TATHAM ENGINEERING

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HYDROGEOLOGICAL ASSESSMENT

Homefield Management Ltd.

File 123069 | September 12, 2024

Document Control

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Issue	Date	Description
1	September 12, 2024	Final Report

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by Homefield Management Ltd. to complete a Hydrogeological Assessment for the proposed residential development located at 496857 Grey Road 2 in the Town of the Blue Mountains as shown on Figure 1.

The site is approximately 37.37 hectares (92.3 acre) in size and is currently located between Grey Road 2 and a recreational rail trail running parallel to Highway 26. The site is currently vacant and is primarily undeveloped and tree covered. The surrounding land uses include a mobile home community to the north, a recreational rail trail and residential dwellings followed by Highway 26 to the east, wooded and agricultural lands to the south, and Grey Road 2 followed by agricultural lands to the west.

It is understood the site is proposed to be developed as a municipally serviced residential development comprising standard and back-to-back townhomes, a Stormwater Management Pond, internal roadways, Environmentally Protected Lands, and landscaped areas.

A geotechnical investigation was carried out concurrently by DS Consultants Ltd. and will be reported separately.

As part of the on-going development planning process, a hydrogeological investigation was completed in general accordance with the applicable Ministry of the Environment, Conservation and Parks (MECP), Grey Sauble Conservation Authority (GSCA), and Source Water Protection (SWP) hydrogeological study requirements.

1.1 PURPOSE AND SCOPE OF WORK

The main objectives of the Hydrogeological Investigation were to:

- Establish local and regional geology and hydrogeology;
- Determine potential construction dewatering requirements and provide an assessment of anticipated construction dewatering flow rates for a generic construction scenario;
- Assess groundwater quality and compare the results to Provincial Water Quality Objectives (PWQO), and O.Reg.153/04, as amended, Table 1 Site Condition Standards (SCSs);
- Qualitatively assess the potential impacts to the nearby structures, water bodies and water uses, if any, and comment on future regulatory agency involvement; and,
- Prepare a Hydrogeological Assessment report.

To achieve the above objectives, Tatham proposed the following scope of work:

- Complete a desktop review of pertinent geological and hydrogeological resources, MECP water well records, previous geotechnical reports completed by others, and proposed site plan drawings;
- Visit the site to note existing site conditions, topography, drainage, water features, neighboring land uses, and/or existing water supply or monitoring wells;
- Perform borehole permeability testing at up to three monitoring wells on-site to determine hydraulic conductivity of the screened soil deposits;
- Determine baseline groundwater quality by collecting and analyzing a representative groundwater sample for PWQO metals and O.Reg.153/04, as amended, Petroleum Hydrocarbons (PHCs) and Volatile Organic Compounds (VOCs);
- Complete twelve months of continuous groundwater level monitoring (to be reported separately);
- Evaluate the background information, field, and laboratory data to evaluate the construction dewatering requirements;
- Assess the feasibility of implementing Low Impact Development (LID) features on-site; and,
- Prepare a Hydrogeological Assessment report.

1.2 WATER TAKING – TEMPORARY

Temporary construction dewatering is governed by the Environmental Protection Act, and the following water taking limits and requirements are outlined in O.Reg.63/16:

- Construction dewatering less than 50,000 L/day: the taking of both groundwater and stormwater does not require a hydrogeological report nor a water taking permit.
- Construction dewatering greater than 50,000 L/day but less than 400,000 L/day: the taking of both groundwater and stormwater does require a hydrogeological report and registration on the Environmental Activity and Sector Registry (EASR) but does not require a Permit to Take Water (PTTW).
- Construction dewatering greater than 400,000 L/day: the taking of groundwater and stormwater requires a hydrogeological report and a PTTW.

This hydrogeological assessment was carried out to assess the potential construction dewatering volumes to proceed in accordance with the applicable water taking regulatory requirements and obtain the applicable water taking permit.

This hydrogeological assessment was also conducted in accordance with the typical MECP, GSCA, and SWP hydrogeological study requirements.

2 Site Setting

The site is approximately 37.37 hectares (92.3 acre) in size and is currently located between Grey Road 2 and a recreational rail trail running parallel to Highway 26. The site is currently vacant and is primarily undeveloped and tree covered. The surrounding land uses include a mobile home community to the north, a recreational rail trail and residential dwellings followed by Highway 26 to the east, wooded and agricultural lands to the south, and Grey Road 2 followed by agricultural lands to the west.

2.1 PHYSIOGRAPHY, SURFICIAL AND BEDROCK GEOLOGY

The site lies within the physiographic region known as the Beaver Valley comprising sand plains (Chapman and Putnam, 1984). Ontario Geological Survey surficial and quaternary geology mapping indicates the site and surrounding area is surfaced by coarse-textured glaciolacustrine deposits comprising sand and gravel with minor silt, and clay. These findings are consistent with the sand and gravel, sandy silt to silty sand till and sand with variable silt and gravel contents encountered in the boreholes advanced on-site as part of the geotechnical investigation completed by DS Consultants Ltd.

The bedrock in the area consists of shale and limestone of the Georgian Bay Formation.

2.2 TOPOGRAPHY AND DRAINAGE

The topography of the site is gently sloping from the southwestern portion of the site at an elevation of approximately 200 m asl to the northeastern portion of the site at an elevation of approximately 185 m asl. It is anticipated the on-site runoff will follow the on-site topography to the northeast towards the Indian Brook which ultimately discharges to Georgian Bay.

The site consists of a wetland in the northern portion of the site, with a tributary of the Indian Brook Bay flowing to the northeast running along the northern site boundary.

2.3 MECP WATER WELL RECORDS

To assess the nature of the groundwater resources as well as the history of the current well usage in the area, MECP water well records were reviewed for a 500 m radius surrounding the site. The approximate MECP water well locations are shown in Figure 2, and a summary of the MECP water well records are provided in Appendix A.

A total of sixteen MECP water well records were reviewed within a 500 m boundary of the site. Ten of the records indicated domestic water well usage, two are not in use, and four of the records did not indicate well usage.

In general, stratigraphy noted from the well records indicated units of clay and sand with variable silt and gravel contents shale and/or limestone bedrock.

Bedrock was encountered at depths of 2.1 to 12.8 m below existing grades. It is noted bedrock was not encountered during the geotechnical borehole drilling program completed by DS Consultants, where five boreholes were extended to depths ranging from approximately 6.2 to 6.6 m below existing grades.

2.4 SOURCE WATER PROTECTION MAPPING

The site lies within the Grey Sauble Source Protection Area (SPA) jurisdiction. The site is not located within a municipal Well Head Protection Area (WHPA); however, the site does lie within Intake Protection Zone (IPZ) 2 as shown on Figures 3 and 4, respectively. Further, portions of the site lie within a Significant Groundwater Recharge Area (SGRA) as well as within a Highly Vulnerable Aquifer (HVA) as shown on Figures 5 and 6, respectively.

2.5 SITE INPSECTION

A visual site inspection was completed on December 1, 2023, to assess the site drainage, topography, and surface water features of the site. The site is currently vacant and is primarily undeveloped and tree covered. There are multiple trails and pathways throughout the site and Indian Brook Bay was noted to the northeast of the property flowing towards Georgian Bay. The site gently slopes from the southwest to the northeast towards Indian Brook and Georgian Bay.

3 Procedures and Methodology

3.1 BOREHOLE DRILLING AND MONITORING WELL INSTALLATION

Boreholes (BH23-1 through BH23-5) were advanced during the geotechnical investigation completed on December 22, 2023, by DS Consultants Ltd. Monitoring wells were installed in all five of the boreholes to facilitate groundwater level monitoring. The Borehole/Monitoring Well locations are presented in Figure 7.

The geotechnical borehole logs are discussed further in Section 4.1 and are provided in Appendix B. The geotechnical laboratory data for the boreholes are provided in Appendix C.

3.2 BOREHOLE PERMEABILITY TESTING

Borehole permeability tests were completed in three of the monitoring wells (MW23-1, MW23-2, and MW23-4) on December 1, 2023, following well development. Water was purged from the well using low density polyethylene (LDPE) tubing and a foot valve. The test was initiated after three well volumes of groundwater and 95% well recovery was achieved. The static water level was measured prior to the start of the testing and the change in water level was manually recorded following purging. The change in water level was recorded on regular intervals for a total of 30 minutes. The test was completed to estimate the hydraulic conductivity (K) of the soils at the well screen depth. The plot for drawdown versus time is presented in Appendix D for the borehole permeability testing.

3.3 GROUNDWATER SAMPLING

To establish baseline conditions and assess the suitability for discharge of pumped groundwater to the surface during potential construction dewatering, a representative groundwater sample was collected from MW23-1 on December 1, 2023.

The sample was collected using low-flow sampling methods to reduce sediment content within the sample. The sample was directly placed into pre-cleaned laboratory-supplied vials and/or bottles, with analytical test group specific preservatives. Dedicated nitrile gloves were used during sampling and non-dedicated equipment was sanitized prior to the start of sampling.

Samples were field filtered for select parameters and submitted for chemical analysis of PWQO metals, and O.Reg.153/04, as amended, PHCs, and VOCs. All samples were analyzed by Caduceon Environmental Laboratories, a CALA accredited lab. The groundwater chemistry results are included in the laboratory Certificates of Analysis, provided in Appendix E.

3.4 LONG-TERM GROUNDWATER LEVEL MONITORING

Following the completion of the geotechnical borehole drilling and monitoring well installation program, data loggers were installed at MW23-1, MW23-2, and MW23-4 to facilitate long-term groundwater monitoring. The purpose of the long-term groundwater level monitoring is to establish the seasonal high groundwater levels across the site.

Hydrographs have been prepared capturing the water levels on-site from November 2023 to March 2024 illustrating the seasonal high during the spring freshet in 2024. The hydrographs are located in Appendix F.

4 Subsurface Conditions

4.1 STRATIGRAPHY

The concurrent geotechnical investigation completed by DS Consultants Ltd was reviewed for this hydrogeological investigation, and the borehole log information was utilized as part of this assessment. The borehole and monitoring well locations are presented in Figure 7, detailed subsurface borehole logs are presented in Appendix B, and grain size distribution curves are provided in Appendix C.

In general, the boreholes encountered topsoil over fill over a unit of sand and gravel/sand/gravelly sand over interbedded layers of sandy silt to silty sand and sandy silt to silty sand till. Locally at Borehole 23-4 a silt till was encountered underlying the silty sand to sandy silt till unit. For further details regarding the soil conditions on-site, reference is made to the DS Consultants (2023) draft geotechnical report.

4.2 GROUNDWATER

Monitoring wells were installed in all five boreholes to establish static water level elevations. The monitoring wells were installed with 50 mm diameter PVC riser pipe and slotted 1.5-meter-long screens. A summary of the monitoring well installations is presented in Table 1. Stabilized groundwater measurements are presented in Table 2.

Table 1: Monitoring Well Installation Details

MONITORING WELL ID	GROUND SURFACE (M ASL)	LOCATION OF SCREEN		STRATA SCREENED
		DEPTH (M)	ELEVATION (M ASL)	
BH23-1	190.8	4.6 – 6.1	186.2 – 184.7	Sandy Silt to Silty Sand Till
BH23-2	188.2	4.6 – 6.1	183.6 – 182.1	Sandy Silt to Silty Sand Till
BH23-3	187.2	4.6 – 6.1	182.6 – 181.1	Sandy Silt Till
BH23-4	182.2	4.6 – 6.1	177.6 – 176.1	Silty Sand to Sandy Silt Till
BH23-5	184.2	4.6 – 6.1	179.6 – 178.1	Silty Sand to Sandy Silt Till

Table 2: Groundwater Levels

WELL ID	GROUND SURFACE ELEVATION (m asl)	GROUNDWATER ELEVATION (M BGS) / ELEVATION (m asl)	
		December 5, 2023	April 4, 2024
BH23-1	190.8	1.2 / 189.6	0.8 / 190.0
BH23-2	188.2	1.8 / 186.4	-0.8 / 189.0
BH23-3	187.2	1.0 / 186.2	1.0 / 186.2
BH23-4	182.2	2.3 / 179.9	1.1 / 181.1
BH23-5	184.2	0.4 / 183.8	0.4 / 183.8

Stabilized groundwater levels were measured on December 5, 2023 and April 4, 2024, and groundwater levels ranged between depths of 0.8 m above existing grade to 2.3 m below existing grade (elevations 179.9 to 190.0 m asl). It is anticipated groundwater will generally flow from the southwest to the northeast towards Indian Brook, as presented on Figure 8. Hydrographs for three monitoring wells on-site have been created and are attached as Appendix F.

4.3 IN-SITU PERMEABILITY

In-situ borehole permeability testing was carried out on three of the five monitoring wells on-site. Rising head tests were conducted and the hydraulic conductivities were calculated using the Hvorslev (1951) solution for each since all the screens on-site were fully submerged with water.

The semi-log plot for drawdown versus time is provided in Appendix D and summarized in Table 3, below.

Table 3: Hydraulic Conductivity

MONITORING WELL ID	WELL DEPTH (m bgs)	STRATA SCREENED	HYDRAULIC CONDUCTIVITY (m/s)
BH23-1	6.1	Sandy Silt to Silty Sand Till	2.8×10^{-7}
BH23-2	6.1	Sandy Silt to Silty Sand Till	2.1×10^{-7}
BH23-4	6.1	Silty Sand to Sandy Silt Till	2.1×10^{-8}

According to Freeze and Cherry (1979), the typical hydraulic conductivity of the strata investigated area:

- Silty Sand and/or Sandy Silt: 10^{-3} m/s to 10^{-7} m/s
- Silt: 10^{-5} m/s to 10^{-9} m/s
- Glacial Till: 10^{-6} to 10^{-12} m/s

The actual measured hydraulic conductivity of the deposits are generally within the expected ranges. For design purposes the hydraulic conductivity was assumed to be 2.5×10^{-5} m/s taking into consideration the upper sand and gravel/gravelly sand units that may be water bearing.

4.4 BASELINE GROUNDWATER CHEMISTRY

To establish baseline conditions and assess the suitability for discharge of pumped groundwater to surface during potential future construction dewatering, one groundwater sample was collected and analyzed for select parameters including: PWQO Metals and O.Reg. 153/04, as amended, PHCs and VOCs. The groundwater samples were obtained from BH23-1. The groundwater chemistry results are included in the laboratory Certificates of Analysis, provided in Appendix E.

The groundwater met PWQO and O.Reg.153/04, as amended, Table 1 SCSs for the parameters tested with the exception of zinc which exceeded both the PWQO and Table 1 SCSs (the most stringent SCSs). It is noted zinc concentrations were below O.Reg.153/04, as amended, Table 2 SCSs for Residential/Parkland/Institutional land uses, which is considered to be the applicable SCSs. Further, elevated concentrations of Boron were noted with respect to the interim PWQO.

The above chemical testing results suggest potential dewatering discharge may not meet the PWQO requirements during construction dewatering. Treatment of dewatering discharge by filtration of sedimentation to reduce the concentration of Total Suspended Solids (TSS) may reduce the concentration of non-dissolved metals to achieve compliance with PWQO guidelines; however, other treatment methods may still be required to reduce the concentration of dissolved analytes during construction.

It is expected during construction dewatering, the pumped water will first be discharged to a silt bag or sedimentation tank, at minimum, before being discharged to the surface and/or nearby waterbodies.

5 Discussion and Analysis

5.1 TEMPORARY CONSTRUCTION DEWATERING

Based on a review of the current conceptual plan the proposed development includes:

- 376 standard and back-to-back townhouse units;
- Municipal servicing including watermain, and stormwater and sanitary sewers;
- A Stormwater Management Pond;
- Environmentally protected lands and landscaped areas; and,
- Internal roadways.

