						
20 ft / 6 m		283.4						
22 ft	**SANDY GRAVEL** compact brown sandy gravel, trace silt moist	6.1						
24 ft								
26 ft / 8 m			4	SS	14		20	
28 ft								

Groundwater Observations and Standpipe Details: Concrete; Bentonite; 51mm PVC Riser

Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 0.41mbgs

ID No.: MW101-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

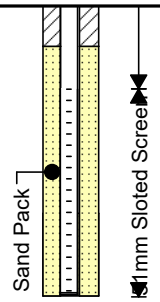
Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
30			280.4						
		GRAVELLY SAND compact brown coarse gravelly sand, trace silt and clay, saturated	9.1						
32									
10									
34									
36			278.4	5	SS	21		12	
		Drilling Terminated	11.1						
38									
12									
40									
42									
44									
46									
14									
48									
50									
52									
16									
54									
56									



Water encountered at 0.6mbgs during drilling

Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 0.41mbgs

ID No.: MW102-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content %	Groundwater Observations and Standpipe Details
	Ground Surface	308.1						
0	**TOPSOIL** black silty topsoil, wet (300mm)	0.0						Concrete
2	**SANDY SILT** compact brown gravelly silt and sand, wet	306.9						
4	**SAND AND GRAVEL** compact brown sand and gravel, trace silt, occasional cobbles, moist	1.2	1	SS	15		10	
6		306.0						
8	**SANDY GRAVEL** compact brown coarse sandy gravel, trace silt, with cobbles and boulders, moist	2.1						
10		305.1						
12	**SAND** compact brown gravelly sand, trace silt, occasional cobbles	3.0	2	SS	23		6	
14		303.6						
16	**SAND AND GRAVEL** compact brown sand and gravel, trace silt, occasional cobbles, moist	4.6	3	SS	15		6	
18								
20			4	SS	24		4	Bentonite
22		301.1						
24	**SAND** compact brown sand, trace silt, moist to damp	7.0						
26			5	SS	23		3	
28								51mm PVC Riser

Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 18.82 mbgs

ID No.: MW102-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
30			299.0						
		trace gravel and silt	9.1	6	SS	25		6	
32									
	10								
34									
36			297.0	7	SS	24		1	
		SAND compact brown medium coarse sand, trace silt, damp	11.1						
38									
	12		295.9						
40		**GRAVELLY SAND** compact brown medium coarse gravelly sand, trace silt, damp	12.2	8	SS	26		5	
42									
44			294.4						
		SAND compact brown medium coarse sand, some gravel, trace silt, damp	13.7	9	SS	27		3	
46	14								
48									
50			292.9						
		SAND compact brown fine sand, some silt, moist	15.2	10	SS	28		3	
52									
	16								
54									
56									

51mm PVC Riser

Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 18.82 mbgs

ID No.: MW102-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

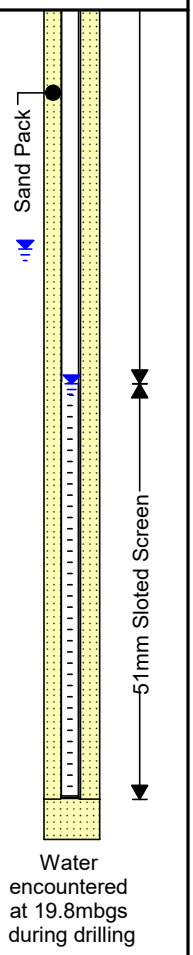
Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)
58			289.8					
60		**SAND** dense brown medium coarse sand, trace gravel and silt, moist	18.3	11	SS	38		3
62								
64			288.3					
66		saturated	19.8					
68								
70			286.8					
72		**SAND** compact grey sand, trace silt and clay, saturated	21.3	12	SS	27		20
74								
76								
78								
80				13	SS	26		19
82		Drilling Terminated	283.3 24.8					
84								



Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 18.82 mbgs

ID No.: MW103-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) / (FV) kPa	Water Content %	Groundwater Observations and Standpipe Details
0 ft / 0 m	Ground Surface	302.0						
	TOPSOIL black silty topsoil, moist (400 mm)	0.0 / 301.6						
2 ft	**FILL** compact brown clayey sandy silt, trace gravel, with topsoil seams, saturated	0.4						
6 ft		300.1	1	SS	12		18	
2 m	**ASPHALT** asphalt particles	1.9						
8 ft	**SAND AND GRAVEL** compact to dense brown coarse sand and gravel, trace to some silt, with cobbles and boulders moist							
10 ft			2	SS	31		5	
12 ft								
4 m								
14 ft		297.4						
	GRAVELLY SAND dense brown grevelly sand, trace silt, occasional cobbles, moist	4.6	3	SS	38		24	
16 ft								
18 ft								
6 m		295.9						
	SAND AND GRAVEL very dense brown sand and gravel, trace silt, with cobbles and boulders, moist	6.1	4	SS	50/5"		0	
22 ft								
24 ft								
		294.2						
26 ft	**GRAVELLY SAND** dense brown coarse gravelly sand, trace silt, occasional cobbles, moist	7.8	5	SS	36		6	
8 m	wet							
28 ft								

