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Lockhart Innisfil Investments (II) Limited

Lockhart II Subdivision

Preliminary Stormwater Management Report

October 2021

The Jones Consulting Group Ltd.
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GOL-20538 (70)

Distribution List

No. Of Hard Copies	PDF	Email	Organization
2	Y	Y	City of Barrie
2	Y	Y	Lake Simcoe Region Conservation Authority
2	Y	Y	Client

Record of Revisions

Rev. No.	Date	Description
-	October 2021	Application for Subdivision & ZBLA

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Disclaimer

This Report was prepared by **The Jones Consulting Group Ltd.** for **Lockhart Innisfil Investments (II) Limited.** The material in the Report reflects **The Jones Consulting Group Ltd.'s** best judgment in light of the information available at the time of the Report preparation. Any use which a third party makes of this Report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **The Jones Consulting Group Ltd**. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Report. This report has been prepared, in part based on the Hewitt's Secondary Plan Area Subwatershed Impact Study (SIS) prepared by R.J. Burnside & Associates, dated September 2016 and the Addendum No. 1, dated November 2017.

Preliminary Stormwater Management Report

Lockhart Innisfil Investments (II) Limited
Lockhart II Subdivision, City of Barrie

1. Introduction

1.1. Appointment

The Jones Consulting Group Ltd. (TJCG) was retained by Lockhart Innisfil Investments (II) Limited (Client) to provide engineering services for a proposed residential subdivision development located in the Hewitt's Creek Secondary Plan Area, along the north side of Lockhart Road and east of Huronia Road, in the City of Barrie (City). The subdivision is to be known as Lockhart II Subdivision.

This *Preliminary Stormwater Management Report* (PSWMR) has been prepared in support of the *Draft Plan of Subdivision* prepared by TJCG and demonstrates how the site can be serviced appropriately by the existing adjacent municipal infrastructure while not adversely impacting receiving waters in the Lover's Creek subwatershed.

A *Functional Servicing Report* (FSR) has also been submitted in conjunction with this report under separate cover in support of this application. In particular, the FSR examines the properties servicing in relation to:

- Stormwater Servicing
- Water Servicing
- Sanitary Servicing
- Roads and Grading
- Utility Servicing

1.2. Property Description

The site is generally rectangular in shape and comprises of approximately 32.10 hectares (ha) of land. The subject property is legally described as South Half of Lot 13, Concession 11, Geographic Township of Innisfil, now in the City of Barrie, County of Simcoe. A copy of the subject lands proposed *Draft Plan of Subdivision* prepared by The Jones Consulting Group (July 2021), has been attached in **Appendix A**.

The site is generally situated northeast of the intersection of Lockhart Road and Huronia Road. It is bound to the north by the proposed GG (9 Mile) Limited Subdivision, to the west by the proposed

Sorbara Subdivision, to the east by the proposed Lockhart I Subdivision, and to the south by Lockhart Road. The location of the subject property is shown in **Figure 1**.

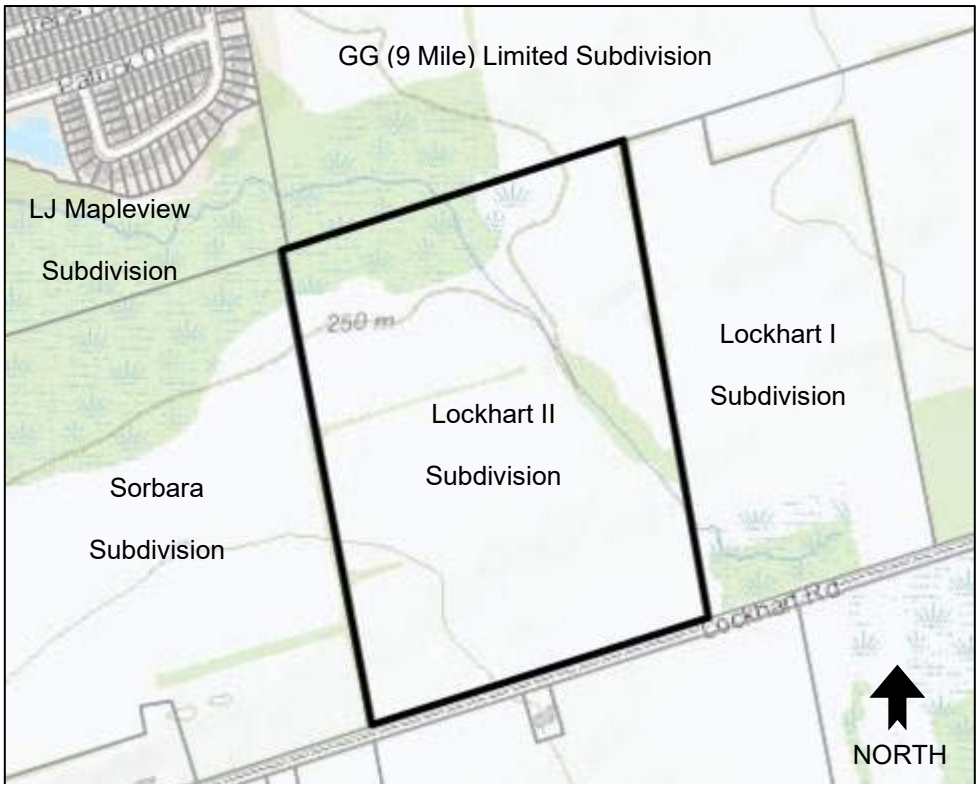


Figure 1 - Site Location

The site currently consists of cropland with scattered clusters of trees and shrubs. A section of Lover's Creek runs north from Lockhart Road along the east property line before turning west into the subject lands. The site and surrounding lands existing uses are shown on the *Hewitt's Secondary Plan Area Subwatershed Impact Study Existing Land Use* figure (Figure No. FIG 2, Dated January 28, 2016, prepared by R.J. Burnside and Associates) attached in **Appendix A**.

The existing ground surface is rolling and generally drains from the limits of the site in towards the existing Lover's Creek. Elevations range from 245 metres along the northern limits to 265 metres at the south-west property limit with slopes from 1% to 5%. Topographical information for the site was obtained from surveys completed by Hunt Surveys Inc. with survey truthing completed by TJCGL. The location of the site is shown in **Figure 1**.

The current Draft Plan proposes the development of 395 units based on single family residential units, street townhome and back-to-back townhome units, future lots, Environmental Protection lands and two (2) stormwater extended detention facilities. In addition, road rights-of-way

consisting of 18.0m wide local roads, and a 27.0m wide major collector road will be created as part of the proposed Draft Plan of Subdivision.

The developable limits of the subject site were established in connection with the *Hewitt's Creek Secondary Plan* and the associated *Secondary Infrastructure Master Plans*, *The Hewitt's Secondary Plan Area Subwatershed Impact Study (SIS)* prepared by R.J. Burnside and Associate (November 2017), as well as Regional Flood Lines and Set Back requirements established by the Lake Simcoe Region Conservation Authority. The *Hewitt's Creek Secondary Plan Area SIS* has been utilized as a framework for developing a servicing strategy that is outlined in further detail in the Functional Servicing Report (under separate cover). As such, many of the assumptions noted in this Preliminary Stormwater Management Report are based on the findings and recommendations of the *Hewitt's Secondary Plan Area SIS*.

Beyond the limits of the subject lands, there are external areas that contribute runoff to this development. Lands to the west include areas associated with the Sorbara Lands.

The site topography ranges in elevation from a maximum elevation of 265 meters at the south-west property limit to 245 along the north property boundary. The site drains generally from the limits of the site in towards Lover's Creek. Existing Slopes range from 1% to 5%.

The soils found on the subject site are a combination of Alliston Sandy Loam (Ans), Smithfield Sandy Clay Loam (Smsc), Bondhead Sandy Loam (Bs), and Muck (M). The Alliston Sandy Loam and Smithfield Silty Clay Loam soils have imperfect drainage characteristics while Bondhead Sandy Loam soils have good drainage characteristics, and Muck is saturated with water at all times. These soils belong predominately to the Group B and C of the SCS Hydrological Soils Group Classification System. Soil Series are determined from the *Soil Map of Simcoe County, Report No. 29* of the *Ontario Soil Survey* produced by the Canada Department of Agriculture with the Ontario Department of Agriculture. Soil series, their respective hydrological soils group and their relative percentage of total land area are shown below in **Figure 2** and **Table 1.**

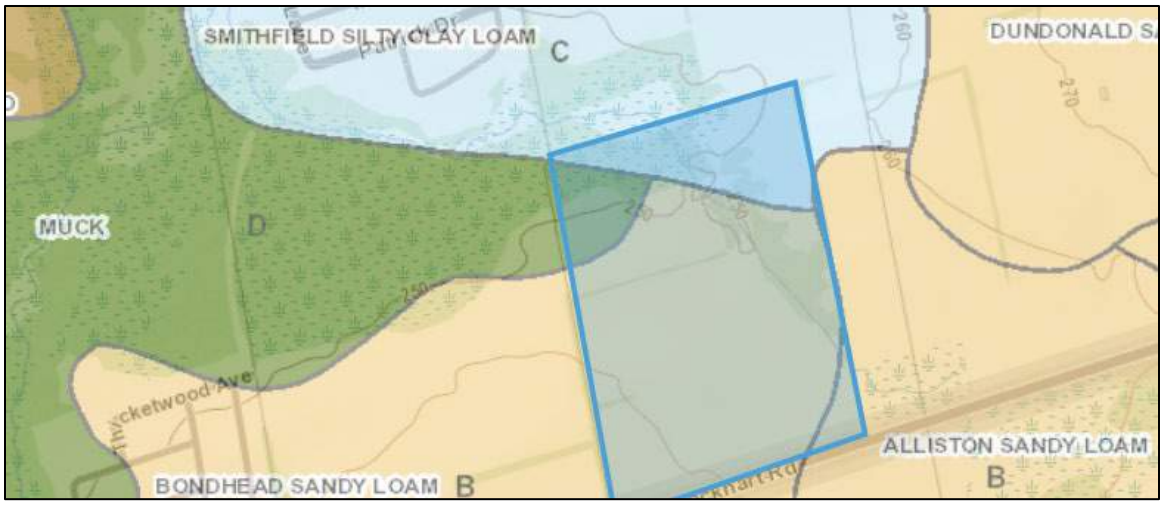


Figure 2 - Site Soils Identification

Table 1 - Soil Type Distribution

Soil Type	Soil Name	SCS Group	Total Area (ha)	Percentage Area (%)
Ans	Alliston Sandy Loam	Group B	0.90	2.8
Smsc	Smithfield Sandy Clay Loam	Group C	5.53	17.2
M	Muck	Group D	2.49	7.7
Bs	Bondhead Sandy Loam	Group B	23.27	72.3

1.3. Existing and Proposed Land Use

The property is currently zoned primarily as Residential with allocations provided for Environmental Protection. Refer to the Schedule 'A' Proposed Zoning By-Law Amendment provided in **Appendix A.** A statistical breakdown of each land use is provided in **Table 2.**

Table 2 - Land Use Statistics

	STATISTICS	Area (ha.)	Units
+	12.2m Singles (LOTS 4, 7 - 42, 51 - 54, 61, 65 - 69, 77, 85, 87 - 92, 96 - 101, 110 - 114, 131 - 134, 149, 153, 171 - 175 & 180)	2.99 ha.	78 units
■	11.0m Singles (LOTS 1-3, 5 & 6, 45 -50, 55 - 60, 62 - 64, 70 - 74, 78 - 84, 86, 93 - 95, 102 - 109, 115 - 118, 123 & 124, 128 - 130, 135 - 140, 150 & 151, 154, 176 - 179, 182 & 194)	2.34 ha.	68 units
☼	9.15m Singles (LOTS 43 & 44, 75 & 76, 119 - 122, 125 - 127, 141 - 148, 152, 155 - 170, 181, & 183 - 193)	1.31 ha.	48 units
	Street Townhomes (6.0m/unit) (BLOCK 195 - 197)	0.47 ha.	20 units
	Back to Back Townhomes (6.4m/unit) (BLOCKS 198 - 214)	1.88 ha.	180 units
	Future Lots and Blocks (LOTS/BLOCKS 215 - 216)	0.02 ha.	1 units
	Environmental Protection (BLOCKS 217 & 218)	12.43 ha.	
	Stormwater Management (BLOCKS 219 - 221)	4.14 ha.	
	Reserves & Widenings (BLOCKS 222 - 225)	0.58 ha.	
	Roads Major Collector - Fenchurch Manor - Ball Gate Local Roads; Thicketwood Avenue, Streets 'A', 'B', 'C', 'D', 'E', & 'F'	5.94 ha.	
	TOTAL	32.10 ha.	395 units

For further detail, refer to the proposed *Draft Plan of Subdivision* prepared by TJCG, dated July 2021 which has been included in **Appendix A**.

The *Barrie-Innisfil Boundary Adjustment Act*, 2009, extended the southern boundary of Barrie to include 2,335 hectares (approximately) of land previously in the Town of Innisfil, which came into effect January 1, 2010. In response to the Boundary Adjustment, the City of Barrie completed in 2013 the Master Planning Process for the *Hewitt's Creek Secondary Plan (East Annexation Lands)* and the associated Infrastructure Master Plans. Those Master and Secondary Planning Documents, along with the City's Growth Management Strategy, have formed a framework for intensification and development activities taking place in the annexation lands. That framework is intended to ensure the developments successful implementation while meeting the City of Barrie's vision for growth.

1.4. Supporting Documents

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

- Hewitt's Secondary Plan Area Subwatershed Impact Study, Lover's, Hewitt's and Sandy Cove Creeks, R.J. Burnside & Associates Ltd., September 2016 and Addendum, November 2017
- City of Barrie, Stormwater Drainage & Stormwater Management Policies & Design Guidelines, updated October 2020
- Lake Simcoe Region Conservation Authority, Technical Guidelines for Stormwater Management Submissions, September 2016
- Credit Valley Conservation Authority & Toronto Region Conservation Authority, Low Impact Development Stormwater Management Planning and Design Guide, 2010
- Ministry of the Environment, Lake Simcoe Protection Plan, July 2009
- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- Ministry of Transportation, Drainage Management Manual, February 2008
- SCS Consulting Group Ltd., Barrie Lockhart Road – Sorbara City of Barrie, Stormwater Management Report, dated November 2020

2. Approval Agencies & Design Criteria

The proposed development is subject to the policies and requirements of the City of Barrie (City), the Lake Simcoe Region Conservation Authority (LSRCA), and the Ministry of the Environment (MOE) all with respect to drainage and stormwater management.

2.1. City of Barrie

The stormwater drainage recommendations must conform to the City of Barrie's Storm Drainage and Stormwater Management Policies and Design Guidelines (October 2020). The City's document was prepared to reflect current accepted design practices and is intended as a guide to provide a solid engineering basis for storm drainage and stormwater management design, to establish uniform guidelines of minimum standards, and to improve the processing of site plan and plan of subdivision applications for approval in the City. The document provides legal and technical requirements specific to Stormwater Drainage Systems, Stormwater Management Systems, Site Grading, Requirements for Erosion & Sediment Control, Guidelines for Hydrologic and Hydraulic Analysis, and Stormwater Quantity & Quality Control Techniques, among other topics.

2.2. Lake Simcoe Region Conservation Authority (LSRCA)

The subject site is located within the Lover's Creek Watershed within the LSRCA's jurisdiction. It is expected that the LSRCA will require the stormwater management plan to adhere to the LSRCA Technical Guidelines for Stormwater Management Submissions (September 2016, Version 1.0) as well as conform to the recommendations of the MOE Stormwater Management Planning and Design Manual (March 2003). The goal of Stormwater Management is to mitigate the effects of urbanization on the hydrologic cycle including increased runoff and decreased infiltration, of rain and snowmelt. The LSRCA Technical Guidelines provide a framework for the planning and design of stormwater management infrastructure to address flooding, water quality, erosion, water balance, and natural heritage.

The LSRCA Technical Guidelines no longer follows a traditional approach to the development of stormwater management infrastructure. The Technical Guidelines provide guidance in developing an effective approach to stormwater management which follows Better Site Design

Techniques developed by the Minnesota Pollution Control Agency's 'Minnesota Stormwater Manual, 2016'. Better Site Design involves techniques applied early in the planning and design process to preserve natural areas, reduce impervious cover, redistribute runoff and use pervious areas to more effectively treat stormwater runoff. A major difference between the traditional development process and Better Site Design process is the implementation of Low Impact Development (LID) measures. The focus of design has shifted to treating and utilizing rainfall as soon as it hits the ground, reducing and controlling runoff volume and mimicking natural hydrology rather than simply conveying runoff.

2.3. Ministry of the Environment, Conservation and Parks (MECP)

An Environmental Compliance Approval (ECA) will be required from the Ministry of Environment, Conservation and Parks (MECP) for the proposed development's storm sewers and stormwater management facilities.

Ontario
Ministry of the Environment, Conservation and Parks

Once the detailed design for the site has been completed, this report will be updated and submitted to the MOE in support of an application for an ECA. Stormwater drainage proposals are to be consistent with the guidelines of the MECP's Stormwater Management Planning and Design Manual (March 2003).

3. Site Physiography

3.1. Existing Drainage Conditions

The subject site consists of approximately 32.10 hectares of land which is primarily used for agricultural purposes. The site's topography contains average slopes ranging from 1% to 5%, generally draining from the site limits in a north-eastern direction towards Lover's Creek. Lover's Creek traverses part of the east property boundary, flowing north, before tuning into west into the subject site before exiting the site along the north property line.

In accordance with Hewitt's Secondary Plan Area SIS Existing Conditions Drainage Plan (FIG. 5), Catchment 112 (207.62Ha) encompasses the central area of the subwatershed and generally sheet flows directly to the Lover's Creek Tributary (Outlet L03). The Lockhart II Lands are encompassed within Catchment 112. The catchment also includes existing lands associated with the Lockhart Innisfil Investments Limited Lands, Sorbara Subdivision, BEMP 2 Subdivision, GG (9 Mile) Limited Subdivision, Rainsong and Mattamy Lands.

There are no existing stormwater management facilities on the subject site and all flows are released uncontrolled to Lover's Creek. The **Existing Conditions Drainage Plan (FIG.5)** included in **Appendix A**, identify the pre-development storm drainage conditions.

