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June 6, 2024

GEL Project Number 1510-001-21
City of Barrie File: D28-088-2022

Functional Servicing Report & Stormwater Management Report 3rd Submission

Regarding:

Proposed Residential Condominium
17 Sophia Street, 3, 5, 7 and 11 McDonald Street and
58 & 60 Clapperton Street
Barrie, Ontario

Prepared on behalf of:

Black Creek Group

By:

GERRITS ENGINEERING LIMITED
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DWG ESC-1 & RM-1	Erosion and Sediment Control and Removals Plans
DWG SS-1 & SG-1	Site Servicing and Grading Plans



1. Introduction

Gerrits Engineering Ltd. (GEL) has been retained by the Black Creek Group to prepare a Functional Servicing Report for the proposed development of the 26 storey tower in the geographic City of Barrie (City), Ontario. The subject lands are approximately 0.31 ha in area and slopes gently from the north to the south in its existing conditions. It is proposed to construct a new building with a footprint of about 904 m² along with underground area and above ground parking, as well as surface parking located to the west and south of the proposed tower. This report will address the detailed design and stormwater management controls required for the proposed building construction.

1.1. Supporting & Reference Documents

The following documents have been referenced in the preparation of this report:

- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- Ministry of Transportation, Drainage Management Manual (MTO, 1997)
- City of Barrie, Storm Drainage & Stormwater Management Policies & Design Guidelines, November 2009
- Water Transmission and Distribution Policies and Design Standard, January 2021
- Sanitary Sewage Collection System Policies and Design Guideline, October 2017
- Lake Simcoe Region Conservation Authority (LSRCA), Technical Guidelines for Stormwater Management, September, 2016
- Ontario Building Code 2012 (O.B.C.)

1.2. Subject Property

The subject site as shown below in Figure 1 (in red) is approximately 0.31 ha in area and is designated for residential use. It is legally described as Part of Lot 15, South Side Sophia Street Part of Lots 12 and 13 and all of Lot 14, South Side McDonald Street, Registered Plan 31 in the City of Barrie, County of Simcoe. The site is primarily vacant in its existing condition and consists mostly of a meadowed area with a few trees. The site, in its existing state, slopes predominantly to the southwest corner of the property before spilling onto the adjacent south parcel. The topographical information is based on a survey completed by Rudy Mak Surveying Ltd., dated May 6, 2021, as well as an aerial map from Google Imagery.



Figure 1 - Subject Property (Red)



1.3. Proposed Land Use

The proponent is seeking to undertake a new 26 Storey High Rise Residential Development. It is proposed that the building will be serviced with their own sanitary sewage, domestic water supply and fire water supply provided by the City of Barrie. There are 260 units being proposed within this building.

2. Servicing

2.1. Overview

Servicing of the Development will involve the connection to the City's existing water and sanitary distribution and collection system. The Development's internal collection and distribution system will be constructed as per the City and Ministry of Environment (MOE) design guidelines. The site's internal water distribution system will be designed to account for domestic and fire protection requirements.

2.2. Design Criteria

A summary of the water and wastewater design criteria is as follows:

Serviced Population

- High Density (Condominium) = 1.67 ppu
- Development residential population – 260 units x 1.67 ppu = 434.2 pers

Wastewater Criteria

- Average Day Flow (ADF) Residential (New Development) = 225 L/c/d
- Extraneous flows (peak per developable ha) = 0.1 L/s/ha
- Peak Factor (residential and commercial) Harmon

$$M = 1 + \frac{14}{4 + P^{0.5}} = 4.35 = 4.0 \text{ (Maximum)}$$

Water Criteria

- Average Day Demand (ADD) Residential (New Development) = 225 L/c/d
- Max Day Factor (MDD) (Table 3.3 MOECC, 2008) = 3.12
- Peak Hour factor (PH) (Table 3.3 MOECC, 2008) = 5.17
- Minimum pressure in system at MDD = 275 kPa
- Maximum pressure in system at MDD = 700 kPa
- Minimum pressure in system at Peak Hour demand = 275 kPa
- Minimum pressure in system at Fire + MDD = 140 kPa

3. Sanitary Servicing

The projected daily average and peak sewage flows from the subject property are summarized in the table below.

Table 1 – Design Wastewater Flows

Average Daily Demand (Design)	394.2	m ³ /d
	4.56	L/s
Peak Hour Flow (Design)	1,627.9	m ³ /d
	18.84	L/s

3.1. Proposed Sanitary Connection Point

Serviceability of the subject site can be provided on Clapperton Street. Flows from the development will be collected and then conveyed by gravity, which will flow east towards the existing sanitary line via a proposed doghouse maintenance hole structure located on Clapperton Street (SAN DHMH 101). This existing sanitary line currently



services the surrounding existing residential and commercial properties. We have been provided with the external flows from the City of Barrie. After applying the above-mentioned design criteria parameters, a preliminary review of the proposed sewers indicate that sufficient capacity should be present for the proposed condominium development. Also, capacity within the existing sewer main is not anticipated to be an issue. Calculations are provided in Appendix A.

3.2. Internal Sanitary Collection System

It is proposed that the sanitary sewers be constructed in accordance with the City's Engineering Standards and the MOE guidelines to service the Development. The proposed sewers will consist of PVC SDR 35 pipe with pipe diameters of 200mm and designed to meet minimum and maximum velocities under full flow conditions. The spacing interval of the manhole structures will be as per MOE and City guidelines. The minimum manhole diameter will be 1200mm, with larger structures being incorporated as required in accordance with Ontario Provincial Standard Specifications (OPSS). An adequately sized service connection will be provided to the proposed Residential Condominium as specified by City Standards. See attached Site Servicing Plan in Appendix C for reference.

4. Water Supply and Distribution

4.1. Existing Water System Analysis

A *Water Systems Analysis* has yet to be completed by Gerrits Engineering Ltd. for the proposed development. We suggest that the City review the watermain design requirements for this development with respect to the City's water treatment and supply capacities and confirm that capacity allocation is available for this development. Given the size and location of this development, this is not expected to be a concern.

The projected daily average, maximum day, and peak hourly flows from the subject property are summarized in the table below.

Table 2 – Design Water Flows

Average Daily Demand (Design)	97.9	m ³ /d
	1.13	L/s
Maximum Day Demand (Design)	305.4	m ³ /d
	3.53	L/s
Peak Hour Flow (Design)	506.0	m ³ /d
	5.86	L/s

4.2. Internal Water Distribution System

The development will provide a water service connection to the Residential Condominium by a new internal 150mm diameter domestic water service and a new internal 150mm diameter fire water service, which are connected to the existing external 200mm diameter watermain on McDonald Street. New hydrants will be installed near the site entrance. Water services will be installed at the minimum 1.7m depth below finished grade. All systems will be constructed and tested in accordance with the City of Barrie Engineering Standards and MOE Guidelines. Refer to the Site Servicing Plan attached for the location of watermain connections and internal layout.

4.3. Fire Flow Requirement

Pressure flow tests have been completed on the municipal system as part of this assessment. The hydrant that was tested is located at the southeast corner of McDonald Street and Clapperton Street, Hydrant #53. A flow of 278.1 L/s was recorded. This hydrant will provide coverage to the entire proposed development and will meet City and MOE standards. Details pertaining to the flow test can be found in Appendix A.



4.4. Fire Flow Analysis

The subject building is a 26 Storey Tower with 1 lower level area. The subject tower will be constructed such that it will be classified as Non-Combustible Construction (Type II). In addition it will have a fully supervised sprinkler system. For conservatism we have assumed that any vertical openings within the building are unprotected, and as such the Total Effective Area will be to consider the two largest adjoining floor areas plus 50% of all floors immediately above them to a maximum of eight. This results in a Total Effective Area, using the two largest floor areas as 3rd and 4th within the ground floor area, of about 8,290 sq.m.

As per the Fire Underwriters Survey for Water Supply for Public Fire Protection (2020), the calculated minimum fire flows for this specific building and projected occupancy is 15,000 L/min (250.0 L/s). To calculate the available hydrant flow, the following equation is outlined in Section 4.3.2. of the design guidelines.

$$Q_A = Q_T \times \sqrt{h_a/h_t}$$

Where:

Q_A – Flow at 20 psi

Q_T – Flow at Test – 2,558 GPM

h_a – Pressure Drop Available (psi)

h_t – Pressure Drop at Test (psi)

Using the information from the hydrant test completed, the following is the calculated available hydrant flow:

$$\begin{aligned} Q_A &= Q_T \times \sqrt{h_a/h_t} \\ &= 1,686 \times \sqrt{(61-20) / (61-55)} \\ &= 4,407.3 \text{ GPM (278.1 L/s)} \end{aligned}$$

As it can be seen, the anticipated hydrant flow will exceed the FUS calculated minimum flow criteria of 250 L/s.



5. Storm Drainage and Stormwater Management

A key component of the Development is the need to address environmental and related Stormwater Management (SWM) issues. These are examined in a framework aimed at meeting the City of Barrie, Lake Simcoe Region Conservation Authority, and Ministry of the Environment, Conservation and Parks (MECP) requirements. SWM parameters have evolved from an understanding of the location and sensitivity of the site's natural systems.

It is understood that 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.
- Protect and provide diverse recreational opportunities that are in harmony with the environment.

5.1. Existing Drainage Conditions

In the pre-development condition, the subject site consists mostly of Undeveloped Lands with a few trees and a small concrete wall, as well as, one 1-storey dwelling (to be demolished) and one 2-storey dwelling (to be demolished). According to the Soil Survey of Simcoe County, Report No. 29 of the Ontario Soil Survey, Ministry of Agriculture and Food, surface soils on the subject property consists of a Tioga Series, which are loamy sands consisting of grey, calcareous outwash sands. Tioga sands are classified within Soil Group A (SCS A). Group A soils represent material with low runoff potential and high infiltration rates. The site's existing grades are between 0 and 4.5%. Referencing the Lake Simcoe Region Conservation Authority (LSRCA) Stormwater Management Guidelines and City of Barrie Engineering Design Standards, we determine the runoff coefficient for the existing drainage conditions as follows:

Grass	=	2,343 m ²	R =	0.15	AR =	351.5
Treed	=	334 m ²	R =	0.08	AR =	26.7
Dwelling roof	=	178 m ²	R =	0.95	AR =	169.1
Gravel	=	198 m ²	R =	0.60	AR =	118.8
Concrete	=	2 m ²	R =	0.95	AR =	<u>1.9</u>
				Total	AR =	668.0
Site Area = 3,055 m ²		ΣAR = 668.0		Weighted R = 0.22		

Given the size of the site, the Modified Rational Method will be used to determine the existing release rates:

Catchment Area	= 0.31 ha
Runoff Coefficient	= 0.22
Time of Concentration (t _c)	= 10 minutes
Rainfall Intensity	= City of Barrie IDF Curve Parameters
Peaking Factor (C _p)	= 1.00 (2-10 year design periods)
	= 1.10 (25 year design period)
	= 1.20 (50 year design period)
	= 1.25 (100 year design period)
Peak Runoff Rate (Q _p)	= C x I x A x 360 ⁻¹

Applying the above results in the following release rates:

**Table 3: Subject Site Allowable Release Rate**

	2 year (L/s)	5 year (L/s)	10 year (L/s)	25 year (L/s)	50 year (L/s)	100 year (L/s)
Pre-Development	15	20	23	30	37	42

5.2. Proposed Drainage Conditions

The proposed Development will increase the imperviousness of the site and it is important to quantify this change to determine quantity control requirements. The typical runoff coefficients as detailed in LSRCA Stormwater Management Guidelines and City of Barrie Engineering Design Standards were referenced to determine the post-development weighted runoff coefficient, which is as follows:

Grass	=	620 m ²	R =	0.15	AR =	93.0
Asphalt	=	340 m ²	R =	0.95	AR =	323.0
Building Roof	=	1,930 m ²	R =	0.95	AR =	1,833.5
Concrete	=	165 m ²	R =	0.95	AR =	<u>156.8</u>

Total AR = 2,406.3

Site Area = 3,055 m²

AR = 2,406.3 Weighted R = 0.79

The anticipated post-development runoff coefficient of 0.79 is reasonable for a development of this type. The Modified Rational Method will be used to determine the proposed release rates.

Catchment Area	= 0.31 ha
Runoff Coefficient	= 0.79
Time of Concentration (t _c)	= 10 minutes
Rainfall Intensity	= City of Barrie IDF Curve Parameters
Peaking Factor (C _r)	= 1.00 (2-10 year design periods)
	= 1.10 (25 year design period)
	= 1.20 (50 year design period)
	= 1.25 (100 year design period)
Peak Runoff Rate (Q _r)	= C x I x A x 360 ⁻¹

Applying the above results in the following release rates:

Table 4: Post Development Release Rate

	2 year (L/s)	5 year (L/s)	10 year (L/s)	25 year (L/s)	50 year (L/s)	100 year (L/s)
Post-Development	56	73	84	109	132	151

When reviewing the post development conditions, we find that the anticipated release rates are greater than the pre-development conditions and therefore additional quantity control measures will be required.



5.3. Quantity Control

The development of this Site increases the existing stormwater runoff rate above that of the allowable release rate. Therefore, site quantity controls have been designed to closely approximate the allowable release rates. Stormwater quantity control will be provided an underground storage room located on P1 of the proposed Residential Condominium. Release from the subject site will be controlled by an outlet pipe sized using the following equation:

$$Q = cA\sqrt{2gh}$$

Q = allowable release rate

A = orifice area = 0.0044 m² (75mm dia)

c = orifice coefficient = 0.63

g = gravitational constant = 9.81m/s²

h = high water level over center of orifice

Applying the above equation, we find that a 75mm orifice plate will restrict the flows such that the controlled stormwater flow from the site is less than the allowable release rates for all storm events. It is proposed to utilize a 75mm diameter orifice plate within the SWMF to allow for sufficient on-site storage of stormwater prior to releasing from the site. The Pre/Post Development (Controlled) calculated release rates for the proposed development are detailed in Table 5 below. Calculations have been included within Appendix A.

Table 5: Site Release Rates

	Design Storm Event Release Rate (L/s)					
	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
Allowable Release Rate	15	20	23	30	37	42
Post Development Release Rate	13	15	16	18	20	21
Storage Volume Required (m ³)	26	34	40	53	64	74

Quantity storage requirements within the stormwater management facility are calculated to be approximately 74 m³. The proposed SWMF has been sized with a total available quantity control volume of about 79.2 m³, which exceeds storage requirements. Detailed calculations have been provided in Appendix A.

5.4. Quality Control

The MOE issued a “Stormwater Management Planning and Design Manual” in March 2003. This manual has been adopted by a variety of agencies including the City. The objective of our SWM quality control will be to ensure MOE’s Enhanced Protection. To achieve Enhanced Protection, permanent and temporary control of erosion and sediment transport are proposed and are discussed in the following sections.

5.4.1. Stormwater Quality Control During Construction

To ensure stormwater quality control during construction, it is imperative that effective environmental and sedimentation controls be in place throughout the entire area subject to construction activities. With the requirement of earth grading, there will be a potential of soil erosion. It is therefore recommended that the following be implemented to assist in achieving acceptable stormwater runoff quality:

- Restoration of exposed surfaces with vegetation and non-vegetative material as soon as construction schedules permit;
- Installation of temporary sediment ponds, filter strips, silt fences and rock check dams or other similar facilities throughout the site, and specifically during all construction activities;



- Reduce stormwater drainage velocities where possible;
- Ensure that disturbed areas that are left inactive for more than 30 days shall be vegetated and stabilized as instructed by the Engineer;
- Minimize the amount of existing vegetation removed.

5.4.2. Permanent Quality Control

The objective of the permanent SWM quality controls will be to ensure MOE's Enhanced Protection. The proposed development will increase the imperviousness of the site. It is important to quantify this increase to evaluate the potential downstream impacts. As per the site's statistics, the post development's Total Imperviousness (TIMP) is:

Area of Building Roof	1,930 m ²
Area of Asphalt	340 m ²
Area of Conc.	165 m ²
Total Area	2,435 m ²

$$\begin{aligned}\text{TIMP} &= (A_{\text{BLD}} + A_{\text{ASP}} + A_{\text{CONC}}) / A_{\text{TOTAL}} \\ &= (2,435) / 3,055 \\ &= 0.789 \text{ (or 79\%)}\end{aligned}$$

Given the nature of the site, and use of the site, Low Impact Development (LID) methods are not recommended. Therefore, it is proposed to install on-site controls in the form of an Oil-Grit Separator that will be sized to treat the respective drainage area from the hardened surfaces.

5.4.3. Oil Grit Separator

A Hydroworks or equivalent treatment unit is proposed to treat the stormwater released from this site to the MECP's Enhanced or Level 1 Protection standard. This MECP standard stipulates a Total Suspended Solids (TSS) removal of at least 80%. The HydroStorm HS4 model will treat the post development flows to the required MOE quality standard, with a TSS removal rate of approximately 84%. The design criteria and background information on how the Hydroworks unit is sized is provided within Appendix B.

5.5. Phosphorous Balance

The existing site generates approximately 0.066 kg of phosphorous annually and the proposed lands will generate approximately 0.322 kg of phosphorous annually. The following chart details the anticipated phosphorous loadings for the pre- and uncontrolled post-development conditions.

	Total P (kg/yr)
Pre-Development	0.066
Uncontrolled Post Development	0.329

Based on the above calculations there is an anticipated phosphorus release from the site in the amount of 0.322 kg/yr. Phosphorus offset fees in accordance with the LSRCA's phosphorus offsetting policy is calculated as follows:

$$2.5 * 0.329 \text{ kg/yr} * \$35,000.00 = \mathbf{\$28,787.50.}$$

$$\$44.97 / \text{m}^3 * (912 \text{ m}^3 - 218 \text{ m}^3) * 15\% \text{ Administration} = \mathbf{\$35,942.27}$$



5.6. Erosion and Sediment Control

To ensure Stormwater runoff quality is controlled during construction, an erosion and sediment control strategy will be implemented to mitigate transportation of silt off-site to the existing roads and sewers. It is imperative that effective controls be put in place and maintained until all areas are stabilized with surface cover.

All erosion and sediment control Best Management Practices (BMP) shall be designed, constructed and maintained in accordance with the LSRCA's erosion control requirements.

Items that will be addressed for both temporary and permanent erosion and sediment controls are based on the following:

- Site location description and area;
- Existing and proposed land use;
- Vegetative cover;
- Existing drainage routes;
- Proposed site works;
- Proposed outlets;
- Permits required;
- Sediment filters and barriers - silt fences;
- Construction entrance location;
- Protection to catch basins and ditch inlets;

To prevent construction generated sediments from entering the storm sewers or leaving the site by overland flow, the following measures should be implemented during the construction phase:

- Temporary sediment control fencing should be erected around the perimeter of the grading activities.
- Temporary sediment fabric and stone filters should be installed on existing and proposed catch basins until surface cover has been stabilized.
- A temporary construction access mud mat should be implemented to reduce the amount of materials that may be transported off site.
- Construction during drier months should be monitored for wind-borne transport of sediments. At the direction of the engineer, the contractor may be directed to water down exposed earth areas with an aqueous solution of calcium chloride.
- All disturbed areas not under immediate construction for 30 days, or not intended for building activities within a 3-month time period, should be stabilized with seeding.

Built up sediment should be removed and disposed off-site at least once a month, or more frequently as directed by the engineer.



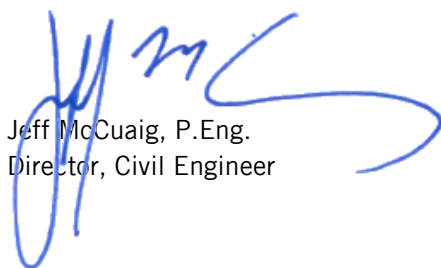
6. Conclusions

A summary of the servicing recommendations is as follows:

- **Water Servicing** – The development will provide a water service connection to the Residential Condominium by a new internal 150mm diameter water service which is connected to the existing external 200mm diameter watermain on McDonald Street. A *Water Systems Analysis* has yet to be completed by Gerrits Engineering Ltd. for the proposed development. We suggest that the City review the watermain design requirements for this development with respect to the City's water treatment and supply capacities and confirm that capacity allocation is available for this development. Given the size and location of this development, this is not expected to be a concern. Flow Tests have been assessed and are acceptable for this type of development.
- **Sanitary Servicing** – Serviceability to the subject site can be provided on Clapperton Street. Flows from the development will be collected and then conveyed by gravity, which will flow east towards the existing sanitary line via a proposed doghouse maintenance hole structure located on Clapperton Street (SAN DHMH 101). Please refer to the SS-1 Drawing in Appendix C.
- **Stormwater Drainage and Management** – The proposed storm sewer system will discharge to the proposed stormwater management facility located in the underground floor. The SWM facility has been sized to provide for the storage of 1:100 year design storm events. A review of the stormwater management facility modeling indicates that the proposed development meets design standards and that sufficient volumes are present. An OGS is being proposed to provide the MECP's Enhanced or Level 1 Protection standard. The HydroStorm HS4 model will treat the post development flows to the required MOE quality standard, with a TSS removal rate of approximately 84%. It is being proposed that no further additional onsite methods will be implemented in order to maintain the water balance or phosphorous loading. An offsetting water balance and phosphorous loading fee is anticipated since the proposed development will not meet the current regime of the site.

The preliminary analysis and conceptual design outlined in this report demonstrates that the servicing of this proposed development is feasible and, if based on sound engineering principles, the development will become a cohesive part of the Community of the City of Barrie.

All of which is respectfully submitted,
Gerrits Engineering Ltd.



Jeff McCuaig, P.Eng.
Director, Civil Engineer



Appendix A

Design Calculations

RESIDENTIAL DEVELOPMENT

SANITARY FLOW CALCULATIONS

CLIENT: Black Creek Group
PROJECT: Proposed Residential Condominium
FILE: 1510-001

Date: 31-May-24
Design: Kevin Filion CET

$n = 0.013$
 $M = 1 + (14 / (4 + (P / 1000) ^ { 0.5 }))$
 $Q_p = P * Q * M / 86400$

$2 \leq "M" \leq 4$
 $Q = 225 \text{ L/cap/day}$

$Q_{tot} = Q_p + Q_i$

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE	PEAK RATE FACTOR: M						
Single Family	3.13 people/unit	225 L/cap/d							
Townhomes	2.34 people/unit	225 L/cap/d							
Condominium Bt	1.67 people/unit	225 L/cap/d							
Extraneous Flow		0.1 L/s/ha							
	SINGLE UNITS	DEVELOPMENT AREA (Ha)	TOTAL UNITS	POPULATION (P)	POPULATION (ACC.)	EXTRANEEOUS FLOW	PEAKING FACTOR (M)	AVERAGE FLOW (L/s)	PEAK FLOW (L/s)
Condominium	260	0.31	260	434.2	435	0.03	4.00	4.56	18.84
TOTAL UNITS	260	0.31	260	434.2	435	0.03	4.00	4.56	18.84
INFILTRATION	0.35 ha							0.00	18.84

RESIDENTIAL DEVELOPMENT

WATER FLOW CALCULATIONS

CLIENT:

Black Creek Group

Date: 31-May-24

PROJECT:

Proposed Residential Condominium

Design Kevin Filion CET

FILE:

1510-001

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE	PEAKING FACTORS*
			MAX DAY FACTOR 3.12
Single Family	3.13 people/unit	225 L/cap/d	PEAK RATE FACTOR 5.17
Townhomes	2.34 people/unit	225 L/cap/d	
Condominium Building	1.67 people/unit	225 L/cap/d	

*From MOE Manual Table 3-3 - Population of Fewer than 500

PHASE	SINGLE UNITS		TOTAL UNITS	POPULATIO N (P)	COMMERCIAL AREA (ha)	EQUIVALENT POPULATIO	EQUIVALENT POPULATIO N	AVERAGE FLOW (L/s)	MAX DAY FLOW (L/s)	PEAK FLOW (L/s)
Condominium	260		260	435			435	1.13	3.53	5.86
TOTAL UNITS	260		260	435			435	1.13	3.53	5.86

FLOW TEST RESULTS



DATE : APRIL 5, 2022 TIME VALVE OPENED : 11:00 AM

TIME LAST VALVE CLOSED : 11:20 AM

LOCATION : CLAPPERTON ST

BARRIE

ONTARIO

TEST BY : LEN.K-ETHAN.B

NAME OF CITY OPERATOR : CAM NEWITT



STATIC PRESSURE : 61 PSI

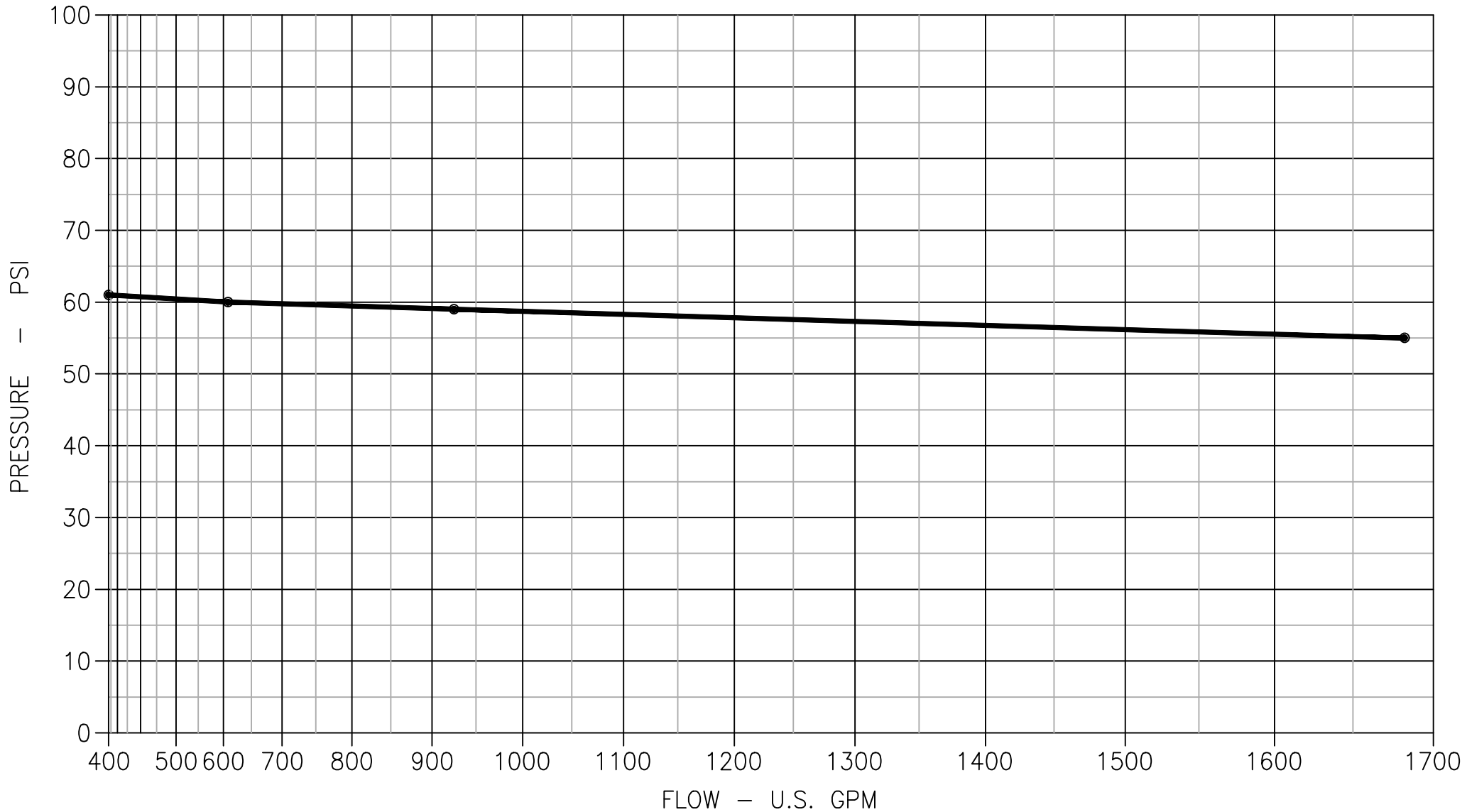
SIZE OF UNDERGROUND MAIN : 200mm

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-3/4	0.995	60	47	610
2	1	2-1/2	0.90	59	30	924
3	2	2-1/2	0.90	55	25	1686



CLAPPERTON ST	BY : LEN.K/ETHAN.B
BARRIE	OFFICE : BARRIE
ONTARIO	TEST BY : VIPOND & PUC
	DATE : APRIL 5, 2022

STATIC:		RESIDUAL:		FLOW:
<u>61</u> PSI	TEST#1	<u>60</u> PSI	@	<u>610</u> GPM
	TEST#2	<u>59</u> PSI	@	<u>924</u> GPM
	TEST#3	<u>55</u> PSI	@	<u>1686</u> GPM



Transforming Hydrant Tests to Pump Flow Points and Fire Flows at 20psi Residual

17 Sophia Street, Barrie, Ontario

Test Location: Southeast corner of Clapperton St and McDonald St
Hydrant 53
Static Pressure: 61.0 psi
Main Size: 200.0 mm

Test Location:
Static Pressure:
Main Size:

Test	
Flow (USGPM)	Residual Pressure (psi)
610	60
924	59
1686	55

Test	
Flow (USGPM)	Residual Pressure (psi)

Pump Flow Points	
Flow (L/s)	Head (m)
0	42.9
38.5	42.2
58.3	41.5
106.4	38.7
0.0	0.0

Pump Flow Points	
Flow (L/s)	Head (m)

Q_T 1686.0 GPM
h_a 41.0 psi
h_t 6.0 psi
Q_A 4407.3 GPM 278.1 L/s

Q_T
h_a
h_t
Q_A 0.0 L/s

Project: 17 Sophia St.
 Project Number 1510-001
 Location City of Barrie



1 FUS Formula			
$F = 220 C \sqrt{A}$		where: F = required fire flow in litres per minute C= the Coefficient related to the type of construction; and A = the total flow area in square metres (including all storeys but excluding basements at least 50% below grade)	
Type of Construction: non-combustible construction			
C =	0.8		
A =	8290		
F =	16000 L/min 267 L/s		
2 Occupancy Adjustment			
Type of Occupancy: Limited			
Hazard Allowance:		-15%	
Adjusted Fire Flow		13600 L/min	
3 Sprinkler Adjustment			
		CREDIT	
NFPA 13 sprinkler standard: Yes		30%	
Standard water supply: Yes		10%	
Fully Supervised system: Yes		10%	
Sprinkler Credit		6800 L/min	
4 Exposure Adjustment			
		Charge	
North Side 0 to 3m		15%	
East Side 3.1 to 10m		11%	
South Side 0 to 3m		15%	
West Side 3.1 to 10m		11%	
Exposures Surcharge		8320	L/min

Total Required Fire Flow	15000 L/min 250.0 L/sec
---------------------------------	----------------------------

PROPOSED MIXED USE DEVELOPMENT

17 Sophia Street East, Barrie, ON

AREA SUMMARY

Zoning:	C2-2 Transition Center Commercial 2	
Lot Area (existing):	3044.8 m ²	32,773.6 ft ²
Lot Area (ultimate):	2885.9 m ²	15949.5 ft ²
Ground Floor Area:	940.2 m ²	10,120.4 ft ²
Lot Coverage:	73.5%	

Residential GFA:	15928.4 m ²	171,451.5 ft ²
Non-Residential GFA:	264.8 m ²	2,850.3 ft ²
Building Total GFA:	16193.2 m ²	174,301.8 ft ²
Floor Space Index (FSI):	5.32	

Number of Stories:	26 + MPH.
Building Height:	81.55 m + MPH.
Building Height including MPH.:	88.55 m

* Gross Construction Area:
Means the area measured to the outside surface of exterior walls for each floor without deduction. This includes enclosed structured parking but excludes the roof level of a structure (whether parking structure or roof of building).

* * * * GFA: Shall mean the total area of all floors in a building, excepting a basement in a residential building, measured from the outside face of the exterior walls, but exclusive of any part of a building which is used for the storage or parking of motor vehicles other than for the automotive purposes defined in Section 3.0 to this By-law, for storage, stairwells, or for mechanical or electrical equipment providing services for the entire building. In addition to the exceptions, in calculating the gross floor area for "dwelling, apartment", the part of the gross corridor areas which are in excess of the minimum corridor areas required under the provisions of the Ontario Building Code and the area occupied by a recreational amenity shall not be included. (City of Barrie By-law 2009-141)

GROSS BUILDING AREA (GCA) AND GROSS FLOOR AREA (GFA)

GROSS BUILDING AREA (GCA) *			GFA EXEMPTIONS ** (PER BY-LAW 2009-141)		TOTAL GFA	
Level	m ²	SF	m ²	sf	m ²	sf
P1	960.2 m ²	10,336.0 ft ²	949.4 m ²	10,218.9 ft ²	10.9 m ²	117.1 ft ²
GROUND FLOOR	940.2 m ²	10,120.4 ft ²	363.1 m ²	3,908.8 ft ²	577.1 m ²	6,211.6 ft ²
2ND FLOOR	1794.6 m ²	19,317.2 ft ²	1749.1 m ²	18,827.4 ft ²	45.5 m ²	489.9 ft ²
3RD FLOOR	1919.1 m ²	20,656.6 ft ²	1873.6 m ²	20,167.4 ft ²	45.4 m ²	489.2 ft ²
4TH FLOOR	1919.1 m ²	20,656.6 ft ²	1873.6 m ²	20,167.4 ft ²	45.4 m ²	489.2 ft ²
5TH FLOOR	1919.1 m ²	20,656.6 ft ²	1877.7 m ²	20,211.0 ft ²	41.4 m ²	445.7 ft ²
6TH FLOOR	855.6 m ²	9,209.6 ft ²	319.3 m ²	3,437.3 ft ²	536.3 m ²	5,772.3 ft ²
7TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
8TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
9TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
10TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
11TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
12TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
13TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
14TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
15TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
16TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
17TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
18TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
19TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
20TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
21ST FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
22ND FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
23RD FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
24TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
25TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
26TH FLOOR	855.6 m ²	9,209.6 ft ²	111.0 m ²	1,195.3 ft ²	744.6 m ²	8,014.3 ft ²
MPH.	579.4 m ²	6,236.9 ft ²	579.4 m ²	6,236.9 ft ²	0.0 m ²	0.0 ft ²
TOTAL	27999.3 m ²	301,382.1 ft ²	11806.1 m ²	127,080.3 ft ²	16193.2 m ²	174,301.8 ft ²

AREA SUMMARY

[illegible]

UNIT SUMMARY

UNIT MIX				
Name	Count	Percentage	Total Unit Area	Average Unit Size
1B	147	56.5%	6,989.2 m²	47.5 m²
2B	113	43.5%	7,853.3 m²	69.5 m²
TOTAL	260	100.0%	14,842.5 m²	

AMENITY AREA

AMENITY REQUIREMENTS SUMMARY	
UNIT COUNT	AMENITY REQUIREMENTS
260	Minimum of 12.0m ² per unit

AMENITY AREA STATISTICS		
	AMENITY REQUIRED	PROPOSED
INDOOR AMENITY		321.86 m ²
OUTDOOR AMENITY	3120 m ²	488.03 m ²
PRIVATE OUTDOOR AMENITY		3444.39 m ²
TOTAL AMENITY		4254.28 m ²

VEHICULAR PARKING

VEHICULAR PARKING STATISTICS		
USE	PROPOSED RATE	PROPOSED COUNT
Residential	0.68	176

PROPOSED VEHICLE PARKING DISTRIBUTION		
LEVEL	TYPE	COUNT
GROUND FLOOR	Accessible Parking	1
2ND FLOOR	Accessible Parking	1
3RD FLOOR	Accessible Parking	3
4TH FLOOR	Accessible Parking	3
5TH FLOOR	Accessible Parking	2
Accessible Parking		10
GROUND FLOOR	Standard Parking	10
2ND FLOOR	Standard Parking	27
3RD FLOOR	Standard Parking	43
4TH FLOOR	Standard Parking	43
5TH FLOOR	Standard Parking	43
Standard Parking		166
TOTAL VEHICULAR PARKING: 176		176

BICYCLE PARKING

BIKE PARKING STATISTICS- BICYCLE ZONE 1				
BICYCLE PARKING TYPE	UNIT COUNT	MIN. RATE	REQUIRED SPACES	PROPOSED SPACES
RESIDENTIAL (INDOOR)	260	1.5	390	470
RESIDENTIAL (OUTDOOR)		0.2	52	12
NON-RESI. (OUTDOOR)		0.3/100 m ² of GFA	1	4
NON-RESI. (INDOOR)		3 plus 0.3/100 m ² of GFA	4	-
TOTAL			447	486

LOADING AND WASTE

LOADING AREA STATISTICS		
UNIT COUNT	260	
LOADING SPACE REQUIREMENT	City of Barrie By-law 2009-141	LENGTH: 9.0m, WIDTH: 3.0m, HEIGHT: 4.0m
STAGING AREA		PROVIDED: 41 m²
RESIDENTIAL WASTE		PROVIDED: 100 m²

NAME OF PRACTICE: Studio JCI Inc. 20 De Boers Drive, suite 525 Toronto, ON M3J 0H1											
NAME OF PROJECT: Mixed-Use Development Residential Multi-Unit/Commercial											
LOCATION: 17 Sophia Street East, Barrie, ON											
Ontario Building Code Data Matrix Part 3			Building Code Reference ¹								
3.00	Building Code Version:	<u>O. Reg. 332/12</u>	Last Amendment <u>O. Reg. 191/14</u>								
3.01	Project Type:	☒ New ☐ Addition ☐ Addition and renovation	[A] 1.1.2.								
		Description: _____									
3.02	Major Occupancy Classification:	<table><tr><td><u>Occupancy</u></td><td><u>Use</u></td></tr><tr><td><u>C</u></td><td><u>Residential Occupancies</u></td></tr><tr><td><u>E/A2</u></td><td><u>Mercantile/Assembly Occupancies (ie. Retail and Amenities)</u></td></tr><tr><td><u>F3</u></td><td><u>Low Hazard Industrial Occupancies</u></td></tr></table>	<u>Occupancy</u>	<u>Use</u>	<u>C</u>	<u>Residential Occupancies</u>	<u>E/A2</u>	<u>Mercantile/Assembly Occupancies (ie. Retail and Amenities)</u>	<u>F3</u>	<u>Low Hazard Industrial Occupancies</u>	3.1.2.1.(1)
<u>Occupancy</u>	<u>Use</u>										
<u>C</u>	<u>Residential Occupancies</u>										
<u>E/A2</u>	<u>Mercantile/Assembly Occupancies (ie. Retail and Amenities)</u>										
<u>F3</u>	<u>Low Hazard Industrial Occupancies</u>										
3.03	Superimposed Major Occupancies:	☐ No ☒ Yes Description: <u>Group C above Group E/A2/F3 Occupancies</u>	3.2.2.7.								
3.04	Building Area (m ²)	<table><tr><td><u>Description:</u></td><td><u>Existing</u></td><td><u>New</u></td><td><u>Total</u></td></tr><tr><td></td><td><u>0</u></td><td><u>1,919.1m²</u></td><td><u>1,919.1m²</u></td></tr></table>	<u>Description:</u>	<u>Existing</u>	<u>New</u>	<u>Total</u>		<u>0</u>	<u>1,919.1m²</u>	<u>1,919.1m²</u>	[A] 1.4.1.2.
<u>Description:</u>	<u>Existing</u>	<u>New</u>	<u>Total</u>								
	<u>0</u>	<u>1,919.1m²</u>	<u>1,919.1m²</u>								
3.05	Gross Area (m ²)	<table><tr><td><u>Description:</u></td><td><u>Existing</u></td><td><u>New</u></td><td><u>Total</u></td></tr><tr><td></td><td><u>0</u></td><td><u>16,193.2m²</u></td><td><u>16,193.2m²</u></td></tr></table>	<u>Description:</u>	<u>Existing</u>	<u>New</u>	<u>Total</u>		<u>0</u>	<u>16,193.2m²</u>	<u>16,193.2m²</u>	[A] 1.4.1.2.
<u>Description:</u>	<u>Existing</u>	<u>New</u>	<u>Total</u>								
	<u>0</u>	<u>16,193.2m²</u>	<u>16,193.2m²</u>								
3.06	Mezzanine Area (m ²)	<table><tr><td><u>Description:</u></td><td><u>Existing</u></td><td><u>New</u></td><td><u>Total</u></td></tr><tr><td></td><td><u>0</u></td><td><u>0</u></td><td><u>0</u></td></tr></table>	<u>Description:</u>	<u>Existing</u>	<u>New</u>	<u>Total</u>		<u>0</u>	<u>0</u>	<u>0</u>	3.2.1.1.
<u>Description:</u>	<u>Existing</u>	<u>New</u>	<u>Total</u>								
	<u>0</u>	<u>0</u>	<u>0</u>								
3.07	Building Height	<table><tr><td><u>26</u></td><td>Stores above grade</td><td><u>81.55</u> (m) Above grade</td></tr><tr><td><u>1</u></td><td>Stores below grade</td><td></td></tr></table>	<u>26</u>	Stores above grade	<u>81.55</u> (m) Above grade	<u>1</u>	Stores below grade		[A] 1.4.1.2. & 3.2.1.1.		
<u>26</u>	Stores above grade	<u>81.55</u> (m) Above grade									
<u>1</u>	Stores below grade										
3.08	High Building	☐ No ☒ Yes	3.2.6.								