To assess the potential dewatering requirements for the anticipated construction works, the following assumptions have been made:

- Excavation depths for the proposed construction work are anticipated to be:
  - Site servicing: 3.0 m below existing grades; and,
  - Stormwater Management Pond: 4.0 m below existing grades.
- Excavation extents for the proposed construction work are anticipated to be:
  - Site servicing: to be completed in sections 50 m length and 3 m width; and,
  - Stormwater Management Pond: 50 m length and 80 m width.
- Groundwater levels are anticipated to range from 0.8 m above existing grade to 2.3 m below existing grade (elevations 179.9 to 190.0 m asl);
- The water bearing soils exposed during construction primarily consist of native sand and gravel/gravelly sand, and silty sand to sandy silt deposits sand. For the purposes of this assessment an assumed K-value of 2.5×10^{-5} m/s was assumed;
- Groundwater is to be drawn down 1.0 m below proposed excavations;
- It is assumed surface water will be managed so it will not enter the excavation; and,
- It is assumed all measures will be implemented to ensure the allowable/permitted water taking volumes are not to be exceeded. This includes completing the work in smaller sections.

5.1.1 Radius of Influence

The Radius of Influence (ROI) for construction dewatering refers to the distance at which the drawdown resulting from pumping becomes negligible. The ROI is calculated using the empirical Sichardt Equation. The equation is empirical and provides representative flow rates using the

steady state flow dewatering equations. The Sichardt Equation is used to provide representative flow calculations; however, it is not precise in determining the actual radius influence by pumping since during steady state conditions, the ROI of pumping will extend until boundary flow conditions are reached and provide sufficient water inputs to the aquifer, such as recharge and surface water bodies.

The Sichardt equation is expressed as the following equation:

$$R_o = 3000(H - h)\sqrt{K}$$

Where:

K = hydraulic conductivity (m/s)

H = Static Saturated Head (m)

h = Dynamic Saturated Head (m)

R_o= Radius of Influence (m)

Based on the Sichardt equation and the design K value, the ROI from the centre of the excavation for radial flow for site servicing is tabulated below in Table 4. Calculation details are provided in Appendix G.

Table 4: Residential Development Radius of Influences

ZONE	DESCRIPTION	ROI (m)
1	Site Servicing (per 50 m of trench)	195
2	Stormwater Management Pond	113

5.1.2 Temporary Dewatering Flow Rate Equation

The Dupuit method for linear flow in an unconfined aquifer for a fully penetrating excavation was used for Zone 1 site servicing, and is expressed as:

$$Q = Kx\frac{H^2 - h^2}{L_o}$$

The Dupuit-Forcheimer method for radial flow in an unconfined aquifer for a fully penetrating excavation was used for Zone 2 Stormwater Management Pond, and is expressed as:

$$Q = \frac{\pi K(H^2 - {h_w}^2)}{In\frac{R_0}{r_e}} + 2\frac{xK(H^2 - {h_w}^2)}{L}$$

Where:

Q = rate of pumping (m^3/s)

x = length of excavation (m)

L = length of excavation (m)

K = hydraulic conductivity (m/s)

H = head beyond the influence of pumping (static groundwater elevation) (m)

h = head above base of aquifer at the excavation (m)

R_0 = Radius of Influence (m)

r_e = Equivalent Radius (m)

X = length of excavation (m)

L = length of excavation (m)

It is anticipated the initial dewatering rate will be higher in order to remove groundwater from within the overburden formation. As the water level reaches its target elevation, dewatering rates are expected to decrease as the local groundwater storage will have been removed and lessen seepage rates into the excavation.

Using the assumptions and equations outlined above, the estimated dewatering rates were determined and are summarized below, in Table 5. Calculation details are provided in Appendix G.

Table 5: Construction Dewatering Estimated Daily Flow Rate

ZONE	DESCRIPTION	CONSTRUCTION DEWATERING FLOW RATE (L/day)	CONSTRUCTION DEWATERING FLOW RATE INLCUDING SAFETY FACTOR OF 1.5 (L/day)	CONSTRUCTION DEWATERING FLOW RATE INCLUDING SAFETY FACTOR OF 1.5 AND A 10 mm RAINFALL EVENT (L/day)
1	Site Servicing (per 50 m of trench)	187,300	280,950	282,950
2	Stormwater Management Pond	208,100	312,150	352,150

To account for seasonal fluctuations of the groundwater table and variation in the hydrogeological properties beyond those encountered during this study, a safety factor of 1.5

was applied. Further, to account for surface water infiltration within the excavation footprint, a 10 mm rain event was applied. This rate can be considered a contingency volume subject to the timing and season of construction.

The estimates provided in this report are based on proposed development information available at the time of the investigation. If design changes are implemented, additional dewatering estimation will be required to reflect the design changes.

The estimated dewatering volumes for the anticipated site servicing and Stormwater Management Pond construction range between 282,950 to 352,150 L/day. As the estimated dewatering rates are over 50,000 L/day but remain below 400,000 L/day it is recommended the anticipated water taking be registered on the MECP EASR.

In accordance with O.Reg. 63/19 a water taking and discharge plan have been prepared for the site and are provided in Appendix H and I, respectively.

5.2 WATER BUDGET

An evaluation of the anticipated changes in the water budget between pre-development and post-development conditions for the residential development have been completed as part of Tatham's Stormwater Management Report reported under separate cover (*Hinds Brook Residential Development Preliminary Stormwater Management Report*, dated September 3, 2024).

5.3 LOW IMPACT DEVELOPMENT FEASIBILITY ASSESSMENT

As discussed in previous sections, the site consists of sand and gravel/sand/gravelly sand deposits over interbedded layers of sandy silt to silty sand and sandy silt to silty sand till.

Further, groundwater level measurements to date have been noted at depths of 0.4 to 2.3 m below existing grade (elevations 179.9 to 189.6 m asl); however, the typically high groundwater period between March and June was not captured with the groundwater levels measured to date.

The native sand and gravel/sand/gravelly sand and/or sandy silt/silty sand till deposits encountered throughout the site may be considered feasible for Low Impact Development (LID) features. However, the native silt till are not considered feasible for LID features given the anticipated low permeability of the soils and resulting low infiltration rates.

It is noted any proposed LID features should be designed so a 1.0 m separation from the base of the proposed LID and the seasonal high groundwater is achieved.

Based on the above, LIDs in theory may be considered feasible in areas where sufficiently permeable soils (sand and gravel/sand/gravelly sand and/or sandy silt/silty sand till) are encountered and where a 1.0 m separation from the base of the proposed LID and the seasonal

high groundwater can be achieved. These conditions will limit where and if LIDs can be installed on the property.

If LID features are to be implemented on-site further on-site infiltration testing (Guelph Permeameter testing) should be carried out in the proposed feature locations to confirm LID feasibility.

Further, the sizing of any proposed LID feature would need to be reviewed with the proposed site plans to ensure sufficient offsets from structures on-site are achieved.

6 References

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Freeze and Cherry, 1979. Groundwater.

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, US Army, Vicksburg, Mississippi, pp 1-50.

Mousa, L., Sangar, A., Zhu, F., Preliminary Geotechnical Investigation Report: Proposed Residential Development: 496857 Grey Road 2, Blue Mountain, ON. DS Consultants., Project No: 23-301-100. Dated December 15, 2023.

Ontario Geological Survey, 2000. Quaternary geology, seamless coverage of the Province of Ontario, Ontario Geological Survey, Data Set 14- Revised.

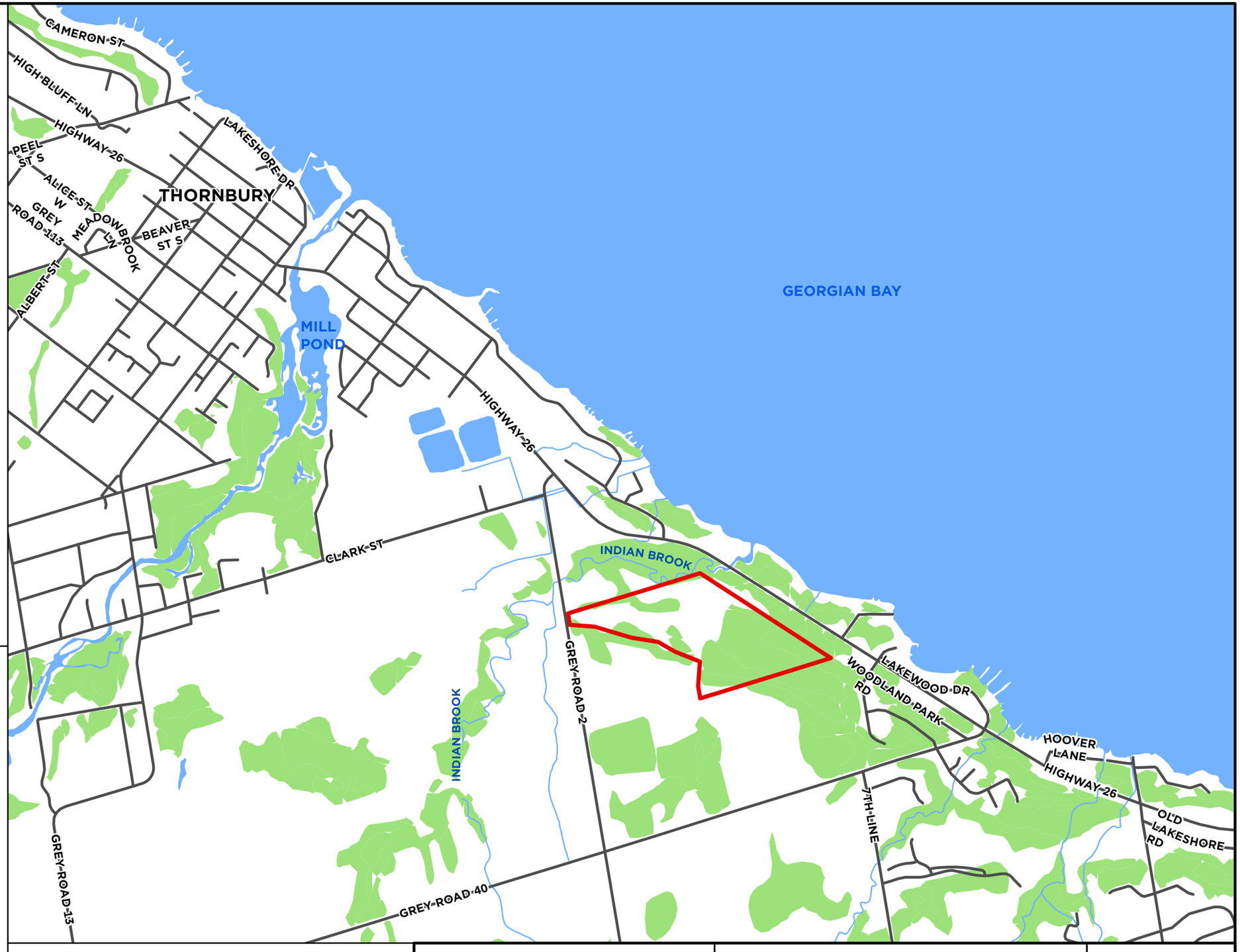
Stormwater Planning and Design Manual. MOE, 2003.

N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- ROADS
- WATERCOURSE
- WATERBODY
- WOODED AREA



0 375 750 1,500 METERS

TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
SITE LOCATION PLAN

DWG. No. **FIG-1**

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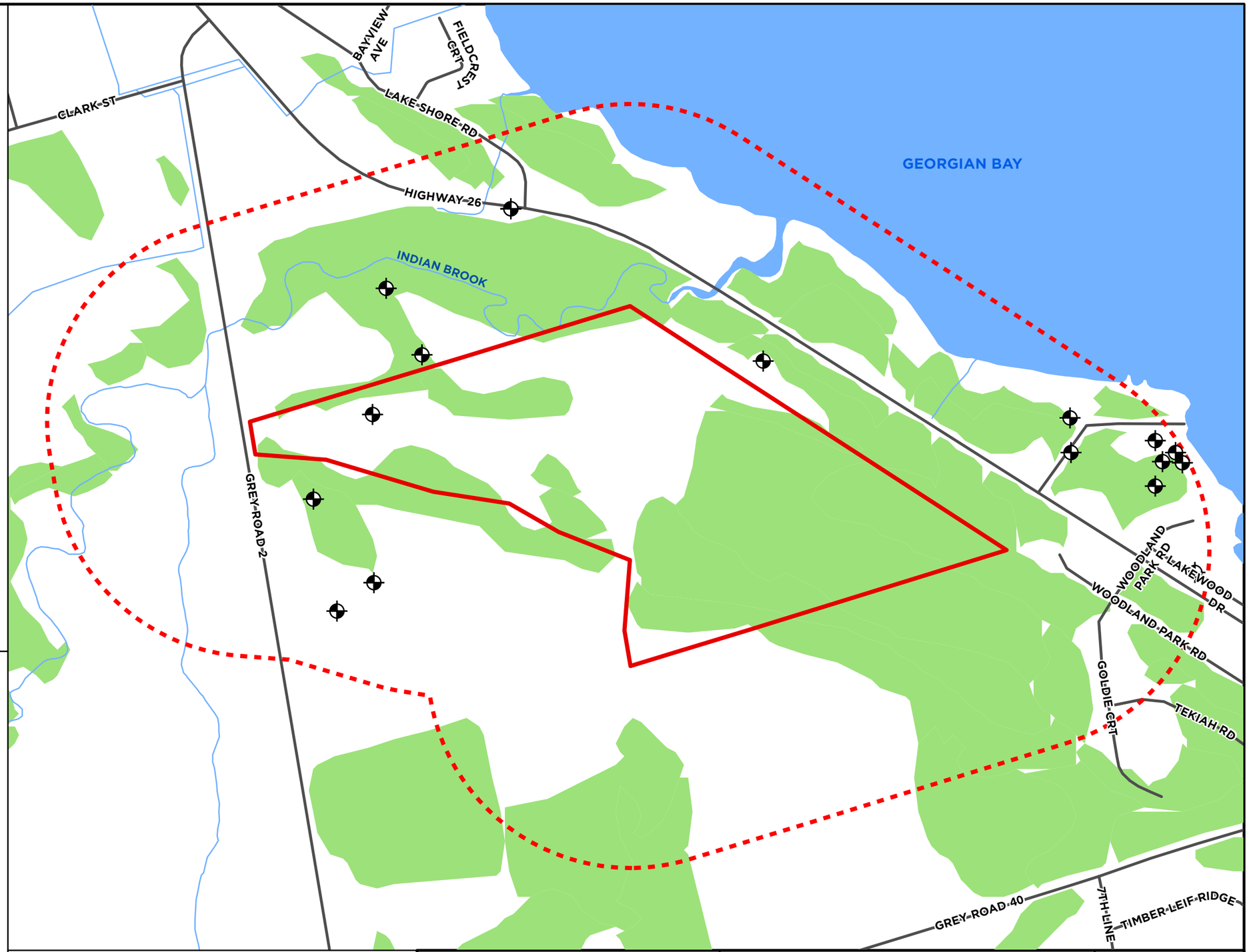
NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- STUDY AREA (500 M)
- MECP WATER WELL LOCATIONS
- ROADS
- WATERCOURSE
- WATERBODY
- WOODED AREA



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TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
MECP WATER WELL RECORDS

