S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing Report

1029-1033 WATERDOWN ROAD

CITY OF BURLINGTON

INFINITY DEVELOPMENT GROUP

November 2021

SLA File: 21089

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Infinity Development Group to provide Consulting Engineering services for the proposed development at 1029-1033 Waterdown Road in the City of Burlington, Region of Halton (see Figure 1.0 for location plan). This report will outline the functional servicing strategy for the proposed development.

The proposed development consists of constructing a 29-storey mixed-use building including two levels of underground parking, an asphalt driveway, concrete sidewalk, and landscaped areas.

This Functional Servicing Report will provide detailed information of the proposed servicing scheme for this development. Please refer to the Preliminary Engineering Plans prepared by S. Llewellyn and Associates Limited (see Appendix F) and the Site Plan prepared by Zedd Architecture for additional information.

1.2 BACKGROUND INFORMATION

The following documents were referenced in the preparation of this report:

Ref. 1: MOE Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)

Ref. 2: City of Burlington Standard Drawings (City of Burlington, March 2014)

Ref. 3: Halton Region Water and Wastewater Linear Design Manual (Halton Region, May 2014)

Ref. 4: Low Impact Development Stormwater Management Planning and Design Guide (Credit Valley Conservation Authority / Toronto and Region Conservation Authority, 2010)

Ref. 5: Geotechnical Investigation (Fisher Engineering, July 26, 2021)

Ref. 6: Hydrogeological Investigation (Fisher Engineering, August 9, 2021)

Ref. 7: Stormwater Management Design Guidelines (City of Burlington, May 21, 2020)

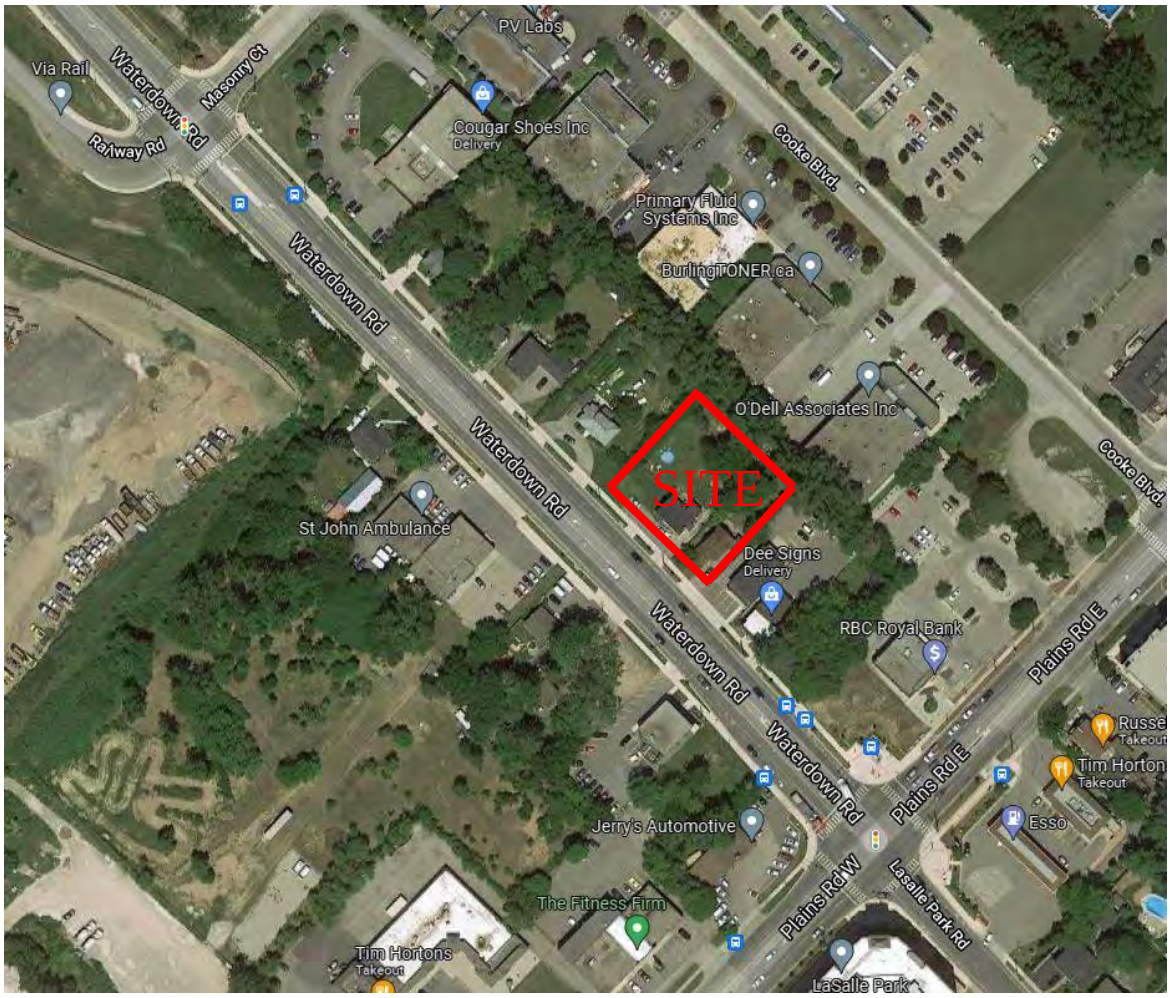


Figure 1.0 – Location Plan

1.3 GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

A Geotechnical and Hydrogeological Investigation was prepared by Fisher Engineering dated July 26, 2021 and August 9, 2021, respectively. Six boreholes were drilled on June 15, 16 & 17, 2021 to depths ranging between 9.6m and 14.18m below grade. Fill consisting of brown to dark brown sandy silt with some trace of topsoil/roots and trace of gravel was encountered at depths ranging between 0.61m and 0.91m below grade. Native brown, moist, loose to compact silty sand to sandy silt were encountered beneath the sill soils extending to approximate depths varying from 1.68m (BH4) to 3.66m (BH5). Reddish brown, moist, compact, silty sand to sandy silt was encountered beneath the brown silty sand/sandy silt extending to approximate depths of 2.59m (BH3) and 3.05m (BH1 & BH2). The brown silty sand/sandy silt of BH4 to BH7 and reddish-brown silty sand of BH1 to BH3 were underlain generally by grown to grey, moist to wet, dense to very dense sand/gravelly sand/gravel & sand deposits extending to termination depths of 9.6m to 14.17m. These layers vary in composition across the site and with depth. Occasional cobbles/boulders were encountered in the gravelly sand/gravel & sand. Layers of reddish to brown or grey, moist, firm to very stiff clayey silt to silty clay were found interbedded in the sandy deposits between depths of 4.57m & 4.88m (BH1), 4.88m & 5.49m (BH2),

4.72m & 5.18m (BH3), 3.20m & 4.57m, 6.10m & 7.01m (BH4), 4.88m & 5.49m (BH6) and 4.72m and 6.10m (BH7). Consistency of these layers varied substantially from firm in the upper layer to hard in the lower layer of BH4, but generally very stiff in the other boreholes.

Groundwater was encountered at depths between 4.20m and 7.62m below grade. The groundwater quality determined by laboratory analyses revealed compliance to parameters of the existing sanitary sewer limits and some exceedance for the proposed storm limits. Temporary construction dewatering will be required and the dewatering flowrate of 36.22 m^3/day (36,220 L/day) (0.42 l/s) is less than the allowable discharge rate of 22.0 l/s noted in Table 2.2 of this report. Permanent drainage rate of 37.83 m^3/day (37,830 L/day) (0.44 l/s) (FS of 1.5) was obtained for two underground levels with the lowest P2 elevation of approximately 6m below grade. A permit to take water is not required since the temporary and permanent dewatering flowrate is less than 50,000 L/day. The underground is to be constructed to be waterproof ("bath-tub" design) to avoid the need for a permanent groundwater discharge.

Groundwater levels are being monitored for three consecutive months and the report will be updated upon completion of the groundwater monitoring programme. For additional information, refer to the Geotechnical and Hydrogeological Investigations in Appendix D and E, respectively.

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the City of Burlington and Region of Halton:

Quantity Control
The proposed condition discharge rates from site will be controlled to the capacity of the existing 375mm storm sewer along Waterdown Road during all storm events up to and including the 100-year storm.

Quality Control
The stormwater runoff from the proposed condition site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

Erosion Control
The 25mm storm event is to be retained on site and released over a 48-to-72-hour period.

2.1 EXISTING CONDITIONS

In the existing condition, there are two existing dwellings with associated asphalt driveways located on the subject site. The site is bounded by Waterdown Road to the west, existing residential lands to the north and south and existing commercial lands to the east. The frontage of the dwellings drains west to Waterdown Road where runoff is captured by the existing 375mmø storm sewers along Waterdown Road and the remained of the site drains east to the existing commercial lands.

Two (2) catchment areas, Catchment 101 and 102 have been identified in the existing condition. Catchment 101 represents the existing condition discharge to Waterdown Road and Catchment 102 represents the existing condition discharge to the adjacent commercial lands to the east. See Table 2.1 below and the Pre-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.1 – Existing Conditions Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Runoff Coefficient
101	To Waterdown Road	0.05	65%	0.68
102	To Adjacent East Property	0.23	16%	0.35

The existing conditions discharge from the site was calculated using the SWMHYMO Hydrologic Modelling Program for the 2-year to 100-year City of Burlington design storms. A summary of the results can be found in Table 2.2.

Table 2.2 – Existing Condition Stormwater Discharge

Storm Event	Catchment 101 Discharge (m^3/s)	Catchment 102 Discharge (m^3/s)
2-year	0.007	0.004
5-year	0.010	0.008
10-year	0.011	0.012
25-year	0.013	0.017
50-year	0.015	0.021
100-year	0.017	0.026

Allowable Discharge Rate

The proposed condition discharge rates from site will be controlled to the capacity of the existing 375mm storm sewer along Waterdown Road during all storm events up to and including the 100-year storm. As per the Drainage Area Plan (Municipal Drawing No. MDR-67) in Appendix A, the existing 375mm storm sewer along Waterdown Road is designed for the 5-year storm event with a drainage area of 0.13ha, a run-off co-efficient of 0.75 and an initial time of concentration of 15 minutes. The calculation for the allowable discharge rate is shown below.

$Q_{Allowable}$ = 2.78CiA=2.78(0.75)(81.32mm/hr)(0.13ha)

= ***22.0 l/s (0.0022 m^3/s)***

2.2 PROPOSED CONDITIONS

It is proposed to develop the site by constructing a 29-storey mixed-use building including two levels of underground parking, an asphalt driveway, concrete sidewalk, and landscaped areas. It is proposed to service the site with a 200mmø storm sewer, designed and constructed in accordance with the City of Burlington and Region of Halton standards.

Four (4) catchment areas, Catchment 201, 202, 203 and 204 have been identified in the proposed condition. Catchment 201 represents controlled drainage from the site, which will be captured by the roof and proposed area drains and discharged to the existing 375mmø storm sewer along Waterdown Road. Catchment 202 represents uncontrolled drainage along the frontage of the site that sheet drains to Waterdown Road. Catchment 203 represents the uncontrolled external drainage from the adjacent property to the north which will be captured by the internal mechanical system and discharged to the existing 375mmø storm sewer along Waterdown Road. Catchment 204 represents uncontrolled drainage from the site that sheet drains east to the adjacent property. See Table 2.3 below and the Post-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.3 – Proposed Condition Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Runoff Coefficient
201	Controlled drainage to Waterdown Road	0.270	99%	0.94
202	Uncontrolled drainage to Waterdown Road	0.006	83%	0.79
203	Uncontrolled external drainage to Waterdown Road	0.050	0%	0.25
204	Uncontrolled drainage to adjacent east property	0.004	0%	0.25

Water Quantity Control

Under proposed conditions, the post development discharge rates from the site will be controlled to maximum discharge rate of 0.022 m^3/s during all storm events up to and including the 100-year storm.

It is proposed to apply quantity control measures to the runoff from Catchment 201 by installing a pump with a discharge rate of 4l/s and an 85mmø outlet on the proposed cast-in-place concrete storage tank. With the installation of quantity control measures for Catchment 201, it will be required to provide 162m^3 of on-site stormwater storage. On-site storage will be provided by a cast-in-place concrete storage tank within the underground parking. See Table 2.4 and Appendix A for the stage-storage-discharge relationship of the orifice controls and on-site storage.

Table 2.4 – Proposed Condition Stage-Storage-Discharge (Catchment 201)		
Elevation (m)	Storage (m^3)	Discharge (m^3/s)
97.50 (Bottom of Tank)	0	0
98.50 (1.0m Deep)	37	0.0040[1]
99.50 (2.0m Deep)	74	0.0040[1]
100.50 (3.0m Deep)	111	0.0040[1]
101.50 (4.0m Deep)	148	0.0040[1]
101.80 (Orifice Invert)	159	0.0040[1]
102.20 (4.7m Deep)	174	0.0130
102.60 (Overflow Pipe)	188	0.0171
103.00 (Top of Tank)	203	0.0202
[1]Pump with a discharge rate of 0.0040m^3/s (4 l/s)		

An analysis was performed on the Proposed Condition site using the SWMHYMO hydrologic modeling program to determine the required volume of stormwater storage during the 2-year to 100-year City of Burlington design storms. A summary of the results can be found in Table 2.5 and 2.6 and the detailed SWMHYMO input/output information can be found in Appendix A.

Table 2.5 – Proposed Condition Stormwater Discharge (To Waterdown Road)						
Storm Event	Catchment 201 Controlled Discharge (m^3/s)	Catchment 202 Uncontrolled Discharge (m^3/s)	Catchment 203 Uncontrolled Discharge (m^3/s)	Total Discharge (m^3/s)	Allowable Discharge (m^3/s)	Required Storage (m^3)
2-Yr	0.004	0.001	0.001	0.006	0.022	67.4
5-Yr	0.004	0.001	0.002	0.007	0.022	91.5
10-Yr	0.004	0.002	0.003	0.008	0.022	108.7
25-Yr	0.004	0.002	0.004	0.009	0.022	131.5
50-Yr	0.004	0.002	0.005	0.010	0.022	148.8
100-Yr	0.006	0.002	0.006	0.011	0.022	161.7

Table 2.6 –Stormwater Discharge (To Adjacent East Property)		
Storm Event	Catchment 204 (Proposed Uncontrolled Discharge) (m^3/s)	Catchment 102 (Existing Uncontrolled Discharge) (m^3/s)
2-Yr	0.000	0.004
5-Yr	0.000	0.008
10-Yr	0.000	0.012
25-Yr	0.000	0.017
50-Yr	0.000	0.021
100-Yr	0.001	0.026

This analysis determined the following:

- The proposed condition discharge rates to Waterdown Road will not exceed the maximum allowable discharge rate of 0.0220 m^3/s during all storm events, with the installation of a pump with a discharge rate of 4l/s and an 85mmø outlet on the cast-in-place concrete storage tank.

- The proposed condition discharge rates to the adjacent east property are less than the existing condition discharge rates.

- Catchment 201 will require 162m^3 of stormwater storage during the 100-year event, which can be accommodated by the proposed storage tank having a volume of 188m^3 to the overflow pipe.

Water Quality Control

The proposed site consists of rooftop, grassed areas and pedestrian walk ways which does not require quality control. Therefore, quality control measures are not proposed.

Erosion Control

The City of Burlington criteria is for the 25mm storm event to be retained on site and released over a 48-to-72-hour period. The drainage area of Catchment 201 is 0.27ha which will generate 67.5m^3 of runoff during the 25mm storm event. In order to discharge this volume of runoff over a 48-hour period the discharge rate would need to be 0.39l/s which is not feasibly possible. We have researched pump options and a low flow pump will discharge approximately 4l/s which will discharge the 25mm storm event in 4.7 hours.

In order to provide the highest possible level of erosion control, the stormwater storage tank has been designed with 159m^3 of storage below the 85mmø outlet (elevation=101.80m) to sufficiently store the 67.5m^3 of runoff from the 25mm storm event. A low flow pump with a discharge rate of 4l/s is proposed at the bottom of the stormwater storage tank (elevation=97.50m) and will discharge to the 450mmø Nyloplast structure downstream of the 85mmø outlet. Further pump details will be provided by the mechanical consultant during the detailed design stage. As noted above, the proposed

design will discharge the 25mm storm event in 4.7 hours which is the highest level of erosion control that is feasibly possible for the site.

2.3 SEDIMENT AND EROSION CONTROL

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install sediment control (silt sacks or silt socks) in the proposed area drains as well as the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system;
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

For details on the proposed erosion and sediment control for the proposed site, see the Preliminary Grading & Erosion Control Plan included in the engineering drawings.

3.0 SANITARY SEWER SERVICING

3.1 EXISTING CONDITIONS

There is an existing 200mmø sanitary sewer located adjacent to the site along Waterdown Road.

3.2 SANITARY DEMAND

Sanitary discharge from the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Table 3.1 summarizes the sanitary sewer discharge rate for the subject lands. Please refer to the Water Usage and Sanitary Discharge Report in Appendix B for details.

Table 3.1 – Proposed Sanitary Sewer Discharge	
Total Sanitary Demand (L/s)	**6.19**

3.3 PROPOSED SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed site will be serviced by a 200mmø sanitary sewer, designed and constructed in accordance with City of Burlington and Region of Halton standards. Drainage from this sewer will discharge to the existing 200mmø sanitary sewer adjacent to the site along Waterdown Road.

The minimum grade of the proposed 200mmø sanitary sewer will be 2.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.039 m^3/s (39 l/s). Therefore, the proposed 200mmø sanitary sewer at a minimum grade of 2.0% is adequately sized to service the proposed development.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 300mmø watermain located on the west side of Waterdown Road and a 600mmø watermain located on the east side of Waterdown Road. An existing fire hydrant is located on the west side of Waterdown Road and is connected to the 300mmø watermain.

4.2 DOMESTIC WATER DEMAND

Water demand for the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Tables 4.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios. Please refer to the Water Usage and Sanitary Discharge Report in Appendix B for details.

Table 4.1 – Proposed Domestic Water Demand	
Max. Daily Demand (l/s)	**3.44**
Max. Hourly Demand (l/s)	**6.12**

4.3 FIRE FLOW DEMAND

Fire flow demands for the proposed development are governed by a number of guidelines and criteria, such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999), Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA).

The proposed building is fire-resistive construction (C=0.6), with limited combustible occupancy (-15% correction) and a fully supervised sprinkler system (-50% correction). Exposure components are based on the following:

North Face: 15% correction (10.1m to 20.0m)
South Face: 20% correction (3.1m to 10.0m)
East Face: 15% correction (10.1m to 20.0m)
West Face: 0% correction (>45m)

It is estimated that the required fire flow for the proposed development will be **183 l/s**. See the Fire Flow Demand Requirements in Appendix C for details.

The existing hydrant located on the west side of Waterdown Road is located within the 90m separation from the building face adjacent to a street (as per Sentence 3.2.5.7 of the

2020 Ontario Building Code), no additional private hydrants are proposed for this development.

The following hydrant flow test data for the public fire hydrant in closest proximity to the proposed development has been analyzed to determine if the municipal system adjacent to the subject site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 4.2 summarizes the hydrant flow data carried out by Aquacom Contracting. Hydrant flow reports can be found in Appendix C.

Table 4.2 – Hydrant Flow Data (Aquacom Contracting)	
Location	1044 Waterdown Road
Test Date	November 18, 2021 1:45 PM
Static Pressure	39 psi
Residual Pressure During Test	37 psi
Test Flow Rate	1138 USGPM (71.8 l/s)
Theoretical Flow @ 20 psi	**3845 USGPM (242.6 l/s)**

Based on the above hydrant flow test data, the theoretical maximum available flow rate is **242.6 l/s**, while the maximum required fire flow for the proposed development is only **183 l/s**.

Therefore, based on the above analysis, the proposed water distribution system will have the capacity and pressure required to adequately service the subject land.

4.4 PROPOSED WATER SERVICING AND ANALYSIS

Proposed water servicing for the site consists of connecting two 150mmø watermains to the existing 300mmø watermain in accordance with sentence 3.2.9.7(4) of the 2020 Ontario Building Code which states that two sources of water supply are required for a building exceeding 84m in height. One of the 150mmø watermains will be a fire water service and the other will split at property line to provide a 150mmø fire water service and 100mmø domestic water service for the proposed building. All proposed water services are to be designed and constructed in accordance with City of Burlington and Region of Halton standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development at 1029-1033 Waterdown Road can be constructed to meet the requirements of the City of Burlington and Region of Halton. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the Preliminary Servicing and Preliminary Grading & Erosion Control Plans prepared by S. Llewellyn & Associates Limited;

- An 85mmø outlet be installed on the cast-in-place storage tank as per the Preliminary Servicing Plan and this report to achieve effective stormwater quantity control;

- A pump with a discharge rate of 4l/s be installed on the cast-in-place storage tank as per the Preliminary Servicing Plan and this report to achieve effective erosion control;

- A cast-in-place concrete storage tank be installed as per the Preliminary Servicing Plan and this report to provide adequate stormwater storage;

- Erosion and sediment controls be installed as described in this report and shown on the Preliminary Grading & Erosion Control Plan prepared by S. Llewellyn & Associates Limited;

- The proposed sanitary and water servicing system be installed as per the Preliminary Servicing Plan and this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

Prepared by:

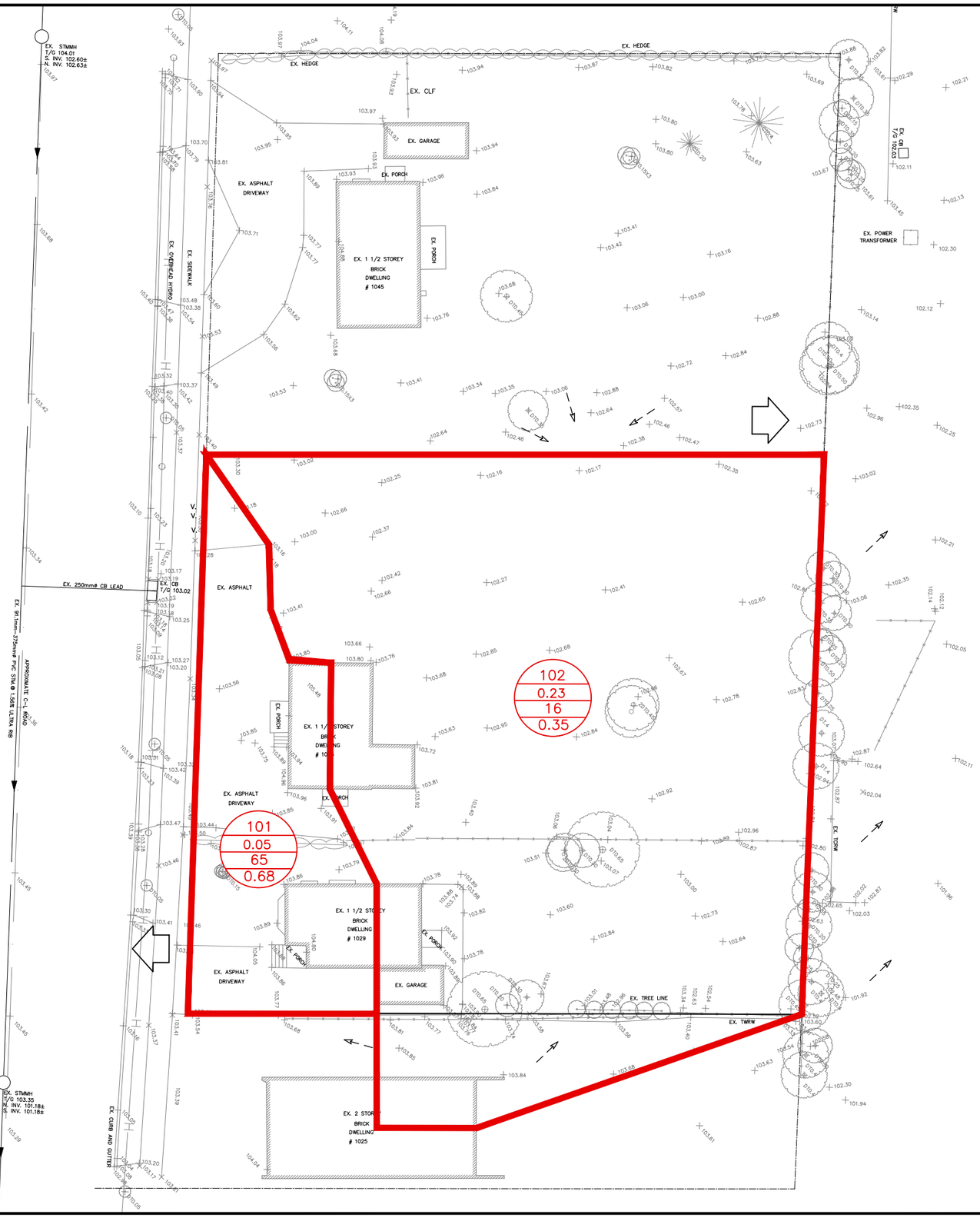
S. LLEWELLYN & ASSOCIATES LIMITED



S. Nelson, P.Eng.

APPENDIX A

STORMWATER MANAGEMENT INFORMATION



LEGEND

201
14.60
77
0.75

DRAINAGE AREA I.D.
DRAINAGE AREA (ha)
PERCENT IMPERVIOUS
RUNOFF COEFFICENT

DRAINAGE BOUNDARY

EXISTING DIRECTION OF SHEET FLOW

OVERLAND FLOW ROUTE

EXISTING CONDITION
STORM DRAINAGE AREA PLAN

SCALE: 1:400

PROJECT: 1029–1033 WATERDOWN RD, BURLINGTON
PROJECT No.: 21089

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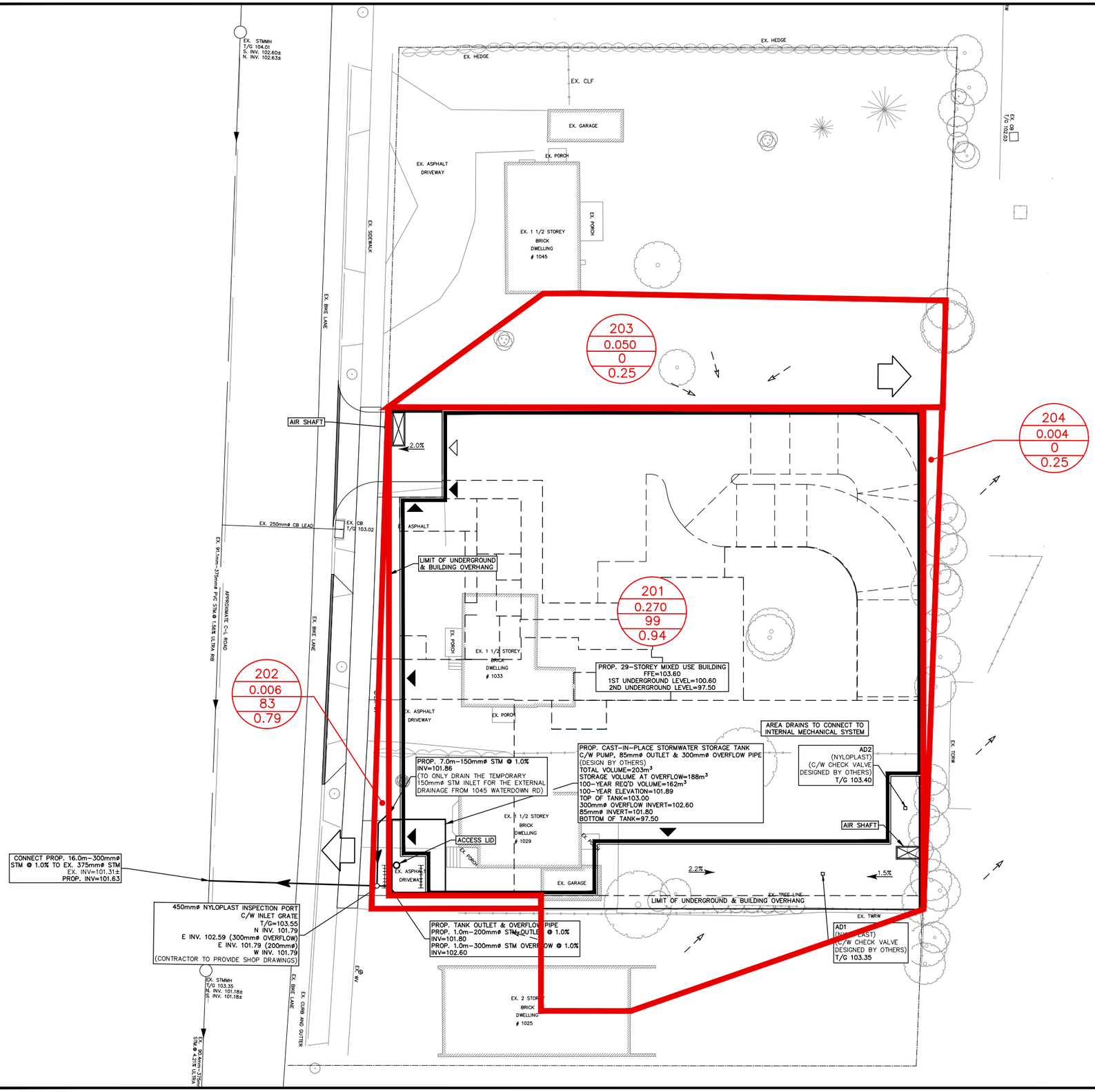

LEGEND

201 14.60 77 0.75	DRAINAGE AREA I.D. DRAINAGE AREA (ha) PERCENT IMPERVIOUS RUNOFF COEFFICENT
	DRAINAGE BOUNDARY
	PROPOSED DIRECTION OF SHEET FLOW
	EXISTING DIRECTION OF SHEET FLOW
	EMERGENCY OVERLAND FLOW ROUTE

PROPOSED CONDITION

STORM DRAINAGE AREA PLAN

SCALE: 1:400

PROJECT: 1029-1033 WATERDOWN RD, BURLINGTON
PROJECT No.: 21089

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S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

STAGE-STORAGE-DISCHARGE CALCULATIONS

Catchment 201

Outlet Device No. 1 (Quantity)

Type:	Pump
Discharge (Q) =	0.0040m^3/s
Number of Pumps:	1

Outlet Device No. 2 (Quantity)

Type:	Tank Outlet
Diameter (mm)	**85**
Area (m^2)	0.00567
Invert Elev. (m)	101.80
C/L Elev. (m)	101.84
Disch. Coeff. (C_d)	0.6
Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1

		SWM Tank Volumes					Outlet No. 1		Outlet No. 2		Total Discharge
	Elevation m	Area m^2	Tank Incremental Volume m^3	Additional Incremental Underground m^3	Additional Incremental Surface m^3	Total Storage Volume m^3	H m	Discharge m^3/s	H m	Discharge m^3/s	Discharge m^3/s
Bottom of Tank	97.50	37	0	0.0	0	0	0.000	0.0000	0.000	0.0000	0.0000
1.0m Deep	98.50	37	37	0.0	0	37	1.000	0.0040	0.000	0.0000	0.0040
2.0m Deep	99.50	37	37	0.0	0	74	2.000	0.0040	0.000	0.0000	0.0040
3.0m Deep	100.50	37	37	0.0	0	111	3.000	0.0040	0.000	0.0000	0.0040
4.0m Deep	101.50	37	37	0.0	0	148	4.000	0.0040	0.000	0.0000	0.0040
4.3m Deep (Orifice Invert)	101.80	37	11	0.0	0	159	4.300	0.0040	0.000	0.0000	0.0040
4.7m Deep	102.20	37	15	0.0	0	174	4.700	0.0040	0.358	0.0090	0.0130
5.1m Deep (Overflow Pipe)	102.60	37	15	0.0	0	188	5.100	0.0040	0.757	0.0131	0.0171
Top of Tank	103.00	37	15	0.0	0	203	5.500	0.0040	1.158	0.0162	0.0202

1029-1033 Waterdown Road
Burlington, ON

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

RUNOFF COEFFICIENT CALCULATIONS

Pre

		C-Value
Drainage Area #:	101	
Roof/Building Area (m²):	95	0.95
Asphalt/Conc. Area (m²):	240	0.90
Gravel Area (m²):I		0.80
Grass Area - Pervious (m²):	180	0.25
Total Area (m²):	515	0.68
Impervious	335	**0.65**
Pervious	180	**0.35**
Site	515	

Pre

		C-Value
Drainage Area #:	102	
Roof/Building Area (m²):	140	0.95
Asphalt/Conc. Area (m²):	225	0.90
Gravel Area (m²):I		0.80
Grass Area - Pervious (m²):	1965	0.25
Total Area (m²):	2330	0.35
Impervious	365	**0.16**
Pervious	1965	**0.84**
Site	2330	

Post

		C-Value
Drainage Area #:	201	
Roof/Building Area (m²):	2500	0.95
Asphalt/Conc. Area (m²):	180	0.90
Grass Area - Pervious (m²):	20	0.25
Total Area (m²):	2700	0.94
Impervious	2680	**0.99**
Pervious	20	**0.01**
Site	2700	

Post

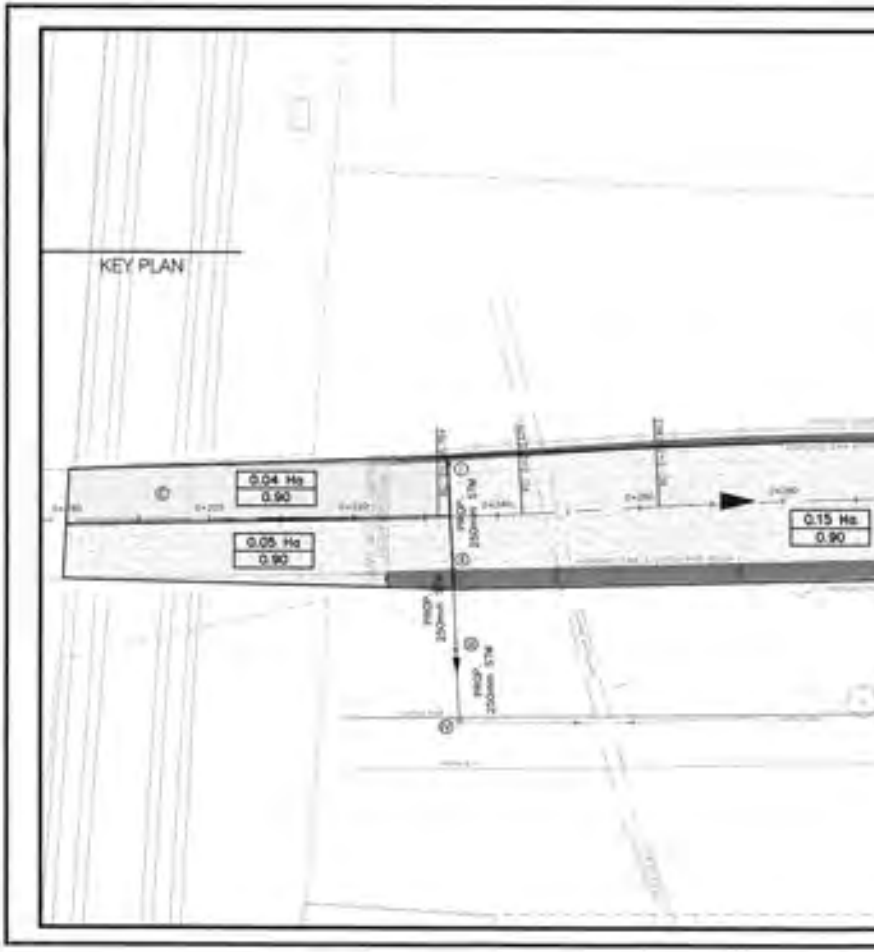
		C-Value
Drainage Area #:	202	
Roof/Building Area (m²):	0	0.95
Asphalt/Conc. Area (m²):	50	0.90
Grass Area - Pervious (m²):	10	0.25
Total Area (m²):	60	0.79
Impervious	50	**0.83**
Pervious	10	**0.17**
Site	60	

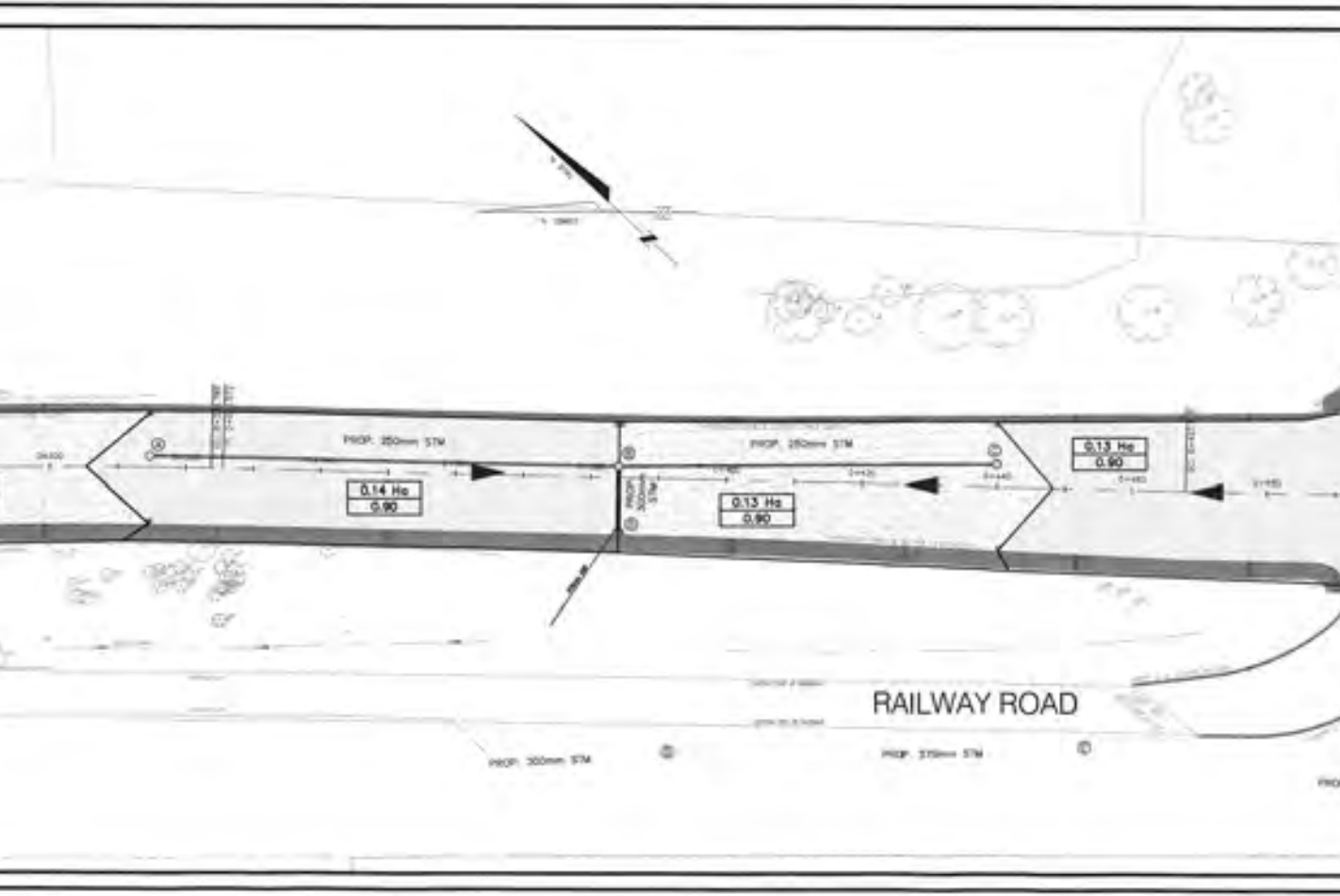
Post

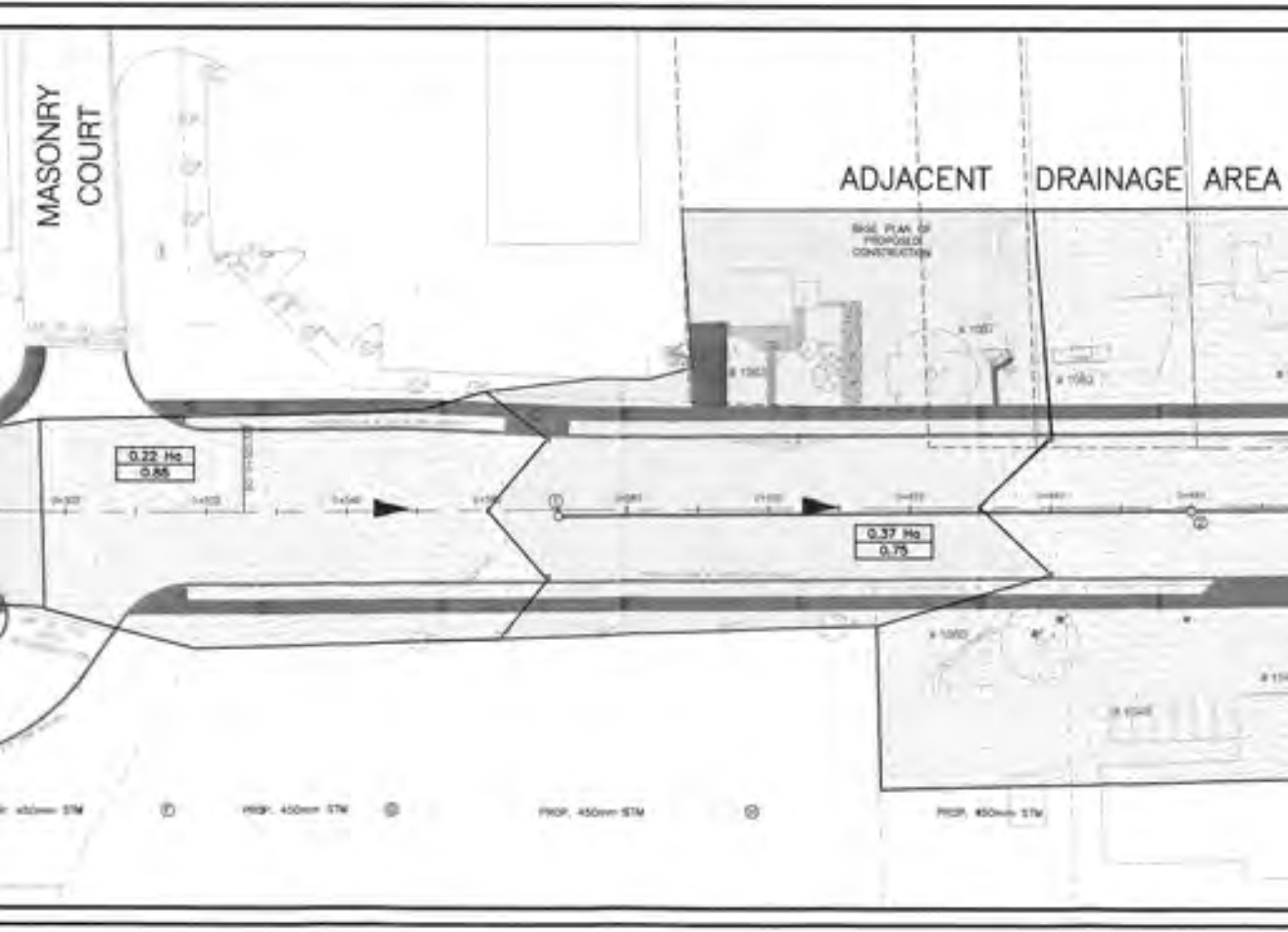
		C-Value
Drainage Area #:	203	
Roof/Building Area (m²):	0	0.95
Asphalt/Conc. Area (m²):	0	0.90
Grass Area - Pervious (m²):	500	0.25
Total Area (m²):	500	0.25
Impervious	0	**0.00**
Pervious	500	**1.00**
Site	500	

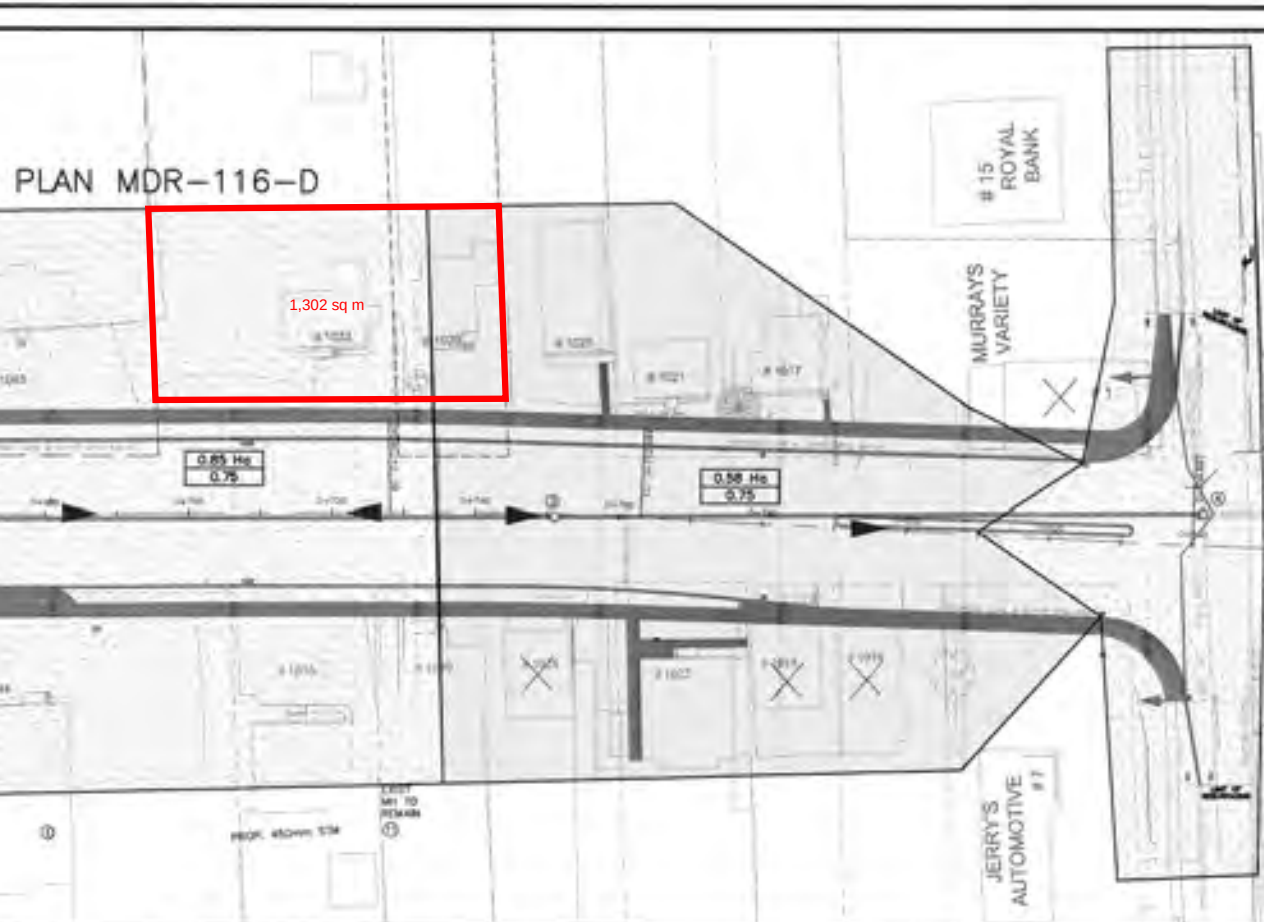
Post

		C-Value
Drainage Area #:	204	
Roof/Building Area (m²):	0	0.95
Asphalt/Conc. Area (m²):	0	0.90
Grass Area - Pervious (m²):	40	0.25
Total Area (m²):	40	0.25
Impervious	0	**0.00**
Pervious	40	**1.00**
Site	40	


KEY PLAN
0.04 Ha
0.90
0.05 Ha
0.90
0.15 Ha
0.90
PROP 250mm STM
PROP 250mm
PROP 250mm STM
0+200
0+280


PROP. 250mm STM
0.14 Ha
0.90
PROP. 300mm STM
PROP. 250mm STM
0+420
0+440
0.13 Ha
0.90
0.13 Ha
0.90
0+460
0+480
RAILWAY ROAD
PROP. 300mm STM
PROP. 375mm STM


MASONRY COURT
ADJACENT DRAINAGE AREA
BASE PLAN OF PROPOSED CONSTRUCTION
0.22 Ha
0.85
0.37 Ha
0.75
450mm STM
PROP. 450mm STM
PROP. 450mm STM
PROP. 450mm STM


PLAN MDR-116-D
1,302 sq m
1033
1029
1025
1021
1017
0.85 Ha
0.75
0.58 Ha
0.75
15
ROYAL
BANK
MURRAYS
VARIETY
JERRY'S
AUTOMOTIVE
7
1016
1027
EXIST
MH TO
REMAIN
①
PROP. 450mm STM

ESSO
0.27 Ha
0.75
PLAINS ROAD

No.	DATE	BY	REVISIONS
2	JULY 08 2014	AKI	ISSUED FOR MOE APPROVAL
1	JUNE 06 2014	AKI	ISSUED FOR COMMENT

DESIGN A. NANAJ CHECKED
DATE JUNE 2014
SCALE HORZ. 1:500
REFERENCES:

APPROVALS
MUNICIPAL
DIRECTOR OF ENGINEERING
Aug 31/14
DATE

STAMP
S. W. HAMILTON
Aug 31/14

CITY OF
Burlington

TITLE
WATERDOWN ROAD
PLAINS ROAD TO CNR OVERPASS
DRAINAGE AREA PLAN

MUNICIPAL DRAWING NO.
MDR-67

CAD FILENAME
W:\2014 CONTRACTS\14-06 WATERDOWN RD\
APRIL 2014 - WATERDOWN ROAD DESIGN.DWG

CONTRACT NO.
14-06

SHEET 1 OF 1

CITY OF BURLINGTON DEPARTMENT OF ENGINEERING

WATERDOWN ROAD	from: Masonry Court	to: Plains Road	PRINT DATE	06-Oct-21
	REQ'D Q = 0.0278 x AVGE C-factor x Intensity x TOTAL Area		DESIGN BY	AXI
10 YEAR STORM DESIGN	RAINFALL Intensity = 798.50 / (TOTAL Time + 5) ^ 0.763		CHECKED BY	