3.09	Number of Streets/ Firefighter access	_____ street(s)		3.2.2.10. & 3.2.5.
3.10	Building Classification: (Size and Construction Relative to Occupancy)	3.2.2.42 3.2.2.57 3.2.2.73	Group/Div _____ Group/Div _____ Group/Div _____ Group C, Any Height, Any Area, Sprinklered Group E, Any Height, Any Area, Sprinklered Group F, Div. 2, Any Height, Any Area, Sprinklered	Group/Div _____ _____
3.11	Sprinkler System	☒ Required <u>Proposed:</u>	☐ Not Required ☒ entire building ☐ selected floor areas ☐ none ☐ selected compartments ☐ basement ☐ in lieu of roof rating	3.2.1.5. & 3.2.2.17.
3.12	Standpipe System	☐ Not required ☒ Required		3.2.9.
3.13	Fire Alarm System	☒ Required <u>Proposed:</u>	☐ Not required ☐ Single stage ☐ Two stage ☐ None	3.2.4.
3.14	Water Service / Supply is Adequate	☐ No ☒ Yes		
3.15	Construction Type:	<u>Restriction:</u> <u>Actual:</u> <u>Heavy Timber Construction:</u>	☐ Combustible permitted ☐ Combustible ☒ Non-combustible ☐ No ☐ Yes ☒ Non-combustible required ☐ Non-combustible ☐ Combination	3.2.2.20. - 83. & 3.2.1.4.
3.16	Importance Category:	☐ Low ☒ Normal ☐ High ☐ Post-disaster	☐ Low human occupancy ☐ Minor storage building ☐ Post-disaster shelter ☐ Explosive or hazardous substances	4.1.2.1.(3) & 7.4.1.2.1.B
3.17	Seismic Hazard Index:	(I _e Fa Sa (0.2)) = _____ Seismic design required for Table 4.1.8.18. items 6 to 21: (I _e Fa Sa (0.2)) ≥ 0.35 or Post-disaster)	☒ No ☐ Yes	4.1.2.1.(3) 4.1.8.18.(2)

Issued:

SPA 2nd Pre-Submission	Jun. xx, 2024
SPA Pre-Submission	Dec. 01, 2023
OPA/ZBA Resubmission	Oct. 26, 2023
Issued for OPA/ZBA	Apr. 08, 2020
Rev. Issuance	Date

General Notes:

1. These Contract Documents are the property of the Architect. The Architect bears no responsibility for the interpretations of these documents by the Contractor. Upon written application the Architect will provide written/graphic clarification or supplementary information regarding the intent of the Contract Documents. The Architect will review Shop Drawings submitted by the Contractor for design conformance only.

2. Drawings are not to be scaled for construction. Contractor to verify all existing conditions and dimensions required to perform the Work and report any discrepancies with the Contract Documents to the Architect before commencing work.

3. Positions of exposed or finished mechanical or electrical devices, fittings, and fixtures are indicated on the Architectural drawings. The locations shown on the Architectural drawings govern over the Mechanical and Electrical drawings. Those items not clearly located will be located as directed by the Architect

SPA File Reference No:
D28-088-2022

Architect:
STUDIO JCI
20 De Boers Drive, Suite 525
Toronto, ON M3J 0H1
t. 416.901.6528
www.studiojci.com

PROPOSED MIXED USE DEVELOPMENT

ADDRESS:
17 Sophia Street East,
Barrie, ON

PROJECT STATISTICS

Project No.: 2115
Scale:
Date: JUNE xx, 2024
Drawn by: STUDIO JCI

Drawing No.:

A001

[illegible]

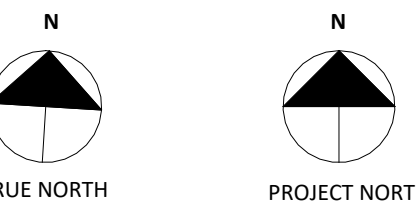
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PA File Reference No:
28-088-2022

Architect:
STUDIO JCI
20 De Boers Drive, Suite 525
Toronto, ON M3J 0H1
t. 416.901.6528
www.studiojci.com



PROPOSED MIXED USE DEVELOPMENT

ADDRESS:
7 Sophia Street East,
Barrie, ON

ITE PLAN

Project No.: 2115
Scale: 1 : 200
Date: JUNE xx, 2024
Drawn by: STUDIO JCI

Drawing No.:

A100



Calculation of Weighted Runoff Coefficient

Pre/Post Development Areas and Sub-Areas

Area ID	Total Area	0.15	0.08	0.95	0.95	0.60	0.95	Weighted Rational Coefficient
		Grass	Treed	Asphalt	Building Roof	Gravel	Concrete	
Pre-Development	3055	2343	334	0	178	198	2	0.22
X-1	2620	2176	334	0	0	108	2	0.16
X-2	435	167	0	0	178	90	0	0.57
Post-Development	3055	620	0	340	1930	0	165	0.79
P-1	1920	0	0	0	1920	0	0	0.95
P-2	265	240	0	0	5	0	20	0.23
P-3	420	70	0	315	0	0	35	0.82
P-4	170	100	0	0	5	0	65	0.48
P-5	120	60	0	20	0	0	40	0.55
P-6	160	150	0	5	0	0	5	0.20
Uncontrolled (P5-P-6)	280	210	0	25	0	0	45	0.35
Controlled SWM Tank (P1-P4)	2775	410	0	315	1930	0	120	0.83

Q= 0.0028*C*I*A (cms)

C=RUNOFF COEFFICIENT

I=RAINFALL INTENSITY=

A=AREA (ha)

A/(Tc+B)*C

City of Barrie

STORM SEWER DESIGN

DATE:

FILE

CONTRACT/PROJECT

June 06 2024

1510-001

17 Sophia Street

	A	B	C
IDF Curve Parameters (5-Yr Return Period):	843.019	4.582	0.763
IDF Curve Parameters (100-Yr Return Period):	1383.628	4.905	0.754

Areas	MANHOLE		LENGTH (m)	INCREMENT			TOTAL CA	FLOW TIME (min)		I (mm/h)	TOTAL Q (cms)	S (%)	D (mm)	Q FULL (cms)	V FULL (m/s)
	FROM	TO		C	A	CA		TO	IN						
P-2	CB#1	CBMH #1	23.7	0.23	0.03	0.01	0.01	10.00	0.41	109.11	0.00	0.50	300	0.07	0.97
P-3	CBMH #1	CONTROL MH	45.0	0.82	0.04	0.03	0.04	10.41	0.78	106.83	0.01	0.50	300	0.07	0.97
P-1	SWM TANK	CBMH #2	1.9	0.95	0.19	0.18	0.18	10.00	0.02	109.11	0.06	1.00	300	0.10	1.37
P-4	CBMH #2	CONTROL MH	20.5	0.48	0.02	0.01	0.19	10.00	0.35	109.11	0.06	0.50	300	0.07	0.97
-	CONTROL MH	OGS	1.8				0.23	11.18	0.03	102.80	0.07	0.50	375	0.12	1.12
-	OGS	STM DHMH	13.1				0.23	11.21	0.19	102.67	0.07	0.50	375	0.12	1.12

Pre-Development Runoff Calculation

Area	X-1 (South Flow) 0.26 ha	X-2 (Clapperton Street) 0.04 ha	Total 0.31 ha
Runoff Coefficient	0.16	0.57	0.22
Time of Concentration	10 min	10 min	
Return Rate	Interpolated	Interpolated	
Coefficient	2 year	2 year	
Rainfall Intesity	1	1	
	83.1 mm/hr	83.1 mm/hr	
Allowable Release Rate	0.01 m ³ /s 10 L/s	0.01 m ³ /s 6 L/s	0.02 m ³ /s 15 L/s
Return Rate	5 year	5 year	
Coefficient	1	1	
Rainfall Intesity	109.1 mm/hr	109.1 mm/hr	
Allowable Release Rate	0.01 m ³ /s 13 L/s	0.01 m ³ /s 8 L/s	0.02 m ³ /s 20 L/s
Return Rate	10 year	10 year	
Coefficient	1	1	
Rainfall Intesity	126.4 mm/hr	126.4 mm/hr	
Allowable Release Rate	0.01 m ³ /s 15 L/s	0.01 m ³ /s 9 L/s	0.02 m ³ /s 23 L/s
Return Rate	25 year	25 year	
Coefficient	1.1	1.1	
Rainfall Intesity	148.3 mm/hr	148.3 mm/hr	
Allowable Release Rate	0.02 m ³ /s 19 L/s	0.01 m ³ /s 11 L/s	0.03 m ³ /s 30 L/s
Return Rate	50 year	50 year	
Coefficient	1.2	1.2	
Rainfall Intesity	164.1 mm/hr	164.1 mm/hr	
Allowable Release Rate	0.02 m ³ /s 23 L/s	0.01 m ³ /s 14 L/s	0.04 m ³ /s 37 L/s
Return Rate	100 year	100 year	
Coefficient	1.25	1.25	
Rainfall Intesity	180.4 mm/hr	180.4 mm/hr	
Allowable Release Rate	0.03 m ³ /s 26 L/s	0.02 m ³ /s 16 L/s	0.04 m ³ /s 42 L/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	675.6	4.681	0.78
5	843.0	4.582	0.763
10	976.9	4.745	0.76
25	1133.1	4.734	0.756
50	1251.5	4.847	0.753
100	1383.6	4.905	0.754

Modified Rational Method
 $Q = C_i C A / 360$

Where:

Q - Flow Rate (m³/s)
C_i - Peaking Coefficient
C - Rational Method Runoff Coefficient
I - Storm Intensity (mm/hr)
A - Area (ha.)

Gerrits Engineering Limited

Post Development Runoff Calculation

Area	0.31 ha	
Runoff Coefficient	0.79	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	83.1 mm/hr	
Allowable Release Rate	0.06 m ³ /s	56 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	109.1 mm/hr	
Allowable Release Rate	0.07 m ³ /s	73 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	126.4 mm/hr	
Allowable Release Rate	0.08 m ³ /s	84 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	148.3 mm/hr	
Allowable Release Rate	0.11 m ³ /s	109 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	164.1 mm/hr	
Allowable Release Rate	0.13 m ³ /s	132 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	180.4 mm/hr	
Allowable Release Rate	0.15 m ³ /s	151 L/s

Storm (yrs) Coeff A Coeff B Coeff C

2	675.6	4.681	0.78
5	843.0	4.582	0.763
10	976.9	4.745	0.76
25	1133.1	4.734	0.756
50	1251.5	4.847	0.753
100	1383.6	4.905	0.754

Modified Rational Method

$$Q = C_i C A / 360$$

Where:

Q - Flow Rate (m³/s)
 C_i - Peaking Coefficient
 C - Rational Method Runoff Coefficient
 I - Storm Intensity (mm/hr)
 A - Area (ha.)

Gerrits
Engineering Limited

Post Development Runoff Calculation

Controlled

Controlled SWM Tank (P1-P4)	0.28 ha	
Runoff Coefficient	0.83	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	83.1 mm/hr	
Allowable Release Rate	0.05 m ³ /s	53 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	109.1 mm/hr	
Allowable Release Rate	0.07 m ³ /s	70 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	126.4 mm/hr	
Allowable Release Rate	0.08 m ³ /s	81 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	148.3 mm/hr	
Allowable Release Rate	0.10 m ³ /s	105 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	164.1 mm/hr	
Allowable Release Rate	0.13 m ³ /s	126 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	180.4 mm/hr	
Allowable Release Rate	0.14 m ³ /s	145 L/s

Uncontrolled

Uncontrolled (P5-P-6)	0.028 ha	
Runoff Coefficient	0.35	
Time of Concentration	10 min	
	Interpolated	
Return Rate	2 year	
Coefficient	1	
Rainfall Intesity	83.1 mm/hr	
Allowable Release Rate	0.00 m ³ /s	2 L/s
Return Rate	5 year	
Coefficient	1	
Rainfall Intesity	109.1 mm/hr	
Allowable Release Rate	0.00 m ³ /s	3 L/s
Return Rate	10 year	
Coefficient	1	
Rainfall Intesity	126.4 mm/hr	
Allowable Release Rate	0.00 m ³ /s	3 L/s
Return Rate	25 year	
Coefficient	1.1	
Rainfall Intesity	148.3 mm/hr	
Allowable Release Rate	0.00 m ³ /s	4 L/s
Return Rate	50 year	
Coefficient	1.2	
Rainfall Intesity	164.1 mm/hr	
Allowable Release Rate	0.01 m ³ /s	5 L/s
Return Rate	100 year	
Coefficient	1.25	
Rainfall Intesity	180.4 mm/hr	
Allowable Release Rate	0.01 m ³ /s	6 L/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	675.6	4.681	0.78
5	843.0	4.582	0.763
10	976.9	4.745	0.76
25	1133.1	4.734	0.756
50	1251.5	4.847	0.753
100	1383.6	4.905	0.754

Modified Rational Method
Q = C_iC_iA / 360

Where:

Q - Flow Rate (m³/s)
C_i - Peaking Coefficient
C - Rational Method Runoff Coefficient
I - Storm Intensity (mm/hr)
A - Area (ha.)

STAGE - STORAGE - DISCHARGE - Subsurface/Surface Storage

Elevation (m)	Area (m ²)	Vol. (m ³)	Cum. Volume (m ³)	Storage Vol. Above Orifice (m ³)	Depth 1 (m)	Flow (m ³ /s)	Depth 2 (m)	Flow (m ³ /s)	Total Flow (m ³ /s)
231.80	36	0	0	0	0.343	0.0072	0.000	0.0000	0.007
232.00	36	7.2	7	7	0.543	0.0091	0.000	0.0000	0.009
232.20	36	7.2	14	14	0.743	0.0106	0.000	0.0000	0.011
232.40	36	7.2	22	22	0.942	0.0120	0.000	0.0000	0.012
232.60	36	7.2	29	29	1.142	0.0132	0.000	0.0000	0.013
232.80	36	7.2	36	36	1.342	0.0143	0.000	0.0000	0.014
233.00	36	7.2	43	43	1.542	0.0153	0.000	0.0000	0.015
233.20	36	7.2	50	50	1.742	0.0163	0.000	0.0000	0.016
233.40	36	7.2	58	58	1.942	0.0172	0.000	0.0000	0.017
233.60	36	7.2	65	65	2.142	0.0180	0.000	0.0000	0.018
233.80	36	7.2	72	72	2.342	0.0189	0.000	0.0000	0.019
233.90	36	3.6	76	76	2.442	0.0193	0.000	0.0000	0.019
234.00	36	3.6	79	79	2.542	0.0197	0.000	0.0000	0.020
234.10	36	3.6	83	83	2.642	0.0200	0.000	0.0000	0.020
234.20	36	3.6	86	86	2.742	0.0204	0.000	0.0000	0.020

Orifice 1	
Diameter	75 mm
Elevation	231.42 m
Orifice Constant	0.63
Orifice Centroid	231.46 m

Rectangular C Equation y=(a+bx)/(1+cx+dx^2)
a -1.04E+04 b 3.42E+06 c 2.13E+06 d -2.35E+05

Underground Storage

Elevation (m)	Outflow (m3/sec)	Storage (m3)	Storage (ha - m)
231.80	0	0	0
232.20	0.011	14	0.0014
232.60	0.013	29	0.0029
233.00	0.015	43	0.0043
233.40	0.017	58	0.0058
233.80	0.019	72	0.0072
234.00	0.020	79	0.0079

Pre/Post Flows and Storage

Year	Pre	Post	Storage
2	0.015	0.013	26
5	0.020	0.015	34
10	0.023	0.016	40
25	0.030	0.018	53
50	0.037	0.020	64
100	0.042	0.021	74

- MTO IDF EQUATIONS -

Uncontrolled Release from Site

100 Year Post Development Flow	0.01 m ³ /sec
Storm Duration	20 min

Total Release From Site

[illegible]

- MTO IDF EQUATIONS -

Uncontrolled Release from Site

50 Year Post Development Flow	0.01 m ³ /sec
Storm Duration	20 min

Hydrograph Data

[illegible]

Total Release From Site

[illegible]

- MTO IDF EQUATIONS -

Uncontrolled Release from Site

25 Year Post Development Flow	0.00 m ³ /sec
Storm Duration	20 min

Total Release From Site

[illegible]

- MTO IDF EQUATIONS -

Uncontrolled Release from Site

10 Year Post Development Flow	0.00 m ³ /sec
Storm Duration	20 min

Total Release From Site

[illegible]

- MTO IDF EQUATIONS -

Uncontrolled Release from Site

5 Year Post Development Flow	0.00 m ³ /sec
Storm Duration	20 min

Total Release From Site

[illegible]

CHECKING STORAGE RELEASE CHARACTERISTICS OF SUBSURFACE STORAGE GALLERIES - MTO IDF EQUATIONS -

Controlled Release from Site

2 Year Post Development Flow	0.05 m ³ /sec
Storm Duration	20 min

Pond Rating Curve

Elevation (m)	Outflow (m ³ /sec)	Storage (ha - m)	Storage (m ³)
231.80	0.01	0.0000	0.00
232.20	0.01	0.0014	14.40
232.60	0.01	0.0029	28.80
233.00	0.02	0.0043	43.20
233.40	0.02	0.0058	57.60
233.80	0.02	0.0072	72.00
234.00	0.02	0.0079	79.20

Uncontrolled Release from Site

2 Year Post Development Flow	0.00	m ³ /sec
Storm Duration	20	min

Hydrograph Data

[illegible]

Hydrograph Data

[illegible]

Total Release From Site

[illegible]

Phosphorous Concentrations by Land Use

	High Intensity	Transition	Low Intensity	Forest		
Average Total P (kg/ha/year) Barrie Creeks	1.32	0.06	0.13	0.05		

Pre-Development Condition

Total Annual Rainfall Percipitation	940.0	mm				
	High Intensity	Transition	Low Intensity	Forest		
Area (ha):	0.0378	0.2677	0	0		
Total P (kg/yr) :	0.04990	0.01606	0.00000	0.00000		
Total Pre-Development P (kg) :	0.066					

Post Development Condition - Untreated

	High Intensity Pavement	High Intensity Dwelling	Low Intensity		
Area (ha):	0.0505	0.193	0.062		
Total P (kg/yr) :	0.06666	0.25476	0.00806		
Total Post Development P (kg/yr) :	0.329				

Post Development Condition - Treated

	High Intensity Pavement	High Intensity Dwelling	Low Intensity		
Area (ha):	0.0505	0.193	0.062		
Total P (kg/yr) :	0.06666	0.25	0.00806		
<u>Without Treatment</u>					
Total Post Development P (kg/yr) :	0.32948				
<u>With Treatment</u>					
Treatment Train Approach Efficiency :	0	0	0		
P Removed (kg/yr) :	0.00	0.00	0.00		
Total Post Development P (kg/yr) :	0.329				

Proposed Residential Condominium Water Balance Calculations

PRE-DEVELOPMENT	Site			
Catchment Designation	Undeveloped Land/Treed	Building	Gravel	TOTALS
Area (m ²)	2,677	178	200	3,055
Pervious Area (m ²)	2,677	0	0	2,677
Impervious Area (m ²)	0	178	200	378
MOE Infiltration Factors				
Topography Infiltration Factor	0.30	0.00	0.00	
Soil Infiltration Factor	0.40	0.00	0.00	
Land Cover Infiltration Factor	0.10	0.00	0.00	
MOE Total Infiltration Factor	0.80	0.00	0	
Runoff Coefficient	0.2	1	1	
Runoff from Impervious Surfaces	0	0.9	0.6	
Inputs (per Unit Area)				
Precipitation (mm/yr)	940	940	940	940
TOTAL INPUTS (mm/yr)	940	940	940	940
Outputs (per Unit Area)				
Precipitation Surplus (mm/yr)	405	846	564	
Evapotranspiration (mm/yr)	535	94	376	
Infiltration (mm/yr)	324	0	226	
Rooftop Infiltration (mm/yr)	0	0	0	
Total Infiltration (mm/yr)	324	0	226	
Runoff Pervious Areas (mm/yr)	81	846	564	
Runoff Impervious Areas (mm/yr)	0	85	226	
Total Runoff (mm/yr)	81	931	790	
TOTAL OUTPUTS (mm/yr)	940	940	940	940
Difference (INPUTS-OUTPUTS)	0	0	0	0
Inputs (Volumes)				
Precipitation (m ³ /yr)	2,516	167	188	2,872
TOTAL INPUTS (m³/yr)	2,516	167	188	2,872
Outputs (Volumes)				
Precipitation Surplus (m ³ /yr)	1,084	151	113	1,348
Evapotranspiration (m ³ /yr)	1,432	17	75	1,524
Infiltration (m ³ /yr)	867	0	45	912
Rooftop Infiltration (m ³ /yr)	0	0	0	0
Total Infiltration (m ³ /yr)	867	0	45	912
Runoff Pervious Areas (m ³ /yr)	217	151	113	480
Runoff Impervious Areas (m ³ /yr)	0	0	113	113
Total Runoff (m ³ /yr)	217	151	226	593
TOTAL OUTPUTS (m³/yr)	2,516	167	188	2,872
Difference (INPUTS-OUTPUTS)	0	0	0	0

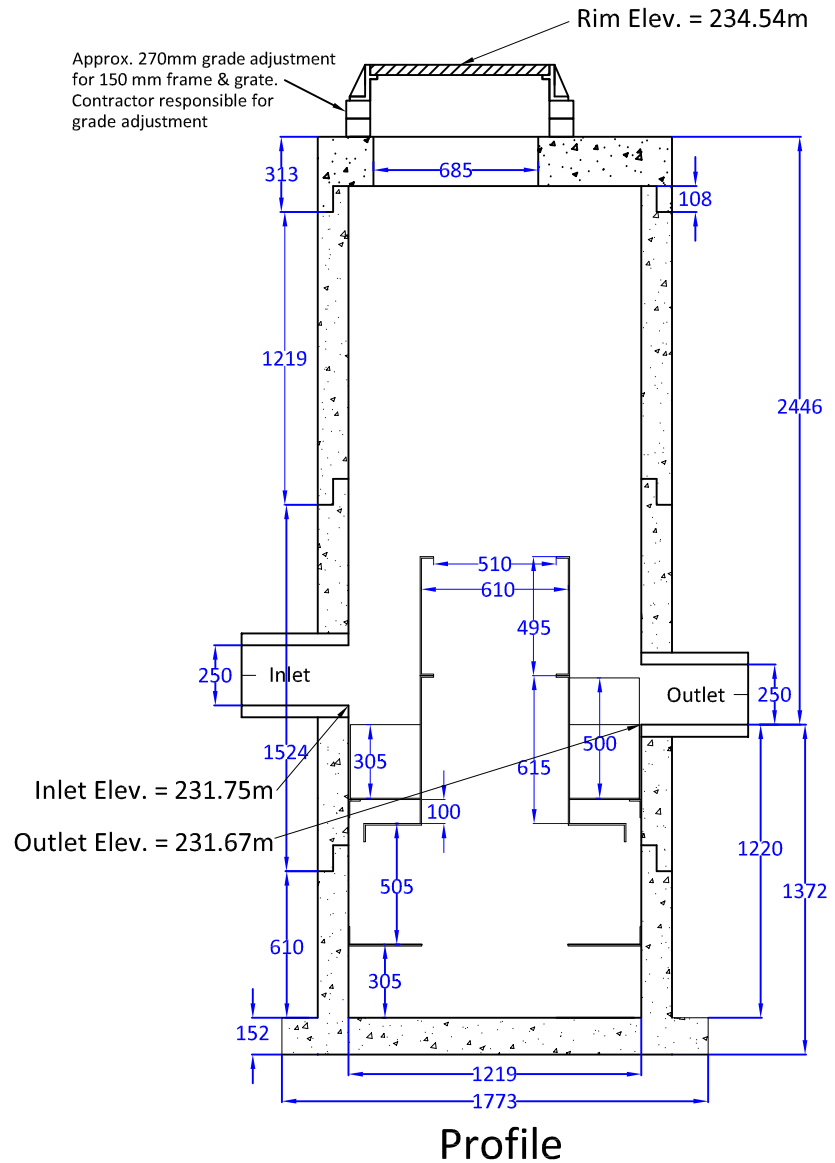
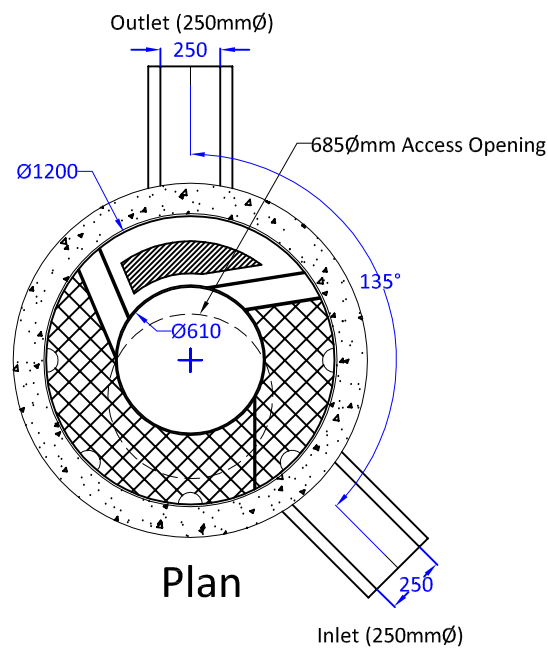
POST-DEVELOPMENT	Site			
Catchment Designation	Undeveloped Land	Paved	Building	TOTALS
Area (m ²)	620	505	1,930	3,055
Pervious Area (m ²)	620	0	0	620
Impervious Area (m ²)	0	505	1,930	2,435
MOE Infiltration Factors				
Topography Infiltration Factor	0.30	0.00	0.00	
Soil Infiltration Factor	0.40	0.00	0.00	
Land Cover Infiltration Factor	0.10	0.00	0.00	
MOE Total Infiltration Factor	0.8	0	0	
Runoff Coefficient	0.2	1	1	
Runoff from Impervious Surfaces	0	0.9	0.9	
Inputs (per Unit Area)				
Precipitation (mm/yr)	940	940	940	940
TOTAL INPUTS (mm/yr)	940	940	940	940
Outputs (per Unit Area)				
Precipitation Surplus (mm/yr)	425	846	846	
Evapotranspiration (mm/yr)	515	94	94	
Infiltration (mm/yr)	340	0	0	
Rooftop Infiltration (mm/yr)	0	0	0	
Total Infiltration (mm/yr)	340	0	0	
Runoff Pervious Areas (mm/yr)	85	846	846	
Runoff Impervious Areas (mm/yr)	0	846	846	
Total Runoff (mm/yr)	85	1692	1692	
TOTAL OUTPUTS (mm/yr)	940	940	940	940
Difference (INPUTS-OUTPUTS)	0	0	0	0
Inputs (Volumes)				
Precipitation (m ³ /yr)	583	475	1,814	2,872
TOTAL INPUTS (m³/yr)	583	475	1,814	2,872
Outputs (Volumes)				
Precipitation Surplus (m ³ /yr)	264	427	1,633	2,324
Evapotranspiration (m ³ /yr)	319	47	181	548
Infiltration (m ³ /yr)	211	0	0	211
Rooftop Infiltration (m ³ /yr)	0	0	0	0
Total Infiltration (m ³ /yr)	211	0	0	211
Runoff Pervious Areas (m ³ /yr)	53	427	1,633	2,113
Runoff Impervious Areas (m ³ /yr)	0	427	1,633	2,060
Total Runoff (m ³ /yr)	53	854	3,266	4,173
TOTAL OUTPUTS (m³/yr)	583	475	1,814	2,872
Difference (INPUTS-OUTPUTS)	0	0	0	0

POST-DEVELOPMENT	Site			
Catchment Designation	Undeveloped Land	Paved	Building	TOTALS
Area (m ²)	620	505	1,930	3,055
Pervious Area (m ²)	620	0	0	620
Impervious Area (m ²)	0	505	1,930	2,435
MOE Infiltration Factors				
Topography Infiltration Factor	0.30	0.00	0.00	
Soil Infiltration Factor	0.40	0.00	0.00	
Land Cover Infiltration Factor	0.10	0.00	0.00	
MOE Total Infiltration Factor	0.8	0	0	
Runoff Coefficient	0.2	1	1	
Runoff from Impervious Surfaces	0	0.9	0.9	
Inputs (per Unit Area)				
Precipitation (mm/yr)	940	940	940	940
TOTAL INPUTS (mm/yr)	940	940	940	940
Outputs (per Unit Area)				
Precipitation Surplus (mm/yr)	425	846	846	
Evapotranspiration (mm/yr)	515	94	94	
Infiltration (mm/yr)	340	0	0	
Rooftop Infiltration (mm/yr)	0	0	0	
Total Infiltration (mm/yr)	340	0	0	
Runoff Pervious Areas (mm/yr)	85	846	846	
Runoff Impervious Areas (mm/yr)	0	846	846	
Total Runoff (mm/yr)	85	1692	1692	
TOTAL OUTPUTS (mm/yr)	940	940	940	940
Difference (INPUTS-OUTPUTS)	0	0	0	0
Inputs (Volumes)				
Precipitation (m ³ /yr)	583	475	1,814	2,872
TOTAL INPUTS (m³/yr)	583	475	1,814	2,872
Outputs (Volumes)				
Precipitation Surplus (m ³ /yr)	264	427	1,633	2,324
Evapotranspiration (m ³ /yr)	319	47	181	548
Infiltration (m ³ /yr)	211	0	0	211
Rooftop Infiltration (m ³ /yr)	0	0	0	0
Total Infiltration (m ³ /yr)	211	0	0	211
Runoff Pervious Areas (m ³ /yr)	53	427	1,633	2,113
Runoff Impervious Areas (m ³ /yr)	0	427	1,633	2,060
Total Runoff (m ³ /yr)	53	854	3,266	4,173
TOTAL OUTPUTS (m³/yr)	583	475	1,814	2,872
Difference (INPUTS-OUTPUTS)	0	0	0	0



Appendix B

OGS Unit Sizing



HydroStorm by
Hydroworks, LLC
Canada Patent #3,085,711
www.hydroworks.com
888-290-7900

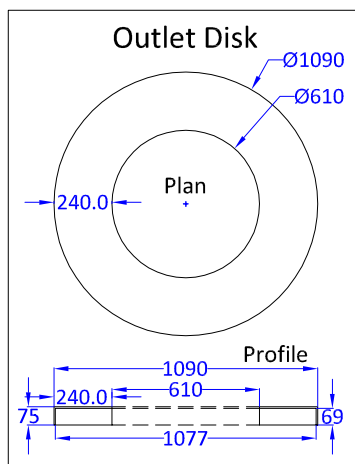
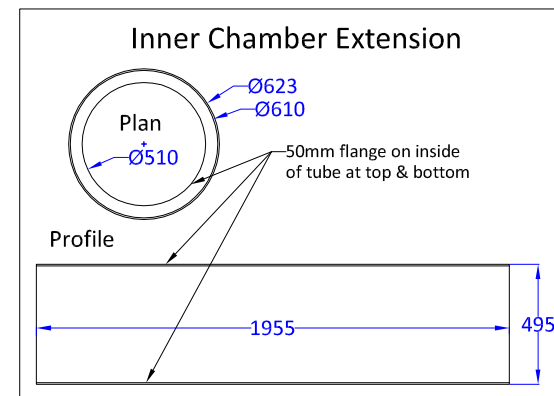
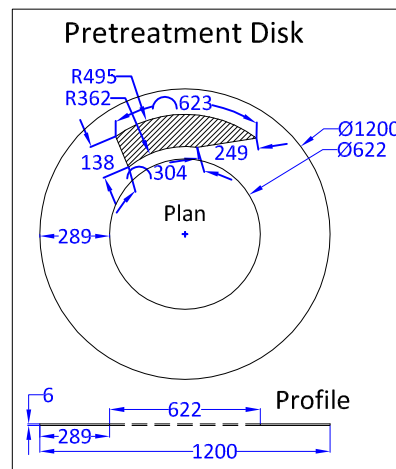
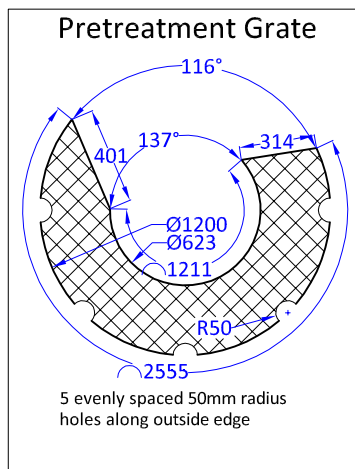
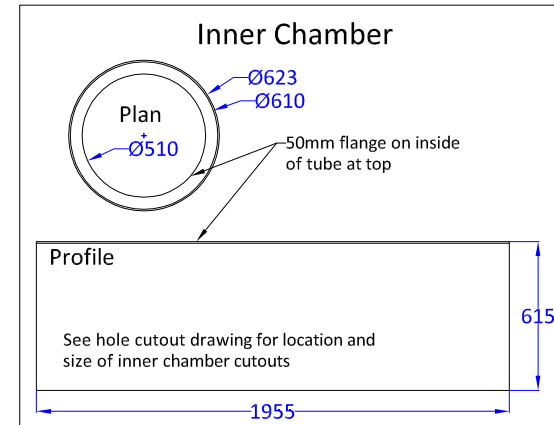
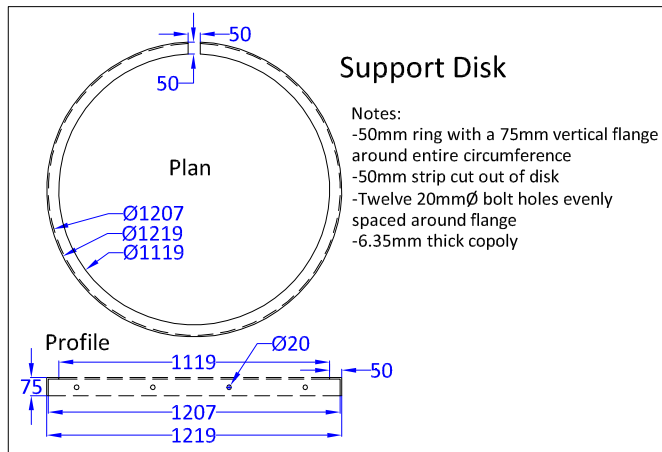
Hydroworks HS4 (1200mmØ)

PROJECT: 17 Sophia St (OGS MH)

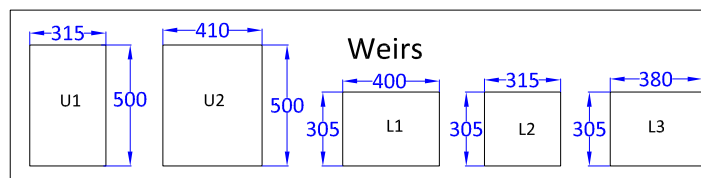
LOCATION: Barrie, ON

REVISION DATE: 04/07/2022





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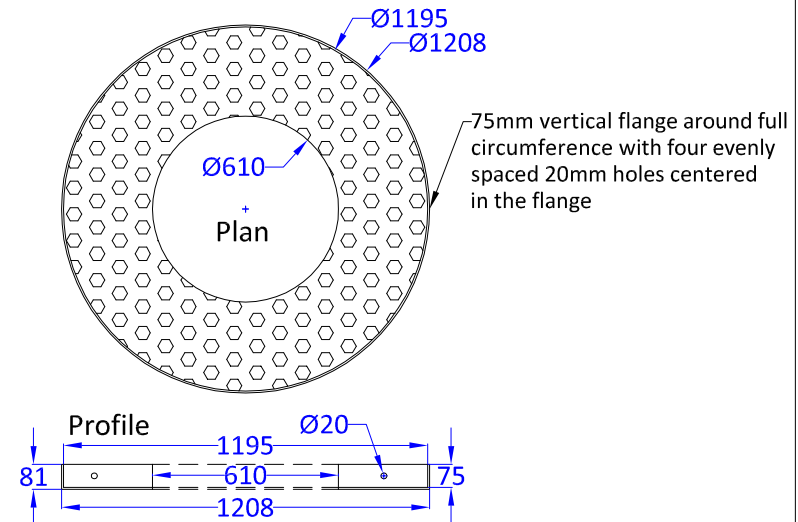
Hydroworks HS 4 (1200mmØ)		
PROJECT: 17 Sophia St (OGS MH)		
LOCATION: Barrie, ON		
REVISION DATE: 04/07/2022		

Insert Assembly

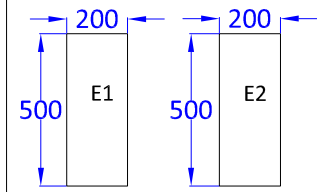
1. Roll and weld inner chamber tube.
2. Weld pretreatment disk floor to outside of inner chamber tube 100mm from bottom of tube.
3. Weld outlet disk to bottom of inner chamber tube with flanges facing downward.
4. Weld lower and upper weirs to base of pretreatment disk and outside of inner chamber.
5. Upper Weirs (U1 and U2) are offset 100mm from lower weirs (L1 and L2).
8. Cut holes in inner chamber at pretreatment disk.
9. Weld grate to lower weirs L1, L2, and L3 and outside of inner chamber. Top of grate is flush with top of L1 and L2 and sits on top of L3.
10. Roll and weld inner chamber extension (keep separate).

Lower Perforated Plate

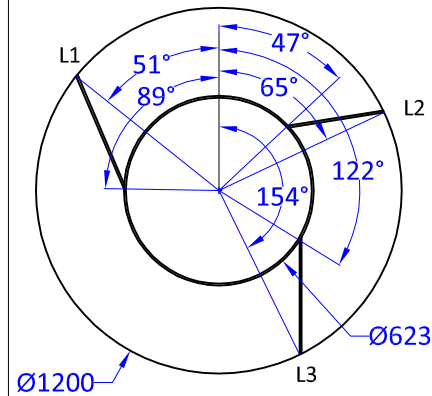
(6.35 mm thick with 5mmØ staggered holes (32% open area))



Bypass Weir Extension

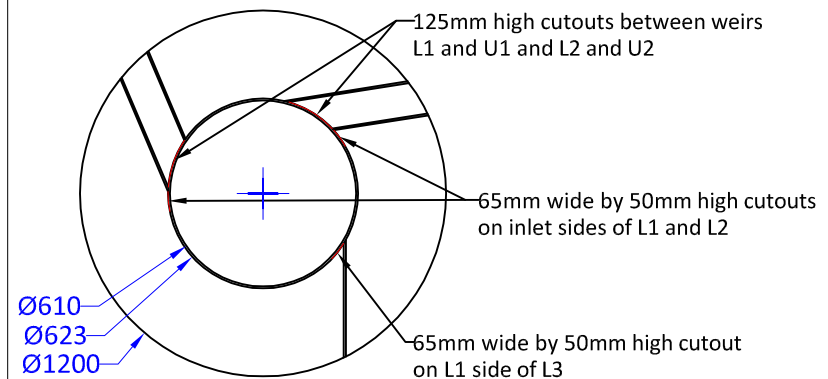


Lower Weir Placement



Inner Chamber Hole Cutouts

Note: All holes start flush with the top of the pretreatment disk



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Hydroworks HS 4 (1200mmØ)

PROJECT: 17 Sophia St (OGS MH)

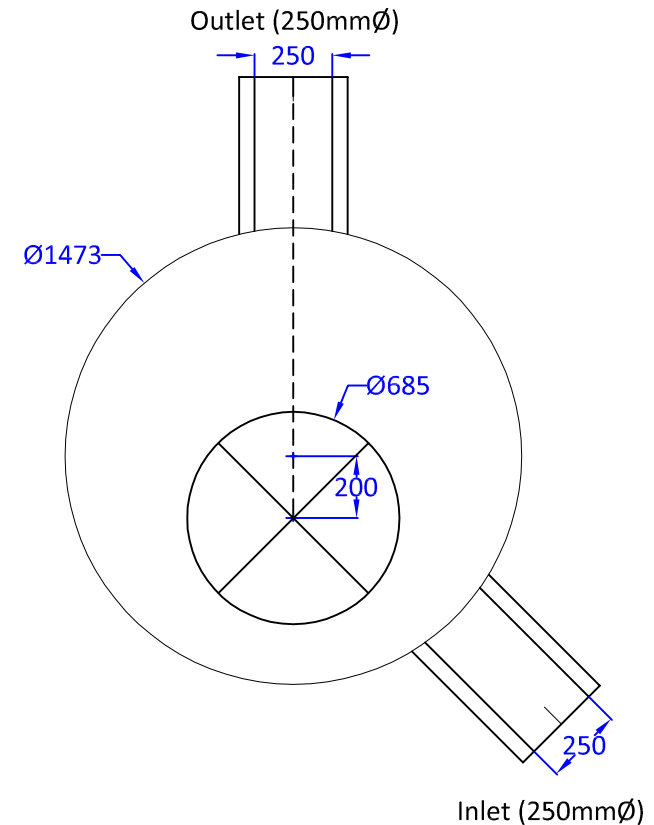
LOCATION: Barrie, ON

REVISION DATE: 04/07/2022



Center of access opening is offset 200 mm from center of cap

Draw a line from center opening, through center of top cap, to the edge of the cap and mark a vertical line and label centerline of outlet pipe.