DWG. No. **FIG-2**

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NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
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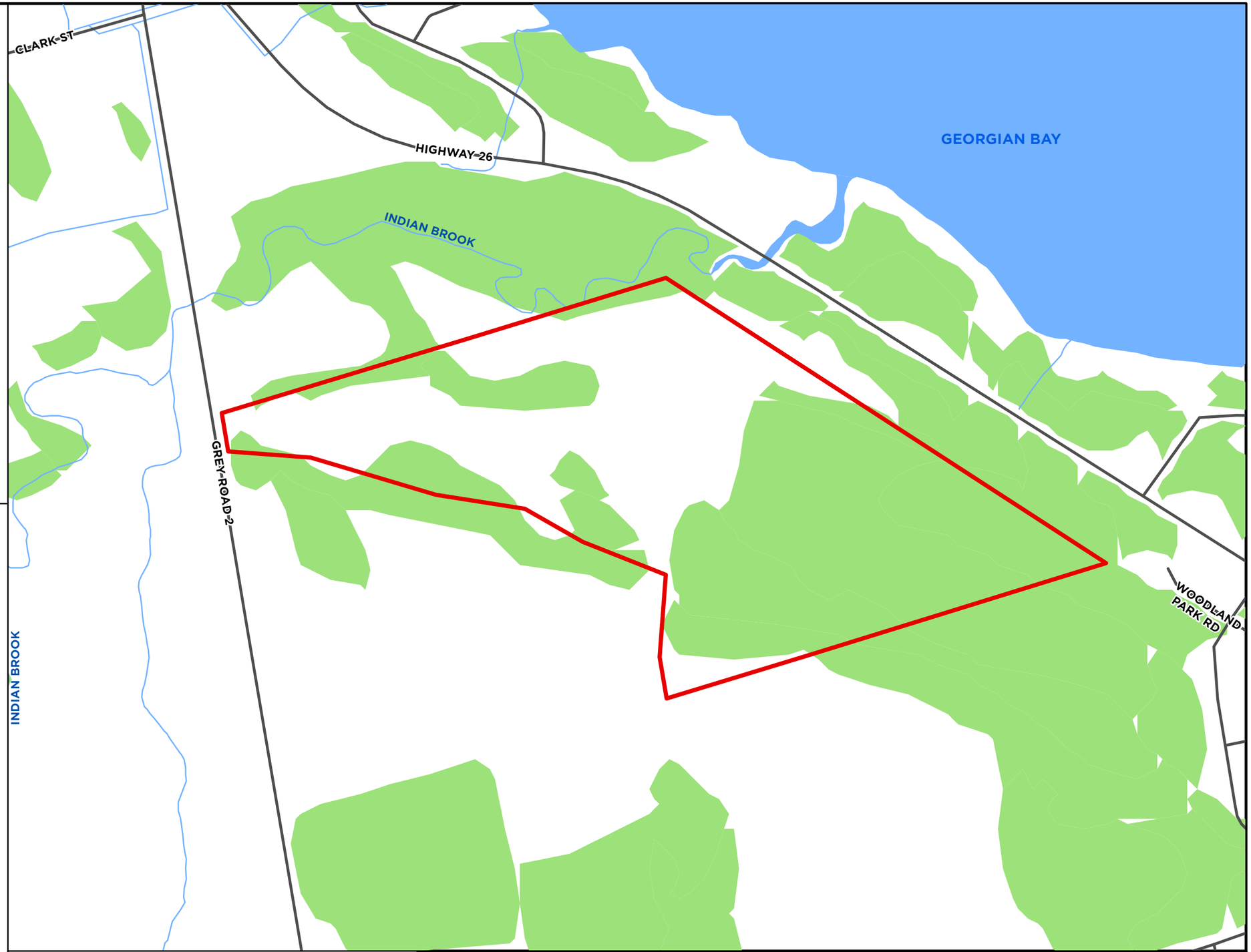
LEGEND

- SITE

WELLHEAD PROTECTION AREA (LSRCA 2022)

ZONE

- A
- B
- C
- C1
- D
- ROADS
- WATERCOURSE
- WATERBODY
- WOODED AREA



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TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
WELLHEAD PROTECTION AREA

DWG. No. **FIG-3**

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NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

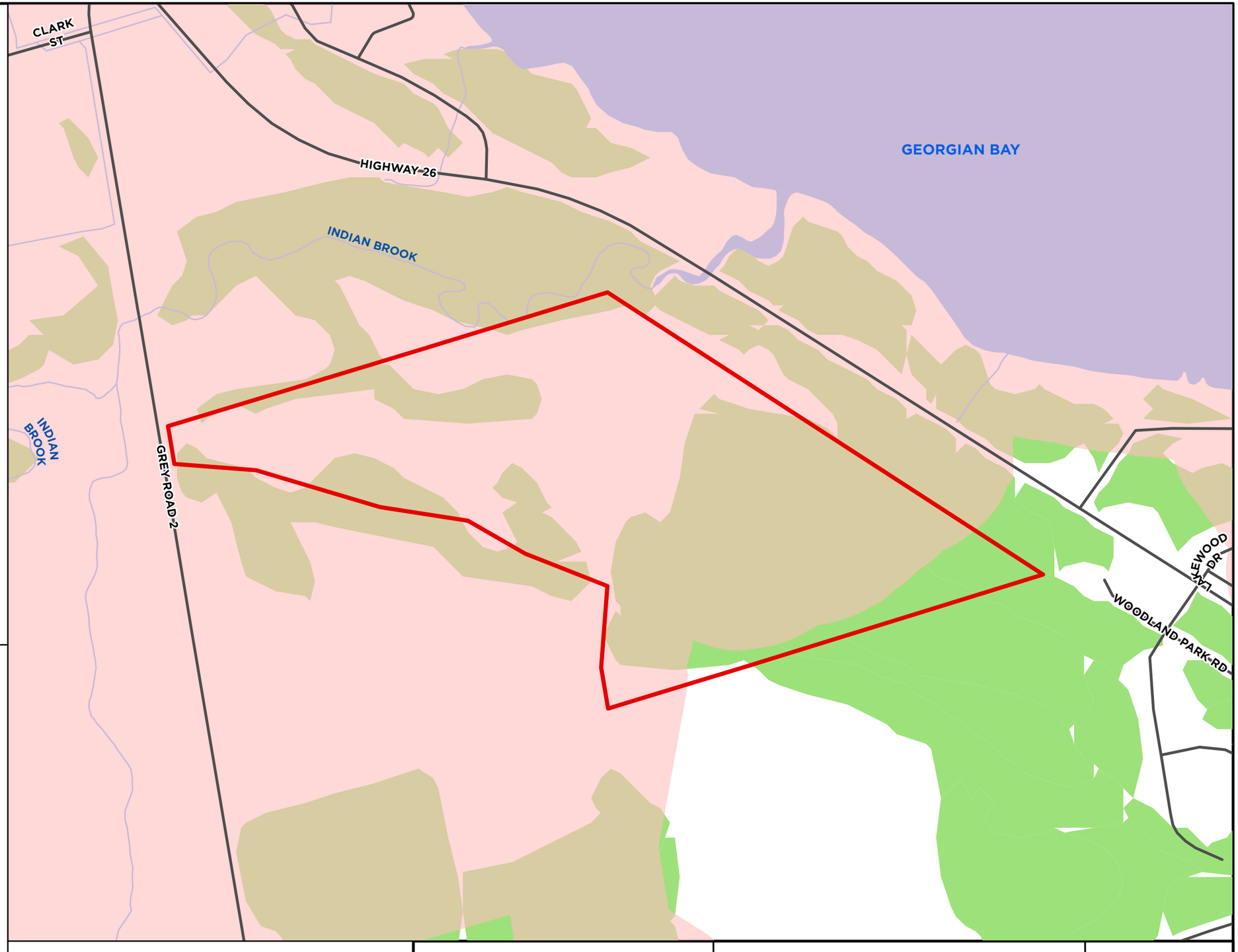
LEGEND

- SITE

INTAKE PROTECTION ZONES (LSRCA 2022)

ZONE

- 1
- 2
- 3
- ROADS
- WATERCOURSE
- WATERBODY
- WOODED AREA



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TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
INTAKE PROTECTION ZONE

DWG. No. **FIG-4**

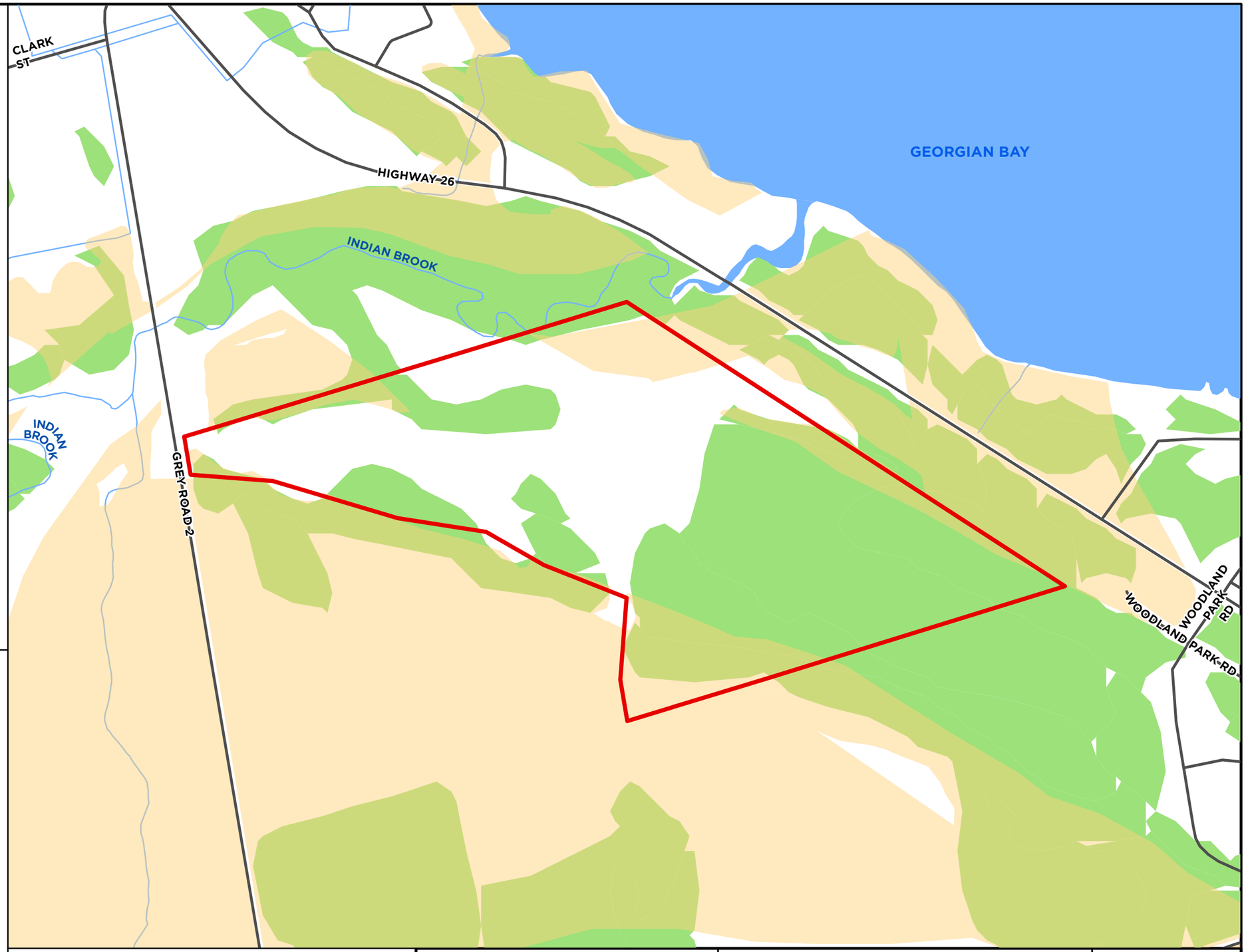
SCALE: 1:6,000	DRAWN: AO	DATE: SEP. 2024	JOB NO. 123069

O:\Collingwood\Digital Mapping\Permission Not Granted - Place here Instead\123069 - Hinds Property\123069 - Hinds Property.aprx

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- SIGNIFICANT GROUNDWATER RECHARGE AREA
- ROADS
- WATERCOURSE
- WATERBODY
- WOODED AREA



TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
SIGNIFICANT GROUNDWATER RECHARGE AREA

DWG. No. **FIG-5**

SCALE: 1:6,000	DRAWN: AO	DATE: SEP. 2024	JOB NO. 123069

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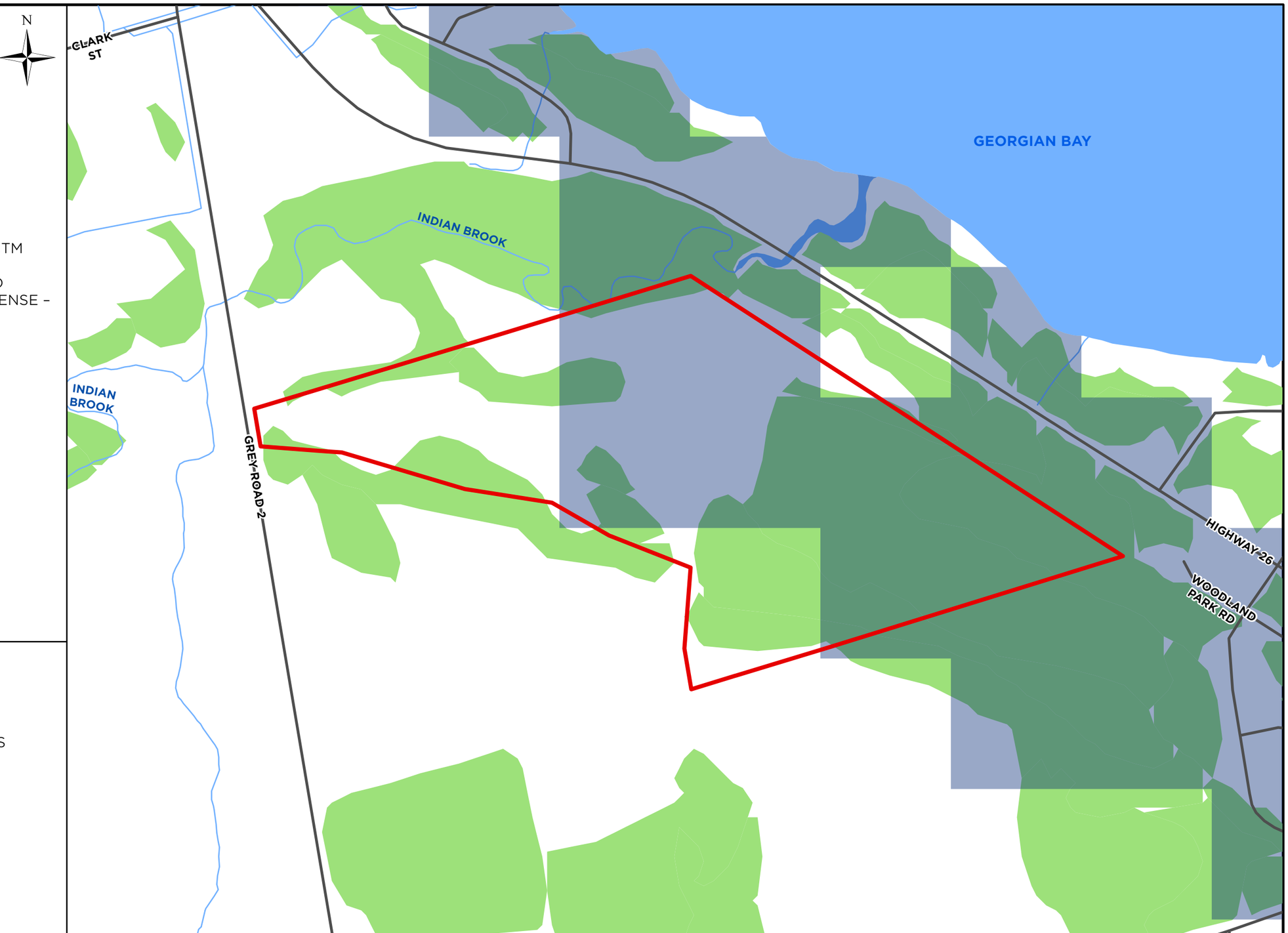
NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- HIGHLY VULNERABLE AQUIFERS
- ROADS
- WATERCOURSE
- WATERBODY
- WOODED AREA



0 112.5 225 450 METERS

TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
HIGHLY VULNERABLE AQUIFER

DWG. No. **FIG-6**

SCALE: 1:6,000 | DRAWN: AO | DATE: SEP. 2024 | JOB NO. 123069

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N

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- MONITORING WELL LOCATIONS
- ROADS

0 90 180 360
METERS

TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
BOREHOLE MONITORING/
WELL LOCATION PLAN