SEWER SECTION LOCATION		+INCREM'T Length	=TOTAL Distance	+INCREM'T Sub Area	=TOTAL Area	Sub Area C-factor	AV'GE C-factor	+INCREM'T Time	=TOTAL Time	RAINFALL Intensity	FLOW REQ'D Q	n = 0.013 PROP. PIPE @		FLOW Q-PIPE	V@GRor V-PIPE
from point	to point	metres	metres	ha	ha	runoff	runoff	min	min	mm/hr	hl/sec	mm-dia	%-slope	hl/sec	m/sec
upstream	downstream	input	auto	input	auto	input	Set Start Time ->		15.00	81.21	auto	input	input	auto	auto
north LIMIT	prop MHS# 1	72.0	72.0	0.22	0.22	0.85	0.85	3.00	18.00	72.99	0.38	OVERLAND		N/A	0.40
prop MHS# 1	prop MHS# 2	91.0	163.0	0.37	0.59	0.75	0.79	0.62	18.62	71.53	0.92	250	4.00	1.24	2.45
prop MHS# 2	prop MHS# 3	91.0	254.0	0.85	1.44	0.75	0.77	0.76	19.38	69.83	2.14	375	1.56	2.28	2.00
prop MHS# 3	prop MHS# 4	72.0	326.0	0.58	2.02	0.75	0.76	0.36	19.74	69.04	2.95	375	4.21	3.75	3.29

```
00001> 2     Metric units
00002> *#*************************************************************************|
00003> *#  Project Name: 1029-1033 WATERDOWN ROAD
00004> *#                BURLINGTON, OMTARIO
00005> *#  JOB NUMBER  : 21089
00006> *#       Date   : NOVEMBER 2021
00007> *#    Revised   :
00008> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00009> *#       File   : 21089.DAT
00010> *#*************************************************************************|
00011> *
00012> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
00013>                     BUR6_002.stm
00014> *
00015> READ STORM          STORM_FILENAME "STORM.001"
00016> *
00017> *#*************************************************************************|
00018> *#
00019> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00020> *#        ============================================
00021> *#
00022> **#************************************************************************|
00023> *# CATCHMENT 101 - EXISTING CONDITIONS (To Waterdown Rd)
00024> CALIB STANDHYD      ID=[1], NHYD=["101"], DT=[1](min), AREA=[0.05](ha),
00025>                     XIMP=[0.65], TIMP=[0.65], DWF=[0](cms), LOSS=[2],
00026>                     SCS curve number CN=[70],
00027>                     Pervious   surfaces: IAper=[10.8](mm), SLPP=[2.0](%),
00028>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00029>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00030>                                          LGI=[10](m), MNI=[0.013], SCI=[0](min),
00031>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00032> *%-----------------|-------------------------------------------------------|
00033> *# CATCHMENT 102 - EXISTING CONDITIONS (To Adjacent East Property)
00034> CALIB NASHYD        ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.23](ha),
00035>                     DWF=[0](cms),  CN/C=[70], IA=[10.8](mm),
00036>                     N=[3], TP=[0.1]hrs,
00037>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00038> *%-----------------|-------------------------------------------------------|
00039> *#*************************************************************************|
00040> *#
00041> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00042> *#        =============================================
00043> *#
00044> **#************************************************************************|
00045> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Waterdown Rd)
00046> CALIB STANDHYD      ID=[3], NHYD=["201"], DT=[1](min), AREA=[0.27](ha),
00047>                     XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
00048>                     SCS curve number CN=[70],
00049>                     Pervious   surfaces: IAper=[10.8](mm), SLPP=[2.0](%),
00050>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00051>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00052>                                          LGI=[10](m), MNI=[0.013], SCI=[0](min),
00053>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00054> *%-----------------|-------------------------------------------------------|
00055> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Waterdown Rd)
00056> CALIB STANDHYD      ID=[4], NHYD=["202"], DT=[1](min), AREA=[0.006](ha),
00057>                     XIMP=[0.83], TIMP=[0.83], DWF=[0](cms), LOSS=[2],
00058>                     SCS curve number CN=[70],
00059>                     Pervious   surfaces: IAper=[10.8](mm), SLPP=[2.0](%),
00060>                                          LGP=[10](m), MNP=[0.250], SCP=[0](min),
00061>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00062>                                          LGI=[10](m), MNI=[0.013], SCI=[0](min),
00063>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00064> *%-----------------|-------------------------------------------------------|
00065> *# CATCHMENT 203 - PROPOSED CONDITIONS (Extrenal Uncontrolled to Waterdown Rd)
```

```
00066> CALIB NASHYD        ID=[5], NHYD=["203"], DT=[1]min, AREA=[0.05](ha),
00067>                     DWF=[0](cms),  CN/C=[70], IA=[10.8](mm),
00068>                     N=[3], TP=[0.1]hrs,
00069>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00070> *%-----------------|-------------------------------------------------------------|
00071> *# CATCHMENT 204 - PROPOSED CONDITIONS (Uncontrolled to Adjacent East Property)
00072> CALIB NASHYD        ID=[6], NHYD=["204"], DT=[1]min, AREA=[0.005](ha),
00073>                     DWF=[0](cms),  CN/C=[70], IA=[10.8](mm),
00074>                     N=[3], TP=[0.1]hrs,
00075>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00076> *%-----------------|-------------------------------------------------------------|
00077> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
00078> *
00079> ROUTE RESERVOIR     IDout=[7],   NHYD=["201"],  IDin=[3],
00080>                     RDT=[1](min),
00081>                           TABLE of ( OUTFLOW-STORAGE ) values
00082>                                     (cms) - (ha-m)
00083>                                      0.0000 , 0.0000
00084>                                      0.0040 , 0.0037
00085>                                      0.0040 , 0.0074
00086>                                      0.0040 , 0.0111
00087>                                      0.0040 , 0.0148
00088>                                      0.0040 , 0.0159
00089>                                      0.0130 , 0.0174
00090>                                      0.0171 , 0.0188
00091>                                      0.0202 , 0.0203
00092>                                      -1  ,  -1    (max twenty pts)
00093>                           IDovf=[8], NHYDovf=["OVF"]
00094> *%-----------------|-------------------------------------------------------------|
00095> ADD HYD             IDsum=[9], NHYD=["Total"], IDs to add=[4+5+7+8]
00096> *%-----------------|-------------------------------------------------------------|
00097> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
00098> *
00099> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
00100>                     BUR6_005.stm
00101> *
00102> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
00103>                     BUR6_010.stm
00104> *
00105> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
00106>                     BUR6_025.stm
00107> *
00108> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
00109>                     BUR6_050.stm
00110> *
00111> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
00112>                     BUR6_100.stm
00113> *
00114> *%-----------------|-------------------------------------------------------------|
00115> FINISH
00116>
00117>
00118>
00119>
00120>
00121>
00122>
00123>
00124>
00125>
00126>
00127>
00128>
00129>
00130>
```

```
00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S  W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>    SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
00008>                                                          9   9  9   9   # 3902680
00009>          StormWater Management HYdrologic Model          999    999    =========
00010>
00011> ********************************************************************************
00012> ***************************** SWMHYMO Ver/4.05  ********************************
00013> *********  A single event and continuous hydrologic simulation model  *********
00014> *********     based on the principles of HYMO and its successors      *********
00015> *********                    OTTHYMO-83 and OTTHYMO-89.                *********
00016> ********************************************************************************
00017> ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
00018> *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019> *********                  Gatineau, Quebec: (819) 243-6858           *********
00020> *********                  E-Mail: swmhymo@jfsa.Com                   *********
00021> ********************************************************************************
00022>
00023> ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024> +++++++++ Licensed user: S. Llewellyn & Associates Ltd                +++++++++
00025> +++++++++                in any City          SERIAL#:3902680       +++++++++
00026> ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028> ********************************************************************************
00029> *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
00030> *********           Maximum value for ID numbers  :     10            *********
00031> *********           Max. number of rainfall points: 105408            *********
00032> *********           Max. number of flow points    : 105408            *********
00033> ********************************************************************************
00034>
00035>
00036> **********************   D E T A I L E D   O U T P U T   **********************
00037> ********************************************************************************
00038> *         DATE: 2021-11-24     TIME: 18:03:02     RUN COUNTER: 000020          *
00039> ********************************************************************************
00040> * Input   filename: T:\projects\21089\SWMHYMO\21089.dat                        *
00041> * Output  filename: T:\projects\21089\SWMHYMO\21089.out                       *
00042> * Summary filename: T:\projects\21089\SWMHYMO\21089.sum                       *
00043> * User comments:                                                             *
00044> * 1:_____________________________________________________________________     *
00045> * 2:_____________________________________________________________________     *
00046> * 3:_____________________________________________________________________     *
00047> ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*****************************************************************************|
00052> *#  Project Name: 1029-1033 WATERDOWN ROAD
00053> *#               BURLINGTON, OMTARIO
00054> *#  JOB NUMBER  : 21089
00055> *#       Date   : NOVEMBER 2021
00056> *#    Revised   :
00057> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00058> *#       File   : 21089.DAT
00059> *#*****************************************************************************|
00060> *
00061>   ** END OF RUN :   1
00062>
00063> ********************************************************************************
00064>
00065>
00066>
00067>
00068>
00069> --------------------
00070> | START            |  Project  dir.: T:\projects\21089\SWMHYMO\
00071> --------------------  Rainfall dir.: T:\projects\21089\SWMHYMO\
00072>     TZERO =   .00 hrs on       0
00073>     METOUT=   2 (output = METRIC)
00074>     NRUN  = 002
00075>     NSTORM=   1
00076>            #  1=BUR6_002.stm
00077> --------------------------------------------------------------------------------
00078> 002:0002--------------------------------------------------------------------------
00079> *#*****************************************************************************|
00080> *#  Project Name: 1029-1033 WATERDOWN ROAD
00081> *#               BURLINGTON, OMTARIO
00082> *#  JOB NUMBER  : 21089
00083> *#       Date   : NOVEMBER 2021
00084> *#    Revised   :
00085> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00086> *#       File   : 21089.DAT
00087> *#*****************************************************************************|
00088> *
00089> --------------------------------------------------------------------------------
00090> 002:0002--------------------------------------------------------------------------
00091> *
00092> --------------------
00093> | READ STORM       |    Filename: Burlington 2-yr 6hr CHICAGO  (A=681.52,
00094> | Ptotal=  40.93 mm|    Comments: Burlington 2-yr 6hr CHICAGO  (A=681.52,
00095> --------------------
00096>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00097>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00098>                .17   1.715 |   1.67   8.325 |   3.17   4.467 |   4.67   2.213
00099>                .33   1.858 |   1.83  19.646 |   3.33   3.978 |   4.83   2.105
00100>                .50   2.032 |   2.00  78.391 |   3.50   3.595 |   5.00   2.008
00101>                .67   2.247 |   2.17  25.776 |   3.67   3.286 |   5.17   1.920
00102>                .83   2.522 |   2.33  13.777 |   3.83   3.030 |   5.33   1.841
00103>               1.00   2.888 |   2.50   9.511 |   4.00   2.815 |   5.50   1.769
00104>               1.17   3.399 |   2.67   7.331 |   4.17   2.632 |   5.67   1.703
00105>               1.33   4.172 |   2.83   6.005 |   4.33   2.474 |   5.83   1.642
00106>               1.50   5.492 |   3.00   5.111 |   4.50   2.335 |   6.00   1.586
00107>
00108> --------------------------------------------------------------------------------
00109> 002:0003--------------------------------------------------------------------------
00110> *
00111> *#*****************************************************************************|
00112> *#
00113> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00114> *#        ============================================
00115> *#
00116> **#*****************************************************************************|
00117> *# CATCHMENT 101 - EXISTING CONDITIONS (To Waterdown Rd)
00118> ----------------------
00119> | CALIB STANDHYD     |   Area    (ha)=     .05
00120> | 01:101    DT= 1.00 |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
00121> ----------------------
00122>                              IMPERVIOUS    PERVIOUS (i)
00123>      Surface Area     (ha)=        .03          .02
00124>      Dep. Storage     (mm)=       1.00        10.80
00125>      Average Slope     (%)=       2.00         2.00
00126>      Length            (m)=      10.00        10.00
00127>      Mannings n            =       .013         .250
00128>
00129>      Max.eff.Inten.(mm/hr)=      78.39         8.00
00130>                   over (min)        1.00         9.00
00131>      Storage Coeff.  (min)=        .57 (ii)    9.01 (ii)
00132>      Unit Hyd. Tpeak (min)=       1.00         9.00
00133>      Unit Hyd. peak  (cms)=       1.40          .13
00134>                                                          *TOTALS*
00135>      PEAK FLOW       (cms)=        .01          .00          .007 (iii)
00136>      TIME TO PEAK    (hrs)=       1.95         2.18         2.000
00137>      RUNOFF VOLUME    (mm)=      39.93         6.53        28.243
00138>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00139>      RUNOFF COEFFICIENT   =        .98          .16          .690
00140>
00141>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00142>            CN* =  70.0    Ia = Dep. Storage  (Above)
00143>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00144>            THAN THE STORAGE COEFFICIENT.
00145>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00146>
00147> --------------------------------------------------------------------------------
00148> 002:0004--------------------------------------------------------------------------
00149> *# CATCHMENT 102 - EXISTING CONDITIONS (To Adjacent East Property)
00150> ----------------------
00151> | CALIB NASHYD       |   Area    (ha)=     .23   Curve Number   (CN)=70.00
00152> | 02:102    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
00153> ----------------------   U.H. Tp(hrs)=    .100
00154>
00155>      Unit Hyd Qpeak  (cms)=     .088
00156>
00157>      PEAK FLOW       (cms)=     .004 (i)
00158>      TIME TO PEAK    (hrs)=    2.100
00159>      RUNOFF VOLUME    (mm)=    6.532
00160>      TOTAL RAINFALL   (mm)=   40.933
00161>      RUNOFF COEFFICIENT   =     .160
00162>
00163>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00164>
00165> --------------------------------------------------------------------------------
00166> 002:0005--------------------------------------------------------------------------
00167> *#*****************************************************************************|
00168> *#
00169> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00170> *#        ==============================================
00171> *#
00172> **#*****************************************************************************|
00173> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Waterdown Rd)
00174> ----------------------
00175> | CALIB STANDHYD     |   Area    (ha)=     .27
00176> | 03:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00177> ----------------------
00178>                              IMPERVIOUS    PERVIOUS (i)
00179>      Surface Area     (ha)=        .27          .00
00180>      Dep. Storage     (mm)=       1.00        10.80
00181>      Average Slope     (%)=       2.00         2.00
00182>      Length            (m)=      10.00        10.00
00183>      Mannings n            =       .013         .250
00184>
00185>      Max.eff.Inten.(mm/hr)=      78.39         8.00
00186>                   over (min)        1.00         9.00
00187>      Storage Coeff.  (min)=        .57 (ii)    9.01 (ii)
00188>      Unit Hyd. Tpeak (min)=       1.00         9.00
00189>      Unit Hyd. peak  (cms)=       1.40          .13
00190>                                                          *TOTALS*
00191>      PEAK FLOW       (cms)=        .06          .00          .058 (iii)
00192>      TIME TO PEAK    (hrs)=       1.97         2.18         2.000
00193>      RUNOFF VOLUME    (mm)=      39.93         6.53        39.599
00194>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00195>      RUNOFF COEFFICIENT   =        .98          .16          .967
00196>
00197>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00198>            CN* =  70.0    Ia = Dep. Storage  (Above)
00199>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00200>            THAN THE STORAGE COEFFICIENT.
00201>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00202>
00203> --------------------------------------------------------------------------------
00204> 002:0006--------------------------------------------------------------------------
00205> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Waterdown Rd)
00206> ----------------------
00207> | CALIB STANDHYD     |   Area    (ha)=     .01
00208> | 04:202    DT= 1.00 |   Total Imp(%)=   83.00   Dir. Conn.(%)=   83.00
00209> ----------------------
00210>                              IMPERVIOUS    PERVIOUS (i)
00211>      Surface Area     (ha)=        .00          .00
00212>      Dep. Storage     (mm)=       1.00        10.80
00213>      Average Slope     (%)=       2.00         2.00
00214>      Length            (m)=      10.00        10.00
00215>      Mannings n            =       .013         .250
00216>
00217>      Max.eff.Inten.(mm/hr)=      78.39         8.00
00218>                   over (min)        1.00         9.00
00219>      Storage Coeff.  (min)=        .57 (ii)    9.01 (ii)
00220>      Unit Hyd. Tpeak (min)=       1.00         9.00
00221>      Unit Hyd. peak  (cms)=       1.40          .13
00222>                                                          *TOTALS*
00223>      PEAK FLOW       (cms)=        .00          .00          .001 (iii)
00224>      TIME TO PEAK    (hrs)=       1.93         2.18         2.000
00225>      RUNOFF VOLUME    (mm)=      39.93         6.53        34.254
00226>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00227>      RUNOFF COEFFICIENT   =        .98          .16          .837
00228>
00229>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00230>            CN* =  70.0    Ia = Dep. Storage  (Above)
00231>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00232>            THAN THE STORAGE COEFFICIENT.
00233>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00234>
00235> --------------------------------------------------------------------------------
00236> 002:0007--------------------------------------------------------------------------
00237> *# CATCHMENT 203 - PROPOSED CONDITIONS (Extrenal Uncontrolled to Waterdown Rd)
00238> ----------------------
00239> | CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=70.00
00240> | 05:203    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
00241> ----------------------   U.H. Tp(hrs)=    .100
00242>
00243>      Unit Hyd Qpeak  (cms)=     .019
00244>
00245>      PEAK FLOW       (cms)=     .001 (i)
00246>      TIME TO PEAK    (hrs)=    2.100
00247>      RUNOFF VOLUME    (mm)=    6.528
00248>      TOTAL RAINFALL   (mm)=   40.933
00249>      RUNOFF COEFFICIENT   =     .159
00250>
00251>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00252>
00253> --------------------------------------------------------------------------------
00254> 002:0008--------------------------------------------------------------------------
00255> *# CATCHMENT 204 - PROPOSED CONDITIONS (Uncontrolled to Adjacent East Property)
00256> ----------------------
00257> | CALIB NASHYD       |   Area    (ha)=     .00   Curve Number   (CN)=70.00
00258> | 06:204    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
00259> ----------------------   U.H. Tp(hrs)=    .100
00260>
00261>      Unit Hyd Qpeak  (cms)=     .002
00262>
00263>      PEAK FLOW       (cms)=     .000 (i)
00264>      TIME TO PEAK    (hrs)=    2.100
00265>      RUNOFF VOLUME    (mm)=    6.451
00266>      TOTAL RAINFALL   (mm)=   40.933
00267>      RUNOFF COEFFICIENT   =     .158
00268>
00269>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00270>
```

```
00271> ------------------------------------------------------------------------------
00272> 002:0009-------------------------------------------------------------------
00273> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
00274> *
00275> ---------------------
00276> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00277> |  IN>03:(201   )   |
00278> | OUT<07:(201   )   |    =========  OUTLFOW STORAGE TABLE  =========
00279> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00280>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00281>                             .000  .0000E+00   |     .004  .1590E-01
00282>                             .004  .3700E-02   |     .013  .1740E-01
00283>                             .004  .7400E-02   |     .017  .1880E-01
00284>                             .004  .1110E-01   |     .020  .2030E-01
00285>                             .004  .1480E-01   |     .000  .0000E+00
00286>
00287>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00288>     --------------------       (ha)     (cms)     (hrs)       (mm)
00289>     INFLOW >03: (201   )        .27      .058     2.000     39.599
00290>     OUTFLOW<07: (201   )        .27      .004     1.950     39.598
00291>    OVERFLOW<08: (OVF   )        .00      .000      .000       .000
00292>
00293>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00294>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00295>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00296>
00297>
00298>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    6.871
00299>                    TIME SHIFT OF PEAK FLOW         (min)=    -3.00
00300>                    MAXIMUM  STORAGE   USED       (ha.m.)=.6741E-02
00301>
00302> ------------------------------------------------------------------------------
00303> 002:0010-------------------------------------------------------------------
00304> ----------------------
00305> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00306> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00307>                         ID1 04:202          .01      .001    2.00  34.25    .000
00308>                        +ID2 05:203          .05      .001    2.10   6.53    .000
00309>                        +ID3 07:201          .27      .004    1.95  39.60    .000
00310>                        +ID4 08:OVF          .00      .000     .00    .00    .000
00311>                         ================================================================
00312>                         SUM 09:Total          .33     .006    2.00  34.43    .000
00313>
00314>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00315>
00316> ------------------------------------------------------------------------------
00317> 002:0011-------------------------------------------------------------------
00318> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
00319> *
00320>   ** END OF RUN :   4
00321>
00322> ********************************************************************************
00323>
00324>
00325>
00326>
00327>
00328> --------------------
00329> | START            |  Project  dir.: T:\projects\21089\SWMHYMO\
00330> --------------------  Rainfall dir.: T:\projects\21089\SWMHYMO\
00331>     TZERO =   .00 hrs on        0
00332>     METOUT=   2 (output = METRIC)
00333>     NRUN  = 005
00334>     NSTORM=   1
00335>               #  1=BUR6_005.stm
00336> ------------------------------------------------------------------------------
00337> 005:0002-------------------------------------------------------------------
00338> *#*************************************************************************|
00339> *#  Project Name: 1029-1033 WATERDOWN ROAD
00340> *#               BURLINGTON, OMTARIO
00341> *#  JOB NUMBER  : 21089
00342> *#       Date   : NOVEMBER 2021
00343> *#    Revised   :
00344> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00345> *#       File   : 21089.DAT
00346> *#*************************************************************************|
00347> *
00348> ------------------------------------------------------------------------------
00349> 005:0002-------------------------------------------------------------------
00350> *
00351> --------------------
00352> | READ STORM       |    Filename: Burlington 5-yr 6hr CHICAGO    (A=802.04
00353> | Ptotal=  53.05 mm|    Comments: Burlington 5-yr 6hr CHICAGO    (A=802.04
00354> --------------------
00355>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00356>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00357>                .17   2.348 |   1.67  10.690 |   3.17   5.897 |   4.67   3.004
00358>                .33   2.537 |   1.83  24.479 |   3.33   5.279 |   4.83   2.862
00359>                .50   2.766 |   2.00 101.312 |   3.50   4.790 |   5.00   2.734
00360>                .67   3.048 |   2.17  31.941 |   3.67   4.394 |   5.17   2.619
00361>                .83   3.407 |   2.33  17.333 |   3.83   4.065 |   5.33   2.514
00362>               1.00   3.881 |   2.50  12.145 |   4.00   3.788 |   5.50   2.419
00363>               1.17   4.539 |   2.67   9.469 |   4.17   3.550 |   5.67   2.331
00364>               1.33   5.523 |   2.83   7.826 |   4.33   3.344 |   5.83   2.251
00365>               1.50   7.185 |   3.00   6.709 |   4.50   3.164 |   6.00   2.176
00366>
00367> ------------------------------------------------------------------------------
00368> 005:0003-------------------------------------------------------------------
00369> *
00370> *#*************************************************************************|
00371> *#
00372> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00373> *#        ============================================
00374> *#
00375> **#*************************************************************************|
00376> *# CATCHMENT 101 - EXISTING CONDITIONS (To Waterdown Rd)
00377> ----------------------
00378> | CALIB STANDHYD     |   Area    (ha)=     .05
00379> | 01:101    DT= 1.00 |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
00380> ----------------------
00381>                              IMPERVIOUS    PERVIOUS (i)
00382>      Surface Area     (ha)=        .03          .02
00383>      Dep. Storage     (mm)=       1.00        10.80
00384>      Average Slope     (%)=       2.00         2.00
00385>      Length            (m)=      10.00        10.00
00386>      Mannings n            =       .013         .250
00387>
00388>      Max.eff.Inten.(mm/hr)=     101.31        19.99
00389>                   over (min)       1.00         6.00
00390>      Storage Coeff.  (min)=        .52 (ii)    6.37 (ii)
00391>      Unit Hyd. Tpeak (min)=       1.00         6.00
00392>      Unit Hyd. peak  (cms)=       1.45          .18
00393>                                                          *TOTALS*
00394>      PEAK FLOW       (cms)=        .01          .00          .010 (iii)
00395>      TIME TO PEAK    (hrs)=       1.95         2.07         2.000
00396>      RUNOFF VOLUME    (mm)=      52.05        11.81        37.970
00397>      TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
00398>      RUNOFF COEFFICIENT   =        .98          .22          .716
00399>
00400>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00401>            CN* =  70.0    Ia = Dep. Storage  (Above)
00402>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00403>            THAN THE STORAGE COEFFICIENT.
00404>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00405>
00406> ------------------------------------------------------------------------------
00407> 005:0004-------------------------------------------------------------------
00408> *# CATCHMENT 102 - EXISTING CONDITIONS (To Adjacent East Property)
00409> ----------------------
00410> | CALIB NASHYD       |   Area    (ha)=     .23   Curve Number   (CN)=70.00
00411> | 02:102    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
00412> ----------------------   U.H. Tp(hrs)=    .100
00413>
00414>      Unit Hyd Qpeak  (cms)=     .088
00415>
00416>      PEAK FLOW       (cms)=     .008 (i)
00417>      TIME TO PEAK    (hrs)=    2.083
00418>      RUNOFF VOLUME    (mm)=   11.814
00419>      TOTAL RAINFALL   (mm)=   53.053
00420>      RUNOFF COEFFICIENT   =     .223
00421>
00422>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00423>
00424> ------------------------------------------------------------------------------
00425> 005:0005-------------------------------------------------------------------
00426> *#*************************************************************************|
00427> *#
00428> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00429> *#        ==============================================
00430> *#
00431> **#*************************************************************************|
00432> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Waterdown Rd)
00433> ----------------------
00434> | CALIB STANDHYD     |   Area    (ha)=     .27
00435> | 03:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00436> ----------------------
00437>                              IMPERVIOUS    PERVIOUS (i)
00438>      Surface Area     (ha)=        .27          .00
00439>      Dep. Storage     (mm)=       1.00        10.80
00440>      Average Slope     (%)=       2.00         2.00
00441>      Length            (m)=      10.00        10.00
00442>      Mannings n            =       .013         .250
00443>
00444>      Max.eff.Inten.(mm/hr)=     101.31        19.99
00445>                   over (min)       1.00         6.00
00446>      Storage Coeff.  (min)=        .52 (ii)    6.37 (ii)
00447>      Unit Hyd. Tpeak (min)=       1.00         6.00
00448>      Unit Hyd. peak  (cms)=       1.45          .18
00449>                                                          *TOTALS*
00450>      PEAK FLOW       (cms)=        .08          .00          .075 (iii)
00451>      TIME TO PEAK    (hrs)=       1.97         2.07         2.000
00452>      RUNOFF VOLUME    (mm)=      52.05        11.81        51.651
00453>      TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
00454>      RUNOFF COEFFICIENT   =        .98          .22          .974
00455>
00456>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00457>            CN* =  70.0    Ia = Dep. Storage  (Above)
00458>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00459>            THAN THE STORAGE COEFFICIENT.
00460>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00461>
00462> ------------------------------------------------------------------------------
00463> 005:0006-------------------------------------------------------------------
00464> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Waterdown Rd)
00465> ----------------------
00466> | CALIB STANDHYD     |   Area    (ha)=     .01
00467> | 04:202    DT= 1.00 |   Total Imp(%)=   83.00   Dir. Conn.(%)=   83.00
00468> ----------------------
00469>                              IMPERVIOUS    PERVIOUS (i)
00470>      Surface Area     (ha)=        .00          .00
00471>      Dep. Storage     (mm)=       1.00        10.80
00472>      Average Slope     (%)=       2.00         2.00
00473>      Length            (m)=      10.00        10.00
00474>      Mannings n            =       .013         .250
00475>
00476>      Max.eff.Inten.(mm/hr)=     101.31        19.99
00477>                   over (min)       1.00         6.00
00478>      Storage Coeff.  (min)=        .52 (ii)    6.37 (ii)
00479>      Unit Hyd. Tpeak (min)=       1.00         6.00
00480>      Unit Hyd. peak  (cms)=       1.45          .18
00481>                                                          *TOTALS*
00482>      PEAK FLOW       (cms)=        .00          .00          .001 (iii)
00483>      TIME TO PEAK    (hrs)=       1.93         2.07         2.000
00484>      RUNOFF VOLUME    (mm)=      52.05        11.81        45.212
00485>      TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
00486>      RUNOFF COEFFICIENT   =        .98          .22          .852
00487>
00488>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00489>            CN* =  70.0    Ia = Dep. Storage  (Above)
00490>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00491>            THAN THE STORAGE COEFFICIENT.
00492>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00493>
00494> ------------------------------------------------------------------------------
00495> 005:0007-------------------------------------------------------------------
00496> *# CATCHMENT 203 - PROPOSED CONDITIONS (Extrenal Uncontrolled to Waterdown Rd)
00497> ----------------------
00498> | CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=70.00
00499> | 05:203    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
00500> ----------------------   U.H. Tp(hrs)=    .100
00501>
00502>      Unit Hyd Qpeak  (cms)=     .019
00503>
00504>      PEAK FLOW       (cms)=     .002 (i)
00505>      TIME TO PEAK    (hrs)=    2.083
00506>      RUNOFF VOLUME    (mm)=   11.811
00507>      TOTAL RAINFALL   (mm)=   53.053
00508>      RUNOFF COEFFICIENT   =     .223
00509>
00510>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00511>
00512> ------------------------------------------------------------------------------
00513> 005:0008-------------------------------------------------------------------
00514> *# CATCHMENT 204 - PROPOSED CONDITIONS (Uncontrolled to Adjacent East Property)
00515> ----------------------
00516> | CALIB NASHYD       |   Area    (ha)=     .00   Curve Number   (CN)=70.00
00517> | 06:204    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
00518> ----------------------   U.H. Tp(hrs)=    .100
00519>
00520>      Unit Hyd Qpeak  (cms)=     .002
00521>
00522>      PEAK FLOW       (cms)=     .000 (i)
00523>      TIME TO PEAK    (hrs)=    2.083
00524>      RUNOFF VOLUME    (mm)=   11.751
00525>      TOTAL RAINFALL   (mm)=   53.053
00526>      RUNOFF COEFFICIENT   =     .222
00527>
00528>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00529>
00530> ------------------------------------------------------------------------------
00531> 005:0009-------------------------------------------------------------------
00532> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
00533> *
00534> ---------------------
00535> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00536> |  IN>03:(201   )   |
00537> | OUT<07:(201   )   |    =========  OUTLFOW STORAGE TABLE  =========
00538> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00539>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00540>                             .000  .0000E+00   |     .004  .1590E-01
```

```
                              .004  .3700E-02   |     .013  .1740E-01
                              .004  .7400E-02   |     .017  .1880E-01
                              .004  .1110E-01   |     .020  .2030E-01
                              .004  .1480E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (201   )        .27      .075     2.000     51.651
     OUTFLOW<07: (201   )        .27      .004     1.900     51.650
    OVERFLOW<08: (OVF   )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    5.313
                    TIME SHIFT OF PEAK FLOW         (min)=    -6.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.9147E-02
```

```
005:0010----------------------------------------------------------------------
----------------------
| ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 04:202             .01     .001    2.00  45.21    .000
                      +ID2 05:203             .05     .002    2.08  11.81    .000
                      +ID3 07:201             .27     .004    1.90  51.65    .000
                      +ID4 08:OVF             .00     .000     .00    .00    .000
                       ============================================================
                       SUM 09:Total           .33     .007    2.00  45.42    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
005:0011----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
*
----------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*
  ** END OF RUN :   9
```

```
**********************************************************************
```

```
----------------------
| START            |  Project  dir.: T:\projects\21089\SWMHYMO\
----------------------  Rainfall dir.: T:\projects\21089\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
             #  1=BUR6_010.stm
----------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 1029-1033 WATERDOWN ROAD
*#               BURLINGTON, OMTARIO
*#  JOB NUMBER  : 21089
*#       Date   : NOVEMBER 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21089.DAT
*#*****************************************************************************|
*
----------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*
----------------------
| READ STORM       |    Filename: Burlington 10-yr 6hr CHICAGO     (A=918.
| Ptotal=  61.10 mm|    Comments: Burlington 10-yr 6hr CHICAGO     (A=918.
----------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   2.714 |   1.67  12.326 |   3.17   6.808 |   4.67   3.472
               .33   2.933 |   1.83  28.176 |   3.33   6.095 |   4.83   3.308
               .50   3.197 |   2.00 116.310 |   3.50   5.532 |   5.00   3.161
               .67   3.523 |   2.17  36.748 |   3.67   5.075 |   5.17   3.027
               .83   3.937 |   2.33  19.967 |   3.83   4.696 |   5.33   2.907
              1.00   4.483 |   2.50  14.001 |   4.00   4.376 |   5.50   2.796
              1.17   5.242 |   2.67  10.921 |   4.17   4.102 |   5.67   2.695
              1.33   6.377 |   2.83   9.030 |   4.33   3.864 |   5.83   2.602
              1.50   8.291 |   3.00   7.743 |   4.50   3.656 |   6.00   2.516

----------------------------------------------------------------------
010:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS (To Waterdown Rd)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .05
| 01:101    DT= 1.00 |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .03          .02
     Dep. Storage     (mm)=       1.00         10.80
     Average Slope     (%)=       2.00          2.00
     Length            (m)=      10.00         10.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=     116.31        28.14
                   over (min)        1.00         6.00
     Storage Coeff.  (min)=        .49 (ii)    5.59 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.48          .20
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .011 (iii)
     TIME TO PEAK    (hrs)=       1.98         2.07         2.000
     RUNOFF VOLUME    (mm)=      60.10        15.90        44.630
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .26          .730

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
----------------------------------------------------------------------
010:0004----------------------------------------------------------------------
*# CATCHMENT 102 - EXISTING CONDITIONS (To Adjacent East Property)
----------------------
| CALIB NASHYD       |   Area    (ha)=     .23   Curve Number   (CN)=70.00
| 02:102    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .088

     PEAK FLOW       (cms)=     .012 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   15.897
     TOTAL RAINFALL   (mm)=   61.101
     RUNOFF COEFFICIENT   =     .260

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------
010:0005----------------------------------------------------------------------
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Waterdown Rd)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .27
| 03:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .27          .00
     Dep. Storage     (mm)=       1.00        10.80
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      10.00        10.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=     116.31        28.14
                   over (min)        1.00         6.00
     Storage Coeff.  (min)=        .49 (ii)    5.59 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.48          .20
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .09          .00          .086 (iii)
     TIME TO PEAK    (hrs)=       1.98         2.07         2.000
     RUNOFF VOLUME    (mm)=      60.10        15.90        59.659
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .26          .976

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
----------------------------------------------------------------------
010:0006----------------------------------------------------------------------
*# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Waterdown Rd)
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .01
| 04:202    DT= 1.00 |   Total Imp(%)=   83.00   Dir. Conn.(%)=   83.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .00          .00
     Dep. Storage     (mm)=       1.00        10.80
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      10.00        10.00
     Mannings n             =     .013          .250

     Max.eff.Inten.(mm/hr)=     116.31        28.14
                   over (min)        1.00         6.00
     Storage Coeff.  (min)=        .49 (ii)    5.59 (ii)
     Unit Hyd. Tpeak (min)=       1.00         6.00
     Unit Hyd. peak  (cms)=       1.48          .20
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .002 (iii)
     TIME TO PEAK    (hrs)=       1.93         2.07         2.000
     RUNOFF VOLUME    (mm)=      60.10        15.90        52.586
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .26          .861

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
----------------------------------------------------------------------
010:0007----------------------------------------------------------------------
*# CATCHMENT 203 - PROPOSED CONDITIONS (Extrenal Uncontrolled to Waterdown Rd)
----------------------
| CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=70.00
| 05:203    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .019

     PEAK FLOW       (cms)=     .003 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   15.894
     TOTAL RAINFALL   (mm)=   61.101
     RUNOFF COEFFICIENT   =     .260

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------
010:0008----------------------------------------------------------------------
*# CATCHMENT 204 - PROPOSED CONDITIONS (Uncontrolled to Adjacent East Property)
----------------------
| CALIB NASHYD       |   Area    (ha)=     .00   Curve Number   (CN)=70.00
| 06:204    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .002

     PEAK FLOW       (cms)=     .000 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   15.843
     TOTAL RAINFALL   (mm)=   61.101
     RUNOFF COEFFICIENT   =     .259

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------
010:0009----------------------------------------------------------------------
*# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
*
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>03:(201   )    |
| OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00    |     .004  .1590E-01
                             .004  .3700E-02    |     .013  .1740E-01
                             .004  .7400E-02    |     .017  .1880E-01
                             .004  .1110E-01    |     .020  .2030E-01
                             .004  .1480E-01    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (201   )        .27      .086     2.000     59.659
```

```
00811>     OUTFLOW<07: (201   )        .27      .004     1.883     59.659
00812>    OVERFLOW<08: (OVF   )        .00      .000      .000       .000
00813>
00814>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00815>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00816>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00817>
00818>
00819>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.626
00820>                    TIME SHIFT OF PEAK FLOW         (min)=    -7.00
00821>                    MAXIMUM  STORAGE   USED       (ha.m.)=.1087E-01
00822>
00823> --------------------------------------------------------------------------------
00824> 010:0010----------------------------------------------------------------------
00825> ----------------------
00826> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00827> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00828>                        ID1 04:202            .01     .002    2.00  52.59    .000
00829>                       +ID2 05:203            .05     .003    2.07  15.89    .000
00830>                       +ID3 07:201            .27     .004    1.88  59.66    .000
00831>                       +ID4 08:OVF            .00     .000     .00    .00    .000
00832>                        ==========================================================
00833>                        SUM 09:Total           .33     .008    2.00  52.82    .000
00834>
00835>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00836>
00837> --------------------------------------------------------------------------------
00838> 010:0011----------------------------------------------------------------------
00839> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
00840> *
00841> --------------------------------------------------------------------------------
00842> 010:0002----------------------------------------------------------------------
00843> *
00844> --------------------------------------------------------------------------------
00845> 010:0002----------------------------------------------------------------------
00846> *
00847>   ** END OF RUN :  24
00848>
00849> ****************************************************************************
00850>
00851>
00852>
00853>
00854>
00855> --------------------
00856> | START            |  Project  dir.: T:\projects\21089\SWMHYMO\
00857> --------------------  Rainfall dir.: T:\projects\21089\SWMHYMO\
00858>     TZERO =   .00 hrs on      0
00859>     METOUT=   2 (output = METRIC)
00860>     NRUN  = 025
00861>     NSTORM=   1
00862>            #  1=BUR6_025.stm
00863> --------------------------------------------------------------------------------
00864> 025:0002----------------------------------------------------------------------
00865> *#*************************************************************************|
00866> *#  Project Name: 1029-1033 WATERDOWN ROAD
00867> *#                BURLINGTON, OMTARIO
00868> *#  JOB NUMBER  : 21089
00869> *#       Date   : NOVEMBER 2021
00870> *#    Revised   :
00871> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00872> *#       File   : 21089.DAT
00873> *#*************************************************************************|
00874> *
00875> --------------------------------------------------------------------------------
00876> 025:0002----------------------------------------------------------------------
00877> *
00878> --------------------
00879> | READ STORM       |    Filename: Burlington 25-yr 6hr CHICAGO      (A=106
00880> | Ptotal=  71.35 mm|    Comments: Burlington 25-yr 6hr CHICAGO      (A=106
00881> --------------------
00882>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00883>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00884>                .17   3.182 |   1.67  14.410 |   3.17   7.968 |   4.67   4.068
00885>                .33   3.437 |   1.83  32.881 |   3.33   7.135 |   4.83   3.876
00886>                .50   3.746 |   2.00 135.380 |   3.50   6.477 |   5.00   3.704
00887>                .67   4.128 |   2.17  42.866 |   3.67   5.943 |   5.17   3.548
00888>                .83   4.612 |   2.33  23.321 |   3.83   5.499 |   5.33   3.407
00889>               1.00   5.251 |   2.50  16.365 |   4.00   5.125 |   5.50   3.278
00890>               1.17   6.138 |   2.67  12.771 |   4.17   4.805 |   5.67   3.160
00891>               1.33   7.465 |   2.83  10.563 |   4.33   4.527 |   5.83   3.051
00892>               1.50   9.700 |   3.00   9.061 |   4.50   4.284 |   6.00   2.950
00893>
00894> --------------------------------------------------------------------------------
00895> 025:0003----------------------------------------------------------------------
00896> *
00897> *#*************************************************************************|
00898> *#
00899> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00900> *#        ============================================
00901> *#
00902> **#***********************************************************************|
00903> *# CATCHMENT 101 - EXISTING CONDITIONS (To Waterdown Rd)
00904> ----------------------
00905> | CALIB STANDHYD     |   Area    (ha)=     .05
00906> | 01:101    DT= 1.00 |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
00907> ----------------------
00908>                              IMPERVIOUS    PERVIOUS (i)
00909>      Surface Area     (ha)=        .03          .02
00910>      Dep. Storage     (mm)=       1.00        10.80
00911>      Average Slope     (%)=       2.00         2.00
00912>      Length            (m)=      10.00        10.00
00913>      Mannings n            =       .013         .250
00914>
00915>      Max.eff.Inten.(mm/hr)=     135.38        41.44
00916>                    over (min)        1.00         5.00
00917>      Storage Coeff.  (min)=        .46 (ii)    4.83 (ii)
00918>      Unit Hyd. Tpeak (min)=       1.00         5.00
00919>      Unit Hyd. peak  (cms)=       1.50          .23
00920>                                                          *TOTALS*
00921>      PEAK FLOW       (cms)=        .01          .00          .013 (iii)
00922>      TIME TO PEAK    (hrs)=       1.93         2.05         2.000
00923>      RUNOFF VOLUME    (mm)=      70.35        21.64        53.299
00924>      TOTAL RAINFALL   (mm)=      71.35        71.35        71.347
00925>      RUNOFF COEFFICIENT   =        .99          .30          .747
00926>
00927>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00928>            CN* =  70.0    Ia = Dep. Storage  (Above)
00929>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00930>            THAN THE STORAGE COEFFICIENT.
00931>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00932>
00933> --------------------------------------------------------------------------------
00934> 025:0004----------------------------------------------------------------------
00935> *# CATCHMENT 102 - EXISTING CONDITIONS (To Adjacent East Property)
00936> ----------------------
00937> | CALIB NASHYD       |   Area    (ha)=     .23   Curve Number   (CN)=70.00
00938> | 02:102    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
00939> ----------------------   U.H. Tp(hrs)=    .100
00940>
00941>      Unit Hyd Qpeak  (cms)=     .088
00942>
00943>      PEAK FLOW       (cms)=     .017 (i)
00944>      TIME TO PEAK    (hrs)=    2.067
00945>      RUNOFF VOLUME    (mm)=   21.639
00946>      TOTAL RAINFALL   (mm)=   71.347
00947>      RUNOFF COEFFICIENT   =     .303
00948>
00949>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00950>
00951> --------------------------------------------------------------------------------
00952> 025:0005----------------------------------------------------------------------
00953> *#*************************************************************************|
00954> *#
00955> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00956> *#        ==============================================
00957> *#
00958> **#***********************************************************************|
00959> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Waterdown Rd)
00960> ----------------------
00961> | CALIB STANDHYD     |   Area    (ha)=     .27
00962> | 03:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00963> ----------------------
00964>                              IMPERVIOUS    PERVIOUS (i)
00965>      Surface Area     (ha)=        .27          .00
00966>      Dep. Storage     (mm)=       1.00        10.80
00967>      Average Slope     (%)=       2.00         2.00
00968>      Length            (m)=      10.00        10.00
00969>      Mannings n            =       .013         .250
00970>
00971>      Max.eff.Inten.(mm/hr)=     135.38        41.44
00972>                    over (min)        1.00         5.00
00973>      Storage Coeff.  (min)=        .46 (ii)    4.83 (ii)
00974>      Unit Hyd. Tpeak (min)=       1.00         5.00
00975>      Unit Hyd. peak  (cms)=       1.50          .23
00976>                                                          *TOTALS*
00977>      PEAK FLOW       (cms)=        .10          .00          .101 (iii)
00978>      TIME TO PEAK    (hrs)=       1.95         2.05         2.000
00979>      RUNOFF VOLUME    (mm)=      70.35        21.64        69.860
00980>      TOTAL RAINFALL   (mm)=      71.35        71.35        71.347
00981>      RUNOFF COEFFICIENT   =        .99          .30          .979
00982>
00983>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00984>            CN* =  70.0    Ia = Dep. Storage  (Above)
00985>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00986>            THAN THE STORAGE COEFFICIENT.
00987>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00988>
00989> --------------------------------------------------------------------------------
00990> 025:0006----------------------------------------------------------------------
00991> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Waterdown Rd)
00992> ----------------------
00993> | CALIB STANDHYD     |   Area    (ha)=     .01
00994> | 04:202    DT= 1.00 |   Total Imp(%)=   83.00   Dir. Conn.(%)=   83.00
00995> ----------------------
00996>                              IMPERVIOUS    PERVIOUS (i)
00997>      Surface Area     (ha)=        .00          .00
00998>      Dep. Storage     (mm)=       1.00        10.80
00999>      Average Slope     (%)=       2.00         2.00
01000>      Length            (m)=      10.00        10.00
01001>      Mannings n            =       .013         .250
01002>
01003>      Max.eff.Inten.(mm/hr)=     135.38        41.44
01004>                    over (min)        1.00         5.00
01005>      Storage Coeff.  (min)=        .46 (ii)    4.83 (ii)
01006>      Unit Hyd. Tpeak (min)=       1.00         5.00
01007>      Unit Hyd. peak  (cms)=       1.50          .23
01008>                                                          *TOTALS*
01009>      PEAK FLOW       (cms)=        .00          .00          .002 (iii)
01010>      TIME TO PEAK    (hrs)=       1.92         2.05         2.000
01011>      RUNOFF VOLUME    (mm)=      70.35        21.64        62.065
01012>      TOTAL RAINFALL   (mm)=      71.35        71.35        71.347
01013>      RUNOFF COEFFICIENT   =        .99          .30          .870
01014>
01015>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01016>            CN* =  70.0    Ia = Dep. Storage  (Above)
01017>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01018>            THAN THE STORAGE COEFFICIENT.
01019>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01020>
01021> --------------------------------------------------------------------------------
01022> 025:0007----------------------------------------------------------------------
01023> *# CATCHMENT 203 - PROPOSED CONDITIONS (Extrenal Uncontrolled to Waterdown Rd)
01024> ----------------------
01025> | CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=70.00
01026> | 05:203    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
01027> ----------------------   U.H. Tp(hrs)=    .100
01028>
01029>      Unit Hyd Qpeak  (cms)=     .019
01030>
01031>      PEAK FLOW       (cms)=     .004 (i)
01032>      TIME TO PEAK    (hrs)=    2.067
01033>      RUNOFF VOLUME    (mm)=   21.636
01034>      TOTAL RAINFALL   (mm)=   71.347
01035>      RUNOFF COEFFICIENT   =     .303
01036>
01037>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01038>
01039> --------------------------------------------------------------------------------
01040> 025:0008----------------------------------------------------------------------
01041> *# CATCHMENT 204 - PROPOSED CONDITIONS (Uncontrolled to Adjacent East Property)
01042> ----------------------
01043> | CALIB NASHYD       |   Area    (ha)=     .00   Curve Number   (CN)=70.00
01044> | 06:204    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
01045> ----------------------   U.H. Tp(hrs)=    .100
01046>
01047>      Unit Hyd Qpeak  (cms)=     .002
01048>
01049>      PEAK FLOW       (cms)=     .000 (i)
01050>      TIME TO PEAK    (hrs)=    2.067
01051>      RUNOFF VOLUME    (mm)=   21.583
01052>      TOTAL RAINFALL   (mm)=   71.347
01053>      RUNOFF COEFFICIENT   =     .303
01054>
01055>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01056>
01057> --------------------------------------------------------------------------------
01058> 025:0009----------------------------------------------------------------------
01059> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
01060> *
01061> ----------------------
01062> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
01063> |  IN>03:(201   )    |
01064> | OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
01065> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01066>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
01067>                              .000  .0000E+00    |     .004  .1590E-01
01068>                              .004  .3700E-02    |     .013  .1740E-01
01069>                              .004  .7400E-02    |     .017  .1880E-01
01070>                              .004  .1110E-01    |     .020  .2030E-01
01071>                              .004  .1480E-01    |     .000  .0000E+00
01072>
01073>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
01074>      --------------------       (ha)     (cms)     (hrs)       (mm)
01075>      INFLOW >03: (201   )        .27      .101     2.000     69.860
01076>      OUTFLOW<07: (201   )        .27      .004     1.867     69.859
01077>     OVERFLOW<08: (OVF   )        .00      .000      .000       .000
01078>
01079>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01080>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
```

```
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.972
                    TIME SHIFT OF PEAK FLOW          (min)=    -8.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1315E-01

---------------------------------------------------------------------------
025:0010----------------------------------------------------------------------
----------
| ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------  (ha)    (cms)   (hrs)   (mm)   (cms)
                          ID1 04:202          .01     .002    2.00  62.07    .000
                         +ID2 05:203          .05     .004    2.07  21.64    .000
                         +ID3 07:201          .27     .004    1.87  69.86    .000
                         +ID4 08:OVF          .00     .000     .00    .00    .000
                          ============================================================
                          SUM 09:Total          .33     .009    2.00  62.32    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------
025:0011----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
*
---------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
---------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
---------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
  ** END OF RUN :  49

********************************************************************************




---------------------
| START             |  Project  dir.: T:\projects\21089\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\21089\SWMHYMO\
    TZERO =   .00 hrs on     0
    METOUT=   2 (output = METRIC)
    NRUN  = 050
    NSTORM=   1
           #  1=BUR6_050.stm
---------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 1029-1033 WATERDOWN ROAD
*#                BURLINGTON, OMTARIO
*#  JOB NUMBER  : 21089
*#       Date   : NOVEMBER 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 21089.DAT
*#*****************************************************************************|
*
---------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
---------------------
| READ STORM        |    Filename: Burlington 50-yr 6hr CHICAGO     (A=1172
| Ptotal=  78.93 mm|    Comments: Burlington 50-yr 6hr CHICAGO     (A=1172
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   3.533 |   1.67  15.961 |   3.17   8.836 |   4.67   4.516
               .33   3.817 |   1.83  36.356 |   3.33   7.913 |   4.83   4.304
               .50   4.160 |   2.00 149.296 |   3.50   7.185 |   5.00   4.113
               .67   4.582 |   2.17  47.374 |   3.67   6.593 |   5.17   3.940
               .83   5.119 |   2.33  25.806 |   3.83   6.102 |   5.33   3.783
              1.00   5.827 |   2.50  18.121 |   4.00   5.688 |   5.50   3.640
              1.17   6.809 |   2.67  14.149 |   4.17   5.333 |   5.67   3.509
              1.33   8.278 |   2.83  11.707 |   4.33   5.025 |   5.83   3.388
              1.50  10.753 |   3.00  10.045 |   4.50   4.755 |   6.00   3.277
---------------------------------------------------------------------------
050:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*****************************************************************************|
*# CATCHMENT 101 - EXISTING CONDITIONS (To Waterdown Rd)
---------------------
| CALIB STANDHYD    |   Area    (ha)=     .05
| 01:101    DT= 1.00 |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .03          .02
     Dep. Storage     (mm)=       1.00        10.80
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      10.00        10.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     149.30        52.80
                 over (min)        1.00         4.00
     Storage Coeff.  (min)=        .44 (ii)    4.41 (ii)
     Unit Hyd. Tpeak (min)=       1.00         4.00
     Unit Hyd. peak  (cms)=       1.52          .26
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .015 (iii)
     TIME TO PEAK    (hrs)=       1.93         2.03         2.000
     RUNOFF VOLUME    (mm)=      77.93        26.23        59.835
     TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
     RUNOFF COEFFICIENT   =        .99          .33          .758

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
050:0004----------------------------------------------------------------------
*# CATCHMENT 102 - EXISTING CONDITIONS (To Adjacent East Property)
---------------------
| CALIB NASHYD      |   Area    (ha)=     .23   Curve Number   (CN)=70.00
| 02:102    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .088

     PEAK FLOW       (cms)=     .021 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   26.227
     TOTAL RAINFALL   (mm)=   78.932
     RUNOFF COEFFICIENT   =     .332

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
050:0005----------------------------------------------------------------------
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*****************************************************************************|
*# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Waterdown Rd)
---------------------
| CALIB STANDHYD    |   Area    (ha)=     .27
| 03:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .27          .00
     Dep. Storage     (mm)=       1.00        10.80
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      10.00        10.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     149.30        52.80
                 over (min)        1.00         4.00
     Storage Coeff.  (min)=        .44 (ii)    4.41 (ii)
     Unit Hyd. Tpeak (min)=       1.00         4.00
     Unit Hyd. peak  (cms)=       1.52          .26
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .11          .00          .111 (iii)
     TIME TO PEAK    (hrs)=       1.95         2.03         2.000
     RUNOFF VOLUME    (mm)=      77.93        26.23        77.415
     TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
     RUNOFF COEFFICIENT   =        .99          .33          .981

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
050:0006----------------------------------------------------------------------
*# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Waterdown Rd)
---------------------
| CALIB STANDHYD    |   Area    (ha)=     .01
| 04:202    DT= 1.00 |   Total Imp(%)=   83.00   Dir. Conn.(%)=   83.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .00          .00
     Dep. Storage     (mm)=       1.00        10.80
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      10.00        10.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     149.30        52.80
                 over (min)        1.00         4.00
     Storage Coeff.  (min)=        .44 (ii)    4.41 (ii)
     Unit Hyd. Tpeak (min)=       1.00         4.00
     Unit Hyd. peak  (cms)=       1.52          .26
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .002 (iii)
     TIME TO PEAK    (hrs)=       1.92         2.03         2.000
     RUNOFF VOLUME    (mm)=      77.93        26.23        69.141
     TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
     RUNOFF COEFFICIENT   =        .99          .33          .876

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
050:0007----------------------------------------------------------------------
*# CATCHMENT 203 - PROPOSED CONDITIONS (Extrenal Uncontrolled to Waterdown Rd)
---------------------
| CALIB NASHYD      |   Area    (ha)=     .05   Curve Number   (CN)=70.00
| 05:203    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .019

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=   26.223
     TOTAL RAINFALL   (mm)=   78.932
     RUNOFF COEFFICIENT   =     .332

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
050:0008----------------------------------------------------------------------
*# CATCHMENT 204 - PROPOSED CONDITIONS (Uncontrolled to Adjacent East Property)
---------------------
| CALIB NASHYD      |   Area    (ha)=     .00   Curve Number   (CN)=70.00
| 06:204    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .002

     PEAK FLOW       (cms)=    .000 (i)
     TIME TO PEAK    (hrs)=   2.067
     RUNOFF VOLUME    (mm)=  26.173
     TOTAL RAINFALL   (mm)=  78.932
     RUNOFF COEFFICIENT   =    .332

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------
050:0009----------------------------------------------------------------------
*# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
*
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(201   )   |
| OUT<07:(201   )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .004  .1590E-01
                           .004  .3700E-02   |     .013  .1740E-01
                           .004  .7400E-02   |     .017  .1880E-01
                           .004  .1110E-01   |     .020  .2030E-01
                           .004  .1480E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (201  )          .27      .111     2.000     77.415
     OUTFLOW<07: (201  )          .27      .004     1.850     77.415
    OVERFLOW<08: (OVF  )          .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
```

```
01351>
01352>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.600
01353>                    TIME SHIFT OF PEAK FLOW        (min)=    -9.00
01354>                    MAXIMUM  STORAGE   USED       (ha.m.)=.1488E-01
01355>
01356> ------------------------------------------------------------------------------
01357> 050:0010-----------------------------------------------------------------------
01358> ----------------------
01359> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01360> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
01361>                        ID1 04:202           .01      .002    2.00  69.14    .000
01362>                       +ID2 05:203           .05      .005    2.07  26.22    .000
01363>                       +ID3 07:201           .27      .004    1.85  77.41    .000
01364>                       +ID4 08:OVF           .00      .000     .00    .00    .000
01365>                        ============================================================
01366>                        SUM 09:Total          .33     .010    2.00  69.41    .000
01367>
01368>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01369>
01370> ------------------------------------------------------------------------------
01371> 050:0011-----------------------------------------------------------------------
01372> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
01373> *
01374> ------------------------------------------------------------------------------
01375> 050:0002-----------------------------------------------------------------------
01376> *
01377> ------------------------------------------------------------------------------
01378> 050:0002-----------------------------------------------------------------------
01379> *
01380> ------------------------------------------------------------------------------
01381> 050:0002-----------------------------------------------------------------------
01382> *
01383> ------------------------------------------------------------------------------
01384> 050:0002-----------------------------------------------------------------------
01385> *
01386>   ** END OF RUN :  99
01387>
01388> ********************************************************************************
01389>
01390>
01391>
01392>
01393>
01394> --------------------
01395> | START            |  Project  dir.: T:\projects\21089\SWMHYMO\
01396> --------------------  Rainfall dir.: T:\projects\21089\SWMHYMO\
01397>     TZERO =   .00 hrs on      0
01398>     METOUT=   2 (output = METRIC)
01399>     NRUN  = 100
01400>     NSTORM=   1
01401>            #  1=BUR6_100.stm
01402> ------------------------------------------------------------------------------
01403> 100:0002-----------------------------------------------------------------------
01404> *#*****************************************************************************|
01405> *#  Project Name: 1029-1033 WATERDOWN ROAD
01406> *#                BURLINGTON, OMTARIO
01407> *#  JOB NUMBER  : 21089
01408> *#       Date   : NOVEMBER 2021
01409> *#    Revised   :
01410> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
01411> *#       File   : 21089.DAT
01412> *#*****************************************************************************|
01413> *
01414> ------------------------------------------------------------------------------
01415> 100:0002-----------------------------------------------------------------------
01416> *
01417> --------------------
01418> | READ STORM       |    Filename: Burlington 100-yr 6hr CHICAGO        (A=
01419> | Ptotal=  86.27 mm|    Comments: Burlington 100-yr 6hr CHICAGO        (A=
01420> --------------------
01421>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01422>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01423>                .17   3.862 |   1.67  17.445 |   3.17   9.657 |   4.67   4.936
01424>                .33   4.172 |   1.83  39.736 |   3.33   8.649 |   4.83   4.704
01425>                .50   4.546 |   2.00 163.177 |   3.50   7.853 |   5.00   4.495
01426>                .67   5.008 |   2.17  51.779 |   3.67   7.206 |   5.17   4.306
01427>                .83   5.595 |   2.33  28.205 |   3.83   6.670 |   5.33   4.135
01428>               1.00   6.369 |   2.50  19.806 |   4.00   6.217 |   5.50   3.979
01429>               1.17   7.443 |   2.67  15.465 |   4.17   5.829 |   5.67   3.835
01430>               1.33   9.048 |   2.83  12.795 |   4.33   5.492 |   5.83   3.703
01431>               1.50  11.752 |   3.00  10.979 |   4.50   5.197 |   6.00   3.581
01432>
01433> ------------------------------------------------------------------------------
01434> 100:0003-----------------------------------------------------------------------
01435> *
01436> *#*****************************************************************************|
01437> *#
01438> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01439> *#        ==============================================
01440> *#
01441> **#****************************************************************************|
01442> *# CATCHMENT 101 - EXISTING CONDITIONS (To Waterdown Rd)
01443> ---------------------
01444> | CALIB STANDHYD    |   Area    (ha)=     .05
01445> | 01:101    DT= 1.00 |   Total Imp(%)=   65.00   Dir. Conn.(%)=   65.00
01446> ---------------------
01447>                                IMPERVIOUS    PERVIOUS (i)
01448>      Surface Area     (ha)=        .03          .02
01449>      Dep. Storage     (mm)=       1.00        10.80
01450>      Average Slope     (%)=       2.00         2.00
01451>      Length            (m)=      10.00        10.00
01452>      Mannings n             =       .013         .250
01453>
01454>      Max.eff.Inten.(mm/hr)=     163.18        62.91
01455>                 over (min)        1.00         4.00
01456>      Storage Coeff.  (min)=        .43 (ii)    4.13 (ii)
01457>      Unit Hyd. Tpeak (min)=       1.00         4.00
01458>      Unit Hyd. peak  (cms)=       1.53          .28
01459>                                                          *TOTALS*
01460>      PEAK FLOW       (cms)=        .01           .00          .017 (iii)
01461>      TIME TO PEAK    (hrs)=       1.93         2.03         2.000
01462>      RUNOFF VOLUME    (mm)=      85.27        30.90        66.241
01463>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01464>      RUNOFF COEFFICIENT   =        .99          .36          .768
01465>
01466>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01467>            CN* =  70.0    Ia = Dep. Storage  (Above)
01468>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01469>            THAN THE STORAGE COEFFICIENT.
01470>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01471>
01472> ------------------------------------------------------------------------------
01473> 100:0004-----------------------------------------------------------------------
01474> *# CATCHMENT 102 - EXISTING CONDITIONS (To Adjacent East Property)
01475> ----------------------
01476> | CALIB NASHYD      |   Area    (ha)=     .23   Curve Number   (CN)=70.00
01477> | 02:102    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
01478> ----------------------   U.H. Tp(hrs)=    .100
01479>
01480>      Unit Hyd Qpeak  (cms)=     .088
01481>
01482>      PEAK FLOW       (cms)=     .026 (i)
01483>      TIME TO PEAK    (hrs)=    2.067
01484>      RUNOFF VOLUME    (mm)=   30.900
01485>      TOTAL RAINFALL   (mm)=   86.271
01486>      RUNOFF COEFFICIENT   =     .358
01487>
01488>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01489>
01490> ------------------------------------------------------------------------------
01491> 100:0005-----------------------------------------------------------------------
01492> *#*****************************************************************************|
01493> *#
01494> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01495> *#        ===============================================
01496> *#
01497> **#****************************************************************************|
01498> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Waterdown Rd)
01499> ---------------------
01500> | CALIB STANDHYD     |   Area    (ha)=     .27
01501> | 03:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
01502> ---------------------
01503>                                IMPERVIOUS    PERVIOUS (i)
01504>      Surface Area     (ha)=        .27          .00
01505>      Dep. Storage     (mm)=       1.00        10.80
01506>      Average Slope     (%)=       2.00         2.00
01507>      Length            (m)=      10.00        10.00
01508>      Mannings n             =       .013         .250
01509>
01510>      Max.eff.Inten.(mm/hr)=     163.18        62.91
01511>                 over (min)        1.00         4.00
01512>      Storage Coeff.  (min)=        .43 (ii)    4.13 (ii)
01513>      Unit Hyd. Tpeak (min)=       1.00         4.00
01514>      Unit Hyd. peak  (cms)=       1.53          .28
01515>                                                          *TOTALS*
01516>      PEAK FLOW       (cms)=        .12           .00          .121 (iii)
01517>      TIME TO PEAK    (hrs)=       1.95         2.03         2.000
01518>      RUNOFF VOLUME    (mm)=      85.27        30.90        84.727
01519>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01520>      RUNOFF COEFFICIENT   =        .99          .36          .982
01521>
01522>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01523>            CN* =  70.0    Ia = Dep. Storage  (Above)
01524>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01525>            THAN THE STORAGE COEFFICIENT.
01526>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01527>
01528> ------------------------------------------------------------------------------
01529> 100:0006-----------------------------------------------------------------------
01530> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Waterdown Rd)
01531> ---------------------
01532> | CALIB STANDHYD     |   Area    (ha)=     .01
01533> | 04:202    DT= 1.00 |   Total Imp(%)=   83.00   Dir. Conn.(%)=   83.00
01534> ---------------------
01535>                                IMPERVIOUS    PERVIOUS (i)
01536>      Surface Area     (ha)=        .00          .00
01537>      Dep. Storage     (mm)=       1.00        10.80
01538>      Average Slope     (%)=       2.00         2.00
01539>      Length            (m)=      10.00        10.00
01540>      Mannings n             =       .013         .250
01541>
01542>      Max.eff.Inten.(mm/hr)=     163.18        62.91
01543>                 over (min)        1.00         4.00
01544>      Storage Coeff.  (min)=        .43 (ii)    4.13 (ii)
01545>      Unit Hyd. Tpeak (min)=       1.00         4.00
01546>      Unit Hyd. peak  (cms)=       1.53          .28
01547>                                                          *TOTALS*
01548>      PEAK FLOW       (cms)=        .00           .00          .002 (iii)
01549>      TIME TO PEAK    (hrs)=       1.92         2.03         2.000
01550>      RUNOFF VOLUME    (mm)=      85.27        30.90        76.028
01551>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01552>      RUNOFF COEFFICIENT   =        .99          .36          .881
01553>
01554>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01555>            CN* =  70.0    Ia = Dep. Storage  (Above)
01556>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01557>            THAN THE STORAGE COEFFICIENT.
01558>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01559>
01560> ------------------------------------------------------------------------------
01561> 100:0007-----------------------------------------------------------------------
01562> *# CATCHMENT 203 - PROPOSED CONDITIONS (Extrenal Uncontrolled to Waterdown Rd)
01563> ---------------------
01564> | CALIB NASHYD       |   Area    (ha)=     .05   Curve Number   (CN)=70.00
01565> | 05:203    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
01566> ----------------------   U.H. Tp(hrs)=    .100
01567>
01568>      Unit Hyd Qpeak  (cms)=     .019
01569>
01570>      PEAK FLOW       (cms)=     .006 (i)
01571>      TIME TO PEAK    (hrs)=    2.067
01572>      RUNOFF VOLUME    (mm)=   30.897
01573>      TOTAL RAINFALL   (mm)=   86.271
01574>      RUNOFF COEFFICIENT   =     .358
01575>
01576>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01577>
01578> ------------------------------------------------------------------------------
01579> 100:0008-----------------------------------------------------------------------
01580> *# CATCHMENT 204 - PROPOSED CONDITIONS (Uncontrolled to Adjacent East Property)
01581> ---------------------
01582> | CALIB NASHYD       |   Area    (ha)=     .00   Curve Number   (CN)=70.00
01583> | 06:204    DT= 1.00 |   Ia      (mm)=  10.800   # of Linear Res.(N)= 3.00
01584> ----------------------   U.H. Tp(hrs)=    .100
01585>
01586>      Unit Hyd Qpeak  (cms)=     .002
01587>
01588>      PEAK FLOW       (cms)=     .001 (i)
01589>      TIME TO PEAK    (hrs)=    2.067
01590>      RUNOFF VOLUME    (mm)=   30.851
01591>      TOTAL RAINFALL   (mm)=   86.271
01592>      RUNOFF COEFFICIENT   =     .358
01593>
01594>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01595>
01596> ------------------------------------------------------------------------------
01597> 100:0009-----------------------------------------------------------------------
01598> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
01599> *
01600> ---------------------
01601> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
01602> |  IN>03:(201   )    |
01603> | OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
01604> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01605>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
01606>                            .000  .0000E+00   |     .004  .1590E-01
01607>                            .004  .3700E-02   |     .013  .1740E-01
01608>                            .004  .7400E-02   |     .017  .1880E-01
01609>                            .004  .1110E-01   |     .020  .2030E-01
01610>                            .004  .1480E-01   |     .000  .0000E+00
01611>
01612>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
01613>      ----------------------      (ha)     (cms)     (hrs)       (mm)
01614>      INFLOW >03: (201   )        .27      .121     2.000     84.727
01615>      OUTFLOW<07: (201   )        .27      .006     3.517     84.727
01616>     OVERFLOW<08: (OVF   )        .00      .000      .000       .000
01617>
01618>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01619>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
01620>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
```

```
01621>
01622>
01623>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.636
01624>                    TIME SHIFT OF PEAK FLOW         (min)=    91.00
01625>                    MAXIMUM  STORAGE   USED       (ha.m.)=.1617E-01
01626>
01627> --------------------------------------------------------------------------------
01628> 100:0010--------------------------------------------------------------------------
01629> ------------------------
01630> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01631> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
01632>                         ID1 04:202          .01     .002    2.00  76.03    .000
01633>                        +ID2 05:203          .05     .006    2.07  30.90    .000
01634>                        +ID3 07:201          .27     .006    3.52  84.73    .000
01635>                        +ID4 08:OVF          .00     .000     .00    .00    .000
01636>                         ============================================================
01637>                         SUM 09:Total        .33     .011    2.00  76.31    .000
01638>
01639>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01640>
01641> --------------------------------------------------------------------------------
01642> 100:0011--------------------------------------------------------------------------
01643> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
01644> *
01645> --------------------------------------------------------------------------------
01646> 100:0002--------------------------------------------------------------------------
01647> *
01648> --------------------------------------------------------------------------------
01649> 100:0002--------------------------------------------------------------------------
01650> *
01651> --------------------------------------------------------------------------------
01652> 100:0002--------------------------------------------------------------------------
01653> *
01654> --------------------------------------------------------------------------------
01655> 100:0002--------------------------------------------------------------------------
01656> *
01657> --------------------------------------------------------------------------------
01658> 100:0002--------------------------------------------------------------------------
01659> *
01660>       FINISH
01661> --------------------------------------------------------------------------------
01662> ********************************************************************************
01663>      WARNINGS / ERRORS / NOTES
01664>       ------------------------
01665>    Simulation ended on 2021-11-24     at 18:03:04
01666> ================================================================================
01667>
01668>
```