Concrete

Bentonite

51mm PVC Riser

Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 9.82 mbgs

ID No.: MW103-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

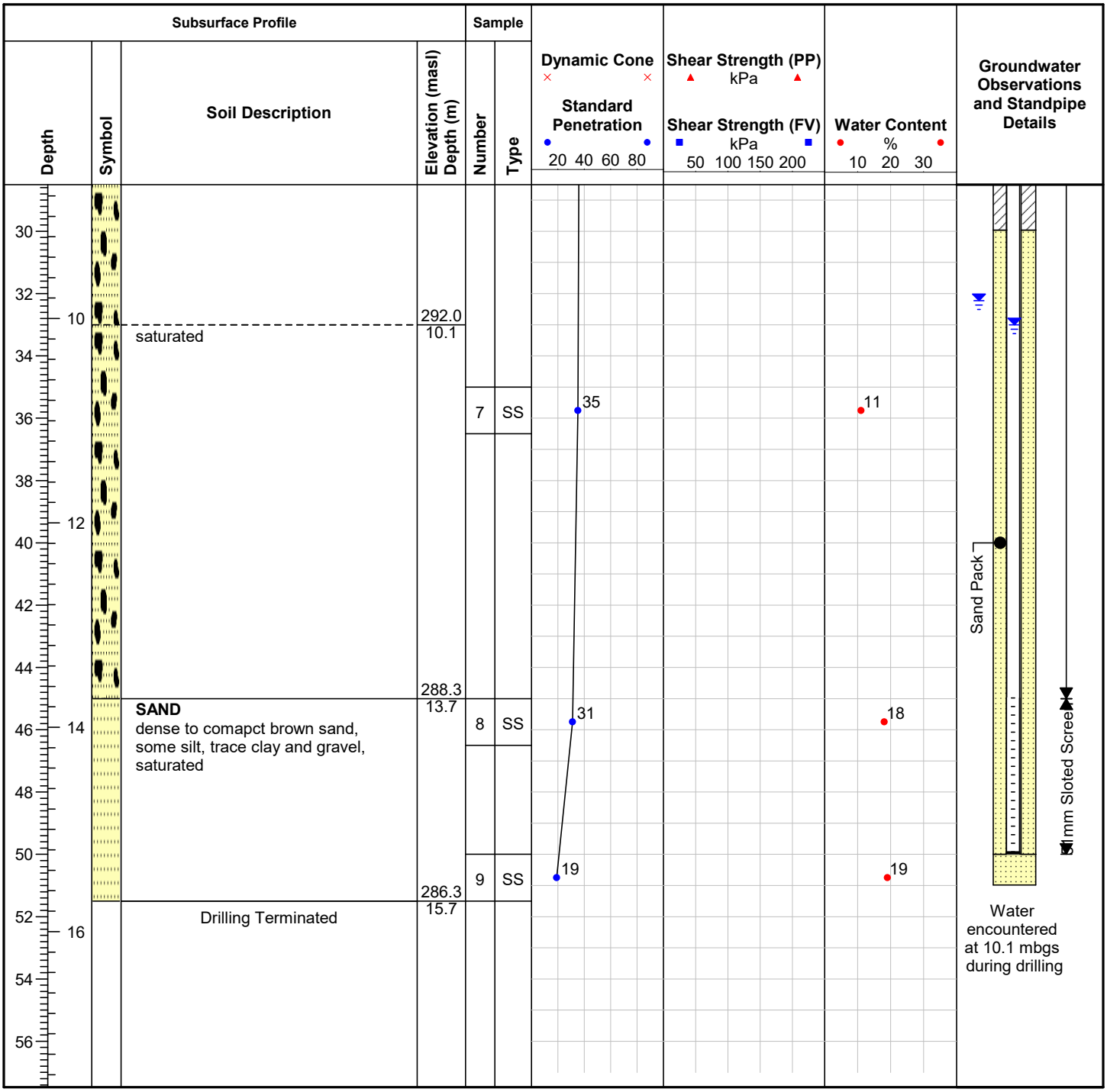
Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing



Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 9.82 mbgs

ID No.: MW104-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

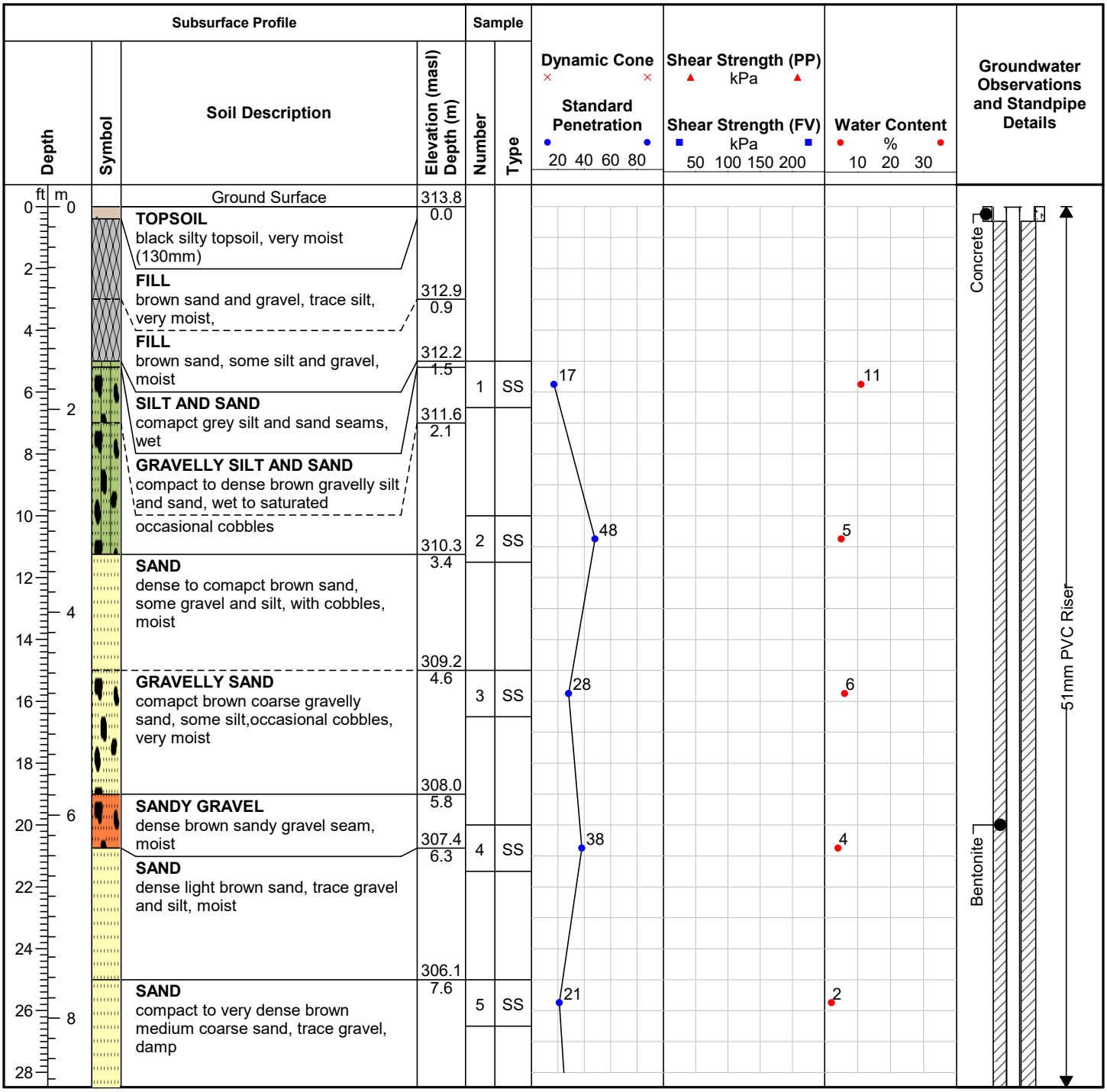
Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing



Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 23.9 mbgs

ID No.: MW104-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

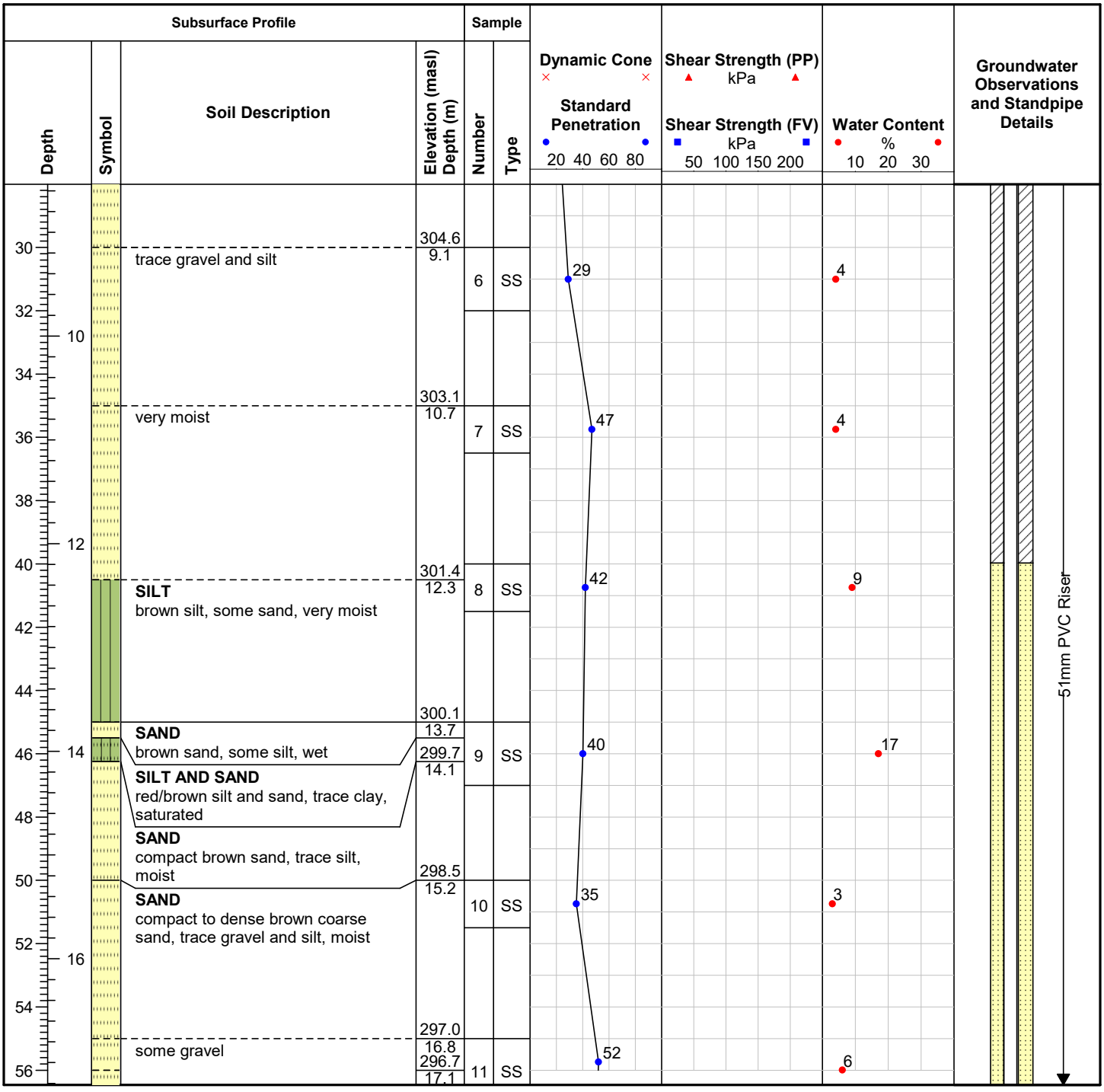
Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing



Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 23.9 mbgs

ID No.: MW104-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
58		medium coarse, moist to wet	295.5	11					
60	18	trace gravel, moist	18.3	12	SS	48		2	
62									
64									
66	20								Sand Pack
68									
70			292.4						
72	22	**GRAVELLY SAND** very dense brown gravelly coarse sand, moist to very moist	21.3	13	SS	50/5"		2	
74									
76									
78	24								
80			289.4						
82		**SAND** compact brown sand, trace to silt, clay and gravel, saturated	24.4	14	SS	14		18	
84									

Field Technician: B. Ehgoetz

Drafted by: L. Kosc

Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 23.9 mbgs

ID No.: MW104-23

Project Name: 1830 Wrigley Rd, Ayr

MTE File No.: 52827-200

Client: J-aar

Site Location: Ayr, ON

Date Completed: 4/26/2023

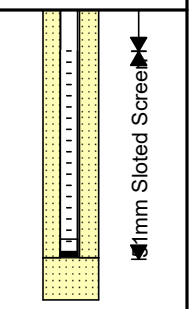
Drilling Contractor: London Soil Ltd.

Drill Rig: D50T Track Mount

Drill Method: 6 1/2" Stem Hollow Augers

Protective Cover: Monument Casing

Depth	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
26 (86)									
88									
90				15	SS	10		21	
28 (92)			285.7						
		Drilling Terminated	28.0						
94									
96									
30 (98)									
100									
102									
104									
32 (106)									
108									
110									
34 (112)									