3.2. Proposed Drainage Conditions

Development of the subject site will consist of low and medium density residential lots, internal looped roadways built to City of Barrie standards, an Environmentally Protected area adjacent to Lover's Creek, a small portion of stormwater management lands that has been utilized in the Lockhart I Subdivision SWMF design and two (2) Stormwater Management facilities (SWMF). The design of SWMF2 has been completed by SCS Consulting Group and at the time of writing this report has been granted approval for construction. For details pertaining to SWMF2 please refer to Drawings **SWM-1** through **SWM-4** attached in **Appendix A** and the *Barrie Lockhart Road – Sorbara Stormwater Management Report* Prepared by SCS Consulting Group, dated November 2020 previously submitted under separate cover.

Each individual lot will be developed with buildings, driveways, parking lots, and landscaped areas. The grading of the lots will direct stormwater runoff to the internal road network, which will contain a proposed storm sewer system to convey minor flow (5 Year event) to the respective stormwater management facility. The roads are also utilized to convey the major overland flow (>5 Year event) within the right-of-way to the designated stormwater management facility. The

proposed end-of-pipe SWM facilities have been designed as an extended detention constructed wetland (SWMF1) and a wetland with two forebays (SWMF2), providing stormwater quantity and quality control for the site. The subject site will also include Low Impact Development (LID) measures to provide lot level at source controls that reduce run-off volumes, promote groundwater recharge and aid in maintaining water balance. The *Hewitt's Secondary Plan Area Subwatershed Impact Study* has identified LID measures suitable for implementation within the subject property that are intended to achieve the LSRCA and City of Barrie targets for infiltration, filtration, water balance and total phosphorus removal. Further design details regarding LID measures are provided in **Section 5.5**.

The post development drainage conditions were derived from the proposed General Servicing and Lot Grading Plans. The overall post development drainage patterns are shown on **Drawing SWM-1**. **Drawing SWM-1** identifies the catchments draining to each of the communal SWM facilities located within the Lockhart II Subdivision, denoted SWMF1 and SWMF2. Refer to **Appendix E**. Note that SWMF2 was designed by SCS Consulting Group Ltd. as part of the Sorbara Subdivision design and will be constructed as part of the Sorbara Subdivision works. SWMF2 has been designed to meet quality and quantity control requirements for Lockhart Innisfil Investments II Limited as well as the Sorbara Subdivision and has been approved by the City and LSRCA.

The proposed SWMF1 will be designed to meet the quality and quantity requirements outlined the *Hewitt's Secondary Plan Area Subwatershed Impact Study* prepared by RJ Burnside (September 2016), along with those of the City of Barrie, LSRCA and MOE, before discharging to Lover's Creek. Further design details are provided in subsequent sections of this report, as well as the design drawings provided in **Appendix E**. All design details are outlined within this report, as well as the *Functional Servicing Report* submitted in conjunction with this report under separate cover.

The proposed works will require an Erosion and Sediment Control Plan in order to provide the appropriate protection of downstream receiving systems during construction. The proposed ESC works are to be outlined during the detailed design stage of approvals and will include the construction and staging requirements at various phases of the development.

4. Hydrology

4.1. Model

The development was hydrologically modeled using the latest version of the PCSWMM Professional computer program by Computational Hydraulics Int. PCSWMM is a GIS-based hydrologic model capable of performing both event-based and continuous rainfall simulations for SWM Facility & LID design and LID water balance & erosion threshold calculations, respectively. Furthermore, the PCSWMM model utilizes the Green-Ampt Method for determining infiltration losses, which allows for the direct incorporation of field-tested infiltration rates. Once additional field-tested infiltration rates are obtained through geotechnical investigation, the model will be further advanced at the detailed design stage to incorporate the Guelph Permeameter field testing needed for LID design.

The PCSWMM model used for this design is derived from the model provided with the Hewitt's Secondary Plan Area Subwatershed Impact Study (SIS) by R.J. Burnside (November 2017). The model has been truncated to include only the subject lands within the Hewitt's Creek subwatershed. The model input parameters (e.g. catchment area, flow lengths, proposed imperviousness) have been updated to reflect the proposed subdivision design.

The hydrologic modeling includes only the post-development conditions as the target flow rates (pre-development) are established within the SIS as unitary discharge rates ($m^3/s/ha$).

4.2. Design Storms & Climatology

The rainfall events used for the PCSWMM model simulations are based on the SIS findings, which include the SCS Type II storm distribution for both the 6-hour and 24-hour durations. It was found that these storm distributions generated the highest peak flow and greatest volumes. The following events have been modeled:

- 4-hour Chicago rainfall distribution for the 2, 5, 10, 25, 50, and 100-year storm events;
- 6-hour SCS Type II rainfall distribution for the 2, 5, 10, 25, 50, and 100-year storm events;
- 12-hour SCS Type II rainfall distribution for the 2, 5, 10, 25, 50, and 100-year storm events;
- 24-hour SCS Type II rainfall distributions for the 2, 5, 10, 25, 50, and 100-year storm events;
- 25 mm 4-hour Chicago rainfall event; and
- Hazel Regional Storm Event.

4.3. Soil Type and Land Use

The *Soil Survey of Simcoe County Report No. 29* shows that the site is comprised of four (4) main soil types; Alliston Sandy Loam (Ans), Smithfield Sandy Clay Loam (Smsc), Bondhead Sandy Loam (Bs), and Muck (M). The Soil Survey's description of each soil type is outlined below. The soil type and locations are delineated in **Figure 2** of this report.

Muck soils occur in all counties and districts in Ontario. They are most commonly found in depressions where water tends to collect and are saturated with water at all times. Muck soils do not exhibit the horizontal differentiation that is typical of mineral soils. Underlaying soils are alternating layers of decomposing material that vary in colour, decomposition and type of plant remains. The soils in this area are classified as Group D under the SCS Hydrologic Soils Group Classification.

Alliston sandy loam is generally described as being similar to Tioga soils, having Podzol Great Soil Group characteristics with evidence of Grey-Brown Podzolic development in the lower part of the profile. This soil generally has imperfect drainage. The soils in this area are classified as Group B under the SCS Hydrologic Soils Group Classification.

Bondhead sandy loam is generally described as light grey, calcareous, loam and sandy loam till, generally having good drainage features. The underlying topography is smooth, moderately to steeply sloping, is slight to very stony, has a neutral pH and belongs to the Grey-Brown Podzolic great soil group. The soils in this area are classified as Group AB under the SCS Hydrologic Soils Group Classification.

Smithfield silty clay loam is characteristic of the imperfectly drained Grey-Brown Podzolic soils and has a dark coloured A1 horizon about 5 inches thick. The A2 horizon is thin, mottled and light yellowish brown in colour. It is under-lain by mottled brown B horizon which contains more clay than the layers above and below it. The varved parent material usually occurs at a depth of about 20 inches. Both the parent material and the B horizon are calcareous and in some places free carbonates occur in the A horizon. The soils are low in phosphorous and fertilizers. The soils in this areas are classified as Group CD under the SCS Hydrologic Soils Group Classification. A breakdown of the soil groups and their respective area, and percentage of sore coverage is provided on **Table 1** above. A copy of the *Soil Survey* has been attached for convenience in **Appendix A**.

4.4. Discretization

The hydrologic modeling includes only the post-development conditions as the target flow rates (pre-development) are established within the SIS as unitary discharge rates ($m^3/s/ha$).

The PCSWMM model derived from the SIS has been updated to reflect the proposed subdivision design. Uncontrolled catchment areas have been added adjacent to the environmental protection areas and stormwater management ponds where the area consists of rear-yards that cannot be graded to the pond. Some of the larger catchment areas from the SIS model have been broken down into smaller catchments in order to quantify the flow from external areas. The numbering of the catchment areas match the pond numbering system presented in the SIS. For example, SWMF1 accepts drainage from Area 1 and generates uncontrolled flows from area 1A.

The imperviousness of the subdivision catchment areas have been increased from the SIS model to account for the proposed increase in allowable lot coverage. The higher imperviousness is conservative to ensure that the SWM pond blocks are adequately sized for a traditional end-of-pipe SWM facility, excluding the benefits to quality and quantity control that may be realized from the implementation of upstream LIDs.

The post-development catchment areas are illustrated on **Drawing SWM-1,** located in **Appendix E**. The PCSWMM model schematic and 100-Year Status Report has been provided in **Appendix C**.

Table 3 summarizes the hydrologic parameters that were used for the PCSWMM model.

Table 3: Summary of Hydrologic Model Input – Post-Development

						Infiltration Parameters: Green-Ampt Method		
Catchment	**Area (ha)**	**Flow Length (m)**	**Width (m)**	**Slope (%)**	**Imperv. (%)**	**Suction Head (mm)**	**Conductivity (mm/hr)**	**Initial Deficit (frac.)**
1	7.4696	25	2987.84	2	65.7	109.98	10.92	0.368
1A	0.4958	30	165.27	10	2.8	109.98	10.92	0.368
2	6.2937	35	1798.20	2	65	109.98	10.92	0.368
2A	0.5300	23	230.44	2	40	109.98	10.92	0.368

Green Ampt parameters have been referenced from the *PCSWMM Manual*, adapted from the *Journal of Hydrologic Engineering, Rawls, W.J. et al., (1983).* Additional detailed site-specific geotechnical investigation information for the subject lands will be submitted at the detailed design stage. These infiltration parameters will be revisited and updated for the detailed design as deemed necessary.

Depression Storage depth for pervious and impervious cover have been determined based on the *City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines*

and are summarized below in **Table 4**. The pervious depression storage is based on the weighted mean of cover type over the catchment area.

Table 4: Depression Storage

Land Cover	Depth (mm)
Woods	10
Pasture Meadow	8
Cultivated	7
Lawns	5
Wetland/SWM Facility	16
Impervious	2

Some of the PCSWMM model input parameters (not shown in **Table 3** or **Table 4** (above) are common among all catchment areas, including the following:

Manning's N for impervious area = 0.013

Manning's N for pervious area = 0.190

4.5. Model Results

The hydrologic modeling results are summarized herein. The pre-development condition was not modeled within PCSWMM as the allowable peak flow rates are established using Unitary Discharge Rates for the Lover's Creek watershed as established within the SIS. The Unitary Discharge Rates, provided in units of $m^3/s/ha$, are summarized in **Table 5** below. **Table 6** summarizes the resulting allowable peak flow rates along with the post development peak flow rates computed by the PCSWMM model for the development lands prior to release to the Lover's Creek Tributary and Outlet OF-1. Refer to OF-1 in the PCSWMM model. The PCSWMM model schematics along with the output printout for the governing 100-Year SCS event are provided in **Appendix C**. A digital copy of the model (including all design storm simulations) is also provided in **Appendix C**.

Table 5: Summary of Unitary Discharge Rates for the Lover's Creek Watershed

Storm Event Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Unitary Discharge Rate ($m^3/s/ha$)	**0.006**	**0.014**	**0.021**	**0.030**	**0.038**	**0.046**	**N/A**
Target Erosion Control Discharge Rate ($m^3/s/ha$)	**0.0011**						

Table 6: SWMF1 Hydrologic Model Results – Overall Development Area

Storm Peak Event Flow (m^3/s) – SWMF1 Lockhart II							
Storm Distribution	**Area (ha)**	**Return Period (years)**					
		2	**5**	**10**	**25**	**50**	**100**
Unitary Discharge Rates ($m^3/s/ha$) per SIS		0.006	0.014	0.021	0.030	0.038	0.046
Erosion Control Unitary Discharge Rate		0.0011					
Target Flow Rates	**7.97**	0.048	0.112	0.167	0.239	0.303	0.366
Target Erosion Control	**7.97**	0.009					
Post Development Condition – (OF-1)							
4-hour Chicago Storm Distribution	7.97	0.013	0.046	0.072	0.112	0.143	0.177
6-hour SCS Type II Storm Distribution	7.97	0.026	0.100	0.154	0.222	0.263	0.303
12-hour SCS Type II Storm Distribution	7.97	0.022	0.089	0.137	0.198	0.238	0.271
24-hour SCS Type II Storm Distribution	7.97	0.029	0.102	0.152	0.214	0.250	0.287
25mm 4-Hr CHI Water Quality Event	7.97	0.007					
Hazel Storm	7.97	0.253					

The results demonstrate that the proposed stormwater management facility – SWMF1 - will provide the required quantity control to reduce post-development peak flows to the allowable release rates. The function of the proposed extended detention constructed wetland is discussed in further detail in **Section 5**.

The overall catchment areas associated with SWMF2 closely match what was accounted for in the design completed by SCS Consulting Group Ltd., as such, no further modelling has been undertaken for this SWM Facility. Table 7 below summarizes the SCS and Jones design drainage to SWMF2.

Table 7 – SWMF2 SCS Design and Jones Design Catchment Comparison

	[1]Catchment ID	Area (Ha)	% Imperviousness	[2]Rational 'C'	Rational 'C' X Area (CA)
SCS Design	408 (To SWMF2)	6.18	72	0.73	4.32
	409 (Uncontrolled)	0.35	72	0.73	0.255
Jones Design	2 (To SWMF2)	6.29	65	0.67	4.15
	2A (Uncontrolled)	0.53	40	0.48	0.254

[1]For SCS design drawing refer to Refer to Figure 4.1 in Appendix A. For Jones design drawing refer to Drawing SWM-1 in Appendix E.
[2]Rational Coefficient Estimated assuming 'B' class soil.

As outlined in Table 7, the CA (run-off coefficient multiplied by area) for the Jones design is less than the CA accounted for in the SCS design for both the drainage to the SWM facility, as well as for uncontrolled areas. Accordingly, it is expected that SWMF2 can accommodate the drainage from Lockhart Innisfil Investments II Limited and provide the required quality and quantity control in accordance with City and LSRCA requirements.

5. Stormwater Management Plan

5.1. Introduction

The stormwater management plan is intended to provide an environmentally sound approach to stormwater and drainage issues. The issues can be divided into four categories: stormwater quality control, stormwater quantity control, water balance, and erosion & sediment control.

In order to provide the development with the required stormwater quality and quantity control measures, two (2) Stormwater Management Facilities (SWMF) are proposed complimented by LID measures distributed throughout the subject lands. Lover's Creek will be the discharge location for the SWMFs treated stormwater and for all other stormwater runoff from the site. As previously mentioned SWMF2 has been designed by SCS Consulting Group and at the time of writing this report has been granted approval for construction. For details pertaining to SWMF2 design please refer to the *Barrie Lockhart Road – Sorbara Stormwater Management Report* Prepared by SCS Consulting Group, dated November 2020.

This PSWMR will outline a proposed design for the Lockhart II Subdivision stormwater management system to meet the compulsory post-development quantity and quality control requirements of the City, LSRCA, MOE and Hewitt's Area SIS. During the detailed design stage, a *Detailed Stormwater Management Report* will be prepared in support of the storm sewer system and facilities application for MOE *Environmental Compliance Approval* (ECA) Certificates, and LSRCA *Application for Development, Interference with Wetlands and Alterations and Watercourses* permits.

The City of Barrie and the LSRCA require Level 1 (Enhanced) quality control for the stormwater runoff generated from this site. The proposed SWMFs have been sized based on the combination of Level 1 quality control, quantity control of the 100 year post- to pre- development flows, the extended detention (24 hour) 25mm storm event for erosion control and the safe conveyance of Hurricane Hazel.

Sediment and erosion control measures will be investigated and recommended during the detailed design stage, taking into consideration the sensitivity of the receiving watercourse.

Additionally, the subject site is proposed to implement a variety of Low Impact Development (LID) measures consisting of surficial infiltration/filtration rain gardens, vegetated buffer strips, reduced lot grading, etc. In addition to the SWMF, the proposed use of LID measures follows the recommendations of the Hewitt's Secondary Plan Area SIS and will assist in reducing runoff volumes

and the subsequent quantity of water to be treated by stormwater management facilities while promoting at-source filtration, infiltration and groundwater recharge. Although reduction in runoff volumes to the SWMF's may be experienced through the implementation of at-source LID's, the SWMF's have been designed for quality and quantity void of upstream LID's.

5.2. SWM Facility 1 - Overview

The proposed extended detention constructed wetland facility has been designed to provide the required levels of quality and quantity control as stipulated above. The preliminary design of the facility is outlined on Drawings **PND-1 and PND-2**, located in **Appendix E**.

The bottom elevation of SWMF1's main cell & forebay are 251.50m and 252.35m, respectively. A permanent pool elevation of 252.50m has been provided, making the main cell and forebay static water levels 0.15m and 1.0m. A low flow channel has been provided within the main cell to direct stormwater towards the main cell plunge pool. The top of facility elevation is 254.70m, providing a total active storage depth of 2.2m. Sideslopes of 5H:1V are proposed throughout the SWMF to the top of the 6H:1V safety shelf 0.5m above and below the permanent pool elevation. 3H:1V sloping has been proposed external to the SWMF as well as below the safety shelf in the sediment forebay and main cell plunge pool. An allowance for a 5m wide access road is provided around the entire perimeter of the facility. A 5m wide maintenance ramp at a maximum 10 percent slope has been provided connecting the maintenance access road and SWMF main cell. Inside the facility a forebay berm is provided at an elevation of 253.00m. The forebay berm has a top width of 2.0m. At the inlet of the SWM facility 2 (two) Jellyfish Filtration units will be utilized in parallel to treat run-off entering the facility. The Jellyfish units (model JF10-11-3) will be placed in an offline configuration and details for this configuration and the required by-pass structures will be detmermined at the detailed design stage.

Flow control of the facility is provided via two (2) circular orifices located within the Control Maintenance Hole. The orifice plates are 100mm and 300mm diameter corresponding to invert elevations of 252.50m and 252.75m, respectively. Flows enter the control manhole by one 450mm diameter reverse sloped drain and one 1200mm x 600mm ditch inlet catchbasin with 450mm leads connected to the control maintenance hole. The sill invert of the ditch inlet catch basin is set at an elevation of 252.70m.

The facility includes a 10.0m wide emergency overflow weir with 10H:1V sideslopes to convey flows in excess of the control structure. The weir is set at an elevation of 254.20m and has been sized to allow the uncontrolled post development flow to be routed safely through the facility in the event of a blockage to the primary outlets. The maximum ponding elevation during the 100

year 6 hour SCS event is approximately 253.39m. During the detailed design stage further consideration will be given to allow for overland flow to bypass the sediment forebay as a protective measure.

5.3. SWM Facility 1 - Quality Control

As per the City and LSRCA requirements, *Enhanced* (Level 1) stormwater quality control is required for the site. The SWMF1 will provide the required level of SWM quality control, as the calculations provided below will demonstrate. In addition, further quality treatment will be provided by the proposed Jellyfish units and through the incorporation of Low Impact Development (LID) measures providing additional TSS and phosphorus removal benefits to ensure that best efforts are taken to reduce post-development phosphorus loadings to pre-development levels (or a minimum 80% removal of TP from post-development). Phosphorus Loading calculations are provided within **Section 5.5** below.