APPENDIX B

WATER USAGE & SANITARY DISCHARGE REPORT

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

October 21, 2021

File: 21089

Halton Region
1151 Bronte Road
Oakville, Ontario
L6M 3L1

Attention: Halton Region

RE: Water Usage & Wastewater Generation Report
1029-1033 Waterdown Road
City of Burlington

The proposed development consists of constructing a 29-storey mixed-use building including two levels of underground parking, an asphalt driveway, concrete sidewalk and landscaped areas. Refer to the Site Plan prepared by Zedd Architecture for additional details.

1.0 Wastewater Generation

Sanitary discharge from the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Table 3.1 summarizes the sanitary sewer discharge rate for the subject lands.

Table 1- Post-Development Sanitary Sewer Discharge

Population [A]	Avg. Demand [B] (l/s)	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [E] (l/s)**
480 persons	1.53	4.0	0.07	**6.19**

[A] Population = (295 units x 1.62 persons/unit) + (189m^2 commercial x 90persons/hectare) = 480 persons
[B] Average demand = 275 l/cap/day x population
[C] Peaking Factor = $1+((14/(4+P^{0.5})))$ with P expressed in thousands Min=2.0
[D] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Site Area (0.261 hectares)
[E] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

2.0 Water Usage

Water demand for the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Tables 2 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios.

Table 2 - Post-Development Domestic Water Demand					
Population [A*]	Average Daily Demand [B] (l/s)	Max. Daily Peaking Factor [C]	Max. Hourly Peaking Factor [D]	**Max. Daily Demand [E] (l/s)**	**Max. Hourly Demand [F] (l/s)**
480 persons	1.53	2.25	4.00	**3.44**	**6.12**

[A] Population = (295 units x 1.62 persons/unit) + (189m^2 commercial x 90persons/hectare) = 480 persons
[B] Average Daily Demand = 275 l/cap/day x population
[C] Max. Daily Peaking Factor = 2.25
[D] Max. Hourly Peaking Factor = 4.00
[E] Max. Daily Demand = Average Daily Demand x Max. Daily Peaking Factor
[F] Max. Hourly Demand = Average Daily Demand x Max. Hourly Peaking Factor

We trust that the information provided addresses the Halton Region requirements.

Prepared by:

S.LLEWELLYN & ASSOCIATES LIMITED



S. Nelson, P.Eng.

APPENDIX C

FIRE FLOW ANALYSIS

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Project Number: 21089
Project Name: 1029-1033 Waterdown Road
Date: 26-Nov-21

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\sqrt{A} \qquad \textbf{(1)}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

	Building Area				(1)		(2)			(3)		(4)		Final Adjusted Fire Flow	
Building / Location	Footprint Area (m^2)	# of Storeys	**Total GFA* (m^2)**	Type of Construction	***Fire Flow "F"*** (l/min)	***Fire Flow "F"*** (l/s)	***Occupancy*** %	***Occupancy*** Adjustment (l/min)	***Occupancy*** **Adjusted Fire Flow (l/min)**	***Sprinkler*** %	***Sprinkler*** Adjustment (l/min)	***Exposure*** %	***Exposure*** Adjustment (l/min)	**(l/min)**	**(l/s)**
29-Storey Building	**9427.5**	**1**	**9427.5**	**0.6**	13000	216.7	**-15**	-1950.0	**11050.0**	**-50**	-5525.0	50	5525.0	**11000**	**183**

Total Area Calculation:

Floor	Area
1	3016
2	1421
3	1602
4	1911
4.5	1378
5	1084
6	1006
7-29	750

*For fire-resistive buildings, consider the two largest adjoining floors plus 50% of each floor immediately above them up to eight.

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

(4) Exposure

0 to 3m	25%	Calculate for all sides. Maximum charge shall not exceed 75%
3.1 to 10m	20%	
10.1 to 20m	15%	
20.1 to 30m	10%	
30.1 to 45m	5%	

Side	Exposure (m)	Charge (%)
North =	**10.1 to 20m**	**15**
South =	**3.1 to 10m**	**20**
East =	**10.1 to 20m**	**15**
West =	**>45**	**0**
Total Expoure =		***50***

AQUACOM CONTRACTING
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SITE NAME	INFINITY DEVELOPMENT GROUP
TEST DATE TIME	THURSDAY 18 NOV 2021 @ 1345
SITE ADDRESS	1029-1033 WATERDOWN ROAD, BURLINGTON
TECHNICIANS	MARC COULTER & TALON BERNHARDT
COMMENTS	MUNICIPAL HYDRANTS

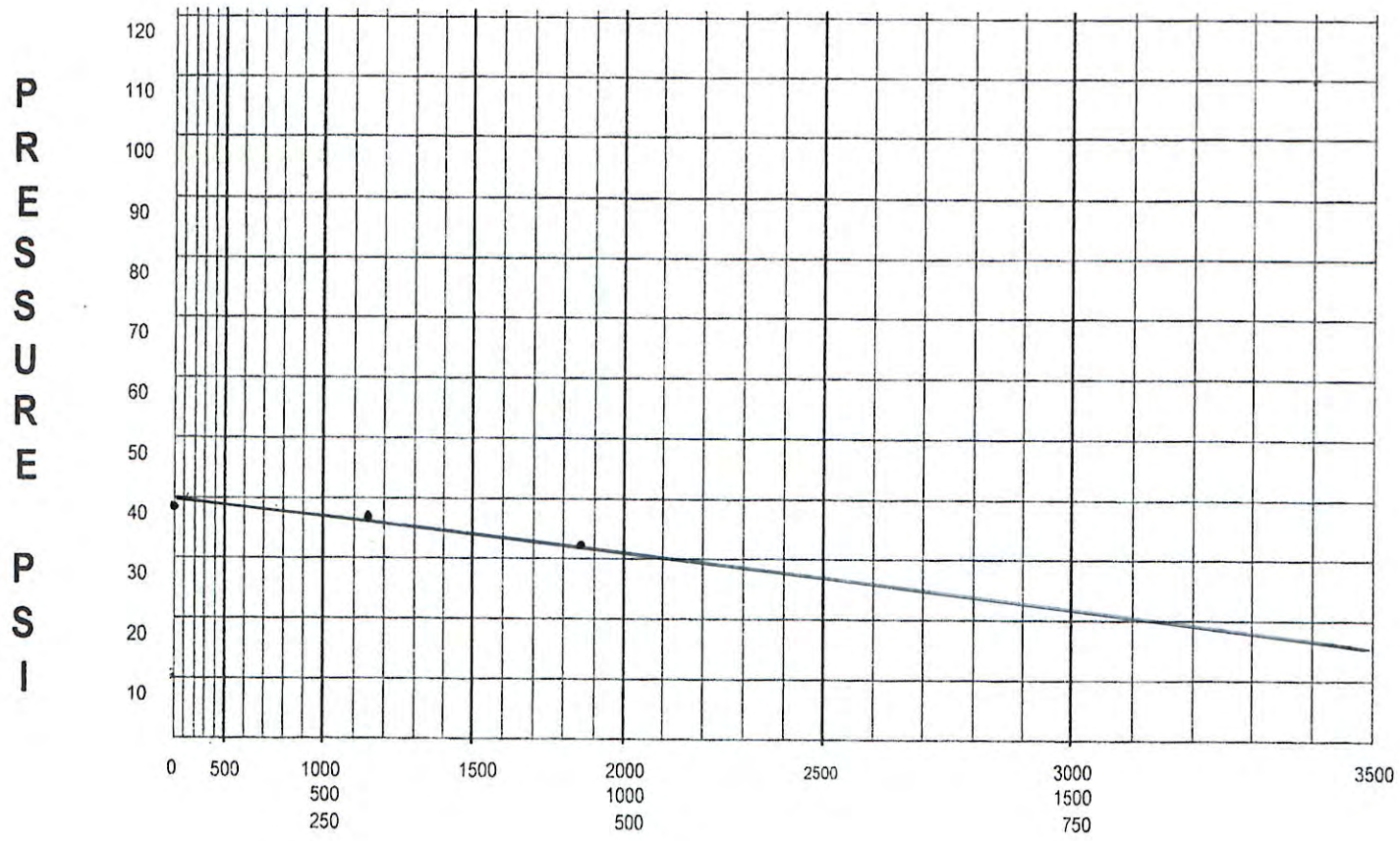
LOCATION OF FLOW HYDRANT

1044 WATERDOWN ROAD

LOCATION OF RESIDUAL HYDRANT

1063 WATERDOWN ROAD

# OUTLETS	SIZE INCHES	PITO PSI	FLOW USGPM	RESIDUAL PSI	STATIC PSI	PIPE DIA. MM
ONE	2.50	46	1138	37	39	300MM
TWO	2.50	31	1870	34		PVC
		THEORETICAL	3845	20	TEST #	THREE
NOZZLE COEFF.		.90				



APPENDIX D

GEOTECHNICAL INVESTIGATION

FISHER ENGINEERING

ENGINEERING

Professional Engineers Ontario

LABORATORY

CALA
Canadian Association for Laboratory Accreditation Inc.

GEOTECHNICAL INVESTIGATION



1029-1033 WATERDOWN ROAD, BURLINGTON, ONTARIO

Prepared for:

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Project No. FE-P 21-11236

July 26, 2021

Issued to:	Infinity Development Group 2275 Upper Middle Road East Oakville, ON L6H 0C3
Contact:	Arjun Anand arjun.anand@infinitydevelopment.ca
Project Name:	Proposed New Development
Project Address:	1029-1033 Waterdown Road, Burlington, ON.
Project Number:	FE-P 21-11236Geo
Issued on:	July 26, 2021
Report Prepared by: **(Primary Contact)**	 Rajinder Chahal, P. Eng., Senior Projecst Engineer 647.227.8473 rajinder@fisherenvironmental.com
Project Manager:	 Sean Fisher, M.Sc. Eng., Project Manager, sean@fisherenvironmental.com
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1. INTRODUCTION

Fisher Engineering Limited was retained by Infinity Development Group to carry out a geotechnical subsurface investigation for the proposed new development at 1029-1033 Waterdown Road East in Burlington, Ontario.

The purpose of the geotechnical investigation was to determine the general subsurface conditions at the site and to provide geotechnical comments/recommendations for the design of the proposed development by means of seven (7) boreholes.

This report presents the results of the tests performed in accordance with the general terms of reference outlined in the scope of work.

The report has been prepared specifically and solely for the proposed new development in regards to geotechnical aspects of design & construction based on the conceptual lay out provided.

2. SITE AND PROJECT DESCRIPTION

The subject properties are located on the east side of Waterdown Road north of Plains Road East in a mixed-use area of Burlington, Ontario.

Two residential dwellings exist in the front portions of the lots. A few mature trees were observed at/near the east property lines.

Residential dwellings were observed towards north and across the road on the west side. Commercial buildings exist towards south and east sides.

The proposed development calls for a 29-story building with two levels of underground parking. Details of the proposed development such as finished geodetic ground/lowest parking floor levels, finished grades, footing founding levels etc were not available at the time of our investigation. We were advised that top of footing will be approximately 7m below existing grades.

3. SCOPE OF GEOTECHNICAL WORK

The geotechnical scope of work includes the following:

- Investigation of the subsurface conditions at the site by advancing boreholes, soil sampling and visual evaluation.

- Prepare a geotechnical report with comments and recommendations regarding:

  - Appropriate foundation depth, type and bearing capacity, and seismic classification.
  - Underground parking garage design/construction.
  - Excavation & shoring design parameters etc.

4. METHOD OF INVESTIGATION

The field work for this investigation was carried out on June 15, 16 & 17, 2021, in which a total of seven (7) boreholes (BH1 – BH7), were drilled to approximate depths ranging between 9.60m and 14.18m below prevailing grades. The approximate locations of the boreholes and elevations are shown on the attached Borehole Location Plan in Appendix A.

Ground surface elevation at each borehole was surveyed by Fisher personnel using a temporary benchmark, 'Catch basin on Waterdown Road in front of #1033'. The TBM was assigned an elevation of 100m for reference.

All boreholes were advanced using solid stem auguring. The subsurface strata were sampled at regular intervals of depth using a split-spoon sampler following the procedure as detailed in ASTM Standard specification D1586 for Standard Penetration Test. Field tests to determine engineering parameters of the soil were carried out during drilling, which included Standard Penetration Tests (SPT).

Water level observations were made in each borehole on completion of drilling. Monitoring wells were installed in all boreholes for groundwater observations, water sampling and/or slug/pump testing purposes.

All soil samples were taken to our accredited laboratory for final visual assessment, classification and selected moisture content testing & grain size analyses. The samples were tested and classified in general accordance with the Unified Soil Classification System, ASTM D 2487, and Standard Practice for Classification of Soil for Engineering Purposes.

Soil Description and test results are given in the borehole Records attached to this report.

The soil samples recovered during the investigation will be stored in our laboratory for a period of 30 days after which they will be discarded unless further instructions are received.

5. SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes are shown on the Borehole Log Sheets provided in Appendix B.

The logs include soil stratification at the borehole locations along with detailed soil descriptions. Variations in soil stratification may occur and should be expected between borehole locations and elsewhere on the site.

FILL

Fill soils were found below the above surficial layer of all boreholes.

Fill extended to the following approximate depths below the prevailing grades.

Borehole No.	BH1	BH2	BH3	BH4	BH5	BH6	BH7
Surface Elevation (m asl)	100.22	100.69	100.45	99.98	100.16	99.28	99.80
Depth of Borehole (m)	12.65	14.18	9.60	11.13	14.18	12.65	9.60
Elevation at Bottom of Borehole (m asl)	87.57	86.51	90.85	88.85	85.98	86.63	90.20
Depth of Fill (m)	0.91	0.76	0.61	0.61	0.61	0.61	0.76
Elevation at Bottom of Fill (m asl)	99.31	99.93	99.84	99.37	99.55	98.67	99.04

The fill generally consisted of brown to dark brown sandy silt with some to trace of topsoil/roots and trace of gravel.

BROWN SILTY SAND TO SANDY SILT

Native soils of brown silty sand to sandy silt were found underlying the fill soils. Relative density of this layer varied from very loose to compact and it extended to approximate depths varying from 1.68m (no. 4) to 3.66m (no. 5).

REDDISH BROWN SILTY SAND/SANDY SILT

Reddish brown silty sand to sandy silt was encountered beneath the brown silty sand/sandy silt of boreholes 1 to 3. This layer was found to be compact in relative density and extended to approximate depths of 3.05m (nos. 1 & 2) & 2.59m (no. 3).

BROWN/GREYISH BROWN/GREY SAND/SILTY SAND/GRAVELLY SAND/GRAVEL & SAND

Brown silty sand/sandy silt of boreholes 4 to 7 and reddish-brown silty sand of boreholes 1 to 3 were followed by predominantly brown to grey sand/gravelly sand/gravel & sand deposits. These layers vary in composition across the site and with depth.

Their relative densities generally varied from dense to very dense and they extended to termination depths of 9.60m to 14.17m bgs. Occasional cobbles/boulders were encountered in the gravelly sand/gravel & sand.

REDDISH BROWN/GREY SILTY CLAY/CLAYEY SILT

Layers of reddish brown or grey clayey silt to silty clay were found interbedded in the sandy deposits between depths of 4.57m & 4.88m (no. 1), 4.88m & 5.49m (no. 2), 4.72m & 5.18m (no.3), 3.20m & 4.57m, 6.10m & 7.01m (no. 4), 4.88m & 5.49m (no. 6) and 4.72m & 6.10m (no. 7). Consistency of these layers varied substantially from firm in the upper layer to hard in lower layer of borehole 4, but generally very stiff in other boreholes.

6. GROUNDWATER CONDITIONS

Boreholes were advanced using dry solid stem auguring. Monitoring wells were installed in boreholes 1 to 6 to monitor groundwater levels and water sampling.

Groundwater depths/elevations as measured on completion of boreholes and from the monitoring wells are summarized in the following table.

No.	Elev. at Ground (m)	Depth of Well/BH, m bgs	On Completion		21-Jun-21		30-Jun-21		14-Jul-21	
			GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl
MW1	100.22	7.62/12.65	3.66	96.56	4.07	96.15	4.20	96.02	4.13	96.09
MW2	100.69	7.62/14.18	Dry	-	Dry	-	Dry	-	Dry	-
MW3	100.45	7.62/9.60	6.71	93.74	7.54	92.91	7.62	92.83	7.60	92.85
MW4	99.98	7.62/11.13	6.71	93.27	5.57	94.41	5.49	94.49	5.50	94.48
MW5	100.16	9.15/14.18	7.01	93.14	Dry	-	Dry	-	Dry	-
MW6	99.28	7.62/12.65	10.67	88.61	Dry	-	Dry	-	Dry	-
BH7	99.80	9.60	9.15	90.66	n/a	-	n/a	-	n/a	-

Based on the above information and visual examination of the soil samples, we conclude that groundwater exists in the wet sand/silty sand to sandy silt/gravelly sand overlying relatively impervious clayey silt and/or encountered towards the bottom of boreholes 2 to 7. Perched water may also be encountered from the wet seams/pockets/layers trapped inside the fill soils. We consider the water levels in monitoring wells 1 & 4 represent perched groundwater. This groundwater table may fluctuate with seasonal weather conditions; climate change; change in the surrounding land use or the water shed area etc. Groundwater in MW3 may be real groundwater table.

It should be noted that 'Fisher' also carried out a hydrogeological investigation in conjunction with this geotechnical investigation. Issues pertaining to the groundwater such as requirements for temporary dewatering, permanent drainage, amount/quality of water for discharge etc have been discussed/addressed separately in the hydrogeological investigation report. These reports should be read in conjunction in finalizing the sub-structure design process.

7. GEOTECHNICAL DISCUSSIONS AND RECOMMENDATIONS

7.1 General Discussion

We understand that the proposed development will comprise the construction of a 29-storey high-rise predominantly residential building with two levels of underground parking.

It should be noted that foundation plan indicating the underside/founding levels of footings was not available at the time of investigation. However, we were advised that top of footings will be approximately 7m below existing grades.

The following sections provide general geotechnical recommendations for design and construction.

7.2 Foundation Considerations

Boreholes indicate that dense to very dense undisturbed native soils of brown/greyish brown to grey sand/silty sand/sand & gravel/gravelly sand encountered below depth of 6.5m can be used for the building support using conventional strip and/or spread footing foundations.

For footings placed over undisturbed native soils between depths of 7.0m and 9.0m, factored geotechnical resistance at ULS of 600kPa & geotechnical reaction at SLS of 400kPa can be used for foundation design purposes.

SLS values are based on the current/general engineering practice of total settlement of 25mm and 19mm differential movements.

Based on the groundwater conditions encountered it appears that localised dewatering may be required.

A mud slab is always preferable to protect the integrity of the base and provide consistent earth cover for the reinforcing steel bars. If the footings are not formed, then footing excavations should be over-sized or sides sloped so that the caved materials do not end up in/under the footing area.

For footings founded at different levels in the vicinity of each other or located adjacent to excavated and backfilled areas, such as sewer/utility trenches etc., the slope of the imaginary line joining the bottom of two footings or the bottom of footing and excavation should not be steeper than 1.5 horizontal to 1 vertical. Preferably footings at the lower levels be excavated/poured first to prevent undermining of footings located at higher elevations.

The base conditions at the footing founding levels should be observed by a soil engineer from our office prior to pouring concrete, to ensure that the design bearing pressures are being attained. During sub-zero temperatures founding soils and footings must be adequately protected to prevent damage due to freezing/adfreezing/frost penetration using insulated or thermal blankets or straw.

For frost protection, a minimum 900 mm soil cover should be provided for the interior/isolated footings located in the unheated two level of underground parking garage areas. For perimeter wall footings 600mm depth is a common practice in GTA. However, in the garage entrance areas and air shaft/ventilation locations, a minimum 1.2 m earth cover should be provided or a combination of earth cover and insulation should be provided.

7.3 Earthquake Considerations

The 2012 OBC Subsection 4.1.8.7 stipulates that earthquake design for building should be based on the average properties of the top 30 m soil profile.

The parameters for determining the Site Classification for Seismic Site Response are given in Table 4.1.8.4A of the 2012 OBC. The Site Classification for Seismic Site Response (Table 4.1.8.4.A) is based on the average shear wave velocity or Standard Penetration Resistance (N60), or the undrained shear strength of the soils (Su).

Based on the results of the current geotechnical investigation, the site designation for seismic analysis applicable for the proposed building with two levels underground parking and for footings placed over undisturbed dense to very dense native soils is expected to be "**Class C**". However, shear wave velocity measurement may be required to confirm the classification.

7.4 Underground Parking Garage

The underground structure should be equipped with efficient permanent drainage system to dissipate perched groundwater accumulations, which includes the perimeter weeping tiles around the bottom of the garage wall footings and the interior weeping tiles below the floor slab. The perimeter weepers should be surrounded by clear stone or pea gravel encased in a granular filter or filter cloth. Both weepers should be connected to independently positive frost-free sump pits from where the water is constantly removed.

Where there is insufficient space for the installation of exterior perimeter weeping tiles, the drainage system can be modified by providing vertical drainage between the garage walls and the adjacent shoring. A series of drain holes should be precast through the walls below the garage floor slab level, forming a complete drainage path to the interior weeping tiles placed beside the garage wall footings.

Underfloor weeping tile drainage system should be provided under the floor slab to release any localised/potential uplift pressure on the slab-on-grade. We recommend that a field review should be carried out at the time of construction to determine the spacing requirements of the underfloor weepers. Top of the underfloor drain should be located below the bottom of granular bedding layer. The drains should be encased in 150 mm of clear stone/pea gravel wrapped in geotextile filter and connected positively to sump pit. The geotextile filter should have equipment opening size of less than 60 µm. A filter fabric should be provided for separation and to prevent migration of the subgrade soils where groundwater is anticipated to rise above the subgrade levels.

Damp or water proofing of garage floor slab will be required depending on the potential/anticipated highest groundwater table/elevations.

The entire drainage system should be designed by competent professionals, to ensure its capacity and effectiveness concerning the efficient transmittal of volume of water generated without any migration of fines from the surrounding soils.

A backup system should be designed for pumping/dewatering operations in the event of power or mechanical failure. Water relief valves/plates may be installed in the garage floor slab to relieve

any excess hydrostatic pressure in the event of malfunction of the drainage system. The floor slab should also be designed to accommodate the maximum allowable pressure for relief valves.

The lowest floor slab can be constructed as slab-on-grade. After excavating to the desired level, any loose or wet soil should be sub-excavated and replaced with granular material compacted to 98% of the Standard Proctor Maximum Dry Density. A 19 mm clear stone granular bedding of at least 200 mm in thickness should be provided.

The modulus of subgrade reaction for slab-on-grade design of 40MN/m^3 can be used provided the subgrade is undisturbed/adequately compacted & granular bedding is well compacted.

The parking garage walls under free drainage conditions, can be designed for a lateral earth pressure P, as given by the following expression:

$$P = K (\gamma h + q)$$

where K = Coefficient of earth pressure
ϒ = Unit weight of soil
Q = Surcharge load, if any

Design parameters K, γ are suggested in section 7.5 of this report.

If the perimeter/underfloor drainage systems are not feasible or permitted, then a watertight structure (bathtub) design (full or partial) should be adopted and the impacted lowest parking garage floor slab must be designed to resist hydrostatic/uplift pressures and be water-proofed. Potential/anticipated highest groundwater level during the life of the structure should be used for determining the water pressures. Parking garage walls should be waterproofed to at least 1m above the highest water level.

For a waterproofed basement, the lateral earth pressures acting on basement walls may be calculated from the following expression:

$$p = K (\gamma h_1 + \gamma' h_2 + q) + \gamma_w h_2$$

where p = lateral earth pressure in kPa acting at depth h
K = earth pressure coefficient, assumed to be 0.4 for vertical walls and horizontal backfill
γ′ = submerged unit weight of backfill of 12kN/m^3 may be assumed
γ_w = Unit weight of water, a value of 10kN/m^3 can be used
h_1 = depth to the highest groundwater table in metre

h_2 = depth below water table in metres

q = Equivalent value of surcharge on the ground surface in kPa

7.5 Excavation / Shoring

It is understood that the excavation for the proposed structure may extend to the depth of 7m or more. According to the Ontario Occupational Health and Safety Act, all excavations deeper than 1.2m should be adequately supported against ground collapse.

If the space will be limited for a safe excavation slope, then a vertical shoring system would be appropriate for the overall parking garage construction.

All structural members should be designed in accordance with relevant codes of practice.

The following soil parameters can be used in the evaluation of lateral earth pressures and design of the shoring system.

	FILL	COMPACT SILTY SAND	SILTY SAND/ SAND/GRAVELLY SAND
Unit weight, γ, kN/m^3	18	20.0	21.0
Coefficient of earth pressure at rest (K_0)	0.48	0.36	0.40
Coefficient of active earth pressure (Ka)	0.35	0.33	0.28
Coefficient of passive earth pressure (Kp)	2.86	3.00	3.57

Extra care will be required to install shoring support system due to anticipated groundwater at/below the approximate depth of 7.6m. Furthermore, obstructions from cobbles/boulders will likely be encountered while auguring shaft holes for soldier pile installation.

Excavations extending into water bearing sand/silty sand should not proceed until dewatering has been carried out to bring the wet sand into moist state.

The excavation sides should be protected to prevent any erosion/migration/flowing or washing out of soils from surface water ingress or water bearing wet pockets/layers. Provision of filler fabric may be required to prevent any migration of soils into the excavation. Any cavities behind the lagging should be filled with compacted soils or unshrinkable fill to prevent their progression into surrounding areas.

Temporary shoring/tie-backs should be designed in accordance with the Canadian Foundation Engineering Manual, 4th Edition. An estimated bond stress value of 60kN/m can be used for preliminary design of soil anchors. It should be noted that inclination, method of grouting/installation etc. influence the bond stress values. Design bond stress should be confirmed by load testing to 200% design load.

Raker pads if required can be designed using soil bearing pressure of 200kPa. Subsoil conditions at the raker founding levels must be observed by our field staff to ensure that they are placed over undisturbed native soils and surrounding soils are not disturbed due to groundwater conditions/excavation operations.

Due to presence of water bearing layers, tie-back holes should be cased during installation to minimize risk of caving. Shoring contractor must provide adequate measures to prevent any caving of loose soils or flow of soils due to groundwater into the augured holes during soldier pile installation operations. Temporary safety liners must be used during soldier pile installation and the withdrawal of liner should be slow and coordinated with pouring of concrete/u-fill.

8. EXCAVATION / VIBRATION MONITORING

We understand that two stage tie backs will be proposed for the proposed soldier pile/lagging support purposes. It should be noted that encroachment agreements will be required with the adjacent property owners. If the above agreements are not feasible/achievable then raker pads may be used for the soldier pile support purposes.

Zone of influence for excavation wall movements/displacements can be estimated as 11m to 12m beyond the property lines. All the control network points should be located outside the above zone of influence. Reflective targets should be installed at the top of each soldier pile and for each tie-back to monitor the movement of shored walls during and after excavation. Precision targets should be installed on the neighbouring structures within the zone of influence to ensure they are not being impacted by the construction activities on the subject site.

Construction activities for the proposed development such as drilled caissons, soil compaction etc. may generate vibrations which could be perceptible to the nearby residents or sensitive to the adjacent structures. Construction activity vibrations must be limited to the maximum peak particle velocity (PPV) as outlined/regulated by the local/regional/provincial authorities or an expert/qualified person in vibration monitoring and control. Frequency & duration of monitoring

and zone of influence due to vibration should also be established by or in accordance with the recommendations by the qualified person.

Pre and post construction surveys should be undertaken to document the existing conditions of properties/infrastructure/adjoining structures prior to the start of construction and at the end of project for determining/establishing any substantial changes resulting from construction within the zones of influence.

9. CHEMICAL ANALYSES & PRELIMINARY METHANE SCREENING

Three soil samples from boreholes 1 & 6 between depths of 3m & 8m, were submitted to Fisher Environmental laboratories for chemical analyses related to potential sulphate attack on buried concrete. Results of testing are presented in Appendix C.

The chemical analyses show that the sulphate concentration in the soil samples varies from 2.6 mg/kg to 8.6 mg/kg or 0.00026% to 0.00094%.

According to CSA-A23. 1-09 Table 3, the result indicates negligible degree of exposure to sulphate attack.

A Landtec GEM-5000 methane detector was used to conduct preliminary screening for methane in monitoring wells MW1, MW5 and MW6. No measurable quantity was detected in any of the three wells at the time of our screening.

10. GENERAL CONSIDERATIONS

This report is limited in scope to those items specifically referenced in the text. No other testing and design calculations have been performed except as specifically reported.

The discussions and recommendations presented in this report are intended for the sole guidance of the client named and the design consultants. It should not be relied upon for any other purpose.

The information on which these recommendations are based is subject to confirmation by engineering personnel at the time of construction.

The fact that localised variations in the subsurface conditions may be present between and beyond the boreholes and that those conditions may be significantly different from the general description provided for design purposes should be understood.

Contractors bidding on or undertaking the work should decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to the classification of the subsurface soils and the potential reuse of these soils on/off Site. Contractors must draw their own conclusions as to how the near surface and subsurface conditions may affect them.

It is strongly urged that Fisher be contacted to provide assistance in the interpretation of the borehole records by anyone undertaking work on/or below the ground surface at this site prior to this work being carried out.

The client expressly agrees that it has entered into this agreement with Fisher, both on its own behalf and as agent on behalf of its employees and principals.

The client expressly agrees that Fisher's employees and principals shall have no personal liability to the client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the client expressly agrees that it will bring no proceedings and take no action in any court of law against any of Fisher's employees or principals in their personal capacity.

11. CLOSING

We trust that the foregoing information is sufficient for your present needs and will be pleased to review the contents of this report in greater detail should you so require. Should you require our services further in this regard, please do not hesitate to contact our office.