Field Technician: B. Ehgoetz

Drafted by: L. Kosc

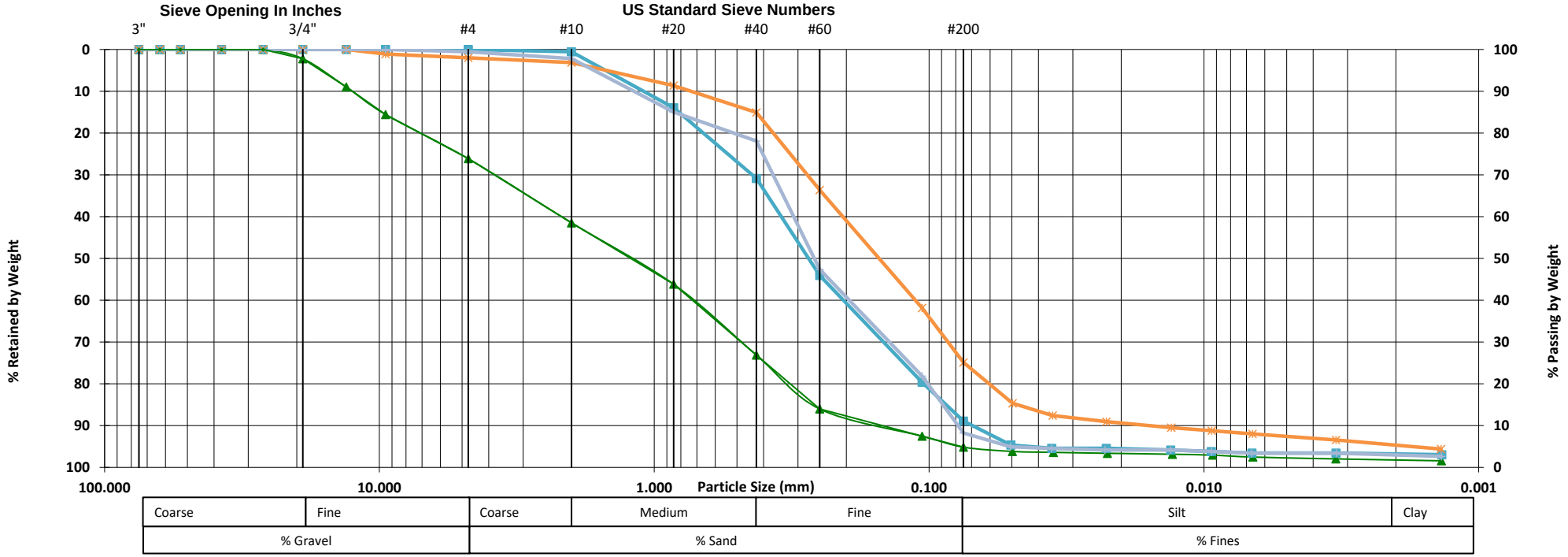
Reviewed by: B. Thorner

Water level measured on May 1, 2023 at 23.9 mbgs

Particle Size Distribution Analysis Test Results

Project Name: 1830 Wrigley Road Geotechnical Investigation
Client: John Aarts Group
Project Location: 1830 Wrigley Road, Ayr, ON
Date Sampled: April 24-26, 2023
Date Tested: May 4-9, 2023
MTE File No.: 52827-200
Table No: 102

Unified Soil Classification



Symbol	Borehole ID	Sample #	Sample Depth	Description
▲	MW101-23	SS-5	10.7-11.1 mbgs	Gravelly SAND, trace Silt and Clay
■	MW102-23	SS-12	21.3-21.8 mbgs	SAND, trace Silt and Clay
✳	MW103-23	SS-8	13.7-14.2 mbgs	SAND, some Silt, trace Clay and Gravel
+	MW104-23	SS-14	24.4-24.8 mbgs	SAND, trace Silt, Clay, and Gravel

CERTIFIED BY CCIL Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

NOTES:

STONE CAIRN CONSULTING	Project	**J-AAR Material Ltd. - Wrigley Pit**	Borehole ID **BH201**
	Project Location	**Part Lot 32, Concession B, Geographic Township North Dumfries**	*Sheet 1 of 1*
	Project Number	**SC-02093**	

Date Drilled	**July 2, 2025**	Ground Surface Elevation	**312.83 m asl**
Drill Rig	**D50 Turbo**	Groundwater Level at Completion	**Dry to 7.0 m, at completion**
Drilling Method	**Hollow Stem**	Technician	**Rob Walker**
Drilling Contractor	**Arrow Drilling**	Checked By	**R Walker, P.Eng.**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
0.5						SANDY GRAVEL - brown, moist, very dense, cobbles observed surfacing	
1.0							
1.5	⊠	1					
2.0							
2.5						- becoming dense below 2.5 m depth	
3.0	⊠	2					
3.5							
4.0						- becoming trace silt below 4.0 m depth	
4.5	⊠	3					
5.0							
5.5						- becoming very dense below 5.6 m depth	
6.0							
6.5	⊠	4					
7.0					7.01 m		
7.5						Auger refusal at 7.01 m Borehole collapse below 4.0 m - unable to install monitoring well into the water table; redrilled 5 m east - auger refusal at 6.85 m depth Borehole observed dry at time of completion	
8.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**no well installed**
Installation Depth	
Screen Length	
Depth of Bentonite Seal	

Additional Notes

STONE CAIRN CONSULTING	Project	**J-AAR Material Ltd. - Wrigley Pit**	Borehole ID **BH202/MW**
	Project Location	**Part Lot 32, Concession B, Geographic Township North Dumfries**	*Sheet 1 of 2*
	Project Number	**SC-02093**	

Date Drilled	**June 12, 2025**	Ground Surface Elevation	**298.59 m asl**
Drill Rig	**D50 Turbo**	Groundwater Level at Completion	**8.54m bgs**
Drilling Method	**Hollow Stem**	Technician	**Rob Walker**
Drilling Contractor	**LST**	Checked By	**R Walker, P.Eng.**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
0.5						SANDY GRAVEL - brown, moist, very dense	
1.0							
1.5							
2.0		1	20	56			
2.5						- becoming dense below 2.5 m depth	
3.0							
3.5		2	60	45			
4.0						- 0.9 m thick cobble layer below 3.7 m depth - becoming trace silt below 4.0 m depth	
4.5							
5.0		3	75	31			
5.5						- becoming very dense below 5.6 m depth	
6.0							
6.5		4	40	50+*			
7.0					7.09 m		
7.5						SAND - brown, fine grained, trace silt, very moist, compact	
8.0		5	80	26			
						continued on the following page	

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	50 mm CPVC Pipe
Installation Depth	10.67 m
Screen Length	3.05 m
Depth of Bentonite Seal	7.01 m

Well equipped with locking J-Plug cap

Additional Notes

* - 50 blows for 76 mm

STONE CAIRN CONSULTING	Project	**J-AAR Material Ltd. - Wrigley Pit**	Borehole ID
	Project Location	**Part Lot 32, Concession B, Geographic Township North Dumfries**	**BH202/MW**
	Project Number	**SC-02093**	*Sheet 2 of 2*

