STORMWATER MANAGEMENT & SERVICING REPORT

720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD
COUNTY OF SIMCOE

720 SOLUTIONS
COMMERCIAL MODULAR HOUSING

PEARSON ENGINEERING
PEARSONENG.COM

(Revised March 2026)
August 2025
24242

TABLE OF CONTENTS

Appendices

Appendix A – Stormwater Management Calculations
Appendix B – Water Servicing Calculations
Appendix C – Sanitary Servicing Calculations
Appendix D – Phosphorous Budget Calculations
Appendix E – Water Balance Calculations
Appendix F – Geotechnical Investigation Report, GEI, June 2025
Appendix G – Hydrogeological Investigation, GEI, August 2025
Appendix H – HEC-RAS Modelling Results
Appendix I – Town of Collingwood – Natural Hazards Plan
Appendix J – Oil and Grit Separator Manual and ETV Verification
Appendix K – Pearson Engineering Drawings

Lists of Figures and Drawings

Figure 1 – Location Plan
Dwg SG-1 – Site Grading Plan
Dwg SS-1 – Site Servicing Plan
Dwg STM-1 – Pre-Development Storm Catchment Plan
Dwg STM-2 – Post-Development Storm Catchment Plan
Dwg FL-1 – Storm Drainage Area Plan
Dwg EP-1 – Environmental Protection and Removals Plan

STORMWATER MANAGEMENT & SERVICING REPORT
29 AND 45 BIRCH STREET, COLLINGWOOD

1. INTRODUCTION

PEARSON Engineering Ltd. (PEARSON) has been retained by 720 Solutions (Client) to prepare a SWM and Servicing Report for the proposed Simcoe County Affordable Housing Development (Project) at 29 and 45 Birch Street in the Town of Collingwood (Town) in the County of Simcoe (County).

The Project site is approximately 0.30 hectares in size and fronts onto Birch Street to the west and existing residential to the north, east and south. The existing site is owned and operated by the County with two buildings and 14 residents. The Project proposes a two-story modular building with 30 affordable housing units and associated parking lot and amenity space. The Project site location can be seen on Figure 1.

1.1. TERMS OF REFERENCE

The intent of this SWM Report is to:

- Identify the existing site characteristics including any external drainage conditions;
- Illustrate the design of the stormwater conveyance and detention system, capable of accommodating both minor and major storm flows from the site;
- Incorporate the appropriate Best Management Practices for controlling on-site erosion and sedimentation during construction while ultimately ensuring that the post-development release of stormwater is of adequate quality; and,
- Summarize this design in a technically comprehensive and concise manner.

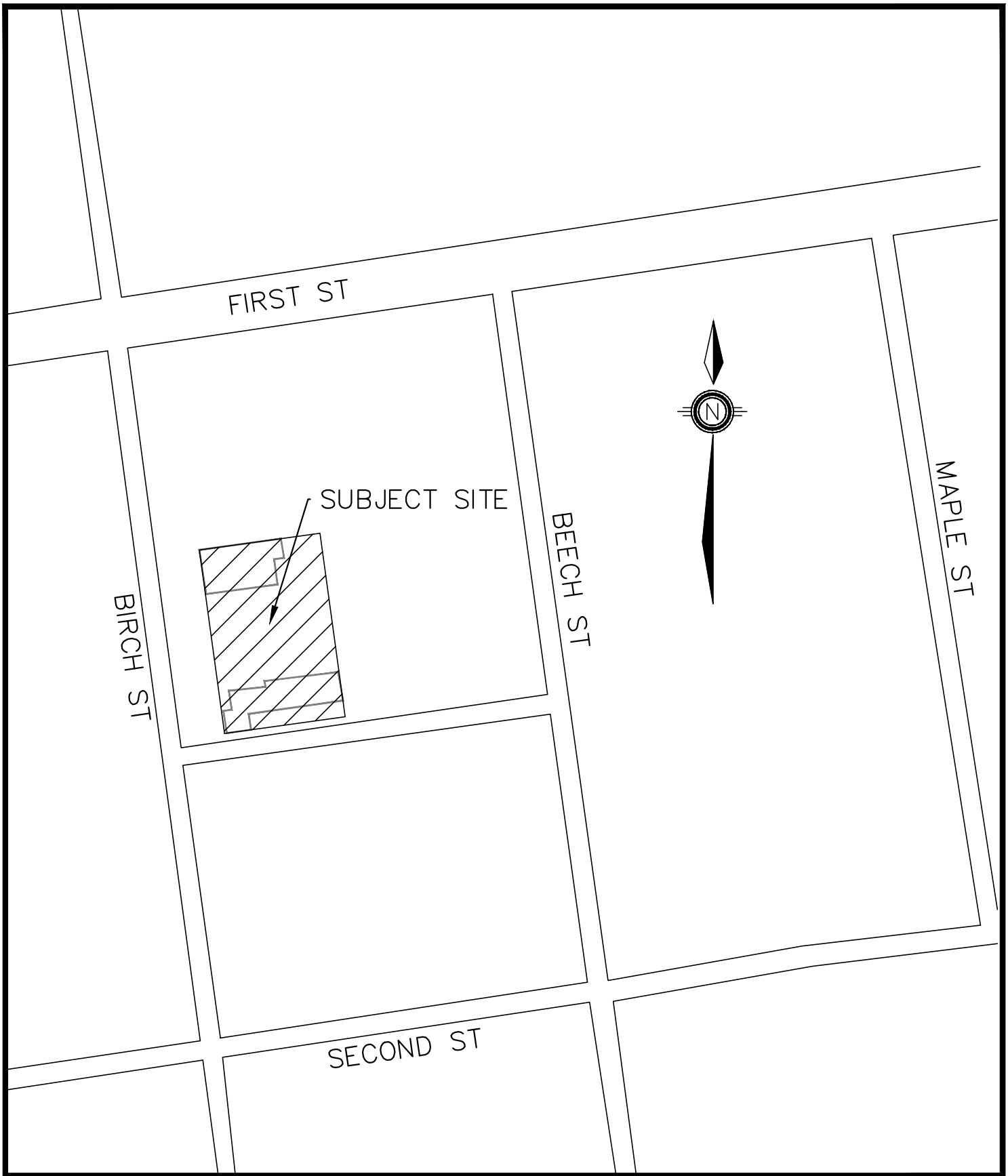
2. WATER SUPPLY AND DISTRIBUTION

2.1. WATER SERVICING DESIGN CRITERIA

The project site is approximately 0.30 ha in size and intended for residential land use for a population of 72 people. Utilizing the Town of Collingwood Development Standards for residential water use of 260 L/capita/day, the required Average Day Demand (ADD) is 0.22 L/s. A Peak Rate Factor of 2.7 was used in calculating a Peak Flow of 0.59 L/s for the development. Calculations for the residential water requirements for the site can be found in Appendix B.

2.2. INTERNAL WATER DISTRIBUTION SYSTEM

The water system for this Project is intended for domestic and firefighting use. The site will be serviced by connecting into the existing 150 mm watermain on the west side of Birch Street with a proposed 150 mm diameter fire service and a 100 mm domestic service. The location of the proposed water services are shown on Dwg SS-1 located in Appendix K.



720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

SITE LOCATION PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE	N/A	PROJECT #	24242
DRAWN BY	KV	VERT SCALE	N/A	DRAWING #	FIG–1
CHECKED BY	MWD	DATE	AUGUST 2025	REVISION #	0

2.3. Fire Fighting Requirements

Fire flow calculations have been completed to ensure sufficient water can be supplied to the site for fire protection. As the Town of Collingwood Development Standards do not have a minimum fire flow requirement for multi-residential use, a flow calculated using the Fire Underwriter Survey 2020 (FUS) is the be utilized for the project site. Calculations have been completed assuming the building will be constructed using Wood frame material including structural elements, walls, floors, and roofs constructed entirely or partially of wood and that the building will be equipped with automated sprinklered system. Based on the listed conditions, the required fire flow was determined to be 150 L/s which will govern for the project. A hydrant valve has been proposed on the west side of Birch Street approximately 35 m from the proposed building, which will provide fire coverage for the development.

As per the Watermain Hydraulic Analysis modelling completed by CIMA+ in February 2026, the available Fire Flow of the existing network is 156 L/s at a residual pressure of 20 psi under existing MDD conditions, which exceeds the required FUS Fire flow of 150 L/s. As such, the existing Town water distribution system can supply the require fire flow for the development.

3. Sanitary Servicing

3.1. Sanitary Design Criteria

The site is currently serviced by a 125mm diameter sewer to service 14 units combined from the two existing buildings. The site is to have a residential land use of approximately 0.30 ha with a population of 72 people. Utilizing the Town of Collingwood Sanitary Design Guidelines for residential use of 260 L/capita/day, an Average Daily Flow (ADF) of 0.21 L/s was calculated. Using a Peak Rate Factor of 4.0 and an infiltration allowance of 0.07 L/s, a peak flow of 0.92 L/s was calculated for the proposed development. Sanitary flows calculations for the site can be found in Appendix C.

3.2. Internal Sanitary Sewer System

The sanitary sewer will be constructed in accordance with the Town of Collingwood's Sewer Design Guidelines and the Ministry of the Environment, Conservation and Parks (MECP) guidelines to service the Project. A 200 mm diameter sanitary sewer from the proposed building will connect to the existing 600 mm diameter PVC sanitary sewer on Birch Street. The existing 600 mm sewer runs from the south to north with a capacity of 288 L/s at a slope of 0.22 %. Since the proposed sanitary peak flows will amount to 0.08% of the total capacity of the existing 600mm pipe, the existing sanitary sewer is expected to have the capacity to convey the sanitary design flows. Refer to Drawing SS-1 in Appendix K for the sanitary servicing layout.

4. Stormwater Management

A key component of the development needs to address environmental and related SWM issues. These are examined in a framework aimed at meeting the Town, the Nottawasaga Valley Conservation Authority (NVCA), and MECP requirements. SWM parameters have evolved from an understanding of the location and sensitivity of the site's natural systems. This SWM Report focuses on the necessary measures to satisfy the MECP's SWM requirements.

It is understood the objectives of the SWM plan are to:

- Protect life and property from flooding and erosion.
- Maintain water quality for ecological integrity, recreational opportunities etc.
- Protect and maintain groundwater flow regime(s).
- Protect aquatic and fishery communities and habitats.
- Maintain and protect significant natural features.

4.1. Analysis Methodology

The design of the SWM Facilities for this site has been conducted in accordance with:

- The Ministry of the Environment Stormwater Management Planning and Design Manual – March 2003
- Town of Collingwood Development Standards (2022)
- Nottawasaga Valley Conservation Authority (NVCA) Stormwater Technical Guide (December 2013)

It is essential to select the appropriate modeling methodology for the storm system design. Given the size of the site, the Modified Rational Method is appropriate for the design for the SWM system.

4.2. Existing Drainage Conditions

The site currently consists of two residential buildings with an asphalt drive aisle through the center of the site and associated parking, walking paths and grassed areas. The topographic survey, completed by Rudy Mak Surveying Ltd. in May 2025, shows that the site has an average slope of 0.4% and ultimately drains overland westerly towards Birch Street where it is captured by the existing catchbasin and storm sewer system. Details of the existing drainage conditions as well as the pre-development storm catchment plans can be seen on Drawing STM-1 in Appendix K.

According to the Geotechnical Investigation Report completed by GEI Consultants Canada, dated May 2025, the project site is comprised of various layers of fill and dense to very dense sand materials. All boreholes encountered bedrock at varying depths with the shallowest being at 0.7m below ground surface (Elev. 178.6) at borehole No. 3. Further information regarding the geotechnical report created by GEI can be found in Appendix F.

Given the size of the Project Site, the Modified Rational Method was used to determine the pre-development peak flows. The Town of Collingwood IDF curve parameters were used for determining the storm intensity values. The following pre-development peak flows have been calculated and are provided in Table 1. Detailed calculations can be found in Appendix A.

Table 1: Pre-Development Peak Flows

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Total Peak Flow (m^3/s)	0.03	0.04	0.04	0.06	0.07	0.08

4.3. Proposed Drainage Conditions

The post-development storm drainage for the project will generally follow pre-development conditions. The site's paved areas have been graded to direct stormwater towards catchbasins within the parking lot and drive aisles. The site's storm sewer will connect to the existing 300 mm storm sewer on Birch Street. A portion of the site located both south and west of the proposed building will drain uncontrolled to the catchbasins along Birch Street via sheet flow.

A proposed 75 mm orifice tube located downstream of CBMH 1 will reduce post-development peak flows to pre-development values. In the event of a storm greater than the 5-year event, the proposed storm sewer will surcharge, forcing stormwater to the surface. The site is graded to provide onsite surface storage for the 10 to 100-year storms. In the event of a storm greater than the 100-year, the major system overland flow route will be conveyed through the driveway to Birch Street. Post-development storm drainage patterns can be found in Drawing STM-2 in Appendix K.

4.4. Stormwater Quantity Control

The proposed development will increase the imperviousness of the site and as such the post-development peak flows will increase. It is important to quantify the increase in stormwater runoff rates and attenuate these increases. The calculated post-development runoff coefficient of 0.74 for the project site is greater than the pre-development runoff coefficient of 0.44. Runoff coefficient calculations can be found in Appendix A.

A 75 mm diameter orifice tube is proposed downstream of CBMH 1 to reduce post-development peak flows leaving the site, causing stormwater to back up into the StormTech storage chambers. The 100-yr controlled peak flows leaving the site will be less than the pre-development 5-year controlled peak flows. Calculations in Appendix A demonstrate that 40.6 m^3 of storage is required to control the 100-year storm event to pre-development values. 12.3 m^3 of storage is provided in underground chambers, 21.1 m^3 will be provided by surface ponding with an elevation of 180.10m and the remaining 7.2 m^3 of storage is provided within the pipes and catchbasin manholes. In the event that the orifice becomes blocked, the emergency overflow location for storm runoff is conveyed through the driveway to Birch Street.

Table 2 below summarises the post-development peak flows. By comparing Table 1 and Table 2, it can be seen that the post-development peak flows for all storm events are smaller than or equal to the pre-development peak flows.

Table 2: Post-Development Peak Flows

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Controlled to Birch Street (m^3/s)	0.01	0.02	0.02	0.02	0.02	0.02
Uncontrolled to Birch Street (m^3/s)	0.02	0.02	0.02	0.03	0.04	0.04
Total Project Site to Birch Street (m^3/s)	**0.03**	**0.04**	**0.04**	**0.05**	**0.06**	**0.06**

4.5. Stormwater Quality Control

The MECP in March 2003 issued a “Stormwater Management Planning and Design Manual”. The Stormwater Quality Control objective will be to ensure Enhanced Protection quality control as stated in the MECP manual. To achieve enhanced protection, permanent and temporary control of erosion and sediment transport are proposed and are discussed in the following sections.

4.5.1. Permanent Quality Control

The development’s active parking facilities and paved surfaces pose a risk to stormwater quality through the collection of grit, salt, sand and oils. The MECP standard stipulates a Total Suspended Solids (TSS) removal of at least 80% for Enhanced Protection Level according to Table 3.2 in the MECP SWM Planning & Design Manual. An OGS unit will be utilized to provide TSS removal over the project site.

The proposed Stormceptor EFO4 OGS will treat the post-development flows with a TSS removal rate of approximately 95.0%, exceeding MECP standards. Detailed information regarding the OGS unit can be seen in Appendix J.

4.5.2. During Construction Activities

During construction, earth grading and excavation will create the potential for soil erosion and sedimentation. It is imperative that effective environmental and sedimentation controls are in place and maintained throughout the duration of construction activities to ensure stormwater runoff's quality.

Therefore, the following recommendations shall be implemented and maintained during construction to achieve acceptable stormwater runoff quality:

- Installation of silt fence along the entire perimeter of the site to reduce sediment migration onto surrounding properties.
- Installation of a construction entrance mat to minimize transportation of sediment onto roadways.
- Restoration of exposed surfaces with vegetative and non-vegetative material as soon as construction schedules permit. The duration in which surfaces are disturbed / exposed shall not exceed 30 days.
- Reduce stormwater drainage velocities where possible.
- Minimize the amount of existing vegetation removed.

The Environmental Protection and Removals Plan can be seen in Appendix K.

5. Water Balance

Since the post-development conditions will increase the imperviousness of the site, considerations were taken in regard to groundwater recharge. Under pre-development conditions, the project site consists of two apartment style buildings with a driveway and associated parking areas. In post-development conditions, a larger building will be constructed, and the overall imperviousness of the site will increase.

The project site under pre-development conditions will infiltrate approximately 362 m^3 annually over the entire site. With the increased imperviousness of the site in post-development conditions, this recharge will be reduced to 145 m^3, resulting in a deficit volume of 217 m^3.

According to the Hydrogeological Investigation by GEI found in Appendix G of this report, it can be seen from Borehole # 3 that the groundwater level is at an elevation of 178.60m. Due to these site conditions, 1m of separation from the underside of any infiltration trench to groundwater or bedrock cannot be achieved on the site. Therefore, no water balance measures are proposed.

Considerations were taken to implement an LID feature between the proposed building and Birch Street in order to promote evapotranspiration and reduce stormwater runoff, however due to the shelters, walkways, and ramps in this area, there is limited space and the drainage area to the facility would be small. Similarly in the rear parking lot, permeable pavers weren't feasible due to grading constraints in order to ensure overland flow is directed through the site's driveway.

Permeable pavers are proposed in the four parking spaces to the west of the proposed building which will provide approximately 13.4 m^3 of stormwater detention volume within the stone reservoir which is equivalent to 4.4 mm over the project site. Table 3 below summarizes various LID facilities with design guidance criteria and the site constraints for each of them. Detailed water balance calculations can be found in Appendix E.

Table 3: Infiltration Control Facilities with Design Guidance Criteria and Constraints

Facility	**Design Guidance Criteria**	**Constraints**	**Remark**
Exfiltration Trench Systems	• Recommended within ROW	• ROW is already constructed.	Not proposed.
Infiltration Trenches/Chambers & Soakaways	• Minimum 4 m building setback • Recommended under road, parking, or walkways	• No sufficient separation from bedrock • No sufficient separation from GW	Not proposed.
Bioretention	• Minimum 4 m building setback	• No sufficient separation from groundwater	Not proposed.
Permeable Pavers	• Minimum 4 m building setback	• Only clean runoff can be infiltrated	Proposed with impermeable liner and subdrain.
Enhanced Swales	• Minimum 4 m building setback	• No sufficient building setback • No sufficient space available	Not proposed.

Due to the site constraints with the bedrock and water table being close to the ground surface of the site, no infiltration for the site has been proposed.

6. Phosphorus Budget

Local conservation authorities have determined the importance of reducing phosphorus levels in water courses in this area. Best efforts are to be employed to reduce phosphorus levels being contributed from the site to pre-development levels or better.

The existing site is a residential property which generates approximately 0.35 kg of phosphorus annually. The development of the project will increase the amount of phosphorus contributed from the site to 0.69 kg without any phosphorus treatment. As the site proposed an OGS the phosphorus levels will be reduced.

According to the NVCA Phosphorus Loading Development guidelines the typical phosphorus reduction is 20% for the OGS treatment unit. The following Table 4 details the anticipated phosphorous loadings for the pre-development and post-development conditions.

Table 4: Phosphorus Loadings

	Total P (kg)
Pre-Development	0.35
Uncontrolled Post-Development	0.69
Controlled Post-Development	0.61

Detailed phosphorus calculations can be found in Appendix D.

7. floodline analysis

7.1. Background information

A Flood Zone Delineation Report was prepared for the Town of Collingwood by R.J. Burnside in 2019 as an initial assessment of the flood risks in the area of the site. Since this report has not yet been formally accepted and the proposed development will be constructed partially within the NVCA regulated area, the NVCA and the Town requested a floodline analysis be performed. Floodlines for the site are associated with Oak Creek which runs north-south towards Georgian Bay approximately 500 m west of the site.

7.2. nvca hydraulic model calibration

The NVCA provided Pearson with their existing HEC-RAS model for Oak Creek. Since the NVCA model uses DEM points to create the cross section, the model was calibrated to existing topographic elevations using the survey for the site. The NVCA DEM was compared against 25 points from the elevations of the topographic survey completed by Rudy Mak for the subject site on May 28, 2025 and a surface adjustment factor of 0.01m was calculated. As the surface adjustment factor is negligible it was not applied to the site-specific topographic survey for the subject site. Calculations for the surface adjustment factor can be found in Appendix H.

The NVCA HEC-RAS model was reviewed, and it was noted that no cross sections were available in the vicinity of the subject site due to a 212 m long culvert starting at the intersection of Oak Street and Second Street. To effectively add cross sections and calculate the surface floodline, the existing 212 m culvert was removed from the model. Utilizing the DEM provided by the NVCA, four cross sections (525.9264, 497.9624, 437.9264, 397.9264) were added to the NVCA HEC-RAS model to update the existing ground surface conditions between station 297 and station 588. Obstructions were added to the new cross sections representing the existing houses and structures. The location of the added cross sections can be seen on Drawing FL-1.

7.2.1. Existing conditions

The HEC-RAS model was revised with four additional cross-sections and was run for the scenario where the culvert is flowing full. Table 5 in section 7.2.3 summarises the pre-development floodline elevations from the modeling as well as the post-development elevations. Cross section 497.9624 intersects through the site and it can be seen that the floodline is 179.58 m for pre-development conditions.

7.2.2. Proposed conditions

The existing conditions model was revised further to include the proposed grading and building location/size for the proposed site. According to the *Oak Street Canal Flood Zone Delineation Report* by R.J. Burnside (2019), there are 'medium' (depth is equal to or greater than 0.3m or velocity is equal to or greater than 1.2 m/s) to 'high risk' (depth is greater than 1.0 m, or depth is greater than 0.3m and velocity is greater than or equal to 1.2m/s) floodzones in the area of the site. Birch Street is labelled as 'high risk' and the Project site is labelled as 'medium risk'. The final building envelope is located mostly outside of the 'medium' and 'high risk' floodzones shown in the Burnside report, which aligns with the proposed grading showing some of the floodline will be encroaching onto the site as was the case in pre-development condition. Table 5 below summarises the floodline elevations in post development conditions for the scenario where the culvert is flowing full.

Table 5: Post-Development Regional Floodline Elevations

HEC-RAS Cross Section Station	Regional Storm Floodline Elevation Pre-Dev (m)	Regional Storm Floodline Elevation Post-Dev (m)	Regional Storm Channel Velocity Pre-Dev (m/s)	Regional Storm Channel Velocity Post-Dev (m/s)
676.4317	179.62	179.62	0.06	0.06
622.1968	179.62	179.62	0.04	0.04
588.6833	179.62	179.62	0.02	0.02
525.9264 (PEL)	179.62	179.62	0.13	0.13
497.9264 (PEL)	**179.58**	**179.58**	**0.25**	**0.24**
437.9264 (PEL)	179.55	179.55	0.08	0.08
397.9264 (PEL)	179.53	179.53	0.20	0.20
297.9264	177.86	177.86	1.92	1.92
215.1441	178.05	178.05	0.40	0.40
155.6810	178.02	178.02	0.18	0.18

Note 1: (PEL) refers to cross sections added by Pearson Engineering.
Note 2: Cross section 497.9264 intersects the project site.

By comparing the floodline elevations in Table 5, it can be seen that the post-development Regional floodline elevations and velocities are equal or less than pre-development for all cross-sections. The velocity-depth product for cross section 497.9264 which intersects the project site is 0.04 m^2/s at the centerline of road and building corner and 0.05 m^2/s at the edge of pavement. Both values are less than the maximum value of 0.40 m^2/s as per NVCA technical guidelines. The depth of flooding is deepest at cross section 497.9264 on the Birch street ROW with a depth of 0.48m which exceeds NVCA's safe access criteria, however the depth of flooding has not changed between pre and post-development. The minimum floodproofing elevation of 0.30 m above the Regional floodline elevation for the proposed building will be 179.88, and the proposed finished floor is 180.40. Given that the Burnside Report only gives a range of depth of flooding, a direct comparison to the Burnside Report cannot be provided. However, given that the Pearson results show that post-development floodline elevations do not change compared to pre-development, it is expected that the Burnside model would provide similar results. Detailed floodline modeling results can be found in Appendix H.

7.2.3. Sensitivity Analysis

To determine the effects that varying capacities of the culvert would have on the floodline, a sensitivity analysis was completed with the three following scenarios:

- Culvert flowing full
- 50% blocked culvert
- 100% blocked culvert scenario

The capacity of the existing culvert was determined using HEC-RAS which demonstrated that the Regional storm peak flow is 21.8 m^3/s and that the culvert conveys 13.02 m^3/s, with the remaining 8.78 m^3/s being conveyed on the surface. Two scenarios were considered for the sensitivity analysis, 50% blockage and 100% blockage of the existing culvert. For the 50% blocked scenario, the culvert's capacity was divided in half to a value of 6.51 m^3/s. This value was subtracted from the total flow through the channel of 21.8 m^3/s to obtain a value of 15.29 m^3/s which represents the flow overtopping the culvert if it becomes 50% blocked. Similarly, if the culvert were to become 100% blocked, then the total flow of 21.8 m^3/s would be conveyed overland.

The overland peak flow values from the sensitivity analysis were then used in calculating the pre and post development floodline elevation for the site. A comparison of the pre and post-development conditions for each of the three scenarios demonstrates that there is no increase to the floodline elevation adjacent to the site or upstream and downstream of the site. Additionally, it can be seen in Table 4 below that the floodline elevation for the site considering the worst-case scenario of the culvert being 100% blocked is 179.73, which is lower than the finished floor of the proposed building of 180.40. A summary of the sensitivity analysis results for the sections near the project site can be seen in Table 6 below, and detailed HEC-RAS results can be seen in Appendix H.

Table 6: Sensitivity Analysis Summary Table

HEC-RAS Cross Section Station	Pre-Development			Post-Development		
	100% Flow	50% Flow	Blocked	100% Flow	50% Flow	Blocked
676.4317	179.62	179.72	179.79	179.62	179.71	179.79
622.1968	179.62	179.72	179.79	179.62	179.71	179.79
588.6833	179.62	179.72	179.79	179.62	179.71	179.79
525.9264 (PEL)	179.62	179.71	179.79	179.62	179.71	179.79
497.9264 (PEL)	**179.58**	**179.66**	**179.73**	**179.58**	**179.66**	**179.73**
437.9264 (PEL)	179.55	179.60	179.65	179.55	179.60	179.65
397.9264 (PEL)	179.53	179.56	179.58	179.53	179.56	179.58
297.9264	177.86	177.86	177.86	177.86	177.86	177.86
215.1441	178.05	178.05	178.05	178.05	178.05	178.05
155.6810	178.02	178.02	178.02	178.02	178.02	178.02

Note: Cross section 497.9264 intersects the project site

8. Conclusions

The proposed development will require the connection of sanitary and watermain services to the existing municipal services on Birch Street.

Quantity control for the development is provided within the project's pipes, manholes and underground storage chambers allowing post-development peak flows to be released at pre-development values through an orifice tube.

Quality control via an OGS unit is provided in order to maintain the quality of stormwater and to satisfy the MECP Enhanced level requirements.

Since 1.0 m separation to bedrock or groundwater cannot be achieved, no water balance measures are proposed for the site.

The NVCA's HEC-RAS model was updated with additional cross-sections and a sensitivity analysis was completed which demonstrates that the proposed building does not impact the existing floodline elevation.

All of which is respectfully submitted,

Pearson Engineering Ltd.

Taylor Arkell, P.Eng.
Senior Project Engineer/Manager

Mike Dejean, P.Eng.
Partner, Manager of Engineering Services

Appendix A

Stormwater Management Calculations

PEARSON ENGINEERING

29 & 45 Birch Street, Town of Collingwood
Calculation of Runoff Coefficients

Runoff Coefficient	=	0.15	0.95	0.95	0.40	0.95		Weighted
Surface Cover	=	Grass	Asphalt	Building	Gravel	Conc.		Runoff Coefficient
Allowable	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)		
1	3062	1955	416	631	0	60		0.44
Pre Total	3062	1955	416	631	0	60		0.44
Post-Development	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)		
1	402	0	0	402	0	0		0.95
2	681	8	528	0	0	145		0.94
3	330	15	269	0	0	45		0.91
4	1036	533	170	0	0	333		0.54
5	210	154	0	0	0	56		0.36
6	402	0	0	402	0	0		0.95
Post Total	3062	710	968	804	0	580		0.76

29 & 45 Birch Street, Town of Collingwood
Pre-Development Peak Flows

Storm Event (yrs)	Town of Collingwood Coeff A	Coeff B	Coeff C
2	**807.440**	**6.750**	**0.828**
5	**1135.400**	**7.500**	**0.841**
10	**1387.000**	**7.970**	**0.852**
25	**1676.200**	**8.300**	**0.858**
50	**1973.100**	**9.000**	**0.868**
100	**2193.100**	**9.040**	**0.871**

Modified Rational Method
Q = CiCIA / 360

Where:
- Q - Flow Rate (m^3/s)
- C - Rational Method Runoff Coefficient
- I - Storm Intensity (mm/hr)
- A - Area (ha.)
- Ci - Peaking Coefficient

	Area Draining to Birch Street	
Area Number	1	
Area	0.31	ha
Runoff Coefficient	0.44	
Time of Concentration	10	min
Return Rate	2	year
Peaking Coefficient (Ci)	1.00	
Rainfall Intensity	78.3	mm/hr
Pre-Development Peak Flow	0.03	m^3/s
Return Rate	5	year
Peaking Coefficient (Ci)	1.00	
Rainfall Intensity	102.3	mm/hr
Pre-Development Peak Flow	0.038	m^3/s
Return Rate	10	year
Peaking Coefficient (Ci)	1.00	
Rainfall Intensity	118.4	mm/hr
Pre-Development Peak Flow	0.04	m^3/s
Return Rate	25	year
Peaking Coefficient (Ci)	1.10	
Rainfall Intensity	138.4	mm/hr
Pre-Development Peak Flow	0.06	m^3/s
Return Rate	50	year
Peaking Coefficient (Ci)	1.20	
Rainfall Intensity	153.2	mm/hr
Pre-Development Peak Flow	0.07	m^3/s
Return Rate	100	year
Peaking Coefficient (Ci)	1.25	
Rainfall Intensity	168.4	mm/hr
Pre-Development Peak Flow	0.08	m^3/s

29 & 45 Birch Street, Town of Collingwood
Post-Development Peak Flows

Storm Event (yrs)	Town of Collingwood Coeff A	Coeff B	Coeff C
2	**807.44**	**6.75**	**0.828**
5	**1135.40**	**7.50**	**0.841**
10	**1387.00**	**7.97**	**0.852**
25	**1676.20**	**8.30**	**0.858**
50	**1973.10**	**9.00**	**0.868**
100	**2193.10**	**9.04**	**0.871**

Modified Rational Method
Q = CiCIA / 360

Where:

- Q - Flow Rate (m^3/s)
- C - Rational Method Runoff Coefficient
- I - Storm Intensity (mm/hr)
- A - Area (ha.)
- Ci - Peaking Coefficient

	Controlled	Uncontrolled
Area Number	1,2,3	4,5,6
Area	0.14 ha	0.16 ha
Runoff Coefficient	0.94	0.46
Time of Concentration	10 min	10 min
Return Rate	2 year	2 year
Peaking Coefficient (Ci)	1.00	1.00
Rainfall Intensity	78.3 mm/hr	78.3 mm/hr
Post-Development Peak Flow	0.03 m^3/s	0.02 m^3/s
Return Rate	5 year	5 year
Peaking Coefficient (Ci)	1.00	1.00
Rainfall Intensity	102.3 mm/hr	102.3 mm/hr
Post-Development Peak Flow	0.04 m^3/s	0.02 m^3/s
Return Rate	10 year	10 year
Peaking Coefficient (Ci)	1.00	1.00
Rainfall Intensity	118.4 mm/hr	118.4 mm/hr
Post-Development Peak Flow	0.04 m^3/s	0.02 m^3/s
Return Rate	25 year	25 year
Peaking Coefficient (Ci)	1.10	1.10
Rainfall Intensity	138.4 mm/hr	138.4 mm/hr
Post-Development Peak Flow	0.06 m^3/s	0.03 m^3/s
Return Rate	50 year	50 year
Peaking Coefficient (Ci)	1.20	1.20
Rainfall Intensity	153.2 mm/hr	153.2 mm/hr
Post-Development Peak Flow	0.07 m^3/s	0.04 m^3/s
Return Rate	100 year	100 year
Peaking Coefficient (Ci)	1.25	1.25
Rainfall Intensity	168.4 mm/hr	168.4 mm/hr
Post-Development Peak Flow	0.08 m^3/s	0.04 m^3/s

PEARSON ENGINEERING

29 & 45 Birch Street, Town of Collingwood
Stage-Storage-Discharge Table

Elevation (m)	Area (m^2)	Surface Vol. (m^3)	Tank Vol. (m^3)	MH/CB Vol. (m^3)	Cum. Vol. (m^3)	Orifice 1 Head (m)	Orifice 1 Flow (m^3/s)	Total Flow (m^3/s)
178.45	0	0	0	0	0	0.000	0.000	0.000
178.50	0	0	0	0.113	0	0.013	0.002	0.002
178.70	0	0	0	1.587	2	0.213	0.007	0.007
178.80	0	0	1.760	1.620	5	0.313	0.009	0.009
178.90	0	0	1.760	1.620	7	0.412	0.010	0.010
179.00	0	0	1.760	0.226	9	0.512	0.011	0.011
179.10	0	0	1.760	0.226	11	0.612	0.012	0.012
179.20	0	0	1.760	0.226	13	0.712	0.013	0.013
179.30	0	0	1.760	0.226	15	0.812	0.014	0.014
179.40	0	0	1.760	0.226	17	0.912	0.015	0.015
179.50	0	0	0	0.226	17	1.012	0.016	0.016
179.60	0	0	0	0.226	17	1.112	0.017	0.017
179.70	0	0	0	0.226	17	1.212	0.017	0.017
179.75	0	0	0	0.226	18	1.263	0.018	0.018
179.80	0	0	0	0.226	18	1.313	0.018	0.018
179.85	0	0	0	0	18	1.363	0.018	0.018
179.86	1	0	0	0	18	1.373	0.018	0.018
179.87	5	0	0	0	18	1.383	0.018	0.018
179.88	12	0	0	0	18	1.393	0.018	0.018
179.89	21	0	0	0	18	1.403	0.019	0.019
179.90	32	0	0	0	18	1.413	0.019	0.019
179.91	45	0	0	0	19	1.423	0.019	0.019
179.92	58	1	0	0	19	1.433	0.019	0.019
179.93	75	1	0	0	20	1.443	0.019	0.019
179.94	93	1	0	0	21	1.453	0.019	0.019
179.95	113	1	0	0	22	1.463	0.019	0.019
179.96	135	1	0	0	23	1.473	0.019	0.019
179.97	159	1	0	0	25	1.483	0.019	0.019
179.98	185	2	0	0	26	1.493	0.019	0.019
179.99	214	2	0	0	28	1.503	0.019	0.019
180.00	246	2	0	0	31	1.513	0.019	0.019
180.01	281	3	0	0	33	1.523	0.019	0.019
180.02	319	3	0	0	36	1.533	0.019	0.019
180.03	360	3	0	0	40	1.543	0.019	0.019
180.04	399	4	0	0	43	1.553	0.020	0.020
180.05	437	4	0	0	48	1.563	0.020	0.020
180.06	473	5	0	0	52	1.573	0.020	0.020
180.07	511	5	0	0	57	1.583	0.020	0.020
180.08	550	5	0	0	62	1.593	0.020	0.020
180.09	590	6	0	0	68	1.603	0.020	0.020
180.10	631	6	0	0	74	1.613	0.020	0.020

Orifice Tube	
Diameter	75 mm
Invert Elevation	178.45
Orifice Constant	0.80
Orifice Centroid	178.49
Orifice Flow Formula	0.80π(D/2,000)2 x (2x9.81xH)0.5

PEARSON ENGINEERING

29 & 45 Birch Street, Town of Collingwood
Quantity Control Volume Calculations

DATE:	2026-03-03
FILE:	24242
CONTRACT/PROJECT:	29 & 45 Birch Street, Collingwood
COMPLETED BY:	DB

Modified Rational Method Parameters

Pre Development Area (ha)	Post Development Area (ha)	Time of Concentration (min)	Time Increments (min)	Pre Development Runoff Coefficient	Post Development Runoff Coefficient
0.306	0.141	10	1	0.44	0.94

Note: Refer to page Calculation of Runoff Coefficients for detailed calculations of Modified Rational Method parameters.

Pre-Development Runoff Rate

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
C	0.44	0.44	0.44	0.48	0.53	0.55
I	78.28	102.27	118.36	138.40	153.18	168.45
A	0.31	0.31	0.31	0.31	0.31	0.31
Q	0.029	0.038	0.044	0.057	0.069	0.079

Note: Q= 0.00278CIA

Rainfall Station	Town of Collingwood

SWM Ponding Design Input

Storm Event (yrs)	Chicago Storm Coefficient A	Chicago Storm Coefficient B	Chicago Storm Coefficient C	Allowable Outflow (m3/s)	Post Development Runoff Coefficient
2	807.440	6.750	0.828	0.01	0.94
5	1135.400	7.500	0.841	0.02	0.94
10	1387.000	7.970	0.852	0.02	0.94
25	1676.200	8.300	0.858	0.02	1
50	1973.100	9.000	0.868	0.02	1
100	2193.100	9.040	0.871	0.02	1

Results

Storm Event (yrs)	Storage m^3	Time min
2	12.7	24
5	17.2	25
10	19.3	25
25	28.8	30
50	34.8	33
100	40.6	35

Note: Storage volume calculated as per Hydrology Handbook, Second Edition, American Society of Civil Engineers, 1996

Time (min)	2 Year Intensity mm/hr	2 Year Inflow m^3/s	2 Year Outflow m^3/s	2 Year Storage m^3	Difference	5 Year Intensity mm/hr	5 Year Inflow m^3/s	5 Year Outflow m^3/s	5 Year Storage m^3	Difference
1	148.17	0.055	0.012	-1	2	187.72	0.069	0.016	-1	3
2	134.01	0.049	0.012	2	2	170.96	0.063	0.016	2	2
3	122.52	0.045	0.012	3	1	157.16	0.058	0.016	4	2
4	113.01	0.042	0.012	5	1	145.58	0.054	0.016	6	2
5	104.98	0.039	0.012	6	1	135.72	0.050	0.016	8	1
6	98.12	0.036	0.012	7	1	127.21	0.047	0.016	9	1
7	92.17	0.034	0.012	8	1	119.79	0.044	0.016	11	1
8	86.97	0.032	0.012	9	1	113.26	0.042	0.016	12	1
9	82.37	0.030	0.012	9	1	107.46	0.040	0.016	12	1
10	78.28	0.029	0.012	10	0	102.27	0.038	0.016	13	1
11	74.61	0.027	0.012	10	0	97.60	0.036	0.016	14	1
12	71.30	0.026	0.012	11	0	93.37	0.034	0.016	14	0
13	68.29	0.025	0.012	11	0	89.53	0.033	0.016	15	0
14	65.56	0.024	0.012	12	0	86.01	0.032	0.016	15	0
15	63.05	0.023	0.012	12	0	82.79	0.030	0.016	16	0
16	60.75	0.022	0.012	12	0	79.81	0.029	0.016	16	0
17	58.62	0.022	0.012	12	0	77.07	0.028	0.016	16	0
18	56.65	0.021	0.012	12	0	74.52	0.027	0.016	17	0
19	54.83	0.020	0.012	12	0	72.14	0.027	0.016	17	0
20	53.12	0.020	0.012	13	0	69.93	0.026	0.016	17	0
21	51.53	0.019	0.012	13	0	67.86	0.025	0.016	17	0
22	50.04	0.018	0.012	13	0	65.92	0.024	0.016	17	0
23	48.65	0.018	0.012	13	0	64.10	0.024	0.016	17	0
24	47.33	0.017	0.012	13	0	62.38	0.023	0.016	17	0
25	46.10	0.017	0.012	13	0	60.77	0.022	0.016	17	0
26	44.93	0.017	0.012	13	0	59.24	0.022	0.016	17	0
27	43.82	0.016	0.012	13	0	57.79	0.021	0.016	17	0
28	42.78	0.016	0.012	13	0	56.42	0.021	0.016	17	0
29	41.78	0.015	0.012	13	0	55.11	0.020	0.016	17	0
30	40.84	0.015	0.012	12	0	53.88	0.020	0.016	17	0
31	39.94	0.015	0.012	12	0	52.70	0.019	0.016	17	0
32	39.09	0.014	0.012	12	0	51.57	0.019	0.016	17	0
33	38.27	0.014	0.012	12	0	50.50	0.019	0.016	17	0
34	37.49	0.014	0.012	12	0	49.47	0.018	0.016	17	0
35	36.75	0.014	0.012	12	0	48.49	0.018	0.016	16	0
36	36.03	0.013	0.012	12	0	47.55	0.017	0.016	16	0
37	35.35	0.013	0.012	12	0	46.65	0.017	0.016	16	0
38	34.69	0.013	0.012	12	0	45.79	0.017	0.016	16	0
39	34.06	0.013	0.012	11	0	44.96	0.017	0.016	16	0
40	33.46	0.012	0.012	11	-11	44.16	0.016	0.016	16	0
41	32.88	0.012	0.000	0	0	43.40	0.016	0.016	15	0
42	32.32	0.012	0.000	0	0	42.66	0.016	0.016	15	-15
43	31.78	0.012	0.000	0	0	41.95	0.015	0.000	0	0
44	31.26	0.012	0.000	0	0	41.26	0.015	0.000	0	0
45	30.76	0.011	0.000	0	0	40.60	0.015	0.000	0	0

Time (min)	10 Year Intensity mm/hr	10 Year Inflow m^3/s	10 Year Outflow m^3/s	10 Year Storage m^3	Difference	25 Year Intensity mm/hr	25 Year Inflow m^3/s	25 Year Outflow m^3/s	25 Year Storage m^3	Difference
1	213.94	0.079	0.019	-1	3	247.38	0.097	0.019	-1	4
2	195.52	0.072	0.019	2	3	226.63	0.089	0.019	4	4
3	180.23	0.066	0.019	5	2	209.31	0.082	0.019	7	3
4	167.32	0.062	0.019	7	2	194.62	0.076	0.019	10	3
5	156.26	0.057	0.019	9	2	182.00	0.071	0.019	13	2
6	146.68	0.054	0.019	10	1	171.02	0.067	0.019	15	2
7	138.29	0.051	0.019	12	1	161.38	0.063	0.019	17	2
8	130.88	0.048	0.019	13	1	152.85	0.060	0.019	18	1
9	124.28	0.046	0.019	14	1	145.24	0.057	0.019	20	1
10	118.36	0.044	0.019	15	1	138.40	0.054	0.019	21	1
11	113.02	0.042	0.019	16	1	132.23	0.052	0.019	22	1
12	108.18	0.040	0.019	16	1	126.62	0.050	0.019	23	1
13	103.77	0.038	0.019	17	0	121.50	0.048	0.019	24	1
14	99.73	0.037	0.019	17	0	116.81	0.046	0.019	25	1
15	96.02	0.035	0.019	18	0	112.50	0.044	0.019	25	1
16	92.60	0.034	0.019	18	0	108.51	0.043	0.019	26	1
17	89.43	0.033	0.019	18	0	104.82	0.041	0.019	26	0
18	86.49	0.032	0.019	19	0	101.39	0.040	0.019	27	0
19	83.75	0.031	0.019	19	0	98.20	0.039	0.019	27	0
20	81.19	0.030	0.019	19	0	95.21	0.037	0.019	28	0
21	78.79	0.029	0.019	19	0	92.42	0.036	0.019	28	0
22	76.55	0.028	0.019	19	0	89.79	0.035	0.019	28	0
23	74.44	0.027	0.019	19	0	87.33	0.034	0.019	28	0
24	72.45	0.027	0.019	19	0	85.00	0.033	0.019	28	0
25	70.57	0.026	0.019	19	0	82.81	0.033	0.019	29	0
26	68.80	0.025	0.019	19	0	80.73	0.032	0.019	29	0
27	67.12	0.025	0.019	19	0	78.77	0.031	0.019	29	0
28	65.53	0.024	0.019	19	0	76.90	0.030	0.019	29	0
29	64.01	0.024	0.019	19	0	75.13	0.029	0.019	29	0
30	62.57	0.023	0.019	19	0	73.44	0.029	0.019	29	0
31	61.20	0.022	0.019	19	0	71.84	0.028	0.019	29	0
32	59.90	0.022	0.019	19	0	70.30	0.028	0.019	29	0
33	58.65	0.022	0.019	19	0	68.84	0.027	0.019	29	0
34	57.46	0.021	0.019	18	0	67.44	0.026	0.019	29	0
35	56.31	0.021	0.019	18	0	66.10	0.026	0.019	29	0
36	55.22	0.020	0.019	18	0	64.82	0.025	0.019	28	0
37	54.17	0.020	0.019	18	0	63.59	0.025	0.019	28	0
38	53.17	0.020	0.019	18	0	62.41	0.024	0.019	28	0
39	52.20	0.019	0.019	17	0	61.28	0.024	0.019	28	0
40	51.27	0.019	0.019	17	-17	60.19	0.024	0.019	28	0
41	50.38	0.019	0.000	0	0	59.14	0.023	0.019	28	0
42	49.52	0.018	0.000	0	0	58.13	0.023	0.019	28	0
43	48.69	0.018	0.000	0	0	57.15	0.022	0.019	27	0
44	47.89	0.018	0.000	0	0	56.21	0.022	0.019	27	0
45	47.12	0.017	0.000	0	0	55.31	0.022	0.019	27	0

Time (min)	50 Year Intensity mm/hr	50 Year Inflow m^3/s	50 Year Outflow m^3/s	50 Year Storage m^3	Difference	100 Year Intensity mm/hr	100 Year Inflow m^3/s	100 Year Outflow m^3/s	100 Year Storage m^3	Difference
1	267.39	0.105	0.019	0	5	294.14	0.115	0.019	1	5
2	246.16	0.097	0.019	5	4	270.79	0.106	0.019	6	4
3	228.25	0.090	0.019	9	3	251.09	0.099	0.019	10	4
4	212.93	0.084	0.019	12	3	234.23	0.092	0.019	14	3
5	199.67	0.078	0.019	15	2	219.64	0.086	0.019	17	3
6	188.06	0.074	0.019	17	2	206.86	0.081	0.019	20	2
7	177.82	0.070	0.019	19	2	195.58	0.077	0.019	22	2
8	168.70	0.066	0.019	21	2	185.54	0.073	0.019	24	2
9	160.54	0.063	0.019	23	1	176.55	0.069	0.019	26	2
10	153.18	0.060	0.019	24	1	168.45	0.066	0.019	28	1
11	146.51	0.058	0.019	26	1	161.10	0.063	0.019	29	1
12	140.43	0.055	0.019	27	1	154.41	0.061	0.019	31	1
13	134.87	0.053	0.019	28	1	148.29	0.058	0.019	32	1
14	129.77	0.051	0.019	29	1	142.67	0.056	0.019	33	1
15	125.06	0.049	0.019	30	1	137.49	0.054	0.019	34	1
16	120.71	0.047	0.019	30	1	132.69	0.052	0.019	35	1
17	116.67	0.046	0.019	31	1	128.24	0.050	0.019	36	1
18	112.91	0.044	0.019	32	1	124.10	0.049	0.019	36	1
19	109.40	0.043	0.019	32	0	120.24	0.047	0.019	37	1
20	106.12	0.042	0.019	33	0	116.62	0.046	0.019	37	0
21	103.04	0.040	0.019	33	0	113.24	0.044	0.019	38	0
22	100.15	0.039	0.019	33	0	110.05	0.043	0.019	38	0
23	97.43	0.038	0.019	34	0	107.05	0.042	0.019	39	0
24	94.86	0.037	0.019	34	0	104.23	0.041	0.019	39	0
25	92.43	0.036	0.019	34	0	101.55	0.040	0.019	39	0
26	90.14	0.035	0.019	34	0	99.02	0.039	0.019	40	0
27	87.96	0.035	0.019	34	0	96.63	0.038	0.019	40	0
28	85.89	0.034	0.019	35	0	94.35	0.037	0.019	40	0
29	83.93	0.033	0.019	35	0	92.19	0.036	0.019	40	0
30	82.05	0.032	0.019	35	0	90.13	0.035	0.019	40	0
31	80.27	0.032	0.019	35	0	88.16	0.035	0.019	40	0
32	78.57	0.031	0.019	35	0	86.29	0.034	0.019	41	0
33	76.94	0.030	0.019	35	0	84.50	0.033	0.019	41	0
34	75.39	0.030	0.019	35	0	82.79	0.032	0.019	41	0
35	73.90	0.029	0.019	35	0	81.15	0.032	0.019	41	0
36	72.47	0.028	0.019	35	0	79.57	0.031	0.019	41	0
37	71.10	0.028	0.019	35	0	78.07	0.031	0.019	41	0
38	69.79	0.027	0.019	35	0	76.62	0.030	0.019	41	0
39	68.52	0.027	0.019	34	0	75.23	0.030	0.019	40	0
40	67.31	0.026	0.019	34	0	73.89	0.029	0.019	40	0
41	66.14	0.026	0.019	34	0	72.60	0.028	0.019	40	0
42	65.01	0.026	0.019	34	0	71.36	0.028	0.019	40	0
43	63.92	0.025	0.019	34	0	70.17	0.028	0.019	40	0
44	62.87	0.025	0.019	34	0	69.01	0.027	0.019	40	0
45	61.86	0.024	0.019	34	0	67.90	0.027	0.019	40	0

: Maximum Storage Volume

Q = 0.0028*C*I*A (m^3/s)
C = RUNOFF COEFFICIENT
I = RAINFALL INTENSITY = A / (Time + B^C)
Where A = 1135.4, B = 7.5, and C = 0.841
A = AREA (ha)

29 & 45 Birch Street, Town of Collingwood
Storm Sewer Pipe Design Sheet
5-Year Storm Event

DATE: 2026-03-03
FILE: 24242
CONTRACT/PROJECT: 29 & 45 Birch Street, Collingwood

Areas	MANHOLE		LENGTH (m)	INCREMENT			TOTAL CA	FLOW TIME (min)		I (mm/h)	TOTAL Q (m^3/s)	S (%)	D (mm)	Q FULL (m^3/s)	V FULL (m/s)	Percent Full (%)
	FROM	TO		C	A	CA		TO	IN							
2	CBMH 1	CBMH 2	26.2	0.94	0.11	0.10	0.10	10.00	0.45	102.27	0.03	0.50	300	0.07	0.97	42%
3	CBMH 2	OGS	38.2	0.95	0.09	0.09	0.19	10.45	0.66	100.10	0.04	0.50	300	0.07	0.97	59%
-	OGS	EX. MH1	7.8	-	-	-	0.19	11.11	0.10	97.12	0.04	1.00	300	0.10	1.37	41%

Note: The flow for CBMH2 to OGS is the 5-year storm orifice flow + flow from Area 6 and CB1

Appendix B

Water Servicing Calculations

PEARSON ENGINEERING

29 and 45 Birch Street, Collingwood
Water Flow Calculations - Proposed Conditions

Design Criteria

Demand per Capita (Q):	260	L/cap/day	
Peak Rate Factor (Max. Hour)	2.70		(As per Town of Colingwood Development Standards, August 2022)
Max. Day Factor	1.77		

Site Data:

Description		Density		Units		Flow Rate		Peaking Factors	
Apartment*	2.40	people/unit	30	units	260	L/cap/d	MAX DAY FACTOR*	1.77
							PEAK RATE FACTOR*	2.70

Calculate Population

Pop. Apartments	=	2.40	x	30
Pop. Total	=	72	people	

Calculate Average Day Demand (ADD)

ADD	=	260	x	72
ADD	=	18,720	L/day	
ADD	=	0.22	L/s	

Calculate Max Day Flow

MDF	=	0.22	x	1.77
MDF	=	0.38	L/s	

Calculate Peak Hour Demand

PHD	=	0.22	x	2.70
PHD	=	0.59	L/s	

* Population density for townhouses utilized as units range from 1 to 3 bedrooms

PEARSON ENGINEERING

29 and 45 Birch Street, Collingwood
Fire Flow Calculations - Apartment Building

Required fire flow calculations as per the Fire Underwritors Survey's Water Supply for Public Fire Protection - 2020:

Location:	720 Solutions, Birch Street	
OBC Occupancy:	Residential Occupancies - Class C	
Building Foot Print:	824 m^2	
# of Stories:	3	**Apartment Building**

Date: 2026-03-03
Project: 720 Solutions
Project Number: 24242

Type	Construction Class	Charge
5	Wood Frame	1.50
4	Heavy Timber (A-D)	0.80 - 1.50
3	Ordinary	1.00
2	Non-Combustible	0.80
1	Fire Resistive	0.60

Construction Class: Type 5 — Wood Frame

Automated Sprinkler Protection:

		Credit	Total
NFPA 13 sprinkler standard	Yes	30%	
Standard Water Supply	Yes	10%	50%
Fully Supervised System	Yes	10%	

Contents	Charge
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Contents Factor: Limited Combustible — **Charge:** -15%

Exposure Side & Building	Length - Height Ratio*	Distance to Exposure Building (m)	Charge
North Ex. Residential	51	24.0	4%
East Ex. Residential	> 100	> 30.1	0%
South Ex. Residential	51	11.9	12%
West Ex. Residential	> 100	> 30.1	0%
		Total:	**16%**

*Length - Height Ratio = exposed wall length x # of stories

Separation Distance	Charge
0.0 - 3.0 m	20% - 25%
3.1 - 10.0 m	15% - 20%
10.1 - 20.0 m	10% - 15%
20.1 - 30.0 m	0% - 10%
> 30.1 m	0%

Note: As per FUS 2020 Table 6, Charges for Type VI were used.