APPENDIX A – SITE PLAN



FISHER ENGINEERING

400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH

LEGEND

- SITE BOUNDARY
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL & GEOTECHNICAL INVESTIGATIONS

1029-1033 Waterdown Road, Burlington, ON

FIGURE 1.1:

SITE PLAN WITH BOREHOLE LOCATIONS

PROJECT NO.	SHEET NO.
FE-P 21-11236/ 37	1.1
DATE: 29 July, 2021	
SCALE: AS SHOWN	

APPENDIX B – LOG OF BOREHOLES

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW1 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

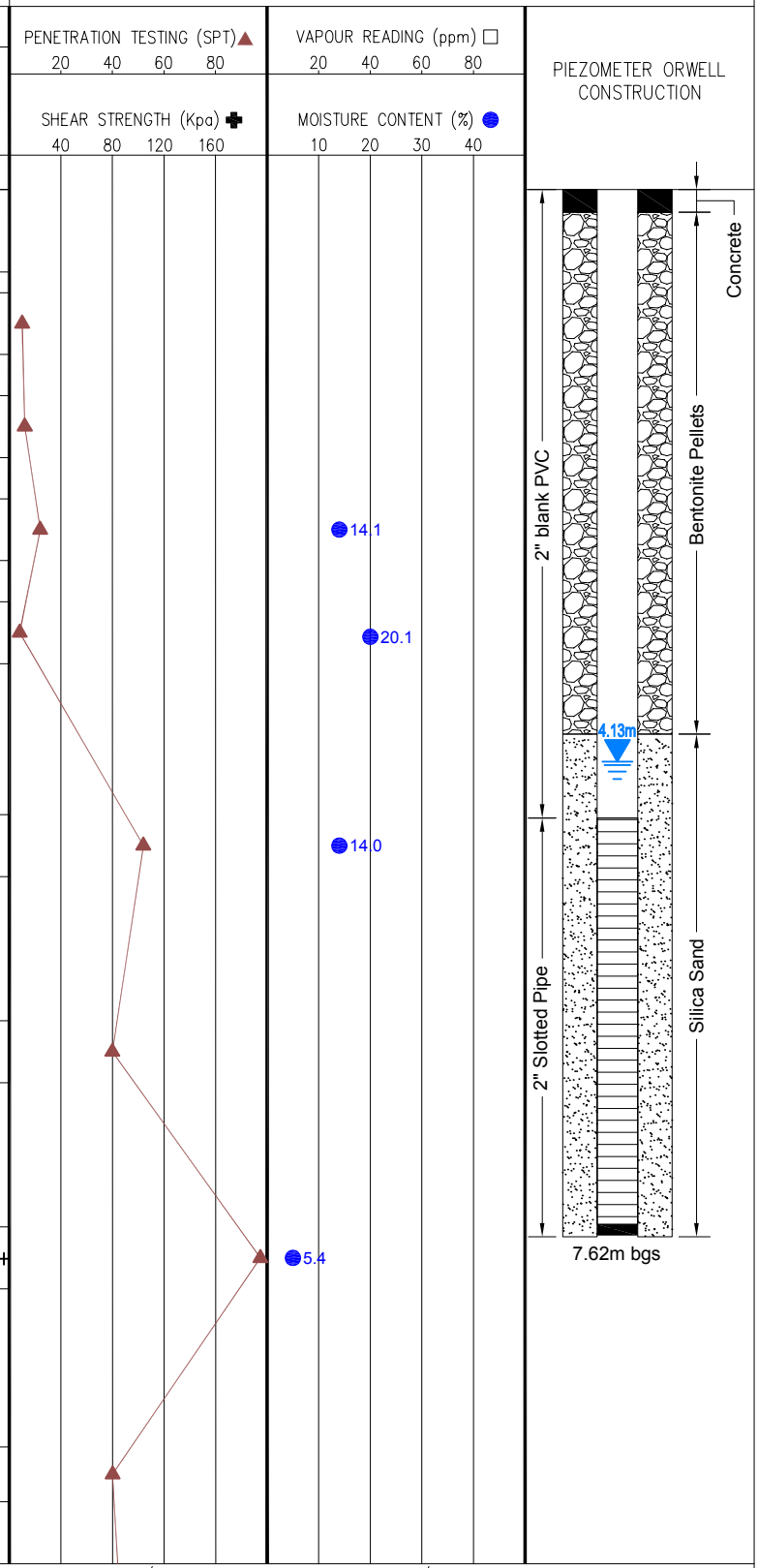
PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME-75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GRAVEL and SAND		100.22			
0	0	FILL (TOPSOIL): Brown sandy silt, some gravel, some roots, dry				SS-1	
2				0.91/ 99.31		SS-2	5
4	1	SANDY SILT: Brown, trace gravel, slightly moist, loose				SS-3	6
6	2						
8		SILTY SAND: Reddish brown, moist, compact		2.44/ 97.78	21-6748-1	SS-4	12
10	3	SAND: Brown, moist to wet, loose @ 3.66m, wet		3.05/ 97.17	21-6748-2	SS-5	4
12	4						
14				4.57/ 95.65	21-6748-3		
16	5	CLAYEY SILT: Red brown, slightly moist, hard		4.88/ 95.34	21-6748-4 (Field Duplicate)	SS-6	52
18		SAND: Grey, trace gravel, occasional cobbles/boulders, occasional clayey silt seams, moist, dense to very dense					
20	6					SS-7	40
22	7						
24							
26	8				21-6748-5	SS-8	100+
28							
30	9					SS-9	40
32	10						



Groundwater Depth: on completion: 3.66m/ On Jun 21, 2021: 4.07m/ On Jun 30, 2021: 4.20/ On Jul 21, 2021: 4.13m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW1 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME–75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE	PENETRATION TESTING (SPT) ▲ 20 40 60 80 / SHEAR STRENGTH (Kpa) ✚ 40 80 120 160	VAPOUR READING (ppm) □ 20 40 60 80 / MOISTURE CONTENT (%) ● 10 20 30 40	PIEZOMETER ORWELL CONSTRUCTION
		GROUND SURFACE (m asl)								
32	10	SAND: Grey, trace gravel, occasional cobbles/boulders, occasional clayey silt seams, moist, dense to very dense								
34										
36	11					SS–10	45			
38										
40	12					SS–11	50			
42	13	End of Borehole		12.65/ 87.57						
44										
46	14									
48										
50	15									
52	16									
54										
56	17									
58										
60	18									
62	19									
64										

Groundwater Depth: on completion: 3.66m/ On Jun 21, 2021: 4.07m/ On Jun 30, 2021: 4.20/ On Jul 21, 2021: 4.13m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW2 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME-75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
		GRAVEL and SAND		100.69			
0	0	FILL: Brown sandy silt, trace gravel, dry				SS-1	
2				0.76/ 99.93			
4	1	SANDY SILT/SILTY SAND: Brown, trace gravel, slightly moist, loose				SS-2	6
6						SS-3	7
	2			2.29/ 98.40			
8		SILTY SAND: Reddish brown, moist compact				SS-4	10
10	3	SAND: Brownish grey, moist, compact		3.05/ 97.64		SS-5	12
12							
	4						
14							
16				4.88/ 95.81		SS-6	18
	5	CLAYEY SILT/ SILTY CLAY: Red to brown, moist, very stiff					
18				5.49/ 95.20			
		SAND: grey, some gravel, moist to wet, dense to very dense					
20	6					SS-7	30
22							
	7						
24							
26	8					SS-8	100+
28							
	9			9.14/ 91.55			
30		GRAVEL: Grey, trace sand, trace cobbles, slightly moist, very dense				SS-9	100+
32	10						

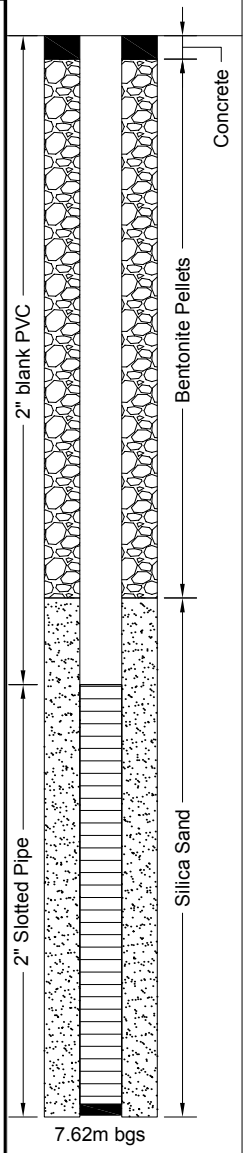
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION



Groundwater Depth: on completion: Dry/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW2 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME–75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE	PENETRATION TESTING (SPT) ▲ 20 40 60 80 / SHEAR STRENGTH (Kpa) ✚ 40 80 120 160	VAPOUR READING (ppm) □ 20 40 60 80 / MOISTURE CONTENT (%) ● 10 20 30 40	PIEZOMETER ORWELL CONSTRUCTION
		GROUND SURFACE (m asl)								
32	10	GRAVEL: Grey, trace sand, trace cobbles, slightly moist, very dense		10.67/ 90.02						
36	11	SAND: Grey, dry, very dense		11.58/ 89.11		SS–10	100+	▲		
38	12	GRAVEL: Grey, trace sand, trace cobbles, slightly moist, very dense				SS–11	100+	▲		
46	14					SS–12	100+	▲		
		End of Borehole		14.17/ 86.52						

Groundwater Depth: on completion: Dry/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

LOG OF BOREHOLE

NO. MW3 SHEET. 1 of 1

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)	100.45			
0	0	FILL: Sandy gravel, grey, trace silt, dry	0.61/ 99.84		SS-1	
2		SILTY SAND: Brown, trace gravel, slightly moist, loose to compact			SS-2	9
4	1					
6			1.83/ 98.62		SS-3	13
	2	SANDY SILT: Red to brown, wet, compact				
8			2.59/ 97.86		SS-4	12
		SAND: Grey, trace gravel, moist, compact				
10	3				SS-5	22
12						
	4					
14						
			4.72/ 95.73	21-6748-6	SS-6	28
16	5	SILTY CLAY: Red to brown, moist, very stiff	5.18/ 95.27			
18		SAND with GRAVEL: Grey, occasional cobbles/ boulders, moist, very dense, wet @ 5.49m, occasional clayey/silty seams				
	6					
20					SS-7	60
22	7					
24						
				21-6748-7	SS-8	100+
26	8					
28						
	9					
30				21-6748-8	SS-9	100+
		End of Borehole	9.60/ 90.85			
32	10					

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

18.2

8.2

7.2

PIEZOMETER ORWELL CONSTRUCTION

Concrete

Bentonite Pellets

2" blank PVC

2" Slotted Pipe

Silica Sand

7.60m

7.62m bgs

Groundwater Depth: on completion: 6.71m/ On Jun 21, 2021: 7.54m/ On Jun 30, 2021: 7.62m/ On Jul 14, 2021: 7.60m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW4 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)	99.98			
0	0	TOPSOIL: Brown sandy silt, trace gravel, dry	0.61/ 99.37		SS-1	
2	1	SILTY SAND to SANDY SILT: Brown, slightly moist, loose	1.68/ 98.30		SS-2	6
4					SS-3	6
6	2	SAND: Grey, wet, loose to compact	3.20/ 96.78		SS-4	12
8					SS-5	4
10	3	SILTY CLAY: Red to brown, moist, firm	4.57 95.41			
12	4					
14		SAND: Grey, wet, compact	6.10/ 93.88		SS-6	13
16	5					
18						
20	6	SILTY CLAY: red, brown, slightly moist, hard	7.01/ 92.97		SS-7	31
22	7					
24		SAND and GRAVEL: Brownish grey, wet, dense		21-6748-9	SS-8	32
26	8					
28						
30	9			21-6748-10	SS-9	33
32	10					

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

10.9

10.8

PIEZOMETER ORWELL CONSTRUCTION

Concrete

Bentonite Pellets

2" blank PVC

2" Slotted Pipe

Silica Sand

5.50m

7.62m bgs

Groundwater Depth: on completion: 6.71m/ On Jun 21, 2021: 5.57m/ On Jun 30, 2021: 5.49m/ On Jul 14, 2021: 5.50m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW4 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)					
32	10	SAND and GRAVEL: Brownish grey, wet, dense					
				10.67/ 89.31			
34		SAND: Grey, fine to medium, moist, very dense				SS-10	52
36	11			11.13/ 88.85			
		End of Borehole					
38	12						
40							
42	13						
44							
46	14						
48							
50	15						
52	16						
54							
56	17						
58							
60	18						
62	19						
64							

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Groundwater Depth: on completion: 6.71m/ On Jun 21, 2021: 5.57m/ On Jun 30, 2021: 5.49m/ On Jul 14, 2021: 5.50m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW5 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)	100.16			
0	0	TOPSOIL: Brown sandy silt, trace gravel, some roots, organics, moist	0.61/ 99.55		SS-1	
2	1	SAND: Brown, some roots, moist, very loose			SS-2	3
4						
6	2				SS-3	3
8					SS-4	3
10	3				SS-5	2
12			3.66/ 96.50			
12	4	SAND and GRAVEL: Grey, moist, very dense				
14						
16	5				SS-6	64
18						
20	6		6.10/ 94.06			
20		SAND and GRAVEL: Grey, moist, compact very dense			SS-7	23
22	7					
24			7.62/ 95.54			
26	8	GRAVEL: Grey, trace sand, dry, very dense		21-6748-11	SS-8	100+
28						
30	9				SS-9	100+
32	10					

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

● 4.6

PIEZOMETER ORWELL CONSTRUCTION

Concrete

2" blank PVC

Bentonite Pellets

2" Slotted Pipe

Silica Sand

9.14m bgs

Groundwater Depth: on completion: 7.01m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW5 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)					
32	10	GRAVEL: Grey, trace sand, dry, very dense		10.67/ 89.49			
34							
36	11	GRAVELY SAND: Grey, moist, very dense				SS-10	60
38							
40	12	SAND: Grey, trace gravel, wet, very dense		12.19/ 87.97		SS-11	53
42	13						
44							
46	14			14.17/ 85.99		SS-12	60
		End of Borehole					
48	15						
50							
52	16						
54							
56	17						
58							
60	18						
62	19						
64							

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Groundwater Depth: on completion: 7.01m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW6 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)		99.28			
0	0	TOPSOIL: Dark brown sandy silt with roots, trace gravel, moist		0.61/ 98.67		SS-1	
2	1	SILTY SAND to SANDY SILT: Brown, slightly moist, loose to compact				SS-2	7
4							
6	2					SS-3	10
8				2.59/ 96.69		SS-4	11
10	3	SAND: Grey to greyish brown, trace gravel, moist, compact				SS-5	25
12	4						
14							
16	5			4.88/ 94.40		SS-6	26
		SILTY CLAY: Brown, moist very stiff		5.49/ 93.79			
18		SAND with GRAVEL: Grey, ccasional cobbles/boulders, moist, dense to very dense,					
20	6				21-6748-12	SS-7	40
22							
24	7						
26	8					SS-8	100+
28							
30	9			9.30/ 89.98		SS-9	24
32	10						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

6.0

PIEZOMETER ORWELL CONSTRUCTION

Concrete

2" blank PVC

Bentonite Pellets

2" Slotted Pipe

Silica Sand

7.62m bgs

Groundwater Depth: on completion: 10.67m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW6 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE	PENETRATION TESTING (SPT) ▲ 20 40 60 80 / SHEAR STRENGTH (Kpa) ✚ 40 80 120 160	VAPOUR READING (ppm) □ 20 40 60 80 / MOISTURE CONTENT (%) ● 10 20 30 40	PIEZOMETER ORWELL CONSTRUCTION
		GROUND SURFACE (m asl)								
32	10	SAND: Grey, medium to fine, occasional cobbles/boulders, dry to wet, compact to dense wet @10.69m								
34										
36	11					SS-10	39			
38										
40	12					SS-11	44			
42	13	End of Borehole		12.65/ 86.63						
44										
46	14									
48										
50	15									
52	16									
54										
56	17									
58										
60	18									
62	19									
64										

Groundwater Depth: on completion: 10.67m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. BH7 SHEET. 1 of 1

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
		GROUND SURFACE (m asl)		99.80			
0	0	TOPSOIL: Brown sandy silt, trace gravel, debris, roots, moist				SS-1	
2				0.76/ 99.04			
4	1	SANDY SILT to SILTY SAND: Brown, trace gravel, moist, loose to compact				SS-2	8
6	2					SS-3	10
8				2.44/ 97.36		SS-4	12
10	3	SAND: Greyish brown, trace gravel, slightly moist, compact				SS-5	24
12	4						
14				4.72/ 95.08		SS-6	24
16	5	SILTY CLAY: Brown, most, very stiff					
18				6.10/ 93.70			
20	6	SAND and GRAVEL: grey, trace silt, occasional cobbles/boulders, moist, dense to very dense,				SS-7	37
22	7						
24							
26	8					SS-8	75
28							
30	9			9.14/ 90.66			
		SAND: Grey, medium to fine, moist, compact, wet				SS-9	27
32	10	End of Borehole		9.60/ 90.20			

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Groundwater Depth: on completion: 9.15m

DRAWN: AM LOGGED: CW CHECKED:

APPENDIX C – MOISTURE CONTENT AND GRAIN SIZE ANALYSES RESULTS

FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL COMPLIANCE PACKAGES • 24 HOUR EMERGENCY RESPONSE • CALA ACCREDITED

400 ESNA PARK DRIVE #15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718
www.fisherenvironmental.com

Client: Infinity Development
Address: 1029/1033 Waterdown Road
Burlington ON

Tel.:
Email:
Attn.:

F.E. Job #: 21-6748
Project Name: Geotechnical and Hydrogeological
Project ID: FE-P 21-11236 & 21-11237
Date Sampled: 15-Jun-2021
Date Received: 18-Jun-2021
Date Reported: 25-Jun-2021
Location: 1029/1033 Waterdown Road
Burlington ON

Certificate of Analysis

Analyses	Matrix	Quantity	Date Extracted	Date Analyzed	Lab SOP	Method Reference
pH	Soil	5	22-Jun-21	22-Jun-21	pH-EC-SAR F-16	SW-846, 9045D
Chloride	Soil	2	N/A	24-Jun-21	Chloride F-20	SM 4500-Cl-E
Sulphate	Soil	3	24-Jun-21	24-Jun-21	Sulphate F-21	SM 4500-SO_4
Moisture Content	Soil	12	21-Jun-21	21-Jun-21	Support Procedures F-99	Carter (1993)
Grain Size	Soil	6	N/A	22-May-21	Grain Size F-28	ASTM D6913-04

Fisher Environmental Laboratories is accredited by CALA (the Canadian Association for Laboratory Accreditation Inc.) for specific parameters as required by Ontario Regulation 153/04. All analytical testing has been performed in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act published by Ontario Ministry of the Environment.

Authorized by:

Roger Lin, Ph. D., C. Chem.
Laboratory Manager

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Ronggen (Roger) Lin
CHEMIST

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-2*** BH1 3.00-3.45m	***21-6748-5*** BH1 7.55-8.05m	***21-6748-7*** BH3 7.55-8.05m	***21-6748-9*** BH4 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m	**Soil Standards** *
pH *(pH unit)*	7.85	8.40	8.51	8.17	7.08	(5-11) 5-9

* Surface soil pH value from 5 - 9, Sub-surface soil pH value from 5-11.

QA/QC Report

Parameter	**LCS**	**AR**	**Duplicate**	**AR**		
	Absolute Difference *(pH Unit)*					
pH *(pH unit)*	7.05	6.90-7.20	0.02	<0.3		

LEGEND:
LCS - Laboratory Control Sample
AR - Acceptable Range

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-7*** BH3 7.55-8.05m	***21-6748-9*** BH4 7.55-8.05m				
	Concentration (µg/g)					
Chloride in Soil	70	56				

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	**Blank**	**RL**	**LCS**	**AR**	**MS**	**AR**
	(µg/g)		**Recovery (%)**		**Recovery (%)**	
Chloride in Soil	<10	10	97	70-130	108	70-130

Parameter	**Duplicate**	**AR**				
	RPD (%)					
Chloride in Soil	3.7	0-20				

LEGEND:

RL - Reporting Limit
LCS - Laboratory Control Sample
MS - Matrix Spike
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-2*** BH1 3.00-3.45m	***21-6748-5*** BH1 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m			
Sulphate *(mg/kg)*	8.6	2.6	3			

QA/QC Report

Parameter	**Blank**	**RL**	**LCS/Spike**	**AR**	**Duplicate**	**AR**
	(mg/kg)		**Recovery (%)**		**RPD (%)**	
Sulphate	<1	1	95	70-130	22	0-30

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-1*** BH1 2.25-2.70m	***21-6748-2*** BH1 3.00-3.45m	***21-6748-3*** BH1 4.55-5.00m A	***21-6748-4*** BH1 4.55-5.00m B	***21-6748-5*** BH1 7.55-8.05m	***21-6748-6*** BH3 4.55-5.00m
Moisture Content (%)	14.1	20.1	14.6	13.3	5.4	18.2

Parameter	***21-6748-7*** BH3 7.55-8.05m	***21-6748-8*** BH3 9.15-9.55m	***21-6748-9*** BH4 7.55-8.05m	***21-6748-10*** BH4 9.15-9.55m	***21-6748-11*** BH5 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m
Moisture Content (%)	8.2	7.2	10.9	10.8	4.6	6.0

QA/QC Report

Parameter	**Blank**	**RL**	**LCS**	**AR**	**Duplicate**	**AR**
			Recovery (%)		**RPD (%)**	
Moisture Content (%)	<0.1	0.1	100	70-130	4.5	0-20

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

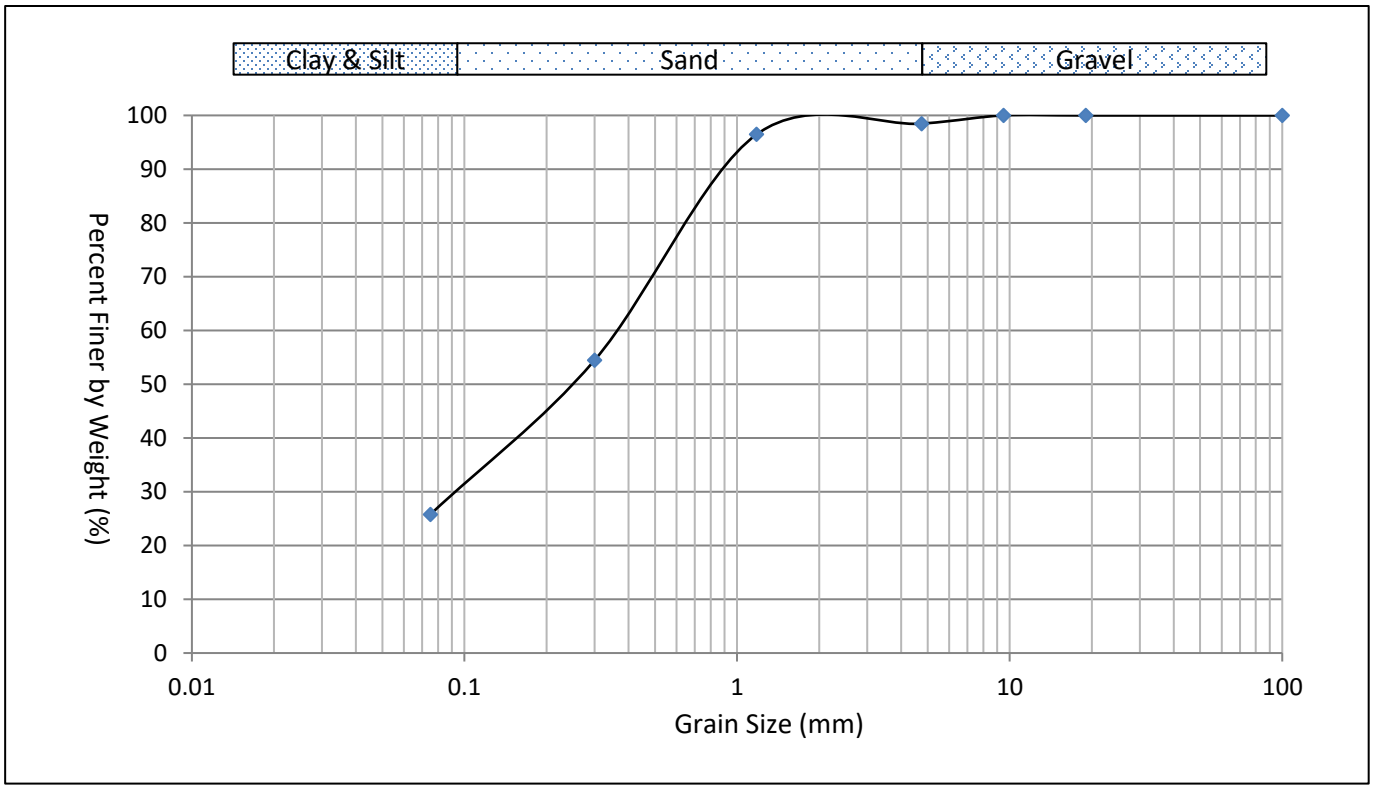
Parameter	***21-6748-3*** BH1 4.55-5.00m A	***21-6748-4*** BH1 4.55-5.00m B	***21-6748-7*** BH3 7.55-8.05m	***21-6748-9*** BH4 7.55-8.05m	***21-6748-11*** BH5 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m
Grain Size (%)						
>19mm	0.0	9.2	0.0	0.0	0.0	0.0
9.5mm-19mm	0.0	5.1	5.7	5.9	20.3	13.0
4.75mm-9.5mm	1.5	2.5	6.5	3.5	31.6	6.8
1.18m-4.75mmm	2.0	2.5	33.4	11.3	21.0	38.9
300um-1.18mm	42.0	8.5	32.4	42.4	4.7	20.8
75um-300um	28.7	19.9	10.7	20.2	9.8	6.0
<75um	25.8	52.2	11.4	16.7	12.7	14.5
Clay & Silt	**26**	**52**	**11**	**17**	**13**	**14**
Sand	**73**	**31**	**77**	**74**	**35**	**66**
Gravel	**2**	**17**	**12**	**9**	**52**	**20**

Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-3 BH1 4.55-5.00m A

Clay & Silt: 26% Sand: 73% Gravel: 2%

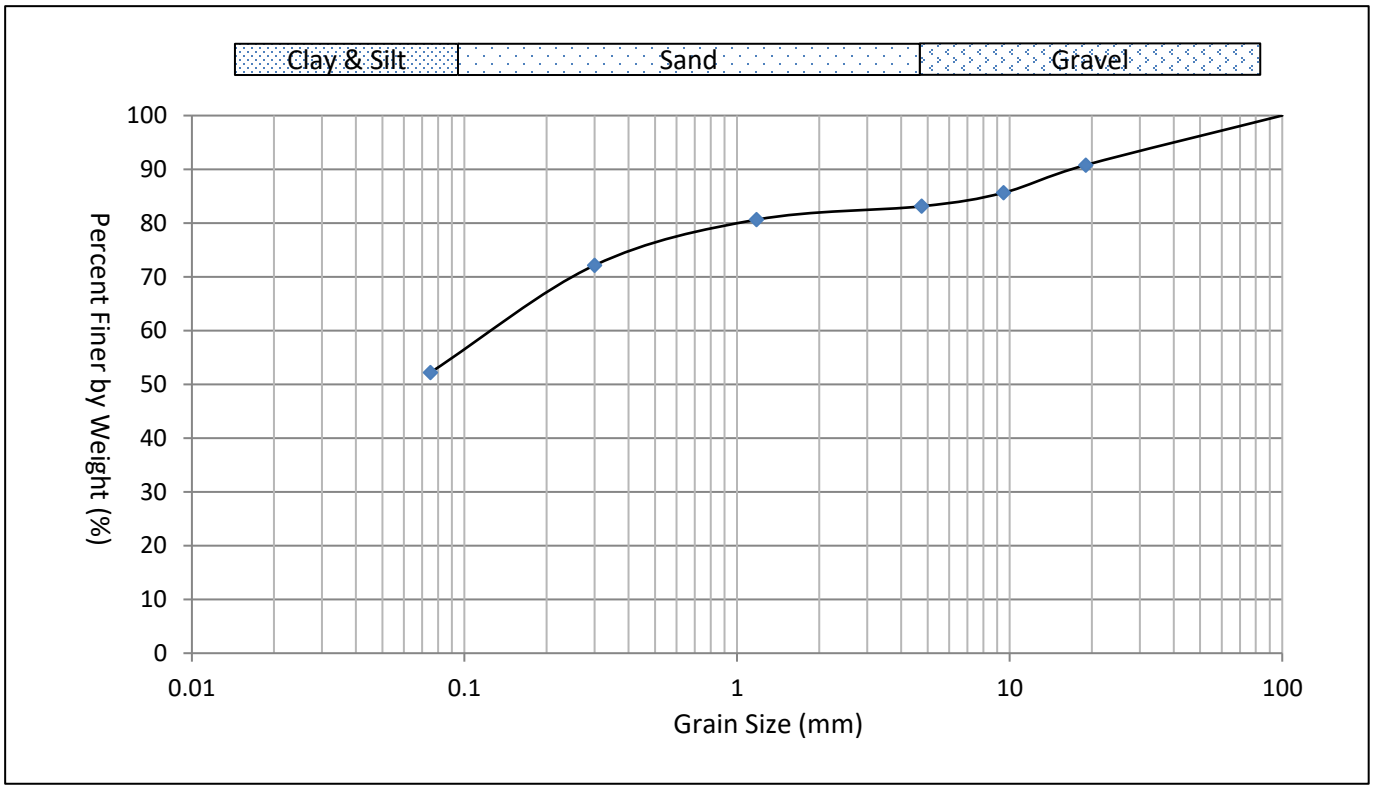


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-4 BH1 4.55-5.00m B

Clay & Silt: 52% Sand: 31% Gravel: 17%

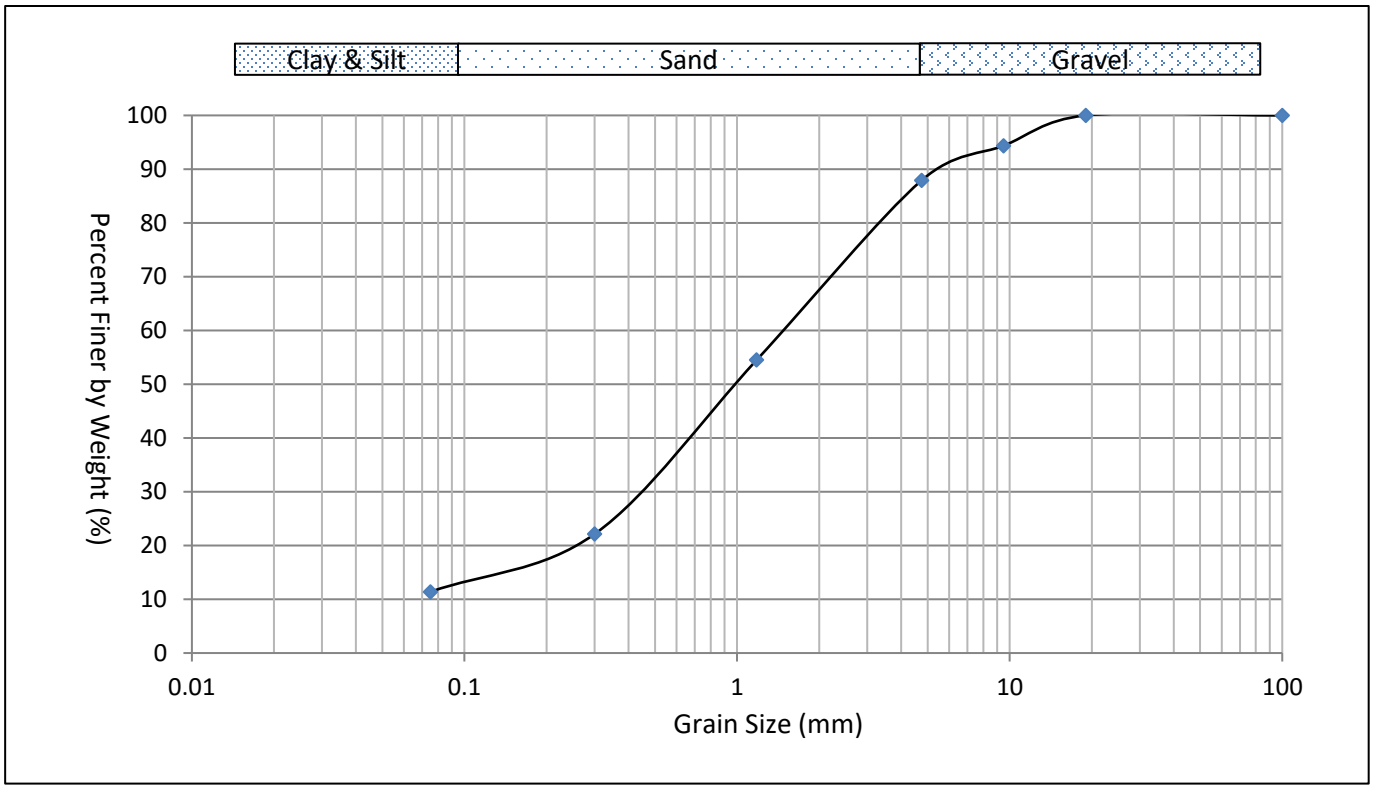


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-7 BH3 7.55-8.05m

Clay & Silt: 11% Sand: 77% Gravel: 12%

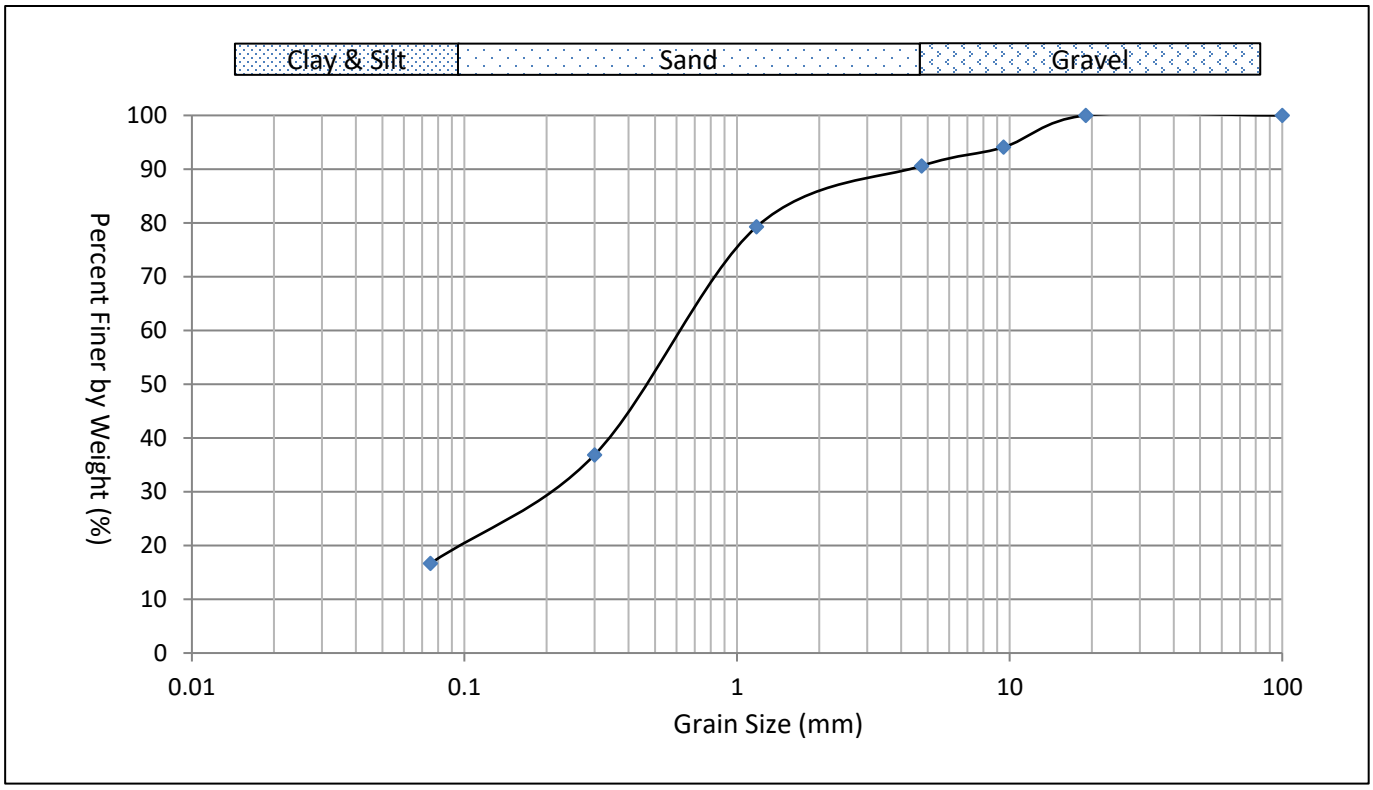


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-9 BH4 7.55-8.05m

Clay & Silt: 17% Sand: 74% Gravel: 9%

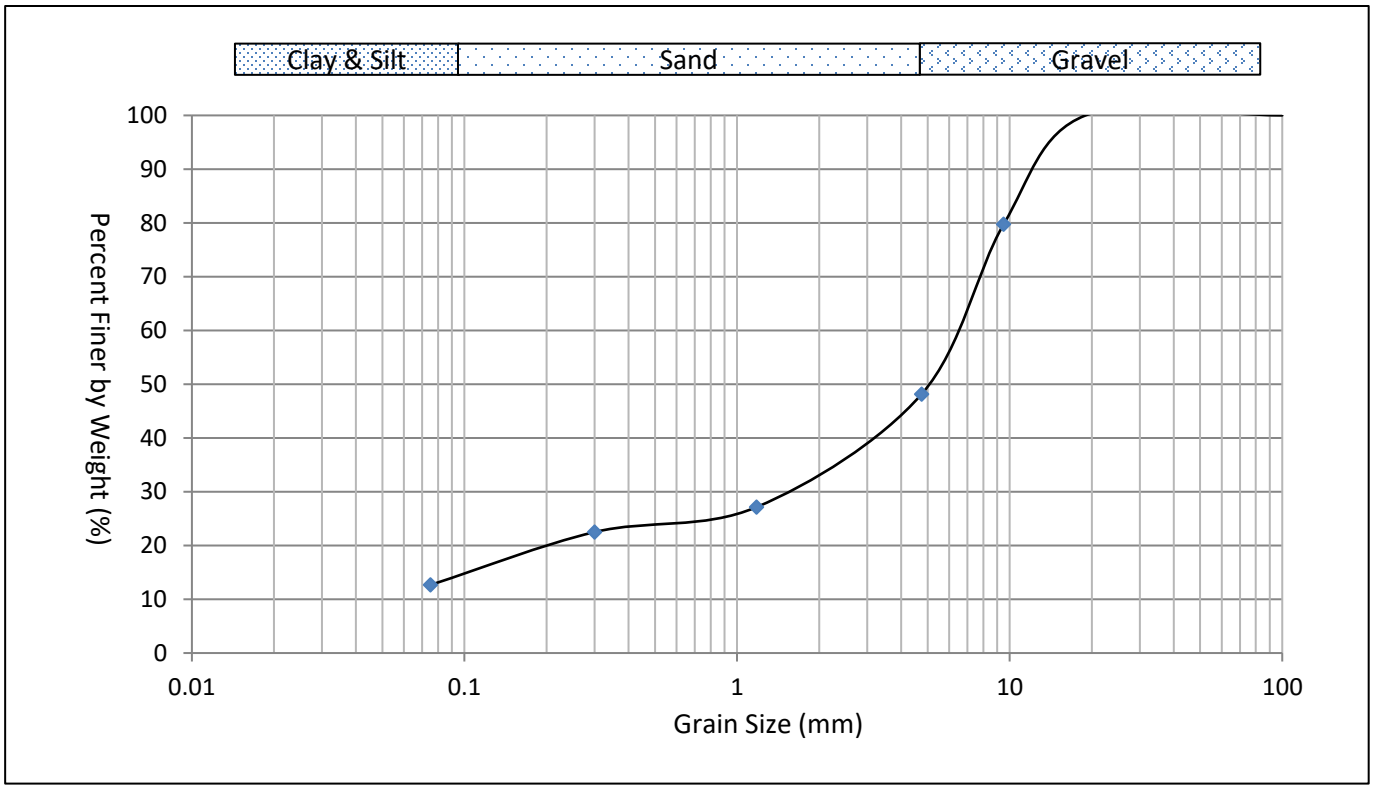


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-11 BH5 7.55-8.05m

Clay & Silt: 13% Sand: 35% Gravel: 52%



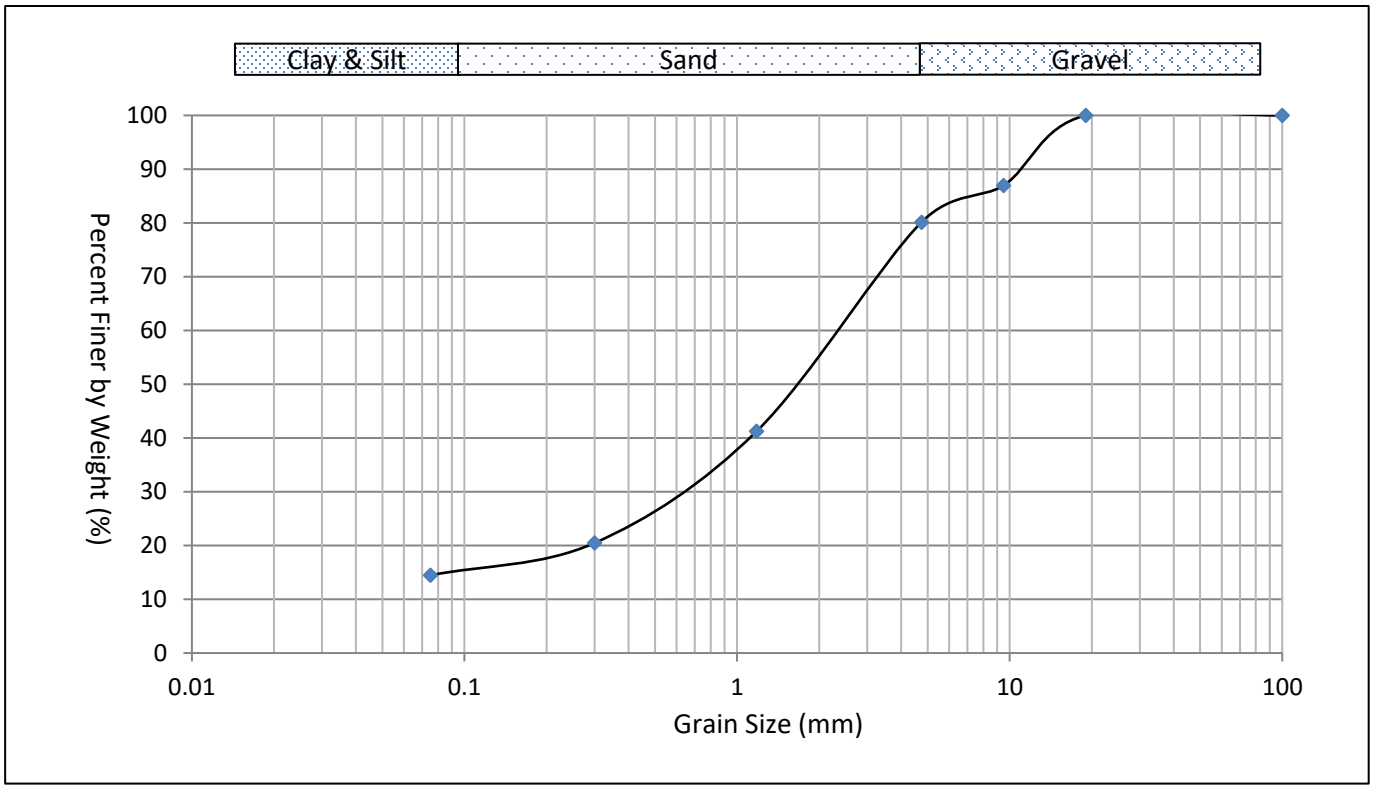
Results related only to the items tested

Client: Infinity Development ***F.E. Job #:*** 21-6748

Grain Size Distribution

Sample ID: 21-6748-12 BH6 6.05-6.50m

Clay & Silt: 14% Sand: 66% Gravel: 20%



Results related only to the items tested

APPENDIX E

HYDROGEOLOGICAL INVESTIGATION

FISHER ENGINEERING

ENGINEERING

Professional Engineers Ontario

LABORATORY

CALA
Canadian Association for Laboratory Accreditation Inc.

INFINITY DEVELOPMENT GROUP

HYDROGEOLOGICAL INVESTIGATION



1029 & 1033 WATERDOWN ROAD, BURLINGTON, ONTARIO

Prepared for:

Infinity Development Group

Project No. FE-P 21-11237H

August 9, 2021

Updated November 24, 2021

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Project Name:	Hydrogeological Investigation for Proposed Development
Project Address:	1029 & 1033 Waterdown Road, Burlington, ON.
Project Number:	FE-P 21-11237H
Issued on:	Updated November 24, 2021
Report Prepared By:	 Clive Wiggan, PhD., PMP., Project Manager clive@fishereng.com
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1. INTRODUCTION

Fisher Engineering Limited was retained by Infinity Development Group to carry out a Hydrogeological Investigation for the proposed redevelopment at the property located at 1029 & 1033 Waterdown Road in Burlington, Ontario, hereinafter referred to as the 'Site'.

The purpose of the Hydrogeological Investigation was to evaluate the groundwater conditions with respect to the future redevelopment of the site.

The report has been prepared specifically and solely for the proposed development regarding hydrogeological aspects for design and construction.

The report was updated to reflect Architectual Plans by Zedd Architecture, dated August 24, 2021 and the results of long term groundwater level monitoring carried out over the period June to November 2021.

Changes to the report with respect to earlier versions are as follows:

- Construction groundwater dewatering flowrate of **45.18 m^3/day instead of 36.22 m^3/day** and
- Permanent drainage rate of **27.76 m^3/day instead of 25.22 m^3/day**.
- Elevations changed from assumed to geodetic based on topographic survey.

2. SITE AND PROJECT DESCRIPTIONS

Site Settings

The subject property is located on the east side of Waterdown Road, in a mixed commercial - residential neighborhood south of Highway 403, in the City of Burlington and is bounded by Waterdown Road to the west, beyond which are residences and a fire hall, houses to the north, commercial properties to the east and houses converted to offices to the south. The site has an approximate area of 2484m^2.

At the time of investigation, the site was occupied by single family dwellings. The property was generally landscaped with mature trees and unpaved driveways.

Topography

The site slopes gentle from west to east with relative elevations changing from approximately 103.83m at BH3 located at the southwest corner of the site, near Waterdown Road, to 102.64 at BH6 located at the southeast corner of the property.

Proposed Development

It was understood that the proposed development will consist of the construction of a 29-storey residential building with two underground levels extending to the property boundaries. Finished floor elevation for P2 underground level was given as 6.1m below grade according to site plans by Zedd Architecture, dated August 24, 2021. Conventional footings would be approximately 1m below FFE at 7m bgs according to the terms of reference provided to Fisher prior to the investigation.

3. SCOPE OF HYDROGEOLOGICAL INVESTIGATION

The Hydrogeological Investigation works were required to:

1) Establish groundwater conditions for the design of dewatering works, if required, prior to construction of the proposed building.
2) Determine the need for permanent drainage and
3) Conduct calculations/analyses of the groundwater quantity and quality to be used for the necessary applications for permits prior to proceeding with construction dewatering and design of permanent drainage, if necessary.

The scope of this work generally consisted of the following:

- **Drilling/locating Monitoring Wells.** Drilling of monitoring wells and reviewing / compiling the borehole logs and onsite / laboratory testing.
- **Data Evaluation.** Evaluating the results of soil types, groundwater static levels, ground surface elevation, groundwater quality, flow direction and other available hydrogeological data for the site and their potential impact on the proposed development.
- **Hydraulic Conductivity Tests.** Conduct single well response tests and record groundwater level drawdown and recovery to model/calculate hydraulic conductivity.
- **Groundwater Quality Analysis.** Carry out laboratory analyses on groundwater to determine compliance with the Ontario Halton Sewer Use Bylaws No. 02-03 (Mar 2003) – Halton Sanitary Sewer and Halton Storm Sewer.
- **Groundwater Level Monitoring.** Conduct long-term monitoring of the groundwater levels to determine the seasonal high-water levels.

- **Hydrogeological Report.** Prepare and submit a report detailing the findings and recommendations of the Hydrogeological Investigation.

4. FIELD AND LABORATORY WORKS

Subsurface exploration for the Hydrogeological Investigation was conducted concurrent with drilling for the Geotechnical Investigation on June 15, 16 & 17, 2021 and consisted of seven (7) boreholes advanced to depths of 9.60m to 14.18m below prevailing grades. The approximate locations of the boreholes and elevations are presented in Appendix A - Borehole Location Plan.

Boreholes BH1 to BH6 were instrumented as monitoring wells (MW1 to MW6) with 2" diameter screens on completion of drilling. A clean silica sand pack was placed around the well screens and isolated with bentonite to depths below prevailing grades as shown in the borehole details in Appendix B.

Track & truck mounted drill rigs equipped with solid stem augers, supplied by Terra Firma Services, was used for all drilling work.

Laboratory Analyses

Soil samples were taken to the Fisher Environmental laboratory for further visual assessment and classification. Twelve (12) representative soil samples from BH1, BH3, BH4, BH5 and BH6 were submitted for moisture content and six (6) for grain size analyses. Five (5) soil sample from BH1, BH3, BH4 and BH6 were submitted for pH, chloride and sulphate analyses. Two (2) soil samples from BH1 and BH4 were submitted to ALS Environmental laboratory for hydrometer tests. The laboratory samples were tested and classified in general accordance with the Unified Soil Classification System, ASTM D 2487, and Standard Practice for Classification of Soil for Engineering Purposes.

One (1) groundwater sample from MW1 was submitted to ALS Environmental laboratory for analyses of water quality under the Ontario Halton Sewer Use Bylaws No. 02-03 (Mar 2003) – Halton Sanitary Sewer and Halton Storm Sewer. The results are presented in Appendix D.

The soil samples recovered during the investigation were stored in the Fisher Environmental laboratory for a period of 30 days after submitting the initital report and were discarded thereafter.

Site Survey

Ground surface elevations at borehole/monitoring well locations were interpolated from an undated topographic survey plan prepared by Ashenhurst nouwens & Associates Inc.

5. SUBSOIL CONDITIONS

Surface and subsurface conditions encountered at borehole locations are shown in Appendix B - Log of Boreholes and are summarized in the following sections. The logs include soil stratification at borehole locations along with detailed soil descriptions. Variations in soil stratification may occur and should be expected between borehole locations and elsewhere on the site.

Fill

Fill soils were found below surficial layer of all boreholes and extended to approximate depths below prevailing grades as shown in Table 1.

The fill generally consisted of brown to dark brown sandy silt with some to trace of topsoil/roots and trace of gravel.

Table 1: Fill Depths and Elevations

Borehole No.	BH1	BH2	BH3	BH4	BH5	BH6	BH7
Surface Elevation (m asl)	103.18	103.75	103.83	102.40	102.84	102.64	102.80
Depth of Borehole (m)	12.65	14.18	9.60	11.13	14.18	12.65	9.60
Elevation at Bottom of Borehole (m asl)	90.53	89.57	94.23	91.27	88.66	89.99	93.20
Depth of Fill (m)	0.91	0.76	0.61	0.61	0.61	0.61	0.76
Elevation at Bottom of Fill (m asl)	102.27	102.99	103.22	101.79	102.23	102.03	102.04

Brown Silty Sand to Sandy Silt

Native brown, moist, loose to compact silty sand to sandy silt were encountered beneath the fill soils extending to approximate depths varying from 1.68m (BH4) to 3.66m (BH5).

Reddish Brown Silty Sand/Sandy Silt

Reddish brown, moist, compact, silty sand to sandy silt was encountered beneath the brown silty sand/sandy silt of BH1 to BH3 extending to approximate depths of 3.05m (BH1 & BH2) and 2.59m (BH3).

Brown/Greyish Brown/Grey Sand/Silty Sand/Gravelly Sand/Gravel & Sand

The brown silty sand/sandy silt of BH4 to BH7 and reddish-brown silty sand of BH1 to BH3 were underlain generally by brown to grey, moist to wet, dense to very dense sand/gravelly sand/gravel & sand deposits extending to termination depths of 9.60m to 14.17m bgs. These layers vary in composition across the site and with depth. Occasional cobbles/boulders were encountered in the gravelly sand/gravel & sand).

Reddish Brown/Grey Silty Clay/Clayey Silt

Layers of reddish brown or grey, moist, firm to very stiff clayey silt to silty clay were found interbedded in the sandy deposits between depths of 4.57m & 4.88m (BH1), 4.88m & 5.49m (BH2), 4.72m & 5.18m (BH3), 3.20m & 4.57m, 6.10m & 7.01m (BH4), 4.88m & 5.49m (BH6) and 4.72m and 6.10m (BH7). Consistency of these layers varied substantially from firm in the upper layer to hard in lower layer of BH4, but generally very stiff in other boreholes

6. HYDROGEOLOGICAL STUDY

A hydrogeological study for the subject site was conducted based on the boreholes/wells' exploration, observation and site/laboratory testing. Groundwater details from the six (6) newly installed monitoring wells were used in the Hydrogeological Study. The wells were constructed with 3.05m (10') long, 51mm diameter PVC slotted screen pipes, with the bases at approximate depths below existing grade as shown in Appendix B. Clean silica sand packs were placed around each well screen which was isolated with bentonite extending to slightly below existing grade.

Groundwater levels on completion of drilling varied from 3.66m to 10.67m below existing grade in the open borehole. MW2 was dry on completion of drilling.

6.1 Hydrogeological Conditions

Review of the available surficial geological and hydrogeological information for the area shows that the site is underlain generally with Coarse-textured glaciolacustrine deposits of sand, gravel, minor silt and

clay. Underlying bedrock is represented by shale, limestone, dolostone and siltstone of the Queenston Formation and is generally less than 20m below prevailing grade. Surficial geology and bedrock maps are presented in Appendix A.

The subsoils and hydrogeological conditions were observed and recorded during both the geotechnical and hydrogeological investigations. Based on the boreholes/wells' exploration, the saturated soil layers on the site were dominated by grey sand/sand and gravel observed at approximately 5m bgs and brown sand at 3m as observed in BH1.

All monitoring wells were purged/developed and allowed to fully recover prior to carrying out groundwater level measurements and sampling. Measured groundwater depths and elevations are summarized in Table 2.

Comments on Table 2:

The following general comments regarding groundwater conditions at the site are based on the groundwater level data and the geotechnical investigation:

- Static groundwater levels were observed at 3.94m to 7.62m below grade (elevations of 99.24m to 96.21m). MW6 (depth of 7.62m bgs) was observed to be dry throughout the investigation.
- Pockets of perched and seepage water from more pervious soils may be expected on the site.
- Grindstone Creek is located approximately 750m west of the site while Lake Ontario is located approximately 950m to the southwest.
- The site is located in a developed residential/commercial area, with no indication of active domestic wells within a 500m radius measured from the centre of the property. Water supply in the area is generally via municipal water system.
- Groundwater levels were monitored over the period June to November 2021 to determine highwater levels at the site.

Table 2: Groundwater Depths and Elevations

No.	Elev. at Ground (m)	Depth of Well/BH, m bgs	On Completion		21-Jun-21		30-Jun-21		14-Jul-21		22-Jul-21		04-Aug-21		01-Sep-21		15-Sep-21		13-Oct-21		27-Oct-21			10-Nov-21
			GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl
MW1	103.18	7.62/12.65	3.66	99.52	4.07	99.11	4.20	98.98	4.13	99.05	4.19	98.99	4.36	98.82	5.15	98.03	5.00	98.18	4.06	99.12	3.94	99.24	3.95	99.23
MW2	103.75	7.62/14.18	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	7.60	96.15	7.51	96.24	7.53	96.22	7.54	96.21
MW3	103.83	7.62/9.60	6.71	97.12	7.54	96.29	7.62	96.21	7.60	96.23	7.62	96.21	7.62	96.21	7.60	96.23	7.59	96.24	7.53	96.30	7.50	96.33	7.52	96.31
MW4	102.40	7.62/11.13	6.71	95.69	5.57	96.83	5.49	96.91	5.50	96.90	Dry	-	6.21	96.19	6.25	96.15	6.05	96.35	5.53	96.87	4.98	97.42	4.99	97.41
MW5	102.84	9.15/14.18	7.01	95.83	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	9.10	93.74	9.14	93.70	9.10	93.74	9.14	93.70
MW6	102.64	7.62/12.65	10.67	91.97	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-	Dry	-
BH7	102.80	9.60	9.15	93.65	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-

6.2 Hydraulic Conductivity K Modeling Results

Single Well Response Tests

Single well response tests (SWRT) were conducted in MW1 and MW3 on July 22, 2021. A rising head test was conducted in MW1 while a falling head test was carried out in MW3 due to limited groundwater in the well at the time of the tests. The water bearing media mainly consisted of layers of sand/sand and gravel, with layers of clayey silt/silty clay interbedded at various intervals, and were assumed to be unconfined, homogenous, isotropic and of uniform thickness. It was also assumed that the wells fully penetrated the water bearing soils. Data from the single well response tests were used to calculate the hydraulic conductivity values using Luthin's method.

Calculated values for hydraulic conductivity (k) are summarized in Table 3 and are representative of the water bearing soil characteristic consisting of sand/ sand and gravel at the screened depths. Details of the hydraulic conductivity analyses are presented in Appendix C.

Table 3: Summary of Single Well Response Tests and Hydraulic Conductivity Results

Test Wells	Well Surface Elevation (m asl)	Groundwater Depth (m)	Screen Elevation (m asl)	Variance of water head created (m)	30 Minutes/ Recovery Percentage	Hydraulic Conductivity, K (Luthin's Method)	
						m/s	m/day
MW1	103.18	4.19	95.56 – 98.61	0.38	27 min / 45%	4.54×10^{-6}	0.392
MW3	103.83	7.66	96.21 – 99.26	0.33	29 min / 97%	1.25×10^{-5}	1.046

6.3 Grain Size Analysis for Hydraulic Conductivity K

Representative samples from BH1 and BH4 were selected and submitted to ALS Environmental Laboratory for grain size distribution and hydrometer analyses. The results for the grain size distribution and hydrometer analyses are presented in Appendix C and summarized in Table 4.