Date Drilled	**June 12, 2025**	Ground Surface Elevation	**298.59 m asl**
Drill Rig	**D50 Turbo**	Groundwater Level at Completion	**8.54m bgs**
Drilling Method	**Hollow Stem**	Technician	**Rob Walker**
Drilling Contractor	**LST**	Checked By	**R. Walker, P.Eng.**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
8.5					▽	*continued from previous page*	
9.0						- becoming saturated below 8.6 m depth	
	SPT	6	100	16			
9.5							
10.0							
10.5							
	SPT	7	100	10			
11.0					11.13 m	BH Terminated at 11.13m Water observed to 8.54 m at time of completion	
11.5							
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	50 mm CPVC Pipe
Installation Depth	10.67 m
Screen Length	3.05 m
Depth of Bentonite Seal	7.01 m

Well equipped with locking J-Plug cap

Additional Notes

STONE CAIRN CONSULTING	Project	**J-AAR Material Ltd. - Wrigley Pit**	Borehole ID **BH203**
	Project Location	**Part Lot 32, Concession B, Geographic Township North Dumfries**	*Sheet 1 of 2*
	Project Number	**SC-02093**	

Date Drilled	**June 13, 2025**	Ground Surface Elevation	**312.71 m asl**
Drill Rig	**D50 Turbo**	Groundwater Level at Completion	**Dry**
Drilling Method	**Hollow Stem**	Technician	**Rob Walker**
Drilling Contractor	**LST**	Checked By	**R. Walker, P.Eng.**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
0.5						SANDY GRAVEL - brown, moist, very dense	
1.0							
1.5	SPT	1	100	47			
2.0							
2.5						- becoming dense below 2.5 m depth	
3.0	SPT	2	80	50			
3.5							
4.0						- becoming trace silt below 4.0 m depth	
4.5	SPT	3	100	36			
5.0							
5.5						- becoming very dense below 5.6 m depth	
6.0							
6.5	SPT	4	80	55			
7.0					7.09 m		
7.5						SAND - brown, fine grained, trace silt, very moist, compact	
8.0	SPT	5	90	28			
						continued on the following page	

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	50 mm CPVC Pipe
Installation Depth	10.67 m
Screen Length	3.05 m
Depth of Bentonite Seal	7.01 m

Additional Notes

STONE CAIRN CONSULTING	Project: **J-AAR Material Ltd. - Wrigley Pit** Project Location: **Part Lot 32, Concession B, Geographic Township North Dumfries** Project Number: **SC-02093**	Borehole ID **BH203** *Sheet 2 of 2*

Date Drilled	**June 13, 2025**	Ground Surface Elevation	**312.71 m asl**
Drill Rig	**D50 Turbo**	Groundwater Level at Completion	**Dry**
Drilling Method	**Hollow Stem**	Technician	**Rob Walker**
Drilling Contractor	**LST**	Checked By	**R. Walker, P.Eng.**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
8.5						*continued from previous page*	
9.0							
	SPT	6	80	26			
9.5							
10.0							
10.5							
	SPT	7	70	29			
11.0					11.13 m	BH Terminated at 11.13m Borehole observed dry at time of completion	
11.5							
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	50 mm CPVC Pipe
Installation Depth	10.67 m
Screen Length	3.05 m
Depth of Bentonite Seal	7.01 m

Additional Notes

APPENDIX C

MECP WELL RECORD SUMMARY

MECP Water Supply Wells

MECP Well ID	Registration Year	Well Type	Depth of Well (m)	Depth Water Found (m)	Static Water Level (m)	Pump Rate (L/min)
6500401	1958-04-18	Domestic	24.4	21.3	17.7	NR
6500404	1962-08-10	Livestock	26.5	26.5	15.8	41.6
6500405	1961-10-18	Livestock	32.0	28.0	18.6	45.4
6500406	1963-09-20	Domestic	46.0	41.1	18.3	37.9
6503024	1969-03-10	Domestic	24.4	21.3	19.8	15.1
6503572	1972-02-29	Domestic	58.2	44.2	19.8	NR
6503680	1972-10-19	Domestic	33.5	33.5	13.7	18.9
6504605	1976-11-25	Domestic	29.6	29.6	14.3	30.3
6506440	1988-10-25	Domestic	8.5	8.5	3.4	75.7
6506567	1988-09-20	Domestic	13.7	13.4	10.1	18.9
7167400	2011-06-03	Domestic	21.9	21.9	0.6	68.1

NR: Not recorded

MECP Observation Wells

Well	Registration Year	Well Use	Depth of Well, m	Depth Water Found, m	Static Water Level, m	Pump Rate, lpm
6510282	2005-09-27	Observation Well	19.6	16.8	NR	NR
7169173	2011-08-31	Observation Well	4.6	NR	NR	NR
7169174	2011-08-30	Monitoring	4.6	NR	NR	NR
7169175	2011-08-30	Monitoring	4.6	NR	NR	NR
7169176	2011-08-31	Monitoring	10.7	NR	NR	NR
7169177	2011-08-30	Monitoring	4.6	NR	NR	NR
7183058	2012-05-20	Observation Well	28.9	NR	NR	NR
7183059	2012-05-21	Monitoring	18.6	NR	NR	NR
7393623	2021-05-31	Monitoring	19.8	4.6	NR	NR
7393624	2021-05-31	Monitoring	7.6	4.6	NR	NR
7443515	2023-01-20	Monitoring	5.3	4.9	NR	NR
7443516	2023-01-20	Monitoring	5.3	4.3	NR	NR
7443517	2023-01-20	Monitoring	5.5	NR	NR	NR
7443547	2023-01-20	Monitoring	5.3	4.6	NR	NR
7443548	2023-01-20	Monitoring	9.1	NR	NR	NR
7447381	2023-04-26	Monitoring	10.7	0.8	NR	NR
7447382	2023-04-24	Monitoring	27.4	NR	NR	NR
7447383	2023-04-25	Monitoring	22.9	19.8	NR	NR
7447384	2023-04-26	Monitoring	15.2	10.7	NR	NR

NR: Not Recorded

SOURCE:
MECP Well Records: www.ontario.ca/environment-and-energy/map-well-records, updated July 24, 2024

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES

DRAWING NAME

MECP WELL LOCATIONS – ALL WELLS

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	C1

SOURCE:
MECP Well Records: www.ontario.ca/environment-and-energy/map-well-records, updated July 24, 2024

STONECAIRN CONSULTING

PROJECT NAME

JEDBURGH PLAINS

PROJECT LOCATION

PART LOT 32, CONCESSION 8,
GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES

DRAWING NAME

MECP WELL LOCATIONS – WATER SUPPLY WELLS

SCALE	PROJECT NO.
AS SHOWN	SC-02093
DATE	**DRAWING NO.**
JULY 2025	C2

APPENDIX D

WATER QUALITY – LAB CERTIFICATES

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

1-800-749-1947
www.paracellabs.com

Certificate of Analysis

LDS Consultants Inc. (London)
2323 Trafalgar Street
London, ON N5V O1E
Attn: Rebecca Walker

Client PO:
Project: GE-00956
Custody: 71660

Report Date: 17-Oct-2023
Order Date: 3-Oct-2023

Order #: 2340216

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2340216-01	BH104
2340216-02	BH101
2340216-03	surface

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, bicarbonate	calculated from EPA 310.1 - Titration to pH 4.5	11-Oct-23	11-Oct-23
Alkalinity, carbonate	calculated from EPA 310.1 - Titration to pH 4.5	11-Oct-23	11-Oct-23
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	11-Oct-23	11-Oct-23
Ammonia, as N	EPA 351.2 - Auto Colour	6-Oct-23	6-Oct-23
Anion Sum	Calculated	16-Oct-23	16-Oct-23
Nitrate + Nitrite as N	calculated from EPA 300.1 - IC	5-Oct-23	5-Oct-23
Anions	EPA 300.1 - IC	5-Oct-23	5-Oct-23
Cation Sum	Calculated	16-Oct-23	16-Oct-23
Colour	SM2120 - Spectrophotometric	5-Oct-23	5-Oct-23
Conductivity	EPA 9050A- probe @25 °C	11-Oct-23	11-Oct-23
Dissolved Organic Carbon	MOE 3247B - Combustion IR	17-Oct-23	17-Oct-23
Hardness	Hardness as CaCO3	5-Oct-23	5-Oct-23
Ion Balance	Calculated	16-Oct-23	16-Oct-23
Langeliers Index	Calculated	16-Oct-23	16-Oct-23
Metals, ICP-MS	EPA 200.8 - ICP-MS	5-Oct-23	5-Oct-23
pH	EPA 150.1 - pH probe @25 °C	11-Oct-23	11-Oct-23
Phosphorus, total dissolved	EPA 365.4; IC, filtration	11-Oct-23	12-Oct-23
Phosphorus, total, water	EPA 365.4 - Auto Colour, digestion	6-Oct-23	10-Oct-23
Saturation pH, calculated	Calculated	16-Oct-23	16-Oct-23
Solids total dissolved, calculated	Calculated	16-Oct-23	16-Oct-23
Tannin/Lignin	SM 5550B - Colourimetric	5-Oct-23	5-Oct-23
Total Dissolved Solids	SM 2540C - gravimetric, filtration	7-Oct-23	7-Oct-23
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	6-Oct-23	10-Oct-23
Total Suspended Solids	SM 2540D - Gravimetric	7-Oct-23	7-Oct-23
Turbidity	SM 2130B - Turbidity meter	5-Oct-23	5-Oct-23

Certificate of Analysis

Report Date: 17-Oct-2023

Client: **LDS Consultants Inc. (London)**

Order Date: 3-Oct-2023

Client PO:

Project Description: GE-00956

	Client ID:	BH104	BH101	surface	-	-	-
	Sample Date:	03-Oct-23 11:00	03-Oct-23 13:00	03-Oct-23 13:00	-		
	Sample ID:	2340216-01	2340216-02	2340216-03	-		
	Matrix:	Ground Water	Ground Water	Surface Water	-		
	MDL/Units						
Calculated Parameters							
Anion Sum	0.01 mEq/L	14.1	3.17	9.14	-	-	-
Cation Sum	0.01 mEq/L	13.6	4.08	9.34	-	-	-
Ion balance	0.1 %	-2.02	12.5	1.1	-	-	-
Solids, total dissolved - calc.	10.0 mg/L	748	195	481	-	-	-
Langlier Index	0.01 S.I.	0.83	-0.28	1.14	-	-	-
Saturation pH	0.10 pH Units	7.17	7.78	7.06	-	-	-
General Inorganics							
Alkalinity, total	5 mg/L	308	112	266	-	-	-
Alkalinity, bicarbonate	5 mg/L	306	111	262	-	-	-
Alkalinity, carbonate	5 mg/L	<5	<5	<5	-	-	-
Ammonia as N	0.01 mg/L	0.02	0.15	0.02	-	-	-
Dissolved Organic Carbon	0.5 mg/L	3.2	37.7	3.5	-	-	-
Colour	2 TCU	<2	306	12	-	-	-
Conductivity	5 uS/cm	1430	333	858	-	-	-
Hardness	mg/L	280	116	381	-	-	-
pH	0.1 pH Units	8.0	7.5	8.2	-	-	-
Phosphorus, total	0.01 mg/L	0.02	0.07	0.02	-	-	-
Phosphorus, total dissolved	0.01 mg/L	<0.01	0.03	<0.01	-	-	-
Total Dissolved Solids	10 mg/L	744	258	496	-	-	-
Total Suspended Solids	2 mg/L	<2	11	5	-	-	-
Tannin & Lignin	0.1 mg/L	<0.1	6.1	0.2	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.3	2.5	0.3	-	-	-
Turbidity	0.1 NTU	0.8	8.4	2.1	-	-	-
Anions							
Bromide	0.1 mg/L	<0.1	<0.1	<0.1	-	-	-

Certificate of Analysis

Report Date: 17-Oct-2023

Client: **LDS Consultants Inc. (London)**

Order Date: 3-Oct-2023

Client PO:

Project Description: GE-00956

	Client ID:	BH104	BH101	surface	-	-	-
	Sample Date:	03-Oct-23 11:00	03-Oct-23 13:00	03-Oct-23 13:00	-		
	Sample ID:	2340216-01	2340216-02	2340216-03	-		
	Matrix:	Ground Water	Ground Water	Surface Water	-		
	MDL/Units						
Anions							
Chloride	1 mg/L	255	4	74	-	-	-
Fluoride	0.1 mg/L	<0.1	<0.1	<0.1	-	-	-
Nitrate as N	0.1 mg/L	4.8	0.2	3.4	-	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	-	-	-
Nitrate + Nitrite as N	0.15 mg/L	4.81	0.223	3.44	-	-	-
Phosphate as P	0.5 mg/L	0.6	<0.5	<0.5	-	-	-
Sulphate	1 mg/L	20	38	72	-	-	-
Metals							
Aluminum	1 ug/L	48	138	12	-	-	-
Antimony	0.5 ug/L	<0.5	0.6	<0.5	-	-	-
Arsenic	1 ug/L	<1	1	<1	-	-	-
Barium	1 ug/L	145	21	94	-	-	-
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	-	-	-
Boron	10 ug/L	11	434	18	-	-	-
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	-	-	-
Calcium	100 ug/L	77500	36900	101000	-	-	-
Chromium	1 ug/L	9	3	<1	-	-	-
Cobalt	0.5 ug/L	<0.5	0.5	<0.5	-	-	-
Copper	0.5 ug/L	2.7	14.2	1.6	-	-	-
Iron	100 ug/L	111	658	<100	-	-	-
Lead	0.1 ug/L	0.5	2.1	0.3	-	-	-
Magnesium	200 ug/L	21000	5700	31200	-	-	-
Manganese	5 ug/L	17	64	24	-	-	-
Molybdenum	0.5 ug/L	<0.5	3.2	0.9	-	-	-
Nickel	1 ug/L	6	6	<1	-	-	-

	Client ID:	BH104	BH101	surface	-		
	Sample Date:	03-Oct-23 11:00	03-Oct-23 13:00	03-Oct-23 13:00	-	-	-
	Sample ID:	2340216-01	2340216-02	2340216-03	-		
	Matrix:	Ground Water	Ground Water	Surface Water	-		
	MDL/Units						
Metals							
Potassium	100 ug/L	1750	4000	2480	-	-	-
Selenium	1 ug/L	<1	<1	<1	-	-	-
Silicon	200 ug/L	4500	902	4540	-	-	-
Silver	0.1 ug/L	<0.1	<0.1	<0.1	-	-	-
Sodium	200 ug/L	182000	38300	38500	-	-	-
Strontium	10 ug/L	341	113	712	-	-	-
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	-	-	-
Tin	5 ug/L	<5	8	<5	-	-	-
Titanium	5 ug/L	<5	<5	<5	-	-	-
Tungsten	10 ug/L	<10	<10	<10	-	-	-
Uranium	0.1 ug/L	0.5	0.7	0.8	-	-	-
Vanadium	0.5 ug/L	<0.5	0.6	<0.5	-	-	-
Zinc	5 ug/L	7	47	8	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Bromide	ND	0.1	mg/L					
Chloride	ND	1	mg/L					
Fluoride	ND	0.1	mg/L					
Nitrate as N	ND	0.1	mg/L					
Nitrite as N	ND	0.05	mg/L					
Phosphate as P	ND	0.5	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
Alkalinity, total	ND	5	mg/L					
Ammonia as N	ND	0.01	mg/L					
Dissolved Organic Carbon	ND	0.5	mg/L					
Colour	ND	2	TCU					
Conductivity	ND	5	uS/cm					
Phosphorus, total	ND	0.01	mg/L					
Phosphorus, total dissolved	ND	0.01	mg/L					
Total Dissolved Solids	ND	10	mg/L					
Total Suspended Solids	ND	2	mg/L					
Tannin & Lignin	ND	0.1	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Turbidity	ND	0.1	NTU					
Metals								
Aluminum	ND	1	ug/L					
Antimony	ND	0.5	ug/L					
Arsenic	ND	1	ug/L					
Barium	ND	1	ug/L					
Beryllium	ND	0.5	ug/L					
Boron	ND	10	ug/L					
Cadmium	ND	0.1	ug/L					
Calcium	ND	100	ug/L					
Chromium	ND	1	ug/L					
Cobalt	ND	0.5	ug/L					
Copper	ND	0.5	ug/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Iron	ND	100	ug/L					
Lead	ND	0.1	ug/L					
Magnesium	ND	200	ug/L					
Manganese	ND	5	ug/L					
Molybdenum	ND	0.5	ug/L					
Nickel	ND	1	ug/L					
Potassium	ND	100	ug/L					
Selenium	ND	1	ug/L					
Silicon	ND	200	ug/L					
Silver	ND	0.1	ug/L					
Sodium	ND	200	ug/L					
Strontium	ND	10	ug/L					
Thallium	ND	0.1	ug/L					
Tin	ND	5	ug/L					
Titanium	ND	5	ug/L					
Tungsten	ND	10	ug/L					
Uranium	ND	0.1	ug/L					
Vanadium	ND	0.5	ug/L					
Zinc	ND	5	ug/L					