DWG. No. **FIG-7**

SCALE: 1:5,000	DRAWN: AO	DATE: SEP. 2024	JOB NO. 123069

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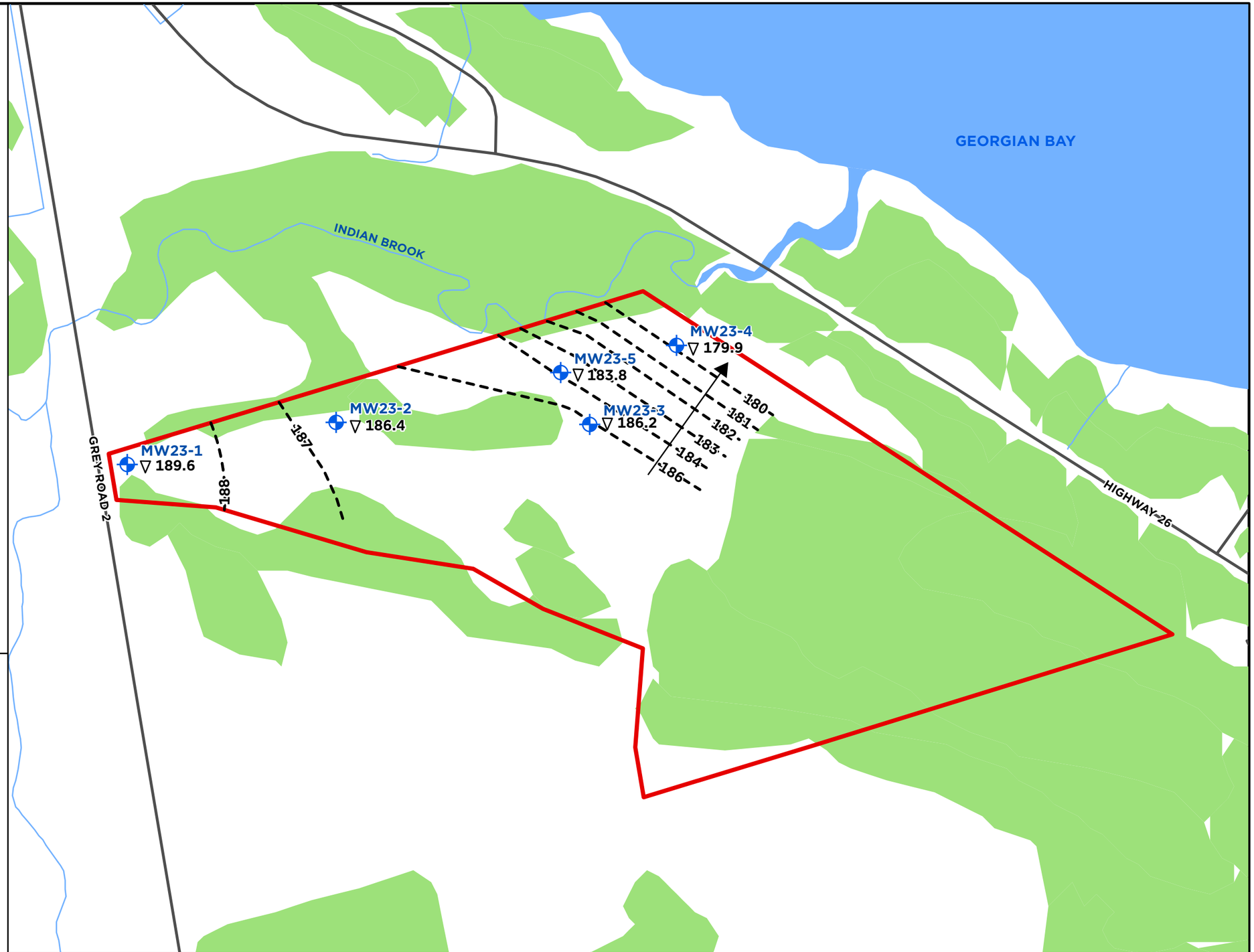
NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
2.CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO.

LEGEND

- SITE
- MONITORING WELL LOCATIONS
- ROADS
- WATERCOURSE
- WATERBODY
- WOODED AREA
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER ELEVATION (MEASURED DECEMBER 5, 2023)



TATHAM ENGINEERING

HINDS PROPERTY, THORNBURY
HYDROGEOLOGICAL SITE ASSESSMENT
GROUNDWATER CONTOUR

DWG. No. **FIG-8**

SCALE: 1:5,000	DRAWN: AO	DATE: SEP. 2024	JOB NO. 123069

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Appendix A:
MECP Water Well Records

TATHAM ENGINEERING

Ministry of the Environment, Conservation and Parks
Water Well Records

Township Con Lot	UTM	Date Centre	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
COLLINGWOOD TOWNSHIP	17 545224 4932774 W	2018/05 7075	36					7315213 (Z252385) A	
COLLINGWOOD TOWNSHIP	17 545161 4932891 W	2018/05 7075	36					7315212 (Z252384) A	
COLLINGWOOD TOWNSHIP CON 07 029	17 546366 4932602 W	2008/11 1565	6.25 6.25	FR 0040	12/18//15:	DO		7116854 (Z88355) A060791	LOAM 0002 GREY CLAY BLDR 0020 BRWN SHLE HARD 0051
COLLINGWOOD TOWNSHIP CON 07 029	17 546550 4932602 W	2015/05 1565	6.25 6.25	FR 0040	7/7/10/40:	DO		7244263 (Z197417) A078614	LOAM 0001 CLAY SNDY 0010 SHLE HARD 0026 SHLE 0050
COLLINGWOOD TOWNSHIP CON 07 029	17 546527 4932586 W	2003/12 1565	6.25	FR 0036	8/12/4/16:30	DO		2515878 (Z02290) A002203	LOAM 0001 BRWN CLAY STNS SNDY 0018 BLCK SHLE LYRD ROCK 0047
COLLINGWOOD TOWNSHIP CON 07 029	17 546562 4932584 W	2019/05 2576	6 6	FR 0034 FR 0048	8/9/8/1:30	DO		7333207 (Z311431) A250100	GREY SAND BLDR 0007 BLCK LMSN HARD 0052
COLLINGWOOD TOWNSHIP CON 07 029	17 546364 4932663 W	1955/06 1725	4 4	FR 0029	5/20/8/3:0	DO		2500529 ()	CLAY 0021 SHLE 0030
COLLINGWOOD TOWNSHIP CON 07 029	17 546514 4932623 W	1964/07 3408	4 4	FR 0035	8/20/10/5:0	DO		2500530 ()	CLAY BLDR 0026 SHLE 0040

Township Con Lot	UTM	Date Centre	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
COLLINGWOOD TOWNSHIP CON 07 029	17 546514 4932543 W	1956/06 1725	4 4	FR 0028	3/10/2/3:0	DO		2500528 ()	HPAN STNS 0012 BLUE CLAY ROCK 0029
COLLINGWOOD TOWNSHIP CON 08 029	17 545033 4932520 W	2010/07 6433	6	FR 0063	27/41/4/1:20			7152421 (Z105916) A091751	BRWN LOAM 0002 BRWN CLAY 0017 GREY CLAY 0022 GREY CLAY 0034 GREY GRVL 0063 GRVL 0065
COLLINGWOOD TOWNSHIP CON 08 029	17 545139 4932373 W	1965/05 3408	5	FR 0090	40/45/5/15:0	DO		2500543 ()	BLDR GRVL 0035 HPAN CLAY GRVL 0080 MSND GRVL 0096
COLLINGWOOD TOWNSHIP CON 08 029	17 545824 4932763 W	1970/06 4716	5	FR 0022 FR 0036	11/34/4/2:0	DO		2503208 ()	BRWN GRVL STNS 0003 GREY CLAY 0015 BLCK SHLE 0040
COLLINGWOOD TOWNSHIP CON 08 029	17 545074 4932323 W	1970/11 4716	4	FR 0058	31/40/8/2:0	DO		2503360 ()	BRWN FILL 0002 BRWN CLAY GRVL STNS 0021 GREY CLAY MSND 0054 GREY MSND CLAY 0058 BRWN MSND GRVL 0060
COLLINGWOOD TOWNSHIP CON 08 030	17 545380 4933031 L	1995/12 2576				NU		2513006 (157968) A	LOAM 0001 BRWN CLAY GRVL 0009 GREY GRVL SILT STNS 0031 GREY SHLE 0056
COLLINGWOOD TOWNSHIP CON 08 030	17 545380 4933031 L	1995/12 2576				NU		2513007 (157967) A	LOAM 0001 BRWN CLAY GRVL 0009 GREY GRVL SILT STNS 0031 GREY SHLE 0063 BLCK LMSN HARD 0078 GREY LMSN SHLE 0098

Ministry of the Environment, Conservation and Parks
Water Well Records

Township Con Lot	UTM	Date Centre	Casing Dia	Water	Pump Test	Well Use	Screen Depth	Well	Formation
COLLINGWOOD TOWNSHIP CON 08 030	17 545137 4932669 W	2009/04 3030						7123132 (Z93584) A	BRWN LOAM STNS 0001 BRWN SAND GRVL 0003 BRWN CLAY STNS 0012 GREY CLAY STNS HARD 0029 GREY SILT 0034 GREY CLAY 0042 GREY GRVL 0042 GREY SHLE 0044

UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completed and Well Contractor Licence Number
CASING DIA: Casing diameter in inches
WATER: Unit of Depth in Feet. See Table 4 for meanign of code.
PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hr : Min
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag. A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

Table 1: Core Material and Descriptive Terms

BLDR BOULDERS	FCRD FRACTURED	IRFM IRON FORMATION	PORS POROUS	SOFT SOFT
BSLT BASALT	FGRD FINE-GRAINED	LIMY LIMY	PRDG PREVIOUSLY DUG	SPST SOAPSTONE
CGRD COARSE-GRAINED	FGVL FINE GRAVEL	LMSN LIMESTONE	PRDR PREV. DRILLED	STKY STICKY
CGVL COARSE GRAVEL	FILL FILL	LOAM TOPSOIL	QRTZ QUARTZITE	STNS STONES
CHRT CHERT	FLDS FELDSPAR	LOOS LOOSE	QSND QUICKSAND	STNY STONEY
CLAY CLAY	FLNT FLINT	LTCL LIGHT-COLOURED	QTZ QUARTZ	THIK THICK
CLN CLEAN	FOSS FOSILIFEROUS	LYRD LAYERED	ROCK ROCK	THIN THIN
CLYY CLAYEY	FSND FINE SAND	MARL MARL	SAND SAND	TILL TILL
CMTD CEMENTED	GNIS GNEISS	MGRD MEDIUM-GRAINED	SHLE SHALE	UNKN UNKNOWN TYPE
CONG CONGLOMERATE	GRNT GRANITE	MGVL MEDIUM GRAVEL	SHLY SHALY	VERY VERY
CRYS CRYSTALLINE	GRSN GREENSTONE	MRBL MARBLE	SHRP SHARP	WBRG WATER-BEARING
CSND COARSE SAND	GRVL GRAVEL	MSND MEDIUM SAND	SHST SCHIST	WDFR WOOD FRAGMENTS
DKCL DARK-COLOURED	GRWK GREYWACKE	MUCK MUCK	SILT SILT	WTHD WEATHERED
DLMT DOLOMITE	GVLY GRAVELLY	OBDN OVERBURDEN	SLTE SLATE	
DNSE DENSE	GYPS GYPSUM	PCKD PACKED	SLTY SILTY	
DRTY DIRTY	HARD HARD	PEAT PEAT	SNDS SANDSTONE	
DRY DRY	HPAN HARDPAN	PGVL PEA GRAVEL	SNDY SANDYOAPSTONE	

Table 2: Core Color

WHIT WHITE
GREY GREY
BLUE BLUE
GREN GREEN
YLLW YELLOW
BRWN BROWN
RED RED
BLCK BLACK
BLGY BLUE-GREY

Table 3: Well Use

DO Domestic	OT Other
ST Livestock	TH Test Hole
IR Irrigation	DE Dewatering
IN Industrial	MO Monitoring
CO Commercial	MT Monitoring TestHole
MN Municipal	
PS Public	
AC Cooling And A/C	
NU Not Used	

Table 4:Water Detail

FR Fresh	GS Gas
SA Salty	IR Iron
SU Sulphur	
MN Mineral	
UK Unknown	

Appendix B:
Borehole Logs

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-1

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932642.81 E 544944.58

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Nov-23-2023

REF. NO.: 23-301-100
ENCL NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
190.8					
190.6 0.0	**TOPSOIL:** 150mm				
0.2	**FILL:** sandy silt, some clay, trace rootlets, some gravel, trace organics, dark brown, moist, loose	1	SS	7	
	stone fragments, wet at 0.8m	2	SS	9	190
189.2	wet sand at 1.5m				
1.6	**SAND AND GRAVEL:** trace silt, with cobbles/boulders, brown, wet, very dense	3	SS	50/ 130mm	189
188.7	grey below 1.8m				
2.1	**SANDY SILT TO SILTY SAND TILL:** trace clay, trace to some gravel, with cobbles/boulders, brown to grey, very moist to wet, very dense	4	SS	50/ 130mm	
		5	SS	50/ 75mm	188
					187
	gravelly at 4.6m	6	SS	50/ 130mm	186
					185
184.6		7	SS	50/ 130mm	
6.2	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Dec. 5, 2023	1.18

W. L. 189.6 m
Dec 05, 2023

Auger grinding at 1.5m

Auger grinding at 3.1m

Auger grinding at 4.6m

33 45 17 6

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-2

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932695.67 E 545205.97

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.2							
0.0 / 188.0	**TOPSOIL:** 230mm						
0.2 / 187.4	**FILL:** sand and gravel, trace topsoil, dark brown, moist, loose	1	SS	9		188	
0.8 / 187.2	**SAND:** some gravel, trace silt, brown, wet, compact						
1.0 / 186.7	**SANDY SILT TILL:** some clay, trace gravel, brown, wet, compact	2	SS	15		187	
1.5	**SILTY SAND:** gravelly, trace clay, with cobbles/rock fragments, brown, wet, compact	3	SS	29	▽		25 44 25 7
2 / 185.9					W. L. 186.4 m Dec 05, 2023	186	
2.3	**SANDY SILT TO SILTY SAND TILL:** trace clay, some gravel, with cobbles/boulders, grey, very moist to wet, very dense	4	SS	71			
3		5	SS	50/ 150mm		185	
4						184	auger grinding at 4.6m 17 28 47 8
5		6	SS	50/ 75mm		183	
6 / 182.0							
6.2	**END OF BOREHOLE:**	7	SS	50/ 50mm		182	

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Dec. 5, 2023	1.81

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-3

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932693.05 E 545523.36

DRILLING DATA
Method: Solid Stem Auger/Hollow Stem Auger
Diameter: 150mm/200mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.2												
186.9 / 0.3	**TOPSOIL:** 50mm											
	FILL: sand and gravel, trace rootlets, trace silt, dark brown, very moist, loose		1	SS	7		187					
186.4												
0.8	**GRAVELLY SAND:** some silt, trace clay, with cobbles/boulders, brown, wet, compact		2	SS	17	▽						
							W. L. 186.2 m Dec 05, 2023					
			3	SS	16							29 54 14 3
184.9							185					
2.3	**SANDY SILT TILL:** trace clay, trace gravel, with cobbles/boulders, grey, very moist, dense to very dense		4	SS	46							
			5	SS	68		184					Switched to Hollow Stem
							183					
			6	SS	50/ 130mm							8 32 51 9
							182					
			7	SS	50/ 130mm		181					
180.6												
6.6	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Dec. 5, 2023 1.0											