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Hydroworks HS4 (1200mmØ) Cap

PROJECT: 17 Sophia St (OGS MH)

LOCATION: Barrie, ON

REVISION DATE: 04/07/2022



Install Instructions

1. Place the perforated plate on the floor of the structure.
2. Position the support disk so that the 50mm gap is centered on the outlet pipe and the flange is facing the bottom of the structure.
3. Squeeze the support disk so it fits in the structure. If the 50mm gap is closed and the support disk doesn't fit, use a saw to expand the 50mm gap until compressing the disk will allow it to fit into the structure.
4. Lower the support disk until the top of the horizontal shelf of the disk is **910mm** above the floor of the structure.
5. Anchor the support disk to the wall of the concrete using twelve 0.5"Ø x 4" long stainless steel wedge anchors, washers, and nuts.
6. Caulk between the disk and the wall around the entire circumference with Pro-Seal 34. Any opening in the disk should be directly below the outlet pipe.
7. Place a bead of caulk on top of the support disk then lower the main insert on to the support disk so that the outlet pipe is centered between the bypass weirs and all inlet pipes are on the other side of the bypass weirs. The outlet disk should fit through the opening in the support disk and hang 100mm below it with the pretreatment disk resting on the support disk.
8. Connect the pretreatment disk and support disk using six stainless steel screws. Use the openings in the pretreatment grate to access the pretreatment disk on the inlet side.
9. Place the bypass weir extensions between the bypass weirs and lower weirs (E1 between U1 and L1, E2 between U2 and L2).
10. Press the weir extensions against the bypass weirs so that their tops line up (E1 against U1 and E2 against U2). Then slide each weir extension until it is flush with the riser wall and bolt each weir extension to its bypass weir using two stainless steel bolts, washers, and nuts on each and caulk between the extensions and the wall and around each bolt hole.
11. Raise the perforated plate so that the top of the horizontal shelf of the plate is **305mm** above the floor of the structure. Anchor the plate to the wall of the concrete using four 0.5"Ø x 4" long stainless steel wedge anchors, washers, and nuts.
12. Bolt the inner chamber extension to the top of the inner chamber using four stainless steel screws. Caulk around each using ProSeal 34.

HydroStorm by
Hydroworks, LLC
Canada Patent #3,085,711
www.hydroworks.com
888-290-7900

Hydroworks HS4 (1200mmØ) Install

PROJECT: 17 Sophia St (OGS MH)

LOCATION: Barrie, ON

REVISION DATE: 04/07/2022





Hydroworks Sizing Summary

Proposed Residential Condominium

17 Sophia Steet, Barrie

04-06-2022

Recommended Size: HydroStorm HS 4

A HydroStorm HS 4 is recommended to provide 80.0 % annual TSS removal based on a drainage area of 0.31 (ha) with an imperviousness of 81 % and Barrie WPCC, Ontario rainfall for the 20 um to 2000 um particle size distribution.

The recommended HydroStorm HS 4 treats 98 % of the annual runoff and provides 84 % annual TSS removal for the Barrie WPCC rainfall records and 20 um to 2000 um particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .04 (m³/s) for the given 250 (mm) pipe diameter at .5% slope. The headloss was calculated to be 39 (mm) based on a flow depth of 250 (mm) (full pipe flow).

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm .

TSS Removal Sizing Summary

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD Video Other

Site Parameters
 Area (ha)
 Imperviousness (%)

Units
☐ U.S.
☒ Metric

Rainfall Station
 Barrie WPCC
 1968 To 2007

Ontario
 Rainfall Timestep = 60 min.

Project Title
 (2 lines)
 Proposed Residential Condominium
 17 Sophia Steet, Barrie

ETV Lab Testing Results ☐ Post Treatment Recharge

HydroStorm Annual Sizing Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
Unavailable	.018	.042	95 %	78 %
HS 4	.03	.042	98 %	84 %
HS 5	.036	.042	99 %	88 %
HS 6	.042	.042	99 %	91 %
Unavailable	.042	.042	99 %	94 %
HS 8	.042	.042	99 %	95 %
HS 10	.042	.042	99 %	97 %
HS 12	.042	.042	99 %	98 %

Particle Size Distribution

Size (um)	%	SG
20	20	2.65
60	20	2.65
150	20	2.65
400	20	2.65
2000	20	2.65

Outlet Pipe
 Diam. (mm) Slope (%)
 Peak Design Flow (m3/s)

Note: Results vary significantly based on particle size distribution

Simulate

TSS Particle Size Distribution

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD Video Other

TSS Particle Size Distribution

	Size (um)	%	SG
▶	20	20	2.65
	60	20	2.65
	150	20	2.65
	400	20	2.65
	2000	20	2.65
*			

Notes:

1. To change data just click a cell and type in the new value(s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings

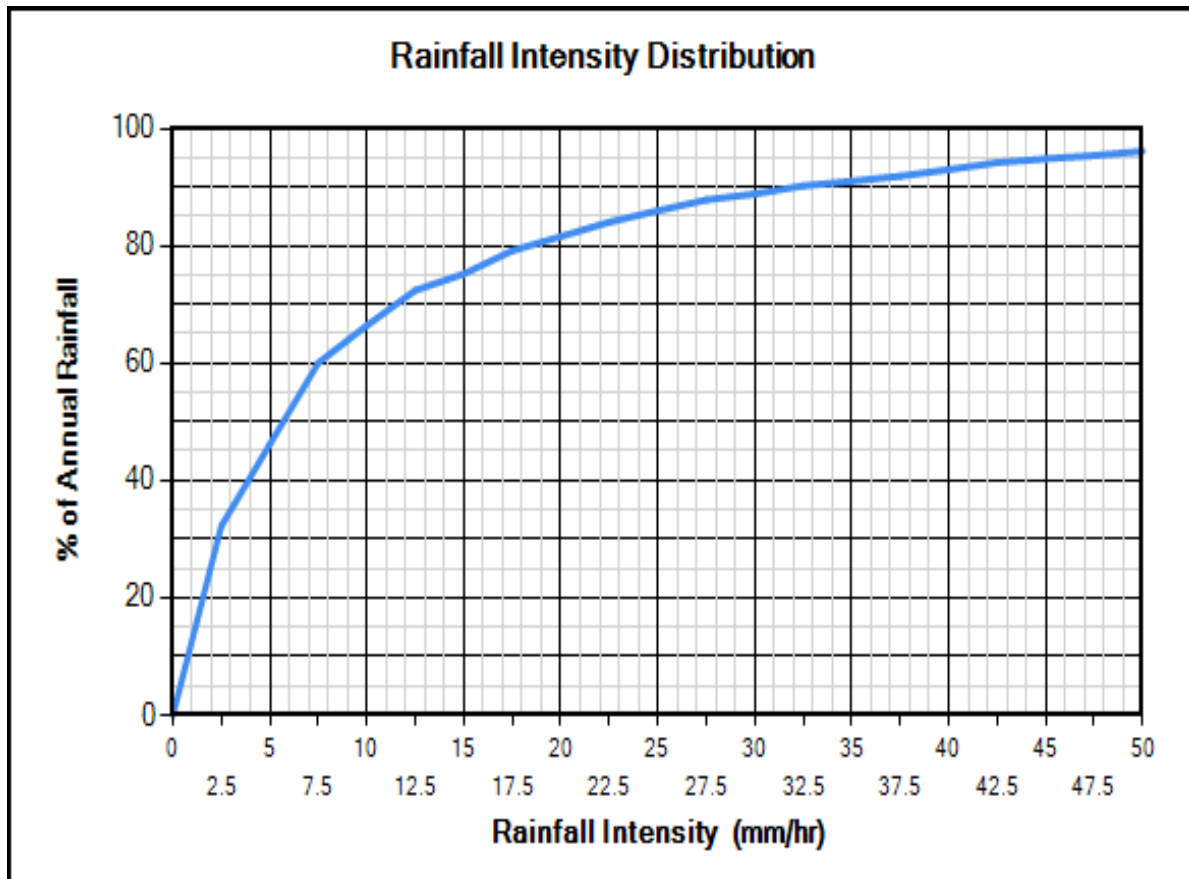
TSS Distributions

☐ Standard Design
☐ ETV Canada
☐ OK110
☐ Toronto
☒ Ontario Fine
☐ Calgary Forebay
☐ Kitchener
☐ User Defined

Clear

You must select a particle size distribution for TSS to simulate TSS removal

Water Temp (C)



Site Physical Characteristics

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD Video Other

Catchment Parameters

Width (m) Imperv. Mannings n Maintenance Frequency (months)

Perv Mannings n

Slope (%) Imp. Depress. Storage (mm)

Perv. Depress. Storage (mm)

Daily Evaporation (mm/day)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	2.54	2.54	3.81	3.81	3.81	2.54	2.54	0	0

Infiltration

Max. Infiltration Rate (mm/hr)

Min. Infiltration Rate (mm/hr)

Infiltration Decay Rate (1/s)

Infiltration Regen. Rate (1/s)

Catch Basins

of Catch basins

Controlled Roof Runoff

Roof Runoff (m3/s)

Resets all parameters excluding input catchment width.

Dimensions And Capacities

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

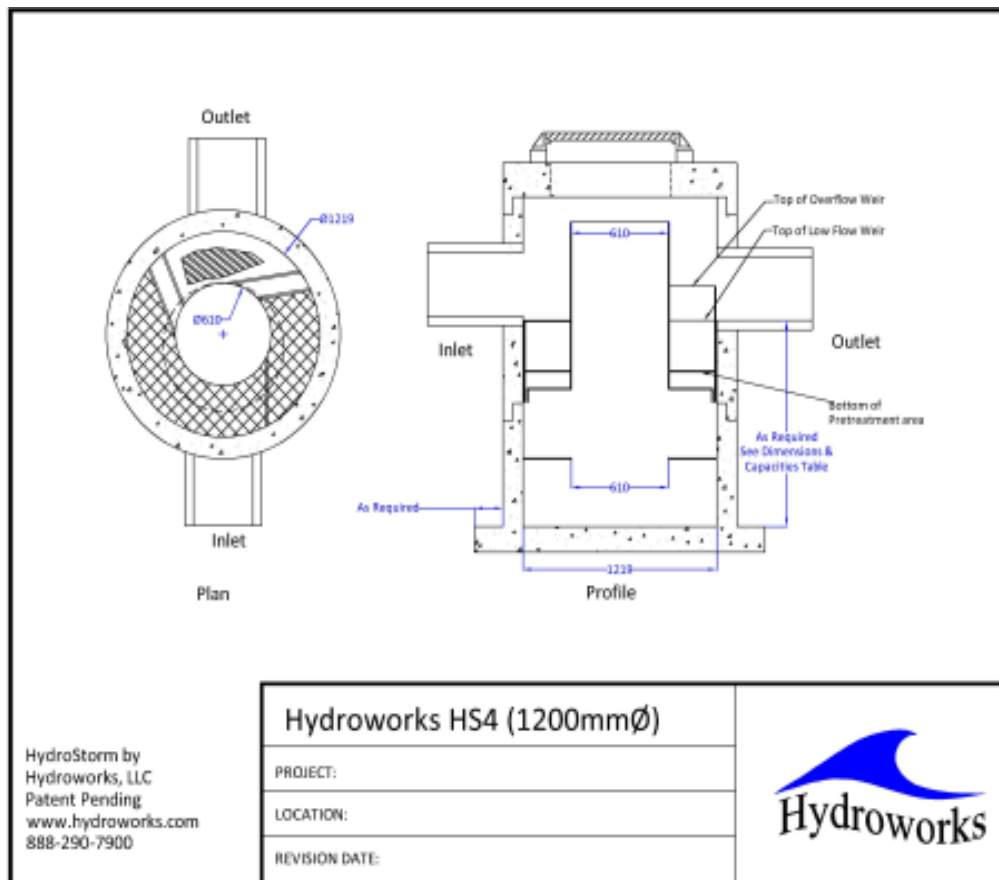
File Product Units CAD Video Help

General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD Video Other

Dimensions and Capacities					
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 3	0.91	1.07	185	0.4	0.7
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

Generic HS 4 CAD Drawing



TSS Buildup And Washoff

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD Video Other

TSS Buildup

☐ Power Linear
☒ Exponential
☐ Michaelis-Menton

TSS Washoff

☒ Power-Exponential
☐ Rating Curve (no upper limit)
☐ Rating Curve (limited to buildup)

Street Sweeping

Efficiency (%)
 Start Month
 Stop Month
 Frequency (days)
 Available Fraction

Soil Erosion

☐ Add Erosion to TSS

Reset to Default Values

TSS Buildup Parameters

Limit (kg/ha)
 Coeff (kg/ha)
 Exponent

TSS Washoff Parameters

Coefficient
 Exponent

TSS Buildup

☒ Based on Area
☐ Based on Curb Length

Upstream Quantity Storage

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD Video Other

Quantity Control Storage

	Storage (m3)	Discharge (m3/s)
▶	0	0
*		

Notes:

1. To change data just click a cell and type in the new value (s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings

Clear

Other Parameters

The screenshot shows the 'Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm' window. The 'Other' tab is selected, displaying several configuration sections:

- Scaling Law:**
 - ☐ Peclet Scaling based on diameter x depth
 - ☒ Peclet Scaling based on surface area (diameter x diameter)
- TSS Removal Extrapolation:**
 - ☒ Extrapolate TSS Removal for flows lower than tested
 - ☐ No TSS Removal extrapolation for flows lower than tested
 - ☐ No TSS Removal extrapolation for lower flows or inter-event periods
- Lab Testing:**
 - ☐ Use NJDEP Lab Testing Results
 - ☒ Use ETV Canada Lab Testing Results
- Oil / Sediment Storage:**
 - ☒ Oil Spill Storage in Pretreatment Area
 - ☐ Sediment Storage in Pretreatment Area
 - ☐ 50% Oil Spill / 50% Sediment Storage in Pretreatment Area
- TSS Removal Results:**
 - ☒ Required TSS Removal
 - ☐ Choose Model #
- TSS Removal Required:**
 - TSS Removal (%) Enter required TSS Removal (%)

Flagged Issues

None

Hydroworks Sizing Program - Version 5.6

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Appendix C

Hydrogeological Assessment



Revised Hydrogeological Assessment

**17 Sophia Street East, and 3, 5, 7, 11
Macdonald Street and 58 & 60
Clapperton Street, Barrie, Ontario**

Prepared for:
Black Creek Group

Prepared by:
Azimuth Environmental
Consulting, Inc.

November 2022

AEC 21-056



Environmental Assessments & Approvals

November 7, 2022

AEC 21-056

Black Creek Group
123 Front Street West, Suite 1200
Toronto, Ontario
M5J 2M2

Attention: Jordan Nott

Re: **Revised Hydrogeological Assessment: 17 Sophia Street East, and 3, 5, 7, 11
Macdonald Street and 58 & 60 Clapperton Street, Barrie, Ontario**

Dear Jordan,

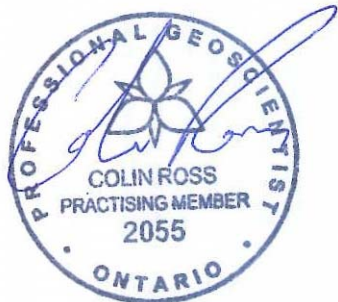
Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide our Revised Hydrogeological Assessment for the property comprised of 17 Sophia Street East, and 3, 5, 7, 11 Macdonald Street and 58 & 60 Clapperton Street, Barrie, ON (the "Site"). This evaluation focuses on the existing soil and ground water regime underlying the Site and the potential for the proposed mixed residential development to impact the existing conditions. It is noted that additional boreholes and monitoring wells were installed at the Site such that information relating to ground water elevations along the eastern property boundary could be confirmed with the expansion of the Site to include 58 & 60 Clapperton Streets.



Should you have any questions or wish to discuss the report in greater detail, please do not hesitate to contact the undersigned.

Yours truly,

AZIMUTH ENVIRONMENTAL CONSULTING, INC.



Colin Ross, B.Sc., P.Geo.
Senior Hydrogeologist

M:\Projects3\21 Projects\21-056 17 Sophia Street Hydrogeological Assessment\05.0 - Reporting\October 2022 Report\221024
Revised Sophia Street Hydrogeologic Report - FINAL.docx



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1.0 INTRODUCTION

Azimuth Environmental Consulting Inc. (Azimuth) has been retained by Black Creek Group to conduct a Revised Hydrogeological Assessment for the property comprised of 17 Sophia Street East and 3, 5, 7, 11 Macdonald Street and 58 & 60 Clapperton Street, Barrie, ON (the “Site”) (Figure 1). This revised report includes some updated information including new monitoring wells installed along the eastern section of the property to gain a better understanding of soil and ground water conditions for the newly included properties at 58 & 60 Clapperton Streets. These monitoring wells were not installed on the new properties given access limitations, but provide a better understanding of conditions in that area.

This assessment addresses development requirements mandated by the Lake Simcoe Region Conservation Authority (LSRCA) under the *Lake Simcoe Protection Act*. This Act provides the authority for the establishment of and amendments to the Lake Simcoe Protection Plan which is addressed in this assessment. This assessment also addresses Source Water Protection policies developed under the *Clean Water Act* as they pertain to water quantity issues.

1.1 Background

The Site is irregular in shape, 0.3 hectares (ha) in size and is to be redeveloped as a 21 storey mixed use residential building. The Site is located on the south side of both Macdonald and Sophia Street and is bound by an apartment building to the west, Clapperton Street to the east and commercial properties to the south. Currently, there are buildings only on 58 and 60 Clapperton Street; however a gravel driveway from Macdonald Street and small paved area in the south east corner of the property remain from historical residential developments at the Site. It is also understood that the foundations for the former residential lots are still present below grade as they were just filled in during demolition. The condition / integrity of these structures are not known.

As per the proposed development plans, the development will be accessed from Clapperton Street and will include three (3) below grade parking levels extending approximately 9.5 m below grade. The proposed Site development plans are provided in Appendix B and also illustrated on Figure 2.

The purpose of this assessment is to characterize the existing physical hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental / hydrogeological conditions. The report follows a standard format addressing typical requirements of both the City of Barrie and Lake Simcoe



Conservation Authority (LSRCA) for hydrogeological submissions, including Source Water Protection and the Lake Simcoe Protection Plan (LSPP).

2.0 ENVIRONMENTAL SETTING

2.1 Soil

The Soil Map of South Simcoe County (Report No. 29) defines the surficial soil for the Site as the Tioga Series which are loamy sands consisting of grey, calcareous outwash sands. Tioga sands are classified within Soil Group A. Group A soils represent material with low runoff potential and high infiltration rates.

2.2 Physiography

According to Chapman and Putnam (1984) the Site falls within the Simcoe Lowlands physiographic region. It lies on one of the numerous glacial shorelines that define the Lake Simcoe basin. Further north and significantly higher in elevation are the Simcoe Uplands, which are a series of broad rolling till plains standing roughly 60 m above the surrounding lowlands. The lowlands are considered to be the former Lake Algonquin shoreline features. The lowland soils are described as being composed of sands, silt and clay. Chapman and Putnam (1984) suggest that along the northern and western shores of Lake Simcoe the lowland consist of a narrow terrace which confined the highest stage of Lake Algonquin. The glacial lake cut into the till that represents the Upland soils leaving the bluff / scarp physiographic setting. However, the topography along Bayfield Street from the Highway 400 interchange to Lake Simcoe appears as several prominent stair-stepping inclines (i.e., beach fronts) of which Sophia Street is the second lowest in this progression.

The South Simcoe Groundwater Study (Golder, 2004) suggests that the property lies on the second deepest aquifer complex present in the Barrie Area. Immediately north and also northeast of the Site are a pair of former glacial stream corridors that have cut into the topographic surface. Historically Sophia Creek, (which is the remnant stream corridor); was eventually constrained / controlled and ran along the north ditch of Sophia Street according to the historical fire insurance mapping (Azimuth, 2016).

Topographically these spillway channels appear to have had a northeast to southwest orientation based on a regional interpretative basis using NASA's shuttle radar topography mission (SRTM) data (OGSEarth, 2020) and stereographic interpretation of historical aerial photography.

Over time, Sophia Creek was engineered and incorporated into the City's storm water infrastructure such that it is now completely buried from Peel Street which is 300 m east of the Site.



2.3 Topography and Drainage

The topographic relief at the Site is quite limited with elevations ranging between approximately 234 masl at the south and 235 masl at the north. The current Site drainage is expected to follow the local topographic dip to the south, although any surface runoff exiting the Site is expected to be captured within the local municipal stormwater system as the area surrounding the Site is fully developed. Surface water run on to the Site is not expected from the north due to the presence of curb and gutters present along the northern property boundary (*i.e.* Sophia and Macdonald streets).

2.4 Bedrock Geology

The underlying bedrock geology has been described by the Ontario Geologic Survey (OGS) as being composed of interbedded bioclastic to very-fine grained limestone and grey-green calcareous shale of the Verulam Formation of the Simcoe Group (OGS, 2016). The Simcoe Group is Middle Ordovician in age. The entire overburden profile beneath the Site is estimated to be over 50 m in depth before encountering the bedrock contact.

2.5 Quaternary Geology

The Quaternary Soil Map of Ontario (Barnett *et al.*, 1991) defines the local surficial soils in the vicinity of the Site as coarse-textured glaciofluvial ice deposits consisting of sand, gravel and minor till.

Based on the Site specific soils data discussed further in Section 3.1.1, the depositional environment appears to consist of interbedded or laminated structure consisting of sands and finer grained materials (*i.e.*, silts to clay sediments). Variations were encountered across the Site and attributed to the fluvial / littoral deposition. Very thinly bedded layers predominated the subsurface environment with occasional lacustrine (*i.e.*, lake lain / quiet water) units.

The layering is relatively thin (*i.e.*, ~5 to 10 cm or less) and interdispersed with clayey sand sediments. Our interpretation is that the deposition is reflective of a braided glaciofluvial river setting which is in keeping with that found throughout the City of Barrie area within the Kempenfelt Bay vicinity.

2.6 Hydrogeology

The South Simcoe Municipal Groundwater Study was completed in 2004 and provides information on regional aquifers, ground water quality and quantity risks, and Wellhead Protection Areas (WHPAs) for municipal supplies (Golder, 2004). In general, three interconnected aquifer sequences have been identified within the local overburden, which



are characterized by coarse-grained sediments interbedded with discontinuous layers of finer-grained materials. In the vicinity of Kempenfelt Bay the deepest aquifer sequence tends to be much more coarse-grained than the sediments above. This produces a fairly complicated hydrogeological sequence that can be thought of simplistically as a series of two, and occasionally three, aquifers separated by discontinuous fine-grained layers. The upper two aquifers (A1 & A2) can generally be thought of as a larger aquifer complex in the vicinity of the Phase One Study Area although they may represent more distinct aquifers elsewhere further north and south. Drilling at the Site was completed up to ~20 mbgs, which did not encounter any defined confining unit, which would support the description of the local aquifer units presented by Golder. The lower aquifer complex (A3) is inferred as being confined by the repetitive layering of the fine-grained sediments and the upper aquifer is unconfined. The coarse-grained nature of the aquifer sediments makes them highly permeable and suitable for use as a municipal source of water. The closest municipal wells (Barrie Heritage Wells 11 & 14) are located within this lower aquifer unit approximately 500 m south of the Site. These wells are screened below 177 masl (Golder, 2004) or 57 m below grade at the Site. For reference, the geological cross-sections illustrating the local aquifer units has been provided in Appendix I.

Regional ground water flow direction in the shallow system generally mirrors the local surface drainage and has been identified to flow southwest toward Kempenfelt Bay (Golder, 2004). The ground water flow direction in the upper aquifer unit underlying the Site is considered to be in a south to southwest direction.

The Ontario Ministry of Environment, Conservation, and Parks (MECP) Water Well Records were referenced for any recorded well information within the vicinity of the Site (200 m) (MECP, 2021). The Site is likely to have been previously serviced with water and sewer utilities; however well records can be used to gain subsurface information which can provide insight into shallow geological formation within the area. The well records found in the vicinity of the Site that are pertinent to this assessment are summarized in Table 1 and are shown on Figure 3.



Table 1: MECP Water Well Database Summary (200 m radius from Site)

MECP Well Record No.	Distance from Site (m)	Direction from Site	MECP Tag No.	Ground Elevation (masl)	Borehole Depth (mbgs)	Drill Date	Well Type
7213134	175	South	241352782	229.4	10.7	26-Sep-13	Monitoring Well
7186920	175	South	240308213	229.9	12.8	23-Jul-12	Monitoring Well
7157255	130	South	241223348	230.4	12.8	6-Dec-10	Other - Industrial
7277585	70	West	241449479	236.5	7.6	4-Oct-16	Geotech Testhole
7355097	130	West	1006880903	236.4	15.2	7-May-19	Monitoring Well
7186921	175	South	240308251	229.9	10.7	23-Jul-12	Monitoring Well
7358538	140	West	1007534810	236.2	-	9-Mar-20	Unknown
7176638	175	South	241600113	229.7	-	20-Dec-11	Unknown
7358539	130	West	1007535086	236.9	-	9-Mar-20	Unknown
7254305	30	West	240298285	233.6	15.2	6-Nov-15	Monitoring Well
7277586	65	West	241449489	236.3	7.6	4-Oct-16	Geotech Testhole
7265150	150	Southeast	240831675	231.2	12.2	17-May-16	Monitoring Well

The surrounding wells in the MECP well record were drilled for monitoring, test holes, and industrial use. The wells were drilled to depths between 7.6 and 15.2 m. Not all actual well records were available online, but those that were available for download have been included in Appendix C. The soils identified in these records were primarily sand, which matches the geological literature outlined above, as well as the Site specific soils identified at the Site through the previous drilling program.

3.0 SOURCE WATER PROTECTION

A review of the Source Water Protection Areas as identified on the MECP Source Protection Information Atlas website indicates the Site is only partially within a Significant Ground Water Recharge Area (SGRA), fully within a Highly Vulnerable Aquifer Area (HVA), Wellhead Protection Area (WHPA-D), WHPA-Q2, an Issues Contributing Area (ICA) for chloride and an Intake Protection Zone (IPZ) 3. As such, a Salt Management Plan will be required to address Source Water Protection requirements.

4.0 MONITORING

4.1 Previous Site Investigations

There have been previous Site investigations undertaken at the Site in recent years (2016-2022) including a Phase I Environmental Site Assessment (ESA), Phase II ESA and Record of Site Condition (RSC) submission, as well as geotechnical investigations. Through the work completed to support these investigations, Site specific data has been collected including soils information, ground water levels and water quality which are relevant to this hydrogeological assessment. This information is summarized in the sections below.



4.1.1 Site Drilling & Monitoring Well Installations

Drilling programs were undertaken by Azimuth as part of the abovementioned assessments in November 2015 and June 2016. A series of ground water monitors were constructed throughout the Site as illustrated on Figure 4, with borehole logs included in Appendix C. It is noted that two additional historic wells (MW-N and MW-S) are also present at the Site; however, no records for these wells are available as they predated the Phase I/II ESA work completed by Azimuth. These wells are summarized Table 1 below.

As these drilling programs were to assess potential contamination at the Site, various depths within the shallow aquifer were targeted based on the varying soil stratigraphy encountered. Although the local well records and geological literature indicated primarily granular materials in the area, the results of the drilling programs showed the surficial geology at the Site consisted of discontinuous geologic layers of silts, sands, and clays at layers of thickness ranging between 1.5 m and 3.8 m of differing stratigraphic packages of soil.

These interbedded layers are found at most boreholes throughout the Site. The soil profile in general is poorly sorted interbedded layers which range from medium to dark brown medium to coarse grained sand to grey and/or mottled dense to very dense clay to fine to medium sand with silt to sandy silt to silty sand to silt and clay. Despite this stratification, the dominant material is sand as illustrated in the geological cross-sections for the Site (Figures 5 & 6), while much of the stratification was not found to be continuous across the Site such that the screened intervals are considered representative of water table conditions at the Site. This was supported by the fact that the ground water elevations were also found to be relatively consistent across the Site.

Subsequent geotechnical investigations were completed by the Azure Group in 2021 and 2022 which included the completion of additional boreholes in 2021 as well as monitoring well installations in 2022, which data from has been included as part of this assessment and summarized in the following table with borehole logs included in Appendix C & H



Table 2: Site Monitoring Well Construction Details

Well ID	Ground Elevation (mASL)	Well Depth (mbgs)
MW-N*	235.07	7.10
MW-S*	234.40	11.16
MW-1	234.02	13.76
MW-2	235.11	11.20
MW-3	234.93	11.55
MW-4	234.97	8.71
MW-4a	234.90	12.62
MW-A1	234.45	15.26
MW-A2	234.41	11.18
MW-B1	234.29	14.96
MW-B2	234.31	10.79
MW-C1	234.33	15.65
MW-C2	234.36	12.76
BH-101	233.66	8.54
BH-102	234.03	8.75

Notes: mbgs - metres below ground surface
mASL - metres above mean sea level
* - historic, no available BH log

4.2 Ground Water Level Monitoring

Ground water elevation data was recorded for the monitoring well network on four occasions in 2016, 2017, 2021 and 2022 as summarized in the following table. It is noted that the 2021 and 2022 monitoring period targeted the spring high water table period (March – June) to confirm high water table conditions at the Site. The data indicates ground water elevations range at the Site generally between 226 and 230 masl, although as noted above, MW-N indicates isolated elevations at approximately 233 masl. The nested ground water monitoring location at MW-N and MW-2 reveals a perched ground water condition at MW-N. The water elevation at MW-N is consistently higher than MW-2 by a few metres. MW-2 being deeper in the soil profile reflects the conductive seam occurring at about 11 mbgs (*i.e.*, MW-S monitoring depth). It is assumed that the near-surface finer-grained sediments evident in the northwest corner have contributed to this perched condition. Thus, this localized perched condition at MW-N is discounted when evaluating the water table condition present elsewhere at the Site.

Slight downward gradients are observed in the nested locations to the south and west portions of the Site, with an isolated reversal at MW-A1/2 in March 2017. Small upward gradients were noted at MW-4/4A on the two occasions they were measured together in 2016 and 2017. These gradients are likely the result of the interbedded deposition as



noted above, but the gradients are relatively small based on the lack of defined confining layer in the profile.

Currently the base of the underground parking level has been established at 225.25 masl such that the building foundation will encroach into the water table by up to ~5 m. As such, these seasonally high ground water elevations need to be considered in the building design such that proper flood proofing is incorporated within the basement level. These seasonal high water table conditions are most accurately represented in the March 2017 data, which is illustrated on Figure 4. Full ground water depth / elevation data is provided in Appendix H.

4.3 Hydraulic Conductivity Testing

In order to understand the hydraulic characteristics of the underlying overburden, transient hydraulic tests were performed on the Site monitoring wells following the November 2015 drilling program. The transient test involves the instantaneous injection or withdrawal of a volume or slug of water or solid cylinder of known volume. This is accomplished by adding or displacing a known volume to/from a well and measuring water level response time to return to equilibrium. Water level measurements were recorded both manually and with automatic dataloggers, which were programmed to record the pressure of water above the data logger every 3 seconds. Data was analyzed using the Hvorslev Method (1951), which assumes a homogeneous, isotropic medium in which soil and water are incompressible. Hydraulic testing results are summarized in Table 3 (below).

Table 3: Hydraulic Testing Results

Monitoring Well	Hydraulic Conductivity (m/s)	Transmissivity (m ² /s)	Soil Description
MW-1*	1×10^{-2} to 1×10^{-4}	2×10^{-5} to 2×10^{-7}	15 cm gravel seam
MW-2	3×10^{-6}	8×10^{-6}	interbedded sand
MW-3	4×10^{-6}	8×10^{-6}	interbedded sand
MW-4	7×10^{-6}	2×10^{-5}	interbedded sand
MW-4a	4×10^{-5}	3×10^{-5}	interbedded sand
MW-S**	8×10^{-7}	2×10^{-6}	interbedded sand

Notes: Values rounded off for presentation purposes

* - It is likely that the bulk lateral hydraulic conductivity at MW-1 is at least 1×10^{-3} m/s

** - It is assumed that MW-S has a 2.9 m well screen which fully contributes to the ground water flow at this location.

The soil transmissivity for all sampling locations is roughly similar, barring MW-S which is slightly less transmissive. The differences in bulk lateral hydraulic conductivity results illustrate the variations in the bulk contributing zone used in each of the analyses. For example, a 0.15 m sand and gravel seam was used for MW-1 whereas larger intervals up to ~4 m were estimated for some of the other monitors. It is speculated that potentially



all of the monitoring wells are intersecting a conductive zone with a limited thickness; but which will convey the ground water laterally through the soil profile.

4.4 Water Quality

Water quality samples have been collected at a number of monitoring wells as part of the previous Site investigations, including the Phase II ESA (Azimuth, 2016). These samples included a wide array of parameters including general inorganics, trace metals, volatile organic compounds (VOC) and petroleum hydrocarbons (PHC). The results of the laboratory ground water quality analyses are summarized in Appendix F, while the following discussion is a summary of that provided in the Phase II ESA.

The PHC analytical results for the ground water samples indicate that through three sampling events, toluene and PHC F₃ detections were detected for the initial sampling event in monitoring well MW-S; but absent from all other sampling events. All monitoring wells barring MW-N had detected concentrations of toluene in the November 2015 and June 2016 sampling events. Monitoring wells MW-3 and MW-4 also noted detectable concentrations of ethylbenzene. Total xylenes were noted in monitoring well MW-3. All measureable concentrations of the above noted detections were below Table 2 SCS.

Monitoring well MW-S had measureable concentrations of *cis*-1,2-DCE, TCE and PCE above the O.Reg. 153/04 Table 2 *Site Condition Standards* (SCS) through all three sampling events. Hexane was also detected in the first sampling event, yet this was below the applicable standards. Monitoring well MW-1 had measureable concentrations of *cis*-1,2-DCE, TCE, PCE, and hexane below Table 2 SCS. Monitoring well MW-A1 had no measureable detections of the PCE and daughter products found in MW-S; yet acetone was detected below the applicable SCS. Ground water well MW-A2 had reported concentrations of *cis*-1,2-DCE and TCE, yet these were below Table 2 SCS. Monitoring well MW-B1 had reported detections of acetone below the SCS. Ground water well MW-C1 had no reportable VOC detections. Other spurious parameters were detected at isolated locations below Table 2 SCS.

The inorganic and trace metals analytical results (Table 7, Appendix F) show that the concentrations of the various parameters were all below the Table 2 SCS at the two (MW-N & MW-S) measured monitoring wells except for road salt parameters at MW-N. The lands have been vacant for years and it is assumed the concentrations are attributable to salt spray from the adjacent roadway and therefore exempt under O.Reg. 153/04 s.48(3). Elevated nitrate concentrations are also found at MW-N (8.51 mg/L); however, this localized elevation is likely the result of a leaking sewer main along Sophia Street as this well is located immediately adjacent to the road. Overall, the



water quality meets City of Barrie Storm Sewer By-Law criteria. Total suspended solids (TSS) and biological oxygen demand (BOD) were not analyzed but are assumed to be able to be met given the ground water source, assuming proper sediment controls are in place and can be confirmed ahead of any dewatering discharge.

As a result of the residual contaminants present at the Site as described above and in the previous Phase II ESA, these contaminants have been delineated as required by the MECP for the Record of Site Conditions process. The MECP has a rigorous vetting process to gain acceptance of a proposed Brownfield redevelopment proposal. This process culminates in the issuance of an RSC acknowledgement. It is acknowledged by the Province that the property redevelopment as described in the RSC application would not endanger the natural environment or those using the property in the manner present in the RSC application.

Conditions of the redevelopment of the property are included in the issued Certificate of Property Use (CPU) which is registered on title. The CPU is a legal document issued by the MECP which outlines how this Site is to be developed for the intended residential building. In the CPU are a myriad of conditions that must be met as the development is constructed and how the completed development is to be monitored and maintained to safeguard the environment. Specific issues within the CPU related to the Hydrogeological Assessment are for the use of ground water as noted below.

4.12 No ground water use Risk Management Measure:

- a) Refrain from using ground water in or under the Property as a source of water; and*
- b) Properly abandon any wells on the Property, as defined in section 35. (1) of O. Reg. 153/04, according to R.R.O. 1990, Regulation 903 (Wells) made under the Ontario Water Resources Act, R.S.O. 1990, c. O.40; and*
- c) Refrain from constructing on the Property any wells as defined in section 35. (1) of O. Reg. 153/04.*

As the Site will be municipally serviced, there are no issues with respect to source water; however, consideration will need to be given to potential dewatering at the Site if required for underground servicing or parking level construction. Water quality treatment may be required for any dewatering discharge prior to entry into the City's storm sewers. It is assumed that this will require obtaining a discharge permit from the City prior to initiation of any dewatering activities at the Site.

As noted in item b and c, all existing monitoring wells shall be properly abandoned according to O.Reg. 903 prior to any construction being initiated.



5.0 WATER BALANCE

In order to determine the potential changes to the natural ground water recharge conditions, a pre- and post-development water balance assessment has been completed using the Thornthwaite and Mather method (1957). This method evaluates evapotranspiration based on precipitation and temperature. Residual soil saturation is a function of topography and soil type. Monthly data are tabulated from daily average temperature and precipitation, and the water budget is a continuous calculation over the period of record. To clarify, the method and the approach used by many individuals in examining infiltration resets annual conditions (moisture deficit, snow storage, etc) over the winter months because of the general lack of infiltration during the frost period. However, we maintain those records and carry them forward from month to month during the entire period of record.

Values were determined on a monthly basis, compiled from daily Environment Canada meteorological data station located in Barrie (Station 6110557), Ontario between 1974 and 2019. The calculations are based on the average conditions during this period; the average precipitation was 909 mm, rainfall was 655 mm, evapotranspiration was 430 mm and the surplus was 479 mm.

5.1 Land Use

5.1.1 Pre-Development

The pre-development Site area was classified according to land use/vegetation type. Approximate pre-development land use classification areas are provided in Table 4.

Table 4: Pre-Development Area Classification

Land Use	Land Area (m ²)
Impervious (rooftop / concrete / asphalt / gravel surfaces)*	575
Landscaped/undeveloped - Pervious	2,433
TOTAL	3,008

* - based on aerial photographs, a gravel laneway is present in the centre of Site and small impervious area at southeast corner of Site

Land within the pre-development scenario is considered 20% impervious. Gravel surfaces are considered impervious for the purpose of this assessment. The pre-development areas are shown on Figure 2.

5.1.2 Post-Development

The land classification in the post-development scenario was classified based on the Site Development Plans (Appendix B). Post-development land use classification areas are provided in Table 5:



Table 5: Post-Development Area Classification

Land Use	Land Area (m ²)
Impervious(building/driveway/driveway)	2,932
Pervious (landscaped/undeveloped)	76
TOTAL	3,008

Land within the post-development scenario is considered 97% impervious. The post-development areas are illustrated in Appendix B.

5.2 Infiltration

Infiltration is generated one of two ways: (1) directly from rainfall impact or snowmelt on pervious surfaces; and (2) indirectly when runoff from impervious surfaces is diverted into adjacent naturalized areas.

Infiltration factors for the Site were estimated based on the underlying soil, local topography, and ground cover as per Table 2 of the Ministry of Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (1995).

The soil variable factor was determined by taking into account information obtained from the regional geologic mapping and the field work programs completed for the Site. This information suggests that the surficial material at the Site is primarily composed of a silty sand till. The infiltration factors utilized in the water balance assessment are summarized in Table 6 below.