Are Buildings Contigious? No

Fire Resistant Building: Are vertical openings and exterior vertical communications protected with a minimum one (1) hr rating? No

Calculations: C = 1.5 — Wood Frame

Required Fire Flow: $RFF = 220 \times C \times \sqrt{A}$

Where: RFF = required fire flow in liters per minute
C = Coefficient related to the type of construction
A= the total floor area in square meters (excluding basements in building considered)

Total Effective Area: A = 2,472 m²

RFF = 16,407 L/min
Round to Nearest 1,000 L/min RFF = 16,000 L/min

* Must be > 2,000 L/min or < 45,000 L/min

Correction Factors:

Contents Charge		-2,400	L/min
RFF Adjusted for Contents	**E =**	13,600	L/min
Reduction For Sprinkler	**F =**	6,800	L/min
RFF w/ Sprinkler Reduction		6,800	L/min

As per "Water Supply for Public Fire Protection" pg.20 note H:
RFF = **E - F + G**

Exposure Charge	**G =**	2,176	L/min
RFF w/ Exposure Charge		8,976	L/min

RFF = 13600 L/min - 6800 L/min + 2176 L/min
RFF = 8976 L/min

Required Fire Flow: **RFF =** 8,976 L/min

Round to Nearest 1,000 L/min **RFF = 9,000 L/min**

RFF= 2,376 GPM

RFF = 150 L/s

Appendix C

Sanitary Servicing Calculations

29 and 45 Birch Street, Collingwood
Sanitary Flow Calculations - Proposed Conditions

Design Criteria:

Flow per Capita (Q):	260	L/cap/day	(As per Town of Colingwood Development Standards, August 2022)
Peak Flow:	Qp = P * Q * M / 86,400 + I * A		
Peaking Factor (Harmon Formula):	M = 1 + (14 / (4 + (P / 1,000) ^ 0.5))	Where:	1.5 <= "M" <= 4.0
Infiltration Allowance:	20	$m^3/ha \cdot d$	

Site Data:

Description		Density		Units		Flow Rate
Apartment	2.40	people/unit	30	units	260	L/cap/d

Calculate Population

Pop. Apartments	=	2.40	x	30
Pop.	=	72	people	

Calculate Average Daily Flows

ADF (L/s)	=	260	x	72
ADF (L/s)	=	18,720	L/day	
ADF (L/s)	=	0.22	L/s	

Calculate Peaking Factor

$$M = 1 + \frac{14}{4 + \left(\frac{72}{1{,}000}\right)^{0.5}}$$

M	=	4.28
		Use Max Peaking Factor 4.00

Calculate Peak Flow

Qp	=	0.22	x	4.00
	=	0.87	L/s	
Infiltration Allowance	=	0.23	x	0.30
	=	0.07	L/s	
Qp (Inc. Infiltration Allowance)	=	0.94	L/s	

* Population density for townhouses utilized as units range from 1 to 3 bedrooms

Appendix D

Phosphorous Budget Calculations

29 & 45 Birch Street, Town of Collingwood
Phosphorus Budget

Sub Watershed: Oak Creek	Residential	Commercial	Industrial	Transportation
Phosphorus Export (mg/L)*	0.41	0.20	0.41	0.50

*Values from the NVCA Hutcheson Phosphorous Report, 2014

Pre-Development Condition

As per the Hutchinson Environmental Services Ltd. Report, October 31, 2004, for the NVCA Phosphorous Tool.

TP_i for Residential (mg/L)= 0.41

Precipitation (mm/yr) = 753.7

Pj = Fraction that produces runoff = 1.00

Impervious Fraction = 0.36

Rv (Runoff Coefficient = 0.05+0.91x Impervious fraction)

= 0.05 + 0.91 x 0.77

= 0.38

TP Export Coefficient (kg/ha/yr) = TPi x Precip X Pj x Rv x 10^{-2}

= 1.17 kg/ha/year

Total Pre-Development P (kg)=	1.17	x	0.3
=	0.35	Kg	

Post Development Condition

As per the Hutchinson Environmental Services Ltd. Report, October 31, 2004, for the NVCA Phosphorous Tool.

TP_i for Residential (mg/L)= 0.41

Precipitation (mm/yr) = 753.7

Pj = Fraction that produces runoff = 1.00

Impervious Fraction = 0.77

Rv (Runoff Coefficient = 0.05+0.91x Impervious fraction)

= 0.05 + 0.91 x 0.77

= 0.75

TP Export Coefficient (kg/ha/yr) = TPi x Precip X Pj x Rv x 10^{-2}

= 2.31 kg/ha/year

Total Pre-Development P (kg) [Without Treatment]=	2.31	x	0.3
=	0.69	Kg	

AREA TO BE TREATED BY OGS

Area (ha): 0.18

Total P (kg) :	0.18	x	2.31
=	0.41		

OGS Treatment

OGS Proficiency (%): 20

P Removed (kg): 0.08

Total Post-Development P (kg):=	0.69	-	0.08
=	0.61		

Appendix E

Water Balance Calculations

29 & 45 Birch Street, Town of Collingwood
Water Balance Calculations

Pre Development Recharge

Precipitation data taken from Environment Canada information for the: Town of Collingwood

Yearly Precipitation = 753.7 mm

Using Table 3.1 of the MOE's SWM Planning & Design Manual, the infiltration amount is approximately 24.0% of the precipitation value for Urban Lawns for Fine Sandy Loam. Using site specific rainfall data, the infiltration can be calculated.

Grassed Area = 0.20 ha

Annual Site Area Recharge Volume = 0.20 x 0.24 x 753.7
= 362 m^3

Therefore, 362m³ per year of recharge volume is required for the proposed project.

Post Development Recharge

Using Table 3.1 of the MOE's SWM Planning & Design Manual, the infiltration amount for Urban Lawns is approximately 24%

Grassed Area = 0.08 ha

Annual Site Area Recharge Volume = 0.08 x 0.24 x 753.7
= 145 m^3

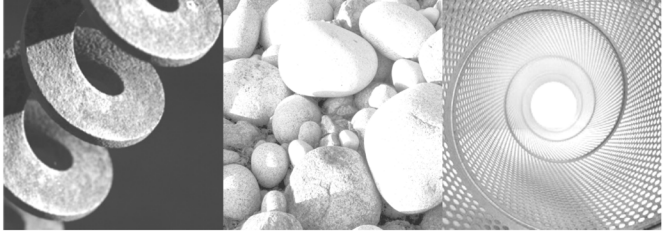
Therefore, post development infiltration deficit is as follows;

Deficit Volume = Pre Development - Post Development
= 362 - 145
= 217 m^3

Appendix F

Geotechnical Investigation Report, GEI,

June 2025



Geotechnical Investigation & Report

Proposed Simcoe County Housing Facility

29 and 45 Birch Street, Collingwood, Ontario

Submitted to:
County of Simcoe
1110 Highway 26
Midhurst, ON, L9X 1N6

Submitted by:
GEI Consultants Canada Ltd.
647 Welham Road, Unit 14
Barrie, ON, L4N 0B7
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2025-06-12
Project No. 2502627

Matthew Hobson
Geotechnical E.I.T

Geoffrey R. White, P.Eng.
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Table of Contents

List of Tables

Figures

Appendices

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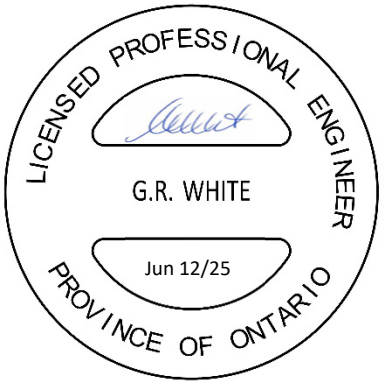


Geoffrey White, P.Eng.
Barrie Office Branch Manager and Senior
Geotechnical Engineer

Acronyms and Abbreviations

%	Percent (per 100 units)
<	Less than …
>	Greater than …
Δ	Change in …
µm	micrometer
ANSI	Area of Natural and Scientific Interest
APEC	Areas of Potential Environmental Concern
BESR	Brownfields Environmental Site Registry
bgs	Below Ground Surface
BH	Borehole
BH/MW	Borehole / Monitoring Well
cm	centimeters
CR	County Road
CTC	Credit Valley, Central Lake Ontario Conservation Authority, and Toronto and Region Conservation Authority
CVC	Credit Valley Conservation
EASR	Environmental Activity and Sector Registry
EBA	Event Based Area
ECA	Environmental Compliance Approval
Elev.	Elevation
EPA	Environmental Protection Act
ERIS	EcoLog Environmental Risk Information Services Ltd.
ESA	Environmental Site Assessment
ET	Evapotranspiration/Evaporation
FOS	Factor of Safety
FSR	Functional Servicing Report
GEI	GEI Consultants Canada Ltd.
GP	Guelph Permeameter
ha	hectares
hr	hours
HVA	Highly Vulnerable Aquifer
I	Infiltration
ICA	Issue Contributing Area
ID	Identification
iPWQO	Interim PWQO
IPZ	Intake Protection Zone
K	Hydraulic Conductivity
kg	kilogram
km	Kilometres
kPa	Kilopascal

L	Litres
LID	Low Impact Development
LSRCA	Lake Simcoe and Region Conservation Authority
m	Metres
m3	Cubic Meters
MECP / MOEE / MOECC / MOE	Ministry of Environment, Conservation and Parks / Ministry of Environment and Energy / Ministry of the Environment and Climate Change / Ministry of the Environment
min	minute
mm	Millimetres
MMAH	Ministry of Municipal Affairs and Housing
MNDM	Ministry of North Development
MNRF	Ministry of Natural Resources and Forestry
MW	Monitoring Well
N values	“N” Values
NRC	Natural Resources Canada
NRCC	National Research Council of Canada
NVCA	Nottawasaga Valley Conservation Authority
O.Reg.	Ontario Regulation
OBC	Ontario Building Code
ODWO	Ontario Drinking Water Objectives
ODWS/ ODWQS	Ontario Drinking Water Standards / Ontario Drinking Water Quality Standards
OGS	Ontario Geological Survey
o-Phosphate	ortho-Phosphate
OWES	Ontario Wetland Evaluation System
OWRA	Ontario Water Resources Act
P	Precipitation
PHC	Petroleum Hydrocarbon
PTTW	Permit to Take Water
PWQO	Provincial Water Quality Objective
R	Runoff
RL	Reporting Limit
ROI/ROIs	Radius/Radii of Influence
ROW	Right-of-Way
RQD	Rock Quality Designation
RSC	Record of Site Condition
s	Seconds
S	Storage
SCS	Site Condition Standards
SGBLS	South Georgian Bay Lake Simcoe
SGRA	Significant Groundwater Recharge Area

SPT	Standard Penetration Test
SS	Split Spoon
SSEA	Severn Sound Environmental Association
SWM	Stormwater Management
TKN	Total Kjeldahl Nitrogen
TRCA	Toronto and Region Conservation Authority
TSS	Total Suspended Solids
USCS	Unified Soil Classification System
VOC	Volatile Organic Compound
WHPA	Wellhead Protection Area
WTRS	Water Taking and Reporting System
WWIS	Water Well Information System

It is noted that all elevations in this report are metric/geodetic and expressed in m. All measurements are also in metric and expressed in mm, m or km.

1. Introduction

GEI was retained by the County of Simcoe (the Client), to complete a geotechnical report in support of the proposed Simcoe County Housing Facility, located at 29 & 45 Birch Street in Collingwood, Ontario. A site location plan is enclosed as Figure 1.

The combined property is approximately 0.3 ha and is located on the east side of Birch Street south of First Street. The site currently consists of a single-storey apartment building and a two-storey apartment building with a parking lot shared by both buildings. It is assumed that the existing buildings are connected to municipal servicing. An aerial image of the site is provided on Figure 2A.

Based on the site configuration provided within the RFP, it is understood that the two existing buildings will be demolished and replaced with a single six-storey building located in the southwest portion of the property. The proposed structure will be slab-on-grade, and it is understood that the proposed structure it will be reconnected to municipal servicing. Outdoor sitting area and other amenities are proposed in the southeast corner of the site. Parking will be located in the northeast with access running along the north property line. A concept plan of the site is shown in Figure 2B.

The purpose of the investigation was to assess the subsurface soil conditions at the site, and based on this information, provide geotechnical engineering recommendations in support of the proposed development. This report summarizes the borehole findings, provides design geotechnical engineering recommendations regarding site earthworks and engineered fill, available bearing capacities for foundations, slabs-on-grade, site servicing installation, and pavement design. Considerations for constructability such as soil excavation, compaction, on-site backfill suitability and temporary groundwater control are also provided.

As the design progresses, further geotechnical review and input may be required which might necessitate the need for additional investigation and/or analysis.

A Hydrogeological Report was requested and are presented under a separate cover.

In addition, one (1) year of groundwater level monitoring has been requested with the summary report to be provided when monitoring is completed.

2. Procedures and Methodology

Prior to the commencement of drilling activities, the borehole locations were staked in the field by GEI. Ground surface elevations of the boreholes and horizontal coordinates (referencing NAD 83 geodetic datum) were surveyed by GEI with a Topcon FC – 5000 GPS Survey unit. Underground utilities including natural gas, electrical, telephone, water, etc. were marked out by public and private utility locating companies prior to drilling.

The fieldwork for the drilling program was carried out on May 14, 2025. Boreholes 1 to 7 were advanced 0.7 to 1.7m below existing grade (Elev. 177.7 to 178.6) across the site. All boreholes met with auger refusal on assumed bedrock. The elevations are provided on the borehole logs in Appendix A. Borehole locations are shown on Figure 2.

The boreholes were advanced by a drilling subcontractor retained and supervised by GEI using a track-mounted drill rig, hollow stem augers, and standard soil sampling equipment. Sampling was conducted using a 51 mm OD SS sampler. SPT N values were recorded for the sampled intervals as the number of blows required to drive an SS sampler 305 mm into the soil using a 63.5 kg drop hammer falling 750 mm, in accordance with ASTM D1586. In each borehole, soil sampling was conducted at 0.75 m intervals for the upper 3.0 m, and at 1.5 m intervals thereafter.

Monitoring wells were installed in two (2) boreholes by GEI to facilitate long-term groundwater monitoring, each consisting of 50 mm diameter PVC pipe with a 0.9 m long screen and protective casing. Monitoring well construction is shown on the borehole logs in Appendix A. Boreholes without wells were backfilled in accordance with O.Reg. 903.

The GEI field staff examined and classified characteristics of the soils encountered in the boreholes, including the presence of fill materials, groundwater observations during and upon completion of the drilling, recorded observations of borehole construction, and processed the recovered samples. All recovered soil samples were logged in the field, carefully packaged, and transported to GEI's laboratory for more detailed examination and classification.

In GEI's laboratory, the soil samples were classified as to their visual and textural characteristics. All samples were submitted for moisture content determination in accordance with ASTM D2216. Four (4) representative soil samples were selected and submitted to our laboratory for grain size analysis. Grain size analysis results are provided in Appendix B.

3. Subsurface Conditions

3.1. General Overview

The detailed soil profiles encountered in the boreholes are indicated in the attached borehole logs in Appendix A. The geotechnical laboratory results are included in Appendix B. The borehole locations are shown on Figure 2.

It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the locations. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. The boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change.

In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.). The passage of time may result in changes in conditions to exist at locations where sampling was conducted.

3.2. Stratigraphy

3.2.1. Topsoil

A topsoil layer was at the ground surface in all boreholes. The topsoil ranged in thickness from 50 to 305 mm. Topsoil thickness may vary between boreholes and in other areas of the site.

3.2.2. Fill

A fill layer was encountered beneath the topsoil in all boreholes and was penetrated at 0.8 m depth (Elev. 178.6. to 178.7) in Boreholes 1, 2, 5, 6 and 7. In Boreholes 3 and 4 the fill was revealed to the 0.7 and 0.9 m depth of the boreholes (Elev. 178.6 to 178.5), respectively. The fill material consisted of silty sand, sand or sand and gravel. Trace to some organics were observed in some samples. The fill was moist, with moisture contents of 8 to 23%. The fill had N values ranging from 4 to over 29 blows, showing loose to compact soil, but typically loose.

3.2.3. Gravelly Sand

Underlying the fill layer in Boreholes 1 and 5, a gravelly sand layer with some silt and trace clay was encountered to 1.7 m depth (Elev. 177.7 to 177.8). Two (2) samples of the material were submitted for grain size analysis and the results are provided in Figure B1 in Appendix B. The gravelly sand was wet with moisture contents of 11 to 16%. The gravelly sand layer had N values over 100, indicating very dense conditions.

3.2.4. Sand

Below the fill layer in Borehole 6, a local sand layer with some silt and trace clay was encountered to the 1.5 m depth of the borehole (Elev. 178.0). One (1) samples of the material was submitted for grain size

analysis and the results are provided in Figure B2 in Appendix B. The sand was moist to wet with a moisture content of 18%. The N value was 49 indicating dense conditions.

3.2.5. Silty Sand

Beneath the fill in Boreholes 2 and 7, a silty sand unit was encountered to the 0.9 m depth of the boreholes (Elev. 178.5). One (1) sample of the material was submitted for grain size analysis and the results are provided in Figure B3 in Appendix B. The silty sand was moist, with moisture contents of 7 to 10%. The material was very dense with N values more than 100.

3.2.6. Auger Refusal

Auger refusal on inferred shallow limestone bedrock common to the Collingwood area was encountered in all boreholes. The depths to auger refusal are summarized below:

Table 3-1. Auger Refusal Depths

Borehole	Depth of Auger Refusal (m) / Elev.
1	1.7/177.8
2	0.9/178.5
3	0.7/178.6
4	0.9/178.5
5	1.7/177.7
6	1.5/178.0
7	0.9/178.5

It is noted that to confirm auger refusal the augers are left to grind on the obstruction for a short period, in the event that a small boulder or cobble is in the borehole path that can be penetrated. As a result, the augers may penetrate slightly into the potentially upper weathered bedrock surface to some degree and the depths noted above may be slightly below the actual bedrock surface. A series of test pits is recommended to confirm the bedrock level when the development concept has been established.

3.3. Groundwater

Unstabilized groundwater level measurements and cave measurements were taken upon the completion of drilling of each borehole as shown on the borehole logs in Appendix A. These measurements were taken to provide a rough estimate of the possible excavation and temporary groundwater control constructability considerations that may arise. Two (2) boreholes were outfitted with a monitoring well with 50 mm diameter pipe and 0.9 m long screen. Monitoring well configuration and groundwater observations are noted on the borehole logs in Appendix A and summarized in the table below.

Table 3-2. Groundwater Levels

Borehole	Depth of Cave (m) / Elev.	Unstabilized Groundwater Level Depth (m) / Elev.	Depth (m) / Elev. of Groundwater Table, May 26, 2025
BH1	Open	0.9 / 178.6	N/A
BH2	Open	0.9 / 178.5	N/A
BH3	Open	No Water	N/A
BH4	Open	No Water	N/A
BH5	Open	1.0 / 178.4	1.1 / 178.3
BH6	Open	0.9 /178.6	1.4 / 178.1
BH7	Open	No Water	N/A

Based on the observations above the groundwater table at the site appears to be 1.1 to 1.4 m (Elev. 178.1 to 178.3).

GEI is currently conducting a one (1) year groundwater level monitoring program, and the results will be provided separately upon completion.

All soils at the site are “sandy” and are permeable and will allow for the free flow of water.

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

4. Engineering Design Parameters & Analysis

The combined property is approximately 0.3 ha and is located on the east side of Birch Street south of First Street. The site currently consists of a single-storey apartment building and a two-storey apartment building with a parking lot shared by both buildings. It is assumed that the existing buildings are connected to municipal servicing. An aerial image of the site is provided on Figure 2A.

Based on the site configuration provided within the RFP, it is understood that the two existing buildings will be demolished and replaced with a single six-storey building located in the southwest portion of the property. The proposed structure will be slab-on-grade, and it is understood that the proposed structure it will be reconnected to municipal servicing. Outdoor sitting area and other amenities are proposed in the southeast corner of the site. Parking will be located in the northeast with access running along the north property line. A concept plan of the site is shown in Figure 2B.

4.1. Site Grading

Grading plans were not available for review at the time of this report; however, it is speculated that only minor grading will be required as the site and surrounding area are already situated/established and considering the presence of shallow bedrock.

It is noted that the upper 0.6 to 1.5 m of soil is comprised of topsoil and fill and is considered unsuitable to support building foundations and floor slabs. Also, considering the shallow bedrock, footings will be extended down to bedrock for uniform performance. As a result, only floor slabs would be supported by the engineered fill. Within the building footprint it is recommended that the topsoil and fill be removed. It is recommended to strip the topsoil and stockpile separately, then sub-excavate the existing fill down to competent native soil. The exposed subgrade surface should be thoroughly compacted and then engineered fill placement can commence to the floor slab subgrade level.

Further, the existing buildings will be demolished. Once the existing structures are removed, all associated fill debris will have to be removed vertically and laterally down to competent bedrock/native soil in the former building areas and then engineered fill placement can commence to the desired grade.

As noted above it is recommended that the footings be set on the bedrock surface. Minor rock excavation to flatten any rock knobs to allow for more preferred footing placement can be expected. However, additional rock excavation/blasting will have challenges. If blasting or other major rock excavation techniques are employed, then vibration monitoring will be required based on the surrounding infrastructure and neighbouring sites. In addition, preconditions surveys for all surrounding buildings would be recommended to reduce future damage claims. Lastly, depending on the depth of excavation required, a “bathtub” would be created for groundwater and surface water run-off to collect in and building drainage would likely need to be enhanced significantly to offset this condition.

Based on the above, for purposes of this report, it is assumed that building will be set on the existing bedrock with no major bedrock excavation/blasting.

4.1.1. Engineered Fill

GEI defines “engineered fill” as material that will support foundations and or slabs, and which is placed and compacted in a specified and controlled manner under full-time supervision of geotechnical engineering staff.

In any location where engineered fill will be placed to raise grades or replace poor/weak soil, the topsoil, vegetation, weathered/disturbed, or existing earth fill must be fully removed down to competent soil or bedrock. The exposed subgrade soil must be proof-rolled and inspected by the geotechnical engineer to ensure all unsuitable material (e.g. organics, weak or soft soil, weathered/disturbed soil, deleterious materials, existing fill) was removed from the engineered fill footprint. Any unsuitable areas must be further sub-excavated and replaced with approved fill compacted to 98% SPmdd in slab areas and 95% SPmdd in road and servicing areas.

Once the subgrade is approved, engineered fill can be placed. Engineered fill must be placed under the full-time supervision of a geotechnical engineer as required in the Ontario Building Code. The engineered fill may consist of excavated on-site cohesionless soil provided the material has been moisture conditioned to a moisture content within 2% of optimum moisture content and do not contain organics, topsoil or deleterious material. It is recommended that any imported soil used for site grading consist of Granular B (OPSS.MUNI 1010) and be first used in building areas, with suitable on-site soil used in landscaped or road/paved areas. Engineered fill must be placed in loose lifts of 200 mm or less and compacted as noted above.

The exposed subgrade may be wet from locally perched water. In wet subgrade areas, the first lift of engineered fill shall consist of 400 mm of Granular B Type II (OPSS.MUNI 1010). This will help to bridge the weaker subgrade and improve the ability to achieve the compaction specifications for subsequent engineered fill lifts.

The engineered fill under foundations (not expected at this site) must extend a minimum of 1 m out from all sides of the foundations and extend at a 1 horizontal to 1 vertical slope (1H:1V) down to the exposed subgrade. A typical detail for engineered fill pad dimensioning is included in Appendix C.

4.2. Foundation Design

4.2.1. Foundations on Bedrock

The grading has not been set for the site however as noted earlier it is speculated that only minor grading will be required as the site and surrounding area are already situated/established.

The topsoil and fill layer are not suitable to support the newly proposed building due to concerns with settlement.

Foundations for the proposed building at this site may be constructed as conventional spread and strip footings. It is recommended that all foundations extend down to bear on the unweathered bedrock surface for uniform performance. Foundations set on the unweathered bedrock surface may be designed using a maximum factored geotechnical resistance at (Ultimate Limit State) ULS of 500 kPa. It is noted that the bedrock is considered to be unyielding, and the design will not be governed by settlement criteria

since the load required to produce 25 mm of settlement would be much larger than the factored geotechnical resistance at ULS.

A unfactored friction factor of 0.7 is recommended for footings constructed in rough bedrock surfaces (asperity height of at least 25 mm) for sliding resistance. For a smooth bedrock, surface a value of 0.6 is recommended for sliding resistance (although a smooth surface may be difficult to construct with this type of bedrock). A reduction factor of 0.8 is recommended.

The foundation design parameters provided above are predicated on the assumption that the foundation subgrade is comprised of unweathered bedrock, and that all loose material is removed. Mass concrete can be placed on top to provide a level founding surface for the footings where required. The foundation excavation must be done in such a way that groundwater is controlled. Temporary groundwater control is discussed in Section 5.2.

Bedrock is not frost susceptible and frost protection for footings on bedrock is not required.

The foundation subgrade must be reviewed by the geotechnical engineer prior to concrete placement to ensure the foundation design parameters provided above are applicable, and to provide remedial recommendations if necessary.

The foundations (whether strip or spread footings) must be made on a relatively flat bedrock surface. If the bedrock surface beneath the proposed foundations slopes less than 10%, about 10 horizontal to 1 vertical (10H:1V), or 5.7°, foundations can be made directly on the rock face. For a slope greater than 10% the bedrock surface must be benched and made flat beneath the foundations. The benched bedrock should have vertical faces no greater than 600 mm in height and horizontal benches no less than 1200 mm in length (for an average slope of 2H:1V or flatter) as best as possible. Where benching cannot be carried out and the bedrock is sloped more than 10%, 20 mm passive dowels inserted vertically into the horizontal benches made in the rock installed at maximum 0.3 m on-centre spacing are required. These dowels provide additional support in the case of sloped bedrock conditions. The dowels must extend a minimum of 1.0 m into the rock face (0.5 m past the weathered zone). The dowels must be grouted with a minimum 10 MPa strength un-shrinkable grout.

4.3. Seismic Site Classification

The 2024 Ontario Building Code came into effect on January 1, 2025, and notable amendments to the 2012 Building Code pertaining to the seismic site classification are listed below:

- As per section 4.1.8.4, Site Properties, OBC 2024, the site designation shall be determined from Table 4.1.8.4.-A using the average shear wave velocity, Vs30, calculated from in situ measurements of shear wave velocity.
- Where Vs30 calculated from in situ measurements is not available, the site designation shall be Xs, where S is the Site Class determined using the energy-corrected average standard penetration resistance, N60, or the average undrained shear strength, Su, in accordance with Table 4.1.8.4,-B, N60 and Su being calculated based on rational analysis.

Table 4.1.8.4.-B Site Classes, S, for Site Designation X_S in OBC 2024 indicates that site class "S" should be determined from the average ground profile characteristics in the top 30 m. As the boreholes were advanced less than this depth at the site, the site classification recommendation provided below assumes that the bedrock conditions are similar below the drilled depth. Based on the known subsurface conditions and the foundations will be supported by bedrock. The Site Designation for the Site is "X_B" corresponding to Site Class B as per Table 4.1.8.4.-B.

4.4. Floor Slabs

The engineered fill is suitable to support the proposed building floor slab.

The exposed top of the engineered fill must be proof-rolled and inspected by the geotechnical engineer. If any soft or weak subgrade areas are identified, or if there are areas containing excessive amounts of deleterious/organic material, they must be locally sub-excavated and backfilled with approved site earth fill or imported granular material and compacted to a minimum of 98% SPmdd within 2% optimum moisture content.

All floor slabs must be provided with a capillary moisture barrier and drainage layer. This is made by placing the concrete slab on a minimum 200 mm layer of 19 mm clear stone (OPSS.MUNI 1004) compacted by vibration to a dense state. The upper 50 mm of clear stone can be replaced with 19 mm crusher run limestone for a working surface. The clear stone and a cohesionless subgrade must be separated by a geotextile such as Terrafix 270R (or approved equivalent) to prevent the migration of fines into the clear stone layer which could result in loss of support for the slab. Alternatively, Granular A (OPSS.MUNI 1010) compacted to 100% SPmdd can be utilized without filter cloth.

4.5. Drainage

The proposed structure will be slab-on-grade with no basement levels, perimeter and under-slab drainage at the foundation level is not required, provided that the underside of the concrete slab is at least 200 mm above the prevailing grade of the site and the surrounding surfaces slope away from the building at a gradient of at least 2% to promote surface water run-off and to reduce groundwater infiltration adjacent to foundations. To minimize infiltration of surface water, the upper 150 mm of backfill should comprise relatively impervious/cohesive compacted soil material. See Appendix C for details.

4.6. Site Servicing

It is assumed that the new building will be connected to the existing municipal services currently at the site such that only minor reconnections will be required for the project.

4.6.1. Bedding

The type of material and depth of granular bedding below the pipe will, to some extent, depend on the method of construction used by the contractor. Pipe bedding for flexible pipes should follow the requirements in OPSD 802.010 or applicable municipal standards. Pipe bedding for rigid pipes should follow the requirements in OPSD 802.030 to 802.032 or applicable municipal standards.

A subgrade consisting of the native bedrock at the site, engineered fil or native soil will provide adequate support for pipes with the bedding requirements as laid out in the above referenced OPS drawings. Where fill is encountered or disturbance of the trench base has occurred from groundwater seepage,

construction traffic, etc., the fill/disturbed soils may have to be sub-excavated and replaced with suitably compacted granular fill. If weak zones are encountered, additional bedding materials and differing construction practices may be required and should be determined during construction.

It is noted that the bedrock is not frost susceptible, however in order protect the service pipes and reduce the amount of bedrock excavation all service pipes not buried a minimum of 1.2 m below the ground surface will need to be provided with insulation in order to make up the difference for frost cover. A 25 mm layer of Polystyrene Insulation is equivalent to 300 mm of earth cover. The insulation must also be spread laterally such that the path to the pipe from the ground surface is also a minimum of 1.2 m.

Regardless of whether flexible or rigid pipes are implemented, granular bedding and cover material should consist of a well graded, free draining material, such as Granular "A" (OPSS.MUNI 1010). All granular bedding must be compacted to a minimum of 95% SPmdd.

4.6.2. Backfill

Excavated site soil free from organics and deleterious materials may be re-used as backfill in trenches, provided they are moisture conditioned so that the moisture content is within 2% of optimum. Additional soil compaction details are provided in Section 5.3. The backfill should be compacted to a minimum of 95% SPmdd. In confined areas the layer thickness will have to be reduced to utilize smaller compaction equipment efficiently or by using granular material instead of locally sourced fill. Any backfill that is frozen, contains a high percentage of organic material (topsoil, organics, etc.) or moisture, or has otherwise unsuitable deleterious inclusion should not be used as backfill. The maximum cobble or boulder size should not exceed half of the loose lift thickness (i.e., all particles with a diameter greater than 100 mm should be removed).

Where trenches are within the traveled portions of a roadway, backfill within the frost penetration depth of 1.2 m should consist non-organic fill material consistent with the soils surrounding the trench in the upper 1.2 m. If this technique is not undertaken, then frequently problems arise with yearly differential frost heave movements between the trench backfill and the adjacent soil. This would occur, for example, if imported granular material is used to backfill trenches which is less susceptible to frost effects compared to the native soils on site. Alternatively, if different soil is used as the backfill due to issues with achieving compaction, a frost taper of 10H:1V can be implemented to help mitigate the potential for differential settlement and frost heave.

4.7. Pavement Design

In general, at this stage of the project, the pavement subgrade is expected to consist of the near surface soils comprising silty sand to sand fill which is considered to have a low to moderate frost susceptibility.

The pavement subgrade must be inspected and approved by the geotechnical engineer at the time of construction. The exposed pavement subgrade should be compacted to a minimum of 95% SPmdd. If any soft or weak subgrade areas are identified, or if there are areas containing excessive amounts of moisture or deleterious/organic material, they must be locally sub-excavated and backfilled with approved clean earth fill or imported granular material and compacted to a minimum of 95% SPmdd.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures must be maintained to ensure that uniform

subgrade moisture and density conditions are achieved as much as possible when fill is placed, and the subgrade is not disturbed or weakened after it is exposed.

Control of surface water is an important factor in achieving a good pavement life. The need for adequate subgrade drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (at a minimum grade of 2 percent) to provide effective drainage toward subgrade drains. Grading adjacent to pavement areas should be designed to ensure that water is not allowed to pond adjacent to the outside edges of the pavement.

Ideally, continuous pavement subdrains should be provided along the edges of the pavement and drained into respective catch basins to facilitate drainage of the subgrade and the granular materials. The subdrain invert should be maintained at least 0.3 m below subgrade level and connect to pavement catchbasins. The shallow bedrock at the site may render the installation of all proposed catchbasins unfeasible. Ditching may be required to local catchbasins. Typical pavement drainage details are provided in Appendix C.

4.7.1. Pavement Structure

The industry pavement design methods are based on a design life of 15 to 20 years for typical weather conditions depending on actual traffic volumes. The following pavement thickness designs are provided on the above noted considerations and anticipating the subgrade will comprise of a low to moderate frost susceptible soil. The pavement design will need to be reviewed once the grading/subgrade has been established.

Table 4-1. Pavement Design

Pavement Layer	Compaction Requirement	Min. Component Thickness (mm)	
		Light Duty	Heavy Duty
Surface Course Asphaltic Concrete: HL3 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)	92% MRD (OPSS.MUNI 310)	40 mm	40 mm
Binder Course Asphaltic Concrete: HL8 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)		50 mm	80 mm
Base Course: Granular A (OPSS.MUNI 1010)	100% SPmdd (OPSS.MUNI 501)	150 mm	150 mm
Subbase Course: Granular B Type I (OPSS.MUNI 1010)		300 mm	450 mm

The granular materials should be placed in lifts 200 mm thick or less and be compacted to a minimum of 100% SPmdd for both granular base and subbase. The granular and asphalt pavement materials and their placement should conform to OPSS 310, 501, 1010 and 1150.

If the pavement construction occurs in wet, winter or inclement weather, it may be necessary to provide additional subgrade support for heavy construction traffic by increasing the thickness of the granular subbase, base or both. Further, traffic areas for construction equipment may experience unstable

subgrade conditions. These areas may be stabilized utilizing additional thickness of granular materials or the use of geogrid.

It should be noted that in addition to adherence of the above pavement design recommendations, a close control on the pavement construction process will also be required in order to obtain the desired pavement life. Therefore, it is recommended that regular inspection and testing should be conducted during the pavement construction to confirm material quality, thickness, and to ensure adequate compaction.

Smooth transitions are required in all areas where the new pavement meets the existing asphalt surface. Asphalt joints shall follow OPSS.MUNI 310. Frost tapers of 10H:1V should be implemented between areas of differing pavement thickness and tie-in areas to existing pavement. Longitudinal asphalt joints should be milled into the existing asphalt a minimum 0.5 m for each lift. Transvers joint shall be milled into the existing asphalt a minimum 0.5 m for each lift. Successive joints should be staggered.

5. Constructability Considerations

5.1. Excavation

Excavations for buildings and service connections are anticipated to extend down to the bedrock surface about 0.7 to 1.7 m below existing grade. Below the surficial pavement, excavations will encounter the silty sand fill and local native units of silty sand or glacial till. Harder digging should be expected in the very dense soil.

Excavations must be carried out in accordance with the Occupational Health and Safety Act, Ontario Regulation 213/91 (as amended), Construction Projects, Part III - Excavations,

Section 222 through 242. Where workers must enter a trench or excavation the soil must be suitably sloped and/or braced in accordance with the OHSA. These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. If more than one soil type is encountered in an excavation, the most conservative soil type must be followed for sloping the sidewalls of the excavation. Based on the soil stratigraphy revealed in the boreholes, and subject to groundwater control being provided, excavation at the site can be completed considering a Type 3 soil geometry with 1H:1V side slopes from the base of the excavation/top of the bedrock.

As discussed above, large bedrock excavation anticipated at this time. However, minor excavation may be need to level small areas. Mechanical means such hoe-ram will likely be adequate to remove bedrock knobs. Bedrock is not considered one of these four soil types under the regulation and can typically be constructed near vertically provided the geotechnical engineer inspects the excavated bedrock and approves it prior to workers entering the excavation or trench. Weathered or fractured bedrock may need flattening in some areas subject to inspection.

Excavation sidewalls will need to be continuously reviewed for evidence of instability and ground water seepage, particularly following periods of heavy rain or thawing. In area of minor bedrock excavation sidewalls will need to also be reviewed for loose material. When required, remedial action must be taken to ensure the continued stability of excavation slopes and the safety of the workers.

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the OHSA and include provisions for timbering, shoring and moveable trench boxes. To reduce the potential for instability of the trench excavations, materials excavated from the service trenches and/or other fill materials, or heavy equipment should not be placed near the crest of the trench excavations.

It is important to note that soils encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in the boreholes advanced on site. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, we recommend that GEI be contacted immediately to evaluate the conditions encountered.

5.2. Temporary Construction Groundwater Control

As noted above, excavation is envisioned to extend to about 0.7 to 1.7 m depth below existing grades for the project.

Groundwater was present in both wells installed in at the site. The stabilized groundwater levels in the monitoring wells were measured at 1.1 to 1.4 m depth below the existing ground surface, corresponding to Elev. 178.1 to 178.3. Also, groundwater was in Boreholes 1 and 2 at 0.9 m depth (Elev 178.5 to 178.6) upon completion. In general, the above observations are considered to reflect localized perched water in bedrock “low points”. Due to the shallow bedrock and anticipated limited perched groundwater volumes (although seepage may be generous initially due to pervious sandy soil at the site) no major groundwater problems are anticipated from the excavation walls. Any seepage should be controllable by the use of conventional pumping from collection sumps and ditches. Areas with greater seepage may require multiple pumps.

The exact scenario where certain groundwater control techniques will work are directly correlated to how coarse/fine the native soils are in an excavation, and both the lateral and vertical extent of the wet cohesionless deposits. If the groundwater table is not controlled during construction, the base of the excavations will be unstable, leading to difficulties in excavating and placement of pipes, footings or engineered fill, and providing safety for the workers.

It is recommended to carry out the work during the dry time of the year when the ground water table is lowest, to mitigate groundwater control measures. Also reducing the size of the excavation that is open at any one time will aid in reducing groundwater control requirements.

Based on the above, a PTTW from the MECP or registry on the EASR system is not anticipated. Monitoring is on-going and recommendations can be updated when the monitoring is finished.

GEI’s hydrogeological study under a separate cover provides further details regarding water taking analysis, regulatory and permitting requirements, impact assessments, monitoring plans, etc. for the site and must be referenced for groundwater control considerations.

5.3. Compaction Specifications

SPmdd is the specification to indicate the degree to which soil or aggregate is compacted. To achieve the specified SPmdd as indicated in this report, all soils or aggregates must be placed in lift thicknesses no greater than 200 mm. If this is not the case, only the upper portion of the lift will be adequately compacted, and the lower portion of the lift has a high probability of not meeting compaction specifications. In addition, industry standard equipment used to determine the degree of compaction consists of nuclear densometers. These devices have an inherent limitation in that they cannot test beyond 300 mm in depth, and so the degree of compaction beyond this depth cannot be quantitatively determined.

Along with lift thickness, ensuring that the soil or aggregate is within 2% of its optimum moisture content ensures that the specified compaction can be reached. If the soil or aggregate is too dry/wet, it is either very difficult or impossible to reach the specified compaction. This is especially true for when higher compaction specifications such as 98% and 100% SPmdd are required.

Moisture can be increased by adding water and mixing the soil prior to re-use, blending the soil with wetter material, or by importing soil to the site that is at optimum and can be readily compacted.

Moisture can be reduced by tilling or spreading out the soil to dry or blending it with drier material. In-situ moisture contents can change based on the season and local groundwater levels and can also change for stockpiled material due to precipitation. Zones of the fine-grained soil with very high moisture contents may fine moisture conditioning to be difficult to accomplish.

In addition to the above compaction specifications, in any areas where compacted fill will be placed over the exposed native soil subgrade, any loose, soft, wet, organic or unstable areas should be sub-excavated, and backfilled with clean earth fill or Granular 'B' (OPSS.MUNI 1010) compacted to a minimum of 95% SPmdd. This recommendation applies to site servicing and pavement subgrades. Where structures/buildings require upfilling beneath the structure the fill should be compacted to 100% SPmdd.

5.4. Quality Verification Services

On-site quality verification services are an integral part of the geotechnical design function, and for foundations, engineered fill and retaining walls, are required under the Ontario Building Code. Quality verification services are used to confirm that construction is being conducted in general conformance with the requirements as outlined in the drawings, reports and specifications prepared for the proposed development.

GEI can provide all the on-site quality verification services outlined below:

- The subgrade/bedrock for shallow foundations for the proposed building will need to be field reviewed by the geotechnical engineer;
- Full-time monitoring, testing and inspection of engineered fill placement is required by the geotechnical engineer per the OBC;
- Part-time monitoring of the subgrade support capabilities, material quality, lift thickness, moisture content, degree of compaction, etc. is recommended for the following areas to ensure the recommendations within this report are followed and they perform adequately in the long-term:
    - Slab-on-grade;
    - Pavement structure (granular and asphalt);
    - Pipe bedding and cover;
- Testing of the concrete (compressive strength, slump, air content, etc.) and testing of the asphalt (asphalt content and gradation) are recommended to ensure that the quality of the materials being brought to site meet the requirements of the project.

6. Limitations and Conclusions

6.1. Limitations

The recommendations and comments provided are necessarily on-going as new information of underground conditions becomes available. More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, conditions not observed during this investigation may become apparent. Should this occur, GEI should be contacted to assess the situation and additional testing and reporting may be required.

GEI should be retained for a general review of the final design drawings and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, GEI will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of the design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

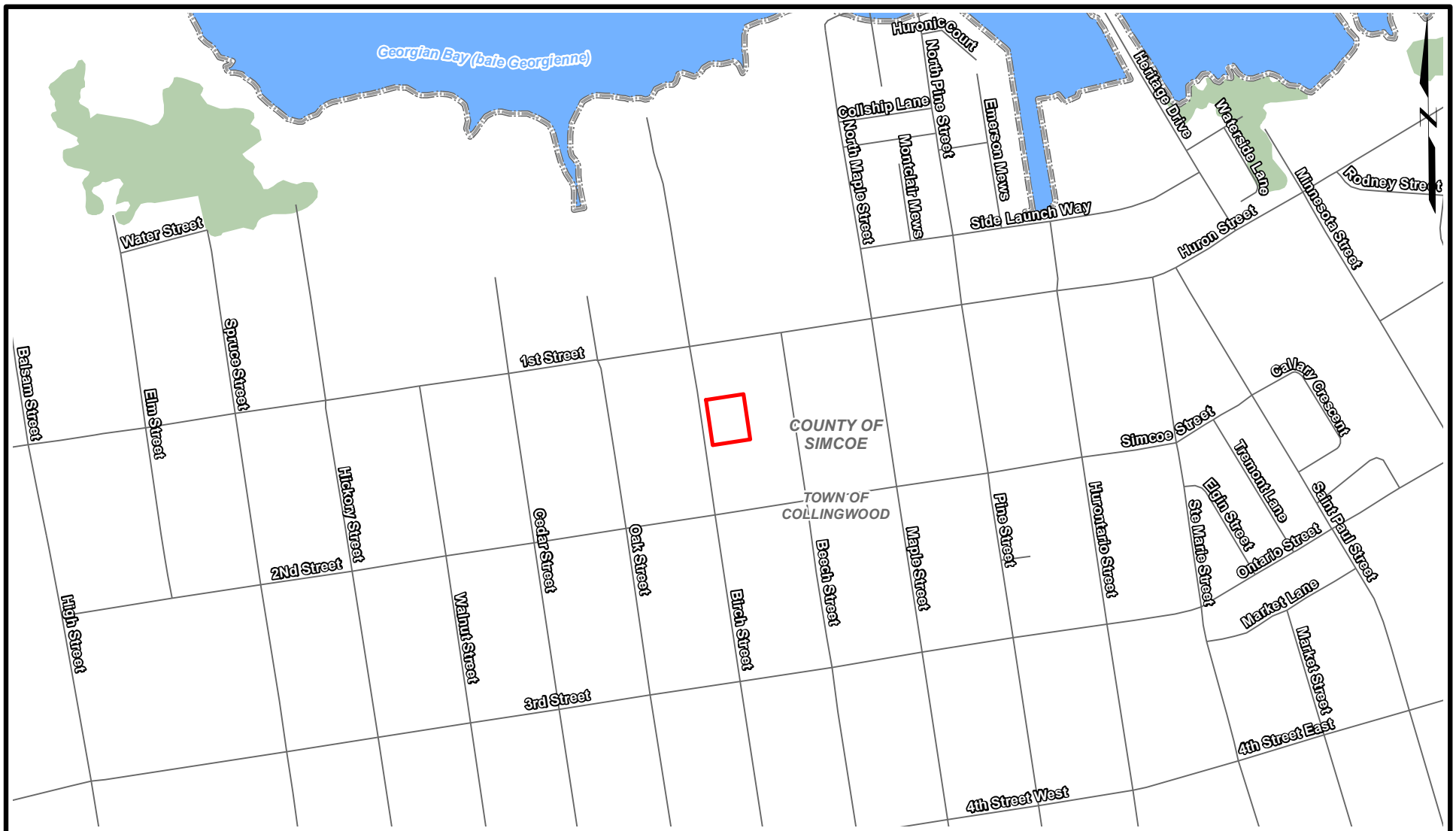
This report was authorized by, and prepared by GEI for, the account of the County of Simcoe. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GEI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

6.2. Conclusions

It is recognized that municipal/regional governing bodies, in their capacity as the planning and building authority under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both as are expressed and implied.

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

Figures



Reference(s):
1. Coordinate System: NAD 1983 CSRS UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025.

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Geotechnical Investigation
Proposed Simcoe County Housing Facility
29 & 45 Birch St, Collingwood, ON

County of Simcoe

GEI Consultants Canada

SITE LOCATION PLAN

Project 2502627 | Jun 2025 | Fig. 1

\\bos-pzcc-1\data_storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025 05 Geotech\2502627_rpt_fig01_Site_Location.mxd

Site Location
Road
Approximate Borehole Location
Approximate Borehole/Monitoring Well Location

Reference(s):
1. Coordinate System: NAD 1983 CSRS UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2024.

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Geotechnical Investigation
Proposed Simcoe County Housing Facility
29 & 45 Birch St, Collingwood, ON

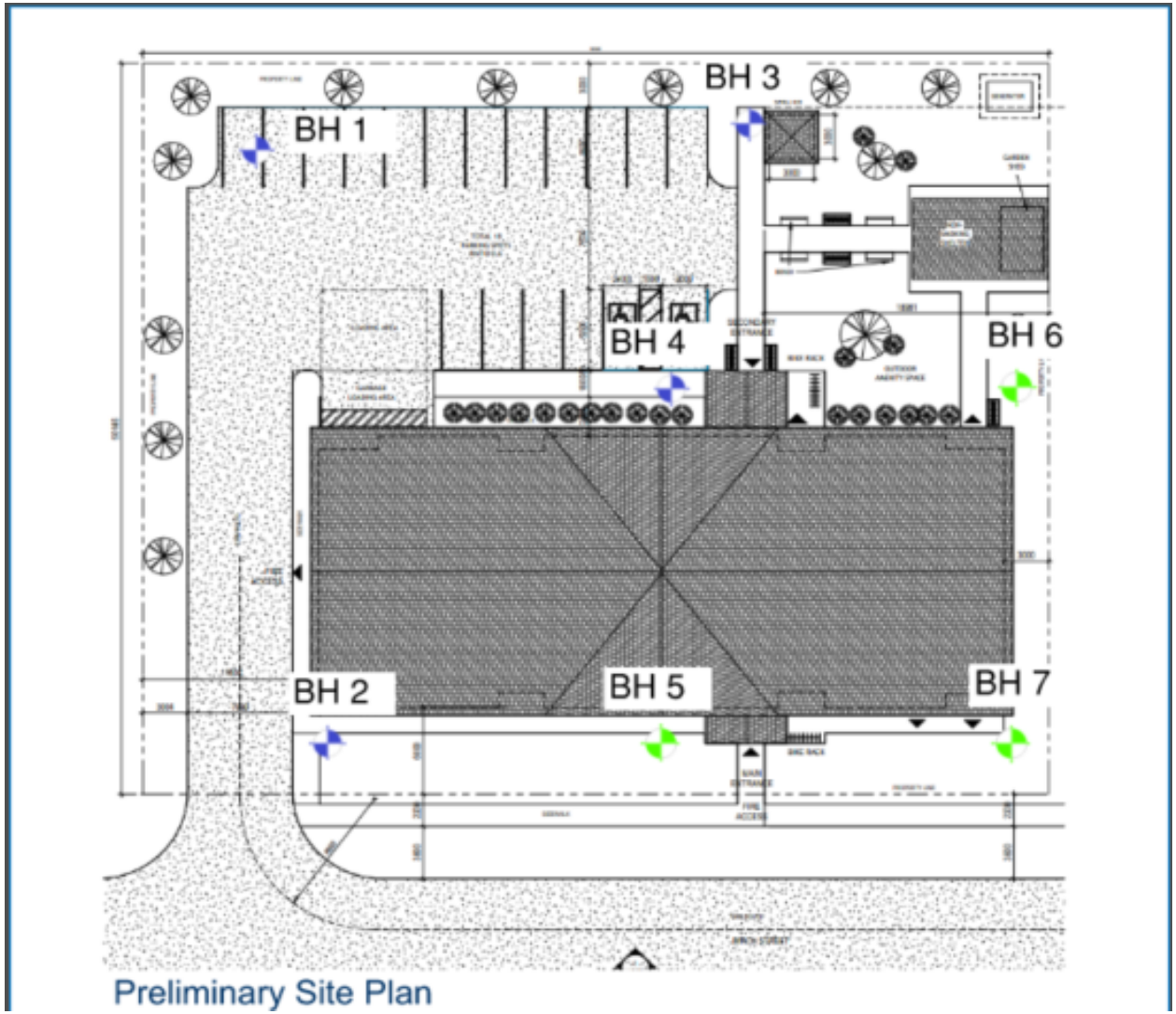
County of Simcoe

GEI Consultants Canada

BOREHOLE LOCATION PLAN (AERIAL)

Project 2502627 | Jun 2025 | Fig. 2A

\\bos-pzcc-1\data_storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025 05 Geotech\2502627_rpt_fig02_bh_location_plan_aerial.mxd



Site Location

Road

Approximate Borehole Location

Approximate Borehole/Monitoring Well Location

Reference(s):
1. Coordinate System: NAD 1983 CSRS UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2024.