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-4

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932792.79 E 545632.71

DRILLING DATA
Method: Solid Stem Auger/Hollow Stem Auger
Diameter: 150mm/200mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
182.2						
182.0 0.0	**TOPSOIL:** 130mm					
0.1	**FILL:** sand and gravel, trace rootlets, dark brown to brown, very moist to wet, loose to dense	1	SS	14	182	
181.2		2	SS	45		
1.0 181.0	**SAND AND GRAVEL:** trace silt, with cobbles/boulders, brown, wet, dense				181	
1.2	**SILTY SAND TO SANDY SILT TILL:** trace to some clay, trace gravel, with cobbles/boulders, brown to grey, very moist to wet, dense to very dense	3	SS	50/ 130mm		
		4	SS	50/ 100mm	180	W. L. 179.9 m Dec 05, 2023 Switched to Hollow Stem Auger @2.3m
		5	SS	50/ 130mm	179	
					178	
		6	SS	50/ 100mm		9 30 51 10
176.2					177	
6.0	**SILT TILL:** sandy, trace gravel, occasional cobble, grey, moist, very dense	7	SS	50/ 130mm	176	
175.6						
6.6	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Dec. 5, 2023 2.25					

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-5

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932757.62 E 545486.69

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.2												
184.0 0.0	**TOPSOIL:** 130mm											
0.1	**FILL:** sand, trace rootlets, trace gravel, brown, very moist to wet, loose to compact		1	SS	4		184					
183.2												
1.0	**SAND AND GRAVEL:** trace silt, trace clay, brown, wet, compact to very dense		2	SS	21		183					
182.3			3	SS	67							
1.9	**SANDY SILT TO SILTY SAND TILL:** trace clay, trace to some gravel, occasional cobbles, grey, moist to wet, very dense		4	SS	50/ 100mm		182					
			5	SS	50/ 100mm		181					
			6	SS	50/ 130mm		180					14 45 34 7
178.2							179					
6.0	**SILT TO SANDY SILT TILL:** trace clay, trace gravel, grey, very moist, very dense		7	SS	50/ 130mm		178					
177.8												
6.4	**END OF BOREHOLE:**											

W. L. 183.8 m
Dec 05, 2023

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Dec. 5, 2023	0.42

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

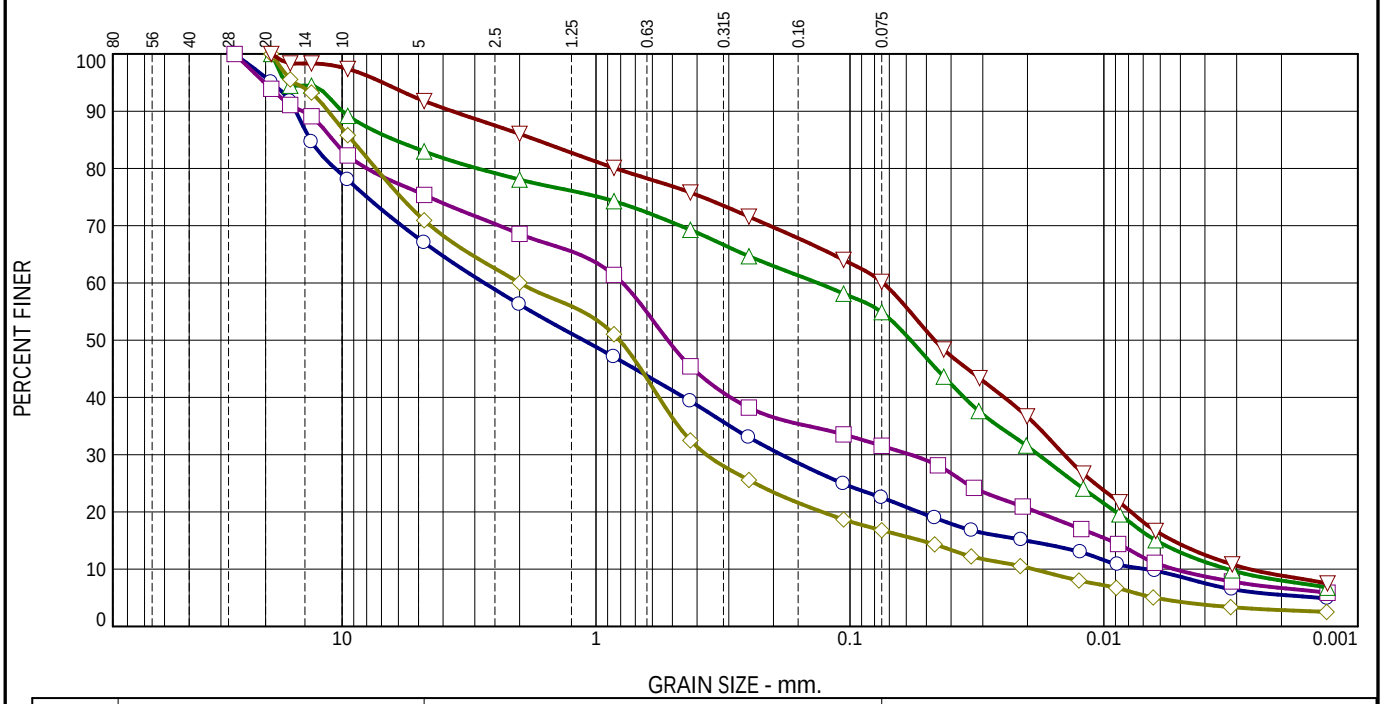
GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

Appendix C:
Grain Size Distribution

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.9	28.1	10.8	16.8	16.9	17.0	5.5
□	0.0	6.0	18.6	6.8	23.2	13.8	24.9	6.7
△	0.0	0.0	17.0	4.9	8.8	14.4	46.9	8.0
◇	0.0	0.0	29.1	10.9	27.5	15.7	13.9	2.9
▽	0.0	0.0	8.2	5.8	10.2	15.6	51.3	8.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			13.3576	2.7542	1.1202	0.1861	0.0203	0.0068	1.85	405.40
□			10.8743	0.7852	0.5219	0.0577	0.0094	0.0053	0.80	148.65
△			6.2187	0.1341	0.0576	0.0181	0.0062	0.0032	0.75	41.27
◇			9.1622	1.9952	0.8072	0.3676	0.0524	0.0189	3.57	105.32
▽			1.7217	0.0741	0.0464	0.0143	0.0054	0.0027	1.04	27.73

Material Description	USCS	AASHTO
○ Gravelly sand, some silt, trace clay		
□ Gravelly sand, some silt, trace clay		
△ Sandy silt, some gravel, trace clay		
◇ Gravelly sand, some silt, trace clay		
▽ Sandy silt till, trace clay, trace gravel		

Project No. 23-301-100 Client: Homefield Communities.

Project: Preliminary Geotechnical Investigation, 496857 Grey Road 2, Blue Mountain.

○ Location: BH23-1 SS6 Sample Number: VM-4940

□ Location: BH23-2 SS3 Sample Number: VM-4940

△ Location: BH23-2 SS6 Sample Number: VM-4940

◇ Location: BH23-3 SS3 Sample Number: VM-4940

▽ Location: BH23-3 SS6 Sample Number: VM-4940

Remarks:

○ F.M.=3.45

□ F.M.=2.84

△ F.M.=1.74

◇ F.M.=3.35

▽ F.M.=1.23

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

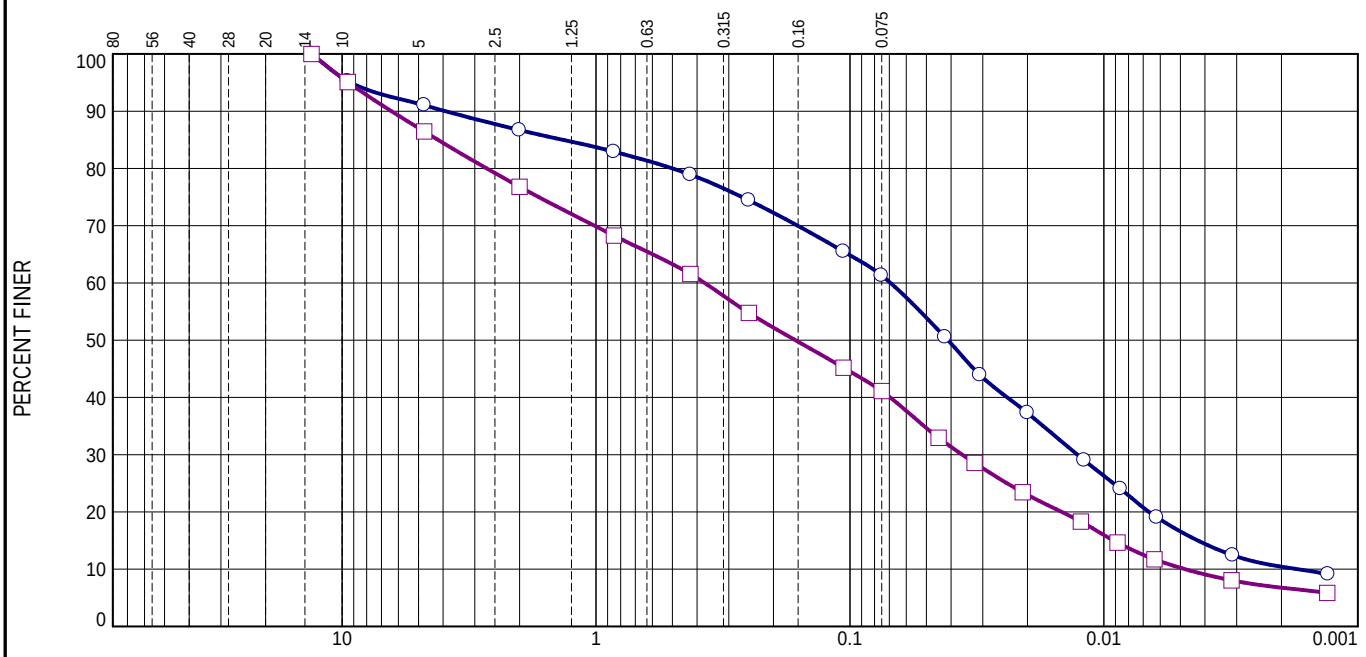
CCIL

Figure 7

Tested By: Helen/Disha Checked By: Kirupa

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	9.0	4.3	7.8	17.6	50.9	10.4
□	0.0	0.0	13.5	9.7	15.2	20.5	34.3	6.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3504	0.0692	0.0411	0.0127	0.0043	0.0017	1.36	40.11
□			4.1948	0.3733	0.1640	0.0361	0.0092	0.0048	0.73	77.87

Material Description	USCS	AASHTO
○ Sandy silt till, some clay, trace gravel □ Silty sand till, trace clay, some gravel		

Project No. 23-301-100 Client: Homefield Communities.

Project: Preliminary Geotechnical Investigation, 496857 Grey Road 2, Blue Mountain.

○Location: BH23-4 SS6 Sample Number: VM-4940

□Location: BH23-5 SS6 Sample Number: Vm-4940

Remarks:

○F.M.=1.15

□F.M.=1.97

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

CCIL

Figure 8

Tested By: Helen/Disha Checked By: Kirupa

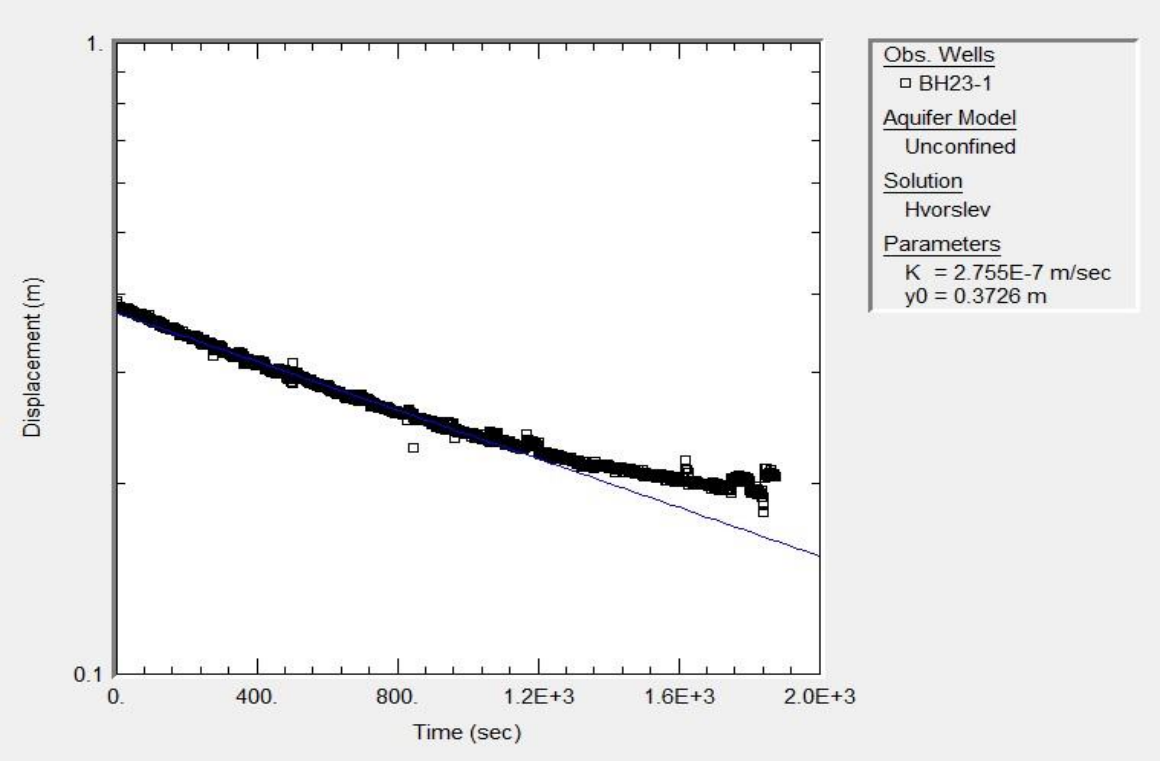
Appendix D:
Borehole Permeability Tests

TATHAM ENGINEERING

Estimated Hydraulic Conductivity - Slug Test
Hvorslev Equation

Date Completed:	12/1/2023
Conducted by:	NT

Well Number:	BH23-1	
Well Screen Bottom:	6.1	mbgs
Top of Pipe:	0.85	mags
Well Casing Diameter:	5	cm
Well Elevation:		masl
Static Water Level:	2.23	mbgs
K:	2.76E-07	m/s



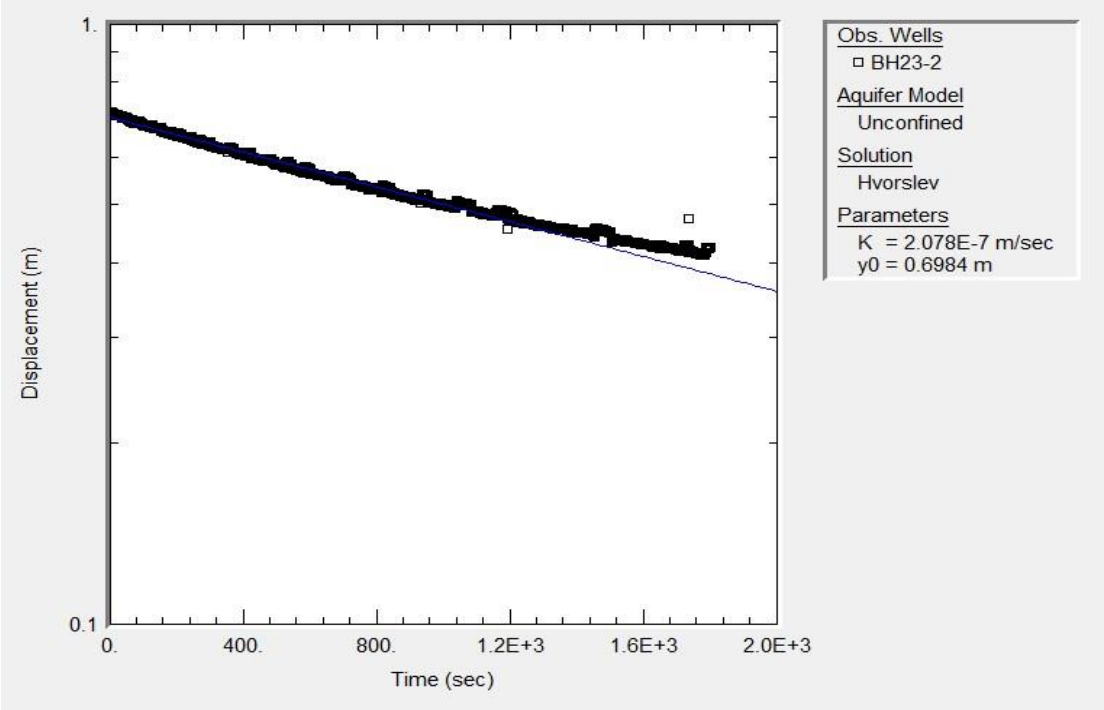
Reference: Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, US Army, Vicksburg, Mississippi, pp 1-50.