Table 6: Summary of Pervious Land Infiltration Factor

Scenario	Land Use	Infiltration Factor	Assumption
Pre-Development	Vacant	0.60	Flat Land (0.25), sand / silty sand (0.3), maintained grasses (0.05)
Post-Development	Residential	0.60	Flat Land (0.25), sand / silty sand (0.3), maintained grasses (0.05)

5.2.1 Pre-Development Infiltration

Pre-development direct infiltration was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The pre-development annual infiltration is therefore 628 m³/year (Appendix D).



5.2.2 Post-Development Infiltration

Post-development infiltration (without mitigation) was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The post-development annual direct infiltration is therefore 20 m³/year. There is therefore a decrease in infiltration of 608 m³/year from pre- to post-development without mitigation measures employed.

5.3 Water Balance Summary

Using the climate model data and calculations mentioned above, the water balance was completed for pre-development and post-development without mitigation (Appendix D) as no LID's are being incorporated into the development plan for ground water infiltration.

The pre-development infiltration volume is 628 m³/year. This assumes the Site is composed of the existing driveways, walkways, car parking, previous commercial building pad and landscaped areas. The post-development without mitigation infiltration volume is 20 m³/year, which is a deficit of 608 m³/year. This is based on the proposed development as described in Section 1.0 of this report and illustrated in Appendix B (Site Development Plans).

Due to the limited size of the Site and presence of underground parking structure, there will not likely be sufficient area to implement LID's. It is noted that the Site is mapped as only being partially within a significant ground water recharge area and partially within lands subject to Lake Simcoe Protection Plan (LSPP) 4.8-DP. As such the calculated infiltration deficit in the post-development scenario does not trigger the LSPP Water Balance Offsetting Policy as is understood from previous completed projects within LSRCA. However, comments received by the LSRCA regarding the first submission indicated it is a requirement. Clarification regarding this comment has been requested as part of the comment response matrix.

6.0 DEWATERING ASSESSMENT

As noted above, the underground parking will encroach into the water table by approximately 5 m, such that construction dewatering will be required for installation of the foundation. Given the required drawdown is greater than 1.5 m, the use of shallow well points or eductor systems will likely be required. The exact dewatering methodology will depend on site-specific conditions and construction methods such that it will be determined by the dewatering contractor.

Given the urban setting, dewatering discharge will be required to be discharged to the local storm sewer along Sophia or Clapperton Street.



6.1 Drawdown Conditions

The details utilized for this assessment are derived from the current Site Plan (Appendix B), which shows the underground parking encompassing the entire building footprint to a depth of 225.25 masl, while the base of the raft foundation is noted to be at an elevation of 223.25 masl (Azure, 2022). The foundation has also been illustrated in Figures 5 & 6. As the water table contouring illustrated on Figure 4 shows a decline to south of approximately 1.7 m, an average water table elevation has been utilized at 229.2 masl.

The following assumptions have been made with respect to variables and approach for the dewatering calculations:

- Construction ground water lowering will target a depth of 1.2 m below the base of the raft foundation elevation liner to ensure dry working conditions;
- The hydraulic conductivity value referenced (1×10^{-4} m/sec) in this assessment is based on the high-end estimate of the overburden aquifer based on the most elevated measured hydraulic conductivity associated with Site slug testing. This value is considered conservative given the location targeted a sand seam, which could be present elsewhere in the profile; and
- The entire foundation is assumed to be constructed as a single dewatering undertaking installed at one time. If the dewatering was done in sections, then the volumes and Zone of Influence would be reduced;

The actual drawdown will depend on construction timing.

6.2 Approximate Dewatering Volumes

For the non-trench dewatering (rectangular configuration), calculations for the dewatering rate / volume were completed using the steady state method from Powers, *et al.* (2007) for estimating radial flow to an excavation in an unconfined aquifer.

The following equation was used:

$$Q = \{[(\pi * K) * (H^2 - h^2)] / [\ln(R_o/r)] * 86400 * 1000$$

(Ref: Powers *et al.* (2007))

The full dewatering assessment is appended, while the details are also summarized in Table 7 below.



Based on the information provided in Table 7 below, the dewatering required for the construction of the building foundation is 416,500 L/day. A 3x safety factor can then be applied to each of the above volumes for a conservative estimate (2,161,200 L/day). These values are based on worst case spring season ground high ground water table depths. The dewatering volume could be lower during the summer and fall months. It is also noted that the sand and gravel material becomes more compact with depth as noted in the Azure borehole logs such that the hydraulic conductivity may reduce with depth such that the calculated values may be less when considering the entire profile that is being dewatered.

Any construction dewatering between 50,000 L/day and 400,000 L/day can be completed after registration under the Environmental Activity and Sector Registry (EASR). Any active construction dewatering above 400,000 L/day requires a Permit To Take Water (PTTW). As noted above, the magnitude of dewatering required will vary on the timing of construction and less dewatering could be needed in the summer drought conditions. Peak ground water elevation typically occurs between mid April and the end of May. Based on the calculations, it is likely that dewatering would be above 400,000 L/day such that a PTTW will be required. It is noted that if target elevations are shallower than those assumed in the above assessment (*i.e.* less underground parking levels), there may be a reduced need for dewatering for some or all items. Once more details are further developed with respect to the raft foundation design and construction methods, the dewatering assessment will be refined as necessary to support a formal PTTW application with the MECP.

Table 7: Summary of Dewatering Conditions

Variable	Foundation Dewatering
Estimate of Equivalent Radius [r_e] (m)	37
Hydraulic Conductivity [K] (m/s)	1×10^{-4}
Maximum Required Drawdown [$H-h$] (m)	7.15
Saturated Thickness Before Pumping [H] (m)	7.15
Depth of Water During Pumping [h] (m)	0
length of excavation [a] (m)	75
width of excavation [b] (m)	40
Radius of Influence [R] (m) ¹	251
Discharge [Q] (L/day)	720,400
Discharge [Q] (L/day) 3 X Safety Factor Applied	<u>2,161,200</u>

6.3 Impact Assessment

Based on the information provided in Table 7, the largest zone of influence is 251 m from the centre of the dewatering zone; however this is the maximum distance where any measurable water table decline is observed (~1-5 cm). In reality, more significant decline



in ground water levels (1 m) will be contained within 38 m distance from the property boundary. As the area is municipally serviced, there are no private wells located within the radius of influence, while the closest Barrie municipal wells (11 & 14) are located >500 m south of the Site. Finally, there are no local natural features such as wetlands or watercourses in proximity to the Site.

Given the presence of residual contamination at the Site, consideration needs to be given to the quality of the dewatering discharge, which may require treatment prior to discharge into the City's storm sewer network. It is assumed that this will require obtaining a discharge permit from the City prior to initiation of any dewatering activities at the Site.

7.0 SUMMARY AND CONCLUSIONS

Azimuth was retained by the Black Creek Group to conduct a Hydrogeological Assessment for the property located at 17 Sophia Street East and 3, 5, 7, 11 Macdonald Street and 58 & 60 Clapperton Street, Barrie, ON. The purpose of this assessment is to characterize the existing hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental / hydrogeological conditions. The report also addresses City of Barrie, LSRCA and Source Water Protection policy requirements.

The Site is generally rectangular in shape and is approximately 0.3 hectares (ha) in size. It is located on the south side of Sophia and Macdonald Streets. Currently, the only buildings at the Site are two small residential / commercial structures fronting Clapperton Street. The remainder of the Site has been cleared; however a small impervious area is present along the southeast corner of the Site, as well as a gravel laneway from Sophia Street into the Centre of the Site. It is also understood that the former building foundations from the residential lots fronting Sophia Street are still present below grade; however, have been filled in to ground surface. The status / integrity of these structures are not known. The Site is to be redeveloped as a 21 storey mixed use residential building including three levels of below grade parking, which will require waterproofing as they will extend approximately 5 m below the water table.

The Site is found at an elevation between 234 and 235 masl, with a slight southern slope. The existing Site drains south via overland flow towards Kempenfelt Bay. Site soils are composed of mostly granular material, although the presence of finer grained materials (i.e. silt and clay) is present in surficial areas of the Site as well as with vertical stratification with depth.

The inferred groundwater table in the vicinity of the Site is 226 – 230 masl varying both seasonally and spatially, creating a southwest flow path towards Kempenfelt Bay.



Hydraulic conductivity testing was completed at a number of the Site monitoring wells indicating the hydraulic conductivity of the deposits varies across the Site, owing to the differing soil types ranging between 2×10^{-7} to 1×10^{-3} m/s.

The pre-development infiltration volume is $628 \text{ m}^3/\text{year}$. This assumes the Site is composed of the existing hardscaped and landscaped areas. The post-development without mitigation infiltration volume is $20 \text{ m}^3/\text{year}$, which is a deficit of $608 \text{ m}^3/\text{year}$.

Given the development footprint encompasses most of the property down to below the water table, there are no opportunities for implementation of any LID's at the Site to address the infiltration deficit resulting from the proposed development. It is noted that the Site is mapped as only being partially within a significant ground water recharge area and partially within lands subject to Lake Simcoe Protection Plan (LSPP) 4.8-DP. As such the calculated infiltration deficit in the post-development scenario does not typically trigger the LSPP Water Balance Offsetting Policy as is understood from previous completed projects within LSRCA. However, comments received by the LSRCA regarding the first submission indicated it is a requirement. Clarification regarding this comment has been requested as part of the comment response matrix.

The overall deficit is considered small and there are no adjacent wetlands / natural features or private wells as the area is municipally serviced which would be impacted as a result of the proposed development. The closest municipal wells (Barrie Heritage Wells 11 & 14) are located approximately 500 m south of the Site. These wells are screened below 177 masl (Golder, 2004) or 57 m below grade at the Site. As such, the small infiltration loss and the vertical separation resulting from the silty clay unit underlying the upper aquifer, limit the development's ability to create a quantitative influence on the municipal wells.

The proposed development will include the construction of underground car parking with associated underground servicing connections (water, sewer, stormwater). At present, elevations for the underground parking would indicate encroachment into the water table approximately 5 m. As such, there will be a need for construction dewatering with the estimated daily volume of 2,161,200 L requiring a PTTW to be obtained. The construction dewatering activities are not anticipated to result in any negative impact to local wells or natural features given the urban setting. No private wells are present in the area and the closest municipal wells are >500 m south of the Site. Similarly, no natural features such as wetlands or watercourses in proximity to the Site. The depth of the municipal aquifer (177 masl) also has a significant vertical separation distance from the subsurface building footprint, which is noted to extend to a depth of 223.25 masl. The 49 m vertical separation distance would limit impacts associated with the below grade



construction and associated construction dewatering to the underlying municipal aquifer. It is further noted that the proposed foundation will be completed as a raft foundation such that no deep footings are required to support the structure and it will be waterproofed to ensure encroachment of the underground parking into the water table is feasible. The water proofing material has been indicated to be PRECON/MEL-ROL by W.R. Meadows or equivalent, which is designed for water proofing of foundations. Based on the ground water quality at the Site, it is not considered corrosive. As such there would be limited potential for leaching of any waterproofing material into the ground water system.

Given the presence of contamination at the Site, consideration needs to be given to the quality of the dewatering discharge, which may require treatment prior to discharge into the City's storm sewer network. It is assumed that this will require obtaining a discharge permit from the City prior to initiation of any dewatering activities at the Site.

As per City of Barrie requirements, all existing monitoring wells which are no longer utilized at the Site will need to be properly decommissioned as per O.Reg. 903 (Wells Regulation) prior to commencement of building construction.

In our professional opinion, the proposed Site development plan does not have an adverse impact on the hydrogeologic setting present at this Site.



8.0 REFERENCES

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APPENDICES

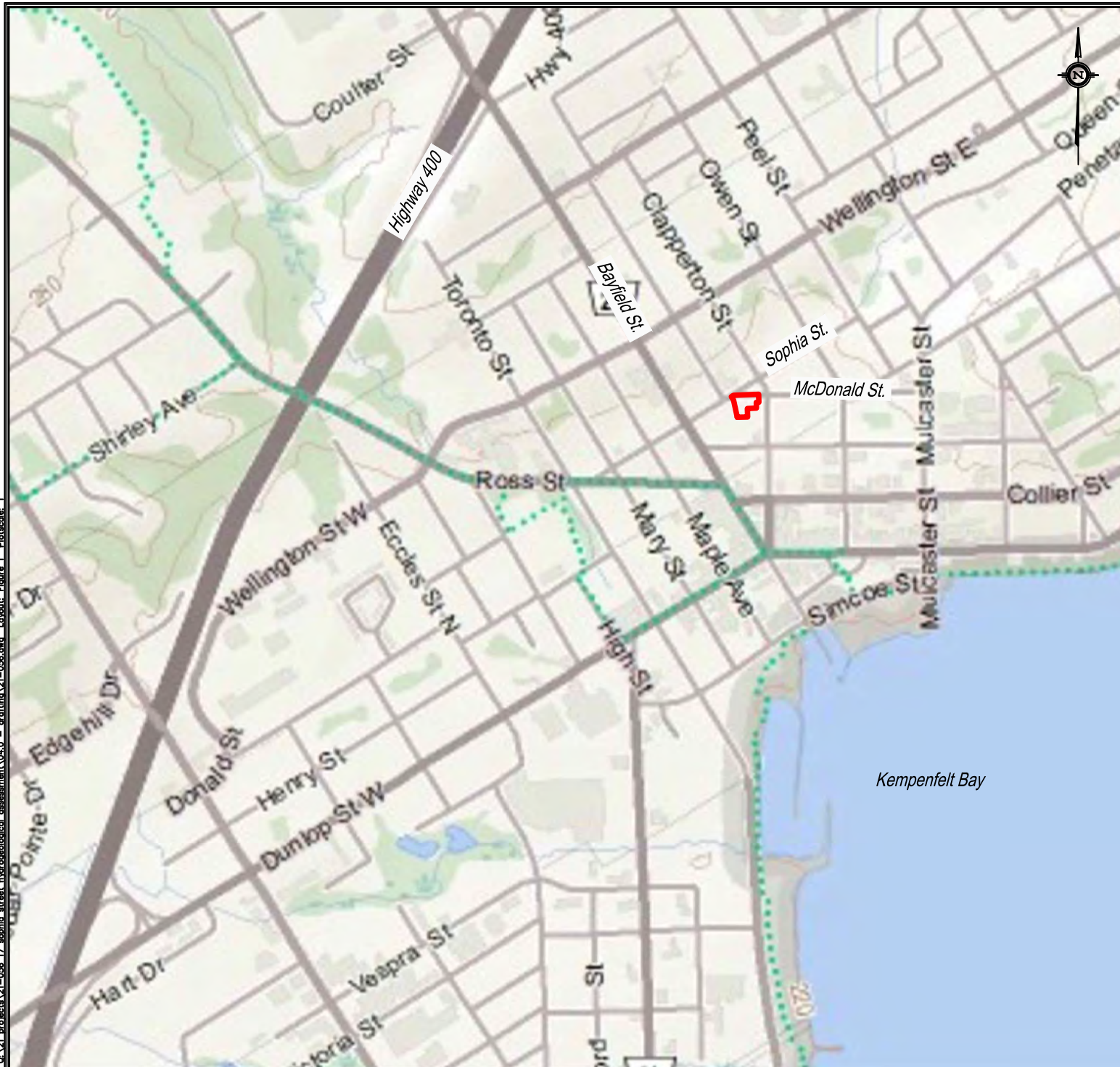
- Appendix A: Figures**
 - Appendix B: Proposed Development Plan**
 - Appendix C: MECP Well Records & Site Borehole Logs**
 - Appendix D: Water Balance Summary Tables**
 - Appendix E: Hydraulic Conductivity Testing**
 - Appendix F: Water Quality Data**
 - Appendix G: Dewatering Calculations**
 - Appendix H: Ground Water Elevation Data**
 - Appendix I: Ground Water Study Figures**
-
-



APPENDIX A

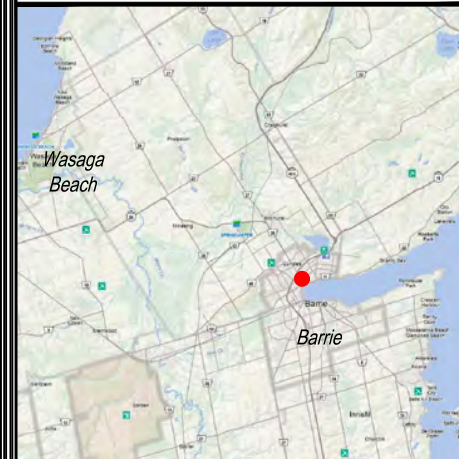
Figures

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LEGEND:

 *Approx. Property Boundary*



REG MAP

150m 0 300m
HORIZONTAL SCALE 1:12,500



Site Location Map

McDonald St. & Sophia St.
Barrie, ON

DATE ISSUED: October 2022

CREATED BY: JLM

PROJECT NO.: 21-056

REFERENCE: MNR

Figure No.

1



LEGEND:

- Approx. Property Boundary
- 1m FBS Contours

5m 0 10m

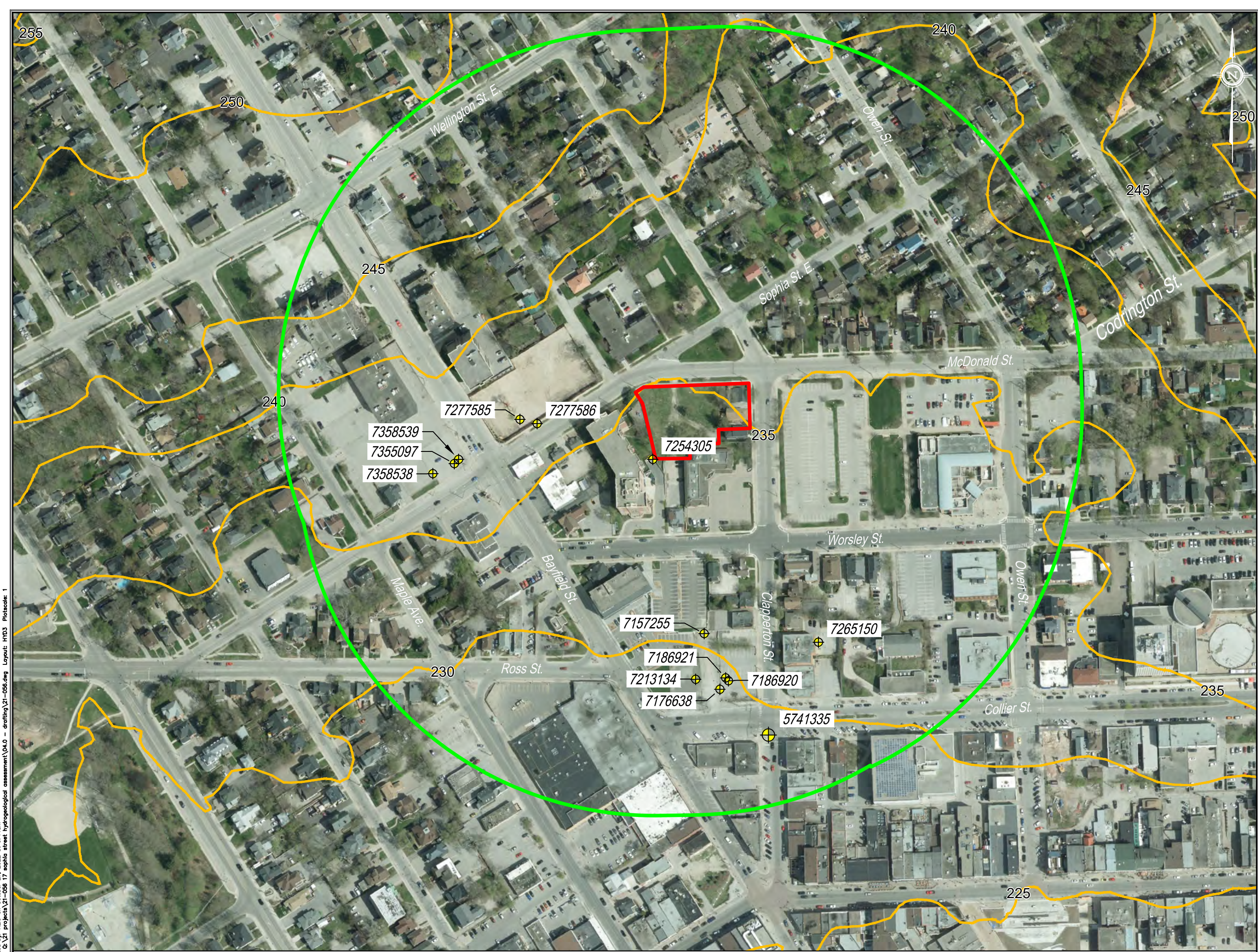
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 **Site Layout**

McDonald St. & Sophia St.
Barrie, ON

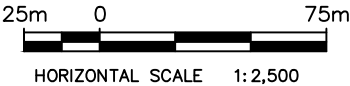
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- LEGEND:**
- Approx. Property Boundary
 - 250m Phase I Study Area
 - 5m OBM Contours
 - MECP Water Well Locations

Note:
Well locations are based on MECP well records and/or GIN (2021) mapping.

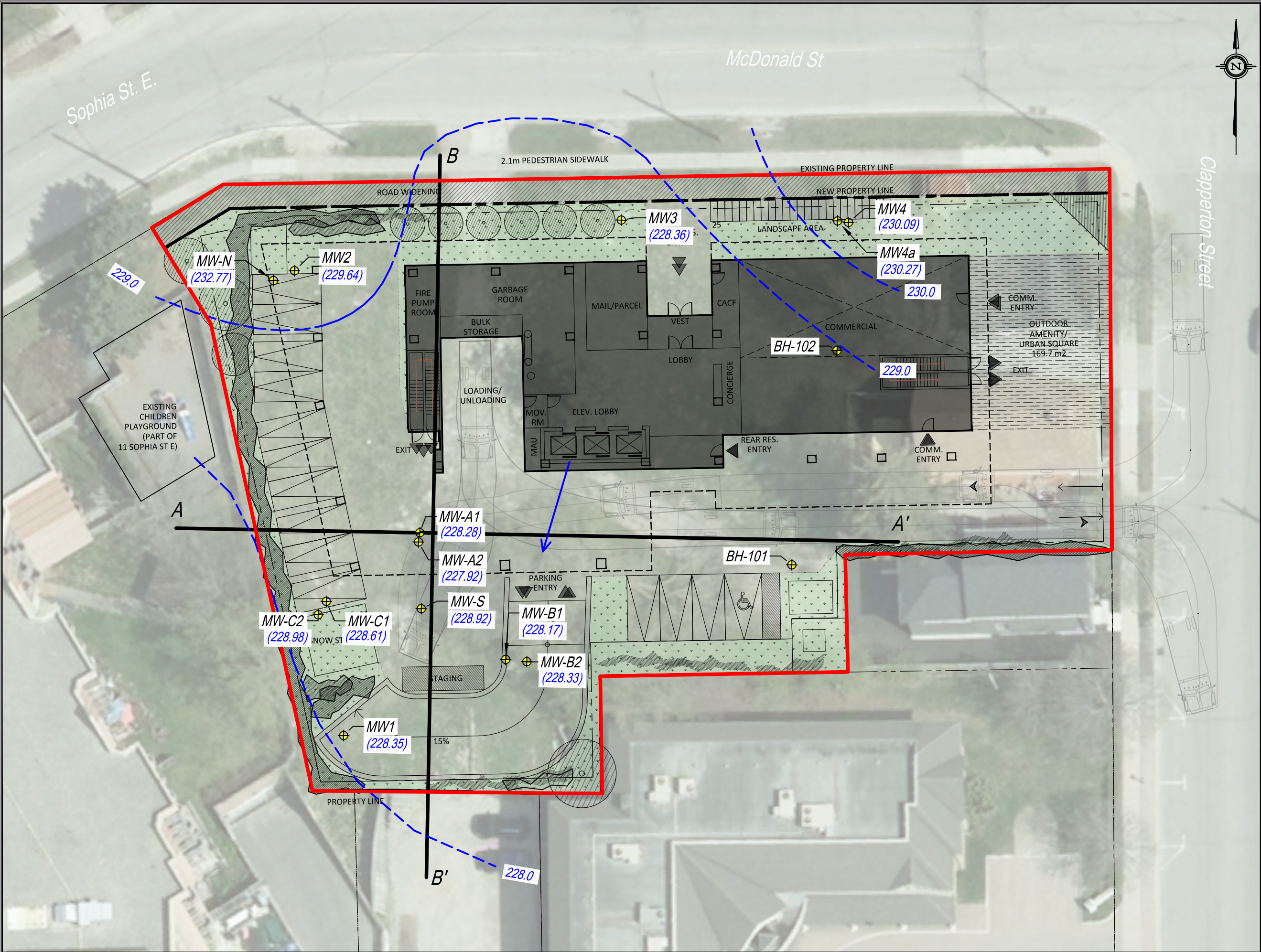


Surrounding Well Records

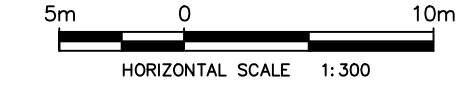
McDonald St. & Sophia St.
Barrie, ON

DATE ISSUED:	October 2022	Figure No. 3
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Plotted by: ALJU on October 27, 2022 at 9:45am
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- LEGEND:**
- Approx. Property Boundary
 - ⊕ Existing Monitoring Well Locations
 - - - Inferred Equipotential Elevation
 - 225.7 Ground Water Elevation (21 March 2017)
 - Inferred Lateral Ground Water Flow Direction

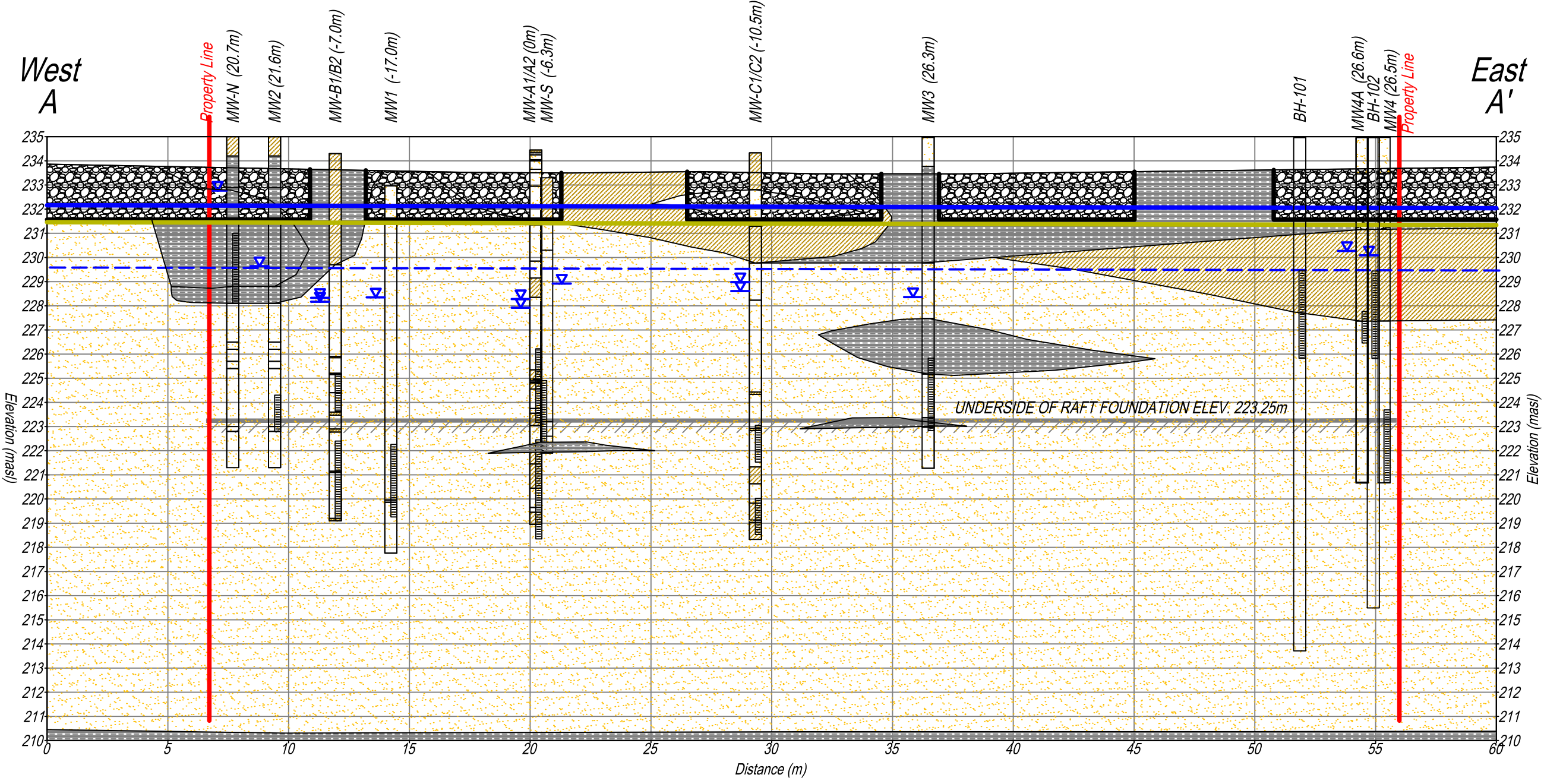


Monitoring Well Locations and
Ground Water Flow

McDonald St. & Sophia St.
Barrie, ON

DATE ISSUED:	October 2022	Figure No. 4
CREATED BY:	JLM	
PROJECT NO.:	21-056	
REFERENCE:	First Base Solutions	

Section W-E



LEGEND:

- Silt/Silty Sand/Silt and Sand/Silt and Clay
- Sand/Sandy Silt/Sand and Gravel
- Clay/Clayey Sand/Clay and Silt/Clay and Sand
- Water Elevation (21 March 2017)
- Screen Length

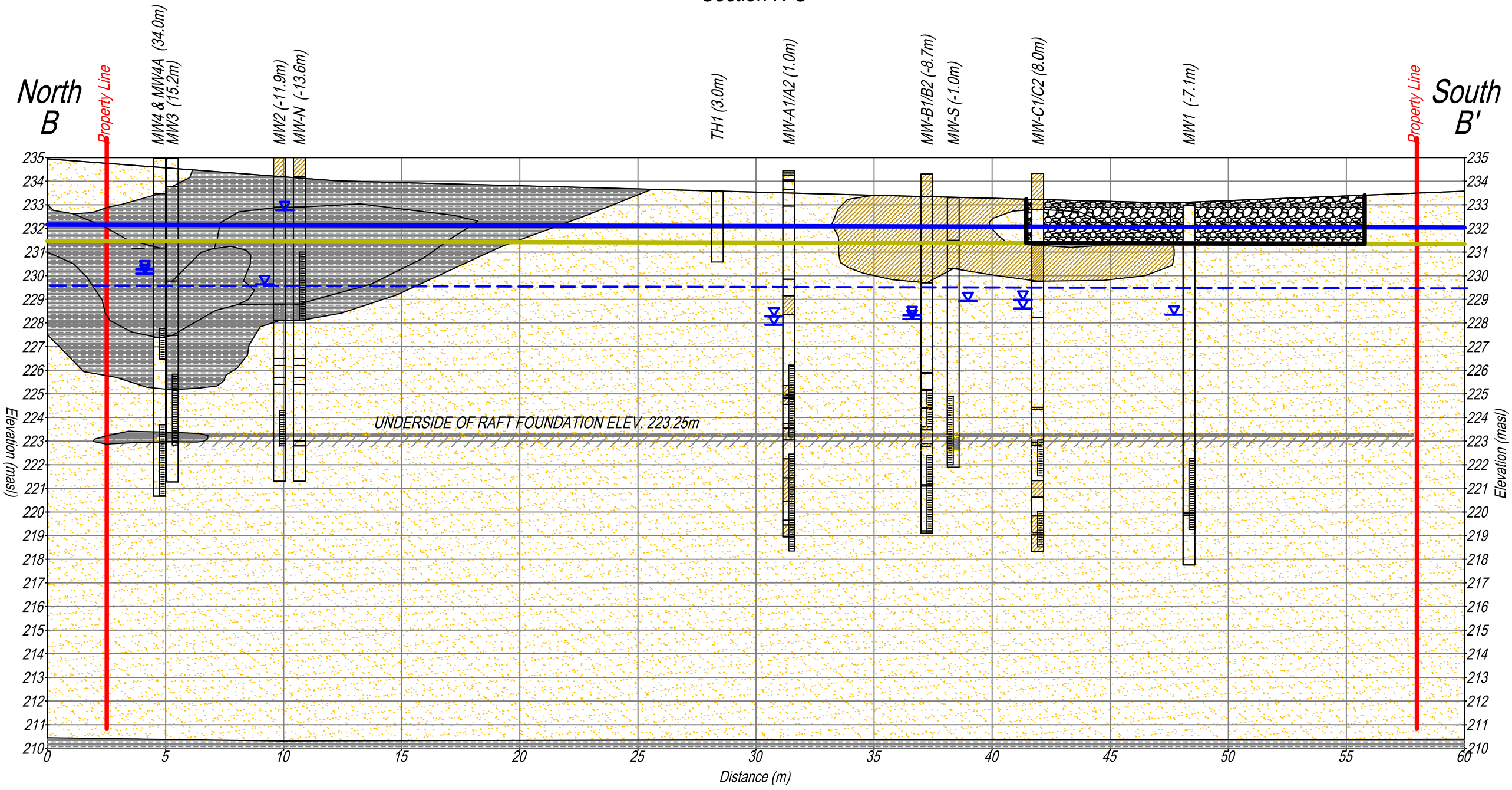


Geological Cross-Section A-A'

McDonald St. & Sophia St.
Barrie, ON

DATE ISSUED:	October 2022	Figure No.
CREATED BY:	JLM	5
PROJECT NO.:	21-056	
REFERENCE:		

Section N-S



- LEGEND:
- Silt/Silty Sand/Silt and Sand/Silt and Clay
 - Sand/Sandy Silt/Sand and Gravel
 - Clay/Clayey Sand/Clay and Silt/Clay and Sand
 - Water Elevation (21 March 2017)
 - Screen Length



Geological Cross-Section B-B'

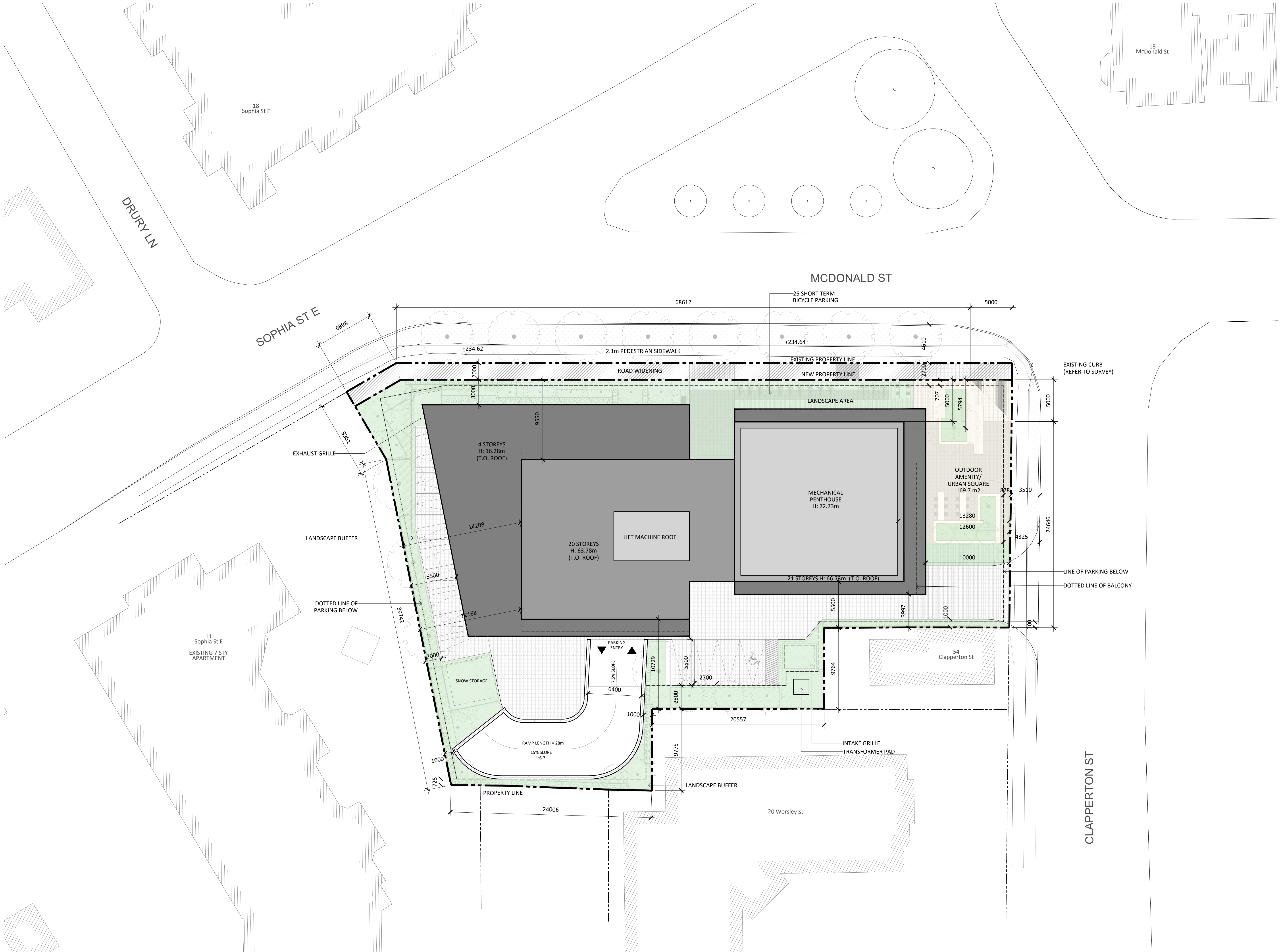
McDonald St. & Sophia St.
Barrie, ON

DATE ISSUED:	October 2022	Figure No.
CREATED BY:	JLM	6
PROJECT NO.:	21-056	
REFERENCE:		



APPENDIX B

Proposed Development Plan



Issued:

Issued for OPA/ZBA	Apr 08, 2022
Issued For	Date

- General Notes:
- These Contract Documents are the property of the Architect. The Architect bears no responsibility for the interpretations of these documents by the Contractor. Upon written application the Architect will provide written/graphic clarification or supplementary information regarding the intent of the Contract Documents. The Architect will review Shop Drawings submitted by the Contractor for design conformance only.
 - Drawings are not to be scaled for construction. Contractor to verify all existing conditions and dimensions required to perform the Work and report any discrepancies with the Contract Documents to the Architect before commencing work.
 - Positions of exposed or finished mechanical or electrical devices, fittings, and fixtures are indicated on the Architectural drawings. The locations shown on the Architectural drawings govern over the Mechanical and Electrical drawings. Those items not clearly located will be located as directed by the Architect.

Architect:
STUDIO JCI
20 De Boers Drive suite 525
Toronto, ON M3J 0H1
t. 416.901.6528
www.studiojci.com



MIXED USE
DEVELOPMENT

17 Sophia St. E., Barrie, ON

SITE PLAN

Project No.: 2115
Scale: 1:200
Date: OCTOBER 24, 2022
Drawn by: -

Drawing No.:

A100



General Notes:

1. These Contract Documents are the property of the Architect. The Architect bears no responsibility for the interpretations of these documents by the Contractor. Upon written application the Architect will provide written/graphic clarification or supplementary information regarding the intent of the Contract Documents. The Architect will review Shop Drawings submitted by the Contractor for design conformance only.

2. Drawings are not to be scaled for construction. Contractor to verify all existing conditions and dimensions required to perform the Work and report any discrepancies with the Contract Documents to the Architect before commencing work.

3. Positions of exposed or finished mechanical or electrical devices, fittings, and fixtures are indicated on the Architectural drawings. The locations shown on the Architectural drawings govern over the Mechanical and Electrical drawings. Those items not clearly located will be located as directed by the Architect.