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Geotechnical Investigation
Proposed Simcoe County Housing Facility
29 & 45 Birch St, Collingwood, ON

County of Simcoe

GEI Consultants Canada

BOREHOLE LOCATION PLAN (CONCEPT)

Project 2502627 | Jun 2025 | Fig. 2B

\\bos-pzcc-1\data_storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025 05 Geotech\2502627_rpt_fig02_bh_location_plan_aerial.mxd

Appendix A Borehole Logs

RECORD OF BOREHOLE No. 01

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927879.40** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561790.171** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); Penetration Testing: SPT, DCPT	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.5													
	TOPSOIL: 205 mm					0	179.5							
	0.2 179.3													
	FILL: Sand, trace organics, trace gravel, compact, brown, moist	SS	1	10	29	0.5	179	29	16					
	0.8 178.7													
	GRAVELLY SAND: Some silt, trace clay, very dense, brown, moist	SS	2	20	100+	1	178.5	100+	16		27	53	13	7
	1.7 177.8					1.5	178							
	Borehole Terminated at 1.7 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: 0.9 m. Cave depth after auger removal: Open
Groundwater depth observed on: Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 02

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927866.15** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561754.812** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING			COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); 40 80 120 160; Penetration Testing: SPT, DCPT; 10 20 30 40	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits PL LL; Water Content (%); 10 20 30 40	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.4														
	TOPSOIL: 130 mm 0.1 179.3					0									
	FILL: Sand, trace organics, trace silt, trace gravel, compact, brown, moist	SS	1	15	10		179	10	8						
	0.8 178.6					0.5									
	SILTY SAND: Trace gravel, very dense, brown, moist 0.9 178.5	SS	2	5	100+		178.5	100+	10						
	Borehole Terminated at 0.9 m Upon Auger Refusal														

Groundwater depth encountered on completion of drilling: 0.9 m. Cave depth after auger removal: Open
Groundwater depth observed on: Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 03

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927848.56** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561796.117** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); 40 80 120 160; Penetration Testing: SPT, DCPT; 10 20 30 40	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits PL LL; Water Content (%); 10 20 30 40	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	0.0 179.3										
	TOPSOIL: 255 mm					0					
	0.2 179.1										
	FILL: Silty sand, trace gravel, loose, brown, moist	SS	1	50	7		179	7	23		
	0.7 178.6					0.5					
	Borehole Terminated at 0.7 m Upon Auger Refusal										

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 04

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927849.13** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561775.963** Date Completed: **May 14/25**

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LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa); Penetration Testing (SPT, DCPT)	Combustible Organic Vapour - Hex; Combustible Organic Vapour - IBL; Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	0.0 179.5										
	TOPSOIL: 205 mm					0					
	0.2 179.3										
	FILL: Sand and gravel, trace organics, loose, brown, moist	SS	1	40	8	0.5	179	8	15		
	0.9 178.5										
	Borehole Terminated at 0.9 m Upon Auger Refusal										

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 05

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927845.50** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561757.344** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); Penetration Testing: SPT, DCPT	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.4													
	TOPSOIL: 205 mm					0								
	0.2 179.2						179							
	FILL: Silty sand, some gravel, trace organics, compact, brown, moist	SS	1	40	12	0.5		12	9					
	0.8 178.6						178.5							
	GRAVELLY SAND: Some silt, trace clay, very dense, brown, moist	SS	2	45	100+	1		100+	11					
							178							
	1.7 177.7	SS	3	45	100+	1.5		100+	11		20	59	14	7
	Borehole Terminated at 1.7 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: 1.0 m. Cave depth after auger removal: Open

Groundwater depth observed on: 2025/05/26 at depth of: 1.11 m. Groundwater Elevation: 178.3 m

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Scale: **1 :25**

RECORD OF BOREHOLE No. 06

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927827.14** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561775.660** Date Completed: **May 14/25**

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LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa); Penetration Testing (SPT, DCPT)	Combustible Organic Vapour - Hex; Combustible Organic Vapour - IBL; Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.5													
	TOPSOIL: 305 mm					0								
	0.3 179.2													
	FILL: Sand, some organics, loose, brown, moist	SS	1	100	8	0.5	179	8	19					
	0.8 178.7													
	SAND: Some silt, trace clay, dense, brown, moist	SS	2	65	49	1	178.5	49	18		0	74	19	7
	1.5 178.0					1.5	178							
	Borehole Terminated at 1.5 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: 0.9 m. Cave depth after auger removal: Open

Groundwater depth observed on: 2025/05/26 at depth of: 1.4 m. Groundwater Elevation: 178.1 m

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Scale: **1 :25**

RECORD OF BOREHOLE No. 07

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927825.70** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561760.184** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); 40 80 120 160; Penetration Testing: SPT, DCPT; 10 20 30 40	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits PL LL; Water Content (%); 10 20 30 40	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.4													
	0.0 TOPSOIL: 50 mm 179.3					0								
	FILL: Sand, some gravel, trace organics, very loose, brown, moist	SS	1	15	4		179	4	12					
	0.8 178.6					0.5								
	SILTY SAND: Some gravel, trace clay, very dense, brown, moist 0.9 178.5	SS	2	20	100+		178.5	100+	7		19	49	23	9
	Borehole Terminated at 0.9 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

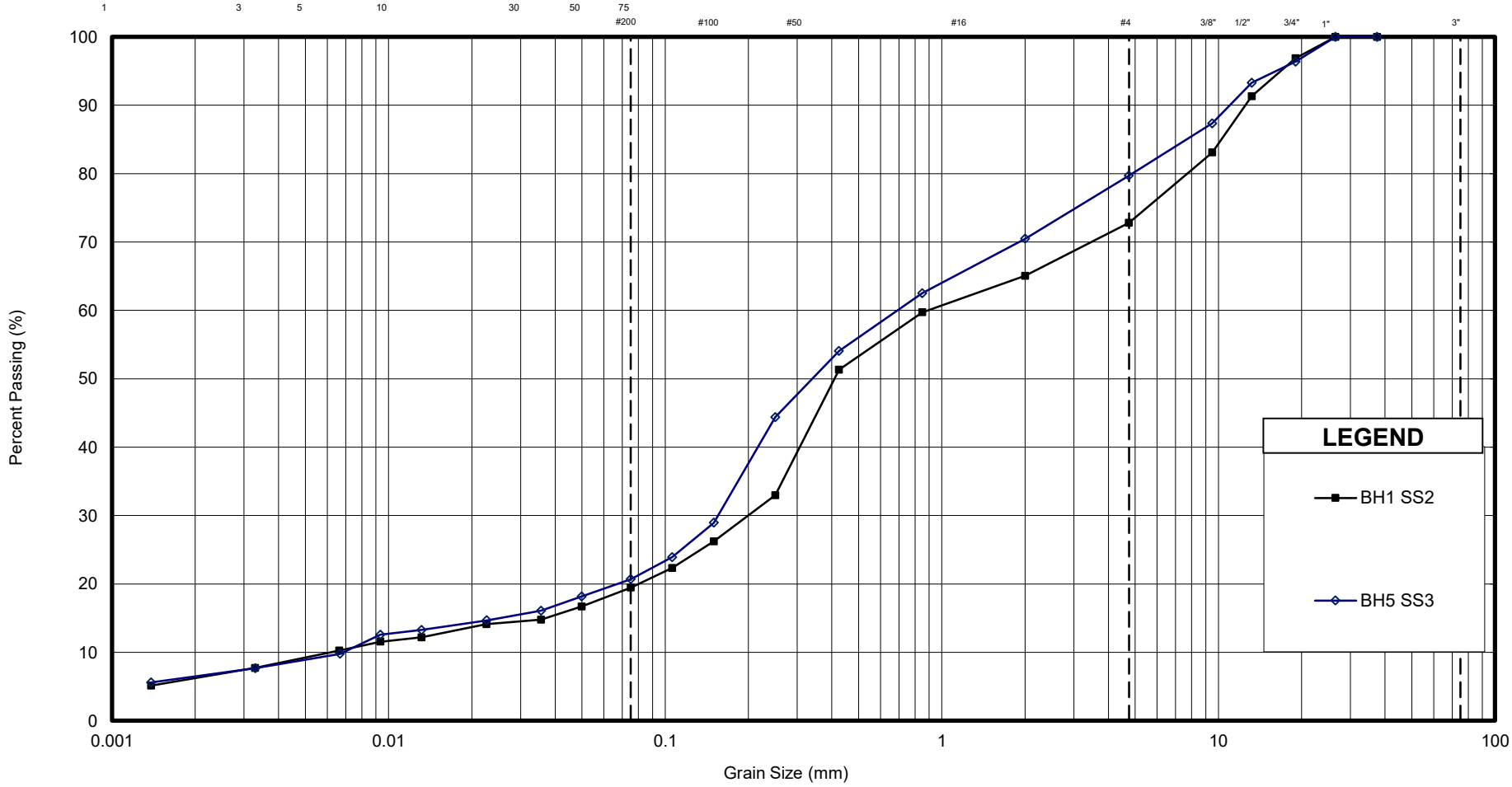
Appendix B Geotechnical Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH1 SS2	GRAVELLY SAND, Some Silt, Trace Clay	27	53	13	7	0.006	0.200	0.889	144.4	7.3
BH5 SS3	GRAVELLY SAND, Some Silt, Trace Clay	20	59	14	7	0.007	0.155	0.692	101.0	5.1

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GRAIN SIZE DISTRIBUTION - Proposed Simcoe County Housing Facility

GRAVELLY SAND

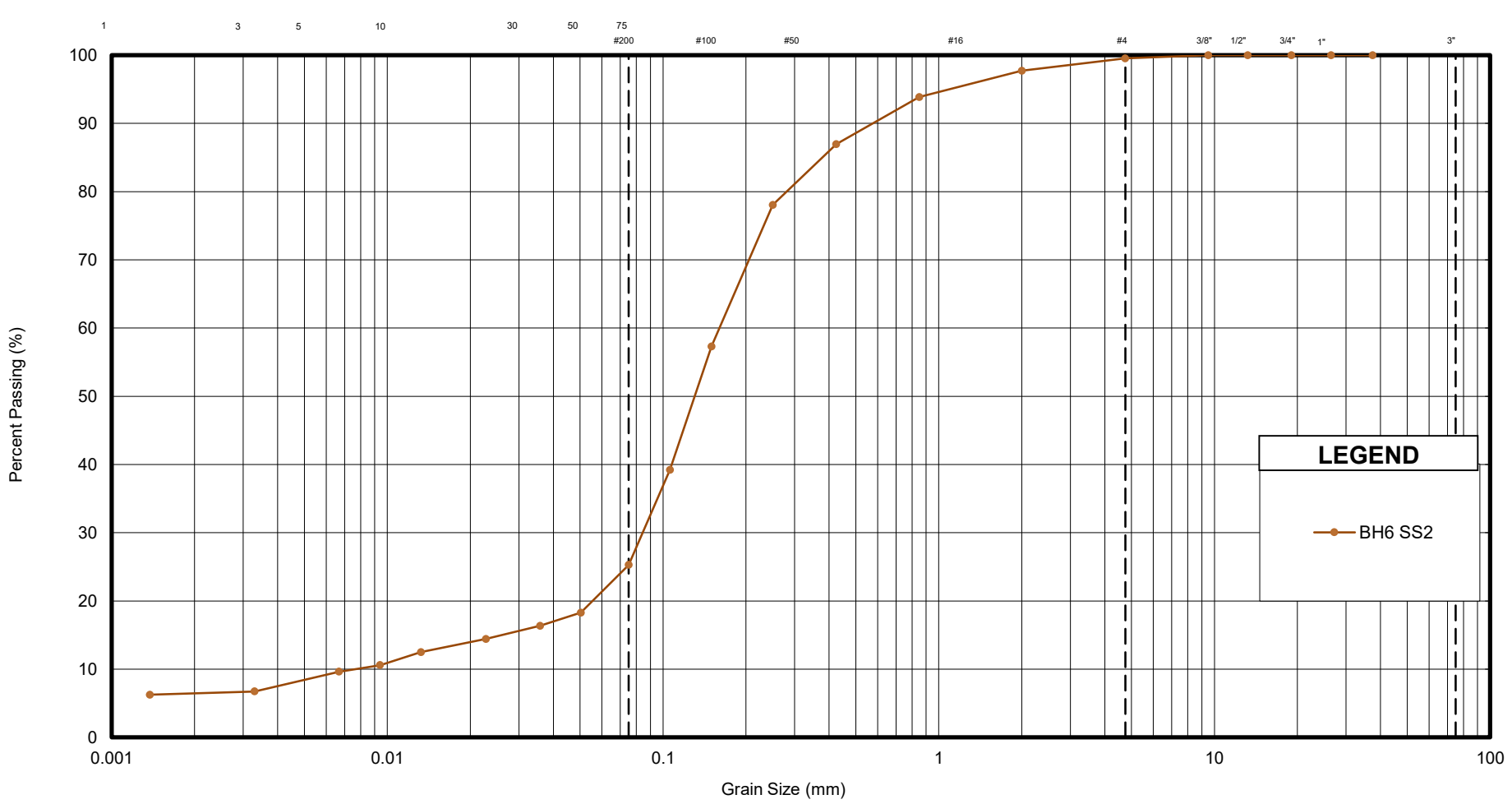
FIGURE No. B1

REF. No. 2502627

DATE June 2025

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH6 SS2	SAND, Some Silt, Trace Clay	-	74	19	7	0.008	0.084	0.160	21.0	5.8

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GRAIN SIZE DISTRIBUTION - Proposed Simcoe County Housing Facility

SAND

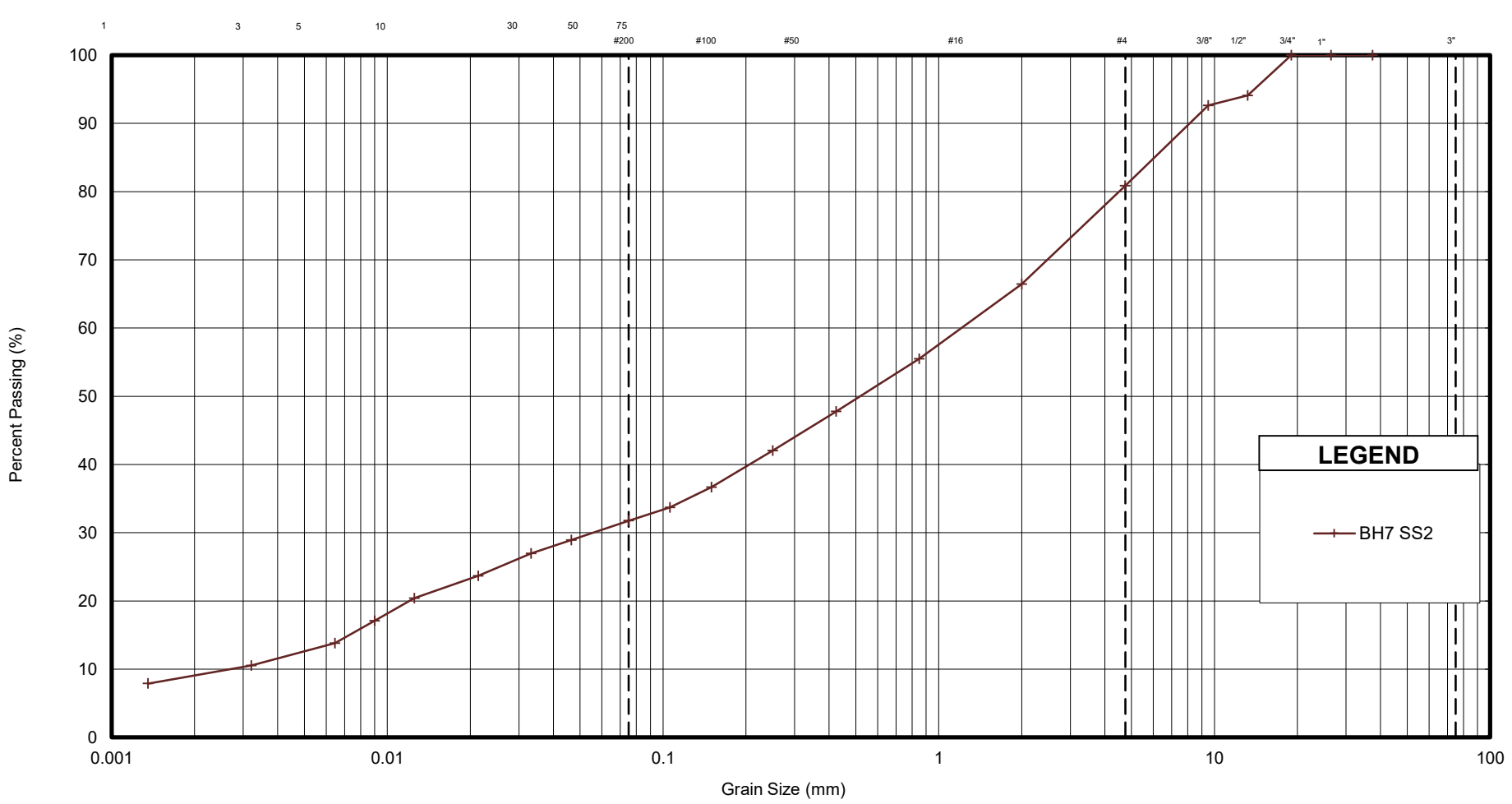
FIGURE No. B2

REF. No. 2502627

DATE June 2025

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH7 SS2	SILTY SAND, Some Gravel, Trace Clay	19	49	23	9	0.003	0.056	1.209	447.1	1.0

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GRAIN SIZE DISTRIBUTION - Proposed Simcoe County Housing Facility

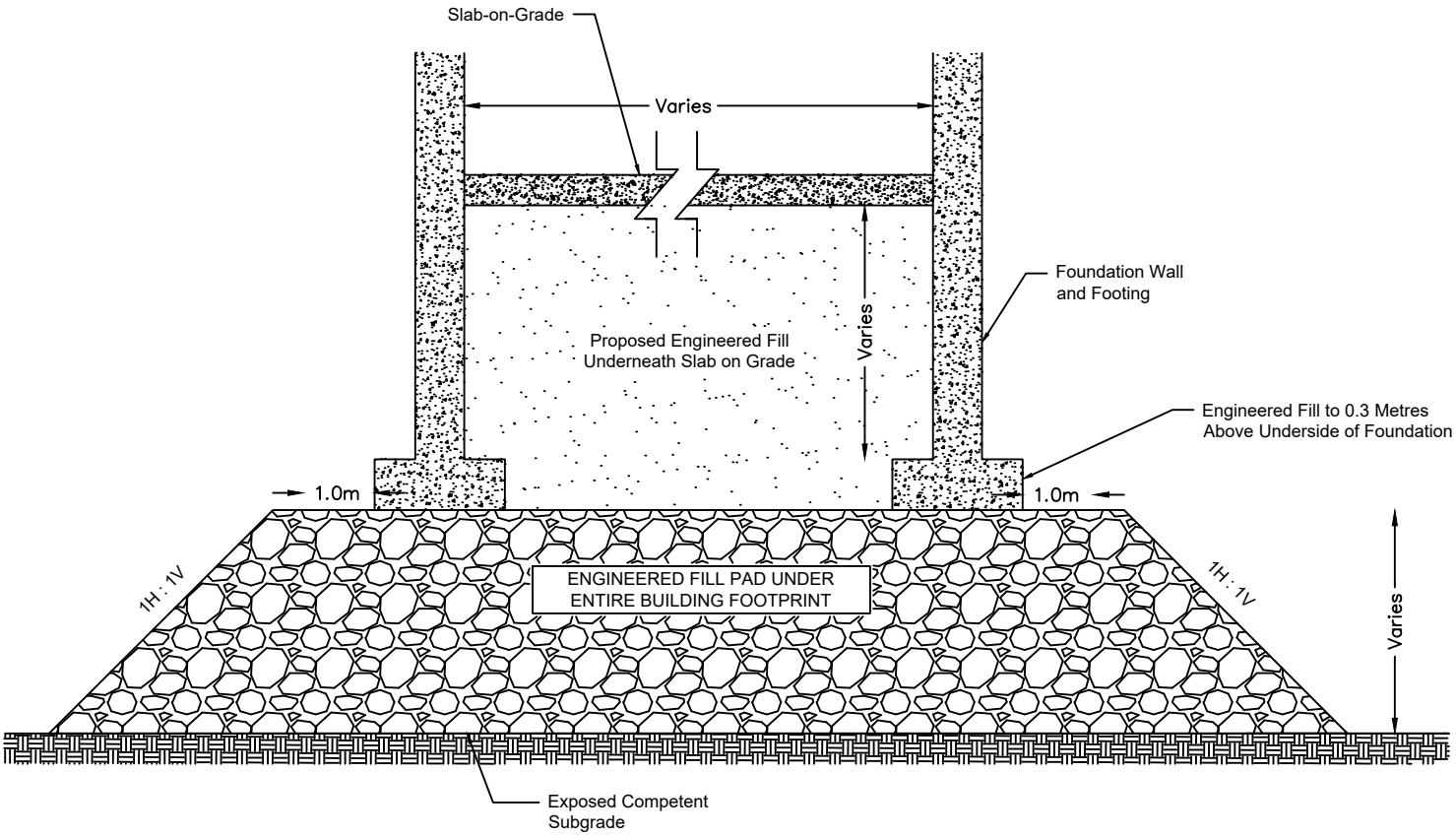
SILTY SAND

FIGURE No.	B3
REF. No.	2502627
DATE	June 2025

Appendix C Typical Details

Notes:

1. Engineered Fill compacted to 100% Standard Proctor Maximum Dry Density (SPMDD) and inspected under the full time supervision of GEI.
2. Engineered fill must be placed in loose lifts of 200 mm or less and then compacted as noted above.
3. Interior engineered compacted to 98% SPMDD with recommended full-time inspection.



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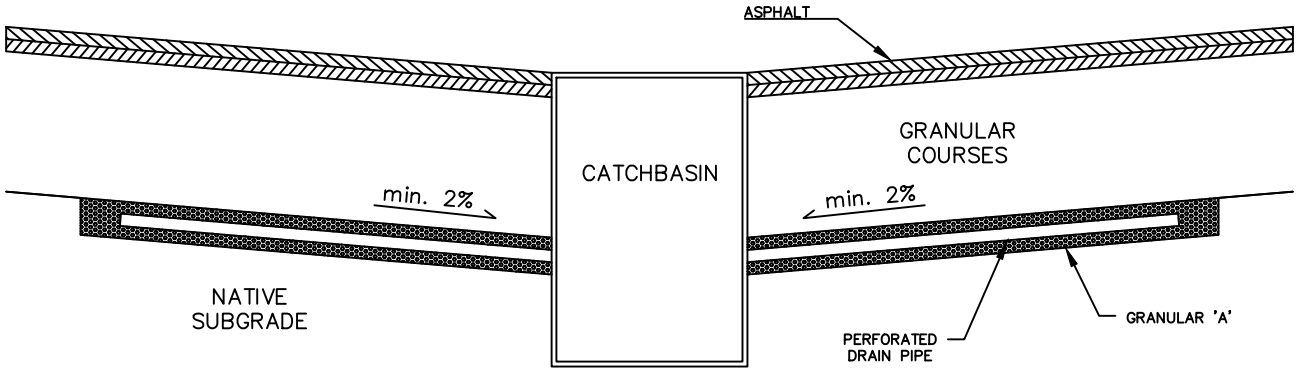
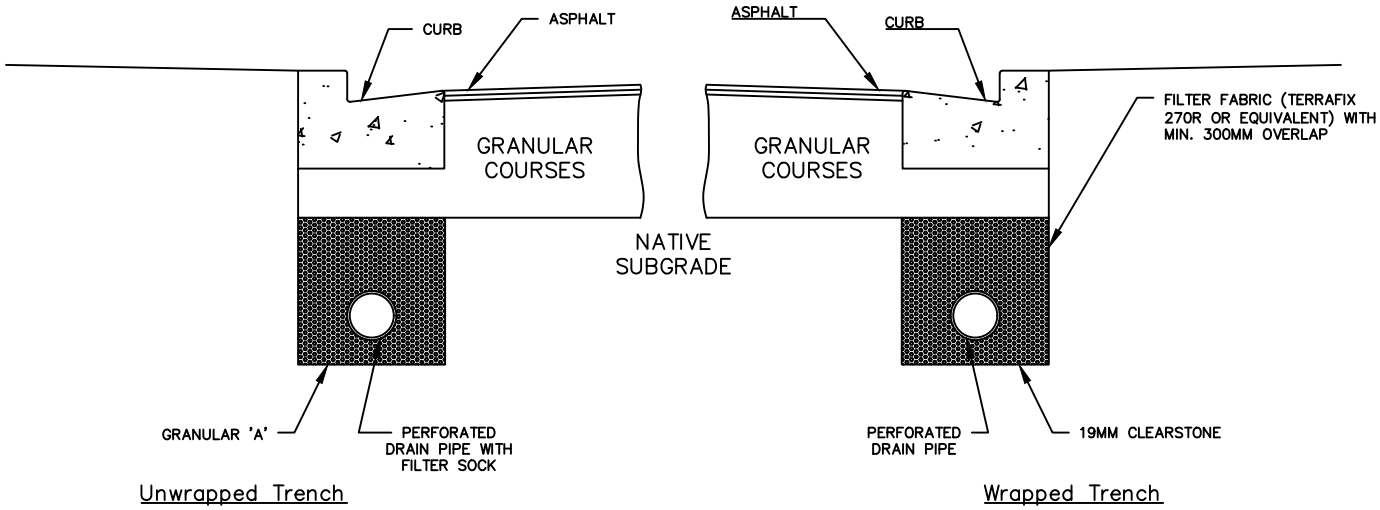
ENGINEERED FILL PAD DIMENSIONING TYPICAL DETAIL

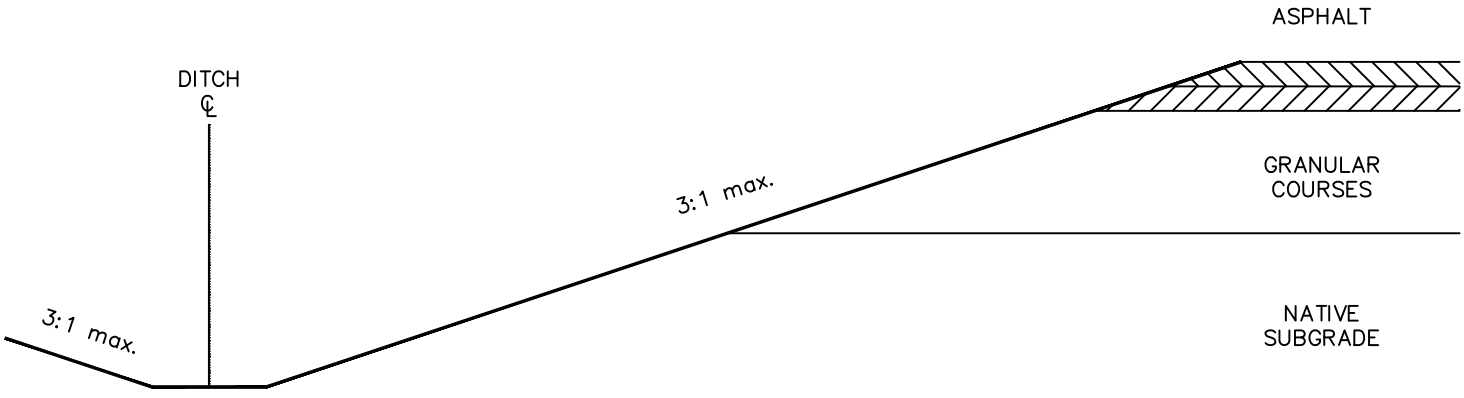




Unwrapped Trench

Wrapped Trench

Urban Cross Sections



Rural Cross Section

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PAVEMENT DRAINAGE ALTERNATIVES TYPICAL DETAILS

Appendix G

Hydrogeological Investigation, GEI,

August 2025

GEI Consultants Canada

Hydrogeological Investigation

Proposed Simcoe County Housing Facility

29 and 45 Birch Street, Collingwood, Ontario

Submitted to:
County of Simcoe
1110 Highway 26
Midhurst, Ontario L9X 1N6

Submitted by:
GEI Consultants Canada Ltd.
647 Welham Road Unit 14
Barrie, ON L4N 0B7
www.geiconsultants.com

August 5, 2025
Project No. 2502627

Joanna Olesiuk, M. A. Sc., C. Tech., P.Geo.
(Limited) Project Geoscientist

Kimberley Pickett, M.Ed., C.E.T, LET
Project Geoscientist

Table of Contents

List of In-Report Tables

Appended Figures

Appendices

Record of Revisions

Identification	Date	Description of Issued and/or Revision
First Submission	August 5, 2025	Hydrogeological Investigation

Acronyms and Abbreviations

%	Percent (per 100 units)
<	Less than …
>	Greater than …
Δ	Change in …
µm	micrometer
ANSI	Area of Natural and Scientific Interest
APEC	Areas of Potential Environmental Concern
BESR	Brownfields Environmental Site Registry
bgs	Below Ground Surface
BH	Borehole
BH/MW	Borehole / Monitoring Well
BMP	Best Management Practice
cm	centimeters
CR	County Road
EASR	Environmental Activity and Sector Registry
EBA	Event Based Area
ECA	Environmental Compliance Approval
Elev.	Elevation
EPA	Environmental Protection Act
ERIS	EcoLog Environmental Risk Information Services Ltd.
ESA	Environmental Site Assessment
ET	Evapotranspiration/Evaporation
FOS	Factor of Safety
FSR	Functional Servicing Report
GEI	GEI Consultants Canada Ltd.
GP	Guelph Permeameter
ha	hectares
hr	hours
HVA	Highly Vulnerable Aquifer
I	Infiltration
ICA	Issue Contributing Area
ID	Identification
iPWQO	Interim PWQO
IPZ	Intake Protection Zone
K	Hydraulic Conductivity
kg	kilogram
km	Kilometres
kPa	Kilopascal
L	Litres
LID	Low Impact Development

m	Metres
m3	Cubic Meters
MECP / MOEE / MOECC / MOE	Ministry of Environment, Conservation and Parks / Ministry of Environment and Energy / Ministry of the Environment and Climate Change / Ministry of the Environment
min	minute
mm	Millimetres
MMAH	Ministry of Municipal Affairs and Housing
MNDM	Ministry of North Development
MNRF	Ministry of Natural Resources and Forestry
MW	Monitoring Well
N values	“N” Values
NRC	Natural Resources Canada
NRCC	National Research Council of Canada
ORMGP	Oak Ridges Moraine Groundwater Program
O.Reg.	Ontario Regulation
OBC	Ontario Building Code
ODWO	Ontario Drinking Water Objectives
ODWS/ ODWQS	Ontario Drinking Water Standards / Ontario Drinking Water Quality Standards
OGS	Ontario Geological Survey
OWES	Ontario Wetland Evaluation System
OWRA	Ontario Water Resources Act
PHC	Petroleum Hydrocarbon
PTTW	Permit to Take Water
PWQO	Provincial Water Quality Objective
QP	“Qualified Person” as defined by O.Reg. 153/04
RL	Reporting Limit
ROI/ROIs	Radius/Radii of Influence
ROW	Right-of-Way
RQD	Rock Quality Designation
RSC	Record of Site Condition
s	Seconds
S	Storage
SCS	Site Condition Standards
SGBLS	South Georgian Bay Lake Simcoe
SGRA	Significant Groundwater Recharge Area
SPT	Standard Penetration Test
SS	Split Spoon
SSEA	Severn Sound Environmental Association
SWM	Stormwater Management
TRCA	Toronto and Region Conservation Authority

TSS	Total Suspended Solids
USCS	Unified Soil Classification System
VOC	Volatile Organic Compound
WHPA	Wellhead Protection Area
WTRS	Water Taking and Reporting System
WWIS	Water Well Information System

It is noted that all elevations in this report are metric/geodetic and expressed in m. All measurements are also in metric and expressed in mm, m, or km.

Executive Summary

GEI was retained by the County of Simcoe, to complete a subsurface investigation and provide a hydrogeological report, in support of the proposed redevelopment of the properties located at 29 and 45 Birch Street, in Collingwood, Ontario. This hydrogeological investigation aimed to assess subsurface geological and groundwater conditions at the site and provide a report with initial recommendations on permitting requirements, and construction dewatering.

E.S.1. Site Description

- Location: 29 and 45 Birch Street, Collingwood, Ontario.
- Geology: Overburden of predominantly gravelly sand, sand and silty sand overlying shallow dolostone/limestone bedrock.

E.S.2. Groundwater Conditions

- Groundwater Levels On Site Reported: May 26, 2025.
    - Groundwater Depths On Site: 1.11 to 1.40 m bgs (Elev. 178.08 to 178.27 masl).
- High Groundwater Levels Possible (based on ORMGP modelling): 0 to 1 m bgs (Elev. 179 to 178).
- Inferred Local Groundwater Flow: Generally north, towards Georgian Bay.
- Regional Groundwater Flow: Generally north, towards Georgian Bay.

E.S.3. Preliminary Construction Dewatering Conditions

- Hypothetical Construction Dewatering Plan
    - Construction of a multi-storey building, assumed to have no basement
    - A mitigated "worst case scenario" approach has been applied to calculations, as limited site-specific groundwater level and site soil hydraulic conductivity data is available.
- Worst Case Predicted Water Taking Rates: As much as 1,032,811 L/day including construction of building and installation of site servicing.
    - Construction during seasonal low groundwater levels (as wells were observed to be dry on June 27, 2025, it is anticipated that dry conditions may occur during summer months) will likely result water taking rates below the volume estimated in this report.
    - Maximum Anticipated Radius of Influence (ROI): Up to 24.5 m.
    - PTTW Application: Not expected to be required.
        - Due to new guidance recently provided by the MECP (ERO number 019-6853, last updated May 27, 2025), water taking for construction purposes only are eligible to be registered on the Environmental Activity and Sector Registry (EASR), even if water taking rates are expected to exceed 400,000 L/day (per previous MECP guidance). If water taking for any

purpose other than or in addition to construction dewatering occurs, a PTTW from the MECP may be necessary.

- EASR Registration: Required during high groundwater conditions.
  - Always required in the event of dewatering over 50,000 L/day.

- Recommended Dewatering Methods:
  - Excavations / Finer Soils: Conventional sump pumping should suffice above the groundwater table.
  - Final Decision: At the discretion of the dewatering contractor based on expertise and site conditions.

E.S.4. Disclaimer

This executive summary provides a high-level overview of the Hydrogeological Investigation's findings and recommendations. It does not encompass all the details and considerations covered in the full report. For comprehensive information and context, it is essential to read the entire report in full.

1. Introduction

GEI was retained by the County of Simcoe (the Client) to complete a subsurface investigation and provide a hydrogeological report, in support of the proposed redevelopment of the properties located at 29 and 45 Birch Street in Collingwood, Ontario. A site location plan is provided in Figure 1.

This hydrogeological investigation aimed to assess the subsurface conditions at the site and to provide a report with initial recommendations on permitting requirements, and construction dewatering.

1.1. Site & Project Description

The combined property is approximately 0.3 ha and is located on the east side of Birch Street, south of First Street. A single-storey residential apartment building and a two-storey apartment building and parking areas are currently present at the site with access from Birch Street. The existing buildings are connected to municipal services. The site is situated in a residential land use setting. An aerial image of the site is provided in Figure 2.

As part of the scope of work, a geotechnical investigation was also carried out by GEI for the project. The results of geotechnical investigation are provided under separate cover.

1.2. Scope of Work

The main objectives of the hydrogeological investigation were to:

a. Establish the local hydrogeological setting of the site.
b. Assess groundwater quality and compare the results to the relevant sewer use bylaw, objectives, and/or other criteria.
c. Carry out preliminary analysis for construction dewatering rates based on the subsurface conditions and assumed site works and discuss the regulatory requirements.
d. Prepare a hydrogeological investigation report.

To achieve the objectives of the investigation, GEI proposed and completed the following scope of work:

a. Conduct a background desktop review of pertinent geological and hydrogeological resources, MECP Water Well Records, previous reports, and proposed site plan drawings.
b. Visit the site and note existing site conditions, site setting, topography, drainage, water features, and potential water wells within 500 m of the site, if any.
c. As part of the concurrent geotechnical investigation, GEI advanced seven (7) BHs across the site and installed two (2) MWs within the selected BHs.
d. Measure groundwater levels in all MWs and perform hydraulic conductivity testing in two (2) selected MWs.
    i. Due to the wells being dry, hydraulic testing could not be completed.

e. Collect and submit one (1) representative unfiltered groundwater samples for laboratory testing to compare against PWQO standards for metals and TSS, subject to sufficient available monitoring well groundwater quantity.

   i. Due to the wells being dry, groundwater sampling could not be completed.

f. Collect and submit one (1) representative filtered groundwater samples for laboratory testing to compare against the PWQO standards for metals and TSS, subject to sufficient available monitoring well groundwater quantity.

   i. Due to the wells being dry, groundwater sampling could not be completed.

g. Assess four (4) composite samples of the underlying subgrade soil for particle size distribution and select soil samples were also submitted for Atterberg Limits (as per Ontario LS standards in reference to ASTM D6913 and D7928).

h. Carry out a dewatering assessment for construction.

i. Prepare a hydrogeological report.

1.3. Applicable Regulations

1.3.1. Source Water Protection

The site is within the jurisdictional boundary of the Nottawasaga Valley Source Protection Authority (NVSPA) which belongs to the South Georgian Bay Lake Simcoe Source Protection. The following document should be used in determination of the regulatory requirements when it comes to maintaining hydrogeological function at this site:

- "Approved Source Protection Plan: South Georgian Bay Lake Simcoe Source Protection Region", as amended, by the LSRCA, NVCA, and SSEA.
  - It is noted that, if the proposed redevelopment at the site includes the construction of a building or buildings on a lot with a cumulative ground floor area equal to or greater than 500 m², and any other impervious surfaces, it will not be considered a "major development".

Based on Source Water Protection and Natural Heritage Areas, the following is noted:

- There are no water bodies identified on site. Within the Study Area is Georgian Bay, located approximately 415 m north of the Site.
- WHPA: The site is not located within a WHPA (Figure 3).
- IPZ: The site is not located within an IPZ, however, portion of the Study Area is located within IPZ-3 (Figure 4).
- HVA: The site is located within an HVA with a vulnerability score of 6 (Figure 5).
  - An HVA is aquifer that is particularly susceptible to contamination because of either its location near the ground's surface or because of the type of materials found in the ground around it.

  - Planning related policies applicable to HVA's with a vulnerability score of 6 or lower may apply to this site.

- SGRA: The site is not located within a SGRA (Figure 6).
- The site is not located within the Oak Ridges Moraine nor Niagara Escarpment planning areas.
- The site is not located in nor within 500 m of an ANSI.

1.3.2. Water Taking / Discharge - Temporary

The volume of water entering the excavation during construction will be based on both groundwater infiltration and precipitation events. Based on requirements of O.Reg. 63/16, the following apply to the dewatering volumes:

- Construction dewatering less than 50,000 L/day: The takings of both groundwater and stormwater does not require a hydrogeological report, does not require registration on the MECP's EASR, and does not require a PTTW from the MECP.
- Construction dewatering greater than 50,000 L/day: The taking of groundwater and/or stormwater requires a hydrogeological report and registration on the EASR but does not require a PTTW from the MECP.
  - Due to new guidance recently provided by the MECP (ERO number 019-6853, last updated May 27, 2025), water taking for construction purposes only are eligible to be registered on the EASR, even if water taking rates are expected to exceed 400,000 L/day (per previous MECP guidance). If water taking for any purpose other than or in addition to construction dewatering occurs, a PTTW from the MECP may be necessary.
- Local Discharge Permit: Typically, all discharges (regardless of discharge rate or total volume) to the local sewer systems are regulated by the local sewer use bylaws. Discharge of water from sources, including construction dewatering water, is typically prohibited without a Discharge Agreement with the municipality or other regulatory body.

2. Background Review & Site Setting

2.1. Available Documents and Information

2.1.1. Oak Ridges Moraine Groundwater Program Website (2018)

As the MWs installed at the site were installed in May of 2025 (as described further in Section 3.1.) and groundwater levels to date have been measured in May and June 2025, therefore, the seasonal high groundwater levels at the site have not been confirmed. As such, reference has been made to the Oak Ridges Moraine Groundwater Program (ORMGP) website to obtain local groundwater information. While the site itself does not lie within the Oak Ridges Moraine (as discussed in Section 1.3.1.), it is within the ORMGP boundary. The ORMGP is a multi-agency, collaborative initiative in south-central Ontario, focused on understanding and managing regional water resources, especially groundwater. Spanning from the Halton and Nottawasaga Watersheds in the west to the Trent River in the east, the program covers a vast area extending north from Lake Ontario to beyond Lake Simcoe and the Kawartha Lakes.

The ORMGP mapping portal models a general water table called WT0:

> *"by contouring the static water levels from all wells where the well screen is less than 20 m deep. It should be noted that the measured static water levels reflect measurements from wells that were drilled in all seasons as well as in wetter and dryer years. So, the water table presented here is an average water table. Given the dynamic nature of the groundwater system, it should be noted that the actual water table at any given time of year may be on the order of up to 2 or 3 metres higher or lower than reflected in the map."*

Additionally, the ORMGP mapping portal can generate a further refined water table model called WT1:

> *"displays the interpreted Water Table surface, constructed using water levels from shallow wells, larger streams and in some areas, intermediate depth wells."*

Reviewing the model results of WT0 and WT1 is useful for approximating the average water table elevation, depth to groundwater, and direction of groundwater flow for sites within the ORMGP boundary. With this in mind, the average water table on site is expected to be generally near Elev. 177 to 178 (or less than 2 m bgs) and flowing generally towards the north.

It is noted that the majority of the site is identified by the ORMGP to be within "Potential Discharge Areas", such that there is:

> *"an indication of [a Potential Discharge Area is] where a groundwater-surface water interface may be possible. This is broadly defined as those areas where an uncorrected Water Table gridded surface (i.e. the Data Driven Water Table, WT0) intersects a Vertical Reference (i.e. a DEM)."*

Further, the ORMGP mapping portal models a deep potentiometric surface called PSO:

> *"shows the interpreted deep potentiometric surface using water levels from wells where the bottom of the screen is greater than 40 m below ground level."*

Reviewing the model results of PSO is useful for approximating the potentiometric surface of deeper wells including an indication of the general vertical direction of groundwater flow for sites within the ORMGP boundary. With this in mind, the deeper potentiometric surface on site is expected to be generally near Elev. 160 to 161, suggesting a general downward vertical gradient across the site.

2.1.2. Geotechnical Investigation (Concurrent) GEI

GEI was retained by the Client to complete a subsurface investigation and geotechnical report for the proposed residential development located at the site.

The purpose of the geotechnical investigation was to assess the subsurface soil conditions at the site, and based on this information, provide geotechnical engineering recommendations in support of the proposed redevelopment of the property. The geotechnical report summarized the BH findings. The BH findings are also provided in Section 4.1. of this hydrogeological report. The geotechnical report provides geotechnical engineering recommendations regarding foundation design, site grading, site servicing bedding and backfill as well as pavement design. Considerations for constructability such as soil excavation, compaction, on-site backfill suitability and temporary groundwater control were also provided.

Excavations at the Site are expected to encounter topsoil and sandy fill, over native gravelly sand, sand and silty sand throughout the site. All overlying shallow bedrock is typically less than 2 m below the existing ground surface.

2.2. Review of MECP Water Well Records

MECP water well records within 500 m of the site area were obtained from the MECP's online interactive well records database and map to assess the general nature of the groundwater resources in the near vicinity of the site, and historical/current uses of wells in the area, as shown in Figure 7 and summarized in Appendix A.

No existing water well records were identified on-site, while 44 records were identified within 500 m of the site. A summary of the available well records in the study area is provided below.

Table 2-1. Summary of MECP Water Well Records within Study Area

Well Use	Number of Records	Year(s) Installed	Water Encountered (Type & Depth)	Well Screen/ Open Hole (Media & Depth)	Closest Well Record to Site (ID & Distance)
Monitoring, Observation, and/or Test Hole	34	2008 to 2022	Unknown	Limestone bedrock	7142313: 155 m northeast of site
Cooling and A/C	1	1951	19.81	Bedrock	430 m east of site
Abandoned	3	1956 to 2011	Unknown	Bedrock	160 m north of site
Other, Not Used, and/or Not Listed	6	2010 to 2022	Unknown	No Information Provided	7189414: 385 m southeast of site
Public and/or Municipal	0	N/A			

Well Use	Number of Records	Year(s) Installed	Water Encountered (Type & Depth)	Well Screen/ Open Hole (Media & Depth)	Closest Well Record to Site (ID & Distance)
Domestic and/or Livestock	0	NA			
Industrial	0	N/A			
Commercial	0	N/A			
Dewatering	0	N/A			

No water supply wells were reported within 500 m of site. If there are any historic water supply wells in the study area, it is anticipated that they are no longer in use, since municipal water is available within the Town boundaries.

The stratigraphic descriptions within the MECP monitoring well records are often inaccurate due to the methodology in which they are determined (observations of cuttings without depositional context and possibly some mixture between layers, plus no consistency between descriptions of soils between drillers). While this may be the case, an overall sense of the regional stratigraphy can be determined by looking at the commonalities between most stratigraphic descriptions and where the wells were terminated in an aquifer. The available well records indicated an overburden of predominantly sand, sand and gravel with cobbles with some occurrence of clay with sand and cobbles over bedrock (reported to be limestone) encountered at 0.61 to 8.53 m bgs.

2.3. Review of MECP Permits to Take Water

Records of PTTW were obtained within 500 m of the site area from the Access Environment and MECP's online interactive PTTW map to assess the general nature of the groundwater resources in the vicinity of the site, and the scale of historical/current groundwater takings required in the area. It should be noted that while these records indicate approved daily water taking volumes, they do not provide details on target depths for the water takings nor do they provide the actual volumes extracted, which could be less.

There are two (2) PTTW records in the 500 m radius from the site. The PTTWs are reported as expired, or revoked and replaced, and the actual PTTW document is not available to be downloaded and reviewed from the MECP website.

2.4. Site Physiographic and Geological Setting

The site is located within the physiographic region denoted as the Simcoe Lowlands physiographic region and the local terrain is characterized predominantly by Bevelled Till Plains (Chapman, L.J. and Putnam, D.F., 2007). The predominant surficial geology of the site is described as stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain (OGS, 2010).

The bedrock underlying the general site area is the limestone, dolostone, shale, arkose and sandstone of the Ottawa Group, Simcoe Group and the Shadow Lake Formation (OGS, 2007).

Based on the bedrock topography modelled by the ORMGP and the MECP Water Well Records (as discussed in Section 2.2.) in the area, bedrock may be expected to be encountered at approximately Elev. 176 to 177 (modelled based on data from the MNDM and ORMGP) with Quaternary period sediment thicknesses anticipated to be 1 to 2 m thick (modelled based on data from the OGS and ORMGP).

2.5. Visual Inspection of the Site

Visual site inspections were conducted by GEI staff on May 26 and June 27, 2025, to evaluate site drainage, topography, surface water features, ground cover, and existing structures.

At the time of the inspections, the site was under residential use. The site's topography appeared to be generally flat with an overall slope towards the nearby surface water feature, the Georgian Bay, (i.e. to the north).

During a site inspection residential dwellings were present on site. There were no private or monitoring wells observed on the site.

Given the site's topography, surface runoff is expected to flow predominantly towards the Georgian Bay, that is located approximately 415 m north of the site. No other surface water features or groundwater discharge points (e.g., seeps) were observed on or near the property at the time of the site visit. Surface runoff is anticipated to follow topography and drain into municipal catch basins. There were no signs of recent ponding water on the site nor areas with phreatophytic vegetation, such as cattails and bull rushes, which could indicate either groundwater at the surface or low permeability soils.

3. Procedures and Methodology

3.1. Borehole Drilling & Monitoring Well Installation

As referenced in Section 2.1.2., a drilling program associated with the concurrent geotechnical investigation at the site was carried out on May 14, 2025.

- Six (6) boreholes (identified as BH1 to BH7) were drilled to depths of 0.7 to 1.7 m depth below existing grade (Elev. 177.7 to 178.6 m).
- Two (2) monitoring wells were installed (MW5 and MW6).
    - Both of these BHs were instrumented with 0.9 m long screened MWs installed 1.5 m bgs (Elev. 177.9 to 178.0). The MWs were screened across the fill material – native soil boundary to promote a sufficient quantity of groundwater entering through the screened materials. This is further discussed in Sections 4.2. to 4.3. MW details are illustrated in the BH logs (Appendix B) and listed in Appendix C.

BH logs are provided in Appendix B, and the borehole locations are shown on Figure 2. The BH locations were laid out in the field by GEI staff prior to commencement of drilling operations. The locations of underground utilities were coordinated with locating companies. Ground surface elevations of the BHs and coordinates (referencing NAD 83 geodetic datum) were surveyed by GEI with a Topcon FC – 5000 GPS Survey unit. The elevations are provided on the BH logs in Appendix B. BH and MW locations are shown on Figure 2.

Drilling and sampling of the BHs was completed using track mounted drilling equipment operated by a specialty drilling subcontractor retained and supervised by GEI. The BHs were advanced to predetermined depths using solid stem augers and sampling was conducted using a 51 mm O.D. SS sampler. SPT N values were recorded for the sampled intervals as the number of blows required to drive an SS sampler 305 mm into the soil using a 63.5 kg drop hammer falling 750 mm, in accordance with ASTM D1586. Soil sampling was conducted at 0.75 m intervals for the shallow boreholes.

The GEI field staff examined, and classified characteristics of the soils encountered in the BHs, including the presence of fill materials, groundwater observations during and upon completion of the drilling, recorded observations of BH advancement, and processed the recovered soil samples. All recovered soil samples were logged in the field, carefully packaged, and transported to the laboratory for more detailed examination and classification.

In the laboratory, the samples were classified as to their visual and textural characteristics. All samples were submitted for moisture content determination. Four (4) samples of the underlying strata were submitted for particle size distribution and are provided in Appendix D.

3.2. Hydraulic Conductivity Testing and Groundwater Sampling

Hydraulic conductivity tests could not be conducted due to the wells being dry when GEI staff returned to the site after drilling. Similarly, groundwater samples could also not be collected, as the wells experienced dry conditions after drilling.

4. Subsurface Conditions

4.1. Stratigraphy

The detailed soil profiles encountered in the BHs are indicated on the BH logs enclosed in Appendix B, and the geotechnical laboratory results are included in Appendix D. The BH locations are shown on Figure 2 and the subsurface profiles (conceptual geological cross sections) interpreted from those logs are included as Figures 9 and 10.

It should be noted that the conditions indicated on the BH logs are for specific locations only and can vary between and beyond the locations. Additionally, the soil boundaries indicated on the BH logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change.

In addition, the descriptions provided in the BH logs are inferred from a variety of factors, including visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.). The passage of time also may result in changes in conditions interpreted to exist at locations where sampling was conducted.

4.1.1. Topsoil

A topsoil layer was at the ground surface in all boreholes. The topsoil ranged in thickness from 50 to 305 mm. Topsoil thickness may vary between boreholes and in other areas of the site.

4.1.2. Fill

A fill layer was encountered beneath the topsoil in all boreholes and was penetrated at 0.8 m depth (Elev. 178.6. to 178.7) in Boreholes 1, 2, 5, 6 and 7. In Boreholes 3 and 4 the fill was revealed to the 0.7 and 0.9 m depth of the boreholes (Elev. 178.6 to 178.5), respectively. The fill material consisted of silty sand, sand or sand and gravel. Trace to some organics were observed in some samples. The fill was moist, with moisture contents of 8 to 23%. The fill had N values ranging from 4 to over 29 blows, showing loose to compact soil, but typically loose.

4.1.3. Gravelly Sand

Underlying the fill layer in Boreholes 1 and 5, a gravelly sand layer with some silt and trace clay was encountered to 1.7 m depth (Elev. 177.7 to 177.8). Two (2) samples of the material were submitted for grain size analysis and the results are provided in Figure B1 in Appendix D. The gravelly sand was wet with moisture contents of 11 to 16%. The gravelly sand layer had N values over 100, indicating very dense conditions.

4.1.4. Sand

Below the fill layer in Borehole 6, a local sand layer with some silt and trace clay was encountered to the 1.5 m depth of the borehole (Elev. 178.0). One (1) sample of the material was submitted for grain size

analysis and the results are provided in Figure B2 in Appendix D. The sand was moist to wet with a moisture content of 18%. The N value was 49 indicating dense conditions.