TATHAM ENGINEERING

Estimated Hydraulic Conductivity - Slug Test
Hvorslev Equation

Date Completed:	12/1/2023
Conducted by:	NT

Well Number:	BH23-2	
Well Screen Bottom:	6.1	mbgs
Top of Pipe:	0.89	mags
Well Casing Diameter:	5	cm
Well Elevation:		masl
Static Water Level:	4.5	mbgs
K:	2.08E-07	m/s



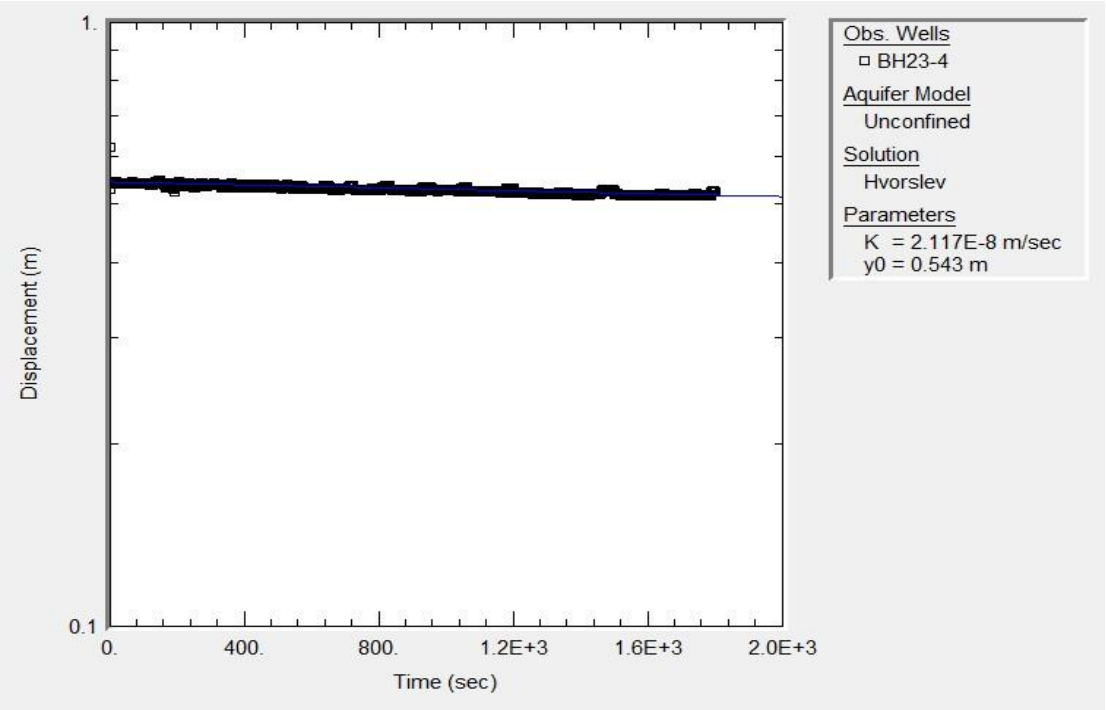
Reference: Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, US Army, Vicksburg, Mississippi, pp 1-50.

TATHAM ENGINEERING

Estimated Hydraulic Conductivity - Slug Test
Hvorslev Equation

Date Completed:	12/1/2023
Conducted by:	NT

Well Number:	BH23-4	
Well Screen Bottom:	6.1	mbgs
Top of Pipe:	0.88	mags
Well Casing Diameter:	5	cm
Well Elevation:		masl
Static Water Level:	4.26	mbgs
K:	2.12E-08	m/s



Reference: Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. No. 36, Waterways Exper. Sta. Corps of Engrs, US Army, Vicksburg, Mississippi, pp 1-50.

Appendix E:
Groundwater Quality

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Canadian owned.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: -

REPORT No: 23-033772 - Rev. 0

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Noah Trembley

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Dec-01
DATE REPORTED: 2023-Dec-07
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: Hinds Brook-123069
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Chromium VI (Liquid)	1	OTTAWA	STAILLON	2023-Dec-07	D-CRVI-01	MECP E3056
ICP/MS Total (Liquid)	1	OTTAWA	AOZKAYMAK	2023-Dec-06	D-ICPMS-01	EPA 6020
ICP/OES Total (Liquid)	1	OTTAWA	APRUDYVUS	2023-Dec-06	D-ICP-01	SM 3120B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Dec-06	D-ICP-01	SM 3120B
Mercury (Liquid)	1	OTTAWA	TBENNETT	2023-Dec-05	D-HG-02	SM 3112B
PHC F1 (Liquid)	1	RICHMOND_HILL	CBURKE	2023-Dec-07	C-VPHW-01	MECP E3421
PHC F2-4 (Liquid)	1	KINGSTON	STHOMPSON	2023-Dec-05	PHC-W-001	MECP E3421
VOC-Volatiles Full (Water)	1	RICHMOND_HILL	CBURKE	2023-Dec-07	C-VOC-02	EPA 8260

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg
F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)
F2 C10-C16 hydrocarbons in µg/g, (F2-napth if requested)
F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)
F4 C34-C50 hydrocarbons in µg/g
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
Any deviations from the method are noted and reported for any particular sample.
nC6 and nC10 response factor is within 30% of response factor for toluene:
nC10,nC16 and nC34 response factors within 10% of each other:
C50 response factors within 70% of nC10+nC16+nC34 average:
Linearity is within 15%:
All results expressed on a dry weight basis.
Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

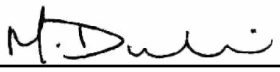
Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met.
If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC
QC will be made available upon request.

Michelle Dubien
Data Specialist

				Client I.D.	MW23-1
				Sample I.D.	23-033772-1
				Date Collected	2023-Dec-01
Parameter	Units	R.L.	Limits		-
Aluminum	µg/L	10	75	INTERIM	33
Hardness (as CaCO3)	mg/L as CaCO3	-			170
Aluminum (Total)	µg/L	10			11
Boron (Total)	µg/L	5	200	INTERIM	409
Calcium (Total)	µg/L	20			36900
Iron (Total)	µg/L	5	300	PWQO	15
Magnesium (Total)	µg/L	20			18900
Tungsten (Total)	µg/L	10	30	INTERIM	<10
Zinc (Total)	µg/L	5	20, 30	INTERIM, PWQO	197
Zirconium (Total)	µg/L	3	4	INTERIM	<3
Antimony (Total)	µg/L	0.1	20	INTERIM	1.1
Arsenic (Total)	µg/L	0.1	5, 5	INTERIM, PWQO	0.7
Beryllium (Total)	µg/L	0.1	11	PWQO	<0.1
Cadmium (Total)	µg/L	0.015	0.1, 0.2	INTERIM, PWQO	<0.015
Chromium (Total)	µg/L	1			<1
Cobalt (Total)	µg/L	0.1	0.9	INTERIM	0.3
Copper (Total)	µg/L	0.1	5	INTERIM	2.8
Lead (Total)	µg/L	0.02	1, 5	INTERIM, PWQO	0.06
Molybdenum (Total)	µg/L	0.1	40	INTERIM	2.6
Nickel (Total)	µg/L	0.2	25	PWQO	0.8
Selenium (Total)	µg/L	1	100	PWQO	<1

Michelle Dubien
Data Specialist

				Client I.D.	MW23-1
				Sample I.D.	23-033772-1
				Date Collected	2023-Dec-01
Parameter	Units	R.L.	Limits		-
Silver (Total)	µg/L	0.1	0.1	PWQO	<0.1
Thallium (Total)	µg/L	0.05	0.3, 0.3	INTERIM, PWQO	<0.05
Uranium (Total)	µg/L	0.05	5	INTERIM	0.17
Vanadium (Total)	µg/L	0.1	6	INTERIM	0.1
Chromium (VI)	µg/L	1	1	PWQO	<1
Mercury	µg/L	0.02	0.2	PWQO	<0.02



Michelle Dubien
Data Specialist

Parameter	Units	R.L.	Limits		Client I.D.: MW23-1 Sample I.D.: 23-033772-1 Date Collected: 2023-Dec-01 -
Acetone	µg/L	30			<30
Benzene	µg/L	0.5	100	INTERIM	<0.5
Bromodichloromethane	µg/L	2	200	INTERIM	<2
Bromoform	µg/L	5	60	INTERIM	<5
Bromomethane	µg/L	0.5	0.9	INTERIM	<0.5
Carbon Tetrachloride	µg/L	0.2			<0.2
Chlorobenzene	µg/L	0.5	15	PWQO	<0.5
Chloroform	µg/L	1			<1
Dibromochloromethane	µg/L	2	40	INTERIM	<2
Ethylene Dibromide	µg/L	0.2	5, 5	INTERIM, PWQO	<0.2
Dichlorobenzene,1,2-	µg/L	0.5	2.5	PWQO	<0.5
Dichlorobenzene,1,3-	µg/L	0.5	2.5	PWQO	<0.5
Dichlorobenzene,1,4-	µg/L	0.5	4	PWQO	<0.5
Dichlorodifluoromethane (Freon 12)	µg/L	2			<2
Dichloroethane,1,1-	µg/L	0.5	200	INTERIM	<0.5
Dichloroethane,1,2-	µg/L	0.5	100	INTERIM	<0.5
Dichloroethylene,1,1-	µg/L	0.5	40	INTERIM	<0.5
Dichloroethylene,1,2-cis-	µg/L	0.5	200	INTERIM	<0.5
Dichloroethylene,1,2-trans-	µg/L	0.5	200	INTERIM	<0.5
Dichloropropane,1,2-	µg/L	0.5	0.7	INTERIM	<0.5
Dichloropropene,1,3-cis-	µg/L	0.5			<0.5

Michelle Dubien
Data Specialist

				Client I.D.	MW23-1
				Sample I.D.	23-033772-1
				Date Collected	2023-Dec-01
Parameter	Units	R.L.	Limits		-
Dichloropropene,1,3-cis+trans-(Calculated)	µg/L	0.5			<0.5
Dichloropropene,1,3-trans-	µg/L	0.5	7	INTERIM	<0.5
Ethylbenzene	µg/L	0.5	8	INTERIM	<0.5
Hexane	µg/L	5			<5
Dichloromethane (Methylene Chloride)	µg/L	5	100	INTERIM	<5
Methyl Ethyl Ketone	µg/L	20	400	INTERIM	<20
Methyl Isobutyl Ketone	µg/L	20			<20
Methyl tert-Butyl Ether (MTBE)	µg/L	2	200	INTERIM	<2
Styrene	µg/L	0.5	4	INTERIM	<0.5
Tetrachloroethane,1,1,1,2-	µg/L	0.5	20	INTERIM	<0.5
Tetrachloroethane,1,1,2,2-	µg/L	0.5	70	INTERIM	<0.5
Tetrachloroethylene	µg/L	0.5	50	INTERIM	<0.5
Toluene	µg/L	0.5	0.8, 0.8	INTERIM, PWQO	<0.5
Trichloroethane,1,1,1-	µg/L	0.5	10	INTERIM	<0.5
Trichloroethane,1,1,2-	µg/L	0.5	800	INTERIM	<0.5
Trichloroethylene	µg/L	0.5	20	INTERIM	<0.5
Trichlorofluoromethane (Freon 11)	µg/L	5			<5
Vinyl Chloride	µg/L	0.2	600	INTERIM	<0.2
Xylene, m,p-	µg/L	1			<1
Xylene, m,p,o-	µg/L	1.1			<1.1
Xylene, o-	µg/L	0.5	40	INTERIM	<0.5

Michelle Dubien
Data Specialist

Parameter	Units	R.L.	Limits		Client I.D.: MW23-1 Sample I.D.: 23-033772-1 Date Collected: 2023-Dec-01
					-
PHC F1 (C6-C10)	µg/L	25			<25
PHC F2 (>C10-C16)	µg/L	50			<50
PHC F3 (>C16-C34)	µg/L	400			<400
PHC F4 (>C34-C50)	µg/L	400			<400

Total metals done from filtered metals bottle as per client request

: PWQO Limits
INTERIM: Interim PWQO
PWQO: PWQO

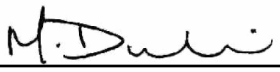
Summary of Exceedances

Interim PWQO

MW23-1	Found Value	Limit
Boron (Total)	409	200
Zinc (Total)	197	20

PWQO

MW23-1	Found Value	Limit
Zinc (Total)	197	30



Michelle Dubien
Data Specialist

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Canadian owned.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: -

REPORT No: 23-033772 - Rev. 0

Report To:
Tatham Engineering
115 Sandford Fleming Drive
Suite 200
Collingwood, ON L9Y 5A6

Attention: Noah Trembley

CADUCEON Environmental Laboratories
112 Commerce Park Dr Unit L
Barrie, ON L4N 8W8

DATE RECEIVED: 2023-Dec-01
DATE REPORTED: 2023-Dec-08
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: Hinds Brook-123069
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Chromium VI (Liquid)	1	OTTAWA	STAILLON	2023-Dec-07	D-CRVI-01	MECP E3056
ICP/MS Total (Liquid)	1	OTTAWA	AOZKAYMAK	2023-Dec-06	D-ICPMS-01	EPA 6020
ICP/OES Total (Liquid)	1	OTTAWA	APRUDYVUS	2023-Dec-06	D-ICP-01	SM 3120B
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Dec-06	D-ICP-01	SM 3120B
Mercury (Liquid)	1	OTTAWA	TBENNETT	2023-Dec-05	D-HG-02	SM 3112B
PHC F1 (Liquid)	1	RICHMOND_HILL	CBURKE	2023-Dec-07	C-VPHW-01	MECP E3421
PHC F2-4 (Liquid)	1	KINGSTON	STHOMPSON	2023-Dec-05	PHC-W-001	MECP E3421
VOC-Volatiles Full (Water)	1	RICHMOND_HILL	CBURKE	2023-Dec-07	C-VOC-02	EPA 8260

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg
F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)
F2 C10-C16 hydrocarbons in µg/g, (F2-napth if requested)
F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)
F4 C34-C50 hydrocarbons in µg/g
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
Any deviations from the method are noted and reported for any particular sample.
nC6 and nC10 response factor is within 30% of response factor for toluene:
nC10,nC16 and nC34 response factors within 10% of each other:
C50 response factors within 70% of nC10+nC16+nC34 average:
Linearity is within 15%:
All results expressed on a dry weight basis.
Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met.
If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC
QC will be made available upon request.