A plan view and section drawing has been provided for SWMF1. Refer to **Drawings PND-2** in **Appendix E**.

The total land draining to SWMF1 includes Catchment 1, totaling an area of 7.47ha. The total imperviousness used to size the pond is 65.7%. Based on the MOE requirements (extrapolation of Table 3.2), 115.7 m^3/ha of storage is required for Enhanced quality control. This storage corresponds to both the extended detention volume (40 m^3/ha) and the permanent pool volume (75.7 m^3/ha).

The extended detention and permanent pool volumes, as per the MOE guidelines, are calculated as follows:

Enhanced (Level 1) Water Quality Protection:

Total area draining to pond for quality control = 7.47 ha

(65.7% Net Impervious Area), (115.7 m^3/ha)

7.47 ha * 75.7 m^3/ha = 565 m^3 (permanent pool)

7.47 ha * 40 m^3/ha = 299 m^3 (extended detention)

However, the extended detention volume must be designed to attenuate the erosion volume from the 4-hour 25 mm Chicago rainfall event. Based on the watershed characteristics and the PCSWMM model, the 25 mm storm event produces a runoff volume of 698 m^3 (9.35 mm * 7.47 ha). Therefore, the runoff volume from the 4-hour 25 mm Chicago storm event will govern.

	Required:	Provided:
Permanent Pool	565 m^3	1,020 m^3
Extended Detention	698 m^3	1,091 m^3

The 24 hour extended detention release rate is the maximum target flow rate to ensure that 24 hour settling occurs in the pond. The extended detention outlet is 100 mm in diameter. The drawdown equation has been used to verify the detention time for the extended detention volume. The equation is given as follows:

$$t = \frac{0.66C_2h\sqrt{h} + 2C_3\sqrt{h}}{2.75A_0}$$

Where:

t = drawdown time (seconds)

C_2 = slope coefficient from the area-depth linear regression (2572.6)

C_3 = intercept from the area-depth linear regression (4043.8)

A_0 = cross-sectional area of the extended detention orifice (0.0079 m^2)

h = maximum water elevation above the orifice, taken from the extended detention elevation to centroid of orifice (0.10 m)

Given the above information, the actual extended detention storage time was determined to be approximately 33.6 hours for the 25mm Water Quality Event, which exceeds MOE criteria. The area-depth curve can be found in **Appendix B** to illustrate how the above coefficients were determined.

Forebay Sizing

The forebay must be sized to provide sufficient length from the inlet to the forebay weir. It is recommended that the forebay be sized according to the length required for settlement of larger suspended particles. The forebay for the pond was designed according to the following criteria (MOE, 2003):

Forebay Settling Length

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Where:

Dist = the minimum forebay length (m)

r = the length to width ratio of the forebay (3:1)

Q_p = the peak flow rate exiting the pond during the 4-hour 25 mm Chicago quality storm event (0.007 m^3/s)

V_s = the settling velocity. It is recommended that a value of 0.0003 m/s be used in most cases.

The required settling lengths of the forebay is 8.4 meters.

Forebay Dispersion Length

$$Dist = \frac{8Q}{dV_f}$$

Where:

Dist = the minimum forebay length (m)

Q = the 5-year peak inlet flow rate (1.937 m^3/s)

d = the depth of the permanent pool in the forebay (1.0 m)

V_f = the desired velocity at forebay berm (0.5 m/s)

The required dispersion length of the forebay is 31.0 meters.

The proposed forebay accommodates both the settling and dispersion lengths. The shortest length is approximately 49 m measured from the inlet headwall to the forebay overflow weir.

As previously noted, the SWM facility will include two (2) Jellyfish units in parallel at the inlet of the facility. The use of filtration units upstream of the SWM facility is required in accordance with City of Barrie standards and further ensures that the 25mm filtration target is achieved in accordance with LSRCA requirements. The Jellyfish units will be designed in an offline, parallel configuration. The Jellyfish model JF10-11-3 provides 89% TSS removal and 49% TP removal and has been sized to treat a minimum of 90% of the average annual run-off volume. Each unit provides a maximum treatment flow rate of 63.1 L/s for a system maximum treatment flow of 126.2 L/s. Supporting Jellyfish sizing calculations are included in **Appendix B** for reference.

5.4. SWM Facility 1 - Quantity Control

In order to provide stormwater quantity control, the site will utilize Low Impact Development (LID) measures and extended detention constructed wetlands. The combination of LID Measures and the facilities active storage and outlet controls will attenuate post-development stormwater peak runoff to the allowable flow rates determined via the *Hewitt's Secondary Plan Subwatershed Impact Study* and those outlined in **Section 4.5** above.

In accordance with the *SIS*, considerations have been given to re-configure the design of SWMF1 from a wet pond to an extended detention constructed wetland. Adjusting the facility from a wet

pond to a constructed wetland has provided more opportunity for quality control and provides a higher overall Total Phosphorus removal efficiency. SWMF1 will be an end-of-pipe stormwater management facility sized to provide the required quantity control for the site for all design storms up to the 100-year event. The facilities' outlet structures and overflow weir have been sized to safely convey the Regional storm event, ensuring a 0.3m freeboard between the top of pond and the Hazel storm event's ponding elevations. The pond block sizing is conservative as reduction in runoff volume that may be realized through the implementations of upstream LIDs has not been considered when sizing the SWMF's.

An abbreviated version of the SWMF1 stage-storage-discharge table is presented in **Table 8** below. The full table is provided in **Appendix B**. The values for storage and pond outflow result from the proposed design height and dimensions for the orifices and overflow weir.

Table 8: SWMF1 Abbreviated Stage-Storage-Discharge Table

Elevation (m)	Total Storage (m^3)	Active Storage (m^3)	Water Depth (m)	Discharge (m^3/s)	Comments (PCSWMM Elev.)
251.20	0	0	0.00	0.000	Bottom of Plunge Pool
251.50	7	0	0.30	0.000	Bottom of Forebay
252.35	451	0	1.15	0.000	Bottom of Main Cell
252.50	1,020	0	1.30	0.000	Permanent Pool
252.65	1,656	635	1.45	0.007	25mm Water Quality (252.650m)
252.75	2,111	1,091	1.55	0.010	Extended Detention / Secondary Orifice
252.85	2,593	1,573	1.65	0.021	2-Year 24-Hour SCS (252.837m)
253.00	3,365	2,345	1.80	0.077	5-Year 24-Hour SCS (252.985m)
253.10	3,922	2,901	1.90	0.104	10-Year 24-Hour SCS (253.077m)
253.20	4.493	3,473	2.00	0.126	25-Year 6-Hour SCS (253.198m)
253.30	5,081	4,061	2.10	0.144	50-Year 6-Hour SCS (253.292m)
253.40	5,684	4,664	2.20	0.160	100-Year 6-Hour SCS (253.385m)
253.90	8,946	7,926	2.70	0.223	Hurricane Hazel (253.892m)
254.20	11,104	10,084	3.00	0.253	Emergency Overflow Weir
254.70	15,134	14,113	3.50	8.149	Top of Facility

5.5. Low Impact Development

Low impact development (LID) is a stormwater management strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution by managing runoff as close to its source as possible. LID comprises a set of site design strategies that minimize runoff and distributed, small scale structural practices that mimic natural or predevelopment hydrology through the processes of infiltration, evapotranspiration, harvesting, filtration and detention of stormwater. These practices

can effectively remove nutrients, pathogens and metals from runoff, and reduce the volume and intensity of stormwater flows.

As per the recommendations of the SIS and current design standards, LIDs are to be implemented for new development in the Hewitt's Secondary Plan Area. As there are no park blocks, open space blocks or site plan blocks associated with the Lockhart Innisfil Investments II limited draft plan, the only available space for LIDs is within the proposed road right-of-way (ROW). LIDs within the ROW will be employed to meet infiltration targets, filtration targets and provide additional Phosphorus removal. The most effective LID within the ROW consists of a dry swale along one or both sides of the street with a subsurface infiltration trench. A plan view showing the proposed location of all proposed dry swales is included on **Drawing LID-1**, refer to **Appendix E**. It is important to recognize that the locations of the dry swales are limited to local roads in accordance with the City's LID screening process. In addition, due to driveway and other utility conflicts, the dry swale locations have been limited to the window street (Street E) and side yards along other local roads. A typical 18.0m ROW plan view and cross-sections of proposed LIDs along with sizing calculations is provided on **Drawings LID-2** in **Appendix E**.

A total of 22 plausible locations were determined for LIDs. The site's proposed LIDs are located within the right-of-way limits and span along lot flankages. LIDs will generally be 2.0m wide and range between 0.78m and 4.2m deep. The depth was determined based on providing a minimum of 1.0m clearance from the high groundwater table. The LIDs will be comprised of engineered Soil Blend B (void ratio of 0.35) wrapped in filter cloth on all sides. The length of the LIDs varies from approximately 19m to 88m.

Using the above standards and information the site's proposed LID cross-sectional details are summarized in the following **Table 9:**

Table 9: LID Summary & Cross-Section Details

LID Summary									
LID Name	Drainage Area ID	Catchment Area (ha)	Percent Impervious	Length (m)	Width (m)	Depth (m)	Volume of LID (cu.m)	% of MOE Required Volume Captured	% of LSRCA Required 25mm Volume Captured
LID-2-1	2-501	0.16	65%	50.00	2.00	1.70	72.50	1295%	279%
LID-2-2	2-502	0.10	65%	50.00	2.00	1.80	75.50	2157%	465%
LID-2-3	2-503	0.15	65%	50.00	2.00	3.08	113.75	2167%	467%
LID-2-4	2-504	0.09	65%	50.00	2.00	3.15	116.00	3683%	793%
LID-2-5	2-505	0.21	65%	53.00	2.00	3.70	140.45	1911%	412%
LID-2-6	2-506	0.11	65%	53.00	2.00	3.85	145.22	3772%	812%
LID-2-7	2-507	0.45	65%	25.00	2.00	0.78	22.38	142%	31%
LID-2-8	2-508	0.19	65%	25.00	2.00	1.55	34.00	511%	110%
LID-2-9	2-509	0.27	65%	26.50	2.00	1.80	40.02	423%	91%
LID-2-10	2-510	0.10	65%	19.00	2.00	1.70	27.55	787%	170%
LID-1-1	1-601	0.37	65%	25.00	2.00	1.75	37.00	286%	62%
LID-1-2	1-602	0.25	65%	25.00	2.00	1.73	36.63	419%	90%
LID-1-3	1-603	0.21	65%	24.00	2.00	3.95	67.20	914%	197%
LID-1-4	1-604	0.06	65%	24.00	2.00	4.20	70.80	3371%	726%
LID-1-5	1-605	0.02	65%	21.00	2.00	4.08	60.38	8625%	1858%
LID-1-6	1-606	0.03	65%	22.50	2.00	4.20	66.38	6321%	1362%
LID-1-7	1-607	0.14	65%	21.00	2.00	2.75	43.68	891%	192%
LID-1-8	1-608	0.05	65%	22.00	2.00	2.88	47.41	2709%	584%
LID-1-9	1-609	0.08	65%	22.50	2.00	2.98	49.84	1780%	383%
LID-1-10	1-610	0.07	65%	70.00	2.00	3.55	179.20	7314%	1575%
LID-1-11	1-611	0.17	65%	88.00	2.00	2.23	155.32	2610%	562%
LID-1-12	1-612	0.16	65%	49.00	2.00	1.88	76.20	1361%	293%
	Total:	3.44					Average:	2430%	523%

Based on the proposed configuration of the LID trenches, it is anticipated that upstream ROW drainage will be conveyed to the LIDs. Therefore, the corresponding total LID drainage area is 3.44 ha. For the 25mm storm, the rainfall volume over this area is 860m^3 (3.44ha x 25mm). Given the total LID trench volume in the ROW is 1,677 m^3, the Proposed LID facilities provide sufficient storage to achieve the 25mm target. Refer to supporting calculations in **Appendix D**.

5.6. Volume Control

The LSRCA's *Technical Guidelines for Stormwater Management* offers guidance in determining the appropriate volumetric control targets for subject sites as a function of the site characteristics. The subject lands are deemed to be a *Major Development* under the *Lake Simcoe Protection Plan*, and are required to provide runoff volume control. A number of constraints have been identified within the subject lands which limit the implementation of LID measures, therefore the targets for the Site were established under *Section 2.2.2.2 Flexible Treatment Alternative for Sites with Restrictions*. Based on the current design and completed background investigations and studies, **Table 10** outlines the constraints restricting the implementation of LIDs.

Table 10 – Runoff Volume Control Target Factors & Constraints

Factor	Site Specific Constraint
iii. High Groundwater	• High Groundwater identified throughout the majority of the subject lands by Geotechnical Investigation and Groundwater Monitoring
v. Areas with high chloride concentrations	• Infiltration of surface water from Mixed Use & High Density Residential, Collector and Arterial roadways discouraged (permitted with conditions) per City of Barrie *Infiltration Low Impact Development Screening Process.*
vi. SGRA	• Presence of SGRA/ESGRA as outlined in *SIS*
vii. Zoning, Setbacks, Land Use Requirements	• No Parks, Open Space, Institutional Blocks given drainage area size available for centralized infiltration based LID practices
viii. Property/Infrastructure Restrictions	• No park or open space blocks for implementation of centralized LIDs. • Limited opportunities within ROW due to servicing constraints, above ground infrastructure i.e. driveways, utilities, etc.
x. Excessive Costs	• Cost of fill required to increase proposed grades to elevations required to provide infiltration based practices within potential locations of catchment 1 & 2 is not feasible.
xi. Poor Soils	• Geotechnical investigation yielded results with soils having on average moderate to poor infiltration potential (approximately 13 mm/hr) throughout the subject lands

The factors identified above limit the location and effectiveness of infiltration based LID practices throughout the subject lands. Alternative #2 was selected, which is to achieve the maximum volume reduction practicable through a best efforts approach (minimum 5mm from all impervious surfaces), providing filtration for the remainder of the 25mm event.

Based on a total catchment area of 19.67 ha and an imperviousness 65%, the impervious area associated with the development is 12.78 ha. If 5 mm is applied to this impervious surface, the target run-off control volume is determined to be 639 m^3 (12.78 ha x 5mm).

The total proposed run-off volume control (capture and infiltration) provided by the proposed dry swale LIDs equates to 1,677 m^3. The remainder of the site is filtered by the proposed Jellyfish units at the upstream inlet of SWMF 1 and the outlet of SWMF. Therefore, through the combination of LIDs and Jellyfish filtration units, the required volume control targets are achieved. In addition, further filtration is provided through the constructed wetlands, improving water quality and providing extended detention.

5.7. Phosphorus Loading Calculations

A pre- to post-development phosphorus balance has been completed for the site using the Phosphorus Budget Tool to address the LSRCA policy requirements. Hutchinson Environmental Sciences Ltd., Greenland International Consulting Ltd. and Stoneleigh Associates Inc. were retained by the MOE to develop the software. The tool provides standardized methods to estimate and compare pre- and post-development phosphorus loadings with the implementation of Best Management Practices (BMP's) and Low Impact Development (LID) techniques. The program uses phosphorus export estimates developed for specific land uses using recent and site-specific estimates.

The land areas used for the analysis are based on the *Draft Plan of Subdivision* and exclude the Environmentally Protected area within the Environmental Protection areas (32.10 – 12.43 ha = 19.67 ha total area). The land uses in the calculation are determined for Low Intensity Residential and Open Water for the SWM blocks. The Phosphorus Loading Tool printouts are provided in **Appendix D**.

Proposed LID's

The site's stormwater management plan includes the LID system described in **Section 5.4** above. The proposed system consists of multiple infiltration dry swales. Overflow from dry swales are directed to the stormwater management facility via the proposed storm sewer system. The development area drains to the proposed SWMF which has a Jellyfish Filter immediately upstream of the inlet in an offline configuration. The Phosphorus removal rates for BMP's are per the values provided in the MOE's *Phosphorus Budget Tool* and *LSRCA SWM Guidelines*. Phosphorus removal rates are summarized below:

- Infiltration/Exfiltration systems 87%
- Extended Detention Constructed Wetlands 77%
- Jellyfish Filter (per manufacturer) 49%
- Treatment Train 98.5%

The removal rate for the Treatment Train is calculated as follows: 1 unit of Phosphorus is treated by the Infiltration/exfiltration System at an 87% removal, which reduces the loading to 0.13 units. The remaining 0.13 units are then treated by the Jellyfish Filter at a 49% removal rate, reducing loads to approximately 0.066 units. Further treatment is provided by the SWMF at a 77% removal rate, further reducing loads to approximately 0.015 units. Therefore, the reduction from 1 unit to 0.015 units equals a 98.5% maximum Phosphorus removal rate. Additional modeling and supporting Mass Balance calculations will be provided in the detailed design stage.

The values calculated for the proposed development are summarized as follows:

Pre-Development Loading: 3.15 kg/year

Post-Development Loading: 21.68 kg/year

Post-Development with BMPs: 2.76 kg/year

The calculation shows a 0.39 kg/year, or 12% net reduction in the Phosphorus load over pre-development conditions with the implementation of LIDs. The Phosphorus Loading Tool printouts are provided in **Appendix D**.

5.8. Water Balance

The primary objective of the LSRCA's water balance target, is to capture and manage annual rainfall on the development site to preserve pre-development hydrology (water balance) through a combination of infiltration, evapotranspiration, landscaping, rainwater reuse and/or other low impact development practices.

A water balance in accordance with the SIS recommendations has been completed by R.J. Burnside & Associates Ltd. and is detailed in the *Hydrogeological Study in Support of Draft Plan – Lockhart Innisfil Investments Limited & Lockhart Innisfil Investments II Limited,* (July 2020). RJB completed a pre- to post-development water balance to estimate the infiltration volume deficit that would need to be mitigated via the proposed SWM Plan. The infiltration and runoff volumes as calculated in the RJB Water Balance Assessment are presented in **Table 11** below and Tables G-1 to G-4 of the RJB study are provided in **Appendix D**.