Architect:

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MIXED USE DEVELOPMENT

17 Sophia St. E., Barrie, ON

SECTION A

Project No.: 2115
Scale: 1:150
Date: OCTOBER 24, 2022
Drawn by: --
Drawing No.:

A600



APPENDIX C

MECP Well Records & Site Borehole Logs

BOREHOLE LOG

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 3, 2015
Borehole Number	MW-1	Contractor	Walker Drilling	Elevation	234.0
Equipment	D-50 Track Mount Drill	Total depth	15.2 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	0.8	TOPSOIL, sandy, brown, pebbles, moist		0 - 0.76		5 7 7 5	
0.76	10.4	Sand, trace silt, brown/black/grey, copper mottles, moist Some silt/clay from 6.2 m to 6.9 m Rocky at 9.1 m	1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 9.1 - 9.9 1L	0.76 - 1.5 1.5 - 2.3 2.3 - 3.0 3.0 - 3.8 3.8 - 4.6 4.6 - 5.3 5.3 - 6.1 6.1 - 6.9 6.9 - 7.6 7.6 - 8.4 8.4 - 9.1 9.1 - 9.9 9.9 - 10.4	0 10 0 0 0 0 0 0 0 0 0 NS 0	2 4 5 7 1 2 4 4 2 2 3 4 3 5 7 9 7 10 14 25 8 12 21 29 14 20 24 50 13 17 23 42 20 26 +50 25 43 47 +50 18 31 +50 32 50 21 36 50	
10.4	13.0	Sand, clayey, moist-wet, massive, grey Medium sand and gravel at 11.9 m	1L 1M 1N 1O	10.4 - 10.7 10.7 - 11.4 11.4 - 12.2 12.2 - 13.0	0 75 0 15	21 36 50 22 34 50 11 35 +50 30 43 +50	MW-1-1 H ₂ O flow MW-1-2
13.0	13.1	Clay, grey, moist	1P	13.0 - 13.1	65	17 32 50	
13.1	15.2	Sand, grey, saturated	1P 1Q 1R	13.1 - 13.7 13.7 - 14.5 14.5 - 15.2	65 25 5	17 32 50 21 49 +50 21 46 +50	

Borehole terminated at 15.2m

<i>Comments</i>	<i>Water Conditions</i>	
Well Completion Details screen length 3 m (10.7 to 13.8 m bgl) 0.15 m sand seam @ 11.9 yielded water (flow)	☒ Wet upon completion ☐ Dry upon completion	

JOB No.
Borehole No.
FIELD STAFF

15-249
MW-1
Jenn Thompson

Environmental Assessments & Approvals

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 4, 2015
Borehole Number	MW-2	Contractor	Walker Drilling	Elevation	235.11
Equipment	D-50 Track Mount Drill	Total depth	13.7 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	0.8	TOPSOIL dark brown silty sand, loose, dry		0 - 0.76			
0.76	2.1	CLAY brown sandy clay, copper mottling, massive, moist	2A	0.76 - 1.5 1.5 - 2.1	15	1 2 2 4	
2.1	5.0	SAND Brown clayey sand, copper mottling, rounded pebbles, stiff, dry	2A 2B 2C	2.1 - 2.3 2.3 - 3.0 3.0 - 3.8 3.8 - 4.6 4.6 - 5.0	15 0 0	1 2 2 4 9 11 22 36 8 21	
5.0	5.3	SAND medium sand, massive, saturated	2D	5.0 - 5.3	5	28 42	
5.3	6.2	SAND Brown clayey sand, copper mottling, rounded pebbles, stiff, dry	2E	5.3 - 6.1 6.1 - 6.2	0	17	
6.2	6.9	CLAY Grey clay, blocky, stiff, dry	2E 2F	6.2 - 6.9 6.9 - 6.9	0 0	17 +50 10	
6.9	8.5	SAND Brown clayey sand, rounded pebbles, massive to platy, moist	2F 2G 2H	6.9 - 7.6 7.6 - 8.4 8.4 - 8.5	0 0 100	29 50 41 +50 28	
8.5	8.8	CLAY Grey clay, blocky, copper mottling	2I	8.5 - 8.8	0	42 +50	
8.8	9.3	SAND Brown sand, saturated	2I 2J	8.8 - 9.1 9.1 - 9.3	0 0	42 +50 27	
9.3	9.6	CLAY Grey clay, blocky, mottled, dry	2J	9.3 - 9.6	0	+50	
9.6	12.0	SAND Brown sand, gravel seam 11.2 to 11.4, loose, saturated	2K 2L 2M	9.6 - 9.9 9.9 - 10.7 10.7 - 11.4 11.4 - 12.0	50 55 65 15	32 +50 14 28 +50	MW-2-1 MW-2-2
12.0	12.2	CLAY Grey sandy clay, massive	2M	12.0 - 12.2	15		MW-2-2
12.2	13.7	SAND Brown sand & gravel, no structure, saturated	2N 2O	12.2 - 13.0 13.0 - 13.7	0 0	15 37 +50 20 39 +50	MW-2-3

Borehole terminated at 13.7 m

Comments	Water Conditions	
Well Completion Details screen length 1.5 m (10.7 to 12.2 m bgl) Borehole adjacent to MW-N	☒ Wet upon completion ☐ Dry upon completion	

JOB No.	15-249
Borehole No.	MW-2
FIELD STAFF	Jenn Thompson

Environmental Assessments & Approvals

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 5, 2015
Borehole Number	MW-3	Contractor	Walker Drilling	Elevation	234.93
Equipment	D-50 Track Mount Drill	Total depth	13.7 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	1.2	FILL Brown sand w rocks, brick, concrete, dry	3A	0 - 0.8 0.8 - 1.2	0	2 2 2 3	
1.2	5.2	CLAYEY SAND Brown clayey sand, interbedded layers, grey clay is blocky, moist to wet	3A 3B 3C	1.2 - 1.5 1.5 - 2.3 2.3 - 3.0 3.0 - 3.8 3.8 - 4.6 4.6 - 5.2	0 0 0	1 1 2 4 1 3 4 10	
5.2	7.5	SAND Brown medium sand, pebbles, trace clay, no structure, moist	3E 3F 3G	5.2 - 5.3 5.3 - 6.1 6.1 - 6.9 6.9 - 7.5	0 5 5	15 26 33 47 16 22 41 49	
7.5	9.8	CLAYEY SAND Brown clayey sand, interbedded layers, grey clay is blocky to platey, mottled, moist to saturated	3G 3H 3I 3K	7.5 - 7.6 7.6 - 8.4 8.4 - 9.1 9.1 - 9.8	35 25 30	21 39 +50 21 30 +50 24 37 48 +50	MW-3-1
9.8	11.6	SAND Brown sand, some gravel, occasion pebble, flowing, saturated	3K 3L 3M 3N	9.8 - 9.9 9.9 - 10.7 10.7 - 11.4 11.4 - 11.6	30 25 40	14 23 42 +50 40 +50 28 42	MW-3-2 MW-3-3 MW-3-4
11.6	12.0	CLAY Grey sandy clay, blocky to platey, wet	3N	11.6 - 12.0		+50	
12.0	13.7	SAND Brown medium sand, saturated	3N 3O	12.0 - 12.2 12.2 - 13.0 13.0 - 13.7	30 0	26 43 +50	MW-3-5

Borehole terminated at 13.7 m

Comments	Water Conditions	
Well Completion Details screen length 3 m (9.14 to 12.19 m bgl)	☒ Wet upon completion ☐ Dry upon completion	

JOB No.
Borehole No.
FIELD STAFF

15-249
MW-3
Jenn Thompson

BOREHOLE LOG

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 6, 2015
Borehole Number	MW-4	Contractor	Walker Drilling	Elevation	234.9
Equipment	D-50 Track Mount Drill	Total depth	14.3 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	1.5	TOPSOIL Black to brown sand, organics, rootlets	4A	0 - 0.8 0.8 - 1.5	5	1 1 2 2	
1.5	3.8	CLAYEY SAND to SAND & CLAY Brown to grey sand with varying clay content up to 50%, mottled, massive, wet	4B	1.5 - 2.3 2.3 - 3.0 3.0 - 3.8	5	1 1 1 2	
3.8	7.6	SAND to SILTY SAND Grey to brown, medium to fine sand to silty sand, occasional gravel, poorly sorted, loose, dry to moist	4C 4D 4E	3.8 - 4.6 4.6 - 5.3 4.6 - 6.1 6.1 - 6.9 6.9 - 7.6	5 5 30	10 18 22 30 15 20 29 42 23 40 +50	
7.6	10.7	SANDY SILT TILL Grey to brown medium to fine sand with silt to silt with fine sand, transitions to siltier content with depth, trace gravel, mottled, dense, moist to wet Brown clayey sand, interbedded layers, grey clay is	4F 4G 4H	7.6 - 8.4 8.4 - 9.1 9.1 - 9.9 9.9 - 10.7	190 110 130	34 45 +50 26 +50 30 46 +50	MW-4-1
10.7	14.3	SANDY SILT Grey very fine sand and silt, trace gravel, trace clay, laminated, mottled, dense, wet	4I 4J 4K 4L 4M	10.7 - 11.4 11.4 - 12.2 12.2 - 13.0 13.0 - 13.7 13.7 - 14.3	75 130 260 250 90	36 +50 23 45 +50 34 +50 21 44 +50 35 +50	MW-4-2 MW-4-3 MW-4-4

Borehole terminated at 14.3 m

<i>Comments</i>	<i>Water Conditions</i>	
Well Completion Details screen length 3 m (11.28 to 14.33 m bgl) screen length 1.5 m (7.6 to 9.1 m bgl)	☒ Wet upon completion ☐ Dry upon completion	

JOB No.
Borehole No.
FIELD STAFF

15-249
MW-4
Jenn Thompson

BOREHOLE LOG

Project Number	15-249	Client/ Project	WJR Hart Holdings Ltd	Date:	November 4, 2015
Borehole Number	BH-1	Contractor	Walker Drilling	Elevation	233.3
Equipment	D-50 Track Mount Drill	Total depth	14.3 m deep	Datum	Ground Surface
Temperature	24 °C	Weather	Sunny		

Depth		Soil description	Samples		Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		No.	Depth (mbg)			
0	1.8	SILTY SAND Black to grey, copper mottled, loose, dry		0 - 1.5 1.5 - 1.8	0	2 2 4 5	
1.8	3.0	CLAY Grey clay, copper mottled, moist	A	1.8 - 2.3			
2.3	10.1	SAND Brown sand, tace silt, occasional rounded pebble, loose, moist	B	2.3 - 3.0	15	3 3 4 5	BH-1
			C	4.6 - 5.3	15	11 16 21 27	
			D	6.1 - 6.9	5	14 26 +50	
			E	6.9 - 7.6	15	16 25 29 48	
			F G	9.1 - 9.9 9.9 - 10.1	75	21 36 +50 10	
10.1	10.7	CLAY Grey clay, copper mottled, stiff, wet	G	10.1 - 10.7	30	21 35 48	BH-2
10.7	11.4	SAND Brown coarse sand, some pebbles, saturated	H	10.7 - 11.4	30	4 15 22 39	

Borehole terminated at 11.4 m

<i>Comments</i>	<i>Water Conditions</i>	
Borehole drilled to document soil profile at MW-S No monitor installed	☒ Wet upon completion ☐ Dry upon completion	

JOB No.

15-249

Borehole No.

BH-1

FIELD STAFF

Jenn Thompson

BOREHOLE LOG

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-A1	Contractor	Lantech Drilling Services	Elevation	234.45 masl
Equipment	CME 75	Borehole Depth	15.5 m	Datum	
Temperature	21 °C	Weather	Cloudy, chance rain	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
0	0.8	0-4' TOPSOIL Silty Sand, brown with grass rootlets, moist, dense 4-8" white clearstone gravel 16" brown coarse grained sand, loose, dry 16-18" clearstone and sand	G	1		0		
0.8	1.5	SAND AND SILT fine grained, brown, loose to compact, dry to moist	G	2	- - -	0		
1.5	2.3	SAND AND SILT banded layers, fine grained, roughly 5-10 cm thick, moist to wet, loose to firm, slight mottling, brown, black, grey, oxidized	G	3	- - - -	0	2 1 2 2	
2.3	3.1	Aggregate sample stuck in head of splitspoon, followed by 3" of Sample No. 3	N/A	4	- - - -		W O R	
3.1	3.7	SAND WITH SILT brown, fine grained, fairly uniform, slight banding, dry to damp, loose to compact	G	5	- - - -	0	4 3 6 2	
3.7	4.6	SANDY SILT brown, fine grained, fairly uniform, slight banding, dry to damp, loose to compact	G	6	- - -	0	5 10 13 13	
4.6	5.3	SANDY SILT brown, fine grained, gravel, fairly uniform, slight banding, dry to damp, loose to compact. Does not ribbon, more sandy	G	7	- - -	0	11 20 20 16	
5.3	6.1	0-10" SAND with silt, brown, fine grained, gravel, fairly uniform, slight banding, dry to damp, loose to compact 10- 24" SILT AND SAND brown, mottled red and grey with trace gravel and laminations, moist to wet, dense	G	8	- - -	0	5 7 11 15	
6.1	6.9	SAND brown, fine grained with trace silt and trace (-) gravel, moist to saturated, loose	G	9	- - -	10	11 19 20 27	PHC's & VOC's

BOREHOLE LOG

CONTINUED

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-A1	Contractor	Lantech Drilling Services	Elevation	234.45 masl
Equipment	CME 75	Borehole Depth	15.5 m	Datum	
Temperature	21 °C	Weather	Cloudy, chance rain	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
6.9	7.6	SAND brown, fine grained with trace silt and trace (-) gravel, moist to saturated, loose	G	10	-	5	19 23 25 32	
7.6	8.4	2-6" smashed cobble 24" SAND brown, fine grained with trace silt and trace (-) gravel, increased silt at 18", almost ribbons, oxidation dense	G	11	-	0	27 16 13 13	
8.4	9.1	SAND fine to medium grained, brown, growing more coarse with depth, trace silt with trace rounded cobbles, loose to dense, moist	G	12	-	0	11 32 50 14	
9.1	9.9	0-8" SAND fine to medium grained, brown, growing more coarse with depth, trace silt with trace rounded cobbles, loose to dense, moist 8-15" SILT with sand seam grey to brown dense dry	G	13	-	10	21 44 50 14	PHC's & VOC's
9.9	10.7	0-10" SAND coarse, brown, moist to wet, loose 10-21" SILT with trace sand trace (-) gravel, grey, dense, dry, trace clay	G	14	-	15	8 28 40 50	
10.7	11.4	0-8" SAND coarse grained, brown/grey, loose, saturated 11" SILT with sand trace (-) gravel, brown-grey, dense dry	G	15	-	60	16 27 24 27	PHC's & VOC's & FOC
11.4	12.2	0-3" FLUFF and aggregate piece 3-15" SILT with clay, grey, dry, very dense, slight mottling	G	16	-	10	21 27 40 50	
12.2	13.0	0-12" SAND fine to coarse grained, grey with tracerounded gravel, loose, saturated 12-24" SILT AND CLAY grey, dense, dry	G	17	-	10	5 15 30 30	
13.0	14.0	0-16" FLUFF 24" SAND AND SILT grey silt and clay till, very dense, dry. Layer is very dense, will act as impermeable barrier	G	18	-	20		
14.0	14.8	0-11" SAND fine to medium grained, dense, moist, brown/grey 11-24" SAND AND SILT with trace clay, grey, very dense, dry, oxidized and mottled black to brown	G	19	-	10		
14.8	15.5	0-8" SAND coarse grained, brown to grey, dense 8-24" SILT AND CLAY till, grey brown, very dense, moist	G	20	-	25		PHC's & VOC's

BOREHOLE LOG

CONTINUED

Environmental Assessments & Approvals

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-A1	Contractor	Lantech Drilling Services	Elevation	234.45 masl
Equipment	CME 75	Borehole Depth	15.5 m	Datum	
Temperature	21 °C	Weather	Cloudy, chance rain	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis			
From (m)	To (m)		Type	No.	Depth (mbg)						
Borehole terminated at 15.5 m											
Comments			Water Conditions								
Well Completion Details Screen length 0.30 m (15.1 to 12.0 m bgl)			☒ Wet upon completion ☐ Dry upon completion								

JOB No.
Borehole No.
FIELD STAFF

16-180
BH-A1
Steven Krbavcic

BOREHOLE LOG

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-B1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	15.2 m	Datum	
Temperature	16 °C	Weather	Cloudy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
0	1.5	Bored to 2.13 m. Thunder and lightning, shut down site at 5:30pm Resumed drilling Tuesday June 7, 2016 at 7:30am. Advanced to 6.1 m before resuming.			- -			
1.5	4.6	SILT AND SAND grey, loose, moist, occasional cobble			- - -			
4.6	6.1	SAND with some silt, till, grey, loose to compact, dry, cobbles			- - - -			
6.1	6.9	SAND with some silt, till with gravel, dense, brown, dry to moist	1	G	- - -	0	11 31 32 31	
6.9	7.6	0-20" SAND with some silt, till with gravel, dense, brown, dry to moist 20-22" deoxidization marks with coarse sand	2	G	- - - -	0	11 15 30 30	
7.6	8.4	0-10" SAND medium to coarse grained, grey/brown, laminations, dense, dry to moist, oxidization banding at 10" 10-15" SILT with clay, grey brown, very dense	3	G	- - -	5	18 46 50 4"	PHC's VOC's
8.4	9.1	0-2" SILT with clay, grey brown, very dense 2-18" SAND with some clay, grey, dense, moist to wet, laminated	4	G	- - -	5	22 40 50 4"	
9.1	9.9	0-2" SAND with some clay and silt, grey, dense, moist to wet, laminated 2-10" SILT AND CLAY grey, very dense, dry to moist	5	G	- - -	0	35 50 3"	
9.9	10.7	SAND coarse to medium, grey, dense, saturated	6	G	- - -	5	13 32 50 3"	GS
10.7	11.4	0-5" SAND coarse to medium, grey, dense, moist to saturated 5-9" SILT and trace sand, grey, very dense, dry	7	G	- - -	0	31 50 3"	
11.4	12.2	SAND and trace silt, trace rounded gravel, grey, compact to dense, wet	8	G	- - -	0	25 50 5"	PHC's & VOC's, FOC, 65

BOREHOLE LOG

CONTINUED

Environmental Assessments & Approvals

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Consession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-B1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	15.2 m	Datum	
Temperature	16 °C	Weather	Cloudy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
12.2	13.0	SAND and trace silt, trace rounded gravel, grey, compact to dense, wet to slightly saturated	9	G	- - -	0	36 50 4"	
13.0	13.7	0-6" SAND and trace silt, trace rounded gravel, grey, compact to dense, wet to slightly saturated 6-8" SILT AND CLAY very dense, grey, dry 8-12" SAND coarse, grey, loose, saturated	10	G	- - -	0	45 50 5"	
13.7	14.5	0-8" SAND coarse, with pebbles, grey, loose, saturated 8-12" SAND medium, trace silt, grey, dense to moist 12-17" SAND and ground water with a cobble, very	11	G	- - -	0	16 25 65 *	
14.5	15.2	0-12" SAND with trace silt, grey, dense, wet 12-18" SILT AND CLAY, very dense, grey, dry to moist	12	G	- - -	0	36 50 3"	PHC's VOC's

Borehole terminated at 15.2 m

Comments	Water Conditions
Well Completion Details Screen length 3.3 m (15.2 to 11.9 m bgl)	☐ Wet upon completion ☐ Dry upon completion

JOB No.
Borehole No.
FIELD STAFF

16-180
BH-B1
Steven Krbavcic

BOREHOLE LOG

Environmental Assessments & Approvals

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-C1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	16.0 m	Datum	
Temperature	10 °C	Weather	Cloudy and windy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
0	6.1	Augered to 20' (6.1 m) 0-5' TOPSOIL with silty sand & trace gravel, black to brown, loose, dry 5-10' SAND with some silt, brown to grey, loose, dry 10-15' SILTY SAND with trace rounded gravel, brown grey, loose to dense with depth, moist to wet 15-20' SANDY SILT brown/grey, loose, moist			- - - -			
6.1	6.9	Split Spoon empty, suspect rock, augered through to 22.5' (6.9 m)			- -			
6.9	7.6	0-9" SAND AND SILT grey, very dense, dry to moist 9-14" SAND AND SILT tan to brown, very dense, dry to moist 14-24" SAND AND SILT grey, very dense, dry to moist, trace rounded gravel	G	1	- - - -	0	27 34 29 24	
7.6	8.4	SAND AND SILT grey, very dense, dry to moist	G	2	- - -	0	18 30 50 5"	
8.4	9.1	0-7" SAND AND SILT grey, very dense, dry to moist. Rock in top of spoon	G	3	- - -	0	34 50 5"	
9.1	9.9	0-8" SAND AND SILT grey, very dense, wet to saturated 24" SILT with some sand, with trace gravel, grey, very dense, dry, mottled grey to brown and black	G	4	- - -	5	10 15 16 17	PHC's & VOC's
9.9	11.4	32.5-35' (9.9-10.7 m) Split spoon empty 0-3" SILT brown to grey, trace sane, very loose, saturated 15" SAND with trace silt, trace gravel, loose, saturated, slight mottling	G	5	- - -	0	11 32 50 5"	
11.4	13.0	0-4" SAND medium to coarse, grey, loose, saturated 4-12" SILT AND CLAY grey, very dense, moist 15" SAND medium to coarse with trace gravel, loose, saturated Rock in tip of split spoon, some sand	G	6	- - - -	0	35 50	

BOREHOLE LOG

CONTINUED

Environmental Assessments & Approvals

Project Name/ Project Client	17 Sophia Street/ 1758601 Ontario Inc.	Project Address	Part Lots 12 - 15 on Lot 23, Concession 4, Barrie, Municipality of Vespa	Date	Monday June 6, 2016
Test Pit Number	BH-C1	Contractor	Lantech Drilling Services	Elevation	234.1 masl
Equipment	CME 75	Borehole Depth	16.0 m	Datum	
Temperature	10 °C	Weather	Cloudy and windy	Sample Type	Soil

Depth		Soil description	Samples			Headspace Combustible Vapour Concentration (ppm)	Blow Counts	Remarks / Chemical Analysis
From (m)	To (m)		Type	No.	Depth (mbg)			
13.0	13.7	0-6" SAND coarse to medium with trace gravel, grey. Loose, saturated 32" SILT with trace sand, trace clay, grey, very dense, moist	G	7	- - -	0	15 18 17 17	
13.7	14.5	0-5" SAND coarse, loose, grey, moist 32" SILT with trace sand, dense, grey, mottled, brown and orange, moist	G	8	- - -	5	16 17 21 50	
14.5	15.2	SAND with trace silt and trace gravel, grey, loose to completely saturated	G	9		15		PHC's & VOC's + dup FOC
15.2	16.0	0-4" SAND coarse with trace silt and trace gravel, grey, loose, laminations, saturated 4-32" SILT with trace sand and trace clay, grey, very dense, dry to moist	G	10			10 16 27 25	

Borehole terminated at 16.0 m

Comments	Water Conditions
Well Completion Details Screen length 1.5 m (15.8 to 14.3 m bgl)	☐ Wet upon completion ☐ Dry upon completion

JOB No.
Borehole No.
FIELD STAFF

16-180
BH-C1
Steven Krbavcic

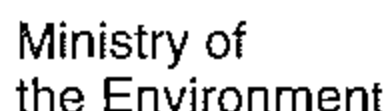
AZURE GROUP**DRAWING NO. 7****JOB NUMBER 2203-002****BH101****PROJECT LOCATION: 58 & 60 Clapperton Street, BARRIE, ONTARIO****Client:** **C_u = Shear Strength (kPa) G% = Gravel, S% = Sand, F% = Fines (Silt and Clay), M = Moisture Content****Temperature: 5°C**

Started/Date April 25, 2022 Time: 9.30 am Sheet 1 of 1
Finished/Date April 26, 2022, Time: 4:15 pm
Azure Rep: Amit Pal Auger Type: 150 mm Open
Ground Surface El: 233.66 m **G.W. Depth:** 5.63 m **G.W. Elevation:** 228.03 m **April 26, 2022** **Time:** 4 pm

Depth/Elev. (m)	Soil Description	Type/No	N	C_u (kPa)	G.W.T	Remark
0	233.7	100 mm Topsoil	SS 1	4		
		Fill: Loose to very loose silty sand, trace clay, gravel, bricks and organics (0.1 m to 2.0 m)				
0.75	233.0		SS 2	3		
1.5	232.2	Loose to compact SILTY SAND, trace clay, moist (1.8 m to 3.4 m)	SS 3	12		
2.25	231.5		SS 4	19		G%= 1.8
						S%=59.6
3.0	230.7		SS 5	47		F%=38.6
4.6	229.1	Dense brown SILTY SAND trace clay and gravel, below 4.0 m, moist	SS 6	45		
					5.63 m	
6.00	227.7	V. dense, grey SILTY SAND trace clay below 6.5 m	SS 7	42		G%=4.4
						S%=59.4
7.60	226.1		SS 8	53		F%=36.2
		Very dense SAND/SILTY SAND				
9.20	224.5	V. dense grey SAND trace silt and gravels	SS 9	63		
10.7	223.0		SS 10	75		
		Hard CLAYEY SILT/SILTY CLAY, SILT trace gravels below 11.5 m				
12.2	221.5		SS 11	>80		
		V. dense SAND/SILTY SAND				
13.7	220.0		SS 12	>80		
		V. dense SAND and gravel below 13.5 m				
15.2	218.5		SS 13	>80	>225	
16.8	216.9		SS 14	>80	>225	
18.3	213.9		SS 15	>80		
19.8	213.9	V. dense SAND and gravel	SS 16	>80		
	213.9	E.O.B				

AZURE GROUP**DRAWING NO. 8****JOB NUMBER 2203-002****BH102****PROJECT LOCATION: 58 & 60 Clapperton Street, BARRIE, ONTARIO****Client:** **C_u = Shear Strength (kPa) G% = Gravel, S% = Sand, F% = Fines (Silt and Clay), M = Moisture Content****Temperature: 5°C****Started/Date April 25, 2022 Time: 9:30 am Sheet 1 of 1****Finished/Date April 26, 2022 Time: 4:15 pm****Azure Rep: Amit Pal Auger Type: 150 mm Open****Ground Surface El: 234.03 m G.W. Depth: 5.63 m G.W. Elevation: 228.4 m April 26, 2022 Time: 4 pm**

Depth/Elev. (m)	Soil Description	Type/No	N	C_u (kPa)	G.W.T	Remark
0	234.0	100 mm Topsoil	SS 1	4		
		Fill: Loose to very loose silty sand, trace clay, gravel, bricks and organics (0.1 m to 2.0 m)				
0.75	233.3		SS 2	3		
1.5	232.5	Loose to compact SILTY SAND, trace clay, moist	SS 3	12		
2.25	231.8		SS 4	19		
3.0	231.0		SS 5	47		
		Dense brown SILTY SAND trace clay and gravel, below 4.0 m, moist				
4.6	229.4		SS 6	45		G%=1.1
						S%=46.6
6.00	228.0	V. dense, grey SILTY SAND trace clay and gravel	SS 7	>80	5.63 m	F%=52.3
7.60	226.4		SS 8	>80		
8.00	226.0	V. dense, grey SILTY SAND trace clay and gravel	SS 9	>80		
9.20	224.8	V. dense, grey SILTY SAND trace clay and gravel	SS 10	>80		G%=0.4
						S%=64.1
10.7	233.3	Very dense SAND/SILTY SAND	SS 11	>80		F%=35.5
12.2	221.8	V. dense grey SAND trace silt and gravels	SS 12	>80		
13.7	220.32	V. dense SILTY SAND trace clay and gravel	SS 13	>80		
15.2	218.8	V. dense SILTY SAND trace clay and gravel	SS 14	>80		
16.8	217.2	V. dense SAND/SILTY SAND	SS 15	>80		
18.3	215.7	V. dense SAND/SILTY SAND	SS 16	>80		
18.9	215.1	V. dense SAND and GRAVEL	SS 18	>80		
18.9		E.O.B				



Well Tag No. for Master Well (Place Sticker and/or Print Below)

A110288

Master Well Record for Cluster Well Construction

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Master Well Owner's and Land Owner's Information

First Name Suncor Energy Products		Last Name		E-mail Address			
Mailing Address (Street Number, Name, RR) 275 Rebecca St.		Municipality Oakville		Province ON	Postal Code L6L 6N5	Telephone No. (inc. area code) 905 469 3749	

Location and Construction of the Master Well in the Cluster

Address of Well Location (Street Number/Name, RR) 0-14 Collier st.				Township		Lot		Concession	
County/District/Municipality Barrie				City/Town/Village Barrie		Province Ontario		Postal Code 	
UTM Coordinates NAD 83		Zone 17		Easting 604285		Northing 49116129		GPS Unit Make Garmin	
						Model etrex		Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify _____	

Overburden and Bedrock Materials (see instructions on the back of this form)

[illegible]

Hole Details

Depth (Metres)		Diameter (Centimetres)
From	To	
○	12.8	21

Water Use

☐ Public ☐ Industrial ☐ Not used ☐ Other, *specify*
☐ Domestic ☐ Commercial ☐ Dewatering
☐ Livestock ☐ Municipal ☒ Monitoring
☐ Irrigation ☐ Test Hole ☐ Cooling & Air Conditioning

Method of Construction

☐ Cable Tool	☐ Air Percussion	☐ Digging
☐ Rotary (Conventional)	☐ Diamond	☒ Boring
☐ Rotary (Reverse)	☐ Jetting	☐ Other, <i>specify</i>
☐ Rotary (Air)	☐ Driving	

Status of Well

☒ Test Hole	☐ Abandoned, Insufficient Supply
☐ Replacement Well	☐ Abandoned, Poor Water Quality
☐ Dewatering Well	☐ Other, <i>specify</i> _____
☐ Alteration (Construction)	☐ Abandoned, other, <i>specify</i> _____

No Casing and Screen Used

Open Hole	☐ Yes ☒ No	10.7 Metres
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Static Water Level Test

10.7 Metres

Screen

☐ Galvanized ☐ Steel ☐ Fibreglass ☐ Concrete ☒ Plastic	
Outside Diameter (Centimetres) 6.4	Slot No. 20

Water Details

Water found at Depth 10.7 Metres ☐ Gas	Kind of Water ☒ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth Metres ☐ Gas	Kind of Water ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth Metres ☐ Gas	Kind of Water ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

Annular Space/Abandonment Sealing Record

[illegible]

Well Contractor and Well Technician Information

Business Name of Well Contractor <i>Geo-Environmental</i>		Well Contractor's Licence No. <i>6607</i>	
Business Address (Street No./Name, number, RR) <i>340 Market St.</i>		Municipality <i>Milton</i>	
Province <i>Ont</i>	Postal Code <i>L9T5A4</i>	Business E-mail Address	
Bus. Telephone No. (inc. area code) Name of Well Technician (Last Name, First Name) <i>905 876 3388 Collins, Tim</i>			
Well Technician's Licence No. <i>2059</i>	Signature of Technician <i>[Signature]</i>	Date Submitted (yyyy/mm/dd) <i>2010/12/06</i>	

Cluster Information (Please also fill out the additional Cluster Well Information for Well Construction for each parcel of land and cluster.)

Total Wells in Cluster <u>3</u>	Please indicate Number of Cluster Well Information Log Sheets Submitted
Total Wells on this Property <u>3</u>	

Location of Well Cluster

Detailed Map must be provided as an attachment no larger than legal size (8.5" x 14"). Sketches are not allowed.

☐ Check box to confirm detailed map is provided as per Section 11.1 (3)

Consent to release additional information concerning the cluster to the Director upon request

Signature of Technician/Contractor	Date (yyyy/mm/dd)
	2010/12/06

Master Well Owner's/Land Owner's consent to use Cluster Form

Signature	Date (yyyy/mm/dd)
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Ministry Use Only

Audit No. M 07428	Well Contractor No.
Date Received (yyyy/mm/dd) JAN 07 2011	Date of Inspection (yyyy/mm/dd)
Remarks	



A 110 2888

Regulation 903 Ontario Water Resources Act

Page i of 1

First Name	Last Name	Mailing Address (Street No./Name, RR)	Municipality
Suncor Energy Products		3275 Rebecca st.	Oakville
Province	Postal Code	E-mail Address	Telephone No. (inc. area code)
Ontario	L6L6N5		9054693740

Address of Well Location (Street Number/Name, RR) 10-14 Collier st.			Lot	Concession	Township	County/District/Municipality Barrie	
City/Town/Village Barrie	Province Ontario	Postal Code	GPS Unit Make Garmin	Model etrex	Unit Mode of Operation ☐ Undifferentiated ☒ Averaged		

Property Owner's Consent to use cluster form

Signature	Date (yyyy/mm/dd)
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Consent to release additional information to the Director upon request

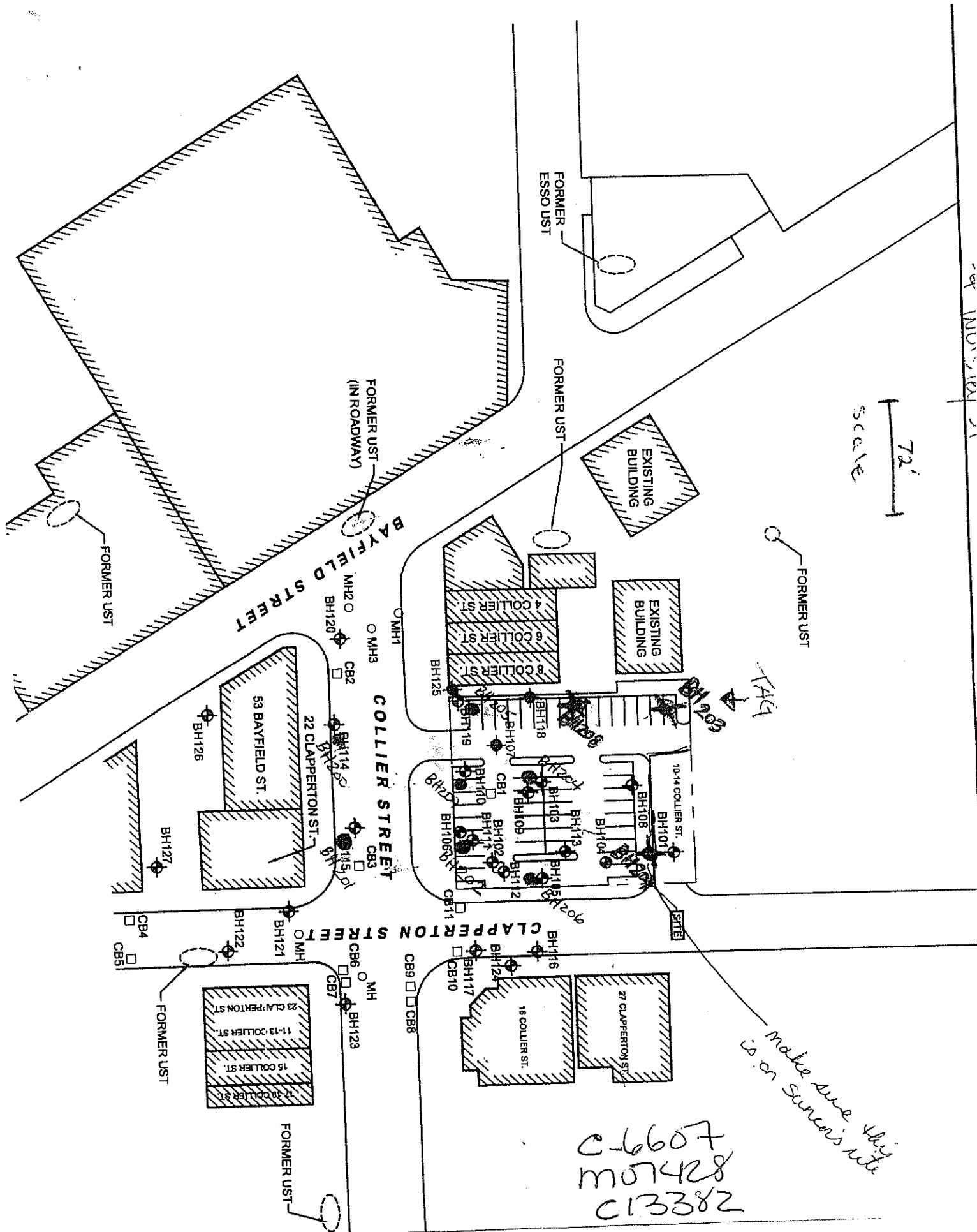
Signature of Technician/Contractor	Date (yyyy/mm/dd)
	2010/12/07

[illegible]

Business Name of Well Contractor <i>Geo-Environmental</i>		Business Address (Street Number/Name, RR) <i>340 Market Dr.</i>		Municipality <i>Milton</i>	Province <i>Ont</i>
Postal Code <i>L9T 5T4</i>	Business Telephone No. (inc. area code) <i>905 876 3388</i>	Well Contractor's Licence No. <i>6607</i>	Business E-mail Address		
Name of Well Technician (First Name, Last Name) <i>Tim Collins</i>		Well Technician's Licence No. <i>2059</i>	Date Submitted (yyyy/mm/dd) <i>2010/12/10</i>	Signature of Technician <i>[Signature]</i>	

Date 1st Well in Cluster Constructed (yyyy/mm/dd)	Date Last Well in Cluster Constructed (yyyy/mm/dd)
2010/12/07	2010/12/09

Date Received (yyyy/mm/dd)	Date Inspected (yyyy/mm/dd)
Audit No. 07-2011 C 13382	Remarks m157428



Master Well Owner's and Land Owner's Information

First Name Suncor Energy Products Partnership		Last Name		E-mail Address	
Mailing Address (Street Number/Name) RR		Municipality		Province	Postal Code Telephone No. (inc. area code)
3275 Rebecca St		Oakville		On	L6L6N5 905 4693754

Location and Construction of the Master Well in the Cluster

Address of Well Location (Street Number/Name, RR) 10-14 Collier St.	Township	Lot	Concession
County/District/Municipality	City/Town/Village	Province	Postal Code

UTM Coordinates	Zone	Easting	Northing	GPS Unit Make	Model	Mode of Operation: ☐ Undifferentiated ☒ Averaged
NAD 83	17	65094	908532	Magellan	SmartTrak	☐ Differentiated, specify _____

Overburden and Bedrock Materials (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (Metres)	
				From	To
Brown	Sand	Silt		0	9
Grey	Sand	Clay		9	12.3
BH307					

Hole Details

Depth (Metres)		Diameter (Centimetres)
From	To	
0	12.3	21

Water Use

☐ Public ☐ Industrial ☐ Not used ☐ Other, specify _____
☐ Domestic ☐ Commercial ☐ Dewatering
☐ Livestock ☐ Municipal ☐ Monitoring
☐ Irrigation ☒ Test Hole ☐ Cooling & Air Conditioning

Method of Construction

☐ Cable Tool ☐ Air Percussion ☐ Digging
☐ Rotary (Conventional) ☐ Diamond ☒ Boring
☐ Rotary (Reverse) ☐ Jetting ☐ Other, *specify*
☐ Rotary (Air) ☐ Driving

Status of Well

☒ Test Hole	☐ Abandoned, Insufficient Supply
☐ Replacement Well	☐ Abandoned, Poor Water Quality
☐ Dewatering Well	☐ Other, <i>specify</i> _____
☐ Alteration (Construction)	☐ Abandoned, other, <i>specify</i> _____

No Casing and Screen Used

Open Hole ☐ Yes ☒ No

Screen

☐ Galvanized
 ☐ Steel
 ☐ Fibreglass
 ☐ Concrete
 ☒ Plastic

Outside Diameter (Centimetres) 6.4
 Slot No. 20

Water Details

Water found at Depth	Kind of Water
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth	Kind of Water
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Water found at Depth	Kind of Water
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

Annular Space/Abandonment Sealing Record

[illegible]

Well Contractor and Well Technician Information

Business Name of Well Contractor <i>Geo-Environmental</i>		Well Contractor's Licence No. <i>661017</i>
Business Address (Street No./Name, number, RR) <i>17 Manswood Crt</i>		Municipality <i>Haltom Hills</i>
Province <i>Ont</i>	Postal Code <i>L7R 0A1</i>	Business E-mail Address .
Bus. Telephone No. (inc. area code) Name of Well Technician (Last Name, First Name) <i>905 876 3388 McDonald, Neil</i>		
Well Technician's Licence No. <i>201717</i>	Signature of Technician <i>[Signature]</i>	Date Submitted (yyyy/mm/dd) <i>2011/12/20</i>

Consent to release additional information concerning the cluster to the Director upon request

Signature of Technician/Contractor	Date (yyyy/mm/dd)
	2011/12/20

Master Well Owner's/Land Owner's consent to use Cluster Form

Signature	Date (yyyy/mm/dd)
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Ministry Use Only

Audit No. M 10518	Well Contractor No.
Date Received (yyyy/mm/dd) FEB 14 2012	Date of Inspection (yyyy/mm/dd)
Remarks	



Job # 111232

Ministry of
the Environment

Well Tag No. for Master Well (Print Well Tag No.)