4.1.5. Silty Sand

Beneath the fill in Boreholes 2 and 7, a silty sand unit was encountered to the 0.9 m depth of the boreholes (Elev. 178.5). One (1) sample of the material was submitted for grain size analysis and the results are provided in Figure B3 in Appendix D. The silty sand was moist, with moisture contents of 7 to 10%. The material was very dense with N values more than 100.

4.1.6. Auger Refusal

Auger refusal on inferred shallow limestone bedrock common to the Collingwood area was encountered in all boreholes. The depths to auger refusal are summarized below:

Table 4-1. Auger Refusal Depths

Borehole	Depth of Auger Refusal (m) / Elev.
1	1.7/177.8
2	0.9/178.5
3	0.7/178.6
4	0.9/178.5
5	1.7/177.7
6	1.5/178.0
7	0.9/178.5

It is noted that to confirm auger refusal, the augers are left to grind on the obstruction for a short period, in the event that a small boulder or cobble is in the borehole path that can be penetrated. As a result, the augers may penetrate slightly into the potentially upper weathered bedrock surface to some degree and the depths noted above may be slightly below the actual bedrock surface. A series of test pits is recommended to confirm the bedrock level when the development concept has been established.

4.2. Groundwater Conditions

Unstabilized groundwater level measurements and cave measurements were taken upon the completion of drilling of each borehole, as shown on the borehole logs in Appendix A. These measurements were taken to provide a rough estimate of the possible excavation and temporary groundwater control constructability considerations that may arise. Two (2) boreholes were outfitted with a monitoring well with 50 mm diameter pipe and 0.9 m long screen. Monitoring well configuration and groundwater observations are noted on the borehole logs in Appendix A and summarized in the table below.

Table 4-2. Groundwater Levels

Borehole	Depth of Cave (m) / Elev.	Unstabilized Groundwater Level Depth (m) / Elev.	Depth (m) / Elev. of Groundwater Table, May 26, 2025
BH1	Open	0.9 / 178.6	N/A
BH2	Open	0.9 / 178.5	N/A
BH3	Open	No Water	N/A
BH4	Open	No Water	N/A
BH5	Open	1.0 / 178.4	1.1 / 178.3
BH6	Open	0.9 /178.6	1.4 / 178.1
BH7	Open	No Water	N/A

Based on the observations above, the groundwater table at the site appears to be 1.1 to 1.4 m below ground surface (Elev. 178.1 to 178.3 m).

GEI is currently conducting a one (1) year groundwater level monitoring program, and the results will be provided separately upon completion. Is it noted that the wells were dry, when GEI staff returned to site after drilling, on June 27, 2025.

The soils at the site are “sandy” and are permeable and will allow for the free flow of water. Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

4.3. Hydrostratigraphy

Based on the available well records (Section 2.2.), the site physiographic and geological setting (Section 2.4.), site stratigraphy (Section 4.1), the current stabilized groundwater levels (Section 4.2.), and other subsurface conditions, at the time of the subsurface investigation, the soils encountered on site to a maximum depth of 1.5 to 1.7 m/Elev. 177.7 to 178.0 m (as described in Section 4.1.3 and 4.1.4) are assumed to comprise a groundwater table reaching into the gravelly sand and sand deposits, a moist layer of dense to very dense cohesive soils, overlying a fractured bedrock aquifer (Section 4.1.6.).

4.4. Groundwater Chemistry

4.4.1. Dewatering Discharge

As indicated in Section 3.2, groundwater samples could not be collected, as the wells experienced dry conditions when GEI staff returned to the site to complete groundwater sampling on June 27, 2025.

If pumped groundwater will be released to the ground surface and/or local sewer systems, it must be suitably treated to remove sediment prior to discharge (treatment methods to be determined by the dewatering contractor or civil engineer).

During construction dewatering, the pumped water is to be first discharged to a sedimentation tank and/or a silt/sediment bag, at a minimum, before being discharged to the surface or a local sewer. However additional treatment methods may be required to further reduce the sediment and potential

contaminants within the dewatering discharge. It is recommended that a groundwater sample be collected during the spring season when the groundwater levels are expected to be higher.

5. Site Dewatering

5.1. Preliminary Construction Dewatering

This section of the report presents hydrogeological assumptions, assessments and recommendations regarding construction dewatering associated with the following excavations:

- The construction of one (1) multi-unit dwelling, with no basement due to the shallow bedrock in the area. Based on preliminary concept plan provided at the proposal stage (Committee of the Whole CCW 2025-068), the building footprint is estimated at 47 m long and 20 m wide.
    - The building will be constructed as a slab-on-grade, with footings estimated at approximately 1.2 m below proposed grades.
- The construction of site services, with maximum depth of excavation assumed at 1.5 m and the dimensions of the servicing trench taken as 50 m long and 3 m wide.

The recommendations are based on our understanding of the project and the results of the field investigation. The interpretation and recommendations are intended for the use of the design consultant and Client and shall not be relied upon by any other parties, including the construction contractor or used for any purposes other than development of the project design.

Comments on construction methodology and equipment, where presented, are provided only to highlight those aspects that could affect the design of the project. Contractors must make their own assessment of the factual information presented in previous sections of the report, and the implications on equipment selection, construction methodology, and scheduling.

It should be noted that these calculations have been prepared using hypothetical scenarios for discussion and preliminary planning purposes. Should the detailed design become available, updated drawings will need to be provided and GEI will need to update the calculations to confirm that any recommendations presented here remain valid.

The following calculations for the excavations are based on the assumed groundwater conditions for temporary dewatering rates anticipated to occur during construction. As previously discussed in Sections 2.1.1. and 4.2., the annual high groundwater levels of the site have not been confirmed, and as such the following analysis assumes that the future construction will occur in conditions such that the groundwater table is within 2 m of the ground surface (less than 2 m bgs) based on ORMGP modelling, which may be assumed to be at the site as a long-term high groundwater level (as long-term groundwater level measurements for the site are not available). It is noted that this is a conservative estimate of the high groundwater level, and the effects are later discussed in Section 5.1.4.

5.1.1. Permit Recommendations

The current recommendations are based on our understanding of the project and the results of the field investigation. The interpretation and recommendations are intended for the use of the design consultant and Client and shall not be relied upon by any other parties including the construction contractor or used for any purposes other than development of the project design.

5.1.2. Construction Description & Dewatering Assumptions

Due to the shallow depth of bedrock, the proposed building will be a slab-on-grade (no basement).

For the purposes of this report and conservative construction dewatering rate calculations, excavations for the construction of the building are assumed to extend to a depth of 1.2 m bgs through the fill (Section 4.1.2) and into the gravelly sand (Section 4.1.3) and sand (Section 4.1.4) to allow for the construction of foundation of the building. For the construction of site services, the maximum depth of excavation is assumed at 1.5 m and the dimensions of the servicing trench are taken as 50 m long and 2 m wide.

The dewatering assessment in the following sections assumes that any surface water is diverted around the excavations and open-cut excavations or permeable shoring during construction. However, it is understood that if sheet pile shoring is utilized during construction dewatering rates may be further reduced from the estimates provided in this report.

A mitigated "worst case scenario" approach has been applied to these preliminary dewatering calculations, due to the limited groundwater level data collected to date which does not reflect the seasonal high levels. This approach assesses the reasonable potential impact and suggests methods to consider during construction dewatering.

Table 5-1. Construction Dewatering Zones

Dewatering Zones	Purpose
Excavations for Building Construction	Linear excavation for the construction of the building (47 m long by 20 m wide by 1.2 m deep)
Excavations for Service Construction	Linear excavation for the construction of the services (assumed 50 m long by 2 m wide by 1.5 m deep)

Note. Excavation dimensions for the building taken from the building footprint dimensions as presented on the Preliminary Site Plan (Committee of the Whole CCW 2025-068).

GEI's understanding of the proposed work, the excavation, dewatering, and site condition assumptions are summarized below, and explanations are provided in the tables below.

Table 5-2. Summary of Assumed Excavation Geometry

Dewatering Zones	Hypothetical Excavation Dimension				Target Groundwater Depth / Elev.[4] (m)
	Length[1] (m)	Width[1] (m)	Assumed Ground Surface (Elev.)	Depth[4] (m) / Elev.	
Excavations for Building Construction	47	20	179.38[2]	1.2 / 178.18	1.7 / 177.68
			179.48[3]	1.2 / 178.28	1.7 / 178.78
Excavations for Service Construction	50	2	179.38[5]	1.5 / 177.88	2.0 / 177.38

Notes:
1. Estimated from preliminary concept plan provided by the Client.

2. Grade at BH5.
3. Grade at BH6.
4. For functionality and stability during construction, groundwater would ideally be 0.5 m below the excavation bottom.
5. Grade at BH2 and BH7

Table 5-3. Summary of Assumed Groundwater Conditions

Dewatering Zones	Assume Ground Surface[1] (Elev.)	Assumed Groundwater[2] Depth / Elev. (m)	Target Groundwater Depth / Elev.[1] (m)	Assumed Aquifer Bottom[3] (Elev.)	Construction Dewatering Expected?[4]
Excavations for Building Construction	179.38	1.1/ 178.28	1.7 / 177.68	174.7	Yes
	179.48	1.4 / 178.08	1.7 / 177.78		
Excavations for Service Construction	179.38	1.1/ 178.30	2.0 / 177.38	174.7	Yes

Notes:
1. Per Table 5-2.
2. Measured groundwater depth at borehole 5 and 6.
3. 3.0 m below lowest excavation.
4. Is the Local Groundwater Depth higher than the Local Target Groundwater Depth for at least a portion of the excavation.

Based on the conditions above, the following points/assumptions were noted:

- A bulk hydraulic conductivity of the materials on site was assumed to be 1×10^{-4} m/s based on a theoretical hydraulic conductivity value for well sorted sand (Fetter, 2001).
- As the annual high groundwater level at the site has not been determined, the depth of groundwater across the site to be encountered during construction was taken as the highest groundwater elevation measured at the site to date, i.e., 1.1 mbgs (178.3 m) at BH5.

As a part of the hypothetical scenario approach, excavations across the site are planned to extend to 1.2 m below the assumed high groundwater table. Therefore, where dewatering is necessary, groundwater drawdowns of 1.7 m are assumed during construction, within the overburden (to bring groundwater level to 0.5 m below the base of the excavation). It has been assumed that construction will take place during the drier times of the year due to the practicality of construction activities taking place in the summer and the load restrictions that are in place during freshet. It is noted that the measured groundwater levels were taken in May 2025 and are considered to represent a conservative worst case scenario as it is expected that the summer months would have lower groundwater levels. In addition, the wells did not have enough water to carry out groundwater sampling or hydraulic conductivity testing as they were considered to be dry.

5.1.3. Radius/Radii of Influence

The ROI for the construction dewatering is based on the empirical Sichardt Equation. This equation is used to predict the distance at which the drawdown resulting from pumping becomes negligible. This equation is simplistic and is based on steady state conditions, as well as homogeneous hydrogeological conditions (i.e., uniform infinite aquifer). As such, steady state dewatering may not be achieved during the relatively short-term construction dewatering work, plus homogeneous hydrogeological conditions are not typically encountered outside of a laboratory, so the ROI presented here may be an overestimation of the actual ROI encountered. The Sichardt equation is described as follows and the results are summarized in the table below (and presented in Appendix G).

$$R_0 = C(H - h)\sqrt{K}$$

Where:

R_0 = ROI (m)
C = Sichardt's Constant (trench flow: 1750 $s^{0.5}/m^{0.5}$ and radial flow: 3000 $s^{0.5}/m^{0.5}$)
H = Static Saturated Head (m)
h = Dynamic Saturated Head (m)
K = Hydraulic Conductivity (m/s)

Based on the Sichardt equation, the assumed, theoretical hydraulic conductivity of 1.0 x 10^{-4} m/s and the total groundwater drawdowns required at this site, the ROIs can be assumed to be up to 24.5 m from the edge of the excavations. Calculation details are provided in Appendix G, and zone-specific ROIs are summarized below.

Table 5-4. Summary of Dewatering Drawdown Conditions for ROI

Dewatering Zones	Static Saturated Head	Dynamic Saturated Head	Hydraulic Conductivity	ROI
	Above Aquifer Bottom			
	H (m)	h (m)	K (m/s)	R_0 (m)
Excavations for Building Construction	3.2	2.6	1.0 x 10^{-4}	10.5
Excavations for Service Construction	3.4	2.5	1.0 x 10^{-4}	15.8

The ROI calculation is a conservative methodology and is calculated based on the assumption of active (steady state) pumping during the construction dewatering. It should be noted that a higher volume of water will be pumped during the first stage of the construction period or when a rain event occurs. It is uncertain whether dewatering efforts would reach steady state prior to the completion of construction of each dewatered segment.

5.1.4. Temporary Dewatering Flow Rates

The Dupuit-Forcheimer method for radial flow from an unconfined aquifer for a fully penetrating excavation was used to calculate steady-state flow rate estimates for non-linear excavations and is expressed as follows:

$$Q = \frac{\pi K(H^2 - h^2)}{In\, {}^{R_0}/_{r_s}}$$

Where:

- Q = Rate of pumping (m^3/s)
- 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_a = Radius of influence from the center of the excavation R_0+r_s (m)
- r_s = Equivalent well radius (m, radius of a circle with an area equal to the excavation footprint)

A combination of groundwater flux and Dupuit-Forcheimer equation was used to calculate steady-state flow rates for linear excavations (culvert replacements) from both sides of a trench and at both ends of the trench through an unconfined aquifer resting on a horizontal impervious surface. This equation was used to obtain a flow rate estimate while dewatering is expressed as follows for an unconfined aquifer:

$$Q = 2\left(\frac{xK(H^2 - h^2)}{2L}\right) + \left(\frac{\pi K(H^2 - h^2)}{\ln {}^{R_a}/_{r_s}}\right)$$

Where:

- Q = Rate of pumping (m^3/s)
- K = Hydraulic conductivity (m/s)
- H = Head beyond influence of pumping (static groundwater elevation) (m)
- h = Head above base of aquifer at excavation (m)
- R_0 = Radius of influence (m)
- r_s = Distance to wellpoints from the centre (assumed half of trench width)
- R_a = Radius of influence from the centre of the excavation (R_0+r_s)
- x = Length of excavation (m)
- L = Length of excavation (m)

It is expected that the initial dewatering rates will be higher in order to remove groundwater from within the overburden formation. The dewatering rates are expected to decrease once the target water levels are achieved in the excavation footprints as groundwater will have been removed locally from storage resulting in lower seepage rates into the excavations.

Please note that the anticipated dewatering rate may increase if larger excavations are undertaken beyond the assumptions detailed in the preceding section. The calculated dewatering rates below are based on the current assumptions; however, larger excavations would likely elevate the overall dewatering requirements beyond these calculations.

Based on the assumptions provided in this report, the results of the dewatering rate estimates are summarized below, and calculation details are provided in Appendix G.

Table 5-5. Summary of Construction Dewatering Flow Rate Calculations

Dewatering Zones	Construction Dewatering Flow Rate	
	As Calculated including FOS[1]	Combined and including Rainfall Event[2,3]
	L/day	
Excavations for Building Construction	394,130 (per 47 m in length and 20 m in width)	434,550
Excavations for Service Construction	376,180 (per 50 m in length and 2 m in width)	380,480
Total (if all excavations are completed concurrently)	770,310	815,030

Notes:

1. A FOS of 2.0 is included to account for seasonal fluctuations in the groundwater table, initial removal of groundwater from storage and variation in hydrogeological properties beyond those encountered during this study.
2. A 43 mm rainfall event was included in the water-taking calculation to account for the maximum projected single-day precipitation in the local area in the immediate future (2021 to 2050) under high carbon emissions (RCP8.5), according to the Climate Atlas of Canada. The Climate Atlas uses data from the Pacific Climate Impacts Consortium, which provides downscaled projections of daily temperature and precipitation from 24 climate models using two carbon emission scenarios.
3. It is noted that under specific conditions, if the water taking is 100% storm water registration on the EASR may not be required, however if water taking consists of any mixture of storm water and groundwater, a typical registry registration or permitting is likely required.

5.1.5. Permit Recommendations

Given that the conservatively estimated combined preliminary temporary water taking rates for construction dewatering on site are calculated to exceed 50,000 L/day, a registration on the EASR is anticipated for dewatering works on site, if conducted in a high groundwater condition on site (within the spring freshet). It is noted that due to recent amendments to O. Reg. 63/16, a Permit to Take Water is no longer required for water taking above 400,000 L/day, however, an EASR registration is required for water takings above 50,000 L/day.

An EASR registration may not be required during lower groundwater conditions on site, however it is prudent to pre-register construction dewatering at the site under an EASR to prevent construction delays.

Dewatering more than 50,000 L/day shall not take place until the proposed water taking is registered with the MECP.

It is the responsibility of the contractor to ensure dry conditions are maintained within the excavations at all times. Based on the calculated water taking rate, it is expected that sump pumping and/or keg wells will be required to achieve the recommended drawdowns during earthworks for the building and/or site servicing. However, the dewatering contractor is responsible for selecting the dewatering method based on their preferred means and methods after reviewing the information provided in this report. Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events.

The maximum flow calculation is intended to provide a conservative estimate to account for unforeseeable conditions that may arise during construction under worst conditions (i.e., groundwater at

surface during the spring freshet). It should be noted that the dewatering estimates provided in this report are based on assumptions and details available at the time of this report. If changes to the design are implemented (e.g., increase to planned excavation depths, widening of excavations, increased length of trenching, basement level etc.), the dewatering estimates must be revised to include and reflect future changes and to ensure that any conclusions or recommendations made by GEI remain valid.

5.1.6. Remedial Dewatering Activities

The dewatering contractor will be responsible for finalizing and implementing the discharge plan, including information such as the exact discharge location, erosion control methods, method of conveyance, treatment systems, temperature of the discharged groundwater, etc. It is the contractor's responsibility to implement a treatment system to ensure that discharged groundwater meets the applicable standards. This may be done by examining the hydrogeologic conditions in a test pit (and/or a full-range pumping test by the dewatering subcontractor).

Treatment and disposal of the dewatering discharge should follow BMPs, including sediment and erosion control measures, removal of suspended solids by a decanting tank and/or filter bag, as well as water quality and quantity control monitoring programs, as mentioned earlier. The contractor should be aware that the purpose of the dewatering system is to maintain stable excavation slopes and dry working conditions during excavation.

The extent and details of the dewatering scheme (trench or well dimensions, spacing, pump levels, screen size and wick gradation, etc.) are left solely to the contractor's discretion to achieve the performance objectives for maintaining stable slopes and dry working conditions and will be based on their own interpretation and analysis of site conditions, equipment, experience, and efficiency. The contractor should also appreciate that additional dewatering means and modifications may be required as variations in site conditions are encountered. The recommended groundwater taking, and discharge plans are provided in Appendices H and I, respectively.

5.1.7. Impact Assessment for Groundwater Dewatering

The impact assessment for taking groundwater during construction is provided in the Groundwater Taking Plan in Appendix H and includes a review of settlement, impacts to nearby groundwater users or to surface water / environmental features.

6. Limitations

The recommendations and comments provided are necessarily on-going as new information of underground conditions becomes available. More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the BH information must, therefore, be validated during excavation operations. Consequently, conditions not observed during this investigation may become apparent. Should this occur, GEI should be contacted to assess the situation and additional testing and reporting may be required.

GEI should be retained for a general review of the final design drawings and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, GEI will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of the design engineers. The number of BHs required to determine the localized underground conditions between BHs affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual BH results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

This report was authorized by and prepared by GEI for County of Simcoe (as provided in the signed Standard Professional Services Agreement). Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GEI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

7. Closure

We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact our office.

Yours truly,

GEI Consultants Canada Ltd.

Prepared By:

PROFESSIONAL GEOSCIENTIST
LIMITED MEMBER
JOANNA OLESIUK
3222
ONTARIO

August 5, 2025

Joanna Olesiuk

_____
Joanna Olesiuk, M.A.Sc., C. Tech., P.Geo. (Limited)
Project Geoscientist

Reviewed By:

Professional Engineers
Ontario
Licensed Engineering Technologist
Name: K. L. PICKETT
Number: 100501338
Limitations: Environmental investigations of soil, groundwater, air and sediment products including Record of Site Conditions, soil management plans and completion of Phase I and Phase II Environmental Site Assessments, excluding design, construction and verification of site remediation.
Association of Professional Engineers of Ontario

_____
Kimberley Pickett, M.Ed., C.E.T, LET, QP$_{ESA}$
Project Geoscientist

Appendix H - Section H.2. Impact Assessment - Land Stability and Settlement only

LICENSED PROFESSIONAL ENGINEER
G.R. WHITE
Aug. 5, 25
PROVINCE OF ONTARIO

_____
Geoffery R. White, P.Eng.
Barrie Office Branch Manager and
Senior Geotechnical Engineer

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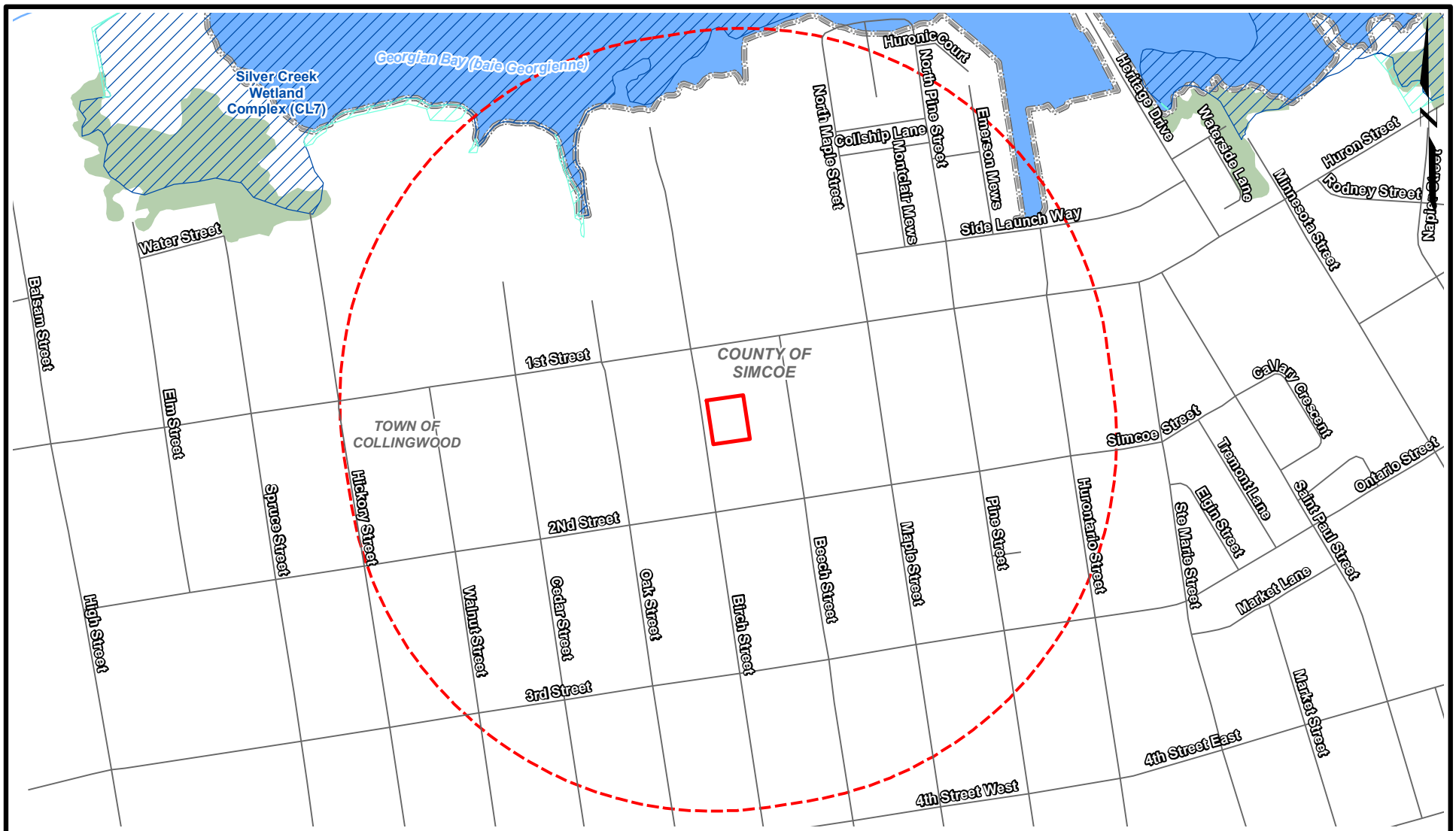
Figures



Reference(s):
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Metres

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Proposed Simcoe County Housing Facility
29 & 45 Birch St, Collingwood, ON

County of Simcoe

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SITE LOCATION PLAN

Project 2502627 | Aug. 2025 | Fig. 1

\\bos-pzcc-1\Data_Storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025-07_HydroG\2502627_rpt_fig01_Site_Location.mxd

Site Location
Road
Approximate Borehole Location
Approximate Borehole/Monitoring Well Location
Cross Section

Reference(s):
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BOREHOLE LOCATION PLAN (AERIAL)

Project 2502627 | Aug. 2025 | Fig. 2

\\bos-pzcc-1\Data_Storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025-07_HydroG\2502627_rpt_fig02_bh_location_plan_aerial.mxd

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WELLHEAD PROTECTION AREAS

Project 2502627 | Aug. 2025 | Fig. 3

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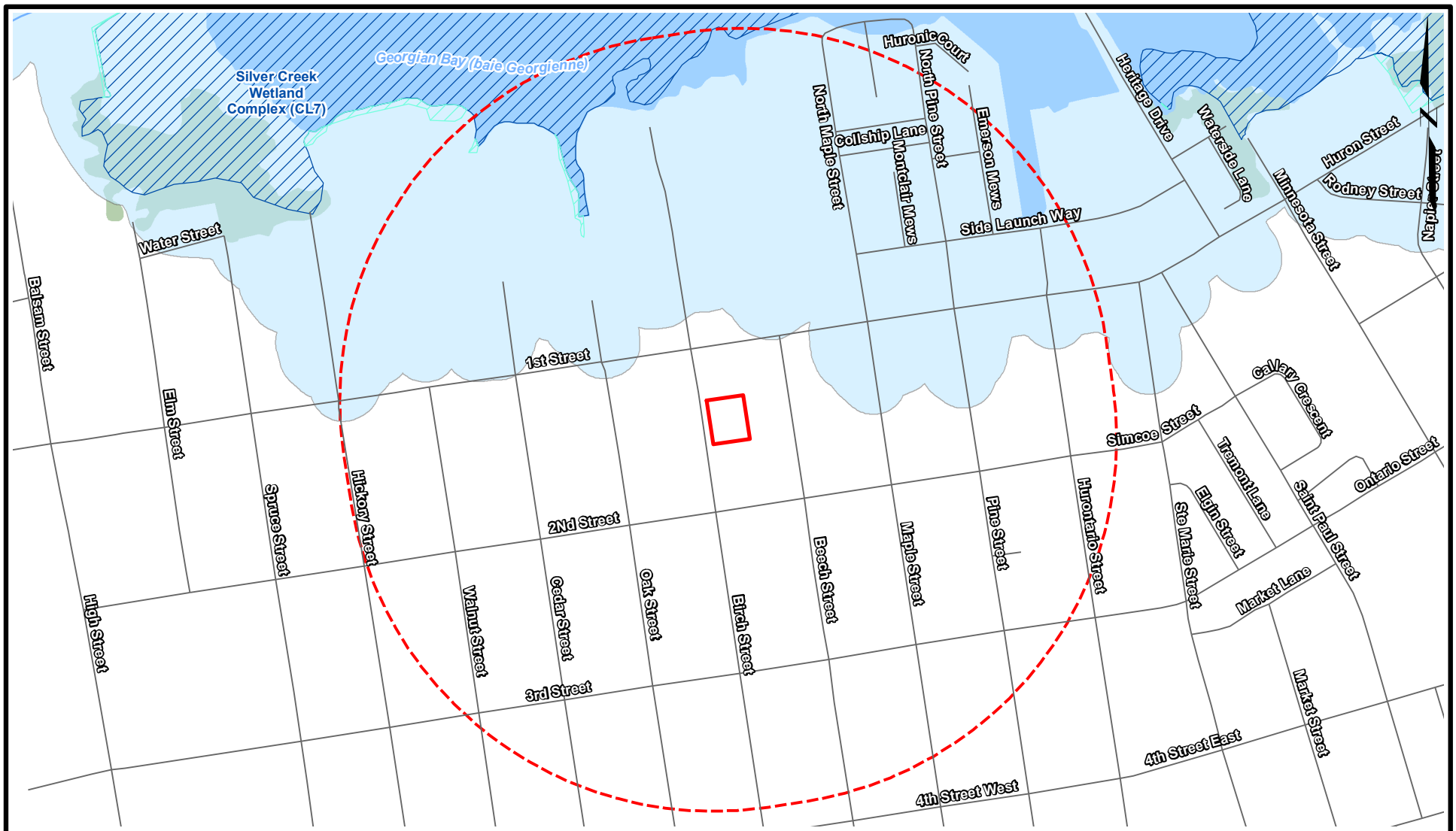

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INTAKE PROTECTION ZONES

Project 2502627 | Aug. 2025 | Fig. 4

\\bos-pzcc-1\Data_Storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025-07_HydroG\2502627_rpt_fig04_IPZ.mxd

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Hydrogeological Investigation Proposed Simcoe County Housing Facility 29 & 45 Birch St, Collingwood, ON	GEI Consultants Canada	HIGLY VULNERABLE AQUIFERS
County of Simcoe	Project 2502627	Aug. 2025 Fig. 5

\\bos-pzcc-1\Data_Storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025-07_HydroG\2502627_rpt_fig05_HVA.mxd

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SIGNIFICANT GROUNDWATER RECHARGE AREAS

Aug. 2025

Fig. 6

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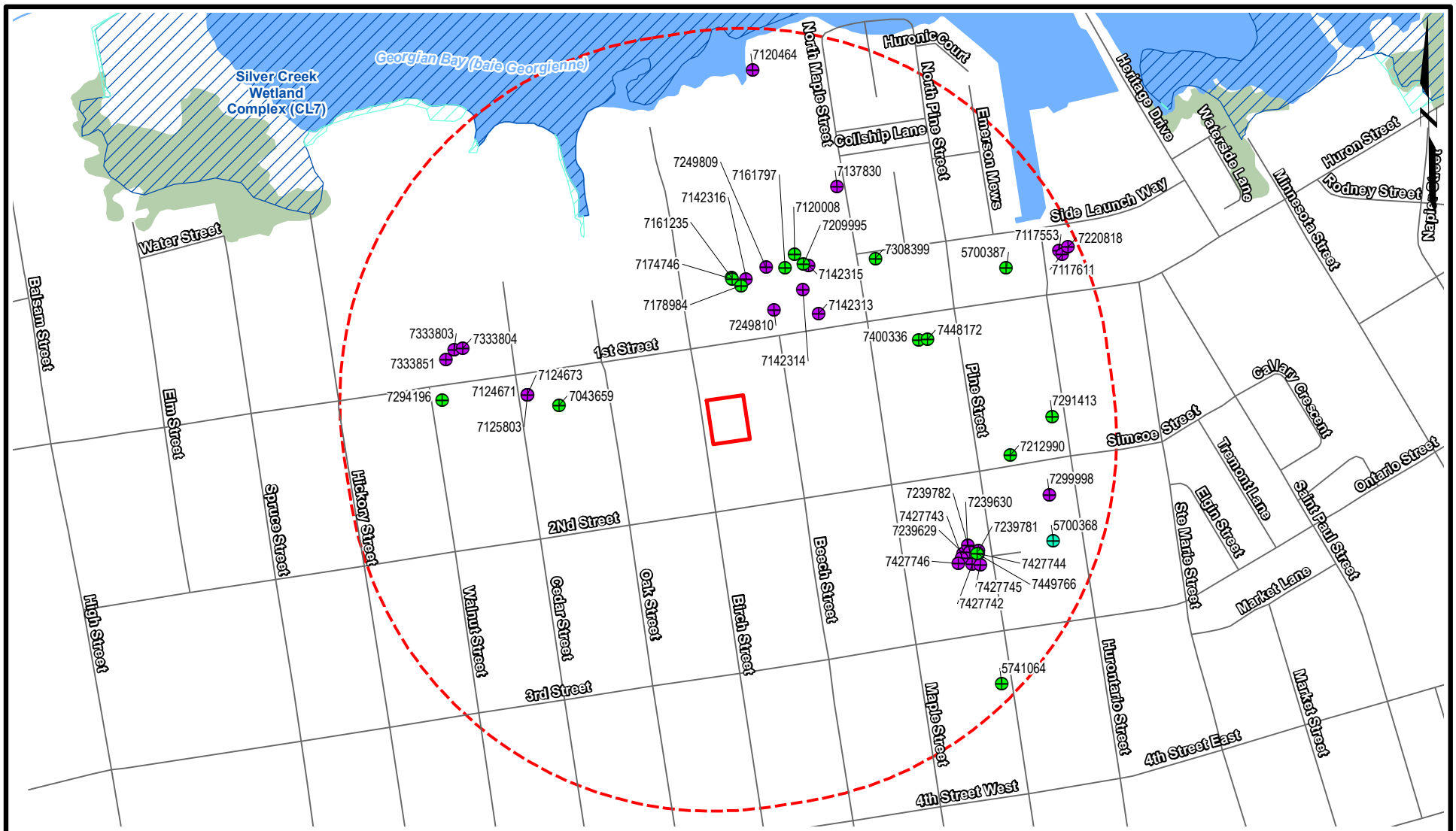

Site Location
Study Area
Road
Watercourse
Waterbody
Wooded Area
Provincially Significant Wetland
Wetland - Not evaluated per OWES

Well Record Uses

- Cooling And A/C
- Monitoring and Test Hole
- Well Record Location (Use Not Listed or Well Not Used)

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Metres

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MECP WATER WELL RECORDS

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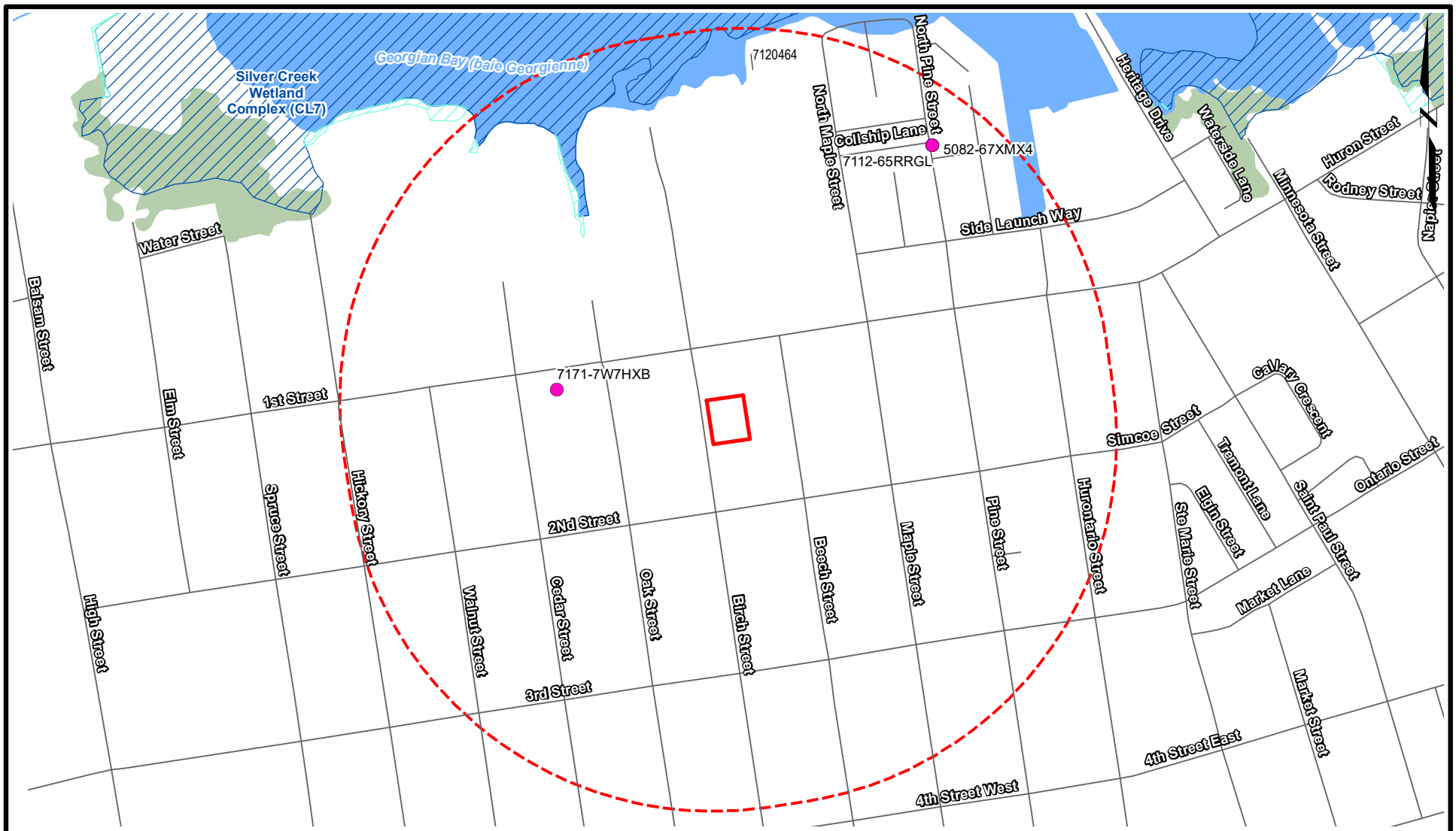

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Metres

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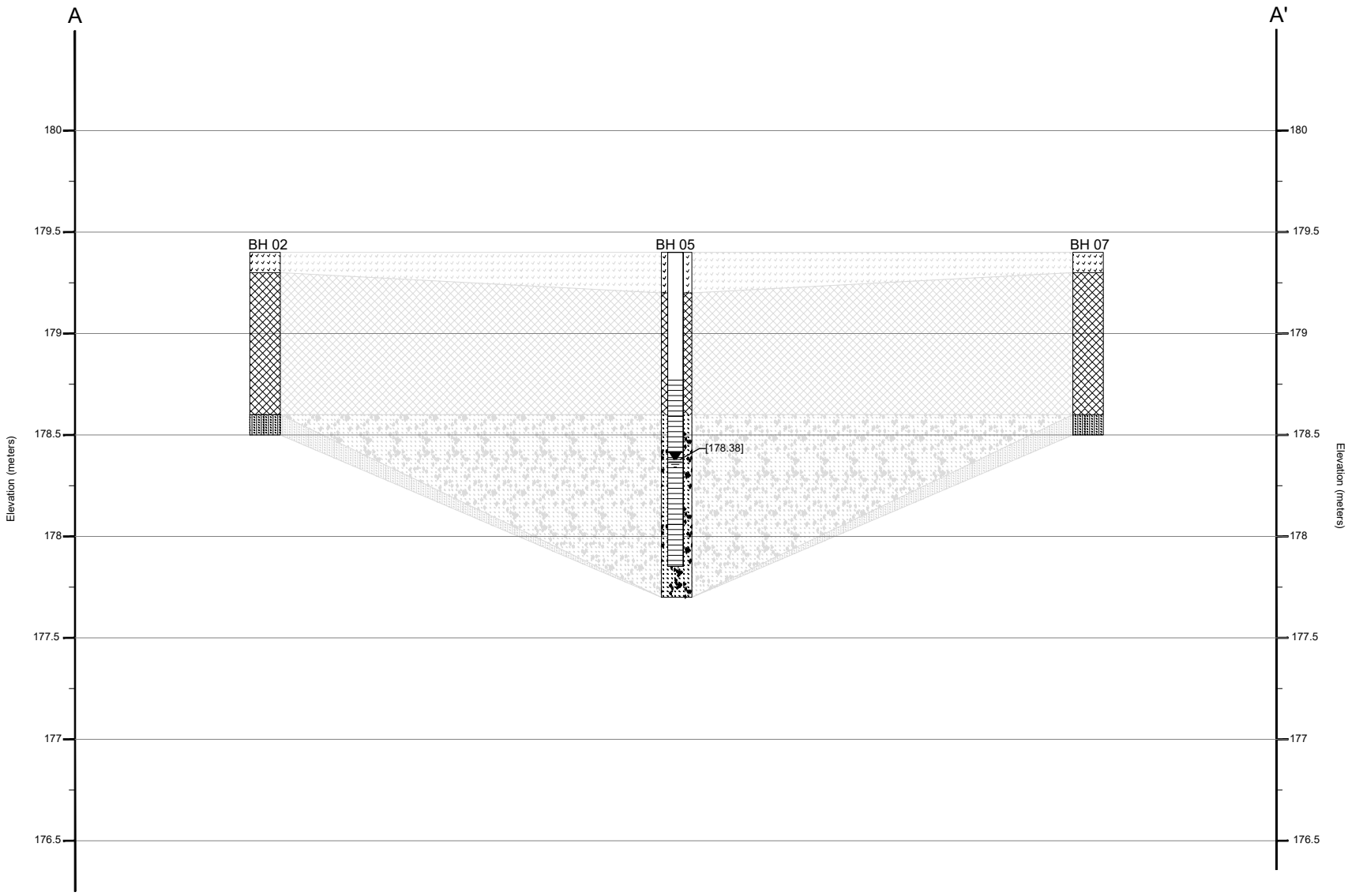
MECP PERMITS TO TAKE WATER

Project 2502627 | Aug. 2025 | Fig. 8

\\bos-pzcc-1\Data_Storage\Working\SIMCOE, COUNTY OF\2502627 Proposed Simcoe County Housing Facility 29 & 45 Birch St Collingwood ON\05_GIS\MXD\2025-07_HydroG\2502627_rpt_fig08_MECP_PTTW.mxd



LEGEND:

- Topsoil
- Fill
- Gravelly Sand
- Silty Sand
- Water Level in Monitoring Well
  [xx.xx] Water Levels (masl). Measured May 26, 2025

NOTES:

HORIZONTAL SCALE

N.T.S.

VERTICAL SCALE

0 0.25 0.50

METERS

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29 & 45 Birch Street, Collingwood, Ontario

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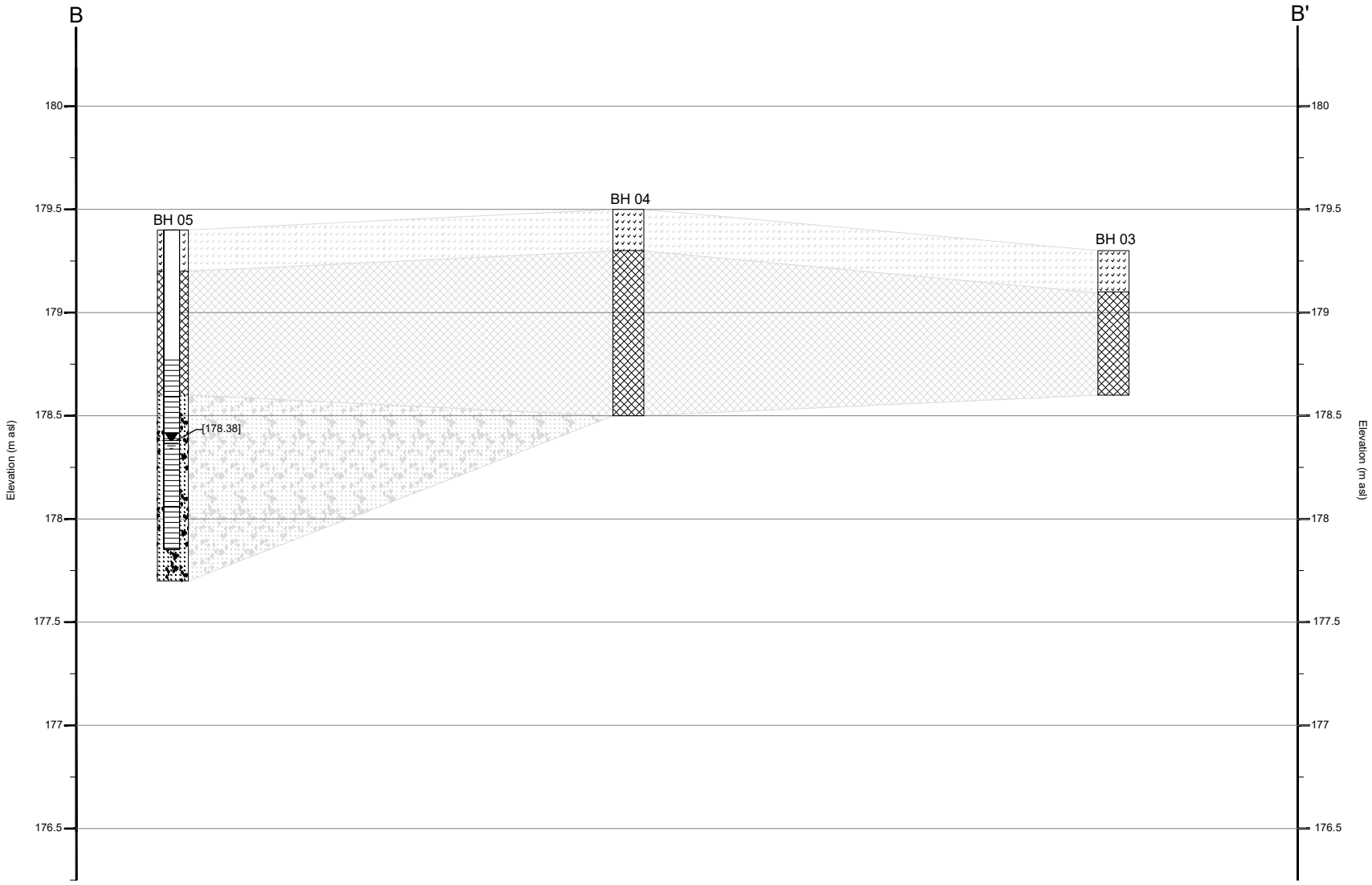
GEOLOGICAL CROSS SECTION A-A'

Aug. 2025 **Fig. 9**



LEGEND:

- Topsoil
- Fill
- Gravelly Sand
- Water Level in Monitoring Well
- [xx.xx] Water Levels (masl). Measured May 26, 2025

NOTES:

HORIZONTAL SCALE

N.T.S.