The effective D_{10} sizes obtained from the Grain Size Distribution Graph were used to estimate the hydraulic conductivity (K) of the overburden soils using Hazen's expression, Equation 1:

$$K=10^{-2} D^2_{10} (m/s) \qquad \text{Equation 1}$$

Hydraulic conductivity values obtained for the sand with high clay content and the silty clay were generally in the order of 10^{-10} m/s and are expectedly lower than those obtained during the slug tests as the insitu

tests account for horizontal seams of sand and silt which are not adequately represented in the laboratory samples.

Table 4: Hydraulic Conductivity Estimated from Grain Size Analysis

Location	Depth of soil sample (m)	Soil Classification	Estimated Hydraulic Conductivity (Hazen Number)	
			m/s	m/day
BH1	5 - 6½'	Sand, some Clay, some Silt	1.0×10^{-10}	0.00000864
BH4	20 – 21½'	Silty Clay	1.0×10^{-11}	0.000000864

7. CONSTRUCTION DEWATERING & PERMANENT DRAINAGE

7.1 Construction Dewatering

It was understood that the development will consist of a proposed 29-storey residential building with two underground levels. Subsoil conditions were observed to be generally consistent across the site. Lowest finished floor elevation for P2 level was given as 6.1m below average grade (average grade is 103.06m based on borehole surface elevations) with lowest footings at 95.96m. Conventional strip and/or spread footing foundations were recommended, in the geotechnical investigation report, at depths between 7.0m and 9.0m below prevailing grades. Groundwater levels were observed between 3.94m and 7.62m bgs during the investigation. This means that the footings will likely extend below the groundwater levels observed during the investigation. The groundwater level should therefore be lowered to 1m below the designed footing depths to protect the footing subgrade from hydraulic pressure disturbance during construction.

Construction dewatering flowrate of **45.18 m^3/day (45,180 L/day)** is recommended with two underground levels. Factored dewatering rate of **67.76 m^3/day (FS of 1.5)** should be used for planning purposes.

Seasonal High Groundwater Levels

Installation of the monitoring wells was undertaken during the latter part of spring and groundwater monitoring continued into autumn. An average groundwater level of 4.31m, observed in MW1, was used

to calculate construction dewatering quantities. The highest groundwater level (3.94m) observed during the field investigation was used to calculate permanent drainage rates.

Accounting for Accumulated Precipitation

Provisions should be made to pump any accumulated water from the excavation areas during construction, particularly following a period of heavy rainfall. For example, 25mm rainfall in 24 hrs may result in accumulation of up to 62m^3 in the excavated area. Subsurface soils at the site are dominated by sandy materials with layers of silty clay/clayey silt interbedded. Consequently, some amount of ponding of rainwater may be expected. A conservative accumulated volume of **20 m^3/day** may therefore be assumed for planning purposes. Accumulated precipitation may be stored on site for subsequent disposal to an MOECC-licensed facility. If the water is to be discharged into the public sewer system, then an application for the discharge of private water will have to be made to Halton Region. The water quality, at the time of the application, will need to be ascertained to ensure compliance with Ontario Sewer Use Bylaws – Halton Sanitary Sewer Bylaw No. 02-03.

*Maximum construction discharge rates, taking into consideration accumulated precipitation volumes, are **65,180 L/day** (unfactored) and **87,760 L/day (factored**).*

7.2 Permanent Drainage

Permanent drainage rate of **27.76 m^3/day (27,760 L/day)** was obtained for two underground levels with the lowest P2 elevation of approximately 96.96m asl. A factored permanent drainage rate of **41.64 m^3/day (FS of 1.5)** should be used for planning purposes.

An application for permission to discharge to the municipal/regional sewer system will be required unless the subsurface structure of the building is designed as watertight or onsite disposal facilities are implemented.

It is further recommended that the subsurface portion of the elevator shaft, below P2 level, be designed as watertight to prevent the need to have deeper groundwater sump pits for permanent drainage.

7.3 Permit to Take Water (PTTW)

As the calculated construction dewatering flowrate for the building, including accumulated precipitation, is more than 50 m^3/day, registration on the MOECC Environmental Activity and Sector Registry (EASR) for Water Taking will be required for construction. An application for permission to take water (PTTW) will

not be required for neither construction dewatering nor permanent drainage as the daily flowrates are less than 400,000 and 50,000 L/day respectively.

7.4 Groundwater Quality

The results (June 2021) of analyses for groundwater quality under the Ontario Halton Sanitary Sewer Bylaw No. 02-03 (Mar 2003) show compliance with all parameters as shown in Appendix D.

Additional tests were conducted based on parameters and limits proposed for storm sewer guidelines by the City of Burlington/Halton Region. The tests revealed compliance with all parameters except those listed in Table 5.

Table 5: Exceedances of Proposed Storm Sewer Limits

Parameters	Proposed Storm Limits	Results (MW1)
Manganese (Total), mg/L	0.05	0.0942
Zinc (Total), mg/L	0.04	0.042

Based on the results, presented in Tables 4 & 5, *pre-treatment of the groundwater will be required prior to discharging to the storm sewer system*. The groundwater in its present form may be discharged to the public sanitary system.

It should be noted however that testing of groundwater at the depths observed during the investigation would not be representative of the water that might accumulate during a high rainfall event. Any accumulation of precipitation occurring in the excavation during construction, that may require offsite discharge, will have to be tested at the time of the event to determine the quality of water for discharge.

7.5 Dewatering Influence Zone

The estimated construction dewatering quantities are based on the worst-case groundwater conditions that might occur during the construction period. Calculated dewatering influence zone is expected to be up to 16.15m from the edge of the dewatering point in the predominantly sandy soils. Based on the field investigation, the soils to the proposed excavation depths are dominated by varying layers of sand/sand and gravel. Recharge was observed to be very fast during SWRT. Consequently, a dewatering system may be required if construction is to take place below the observed water table.

7.6 Hydrogeological Impact

During the investigation, it was determined that there will not be any negative impact to the natural environment, Halton Region Sewer works nor surrounding properties due to construction dewatering because of the depth at which groundwater was observed. No groundwater induced depression at surface level is expected. Consequently, it is not expected that construction will impact public infrastructure, the natural environment nor will there be any settlement issues.

8. DISCUSSION

Hydraulic conductivity values (k) calculated from onsite single well response tests are 4.54×10^{-6} and 1.21×10^{-5} m/s (0.392 to 1.046 m/day) in the wells screened within the sand/gravelly and sand/silt. These are representative of the water bearing soils comprising sandy material at the expected excavation depths for footings based on the geotechnical and hydrogeological field investigations.

An approximate construction dewatering discharge rate of 45.18 m^3/day will be required for the recommended footing depths for two underground level (lowest at 7.0m bgs). Permanent drainage of 27.76 m^3/day will be required. A factor of safety of 1.5 should be applied to construction dewatering and permanent drainage rates.

Registration on the MOECP's EASR Website for water taking will be required during construction however an application for PTTW will not be required under conditions observed on the site during the investigation.

The groundwater quality determined by laboratory analyses revealed compliance to parameters of the existing sanitary sewer limits and some exceedances of the proposed storm limits. Consequently, pre-treatment of the water will be required before it can be discharged to the public storm sewer under proposed conditions. Groundwater may be discharged to the public sanitary system under existing sewer use bylaw limits.

It should be noted that if it is intended that any accumulated water, following periods of heavy rainfall, be discharged into the public sewer, then a permit to discharge would be required along with laboratory analyses to ensure compliance with relevant sewer bylaws.

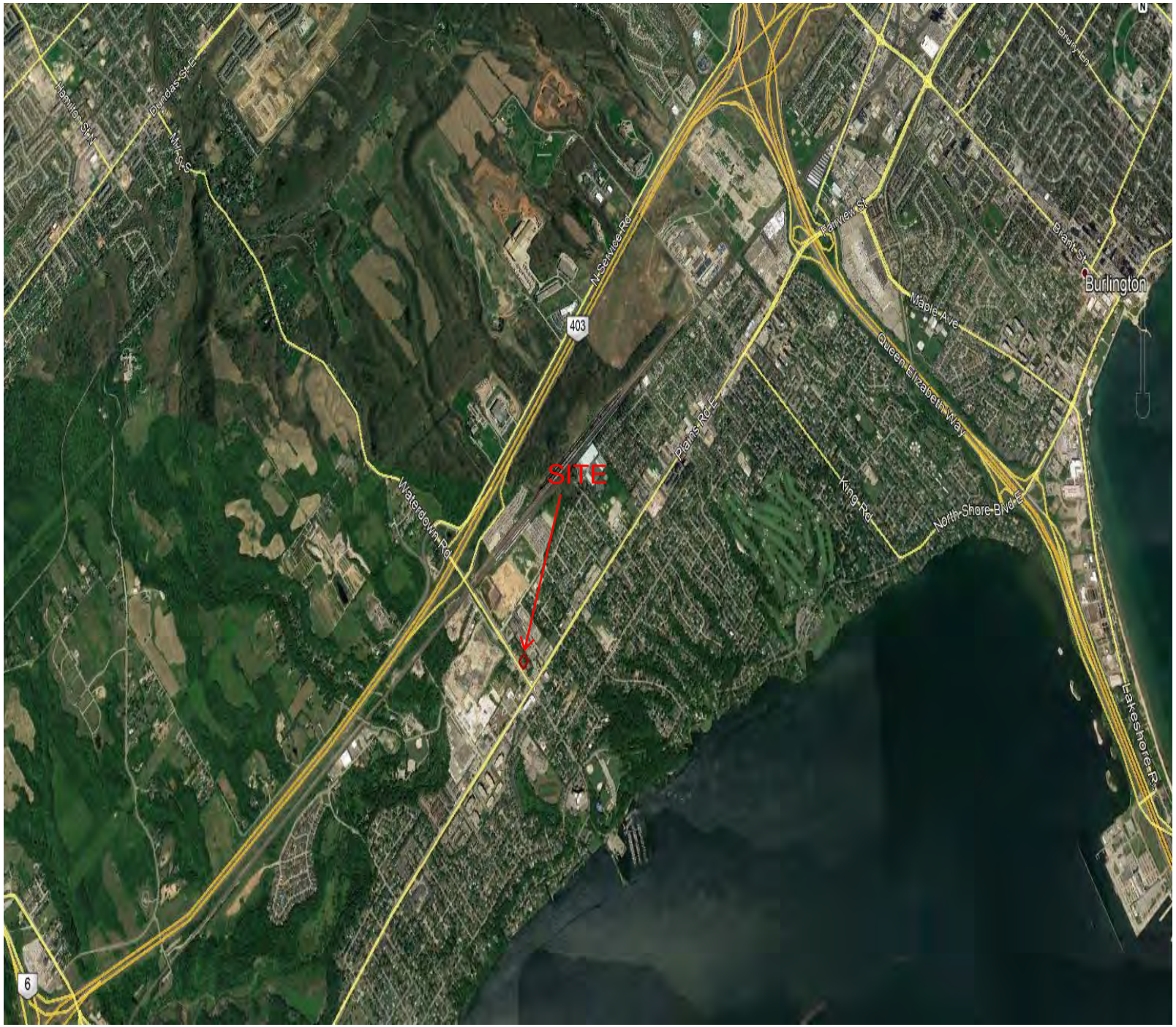
The discharge rates for construction dewatering and permanent drainage, given in the preceding, are based on common practice and reasonable assumption for excavation depths and are subject to further modifications when details of the structures become available.

9. LIMITATIONS

This report is limited in scope to those items specifically referenced in the text. The discussions and recommendations presented in this report are intended only as guidance for the named client, design engineers and those directly associated with implementing, regulating and monitoring of the project. The information on which these recommendations are based is subject to confirmation by engineering personnel at the time of construction. Localized variations in the subsoil conditions may be present between and beyond the boreholes and should be verified during construction.

As more specific subsurface information becomes available during excavations on the Site, this report should be updated. Contractors bidding on or undertaking the work should decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to the classification of the subsurface soil and the potential reuse of these soils on/off Site. Contractors should draw their own conclusions as to how the near surface and subsurface conditions may affect them.

APPENDIX A – SITE AND LOCATION MAPS AND PLAN



FISHER ENGINEERING

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Markham, Ontario
L3R 3K2

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Fax: 905 475-7718

NORTH

N

LEGEND

SITE BOUNDARY

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL INVESTIGATION

1029 & 1033 Waterdown Road,
BURLINGTON,ONTARIO

FIGURE 1:

SITE LOCATION PLAN

SHEET NO.

A1

PROJECT NO.

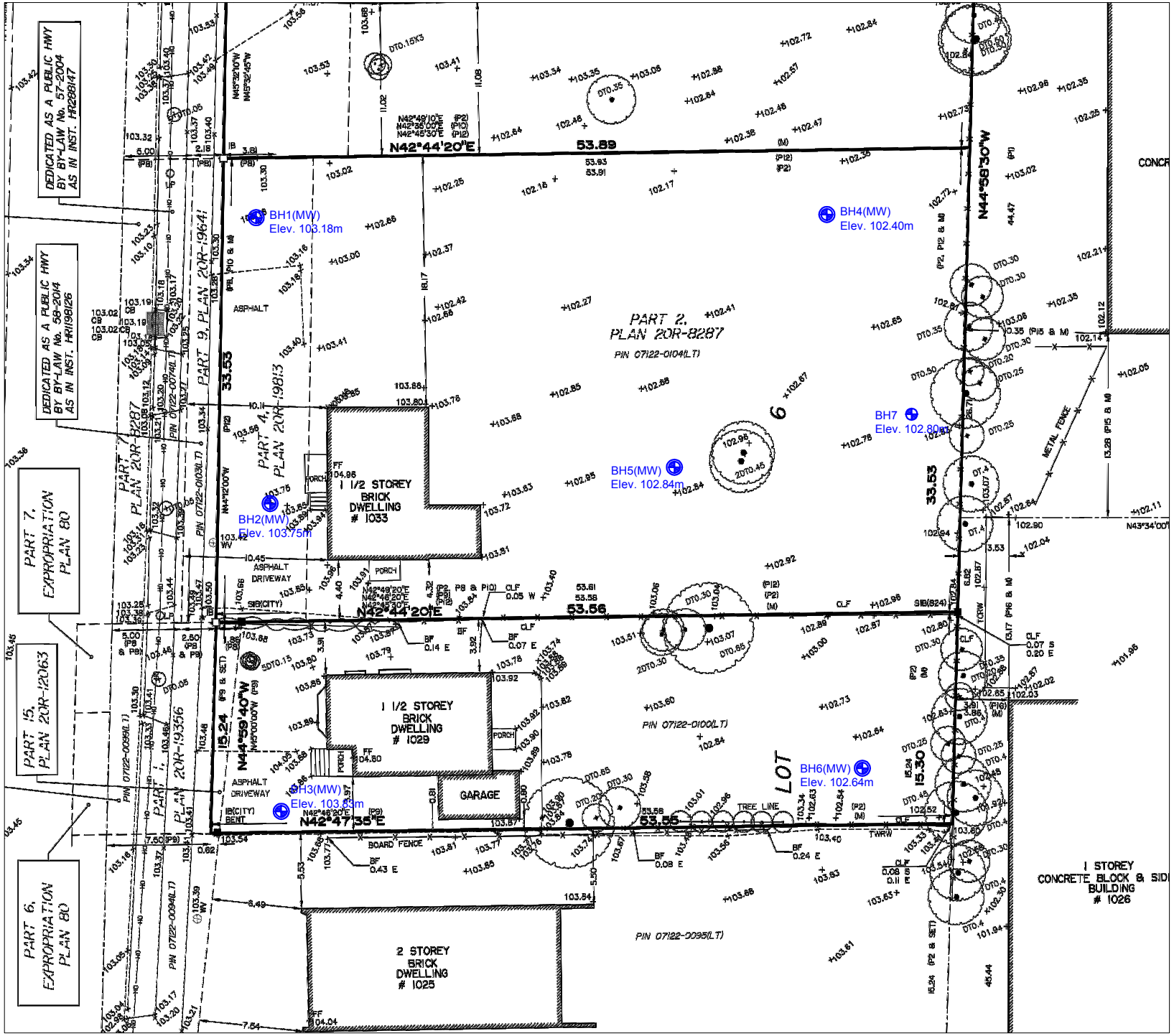
FE-P20-11237

DATE

JULY 2021

SCALE

AS SHOWN



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NORTH

LEGEND

Borehole/
Monitoring Well

PROJECT NAME AND ADDRESS

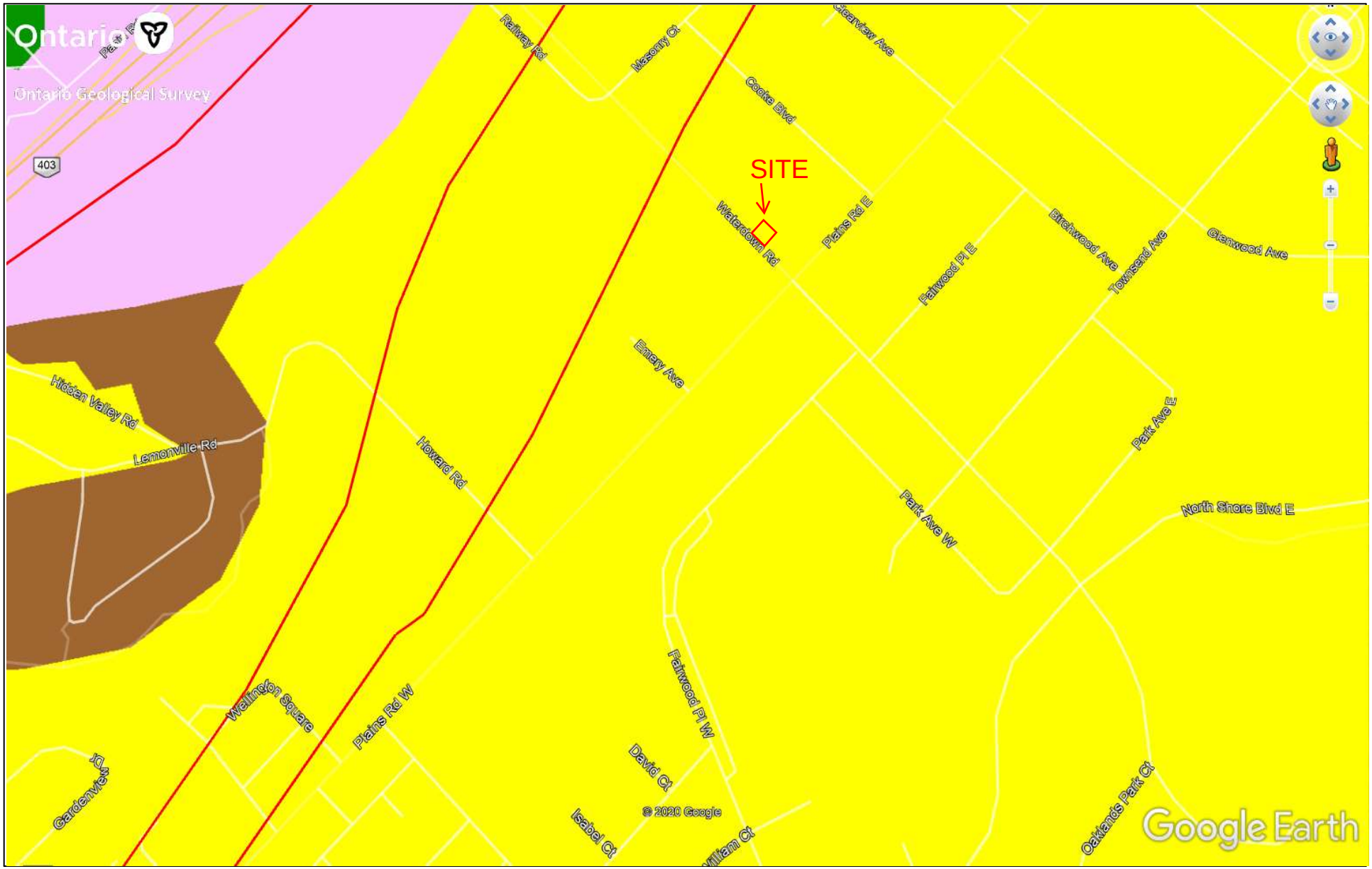
HYDROGEOLOGICAL & GEOTECHNICAL INVESTIGATIONS

1029-1033 WATERDOWN ROAD, BURLINGTON, ONTARIO

FIGURE 1:

SITE PLAN WITH BOREHOLE LOCATIONS

PROJECT NO.	SHEET NO.
FE-P 21-11236/37	2
DATE: NOVEMBER 2021	
SCALE: AS SHOWN	



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KEY PLAN

LEGEND

Coarse-textured glaciolacustrine deposits: sand, gravel, minor silt and clay

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL INVESTIGATION

1029 & 1033 Waterdown Road, Burlington, Ontario

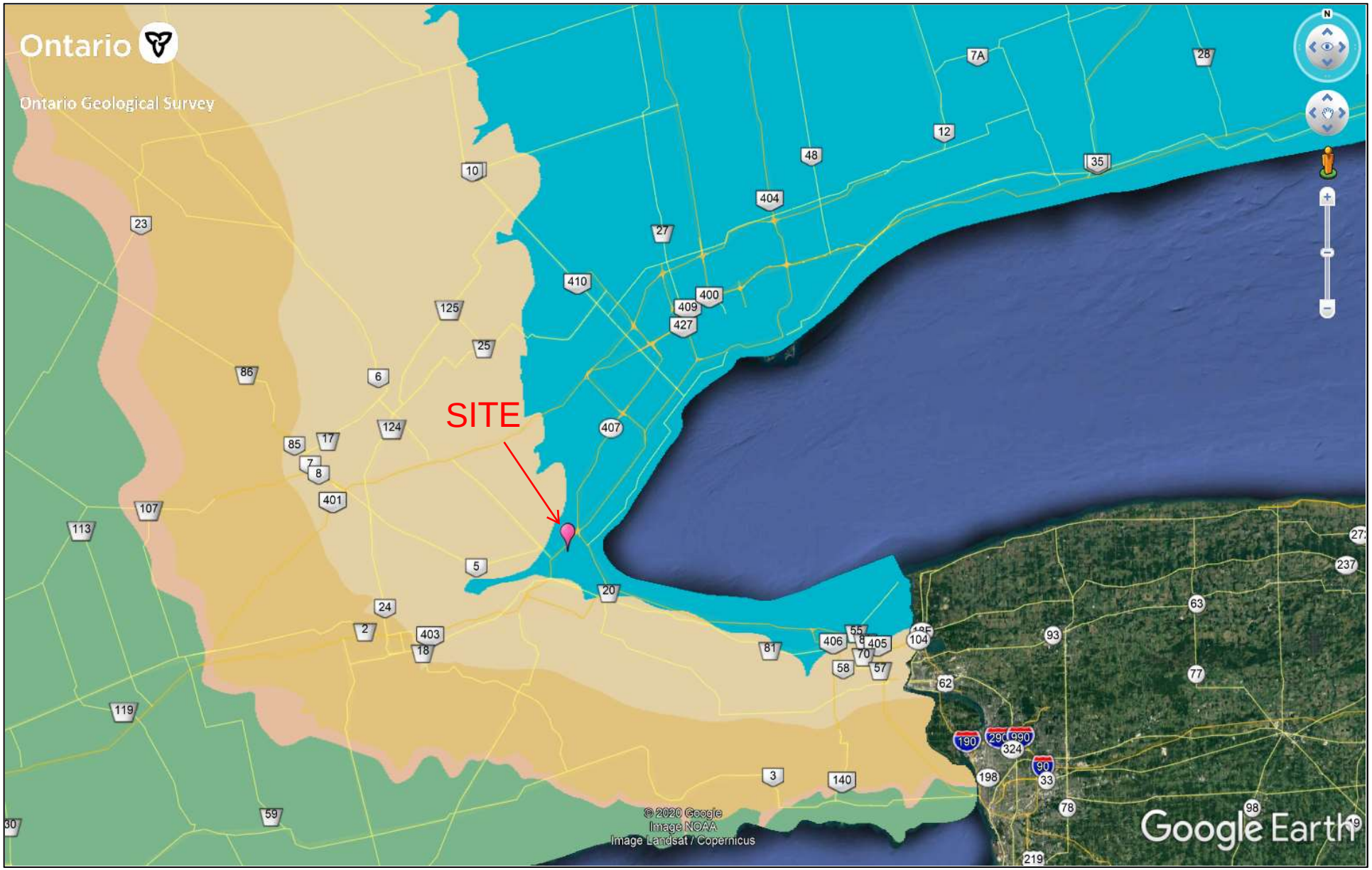
PROJECT NO. FE-P 21-11237H

DATE JULY 2021

SCALE

A3

Surficial Geology Map



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KEY PLAN

LEGEND

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL INVESTIGATION

1029 & 1033 Waterdown Road,
Burlington, Ontario

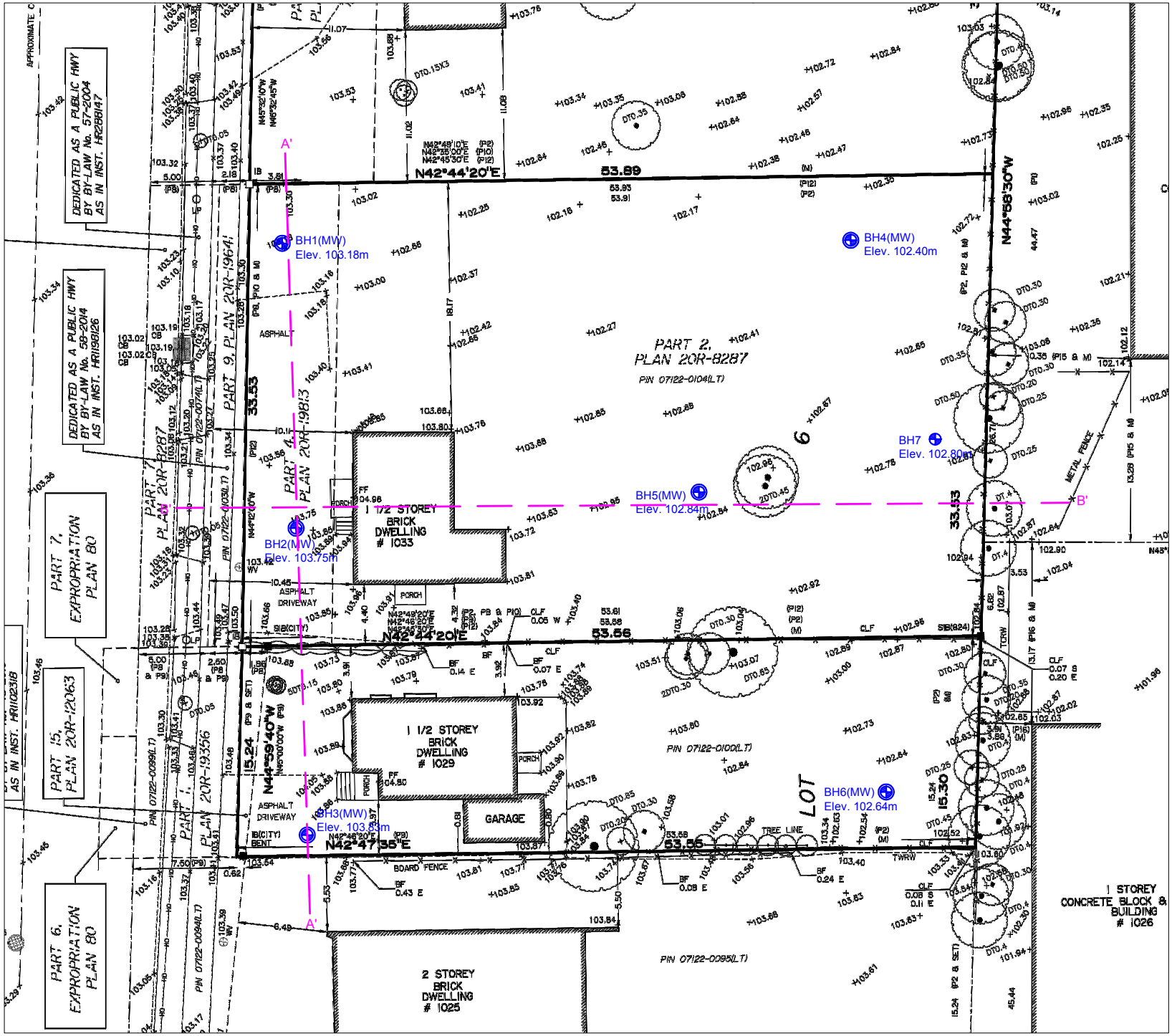
PROJECT NO.
FE-P 21-11237H

DATE
JULY 2021

SCALE

A4

Bedrock Geology Map



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NORTH

LEGEND

- Borehole/ Monitoring Well
- Cross Section Line

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL & GEOTECHNICAL INVESTIGATIONS

1029-1033 WATERDOWN ROAD, BURLINGTON, ONTARIO

FIGURE 1:

SITE PLAN WITH CROSS SECTION LINES

PROJECT NO.	SHEET NO.
FE-P 21-11236/37	A5
DATE: NOVEMBER 2021	
SCALE: AS SHOWN	

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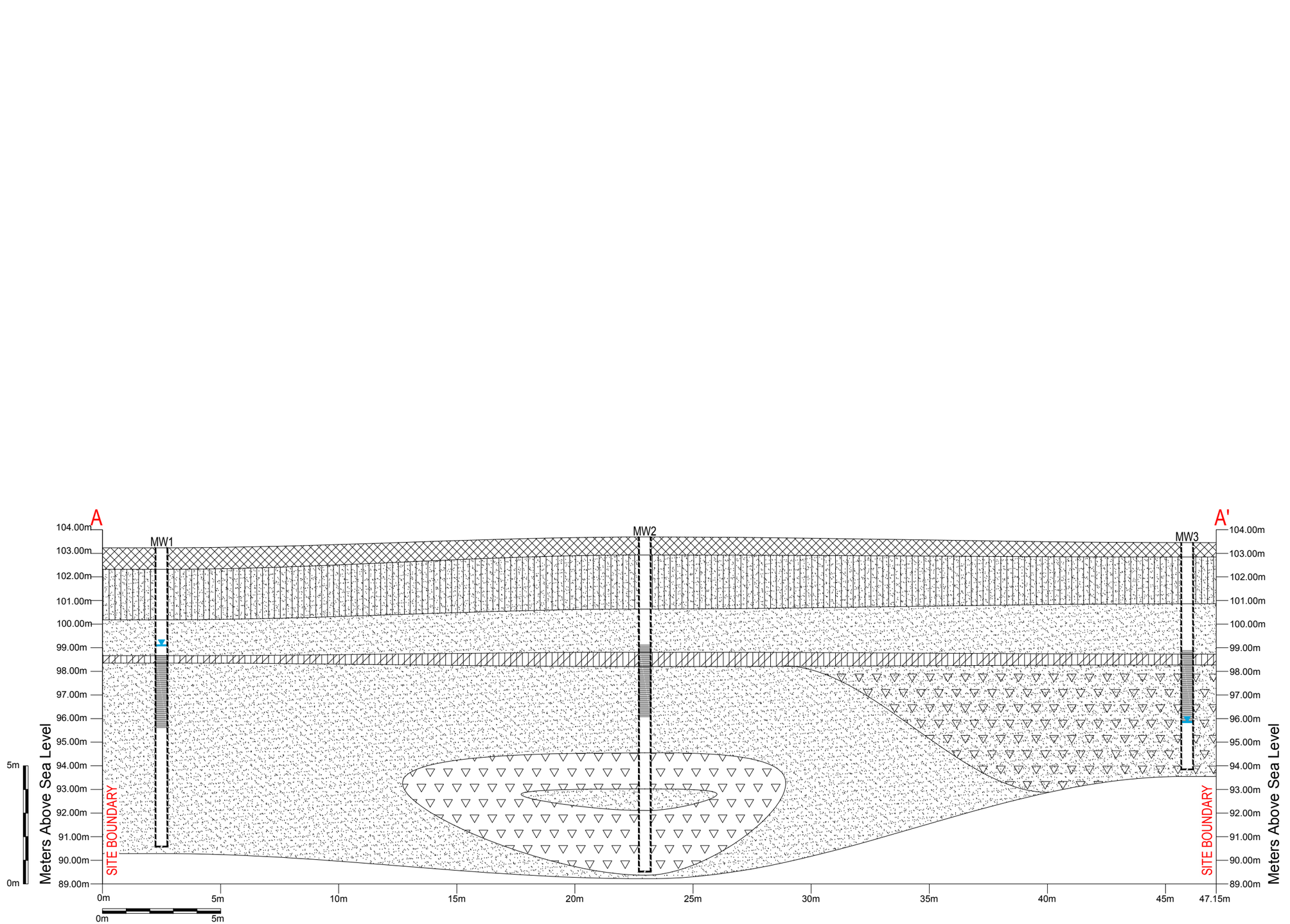

NORTH

LEGEND

- ASPHALT
- FILL
- SAND
- SILT
- CLAY
- GRAVEL
- GROUNDWATER POTENTIOMETRIC LEVEL

PROJECT NAME AND ADDRESS

GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATION

1029-1033 Waterdown Road, Burlington, Ontario

FIGURE 5.1:

CROSS-SECTION A - A';

PROJECT NO.	SHEET NO.
FE-P 21-11236/ 37	5.1
DATE: 6 August 2021	
SCALE: AS SHOWN	

FISHER ENGINEERING

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Markham, Ontario
L3R 3K2

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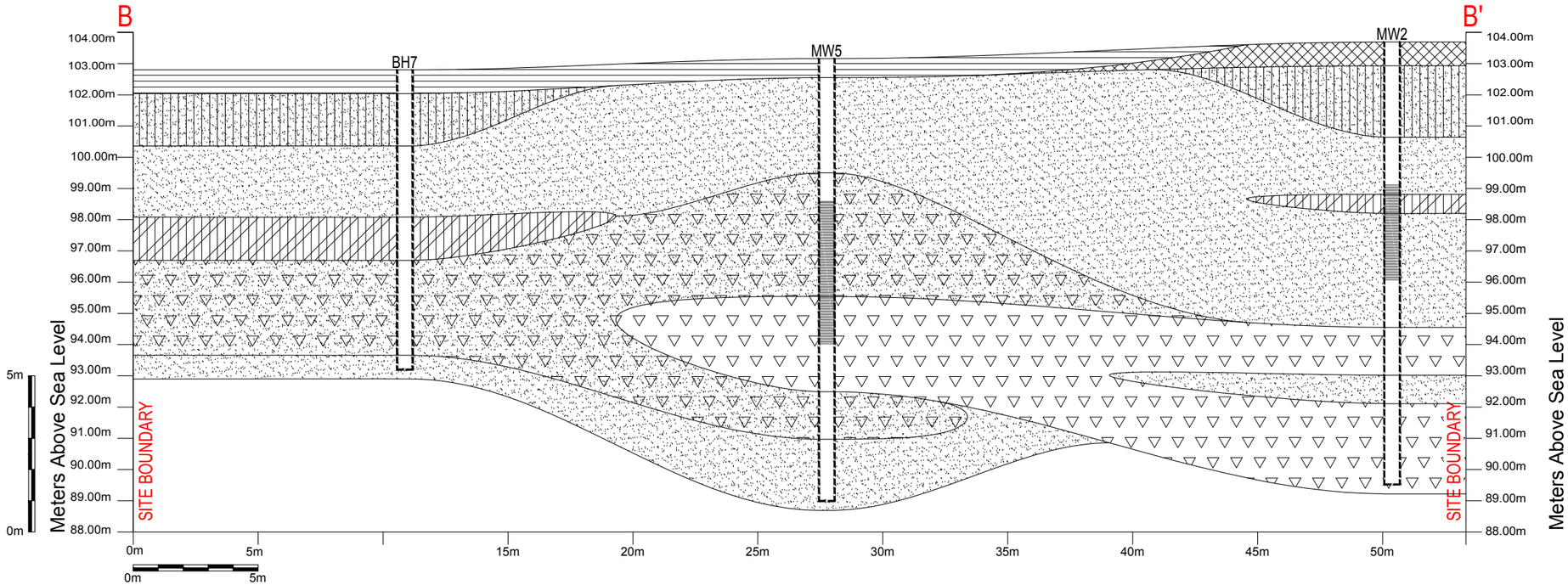
Fax: 905 475-7718

NORTH

LEGEND

- FILL
- TOPSOIL
- SAND
- SILT
- CLAY
- GRAVEL
- GROUNDWATER POTENTIOMETRIC LEVEL



PROJECT NAME AND ADDRESS

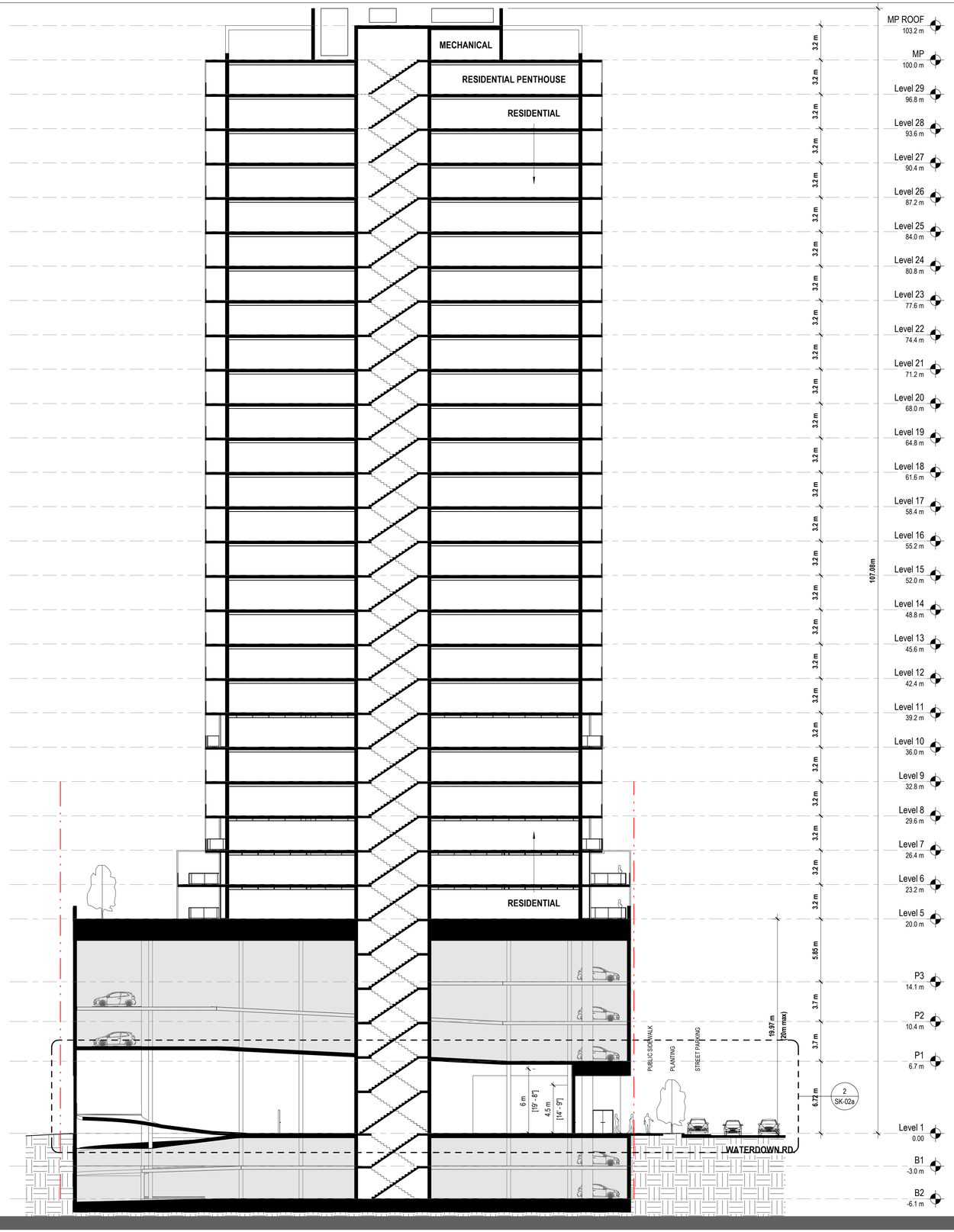
GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATION

1029-1033 Waterdown Road, Burlington, Ontario

FIGURE 5.2:

CROSS-SECTION B - B';

PROJECT NO.	SHEET NO.
FE-P 21-11236/ 37	5.2
DATE: 6 August 2021	
SCALE: AS SHOWN	



BUILDING STATS

Floor Level	Parking Count	Parking Area BG (Sqm)	Parking Area AG (sqm)	Retail (sqm)	Amenity (Sqm)	Floor Area (Sqm)	Total Units	Unit Types 1 Bed	Unit Types 2 Bed
29						750	6	0	6
28						750	12	10	2
27						750	12	10	2
26						750	12	10	2
25				0	0	750	12	10	2
24						750	12	10	2
23						750	12	10	2
22						750	12	10	2
21						750	12	10	2
20						750	12	10	2
19						750	12	10	2
18						750	12	10	2
17						750	12	10	2
16						750	12	10	2
15						750	12	10	2
14						750	12	10	2
13						750	12	10	2
12						750	12	10	2
11						750	12	10	2
10						750	12	10	2
9						750	12	10	2
8						750	12	10	2
7						750	12	10	2
6						1006	13	4	9
5				0	78	1006	12	4	8
4.5	41	0	1337						
4	53	0	1858			0	0	0	
3	56	0	1602			0	0	0	
2	42	0	1421			0	0	0	
1 (GRADE)	0			189	650	2177			
-2	64	2353							
-1	64	2353							
	320	4706	6218	189	728	21439	295	228	67

PARKING AREA BELOW GRADE = 4,706sqm
PARKING AREA ABOVE GRADE = 6,218sqm
BUILDING AREA ABOVE GRADE = 27,657sqm

TOTAL PARKING = 320
TOTAL UNITS = 295
TOTAL AMENITY = 728sqm

Site Development Stats

1029-1033 Waterdown Rd.

	ITEM	PROPOSED
1	ZONE - PROPOSED BUILDING PERMITTED USES	/
2	LOT AREA	2,614sqm (0.261 ha)
3	LOT FRONTAGE	48.67m
4	FRONT YARD SETBACK (podium)	0.0m
4.5	FRONT YARD SETBACK (tower)	3.77m
5	REAR YARD DEPTH (podium)	0m
5.5	REAR YARD DEPTH (tower)	13.55m
6	INTERIOR SIDEYARD DEPTH (podium)	0.25m (north) 1.21m (south)
6.5	INTERIOR SIDEYARD DEPTH (tower)	12.59m (north) 12.5 (south)
7	LANDSCAPE OPEN SPACE	6%
8	COVERAGE	94%
9	HEIGHT	107.08m
10	DENSITY	1130 uph (295 units)
11	RESIDENTIAL PARKING	320 spaces (1.08 per)
12	RESIDENTIAL BIKE PARKING	60 spaces (0.2 per)

VEHICLE PARKING:
RESIDENTIAL REQUIREMENTS
295 UNITS
RESIDENTIAL (1:1) = 295 REQUIRED **= 295 PROVIDED (1:1)**
VISITOR (1:0.25) = 75 REQUIRED **= 25 PROVIDED (1:0.08)**

BIKE PARKING:
RESIDENTIAL REQUIREMENTS
295 UNITS
SHORT TERM (0.05) = 15 REQUIRED = 15 PROVIDED
LONG TERM (0.5) = 150 REQUIRED = 60 PROVIDED

RETAIL REQUIREMENTS
189sqm
SHORT TERM (3 PLUS 1/1000sqm) = 4 REQUIRED = 4 PROVIDED
LONG TERM (2 PLUS 1/1000sqm) = 3 REQUIRED = 0 PROVIDED

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PROJECT NAME

ZONING PACKAGE
1029-1033 Waterdown Rd.
Burlington, ON

DRAWING TITLE

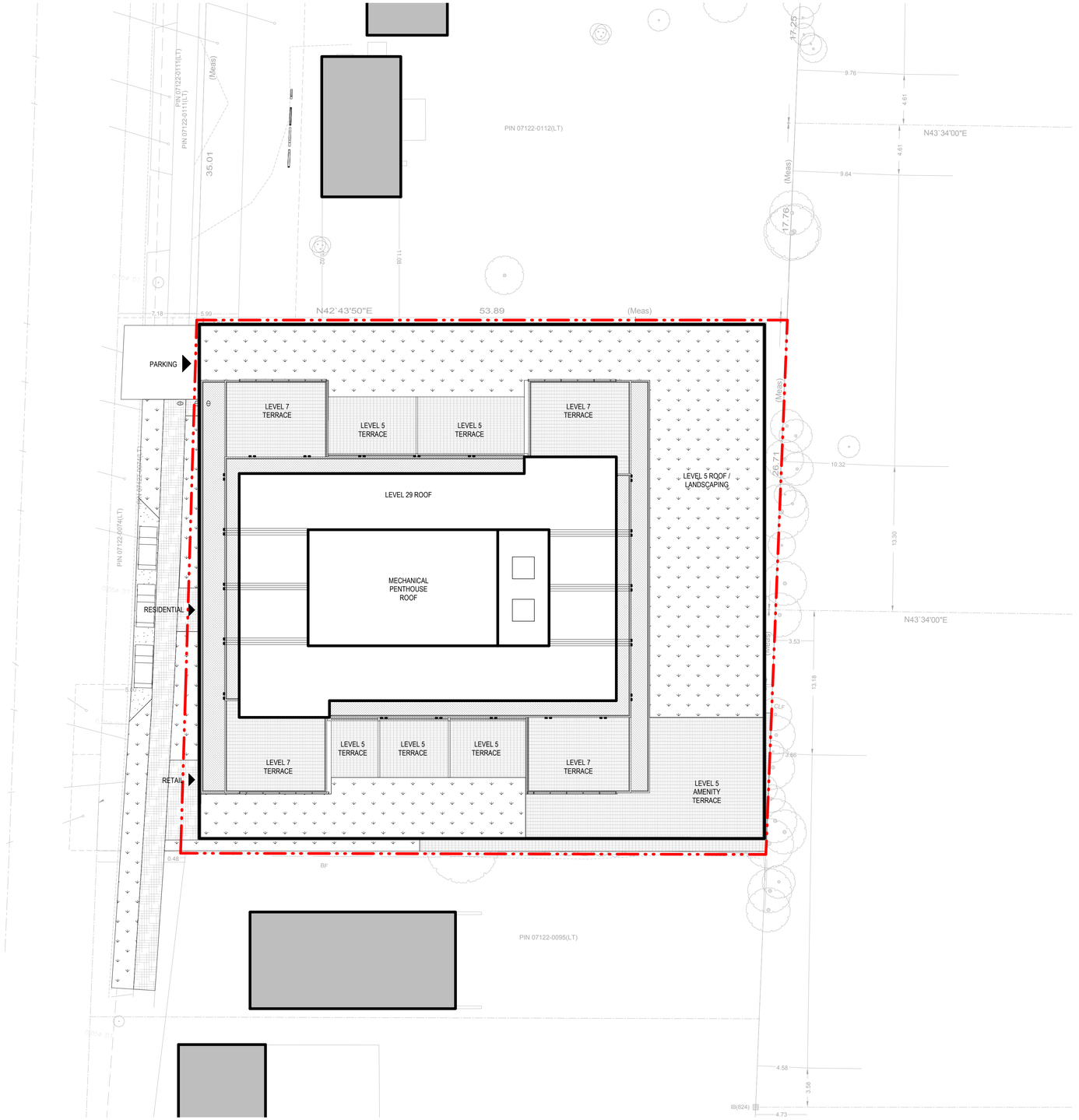
Stats

DRAWING INFO.

Project Number	20-026
Date	2021-08-24
Scale	1 : 200
Drawn by	STF
Checked by	DY

SHEET NO.

SK-01



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PROJECT NAME

ZONING PACKAGE
1029-1033 Waterdown Rd.
Burlington, ON

DRAWING TITLE

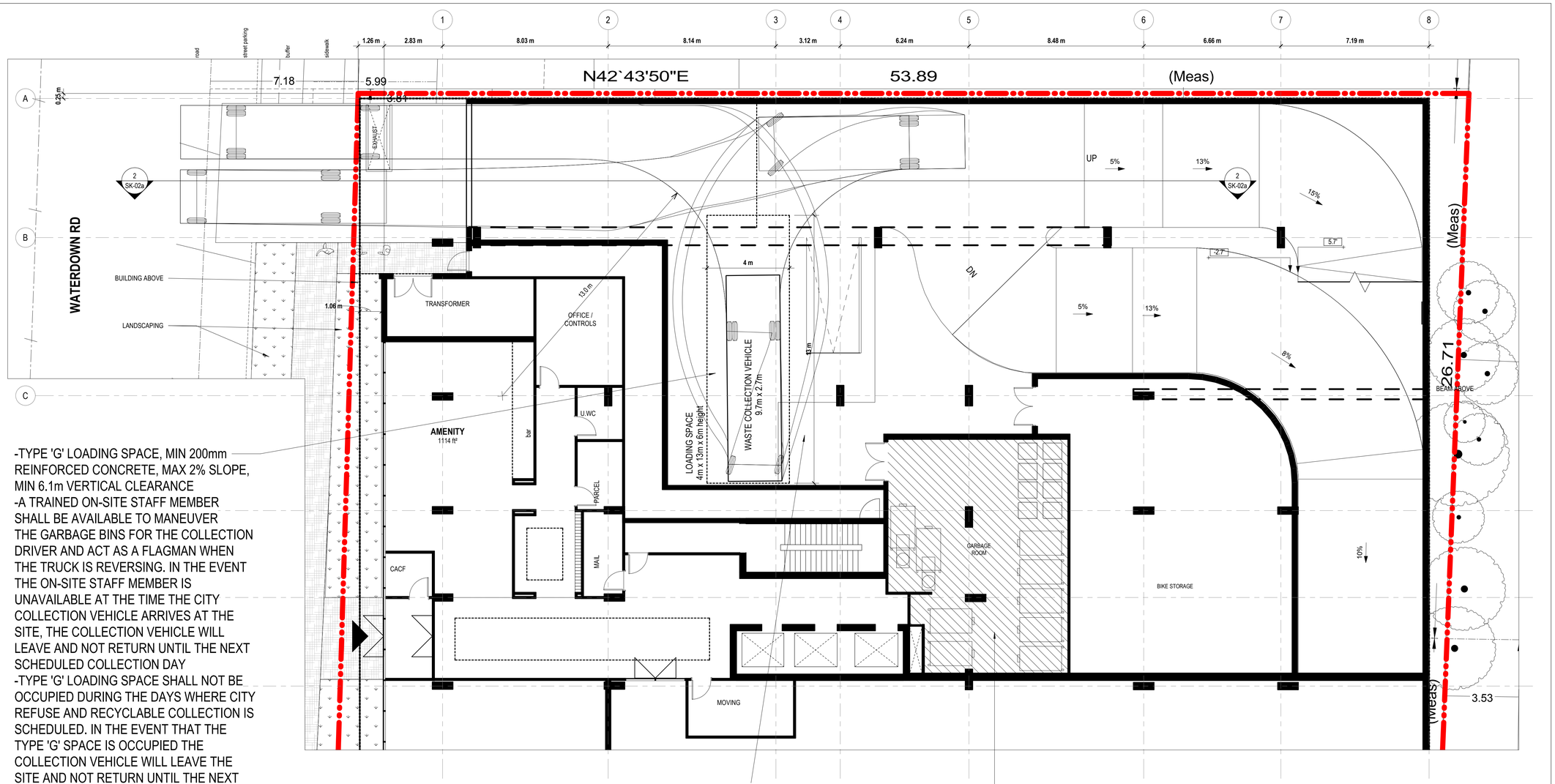
Site Plan

DRAWING INFO.

Project Number	20-026
Date	2021-08-24
Scale	1 : 200
Drawn by	STF
Checked by	DY

SHEET NO.