A115215

115215

Cluster Well Information for Cluster Well Construction

Regulation 903 Ontario Water Resources Ac

Page 2 of 2

Property Owner's Information

First Name	Last Name	Mailing Address (Street No./Name, RR)	Municipality
Suncor Energy Products Partnership		3275 Rebecca St	Oakville
Province	Postal Code	E-mail Address	Telephone No. (inc. area code)
On.	L6L6N5		9054693754

Cluster Well Information

Address of Well Location (Street Number/Name, RR) 10-14 Collier St.		Lot	Concession	Township		County/District/Municipality	
City/Town/Village Barrie	Province Ontario	Postal Code [][][][][][]	GPS Unit Make Maxellan	Model Sporttrak	Unit Mode of Operation ☐ Differentiated, specify: _____	☐ Undifferentiated	☒ Averaged

Consent

Property Owner's Consent to use cluster form

Signature	Date (yyyy/mm/dd)
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Consent to release additional information to the Director upon request

Signature of Technician/Contractor	Date (yyyy/mm/dd)
	2011/12/1

[illegible]

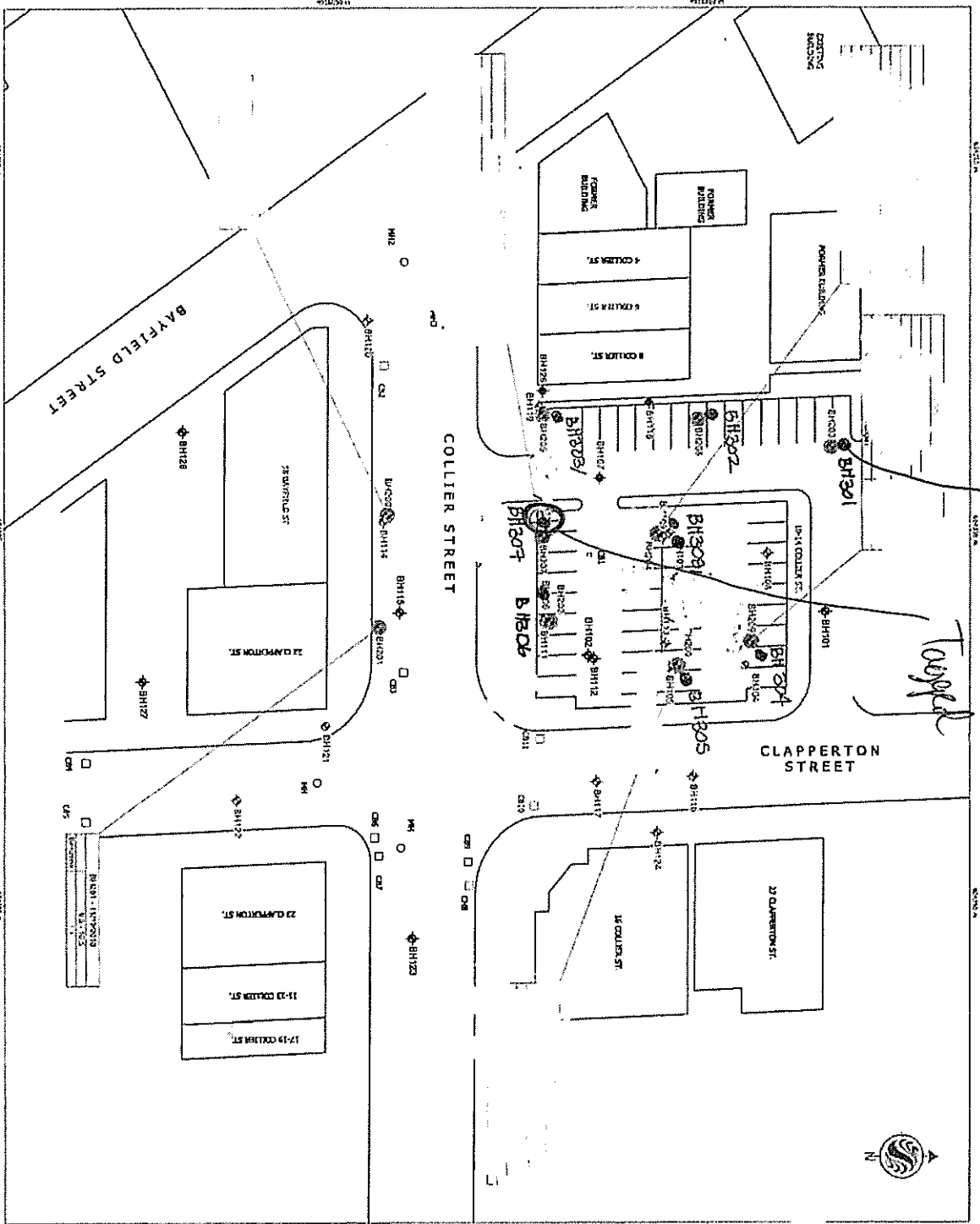
Well Contractor and Well Technician Information

Business Name of Well Contractor <i>Geo-Environmental</i>			Business Address (Street Number/Name, RR) <i>17 Mansewood Crt</i>			Municipality <i>Dalton Hill</i>		Province <i>Ont</i>	
Postal Code <i>L7R0A1</i>		Business Telephone No. (inc. area code) <i>9058763388</i>		Well Contractor's Licence No. <i>6607</i>		Business E-mail Address			
Name of Well Technician (First Name, Last Name) <i>Neil McDonald</i>				Well Technician's Licence No. <i>2077</i>		Date Submitted (yyyy/mm/dd) <i>2011/12/20</i>		Signature of Technician 	

Date 1st Well in Cluster Constructed (yyyy/mm/dd)	2011/12/16	Date Last Well in Cluster Constructed (yyyy/mm/dd)	2011/12/21
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Ministry Use Only

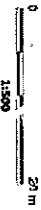
Date Received (yyyy/mm/dd) FEB 14 2012	Date Inspected (yyyy/mm/dd)
Audit No. C 14726	Remarks m10518



Legend

- Property Use
- Borehole (By Others)
- Borehole (Santec, Dec 2010)
- Monitoring Well (By Others)
- Monitoring Well (Santec, Dec 2010)
- Monitoring Well Assumed Destroyed
- Tested Parameters Below Regulatory
- Standards O.Reg. 571/03 Table 2 SCS
- One or More Tested Parameters Exceeds Regulatory Standards O.Reg. 571/03 Table 2 SCS

Sampling ID and Date	Sampling Depth	Sampling Depth



Notes

1. Coordinate system: UTM NAD 83, Zone 17 (N).



Santec

Santec Energy Products Partnership
14 Collier Street
Burlington, Ontario

Drawn by:
Date:

6667
M10518
C14726
FEB 14 2012



Tag#: A126223 A126223

Regulation 903 Ontario Water Resources Act

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Measurements recorded in: ☒ Metric ☐ Imperial

Well Owner's Information

First Name Suncor Energy	Last Name / Organization Products	E-mail Address			☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name) 3375 Belterra St.		Municipality Oakville	Province ON	Postal Code L6L 6N5	Telephone No. (inc. area code) 905 46 93 749

Well Location

Address of Well Location (Street Number/Name) 10-14 Collier St.				Township				Lot		Concession	
County/District/Municipality Simcoe				City/Town/Village Barrie				Province Ontario		Postal Code 	
UTM Coordinates NAD 83 17 604 3024 9 16 096				Municipal Plan and Sublot Number				Other			

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
Brown	sand	Gravel	loose	0	2.4
Brown	sand	Gravel / stones	loose	2.4	5.1
Brown	sand	sand	dense	5.1	6.3
Grey	silt	sand	soft	6.3	12.8

Annular Space			
Depth Set at (m/ft)		Type of Sealant Used (Material and Type)	Volume Placed (m ³ /ft ³)
From	To		
0	0.3	concrete	
0.3	9.1	Bentonite chips	

Method of Construction		Well Use		
☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial	☐ Not used
☐ Rotary (Conventional)	☐ Jetting	☐ Domestic	☐ Municipal	☐ Dewatering
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole	☒ Monitoring
☒ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning	
☐ Air percussion		☐ Industrial		
☐ Other, <i>specify</i> _____		☐ Other, <i>specify</i> _____		

Construction Record - Casing					Status of Well
Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply
			From	To	
S.1	Plastic	0.65	0	9.7	

Construction Record - Screen				
Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To
6.4	Plastic	20	9.7	12.8

☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify* _____
☐ Other, *specify* _____

Water Details		Hole Diameter		
Water found at Depth 11 (m/ft) ☐ Gas	Kind of Water: ☒ Fresh ☐ Untested ☐ Other, specify _____	Depth (m/ft) From	To	Diameter (cm/in)
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify _____	0	12.8	21
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify _____			

Well Contractor and Well Technician Information

Business Name of Well Contractor Geo-Environmental Drilling inc		Well Contractor's Licence No. 6607	
Business Address (Street Number/Name) 1 Mansewood crt		Municipality Halton	
Province ON	Postal Code L9G0A1	Business E-mail Address	
Bus. Telephone No. (inc. area code) 905 876 3388		Name of Well Technician (Last Name, First Name) Collins Tim	
Well Technician's Licence No. T3694	Signature of Technician and/or Contractor 	Date Submitted 20120703	

Results of Well Yield Testing

After test of well yield, water was:	Draw Down		Recovery	
☐ Clear and sand free	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
☐ Other, <i>specify</i> _____				
If pumping discontinued, give reason:	Static Level			
	1		1	
Pump intake set at (m/ft)	2		2	
Pumping rate (l/min / GPM)	3		3	
	4		4	
Duration of pumping _____ hrs + _____ min	5		5	
Final water level end of pumping (m/ft)	10		10	
	15		15	
If flowing give rate (l/min / GPM)	20		20	
	25		25	
Recommended pump depth (m/ft)	30		30	
	40		40	
Recommended pump rate (l/min / GPM)	50		50	
	60		60	
Well production (l/min / GPM)				
Disinfected?				
☐ Yes ☐ No				

Map of Well Location

Please provide a map below following instructions on the back.

see attached map

Comments:

Well owner's information package delivered	Date Package Delivered	Ministry Use Only Audit No. z 147856 SEP 11 2012 Received
	Y Y Y Y M M D D Date Work Completed 20120723	

Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

First Name <i>Embee Properties Limited</i>		Last Name / Organization		E-mail Address		☐ Well Constructed by Well Owner	
Mailing Address (Street Number/Name) <i>88 Sheppard Ave. W., Ste 200</i>			Municipality <i>Toronto</i>		Province <i>ON</i>	Postal Code <i>M5H1B6</i>	Telephone No. (inc. area code) <i>416 250 5858</i>

Well Location

Address of Well Location (Street Number/Name) 4-8 Collier St.			Township		Lot		Concession	
County/District/Municipality			City/Town/Village Barrie				Province Ontario	
UTM Coordinates Zone Easting Northing NAD 83 17 604279 4916097			Municipal Plan and Sublot Number				Postal Code 	
Other			Other					

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

[illegible]

Annular Space

Depth Set at (m/ft)		Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
From	To		
35'	18'	Sand	
18'	2'	Hole Plug	
2'	0'	Sand	

Method of Construction

☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial	☐ Not used
☒ Rotary (Conventional)	☐ Jetting	☐ Domestic	☐ Municipal	☐ Dewatering
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole	☒ Monitoring
☐ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning	
☐ Air percussion		☐ Industrial		
☐ Other, <i>specify</i> _____		☐ Other, <i>specify</i> _____		

Well Use

☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial	☐ Not used
☒ Rotary (Conventional)	☐ Jetting	☐ Domestic	☐ Municipal	☐ Dewatering
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole	☒ Monitoring
☐ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning	
☐ Air percussion		☐ Industrial		
☐ Other, <i>specify</i> _____		☐ Other, <i>specify</i> _____		

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned,
			From	To	
2"	Plastic		25'	0'	

Status of Well

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned,
			From	To	
2"	Plastic		25'	0'	

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To
2"	Plastic		35'	25'

☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify* _____
☐ Other, *specify* _____

Water Details

Water found at Depth <i>20'</i> (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, <i>specify</i> _____
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, <i>specify</i> _____
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, <i>specify</i> _____

Hole Diameter

Water found at Depth		Depth (m/ft)		Diameter (cm/in)
		From	To	
20' (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify _____			
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify _____			
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify _____			

Well Contractor and Well Technician Information

Business Name of Well Contractor London Soil test LTD.		Well Contractor's Licence No. 7190
Business Address (Street Number/Name) 3336 Whit Oak Rd, UNIT 16		Municipality LONDON
Province	Postal Code	Business E-mail Address

ONT NL0E279
Bus. Telephone No. (inc. area code) Name of Well Technician (Last Name, First Name)
5194553777 Sayers James
Well Technician's Licence No. Signature of Technician and/or Contractor Date Submitted

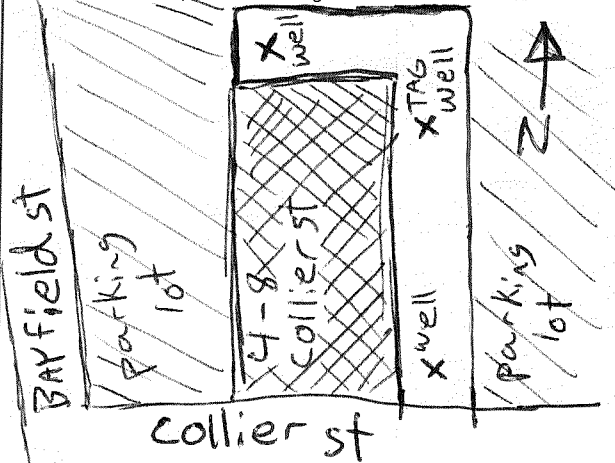
0506E (2007/12) © Queen's Printer for Ontario, 2007

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, <i>specify</i> _____		Draw Down		Recovery	
		Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason:	Static Level				
	1		1		
Pump intake set at (m/ft)	2		2		
Pumping rate (l/min / GPM)	3		3		
Duration of pumping ____ hrs + ____ min	4		4		
	5		5		
Final water level end of pumping (m/ft)	10		10		
If flowing give rate (l/min / GPM)	15		15		
	20		20		
Recommended pump depth (m/ft)	25		25		
Recommended pump rate (l/min / GPM)	30		30		
Well production (l/min / GPM)	40		40		
	50		50		
Disinfected?	60		60		
☐ Yes ☐ No					

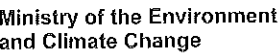
Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well owner's information package delivered ☐ Yes ☐ No	Date Package Delivered Y Y Y Y M M D D 20130926	Ministry Use Only Audit No. Z 169392 Received DEC 17 2013
	Date Work Completed 20130926	



Well Record for Well Cluster – Part 1 of 3
(Only for Multiple Test Holes or Dewatering Wells)
Regulation 903 Ontario Water Resources Act

All measurements recorded in: ☐ Metric ☐ Imperial

Follow instructions on the front and back of this form. Print or Type

Well Tag#: A139474 (Int Well Tag No.)

Well No. on Drawing of Deepest Well:

☐ Dewatering wells

☐ Test holes

No. of wells reported

Page 2 of 3

Well Cluster Location Information													Mandatory Attachments/Additional Information					
Address of Well Location (Street Number(s)/Name(s), RR, if available)										Lot(s)		Concession(s)		Geographic Township		County/District/Upper Tier Municipality		
City, Town, Village or Hamlet										Province		GPS Unit Make		Model		Unit Mode of Operation ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify: _____		
Well Details																		
Well # on Drawing	UTM Coordinates				Hole Depth (m/ft)	Hole Diameter (cm/in)	Method of Construction	Casing Material; Diameter (cm/in)	Casing (m/ft)		Screen Interval (m/ft)		Annular Space Material (m/ft)			Overburden/Bedrock or Abandonment Filling Material Intervals (m/ft)	Static Water Level (m/ft)	Date of Completion (yyyy/mm/dd)
	Zone	Easting	Northing						From	To	From	To	From	To	Material:			
BH1	17	60410811	4916214		20	15	BORING	2"	0	10	10	20				MASTER WELL	17	2018/05/10
BH2	17	6038491	4916294		20	15		2"	0	15	15	20					8.6	2018/05/10
BH3	17	6039511	4916362		18	15		2"	0	15	15	20					7	2018/05/10
Well Contractor and Well Technician Information													Date First Well in Cluster Constructed or Abandoned (yyyy/mm/dd)		Date Last Well in Cluster Completed (yyyy/mm/dd)		Ministry Use Only	
Business Name of Well Contractor			Business Address (Street Number/Name, RR)				Municipality		Province						Date Received (yyyy/mm/dd)		Audit No.	
1617168 ONT INC			557 MAPLEVIEW DR				BARRIE		ON						JUN 14 2018		C 38608	
Postal Code		Bus. Telephone No.		Well Contractor's Licence No.			Business E-mail Address						Well Abandonment				Comments	
L9S10K3		7057915351		7314			ontariosoildrillingat/nc.ca											
Name of Well Technician (First Name, Last Name)				Well Technician's Licence No.			Signature of Well Technician			Date Submitted (yyyy/mm/dd)					Name			
MICHAEL BISSON				3266			Mike B			2018/05/31					(Print or Type) - See instruction 11 on the back of this form			



APPENDIX D

Water Balance Summary Tables

Table A: Pre-Development

Catchment Designation	Landscaped Grass	Impervious (parking, driveway and former foundation)	Total
Area (m ²)	2,433	575	3,008
Pervious Area (m ²)	2,433	0	2,433
Impervious Area (m ²)	0	575	575
Infiltration Factors			
Topography Infiltration Factor	0.25	0	
Soil Infiltration Factor	0.3	0	
Land Cover Infiltration Factor	0.05	0	
Infiltration Factor	0.6	0	
Run-Off Coefficient	0.4	1	
Run-Off From Impervious Surfaces	0.8	0.8	
Inputs (Per Unit Area)			
Precipitation (mm/yr)	909	909	909
Rainfall (mm/yr)	655	655	655
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
Total Inputs (mm/yr)	909	909	909
Outputs (Per Unit Area)			
Precipitation Surplus (mm/yr)	430	727	487
Net Surplus (mm/yr)	430	727	487
Evapotranspiration (mm/yr)	479	182	422
Infiltration (mm/yr)	258	0	209
Surplus Infiltration (mm/yr)	0	0	0
Total Infiltration (mm/yr)	258	0	209
Run-Off Pervious Areas (mm/yr)	172	0	139
Run-Off Impervious Areas (mm/yr)	0	727	139
Total Run-Off (mm/yr)	172	727	278
Total Outputs (mm/yr)	909	909	909
Difference (Inputs - Outputs)	0	0	0
Inputs (Volumes)			
Precipitation (m ³ /yr)	2,212	523	2,734
Run-On (m ³ /yr)	0	0	0
Other Inputs (m ³ /yr)	0	0	0
Total Inputs (m³/yr)	2,212	523	2,734
Outputs (Volumes)			
Precipitation Surplus (m ³ /yr)	1,046	418	1,464
Net Surplus (m ³ /yr)	1,046	418	1,464
Evapotranspiration (m ³ /yr)	1,165	105	1,270
Infiltration (m ³ /yr)	628	0	628
Surplus Infiltration (m ³ /yr)	0	0	0
Total Infiltration (m³/yr)	628	0	628
Run-Off Pervious Areas (m ³ /yr)	418	0	418
Run-Off Impervious Areas (m ³ /yr)	0	418	418
Total Run-Off (m ³ /yr)	418	418	837
Total Outputs (m³/yr)	2,212	523	2,734
Difference (Inputs - Outputs)	0	0	0

Table B: Post-Development (no mit)

Catchment Designation	Landscaped Grass	Roof, Parking, Laneway, Other Imperivous	Total
Area (m ²)	76	2,932	3,008
Pervious Area (m ²)	76	0	76
Impervious Area (m ²)	0	2,932	2,932
Infiltration Factors			
Topography Infiltration Factor	0.25	0	
Soil Infiltration Factor	0.3	0	
Land Cover Infiltration Factor	0.05	0	
Infiltration Factor	0.6	0	
Run-Off Coefficient	0.4	1	
Run-Off From Impervious Surfaces	0.8	0.8	
Inputs (Per Unit Area)			
Precipitation (mm/yr)	909	909	909
Rainfall (mm/yr)	655	655	655
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
Total Inputs (mm/yr)	909	909	909
Outputs (Per Unit Area)			
Precipitation Surplus (mm/yr)	430	727	720
Net Surplus (mm/yr)	430	727	720
Evapotranspiration (mm/yr)	479	182	189
Infiltration (mm/yr)	258	0	7
Surplus Infiltration (mm/yr)	0	0	0
Total Infiltration (mm/yr)	258	0	7
Run-Off Pervious Areas (mm/yr)	172	0	4
Run-Off Impervious Areas (mm/yr)	0	727	709
Total Run-Off (mm/yr)	172	727	713
Total Outputs (mm/yr)	909	909	909
Difference (Inputs - Outputs)	0	0	0
Inputs (Volumes)			
Precipitation (m ³ /yr)	69	2,665	2,734
Run-On (m ³ /yr)	0	0	0
Other Inputs (m ³ /yr)	0	0	0
Total Inputs (m³/yr)	69	2,665	2,734
Outputs (Volumes)			
Precipitation Surplus (m ³ /yr)	33	2,132	2,165
Net Surplus (m ³ /yr)	33	2,132	2,165
Evapotranspiration (m ³ /yr)	36	533	569
Infiltration (m ³ /yr)	20	0	20
Surplus Infiltration (m ³ /yr)	0	0	0
Total Infiltration (m³/yr)	20	0	20
Run-Off Pervious Areas (m ³ /yr)	13	0	13
Run-Off Impervious Areas (m ³ /yr)	0	2,132	2,132
Total Run-Off (m ³ /yr)	13	2,132	2,145
Total Outputs (m³/yr)	69	2,665	2,734
Difference (Inputs - Outputs)	0	0	0

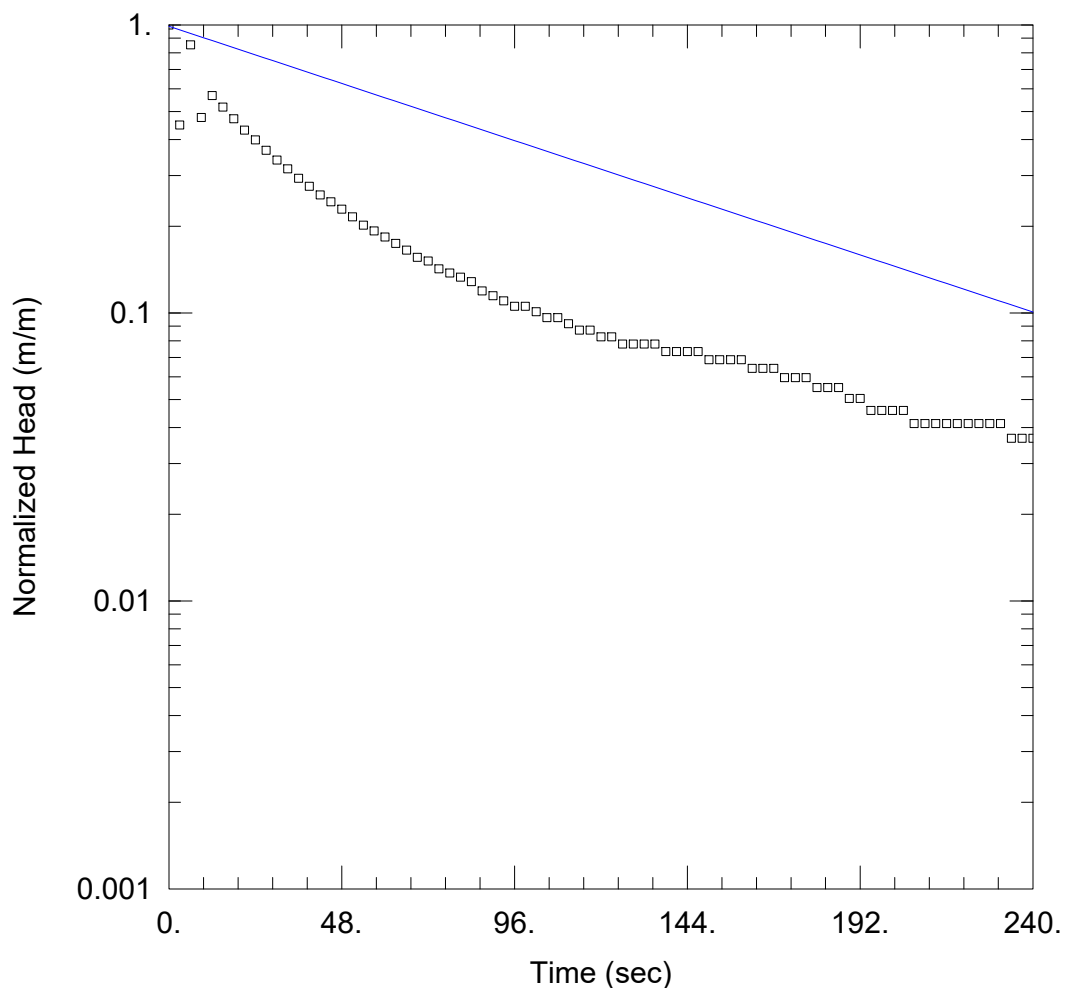
Table C: Water Balance Summary Table

Characteristic	Site			
	Pre-Development	Post-Development	Change (Pre to Post)	
Inputs (Volume)				
Precipitation (m ³ /yr)	2,734	2,734	0	0%
Run-On (m ³ /yr)	0	0	0	NA
Other Inputs (m ³ /yr)	0	0	0	NA
Total Inputs (m ³ /yr)	2,734	2,734	0	0%
Outputs (Volume)				
Precipitation Surplus (m ³ /yr)	1,464	2,165	701	48%
Net Surplus (m3/yr)	1,464	2,165	701	48%
Evapotranspiration (m ³ /yr)	1,270	569	-701	-55%
Infiltration (m ³ /yr)	628	20	-608	-97%
Rooftop Infiltration (m ³ /yr)	0	0	0	NA
Total Infiltration (m ³ /yr)	628	20	-608	-97%
Run-Off Pervious Areas (m ³ /yr)	418	13	-405	-97%
Run-Off Impervious Areas (m ³ /yr)	418	2,132	1,714	410%
Total Run-Off (m ³ /yr)	837	2,145	1,309	156%
Total Outputs (m ³ /yr)	2,734	2,734	0	0%



APPENDIX E

Hydraulic Conductivity Testing



MW-1

Data Set: L:\...\160209 - MW-1 - Hvorslev - Confined.aqt

Date: 03/23/21

Time: 16:18:42

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-1

AQUIFER DATA

Saturated Thickness: 0.15 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-1)

Initial Displacement: -2.18 m

Static Water Column Height: 4.77 m

Total Well Penetration Depth: 4.77 m

Screen Length: 0.15 m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

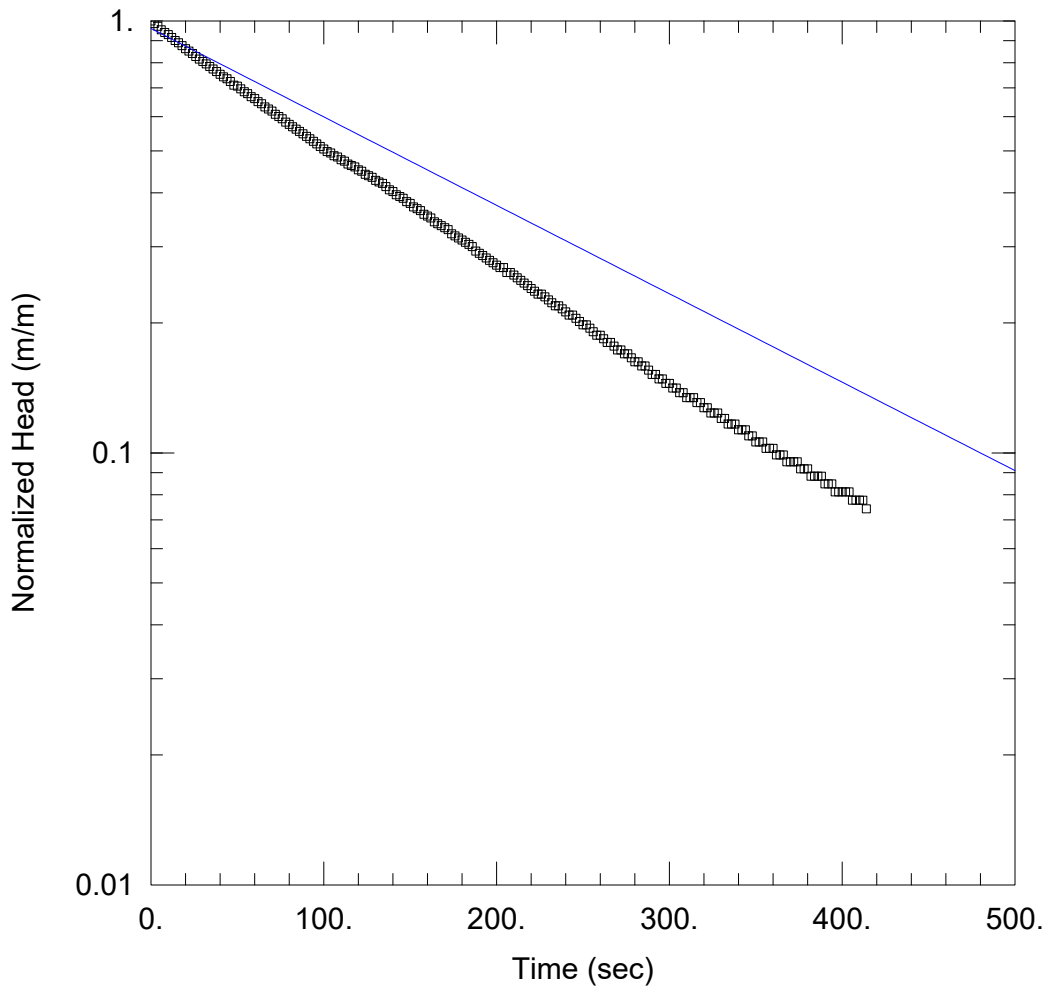
SOLUTION

Aquifer Model: Confined

Solution Method: Hvorslev

$K = 0.0001136$ m/sec

$y_0 = -2.156$ m



WELL TEST ANALYSIS

Data Set: L:\...\160222 - MW-2 - Hvorslev - Confined.aqt

Date: 03/23/21

Time: 16:19:33

PROJECT INFORMATION

Company: Azimuth Environmental

Test Well: MW-2

AQUIFER DATA

Saturated Thickness: 2.75 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-2)

Initial Displacement: -2.83 m

Static Water Column Height: 3.27 m

Total Well Penetration Depth: 3.27 m

Screen Length: 2.75 m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

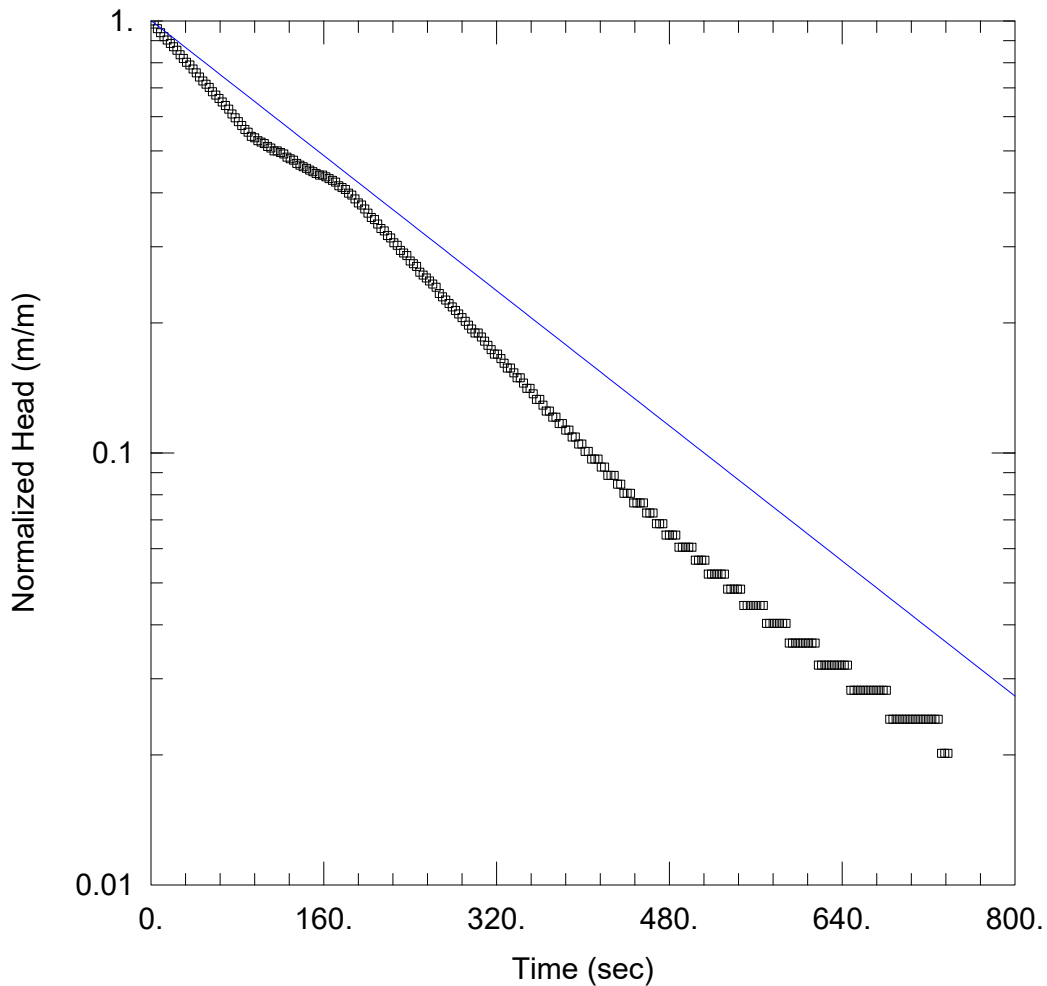
SOLUTION

Aquifer Model: Confined

Solution Method: Hvorslev

$K = 3.069E-6$ m/sec

$y_0 = -2.718$ m



MW-3 RISING HEAD

Data Set: L:\...\160209 - MW-3 - Hvorslev.aqt

Date: 03/23/21

Time: 16:18:49

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-3

AQUIFER DATA

Saturated Thickness: 1.8 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-3)

Initial Displacement: -2.48 m

Static Water Column Height: 3.41 m

Total Well Penetration Depth: 3.41 m

Screen Length: 1.8 m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

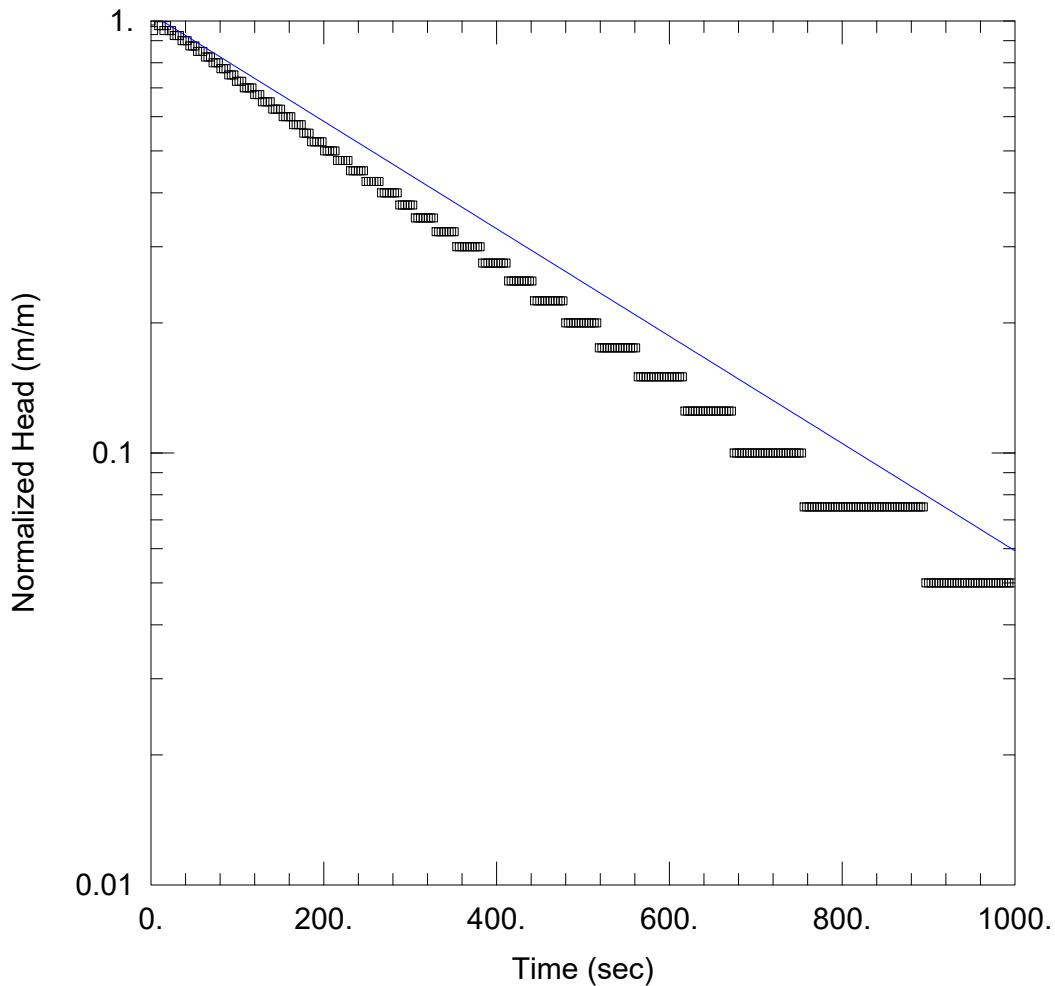
SOLUTION

Aquifer Model: Confined

Solution Method: Hvorslev

$K = 4.478E-6$ m/sec

$y_0 = -2.486$ m



MW-4 RISING HEAD

Data Set: L:\...\160210 - MW-4 - Hvorslev.aqt

Date: 03/23/21

Time: 16:19:06

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-4

AQUIFER DATA

Saturated Thickness: 3.6 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-4)

Initial Displacement: -4. m

Static Water Column Height: 7.61 m

Total Well Penetration Depth: 7.61 m

Screen Length: 3. m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

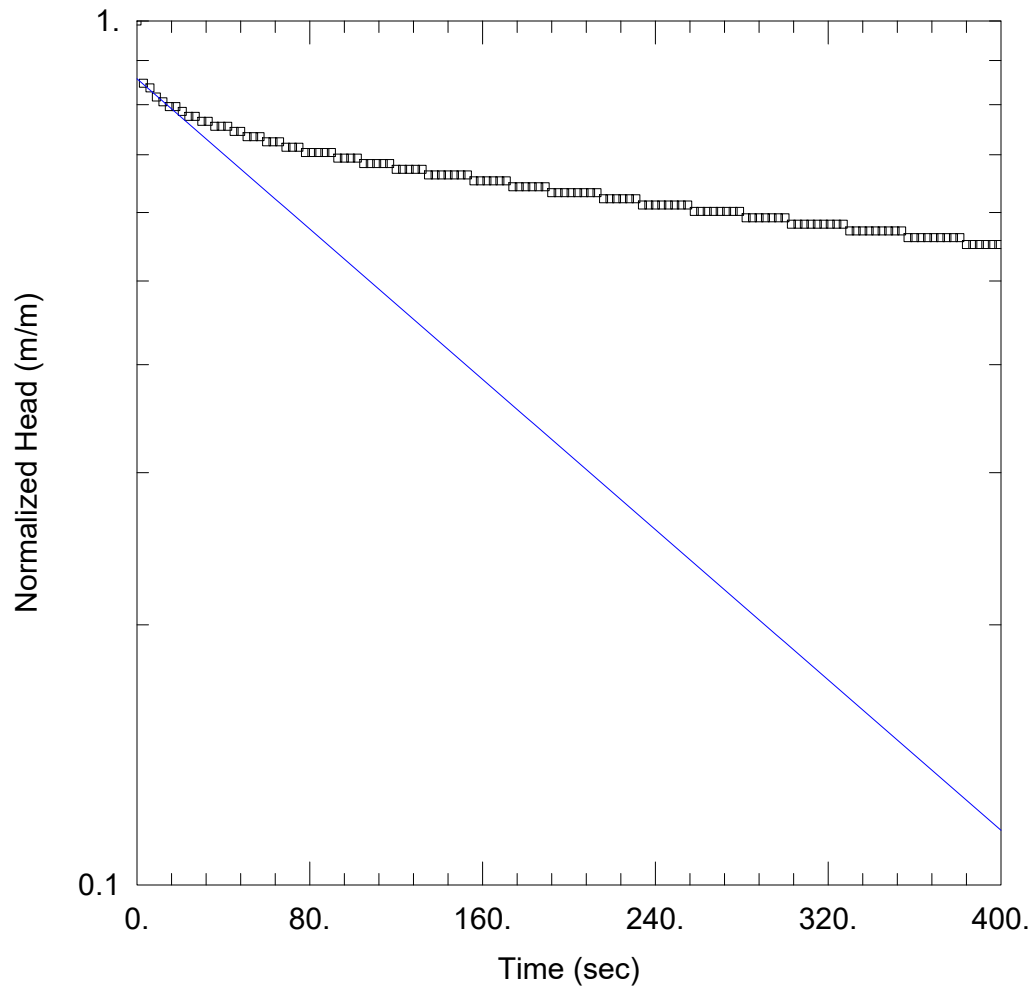
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 6.944E-6$ m/sec