VERTICAL SCALE

0 0.25 0.50 METERS

Hydrogeological Investigation
Proposed Simcoe County Housing Facility
29 & 45 Birch Street, Collingwood, Ontario

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GEOLOGICAL CROSS SECTION B-B'

Aug. 2025 **Fig. 10**

Appendix A MECP Water Well Records

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Well ID	Date Completed	Well Depth (m)	Well Use	UTM Easting	UTM Northing	Lot	Concession
7333803	2019-02-26	4.6	Monitoring and Test Hole	561404	4927950		
7333804	2019-02-26	4.0	Monitoring and Test Hole	561416	4927952		
7333851	2019-02-26	4.6	Monitoring and Test Hole	561393	4927936		
7427742	2022-08-08	3.0	Monitoring	562110	4927657	043	09
7427743	2022-08-08	3.0	Monitoring	562096	4927666	043	09
7427744	2022-08-08	4.3	Monitoring	562118	4927672	043	09
7427745	2022-08-08	3.0	Monitoring	562121	4927656	043	09
7427746	2022-08-08	3.0	Monitoring	562091	4927658	043	09
7117553	2008-11-18	3.7	Monitoring and Test Hole	562228	4928085		
7117611	2008-11-18	3.7	Monitoring and Test Hole	562233	4928080		
7120464	2009-02-23	11.0	Test Hole	561811	4928331	044	09
7124671	2009-05-28	7.6	Monitoring	561504	4927888		
7124673	2009-04-09	3.7	Monitoring	561504	4927888		
7137830	2009-12-18	8.1	Monitoring	561926	4928172		
7142313	2010-03-11	6.1	Monitoring and Test Hole	561901	4927999		
7142314	2010-03-11	6.1	Monitoring and Test Hole	561879	4928031		
7142315	2010-03-11	4.6	Monitoring and Test Hole	561887	4928065		
7142316	2010-03-11	6.7	Monitoring and Test Hole	561802	4928046		
7220818	2013-05-16	4.6	Monitoring	562241	4928090		
7239629	2015-02-18	2.7	Monitoring	562098	4927672		
7239630	2015-02-18	2.7	Monitoring	562104	4927683		
7239781	2015-02-18	2.7	Monitoring	562119	4927676		
7239782	2015-02-10	2.7	Monitoring	562107	4927674		
7249809	2015-01-15	20.7	Monitoring	561829	4928062		
7249810	2015-01-16	20.7	Monitoring	561840	4928004		
7299998	2017-10-16	7.6	Test Hole	562215	4927752		
7043659	2007-04-11	2.1	Monitoring	561547	4927874		
7400336	2021-08-03	0.0	Monitoring	562037	4927963		
7308399	2018-01-23	0.0	Monitoring	561978	4928074		
7294196		0.0	Monitoring	561388	4927881		
5741064	2006-08-21	2.8	Monitoring	562150	4927494		
7291413	2017-07-18	0.0	Monitoring	562219	4927859		
7161235	2010-10-12	0.0	Monitoring	561782	4928048		
7125803	2009-06-22	0.0	Monitoring	561504	4927888		
5700368	1951-08-24	21.3	Cooling And A/C	562220	4927689		
5700387	1956-06-29	9.8	Abandoned, gassy formation hit	562156	4928061		
7174746	2011-08-08	0.0	Abandoned	561783	4928046		
7178984	2011-06-09	0.0	Abandoned	561795	4928037		
7161797	2010-12-16	0.0	Unknown	561855	4928061		
7209995	2013-05-15	0.0	Unknown	561880	4928066		
7212990	2013-09-11	0.0	Unknown	562162	4927806		
7448172	2021-08-06	0.0	Unknown	562049	4927964		
7449766	2022-11-25	0.0	Unknown	562117	4927672		
7120008	2008-04-14	6.1	Not Used	561868	4928080		

Appendix B Borehole Logs

RECORD OF BOREHOLE No. 01

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927879.40** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561790.171** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); Penetration Testing: SPT, DCPT	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.5													
	TOPSOIL: 205 mm					0	179.5							
	0.2 179.3													
	FILL: Sand, trace organics, trace gravel, compact, brown, moist	SS	1	10	29	0.5	179	29	16					
	0.8 178.7													
	GRAVELLY SAND: Some silt, trace clay, very dense, brown, moist	SS	2	20	100+	1	178.5	100+	16		27	53	13	7
	1.7 177.8					1.5	178							
	Borehole Terminated at 1.7 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: 0.9 m. Cave depth after auger removal: Open
Groundwater depth observed on: Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 02

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927866.15** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561754.812** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING			COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); 40 80 120 160; Penetration Testing: SPT, DCPT; 10 20 30 40	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits PL LL; Water Content (%); 10 20 30 40	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.4														
	TOPSOIL: 130 mm 0.1 179.3					0									
	FILL: Sand, trace organics, trace silt, trace gravel, compact, brown, moist	SS	1	15	10		179	10	8						
	0.8 178.6					0.5									
	SILTY SAND: Trace gravel, very dense, brown, moist 0.9 178.5	SS	2	5	100+		178.5	100+	10						
	Borehole Terminated at 0.9 m Upon Auger Refusal														

Groundwater depth encountered on completion of drilling: 0.9 m. Cave depth after auger removal: Open
Groundwater depth observed on: Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 03

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927848.56** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561796.117** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); 40 80 120 160; Penetration Testing: SPT, DCPT; 10 20 30 40	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits PL LL; Water Content (%); 10 20 30 40	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	0.0 179.3										
	TOPSOIL: 255 mm					0					
	0.2 179.1										
	FILL: Silty sand, trace gravel, loose, brown, moist	SS	1	50	7		179	7	23		
	0.7 178.6					0.5					
	Borehole Terminated at 0.7 m Upon Auger Refusal										

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

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Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 04

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927849.13** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561775.963** Date Completed: **May 14/25**

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LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa); Penetration Testing (SPT, DCPT)	Combustible Organic Vapour - Hex; Combustible Organic Vapour - IBL; Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	0.0 179.5										
	TOPSOIL: 205 mm					0					
	0.2 179.3										
	FILL: Sand and gravel, trace organics, loose, brown, moist	SS	1	40	8	0.5	179	8	15		
	0.9 178.5										
	Borehole Terminated at 0.9 m Upon Auger Refusal										

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

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Scale: **1 :25**
Page: **1 of 1**

RECORD OF BOREHOLE No. 05

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927845.50** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561757.344** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); Penetration Testing: SPT, DCPT	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.4													
	TOPSOIL: 205 mm					0								
	0.2 179.2						179							
	FILL: Silty sand, some gravel, trace organics, compact, brown, moist	SS	1	40	12	0.5		12	9					
	0.8 178.6						178.5							
	GRAVELLY SAND: Some silt, trace clay, very dense, brown, moist	SS	2	45	100+	1		100+	11					
							178							
	1.7 177.7	SS	3	45	100+	1.5		100+	11		20	59	14	7
	Borehole Terminated at 1.7 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: 1.0 m. Cave depth after auger removal: Open

Groundwater depth observed on: 2025/05/26 at depth of: 1.11 m. Groundwater Elevation: 178.3 m

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Scale: **1 :25**

RECORD OF BOREHOLE No. 06

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927827.14** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561775.660** Date Completed: **May 14/25**

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LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa); Penetration Testing (SPT, DCPT)	Combustible Organic Vapour - Hex; Combustible Organic Vapour - IBL; Total Organic Vapour (ppm); Atterberg Limits; Water Content (%)	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.5													
	TOPSOIL: 305 mm					0								
	0.3 179.2													
	FILL: Sand, some organics, loose, brown, moist	SS	1	100	8	0.5	179	8	19					
	0.8 178.7													
	SAND: Some silt, trace clay, dense, brown, moist	SS	2	65	49	1	178.5	49	18		0	74	19	7
	1.5 178.0					1.5	178							
	Borehole Terminated at 1.5 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: 0.9 m. Cave depth after auger removal: Open

Groundwater depth observed on: 2025/05/26 at depth of: 1.4 m. Groundwater Elevation: 178.1 m

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Scale: **1 :25**

RECORD OF BOREHOLE No. 07

Project Number: **2502627**
Project Client: **County of Simcoe**
Project Name: **Birch Street Simcoe Housing Project**
Project Location: **29 Birch St, Collingwood, ON**
Drilling Location: **See Borehole Location Plan**
Local Benchmark:

Drilling Method: **Solid Stem Augers** Drilling Machine: **Rubber Tire**
Logged By: **AG** Northing: **4927825.70** Date Started: **May 14/25**
Reviewed By: **MH** Easting: **561760.184** Date Completed: **May 14/25**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); 40 80 120 160; Penetration Testing: SPT, DCPT; 10 20 30 40	Combustible Organic Vapour - Hex, Combustible Organic Vapour - IBL, Total Organic Vapour (ppm); 100 200 300 400; Atterberg Limits PL LL; Water Content (%); 10 20 30 40	Instrumentation Installation	GR	SA	SI	CL
	0.0 179.4													
	0.0 TOPSOIL: 50 mm 179.3					0								
	FILL: Sand, some gravel, trace organics, very loose, brown, moist	SS	1	15	4		179	4	12					
	0.8 178.6					0.5								
	SILTY SAND: Some gravel, trace clay, very dense, brown, moist 0.9 178.5	SS	2	20	100+		178.5	100+	7		19	49	23	9
	Borehole Terminated at 0.9 m Upon Auger Refusal													

Groundwater depth encountered on completion of drilling: Dry
Groundwater depth observed on:
Cave depth after auger removal: Open
Groundwater Elevation:

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Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :25**
Page: **1 of 1**

Appendix C Well Details & Groundwater Levels

Hydrogeological Investigation
Proposed Simcoe County Housing Facility
Collingwood, Ontario
Project No. 2502627

Monitoring Well Installation Details

WELL ID	GROUND ELEV. (m asl)	TOP OF PIPE ELEV. (m abg)	Screen Placement Detail (Top - Bottom)				Install Date	Installer	Material Screened
			Depth (m bgs)		Elev. (m asl)				
BH5	179.38	-	0.61	1.52	178.77	177.86	5/14/2025	GEI	Fill over Gravelly Sand
BH6	179.48	-	0.61	1.52	178.87	177.96	5/14/2025	GEI	Fill over Sand

Groundwater Level Measurements

WELL ID	Unstabilized Groundwater Level		Stabilized Groundwater Levels				
			2025-05-26		2025-06-27		
	Depth (m bgs)	Elev. (m asl)	Depth (m bgs)	Elev. (m asl)	Depth (m bgs)	Elev. (m asl)	
BH5	1.00	178.38	1.11	178.27	DRY	-	*A long-term, annual, nor seasonal groundwater monitoring program is within the scope of this investigation. Groundwater levels presented may not reflect the highest nor lowest groundwater conditions at the site.*
BH6	0.90	178.58	1.40	178.08	DRY	-	

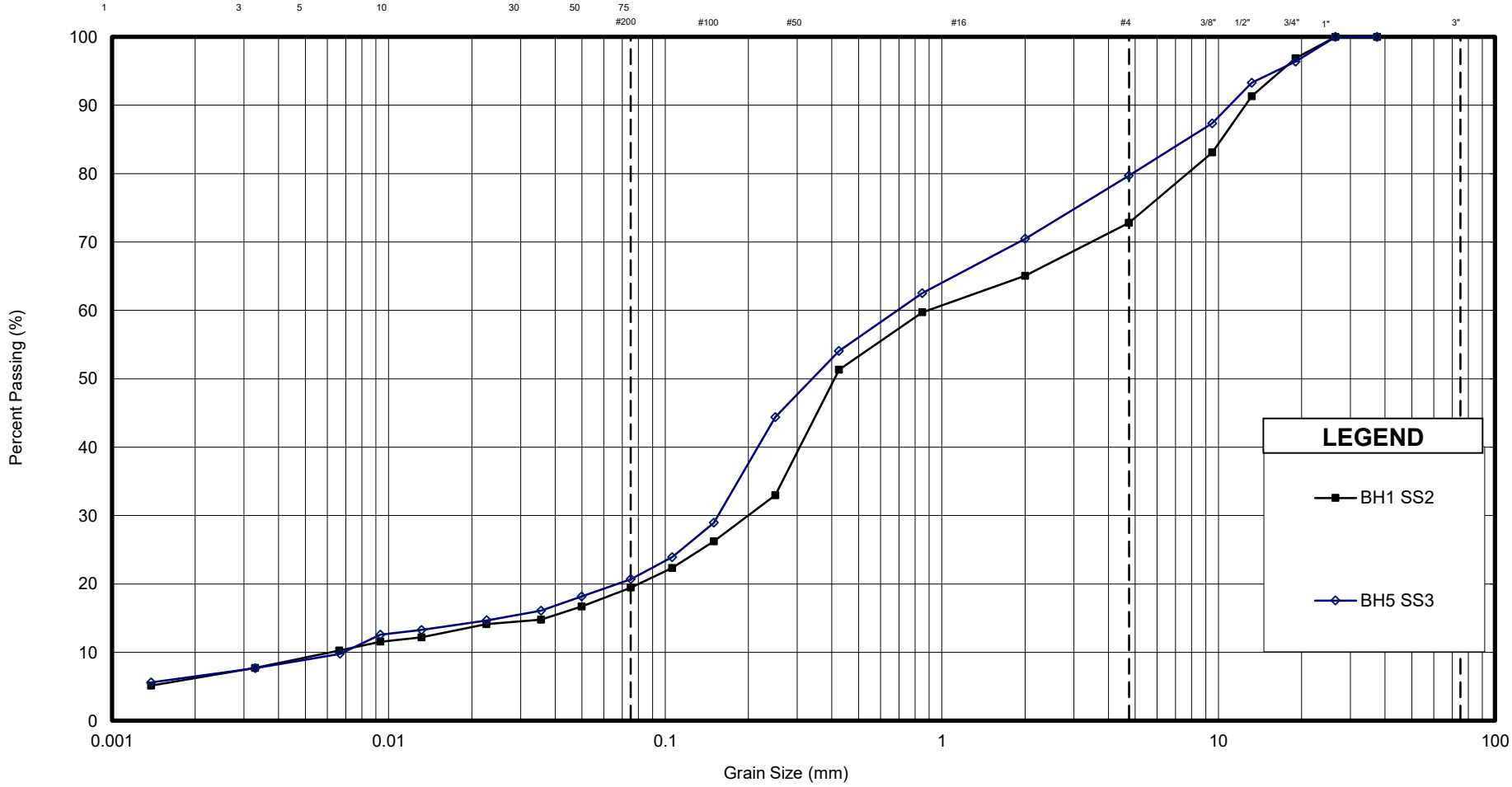
Appendix D Geotechnical Laboratory Testing

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH1 SS2	GRAVELLY SAND, Some Silt, Trace Clay	27	53	13	7	0.006	0.200	0.889	144.4	7.3
BH5 SS3	GRAVELLY SAND, Some Silt, Trace Clay	20	59	14	7	0.007	0.155	0.692	101.0	5.1

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GRAIN SIZE DISTRIBUTION - Proposed Simcoe County Housing Facility

GRAVELLY SAND

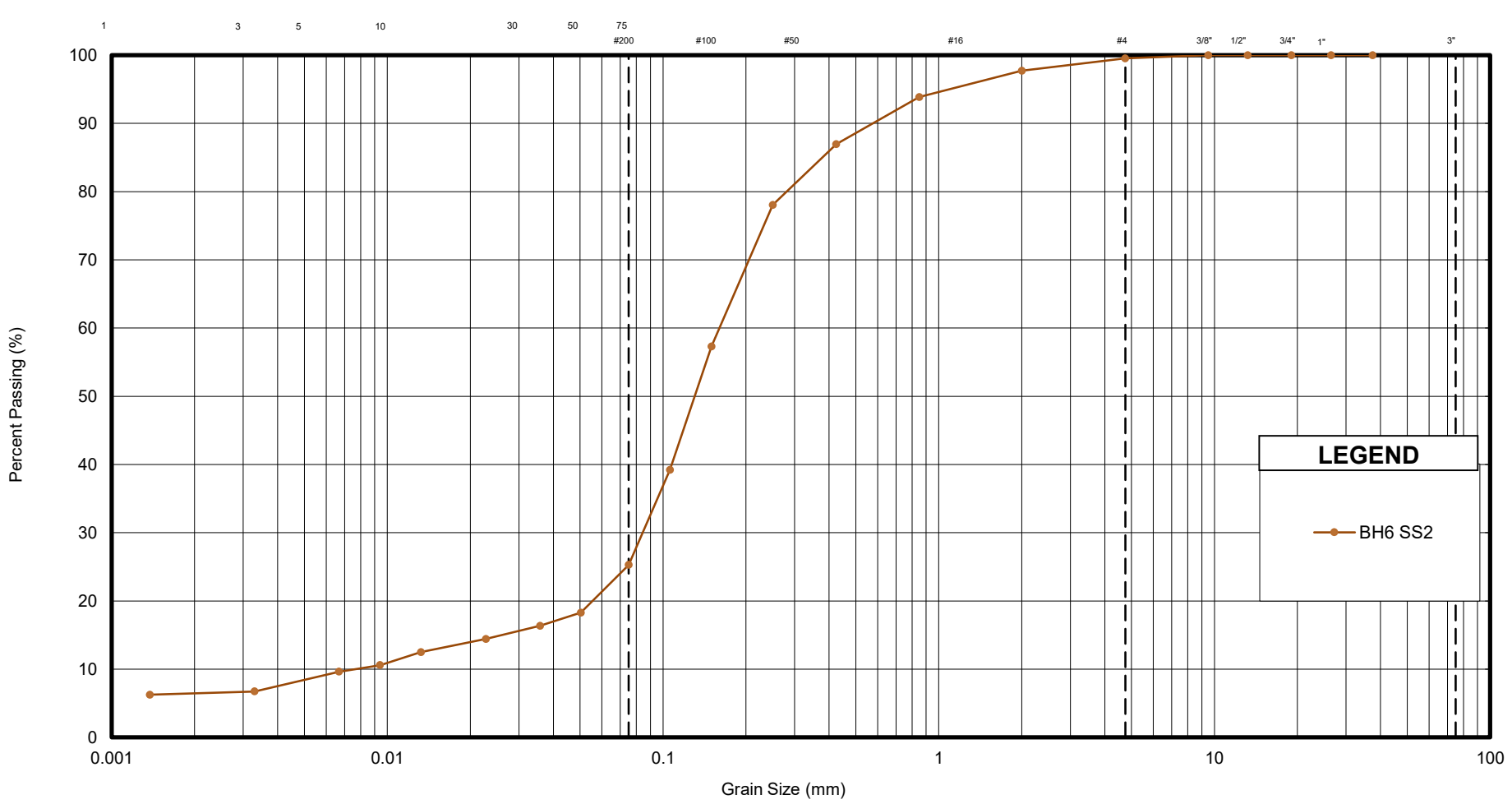
FIGURE No. B1

REF. No. 2502627

DATE June 2025

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH6 SS2	SAND, Some Silt, Trace Clay	-	74	19	7	0.008	0.084	0.160	21.0	5.8

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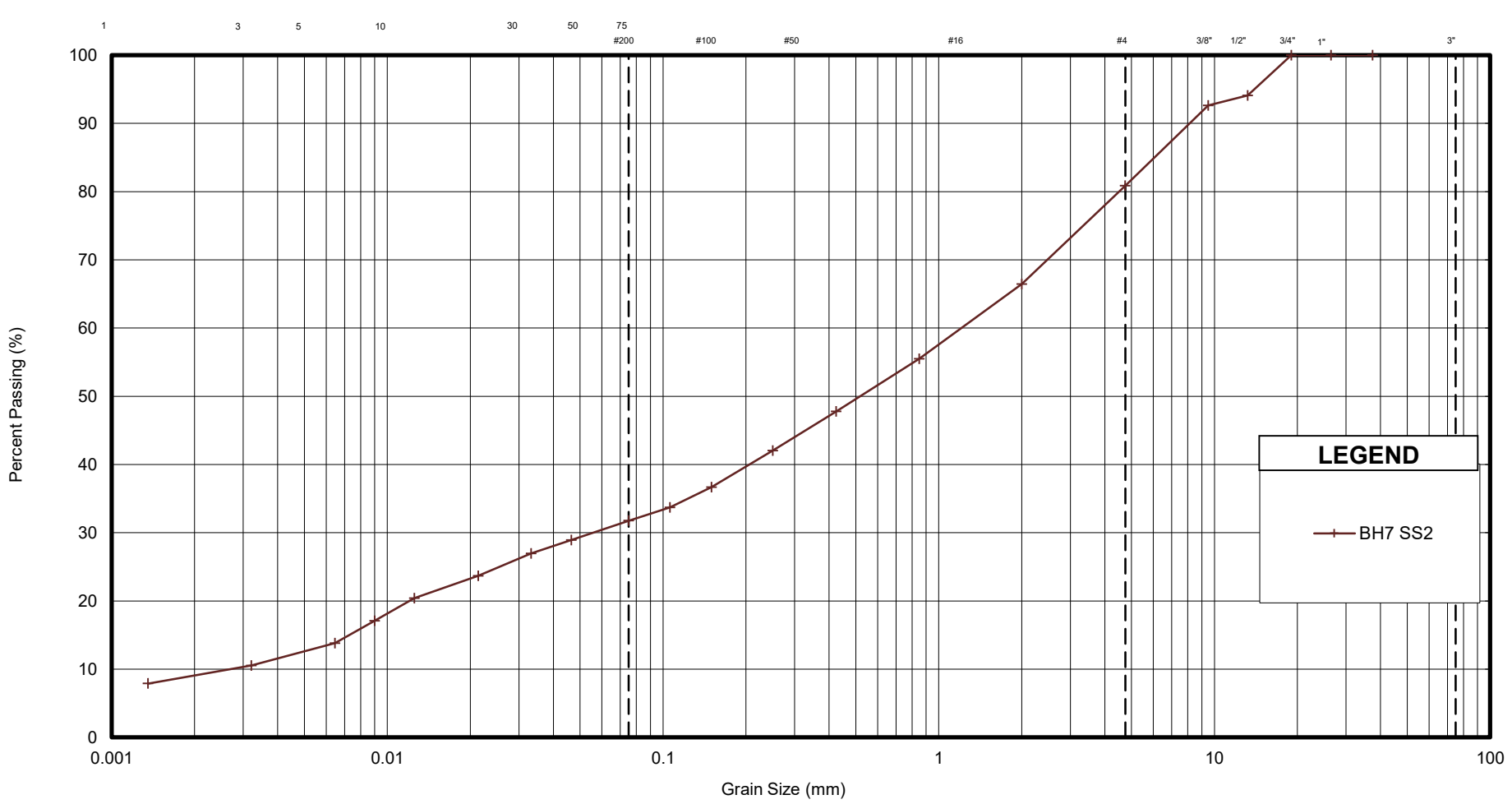
GRAIN SIZE DISTRIBUTION - Proposed Simcoe County Housing Facility

SAND

FIGURE No.	B2
REF. No.	2502627
DATE	June 2025

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH7 SS2	SILTY SAND, Some Gravel, Trace Clay	19	49	23	9	0.003	0.056	1.209	447.1	1.0

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GRAIN SIZE DISTRIBUTION - Proposed Simcoe County Housing Facility

SILTY SAND

FIGURE No.	B3
REF. No.	2502627
DATE	June 2025

Appendix E Construction Dewatering Calculations

Hydrogeological Investigation
Proposed Simcoe County Housing Facility
Collingwood, Ontario
Project No. 2502627

Summary of Predicted Temporary Groundwater Flow Rate and Zone of Influence at: 29 and 45 Birch Street, Collingwood, Ontario

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Excavations for Building Construction

Dewatering Zone	Hydraulic Conductivity (m/s)	Hydraulic Conductivity (m/day)	Material Encountered	Ground Elevation (masl)	Assumed Groundwater Depth (m bgs)	Lowest Excavation Depth (mbgs)	Lowest Excavation Depth (masl)	Assumed Base of Aquifer (masl) (3.0 m below lowest excavation on site)	Length (m)	Width (m)	Length ÷ Width (>1.5)	Inferred Groundwater Elevation (masl)	**Target Pumping Groundwater (masl) (0.5 m below excavations)	H (m)	h (m)	r_s (m)	R_0 (m)	R_a (m)	Q per half length (m^3/day)	Safety Factor (S.F.)	Construction Flow Rate with S.F. for full length (L/day)
Building Construction	1.0E-04	8.6E+00	Fill over gravelly sand	179.38	1.1	1.2	178.18	175.2	47	20	2.4	178.3	177.7	3.1	2.5	10.0	10.5	20.5	96.8	2.0	394,130
				179.48		1.2	178.28					178.4	177.8	3.2	2.6		10.5	20.5	100.3		
																					394,130

Notes:

** Target Groundwater Level Assumed 0.5 m below Lowest Excavation Depth. Excavation depth taken as 1.2 mbgs (footing/slab on grade)

Precipitation = Max 1-Day Precipitation (Climate Altas of Canada [climateatlas.ca])

Precipitation Estimate				
Precipitation (mm)	Area (m^2)	Total (L)		
43	940	40,420	Sum of Precipitation and Groundwater	434,550

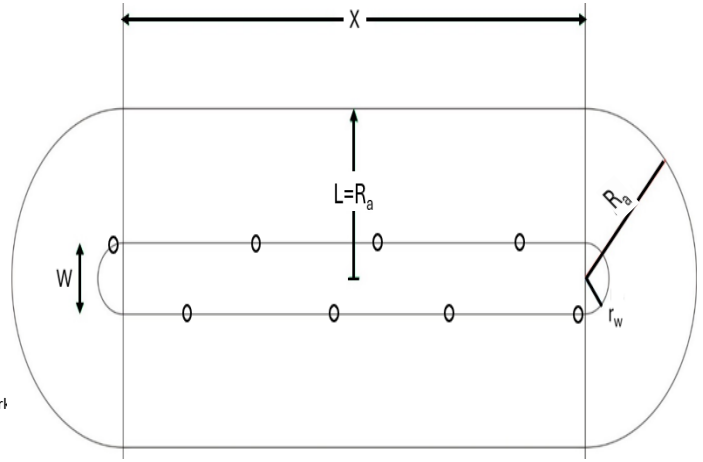
Input

Output

When ratio of X/W is greater than 1.5, Trench Equation is used (below)

$$Q = \frac{\pi K(H^2 - h^2)}{ln\left(R_a/r_s\right)} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right]$$

Where:
Q = Anticipated pumping rate (m^3/day)
K = Hydraulic conductivity (m/day)
H = Saturated thickness prior to dewatering (m)
h = Saturated thickness after dewatering (m)
R_0 = Radius of influence from the edge of excavation (m); it is estimated using
an empirical relationship developed by Sichart that is a function of drawdown and hydraulic conductivity
$R_0 = C\ (H - h)\sqrt{K}$; Where: C is a factor equal to 3000 for radial flow and
between 1500 to 2000 for the trench (Somerville 2005). For the purpose of this estimate a value of 1750 for C is considered.
rs = Distance to the wellpoints from the centre of the trench, assumed to be half of the trench width (W) in m
R_a = radius of influence from the center of the excavation (R0+rs)
x = Trench length (m)
L = Distance from a line source to the trench, assumed to be equivalent to R_a (m)



References:

Driscoll, F.G., 1986: Groundwater and Wells, 2nd edition, Johnson Division, St. Paul, Minnesota
Powers, J.P., Corwin, A.B., Schmall, P.C., and Kaeck, W.E. (2007) Construction Dewatering and Groundwater Control: New Methods and Applications – Third Edition. New York, New York
Somerville, S. H., (2005). Control of groundwater for temporary work. SIRIA

Hydrogeological Investigation
Proposed Simcoe County Housing Facility
Collingwood, Ontario
Project No. 2502627

Summary of Predicted Temporary Groundwater Flow Rate and Zone of Influence at: 29 and 45 Birch Street, Collingwood, Ontario

GEI Consultants

Excavations for Site Services

Dewatering Zone	Hydraulic Conductivity (m/s)	Hydraulic Conductivity (m/day)	Material Encountered	Ground Elevation (masl)	Assumed Groundwater Depth (m bgs)	Lowest Excavation Depth (mbgs)	Lowest Excavation Depth (masl)	Assumed Base of Aquifer (masl) (3.0 m below lowest excavation on site)	Length (m)	Width (m)	Length ÷ Width (>1.5)	Inferred Groundwater Elevation (masl)	**Target Pumping Groundwater (masl) (0.5 m below excavations)	H (m)	h (m)	r_s (m)	R_0 (m)	R_a (m)	Q per half length (m^3/day)	Safety Factor (S.F.)	Construction Flow Rate with S.F. for full length (L/day)
Site Services	1.0E-04	8.6E+00	Fill over gravelly sand	179.38	1.1	1.5	177.9	174.9	50	2	25.0	178.3	177.4	3.4	2.5	1.0	15.8	16.8	94.0	2.0	376,180
				179.38		1.5	177.9					178.3	177.4	3.4	2.5		15.8	16.8	94.0		
																					376,180

Notes:

** Target Groundwater Level Assumed 0.5 m below Lowest Excavation Depth. Excavation depth taken as 1.5 mbgs (shallow bedrock on site, services are assumed to be above bedrock)

Precipitation = Max 1-Day Precipitation (Climate Altas of Canada [climateatlas.ca])

Precipitation Estimate		
Precipitation (mm)	Area (m^2)	Total (L)
43	100	4,300

Sum of Precipitation and Groundwater	380,480

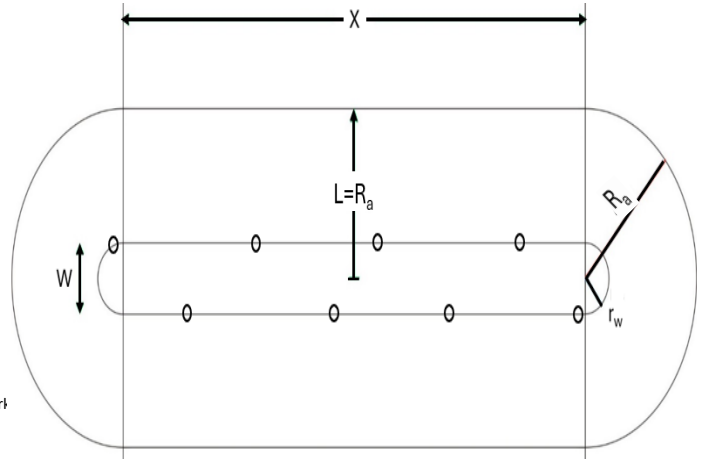
Input

Output

When ratio of X/W is greater than 1.5, Trench Equation is used (below)

$$Q = \frac{\pi K(H^2 - h^2)}{ln\left(R_a/r_s\right)} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right]$$

Where:
Q = Anticipated pumping rate (m^3/day)
K = Hydraulic conductivity (m/day)
H = Saturated thickness prior to dewatering (m)
h = Saturated thickness after dewatering (m)
R_0 = Radius of influence from the edge of excavation (m); it is estimated using
an empirical relationship developed by Sichart that is a function of drawdown and hydraulic conductivity
$R_0 = C\ (H - h)\sqrt{K}$; Where: C is a factor equal to 3000 for radial flow and
between 1500 to 2000 for the trench (Somerville 2005). For the purpose of this estimate a value of 1750 for C is considered.
r_s = Distance to the wellpoints from the centre of the trench, assumed to be half of the trench width (W) in m
R_a = radius of influence from the center of the excavation (R0+rs)
x = Trench length (m)
L = Distance from a line source to the trench, assumed to be equivalent to R_a (m)



References:

Driscoll, F.G., 1986: Groundwater and Wells, 2nd edition, Johnson Division, St. Paul, Minnesota
Powers, J.P., Corwin, A.B., Schmall, P.C., and Kaeck, W.E. (2007) Construction Dewatering and Groundwater Control: New Methods and Applications – Third Edition. New York, New York
Somerville, S. H., (2005). Control of groundwater for temporary work. SIRIA

Appendix F Groundwater Taking Plan

This plan, as required under the OWRA, Section 34 - 34.11 and O.Reg. 387/04 (Water Taking and Transfer) and/or O.Reg. 63/16 – Registration Under Part II.2 of the Act – Water Taking, provides a general outline of the dewatering plan for the site to satisfy the EASR requirements and that a detailed plan will be generated as needed by the contractor and their dewatering subcontractor that will include detailed treatment and monitoring measures.

Based on the conditions at and around the site, the target receiver for any dewatering discharge will be the surface and/or storm and/or sanitary sewers. Should discharge be planned for either of the sewer systems, the contractor and/or its dewatering subcontractor will need to ensure that all permissions and/or permits are obtained to allow for discharge to that sewer and that all dewatering discharge meets the appropriate chemistry and discharge flow requirements imposed for that system.

Ultimately the method(s) employed to complete the dewatering will be left up to the contractor and/or its dewatering contractor to determine what will work best for them to achieve the dry working conditions that they require.

A mitigated "worst case scenario" approach has been applied to these preliminary dewatering calculations, due to the limited groundwater level data collected to date which does not reflect seasonal high groundwater levels and lack of onsite hydraulic conductivity data. This approach assesses the reasonable potential impact and suggests methods to consider during construction dewatering. The following values should be used for discussion and preliminary planning purposes only until final designs are available.

F.1. Construction Dewatering

The ROIs were estimated in Section 5.1.3. and the details are summarized below.

Table F-1. Summary of Dewatering Drawdown Conditions for ROI

Dewatering Zones	Purpose	ROI
		R_0 (m)
		Individual
Excavations for Building Construction	Excavation for the building construction, assumed slab on grade with foundation (approximately 47 m long by 20 m wide by 1.2 m deep)	10.5
Excavations for Service Construction	Linear excavation for the construction of the services (assumed 50 m long by 2 m wide by 1.5 m deep)	15.8

The estimated water taking rates are below.

Table F-2. Summary of Construction Dewatering Flow Rate Calculations

Dewatering Zones	Construction Dewatering Flow Rate	
	As Calculated including FOS[1]	Combined and including Rainfall Event[2,3]
	L/day	
Excavations for Building Construction	394,130 (per 47 m in length and 20 m in width)	434,550
Excavations for Service Construction	376,180 (per 50 m in length and 2 m in width)	380,480
Total (if all excavations are completed concurrently)	770,310	815,030

Notes:

1. A Factor of Safety of 2.0 is included to account for seasonal fluctuations in the groundwater table, initial removal of groundwater from storage and variation in hydrogeological properties beyond those encountered during this study.
2. A 43 mm rainfall event was included in the water-taking calculation to account for the maximum projected single-day precipitation in the local area in the immediate future (2021 to 2050) under high carbon emissions (RCP8.5), according to the Climate Atlas of Canada. The Climate Atlas uses data from the Pacific Climate Impacts Consortium, which provides downscaled projections of daily temperature and precipitation from 24 climate models using two carbon emission scenarios.
3. It is noted that under specific conditions, if the water taking is 100% storm water registration on the EASR may not be required, however if water taking consists of any mixture of storm water and groundwater typical registry or permitting is likely required.

F.2. Impact Assessment

Land Stability and Settlement

Construction dewatering has the potential to result in ground settlement which could damage buried utilities, building foundations, or cause subsidence in adjacent lands. Settlement of the soil within the zone of influence can be calculated based on the increase in effective stress (10 kPa per m of drawdown) from reducing the pore water pressures. The maximum settlement will occur adjacent to the dewatering system where the maximum drawdown occurs and decrease exponentially to zero towards the ROI limit.

At this site, groundwater drawdowns as much as 2.0 m have been assumed during construction, with a corresponding increase in effective stress of 40 kPa. Based on the predominant soil conditions (silty sand, sand or sand and gravel fill overlying dense gravelly sand or sand and shallow bedrock, theoretically it is estimated that this magnitude of effective stress increase/groundwater drawdown will not result in any significant settlement (less than 5 mm). However given the conservative approach to calculating the dewatering values, it is believed that the potential for settlement would be much less. Given the magnitude of settlement, the risk of settlement related impacts to nearby buildings from the construction dewatering is considered to be very low.

The estimated settlement does not include potential settlement associated with ground loss due to the pumping of fines through the system. It is imperative that any dewatering systems (e.g., well-points, deep wells, sump pumps) be installed adequately to ensure no soil is conveyed through the system. Sufficient filtering techniques are incorporated at the entry point to avoid migration fines in the pumping/dewatering system. The turbidity of pumped water should be monitored daily to ensure that only minimal fines are being conveyed through the system.

Potential Impact on Nearby Groundwater Users

As discussed in Section 2.2, no existing water well records were identified on-site, while 44 records were identified within 500 m of the site. A table of these records was provided in Appendix A and summary of these records is provided below.

Table F-3. Summary of MECP Water Well Records within Study Area

Well Use	Number of Records	Year(s) Installed	Water Encountered (Type & Depth)	Well Screen/ Open Hole (Media & Depth)	Closest Well Record to Site (ID & Distance)
Monitoring, Observation, and/or Test Hole	34	2008 to 2022	Unknown	Limestone bedrock	7142313: 155 m northeast of site
Cooling and A/C	1	1951	19.81	Bedrock	430 m east of site
Abandoned	3	1956 to 2011	Unknown	Bedrock	160 m north of site
Other, Not Used, and/or Not Listed	6	2010 to 2022	Unknown	No Information Provided	7189414: 385 m southeast of site
Public and/or Municipal	0	N/A			
Domestic and/or Livestock	0	NA			
Industrial	0	N/A			
Commercial	0	N/A			
Dewatering	0	N/A			

No domestic or municipal water supply wells were reported within 500 m of site, therefore impacts to groundwater supply wells are not anticipated. If there are any historic water supply wells in the study area, it is anticipated that they are no longer in use, since municipal water is available within the Town boundaries.

As discussed in Section 2.3., there are two (2) PTTW records in the 500 m radius from the site. The PTTWs are reported as expired, or revoked and replaced, therefore it is not anticipated that water supply PTTWs will be affected.

Potential Impact on Nearby Waterbodies or Other Surface Water Features

Georgian Bay is located approximately 415 m north of the site. It was not a part of the current scope to determine if this feature contains a base flow year-round or only seasonally. No other surface water features were identified on the Site or within the study area.

Minimal impacts to groundwater levels or flow directions, deeper aquifers, or other environmental features are expected due to the construction dewatering being temporary (short-term), with the ROI for drawdown being relatively small, and only a limited area being dewatered at any given time during construction.

As no ANSIs nor wetlands were identified within 500 m of the site and the water removed will be returned to the Georgian Bay subwatershed it is not anticipated that the proposed construction dewatering activity will have a negative impact on the overall groundwater flow to the surrounding area.

F.3. Water Quantity, Quality and Groundwater Level Monitoring Program

Discharge Options

Groundwater quality could not be assessed, as the wells were dry when GEI staff returned to collect groundwater quality samples. It is anticipated that the discharge from dewatering operations can be directed to the surface, provided that the groundwater quality meets the PWQO during dewatering activities. Therefore, some level of water quality testing is recommended to be completed prior to the dewatering. Local sewers are anticipated in the vicinity of the site and are assumed to be the discharge location target for construction dewatering activities.

If based on water quality testing, the groundwater quality of the construction dewatering discharge fails to meet the applicable standards, treatment options should be assessed, and/or the system should be shut down.

Treatment of the dewatering discharge water by filtration (using a decantation tank and/or silt bag at a minimum) to remove sediment and fines is expected to improve water quality by reducing the concentrations of TSS and/or metals. However, additional treatment may be necessary for the groundwater to meet the applicable sewer use bylaw, objective, and/or other criteria.

The purpose of sampling for PWQO metals and for PHCs and VOCs are for the evaluation of the groundwater to discharge into the natural environment and/or into sewer systems in which local discharge water quality standards do not currently exist.

The contractor is responsible for designing and operating a treatment system for the collected discharge using their own methods to ensure compliance with the applicable standard.

Although PWQO and iPWQO are not legally binding standards, they serve as the foundation for establishing acceptable wastewater loading limits on a site-specific basis (such as the natural environment and/or sewer systems in which local discharge water quality standards do not currently exist). The MECP has acknowledged that applying PWQOs can pose challenges, especially in regard to the limits of PHCs and VOCs. These challenges include instances where PWQOs may fall below the laboratory limits of detection, or PWQOs may be more stringent than background concentrations (even in water bodies with apparently thriving aquatic ecosystems).

As such, the QPs discretion has been used to evaluate the groundwater on site for future discharge to the natural environment and/or to sewer systems in which local discharge water quality standards do not currently exist, specifically for assessing the concentrations of PHCs and VOCs found in the groundwater.

Should the quality groundwater discharged during dewatering exceed the PWQO and/or QP's discretion, additional treatment measured from the dewatering contractor may be required before discharging to the natural environment is advisable and/or approved, and as such discharge to local sewers may be a more efficient option for groundwater discharge during dewatering operations.

If surface discharge is required, it is imperative to establish the natural background levels of parameters within nearby water bodies or features (such as the local creeks) before dewatering begins. Furthermore, continuous water quality monitoring should be conducted regularly during and after groundwater discharge activities.

Water Quality Monitoring and Potential Treatment Plan
The monitoring plan for discharge to the surface and/or sewers is outlined on Table H-4.

Groundwater Level Monitoring Program
The ground water level monitoring program is outlined on Table H-5.

Discharge Rate Monitoring
The total groundwater volume pumped must be measured and recorded daily by the dewatering contractor. The water taking rates should be measured using an electronic device, and the daily water volumes must be reported to MECP on the Water Taking Reporting System or through the Regulatory Self Reporting System. The volume of water taken daily for each dewatered work area shall be reported to the Ministry on or before March 31 of each year, for each location from which water was taken in the previous calendar year. If no water is taken, then a "no taking" report must be entered.

The contractor will maintain a record of all water takings. This record will include the dates and duration of water takings, and the total measured volume of water pumped per day for each day that water is taken and will be updated and reported to the Client weekly. Daily precipitation must also be recorded by the contractor. The records must be kept up to date and available at or near the site and provided to the MECP upon request.

F.4. Summary of Qualifications

Joanna Olesiuk, M. A. Sc., C. Tech., P. Geo. (Limited)
Ms. Olesiuk is a project geoscientist with a background in environmental science, hydrogeology, and environmental engineering application fields. Ms. Olesiuk has over 20 years of industry experience conducting field activities, data analysis and reporting for Phase One/I and Two/II ESAs for due-diligence and O. Reg. 153/04 RSC projects including site remediation, O. Reg. 406/19 excess soil management investigations, MECP Permits to Take Water, Environmental Compliance Approvals, Environmental Activity and Section Registry projects as well as wide range of hydrogeological assessments to support private sewage and water servicing, subdivision and irrigation approvals.

Kimberley Pickett, M. Ed., C.E.T, LET
Ms. Pickett is an experienced project manager with over 20 years' experience in both the public and private sectors. Ms. Pickett holds a Master of Education from Yorkville University, an undergraduate degree in Geoscience from McMaster University and a diploma in Environmental Engineering Technology from Confederation College. Ms. Pickett has been involved in numerous environmental projects and hydrogeological assessments. Ms. Pickett brings a strong balance of theoretical knowledge combined with practical on-site experience. Along with her technical abilities, Ms. Pickett is well versed in project management, proposal preparation and client liaison. In addition, due to various roles within a municipal setting, Ms. Pickett has significant experience with public consultation, public meetings, and liaising with stakeholders on a number of environmental and hydrogeological projects.

Geoffrey White, P.Eng.

Mr. White, P.Eng., is a senior geotechnical engineer with 29 years of interdisciplinary professional experience Mr. White specializes in geotechnical engineering, with experience in geoenvironmental project, hydrogeological projects and support for materials inspection and testing. Mr. White's hydrogeological experience includes long-term/short-term groundwater and surface water monitoring, local scale groundwater assessments, water budgets, supervising the installation, development, sampling and decommissioning of monitoring wells, and determination of groundwater flow characteristics.

Date of Plan Preparation: This plan was prepared on the date August 5, 2025.

Table F-4. Water Quality Monitoring Plan for Dewatering Discharge to Surface or Available Storm and/or Sanitary Sewers[1]

Time Period	Monitoring Location	Parameters[2]	Monitoring Frequency[3]	Trigger for Mitigation	Mitigation Measures / Comments
Trial Dewatering or at the Start of Construction	Dewatering System Discharge Upstream And Downstream of Any Discharge Directed to Local Water Bodies / Water Courses	Applicable Sewer Use Bylaw Criteria (including PHCs and VOCs) PWQO Metals and TSS	Once during trial dewatering or on the first day of dewatering (with rushed samples)	Exceeds the Applicable Sewer Use Bylaw Criteria or PWQOs: ● No ● Yes – Proceed to Mitigation Measures / Comments	Modify treatment method and/or shut down.
		Turbidity	Daily until stable (minimum 5 samples) then weekly	Exceeds 8 NTU above the baseline levels: ● No ● Yes – Proceed to Mitigation Measures / Comments	Modify treatment method and/or shut down.
During Construction Dewatering	Dewatering System Discharge Upstream And Downstream of Any Discharge Directed to Local Water Bodies / Water Courses	Applicable Sewer Use Bylaw Criteria (including PHCs and VOCs) PWQO Metals and TSS	Weekly then every four weeks after 3 consecutive weekly compliant samples	Exceeds the Applicable Sewer Use Bylaw Criteria or PWQOs: ● No ● Yes – Proceed to Mitigation Measures / Comments	Modify treatment method and/or shut down.
		Turbidity	Daily until stable (minimum 5 samples) then weekly	Exceeds 8 NTU above the baseline levels: ● No ● Yes – Proceed to Mitigation Measures / Comments	
		Hydrocarbon sheen in discharge	Daily	Hydrocarbon sheen observed ● No ● Yes – Proceed to Mitigation Measures / Comments	Stop dewatering until the source can be determined and remediate prior to continuing to discharge.

Time Period	Monitoring Location	Parameters[2]	Monitoring Frequency[3]	Trigger for Mitigation	Mitigation Measures / Comments
		Total groundwater pumping / discharge rate	Daily with electronic device	Flows exceeds the permitted rate (e.g., due to heavy rainfall event) ● No ● Yes – Proceed to Mitigation Measures / Comments	Temporarily reduce pumping rate or shorten the length of trench being dewatered until rate drops below the permitted rate.
		Record the daily precipitation at the construction site	Daily	N/A	N/A
		Signs of erosion, sediment, or flooding	Daily	Sedimentation, erosion, flooding observed. ● No ● Yes – Proceed to Mitigation Measures / Comments	Reduce pumping and/or improve sediment/erosion control measures.
		Settlement / Subsidence of nearby land	Daily	Visual indication of settlement/subsidence ● No ● Yes – Proceed to Mitigation Measures / Comments	Reduce pumping and consult both dewatering contractor and geotechnical engineer
		N/A	N/A	Complaint received with respect to water taking and pertains to natural environment. ● No ● Yes – Proceed to Mitigation Measures / Comments	Document and evaluate if actually related to dewatering, implement mitigation measures. Submit complaint and mitigation measures to local MECP office

Notes: All items and observations during dewatering should be recorded in a log on site, accessible for inspection.

1. It is recommended that discharge be treated by a sediment control facility such as a decantation tank and filtration bags at a minimum. Means and methods determined by the contractor.
2. Parameters may be removed from future testing after three consecutive compliant results and with agreement by QP. If dewatering moves to a different location all initial parameters may need to be retested at the discretion of the QP. Additionally, at the discretion of the QP, parameter sets required to be sampled can be added or removed to

reflect the planned/approved discharge location (such as sanitary sewer, storm sewer or to the natural environment, etc.). Additionally, parameters not applicable to the approved discharge location can be removed with the approval of the QP.

3. If dewatering moves to a different location or a non-compliant result is detected, the sampling may need to return to the initial frequency at the QP's discretion

Table F-5. Summarized Groundwater Level Monitoring Plan

Time Period	Monitoring Location	Method	Monitoring Frequency	Trigger for Mitigation	Mitigation Measures / Comments
Trial Dewatering or at the Start of Construction	On-Site Monitoring Wells Upstream And Downstream of Any Discharge Directed to Local Water Bodies / Water Courses	Water Level Meter	At a minimum, once prior to dewatering	None.	Together with previous measurements establish baseline water levels.
During Construction	On-Site Monitoring Wells Upstream And Downstream of Any Discharge Directed to Local Water Bodies / Water Courses	Water Level Meter	Every two weeks	Water level drops more than 2 m below the target dewatering elevation	Reduce pumping
Post-Construction	On-Site Monitoring Wells Upstream And Downstream of Any Discharge Directed to Local Water Bodies / Water Courses	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 G Groundwater Discharge Plan

This plan, as required under the Ontario Water Resources Act, Section 34 - 34.11 and O.Reg. 387/04 (Water Taking and Transfer) and/or O.Reg. 63/16 – Registration Under Part II.2 of the Act – Water Taking, provides a general outline of the discharge plan for the site to satisfy the PTTW and/or EASR requirements and that a detailed plan will be generated as needed by the contractor and their dewatering subcontractor that will include detailed treatment and monitoring measures.

Based on the conditions at and around the site, the target receiver for any dewatering discharge will be the surface or existing sewers. Should discharge be planned for either of the sewer systems, the contractor and/or its dewatering subcontractor will need to ensure that all permissions and/or permits are obtained to allow for discharge to that sewer and that all dewatering discharge meets the appropriate chemistry and discharge flow requirements imposed for that system.

Ultimately the treatment and discharge method(s) employed during dewatering will be left up to the contractor and/or its dewatering contractor to determine.

It is noted that these dewatering estimates are considered preliminary and conservative such that they do not reflect analysis with the information regarding the seasonal or annual high groundwater levels. The following values should be used for discussion and preliminary planning purposes only until final designs are available.

G.1. Construction Dewatering

The temporary dewatering discharge rates were estimated in Section 5.1.4. and the details are summarized below.

Table G-1. Summary of Construction Dewatering Flow Rate Calculations

Dewatering Zones	Construction Dewatering Flow Rate	
	As Calculated including FOS[1]	Combined and including Rainfall Event[2,3]
	L/day	
Excavations for Building Construction	394,130 (per 47 m in length and 20 m in width)	434,550
Excavations for Service Construction	376,180 (per 50 m in length and 2 m in width)	380,480
Total (if all excavations are completed concurrently)	770,310	815,030

Notes:

1. A FOS of 2.0 is included to account for seasonal fluctuations in the groundwater table, initial removal of groundwater from storage and variation in hydrogeological properties beyond those encountered during this study.
2. A 43 mm rainfall event was included in the water-taking calculation to account for the maximum projected single-day precipitation in the local area in the immediate future (2021 to 2050) under high carbon emissions (RCP8.5), according to the Climate Atlas of Canada. The Climate Atlas uses data from the Pacific Climate Impacts Consortium, which provides downscaled projections of daily temperature and precipitation from 24 climate models using two carbon emission scenarios.
3. It is noted that under specific conditions, if the water taking is 100% storm water registration on the EASR may not be required, however if water taking consists of any mixture of storm water and groundwater typical registry or permitting is likely required.

G.2. Proposed Discharge Method and Location

It is understood that the preferred discharge location would be the surface or the existing sewers. Dewatering discharge will be directed by hose or pipe from the dewatering system to any pre-treatment systems (such as a sediment tank and silt bag), and then by hose or pipe to the preferred discharge location.

In the event of a significant rainfall event (100-year storm event), on-site excavation will cease until the dewatering system can be re-evaluated and/or storm water flow subsides.

G.3. Erosion and Sediment Control Measures

The construction dewatering setup will include sediment and erosion control measures, and sufficient filtration to ensure removal of suspended solids prior to discharge in accordance with typical BMPs and to be sufficient to meet relevant receptor requirements.

G.4. Statements

If discharge is directed to the surface or future sewers with adherence to the water quantity and quality monitoring program outlined in the Water Taking Plan in Appendix H, no adverse effect on the environment is expected. The discharge water temperature was considered in determining the method of transfer and discharge and is not expected to have an adverse impact.

G.5. Summary of Qualifications

Joanna Olesiuk, M. A. Sc., C. Tech., P. Geo. (Limited)

Ms. Olesiuk is a project geoscientist with a background in environmental science, hydrogeology, and environmental engineering application fields. Ms. Olesiuk has over 20 years of industry experience conducting field activities, data analysis and reporting for Phase One/I and Two/II ESAs for due-diligence and O. Reg. 153/04 RSC projects including site remediation, O. Reg. 406/19 excess soil management investigations, MECP Permits to Take Water, Environmental Compliance Approvals, Environmental Activity and Section Registry projects as well as wide range of hydrogeological assessments to support private sewage and water servicing, subdivision and irrigation approvals.

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Ms. Pickett is an experienced project manager with over 20 years' experience in both the public and private sectors. Ms. Pickett holds a Master of Education from Yorkville University, an undergraduate degree in Geoscience from McMaster University and a diploma in Environmental Engineering Technology from Confederation College. Ms. Pickett has been involved in numerous environmental projects and hydrogeological assessments. Ms. Pickett brings a strong balance of theoretical knowledge combined with practical on-site experience. Along with her technical abilities, Ms. Pickett is well versed in project management, proposal preparation and client liaison. In addition, due to various roles within a municipal setting, Ms. Pickett has significant experience with public consultation, public meetings, and liaising with stakeholders on a number of environmental and hydrogeological projects.

Date of Plan Preparation: This plan was prepared on the date August 5, 2025.