Christine Burke
Laboratory Manager

				Client I.D.	MW23-1
				Sample I.D.	23-033772-1
				Date Collected	2023-Dec-01
Parameter	Units	R.L.	Limits	Reg 153 - Liquid	-
Aluminum	µg/L	10.0			33.0
Hardness (as CaCO3)	mg/L	-			170
Aluminum (Total)	mg/L	0.01			0.011
Boron (Total)	mg/L	0.005			0.409
Calcium (Total)	mg/L	0.02			36.9
Iron (Total)	mg/L	0.005			0.015
Magnesium (Total)	mg/L	0.02			18.9
Tungsten (Total)	mg/L	0.01			<0.01
Zinc (Total)	mg/L	0.005			0.197
Zirconium (Total)	mg/L	0.003			<0.003
Antimony (Total)	mg/L	0.0001			0.0011
Arsenic (Total)	mg/L	0.0001			0.0007
Beryllium (Total)	mg/L	0.0001			<0.0001
Cadmium (Total)	mg/L	0.000015			<0.000015
Chromium (Total)	mg/L	0.001			<0.001
Cobalt (Total)	mg/L	0.0001			0.0003
Copper (Total)	mg/L	0.0001			0.0028
Lead (Total)	mg/L	0.00002			0.00006
Molybdenum (Total)	mg/L	0.0001			0.0026
Nickel (Total)	mg/L	0.0002			0.0008
Selenium (Total)	mg/L	0.001			<0.001

Christine Burke
Laboratory Manager

Parameter	Units	R.L.	Limits	Reg 153 - Liquid	Client I.D.	MW23-1
					Sample I.D.	23-033772-1
					Date Collected	2023-Dec-01
						-
Silver (Total)	mg/L	0.0001				<0.0001
Thallium (Total)	mg/L	0.00005				<0.00005
Uranium (Total)	mg/L	0.00005				0.00017
Vanadium (Total)	mg/L	0.0001				0.0001
Chromium (VI)	µg/L	1	25	T1GW		<1
Mercury	µg/L	0.02	0.1	T1GW		<0.02

Christine Burke
Laboratory Manager

Parameter	Units	R.L.	Limits	Client I.D. / Sample I.D. / Date Collected / Reg 153 - Liquid	MW23-1 / 23-033772-1 / 2023-Dec-01 / -
Acetone	µg/L	30	2700	T1GW	<30
Benzene	µg/L	0.5	0.5	T1GW	<0.5
Bromodichloromethane	µg/L	2	2	T1GW	<2
Bromoform	µg/L	5	5	T1GW	<5
Bromomethane	µg/L	0.5	0.89	T1GW	<0.5
Carbon Tetrachloride	µg/L	0.2	0.2	T1GW	<0.2
Chlorobenzene	µg/L	0.5	0.5	T1GW	<0.5
Chloroform	µg/L	1	2	T1GW	<1
Dibromochloromethane	µg/L	2	2	T1GW	<2
Ethylene Dibromide	µg/L	0.2	0.2	T1GW	<0.2
Dichlorobenzene,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Dichlorobenzene,1,3-	µg/L	0.5	0.5	T1GW	<0.5
Dichlorobenzene,1,4-	µg/L	0.5	0.5	T1GW	<0.5
Dichlorodifluoromethane (Freon 12)	µg/L	2	590	T1GW	<2
Dichloroethane,1,1-	µg/L	0.5	0.5	T1GW	<0.5
Dichloroethane,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Dichloroethylene,1,1-	µg/L	0.5	0.5	T1GW	<0.5
Dichloroethylene,1,2-cis-	µg/L	0.5	1.6	T1GW	<0.5
Dichloroethylene,1,2-trans-	µg/L	0.5	1.6	T1GW	<0.5
Dichloropropane,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Dichloropropene,1,3-cis-	µg/L	0.5			<0.5

Christine Burke
Laboratory Manager

				Client I.D.	MW23-1
				Sample I.D.	23-033772-1
				Date Collected	2023-Dec-01
Parameter	**Units**	**R.L.**	**Limits**	**Reg 153 - Liquid**	-
Dichloropropene,1,3-cis+trans-(Calculated)	µg/L	0.5	0.5	T1GW	<0.5
Dichloropropene,1,3-trans-	µg/L	0.5			<0.5
Ethylbenzene	µg/L	0.5	0.5	T1GW	<0.5
Hexane	µg/L	5	5	T1GW	<5
Dichloromethane (Methylene Chloride)	µg/L	5	5	T1GW	<5
Methyl Ethyl Ketone	µg/L	20	400	T1GW	<20
Methyl Isobutyl Ketone	µg/L	20	640	T1GW	<20
Methyl tert-Butyl Ether (MTBE)	µg/L	2	15	T1GW	<2
Styrene	µg/L	0.5	0.5	T1GW	<0.5
Tetrachloroethane,1,1,1,2-	µg/L	0.5	1.1	T1GW	<0.5
Tetrachloroethane,1,1,2,2-	µg/L	0.5	0.5	T1GW	<0.5
Tetrachloroethylene	µg/L	0.5	0.5	T1GW	<0.5
Toluene	µg/L	0.5	0.8	T1GW	<0.5
Trichloroethane,1,1,1-	µg/L	0.5	0.5	T1GW	<0.5
Trichloroethane,1,1,2-	µg/L	0.5	0.5	T1GW	<0.5
Trichloroethylene	µg/L	0.5	0.5	T1GW	<0.5
Trichlorofluoromethane (Freon 11)	µg/L	5	150	T1GW	<5
Vinyl Chloride	µg/L	0.2	0.5	T1GW	<0.2
Xylene, m,p-	µg/L	1			<1
Xylene, m,p,o-	µg/L	1.1	72	T1GW	<1.1
Xylene, o-	µg/L	0.5			<0.5

Christine Burke
Laboratory Manager

				Client I.D.	MW23-1
				Sample I.D.	23-033772-1
				Date Collected	2023-Dec-01
Parameter	Units	R.L.	Limits	Reg 153 - Liquid	-
PHC F1 (C6-C10)	µg/L	25	420	T1GW	<25
PHC F2 (>C10-C16)	µg/L	50	150	T1GW	<50
PHC F3 (>C16-C34)	µg/L	400	500	T1GW	<400
PHC F4 (>C34-C50)	µg/L	400	500	T1GW	<400

Total metals done from filtered metals bottle as per client request

Reg 153 - Liquid: Reg 153 - Liquid
T1GW: R153 Tbl. 1 - GW

Christine Burke
Laboratory Manager

GENERAL SAMPLE SUBMISSION FORM

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Proudly Canadian.

SAMPLES SUBMITTED TO:

Kingston	
Ottawa	
Richmond Hill	
Barrie	X
Windsor	

TESTING REQUIREMENTS

X	O'Reg 153/04	Table (1 - 9)	1	Record of Site	
	O'Reg 406/19	Table (1 - 9.1)		SPLP Table (1-9.1)	
	RPI			ICC	Agricultural
	Coarse			Medium/Fine	O'Reg 558 TCLP
	MISA		X	PWQO	Landfill Monitoring
	Other:				

REPORT NUMBER (Lab Use)

23-033772

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? ☐ Yes ☒ No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Organization: Tatham Engineering Ltd.	Address: 41 King Street, Barrie, ON	Invoicing Address (if different):
Contact: Noah Trembley		
Tel: (705) 791-7858 / Fax:		
Email: ntrembley@tathameng.com	Quote #: Tatham Q3091	Project Name or #: Hinds Brook - 123069
Additional Info (email, cell, etc):	P.O. #:	Additional Info:

ANALYSES REQUESTED

PWQO Metals; O.Reg 153/04 PHCs; O.Reg 153/04 VOCs; Suspected Highly Contaminated

TURNAROUND SERVICE REQUESTED (see back page)

*Must be arranged in advance

☐	Platinum*	200% Surcharge
☐	Gold*	100% Surcharge
☐	Silver	50% Surcharge
☐	Bronze	25% Surcharge
X	Standard	5-7 days
☐	Specific Date:	

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

Lab No.	Sample Source and/or Sample Identification	S.P.L. (Watertrax)	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	Indicate Test For Each Sample By Using A Check Mark In The Box Provided	X	Field pH	Field Temp.	# Bottles/ Sample	Field Filtered Y/N
1	MW23-1		GW	23-12-01	~~2:30PM~~ 10:00AM	X X X				4 bottles, 2 vials	Y
	itg Cr(VI), metals → O										
	GW: PHCs, VOCs → K										
	2 vials → R.H										

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	Noah Trembley	Noah Trembley
Sign:	N. Trembley	N. Trembley
	23-12-01	23-12-01
	Date (yy-mm-dd)/Time:	Date (yy-mm-dd)/Time:

SHIPPING INFORMATION

		Invoice
Courier (Client account)	☐	
Courier (Caduceon account)	☐	
Drop Off	X	# of Pieces
Caduceon (Pick-up)	☐	1

REPORTING / INVOICING

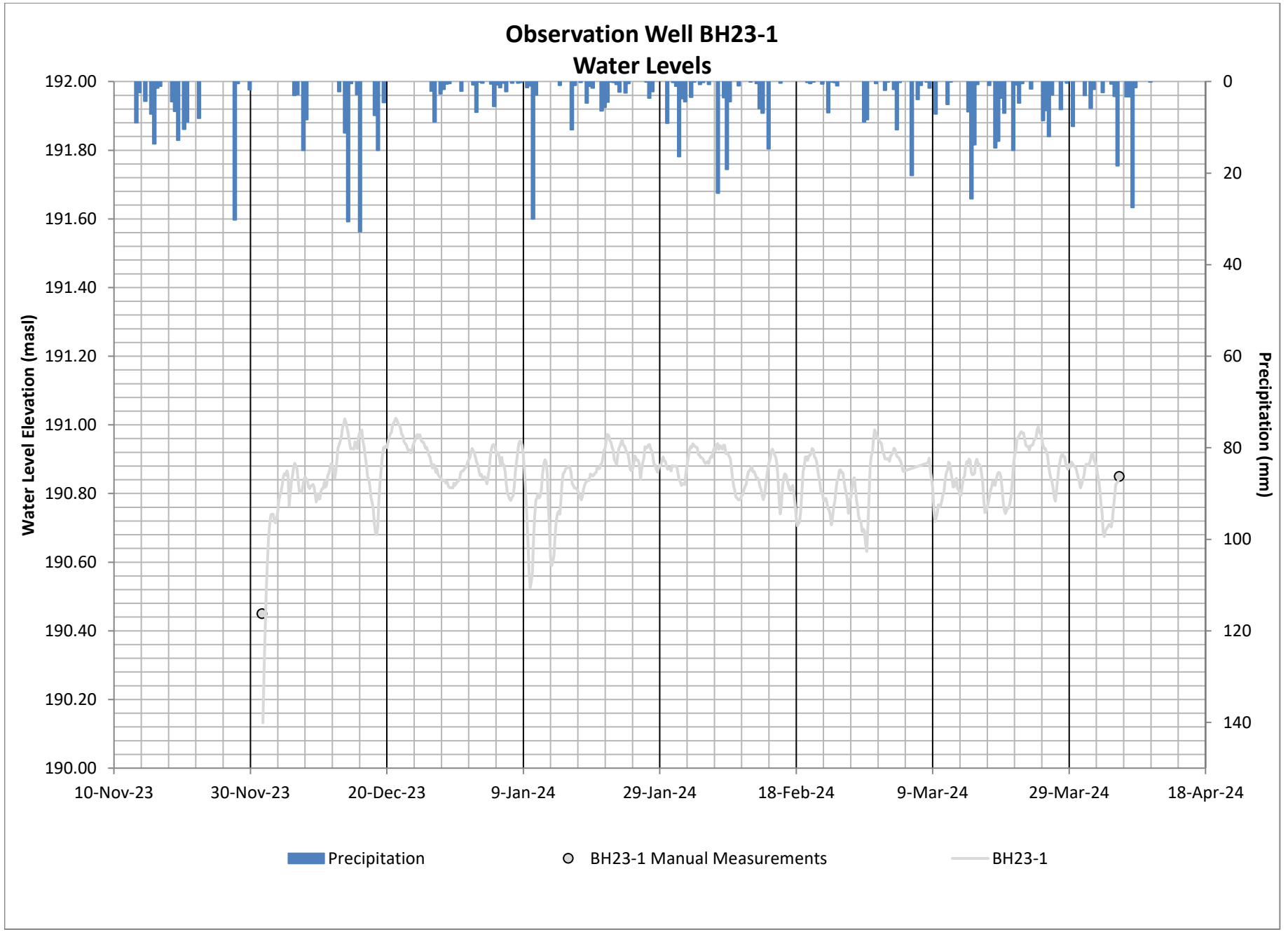
Report by Fax	☐
Report by Email	X
Invoice by Email	☐
Invoice by Mail	☐

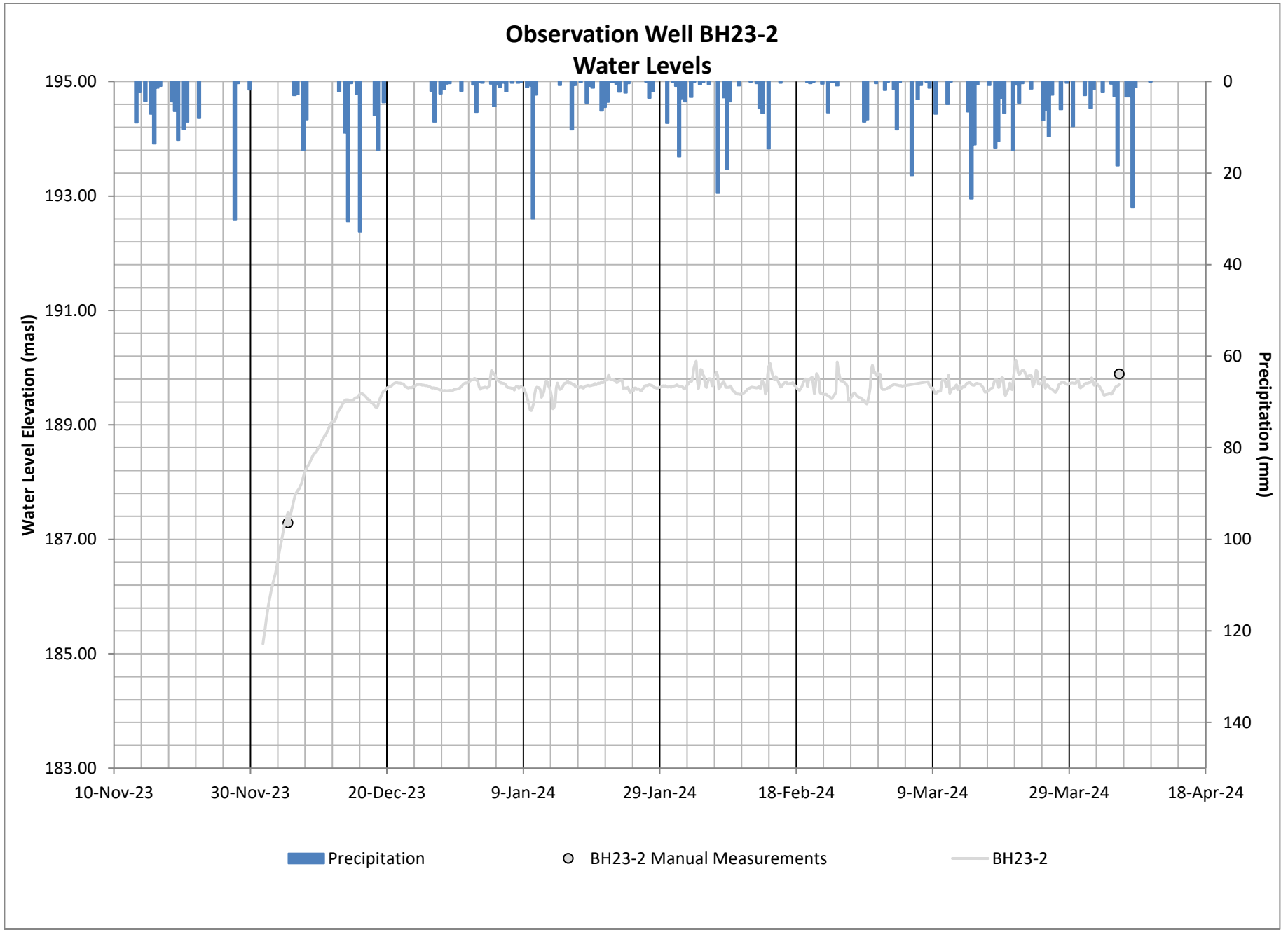
SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