$y_0 = -4.151$ m



MW-4A

Data Set: L:\...\160210 - MW-4a - Hvorslev.aqt

Date: 03/23/21

Time: 16:19:17

PROJECT INFORMATION

Company: Azimuth Environmental

Project: 15-249

Location: MacDonald and Sophia st

Test Well: MW-4a

AQUIFER DATA

Saturated Thickness: 0.83 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW4a)

Initial Displacement: -0.98 m

Static Water Column Height: 0.83 m

Total Well Penetration Depth: 0.83 m

Screen Length: 0.59 m

Casing Radius: 0.026 m

Well Radius: 0.1015 m

Gravel Pack Porosity: 0.3

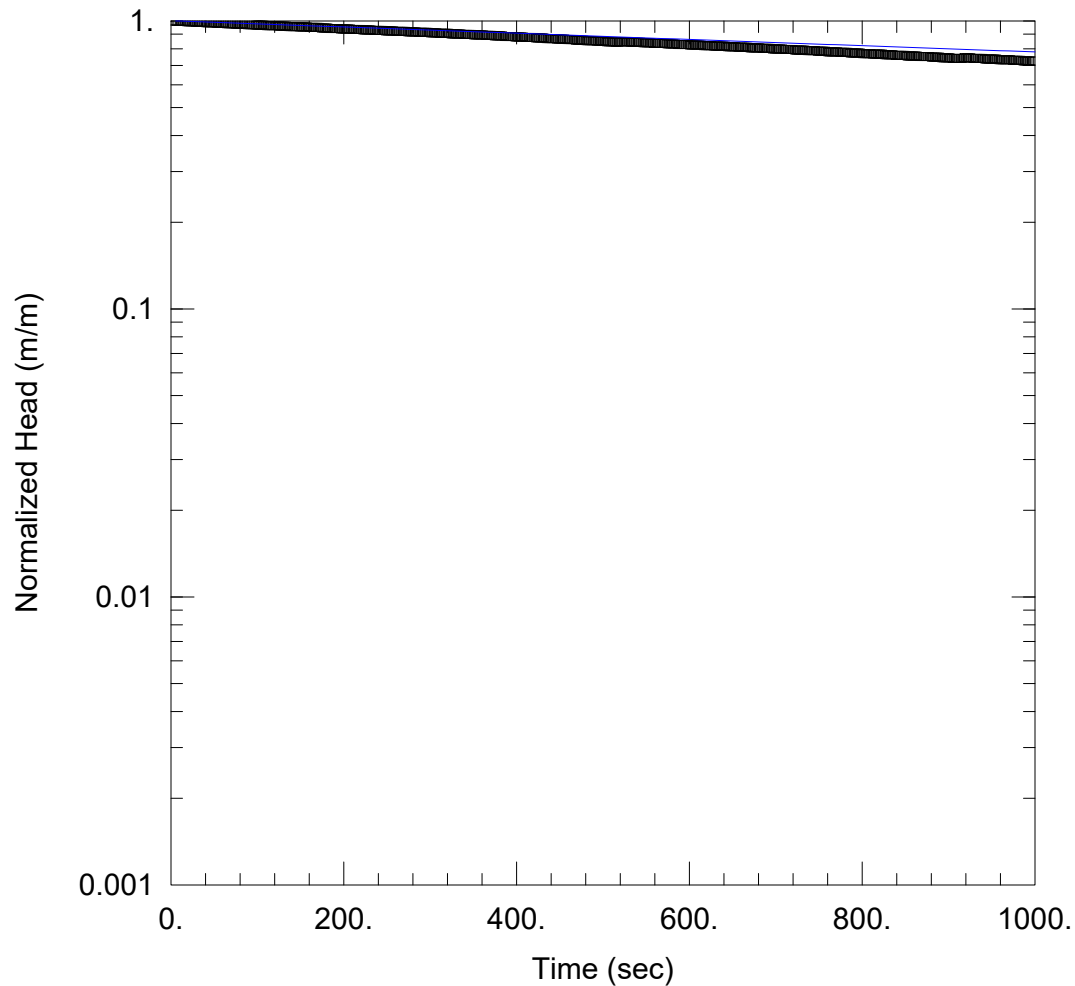
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 3.721E-5$ m/sec

$y_0 = -0.84$ m



WELL TEST ANALYSIS

Data Set: L:\...\160223 - MW-S - Hvorslev - Unconfined.aqt

Date: 03/23/21

Time: 16:19:49

PROJECT INFORMATION

Company: Azimuth Environmental

Test Well: MW-S

AQUIFER DATA

Saturated Thickness: 3. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW-S)

Initial Displacement: -2.74 m

Static Water Column Height: 4.22 m

Total Well Penetration Depth: 4.22 m

Screen Length: 3. m

Casing Radius: 0.026 m

Well Radius: 0.1016 m

Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 7.859E-7$ m/sec

$y_0 = -2.744$ m



APPENDIX F

Water Quality Data

Table 5

Ground Water Quality Analytical Results: Hydrocarbons

PROJECT NO.: 16-180		BTEX				HYDROCARBONS				
Borehole	Date (d-m-y)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	F1 (C ₆ -C ₁₀)- BTEX (µg/L)	F1 (C ₆ -C ₁₀) (µg/L)	F2 (C ₁₀ -C ₁₆) (µg/L)	F3 (C ₁₆ -C ₃₄) (µg/L)	F4 (C ₃₄ -C ₅₀) (µg/L)
Table 1 (O.Reg. 153/04*)		0.5	0.8	0.5	72	420	---	150	500	500
Table 2 (O.Reg. 153/04**)		5.0	24	2.4	300	750	---	150	500	500
MW-N	21-Jul-15	<0.20	<20	<0.10	<0.20	<25	<25	<100	<100	<100
MW-S	21-Jul-15	<0.20	0.22	<0.10	<0.20	<25	<25	<100	450	<100
	10-Nov-15	<0.20	<0.20	<0.10	<0.20	<25	<25	<100	<100	<100
	15-Jun-16	<0.20	<0.20	<0.10	<0.20	<25	<25	<100	<100	<100
MW-1	10-Nov-15	<0.2	0.31	<0.1	<0.2	<25	<25	<100	<100	<100
	15-Jun-16	<0.20	0.33	<0.10	<0.20	<25	<25	<100	<100	<100
MW-2	10-Nov-15	<0.2	7.4	<0.1	<0.2	<25	<25	<100	<100	<100
MW-3	10-Nov-15	<0.2	0.81	0.15	0.32	<25	<25	<100	<100	<100
MW-4	10-Nov-15	<0.2	0.61	0.10	<0.2	<25	<25	<100	<100	<100
(duplicate)	10-Nov-15	<0.2	0.57	0.13	<0.2	<25	<25	<100	<100	<100
MW-4a	10-Nov-15	<0.2	0.43	<0.1	<0.2	<25	<25	<100	<100	<100
MW-A1	15-Jun-16	<0.20	0.30	<0.10	<0.20	<25	<25	<100	<100	<100
(duplicate)	15-Jun-16	<0.20	0.29	<0.10	<0.20	<25	<25	<100	<100	<100
MW-A2	15-Jun-16	<0.20	0.32	<0.10	<0.20	<25	<25	<100	<100	<100
MW-B1	15-Jun-16	<0.20	0.48	<0.10	<0.20	<25	<25	<100	<100	<100
MW-B2	15-Jun-16	<0.20	1.1	<0.10	<0.20	<25	<25	<100	<100	<100
MW-C1	15-Jun-16	<0.20	1.1	<0.10	<0.20	<25	<25	<100	<100	<100
MW-C2	15-Jun-16	<0.20	1.3	<0.10	<0.20	<25	<25	<100	<100	<100

NOTES:

1. Bold values indicate parameters above Table 2 guidelines.
2. Hi-lighted values indicate parameters above laboratory detection limits.
3. * denotes O.Reg. 153/04 Table 1 ground water standards for all types of property use.
4. ** denotes O.Reg. 153/04 Table 2 Generic Site Condition Standards in a Potable Ground Water Condition for All Types of Property Use.

Table 6

Ground Water Quality Analytical Results: VOCs

PROJECT NO: 16-180		VOC Parameters																																		
Borehole	Date (d-m-y)	Dichlorodifluoromethane	Vinyl Chloride	Bromomethane	Trichlorofluoromethane	Acetone	1,1-Dichloroethene	Dichloromethane (methylene chloride)	trans-1,2-Dichloroethene	Methyl tert-Butyl Ether	1,1-Dichloroethane	Methyl Ethyl Ketone	cis-1,2-Dichloroethene	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Carbon Tetrachloride	1,2-Dichloropropane	Trichloroethene	Bromodichloromethane	Methyl Isobutyl Ketone	1,1,2-Trichloroethane	Dibromochloromethane	Ethylene Dibromide	Tetrachloroethene	1,1,1,2-Tetrachloroethane	Chlorobenzene	Bromoform	Styrene	1,1,2,2-Tetrachloroethane	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichlorobenzene	1,3-Dichloropropene (cis+trans)	n-Hexane	
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µ g/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µ g/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	
Table 1 (O.Reg. 153/04*)		590	0.5	0.89	150	2700	0.5	5.0	1.6	15	0.5	400	1.6	2.0	0.5	0.5	0.2	0.5	0.5	2.0	640	0.5	2.0	0.2	0.5	1.1	0.5	5.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0
Table 2 (O.Reg. 153/04**)		590	0.5	0.89	150	2700	1.6	50	1.6	15	1.6	1800	1.6	2.4	1.6	200	0.79	5.0	1.6	16	640	4.7	25	0.2	1.6	1.1	30	25	5.4	1.0	59	1.0	3.0	0.5	51	
MW-N	21-Jul-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-S	21-Jul-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	0.31	<0.20	<0.30	<1.0	4.7	<0.20	<0.20	<0.30	<0.20	<0.20	2.1	<0.20	<1.0	<0.20	<0.10	<0.10	3.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.41	
	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	0.34	<0.20	<0.30	<1.0	5.2	<0.20	<0.20	<0.30	<0.20	<0.20	3.5	<0.20	<1.0	<0.20	<0.10	<0.10	3.6	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	3.3	<0.20	<0.20	<0.30	<0.20	<0.20	2.9	<0.20	<1.0	<0.20	<0.10	<0.10	7.7	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-1	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	0.72	<0.20	<0.20	<0.30	<0.20	<0.20	0.29	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.33	
	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	0.94	<0.20	<0.20	<0.30	<0.20	<0.20	0.95	<0.20	<1.0	<0.20	<0.10	<0.10	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-2	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-3	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-4	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.3	
(duplicate)	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	0.3	
MW-4a	10-Nov-15	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	1.4	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-A1	24-Jun-16	<0.20	<0.17	<0.20	<0.40	68	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
(duplicate)	24-Jun-16	<0.20	<0.17	<0.20	<0.40	54	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-A2	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	0.30	<0.20	<0.20	<0.30	<0.20	<0.20	0.33	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-B1	24-Jun-16	<0.20	<0.17	<0.20	<0.40	160	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-B2	24-Jun-16	<0.20	<0.17	<0.20	<0.40	11	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-C1	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	<0.20	<0.20	<0.30	<0.20	<0.20	<0.20	<0.20	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	
MW-C2	24-Jun-16	<0.20	<0.17	<0.20	<0.40	<1.0	<0.30	<0.30	<0.20	<0.20	<0.30	<1.0	<0.20	1.1	<0.20	<0.30	<0.20	<0.20	<0.20	0.35	<1.0	<0.20	<0.10	<0.10	<0.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.30	<0.20	

NOTES:

1. Bold values denote parameters above Table 2 guidelines.
2. Hi-lighted values indicate parameters above laboratory detection limits.
3. * denotes O.Reg. 153/04 Table 1 ground water standards for all property use.
4. ** denotes O.Reg. 153/04 Table 2 Full Depth Generic Site Condition Standards in a Potable Ground Water Conditions in Coarse Grained Soils for Residential/ Parkland/ Institutional Property Use.

Table 7

Ground Water Quality Analytical Results: Inorganics & Trace Metals

PROJECT NO: 16-180		Inorganics						Trace Metals																		
Borehole	Date (d-m-y)	Sodium	Chloride	Nitrate as N	Nitrite as N	Electrical Conductivity	pH	Antimony	Arsenic	Barium	Beryllium	Total Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Uranium	Vanadium	Zinc
		(mg/L)	(mg/L)	(µg/L)	(µg/L)	(µS/cm)		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/ L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Table 1 (O.Reg. 153/04 *)		490	790	---	---	---	---	1.5	13	610	0.5	1700	0.5	11	3.8	5.0	1.9	0.1	23	14	5.0	0.3	0.5	8.9	3.9	160
Table 2 (O.Reg. 153/04**)		490	790	---	---	---	---	6.0	25	1000	4.0	5000	2.7	50	3.8	87	10	0.29	70	100	10	1.5	2.0	20	6.2	1100
MW-N	21-Jul-15	1650	2770	8510	<5000	8970	7.90	<0.50	<1.0	384	<0.50	38.5	<0.20	2.9	1.3	5.0	<0.50	<0.02	0.60	5.7	2.5	<0.20	<0.30	4.6	<0.40	<5.0
MW-S	21-Jul-15	124	232	<500	<500	1490	7.93	0.60	1.6	151	<0.50	63.0	<0.20	<2.0	1.4	1.8	<0.50	<0.02	2.9	6.3	<1.0	<0.20	<0.30	2.2	3.1	5.9

NOTES:

1. Bold values denote parameters above Table 2 guidelines.
2. Hi-lighted values indicate parameters above laboratory detection limits.
3. --- in guideline(s) row denotes no criteria, and in data row(s) indicates parameter not analyzed.
4. * denotes O.Reg. 153/04 Table 1 ground water standards for all property use.
5. ** denotes O.Reg. 153/04 Table 2 Generic Site Condition Standards in a Potable Ground Water Condition for All Types of Property Use.



APPENDIX G

Dewatering Calculations

Dewatering Assessment Calculations

Type	ID	Length (m)	Width (m)	Effectivve Radius ¹ (m)	Hydraulic Conductivity (m/s)	Hydraulic Conductivity (m/day)	Initial Depth of Water (static head) prior to dewatering (m)	H ²	Depth of Water in the well while pumping (m)	h ²	H ² -h ²	Radius of Influence ² (m)	Ro/r	Discharge Into Ends ³ (m ³ /day)	Plane Discharge ⁴ (m ³ /day)	Total Discharge (m ³ /day)	Total Discharge (L/day)	Total Discharge x 3Safety Factor (L/day)
		a	b	re	k	k	H		h			Ro		Q	Q	Q	Q	Q
Building Foundation	Building	75	40	37	1.00E-04	8.64E+00	7.15	51	0.0	0.0	51	251	6.86	720	0.0	720.4	720,400	2,161,200

Notes

¹ $r_e = (a+b) / \pi$ - assuming $a/b > 1.5$, (Driscoll, 1986)

² $Ro = r_e + 3000 * (H-h) * \sqrt{k}$ - Sichardt's Formula, (Cashman and Preene, 2001)

³ $Q = [(n * K) * (H^2 - h^2)] / [ln(R_o / r)]$ (Powers et al., 2007)

⁴ $Q = 2 * [a * K * (H^2 - h^2) / (2R_o)]$ (Powers et al., 2007)

**For trench dewatering, only plane discharge is counted since the trench is only 2m wide so in most cases $a \gg b$. Radial flow for the buildings and the stormtech chamber was determined since they are more proportional



APPENDIX H

Ground Water Elevation Data

Ground Water Level & Elevation Data

Borehole / Monitoring Well No.	Ground Elevation	Total Borehole Depth*		TOC Elevation	Ground Water Levels									
		(mbgs)												
		(m asl)	(m bgl)		(m asl)	(m asl)	13-Jun-16	12-Sep-16	21-Mar-17	24-Mar-21	26-Apr-21	21-May-21	28-Jun-21	30-Apr-22
MW-N	235.07	6.90	228.17	235.07	-	4.45	2.30	-	-	-	-			
MW-S	234.40	11.30	223.10	234.40	6.40	7.21	5.48	-	-	-	-			
MW-1	234.02	15.20	218.82	234.02	6.14	7.22	5.67	-	-	-	-			
MW-2	235.11	13.70	221.41	235.11	-	7.62	5.47	6.50	6.30	6.63	7.06	6.14	6.02	6.73
MW-3	234.93	13.70	221.23	234.93	-	8.05	6.57	7.27	7.00	7.24	7.66	6.82	6.90	7.26
MW-4	234.97	8.60	226.37	234.97	-	6.41	4.81	-	-	-	-			
MW-4A	234.90	14.30	220.60	234.90	-	6.40	4.70	6.12	6.00	5.95	6.33	5.73	5.72	5.95
MW-A1	234.45	15.50	218.95	234.45	6.76	7.61	6.17	-	-	-	-			
MW-A2	234.41	12.04	222.37	234.41	6.71	6.85	6.49	6.94	6.50	6.85	7.19	6.43	6.42	6.84
MW-B1	234.29	15.20	219.09	234.29	6.59	7.63	6.12	6.79	6.55	6.75	7.16	6.34	6.40	6.77
MW-B2	234.31	10.36	223.95	234.31	6.55	7.63	5.98	6.80	6.53	6.75	7.16	6.36	6.40	6.78
MW-C1	234.33	16.00	218.33	234.33	6.59	8.18	5.72	7.03	6.82	7.32	7.7	6.74	6.72	7.44
MW-C2	234.36	13.11	221.25	234.36	6.60	7.50	5.38	6.63	6.40	6.65	6.97	6.2	6.25	7.01
MW101	233.66	8.54	225.12	233.66								5.98	6.09	6.36
MW102	234.03	8.75	225.28	234.03								5.59	5.54	5.77

monitoring well component of borehole

Ground Water Level & Elevation Data

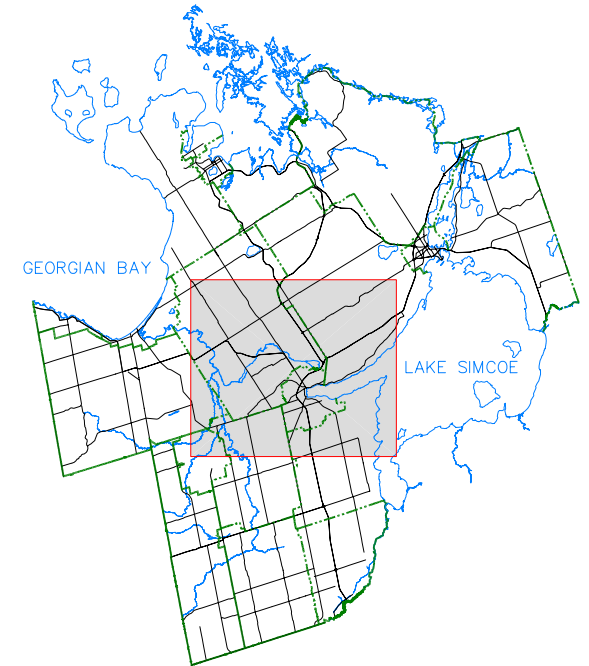
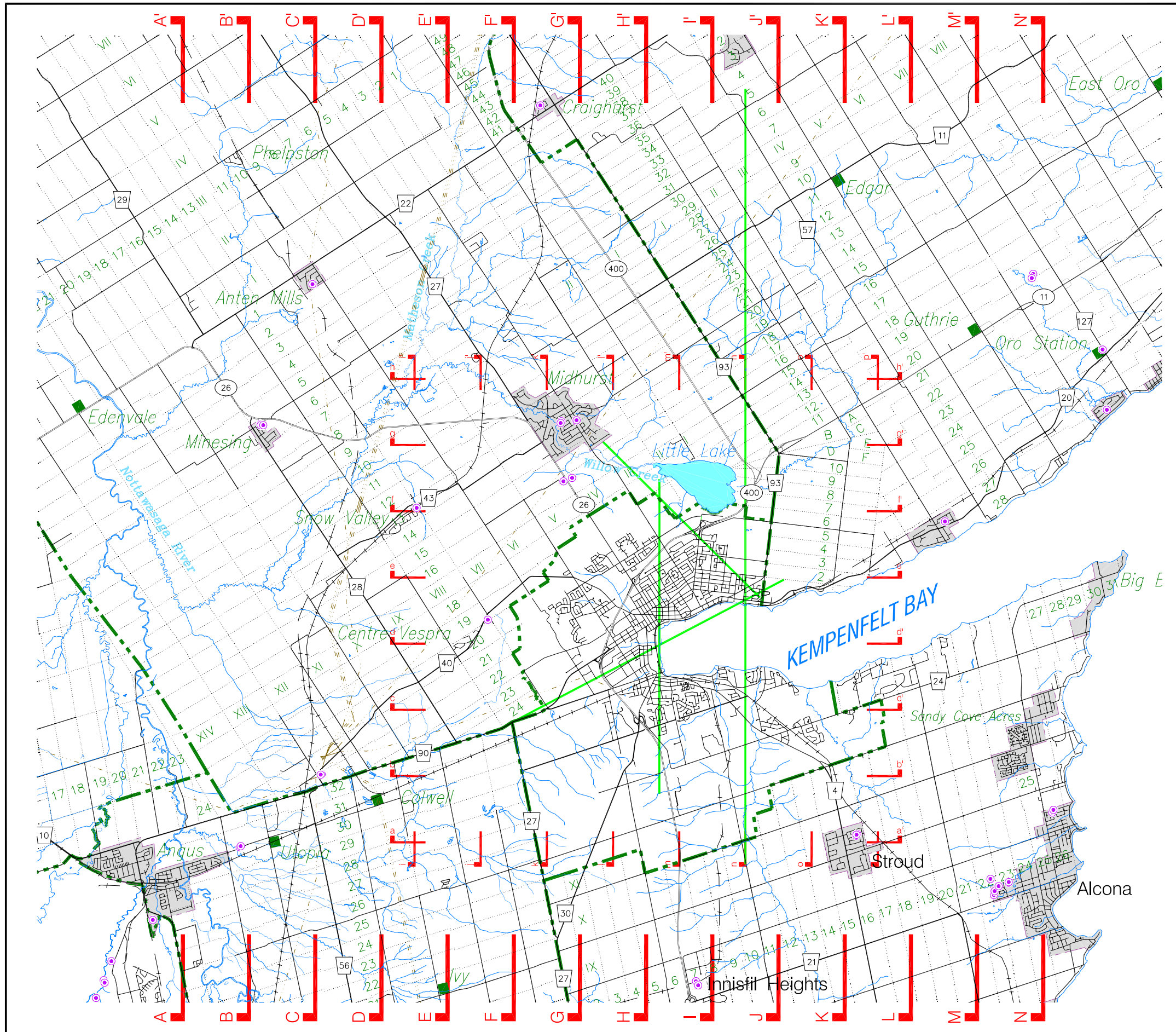
Borehole / Monitoring Well No.	Ground Elevation (m asl)	Total Borehole Depth*		TOC Elevation (m asl)	Ground Water Elevations									
		(masl)												
		(m bgl)	(m asl)		(m asl)	13-Jun-16	12-Sep-16	21-Mar-17	24-Mar-21	26-Apr-21	21-May-21	28-Jun-21	30-Apr-22	30-May-22
MW-N	235.07	6.90	228.17	235.07	-	230.62	232.77	-	-	-	-	-	-	-
MW-S	234.40	11.30	223.10	234.40	228.00	227.19	228.92	-	-	-	-	-	-	-
MW-1	234.02	15.20	218.82	234.02	227.88	226.80	228.35	-	-	-	-	-	-	-
MW-2	235.11	13.70	221.41	235.11	-	227.49	229.64	228.61	228.81	228.48	228.05	228.97	229.09	228.38
MW-3	234.93	13.70	221.23	234.93	-	226.88	228.36	227.66	227.93	227.69	227.27	228.11	228.03	227.67
MW-4	234.97	8.60	226.37	234.97	-	228.49	230.09	-	-	-	-	-	-	-
MW-4A	234.90	14.30	220.60	234.90	-	228.57	230.27	228.85	228.97	229.02	228.64	229.24	229.25	229.02
MW-A1	234.45	15.50	218.95	234.45	227.69	226.84	228.28	-	-	-	-	-	-	-
MW-A2	234.41	12.04	222.37	234.41	227.70	227.56	227.92	227.47	227.91	227.56	227.22	227.98	227.99	227.57
MW-B1	234.29	15.20	219.09	234.29	227.70	226.66	228.17	227.50	227.74	227.54	227.13	227.95	227.89	227.52
MW-B2	234.31	10.36	223.95	234.31	227.76	226.68	228.33	227.51	227.78	227.56	227.15	227.95	227.91	227.53
MW-C1	234.33	16.00	218.33	234.33	227.74	226.15	228.61	227.30	227.51	227.01	226.63	227.59	227.61	226.89
MW-C2	234.36	13.11	221.25	234.36	227.76	226.86	228.98	227.73	227.96	227.71	227.39	228.16	228.11	227.35
MW101	233.66	8.54	225.12	233.66								227.68	227.57	227.30
MW102	234.03	8.75	225.28	234.03								228.44	228.49	228.26

monitoring well component of borehole

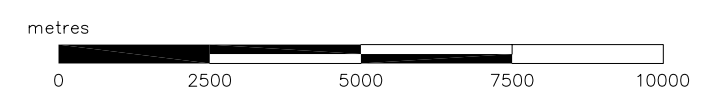


APPENDIX I

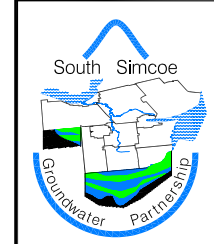
Ground Water Study Figures



- Model Boundary
- Detail Site Section Model Boundary
- Municipal Boundary



SCALE 1:125000



SOUTH SIMCOE GROUNDWATER STUDY
WELLHEAD PROTECTION AREA REPORT
CITY OF BARRIE

MUNICIPAL WELL SYSTEMS CROSS SECTION LOCATIONS

Job No. S41 W01
Date: 29 Apr 03
Drawn: J.Regier
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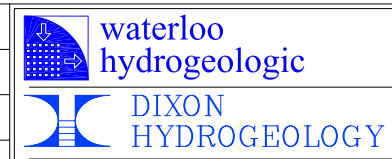
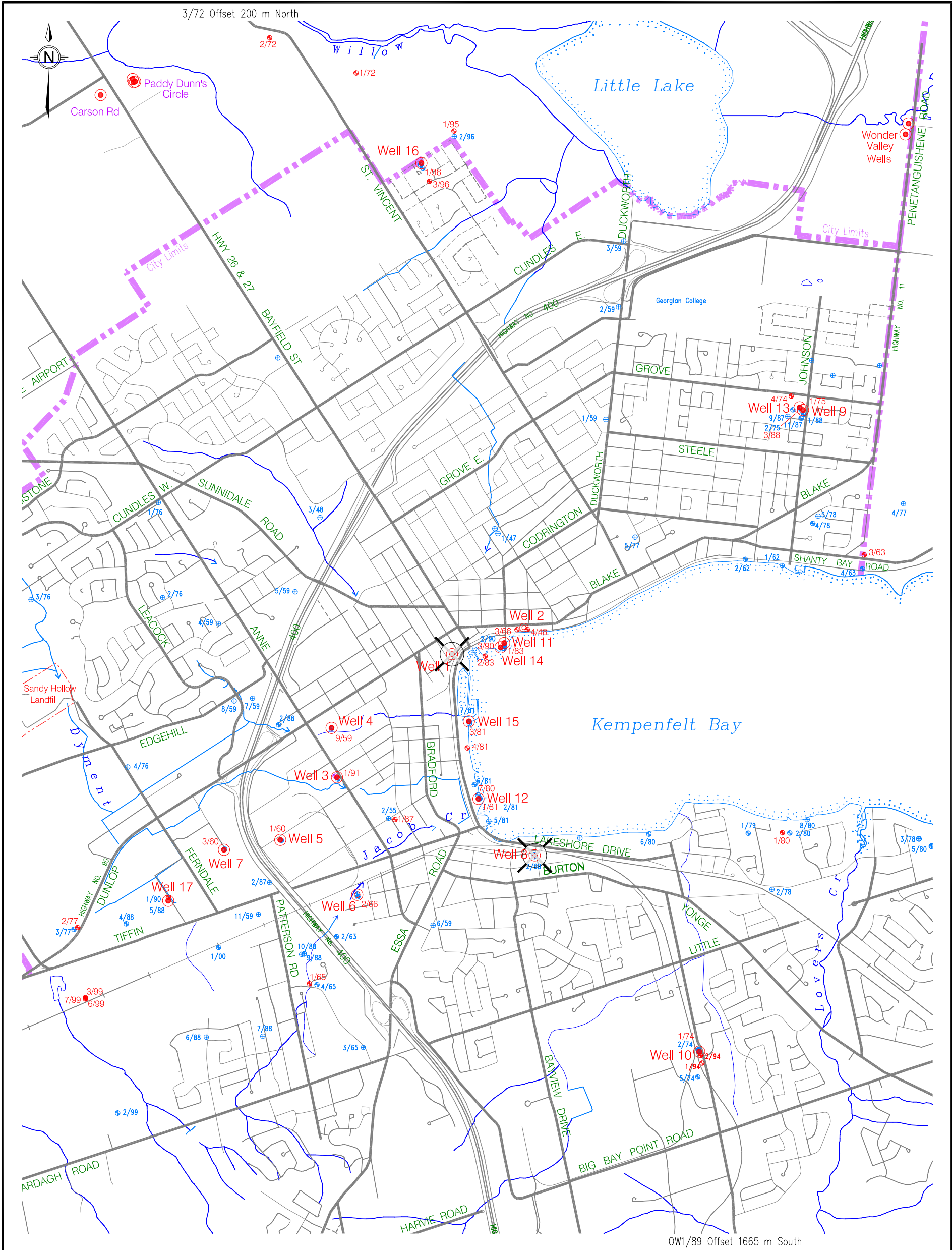
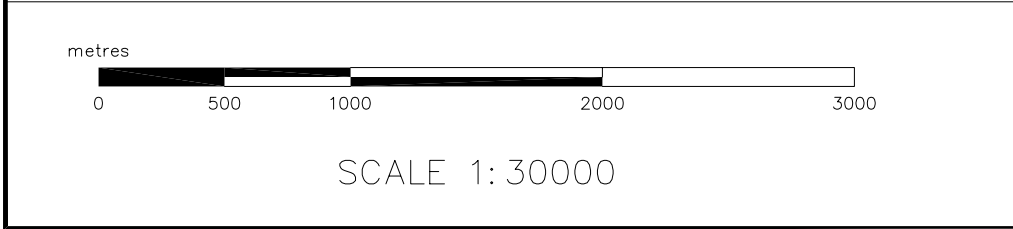
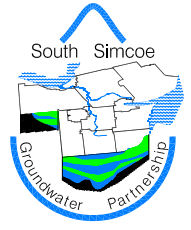


Figure 1.1



- Municipal Water Supply Well
- Non-Operational Municipal Well
- ✕ Abandoned Municipal Well
- Monitored Observation Well
- ⊕ ⊖ Other Existing Test Hole and Observation Wells





SOUTH SIMCOE GROUNDWATER STUDY
WELLHEAD PROTECTION AREA REPORT
CITY OF BARRIE

**MUNICIPAL WELL LOCATIONS
OBSERVATION WELLS**

Job No.	
Date:	15 May 03
Drawn:	J. Regier
FILE:	MDLBARRIE:BAR

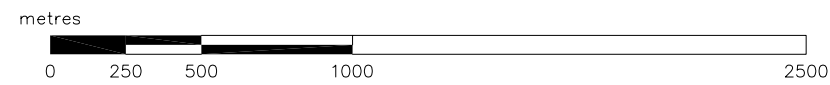
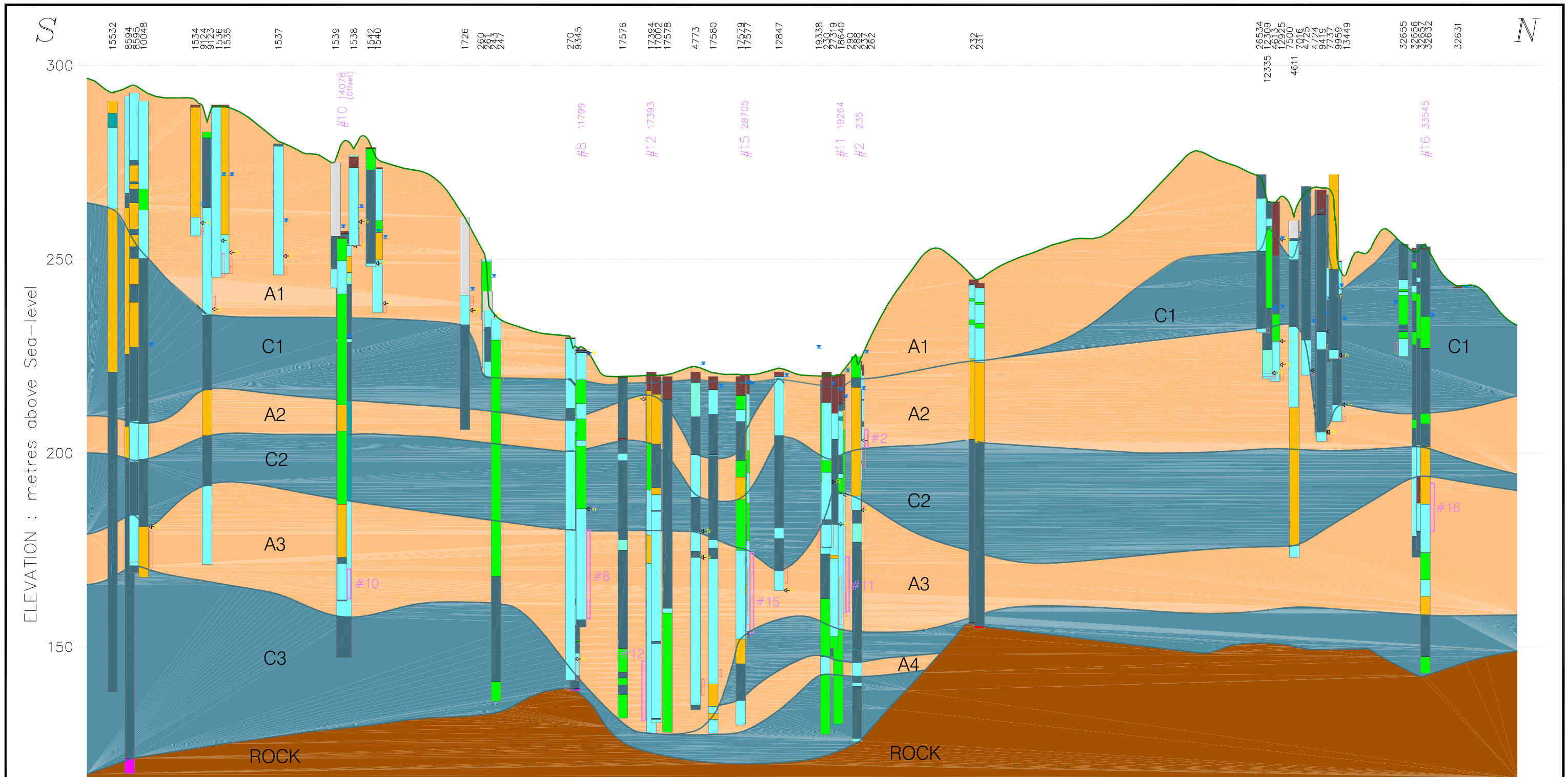


waterloo
hydrogeologic



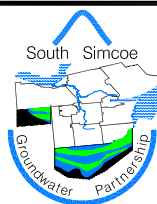
DIXON
HYDROGEOLOGY

Figure 1.2



SCALE 1:25000

Refer to Figure 3.5 for Legend and Notes



SOUTH SIMCOE GROUNDWATER STUDY
WELLHEAD PROTECTION AREA REPORT
CITY OF BARRIE

Drawn: J Regier

File: MDLBARRIE:E3

Job No. S41 W01

Date: 13 May 03



waterloo
hydrogeologic



DIXON
HYDROGEOLOGY

Figure 3.3

SECTION E3 - E3'

Hydrostratigraphy

	Unknown		Silt Clayey
	Peat/Loam		Clay
	Aquifer		Till
	Aquifer Clayey		Limestones
	Silt		Shales
			Precambrian

Stratigraphy (see Note)

	Aquifer
	Hydrostratigraphic Contact
	Confining Material
	Bedrock
	Limestone or Undifferentiated

Well Section Symbols

	Screen
	Recorded Static Water Level
	Water Producing Zone
	Flowing Well
	MOE Recorded Private Well

NOTE: On all sections, boundaries between soil strata have been determined only at well and test well locations. Between the wells and test wells, boundaries are not proven but are assumed from geological evidence.

Wells are located to MOE Water Well Bulletin Data. Locations and elevations are subject to field verification.