Appendix H

HEC-RAS Modelling Results

HEC-RAS River: OAK Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Chnl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)
1	1686.002	PF 1	PRE - 100%	21.80	182.90	185.48	185.04	185.49	0.002900	0.41	53.35	111.71	0.19	0.41
1	1686.002	PF 1	POST - 100%	21.80	182.90	185.48	185.04	185.49	0.002900	0.41	53.35	111.71	0.19	0.41
1	1686.002	PF 1	PRE - 50%	21.80	182.90	185.48	185.04	185.49	0.002900	0.41	53.35	111.71	0.19	0.41
1	1686.002	PF 1	POST - 50%	21.80	182.90	185.48	185.04	185.49	0.002900	0.41	53.35	111.71	0.19	0.41
1	1686.002	PF 1	PRE - Blocked	21.80	182.90	185.48	185.04	185.49	0.002900	0.41	53.35	111.71	0.19	0.41
1	1686.002	PF 1	POST - Blocked	21.80	182.90	185.48	185.04	185.49	0.002900	0.41	53.35	111.71	0.19	0.41
1	1671.035	PF 1	PRE - 100%	21.80	184.68	185.23	185.23	185.35	0.102414	1.52	14.37	61.51	1.00	1.52
1	1671.035	PF 1	POST - 100%	21.80	184.68	185.23	185.23	185.35	0.102414	1.52	14.37	61.51	1.00	1.52
1	1671.035	PF 1	PRE - 50%	21.80	184.68	185.23	185.23	185.35	0.102414	1.52	14.37	61.51	1.00	1.52
1	1671.035	PF 1	POST - 50%	21.80	184.68	185.23	185.23	185.35	0.102414	1.52	14.37	61.51	1.00	1.52
1	1671.035	PF 1	PRE - Blocked	21.80	184.68	185.23	185.23	185.35	0.102414	1.52	14.37	61.51	1.00	1.52
1	1671.035	PF 1	POST - Blocked	21.80	184.68	185.23	185.23	185.35	0.102414	1.52	14.37	61.51	1.00	1.52
1	1655.405	PF 1	PRE - 100%	21.80	182.74	184.97	184.71	184.98	0.003933	0.36	60.14	190.52	0.21	0.36
1	1655.405	PF 1	POST - 100%	21.80	182.74	184.97	184.71	184.98	0.003933	0.36	60.14	190.52	0.21	0.36
1	1655.405	PF 1	PRE - 50%	21.80	182.74	184.97	184.71	184.98	0.003933	0.36	60.14	190.52	0.21	0.36
1	1655.405	PF 1	POST - 50%	21.80	182.74	184.97	184.71	184.98	0.003933	0.36	60.14	190.52	0.21	0.36
1	1655.405	PF 1	PRE - Blocked	21.80	182.74	184.97	184.71	184.98	0.003933	0.36	60.14	190.52	0.21	0.36
1	1655.405	PF 1	POST - Blocked	21.80	182.74	184.97	184.71	184.98	0.003933	0.36	60.14	190.52	0.21	0.36
1	1627.37	PF 1	PRE - 100%	21.80	182.74	184.88	184.45	184.89	0.002835	0.32	68.28	204.82	0.18	0.32
1	1627.37	PF 1	POST - 100%	21.80	182.74	184.88	184.45	184.89	0.002835	0.32	68.28	204.82	0.18	0.32
1	1627.37	PF 1	PRE - 50%	21.80	182.74	184.88	184.45	184.89	0.002835	0.32	68.28	204.82	0.18	0.32
1	1627.37	PF 1	POST - 50%	21.80	182.74	184.88	184.45	184.89	0.002835	0.32	68.28	204.82	0.18	0.32
1	1627.37	PF 1	PRE - Blocked	21.80	182.74	184.88	184.45	184.89	0.002835	0.32	68.28	204.82	0.18	0.32
1	1627.37	PF 1	POST - Blocked	21.80	182.74	184.88	184.45	184.89	0.002835	0.32	68.28	204.82	0.18	0.32
1	1582.794	PF 1	PRE - 100%	21.80	182.74	184.60	184.37	184.63	0.017608	0.74	29.46	98.33	0.43	0.74
1	1582.794	PF 1	POST - 100%	21.80	182.74	184.60	184.37	184.63	0.017608	0.74	29.46	98.33	0.43	0.74
1	1582.794	PF 1	PRE - 50%	21.80	182.74	184.60	184.37	184.63	0.017608	0.74	29.46	98.33	0.43	0.74
1	1582.794	PF 1	POST - 50%	21.80	182.74	184.60	184.37	184.63	0.017608	0.74	29.46	98.33	0.43	0.74
1	1582.794	PF 1	PRE - Blocked	21.80	182.74	184.60	184.37	184.63	0.017608	0.74	29.46	98.33	0.43	0.74
1	1582.794	PF 1	POST - Blocked	21.80	182.74	184.60	184.37	184.63	0.017608	0.74	29.46	98.33	0.43	0.74
1	1552.021	PF 1	PRE - 100%	21.80	182.74	184.52	184.12	184.52	0.001210	0.21	102.49	299.16	0.12	0.21
1	1552.021	PF 1	POST - 100%	21.80	182.74	184.52	184.12	184.52	0.001210	0.21	102.49	299.16	0.12	0.21
1	1552.021	PF 1	PRE - 50%	21.80	182.74	184.52	184.12	184.52	0.001210	0.21	102.49	299.16	0.12	0.21
1	1552.021	PF 1	POST - 50%	21.80	182.74	184.52	184.12	184.52	0.001210	0.21	102.49	299.16	0.12	0.21
1	1552.021	PF 1	PRE - Blocked	21.80	182.74	184.52	184.12	184.52	0.001210	0.21	102.49	299.16	0.12	0.21
1	1552.021	PF 1	POST - Blocked	21.80	182.74	184.52	184.12	184.52	0.001210	0.21	102.49	299.16	0.12	0.21
1	1536.229	PF 1	PRE - 100%	21.80	183.98	184.40	184.27	184.42	0.015178	0.56	38.81	176.12	0.38	0.56
1	1536.229	PF 1	POST - 100%	21.80	183.98	184.40	184.27	184.42	0.015178	0.56	38.81	176.12	0.38	0.56
1	1536.229	PF 1	PRE - 50%	21.80	183.98	184.40	184.27	184.42	0.015178	0.56	38.81	176.12	0.38	0.56
1	1536.229	PF 1	POST - 50%	21.80	183.98	184.40	184.27	184.42	0.015178	0.56	38.81	176.12	0.38	0.56
1	1536.229	PF 1	PRE - Blocked	21.80	183.98	184.40	184.27	184.42	0.015178	0.56	38.81	176.12	0.38	0.56
1	1536.229	PF 1	POST - Blocked	21.80	183.98	184.40	184.27	184.42	0.015178	0.56	38.81	176.12	0.38	0.56
1	1519.628	PF 1	PRE - 100%	21.80	182.04	184.24	183.93	184.26	0.006705	0.58	37.67	87.96	0.28	0.58
1	1519.628	PF 1	POST - 100%	21.80	182.04	184.24	183.93	184.26	0.006705	0.58	37.67	87.96	0.28	0.58
1	1519.628	PF 1	PRE - 50%	21.80	182.04	184.24	183.93	184.26	0.006705	0.58	37.67	87.96	0.28	0.58
1	1519.628	PF 1	POST - 50%	21.80	182.04	184.24	183.93	184.26	0.006705	0.58	37.67	87.96	0.28	0.58
1	1519.628	PF 1	PRE - Blocked	21.80	182.04	184.24	183.93	184.26	0.006705	0.58	37.67	87.96	0.28	0.58
1	1519.628	PF 1	POST - Blocked	21.80	182.04	184.24	183.93	184.26	0.006705	0.58	37.67	87.96	0.28	0.58
1	1487.796	PF 1	PRE - 100%	21.80	182.01	184.07	183.71	184.08	0.004726	0.50	43.27	95.78	0.24	0.50
1	1487.796	PF 1	POST - 100%	21.80	182.01	184.07	183.71	184.08	0.004726	0.50	43.27	95.78	0.24	0.50
1	1487.796	PF 1	PRE - 50%	21.80	182.01	184.07	183.71	184.08	0.004726	0.50	43.27	95.78	0.24	0.50
1	1487.796	PF 1	POST - 50%	21.80	182.01	184.07	183.71	184.08	0.004726	0.50	43.27	95.78	0.24	0.50
1	1487.796	PF 1	PRE - Blocked	21.80	182.01	184.07	183.71	184.08	0.004726	0.50	43.27	95.78	0.24	0.50
1	1487.796	PF 1	POST - Blocked	21.80	182.01	184.07	183.71	184.08	0.004726	0.50	43.27	95.78	0.24	0.50
1	1453.554	PF 1	PRE - 100%	21.80	181.31	183.89	183.06	183.90	0.005658	0.52	42.27	103.20	0.26	0.52
1	1453.554	PF 1	POST - 100%	21.80	181.31	183.89	183.06	183.90	0.005658	0.52	42.27	103.20	0.26	0.52
1	1453.554	PF 1	PRE - 50%	21.80	181.31	183.89	183.06	183.90	0.005658	0.52	42.27	103.20	0.26	0.52
1	1453.554	PF 1	POST - 50%	21.80	181.31	183.89	183.06	183.90	0.005658	0.52	42.27	103.20	0.26	0.52
1	1453.554	PF 1	PRE - Blocked	21.80	181.31	183.89	183.06	183.90	0.005658	0.52	42.27	103.20	0.26	0.52
1	1453.554	PF 1	POST - Blocked	21.80	181.31	183.89	183.06	183.90	0.005658	0.52	42.27	103.20	0.26	0.52
1	1423.191	PF 1	PRE - 100%	21.80	180.92	183.76	182.64	183.76	0.003917	0.27	82.00	412.96	0.19	0.27
1	1423.191	PF 1	POST - 100%	21.80	180.92	183.76	182.64	183.76	0.003917	0.27	82.00	412.96	0.19	0.27
1	1423.191	PF 1	PRE - 50%	21.80	180.92	183.76	182.64	183.76	0.003917	0.27	82.00	412.96	0.19	0.27
1	1423.191	PF 1	POST - 50%	21.80	180.92	183.76	182.64	183.76	0.003917	0.27	82.00	412.96	0.19	0.27
1	1423.191	PF 1	PRE - Blocked	21.80	180.92	183.76	182.64	183.76	0.003917	0.27	82.00	412.96	0.19	0.27
1	1423.191	PF 1	POST - Blocked	21.80	180.92	183.76	182.64	183.76	0.003917	0.27	82.00	412.96	0.19	0.27
1	1407			Culvert										
1	1393.158	PF 1	PRE - 100%	21.80	181.09	183.65		183.66	0.004510	0.32	68.40	291.54	0.21	0.32
1	1393.158	PF 1	POST - 100%	21.80	181.09	183.65		183.66	0.004510	0.32	68.40	291.54	0.21	0.32
1	1393.158	PF 1	PRE - 50%	21.80	181.09	183.65		183.66	0.004510	0.32	68.40	291.54	0.21	0.32
1	1393.158	PF 1	POST - 50%	21.80	181.09	183.65		183.66	0.004510	0.32	68.40	291.54	0.21	0.32
1	1393.158	PF 1	PRE - Blocked	21.80	181.09	183.65		183.66	0.004510	0.32	68.40	291.54	0.21	0.32
1	1393.158	PF 1	POST - Blocked	21.80	181.09	183.65		183.66	0.004510	0.32	68.40	291.54	0.21	0.32
1	1367.45	PF 1	PRE - 100%	21.80	180.52	183.42	182.54	183.46	0.013414	0.88	24.80	50.83	0.40	0.88
1	1367.45	PF 1	POST - 100%	21.80	180.52	183.42	182.54	183.46	0.013414	0.88	24.80	50.83	0.40	0.88
1	1367.45	PF 1	PRE - 50%	21.80	180.52	183.42	182.54	183.46	0.013414	0.88	24.80	50.83	0.40	0.88
1	1367.45	PF 1	POST - 50%	21.80	180.52	183.42	182.54	183.46	0.013414	0.88	24.80	50.83	0.40	0.88

HEC-RAS River: OAK Reach: 1 Profile: PF 1 (Continued)

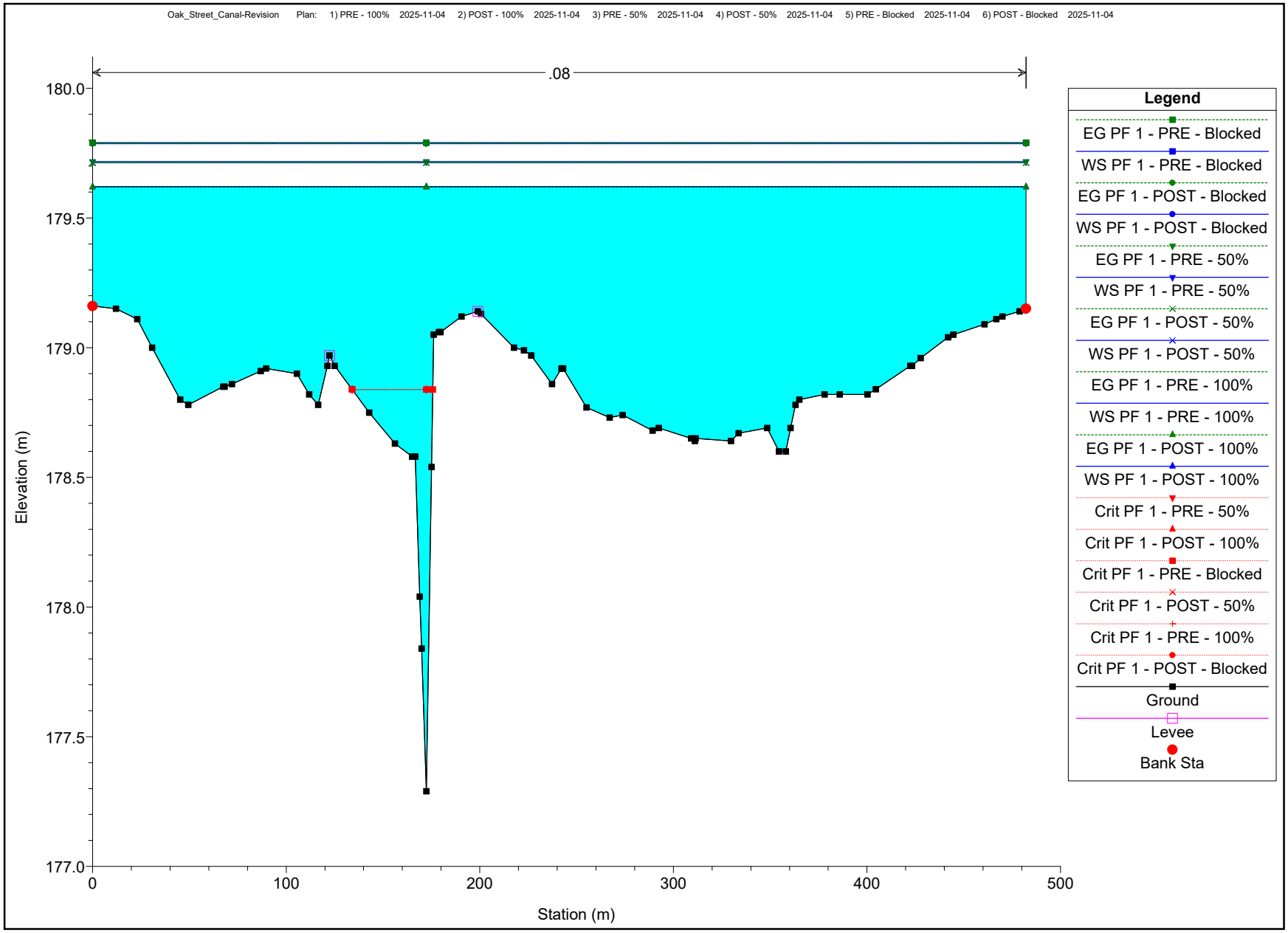
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Chnl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)
1	1367.45	PF 1	PRE - Blocked	21.80	180.52	183.42	182.54	183.46	0.013414	0.88	24.80	50.83	0.40	0.88
1	1367.45	PF 1	POST - Blocked	21.80	180.52	183.42	182.54	183.46	0.013414	0.88	24.80	50.83	0.40	0.88
1	1330.241	PF 1	PRE - 100%	21.80	180.59	182.59	182.59	183.08	0.117755	3.12	7.00	7.02	1.00	3.12
1	1330.241	PF 1	POST - 100%	21.80	180.59	182.59	182.59	183.08	0.117755	3.12	7.00	7.02	1.00	3.12
1	1330.241	PF 1	PRE - 50%	21.80	180.59	182.59	182.59	183.08	0.117755	3.12	7.00	7.02	1.00	3.12
1	1330.241	PF 1	POST - 50%	21.80	180.59	182.59	182.59	183.08	0.117755	3.12	7.00	7.02	1.00	3.12
1	1330.241	PF 1	PRE - Blocked	21.80	180.59	182.59	182.59	183.08	0.117755	3.12	7.00	7.02	1.00	3.12
1	1330.241	PF 1	POST - Blocked	21.80	180.59	182.59	182.59	183.08	0.117755	3.12	7.00	7.02	1.00	3.12
1	1306.005	PF 1	PRE - 100%	21.80	180.59	183.25	182.52	183.30	0.047019	0.96	22.74	106.78	0.66	0.96
1	1306.005	PF 1	POST - 100%	21.80	180.59	183.25	182.52	183.30	0.047019	0.96	22.74	106.78	0.66	0.96
1	1306.005	PF 1	PRE - 50%	21.80	180.59	183.25	182.52	183.30	0.047019	0.96	22.74	106.78	0.66	0.96
1	1306.005	PF 1	POST - 50%	21.80	180.59	183.25	182.52	183.30	0.047019	0.96	22.74	106.78	0.66	0.96
1	1306.005	PF 1	PRE - Blocked	21.80	180.59	183.25	182.52	183.30	0.047019	0.96	22.74	106.78	0.66	0.96
1	1306.005	PF 1	POST - Blocked	21.80	180.59	183.25	182.52	183.30	0.047019	0.96	22.74	106.78	0.66	0.96
1	1291			Culvert										
1	1274.975	PF 1	PRE - 100%	21.80	180.59	182.98	182.69	183.01	0.015897	0.82	26.44	69.01	0.43	0.82
1	1274.975	PF 1	POST - 100%	21.80	180.59	182.98	182.69	183.01	0.015897	0.82	26.44	69.01	0.43	0.82
1	1274.975	PF 1	PRE - 50%	21.80	180.59	182.98	182.69	183.01	0.015897	0.82	26.44	69.01	0.43	0.82
1	1274.975	PF 1	POST - 50%	21.80	180.59	182.98	182.69	183.01	0.015897	0.82	26.44	69.01	0.43	0.82
1	1274.975	PF 1	PRE - Blocked	21.80	180.59	182.98	182.69	183.01	0.015897	0.82	26.44	69.01	0.43	0.82
1	1274.975	PF 1	POST - Blocked	21.80	180.59	182.98	182.69	183.01	0.015897	0.82	26.44	69.01	0.43	0.82
1	1177.371	PF 1	PRE - 100%	21.80	180.42	182.19		182.20	0.004965	0.44	49.31	138.24	0.24	0.44
1	1177.371	PF 1	POST - 100%	21.80	180.42	182.19		182.20	0.004965	0.44	49.31	138.24	0.24	0.44
1	1177.371	PF 1	PRE - 50%	21.80	180.42	182.19		182.20	0.004965	0.44	49.31	138.24	0.24	0.44
1	1177.371	PF 1	POST - 50%	21.80	180.42	182.19		182.20	0.004965	0.44	49.31	138.24	0.24	0.44
1	1177.371	PF 1	PRE - Blocked	21.80	180.42	182.19		182.20	0.004965	0.44	49.31	138.24	0.24	0.44
1	1177.371	PF 1	POST - Blocked	21.80	180.42	182.19		182.20	0.004965	0.44	49.31	138.24	0.24	0.44
1	1125.703	PF 1	PRE - 100%	21.80	180.00	182.06	181.57	182.07	0.001576	0.26	85.17	229.50	0.13	0.26
1	1125.703	PF 1	POST - 100%	21.80	180.00	182.06	181.57	182.07	0.001576	0.26	85.17	229.50	0.13	0.26
1	1125.703	PF 1	PRE - 50%	21.80	180.00	182.06	181.57	182.07	0.001576	0.26	85.17	229.50	0.13	0.26
1	1125.703	PF 1	POST - 50%	21.80	180.00	182.06	181.57	182.07	0.001576	0.26	85.17	229.50	0.13	0.26
1	1125.703	PF 1	PRE - Blocked	21.80	180.00	182.06	181.57	182.07	0.001576	0.26	85.17	229.50	0.13	0.26
1	1125.703	PF 1	POST - Blocked	21.80	180.00	182.06	181.57	182.07	0.001576	0.26	85.17	229.50	0.13	0.26
1	1079.335	PF 1	PRE - 100%	21.80	179.88	181.99	181.70	181.99	0.001595	0.26	82.91	216.17	0.14	0.26
1	1079.335	PF 1	POST - 100%	21.80	179.88	181.99	181.70	181.99	0.001595	0.26	82.91	216.17	0.14	0.26
1	1079.335	PF 1	PRE - 50%	21.80	179.88	181.99	181.70	181.99	0.001595	0.26	82.91	216.17	0.14	0.26
1	1079.335	PF 1	POST - 50%	21.80	179.88	181.99	181.70	181.99	0.001595	0.26	82.91	216.17	0.14	0.26
1	1079.335	PF 1	PRE - Blocked	21.80	179.88	181.99	181.70	181.99	0.001595	0.26	82.91	216.17	0.14	0.26
1	1079.335	PF 1	POST - Blocked	21.80	179.88	181.99	181.70	181.99	0.001595	0.26	82.91	216.17	0.14	0.26
1	1065.735	PF 1	PRE - 100%	21.80	181.29	181.92	181.77	181.94	0.017412	0.69	31.64	206.94	0.42	0.69
1	1065.735	PF 1	POST - 100%	21.80	181.29	181.92	181.77	181.94	0.017412	0.69	31.64	206.94	0.42	0.69
1	1065.735	PF 1	PRE - 50%	21.80	181.29	181.92	181.77	181.94	0.017412	0.69	31.64	206.94	0.42	0.69
1	1065.735	PF 1	POST - 50%	21.80	181.29	181.92	181.77	181.94	0.017412	0.69	31.64	206.94	0.42	0.69
1	1065.735	PF 1	PRE - Blocked	21.80	181.29	181.92	181.77	181.94	0.017412	0.69	31.64	206.94	0.42	0.69
1	1065.735	PF 1	POST - Blocked	21.80	181.29	181.92	181.77	181.94	0.017412	0.69	31.64	206.94	0.42	0.69
1	1049.29	PF 1	PRE - 100%	21.80	179.84	181.78	181.51	181.79	0.005446	0.40	54.21	187.63	0.24	0.40
1	1049.29	PF 1	POST - 100%	21.80	179.84	181.78	181.51	181.79	0.005446	0.40	54.21	187.63	0.24	0.40
1	1049.29	PF 1	PRE - 50%	21.80	179.84	181.78	181.51	181.79	0.005446	0.40	54.21	187.63	0.24	0.40
1	1049.29	PF 1	POST - 50%	21.80	179.84	181.78	181.51	181.79	0.005446	0.40	54.21	187.63	0.24	0.40
1	1049.29	PF 1	PRE - Blocked	21.80	179.84	181.78	181.51	181.79	0.005446	0.40	54.21	187.63	0.24	0.40
1	1049.29	PF 1	POST - Blocked	21.80	179.84	181.78	181.51	181.79	0.005446	0.40	54.21	187.63	0.24	0.40
1	1002.112	PF 1	PRE - 100%	21.80	179.73	181.46	181.21	181.47	0.008348	0.56	39.26	115.30	0.30	0.56
1	1002.112	PF 1	POST - 100%	21.80	179.73	181.46	181.21	181.47	0.008348	0.56	39.26	115.30	0.30	0.56
1	1002.112	PF 1	PRE - 50%	21.80	179.73	181.46	181.21	181.47	0.008348	0.56	39.26	115.30	0.30	0.56
1	1002.112	PF 1	POST - 50%	21.80	179.73	181.46	181.21	181.47	0.008348	0.56	39.26	115.30	0.30	0.56
1	1002.112	PF 1	PRE - Blocked	21.80	179.73	181.46	181.21	181.47	0.008348	0.56	39.26	115.30	0.30	0.56
1	1002.112	PF 1	POST - Blocked	21.80	179.73	181.46	181.21	181.47	0.008348	0.56	39.26	115.30	0.30	0.56
1	894.4504	PF 1	PRE - 100%	21.80	178.96	181.02	180.42	181.03	0.002457	0.30	73.85	224.04	0.16	0.30
1	894.4504	PF 1	POST - 100%	21.80	178.96	181.02	180.42	181.03	0.002457	0.30	73.85	224.04	0.16	0.30
1	894.4504	PF 1	PRE - 50%	21.80	178.96	181.02	180.42	181.03	0.002457	0.30	73.85	224.04	0.16	0.30
1	894.4504	PF 1	POST - 50%	21.80	178.96	181.02	180.42	181.03	0.002457	0.30	73.85	224.04	0.16	0.30
1	894.4504	PF 1	PRE - Blocked	21.80	178.96	181.02	180.42	181.03	0.002457	0.30	73.85	224.04	0.16	0.30
1	894.4504	PF 1	POST - Blocked	21.80	178.96	181.02	180.42	181.03	0.002457	0.30	73.85	224.04	0.16	0.30
1	856.7595	PF 1	PRE - 100%	21.80	178.92	180.78	180.66	180.81	0.026767	0.66	32.84	177.03	0.49	0.66
1	856.7595	PF 1	POST - 100%	21.80	178.92	180.78	180.66	180.81	0.026767	0.66	32.84	177.03	0.49	0.66
1	856.7595	PF 1	PRE - 50%	21.80	178.92	180.78	180.66	180.81	0.026767	0.66	32.84	177.03	0.49	0.66
1	856.7595	PF 1	POST - 50%	21.80	178.92	180.78	180.66	180.81	0.026767	0.66	32.84	177.03	0.49	0.66
1	856.7595	PF 1	PRE - Blocked	21.80	178.92	180.78	180.66	180.81	0.026767	0.66	32.84	177.03	0.49	0.66
1	856.7595	PF 1	POST - Blocked	21.80	178.92	180.78	180.66	180.81	0.026767	0.66	32.84	177.03	0.49	0.66
1	841			Culvert										
1	826.551	PF 1	PRE - 100%	21.80	178.46	180.60	180.15	180.61	0.004547	0.28	77.66	403.31	0.20	0.28
1	826.551	PF 1	POST - 100%	21.80	178.46	180.60	180.15	180.61	0.004547	0.28	77.66	403.31	0.20	0.28
1	826.551	PF 1	PRE - 50%	21.80	178.46	180.60	180.15	180.61	0.004547	0.28	77.66	403.31	0.20	0.28
1	826.551	PF 1	POST - 50%	21.80	178.46	180.60	180.15	180.61	0.004547	0.28	77.66	403.31	0.20	0.28
1	826.551	PF 1	PRE - Blocked	21.80	178.46	180.60	180.15	180.61	0.004547	0.28	77.66	403.31	0.20	0.28
1	826.551	PF 1	POST - Blocked	21.80	178.46	180.60	180.15	180.61	0.004547	0.28	77.66	403.31	0.20	0.28

HEC-RAS River: OAK Reach: 1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Chnl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)
1	771.1432	PF 1	PRE - 100%	21.80	177.96	179.77	179.77	179.89	0.101216	1.52	14.34	60.03	0.99	1.52
1	771.1432	PF 1	POST - 100%	21.80	177.96	179.77	179.77	179.89	0.101216	1.52	14.34	60.03	0.99	1.52
1	771.1432	PF 1	PRE - 50%	21.80	177.96	179.77	179.77	179.89	0.101216	1.52	14.34	60.03	0.99	1.52
1	771.1432	PF 1	POST - 50%	21.80	177.96	179.77	179.77	179.89	0.101216	1.52	14.34	60.03	0.99	1.52
1	771.1432	PF 1	PRE - Blocked	21.80	177.96	179.77	179.77	179.89	0.101216	1.52	14.34	60.03	0.99	1.52
1	771.1432	PF 1	POST - Blocked	21.80	177.96	179.77	179.77	179.89	0.101216	1.52	14.34	60.03	0.99	1.52
1	676.4317	PF 1	PRE - 100%	21.80	177.29	179.62	178.84	179.62	0.000032	0.06	368.91	482.17	0.02	0.06
1	676.4317	PF 1	POST - 100%	21.80	177.29	179.62	178.84	179.62	0.000032	0.06	368.07	482.17	0.02	0.06
1	676.4317	PF 1	PRE - 50%	21.80	177.29	179.72	178.84	179.72	0.000022	0.05	415.36	482.17	0.02	0.05
1	676.4317	PF 1	POST - 50%	21.80	177.29	179.71	178.84	179.71	0.000022	0.05	413.33	482.17	0.02	0.05
1	676.4317	PF 1	PRE - Blocked	21.80	177.29	179.79	178.84	179.79	0.000016	0.05	450.56	482.17	0.02	0.05
1	676.4317	PF 1	POST - Blocked	21.80	177.29	179.79	178.84	179.79	0.000017	0.05	448.95	482.17	0.02	0.05
1	622.1968	PF 1	PRE - 100%	21.80	177.29	179.62	179.00	179.62	0.000015	0.04	503.24	602.67	0.02	0.04
1	622.1968	PF 1	POST - 100%	21.80	177.29	179.62	179.00	179.62	0.000015	0.04	502.19	602.67	0.02	0.04
1	622.1968	PF 1	PRE - 50%	21.80	177.29	179.72	179.00	179.72	0.000011	0.04	561.51	602.67	0.01	0.04
1	622.1968	PF 1	POST - 50%	21.80	177.29	179.71	179.00	179.71	0.000011	0.04	558.96	602.67	0.01	0.04
1	622.1968	PF 1	PRE - Blocked	21.80	177.29	179.79	179.00	179.79	0.000008	0.04	605.59	602.67	0.01	0.04
1	622.1968	PF 1	POST - Blocked	21.80	177.29	179.79	179.00	179.79	0.000008	0.04	603.59	602.67	0.01	0.04
1	604			Culvert										
1	588.6833	PF 1	PRE - 100%	8.78	177.19	179.62	178.29	179.62	0.000002	0.02	491.28	482.87	0.01	0.02
1	588.6833	PF 1	POST - 100%	8.78	177.19	179.62	178.29	179.62	0.000002	0.02	490.43	482.87	0.01	0.02
1	588.6833	PF 1	PRE - 50%	15.29	177.19	179.72	178.58	179.72	0.000005	0.03	537.78	482.87	0.01	0.03
1	588.6833	PF 1	POST - 50%	15.29	177.19	179.71	178.58	179.71	0.000005	0.03	535.71	482.87	0.01	0.03
1	588.6833	PF 1	PRE - Blocked	21.80	177.19	179.79	178.93	179.79	0.000007	0.04	573.26	482.87	0.01	0.04
1	588.6833	PF 1	POST - Blocked	21.80	177.19	179.79	178.93	179.79	0.000007	0.04	571.65	482.87	0.01	0.04
1	525.9264	PF 1	PRE - 100%	8.78	179.08	179.62		179.62	0.000564	0.13	66.44	221.89	0.08	0.13
1	525.9264	PF 1	POST - 100%	8.78	179.08	179.62		179.62	0.000573	0.13	66.06	221.15	0.08	0.13
1	525.9264	PF 1	PRE - 50%	15.29	179.08	179.71		179.71	0.000871	0.17	89.98	285.15	0.10	0.17
1	525.9264	PF 1	POST - 50%	15.29	179.08	179.71		179.71	0.000871	0.17	88.76	275.33	0.10	0.17
1	525.9264	PF 1	PRE - Blocked	21.80	179.08	179.79		179.79	0.001081	0.19	113.36	350.27	0.11	0.19
1	525.9264	PF 1	POST - Blocked	21.80	179.08	179.78		179.78	0.001113	0.19	112.16	348.72	0.11	0.19
1	497.9264	PF 1	PRE - 100%	8.78	179.00	179.58		179.59	0.003905	0.25	34.65	186.16	0.19	0.25
1	497.9264	PF 1	POST - 100%	8.78	179.00	179.58		179.58	0.003456	0.24	37.04	200.84	0.18	0.24
1	497.9264	PF 1	PRE - 50%	15.29	179.00	179.66		179.67	0.004527	0.29	51.91	248.07	0.21	0.29
1	497.9264	PF 1	POST - 50%	15.29	179.00	179.66		179.67	0.003968	0.28	55.19	262.09	0.19	0.28
1	497.9264	PF 1	PRE - Blocked	21.80	179.00	179.73		179.73	0.004221	0.31	70.20	293.48	0.20	0.31
1	497.9264	PF 1	POST - Blocked	21.80	179.00	179.73		179.73	0.003740	0.29	74.15	307.55	0.19	0.29
1	437.9264	PF 1	PRE - 100%	8.78	178.89	179.55		179.55	0.000217	0.08	103.59	328.44	0.05	0.08
1	437.9264	PF 1	POST - 100%	8.78	178.89	179.55		179.55	0.000217	0.08	103.59	328.44	0.05	0.08
1	437.9264	PF 1	PRE - 50%	15.29	178.89	179.60		179.60	0.000450	0.13	121.80	370.49	0.07	0.13
1	437.9264	PF 1	POST - 50%	15.29	178.89	179.60		179.60	0.000450	0.13	121.80	370.49	0.07	0.13
1	437.9264	PF 1	PRE - Blocked	21.80	178.89	179.65		179.65	0.000664	0.16	140.28	414.70	0.09	0.16
1	437.9264	PF 1	POST - Blocked	21.80	178.89	179.65		179.65	0.000664	0.16	140.28	414.70	0.09	0.16
1	397.9264	PF 1	PRE - 100%	8.78	179.03	179.53		179.53	0.002390	0.20	44.68	244.23	0.15	0.20
1	397.9264	PF 1	POST - 100%	8.78	179.03	179.53		179.53	0.002390	0.20	44.68	244.23	0.15	0.20
1	397.9264	PF 1	PRE - 50%	15.29	179.03	179.56	179.37	179.56	0.004426	0.30	51.82	244.23	0.20	0.30
1	397.9264	PF 1	POST - 50%	15.29	179.03	179.56	179.37	179.56	0.004426	0.30	51.82	244.23	0.20	0.30
1	397.9264	PF 1	PRE - Blocked	21.80	179.03	179.58		179.59	0.006067	0.37	58.34	244.23	0.24	0.37
1	397.9264	PF 1	POST - Blocked	21.80	179.03	179.58		179.59	0.006067	0.37	58.34	244.23	0.24	0.37
1	297.9264	PF 1	PRE - 100%	21.80	176.34	177.86	177.86	178.05	0.088774	1.92	11.34	30.05	1.00	1.92
1	297.9264	PF 1	POST - 100%	21.80	176.34	177.86	177.86	178.05	0.088774	1.92	11.34	30.05	1.00	1.92
1	297.9264	PF 1	PRE - 50%	21.80	176.34	177.86	177.86	178.05	0.088774	1.92	11.34	30.05	1.00	1.92
1	297.9264	PF 1	POST - 50%	21.80	176.34	177.86	177.86	178.05	0.088774	1.92	11.34	30.05	1.00	1.92
1	297.9264	PF 1	PRE - Blocked	21.80	176.34	177.86	177.86	178.05	0.088774	1.92	11.34	30.05	1.00	1.92
1	297.9264	PF 1	POST - Blocked	21.80	176.34	177.86	177.86	178.05	0.088774	1.92	11.34	30.05	1.00	1.92
1	215.1441	PF 1	PRE - 100%	21.80	176.11	178.05	177.25	178.06	0.002572	0.40	53.83	105.16	0.18	0.40
1	215.1441	PF 1	POST - 100%	21.80	176.11	178.05	177.25	178.06	0.002572	0.40	53.83	105.16	0.18	0.40
1	215.1441	PF 1	PRE - 50%	21.80	176.11	178.05	177.25	178.06	0.002572	0.40	53.83	105.16	0.18	0.40
1	215.1441	PF 1	POST - 50%	21.80	176.11	178.05	177.25	178.06	0.002572	0.40	53.83	105.16	0.18	0.40
1	215.1441	PF 1	PRE - Blocked	21.80	176.11	178.05	177.25	178.06	0.002572	0.40	53.83	105.16	0.18	0.40
1	215.1441	PF 1	POST - Blocked	21.80	176.11	178.05	177.25	178.06	0.002572	0.40	53.83	105.16	0.18	0.40
1	155.681	PF 1	PRE - 100%	21.80	176.11	178.02	177.26	178.02	0.000309	0.18	124.14	173.45	0.07	0.18
1	155.681	PF 1	POST - 100%	21.80	176.11	178.02	177.26	178.02	0.000309	0.18	124.14	173.45	0.07	0.18
1	155.681	PF 1	PRE - 50%	21.80	176.11	178.02	177.26	178.02	0.000309	0.18	124.14	173.45	0.07	0.18
1	155.681	PF 1	POST - 50%	21.80	176.11	178.02	177.26	178.02	0.000309	0.18	124.14	173.45	0.07	0.18
1	155.681	PF 1	PRE - Blocked	21.80	176.11	178.02	177.26	178.02	0.000309	0.18	124.14	173.45	0.07	0.18
1	155.681	PF 1	POST - Blocked	21.80	176.11	178.02	177.26	178.02	0.000309	0.18	124.14	173.45	0.07	0.18
1	113.4778	PF 1	PRE - 100%	21.80	176.29	178.01	177.06	178.01	0.000243	0.18	124.17	144.97	0.06	0.18
1	113.4778	PF 1	POST - 100%	21.80	176.29	178.01	177.06	178.01	0.000243	0.18	124.17	144.97	0.06	0.18
1	113.4778	PF 1	PRE - 50%	21.80	176.29	178.01	177.06	178.01	0.000243	0.18	124.17	144.97	0.06	0.18
1	113.4778	PF 1	POST - 50%	21.80	176.29	178.01	177.06	178.01	0.000243	0.18	124.17	144.97	0.06	0.18
1	113.4778	PF 1	PRE - Blocked	21.80	176.29	178.01	177.06	178.01	0.000243	0.18	124.17	144.97	0.06	0.18
1	113.4778	PF 1	POST - Blocked	21.80	176.29	178.01	177.06	178.01	0.000243	0.18	124.17	144.97	0.06	0.18
1	78.65643	PF 1	PRE - 100%	21.80	176.11	178.00	176.77	178.00	0.000168	0.11	192.01	326.61	0.05	0.11
1	78.65643	PF 1	POST - 100%	21.80	176.11	178.00	176.77	178.00	0.000168	0.11	192.01	326.61	0.05	0.11
1	78.65643	PF 1	PRE - 50%	21.80	176.11	178.00	176.77	178.00	0.000168	0.11	192.01	326.61	0.05	0.11