Table 11 – Summary of Water Balance Calculations by RJB

Water Balance Runoff & Infiltration Volumes – RJB Table G-4			
	Pre-Development	**Post-Development**	**Difference**
Impervious Area Runoff Volume (m^3/a)	0	178,905	+178,905
Pervious Area Runoff Volume (m^3/a)	91,835	50,040	- 41,795
Total Runoff Volume (m^3/a)	91,835	228,944	+137,109
Total Infiltration Volume from Pervious Surfaces (m^3/a)	84,205	51,065	**- 33,140**

The results summarized in the tables above indicate that there is an increase in total runoff volume and a deficit in infiltration volume from pre- to post-development without incorporating for LIDs. It is important to recognize that the total deficit is based on both the Lockhart Innisfil Investments Limited Subdivision and Lockhart Innisfil Investments II Limited subdivisions. The total deficit

between both properties is 33,140 m3/a. The SWM Plan provided herein is intended to mitigate or reduce the water balance deficit as outlined above. Runoff generated from this development is directed to the proposed Low Impact Development (LID) measures. The LIDs and their contributing drainage areas are shown on **Drawing LID-1** in **Appendix E**.

Upon review of the *Environment Canada Daily Climate Normals* for the *Barrie WPCC* from the years 1979 to 2008, a statistical analysis of rainfall data was completed and it is noted that on an annual average over that time period, this gauge has received **928.1 mm** of total precipitation, comparable to the mean average annual precipitation of 939 mm for Hewitts Creek, published in the *LSRCA Climate Data Set, April 2017* and comparable to average annual precipitation of 933mm used by RJB in their water balance calculations.

The daily precipitation recordings were truncated following recommendations provided by the USEPA, removing any precipitation occurring during winter months (December, January and February) as they have been assumed to not directly produce runoff. This leaves a period of nine (9) continuous months in a given calendar year, which are described as *effective precipitation*, or precipitation events expected to produce runoff. In the nine (9) month period, there are on average 112.7 days of rainfall recorded, with 3.9 of those instances having a total depth of precipitation greater than 25 mm. There are, on average, 63.6 instances with a depth of precipitation greater than 2.0 mm but not greater than 25 mm, and 45.1 instances of precipitation events with a depth 2.0 mm or less. Events with recorded depth of 2.0 mm or less were removed from the data set as this is the lower limit of *Initial Abstractions* typically used in hydrologic modeling of urbanized areas. These two ranges encapsulate 96% of all recorded precipitation events on an annual basis.

Of key interest are the 63.6 recorded instances of precipitation events with a recorded depth between 2.1 and 25 mm, as these events represent the lower and upper bounds of the *Water Quality Event* (WQE). These events were sorted and tallied for each given year of recorded data and represent on an annual average over the 30-year period, 56% of the total precipitation received in a calendar year. This *effective precipitation* driven by *Water Quality Events*, totalling 520.9mm on average, is the subset of precipitation events deemed to be producing runoff, for which the LID facilities have been sized to treat. Effectively, all runoff generated from this subset of the annual precipitation is captured, treated and infiltrated within areas draining to a proposed LID. Assuming hydrologic losses remain constant across these *Water Quality Events,* it can be inferred that if 56% of the total average annual precipitation is produced by events less than or equal to the design event of the facility, then 56% of the average annual runoff would therefore be captured by the LID facility. Furthermore, events exceeding the design event (25 mm 4-hour

storm) for the facility do not by-pass the LID in their entirety, as the by-pass is only engaged above a certain depth of flow in the upstream storm sewers.

The proposed infiltration dry swales were designed to capture 25mm depth of runoff over the impervious surfaces draining to the LIDs. While four (4) LIDs fell short of this requirement, the remaining 18 LID's exceeded this requirement. The average percent capture of the 25mm run-off depth for all LID's corresponded to 525%. As the average is much greater than 100%, it can be assumed that at a minimum, all storm events less than or equal to 25mm are captured by the LID's. It can therefore be inferred that 56% of the average annual runoff draining to the LIDs is captured and infiltrated. Based on an area of 3.44 Ha draining to the LID's, an imperviousness of 65% and a runoff volume depth of 793 mm/a (per RJB calculations), the average annual runoff volume draining to the LIDs is determined to be 17,731m^3/a. Assuming 56% of the average annual runoff is captured the total infiltration from the proposed LIDs is calculated to be 9,929m^3/a. As part of the detailed design the calculated infiltration volume will be confirmed via a continuous model through PCSWMM.

In addition to the infiltration volume associated with the proposed LID's additional infiltration is expected through the inclusion of additional topsoil depth and disconnection of roof leaders in residential areas. It is estimated that this results in a 25% reduction in runoff (increase in infiltration) over the areas this is implemented. Based on a runoff volume of 98,528m^3/a (per RJB calculations) associated with the single residential and townhouse residential, the estimated increase in infiltration is determined to be 24,632m^3/a.

The supporting calculations used to determine the deficit is further broken as summarized in **Table 12** below.

Table 12 – Summary of Water Balance Deficits

Water Balance Deficits by Catchment	
Post Development	**Lockhart I and Lockhart II**
Total Infiltration Volume Deficit (m^3/a) - RJB	-33,140
Total Volume Infiltrated by Infiltration Only LIDs (m^3/a)	9,929
Total Infiltration Volume from Disconnected Roof Leaders (m^3/a)	24,632
Total Infiltration Volume Surplus after LID's (m^3/a)	**1,421**

In summary, the proposed stormwater management plan results in an increase in infiltration in the post development condition over the pre-development condition.

5.9. Erosion & Sediment Control

During construction, the majority of the development's natural features will be removed and the topsoil stripped within the development area. The exposed surface will be susceptible to erosion, increasing the potential for sediment runoff. To minimize local and downstream impacts from erosion and sedimentation during construction, the following measures have been recommended:

- Excess earth and topsoil is to be stockpiled away from the creek limits and/or removed from site. Stockpiles shall be seeded or covered with erosion control if left for periods of greater than 30 days.
- Temporary sediment control fencing should be erected around the perimeter of all grading activities;
- Temporary sediment fabric and stone filters should be installed on catch basins until surface cover has been stabilized;
- Temporary rock flow check dams should be installed within drainage cut-off swales;
- A temporary construction access mud mat should be installed at the construction accesses to reduce the amount of materials that may be transported off site;
- Temporary erosion and sediment control basins are to be constructed, complete with a Hickenbottom outlet control structure and overflow weir. The basins' purpose is to detain runoff long enough to allow the majority of soil particles to settle out of suspension.
- Construction during drier months should be monitored for wind-borne transport of sediments. At the direction of the engineer, the contractor may be directed to water down exposed earth areas with an aqueous solution of calcium chloride.
- All disturbed areas not under immediate construction for 30 days, or not intended for building activities within a 3-month time period, should be stabilized with seeding.
- Phased removal of temporary sediment basins during building phase of the development to coincide with upstream stabilization (established vegetation) of catchment areas.

A detailed Erosion and Sediment Control Plan (ESC Plan) will be prepared and submitted at the detailed design stage to identify the location and details of the temporary devices. The design particulars will be provided within the detailed Stormwater Management Report at that time.

6. Conclusions

This *Preliminary Stormwater Management Report* identifies the recommended stormwater management strategies for the proposed Lockhart II residential subdivision. This Report outlines the proposed infrastructure required to service the site with regards to stormwater management quality control, quantity control, water balance and erosion and sediment control.

In particular, this Report has recommended the following:

- The stormwater management plan for the subject site includes the use of two (2) stormwater management facilities. SWMF1 is designed as an extended detention constructed wetland and SWMF2 has been designed by external consultants and is not part of the scope of this report. SWMF1, as detailed in **Section 5**, address both stormwater quality and quantity control for the subject property.
- Low Impact Development approaches are recommended to be implemented throughout the development to promote groundwater recharge and mitigate the impacts of increased runoff and stormwater pollution (including Phosphorus loadings) on end-of-pipe SWM facilities by managing runoff as close to its source as possible.
- Prior to construction, the erosion and sediment control measures outlined in **Section 5.9** should be implemented. These controls are to be maintained throughout the construction period and only removed once exposed areas have been stabilized with vegetative cover.
- The Designs in this report are consistent with the SIS by R.J. Burnside, City of Barrie Guidelines & Policies, LSRCA Technical Guidelines for SWM, and the MOE SWMP Design Guidelines.

In Conclusion, it is recommended that this report be accepted as fulfilling the civil engineering and stormwater management requirements for Draft Plan Approval.

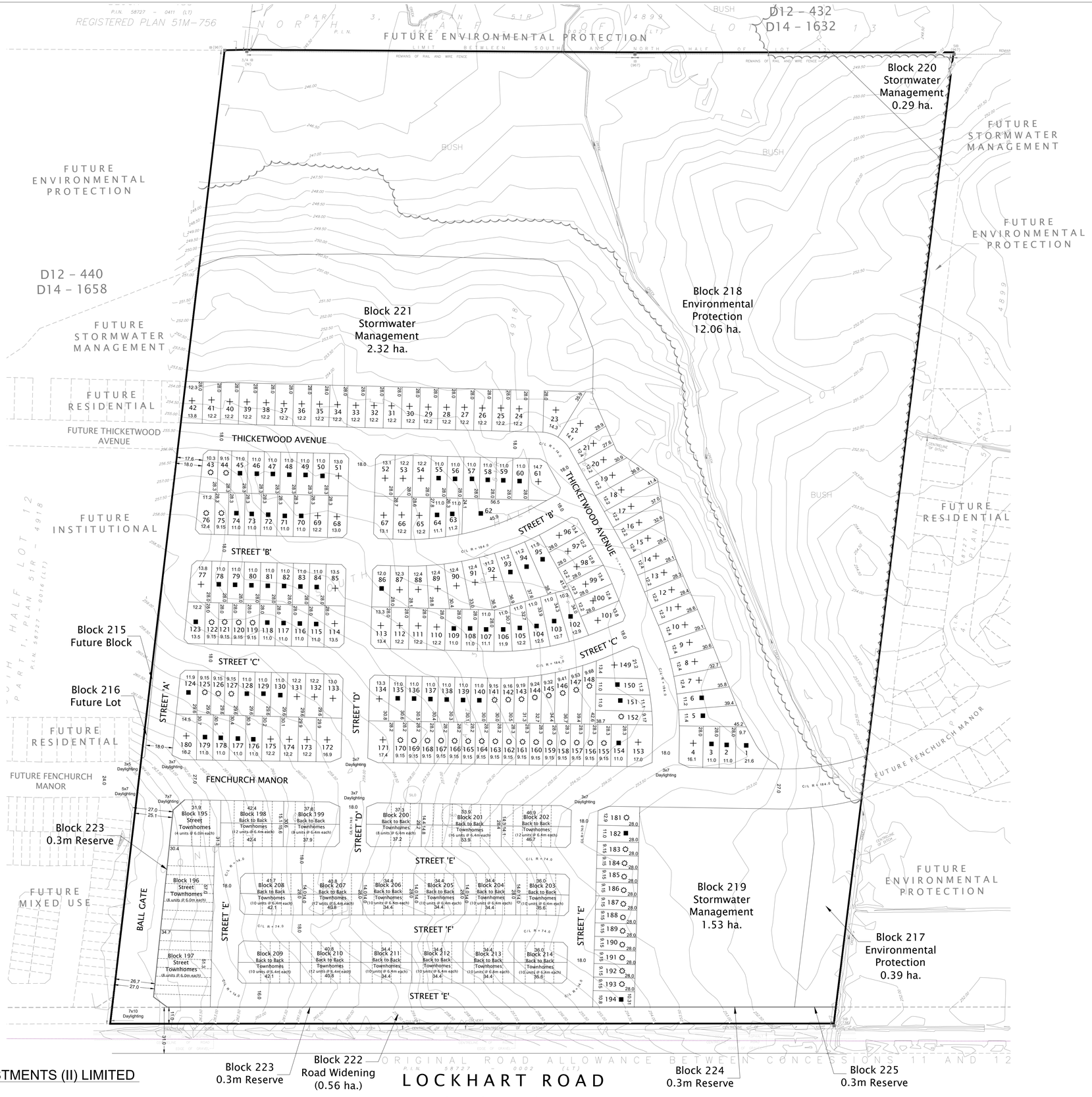
All of which is respectfully submitted,

THE JONES CONSULTING GROUP LTD.

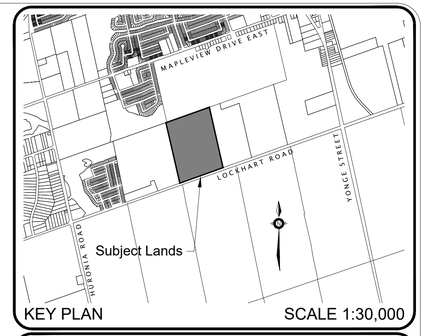
Appendix A

External Reference Information

- Proposed Draft Plan of Subdivision by TJCG signed and dated July 29th, 2021
- Schedule 'A' of Proposed Zoning By-Law Amendment
- Excerpt from Subwatershed Impact Study Lover's Hewitt's and Sandy Cove Creeks, by R.J. Burnside & Associates Limited, September 13, 2016
    - Figure 2 – Existing Land Use
    - Figure 5 – Existing Conditions Drainage Plan
- Excerpt from Soils Map of Simcoe County, Ontario, Soil Survey Report No. 29
- Excerpt from the Hydrogeological Study in Support of Draft Plan, ny R.J. Burnside & Associates Limited, dated July 2021
    - Figure 9 Interpreted Groundwater Flow
- Excerpts from Barrie Lockhart Road – Sorbara civil drawing set, stamp dated November 18th 2020 prepared by SCS Consulting Group
    - SWM1 Stormwater Management Facility Plan
    - SWM2 Stormwater Management Facility Cross-Sections
    - SWM3 Stormwater Management Facility Details 1
    - SWM4 Stormwater Management Facility Details 2
    - STM1 Storm Drainage Plan 1
    - STM2 Storm Drainage Plan 2
    - STM3 Storm Sewer Design Sheet
- Excerpts from Barrie Lockhart Road – Sorbara Stormwater Management Report dated March 2020 prepared by SCS Consulting Group
    - Figure 4.1 Proposed Storm Drainage Plan
    - Figure 4.2 LID Drainage Plan
    - Figure 4.3 Existing Phosphorus Loading Plan



LOCKHART INNISFIL INVESTMENTS (II) LIMITED
CITY OF BARRIE



Draft Plan of Subdivision

South Half Lot 13, Concession 11
(Geographic Township of Innisfil)
City of Barrie
2021

OWNER'S CERTIFICATE

I, THE UNDERSIGNED, BEING THE REGISTERED OWNER OF THE SUBJECT LANDS, HEREBY AUTHORIZE THE JONES CONSULTING GROUP LTD., TO PREPARE THIS DRAFT PLAN OF SUBDIVISION AND TO SUBMIT SAME TO THE CITY OF BARRIE FOR APPROVAL.

July 16, 2021
DATE

LOCKHART INNISFIL INVESTMENTS (II) LIMITED

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

JULY 16, 2021
DATE

J. D. BARNES LIMITED
ONTARIO LAND SURVEYORS

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

a) SHOWN ON DRAFT PLAN
b) SHOWN ON DRAFT PLAN
c) SHOWN ON KEY PLAN
d) RESIDENTIAL, SWM, & EP
e) SHOWN ON DRAFT PLAN
f) SHOWN ON DRAFT PLAN
g) SHOWN ON DRAFT PLAN
h) MUNICIPAL PIPED WATER TO BE PROVIDED
i) SANDY CLAY LOAM
j) SHOWN ON DRAFT PLAN
k) ALL MUNICIPAL SERVICES TO BE PROVIDED
l) SHOWN ON DRAFT PLAN

STATISTICS	Area (ha.)	Units
+ 12.2m Singles (LOTS 4, 7 - 42, 51 - 54, 61, 65 - 69, 77, 85, 87 - 92, 96 - 101, 110 - 114, 131 - 134, 149, 153, 171 - 175 & 180)	2.99 ha.	78 units
■ 11.0m Singles (LOTS 1-3, 5 & 6, 45 -50, 55 - 60, 62 - 64, 70 - 74, 78 - 84, 86, 93 - 95, 102 - 109, 115 - 118, 123 & 124, 128 - 130, 135 - 140, 150 & 151, 154, 176 - 179, 182 & 194)	2.34 ha.	68 units
☼ 9.15m Singles (LOTS 43 & 44, 75 & 76, 119 - 122, 125 - 127, 141 - 148, 152, 155 - 170, 181, & 183 - 193)	1.31 ha.	48 units
Street Townhomes (6.0m/unit) (BLOCK 195 - 197)	0.47 ha.	20 units
Back to Back Townhomes (6.4m/unit) (BLOCKS 198 - 214)	1.88 ha.	180 units
Future Lots and Blocks (LOTS/BLOCKS 215 - 216)	0.02 ha.	1 units
Environmental Protection (BLOCKS 217 & 218)	12.43 ha.	
Stormwater Management (BLOCKS 219 - 221)	4.14 ha.	
Reserves & Widenings (BLOCKS 222 - 225)	0.58 ha.	
Roads Major Collector - Fenchurch Manor - Ball Gate Local Roads: Thicketwood Avenue, Streets 'A', 'B', 'C', 'D', 'E', & 'F'	5.94 ha.	
TOTAL	32.10 ha.	395 units

0 10 50 100M
SCALE 1 : 1250 (A1)

Lockhart Innisfil Investments (II) Limited

Draft Plan of Subdivision

Raymond J. Duhamel
REGISTERED PROFESSIONAL PLANNER
R.P.P.