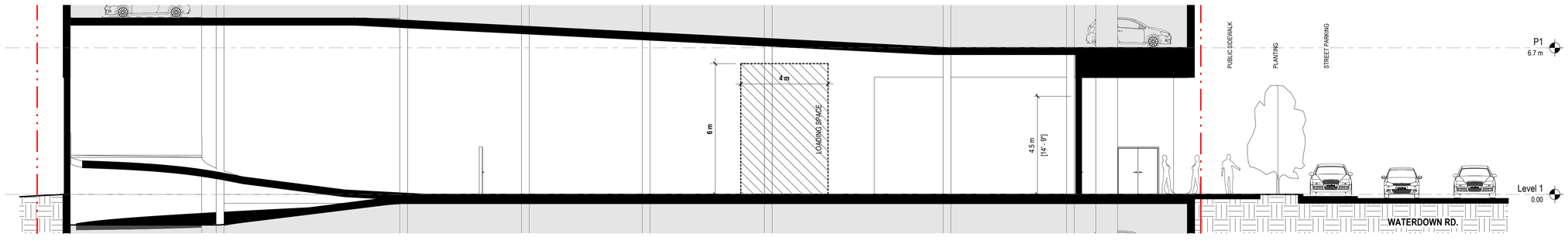
SK-02



-TYPE 'G' LOADING SPACE, MIN 200mm REINFORCED CONCRETE, MAX 2% SLOPE, MIN 6.1m VERTICAL CLEARANCE
-A TRAINED ON-SITE STAFF MEMBER SHALL BE AVAILABLE TO MANEUVER THE GARBAGE BINS FOR THE COLLECTION DRIVER AND ACT AS A FLAGMAN WHEN THE TRUCK IS REVERSING. IN THE EVENT THE ON-SITE STAFF MEMBER IS UNAVAILABLE AT THE TIME THE CITY COLLECTION VEHICLE ARRIVES AT THE SITE, THE COLLECTION VEHICLE WILL LEAVE AND NOT RETURN UNTIL THE NEXT SCHEDULED COLLECTION DAY
-TYPE 'G' LOADING SPACE SHALL NOT BE OCCUPIED DURING THE DAYS WHERE CITY REFUSE AND RECYCLABLE COLLECTION IS SCHEDULED. IN THE EVENT THAT THE TYPE 'G' SPACE IS OCCUPIED THE COLLECTION VEHICLE WILL LEAVE THE SITE AND NOT RETURN UNTIL THE NEXT SCHEDULED COLLECTION DAY
-ENTIRE SLAB STRUCTURE WHERE COLLECTION VEHICLE IS REQUIRED TO DRIVE ONTO TO BE DESIGNED TO COMPLY WITH OBC AND CITY OF TORONTO BULK LIFT VEHICLE TO SUPPORT FULLY LOADED COLLECTION VEHICLE

- CONCRETE STAGING PAD, MIN. 10sqm. MIN 200mm REINFORCED CONCRETE, MAX 2% SLOPE, MIN 6.1 CLEAR
- A TRAINED ON-SITE STAFF MEMBER MUST TRANSFER THE REFUSE FROM THE STAGING AREA TO THE COLLECTION VEHICLE AND BE PRESENT DURING COLLECTION FOR JOCKEYING OF BINS AND ENSURING SAFE BACK-UP MANEUVERS

NOTE: BINS TO BE FILLED AND STORED IN DESIGNATED WASTE/RECYCLING ROOMS AND BROUGHT TO LOADING / STAGING AREA ONLY ON DAY OF COLLECTION



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PROJECT NAME

ZONING PACKAGE
1029-1033 Waterdown Rd.
Burlington, ON

DRAWING TITLE

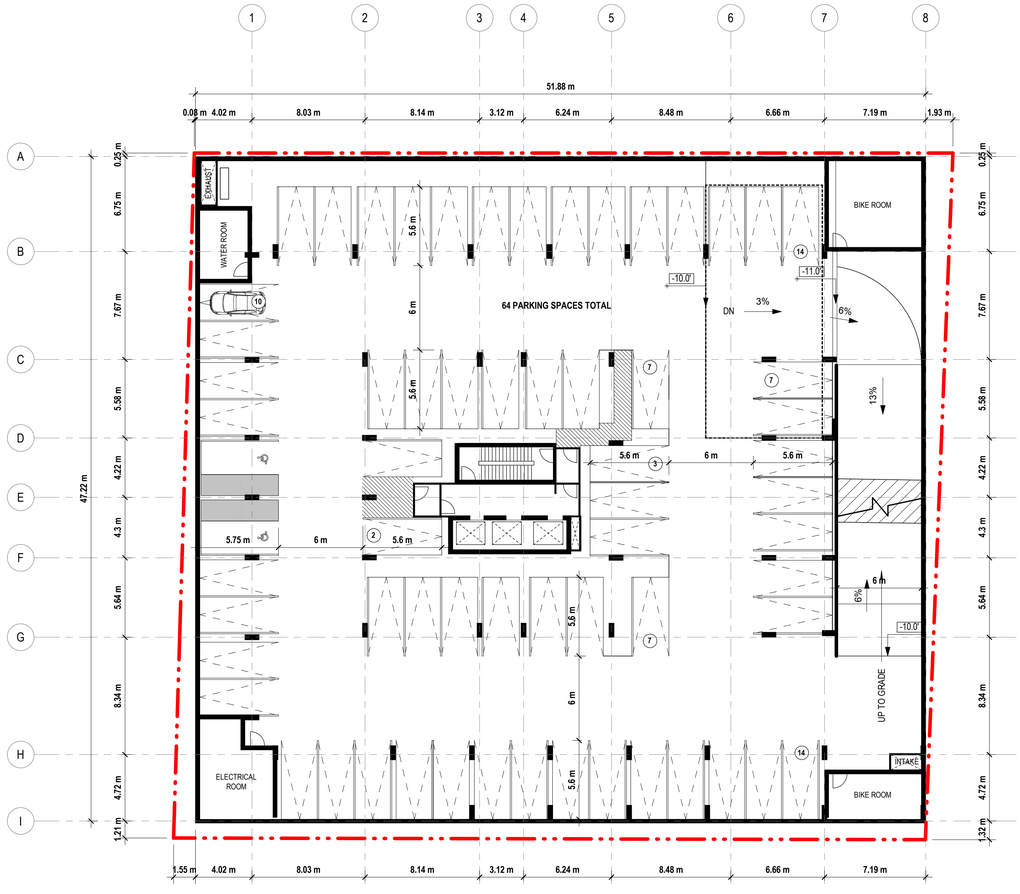
Waste Management Plan

DRAWING INFO.

Project Number	20-026
Date	2021-08-24
Scale	1 : 100
Drawn by	STF
Checked by	DY

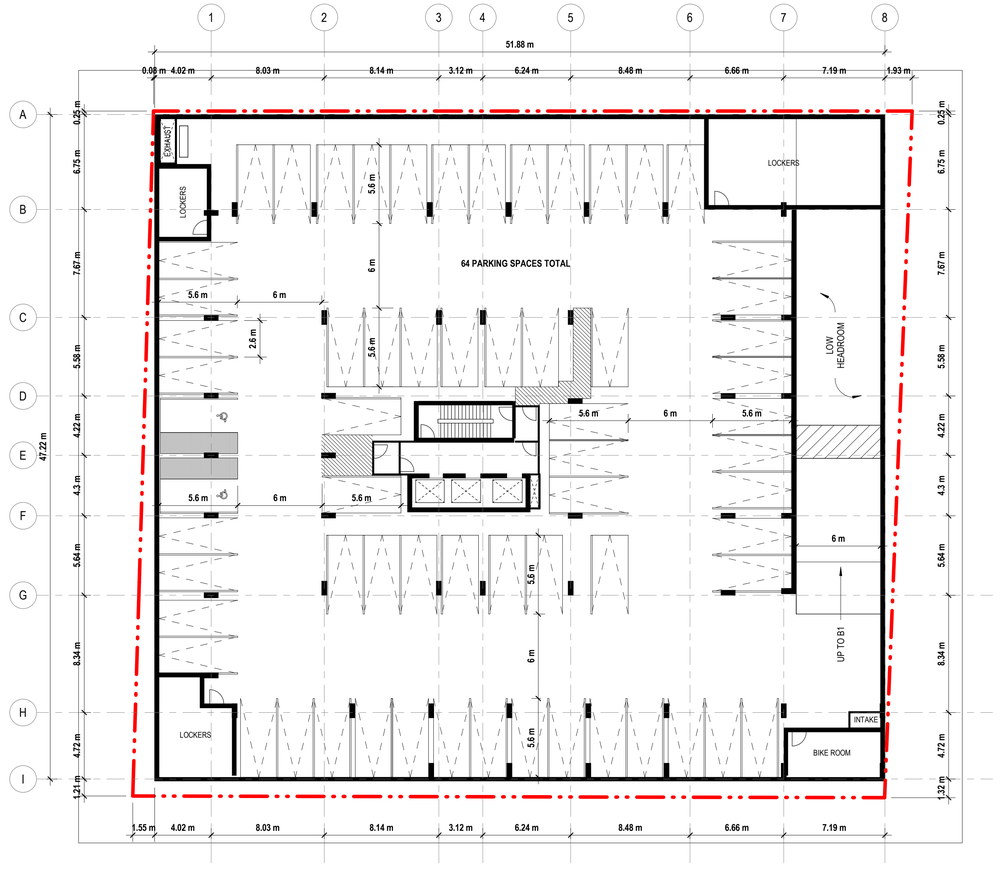
SHEET NO.

SK-02a



LEVEL B1
FLOOR PLATE:
25,330sf (2353sqm)

64 PARKING



LEVEL B2
FLOOR PLATE:
25,330sf (2353sqm)

64 PARKING

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ARCHITECTURE

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NO.	DATE	DESCRIPTION
REVISION		

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PROJECT NAME

ZONING PACKAGE
1029-1033 Waterdown Rd.
Burlington, ON

DRAWING TITLE

Below Grade Parking

DRAWING INFO.

Project Number	20-026
Date	2021-08-24
Scale	1 : 200
Drawn by	STF
Checked by	DY

SHEET NO.

SK-03

APPENDIX B – LOG OF BOREHOLES

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW1 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

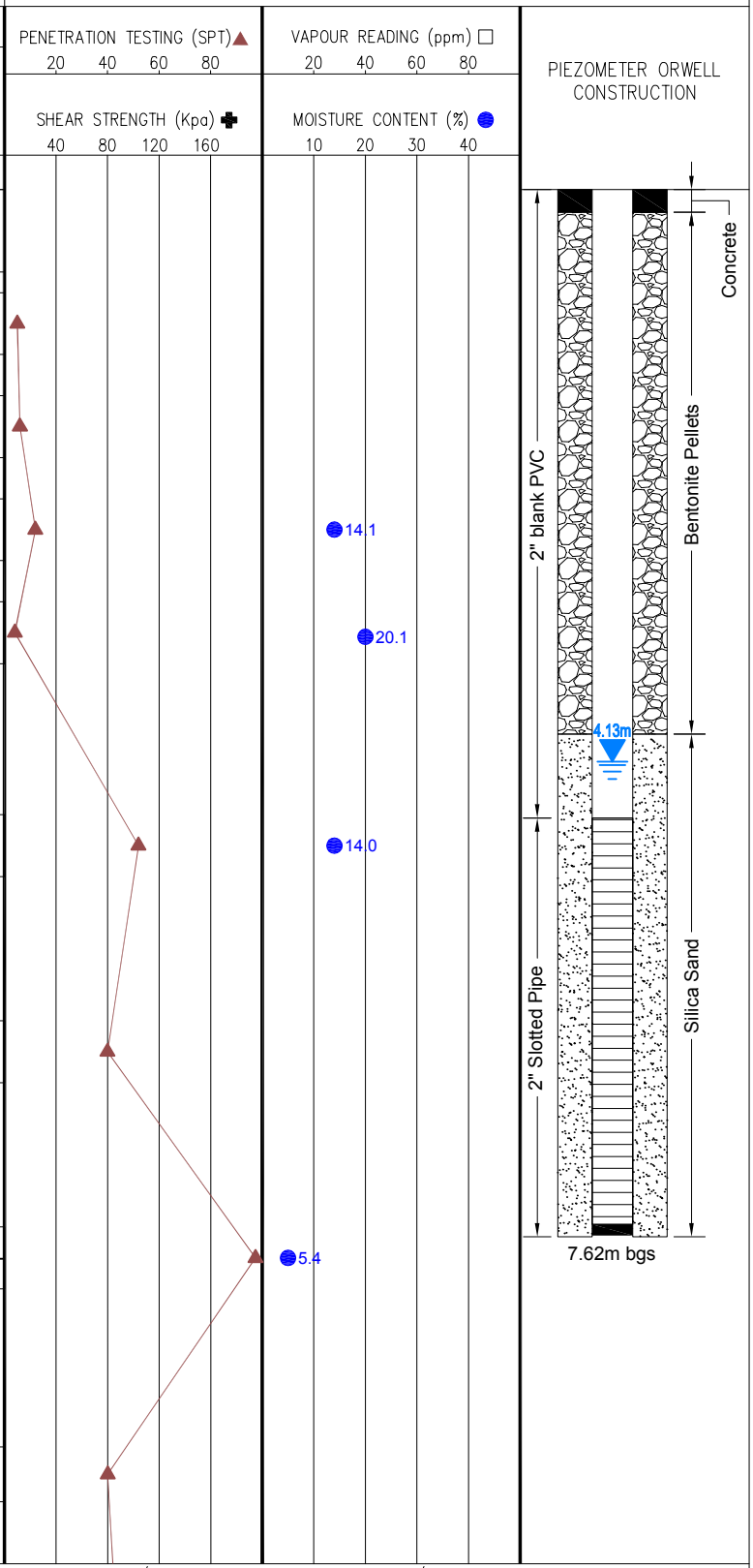
PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME-75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GRAVEL and SAND		103.18			
0	0	FILL (TOPSOIL): Brown sandy silt, some gravel, some roots, dry				SS-1	
2	1			0.91/ 102.27		SS-2	5
4		SANDY SILT: Brown, trace gravel, slightly moist, loose					
6	2					SS-3	6
8				2.44/ 100.74	21-6748-1	SS-4	12
		SILTY SAND: Reddish brown, moist, compact					
10	3			3.05/ 100.13	21-6748-2	SS-5	4
12	4	SAND: Brown, moist to wet, loose @ 3.66m, wet					
14				4.57/ 98.61	21-6748-3		
16	5	CLAYEY SILT: Red brown, slightly moist, hard		4.88/ 98.30	21-6748-4 (Field Duplicate)	SS-6	52
18		SAND: Grey, trace gravel, occasional cobbles/boulders, occasional clayey silt seams, moist, dense to very dense					
20	6					SS-7	40
22	7						
24							
26	8				21-6748-5	SS-8	100+
28							
30	9					SS-9	40
32	10						



Groundwater Depth: on completion: 3.66m/ On Jun 21, 2021: 4.07m/ On Jun 30, 2021: 4.20/ On Jul 21, 2021: 4.13m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW1 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME–75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE	PENETRATION TESTING (SPT) ▲ 20 40 60 80 / SHEAR STRENGTH (Kpa) ✚ 40 80 120 160	VAPOUR READING (ppm) □ 20 40 60 80 / MOISTURE CONTENT (%) 10 20 30 40	PIEZOMETER ORWELL CONSTRUCTION
		GROUND SURFACE (m asl)								
32	10	SAND: Grey, trace gravel, occasional cobbles/boulders, occasional clayey silt seams, moist, dense to very dense								
34										
36	11					SS–10	45			
38										
40	12					SS–11	50			
42	13	End of Borehole		12.65/ 90.53						
44										
46	14									
48										
50	15									
52	16									
54										
56	17									
58										
60	18									
62	19									
64										

Groundwater Depth: on completion: 3.66m/ On Jun 21, 2021: 4.07m/ On Jun 30, 2021: 4.20/ On Jul 21, 2021: 4.13m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW2 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME-75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
		GRAVEL and SAND		103.75			
0	0	FILL: Brown sandy silt, trace gravel, dry				SS-1	
2				0.76/ 102.99			
4	1	SANDY SILT/SILTY SAND: Brown, trace gravel, slightly moist, loose				SS-2	6
6						SS-3	7
	2			2.29/ 101.46			
8		SILTY SAND: Reddish brown, moist compact				SS-4	10
10	3	SAND: Brownish grey, moist, compact		3.05/ 100.70		SS-5	12
12							
	4						
14							
16				4.88/ 98.87		SS-6	18
	5	CLAYEY SILT/ SILTY CLAY: Red to brown, moist, very stiff		5.49/ 98.26			
18		SAND: grey, some gravel, moist to wet, dense to very dense					
20	6					SS-7	30
22							
	7						
24							
26						SS-8	100+
	8						
28							
30	9			9.14/ 94.61		SS-9	100+
32		GRAVEL: Grey, trace sand, trace cobbles, slightly moist, very dense					
	10						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Concrete

Bentonite Pellets

2" blank PVC

2" Slotted Pipe

Silica Sand

7.62m bgs

Groundwater Depth: on completion: Dry/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW2 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: CME–75 SOLID STEM

DRILLING DATE: June 15, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE	PENETRATION TESTING (SPT) ▲ 20 40 60 80 / SHEAR STRENGTH (Kpa) ✚ 40 80 120 160	VAPOUR READING (ppm) □ 20 40 60 80 / MOISTURE CONTENT (%) ● 10 20 30 40	PIEZOMETER ORWELL CONSTRUCTION
		GROUND SURFACE (m asl)								
32	10	GRAVEL: Grey, trace sand, trace cobbles, slightly moist, very dense								
				10.67/ 93.08						
34		SAND: Grey, dry, very dense				SS–10	100+			
36	11									
				11.58/ 92.17						
38		GRAVEL: Grey, trace sand, trace cobbles, slightly moist, very dense								
40	12					SS–11	100+			
42	13									
44										
46	14					SS–12	100+			
				14.17/ 89.58						
		End of Borehole								
48	15									
50										
52	16									
54										
56	17									
58										
60	18									
62	19									
64										

Groundwater Depth: on completion: Dry/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW3 SHEET. 1 of 1

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)	103.83			
0	0	FILL: Sandy gravel, grey, trace silt, dry	0.61/ 103.22		SS-1	
2		SILTY SAND: Brown, trace gravel, slightly moist, loose to compact			SS-2	9
4	1				SS-3	13
6		SANDY SILT: Red to brown, wet, compact	1.83/ 102.00		SS-4	12
8	2		2.59/ 101.24			
10		SAND: Grey, trace gravel, moist, compact			SS-5	22
12	3					
14						
16	4		4.72/ 99.11	21-6748-6	SS-6	28
	5	SILTY CLAY: Red to brown, moist, very stiff	5.18/ 98.65			
18		SAND with GRAVEL: Grey, occasional cobbles/ boulders, moist, very dense, wet @ 5.49m, occasional clayey/silty seams				
20	6				SS-7	60
22						
24	7					
26				21-6748-7	SS-8	100+
28	8					
30				21-6748-8	SS-9	100+
32	9		9.60/ 94.23			
	10	End of Borehole				

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

18.2

8.2

7.2

PIEZOMETER ORWELL CONSTRUCTION

Concrete

Bentonite Pellets

2" blank PVC

2" Slotted Pipe

Silica Sand

7.60m

7.62m bgs

Groundwater Depth: on completion: 6.71m/ On Jun 21, 2021: 7.54m/ On Jun 30, 2021: 7.62m/ On Jul 14, 2021: 7.60m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW4 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)		102.40			
0	0	TOPSOIL: Brown sandy silt, trace gravel, dry		0.61/ 101.79		SS-1	
2		SILTY SAND to SANDY SILT: Brown, slightly moist, loose				SS-2	6
4	1			1.68/ 100.72		SS-3	6
6		SAND: Grey, wet, loose to compact				SS-4	12
8	2						
10				3.20/ 99.20		SS-5	4
12	3	SILTY CLAY: Red to brown, moist, firm					
14				4.57 97.83			
16	4	SAND: Grey, wet, compact				SS-6	13
18							
20	5			6.10/ 96.30		SS-7	31
22		SILTY CLAY: red, brown, slightly moist, hard					
24	6			7.01/ 95.39			
26		SAND and GRAVEL: Brownish grey, wet, dense			21-6748-9	SS-8	32
28	7						
30					21-6748-10	SS-9	33
32	8						
	9						
	10						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

10.9

10.8

PIEZOMETER ORWELL CONSTRUCTION

Concrete

Bentonite Pellets

2" blank PVC

2" Slotted Pipe

Silica Sand

5.50m

7.62m bgs

Groundwater Depth: on completion: 6.71m/ On Jun 21, 2021: 5.57m/ On Jun 30, 2021: 5.49m/ On Jul 14, 2021: 5.50m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW4 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)					
32	10	SAND and GRAVEL: Brownish grey, wet, dense					
				10.67/ 91.73			
34		SAND: Grey, fine to medium, moist, very dense				SS-10	52
36	11			11.13/ 91.27			
		End of Borehole					
38	12						
40							
42	13						
44							
46	14						
48							
50	15						
52	16						
54							
56	17						
58							
60	18						
62	19						
64							

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Groundwater Depth: on completion: 6.71m/ On Jun 21, 2021: 5.57m/ On Jun 30, 2021: 5.49m/ On Jul 14, 2021: 5.50m

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW5 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)	102.84			
0	0	TOPSOIL: Brown sandy silt, trace gravel, some roots, organics, moist	0.61/ 102.23		SS-1	
2	1	SAND: Brown, some roots, moist, very loose			SS-2	3
4						
6	2				SS-3	3
8					SS-4	3
10	3				SS-5	2
12			3.66/ 99.18			
	4	SAND and GRAVEL: Grey, moist, very dense				
14						
16	5				SS-6	64
18						
	6		6.10/ 96.74			
20		SAND and GRAVEL: Grey, moist, compact very dense			SS-7	23
22	7					
24			7.62/ 95.22			
26	8	GRAVEL: Grey, trace sand, dry, very dense		21-6748-11	SS-8	100+
28						
30	9				SS-9	100+
32	10					

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

● 4.6

PIEZOMETER ORWELL CONSTRUCTION

Concrete

2" blank PVC

Bentonite Pellets

2" Slotted Pipe

Silica Sand

9.14m bgs

Groundwater Depth: on completion: 7.01m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW5 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 17, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)					
32	10	GRAVEL: Grey, trace sand, dry, very dense		10.67/ 92.17			
34							
36	11	GRAVELY SAND: Grey, moist, very dense				SS-10	60
38							
40	12	SAND: Grey, trace gravel, wet, very dense		12.19/ 90.65		SS-11	53
42	13						
44							
46	14			14.17/ 88.67		SS-12	60
		End of Borehole					
48	15						
50							
52	16						
54							
56	17						
58							
60	18						
62	19						
64							

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Groundwater Depth: on completion: 7.01m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE NO. MW6 SHEET. 1 of 2

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
		GROUND SURFACE (m asl)	102.64			
0	0	TOPSOIL: Dark brown sandy silt with roots, trace gravel, moist	0.61/ 102.03		SS-1	
2	1	SILTY SAND to SANDY SILT: Brown, slightly moist, loose to compact			SS-2	7
4					SS-3	10
6	2					
8			2.59/ 100.05		SS-4	11
	3	SAND: Grey to greyish brown, trace gravel, moist, compact			SS-5	25
10						
12	4					
14						
			4.88/ 97.76		SS-6	26
16	5	SILTY CLAY: Brown, moist very stiff	5.49/ 97.15			
18		SAND with GRAVEL: Grey, ccasional cobbles/boulders, moist, dense to very dense,				
20	6			21-6748-12	SS-7	40
22						
24	7					
					SS-8	100+
26	8					
28						
30	9		9.30/ 93.34		SS-9	24
32						
	10					

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

6.0

PIEZOMETER ORWELL CONSTRUCTION

Concrete

2" blank PVC

Bentonite Pellets

2" Slotted Pipe

Silica Sand

7.62m bgs

Groundwater Depth: on completion: 10.67m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW6 SHEET. 2 of 2

PROJECT NO.:

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029–1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	SAMPLES "N" VALUE
		GROUND SURFACE (m asl)					
32	10	SAND: Grey, medium to fine, occasional cobbles/boulders, dry to wet, compact to dense wet @10.69m					
34							
36	11					SS-10	39
38							
40	12					SS-11	44
				12.65/ 89.99			
42		End of Borehole					
44	13						
46							
48	14						
50							
52	15						
54							
56	16						
58							
60	17						
62							
64	18						
	19						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Groundwater Depth: on completion: 10.67m/ On Jun 21, 2021: Dry/ On Jun 30, 2021: Dry/ On Jul 14, 2021: Dry

DRAWN: AM LOGGED: CW CHECKED:

FISHER ENGINEERING

LOG OF BOREHOLE

NO. BH7 SHEET. 1 of 1

PROJECT NO.: FE-P 21-11236/ 37

PROJECT NAME: Hydrogeological and Geotechnical Investigations

LOCATION: 1029-1033 Waterdown Road., Burlington, ON

DRILLING METHOD: GEOPROBE SOLID STEM

DRILLING DATE: June 16, 2021

DEPTH (feet)	DEPTH (metres)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	SAMPLES Type NO.	"N" VALUE
		GROUND SURFACE (m asl)		102.80			
0	0	TOPSOIL: Brown sandy silt, trace gravel, debris, roots, moist				SS-1	
2				0.76/ 102.04			
4	1	SANDY SILT to SILTY SAND: Brown, trace gravel, moist, loose to compact				SS-2	8
6	2					SS-3	10
8				2.44/ 100.36		SS-4	12
10	3	SAND: Greyish brown, trace gravel, slightly moist, compact				SS-5	24
12	4						
14				4.72/ 98.08		SS-6	24
16	5	SILTY CLAY: Brown, most, very stiff					
18				6.10/ 96.70			
20	6	SAND and GRAVEL: grey, trace silt, occasional cobbles/boulders, moist, dense to very dense,				SS-7	37
22	7						
24						SS-8	75
26	8						
28				9.14/ 93.66			
30	9	SAND: Grey, medium to fine, moist, compact, wet				SS-9	27
32	10	End of Borehole		9.60/ 93.20			

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER ORWELL CONSTRUCTION

Groundwater Depth: on completion: 9.15m

DRAWN: AM LOGGED: CW CHECKED:

APPENDIX C – MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION ANALYSES

FISHER ENVIRONMENTAL
ATTN: CLIVE
15-400 ESNA PARK DRIVE
MARKHAM ON N/A

Date Received: 21-JUN-21
Report Date: 06-JUL-21 14:55 (MT)
Version: FINAL

Client Phone: 905-475-7755

Certificate of Analysis

Lab Work Order #: L2603951

Project P.O. #: NOT SUBMITTED
Job Reference: 1029 / 1033 WATERDOWN ROAD BURLINGTON
C of C Numbers: 17-796985
Legal Site Desc:

Emily Hansen
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2603951-1 BH1 5-6.5 Sampled By: CLIENT on 15-JUN-21 Matrix: SOIL							
Physical Tests							
Grain Size Curve	SEE ATTACHED				05-JUL-21	05-JUL-21	R5513314
Particle Size							
Gravel (4.75mm - 3in.)	<1.0		1.0	%	05-JUL-21	05-JUL-21	R5513314
Medium Sand (0.425mm - 2.0mm)	13.5		1.0	%	05-JUL-21	05-JUL-21	R5513314
Coarse Sand (2.0mm - 4.75mm)	<1.0		1.0	%	05-JUL-21	05-JUL-21	R5513314
Fine Sand (0.075mm - 0.425mm)	48.6		1.0	%	05-JUL-21	05-JUL-21	R5513314
Silt (0.002mm - 0.075mm)	15.2		1.0	%	05-JUL-21	05-JUL-21	R5513314
Silt (0.005mm - 0.075mm)	13.2		1.0	%	05-JUL-21	05-JUL-21	R5513314
Clay (<0.002mm)	22.8		1.0	%	05-JUL-21	05-JUL-21	R5513314
Clay (<0.005mm)	24.7		1.0	%	05-JUL-21	05-JUL-21	R5513314
L2603951-2 BH6 20-20.5 Sampled By: CLIENT on 15-JUN-21 Matrix: SOIL							
Physical Tests							
Grain Size Curve	SEE ATTACHED				05-JUL-21	05-JUL-21	R5513314
Particle Size							
Gravel (4.75mm - 3in.)	<1.0		1.0	%	05-JUL-21	05-JUL-21	R5513314
Medium Sand (0.425mm - 2.0mm)	<1.0		1.0	%	05-JUL-21	05-JUL-21	R5513314
Coarse Sand (2.0mm - 4.75mm)	<1.0		1.0	%	05-JUL-21	05-JUL-21	R5513314
Fine Sand (0.075mm - 0.425mm)	<1.0		1.0	%	05-JUL-21	05-JUL-21	R5513314
Silt (0.002mm - 0.075mm)	48.7		1.0	%	05-JUL-21	05-JUL-21	R5513314
Silt (0.005mm - 0.075mm)	26.2		1.0	%	05-JUL-21	05-JUL-21	R5513314
Clay (<0.002mm)	50.5		1.0	%	05-JUL-21	05-JUL-21	R5513314
Clay (<0.005mm)	72.9		1.0	%	05-JUL-21	05-JUL-21	R5513314

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
GRAIN SIZE-HYD-SK	Soil	Grain Size by Hydrometer	ASTM D6913/D7928

Particle size curve is generated from dry sieving (particles > 2 mm), wet sieving (particles 2 mm-75 um) and hydrometer readings (particles < 75 um)

ASTM D422-63 has been withdrawn, the ASTM D6913/D7928 standard serves as the successor method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

17-796985

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON N/A
Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
GRAIN SIZE-HYD-SK	**Soil**							
Batch R5513314								
WG3565120-2 IRM		**2020-PSA_SOIL**						
Medium Sand (0.425mm - 2.0mm)			7.8		%		2-12	05-JUL-21
Fine Sand (0.075mm - 0.425mm)			35.5		%		29.6-39.6	05-JUL-21
Silt (0.005mm - 0.075mm)			30.2		%		27.4-37.4	05-JUL-21
Clay (<0.005mm)			26.5		%		21-31	05-JUL-21
Silt (0.002mm - 0.075mm)			35.1		%		32.3-42.3	05-JUL-21
Clay (<0.002mm)			21.7		%		16.1-26.1	05-JUL-21

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

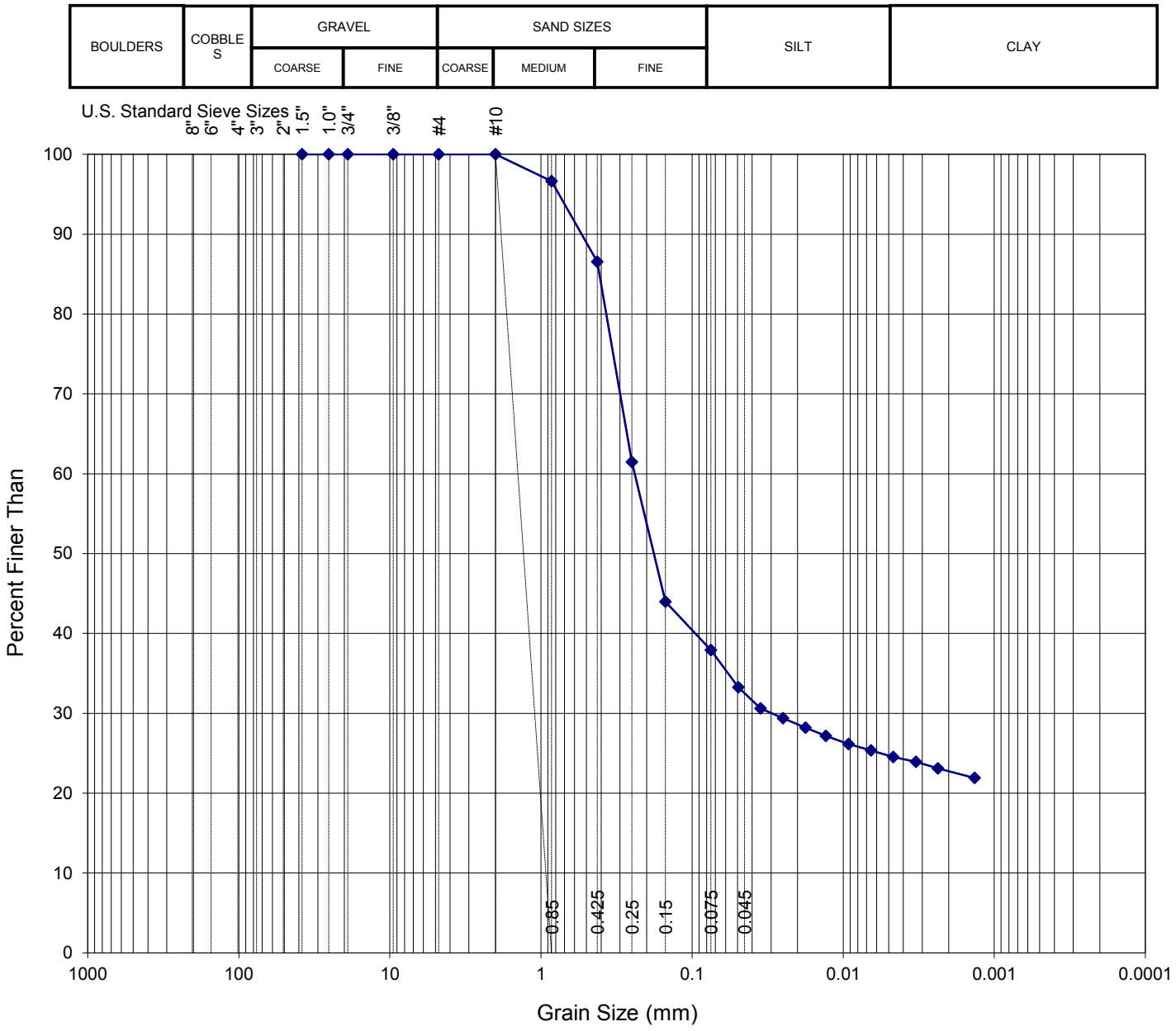
Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	FISHER ENVIRONMENTAL
Project Number:	
Client Sample ID	BH1 5-6.5
Lab Sample ID	L2603951-1
Date Sample Received	21-Jun-21
Test Completion Date:	06-Jul-21
Analyst:	HML



METHOD DESCRIPTION

Method Reference: ASTM D 422 - 63 (2002)

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

Soil classification system used: ASTM D422-63 Classification

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

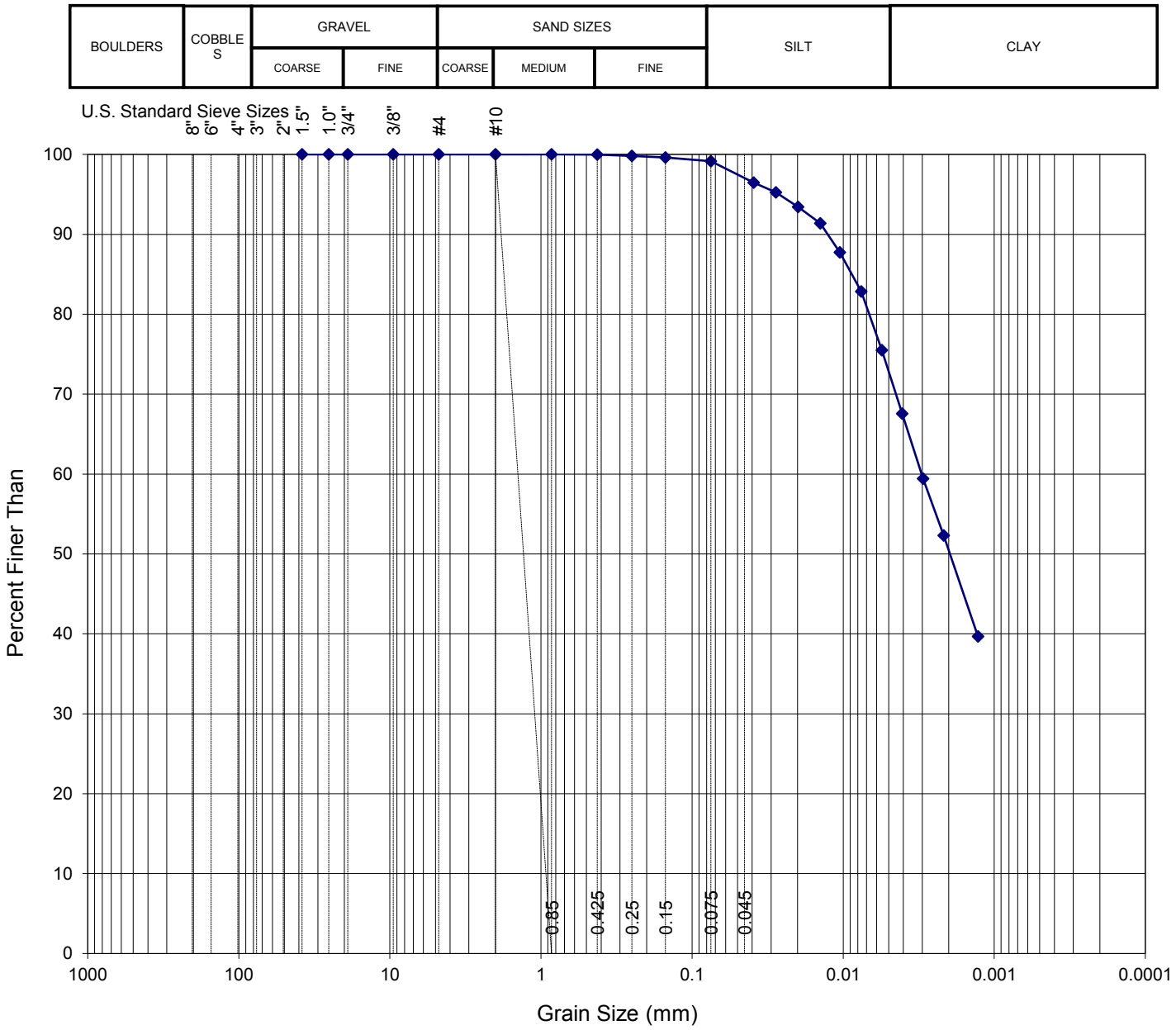
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	<1	2.0 - 4.75
% MEDIUM SAND :	13.46	0.425 - 2.0
% FINE SAND :	48.63	0.075 - 0.425
% SILT :	13.21	0.075 - 0.005
% CLAY :	24.70	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	FISHER ENVIRONMENTAL
Project Number:	
Client Sample ID	BH6 20-20.5
Lab Sample ID	L2603951-2
Date Sample Received	21-Jun-21
Test Completion Date:	06-Jul-21
Analyst:	HML



METHOD DESCRIPTION

Method Reference: ASTM D 422 - 63 (2002)

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

Soil classification system used: ASTM D422-63 Classification

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	<1	2.0 - 4.75
% MEDIUM SAND :	<1	0.425 - 2.0
% FINE SAND :	<1	0.075 - 0.425
% SILT :	26.24	0.075 - 0.005
% CLAY :	72.90	< 0.005

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2603951-COFC

COC Number: 17 - 796985

Page of

Report To	Contact and company name below, will appear on the final report	Report Format / Distribution				Turn-around Time (TAT) Requested - Contact your AM to confirm all E&P TATs (surcharges may apply)			
Company:	Fisher Engineering	Select Report Format:	✓ PDF	EXCEL	EDD (DIGITAL)	Regular [R]	✓	Standard TAT if received by 3 pm - business days - no surcharges apply	
Contact:	Clive	Quality Control (QC) Report with Report		YES	NO	PRIORITY (Business Days) 4 day [P4-20%]		EMERGENCY 1 Business day [E - 100%]	
Phone:	416 605 9722	Compare Results to Criteria on Report - provide details below if box checked				3 day [P3-25%]		Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	
	Company address below will appear on the final report	Select Distribution:	✓ EMAIL	MAIL	FAX	2 day [P2-50%]			
Street:		Email 1 or Fax	Clive			Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm	
City/Province:		Email 2	Frank			For tests that can not be performed according to the service level selected, you will be contacted.			
Postal Code:		Email 3							

Invoice To		Invoice Distribution			
	Same as Report To	YES	✓ NO	Select Invoice Distribution:	✓ EMAIL MAIL FAX
	Copy of Invoice with Report	YES	✓ NO	Email 1 or Fax	Elena
Company:				Email 2	Clive
Contact:					

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	1029/1033 Matadavis Road	Major/Minor Code:	Routing Code:
PO / AFE:	Burlington	Requisitioner:	
LSD:	AP	Location:	
ALS Lab Work Order # (lab use only):	L2603951	ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

NUMBER OF CONTAINERS: ✓ Hydrometer - Grain Size

SAMPLES ON HOLD

SUSPECTED HAZARD (see Special Instructions)

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type
	BH1 5-6½	15-06-21		Soil
	BH4 20-21½	"		"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? [ ] YES [✓] NO	
Are samples for human consumption/ use? [ ] YES [✓] NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes		No
Ice Packs	✓	Ice Cubes	Custody seal intact	Yes	No
Cooling Initiated					

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
					5.8		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Clive							6/21/21	15:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

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FAX: 905 475-7718
www.fisherenvironmental.com

Client: Infinity Development
Address: 1029/1033 Waterdown Road
Burlington ON

Tel.:
Email:
Attn.:

F.E. Job #: 21-6748
Project Name: Geotechnical and Hydrogeological
Project ID: FE-P 21-11236 & 21-11237
Date Sampled: 15-Jun-2021
Date Received: 18-Jun-2021
Date Reported: 25-Jun-2021
Location: 1029/1033 Waterdown Road
Burlington ON

Certificate of Analysis

Analyses	Matrix	Quantity	Date Extracted	Date Analyzed	Lab SOP	Method Reference
pH	Soil	5	22-Jun-21	22-Jun-21	pH-EC-SAR F-16	SW-846, 9045D
Chloride	Soil	2	N/A	24-Jun-21	Chloride F-20	SM 4500-Cl-E
Sulphate	Soil	3	24-Jun-21	24-Jun-21	Sulphate F-21	SM 4500-SO_4
Moisture Content	Soil	12	21-Jun-21	21-Jun-21	Support Procedures F-99	Carter (1993)
Grain Size	Soil	6	N/A	22-May-21	Grain Size F-28	ASTM D6913-04

Fisher Environmental Laboratories is accredited by CALA (the Canadian Association for Laboratory Accreditation Inc.) for specific parameters as required by Ontario Regulation 153/04. All analytical testing has been performed in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act published by Ontario Ministry of the Environment.

Authorized by:

Roger Lin, Ph. D., C. Chem.
Laboratory Manager

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Ronggen (Roger) Lin
CHEMIST

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-2*** BH1 3.00-3.45m	***21-6748-5*** BH1 7.55-8.05m	***21-6748-7*** BH3 7.55-8.05m	***21-6748-9*** BH4 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m	**Soil Standards** *
pH *(pH unit)*	7.85	8.40	8.51	8.17	7.08	(5-11) 5-9

* Surface soil pH value from 5 - 9, Sub-surface soil pH value from 5-11.

QA/QC Report

Parameter	**LCS**	**AR**	**Duplicate**	**AR**		
	Absolute Difference *(pH Unit)*					
pH *(pH unit)*	7.05	6.90-7.20	0.02	<0.3		

LEGEND:
LCS - Laboratory Control Sample
AR - Acceptable Range

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-7*** BH3 7.55-8.05m	***21-6748-9*** BH4 7.55-8.05m				
	Concentration (µg/g)					
Chloride in Soil	70	56				

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	**Blank**	**RL**	**LCS**	**AR**	**MS**	**AR**
	(µg/g)		**Recovery (%)**		**Recovery (%)**	
Chloride in Soil	<10	10	97	70-130	108	70-130

Parameter	**Duplicate**	**AR**				
	RPD (%)					
Chloride in Soil	3.7	0-20				

LEGEND:

RL - Reporting Limit
LCS - Laboratory Control Sample
MS - Matrix Spike
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-2*** BH1 3.00-3.45m	***21-6748-5*** BH1 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m			
Sulphate *(mg/kg)*	8.6	2.6	3			

QA/QC Report

Parameter	**Blank**	**RL**	**LCS/Spike**	**AR**	**Duplicate**	**AR**
	(mg/kg)		**Recovery (%)**		**RPD (%)**	
Sulphate	<1	1	95	70-130	22	0-30

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

Parameter	***21-6748-1*** BH1 2.25-2.70m	***21-6748-2*** BH1 3.00-3.45m	***21-6748-3*** BH1 4.55-5.00m A	***21-6748-4*** BH1 4.55-5.00m B	***21-6748-5*** BH1 7.55-8.05m	***21-6748-6*** BH3 4.55-5.00m
Moisture Content (%)	14.1	20.1	14.6	13.3	5.4	18.2

Parameter	***21-6748-7*** BH3 7.55-8.05m	***21-6748-8*** BH3 9.15-9.55m	***21-6748-9*** BH4 7.55-8.05m	***21-6748-10*** BH4 9.15-9.55m	***21-6748-11*** BH5 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m
Moisture Content (%)	8.2	7.2	10.9	10.8	4.6	6.0

QA/QC Report

Parameter	**Blank**	**RL**	**LCS**	**AR**	**Duplicate**	**AR**
			Recovery (%)		**RPD (%)**	
Moisture Content (%)	<0.1	0.1	100	70-130	4.5	0-20

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
AR - Acceptable Range
RPD - Relative Percent Difference

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Sulphate, Chloride, Moisture Content, Grain Size
Sample Description:	12 Soil Sample(s)

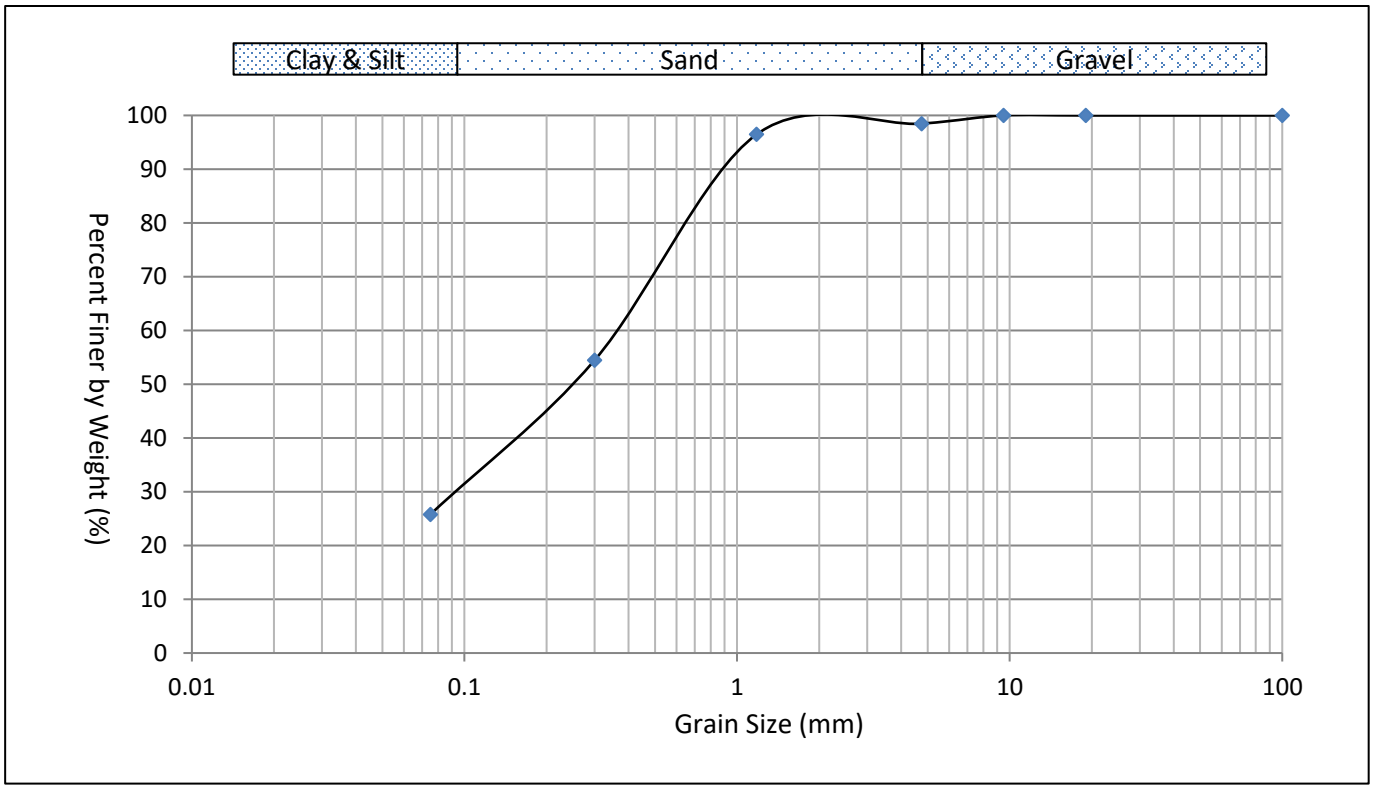
Parameter	***21-6748-3*** BH1 4.55-5.00m A	***21-6748-4*** BH1 4.55-5.00m B	***21-6748-7*** BH3 7.55-8.05m	***21-6748-9*** BH4 7.55-8.05m	***21-6748-11*** BH5 7.55-8.05m	***21-6748-12*** BH6 6.05-6.50m
Grain Size (%)						
>19mm	0.0	9.2	0.0	0.0	0.0	0.0
9.5mm-19mm	0.0	5.1	5.7	5.9	20.3	13.0
4.75mm-9.5mm	1.5	2.5	6.5	3.5	31.6	6.8
1.18m-4.75mmm	2.0	2.5	33.4	11.3	21.0	38.9
300um-1.18mm	42.0	8.5	32.4	42.4	4.7	20.8
75um-300um	28.7	19.9	10.7	20.2	9.8	6.0
<75um	25.8	52.2	11.4	16.7	12.7	14.5
Clay & Silt	**26**	**52**	**11**	**17**	**13**	**14**
Sand	**73**	**31**	**77**	**74**	**35**	**66**
Gravel	**2**	**17**	**12**	**9**	**52**	**20**

Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-3 BH1 4.55-5.00m A

Clay & Silt: 26% Sand: 73% Gravel: 2%

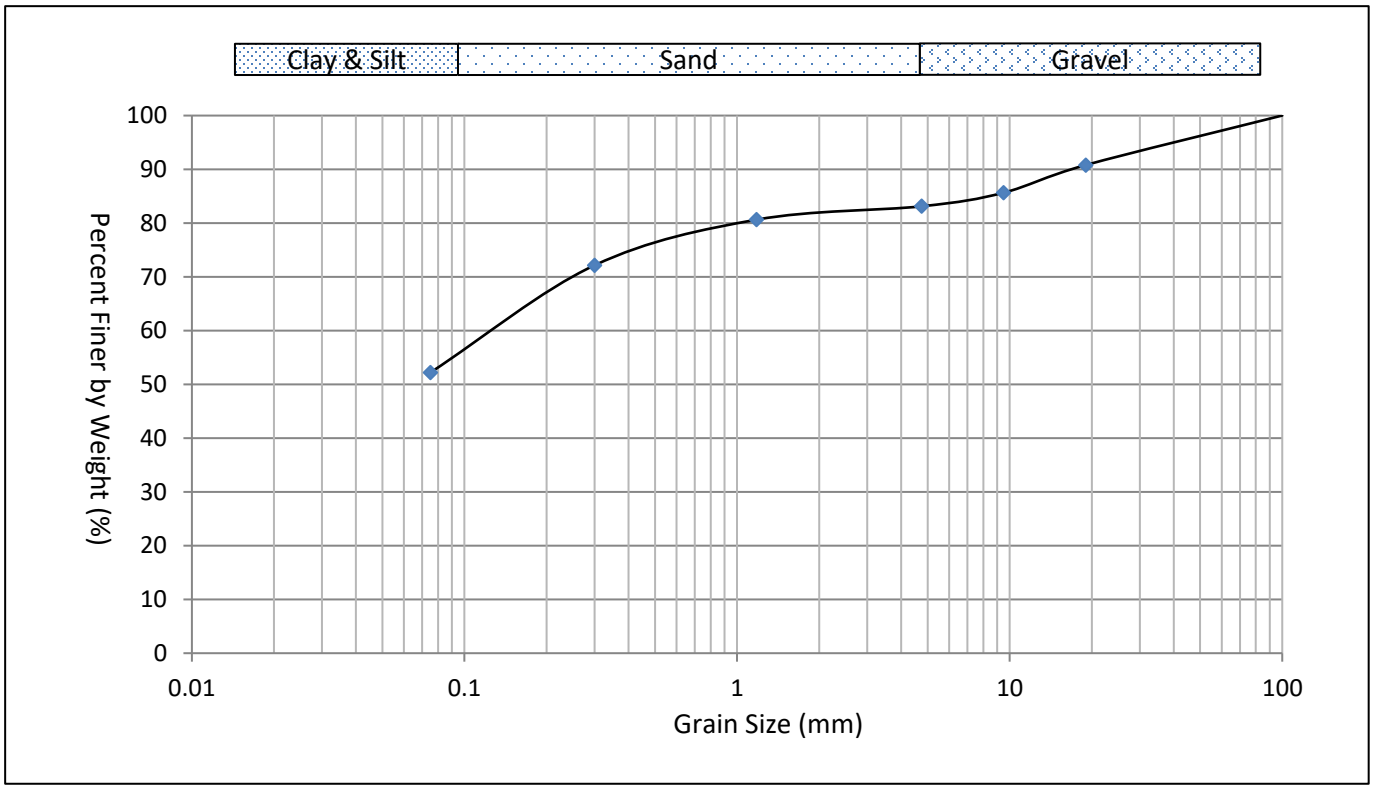


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-4 BH1 4.55-5.00m B

Clay & Silt: 52% Sand: 31% Gravel: 17%

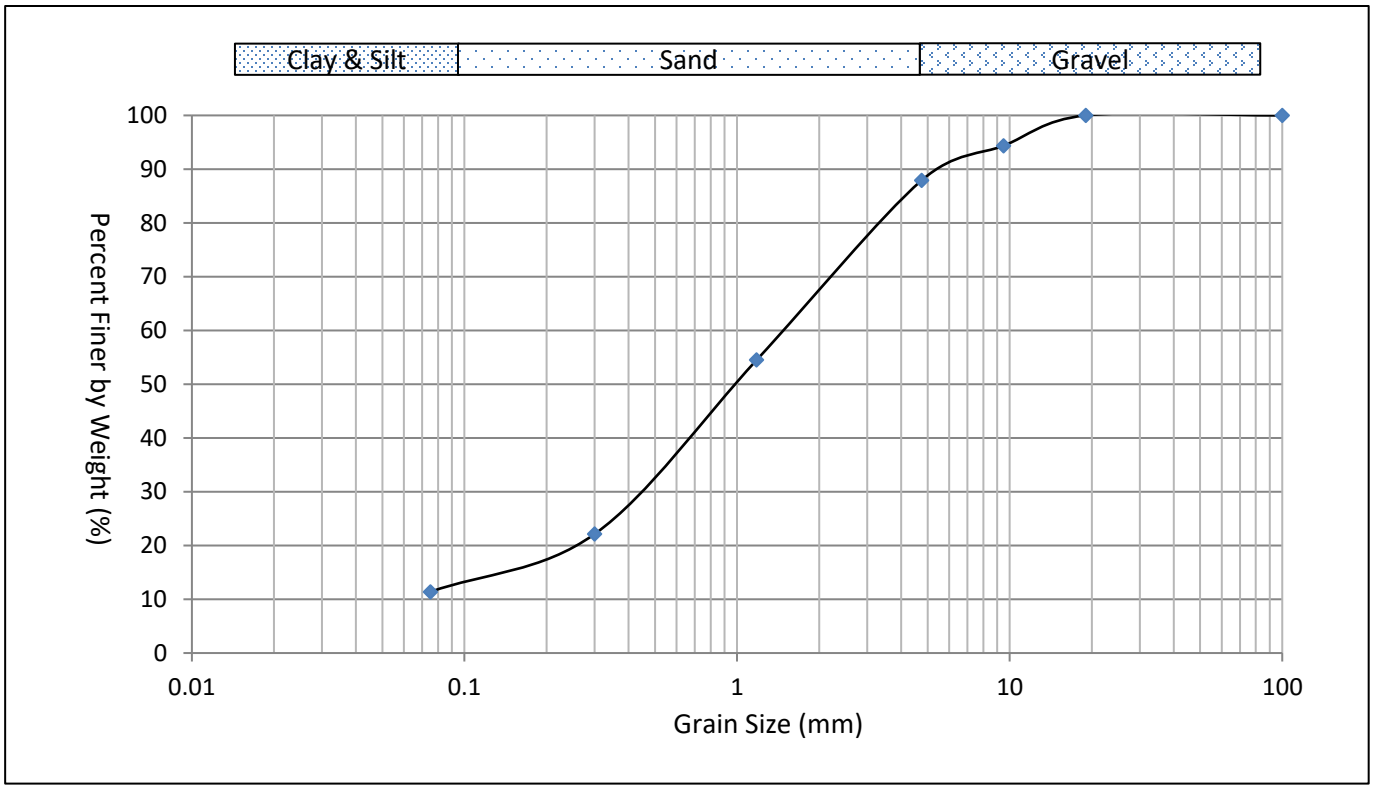


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-7 BH3 7.55-8.05m

Clay & Silt: 11% Sand: 77% Gravel: 12%

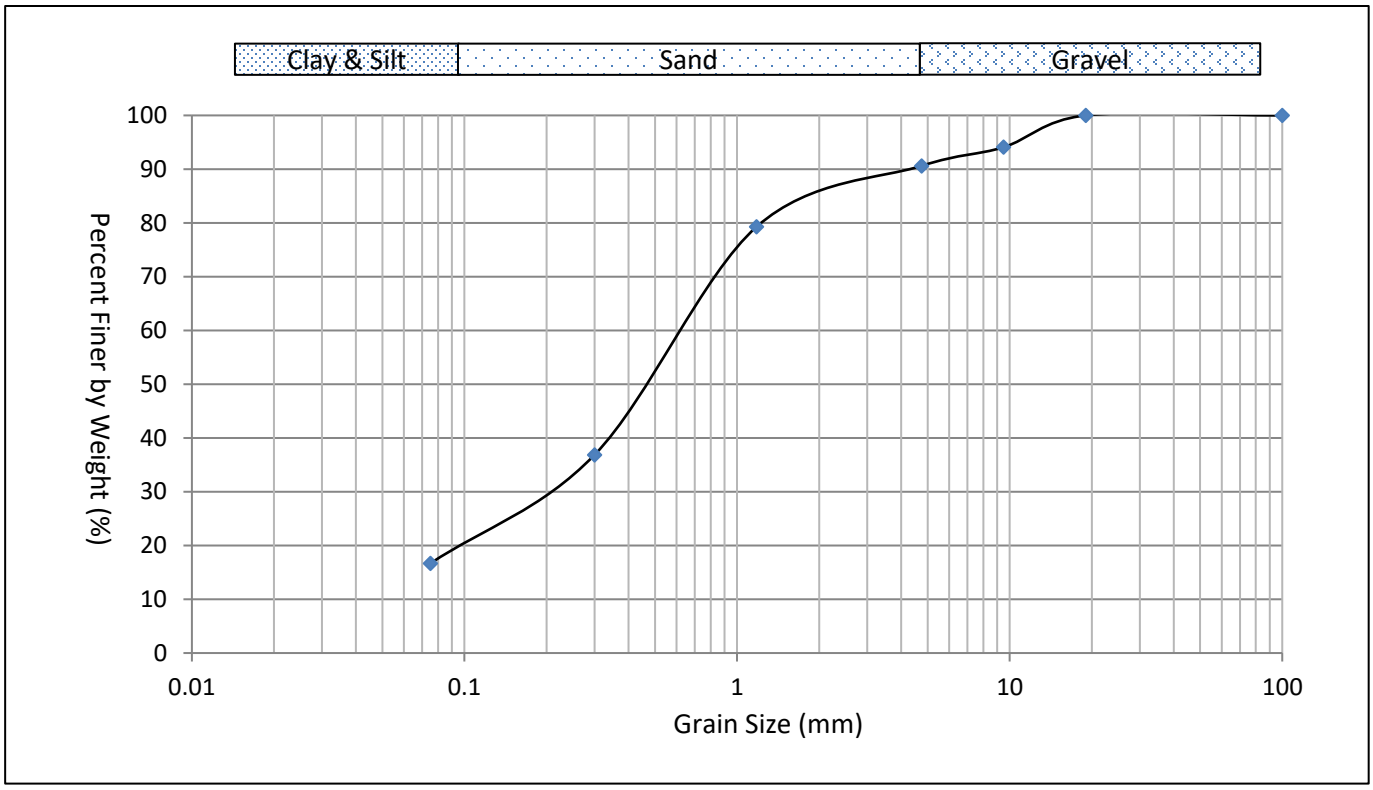


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-9 BH4 7.55-8.05m

Clay & Silt: 17% Sand: 74% Gravel: 9%

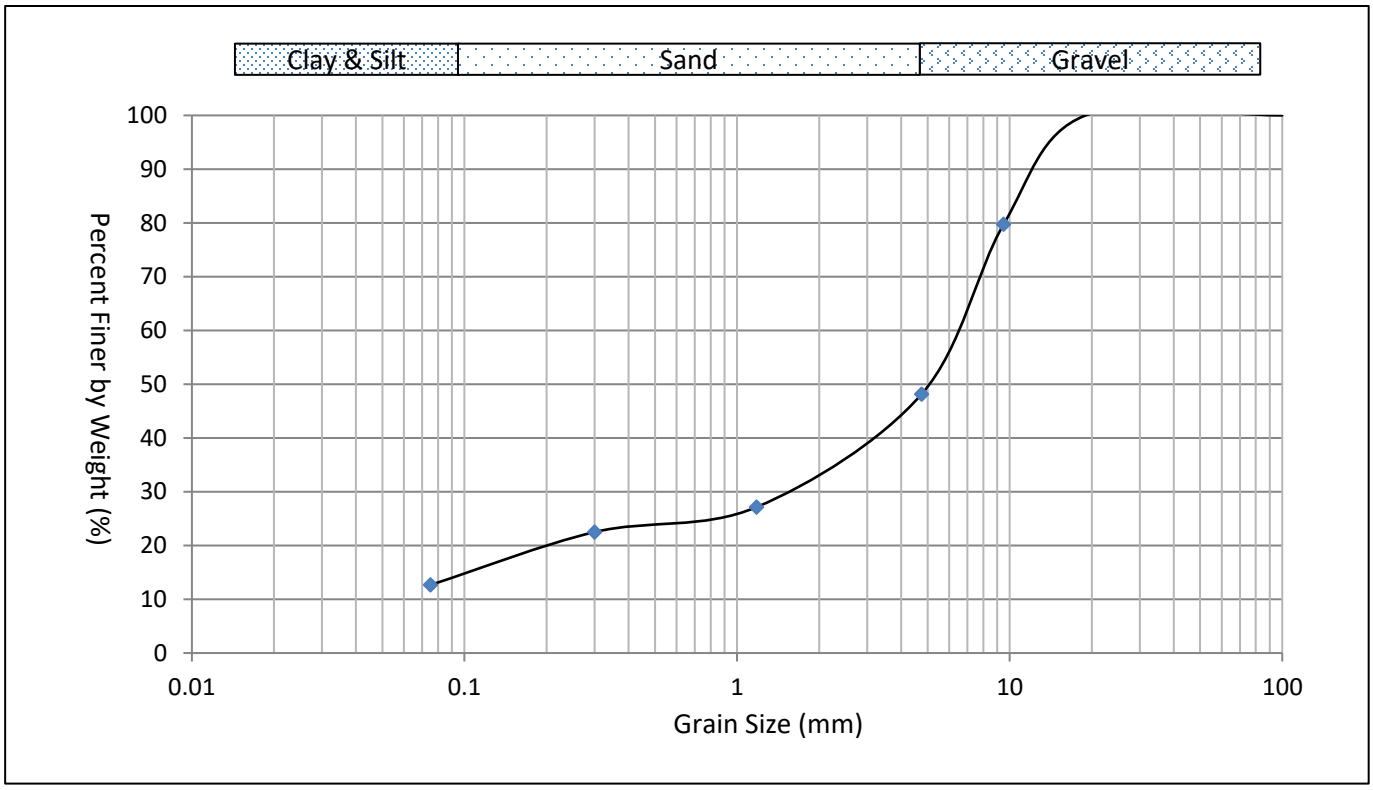


Results related only to the items tested

Grain Size Distribution

Sample ID: 21-6748-11 BH5 7.55-8.05m

Clay & Silt: 13% Sand: 35% Gravel: 52%



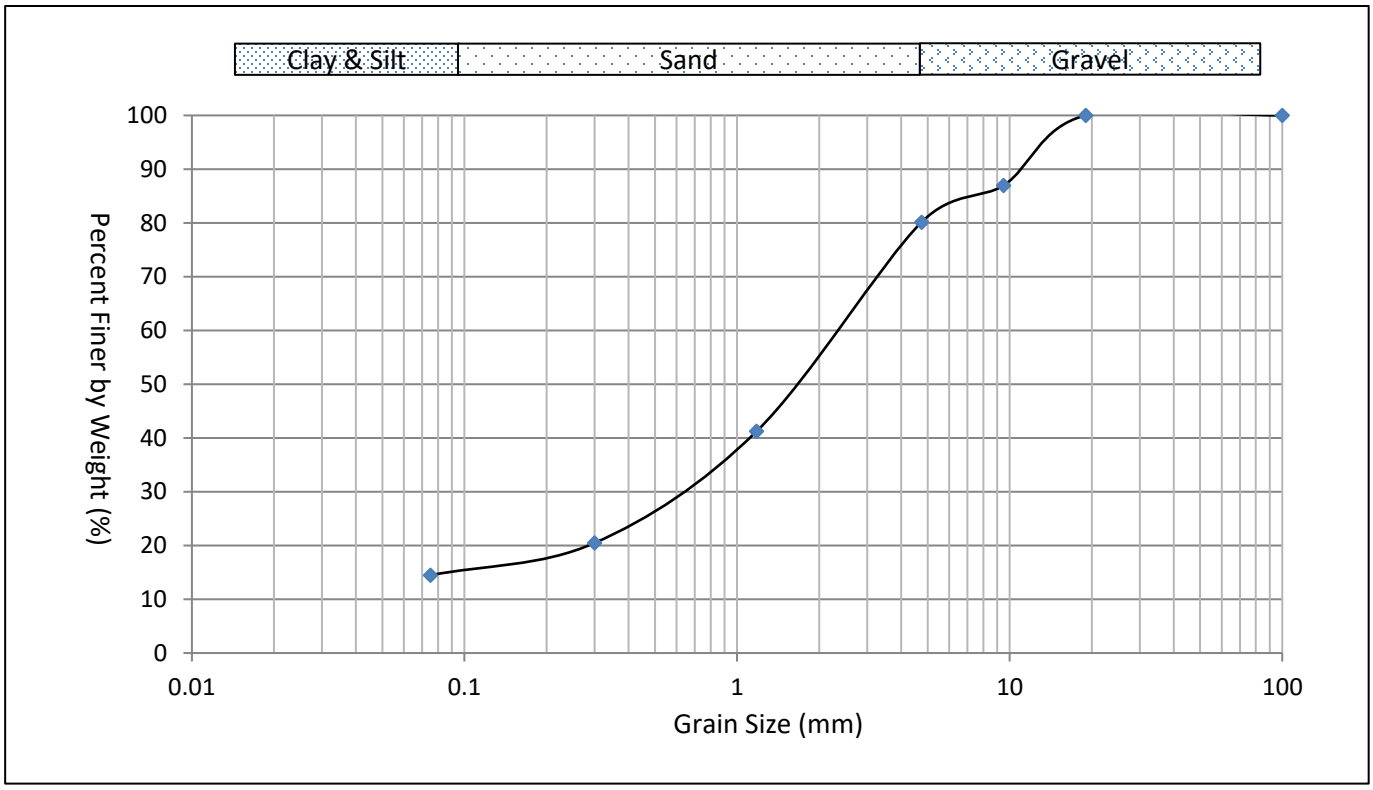
Results related only to the items tested

Client: Infinity Development ***F.E. Job #:*** 21-6748

Grain Size Distribution

Sample ID: 21-6748-12 BH6 6.05-6.50m

Clay & Silt: 14% Sand: 66% Gravel: 20%



Results related only to the items tested

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laboratory@fisherenvironmental.com

LAB JOB #: 21-6748

CHAIN OF CUSTODY 2496

Page 1 of 1

CLIENT INFORMATION
Company Name: Infinity Development
Contact:
Address: 1029/1033 Waterdown Rd Burlington
Phone:
Fax:
Email:
Fax results? Y/N
Email results? Y/N

PROJECT INFORMATION
Project Name: Geotechnical & Hydrogeological Investigation
Project ID:
Sampled By: CAW

TURNAROUND TIME (TAT) REQUIRED
STD - Standard (5-7 working days)
SR - Semi Rush (48 hours) 50%
R - Rush (24 hours) 75%
SD - Same Day - 100%
Surcharges apply; Sample received after 2pm will be considered received the next business day
Working Time: Monday-Friday 9:00am-5:00pm

BILLING INFORMATION
Purchase Order #:
Verbal Authorization:
Credit Card (type):
Credit Card #:
Expiry Date:

LAB SAMPLE ID	CLIENT'S SAMPLE ID AND DESCRIPTION	SAMPLING DATE/TIME	SAMPLE MATRIX	CONTAINER # & TYPE	TAT (Above)	ANALYSIS REQUESTED (Check or Specify) Metals	PHCs	VOCs	PAHs	PCBs	Asbestos	GS	M		NOTES
1	BH1 7½-9	June 15-17	Soil	Bag									-		
2	10-11½	"	"	"			-	*	-				-		
3	15-16½ A	"	"	"								✓	-		
4	15-16½ B	"	"	"								✓	-		
5	25-26½	"	"	"			✓	*	-				-		
6	BH3 15-16½	"	"	"									-		
7	25-26½	"	"	"			✓	-	*			✓	✓		
8	30-31½	"	"	"									✓		
9	BH4 25-26½	"	"	"			✓	-	*			✓	✓		
10	30-31½	"	"	"									✓		
11	BH5 25-26½	"	"	"								✓	-		
12	BH6 20-22½	"	"	"			✓	*	-			✓	✓		

Relinquished by: (Signature & Print)
Date & Time:
Method of Shipment: By Hand

Received by: (Signature & Print)
Date & Time: June 18, 21.

Client's Comments:

Arrival Temperature (°C): 12°C
Laboratory Remarks:

Regulatory Requirements
Reg. 153
Table _____
☐ Residential / Parkland
☐ Industrial / Commercial
☐ Agricultural
Soil Texture
☐ Coarse ☐ Med/Fine

Sewer Use
☐ Sanitary
☐ Storm
Region _____

Reg. 558
☐ TCLP

Revision: 2.2

APPENDIX D – SEWER BYLAW RESULTS

FISHER ENVIRONMENTAL
ATTN: CLIVE
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2

Date Received: 17-JUN-21
Report Date: 29-JUN-21 12:06 (MT)
Version: FINAL

Client Phone: 905-475-7755

Certificate of Analysis

Lab Work Order #: L2602906

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 20-892013
Legal Site Desc:

Emily Hansen
Account Manager

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ANALYTICAL REPORT

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit	Guideline

Ontario Halton Santitary Sewer By-law No. 02-03 (MAR, 2003) - Halton Sanitary Sewer By-Law No. 02-03

(No parameter exceedances)

Ontario Halton Santitary Sewer By-law No. 02-03 (MAR, 2003) - Halton Storm Sewer By-Law No, 02-03

(No parameter exceedances)

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2602906-1 Sample Date: 17-JUN-21 Sample ID: MW1 1029-1033 WATERDOWN RD BURLINGTON
pH	pH units	6.00-10.0	6.5-8.5	7.41
Total Suspended Solids	mg/L	350	-	6.2

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Anions and Nutrients - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2602906-1 Sample Date: 17-JUN-21 Sample ID: MW1 1029-1033 WATERDOWN RD BURLINGTON
Fluoride (F)	mg/L	10	-	<0.20 DLDS
Total Kjeldahl Nitrogen	mg/L	100	-	0.330
Phosphorus, Total	mg/L	10.0	-	0.0912
Sulfate (SO4)	mg/L	1500	-	142 DLDS

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Cyanides - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2602906-1 Sample Date: 17-JUN-21 Sample ID: MW1 1029-1033 WATERDOWN RD BURLINGTON
Cyanide, Total	mg/L	2	-	0.0038

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Bacteriological Tests - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2602906-1 Sample Date: 17-JUN-21 Sample ID: MW1 1029-1033 WATERDOWN RD BURLINGTON
E. Coli	CFU/100mL	-	200	0

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Total Metals - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2602906-1 Sample Date: 17-JUN-21 Sample ID: MW1 1029-1033 WATERDOWN RD BURLINGTON
Aluminum (Al)-Total	mg/L	50	-	1.32 DLHC
Antimony (Sb)-Total	mg/L	5	-	<0.0010 DLHC
Arsenic (As)-Total	mg/L	1	-	<0.0010 DLHC
Beryllium (Be)-Total	mg/L	5	-	<0.0010 DLHC
Cadmium (Cd)-Total	mg/L	1	-	<0.000050 DLHC
Chromium (Cr)-Total	mg/L	3	-	<0.0050 DLHC
Cobalt (Co)-Total	mg/L	5	-	0.0011 DLHC
Copper (Cu)-Total	mg/L	3	-	0.0050 DLHC
Iron (Fe)-Total	mg/L	50	-	1.81 DLHC
Lead (Pb)-Total	mg/L	3	-	0.00114 DLHC
Manganese (Mn)-Total	mg/L	5	-	0.0942 DLHC
Mercury (Hg)-Total	mg/L	0.05	-	<0.0000050
Molybdenum (Mo)-Total	mg/L	5	-	<0.00050 DLHC
Nickel (Ni)-Total	mg/L	3	-	<0.0050 DLHC
Selenium (Se)-Total	mg/L	5	-	0.00111 DLHC
Silver (Ag)-Total	mg/L	5	-	<0.00050 DLHC
Tin (Sn)-Total	mg/L	5	-	<0.0010 DLHC
Titanium (Ti)-Total	mg/L	5	-	0.0256 DLHC
Zinc (Zn)-Total	mg/L	3	-	0.042 DLHC

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Aggregate Organics - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2602906-1 Sample Date: 17-JUN-21 Sample ID: MW1 1029-1033 WATERDOWN RD BURLINGTON
BOD Carbonaceous	mg/L	300	-	<3.0 BODL
Oil and Grease, Total	mg/L	-	-	<5.0
Animal/Veg Oil & Grease	mg/L	150	-	<5.0
Mineral Oil and Grease	mg/L	15	-	<2.5
Phenols (4AAP)	mg/L	1.0	-	<0.0010

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Volatile Organic Compounds - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2602906-1 Sample Date: 17-JUN-21 Sample ID: MW1 1029-1033 WATERDOWN RD BURLINGTON
Benzene	ug/L	10	-	<0.50 OWP
Chloroform	ug/L	40	-	<1.0 OWP
1,4-Dichlorobenzene	ug/L	80	-	<0.50 OWP
Dichloromethane	ug/L	2000	-	<2.0 OWP
Ethylbenzene	ug/L	160	-	<0.50 OWP
Tetrachloroethylene	ug/L	1000	-	<0.50 OWP
Toluene	ug/L	16	-	<0.50 OWP
Trichloroethylene	ug/L	400	-	<0.50 OWP
Surrogate: 4-Bromofluorobenzene	%	-	-	90.2
Surrogate: 1,4-Difluorobenzene	%	-	-	98.8

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Polycyclic Aromatic Hydrocarbons - WATER

			Lab ID	L2602906-1
			Sample Date	17-JUN-21
			Sample ID	MW1 1029-1033 WATERDOWN RD BURLINGTON
		Guide Limits		
Analyte	Unit	#1	#2	
Naphthalene	ug/L	140	-	<0.020
Surrogate: d8-Naphthalene	%	-	-	92.2

Guide Limit #1: Halton Sanitary Sewer By-Law No. 02-03
Guide Limit #2: Halton Storm Sewer By-Law No, 02-03

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
BODL	Limit of Reporting for BOD was increased to account for the largest volume of sample tested.
OWP	Organic water sample contained visible sediment (must be included as part of analysis). Measured concentrations of organic substances in water can be biased high due to presence of

sediment.

DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B (CBOD)

This analysis is carried out using procedures adapted from APHA Method 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

CN-TOT-WT	Water	Cyanide, Total	ISO 14403-2

Total cyanide is determined by the combination of UV digestion and distillation. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

When using this method, high levels of thiocyanate in samples can cause false positives at ~1-2% of the thiocyanate concentration. For samples with detectable cyanide analyzed by this method, ALS recommends analysis for thiocyanate to check for this potential interference

EC-SCREEN-WT	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

EC-WW-MF-WT	Water	E. Coli	SM 9222D

A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h. Method ID: WT-TM-1200

F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HG-T-CVAA-WT	Water	Total Mercury in Water by CVAAS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

MET-T-CCMS-WT	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

OGG-SPEC-CALC-WT	Water	Speciated Oil and Grease A/V Calc	CALCULATION

Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

OGG-SPEC-WT	Water	Speciated Oil and Grease-Gravimetric	APHA 5520 B

The procedure involves an extraction of the entire water sample with hexane. Sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.			
PAH-NAPHTHALENE-WT	Water	Polyaromatic Hydrocarbons (PAHs)	SW846 8270
Sample is extracted at neutral pH using separate aliquots of dichloromethane with a modified separatory funnel technique, extracts are then concentrated and analyzed by GC/MSD.			
PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
PHENOLS-4AAP-WT	Water	Phenol (4AAP)	EPA 9066
An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.			
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.			
TKN-F-WT	Water	TKN in Water by Fluorescence	J. ENVIRON. MONIT., 2005,7,37-42,RSC
Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection			
VOC-ROU-HS-WT	Water	Volatile Organic Compounds	SW846 8260
Aqueous samples are analyzed by headspace-GC/MS.			

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

20-892013

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2602906 Report Date: 29-JUN-21

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2

Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R5497316								
WG3558317-6 DUP		**L2602823-1**						
BOD Carbonaceous		247	251		mg/L	1.6	30	18-JUN-21
WG3558317-7 LCS								
BOD Carbonaceous			99.5		%		85-115	18-JUN-21
WG3558317-5 MB								
BOD Carbonaceous			<2.0		mg/L		2	18-JUN-21
CN-TOT-WT	**Water**							
Batch R5496639								
WG3561439-3 DUP		**WG3561439-5**						
Cyanide, Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	23-JUN-21
WG3561439-2 LCS								
Cyanide, Total			91.3		%		80-120	23-JUN-21
WG3561439-1 MB								
Cyanide, Total			<0.0020		mg/L		0.002	23-JUN-21
WG3561439-4 MS		**WG3561439-5**						
Cyanide, Total			91.4		%		70-130	23-JUN-21
EC-WW-MF-WT	**Water**							
Batch R5493717								
WG3558406-3 DUP		**L2602906-1**						
E. Coli		0	<10	RPD-NA	CFU/100mL	N/A	65	18-JUN-21
WG3558406-4 DUP		**L2602909-1**						
E. Coli		0	<10	RPD-NA	CFU/100mL	N/A	65	18-JUN-21
WG3558406-1 MB								
E. Coli			0		CFU/100mL		1	18-JUN-21
F-IC-N-WT	**Water**							
Batch R5494522								
WG3558621-15 DUP		**WG3558621-13**						
Fluoride (F)		0.715	0.715		mg/L	0.0	20	18-JUN-21
WG3558621-12 LCS								
Fluoride (F)			104.8		%		90-110	18-JUN-21
WG3558621-11 MB								
Fluoride (F)			<0.020		mg/L		0.02	18-JUN-21
WG3558621-14 MS		**WG3558621-13**						
Fluoride (F)			101.5		%		75-125	18-JUN-21
HG-T-CVAA-WT	**Water**							

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-T-CVAA-WT	**Water**							
Batch R5494458								
WG3558653-3 DUP		**L2602736-1**						
Mercury (Hg)-Total		<0.0000050	<0.000005C	RPD-NA	mg/L	N/A	20	21-JUN-21
WG3558653-2 LCS								
Mercury (Hg)-Total			99.2		%		80-120	21-JUN-21
WG3558653-1 MB								
Mercury (Hg)-Total			<0.000005C		mg/L		0.000005	21-JUN-21
WG3558653-4 MS		**L2601990-1**						
Mercury (Hg)-Total			86.9		%		70-130	21-JUN-21
MET-T-CCMS-WT	**Water**							
Batch R5493362								
WG3557811-4 DUP		**WG3557811-3**						
Aluminum (Al)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	18-JUN-21
Antimony (Sb)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	18-JUN-21
Arsenic (As)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	18-JUN-21
Beryllium (Be)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	18-JUN-21
Cadmium (Cd)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	18-JUN-21
Chromium (Cr)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	18-JUN-21
Cobalt (Co)-Total		0.0014	0.0014		mg/L	3.2	20	18-JUN-21
Copper (Cu)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	18-JUN-21
Iron (Fe)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	18-JUN-21
Lead (Pb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-JUN-21
Manganese (Mn)-Total		0.609	0.610		mg/L	0.2	20	18-JUN-21
Molybdenum (Mo)-Total		0.00404	0.00409		mg/L	1.3	20	18-JUN-21
Nickel (Ni)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	18-JUN-21
Selenium (Se)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-JUN-21
Silver (Ag)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-JUN-21
Tin (Sn)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	18-JUN-21
Titanium (Ti)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	18-JUN-21
Zinc (Zn)-Total		<0.030	<0.030	RPD-NA	mg/L	N/A	20	18-JUN-21
WG3557811-2 LCS								
Aluminum (Al)-Total			106.8		%		80-120	18-JUN-21
Antimony (Sb)-Total			105.8		%		80-120	18-JUN-21
Arsenic (As)-Total			106.9		%		80-120	18-JUN-21
Beryllium (Be)-Total			102.3		%		80-120	18-JUN-21
Cadmium (Cd)-Total			104.2		%		80-120	18-JUN-21

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5493362								
WG3557811-2 LCS								
Chromium (Cr)-Total			105.3		%		80-120	18-JUN-21
Cobalt (Co)-Total			106.7		%		80-120	18-JUN-21
Copper (Cu)-Total			105.9		%		80-120	18-JUN-21
Iron (Fe)-Total			106.3		%		80-120	18-JUN-21
Lead (Pb)-Total			105.2		%		80-120	18-JUN-21
Manganese (Mn)-Total			104.7		%		80-120	18-JUN-21
Molybdenum (Mo)-Total			104.6		%		80-120	18-JUN-21
Nickel (Ni)-Total			105.4		%		80-120	18-JUN-21
Selenium (Se)-Total			103.4		%		80-120	18-JUN-21
Silver (Ag)-Total			105.2		%		80-120	18-JUN-21
Tin (Sn)-Total			104.6		%		80-120	18-JUN-21
Titanium (Ti)-Total			104.7		%		80-120	18-JUN-21
Zinc (Zn)-Total			105.8		%		80-120	18-JUN-21
WG3557811-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	18-JUN-21
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	18-JUN-21
Arsenic (As)-Total			<0.00010		mg/L		0.0001	18-JUN-21
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	18-JUN-21
Cadmium (Cd)-Total			<0.000005(		mg/L		0.000005	18-JUN-21
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	18-JUN-21
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	18-JUN-21
Copper (Cu)-Total			<0.00050		mg/L		0.0005	18-JUN-21
Iron (Fe)-Total			<0.010		mg/L		0.01	18-JUN-21
Lead (Pb)-Total			<0.000050		mg/L		0.00005	18-JUN-21
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	18-JUN-21
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	18-JUN-21
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	18-JUN-21
Selenium (Se)-Total			<0.000050		mg/L		0.00005	18-JUN-21
Silver (Ag)-Total			<0.000050		mg/L		0.00005	18-JUN-21
Tin (Sn)-Total			<0.00010		mg/L		0.0001	18-JUN-21
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	18-JUN-21
Zinc (Zn)-Total			<0.0030		mg/L		0.003	18-JUN-21
WG3557811-5 MS		**WG3557811-6**						
Aluminum (Al)-Total			99.2		%		70-130	18-JUN-21

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	**Water**							
Batch R5493362								
WG3557811-5 MS		**WG3557811-6**						
Antimony (Sb)-Total			102.3		%		70-130	18-JUN-21
Arsenic (As)-Total			102.7		%		70-130	18-JUN-21
Beryllium (Be)-Total			102.3		%		70-130	18-JUN-21
Cadmium (Cd)-Total			99.0		%		70-130	18-JUN-21
Chromium (Cr)-Total			101.4		%		70-130	18-JUN-21
Cobalt (Co)-Total			99.8		%		70-130	18-JUN-21
Copper (Cu)-Total			95.2		%		70-130	18-JUN-21
Iron (Fe)-Total			91.7		%		70-130	18-JUN-21
Lead (Pb)-Total			97.5		%		70-130	18-JUN-21
Manganese (Mn)-Total			N/A	MS-B	%		-	18-JUN-21
Molybdenum (Mo)-Total			101.5		%		70-130	18-JUN-21
Nickel (Ni)-Total			96.9		%		70-130	18-JUN-21
Selenium (Se)-Total			100.4		%		70-130	18-JUN-21
Silver (Ag)-Total			98.3		%		70-130	18-JUN-21
Tin (Sn)-Total			101.6		%		70-130	18-JUN-21
Titanium (Ti)-Total			101.5		%		70-130	18-JUN-21
Zinc (Zn)-Total			91.4		%		70-130	18-JUN-21
OGG-SPEC-WT	**Water**							
Batch R5505647								
WG3564619-2 LCS								
Oil and Grease, Total			96.0		%		70-130	28-JUN-21
Mineral Oil and Grease			92.1		%		70-130	28-JUN-21
WG3564619-1 MB								
Oil and Grease, Total			<5.0		mg/L		5	28-JUN-21
Mineral Oil and Grease			<2.5		mg/L		2.5	28-JUN-21
P-T-COL-WT	**Water**							
Batch R5494354								
WG3558105-3 DUP		**L2602581-1**						
Phosphorus, Total		0.0638	0.0696		mg/L	8.7	20	21-JUN-21
WG3558105-2 LCS								
Phosphorus, Total			100.4		%		80-120	21-JUN-21
WG3558105-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	21-JUN-21
WG3558105-4 MS		**L2602581-1**						
Phosphorus, Total			98.1		%		70-130	21-JUN-21

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-NAPHTHALENE-WT	**Water**							
Batch R5495177								
WG3557874-2 LCS								
Naphthalene			70.0		%		50-130	22-JUN-21
WG3557874-1 MB								
Naphthalene			<0.020		ug/L		0.02	22-JUN-21
Surrogate: d8-Naphthalene			97.6		%		60-140	22-JUN-21
PH-WT	**Water**							
Batch R5493695								
WG3558166-4 DUP		**WG3558166-3**						
pH		7.75	7.78	J	pH units	0.03	0.2	18-JUN-21
WG3558166-2 LCS								
pH			6.99		pH units		6.9-7.1	18-JUN-21
PHENOLS-4AAP-WT	**Water**							
Batch R5496796								
WG3558246-3 DUP		**L2602728-2**						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	23-JUN-21
WG3558246-2 LCS								
Phenols (4AAP)			95.9		%		85-115	22-JUN-21
WG3558246-1 MB								
Phenols (4AAP)			<0.0010		mg/L		0.001	22-JUN-21
WG3558246-4 MS		**L2602728-2**						
Phenols (4AAP)			108.2		%		75-125	23-JUN-21
SO4-IC-N-WT	**Water**							
Batch R5494522								
WG3558621-15 DUP		**WG3558621-13**						
Sulfate (SO4)		27.9	27.9		mg/L	0.0	20	18-JUN-21
WG3558621-12 LCS								
Sulfate (SO4)			104.4		%		90-110	18-JUN-21
WG3558621-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	18-JUN-21
WG3558621-14 MS		**WG3558621-13**						
Sulfate (SO4)			102.8		%		75-125	18-JUN-21
SOLIDS-TSS-WT	**Water**							
Batch R5496203								
WG3560300-3 DUP		**L2602816-1**						
Total Suspended Solids		<3.0	3.2	RPD-NA	mg/L	N/A	20	23-JUN-21
WG3560300-2 LCS								
Total Suspended Solids			94.3		%		85-115	23-JUN-21

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TSS-WT	**Water**							
Batch R5496203								
WG3560300-1 MB								
Total Suspended Solids			<3.0		mg/L		3	23-JUN-21
TKN-F-WT	**Water**							
Batch R5493557								
WG3558182-3 DUP		**L2602909-1**						
Total Kjeldahl Nitrogen		0.300	0.300		mg/L	0.0	20	18-JUN-21
WG3558182-2 LCS								
Total Kjeldahl Nitrogen			89.5		%		75-125	18-JUN-21
WG3558182-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	18-JUN-21
WG3558182-4 MS		**L2602909-1**						
Total Kjeldahl Nitrogen			98.4		%		70-130	18-JUN-21
VOC-ROU-HS-WT	**Water**							
Batch R5502389								
WG3562830-4 DUP		**WG3562830-3**						
1,4-Dichlorobenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	25-JUN-21
Benzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	25-JUN-21
Chloroform		<1.0	<1.0	RPD-NA	ug/L	N/A	30	25-JUN-21
Dichloromethane		<2.0	<2.0	RPD-NA	ug/L	N/A	30	25-JUN-21
Ethylbenzene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	25-JUN-21
Tetrachloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	25-JUN-21
Toluene		0.45	0.47		ug/L	4.2	30	25-JUN-21
Trichloroethylene		<0.50	<0.50	RPD-NA	ug/L	N/A	30	25-JUN-21
WG3562830-1 LCS								
1,4-Dichlorobenzene			103.3		%		70-130	25-JUN-21
Benzene			93.9		%		70-130	25-JUN-21
Chloroform			98.4		%		70-130	25-JUN-21
Dichloromethane			97.6		%		70-130	25-JUN-21
Ethylbenzene			91.7		%		70-130	25-JUN-21
Tetrachloroethylene			103.6		%		70-130	25-JUN-21
Toluene			94.2		%		70-130	25-JUN-21
Trichloroethylene			103.7		%		70-130	25-JUN-21
WG3562830-2 MB								
1,4-Dichlorobenzene			<0.50		ug/L		0.5	25-JUN-21
Benzene			<0.50		ug/L		0.5	25-JUN-21

Quality Control Report

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: CLIVE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-ROU-HS-WT	**Water**							
Batch R5502389								
WG3562830-2 MB								
Chloroform			<1.0		ug/L		1	25-JUN-21
Dichloromethane			<2.0		ug/L		2	25-JUN-21
Ethylbenzene			<0.50		ug/L		0.5	25-JUN-21
Tetrachloroethylene			<0.50		ug/L		0.5	25-JUN-21
Toluene			<0.40		ug/L		0.4	25-JUN-21
Trichloroethylene			<0.50		ug/L		0.5	25-JUN-21
Surrogate: 1,4-Difluorobenzene			98.9		%		70-130	25-JUN-21
Surrogate: 4-Bromofluorobenzene			91.3		%		70-130	25-JUN-21
WG3562830-5 MS		**WG3562830-3**						
1,4-Dichlorobenzene			111.5		%		50-150	25-JUN-21
Benzene			95.9		%		50-150	25-JUN-21
Chloroform			101.1		%		50-150	25-JUN-21
Dichloromethane			100.2		%		50-150	25-JUN-21
Ethylbenzene			89.8		%		50-150	25-JUN-21
Tetrachloroethylene			104.6		%		50-150	25-JUN-21
Toluene			94.4		%		50-150	25-JUN-21
Trichloroethylene			106.2		%		50-150	25-JUN-21

Quality Control Report

Workorder: L2602906 Report Date: 29-JUN-21

Client: FISHER ENVIRONMENTAL
15-400 ESNA PARK DRIVE
MARKHAM ON L3R 3K2
Contact: CLIVE

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS www.alsglobal.com

Chain of Cus

L2602906-COFC

COC Number: 20 - 892013

Page of

Report To	Contact and company name below will appear on the final report
Company:	Fisher Environmental
Contact:	Clwe
Phone:	416 605-9722
	Company address below will appear on the final report
Street:	15-400 Esna Park Dr.
City/Province:	Markham
Postal Code:	L3R 3K2
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Fisher Environmental
Contact:	Clwe

Reports / Recipients

Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Clwe @ FE

Email 2:

Email 3:

Invoice Recipients

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax:

Email 2:

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests

Date and Time Required for all E&P TATs:

For all tests with rush TATs requested, please contact your AM to confirm availability.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Project Information

ALS Account # / Quote #:	
Job #:	
PO / AFE:	
LSD:	
ALS Lab Work Order # (ALS use only):	L2602906

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS: Halton Sewer discharge bylaws	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	1029-1033 Waterdown Rd Burlington. Halton Sewer discharge bylaws - MW1	17/06/21		Water				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☑ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
10.6				7.3			

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
Nnamdi	17/06/21	

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:
[illegible]	June 17/21	10:15

FINAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:
[illegible]	Jun 17/21	1730

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS 2020 FRONT

APPENDIX E – HYDRAULIC CONDUCTIVITY ANALYSES

FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *1029-1033 Waterdown Road, Burlington, On*
Project: *FE-P-21-11237H*
Test Date: *2021-07-22*
Well No. *MW1*

Equilibrium Water level (from top of pipe) HE	*419*	*cm*
Initial Water level (from top of pipe) Ho	*457*	*cm*
Monitoring well inner diameter d	*0.05*	*m*
Initial Time offset To	*5*	*second*
Reverse of Luthin's reference system Ru = Ho - HE	*38.00*	*cm*
Slope of Log((ho-he)/(ht-he)) / T	*3.00E-04*	
G = Ru / (HT - HE)		

Hydraulic conductivity computed k =

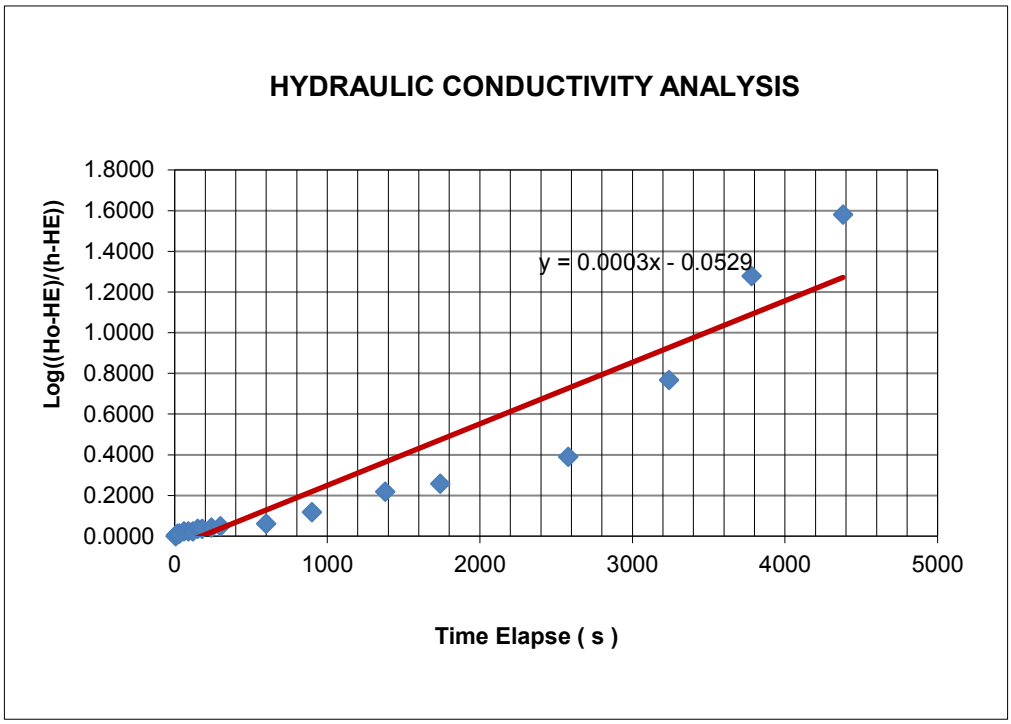
0.0004540	**cm/s**
4.54E-06	**m/s**
0.392	**m/day**

Time	HT (Water Drop)			G	LOG (G)
(Interval s)	(Elapsed s)	(m)	(cm)		
	0	4.57			
5	5	4.570	457.00	1.0000	0.0000
5	10	4.565	456.50	1.0133	0.0058
5	15	4.565	456.50	1.0133	0.0058
5	20	4.560	456.00	1.0270	0.0116
10	30	4.560	456.00	1.0270	0.0116
30	60	4.550	455.00	1.0556	0.0235
30	90	4.550	455.00	1.0556	0.0235
30	120	4.550	455.00	1.0556	0.0235
30	150	4.540	454.00	1.0857	0.0357
30	180	4.540	454.00	1.0857	0.0357
60	240	4.535	453.50	1.1014	0.0420
60	300	4.530	453.00	1.1176	0.0483
300	600	4.520	452.00	1.1515	0.0613
300	900	4.480	448.00	1.3103	0.1174
480	1380	4.420	442.00	1.6522	0.2181
360	1740	4.400	440.00	1.8095	0.2576
840	2580	4.345	434.50	2.4516	0.3895
660	3240	4.255	425.50	5.8462	0.7669
540	3780	4.210	421.00	19.0000	1.2788
600	4380	4.200	420.00	38.0000	1.5798

FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *1029-1033 Waterdown Road, Burlington, On*
Project: *FE-P-21-11237H*
Test Date: *2021-07-22*
Well No. *MW1*



FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *1029-1033 Waterdown Road, Burlington, On*
Project: *FE-P-21-11237H*
Test Date: *2021-07-22*
Well No. *MW3*

Equilibrium Water level (from top of pipe) HE	*766*	*cm*
Initial Water level (from top of pipe) Ho	*733*	*cm*
Monitoring well inner diameter d	*0.05*	*m*
Initial Time offset To	*5*	*second*
Reverse of Luthin's reference system Ru = Ho - HE	*33.00*	*cm*
Slope of Log((ho-he)/(ht-he)) / T	*8.00E-04*	
G = Ru / (HT - HE)		

Hydraulic conductivity computed k =

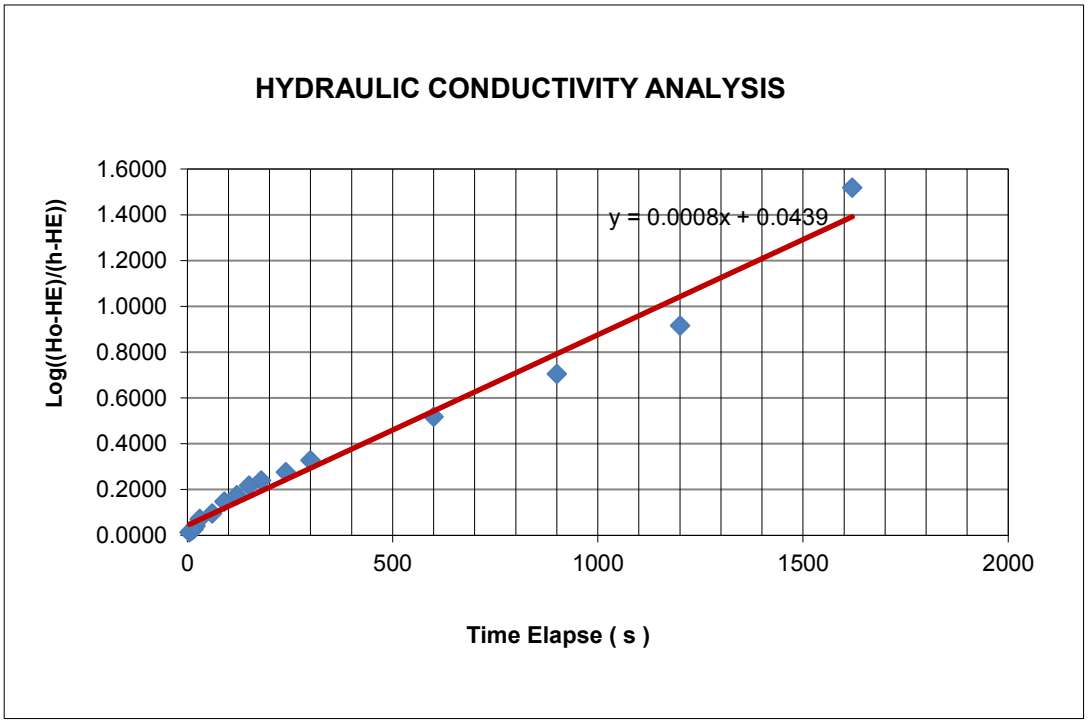
0.0012106	**cm/s**
1.21E-05	**m/s**
1.046	**m/day**

Time		HT (Water Drop)		G	LOG (G)
(Interval s)	(Elapsed s)	(m)	(cm)		
	0	**7.33**			
5	**5**	7.340	734.00	1.0313	0.0134
5	**10**	7.345	734.50	1.0476	0.0202
5	**15**	7.350	735.00	1.0645	0.0272
5	**20**	7.360	736.00	1.1000	0.0414
10	**30**	7.380	738.00	1.1786	0.0714
30	**60**	7.395	739.50	1.2453	0.0953
30	**90**	7.425	742.50	1.4043	0.1474
30	**120**	7.440	744.00	1.5000	0.1761
30	**150**	7.460	746.00	1.6500	0.2175
30	**180**	7.470	747.00	1.7368	0.2398
60	**240**	7.485	748.50	1.8857	0.2755
60	**300**	7.505	750.50	2.1290	0.3282
300	**600**	7.560	756.00	3.3000	0.5185
300	**900**	7.595	759.50	5.0769	0.7056
300	**1200**	7.620	762.00	8.2500	0.9165
420	**1620**	7.650	765.00	33.0000	1.5185

FISHER ENGINEERING

HYDRAULIC CONDUCTIVITY ANALYSIS

Location: *1029-1033 Waterdown Road, Burlington, On*
Project: *FE-P-21-11237H*
Test Date: *2021-07-22*
Well No. *MW3*



APPENDIX F – CONSTRUCTION DEWATERING AND PERMANENT DRAINAGE

Construction Dewatering Calculation

Location: *1029-1033 Waterdown Road, Burlington*
Project: *FE-P-21-11237H*
Date: *2021-11-19*

Dupuit Forcheimer for Radial Flow to a Closely Welled System or Excavation

Construction Units	Finished lowest floor elevation (m asl)	Average Grade (m asl)	Lowest Footing Elevation (m asl)	Required Dewatering Elevation (m asl)	Static water level		Well base elevation	H (m)	h_w (m)	H-h_w (m)	R_0 (m)		r_w	ab (m^2)	K (m/s)	H^2-h_w^2	lnR_0	lnr_w	Q, (m^3/s)	Q, (m^3/day)
					BGS (m)	Elevation (m asl)	(m)				Model	Adjusted								
Building with two UG levels	96.96	103.06	95.96	94.96	4.31	98.75	94.66	4.09	0.3	3.79	16.15	44.27	28.12	2484	4.54E-06	16.64	3.79	3.34	5.23E-04	45.18

Dupuit Forcheimer Equation

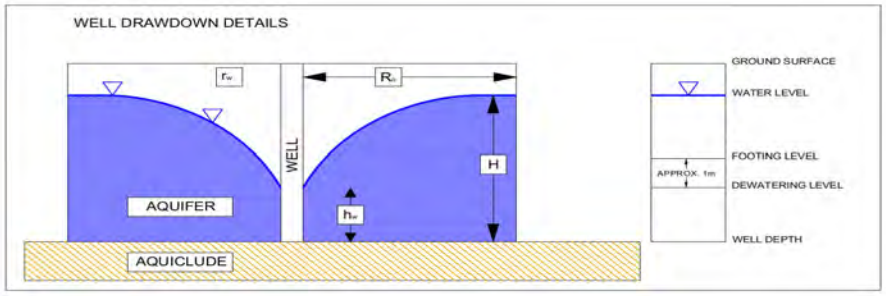
$$Q = \frac{\pi K(H^2 - h_w{}^2)}{lnR_0 - lnr_w}$$

Equivalent radius of well, r_w

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Radius of influence in m, calculated from Sichardt's equation

$$R_0 = 2000(H - h_w)\sqrt{k}$$



Where:

r_w = equivalent radius of the well in m,
H = hydraulic head of the original water table (total saturated aquifer thickness) in m,
h_w = hydraulic head at maximum dewatering (proposed drawdown) in m,
R_0 = radius of influence in m, calculated from Sichardt's equation, and
K = hydraulic conductivity, in m/s
a = length of excavation area in m
b = width of excavation area in m

FISHER ENGINEERING

Permanent Drainage

Location: *1029-1033 Waterdown Road, Burlington*
Project: *FE-P-21-11237H*
Date: *2021-11-19*

Dupuit Forcheimer for Radial Flow to a Closely Welled System or Excavation

Construction Units	Finished lowest floor elevation (m asl)	Average Grade (m asl)	Lowest Footing Elevation (m asl)	Required Dewatering Elevation (m asl)	Static water level		Well base elevation	H (m)	h_w (m)	H-h_w (m)	R_0 (m)		r_w	ab (m^2)	K (m/s)	H^2-h_w^2	lnR_0	lnr_w	Q, (m^3/s)	Q, (m^3/day)
					BGS (m)	Elevation (m asl)	(m)				Model	Adjusted								
Building with two UG levels	96.96	103.06	95.96	96.71	3.94	99.12	96.46	2.66	0.3	2.41	10.27	38.39	28.12	2484	4.54E-06	7.01	3.65	3.34	3.21E-04	27.76

Dupuit Forcheimer Equation

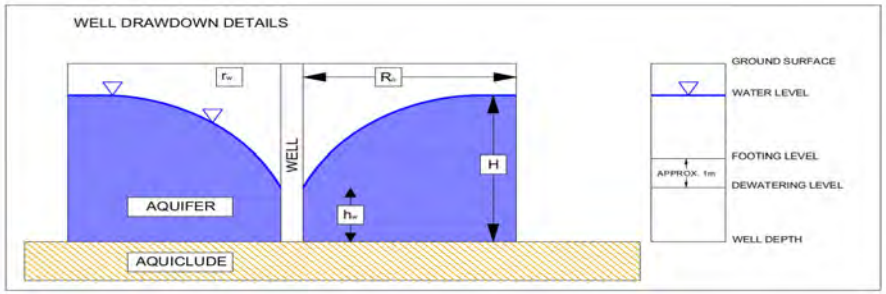
$$Q = \frac{\pi K(H^2 - h_w{}^2)}{lnR_0 - lnr_w}$$

Equivalent radius of well, r_w

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Radius of influence in m, calculated from Sichardt's equation

$$R_0 = 2000(H - h_w)\sqrt{k}$$

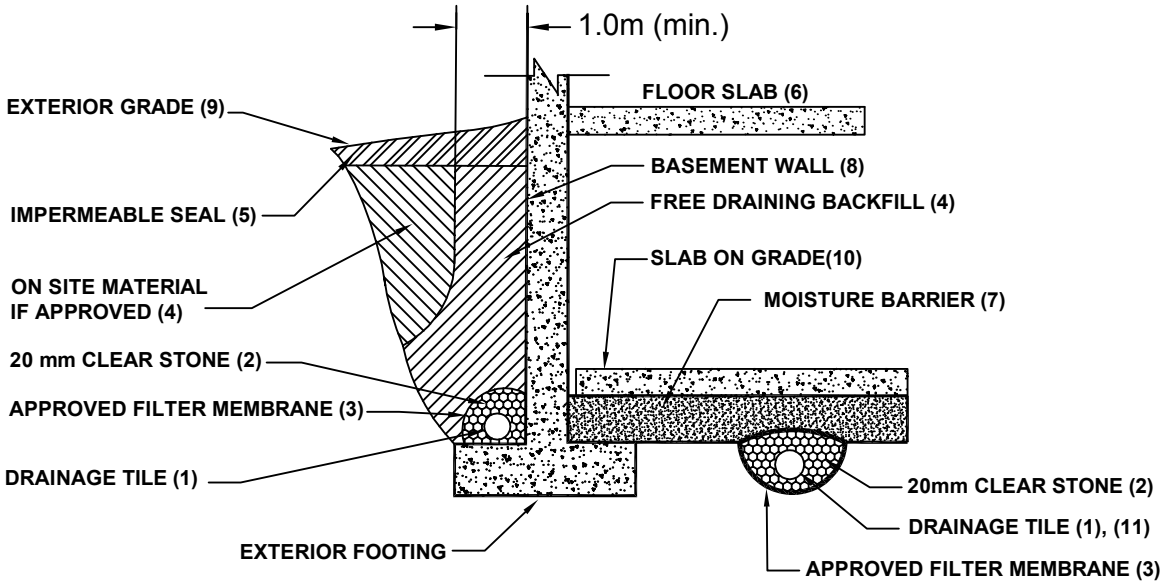


Where:

r_w = equivalent radius of the well in m,
H = hydraulic head of the original water table (total saturated aquifer thickness) in m,
h_w = hydraulic head at maximum dewatering (proposed drawdown) in m,
R_0 = radius of influence in m, calculated from Sichardt's equation, and
K = hydraulic conductivity, in m/s
a = length of excavation area in m
b = width of excavation area in m

APPENDIX G – BACKFILL AND DRAINAGE DESIGN

FISHER ENGINEERING



NOTES:

(1) DRAINAGE TILE TO CONSIST OF 100mm (4") DIAMETER WEEPING TILE OR EQUIVALENT PERFORATED PIPE LEADING TO A POSITIVE SUMP OR OUTLET.