HEC-RAS River: OAK Reach: 1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Vel Chnl
				(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)
1	78.65643	PF 1	POST - 50%	21.80	176.11	178.00	176.77	178.00	0.000168	0.11	192.01	326.61	0.05	0.11
1	78.65643	PF 1	PRE - Blocked	21.80	176.11	178.00	176.77	178.00	0.000168	0.11	192.01	326.61	0.05	0.11
1	78.65643	PF 1	POST - Blocked	21.80	176.11	178.00	176.77	178.00	0.000168	0.11	192.01	326.61	0.05	0.11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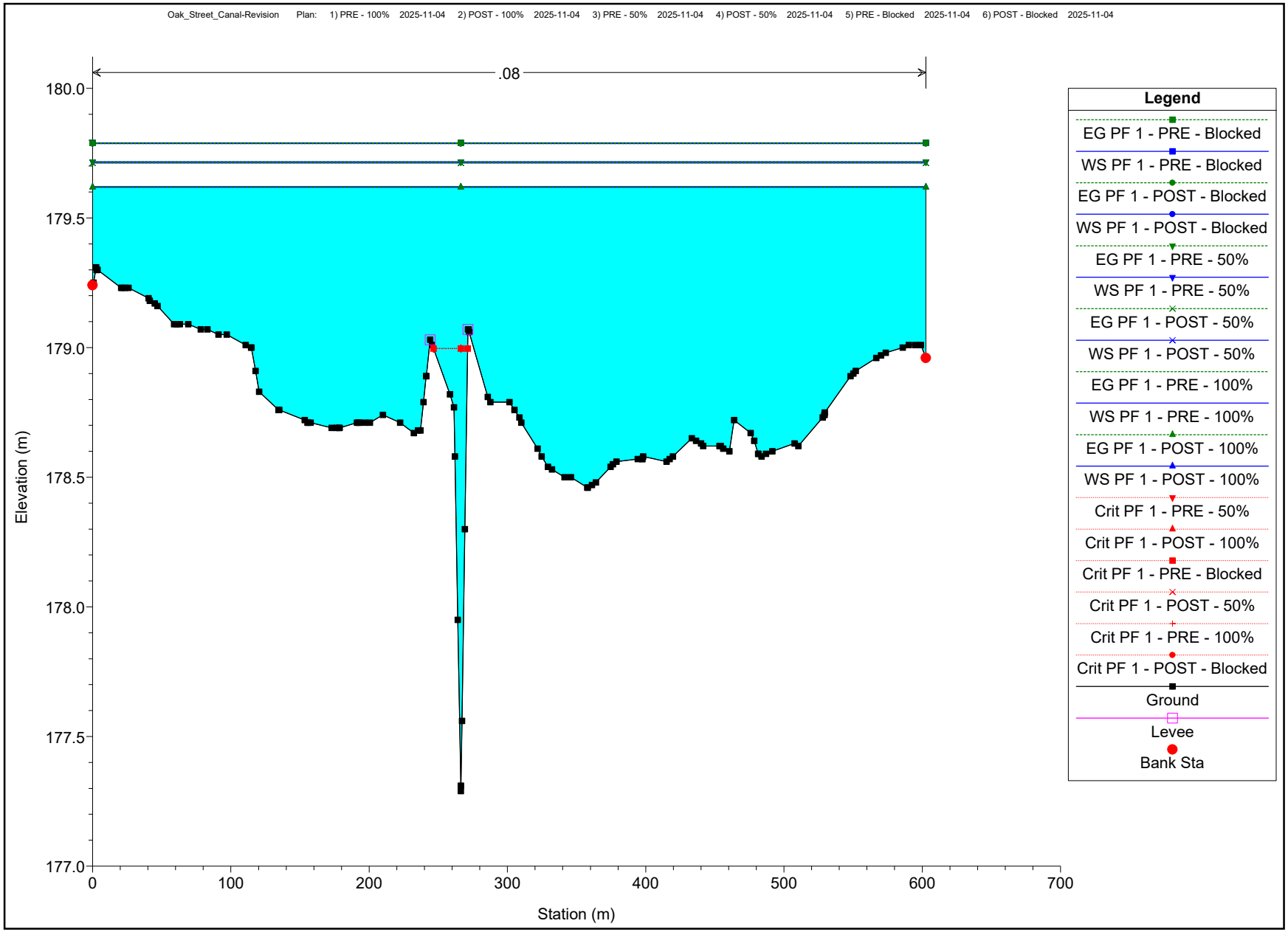
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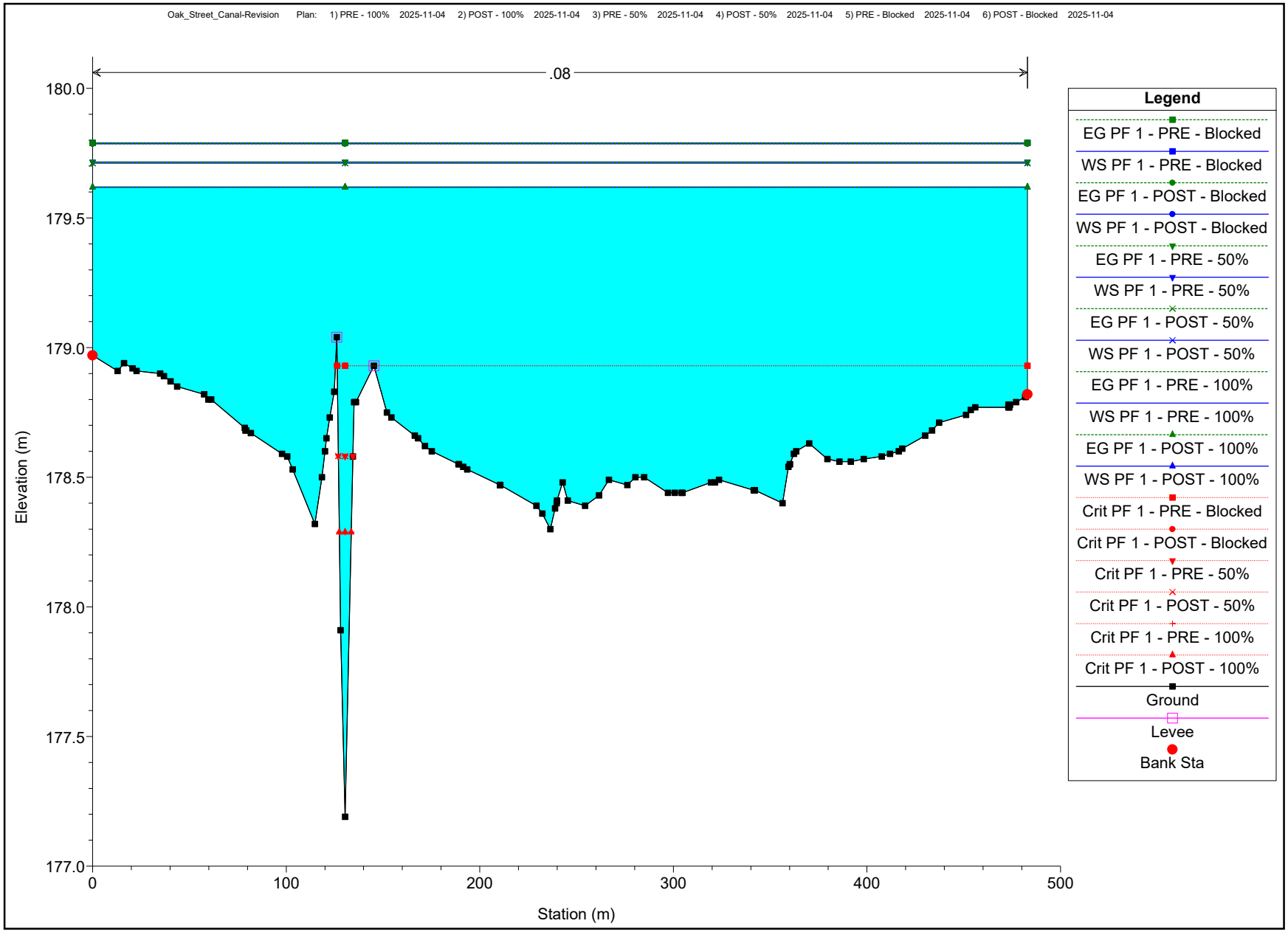
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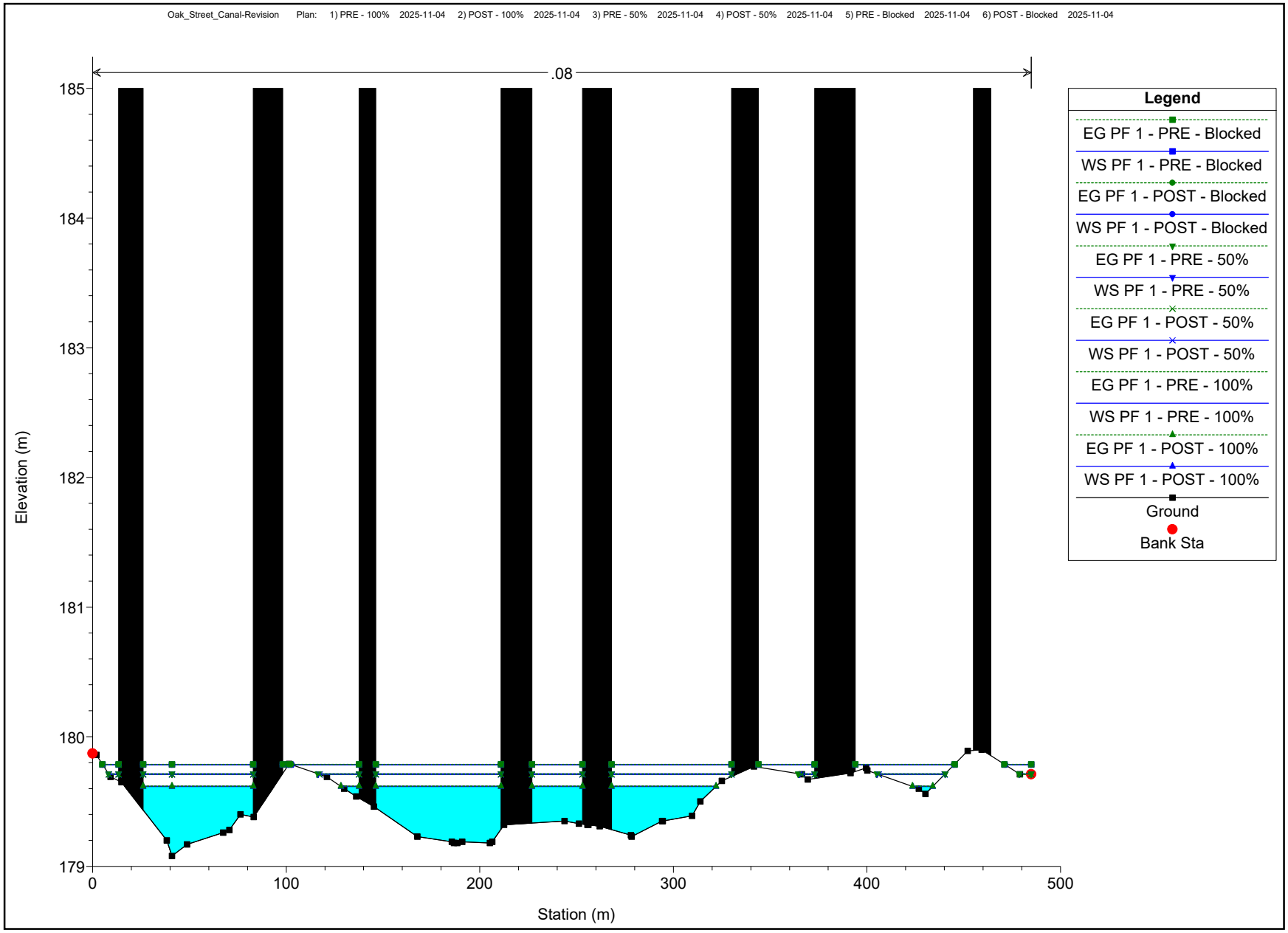
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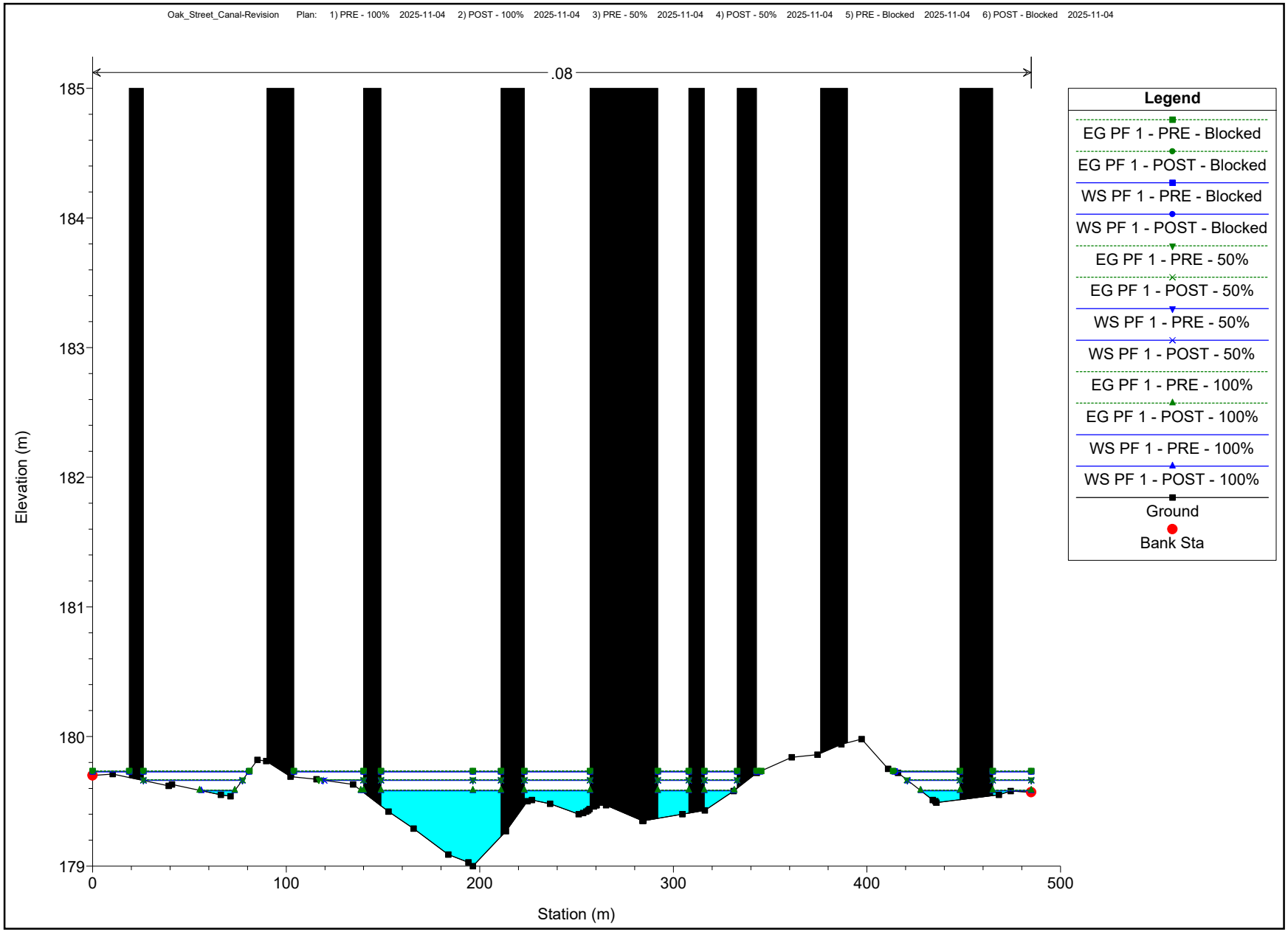
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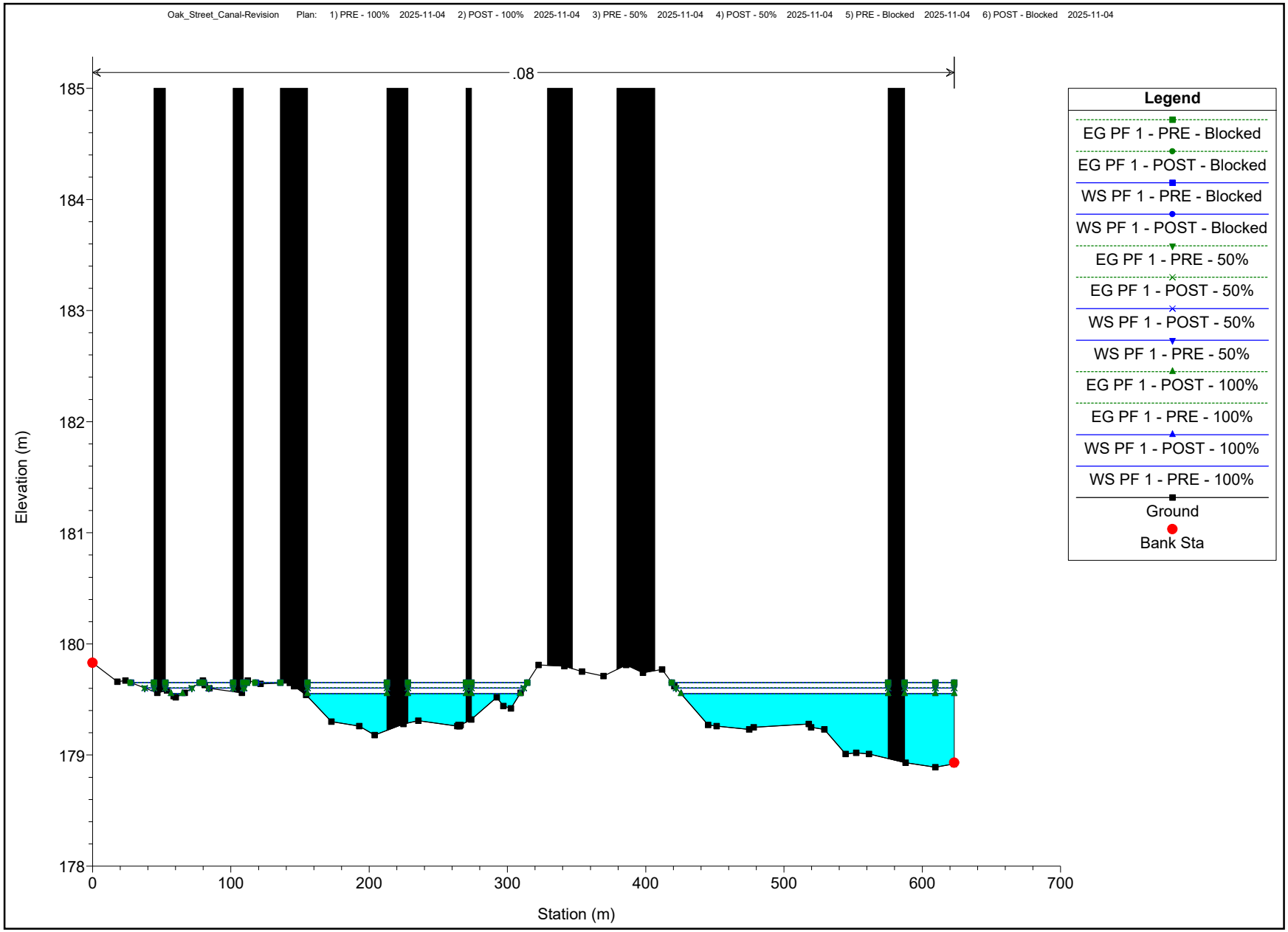
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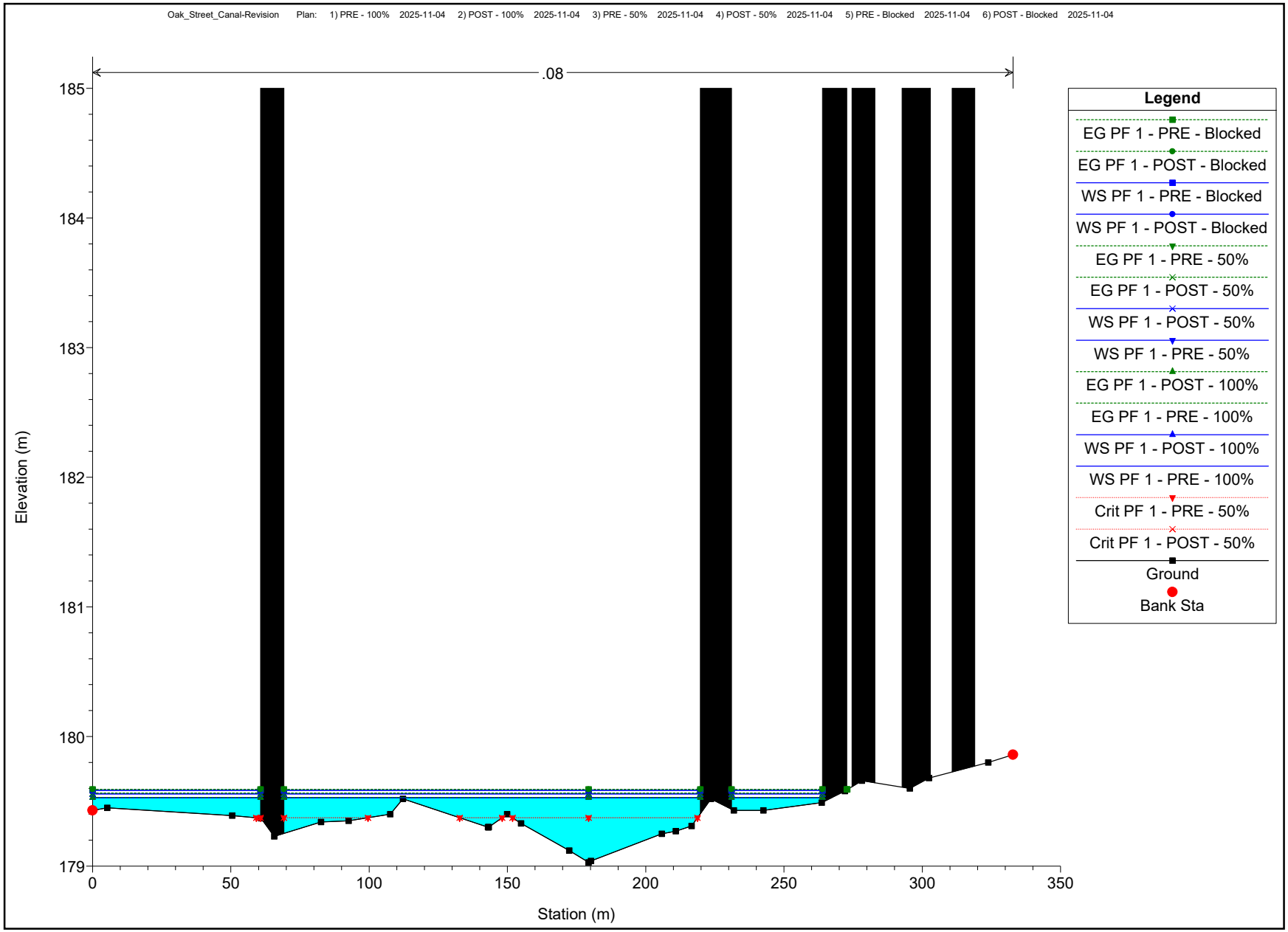
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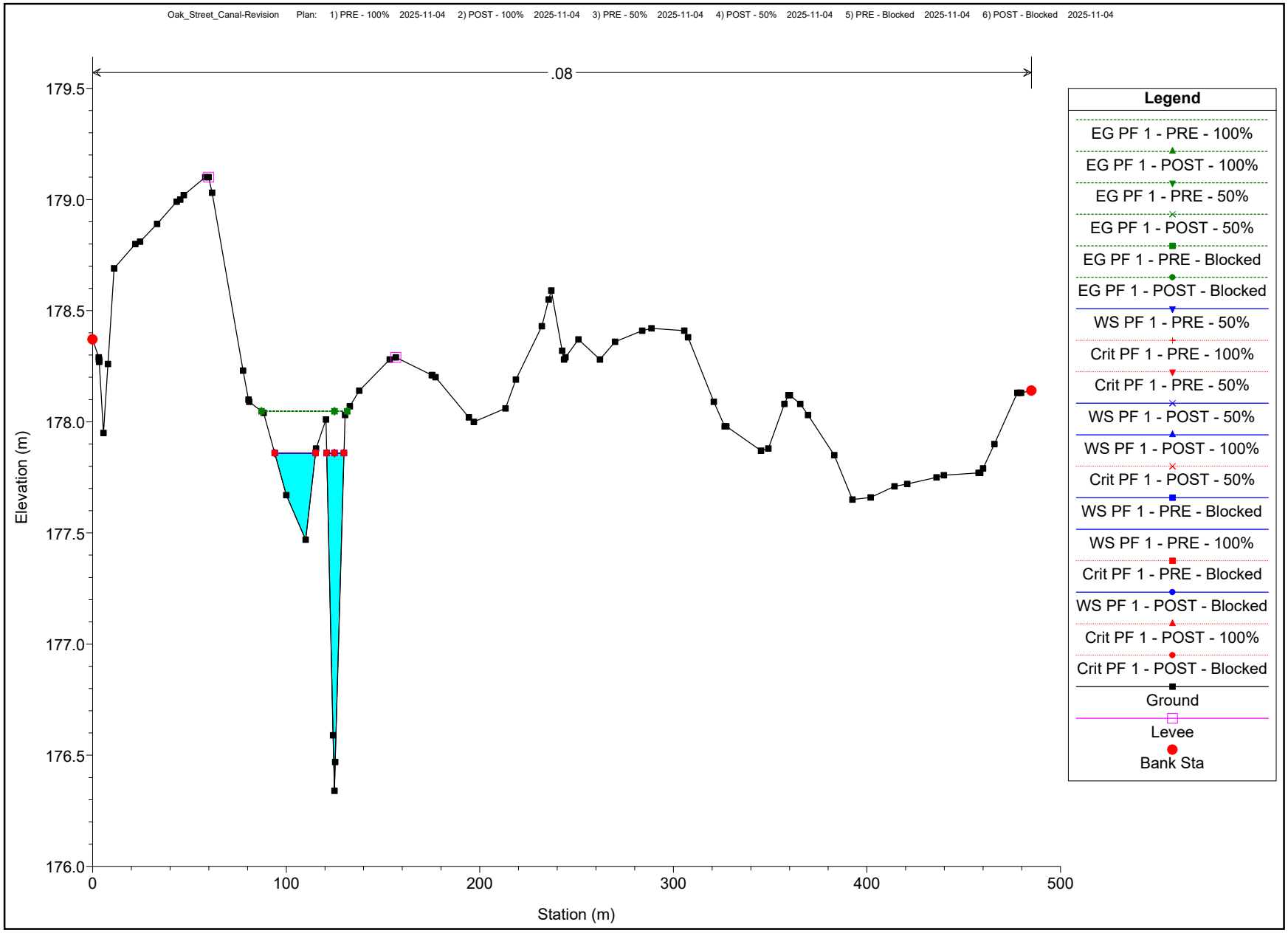
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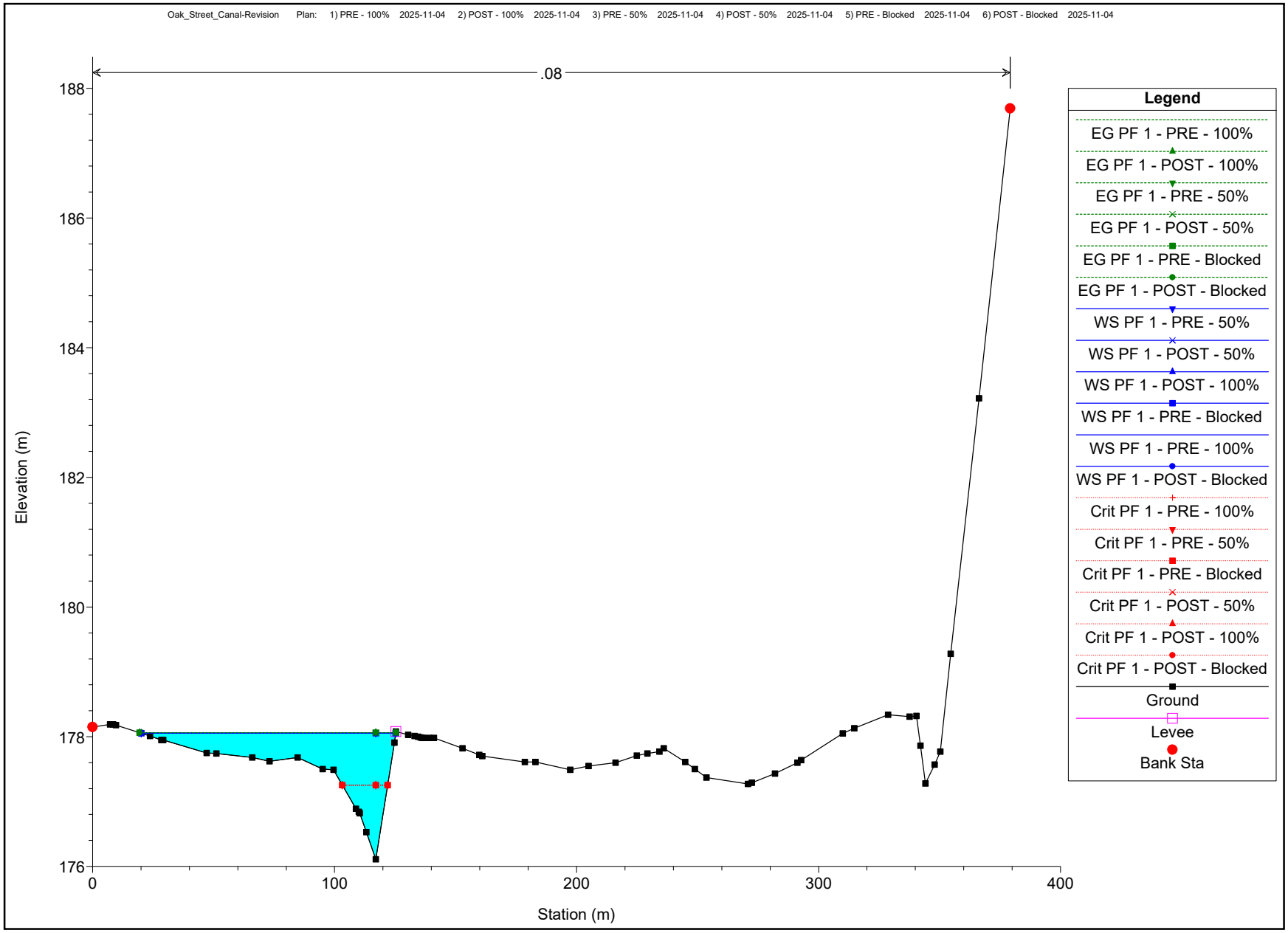
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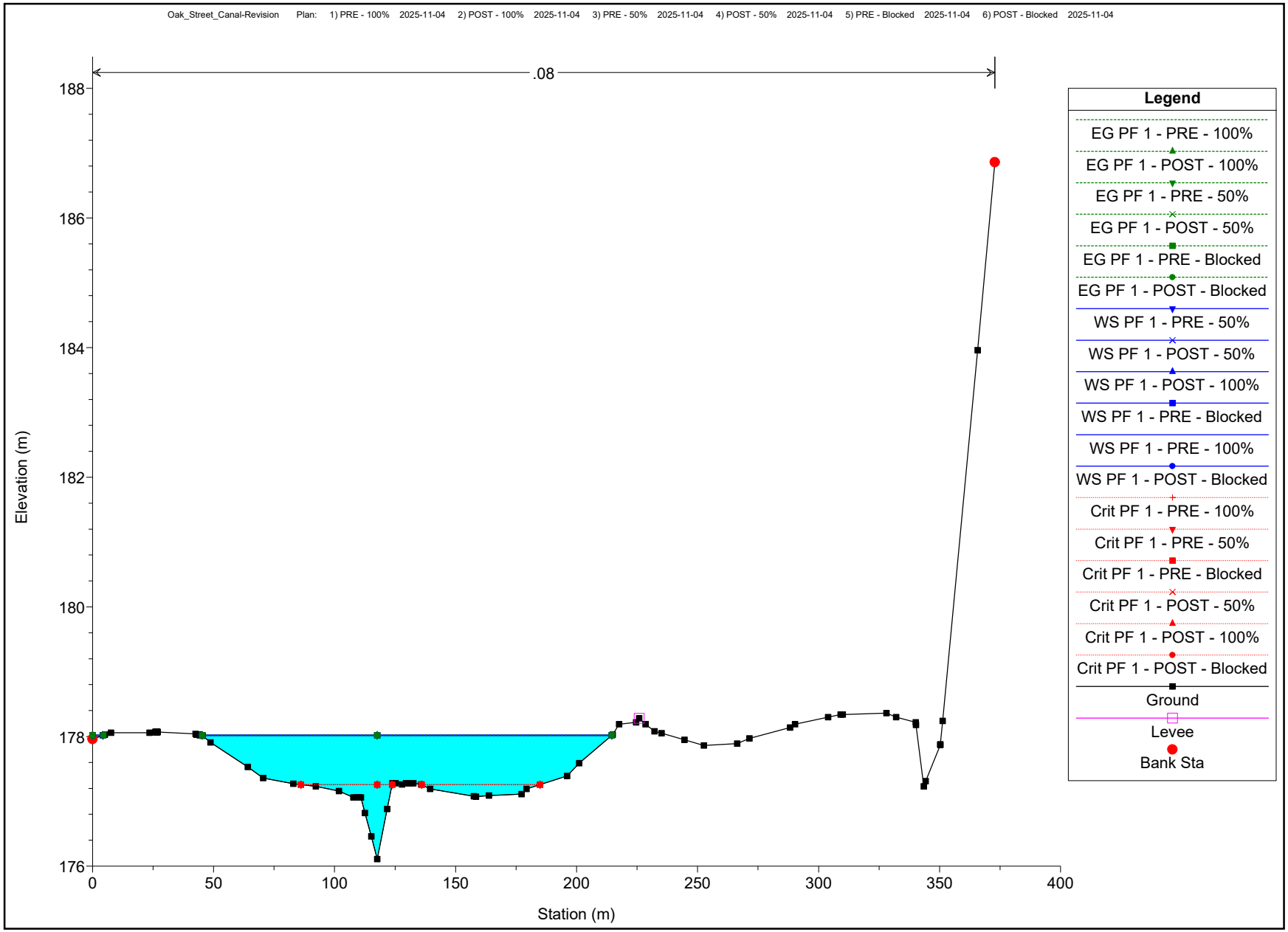
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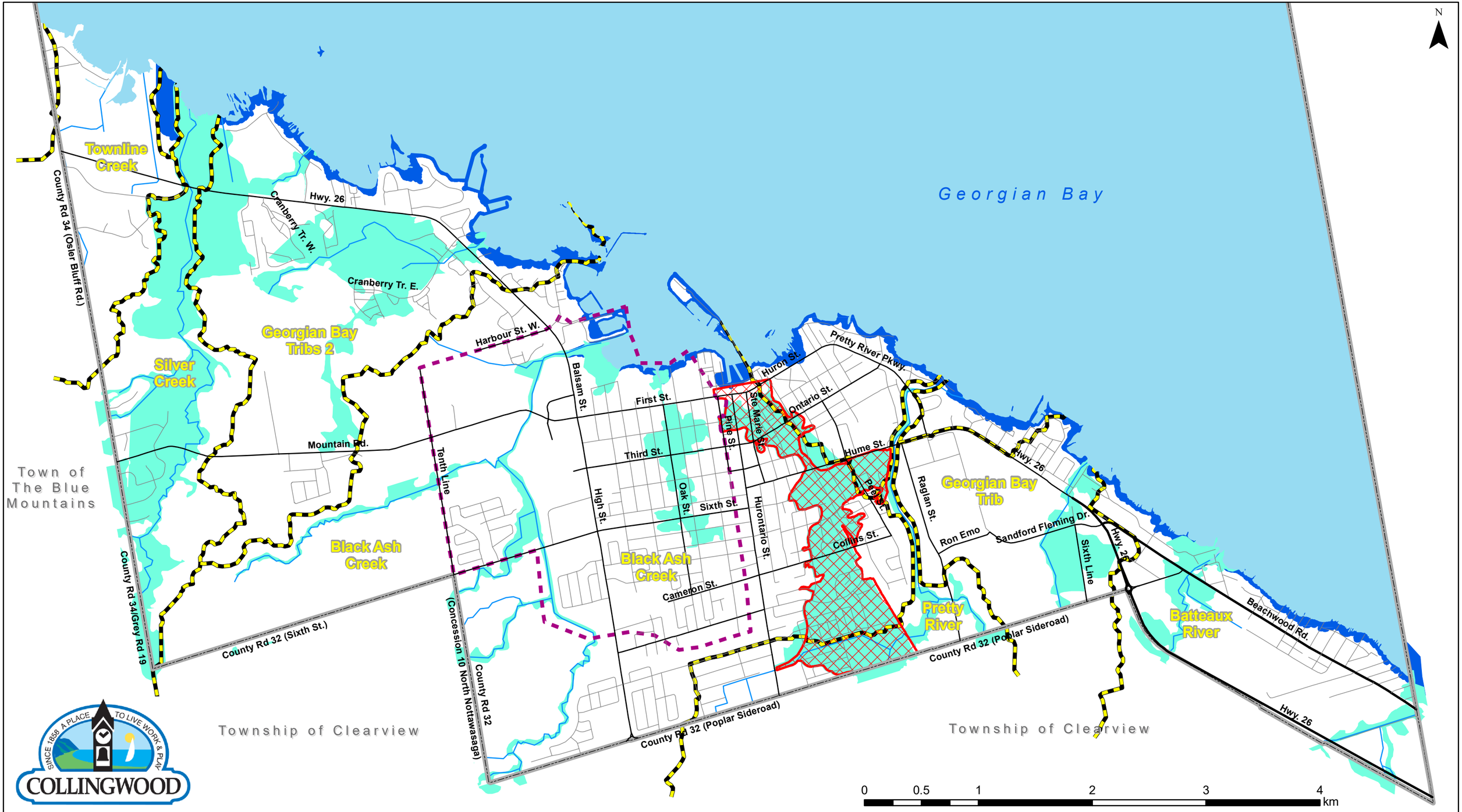
Appendix I

Town of Collingwood
Natural Hazards Plan



Official Plan of the Town of Collingwood Schedule '3.1' Natural Hazards

- Shoreline Flooding Hazards (NVCA jurisdiction)
- Floodplain Limits (NVCA jurisdiction)
- Subwatershed Boundaries
- Pretty River Flood Fringe - Two-Zone Concept
- Black Ash Creek Special Policy Area
- Municipal Boundary

NOTES:
1. Floodplain and shoreline hazard mapping does not replace the Conservation Authority regulatory jurisdiction. Please consult with the appropriate Conservation Authority for permitting requirements within areas regulated under the Conservation Authorities Act.
2. Townline Creek subwatershed:
Specific floodplain data is not available from the Grey Sauble Conservation Authority.

The Planning Partnership
PLAN B Natural Heritage
Plan-It Geographical

December 4, 2023

Appendix J

OIL AND Grit Separator Manual and ETV Verification

Stormceptor®

Rinker MATERIALS® A QUIKRETE® COMPANY

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

08/15/2025

Province:	Ontario
City:	Collingwood
Nearest Rainfall Station:	BARRIE-ORO
Climate Station Id:	6117700
Years of Rainfall Data:	14

Site Name:	29 and 45 Birch St.

Drainage Area (ha):	0.17
% Imperviousness:	100.00

Runoff Coefficient 'c': 0.90

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.0
Estimated Water Quality Flow Rate (L/s):	4.99
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	

Project Name:	29 and 45 Birch St.
Project Number:	24242
Designer Name:	Brandon O'Leary
Designer Company:	Rinker Pipe
Designer Email:	brandon.oleary@RinkerPipe.com
Designer Phone:	905-630-0359
EOR Name:	Dennis Bozek
EOR Company:	Pearson Engineering Ltd.
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	95
EFO5	97
EFO6	99
EFO8	100
EFO10	100
EFO12	100

Recommended Stormceptor EFO Model: EFO4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 95

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

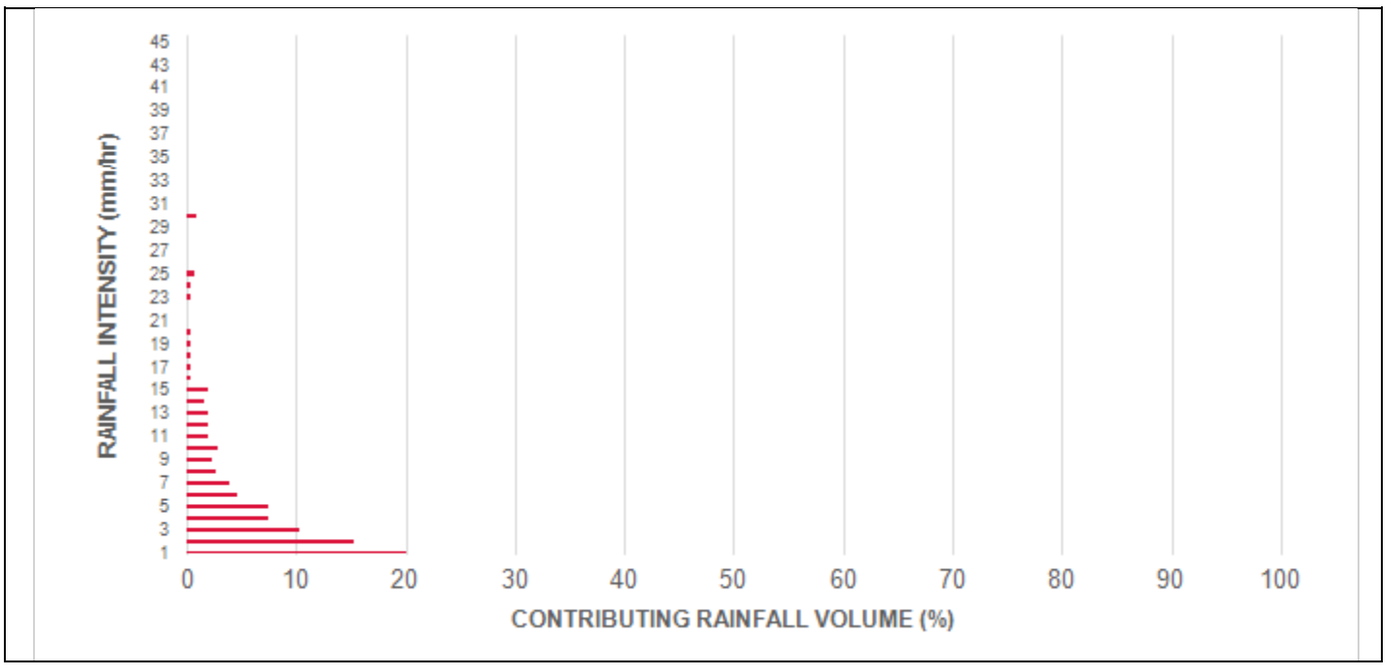
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

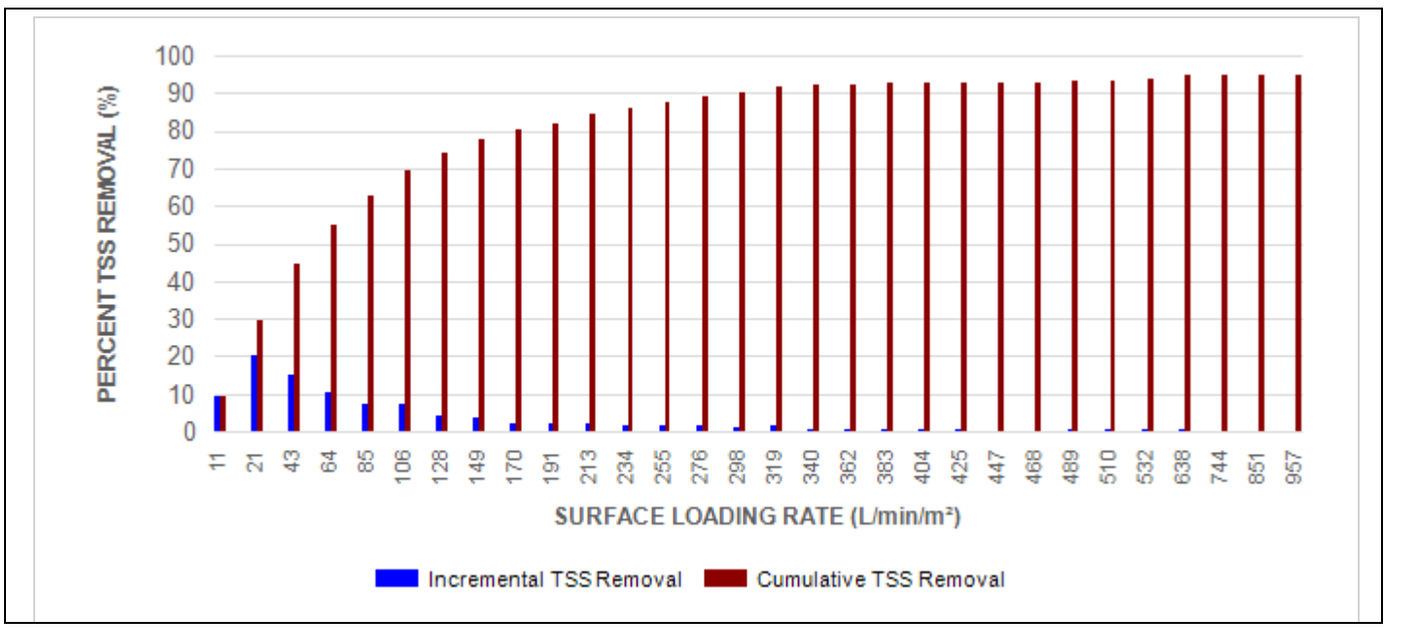
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.4	9.4	0.21	13.0	11.0	100	9.4	9.4
1.00	20.0	29.4	0.43	26.0	21.0	100	20.0	29.4
2.00	15.3	44.7	0.85	51.0	43.0	100	15.3	44.7
3.00	10.4	55.1	1.28	77.0	64.0	100	10.4	55.1
4.00	7.5	62.6	1.70	102.0	85.0	98	7.4	62.5
5.00	7.5	70.1	2.13	128.0	106.0	96	7.2	69.7
6.00	4.7	74.9	2.55	153.0	128.0	93	4.4	74.1
7.00	4.0	78.8	2.98	179.0	149.0	91	3.6	77.7
8.00	2.7	81.6	3.40	204.0	170.0	87	2.4	80.1
9.00	2.3	83.9	3.83	230.0	191.0	84	1.9	82.1
10.00	2.8	86.6	4.25	255.0	213.0	83	2.3	84.3
11.00	1.9	88.6	4.68	281.0	234.0	82	1.6	85.9
12.00	1.9	90.5	5.10	306.0	255.0	81	1.6	87.5
13.00	1.9	92.4	5.53	332.0	276.0	80	1.5	89.0
14.00	1.6	94.0	5.95	357.0	298.0	79	1.3	90.3
15.00	2.0	96.0	6.38	383.0	319.0	78	1.5	91.8
16.00	0.3	96.3	6.81	408.0	340.0	77	0.2	92.0
17.00	0.3	96.6	7.23	434.0	362.0	76	0.2	92.2
18.00	0.3	96.9	7.66	459.0	383.0	75	0.2	92.5
19.00	0.3	97.2	8.08	485.0	404.0	74	0.2	92.7
20.00	0.3	97.5	8.51	510.0	425.0	73	0.2	92.9
21.00	0.0	97.5	8.93	536.0	447.0	72	0.0	92.9
22.00	0.0	97.5	9.36	561.0	468.0	71	0.0	92.9
23.00	0.4	97.9	9.78	587.0	489.0	70	0.3	93.2
24.00	0.4	98.3	10.21	612.0	510.0	69	0.3	93.5
25.00	0.8	99.1	10.63	638.0	532.0	68	0.6	94.0
30.00	0.9	100.0	12.76	766.0	638.0	64	0.6	94.6
35.00	0.0	100.0	14.89	893.0	744.0	64	0.0	94.6
40.00	0.0	100.0	17.01	1021.0	851.0	63	0.0	94.6
45.00	0.0	100.0	19.14	1148.0	957.0	62	0.0	94.6
						Estimated Net Annual Sediment (TSS) Load Reduction =		**95 %**

Climate Station ID: 6117700 *Years of Rainfall Data*: 14

RAINFALL DATA FROM BARRIE-ORO RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

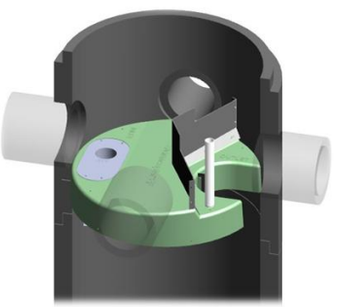
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

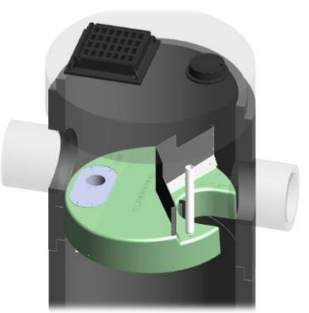
DESIGN FLEXIBILITY

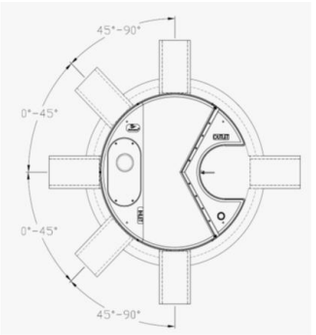
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

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STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental

management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

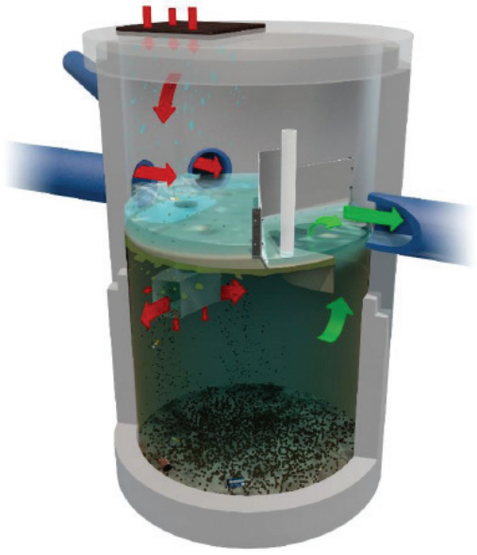
Rinker Materials Quality Assurance Program (QAP)

Stormceptor® Quality Assurance Program

The QAP provides the following to ensure Stormceptor's top performance:

- Six inspections over a 5-year period, cleaning not included
- First inspection when installed
- At 6 months a second inspection
- Inspections every 12 months thereafter for 5 years
- Oil and sediment level are documented along with maintenance recommendations

All QAP programs are completed by Minotaur.



We've got you covered.

Your QAP starts with post construction inspection to ensure the unit has been installed as designed. The unit is recorded in our expansive database summarizing all installed units with their GPS locations. When you inspect and maintain these OGS units, you play an important part in protecting the environment, while ensuring your stormwater assets remain in compliance with environmental regulations. Rinker Materials industry leading line of Stormceptor products are one of the lowest-cost OGS units in the market, functioning effectively in all aspects of keeping pollutants out of our waterways. The Rinker Materials' Quality Assurance Program is in place at no extra cost to the asset's owner, providing inspections for up to 5 years.

Improving products, improving service.

Our commitment to providing the best storm water quality devices continues as we have recently expanded our already impressive line of Stormceptor® products with the addition of the ISO14034/ETV verified Stormceptor EF and EFO - simply the most cost competitive stormwater quality device on the market. Now we're improving our service by ensuring inspections on our entire Stormceptor product line for up to 5 years after installation.

At Rinker Materials, we understand that maintaining a high standard of water quality is crucial to the environment and to our lives. That's why, 20 years ago, we introduced a 2-year inspection plan with every Stormceptor unit sold. As municipalities continue to focus on OGS units operating as designed, we felt it was time to strengthen our program even further. We are now offering at no additional cost to the asset's owner, a 5- year QAP with every Stormceptor unit to ensure water quality continues to be at its best.

2099 Roseville Road, Cambridge, On N1R 5S3 | 519.622.7574

Rinker Materials Quality Assurance Program (QAP)

Jellyfish® Quality Assurance Program

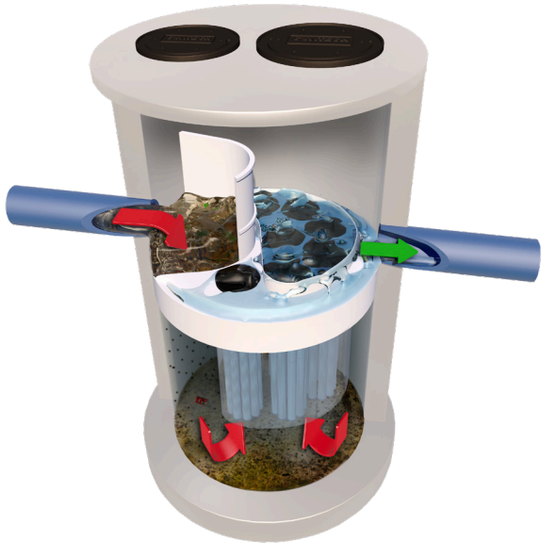
The activation of a Jellyfish Unit is the procedure to bring the installed unit into full operation in the post construction phase.

- Minotaur Services Limited is the company licensed by Rinker Materials that performs the Jellyfish Unit's filter installation.
- The installation of the filter cartridges can only be done once the unit is installed and cleaned out by the contractor.

Project site completed: (asphalt/landscaping) an activation form must be completed and submitted.

- Our partner Minotaur can complete the activation within 5 weeks of initial contact.

Post-activation sediment level inspection: is scheduled and performed by Minotaur 6 – 12 months after the initial system activation. The owner will then be informed of the sediment level.



We've got you covered.

When you inspect and maintain filtration units, you play an important part in protecting the environment, while ensuring your stormwater assets remain in compliance with environmental regulations.

Rinker Materials line of stormwater products are known as a leader in the market, functioning effectively in all aspects of keeping pollutants out of our waterways. The Rinker Materials Quality Assurance Program is in place at no extra cost to the asset's owner.

Improving products, improving service.

At Rinker Materials, we understand that maintaining a high standard of water quality is crucial to the environment and to our lives. Now we're improving our service by ensuring proper activation of the Jellyfish unit after installation.

2099 Roseville Road, Cambridge, On N1R 5S3 | 519.622.7574

STANDARD SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE WITH THIRD-PARTY VERIFIED LIGHT LIQUID RE-ENTRAINMENT SIMULATION PERFORMANCE TESTING RESULTS

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, designing, maintaining, and constructing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, **specifically an OGS device that has been third-party tested for oil and fuel retention capability using a protocol for light liquid re-entrainment simulation testing, with testing results and a Statement of Verification in accordance with all the provisions of ISO 14034 Environmental Management – Environmental Technology Verification (ETV)**. Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with OGS internal components correctly installed within the system, watertight sealed to the precast concrete prior to arrival to the project site.

1.2 REFERENCE STANDARDS

1.2.1 For Canadian projects only, the following reference standards apply:

CAN/CSA-A257.4-14: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets
CAN/CSA-A257.4-14: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings
CAN/CSA-S6-00: Canadian Highway Bridge Design Code

1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM D2563: Standard Practice for Classification of Visual Defects in Reinforced Plastics

1.3 SHOP DRAWINGS

1.3.1 Shop drawings shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail the precast concrete components and OGS internal components prior to shipment, including the sequence for installation.

1.3.2 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 OGS internal components supplied by the Manufacturer for attachment to the precast concrete vessel shall be pre-fabricated, bolted to the precast and watertight sealed to the precast vessel surface prior to site delivery to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent materials damage on site.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The OGS vessel shall be cylindrical and constructed from precast concrete riser and slab components.

2.1.2 The precast concrete OGS internal components shall include a fiberglass insert bolted and watertight sealed inside the precast concrete vessel, prior to site delivery. Primary internal components that are to be anchored and watertight sealed to the precast concrete vessel shall be done so only by the Manufacturer prior to arrival at the job site to ensure product quality.

2.1.3 The OGS shall be allowed to be specified and have the ability to function as a 240-degree bend structure in the stormwater drainage system, or as a junction structure.

2.1.4 The OGS to be specified shall have the capability to accept influent flow from an inlet grate and an inlet pipe.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

2.3 GASKETS

Only profile neoprene or nitrile rubber gaskets that are oil resistant shall be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.4-14. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials.

2.4 JOINTS

The concrete joints shall be watertight and meet the design criteria according to ASTM C-990. For projects where joints require gaskets, the concrete joints shall be watertight and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

2.5 FRAMES AND COVERS

Frames and covers shall be manufactured in accordance with State/Provincial or local requirements for inspection and maintenance access purposes. A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

2.6 PRECAST CONCRETE

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

2.7 FIBERGLASS

The fiberglass portion of the OGS device shall be constructed in accordance with ASTM D2563, and in accordance with the PS15-69 manufacturing standard, and shall only be installed, bolted and watertight sealed to the precast concrete by the Manufacturer prior to arrival at the project site to ensure product quality.

2.8 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a fiberglass insert for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The total sediment storage capacity shall be a minimum 40 ft^3 (1.1 m^3). The total petroleum hydrocarbon storage capacity shall be a minimum 50 gallons (189 liters). The access opening to the sump of the OGS device for periodic inspection and maintenance purposes shall be a minimum 16 inches (406 mm) in diameter.

2.9 LADDERS

Ladder rungs shall be provided upon request or to comply with State/Provincial or local requirements.

2.10 INSPECTION

All precast concrete sections shall be level and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 HYDROLOGY AND RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the average annual runoff volume, unless otherwise stated by the Engineer of Record, using historical rainfall data. Rainfall data sets should be comprised of a minimum 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases a minimum 5-year period of rainfall data.

3.3 ANNUAL (TSS) SEDIMIMENT LOAD AND STORAGE CAPACITY

The OGS device shall be capable of removing and have sufficient storage capacity for the calculated annual total suspended solids (TSS) mass load and volume without scouring previously captured pollutants prior to maintenance being required. The annual (TSS) sediment load and volume transported from the drainage area should be calculated and compared to the OGS device's available storage capacity by the specifying Engineer to ensure adequate capacity between maintenance cycles. Sediment loadings shall be determined by land use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater based on land use, as noted in Table 1 below.

Annual sediment volume calculations shall be performed using the projected average annual treated runoff volume, a typical sediment bulk density of 1602 kg/m^3 (100 lbs/ft^3) and an assumed Event Mean Concentration (EMC) of 125 mg/L TSS in the runoff, or as otherwise determined by the Engineer of Record.

Example calculation for a 1.3-hectares parking lot site:

- 1.28 meters of rainfall depth, per year
- 1.3 hectares of 100% impervious drainage area
- EMC of 125 mg/L TSS in runoff
- Treatment of 90% of the average annual runoff volume
- Target average annual TSS removal rate of 60% by OGS

Annual Runoff Volume:

- 1.28 m rain depth x 1.3 ha x 10,000 m^2/ha= 16,640 m^3 of runoff volume
- 16,640 m^3 x 1000 L/m^3 = 16,640,000 L of runoff volume
- 16,640,000 L x 0.90 = 14,976,000 L to be treated by OGS unit

Annual Sediment Mass and Sediment Volume Load Calculation:

- 14,976,000 L x 125 mg/L x kg/1,000,000 mg = 1,872 kg annual sediment mass
- 1,872 kg x m^3/1602 kg = 1.17 m^3 annual sediment volume
- 1.17 m^3 x 60% TSS removal rate by OGS = 0.70 m^3 minimum expected annual storage requirement in OGS

As a guideline, the U.S. EPA has determined typical annual sediment loads per drainage area for various sites by land use (see Table 1). Certain States, Provinces and local jurisdictions have also established such guidelines.

Table 1 – Annual Mass Sediment Loading by Land Use

	Commercial	Parking Lot	Residential			Highways	Industrial	Shopping Center
			High	Med.	Low			
(lbs/acre/yr)	1,000	400	420	250	10	880	500	440
(kg/hectare/yr)	1,124	450	472	281	11	989	562	494

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

3.4 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in Table 2, Section 3.5, and based on third-party performance testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol *Procedure for Laboratory Testing of Oil-Grit Separators*, as follows:

3.4.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.4.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.4.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.4.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 3.3.

3.4.5 The Peclet Number is not an approved method or model for calculating TSS removal, sizing, or scaling OGS devices.

3.4.6 If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates:

- Canadian ETV or ISO 14034 ETV Verification Statement which verifies third-party performance testing conducted in accordance with the **Procedure for Laboratory Testing of Oil-Grit Separators,** including the Light Liquid Re-entrainment Simulation Testing.
- Equal or better sediment (TSS) removal of the PSD specified in Table 2 at equivalent surface loading rates, as compared to the OGS device specified herein.
- Equal or better Light Liquid Re-entrainment Simulation Test results (using low-density polyethylene beads as a surrogate for light liquids such as oil and fuel) at equivalent surface loading rates, as compared to the OGS device specified herein. However, an alternative OGS device shall not be allowed as a substitute if the Light Liquid Re-entrainment Simulation Test was performed with screening components within the OGS device that are effective at retaining the low-density polyethylene beads, but would not be expected to retain light liquids such as oil and fuel.
- Equal or greater sediment storage capacity, as compared to the OGS device specified herein.
- Supporting documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall be sized to achieve the Engineer-specified average annual percent sediment (TSS) removal based solely on the test sediment used in the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** This test sediment is comprised of inorganic ground silica with a specific gravity of 2.65, uniformly mixed, and containing a broad range of particle sizes as specified in Table 2. No alternative PSDs or deviations from Table 2 shall be accepted.

Table 2
Canadian ETV Program Procedure for Laboratory Testing of Oil-Grit Separators
Particle Size Distribution (PSD) of Test Sediment

Particle Diameter (Microns)	% by Mass of All Particles	Specific Gravity
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

3.6 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party scour testing conducted and have in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This scour testing is conducted with the device pre-loaded with test sediment comprised of the particle size distribution (PSD) illustrated in Table 2.

3.6.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

Data generated from laboratory scour testing performed with an OGS device pre-loaded with a coarser PSD than in Table 2 (i.e. the coarser PSD has no particles in the 1-micron to 50-micron size range, or the D_{50} of the test sediment exceeds 75 microns) shall not be acceptable for the determination of the device's suitability for on-line installation.

3.7 DESIGN ACCOUNTING FOR BYPASS

3.7.1 The OGS device shall be specified to achieve the TSS removal performance and water quality objectives without washout of previously captured pollutants. The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. To ensure this is achieved, there are two design options with associated requirements:

3.7.1.1 The OGS device shall be placed **off-line** with an upstream diversion structure (typically in an upstream manhole) that only allows the water quality volume to be diverted to the OGS device, and excessive flows diverted downstream around the OGS device to prevent high flow washout of pollutants previously captured. This design typically incorporates a triangular layout including an upstream bypass manhole with an appropriately engineered weir wall, the OGS device, and a downstream junction manhole, which is connected to both the OGS device and bypass structure. In this case with an external bypass required, the OGS device manufacturer must provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

3.7.1.2 Alternatively, OGS devices in compliance with Section 3.6 shall be acceptable for an **on-line** design configuration, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole.

3.7.2 The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates equal or better hydraulic conveyance capacity as compared to the OGS device specified herein. This documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.8 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**, with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.8.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

3.9 PETROLEUM HYDROCARBONS AND FLOATABLES STORAGE CAPACITY

Petroleum hydrocarbons and floatables storage capacity in the OGS device shall be a minimum 50 gallons (189 Liters), or more as specified.

3.9.1 The OGS device shall have gasketed precast concrete joints that are watertight, and oil resistant and meet the design criteria according to ASTM C-443 to provide safe oil and other hydrocarbon materials storage and ground water protection. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

3.10 SURFACE LOADING RATE SCALING OF DIFFERENT MODEL SIZES

The reference device for scaling shall be an OGS device that has been third-party tested in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Other model sizes of the tested device shall only be scaled such that the claimed TSS removal efficiency of the scaled device shall be no greater than the TSS removal efficiency of the tested device at identical **surface loading rates** (flow rate divided by settling surface area). The depth of other model sizes of the tested device shall be scaled in accordance with the depth scaling provisions within Section 6.0 of the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.10.1 The Peclet Number and volumetric scaling are not approved methods for scaling OGS devices.

PART 4 – INSPECTION & MAINTENANCE

The OGS manufacturer shall provide an Owner's Manual upon request.
Maintenance shall be performed by a professional service provider who has experience in cleaning OGS devices and has been trained and certified in applicable health and safety practices, including confined space entry procedures.

4.1 A Quality Assurance Plan that provides inspection for a minimum of 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.

4.2 OGS device inspection shall include determination of sediment depth and presence of petroleum hydrocarbons below the insert. Inspection shall be easily conducted from finished grade through a frame and cover of at least 22 inch (560 mm) in diameter.

4.3 Inspection and pollutant removal shall be conducted periodically. For routine maintenance cleaning activities, pollutant removal shall typically utilize a truck equipped with vacuum apparatus, and shall be easily conducted from finished grade through a frame and cover of at least 22-inches (560 mm) in diameter.

4.4 Diameter of the maintenance access opening to the lower chamber and sump shall be scaled consistently across all model sizes, and shall be 1/3 the inside diameter of the OGS structure, or larger.

4.5 No confined space entry shall be required for routine inspection and maintenance cleaning activities.

4.6 For OGS model sizes of diameter 72 inches (1828 mm) and greater, the access opening to the OGS device's lower chamber and sump shall be large enough to allow a maintenance worker to enter the lower chamber to facilitate non-routine maintenance cleaning activities and repairs, as needed.

4.7 The orifice-containing component (i.e. drop pipe, duct, chute, etc.) of the OGS device used to control flow rate into the lower chamber shall be removable from the insert to facilitate cleaning, repair, or replacement of the orifice-containing component, as needed.

PART 5 – EXECUTION

5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS stormwater quality treatment device shall conform to ASTM C 891, ASTM C 478, ASTM C 443, CAN/CSA-A257.4-14, CAN/CSA-A257.4-14, CAN/CSA-S6-00 and all highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below. The Contractor shall furnish all labor, equipment and materials necessary to offload, assemble as needed the OGS internal components as specified in the Shop Drawings.

5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS stormwater quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS stormwater quality treatment device is installed and leveled in sections in the following sequence:

- aggregate base
- base slab, or base
- riser section(s) (if required)
- riser section w/ pre-installed fiberglass insert
- upper riser section(s)
- internal OGS device components
- connect inlet and outlet pipes
- riser section, top slab and/or transition (if required)
- frame and access cover

5.4.2 The precast concrete base shall be placed level at the specified grade. The entire base shall be in contact with the underlying compacted granular material. Subsequent sections, complete with oil resistant, watertight joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

5.5 DROP PIPE AND OIL INSPECTION PIPE

Once the upper precast concrete riser has been attached to the lower precast concrete riser section, the OGS device Drop Pipe and Oil Inspection Pipe must be attached, and watertight sealed to the fiberglass insert using Sikaflex 1a. Installation instructions and required materials shall be provided by the OGS manufacturer.

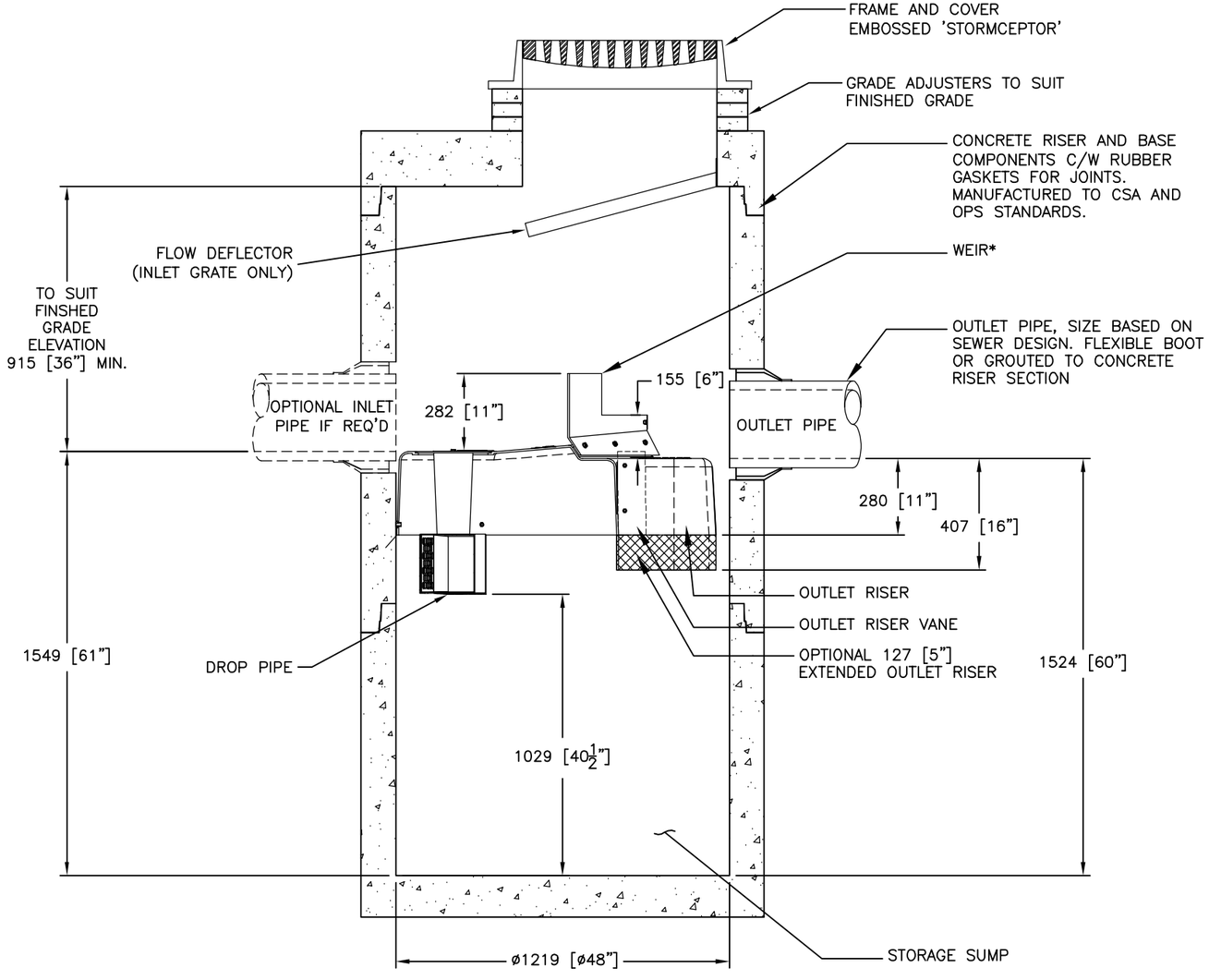
5.6 INLET AND OUTLET PIPES

Inlet and outlet pipes shall be securely set using grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Non-secure inlets and outlets will result in improper performance.