Date Issued:	JULY 29, 2021
Checked By:	RD
Project No.:	GOL-20538
Drawn By:	m.c.r.
Drawing Name:	GOL-20538-DP-4b.dwg

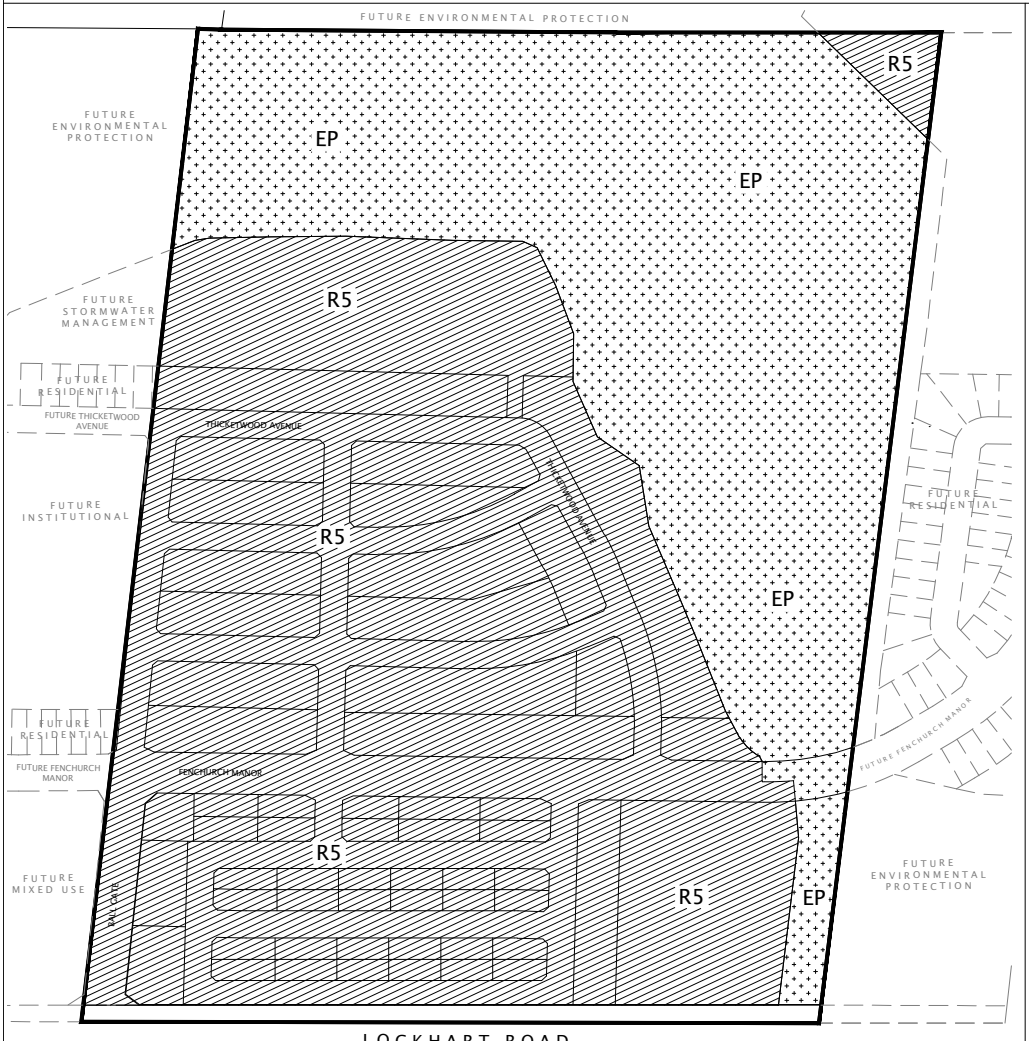
JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Drive East, Unit 1, Barrie, Ontario, L4N 0W5
Phone: 705-734-2538 Fax: 705-734-1056
www.jonesconsulting.com

G:\Planning Drawings\GOL-20538\Submitted\July2021\GOL-20538-DP-4b.dwg Layout:DP Plotted Jul 29, 2021 @ 11:46am by mariohards The Jones Consulting Group Ltd.

Schedule 'A'
Proposed Zoning By-Law Amendment
South Half Lot 13Concession 11,
Geographic Township of Innisfil
Now in the City of Barrie, County of Simcoe
2021



Scale 1:50,000 (8.5x11)



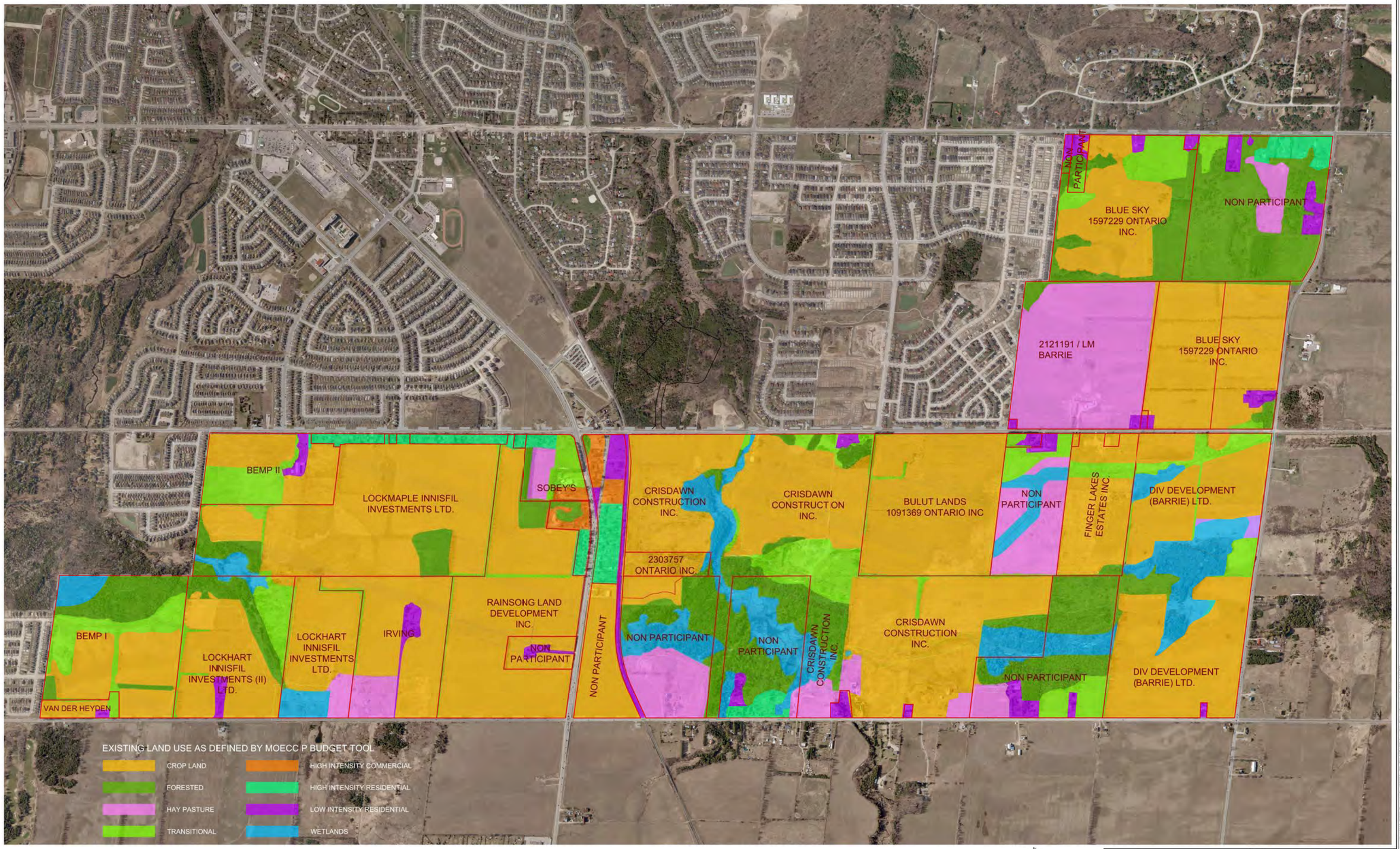
Lands Subject to Zoning By-Law Amendment

Lands to be Zoned Neighbourhood Residential (R5) Zone

Lands to be Zoned Environmental Protection (EP)

Scale 1:5000 (8.5x11)
GOL-20538-PH-2-ZBLA-1.dwg
21-05-31

JONES
CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Drive East, Unit 1, Barrie, Ontario, L4N 0W5
Phone: 705-734-2538 Fax: 705-734-1056
www.jonesconsulting.com



N

0 100 200 400 600
Metres

NOTE: "SCALE ONLY VALID FOR 24" x 36" SIZED PLOTS"

BURNSIDE

Figure Title
HEWITT'S SECONDARY PLAN AREA SUBWATERSHED IMPACT STUDY
EXISTING LAND USE

Client
HEWITT'S CREEK LANDOWNERS GROUP INC.

Drawn	Checked	Date
BH	CC	16/09/07
Scale		Project No.
H 1:7,500"		300032860

Figure No.
FIG 2

OUTLET S14
OUTLET H11
OUTLET H10
OUTLET H09
OUTLET H08
OUTLET H07
OUTLET L06
OUTLET L05
OUTLET L04
OUTLET L03
OUTLET L02
OUTLET L01
OUTLET S13
OUTLET S12
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132
133

110 DRAINAGE AREA ID

DRAINAGE BOUNDARY

EXISTING CONTOURS

ELC BOUNDARIES

WATERSHED BOUNDARY

STAKED 2015 NHS LIMITS

STAKED NHS BUFFER LIMITS

COB GENERATED NHS BUFFER LIMITS (2013)

EXISTING 100yr STORM FLOOD LIMIT

EXISTING REGIONAL STORM FLOOD LIMIT

OVERLAND FLOW ROUTE

UNSTAKED 2015 NHS LIMITS

UNSTAKED NHS BUFFER LIMITS

DASHED FLOOD LINES ARE APPROXIMATE ONLY, BASED ON INTERPOLATED DATA BETWEEN FINGERLAKES AND 1091369 ONTARIO INC. DETAILED TOPOGRAPHIC DATA. FLOODLINES ARE SUBJECT TO CHANGE BASED ON ADDITION OF DETAILED TOPOGRAPHIC SURVEY.

N

0 100 200 400 600

Metres

NOTE: *SCALE ONLY VALID FOR 24" x 36" SIZED PLOTS*

BURNSIDE

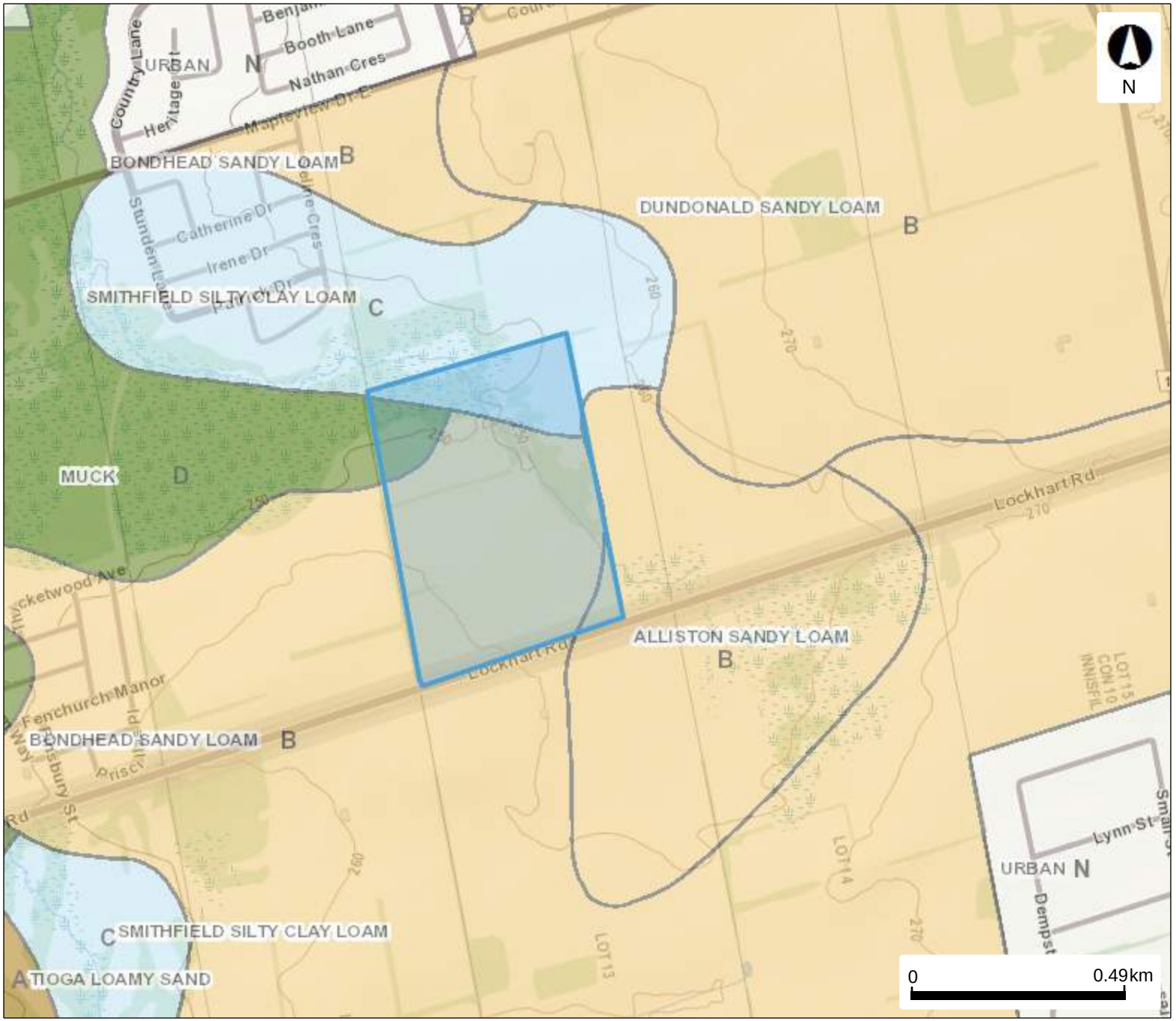
Figure Title
HEWITT'S SECONDARY PLAN AREA SUBWATERSHED IMPACT STUDY
EXISTING CONDITIONS DRAINAGE PLAN

Client
HEWITT'S CREEK LANDOWNERS GROUP INC.

Drawn	Checked	Date	Figure No.
BH	MZ	17/09/14	**FIG 5**
Scale		Project No.	
H 1:7,500*		300032860	

M:\Waterloo\Drawn\300032860_Reports\Report Layout\FIG 5 - Existing Conditions Drainage Plan.dwg Date Plotted: September 14, 2017 11:44 AM

LOCKHART II SUBDIVISION SOILS



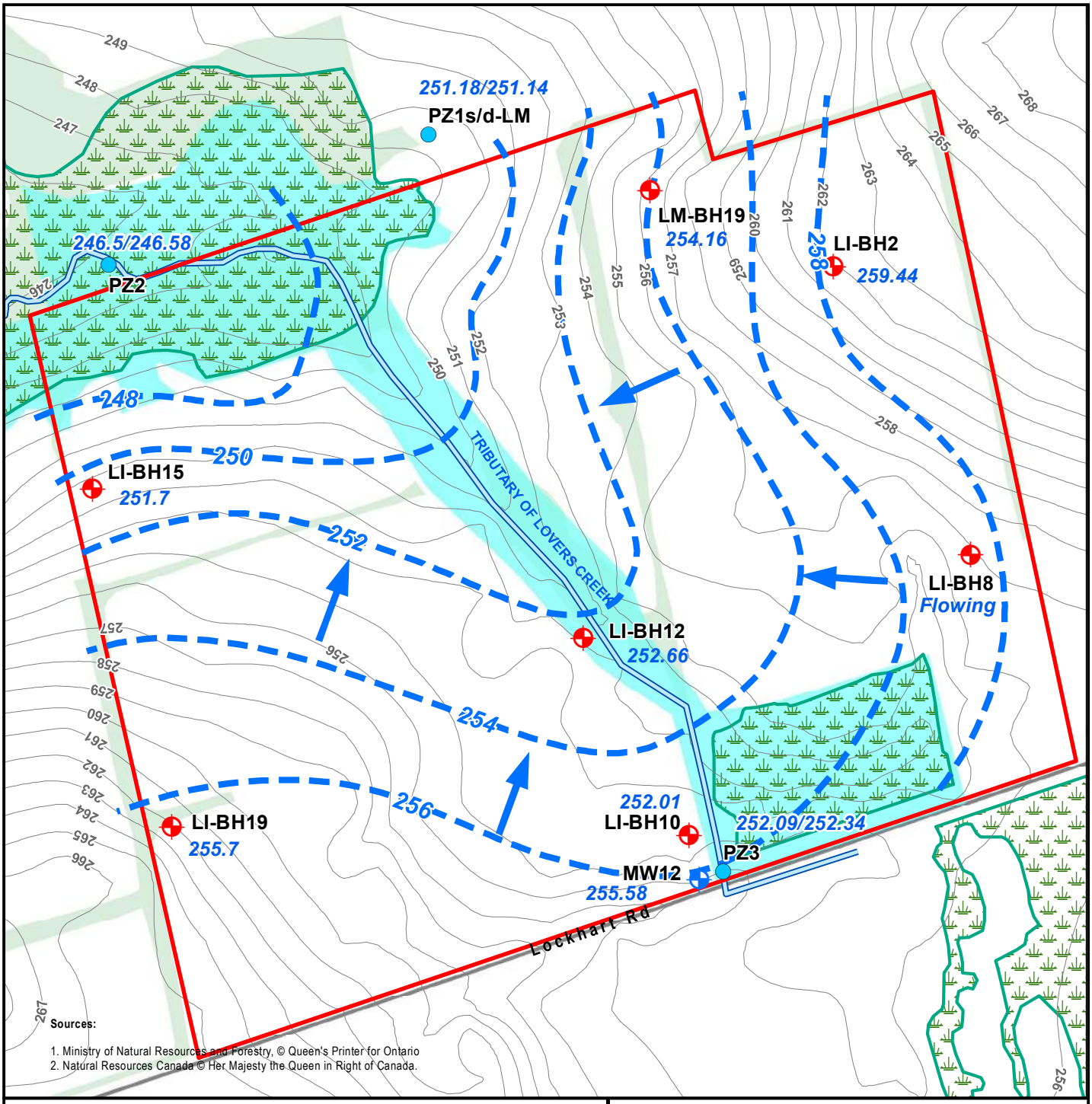
Legend

- @language-layer-soil-name
- @ language-layer-hydrologic-soil-group
  - A - High
  - B - Moderate
  - C - Slow
  - D - Very Slow

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

Ontario © Queen's Printer for Ontario, 2021

Map Created: 6/7/2021
Map Center: 44.33562 N, -79.63976 W



LEGEND

- SUBJECT LANDS
- WATERCOURSE
- CONTOUR (1m intervals - masl)
- ROADWAY
- WETLAND (AZIMUTH, 2014)
- WETLAND (MNR, 2021)
- WOODED AREA
- MONITORING WELL (SOIL ENG., 2019)
- MONITORING WELL (RJB, 2014)
- DRIVE POINT PIEZOMETER (RJB, 2014)
- INTERPRETED GROUNDWATER CONTOUR (masl)
- GROUNDWATER FLOW DIRECTION
- 255.7 MEASURED WATER LEVEL (March 26, 2020)

0 50 100 200 300 400
Metres

N

BURNSIDE

Client / Report

LOCKHART INNISFIL INVESTMENTS LIMITED &
LOCKHART INNISFIL INVESTMENTS II LIMITED
BARRIE, ONTARIO

HYDROGEOLOGICAL ASSESSMENT

Figure Title:

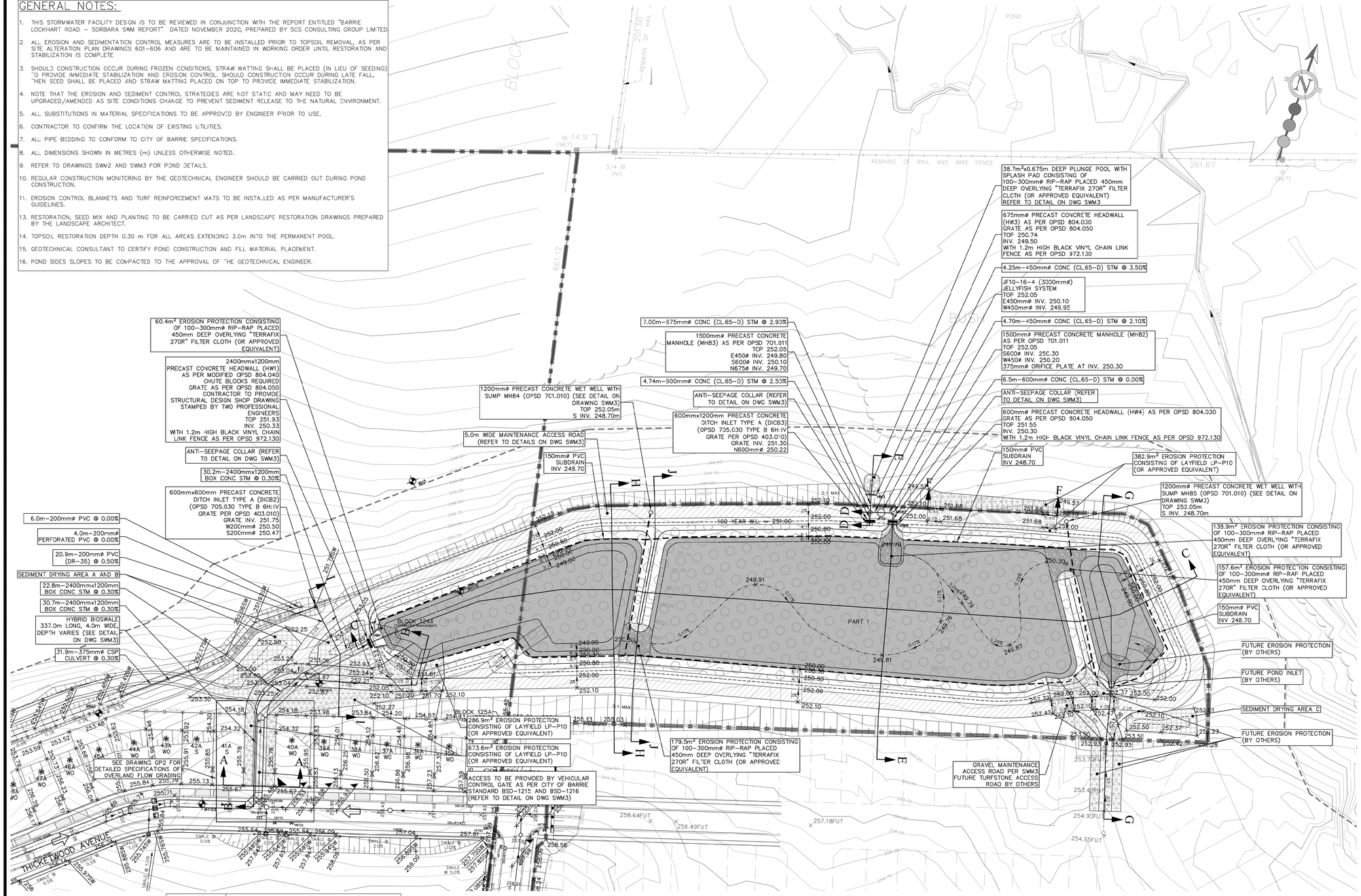
INTERPRETED GROUNDWATER FLOW

Drawn	Checked	Date	Figure No.
SK	SC	July 2021	9
Scale		Project No.	
1:5,000		300043818	

File Path: Nigel/Shared Work Areas/043818 Lockhart Innisfil/06_GIS/043818 Groundwater Flow.mxd

GENERAL NOTES:

1. THIS STORMWATER FACILITY DESIGN IS TO BE REVIEWED IN CONJUNCTION WITH THE REPORT ENTITLED "BARRIE LOCKHART ROAD – SORBARA SWM REPORT" DATED NOVEMBER 2020, PREPARED BY SCS CONSULTING GROUP LIMITED.
2. ALL EROSION AND SEDIMENTATION CONTROL MEASURES ARE TO BE INSTALLED PRIOR TO TOPSOIL REMOVAL, AS PER SITE ALTERATION PLAN DRAWINGS 601–606 AND ARE TO BE MAINTAINED IN WORKING ORDER UNTIL RESTORATION AND STABILIZATION IS COMPLETE
3. SHOULD CONSTRUCTION OCCUR DURING FROZEN CONDITIONS, STRAW MATTING SHALL BE PLACED (IN LIEU OF SEEDING) TO PROVIDE IMMEDIATE STABILIZATION AND EROSION CONTROL. SHOULD CONSTRUCTION OCCUR DURING LATE FALL, THEN SEED SHALL BE PLACED AND STRAW MATTING PLACED ON TOP TO PROVIDE IMMEDIATE STABILIZATION.
4. NOTE THAT THE EROSION AND SEDIMENT CONTROL STRATEGIES ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO PREVENT SEDIMENT RELEASE TO THE NATURAL ENVIRONMENT.
5. ALL SUBSTITUTIONS IN MATERIAL SPECIFICATIONS TO BE APPROVED BY ENGINEER PRIOR TO USE.
6. CONTRACTOR TO CONFIRM THE LOCATION OF EXISTING UTILITIES.
7. ALL PIPE BEDDING TO CONFORM TO CITY OF BARRIE SPECIFICATIONS.
8. ALL DIMENSIONS SHOWN IN METRES (m) UNLESS OTHERWISE NOTED.
9. REFER TO DRAWINGS SWM2 AND SWM3 FOR POND DETAILS.
10. REGULAR CONSTRUCTION MONITORING BY THE GEOTECHNICAL ENGINEER SHOULD BE CARRIED OUT DURING POND CONSTRUCTION.
11. EROSION CONTROL BLANKETS AND TURF REINFORCEMENT MATS TO BE INSTALLED AS PER MANUFACTURER'S GUIDELINES.
13. RESTORATION, SEED MIX AND PLANTING TO BE CARRIED OUT AS PER LANDSCAPE RESTORATION DRAWINGS PREPARED BY THE LANDSCAPE ARCHITECT.
14. TOPSOIL RESTORATION DEPTH 0.30 m FOR ALL AREAS EXTENDING 3.0m INTO THE PERMANENT POOL.
15. GEOTECHNICAL CONSULTANT TO CERTIFY POND CONSTRUCTION AND FILL MATERIAL PLACEMENT.
16. POND SIDES SLOPES TO BE COMPACTED TO THE APPROVAL OF THE GEOTECHNICAL ENGINEER.



KEY PLAN
NOT TO SCALE

LEGEND

- PROPERTY BOUNDARY
- LIMIT OF DEVELOPMENT
- PROPOSED STORM MANHOLE/SEWER
- FUTURE STORM MANHOLE/SEWER (BY OTHERS)
- CATCHBASIN
- DOUBLE CATCHBASIN
- 249.25 EXISTING CONTOUR AND ELEVATION
- ×223.23 PROPOSED GRADE ELEVATION
- ×223.23FUT FUTURE GRADE ELEVATION
- ×229.66EX EXISTING GRADE ELEVATION
- OVERLAND FLOW DIRECTION
- PROPOSED EMBANKMENT (MAX 3:1 SLOPE UNLESS OTHERWISE NOTED)
- RIP–RAP
- TURFSTONE MAINTENANCE ACCESS ROAD FUTURE WHERE SPECIFIED
- GRANULAR MAINTENANCE ACCESS ROAD
- NORMAL WATER LEVEL
- EROSION MATTING HATCH
- SEDIMENT DRYING AREA
- 1.0m THICK CLAY LINER
- BH16 BOREHOLE LOCATION
- PROPOSED BLACK VINYL 9 GAUGE CHAIN LINK FENCE AS PER CITY OF BARRIE STANDARD BSD–1211
- FUTURE BLACK VINYL 9 GAUGE CHAIN LINK FENCE AS PER CITY OF BARRIE STANDARD BSD–1211
- 217.60 PROPOSED CONTOUR AND POND ELEVATION
- 218.85 100 YEAR WATER LEVEL AND ELEVATION
- LOW FLOW CHANNEL
- 60 LOT NUMBER

NOTES:
- ALL LOTS TO BE EQUIPPED WITH SUMP PUMPS AND INDIVIDUAL PRVS (SEE DETAIL ON DET SERIES DRAWINGS)

BENCH MARKS

TOPOGRAPHIC SURVEY PROVIDED BY JoeTOPO SURVEYS AND CADD
DATE: 12–DEC–2013

ELEVATIONS SHOWN HEREON ARE GEODETIC BASED ON NAD83(CSRS) AND ARE DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS USING THE "CAN–NET" VRS NETWORK, IN UTM 17N.

LEGAL INFORMATION AND BOUNDARIES SHOWN ARE PER DRAWING PROVDED BY CLIENT.

LOCAL SITE BENCHMARKS:
BM1: TOP OF SIB, NORTH WEST CORNER OF SITE AT SOUTHWEST LIMIT OF EXIST. WALKWAY BLOCK, AS INDICATED ON PLAN, ELEV. 248.65
BM2: TOP NUT OF HYDRANT, SOUTH WEST CORNER OF SITE AS INDICATED ON PLAN, ELEV. 261.66
BM3: TOP OF IB, SOUTH EAST CORNER OF SITE, AS NDICATED ON PLAN.

CITY OF BARRIE CONTROL MONUMENTS:
HORIZONTAL
01019860405 N: 4911111.934 E: 608244.931
031910017 N: 4909253.265 E: 606886.130

VERTICAL AND HORIZONTAL
03120110013 N: 4909870.258 E: 608733.580 EL: 252.807

NO.	REVISIONS	DATE	APPROVED

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

scs consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475–1900
FAX: (905) 475–8335

SORBARA group of companies
3700 STEELES AVE WEST, SUITE 800
VAUGHAN, ONTARIO L4L 8M9
TEL: (905) 850–6154

BARRIE
LOCKHART ROAD GP INC.

STORMWATER MANAGEMENT FACILITY PLAN

LICENSED PROFESSIONAL ENGINEER
M. T. TREMBLAY
100226645
Nov. 16, 2020
PROVINCE OF ONTARIO

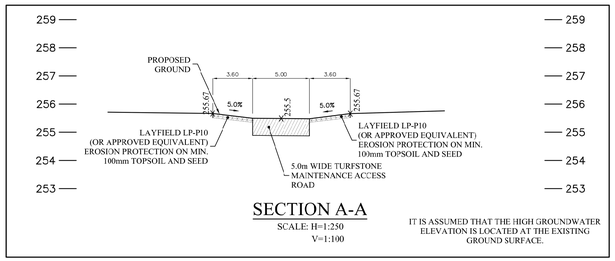
Barrie
ENGINEERING DEPARTMENT

SCALE 1:750		CONTRACT NO.	2000
DESIGN M.T.T.	DRAWN M.T.C.	SHEET NO.	SWM1
REVIEWED J.M.P.	DATE NOVEMBER 2020		

SWM FACILITY SUMMARY: SWM POND (2.84ha)

	VOLUME (m³) REQUIRED	VOLUME (m³) PROVIDED	ELEVATION (m)	FREEBOARD (m)	OUTLET FLOW (Q) (m³/s)
PERMANENT POOL	2,961	10,827	250.30	1.70	–
Extended Detention	4,692	4,692	250.64	1.36	0.118
2 YEAR	N/R	7,838	250.84	1.16	0.179
5 YEAR	N/R	12,090	251.08	0.92	0.238
10 YEAR	N/R	15,174	251.30	0.70	0.298
25 YEAR	N/R	17,657	251.44	0.56	0.657
50 YEAR	N/R	19,429	251.54	0.46	0.958
100 YEAR	N/R	20,703	251.60	0.40	1.200

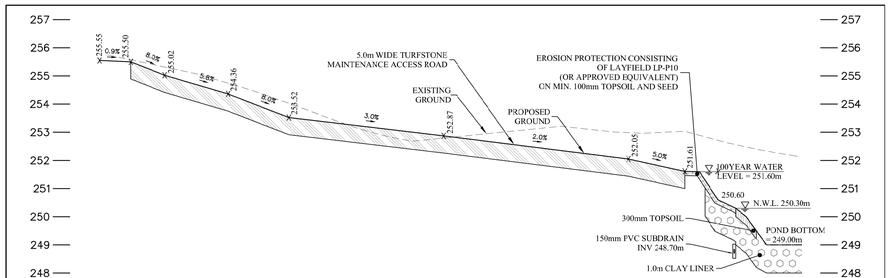
N/R – NOT REQUIRED



SECTION A-A

SCALE: H=1:250
V=1:100

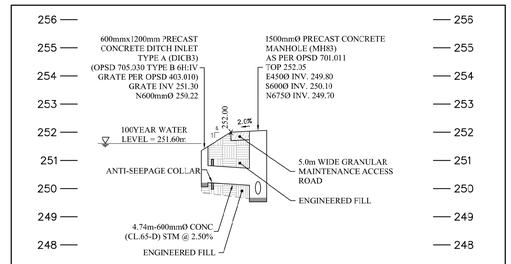
IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.



SECTION B-B

SCALE: H=1:500
V=1:100

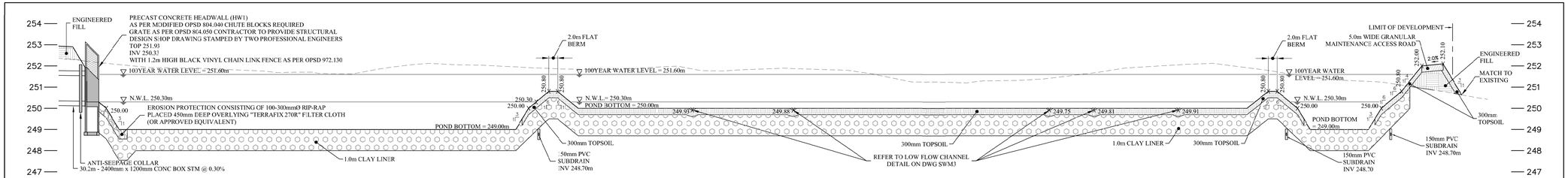
IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.



SECTION D-D

SCALE: H=1:250
V=1:100

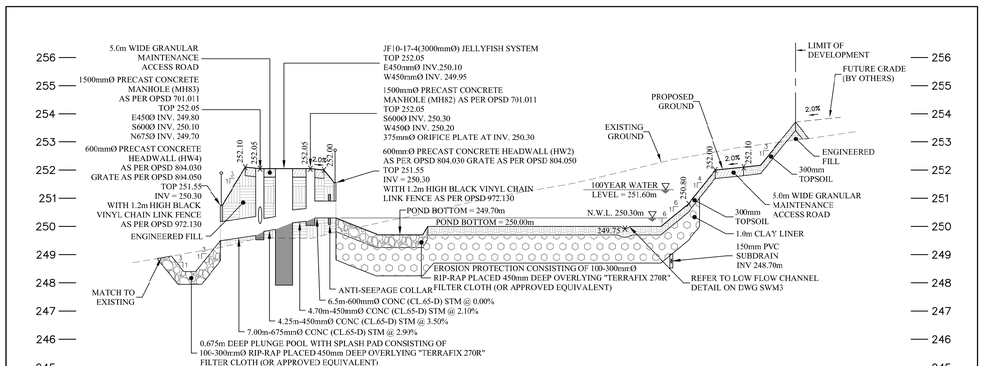
IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE



SECTION C-C

SCALE: H=1:500
V=1:100

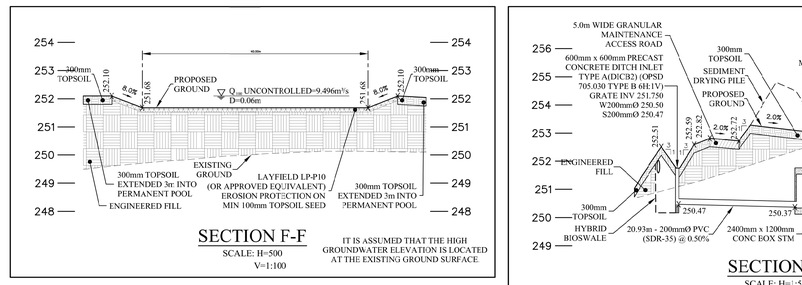
IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.



SECTION E-E

SCALE: H=1:500
V=1:100

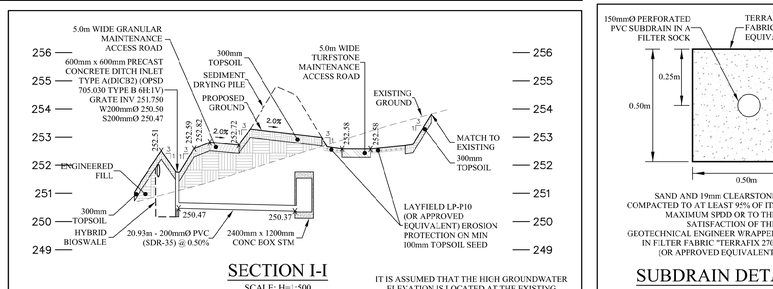
IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.