(2) 20mm (3/4") CLEAR STONE - 150mm (6") TOP AND SIDE OF DRAIN. IF DRAIN IS NOT ON FOOTING, PLACE 100mm (4") OF STONE BELOW DRAIN.

(3) WRAP THE CLEAR STONE WITH AN APPROVED FILTER MEMBRANE (TERRAFIX 279R OR EQUIVALENT).

(4) FREE DRAINING BACKFILL - OPSS GRANULAR B OR EQUIVALENT COMPACTED TO THE SPECIFIED DENSITY. DO NOT USE HEAVY COMPACTION EQUIPMENT WITHIN 1.8m (6') OF WALL.

(5) IMPERMEABLE BACKFILL SEAL - COMPACTED CLAY, CLAYEY SILT OR EQUIVALENT. IF ORIGINAL SOIL IS FREE-DRAINING, SEAL MAY BE OMITTED. MAXIMUM THICKNESS OF SEAL TO BE 0.5m.

(6) DO NOT BACKFILL UNTIL WALL IS SUPPORTED BY BASEMENT AND FLOOR SLABS OR ADEQUATE BRACING.

(7) MOISTURE BARRIER TO BE AT LEAST 200mm (8") OF COMPACTED CLEAR 20mm (3/4") STONE OR EQUIVALENT FREE DRAINING MATERIAL. A VAPOUR BARRIER MAY BE REQUIRED FOR SPECIALTY FLOORS.

(8) BASEMENT WALL TO BE DAMP PROOFED.

(9) EXTERIOR GRADE TO SLOPE AWAY FROM BUILDING.

(10) SLAB ON GRADE SHOULD NOT BE STRUCTURALLY CONNECTED TO THE WALL OR FOOTING

(11) UNDERFLOOR DRAIN INVERT TO BE AT LEAST 300mm (12") BELOW UNDERSIDE OF FLOOR SLAB. DRAINAGE TILE PLACED IN PARALLEL ROWS 6 TO 8m (20-25') CENTERS ONE WAY. PLACE DRAIN ON 100mm (4") CLEAR STONE WITH 150mm (6") OF CLEAR STONE ON TOP AND SIDES. ENCLOSE STONE WITH FILTER FABRIC AS NOTED IN (3)

(12) THE ENTIRE SUBGRADE TO BE SEALED WITH APPROVED FILER FABRIC (TERRAFIX 270R OR EQUIVALENT) IF NON-COHESIVE(SANDY) SOILS BELOW GROUND WATER TABLE ENCOUNTERED.

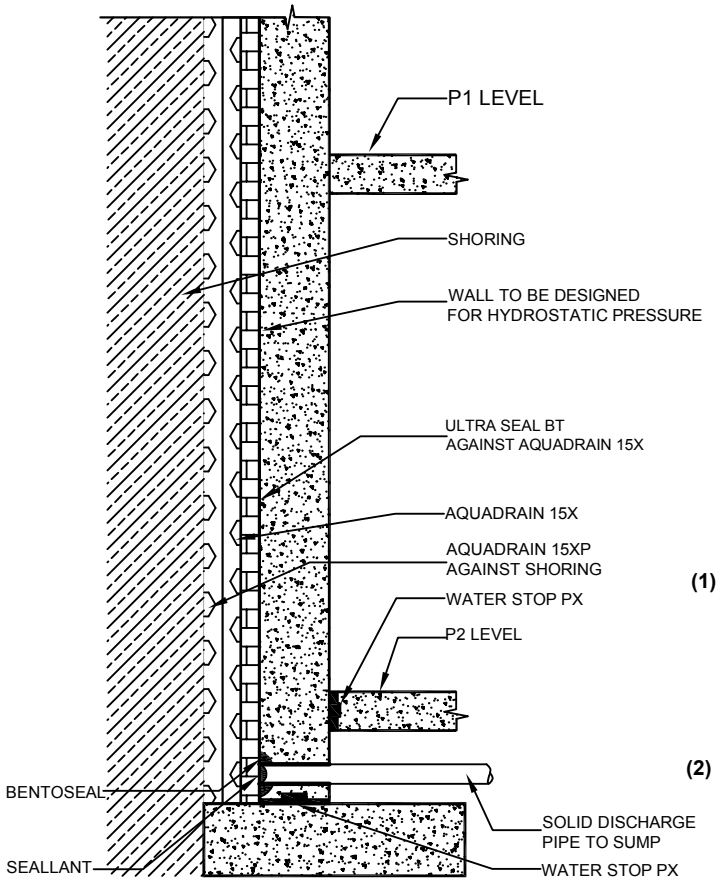
(13) DO NOT CONNECT THE UNDERFLOOR DRAINS TO PERIMETER DRAINS.

(14) REVIEW THE GEOTECHNICAL REPORT FOR SPECIFIC DETAILS.

DRAINAGE AND BACKFILL RECOMMENDATIONS

BASEMENT WITH UNDERFLOOR DRAINAGE

(NOT TO SCALE)



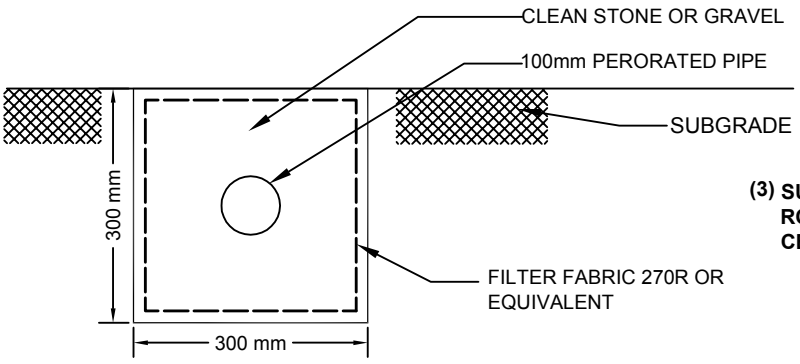
NOTES:

(1) ALL PERMANENT DRAINAGE PIPES MUST HAVE GEOTEXTILE FILTER SLEEVE TO PREVENT LONG TERM SILTING. TO FURTHER MINIMIZE SILTATION OF THE DRAINAGE SYSTEM, ALL DRAINAGE PIPE CONNECTION MUST BE SOLID PVC ELBOWS AND Ts. NO "BUTT" END CONNECTIONS SHOULD BE PERMITTED.

(2) PERIMETER COLLECTION PIPE TO BE SOLID PIPE,

SUGGESTED EXTERIOR DRAINAGE AGAINST SHORING

(NOT TO SCALE)



(3) SUBGRADE DRAIN TO BE PLACED IN PARALLEL ROWS 6-8 m (20'-25'), FROM CENTERLINE TO CENTERLINE.

DETAIL OF SUBGRADE DRAIN

(NOT TO SCALE)

APPENDIX F

ENGINEERING PLANS

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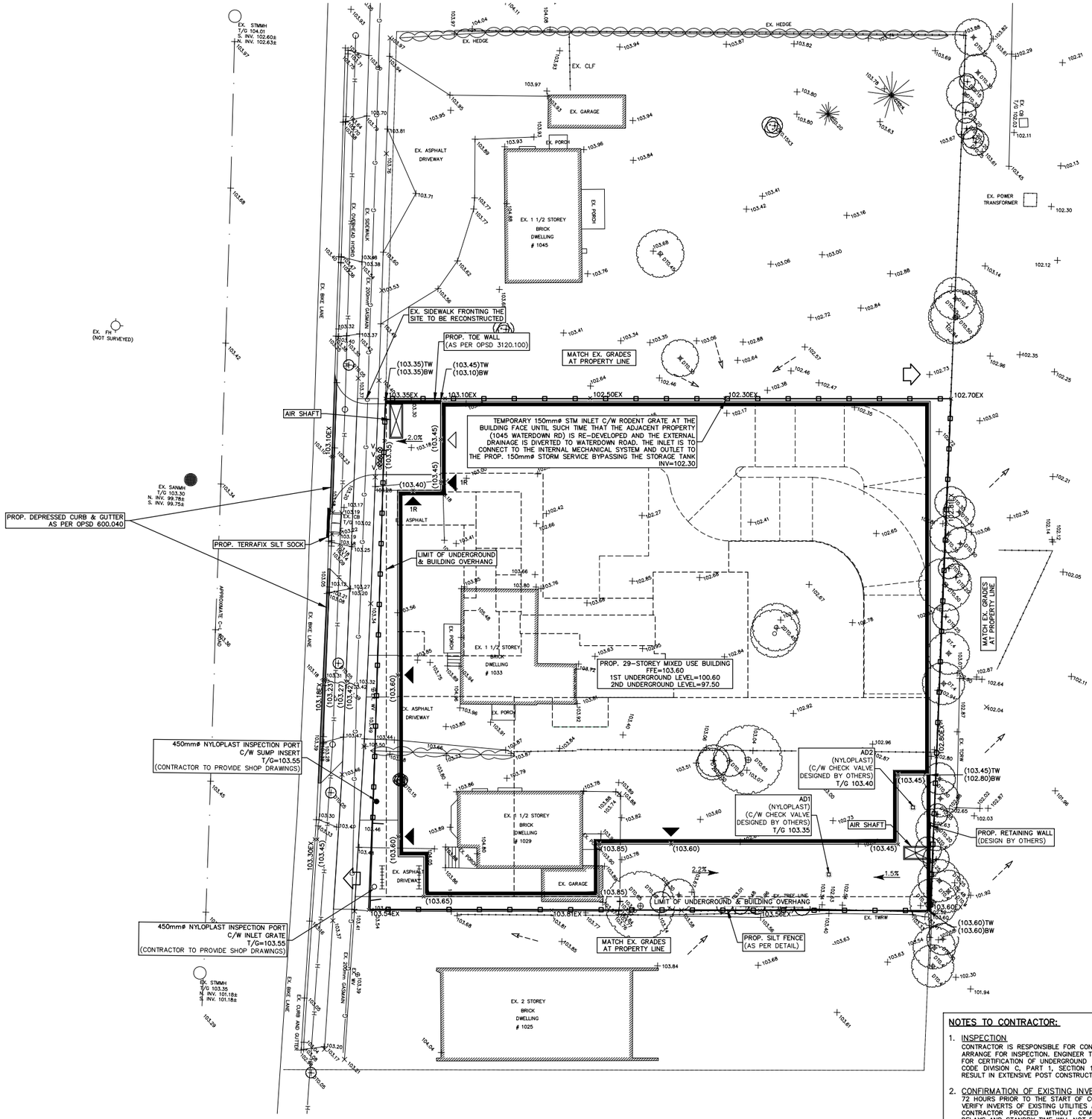
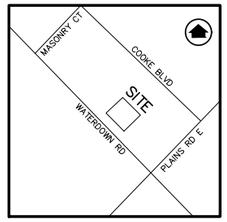


LEGEND:

- 209.00 — EXISTING GROUND ELEVATION
- ×(209.00) — PROPOSED GROUND ELEVATION
- 209.00EX — PROPOSED ELEVATION TO MATCH EXISTING
- (209.00)TW — PROPOSED ELEVATION TO MATCH TOP OF WALL
- 2.0% — PROPOSED DIRECTION OF SHEET FLOW
- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED AREA DRAIN
- PROPOSED SILTATION CONTROL FENCE
- PROPOSED CATCHBASIN SILT SACK
- EMERGENCY OVERLAND FLOW ROUTE
- PROPOSED GATE VALVE
- EXISTING DIRECTION OF DRAINAGE



KEY MAP
N.T.S.

BENCH MARK NOTE:
CITY OF BURLINGTON BENCHMARK No. 1072 (HCM043921230)
BRASS CAP SET VERTICALLY IN CONCRETE CYLINDER ON THE SOUTH SIDE OF NORTHSHORE BOULEVARD OPPOSITE UNSWORTH AVENUE 1m BACK OF PAVEMENT DRIVEWAY #340 AND #344

ELEVATION = 100.034m (DATUM: CGVD 1928:1978)

NO.	DATE	BY	REVISIONS

NOTES TO CONTRACTOR:
1. CONTRACTORS AND SUBCONTRACTORS SHALL NOT SCALE FROM THIS DRAWING.
2. ANY INCONSISTENCIES AND OMISSIONS FOUND ON THE DRAWINGS MUST BE REPORTED TO THE ENGINEER FOR CLARIFICATION BEFORE COMMENCING THE WORK.
3. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ALL FINDINGS TO THE ENGINEER. ONCE CONSTRUCTION HAS COMMENCED, THE CONTRACTOR ACCEPTS RESPONSIBILITY FOR ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS.
4. THE POSITIONS OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVER-GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWING, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
5. ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED, REUSED, OR REVISED WITHOUT THE WRITTEN CONSENT OF S. LLEWELLYN AND ASSOCIATES LIMITED.

DESIGN	SN	CHK'D	SF	DATE
DRAWN	SN	CHK'D	SF	Nov. 25, 2021

SCALE 1:200 (0, 5, 10, 20)

APPROVALS

STAMP: LICENSED PROFESSIONAL ENGINEER — Scott Nelson — S. J. NELSON — 100228748 — Nov.26/21 — PROVINCE OF ONTARIO

NOTES TO CONTRACTOR:

1. INSPECTION
CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HRS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.

2. CONFIRMATION OF EXISTING INVERTS
72 HOURS PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE AND VERIFY INVERTS OF EXISTING UTILITIES AND EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT
INFINITY DEVELOPMENT GROUP
2275 UPPER MIDDLE RD E, OAKVILLE, ON

PROJECT NAME
1029–1033 WATERDOWN ROAD
BURLINGTON, ON

TITLE
PRELIMINARY GRADING & EROSION CONTROL PLAN

PROJECT No.	DRAWING No.
21089	C101

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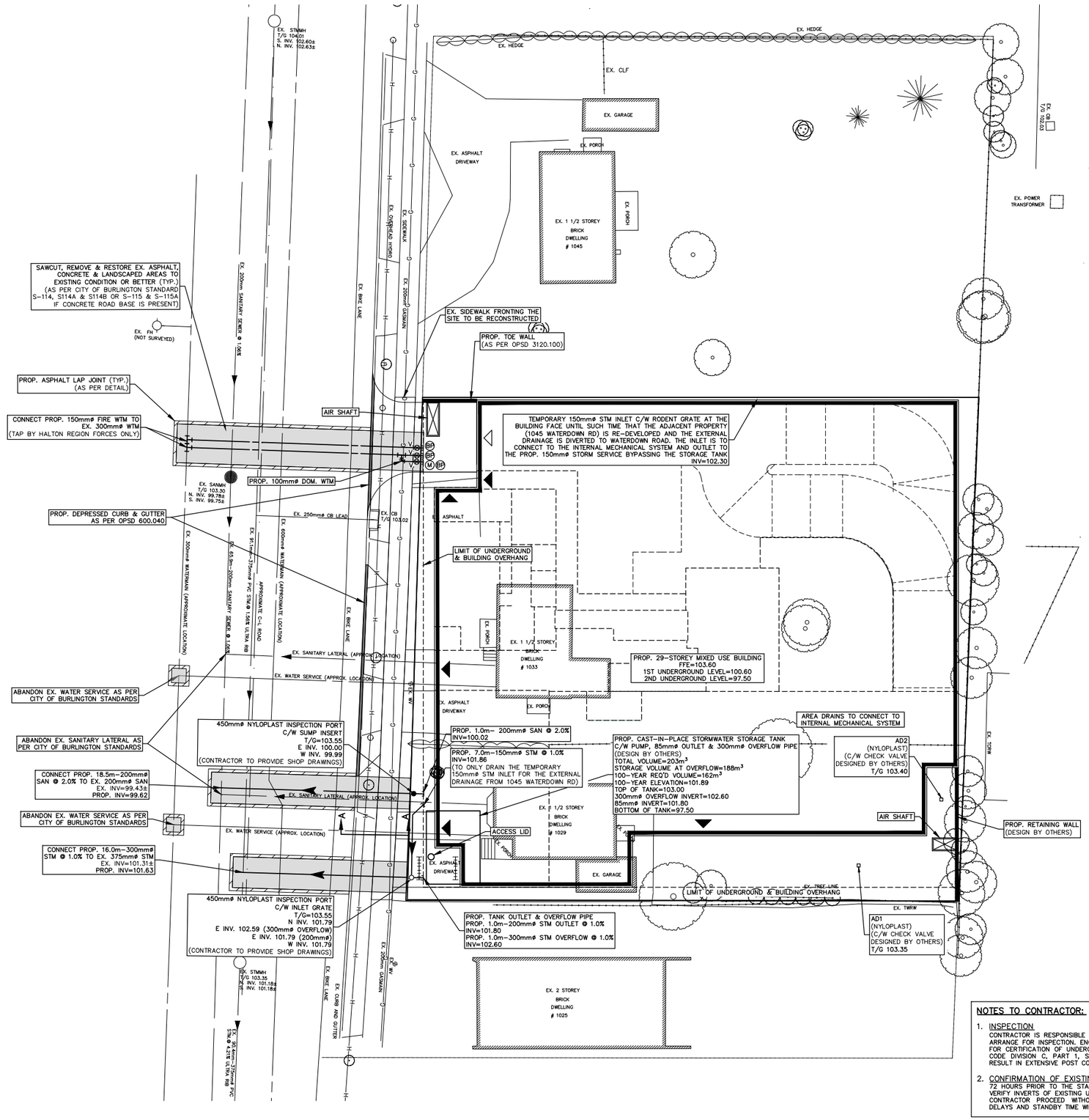
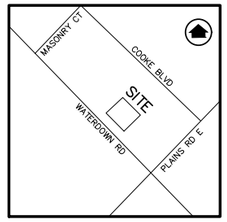


LEGEND:

- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED AREA DRAIN
- PROPOSED GATE VALVE
- PROPOSED WATER METER
- PROPOSED BACKFLOW PREVENTOR
- PROPOSED ROAD RESTORATION



KEY MAP
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BENCH MARK NOTE:
CITY OF BURLINGTON BENCHMARK No. 1072 (HCM043921230) BRASS CAP SET VERTICALLY IN CONCRETE CYLINDER ON THE SOUTH SIDE OF NORTHSHORE BOULEVARD OPPOSITE UNSWORTH AVENUE 1m BACK OF PAVEMENT DRIVEWAY #340 AND #344

ELEVATION = 100.034m (DATUM: CGVD 1928:1978)

NO.	DATE	BY	REVISIONS

NOTES TO CONTRACTOR:

1. CONTRACTORS AND SUBCONTRACTORS SHALL NOT SCALE FROM THIS DRAWING.
2. ANY INCONSISTENCIES AND OMISSIONS FOUND ON THE DRAWINGS MUST BE REPORTED TO THE ENGINEER FOR CLARIFICATION BEFORE COMMENCING THE WORK.
3. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ALL FINDINGS TO THE ENGINEER. ONCE CONSTRUCTION HAS COMMENCED, THE CONTRACTOR ACCEPTS RESPONSIBILITY FOR ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS.
4. THE POSITIONS OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVER-GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWING, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
5. ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED, REUSED, OR REVISED WITHOUT THE WRITTEN CONSENT OF S. LLEWELLYN AND ASSOCIATES LIMITED.

DESIGN	SN	CHK'D	SF
DRAWN	SN	CHK'D	SF

DATE: Nov. 25, 2021

SCALE 1:200 (0, 5, 10, 20)

APPROVALS

STAMP: LICENSED PROFESSIONAL ENGINEER — Scott Nelson — S. J. NELSON — 100228748 — Nov.26/21 — PROVINCE OF ONTARIO

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
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3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT
INFINITY DEVELOPMENT GROUP
2275 UPPER MIDDLE RD E, OAKVILLE, ON

PROJECT NAME
1029-1033 WATERDOWN ROAD
BURLINGTON, ON

TITLE
PRELIMINARY SERVICING PLAN

PROJECT No. 21089

DRAWING No. C102

NOTES TO CONTRACTOR:

1. INSPECTION
CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HRS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.

2. CONFIRMATION OF EXISTING INVERTS
72 HOURS PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE AND VERIFY INVERTS OF EXISTING UTILITIES AND EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.

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GENERAL NOTES:

1. CONSTRUCTION OF SEWERS, AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE CITY OF BURLINGTON, THE REGIONAL MUNICIPALITY OF HALTON AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD). THE TOWN AND THE REGION'S DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. ONTARIO PROVINCIAL STANDARD DRAWINGS TO BE READ IN CONJUNCTION WITH THE REGION OF HALTON REVISIONS.
3. RELOCATION OF EXISTING SERVICES AND/OR UTILITIES SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER.
4. THE CONTRACTOR SHALL OBTAIN ALL PERMITS FOR CONSTRUCTION.
5. FOR ALL SEWERS AND WATERMAIN IN FILL SECTIONS, THE COMPACTION SHALL BE VERIFIED PRIOR TO LAYING OF PIPE.
6. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT WRITTEN APPROVAL FROM THE REGIONAL ENGINEER, CITY OF BURLINGTON OR THE ENGINEER.
7. ALL EXCAVATIONS TO BE BACKFILLED WITH SELECT NATIVE MATERIAL, APPROVED BY THE ENGINEER, TO 95% SPD.
8. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING SILT CONTROL DEVICES AS SHOWN ON THE DRAWINGS AND AS DIRECTED BT THE ENGINEER.
9. TREE PROTECTION PROCEDURES TO BE IMPLEMENTED IN ACCORDANCE WITH CITY OF BURLINGTON STANDARDS.
10. THESE PLANS ARE NOT TO BE USED FOR CONSTRUCTION UNTIL SEALED BY THE ENGINEER AND INDICATED ISSUED FOR CONSTRUCTION ON THE DRAWING.
11. THIS/THESE PLAN(S) IS/ARE NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF S. LLEWELLYN AND ASSOCIATES LIMITED.
12. INFORMATION REGARDING ANY EXISTING SERVICES AND/OR UTILITIES SHOWN ON THE APPROVED SET OF CONSTRUCTION DRAWINGS ARE FURNISHED AS THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS HE SEES FIT WITH THE UNDERSTANDING THAT THE OWNER AND HIS AGENTS DISCLAIM ALL RESPONSIBILITY FOR ITS ACCURACY AND /OR SUFFICIENCY. THE CONTRACTOR SHALL ASSUME LIABILITY FOR ANY DAMAGE TO EXISTING WORKS.
13. SITE PLAN INFORMATION TAKEN FROM PLANS PREPARED BY ZEDD ARCHITECTURE.
14. THIS/THESE PLAN(S) TO BE READ IN CONJUNCTION WITH THE FUNCTIONAL SERVICING REPORT (FSR) PREPARED BY S. LLEWELLYN AND ASSOCIATES LIMITED.
15. THIS PLAN TO BE USED FOR SERVICING AND GRADING ONLY, FOR BUILDING LOCATION REFER TO TO THE SITE PLAN.
16. MUNICIPAL APPROVAL OF THESE DRAWINGS IS FOR MATERIAL AND COMPLIANCE WITH CITY OF BURLINGTON AND PROVINCIAL SPECIFICATIONS AND STANDARDS ONLY. APPROVAL AND INSPECTION OF THE WORKS BY THE CITY OF BURLINGTON STAFF DOES NOT CERTIFIY THE LINE AND GRADE OF THE WORKS NOR RELIEVE THE CONTRACTOR OF CERTIFICATION OF ALL WORKS BY THE OWNER'S ENGINEER.
17. ALTERNATE MATERIALS MAY BE ACCEPTABLE PROVIDED WRITTEN APPROVAL HAS FIRST BEEN OBTAINED FROM THE CITY OF BURLINGTON AND THE THE ENGINEER.
18. THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S BONDED CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS NORMALLY REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS, BUT NOT LIMITED TO THE FOLLOWING:
    - ROAD CUT PERMITS
    - SEWER PERMITS
    - APPROACH APPROVAL PERMITS
    - RELOCATION OF SERVICES
    - COMMITTEE OF ADJUSTMENT
    - ENCROACHMENT AGREEMENTS
20. PRIOR TO CONSTRUCTION THE CONTRACTOR MUST:
    i. CHECK AND VERIFIY ALL DIMENSIONS AND EXISTING ELEVATIONS WHICH INCLUDE BUT ARE NOT LIMITED TO THE BENCHMARK ELEVATIONS, EXISTING SERVICE CONNECTIONS, EXISTING INVERTS AND REPORT FINDING IN WRITING TO THE ENGINEER.
    ii. OBTAIN ALL UTILITY LOCATES AND REQUIRED PERMITS AND LICENSES.
    iii. VERIFY ALL FINISHED FLOOR ELEVATIONS AND BASEMENT FLOOR ELEVATIONS WHICH MY APPEAR ON THESE PLANS COMPLY WITH THE FINAL ARCHITECTURAL DRAWINGS.
    iv. CONFIRM ALL DRAWINGS USED FOR CONSTRUCTION ARE OF THE MOST RECENT REVISION.
    v. NOTIFY THE ENGINEER OF THE PROPOSED CONSTRUCTION SCHEDULE FOR COORDINATION OF NECESSARY INSPECTIONS.
21. **THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING THE ENGINEER 48 HOURS PRIOR TO THE COMMENCING SITE WORKS TO ARRANGE FOR INSPECTION. THE ENGINEER SHALL DETERMINE THE EXTENT OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF THE UNDERGROUND SERVICE INSTALLATION AS MANDATED BY THE ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2. GENERAL REVIEW. FAILURE TO MAKE SUITABLE ARRANGEMENTS FOR INSPECTION WILL LEAD TO POST CONSTRUCTION TESTING AND INSPECTION AS DETERMINED BY THE ENGINEER, THE COSTS OF WHICH INCLUDING ANY DELAYS IN CONSTRUCTION SHALL BE BOURNE BY THE CONTRACTOR. FULL PAYMENT FOR UN-INSPECTED WORKS MAY BE WITHHELD UNTIL THE COMPLETION OF THE POST CONSTRUCTION INSPECTION AND TESTING TO THE SATISFACTION OF THE ENGINEER.**
22. INSPECTION BY THE OWNER'S ENGINEER IS FOR CERTIFICATION AND GENERAL CONFORMANCE PURPOSES AND DOES NOT CERTIFY LINE AND GRADE OR IMPLY AN ASSURANCE OF QUALITY CONTROL. THE CONTRACTOR SHALL BE RESPONSIBLE TO ENSURE THE INSTALLATION OF THE WORKS TO PROPER LINE, GRADE AND QUALITY TO CURRENT INDUSTRY STANDARDS.
23. ANY UTILITY RELOCATIONS AND RESTORATIONS DUE TO THE DEVELOPMENT TO BE UNDERTAKEN AT THE EXPENSE OF THE OWNER/DEVELOPER AND SHALL BE COORDINATED BY THE CONTRACTOR.
24. ALL RESTORATIONS AND RECONSTRUCTIONS SHALL BE TO COMPLETED TO MATCH EXISTING CONDITIONS OR BETTER AND ARE TO BE PERFORMED TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF BURLINGTON.
25. SERVICING CONTRACTOR TO MAINTAIN A "CONFINED TRENCH CONDITION" IN ALL SEWER AND WATERMAIN INSTALLATION TRENCHES.
26. THE SITE SERVICING CONTRACTOR SHALL TERMINATE ALL SERVICES 1.0m FROM THE BUILDING FACE.
27. NO BLASTING WILL BE PERMITTED.

ROADWORKS:

1. APPROVED FILL, FREE OF DELETERIOUS AND ORGANIC MATERIAL AND BOULDERS SHALL BE COMPACTED TO A DRY DENSITY NOT LESS THAN 95% THAN THE STANDARD PROCTOR DENSITY. AFTER COMPACTION, SOIL DENSITY TESTS SHALL BE CONDUCTED TO ENSURE ADEQUATE COMPACTION AND STABILITY OF THE FILL AND TEST RESULTS SHALL BE SUBMITTED TO THE ENGINEER.
2. SUBGRADE TO BE PROOF ROLLED PRIOR TO PLACEMENT OF SUB BASE. UNSUITABLE MATERIAL TO BE REMOVED AND REPLACED WITH SELECT FILL OR GRANULAR "B" AND COMPACTED TO 98% SPD.
3. ASPHALTIC CONCRETE TO BE COMPACTED TO 97% MARSHALL DENSITY.
4. PAVEMENT STRUCTURE FOR INTERNAL ROADS SHALL CONSIST OF COMPACTED THICKNESSES OF: 40mm HL3 SURFACE ASPHALT 60mm HL8 BASE BINDER ASPHALT 150mm GRANULAR "A" BASE COURSE 250mm GRANULAR "B" SUB-BASE COURSE
5. BOULEVARDS TO BE SODDED WITH #1 NURSERY SOD ON A MINIMUM 150mm OF SELECT TOPSOIL.
6. MANHOLE FRAMES AND COVERS AND WATER VALVE BOXES SHALL BE SET FLUSH WITH BASE COURSE ASPHALT AND ADJUSTED TO FINAL GRADE AFTER INSTALLATION OF SURFACE ASPHALT AS PER CITY OF BURLINGTON STANDARD DRAWINGS S-130.
7. TRAFFIC CONTROL SHALL BE MAINTAINED AT ALL TIMES FOR WORKS ON EXISTING ROADWAYS TO THE SATISFACTION OF THE DIRECTOR OF ENGINEERING. THE EXPENSE FOR THE ERECTION OF SIGNS, DELINEATORS AND OTHER TRAFFIC CONTROL DEVICES SHALL BE BORNE BY THE CONTRACTOR.
8. STANDARD PARKING SPACES SHALL BE 2.6mx5.6m.

GRADING NOTES

1. ALONG ADJOINING PROPERTIES GRADE TO MEET EXISTING OR PROPOSED ELEVATIONS WITH SODDED SLOPES (MIN. 3H TO 1V) AND/OR RETAINING WALLS AS SPECIFIED.
2. ALL RETAINING WALLS, WALKWAYS, CURBS, ETC., SHALL BE PLACED A MIN. OF 0.3m OFF THE PROPERTY LINE. ALL WALLS 1.0m OR HIGHER SHALL BE DESIGNED BY A P.ENG.
3. SHOULD A RETAINING WALL BE REQUIRED, THE TOP OF WALL ELEVATIONS SHALL BE SET 150mm ABOVE THE PROPOSED SIDE YARD SWALES.
4. RETAINING WALLS 0.6m IN HEIGHT OR GREATER REQUIRE CONSTRUCTION OF A FENCE OR GUARD RAIL AT THE TOP OF THE REAR OF THE WALL. GUARDS FOR RETAINING WALLS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF EXTERIOR GUARDS AS CONTAINED IN THE ONTARIO BUILDING CODE.
5. TOP OF FOUNDATION WALLS FOR BUILDINGS SHALL BE 150mm (MIN) ABOVE FINISHED GRADE.
6. DRIVEWAY SLOPES SHALL NOT BE LESS THAN 2% AND NOT MORE THAN 7.0% REVERSED SLOPED DRIVEWAYS IN NEW DEVELOPMENTS ARE NOT PERMITTED.
7. IF GRADING IS REQUIRED ON LANDS ADJACENT TO THE DEVELOPMENT WHICH ARE NOT OWNED BY THE DEVELOPER, THEN THE DEVELOPER MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNER TO ALLOW THE DEVELOPER TO GRADE ON THE ADJACENT LANDS, OTHERWISE RETAINING WALLS MUST BE USED.
8. THE WRITTEN PERMISSION REQUIRED FROM THE ADJACENT LANDOWNER SHALL BE OBTAINED PRIOR TO ENTERING THE LANDS. SHOULD PERMISSION NOT BE OBTAINED OR IS WITHDRAWN PRIOR TO COMMENCING THE WORK, THEN THE DEVELOPER SHALL LIMIT HIS ACTIVITIES TO THE LIMITS OF THE DEVELOPMENT SITE.
9. DRIVEWAY AND DRIVEWAY APPROACHES SHALL BE LOCATED SUCH THAT HYDRO VAULTS AND OTHER STREET FURNITURE ARE A MIN. OF 1.2m FROM THE DRIVEWAY ENTRANCE CURB RADII.
10. ANY CHANGES IN GRADES AND CATCH BASINS REQUIRE THE APPROVAL OF THE CITY'S MANAGER OF DEVELOPMENT ENGINEERING.
11. ALL DRIVEWAYS FROM PROPERTY LINES FOR THE FIRST 7.5m SHALL BE WITHIN 5% MAXIMUM GRADE, THEREAFTER, ALL DRIVEWAYS SHALL BE WITHIN 10% MAXIMUM GRADES.

SILTATION AND EROSION CONTROL

1. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED.
2. ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL AS DIRECTED AND TO THE SATISFACTION OF THE CITY OF BURLINGTON AND/OR THE HALTON CONSERVATION AUTHORITY.
3. ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER, THE CITY OF BURLINGTON AND/OR THE HALTON CONSERVATION AUTHORITY.

SANITARY SEWERS:

1. SANITARY SEWERS SHALL BE PVC. PVC PIPE IS TO BE BELL AND SPIGOT AND COMPLY TO ASTM D-3034 WITH MINIMUM SDR 35.
2. MINIMUM BEDDING REQUIREMENTS FOR ALL SANITARY SEWER MAINS AND RELATED CONNECTIONS IN A SINGLE TRENCH SHALL BE CLASS B GRANULAR BEDDING AS PER OPSD 802.010 UNLESS OTHERWISE NOTED.
3. SANITARY SEWER MANHOLES FRAME AND COVER AS PER OPSD 401.010.
4. TAPPING AT EXISTING SANITARY SEWERS SHALL BE UNDERTAKEN IN ACCORDANCE WITH REGION OF HALTON REQUIREMENTS.
5. ALL SEWERS TO BE VIDEO INSPECTED.
6. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
7. ALL PVC SEWERS ARE TO BE TESTED FOR DEFLECTION (MANDREL PASSAGE) AFTER INSTALLATION. SANITARY SEWERS SHALL ALSO BE TESTED FOR LEAKAGE (LOW AIR PRESSURE). PRIOR TO ASSUMPTION BY THE CITY, PIPE DEFLECTION TESTING SHALL BE REPEATED.

STORM SEWERS:

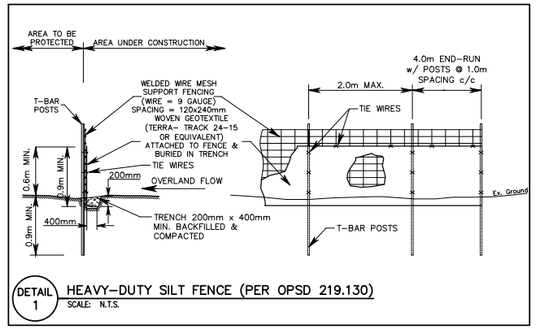
1. 300mm-450mm STORM SEWERS SHALL BE PVC, BELL AND SPIGOT AND SHALL COMPLY TO ASTM D-3034 WITH MINIMUM SDR 35.
2. MINIMUM BEDDING REQUIREMENTS FOR ALL SINGLE STORM SEWER MAINS AND ALL RELATED CONNECTIONS SHALL BE HIGH PERFORMANCE CLEAR STONE (HL-8 GRADED) AS PER CITY OF BURLINGTON STANDARD DRAWINGS S-188.
3. STORM SEWER MANHOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010. AND 703.010. FRAME AND COVER AS PER OPSD 401.01 TYPE A. FRAMES TO BE STAMPED "DANGER" AND "STORM".
4. CATCHBASINS SHALL BE IN ACCORDANCE WITH OPSD 705.010. CATCHBASIN MANHOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010 AND 701.030 UNLESS OTHERWISE SPECIFIED. CATCHBASINS TO LOCATED WITHIN LANDSCAPED AREAS TO BE SUMPLESS. FRAME AND COVER FOR CATCHBASINS AND CATCHBASIN MANHOLES SHALL BE AS PER OPSD 400.100 (ROADS) AND PER CITY OF BURLINGTON STANDARD DRAWING S-176 (REAR YARDS).
5. DOUBLE CATCH BASINS SHALL BE IN ACCORDANCE WITH OPSD 705.020 WITH 250mm DIA. LEAD. FRAMES AND COVERS TO BE OPSD 400.11 (ROADS) AND CITY OF BURLINGTON STD. S-176 (REAR YARDS). LEADS TO BE PVC SDR 35.
6. CATCH BASIN AND MANHOLE TOPS SHALL BE INITIALLY SET TO BASE COURSE ASPHALT ELEVATION AND ADJUSTED TO GRADE PRIOR TO PLACEMENT OF TOP LIFT OF ASPHALT.
7. ALL TRENCH EXCAVATIONS ARE TO BE BACKFILLED WITH SELECT NATIVE MATERIAL PLACED IN MAXIMUM 200mm LIFT THICKNESSES WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO A MINIMUM OF 95% SPD, UNLESS OTHERWISE SPECIFIED.
8. INVERTS OF ALL SWALES TO BE SODDED TO A MINIMUM WIDTH OF 3.0m. ALL OTHER DISTURBED AREAS TO BE TOPSOILED AND SEEDED. SOD SHALL BE #1 NURSERY LAID ON A MINIMUM OF 150mm OF TOPSOIL.
9. ALL SEWERS TO BE VIDEO INSPECTED.
10. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
11. ALL PVC SEWERS (SANITARY AND STORM) ARE TO BE TESTED FOR DEFLECTION (MANDREL PASSAGE) AFTER INSTALLATION. PRIOR TO ASSUMPTION BY THE CITY, PIPE DEFLECTION TESTING SHALL BE REPEATED.

RESTORATIONS:

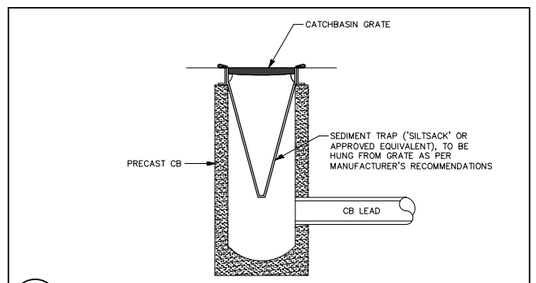
1. ALL TRENCH EXCAVATIONS WITHIN EXISTING ROAD ALLOWANCES SHALL BE AS BACKFILLED AS PER CITY OF BURLINGTON STANDARD DRAWING S-114 AND S-114A, OR S-115 AND S-115A WHERE CONCRETE ROAD BASE IS PRESENT.
2. EXISTING PRIVATE FENCING IS TO BE MAINTAINED THROUGHOUT CONSTRUCTION. WHERE REMOVAL OR RELOCATION OF FENCING IS NECESSARY IT SHALL BE RESTORED OR REPLACED TO ORIGINAL CONDITIONS OR BETTER UNDER THE DIRECTION OF THE ENGINEER.
3. DAMAGED CURB, GUTTER AND SIDEWALK TO BE REPLACED WITH 28 MPa CONCRETE TO EXISTING CONDITIONS OR BETTER.
4. PAVEMENT SURFACE ON EXISTING PLAINS ROAD EAST TO BE REPAIRED BY CONTRACTOR AT THEIR EXPENSE IF DAMAGED BY CONSTRUCTION TRAFFIC.

WATERMAINS:

1. FLEXIBLE WATERMAIN PIPE UP TO 300mm DIAMETER TO BE P.V.C. DR-18 AND CONFORM TO A.W.W.A. C-900 WITH MECHANICAL JOINTS AS PER A.W.W.A. C-110, AND TO BE INSTALLED WITH A 10 GAUGE TRACER WIRE.
2. FLEXIBLE PIPE BEDDING TO BE OPSD 802.010 WITH COMPACTED GRANULAR B MATERIAL.
3. MINIMUM COVER TO BE 1.7m TO TOP OF PIPE.
4. DEFLECTION AT JOINTS NOT TO EXCEED 2.5 DEGREES AND SHALL BE EQUAL AT ALL JOINTS.
5. GATE VALVES AND BOXES FOR 150mm DIAMETER WATERMAINS AS PER A.W.W.A. STANDARD C-500 AND ARE TO OPEN TO THE LEFT (COUNTER CLOCKWISE).
6. HYDRANTS SHALL MEET THE REQUIREMENTS OF A.W.W.A. STANDARD C-502 AND SHALL BE SET IN ACCORDANCE WITH REGION OF HALTON, AND CITY OF BURLINGTON BUILDING DEPARTMENT STANDARDS, COMPLETE WITH STEAMER CONNECTIONS. THE 100mm STEAMER PORT SHALL FACE THE FIRE ROUTE AND SHALL BE UNOBSTRUCTED BY ANY PROPOSED LANDSCAPING.
7. ALL FITTINGS TO HAVE MECHANICAL RESTRAINTS THAT MEET UNI-B-13-92.
8. ALL TEMPORARY AND PERMANENT WATERMAIN PLUGS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH OPSD 1103.01.
9. TAPPING AT EXISTING WATERMAINS SHALL BE UNDERTAKEN IN ACCORDANCE WITH REGION OF HALTON REQUIREMENTS.
10. ALL WATER CUSTOMERS SUPPLIED BY A WATERMAIN TO BE SHUT DOWN SHALL BE NOTIFIED BY THE CONTRACTOR AT LEAST 48 HOURS IN ADVANCE OF THE SHUT DOWN AS PER REGION OF HALTON SPECIFICATIONS. NOTIFICATION SHALL TAKE PLACE UNDER THE ENGINEER'S DIRECTION.
11. MINIMUM HORIZONTAL SEPERATION BETWEEN WATERMAINS (INCLUDING PRIVATE SERVICES) AND STORM AND SANITARY SEWERS SHALL BE 2.5m. WATERMAINS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 500mm BETWEEN ALL OTHER UTILITIES WHEN CROSSING.



DETAIL 1 — HEAVY-DUTY SILT FENCE (PER OPSD 219.130)
SCALE: N.T.S.



DETAIL 2 — CATCH BASIN SEDIMENT TRAP
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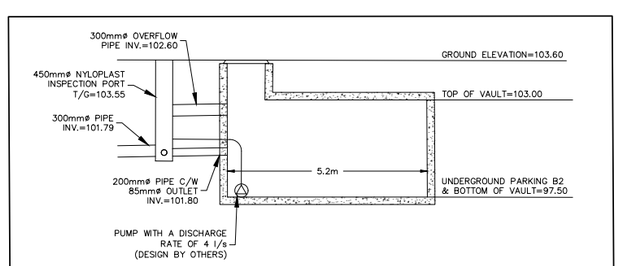
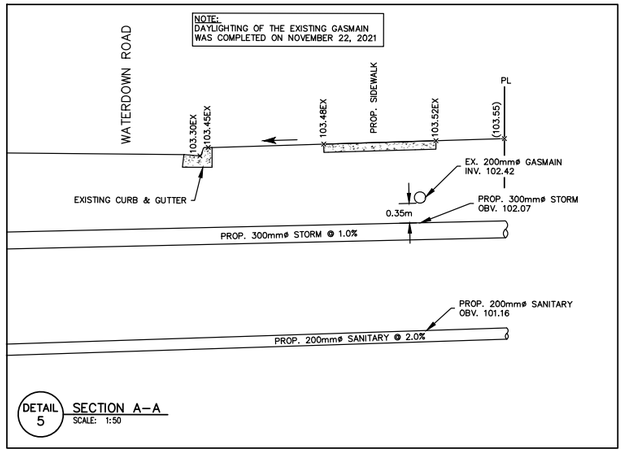
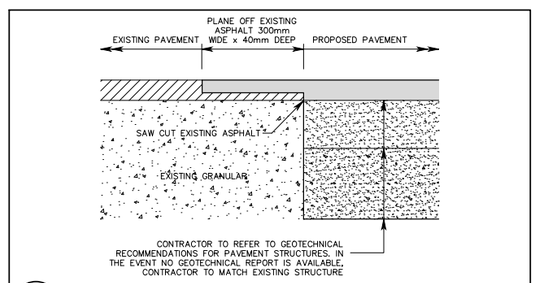


DETAIL 4 — STORMWATER STORAGE VAULT (DESIGN BY OTHERS)
SCALE: N.T.S.



DETAIL 5 — SECTION A-A
SCALE: 1:50



DETAIL 3 — ASPHALT LAP JOINT
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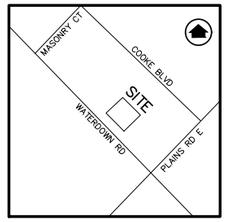

KEY MAP
N.T.S.

BENCH MARK NOTE:
CITY OF BURLINGTON BENCHMARK No. 1072 (HCM043921230)
BRASS CAP SET VERTICALLY IN CONCRETE CYLINDER ON THE SOUTH SIDE OF NORTHSHORE BOULEVARD OPPOSITE UNSWORTH AVENUE 1m BACK OF PAVEMENT DRIVEWAY #340 AND #344

ELEVATION = 100.034m (DATUM: CGVD 1928:1978)

NO.	DATE	BY	REVISIONS

NOTES TO CONTRACTOR:
1. CONTRACTORS AND SUBCONTRACTORS SHALL NOT SCALE FROM THIS DRAWING.
2. ANY INCONSISTENCIES AND OMISSIONS FOUND ON THE DRAWINGS MUST BE REPORTED TO THE ENGINEER FOR CLARIFICATION BEFORE COMMENCING THE WORK.
3. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ALL FINDINGS TO THE ENGINEER. ONCE CONSTRUCTION HAS COMMENCED, THE CONTRACTOR ACCEPTS RESPONSIBILITY FOR ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS.
4. THE POSITIONS OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVER-GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWING, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
5. ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED, REUSED, OR REVISED WITHOUT THE WRITTEN CONSENT OF S. LLEWELLYN AND ASSOCIATES LIMITED.

DESIGN	SN	CHK'D	SF	DATE: Nov. 25, 2021
DRAWN	SN	CHK'D	SF	

SCALE

APPROVALS

STAMP: LICENSED PROFESSIONAL ENGINEER — Scott Nelson — S. J. NELSON — 100228748 — Nov.26/21 — PROVINCE OF ONTARIO

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CLIENT
INFINITY DEVELOPMENT GROUP
2275 UPPER MIDDLE RD E, OAKVILLE, ON

PROJECT NAME
1029-1033 WATERDOWN ROAD
BURLINGTON, ON

TITLE
GENERAL NOTES & DETAILS

PROJECT No. 21089
DRAWING No. C103