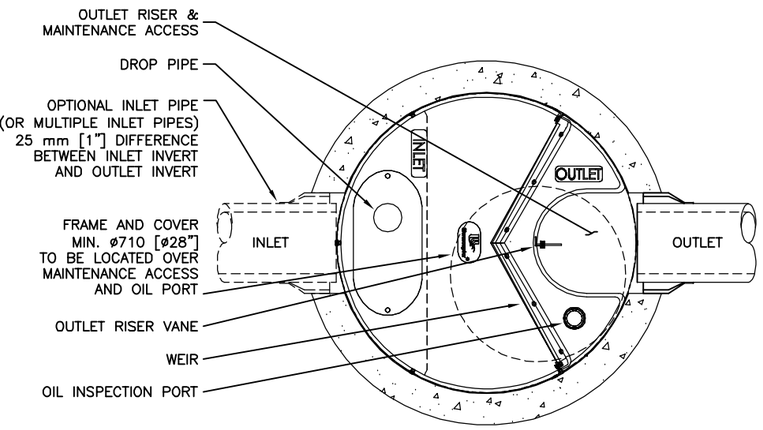
5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

Precast concrete adjustment units shall be installed to set the frame and cover/grate at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover/grate should be set in a full bed of mortar at the elevation specified.

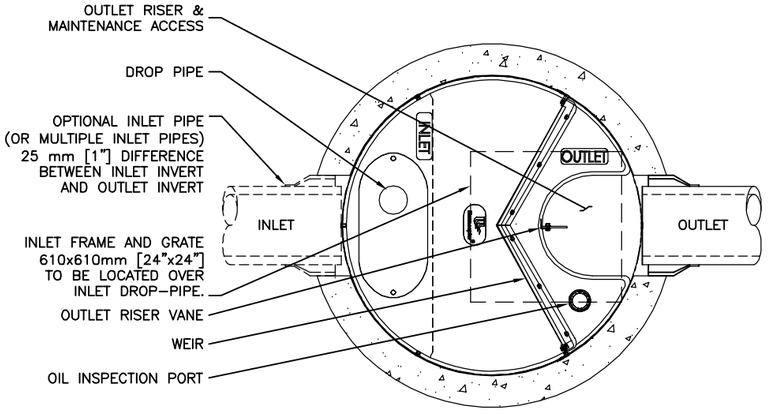
5.7.1 A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS device brand or product name to properly identify this asset's purpose is for stormwater quality treatment.



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF4 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO4 (OIL CAPTURE CONFIGURATION). WEIR HEIGHT IS 150 mm (6 INCH) FOR EF04.

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO4
STRUCTURE ID	*
HYDROCARBON STORAGE REQ'D (L)	*
WATER QUALITY FLOW RATE (L/s)	*
PEAK FLOW RATE (L/s)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
DRAINAGE AREA (HA)	*
DRAINAGE AREA IMPERVIOUSNESS (%)	*

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
1	6/8/18	UPDATES	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
7007 RIDGE ROAD, SUITE 550, HANOVER, MD 21076
USA 888-279-9828 CA 800-386-4801 INTL +1-416-960-9900

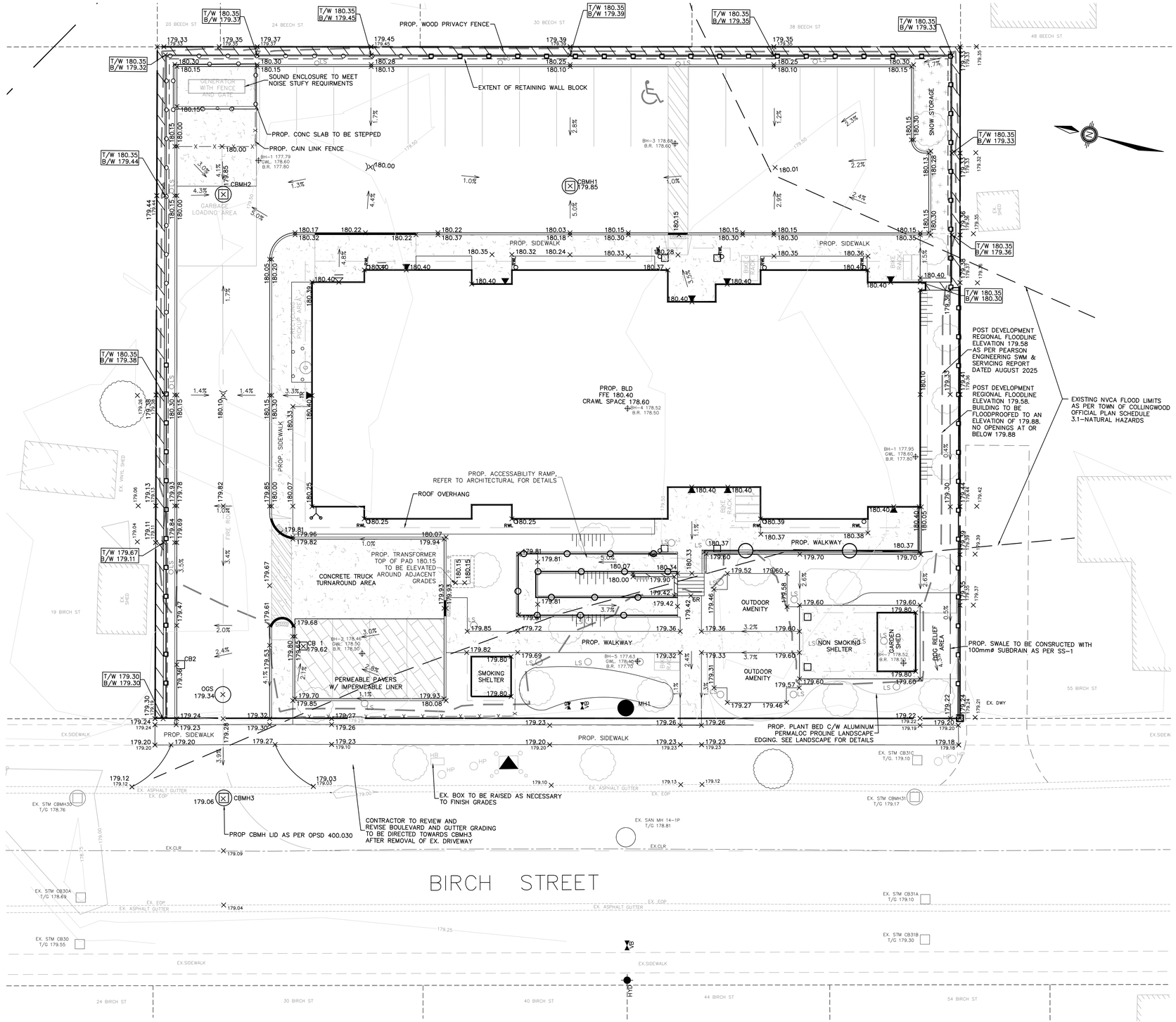
DATE: 10/13/2017

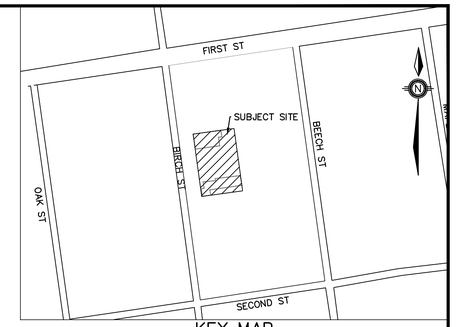
DESIGNED:	DRAWN:
JSK	JSK
CHECKED:	APPROVED:
BSF	SP
PROJECT No.:	SEQUENCE No.:
EFO4	*

SHEET: 1 OF 1

Appendix K

Pearson Engineering Drawings





KEY MAP
NTS

LEGEND

- STM CB / EX. CB — PROPOSED / EXISTING CATCH BASIN
- STM DCB — PROPOSED DOUBLE CATCH BASIN
- STM MH / EX. STM MH — PROPOSED / EXISTING STORM MANHOLE
- SAN MH / EX. SAN MH — PROPOSED / EXISTING SANITARY MANHOLE
- HYD. / EX. HYD — PROPOSED / EXISTING FIRE HYDRANT
- VB — WATER VALVE
- 254.63 / 254.09 — PROPOSED / EXISTING ELEVATION
- 1.5% — PROPOSED DIRECTION AND GRADE
- BACK OF CURB
- EDGE OF PAVEMENT
- PROP. CURB CUT LOCATION
- EX. CURB CUT LOCATION
- HIGH POINT
- PROPERTY LINE
- LIMIT OF WORK
- PERSON DOOR
- OVERHEAD DOOR
- RETAINING WALL (BY OTHERS)
- BH-1 GWL.178.50 B.R.178.50 — BOREHOLE/MONITORING WELL LOCATION AS PER GEI CONSULTANTS CANADA LTD. GEOTECHNICAL INVESTIGATION REPORT DATED.AUGUST 2025; GWL. – GROUND WATER LEVEL; B.R – BEDROCK ELEVATION
- EX. OAK ST. CANAL FLOODPLAIN LIMITS
- POST DEVELOPMENT REGIONAL FLOODLINE
- PRIVACY FENCE
- ACOUSTICAL FENCE
- 1.5m HIGH ORNAMENTAL FENCE
- RWL O — ROOF LEADER
- CONCRETE
- PERMEABLE PAVERS WITH IMPERMEABLE LINER
- G — PROPOSED GAS METER (BY OTHERS)
- LS — LIGHT STANDARD REFER TO ELECTRICAL DRAWINGS
- PROPOSED TACTILE PLATE

SEE S1 & S2 FOR RETAINING WALL DETAILS
T/W AND B/W SHOWS GRADES ADJACENT TO WALL AND BASE OF WALL AT FINISHED GRADE ELEVATIONS.
* THIS DOES NOT INCLUDE BURIED DEPTH OF WALL.

NO.	REVISION NOTE	DATE	BY
2.	REVISED AS PER SUBMISSION 2 COMMENTS	03/06/26	JM
1.	REVISED AS PER SUBMISSION 1 COMMENTS	11/07/25	JM

BENCHMARK

AS PER SURVEY BY RUDY MAK SURVEYING LTD. DATED MAY 28,2025

SITE BENCHMARK#1 IS TOP OF IB LOCATED AT THE SOUTHEAST CORNER OF THE PROPERTY HAVING AN ELEVATION OF 179.35.

SITE BENCHMARK#2 IS TOP OF IB LOCATED AT THE NORTHWEST CORNER OF LOT 13 HAVING AN ELEVATION OF 179.37.

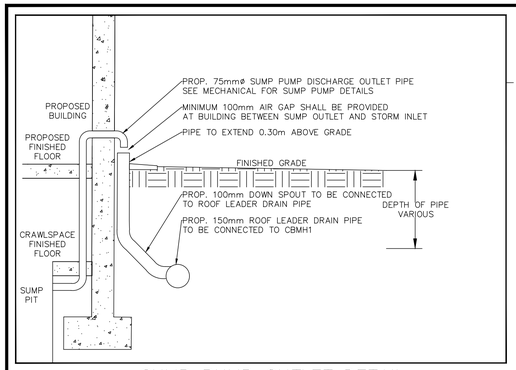
LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
Mar 06, 2026
PROVINCE OF ONTARIO

720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

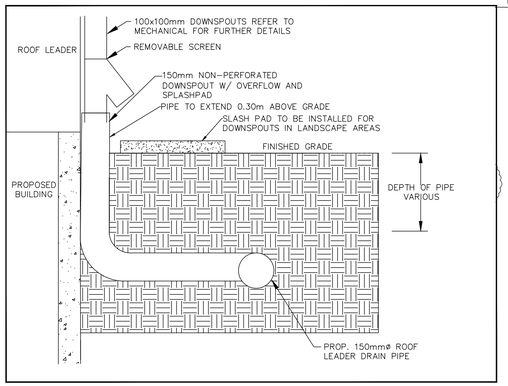
SITE GRADING PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

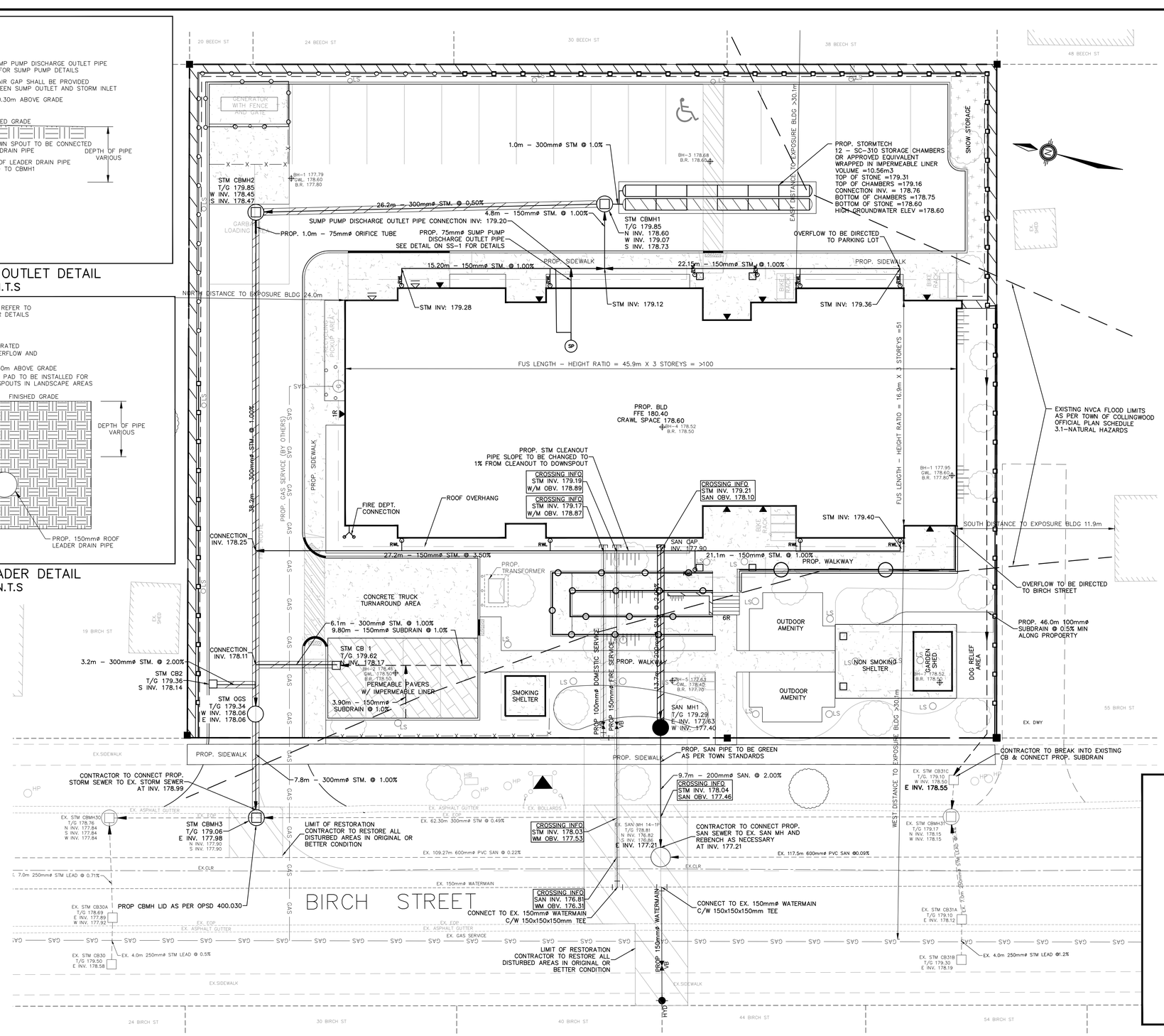
DESIGNED BY	AMC	HORIZ SCALE	1:150
DRAWN BY	JM	VERT SCALE	N/A
CHECKED BY	MWD	DATE	JULY 2025
PROJECT #	24242		
DRAWING #	SG-1		
REVISION #	2		

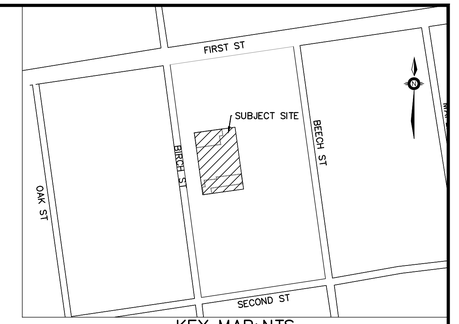


SUMP PUMP OUTLET DETAIL
N.T.S



ROOF LEADER DETAIL
N.T.S

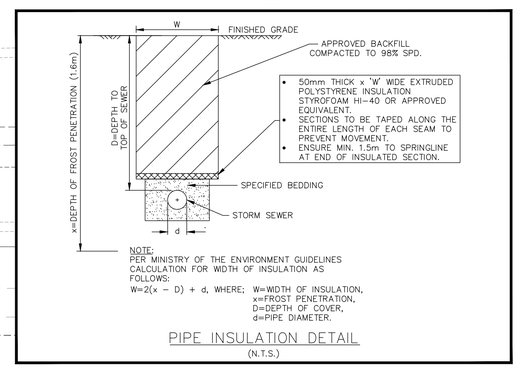




KEY MAP: NTS

LEGEND

- STM CB — PROPOSED CATCH BASIN
- EX. CB — EXISTING CATCH BASIN
- STM DCB — PROPOSED DOUBLE CATCH BASIN
- STM MH — PROPOSED STORM MANHOLE
- EX. STM MH — EXISTING STORM MANHOLE
- SAN MH — PROPOSED SANITARY MANHOLE
- EX. SAN MH — EXISTING SANITARY MANHOLE
- HYD. — PROPOSED FIRE HYDRANT
- EX. HYD — EXISTING FIRE HYDRANT
- VB — WATER VALVE
- x 254.63 — PROPOSED ELEVATION
- 254.09 — EXISTING ELEVATION
- 1.5% — PROPOSED DIRECTION AND GRADE
- BACK OF CURB
- EDGE OF PAVEMENT
- PROP. CURB CUT LOCATION
- EX. CURB CUT LOCATION
-) (— HIGH POINT
- PROPERTY LINE
- LIMIT OF WORK
- PERSON DOOR
- OVERHEAD DOOR
- RETAINING WALL (BY OTHERS)
- PIPE INSULATION
- EX. OAK ST. CANAL FLOODPLAIN LIMITS
- ROOF LEADER
- G — PROPOSED GAS METER (BY OTHERS)
- PROPOSED TACTILE PLATE
- SP — PROPOSED SUMP PUMP (SEE MECHANICAL FOR DETAILS)



NOTE:
PER MINISTRY OF THE ENVIRONMENT GUIDELINES CALCULATION FOR WIDTH OF INSULATION AS FOLLOWS:
W=2(x – D) + d, WHERE; W=WIDTH OF INSULATION, x=FROST PENETRATION, D=DEPTH OF COVER, d=PIPE DIAMETER.

PIPE INSULATION DETAIL
(N.T.S.)

NO.	REVISION NOTE	DATE	BY
2.	REVISED AS PER SUBMISSION 2 COMMENTS	03/06/26	JM
1.	REVISED AS PER SUBMISSION 1 COMMENTS	11/07/25	JM

BENCHMARK

AS PER SURVEY BY RUDY MAK SURVEYING LTD. DATED MAY 28,2025

SITE BENCHMARK#1 IS TOP OF IB LOCATED AT THE SOUTHEAST CORNER OF THE PROPERTY HAVING AN EVALUATION OF 179.35.

SITE BENCHMARK#2 IS TOP OF IB LOCATED AT THE NORTHWEST CORNER OF LOT 13 HAVING AN EVALUATION OF 179.37.

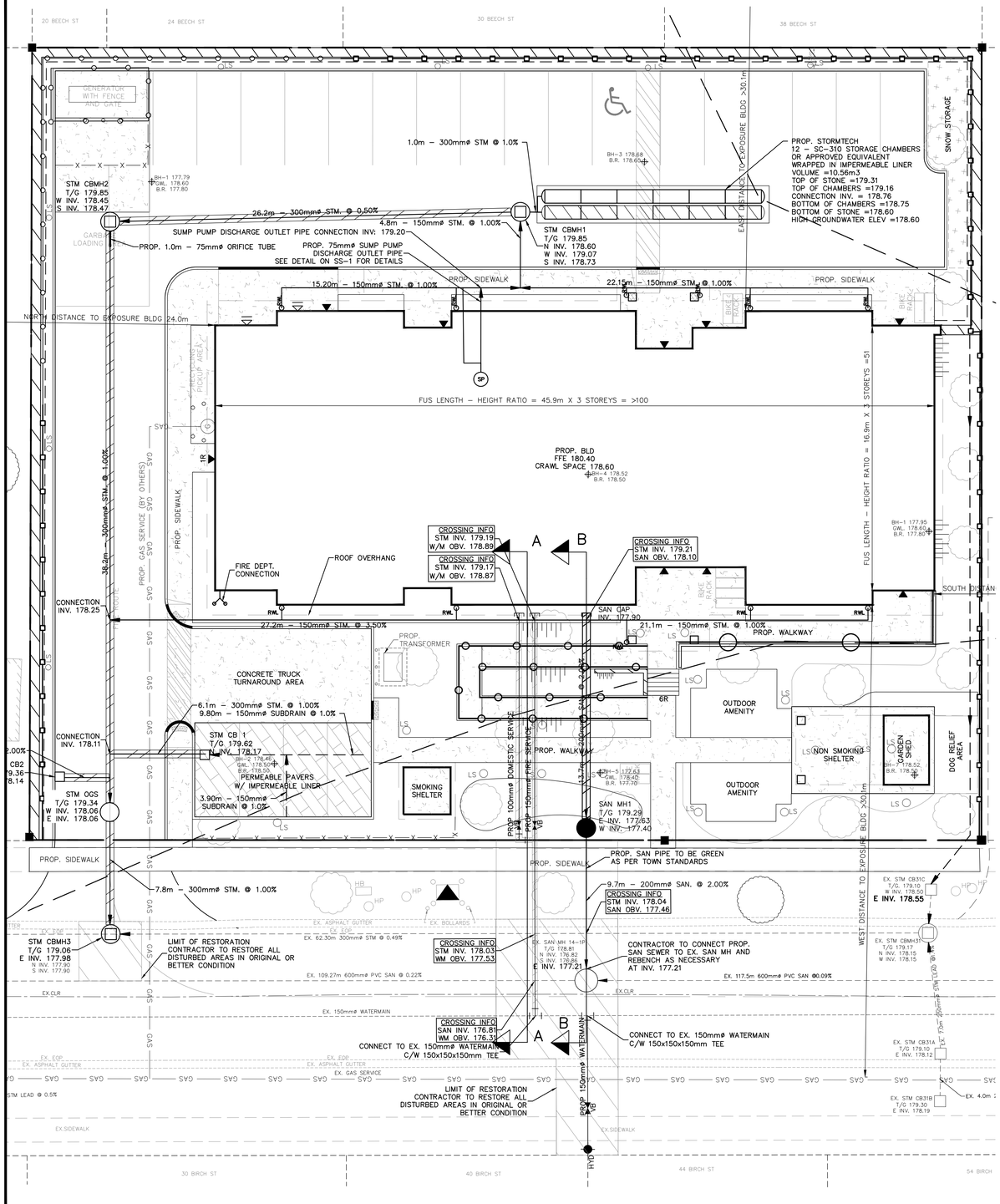
LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
Mar 06, 2026
PROVINCE OF ONTARIO

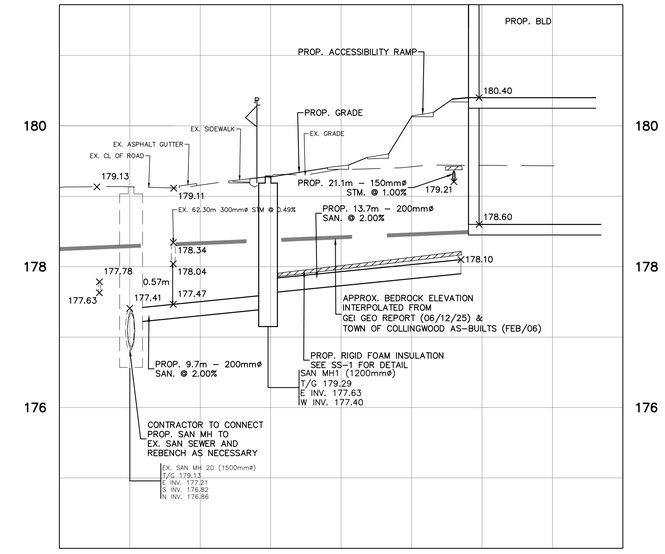
720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

SITE SERVICING PLAN

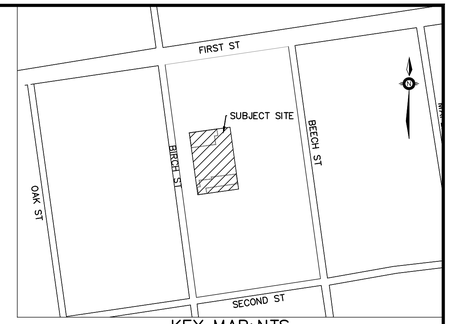
PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE	1:150
DRAWN BY	JM	VERT SCALE	N/A
CHECKED BY	MWD	DATE	JULY 2025
PROJECT #	24242		
DRAWING #	SS–1		
REVISION #	2		





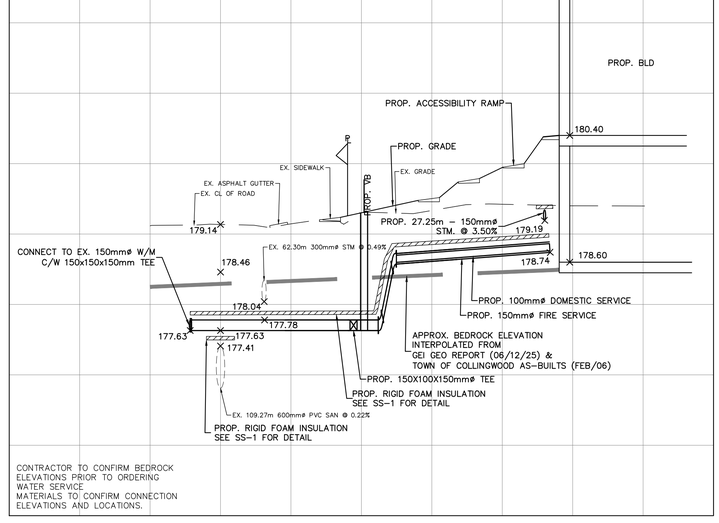
PROP. SANITARY CONNECTION
SECTION B–B
SCALE H – 1:200
SCALE V – 1:50



KEY MAP: NTS

LEGEND

- STM CB / EX. CB — PROPOSED CATCH BASIN / EXISTING CATCH BASIN
- STM DCB — PROPOSED DOUBLE CATCH BASIN
- STM MH / EX. STM MH — PROPOSED STORM MANHOLE / EXISTING STORM MANHOLE
- SAN MH / EX. SAN MH — PROPOSED SANITARY MANHOLE / EXISTING SANITARY MANHOLE
- HYD. / EX. H&V — PROPOSED FIRE HYDRANT / EXISTING FIRE HYDRANT
- VB — WATER VALVE
- × 254.63 / 254.09 — PROPOSED ELEVATION / EXISTING ELEVATION
- 1.5% — PROPOSED DIRECTION AND GRADE
- BACK OF CURB
- EDGE OF PAVEMENT
- PROP. CURB CUT LOCATION
- EX. CURB CUT LOCATION
-) (— HIGH POINT
- PROPERTY LINE
- LIMIT OF WORK
- PERSON DOOR
- OVERHEAD DOOR
- RETAINING WALL (BY OTHERS)
- SIAMESE CONNECTION
- PIPE INSULATION
- EX. OAK ST. CANAL FLOODPLAIN LIMITS
- ROOF LEADER
- G — PROPOSED GAS METER (BY OTHERS)
- PROPOSED TACTILE PLATE



PROP. WATERMAIN CONNECTION
SECTION A–A
SCALE H – 1:200
SCALE V – 1:50

NO.	REVISION NOTE	DATE	BY
2.	REVISED AS PER SUBMISSION 2 COMMENTS	03/06/26	JM
1.	REVISED AS PER SUBMISSION 1 COMMENTS	11/07/25	JM

BENCHMARK

AS PER SURVEY BY RUDY MAK SURVEYING LTD. DATED MAY 28,2025

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LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
Mar 06, 2026
PROVINCE OF ONTARIO

720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

CROSS SECTION PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE	1:150
DRAWN BY	JM	VERT SCALE	N/A
CHECKED BY	MWD	DATE	JULY 2025
PROJECT #	24242		
DRAWING #	CS–1		
REVISION #	2		

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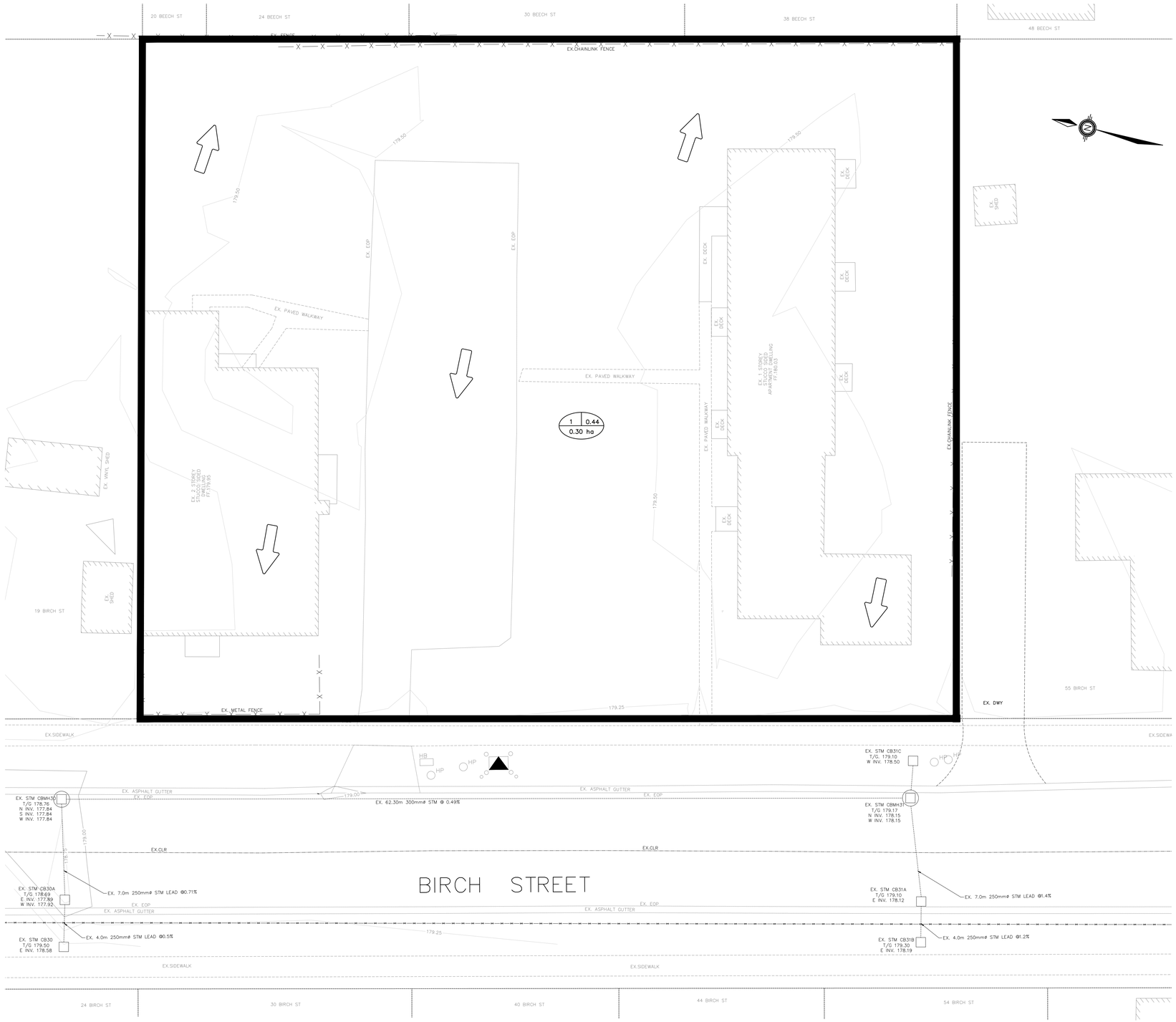

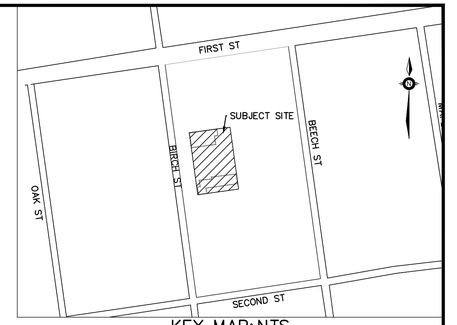

KEY MAP: NTS

LEGEND

OVERLAND FLOW DIRECTION

CATCHMENT AREA — 1 | 0.75 — RUNOFF COEFFICIENT
1.00 ha
AREA IN HECTARES

CATCHMENT BOUNDARY

NO.	REVISION NOTE	DATE	BY
2.	REVISED AS PER SUBMISSION 2 COMMENTS	03/06/26	JM
1.	REVISED AS PER SUBMISSION 1 COMMENTS	11/07/25	JM

BENCHMARK

AS PER SURVEY BY RUDY MAK SURVEYING LTD. DATED MAY 28,2025

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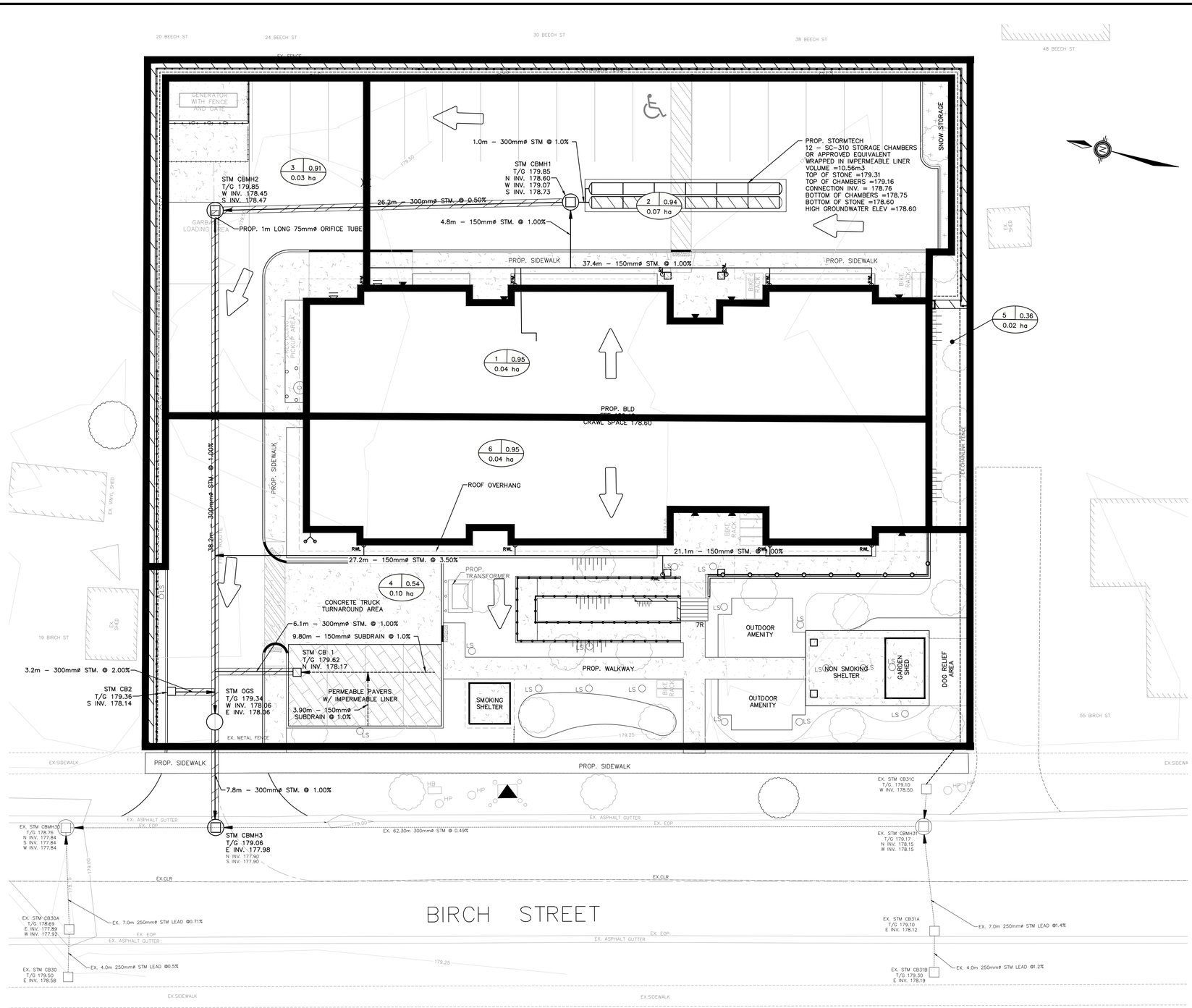
LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
Mar 06, 2026
PROVINCE OF ONTARIO

720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

PRE-DEVELOPMENT STORM CATCHMENT PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE 1:150	PROJECT # 24242
DRAWN BY	KV	VERT SCALE N/A	DRAWING # STM-1
CHECKED BY	MWD	DATE JULY 2025	REVISION # 2



KEY MAP: NTS

LEGEND

- OVERLAND FLOW DIRECTION
- CATCHMENT AREA: 1 | 0.75 | 1.00 ha — RUNOFF COEFFICIENT / AREA IN HECTARES
- CATCHMENT BOUNDARY

NO.	REVISION NOTE	DATE	BY
2.	REVISED AS PER SUBMISSION 2 COMMENTS	03/06/26	JM
1.	REVISED AS PER SUBMISSION 1 COMMENTS	11/07/25	JM

BENCHMARK

AS PER SURVEY BY RUDY MAK SURVEYING LTD. DATED MAY 28,2025

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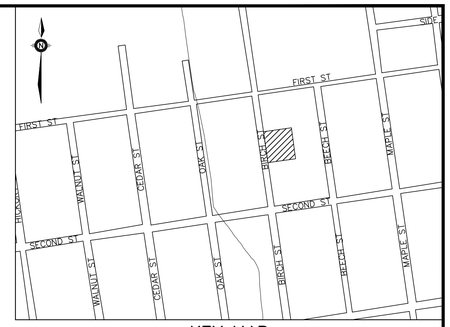
LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
Mar 06, 2026
PROVINCE OF ONTARIO

720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

POST-DEVELOPMENT STORM CATCHMENT PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE 1:150	PROJECT # 24242
DRAWN BY	KV	VERT SCALE N/A	DRAWING # STM-2
CHECKED BY	MWD	DATE JULY 2025	REVISION # 2



KEY MAP
NTS

LEGEND

- POST DEVELOPMENT REGIONAL FLOODLINE
- PROPERTY LINE
- HECRAS CROSS SECTIONS
- NVCA FLOODLINE

155.681 / 177.70 / 177.70 — CROSS SECTION STATION; PRE DEVELOPMENT REGIONAL FLOODLINE ELEVATION; POST DEVELOPMENT REGIONAL FLOODLINE ELEVATION

NO.	REVISION NOTE	DATE	BY
2.	REVISED AS PER SUBMISSION 2 COMMENTS	03/06/26	JM
1.	REVISED AS PER SUBMISSION 1 COMMENTS	11/07/25	JM

BENCHMARK

AS PER SURVEY BY RUDY MAK SURVEYING LTD. DATED MAY 28,2025

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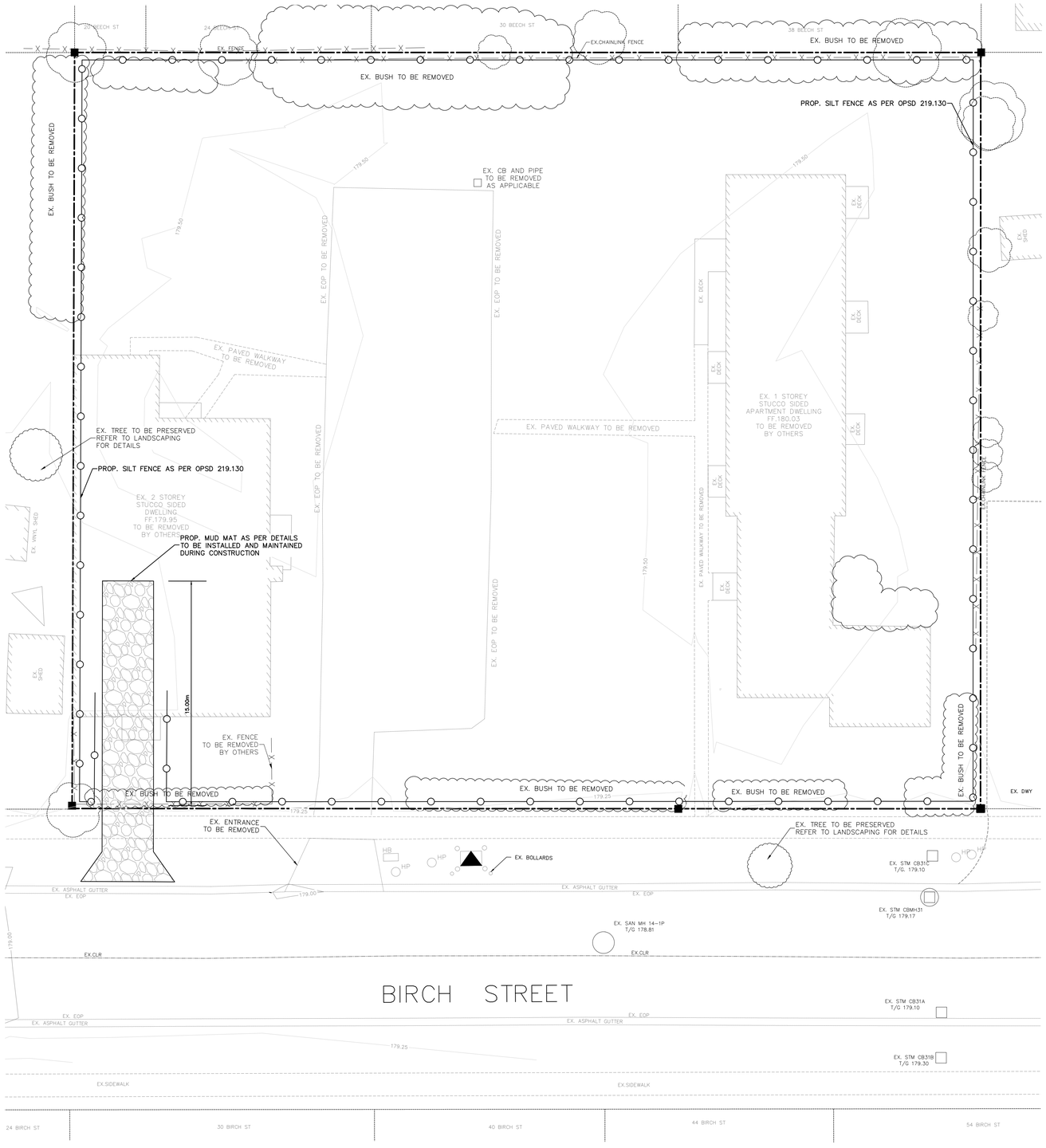
M.W. DEJEAN
Mar 06, 2026
PROVINCE OF ONTARIO

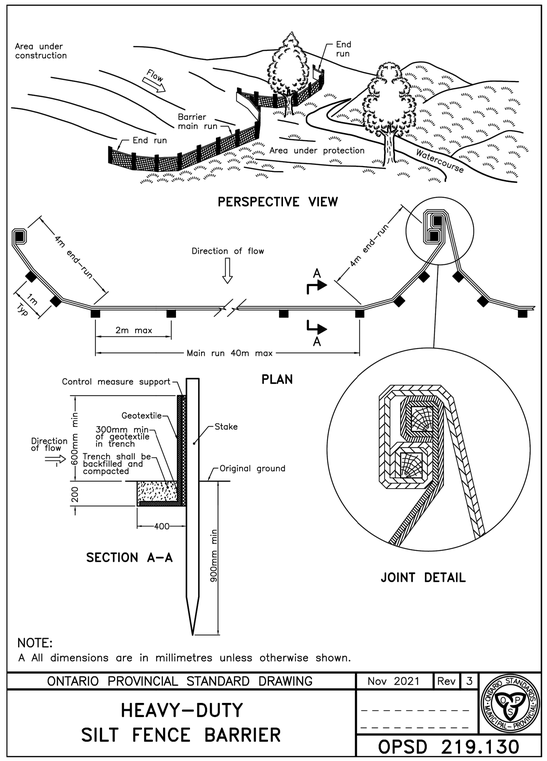
720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

FLOODLINE LOCATION PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

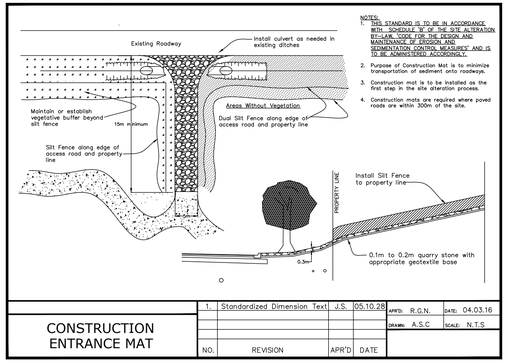
DESIGNED BY	AMC	HORIZ SCALE	1:1000
DRAWN BY	KV	VERT SCALE	N/A
CHECKED BY	MWD	DATE	JULY 2025
PROJECT #	24242		
DRAWING #	FL-1		
REVISION #	2		



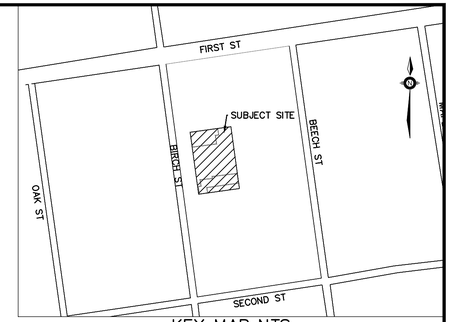


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev	3
HEAVY-DUTY SILT FENCE BARRIER			
	OPSD 219.130		



CONSTRUCTION ENTRANCE MAT	NO.	REVISION	APR'D	DATE
	1.	Standardized Dimension Text	J.S.	05.10.28
	APR'D: R.G.N.	DATE: 04.03.16		
	DRAWN: A.S.C.	SCALE: N.T.S		



KEY MAP: NTS

LEGEND

SILT FENCE

1. SEQUENCE OF CONSTRUCTION

1. ENGINEER TO BE NOTIFIED PRIOR TO INITIATION OF ANY ON SITE WORKS.
2. SILT FENCE AS PER DETAIL OPSD 219.110 AND CONSTRUCTION ACCESS MATS AS PER TOWN STANDARD ARE TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY WORKS ONSITE.
3. VEGETATION REMOVAL MAY COMMENCE AFTER ALL SILT FENCE IS INSTALLED AND APPROVED BY THE ENGINEER.
4. COMMENCE WITH EARTH WORKS AND SITE SERVICING.
5. EROSION CONTROL MEASURES TO BE MAINTAINED AS DIRECTED BY THE ENGINEER DURING THE CONSTRUCTION PERIOD. ADDITIONAL CONTROL MEASURES MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
6. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED WITH SEED, SOD, MULCH OR OTHER ADEQUATE COVERING, AS INSTRUCTED BY THE ENGINEER.

2. NOTES FOR SEDIMENT & EROSION CONTROL

1. DISTURBED AREAS THAT HAVE FAILED TO HAVE STABLE GROUND COVER ESTABLISHED BY OCTOBER 30TH SHALL BE PROTECTED WITH A SILTATION CONTROL FENCE OR STRAW MULCH ETC. AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION BECOMES ESTABLISHED IN THE SUBSEQUENT GROWING SEASON.
2. ANY DEWATERING WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30m FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE ADMINISTRATOR.
3. SILT FENCE SHALL BE PUT IN PLACE PRIOR TO AND MAINTAINED DURING ALL GRADING. SILT FENCE TO BE INSPECTED PRIOR TO COMMENCEMENT OF EARTH GRADING ACTIVITIES. SILT FENCE TO BE INSPECTED AND REPAIRED OR REPLACED IF DAMAGED AS DIRECTED BY THE SITE ADMINISTRATOR.SILT CONTROLS TO BE INSPECTED ON A REGULAR BASIS AND AFTER EVERY RAIN EVENT. INSTALLATION SHALL BE TO THE MANUFACTURER'S RECOMMENDED SPECIFICATIONS.
4. THE CONTRACTOR SHALL BE PREPARED FOR UNEXPECTED CONDITIONS AND ACCORDINGLY HAVE STOCKPILED MATERIALS ON SITE FOR NECESSARY REPAIRS AS A RESULT OF FAILED OR INADEQUATE CONTROL MEASURES. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSPECTED AT LEAST ONCE A WEEK, AND AFTER EVERY RAINFALL EVENT.
5. MUD MATS AT ALL LOCATIONS WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES THE SITE SHALL BE USED. MUD MATS TO CONSIST OF 300mm MIN. 100mm CLEAR STONE HAVING DIMENSIONS 5m WIDE X 15m LONG.
6. CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 577, CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES AS WELL AS ALL APPLICABLE MUNICIPAL STANDARDS.
7. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES. SUCH MEASURES SHOULD BE PRESENTED IN WRITING FOR APPROVAL OF THE SITE ADMINISTRATOR AND MUST BE APPROVED IN WRITING BY THE MUNICIPALITY AND CONSERVATION AUTHORITY.
8. THE TOPS OF ALL FILTER FABRIC MUST BE A MINIMUM OF 1.0 METRES ABOVE THE GROUND LEVEL AND ATTACHED TO THE FENCE WITH A CONTINUOUS STEEL WIRE. ALTERNATIVELY, THE FILTER FABRIC MUST BE FOLDED OVER THE TOP OF THE FENCE AND ATTACHED TO THE FENCE WITH WIRE LOOPED THROUGH THE FABRIC ON BOTH SIDES OF THE FENCE. FILTER FABRIC IS TO BE TERRAFIX 270R OR EQUIVALENT.
9. ALL DISTURBED GROUND LEFT FOR MORE THAN 30 DAYS SHALL BE STABILIZED BY SEEDING, SODDING, MULCHING, OR COVERING OR OTHER EQUIVALENT CONTROL MEASURES. THIS PERIOD OF INACTIVITY SHALL BE AT THE DISCRETION OF THE TOWNSHIP OF ORO MANAGER OF ENGINEERING BUT SHALL NOT EXCEED THIRTY DAYS OR SUCH LONGER PERIOD DEEMED ADVISABLE BY THE TOWN OF COLLINGWOOD'S MANAGER OF ENGINEERING.
10. CONTRACTOR RESPONSIBLE FOR MUD TRACKING, PREVENTION, AND MAINTENANCE ON SURROUNDING ROADS.

NO.	REVISION NOTE	DATE	BY
2.	REVISED AS PER SUBMISSION 2 COMMENTS	03/06/26	JM
1.	REVISED AS PER SUBMISSION 1 COMMENTS	11/07/25	JM

BENCHMARK

AS PER SURVEY BY RUDY MAK SURVEYING LTD. DATED MAY 28,2025

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LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
Mar 06, 2026
PROVINCE OF ONTARIO

720 SOLUTIONS
29 AND 45 BIRCH STREET
TOWN OF COLLINGWOOD

EROSION PROTECTION AND REMOVALS PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE 1:150	PROJECT # 24242
DRAWN BY	KV	VERT SCALE N/A	DRAWING # EPR-1
CHECKED BY	MWD	DATE JULY 2025	REVISION # 2