SECTION F-F

SCALE: H=500
V=1:100

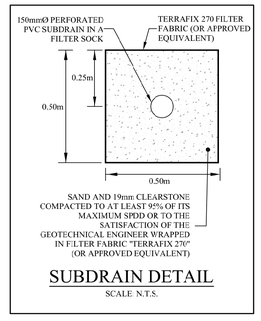
IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE



SECTION I-I

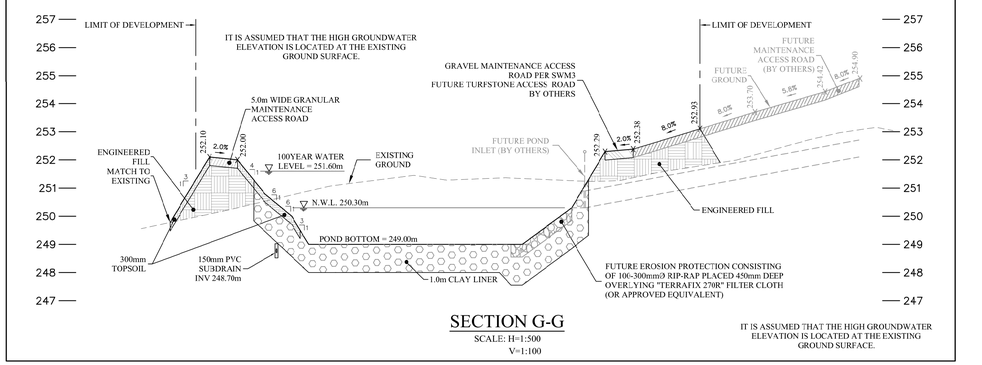
SCALE: H=1:500
V=1:100

IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.



SUBDRAIN DETAIL

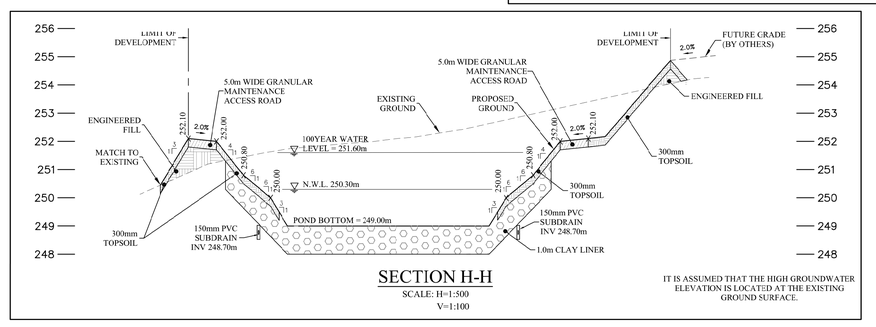
SCALE N.T.S.



SECTION G-G

SCALE: H=1:500
V=1:100

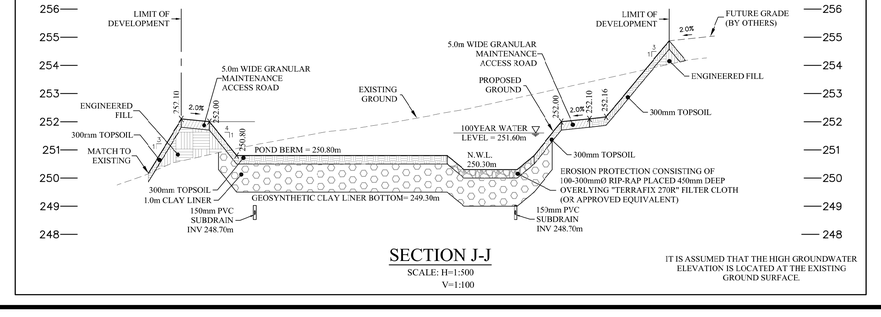
IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.



SECTION H-H

SCALE: H=1:500
V=1:100

IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.



SECTION J-J

SCALE: H=1:500
V=1:100

IT IS ASSUMED THAT THE HIGH GROUNDWATER ELEVATION IS LOCATED AT THE EXISTING GROUND SURFACE.

NO.	REVISIONS	DATE	APPROVED

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

scs consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

SORBARA group of companies
3700 STEELES AVE WEST, SUITE 800
VAUGHAN, ONTARIO L4L 8M9
TEL: (905) 850-6154

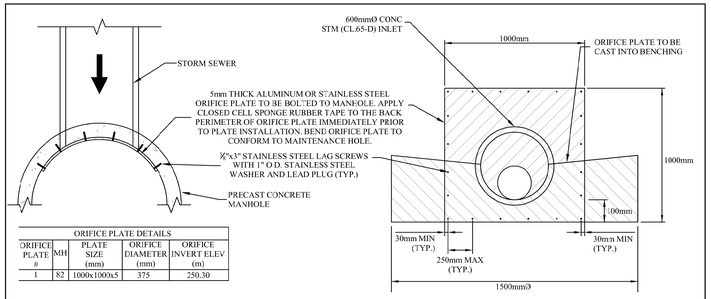
BARRIE
LOCKHART ROAD GP INC.

STORMWATER MANAGEMENT FACILITY CROSS-SECTIONS

LICENSED PROFESSIONAL ENGINEER
M. T. TREMBLAY
100226845
Nov. 18, 2020
PROVINCE OF ONTARIO

Barrie
ENGINEERING DEPARTMENT

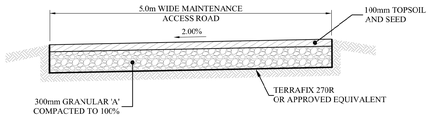
SCALE	AS SHOWN	CONTRACT NO.	2000
DESIGN	M.T.T. / S.V.	DRAWN	D.M.D.
REVIEWED	J.M.P.	DATE	NOVEMBER 2020
		SHEET NO.	SWM2



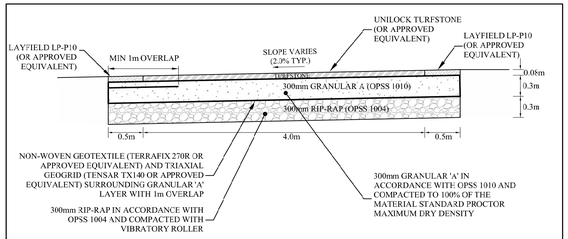
ORIFICE PLATE DETAILS				
ORIFICE PLATE #	MH	PLATE SIZE (mm)	ORIFICE DIAMETER (mm)	ORIFICE INVERT ELEV (m)
1	82	1000x1000x5	375	250.30

ORIFICE PLATE DETAIL
SCALE: N.T.S.

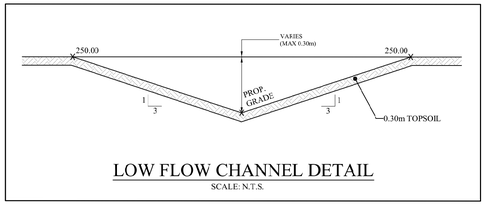
ORIFICE PLATE 1
SCALE: N.T.S.



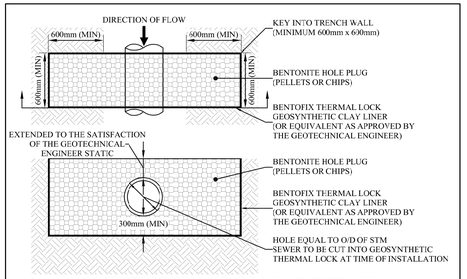
GRANULAR MAINTENANCE ACCESS ROAD DETAIL
SCALE: 1:40



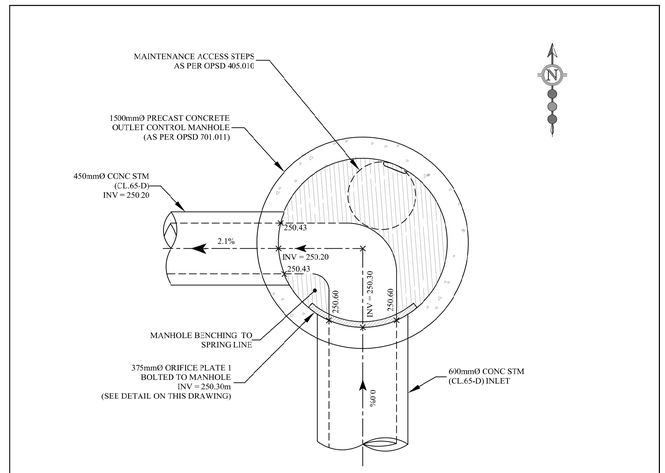
TURFSTONE MAINTENANCE ACCESS ROAD DETAIL
SCALE: 1:40



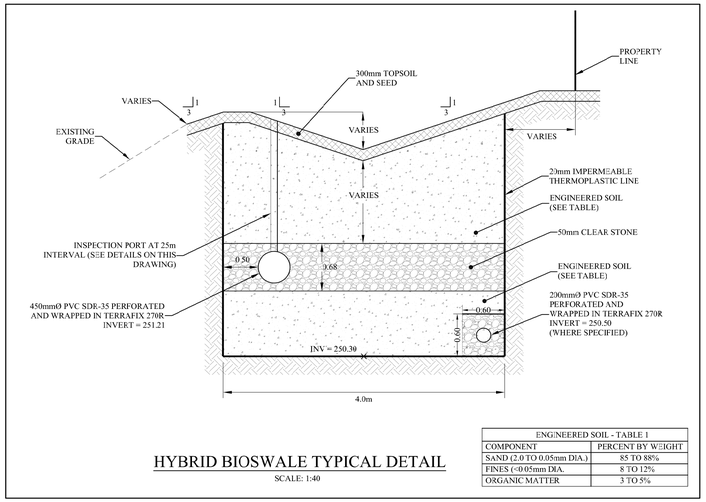
LOW FLOW CHANNEL DETAIL
SCALE: N.T.S.



ANTI-SEEPAGE COLLAR DETAIL
SCALE: N.T.S.

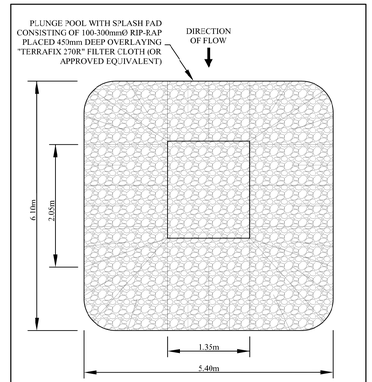


MH82 POND OUTLET CONTROL STRUCTURE PLAN VIEW
SCALE: 1:25

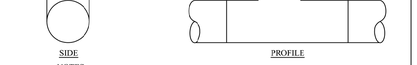


HYBRID BIOSWALE TYPICAL DETAIL
SCALE: 1:40

ENGINEERED SOIL - TABLE 1	
COMPONENT	PERCENT BY WEIGHT
SAND (2.0 TO 0.05mm DIA.)	85 TO 88%
FINES (<0.05mm DIA.	8 TO 12%
ORGANIC MATTER	3 TO 5%

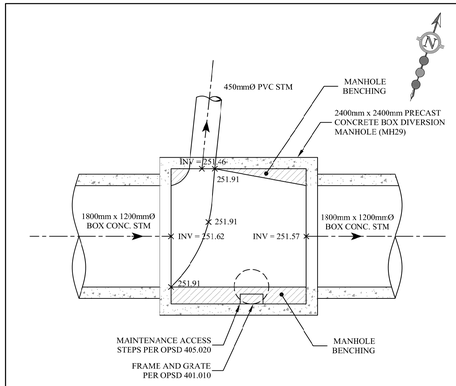


OUTLET HW3 PLUNGE POOL DETAIL
SCALE: N.T.S.

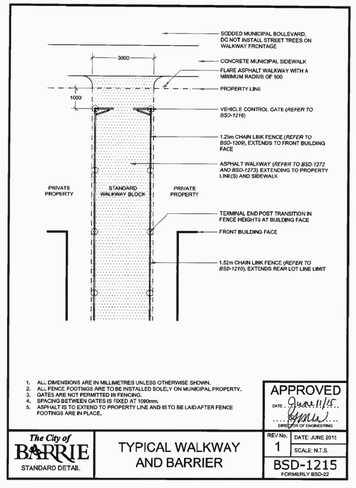


NOTES:
A) RISER SHALL BE PLACED PLUMB.
B) ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

INSPECTION PORT DETAIL
SCALE: N.T.S

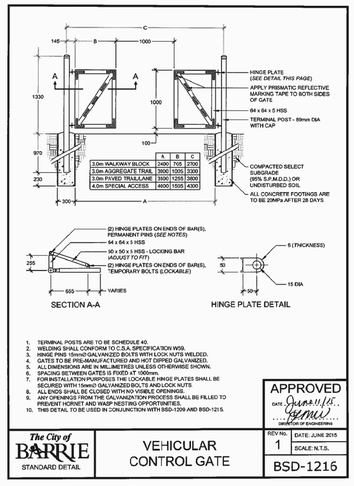


DDLV5949 FLOW DIVERSION MAINTENANCE HOLE DETAIL PLAN VIEW
SCALE: 1:50



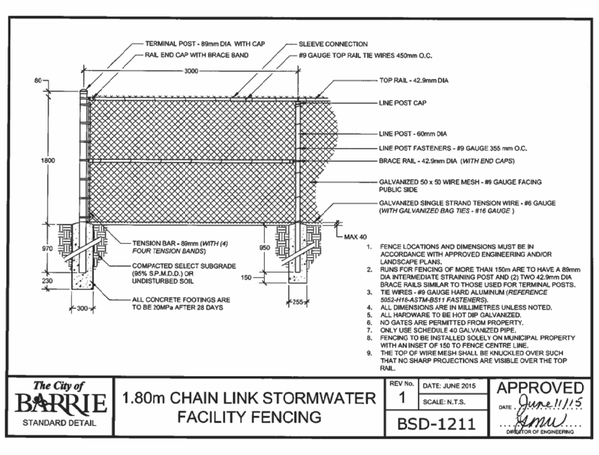
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. ALL FENCE FOOTINGS ARE TO BE INSTALLED SOLELY ON MUNICIPAL PROPERTY.
3. GATES ARE NOT PERMITTED IN FENCING.
4. SPACING BETWEEN GATES IS FIXED AT 1000mm.
5. ASPHALT IS TO EXTEND TO PROPERTY LINE AND IS TO BE LAID AFTER FENCE FOOTINGS ARE IN PLACE.

The City of BARRIE STANDARD DETAIL	TYPICAL WALKWAY AND BARRIER	APPROVED DATE June 11/15 DIRECTOR OF ENGINEERING	REV No. 1	DATE: JUNE 2011	SCALE: N.T.S.	BSD-1215 FORMERLY BSD-22



1. TERMINAL POSTS ARE TO BE SCHEDULE 40.
2. WELDING SHALL CONFORM TO C.S.A. SPECIFICATION W59.
3. HINGE PINS 15mmØ GALVANIZED BOLTS WITH LOCK NUTS WELDED.
4. GATES TO BE PRE-MANUFACTURED AND HOT DIPPED GALVANIZED.
5. ALL EXPOSED METAL SURFACES TO BE GALVANIZED OTHERWISE SHOWN.
6. LATCHING DEVICE IN GATES IS FIXED AT 1000mm.
7. FOR INSTALLATION PURPOSES THE LOCKABLE HINGE PLATES SHALL BE SECURED WITH 15mmØ GALVANIZED BOLTS AND LOCK NUTS.
8. ALL ENDS SHALL BE CLOSED WITH NO VISIBLE OPENINGS.
9. ANY OPENINGS FROM THE GALVANIZATION PROCESS SHALL BE FILLED TO PREVENT HORNET AND WASP NESTING OPPORTUNITIES.
10. THIS DETAIL TO BE USED IN CONJUNCTION WITH BSD-1209 AND BSD-1215.

The City of BARRIE STANDARD DETAIL	VEHICULAR CONTROL GATE	APPROVED DATE June 11/15 DIRECTOR OF ENGINEERING	REV No. 1	DATE: JUNE 2015	SCALE: N.T.S.	BSD-1216



1. FENCE LOCATIONS AND DIMENSIONS MUST BE IN ACCORDANCE WITH APPROVED ENGINEERING AND/OR LANDSCAPE PLANS.
2. RUNS FOR FENCING OF MORE THAN 150m ARE TO HAVE A 89mm DIA INTERMEDIATE STRAINING POST AND (2) TWO 42.9mm DIA BRACE RAILS SIMILAR TO THOSE USED FOR TERMINAL POSTS.
3. TIE WIRES - #9 GAUGE HARD ALUMINUM (REFERENCE SIS(5-H16-4.2TM-B511 FASTENERS).
4. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED.
5. ALL HARDWARE TO BE HOT DIP GALVANIZED.
6. NO GATES ARE PERMITTED FROM PROPERTY.
7. ONLY USE SCHEDULE 40 GALVANIZED PIPE.
8. FENCING TO BE INSTALLED SOLELY ON MUNICIPAL PROPERTY WITH AN INSET OF 150 TO FENCE CENTRE LINE.
9. THE TOP OF WIRE MESH SHALL BE KNUCKLED OVER SUCH THAT NO SHARP PROJECTIONS ARE VISIBLE OVER THE TOP RAIL.

The City of BARRIE STANDARD DETAIL	1.80m CHAIN LINK STORMWATER FACILITY FENCING	REV No. 1	DATE: JUNE 2015	SCALE: N.T.S.	BSD-1211	APPROVED DATE June 11/15 DIRECTOR OF ENGINEERING

NO.	REVISIONS	DATE	APPROVED

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

scs consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

SORBARA group of companies
3700 STEELES AVE WEST, SUITE 800
VAUGHAN, ONTARIO L4L 8M9
TEL: (905) 850-6154

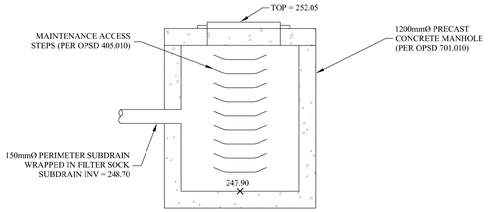
BARRIE
LOCKHART ROAD GP INC.

STORMWATER MANAGEMENT FACILITY DETAILS 1

LICENSED PROFESSIONAL ENGINEER
M. T. TREMBLAY
100226645
Nov. 18, 2020
PROVINCE OF ONTARIO

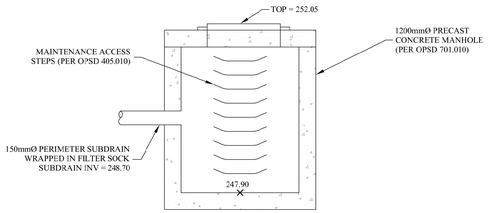
Barrie
ENGINEERING DEPARTMENT

SCALE	AS SHOWN	CONTRACT NO.	2000
DESIGN	M.T.T. / S.V.	DRAWN D.M.D.	
REVIEWED	J.M.P.	DATE NOVEMBER 2020	SHEET NO. SWM3



WEST WET WELL (MH84) DETAIL

SCALE: N.T.S.



EAST WET WELL (MH85) DETAIL

SCALE: N.T.S.

NO.	REVISIONS	DATE	APPROVED

CITY OF BARRIE
ACCEPTED

DATE. . . . . .