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Bromide	0.27	0.1	mg/L	0.28			3.7	20	
Chloride	112	1	mg/L	112			0.3	20	
Fluoride	0.91	0.1	mg/L	0.91			0.3	20	
Nitrate as N	0.53	0.1	mg/L	0.54			0.6	20	
Nitrite as N	ND	0.05	mg/L	ND			NC	20	
Phosphate as P	ND	0.5	mg/L	ND			NC	20	
Sulphate	325	1	mg/L	324			0.4	10	
General Inorganics									
Alkalinity, total	257	5	mg/L	261			1.3	14	
Ammonia as N	ND	0.01	mg/L	ND			NC	18	
Dissolved Organic Carbon	2.8	0.5	mg/L	3.2			13.2	37	
Colour	ND	2	TCU	ND			NC	12	
Conductivity	2720	5	uS/cm	2780			2.0	5	
pH	7.8	0.1	pH Units	7.8			0.4	3.3	
Phosphorus, total	0.0207	0.01	mg/L	0.0235			12.8	15	
Phosphorus, total dissolved	0.03	0.01	mg/L	0.03			2.1	10	
Total Dissolved Solids	730	10	mg/L	744			1.9	10	
Total Suspended Solids	ND	2	mg/L	ND			NC	10	
Tannin & Lignin	0.2	0.1	mg/L	0.2			6.3	11	
Total Kjeldahl Nitrogen	0.28	0.1	mg/L	0.28			1.7	16	
Turbidity	0.8	0.1	NTU	0.8			4.9	10	
Metals									
Aluminum	8.6	1	ug/L	8.8			2.3	20	
Antimony	ND	0.5	ug/L	ND			NC	20	
Arsenic	ND	1	ug/L	ND			NC	20	
Barium	136	1	ug/L	141			3.5	20	
Beryllium	ND	0.5	ug/L	ND			NC	20	
Boron	77	10	ug/L	78			1.9	20	
Cadmium	ND	0.1	ug/L	ND			NC	20	
Calcium	203000	100	ug/L	204000			0.4	20	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chromium	ND	1	ug/L	ND			NC	20	
Cobalt	ND	0.5	ug/L	ND			NC	20	
Copper	2.61	0.5	ug/L	2.58			1.2	20	
Iron	ND	100	ug/L	ND			NC	20	
Lead	0.19	0.1	ug/L	0.14			NC	20	
Magnesium	36400	200	ug/L	38100			4.5	20	
Manganese	72.5	5	ug/L	73.0			0.7	20	
Molybdenum	1.24	0.5	ug/L	1.25			0.4	20	
Nickel	4.2	1	ug/L	4.2			0.9	20	
Potassium	8070	100	ug/L	7660			5.3	20	
Selenium	ND	1	ug/L	ND			NC	20	
Silicon	4470	200	ug/L	4500			0.6	30	
Silver	ND	0.1	ug/L	ND			NC	20	
Sodium	318000	1530	ug/L	340000			6.7	20	
Strontium	4540	77	ug/L	4650			2.4	20	
Thallium	0.17	0.1	ug/L	0.16			6.1	20	
Tin	ND	5	ug/L	ND			NC	20	
Titanium	ND	5	ug/L	ND			NC	20	
Tungsten	ND	10	ug/L	ND			NC	20	
Uranium	3.1	0.1	ug/L	3.1			0.1	20	
Vanadium	ND	0.5	ug/L	ND			NC	20	
Zinc	ND	5	ug/L	ND			NC	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Bromide	1.31	0.1	mg/L	0.28	103	85-117			
Chloride	122	1	mg/L	112	97.1	70-124			
Fluoride	1.83	0.1	mg/L	0.91	92.8	70-130			
Nitrate as N	1.60	0.1	mg/L	0.54	106	77-126			
Nitrite as N	0.910	0.05	mg/L	ND	91.0	82-115			
Phosphate as P	5.52	0.5	mg/L	ND	110	76-130			
Sulphate	332	1	mg/L	324	84.6	74-126			
General Inorganics									
Ammonia as N	1.03	0.01	mg/L	ND	103	81-124			
Dissolved Organic Carbon	11.7	0.5	mg/L	3.5	82.3	60-133			
Phosphorus, total	0.983	0.01	mg/L	0.0235	95.9	80-120			
Phosphorus, total dissolved	0.94	0.01	mg/L	0.03	91.4	80-120			
Total Dissolved Solids	88.0	10	mg/L	ND	88.0	75-125			
Total Suspended Solids	21.0	2	mg/L	ND	97.7	75-125			
Tannin & Lignin	1.1	0.1	mg/L	0.2	91.9	71-113			
Total Kjeldahl Nitrogen	1.44	0.1	mg/L	0.28	116	81-126			
Metals									
Aluminum	53.3	1	ug/L	8.8	89.0	80-120			
Arsenic	53.7	1	ug/L	ND	107	80-120			
Barium	181	1	ug/L	141	80.2	80-120			
Beryllium	40.0	0.5	ug/L	ND	80.0	80-120			
Boron	43	10	ug/L	ND	86.2	80-120			
Cadmium	43.0	0.1	ug/L	ND	86.0	80-120			
Calcium	9690	100	ug/L	ND	96.9	80-120			
Chromium	56.0	1	ug/L	ND	112	80-120			
Cobalt	51.6	0.5	ug/L	ND	103	80-120			
Copper	49.1	0.5	ug/L	2.58	93.0	80-120			
Iron	2480	100	ug/L	ND	98.3	80-120			
Lead	42.1	0.1	ug/L	0.14	83.9	80-120			
Magnesium	44800	200	ug/L	38100	67.3	80-120			QM-07

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Manganese	124	5	ug/L	73.0	103	80-120			
Molybdenum	48.2	0.5	ug/L	1.25	93.9	80-120			
Nickel	53.9	1	ug/L	4.2	99.3	80-120			
Potassium	18800	100	ug/L	7660	111	80-120			
Selenium	42.8	1	ug/L	ND	85.2	80-120			
Silicon	7950	200	ug/L	4500	86.4	70-130			
Silver	43.6	0.1	ug/L	ND	87.3	80-120			
Sodium	9210	200	ug/L	ND	92.1	80-120			
Strontium	51	10	ug/L	ND	101	80-120			
Thallium	41.1	0.1	ug/L	0.16	81.8	80-120			
Tin	47.1	5	ug/L	ND	93.8	80-120			
Titanium	62.7	5	ug/L	ND	125	80-120			QM-07
Tungsten	41.6	10	ug/L	ND	82.6	80-120			
Uranium	50.8	0.1	ug/L	3.1	95.3	80-120			
Vanadium	58.0	0.5	ug/L	ND	116	80-120			
Zinc	40	5	ug/L	ND	78.8	80-120			QM-07

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers:

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

PARACE LABORATORIES L

Paracel ID: 2340216

Blvd. 4J8 s.com

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2340716	№ 71660

Client Name: LDS Consultants Inc	Project Ref: GE-00956	Page __ of __
Contact Name: Rebecca Walker	Quote #:	Turnaround Time
Address: 2323 Trafalgar street, London	PO #:	☐ 1 day ☐ 3 day
	E-mail: rebecca.walker@LDSconsultants.ca	☐ 2 day ☑ Regular
Telephone: 519 200 3742		Date Required:

☐ REG 153/04 ☐ REG 406/19

☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other
☐ Table ___
For RSC: ☐ Yes ☐ No

Other Regulation

☐ REG 558 ☐ PWQO
☐ CCME ☐ MISA
☐ SU - Sani ☐ SU - Storm
Mun: ___
☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analysis: LDS water quality no microbe
1	BH 104	GW		8	Oct 3, 2023	AM	✓
2	BH 101	GW		8	↓	PM	✓
3	surface	SW		8	↓	PM	✓
4							
5							
6							
7							
8							
9							
10							

Comments:

Method of Delivery: Walk in

Relinquished By (Sign): Rob Walker	Received By Driver/Depot:	Received at:	Verified By:
Relinquished By (Print): Rob Walker	Date/Time: Oct 3/23 15:01	Date/Time: Oct 5 2023 10:30	Date/Time: Oct 5 2023 10:36
Date/Time: Oct 3, 2023	Temperature: 21.1 °C	Temperature: 16.2 °C	pH Verified: ☐ By:

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