Location Map Symbols (see Note)

	Shallow Dug or Bored <10 m
	Deep Bored Well >10 m
	Drilled Overburden Well
	Test or Observation Well
	Test Pit
	Drilled Bedrock Well
	Sandpoint
	Municipal / Public Supply

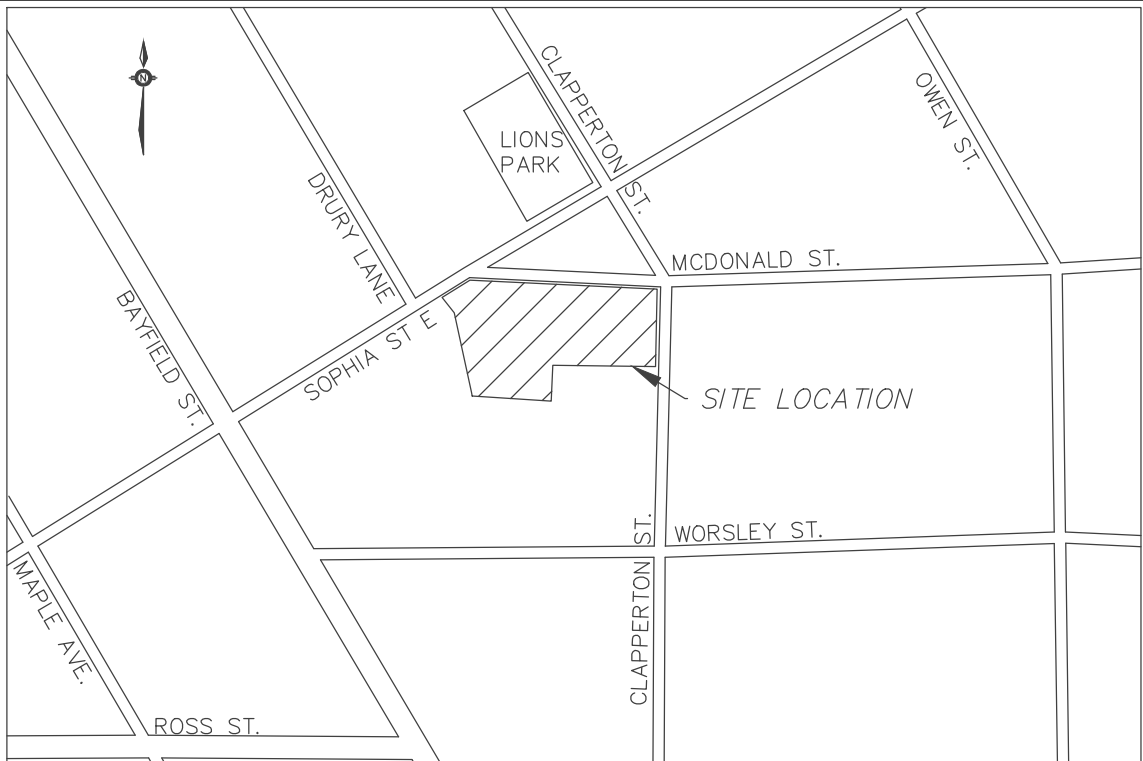
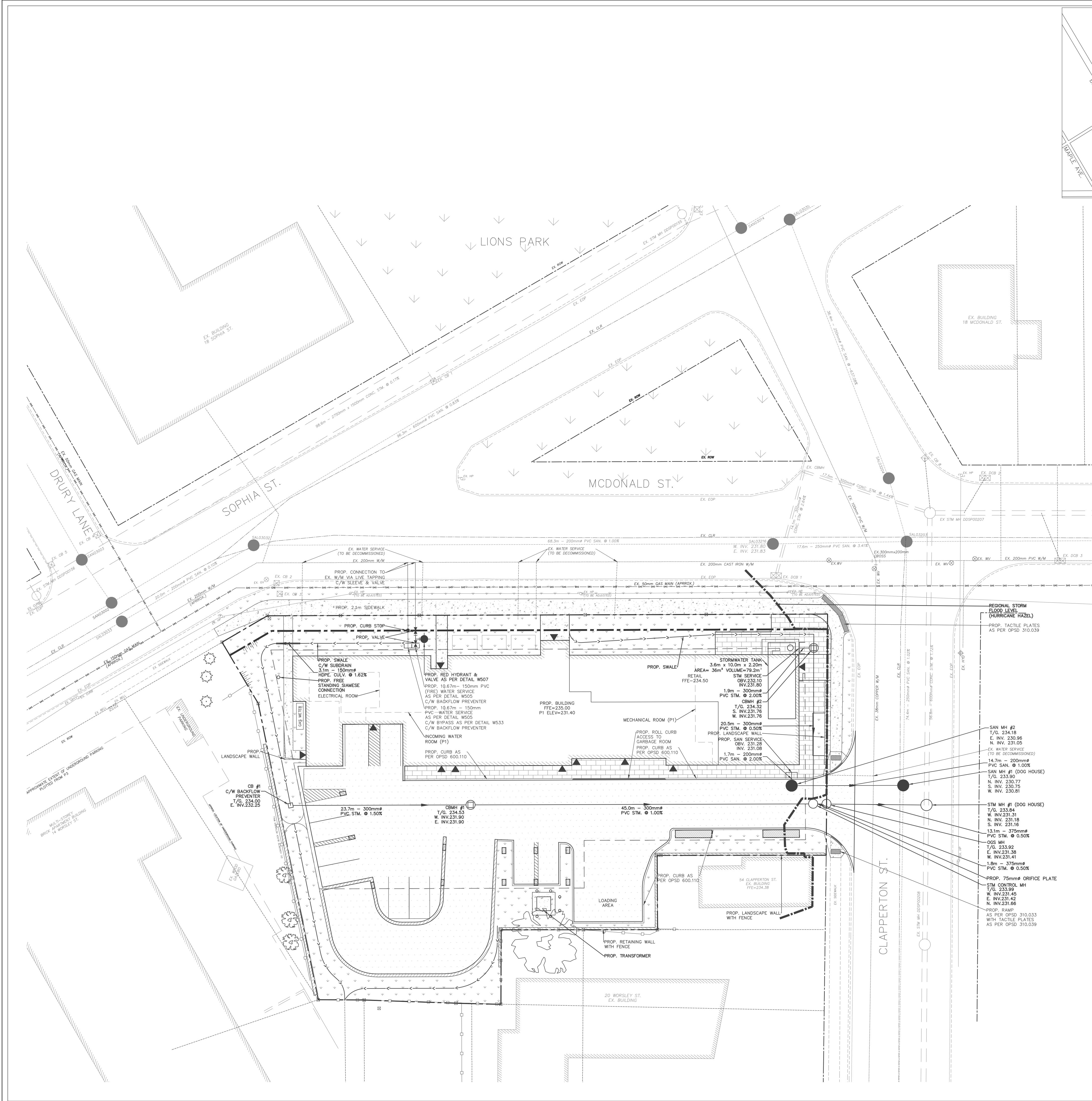
HYDROGEOLOGICAL SYMBOLS

Drawn	Job No.	Date: 14 Aug 03
Reviewed	File: HYDSYM_2	Dwg No.



Appendix D

Design Drawings

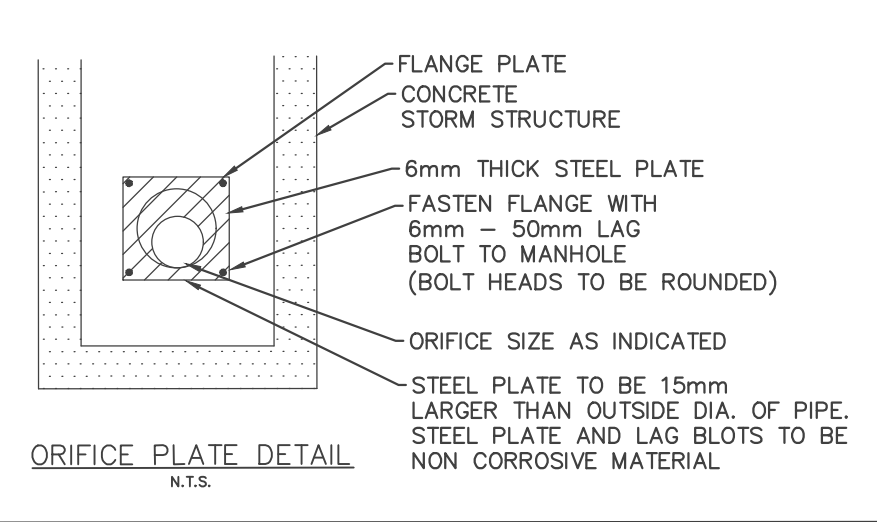


KEYMAP
N.T.S.

LEGEND

- PRIVACY FENCE
- ACOUSTIC FENCE
- CHAIN LINK FENCE
- SILT FENCE
- GAS LINE
- HYDRO LINE
- BELL LINE
- UNDERGROUND PARKING
- ROOF OVERHANG
- REGIONAL STORM FLOOD LEVEL (HURRICANE HAZEL)
- EXISTING SANITARY MAINTENANCE HOLE
- PROPOSED SANITARY MAINTENANCE HOLE
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING STORM MAINTENANCE HOLE
- PROPOSED STORM MAINTENANCE HOLE
- SERVICE CAP
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- PROPOSED VALVE BOX
- EXISTING VALVE BOX
- PROPOSED SIGN
- EXISTING LIGHT POLE
- MANDOOR
- OVERHEAD DOOR
- FIRE DEPT CONNECTION

- LANDSCAPE AREA
- ASPHALT AREA
- CONCRETE AREA
- INTERLOCK AREA



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0" 1/4" 1/2" 1" 1 1/2" 2"

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3.	ZONING BY-LAW AMENDMENT APPLICATION REV-1	22/10/27
4.	SITE PLAN APPLICATION	23/12/05
5.	SITE PLAN APPROVAL	24/06/06

SITE PLAN APPROVAL

Client
BLACK CREEK GROUP

Project
17 SOPHIA STREET

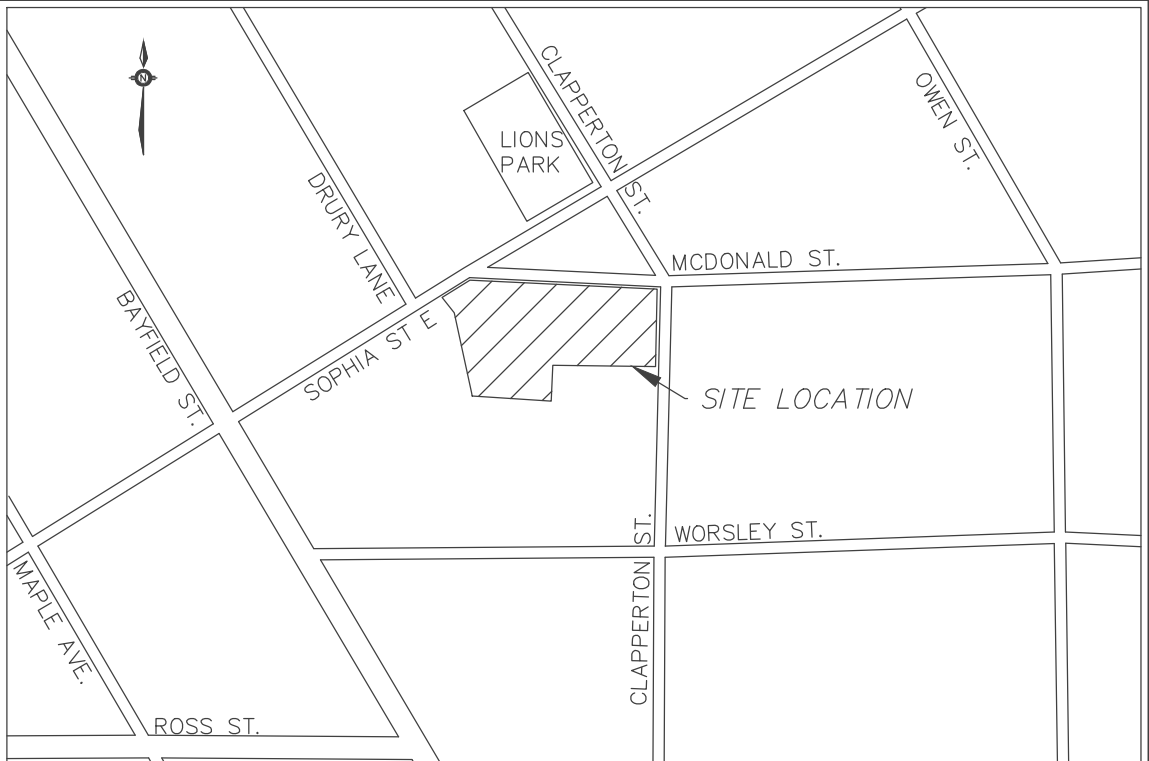
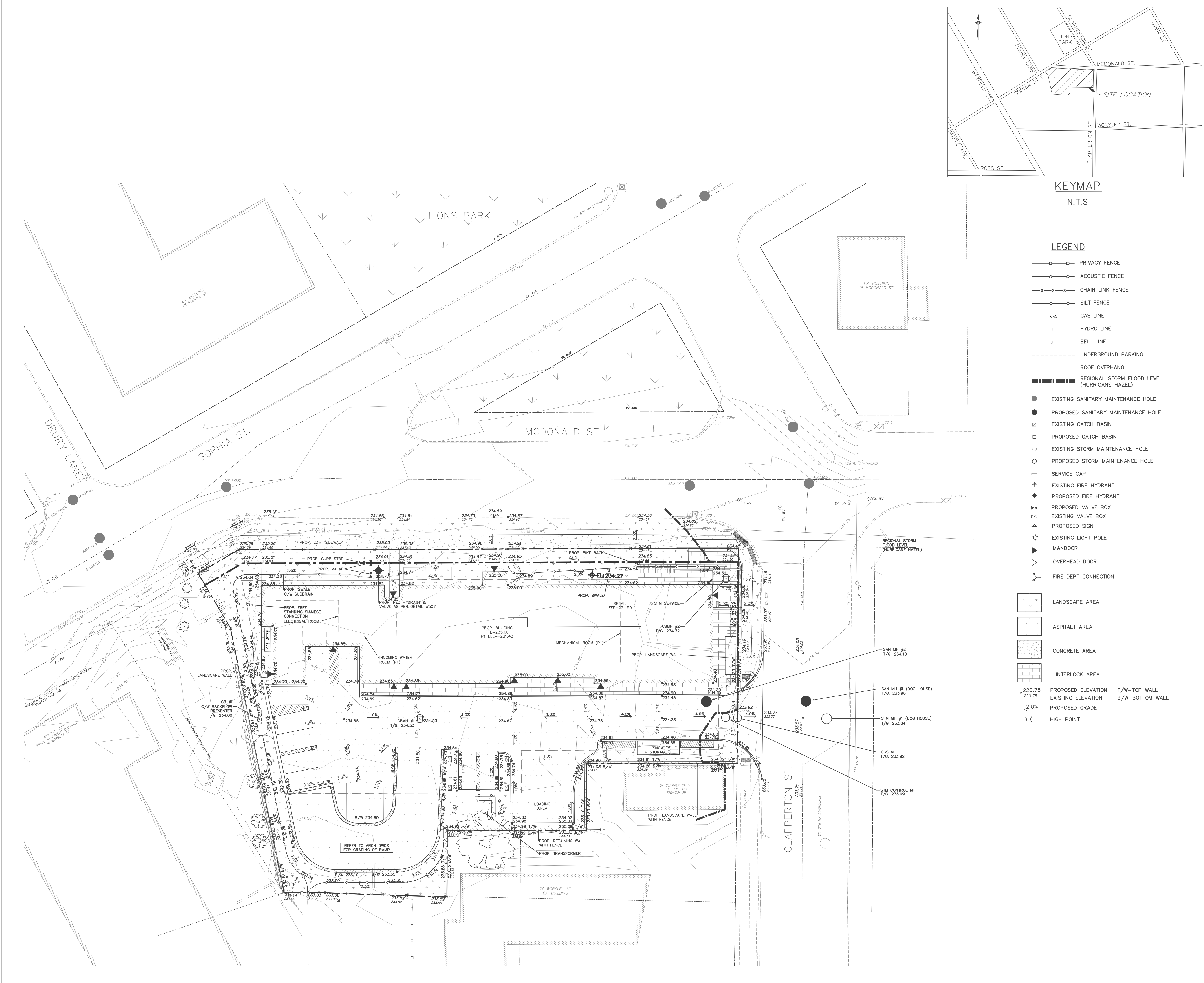
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3.57 & 11 McDonald Street
58 & 60 CLAPERTON STREET

Site Servicing Plan

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Orientation	Stamp				



Drawing No.



KEYMAP
N.T.S

LEGEND

- PRIVACY FENCE
- ACOUSTIC FENCE
- CHAIN LINK FENCE
- SILT FENCE
- GAS LINE
- HYDRO LINE
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- PROPOSED VALVE BOX
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- PROPOSED SIGN
- EXISTING LIGHT POLE
- MANDOOR
- OVERHEAD DOOR
- FIRE DEPT CONNECTION
- LANDSCAPE AREA
- ASPHALT AREA
- CONCRETE AREA
- INTERLOCK AREA
- PROPOSED ELEVATION
- EXISTING ELEVATION
- PROPOSED GRADE
- HIGH POINT
- T/W-TOP WALL
- B/W-BOTTOM WALL

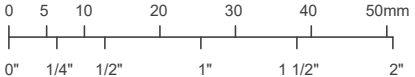


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5.	SITE PLAN APPROVAL	24/06/06

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BLACK CREEK GROUP

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17 Sophia Street
3.57 & 11 McDonald Street
58 & 60 CLAPERTON STREET

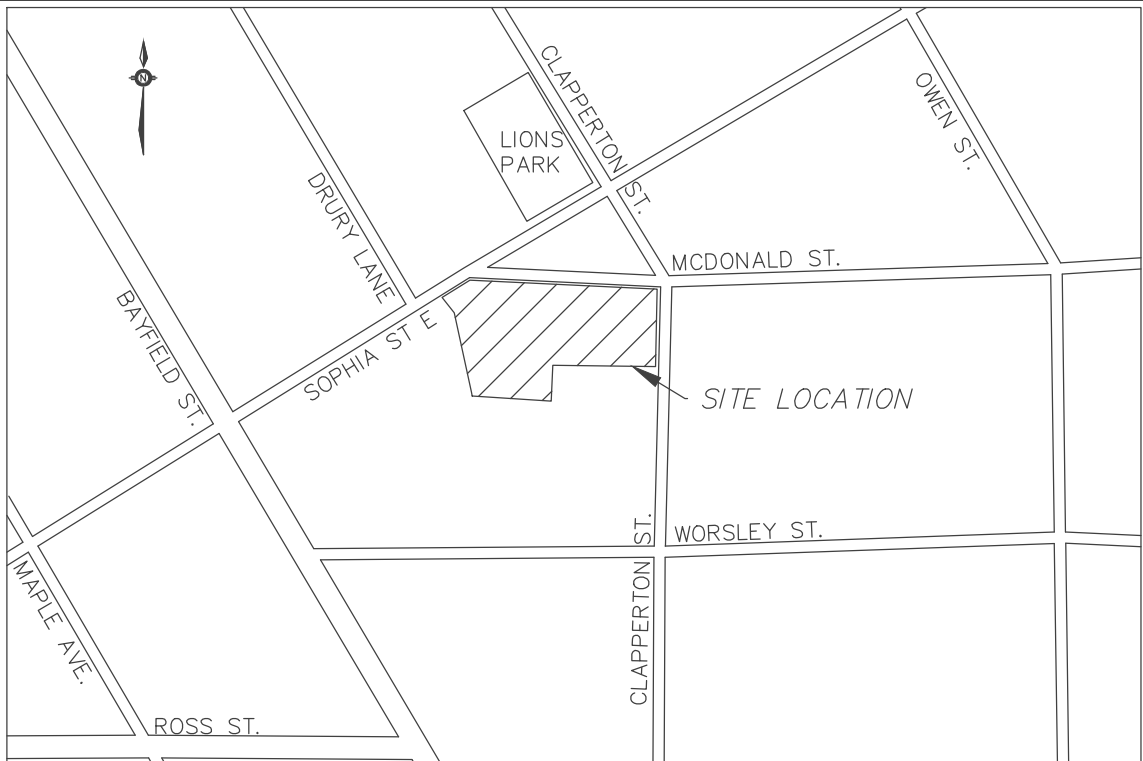
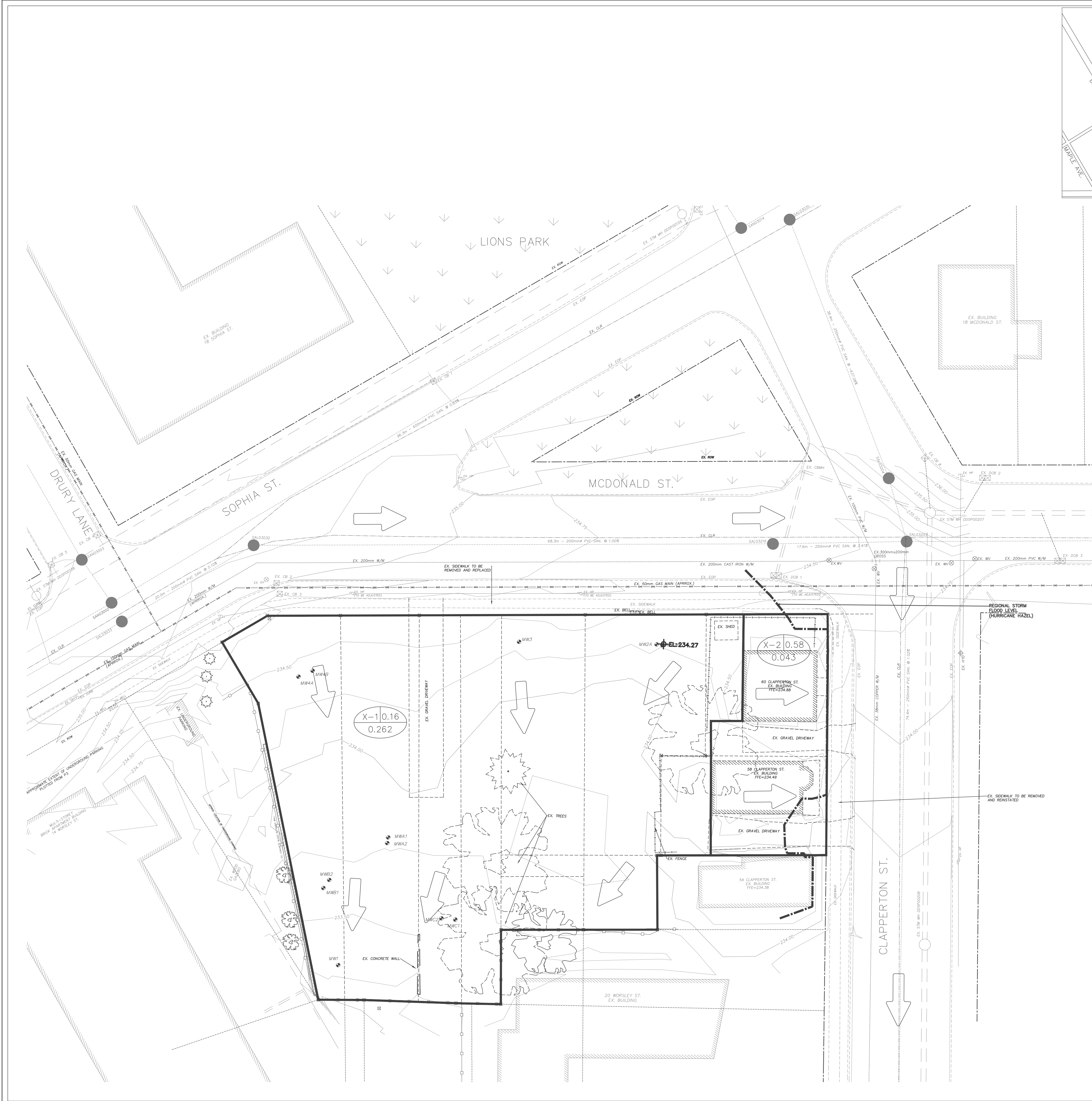
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Scale:	1:250	Drawn by:	RM	Approved by:	JDM
Orientation	Stamp				

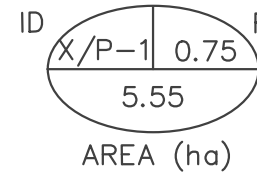


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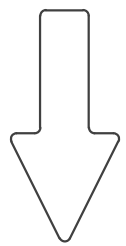


LEGEND



RUNOFF COEFFICIENT

CATCHMENT BOUNDARY



OVERLAND FLOW

REGIONAL STORM FLOOD LEVEL (HURRICANE HAZEL)

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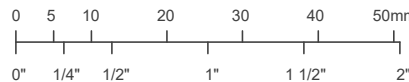
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5.	SITE PLAN APPROVAL	24/06/06

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3.57 & 11 McDonald Street
58 & 60 CLAPPERTON STREET

Drawing:

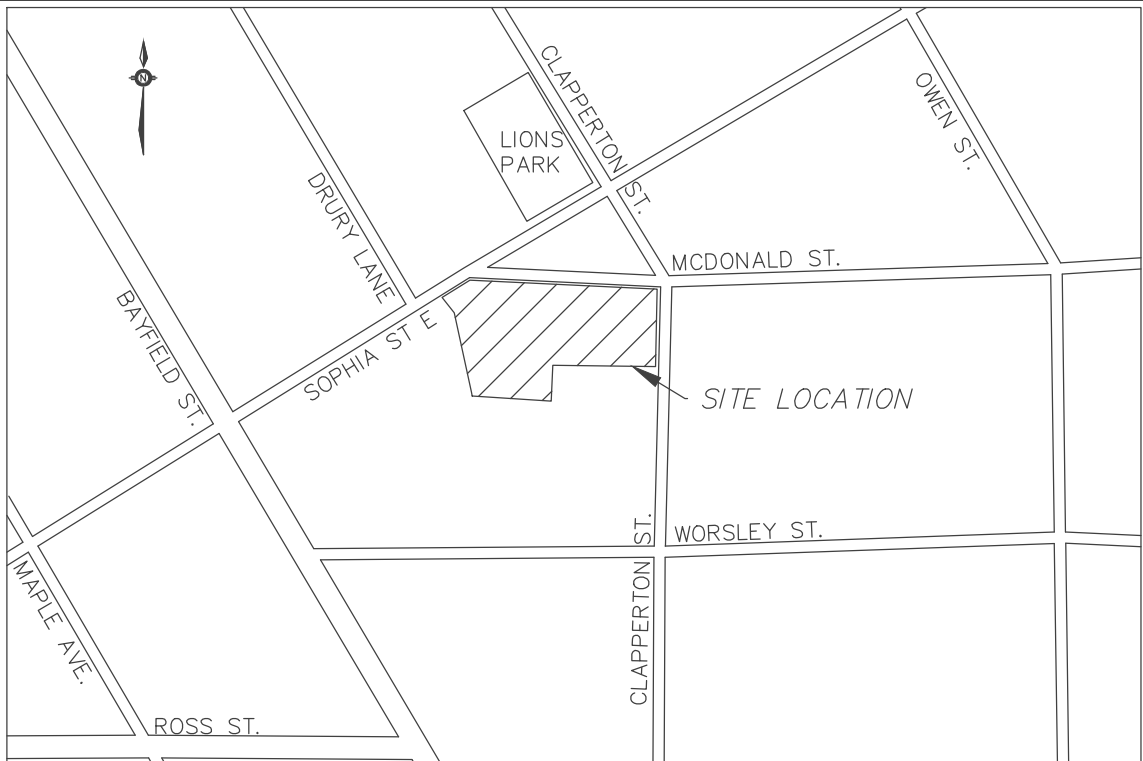
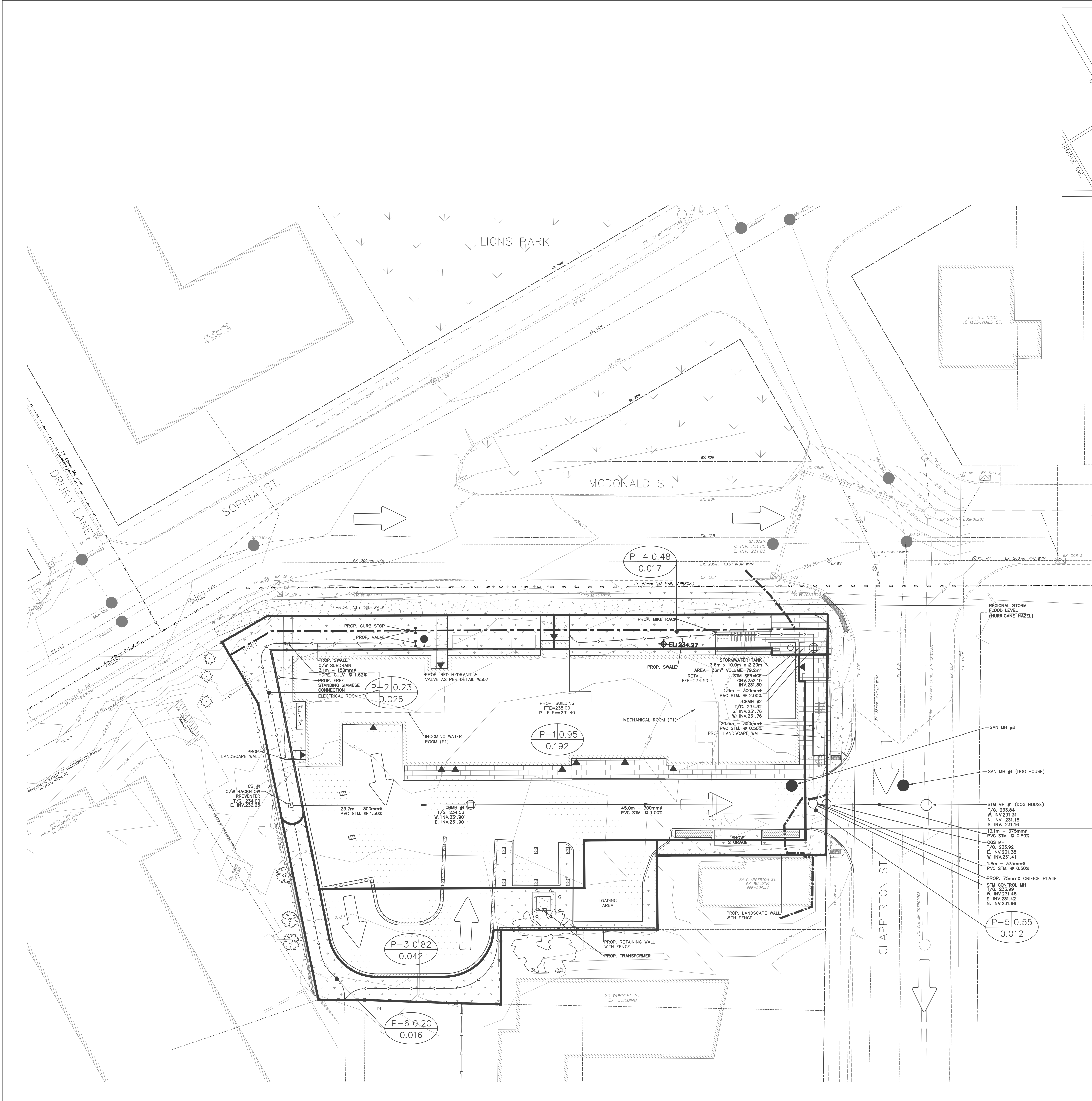
PRE-DEVELOPMENT
STORMWATER
MANAGEMENT PLAN

Project No.	1510-001-21	Designed by:	RM	Checked by:	KF
Scale:	1:250	Drawn by:	RM	Approved by:	JDM
Orientation	Stamp				



Drawing No.

STM-1



LEGEND

- ID $\frac{X/P-1}{5.55}$ RUNOFF COEFFICIENT
AREA (ha)
CATCHMENT BOUNDARY
OVERLAND FLOW
REGIONAL STORM FLOOD LEVEL (HURRICANE HAZEL)

SECTION NUMBER
263
233.67
REGIONAL STORM FLOOD LEVEL (HURRICANE HAZEL)
FLOOD DATA FROM C.G. TATHAM & ASSOCIATES LTD
FLOOD PLAIN MAPPING PLAN
OWEN ST./CLAPPERTON ST. - NORTH
(JOB #107015, DWG FM-2)



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SITE PLAN APPROVAL

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58 & 60 Clapperton Street

POST-DEVELOPMENT
STORMWATER
MANAGEMENT PLAN

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Orientation	Stamp				



Drawing No.

STM-2

NOTES FOR SEDIMENT & EROSION CONTROL

- 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.
- ANY DEWATERING WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30 M FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE ADMINISTRATOR.
- SILT FENCE SHALL BE PUT IN PLACE PRIOR TO AND MAINTAINED DURING ALL GRADING. SILT FENCE SHALL COMPLY WITH OPSD 219.110 FOR LIGHT DUTY AND / OR OPSD 219.130 FOR HEAVY DUTY; UNLESS NOTED OTHERWISE. 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 SUGGESTED SPECIFICATIONS.
- 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.
- MUD MATS WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES THE SITE SHALL BE USED. MUD MATS TO BE 300mm IN DEPTH, 6.0m WIDE BY 20.0m LONG, FIRST 10.0m TO 150mmØ CLEAR STONE WITH THE REMAINING 10.0m CONSISTING OF 50mmØ CLEAR STONE; OR MEET MUNICIPAL STANDARDS WHERE IDENTIFIED.
- CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 805, CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES AS WELL AS ALL APPLICABLE MUNICIPAL STANDARDS.
- 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 CONSERVATION AUTHORITY.
- 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.
- ALL DISTURBED GROUND LEFT INACTIVE 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 MUNICIPAL DIRECTOR OF ENGINEERING BUT SHALL NOT EXCEED THIRTY DAYS OR SUCH LONGER PERIOD DEEMED ADVISABLE BY THE MUNICIPAL DIRECTOR OF ENGINEERING.
- CONTRACTOR SHALL INSTALL AND MAINTAIN CATCHBASIN SEDIMENT BARRIERS THROUGHOUT THE SITE DURING ALL CONSTRUCTION ACTIVITIES IN ORDER TO TRAP SEDIMENT.

SEQUENCE OF CONSTRUCTION

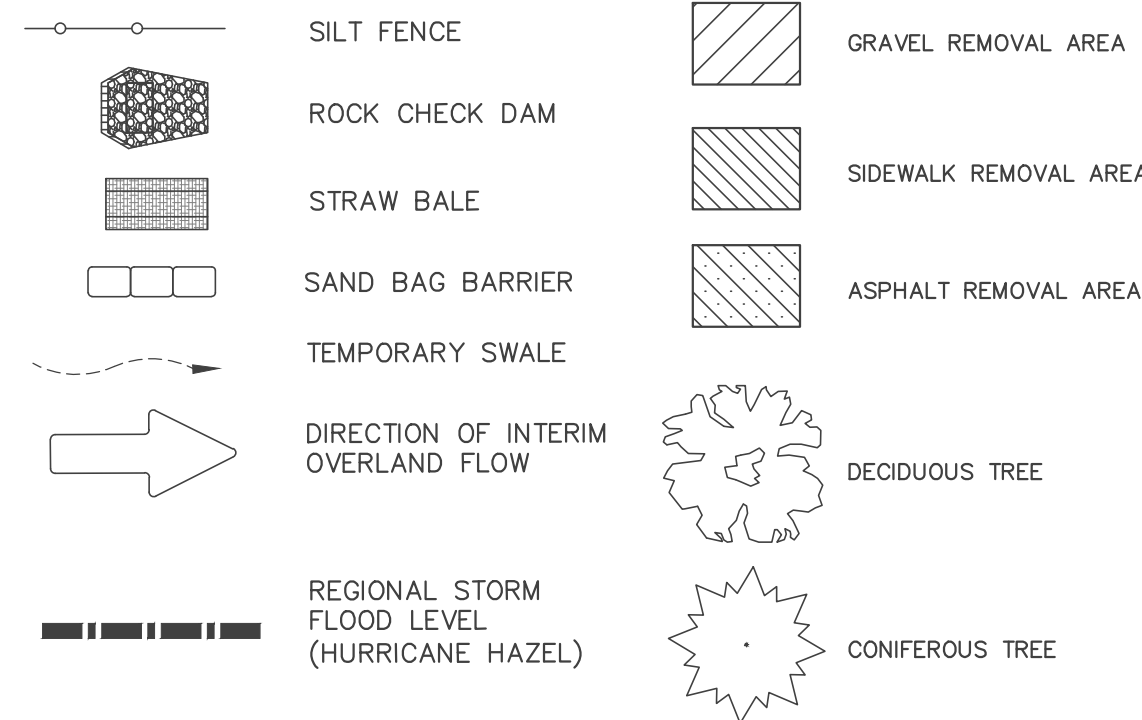
- ENGINEER TO BE NOTIFIED PRIOR TO INITIATION OF ANY ON SITE WORKS.
- SILT FENCE AND CONSTRUCTION ACCESS MATS TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY WORKS ON SITE.
- VEGETATION REMOVAL MAY COMMENCE AFTER ALL SILT FENCE IS INSTALLED AND APPROVED BY THE ENGINEER.
- COMMENCE WITH EARTH EXCAVATION AND SITE SERVICING (TO BE REMOVED FROM SITE - NO STOCKPILE).
- 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.
- 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.



KEYMAP

N.T.S.

LEGEND



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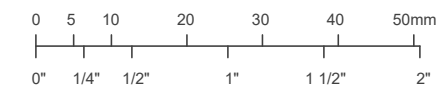
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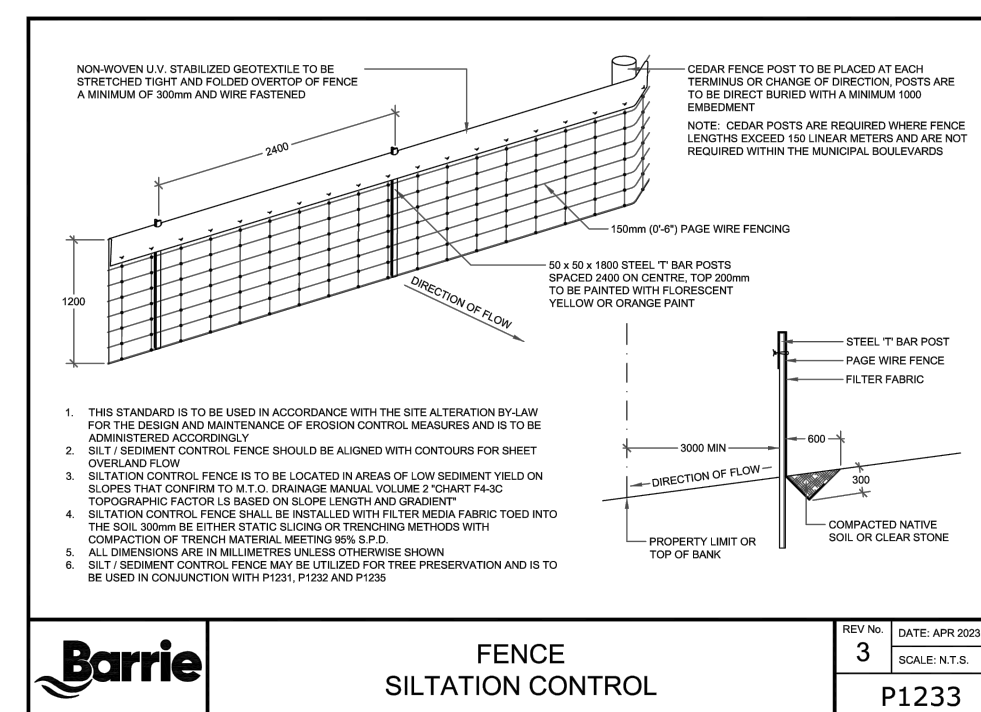
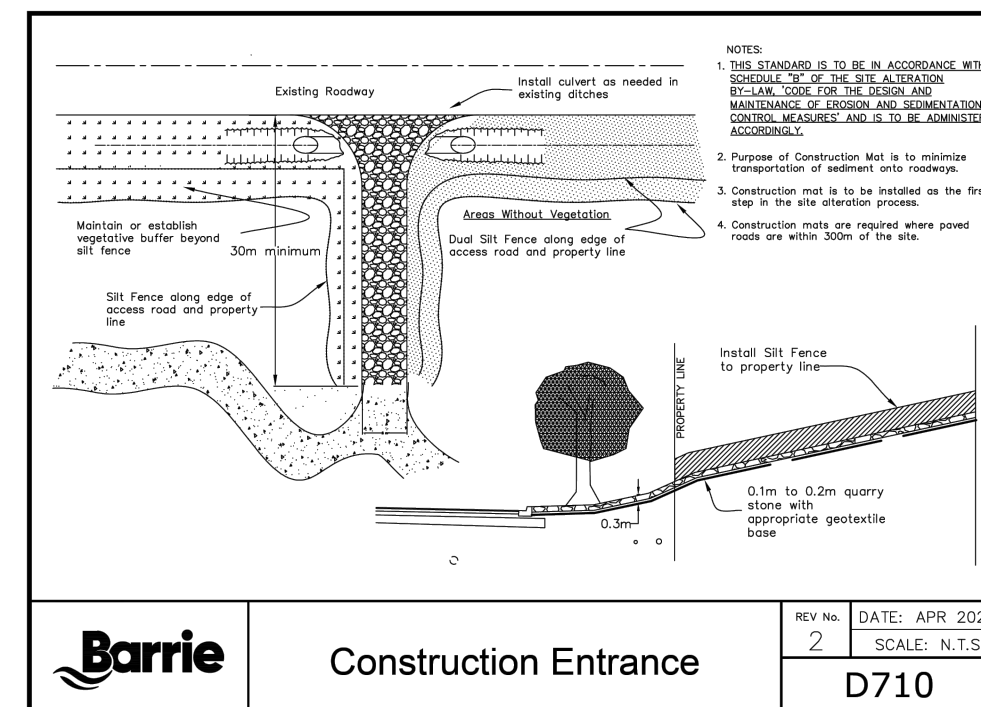
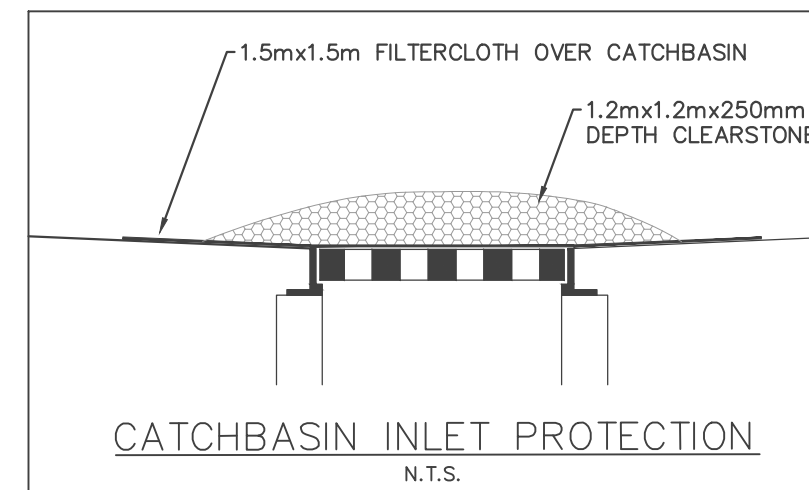
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5.	SITE PLAN APPROVAL	24/06/06



SITE PLAN APPROVAL

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BLACK CREEK GROUP

Project

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17 Sophia Street
3,57 & 11 McDonald Street
58 & 60 CLAPPERTON STREET

Drawing:

EROSION & SEDIMENT CONTROL PLAN & REMOVALS PLAN

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