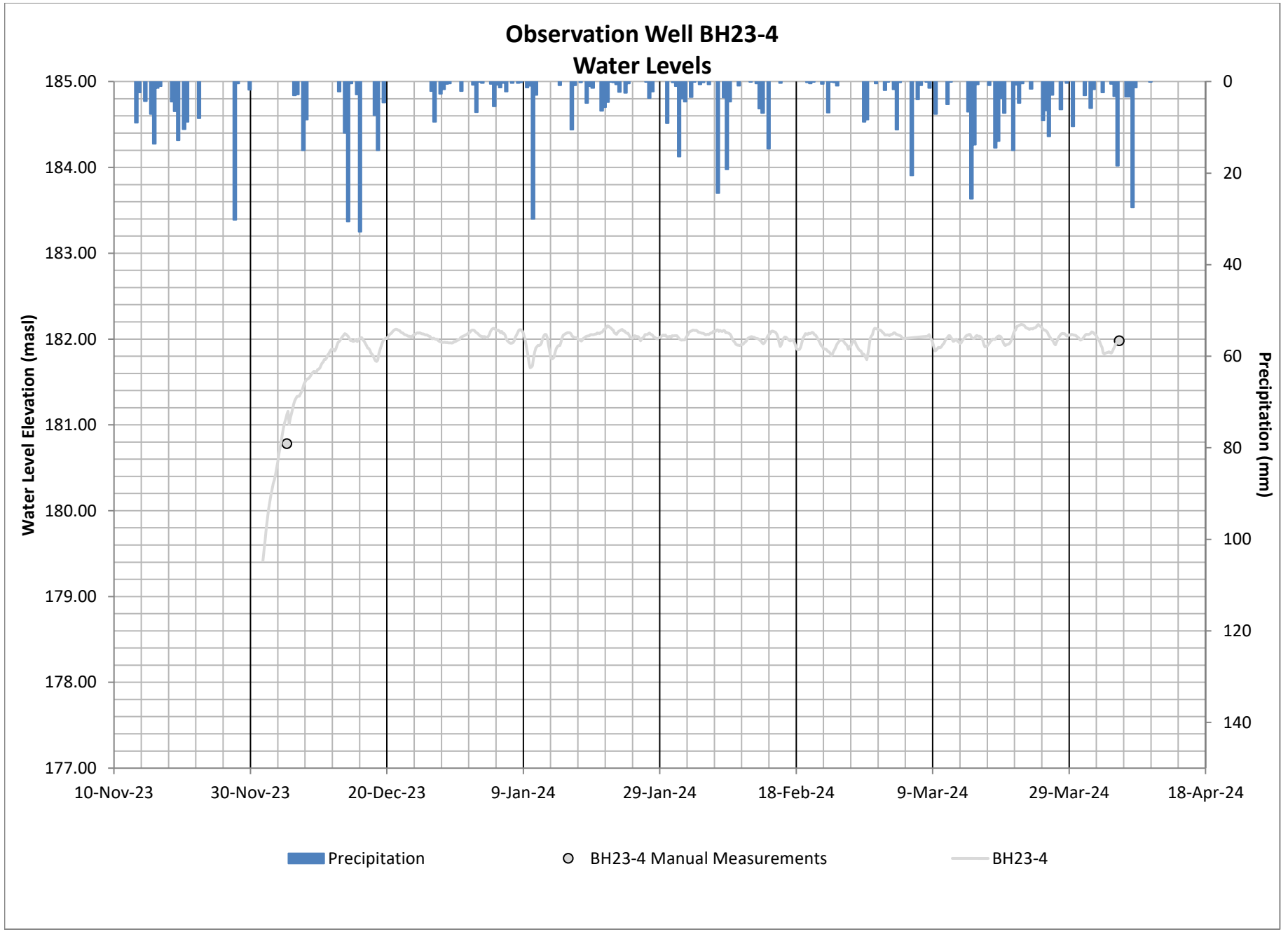
Received By (print):	Ashton	Signature:	AH
Date Received (yy-mm-dd):	23-12-01	Time Received:	1445
Laboratory Prepared Bottles:	☑ Yes	☐ No	
Sample Temperature °C:	13.0	Labeled by:	AH

Comments:

Appendix F: Hydrographs


Observation Well BH23-1
Water Levels
Water Level Elevation (masl)
192.00
191.80
191.60
191.40
191.20
191.00
190.80
190.60
190.40
190.20
190.00
0
20
40
60
80
100
120
140
Precipitation (mm)
10-Nov-23
30-Nov-23
20-Dec-23
9-Jan-24
29-Jan-24
18-Feb-24
9-Mar-24
29-Mar-24
18-Apr-24
Precipitation
BH23-1 Manual Measurements
BH23-1


Observation Well BH23-2
Water Levels
195.00
193.00
191.00
189.00
187.00
185.00
183.00
Water Level Elevation (masl)
0
20
40
60
80
100
120
140
Precipitation (mm)
10-Nov-23
30-Nov-23
20-Dec-23
9-Jan-24
29-Jan-24
18-Feb-24
9-Mar-24
29-Mar-24
18-Apr-24
Precipitation
BH23-2 Manual Measurements
BH23-2


Observation Well BH23-4
Water Levels
Water Level Elevation (masl)
185.00
184.00
183.00
182.00
181.00
180.00
179.00
178.00
177.00
0
20
40
60
80
100
120
140
Precipitation (mm)
10-Nov-23
30-Nov-23
20-Dec-23
9-Jan-24
29-Jan-24
18-Feb-24
9-Mar-24
29-Mar-24
18-Apr-24
Precipitation
BH23-4 Manual Measurements
BH23-4

Appendix G:
Water Taking Estimates

TATHAM ENGINEERING

Construction Dewatering Rate Estimate
Dupuit - Linear Flow

Zone 1 - Site Servicing (per 50 m of trench)

$$Q = Kx\frac{H^2 - h^2}{L_0}$$

Ground Elevation		182	m asl	Lowest elevation on-site
Highest Groundwater Elevation		191.01	m asl	BH23-1 on December 14, 2023 (hydrograph)
Lowest Proposed Excavation		179	m asl	Assume excavation 3 m below existing grade
Target Water Level		178	m asl	Assume 1 m of drawdown
Aquifer Bottom		178	m asl	
Hydraulic Conductivity	K	2.50E-05	m/s	Assumed K value
Length of Excavation	x	50	m	Assumed per 50 m of trench
Width of Excavation	a	4	m	4m roadway based on concept plans to date
Calculated Parameters				
Water level above aquifer bottom	H	13.01	m	
Target water level above aquifer bottom	h	0	m	
Radius of Influence	R_0	195	m	
Length of Influence (L_0=R_0/2)	L_0	98	m	
Precipitation		2,000	L/day	
Construction Dewatering Flow Rate - Steady State	Q	**187,300**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 1.5)	1.5Q	**280,950**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 1.5) with 10 mm rainfall event per 50 m	1.5Q	**282,950**	L/day	

Zone 2: Stormwater Management Pond

$$Q = \frac{\pi K(H^2 - {h_w}^2)}{In\frac{R_0}{r_e}} + 2\frac{xK(H^2 - {h_w}^2)}{L}$$

Ground Elevation		182	m asl	Approximate ground elevation
Highest Groundwater Elevation		182.17	m asl	MW23-4 on March 22, 2024 (hydrograph)
Lowest Proposed Excavation		178	m asl	Assuming max depth of 4m
Target Water Level		177	m asl	Assume 1 m of drawdown
Aquifer Bottom		177	m asl	
Hydraulic Conductivity	K	2.50E-05	m/s	
Length of Excavation	x	50	m	Total Proposed Area = 0.71 ha
Width of Excavation	a	80	m	
Calculated Parameters				
Water level above aquifer bottom	H	5.17	m	
Target water level above aquifer bottom	h	0	m	
Radius of Influence	R_0	113	m	$R_0<r_e$, $R_0=r_e+3000(H-h_w)K^{0.5}$
Equivalent Radius (re=(a*x)/π)^0.5)	r_e	36	m	
Length of Influence ($L_0=R_0/2$)	L_0	57	m	
Precipitation		40,000	L/day	Assume 10 mm rain event
Construction Dewatering Flow Rate - Steady State	Q	**208,100**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 1.5)	1.5Q	**312,150**	L/day	
Maximum Construction Dewatering Flow Rate (safety factor of 1.5) with 10 mm rainfall event per 100 m	1.5Q	**352,150**	L/day	

Appendix H:
Water Taking Plan

Water Taking Plan

CONSTRUCTION DEWATERING DISCHARGE RATE AND ZONE OF INFLUENCE

The Radius of Influence (ROI) and temporary dewatering discharge rates were calculated in Section 5.1 and the details are summarized below:

ZONE	DESCRIPTION	ROI (m)	CONSTRUCTION DEWATERING FLOW RATE (L/day)	CONSTRUCTION DEWATERING FLOW RATE INLCUDING SAFETY FACTOR OF 1.5 (L/day)	CONSTRUCTION DEWATERING FLOW RATE INCLUDING SAFETY FACTOR OF 1.5 AND A 10 mm RAINFALL EVENT (L/day)
1	Site Servicing (per 50 m of trench)	195	187,300	280,950	282,950
2	Stormwater Management Pond	113	208,100	312,150	352,150

POTENTIAL SETTLEMENT AND MONITORING

The site is located between Grey Road 2 and a recreational rail trail running parallel to Highway 26. The site is currently occupied by a single residential dwelling and is primarily undeveloped and tree covered. The surrounding land uses include a mobile home community to the north, a recreational rail trail and residential dwellings followed by Highway 26 to the east, wooded and agricultural lands to the south, and Grey Road 2 followed by agricultural lands to the west. Some structures may lie within the dewatering ROI; therefore, there is the potential for settlement related impacts. Prior to construction dewatering, a settlement analysis is to be completed by the geotechnical engineer, to provide input on the recommended monitoring and/or mitigative actions (if any).

Another cause of significant dewatering related settlement is due to pumping of fines through the system. It is imperative any dewatering systems shall be designed and installed adequately to ensure no soil is conveyed through the system. Sufficient filtering techniques should be incorporated at the entry point to avoid migration of fines in the pumping and/or dewatering system. The turbidity of pumped water should be monitored daily to ensure the minimal fines are being conveyed.

POTENTIAL IMPACT ON OTHER WATER USERS

Temporary dewatering activities are not anticipated to impact any water well users as municipal water is available to the nearest neighboring properties, and the proposed development consists of relatively shallow works.

REDUCTION OF GROUNDWATER FLOW TO WATERBODIES

Given the short duration of the proposed construction dewatering and that the water removed will be returned back to the watershed, dewatering activities are not anticipated to have negative impacts to Indian Brook immediate northeast of the site and/or Georgian Bay.

WATER QUANTITY, QUALITY AND GROUNDWATER LEVEL MONITORING PROGRAM

Based on baseline groundwater quality analysis, potential dewatering discharge may not meet the PWQO requirements during construction dewatering. Water Quality parameters shall be confirmed during the trail dewatering.

Based on the preliminary background quality, it is recommended discharge be treated by a sediment control facility such as sediment/ filtration bags or a decantation tank. Treatment of dewatering discharge water by filtration or sedimentation to reduce the concentration of suspended solids will likely reduce the concentration of non-dissolved metals to achieve compliance with the PWQO.

If water quality parameters exceed the PWQO during construction dewatering, standard treatment options should be evaluated and/or the system should be shut down.

WATER QUALITY MONITORING AND POTENTIAL TREATMENT PLAN

The discharge and monitoring plan are detailed in Table G-1, below.

GROUNDWATER LEVEL MONITORING PROGRAM

The ground water level monitoring program is detailed in Appendix G-1, below.

DISCHARGE RATE MONITORING

Daily groundwater takings are to be measured and recorded using a flow measuring device during construction dewatering by the contractor, in accordance with O.Reg. 63/16. The total daily takings shall be recorded for the duration of the EASR and be submitted through the MECP online reporting system.

SUMMARY OF QUALIFICATIONS

Alicia Kimberley is a licensed professional geoscientist with a Bachelors and Masters degree in Earth Sciences from McMaster University and the University of Waterloo, respectively. She has twelve years of professional experience with geoenvironmental and hydrogeological assessments.

Her experiences include the design and execution of aquifer testing, in-situ groundwater sampling, groundwater modelling, and preparation of hydrogeological reports to support EASR registry.

Noah Trembley obtained a bachelor's degree in Environmental Engineering from the University of Guelph and is a registered Engineering Intern with PEO. He has over a year of experience with geotechnical and environmental engineering and consulting, focusing mostly on excess soil programs, field investigations (soil and groundwater sampling and monitoring), and preparation of a variety of environmental/hydrogeological reports.

DATE OF PLAN PREPARATION

This plan was prepared on July 25, 2024

Table G-1: Water Quality Monitoring Plan for Dewatering Discharge to Surface

PERIOD	MONITORING LOCATION	PARAMETERS	MONITORING FREQUENCY	TRIGGIER FOR MITIGATION	MITIGATION MEASURES/COMMENTS
Trial Dewatering	Dewatering Discharge	PWQO Metals	Once during trial dewatering	Exceeds the PWQO	Modify treatment method and/or shut down.
During Construction	Dewatering Discharge	PWQO Metals	Weekly, then every four weeks after three consecutive weekly compliant samples	Exceeds the PWQO	Modify/change treatment method and/or shut down.
		Turbidity	Daily until stable, then weekly. Minimum of five samples	Exceeds 15 NTU	
	Discharge Point	Impact Assessment	At each sampling event	Sedimentation, erosion	Reduce pumping and/or improve sediment/erosion control measures
	On-site monitoring wells	Water level meter	Every two weeks	Water level to be no more than 1 m lower than proposed depth of excavation	Reduce pumping
Post Construction	On-site monitoring wells	Water level meter	Every two weeks for four weeks, then every four weeks until 90% recovery	Water level recovery less than 90% of baseline level	Continue monitoring

Appendix I:
Discharge Plan

Discharge Plan

CONSTRUCTION DEWATERING DISCHARGE RATE AND ZONE OF INFLUENCE

The Radius of Influence (ROI) and temporary dewatering discharge rates were calculated in Section 5.1 and the details are summarized below:

ZONE	DESCRIPTION	ROI (m)	CONSTRUCTION DEWATERING FLOW RATE (L/day)	CONSTRUCTION DEWATERING FLOW RATE INLCUDING SAFETY FACTOR OF 1.5 (L/day)	CONSTRUCTION DEWATERING FLOW RATE INCLUDING SAFETY FACTOR OF 1.5 AND A 10 mm RAINFALL EVENT (L/day)
1	Site Servicing (per 50 m of trench)	195	187,300	280,950	282,950
2	Stormwater Management Pond	113	208,100	312,150	352,150

PROPOSED DISCHARGE METHOD AND LOCATION

The preferred discharge location is the ground surface. The dewatering discharge will be transported by a hose and/or pipe to the treatment system. Following treatment at a sediment tank, filtration/silt bag or similar, the dewatering discharge will be transported by a hose/pipe to the preferred discharge location.

If significant rainfall events occur (including a 100-year storm event), the on-site excavation shall shut down until storm water infiltration is reduced and the dewatering system can operate efficiently and accurately.

EROSION AND SEDIMENT CONTROL MEASURES

Sediment and erosion control measures will be set up on-site according to typical best management practices.

STATEMENTS

The Water Taking Plan included in Appendix G, including the water quantity and quality monitoring program shall be implemented at the site. No adverse effects on the environment are expected if the plan is adhered to.

SUMMARY OF QUALIFICATIONS

Alicia Kimberley is a licensed professional geoscientist with a Bachelors and Masters degree in Earth Sciences from McMaster University and the University of Waterloo, respectively. She has twelve years of professional experience with geoenvironmental and hydrogeological assessments.

Her experiences include the design and execution of aquifer testing, in-situ groundwater sampling, groundwater modelling, and preparation of hydrogeological reports to support EASR registry.

Noah Trembley obtained a bachelor's degree in Environmental Engineering from the University of Guelph and is a registered Engineering Intern with PEO. He has over a year of experience with geotechnical and environmental engineering and consulting, focusing mostly on excess soil programs, field investigations (soil and groundwater sampling and monitoring), and preparation of a variety of environmental/hydrogeological reports.

DATE OF PLAN PREPARATION

This plan was prepared on July 25, 2024.