. . . . . .
DIRECTOR OF ENGINEERING

scs consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
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SORBARA group of companies
3700 STEELES AVE WEST,
SUITE 800
VAUGHAN, ONTARIO L4L 8M9
TEL: (905) 850-6154

BARRIE
LOCKHART ROAD GP INC.

STORMWATER MANAGEMENT
FACILITY DETAILS 2

LICENSED PROFESSIONAL ENGINEER
M.T. TREMBLAY
100226645
Nov. 18, 2020
PROVINCE OF ONTARIO

Barrie
ENGINEERING DEPARTMENT

SCALE	AS SHOWN	CONTRACT NO.	2000
DESIGN	M.T.T. / S.V.	SHEET NO.	SWM4
DRAWN	D.M.D.		
REVIEWED	J.M.P.	DATE	NOVEMBER 2020

PROJECT #2000 - BARRIE LOCKHART ROAD-SORBARA - CITY OF BARRIE - SECOND SUBMISSION - NOVEMBER 13, 2020


BLOCK 133A
EXISTING RESIDENTIAL
THICKETWOOD AVENUE
THICKETWOOD AVENUE
NEW TH
PHASE 1
PHASE 2
PHASE 3
0.17ha 0.70
0.34ha 0.70
0.45ha 0.70
0.16ha 0.70
0.19ha 0.70
0.11ha 0.70
0.10ha 0.70
0.06ha 0.70
0.20ha 0.70
0.18ha 0.70
0.10ha 0.70
0.62ha 0.70
0.07ha 0.70
0.96ha 0.70
0.11ha 0.70
0.09ha 0.70
0.51ha 0.70
1.21ha 0.70
0.14ha 0.70
0.04ha 0.74
0.14ha 0.74
0.05ha 0.70
0.26ha 0.70
0.08ha 0.70
0.54ha 0.40 Tc = 11.10
0.55ha 0.70
1.05ha 0.70
0.10ha 0.70
0.12ha 0.70
0.08ha 0.70
0.41ha 0.70
0.10ha 0.70
0.06ha 0.70
0.20ha 0.70
0.03ha 0.70
0.14ha 0.70
0.21ha 0.70
0.50ha 0.70
0.07ha 0.70
0.04ha 0.70
0.19ha 0.70
0.56ha 0.30 Tc = 11.17
0.27ha 0.70
0.38ha 0.70
0.21ha 0.70
0.61ha 0.70
1.23ha 0.70
0.07ha 0.70
0.32ha 0.70
0.14ha 0.70
0.79ha 0.71
0.02ha 0.74
0.29ha 0.71
0.12ha 0.70
0.15ha 0.70
0.09ha 0.70
0.08ha 0.70
0.08ha 0.70
0.07ha 0.70
0.56ha 0.70
0.10ha 0.70
0.06ha 0.70
1.13ha 0.73
0.44ha 0.73
0.33ha 0.70
0.06ha 0.70
0.16ha 0.70
0.12ha 0.70
0.14ha 0.74
0.23ha 0.74
2.43ha 0.76 Tc = 12.17
0.63ha 0.70
0.11ha 0.74
0.24ha 0.74
0.02ha 0.74
0.17ha 0.70
0.14ha 0.70
0.10ha 0.70
0.66ha 0.70
0.68ha 0.77
0.07ha 0.70
0.12ha 0.74
0.33ha 0.74
0.49ha 0.74
0.55ha 0.84
0.62ha 0.84
0.51ha 0.84
0.30ha 0.84
0.16ha 0.74
0.25ha 0.74
0.16ha 0.74
100 YEAR AREA = 5.09ha RUNOFF COEFFICIENT = 0.875
100 YEAR AREA = 6.08ha RUNOFF COEFFICIENT = 0.875
NON-PARTICIPATING PROPERTY
FENCHURCH MANOR
WATFORD CRESCENT
HENLOW TRAIL
WEMBLEY GATE
MILADY GROVE
ASCOT LANE
KINGSBURY TRAIL
ABBEY CRESCENT
ADDINGTON HEIGHTS
REDHILL CRESCENT
SHIPLEY CRESCENT
BALL GATE
LOCKHART ROAD
LOCKHART ROAD
LOCKHART ROAD
BLOCK 122A
BLOCK 123A
BLOCK 124A
BLOCK 125A
BLOCK 120A
BLOCK 121A
BLOCK 128A
BLOCK 129A
BLOCK 111A
BLOCK 112A
BLOCK 113A
BLOCK 114A
BLOCK 115A
BLOCK 116A
BLOCK 117A
BLOCK 118A
BLOCK 119A
BLOCK 120A
BLOCK 121A
BLOCK 122A
BLOCK 123A
BLOCK 124A
BLOCK 125A
BLOCK 126A
BLOCK 127A
BLOCK 128A
BLOCK 129A
BLOCK 130A
BLOCK

PROJECT #2000 - BARRIE LOCKHART ROAD-SORBARA - CITY OF BARRIE - SECOND SUBMISSION - NOVEMBER 13, 2020

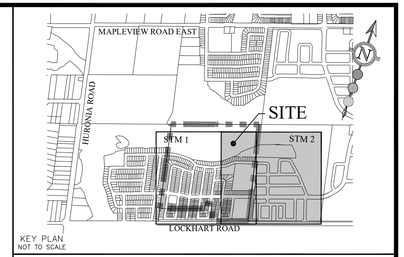
SEE DWG. STM1

REFER TO SWM DWGS. FOR STORMWATER MANAGEMENT POND DETAILS

THICKETWOOD AVENUE
ABBEY CRESCENT
SHIPLEY CRESCENT
BALL GATE
FENCHURCH MANOR
LOCKHART ROAD
LOCKHART INNISFIL INVESTMENTS LIMITED II
BUSH
CREEK
SILO

BLOCK 122A (VALVE HOUSE) — 0.56ha / 0.30 / Tc = 11.17
BLOCK 123A (BOTHWELL) — 2.43ha / 0.76 / Tc = 12.17
BLOCK 124A (WATER BOOSTER) — 0.33ha / 0.70
BLOCK 125A
BLOCK 117A — 0.14ha / 0.70
BLOCK 118A
BLOCK 119A — 0.10ha / 0.70
BLOCK 120A — 0.66ha / 0.70
BLOCK 121A — 0.68ha / 0.77
BLOCK 127A — 0.07ha / 0.70
BLOCK 128A — 0.44ha / 0.73
BLOCK 129A (INCOMING BLOCK)

0.06ha / 0.70
0.16ha / 0.70
0.12ha / 0.70
0.14ha / 0.74
0.04ha / 0.70
0.23ha / 0.74
0.27ha / 0.70
0.16ha / 0.74
0.25ha / 0.74
21ha / 0.70
0.63ha / 0.70
0.11ha / 0.74
0.24ha / 0.74
0.12ha / 0.74
0.49ha / 0.74
0.02ha / 0.74
0.33ha / 0.74
0.17ha / 0.70
0.55ha / 0.84
0.62ha / 0.84
0.51ha / 0.84
0.33ha / 0.70
0.30ha / 0.84



KEY PLAN
NOT TO SCALE

LEGEND

- LIMIT OF SUBDIVISION
- LIMIT OF PHASE
- STORM MANHOLE/SEWER
- STORM MANHOLE/SEWER (BY-OTHERS)
- SINGLE CATCHBASIN WITH NO ICD
- DOUBLE CATCHBASIN WITH NO ICD
- 1800 x 900 mm PRECAST BOX SECTION WITH BORDEN TYPE GALVANIZED GRATING R/W-22-4 (TYP), EQUIPPED WITH CB SHIELD (OR APPROVED EQUIVALENT)
- STORM DRAINAGE BOUNDARY
- 100 YEAR STORM DRAINAGE BOUNDARY
- STORM DRAINAGE BOUNDARY (BY-OTHERS)
- RETAINING WALL
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- 1.18ha / 0.35 — DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- 0.22ha / 0.73 — EXTERNAL DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- 323.00 — EXISTING CONTOURS
- 100 YEAR STORM CAPTURE POINT
- RAIN GARDEN / BIOSWALE

NOTES:
- ALL LOTS TO BE EQUIPPED WITH SUMP PUMPS AND INDIVIDUAL PRVS (SEE DETAIL ON DET SERIES DRAWINGS)

BENCH MARKS

TOPOGRAPHIC SURVEY PROVIDED BY JoeTOPO SURVEYS AND CADD
DATE: 12-DEC-2013

ELEVATIONS SHOWN HEREON ARE GEODETIC BASED ON NAD83(CSRS) AND ARE DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS USING THE 'CAN-NET' VRS NETWORK, IN UTM 17N.

LEGAL INFORMATION AND BOUNDARIES SHOWN ARE PER DRAWING PROVIDED BY CLIENT.

LOCAL SITE BENCHMARKS:
BM1: TOP OF SIB, NORTH WEST CORNER OF SITE AT SOUTHWEST LIMIT OF EXIST. WALKWAY BLOCK, AS INDICATED ON PLAN, ELEV. 248.65
BM2: TOP NUT OF HYDRANT, SOUTH WEST CORNER OF SITE AS INDICATED ON PLAN. ELEV. 261.66
BM3: TOP OF IB, SOUTH EAST CORNER OF SITE, AS INDICATED ON PLAN.

CITY OF BARRIE CONTROL MONUMENTS:
HORIZONTAL
01019860405 N: 4911111.934 E: 608244.931
031910017 N: 4909253.265 E: 606886.130

VERTICAL AND HORIZONTAL
03120110013 N: 4909870.258 E: 608733.580 EL: 252.807

NO.	REVISIONS	DATE

CITY OF BARRIE
ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

SORBARA group of companies
3700 STEELES AVE WEST, SUITE 800
VAUGHAN, ONTARIO L4L 8M9
TEL: (905) 850-6154

BARRIE
LOCKHART ROAD GP INC.

STORM DRAINAGE PLAN 2

LICENSED PROFESSIONAL ENGINEER
R. S. HAYES
100517803
PROVINCE OF ONTARIO

Barrie
ENGINEERING DEPARTMENT

SCALE	1:1000			CONTRACT NO.	2000
DESIGN	R.S.H./M.A.M.	DRAWN	M.T.C.	SHEET NO.	STM2
REVIEWED	M.R.C./P.S.	DATE	NOVEMBER 2020		

PROJECT #2000 - BARRIE LOCKHART ROAD-SORBARA - CITY OF BARRIE - SECOND SUBMISSION - NOVEMBER 13, 2020

5-Year Storm Design
BARRIE LOCKHART ROAD GP INC.
CITY OF BARRIE

Rainfall Intensity (i) = $\frac{A}{(Tc+B)^C}$ A= 853.61 B= 4.699 c= 0.766

Starting Tc (min)= 10

Legend:
- 1821 — Equivalent pipe diameter for 1800x1200 box culvert, based on hydraulic capacity with same slope
- 1859 — Equivalent pipe diameter for 2400x1200 box culvert, based on hydraulic capacity with same slope
- Pipe sized for 100 Year Storm

Project: BARRIE LOCKHART ROAD GP INC.
Project No. 2000
Date: 6-Nov-20
Designed By: R.S.H/M.A.M
Reviewed By: P.S

LOCATION			5 YEAR							TOTAL FLOW	PIPE DATA								
STREET	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	5-YEAR AREA (ha)	RUNOFF COEFF. (R)	"AR"	ACCUM. "AR"	RAINFALL INTENSITY (mm/hr)	ACCUM. FLOW (m3/s)	TOTAL (Q dev) (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	TIME OF CONC. (min)	ACCUM. TIME OF CONC. (min)	CAPACITY (% FULL) Qdev/Qcap
LOT XX (REA'S LOT AREA)	DDLVS6115	DDLVS5922	3.08	0.70	0.06	0.36	108.92	0.017	0.017	37.4	0.50	250	0.042	0.857	0.73	10.73	40%
REDHILL CRESENT	DDLVS5923	DDLVS5923	3.56	0.70	0.39	0.45	104.96	0.131	0.131	43.1	1.00	375	0.175	1.587	0.45	11.18	75%
REDHILL CRESENT	DDLVS5923	DDLVS5924	3.29	0.71	0.21	0.65	102.67	0.186	0.186	50.7	1.70	375	0.228	2.070	0.41	11.59	82%
FENCHURCH MANOR	DDLVS5924	DDLVS5925	3.02	0.74	0.01	0.67	100.69	0.187	0.187	9.9	2.00	375	0.248	2.245	0.07	11.66	75%
BLOCK 154B (REAR LOT AREA)	DDLVS6116	DDLVS5925	3.08	0.70	0.06	0.36	108.92	0.017	0.017	10.2	0.50	250	0.042	0.857	0.20	10.20	40%
FENCHURCH MANOR	DDLVS5925	DDLVS5926	3.15	0.74	0.11	0.84	100.34	0.233	0.233	60.7	1.90	450	0.393	2.471	0.41	12.07	59%
LOCKHART ROAD	EXT 1	DDLVS5926	1.19	0.73	0.87	0.67	108.92	0.263	0.263	1.0	1.00	525	0.430	1.987	0.01	10.08	61%
LOT XX (REA'S LOT AREA)	DDLVS6117	DDLVS5926	3.10	0.70	0.07	0.07	108.92	0.021	0.021	33.4	0.50	250	0.042	0.857	0.65	10.65	50%
LOT XX (REA'S LOT AREA)	DDLVS6118	DDLVS5926	3.08	0.70	0.06	0.36	108.92	0.017	0.017	33.4	0.50	250	0.042	0.857	0.65	10.65	40%
ADDINGTON HEIGHTS	DDLVS5926	DDLVS5927	3.20	0.70	0.14	1.13	105.37	0.332	0.332	69.3	1.00	525	0.430	1.987	0.58	11.28	77%
BLOCK 156B (REAR LOT AREA)	DDLVS6119	DDLVS5927	3.09	0.70	0.06	0.36	108.92	0.019	0.019	33.4	0.50	250	0.042	0.857	0.65	10.65	45%
ADDINGTON HEIGHTS	DDLVS5927	DDLVS5928	3.55	0.70	0.39	1.58	102.41	0.450	0.450	72.9	2.50	525	0.680	3.141	0.39	11.62	66%
LOT XX (REA'S LOT AREA)	DDLVS6120	DDLVS5928	3.08	0.70	0.06	0.36	108.92	0.017	0.017	11.2	0.50	250	0.042	0.857	0.22	10.22	40%
FENCHURCH MANOR	DDLVS5928	DDLVS5930	3.16	0.74	0.12	2.59	98.46	0.709	0.709	74.2	1.40	675	0.994	2.779	0.44	12.52	71%
LOT XX (REA'S LOT AREA)	DDLVS6121	DDLVS5989	3.10	0.70	0.07	0.07	108.92	0.021	0.021	33.4	0.50	250	0.042	0.857	0.65	10.65	50%
LOT XX (REA'S LOT AREA)	DDLVS6122	DDLVS5989	3.06	0.70	0.04	0.04	108.92	0.013	0.013	37.9	0.50	250	0.042	0.857	0.74	10.78	30%
LOT XX (REA'S LOT AREA)	DDLVS6123	DDLVS5989	3.12	0.70	0.08	0.08	108.92	0.025	0.025	33.4	0.50	250	0.042	0.857	0.65	10.65	60%
WATFORD CRESENT	DDLVS5989	DDLVS5929	3.41	0.70	0.29	0.88	104.91	0.141	0.141	45.6	1.00	375	0.175	1.587	0.48	11.22	80%
BLOCK 161B (REA'S LOT AREA)	DDLVS6124	DDLVS5929	3.10	0.70	0.07	0.07	108.92	0.021	0.021	33.4	0.50	250	0.042	0.857	0.65	10.65	50%
WATFORD CRESENT	DDLVS5929	DDLVS5930	3.26	0.70	0.18	0.74	102.49	0.209	0.209	83.5	1.55	450	0.355	2.232	0.62	11.84	59%
FENCHURCH MANOR	DDLVS5930	DDLVS5931	3.18	0.74	0.13	3.86	96.50	0.928	0.928	61.7	2.25	675	1.260	3.524	0.29	12.81	74%
PARK (BLOCK 166B)	DDLVS5934	DDLVS5931	3.54	0.40	0.22	0.22	108.92	0.065	0.065	11.7	0.50	900	1.279	2.012	0.10	10.13	5%
FENCHURCH MANOR	DDLVS5930	DDLVS5936	3.00	0.70	0.00	3.08	95.27	0.973	0.973	12.4	0.50	900	1.279	2.012	0.10	12.91	76%
WATFORD CRESENT	DDLVS5933	DDLVS5935	1.65	0.70	0.74	0.74	108.92	0.222	0.222	100.0	3.00	375	0.304	2.750	0.61	10.64	73%
WATFORD CRESENT	DDLVS5935	DDLVS5936	3.05	0.70	0.04	0.77	105.60	0.226	0.226	21.9	0.50	750	0.797	1.782	0.20	10.84	29%
HENLOW TRAIL	DDLVS5936	DDLVS5937	3.51	0.70	0.36	4.80	94.84	1.266	1.266	79.9	0.50	1050	1.930	2.230	0.60	13.51	66%
HENLOW TRAIL	DDLVS5937	DDLVS5938	3.62	0.70	0.43	5.24	92.45	1.345	1.345	100.0	0.50	1050	1.930	2.230	0.75	14.26	70%
HENLOW TRAIL	DDLVS5938	DDLVS5939	3.06	0.70	0.04	5.28	89.65	1.315	1.315	11.8	0.50	1050	1.930	2.230	0.09	14.34	68%
HENLOW TRAIL	DDLVS5939	DDLVS5940	3.19	0.70	0.13	5.41	89.33	1.343	1.343	43.9	0.50	1050	1.930	2.230	0.33	14.67	70%
HENLOW TRAIL	DDLVS5940	DDLVS5941	3.11	0.70	0.08	5.49	88.17	1.345	1.345	29.5	0.50	1050	1.930	2.230	0.22	14.89	70%
WEMBLEY GATE	DDLVS5941	DDLVS5942	3.96	0.70	0.67	0.67	108.92	0.203	0.203	66.4	3.00	375	0.304	2.750	0.40	10.43	67%
WEMBLEY GATE	DDLVS5942	DDLVS5943	3.10	0.70	0.07	0.74	106.69	0.226	0.220	24.5	0.50	525	0.304	1.405	0.29	10.69	72%
HENLOW TRAIL	DDLVS5943	DDLVS5944	3.20	0.70	0.14	6.37	87.41	1.547	1.547	33.7	0.50	1050	1.930	2.230	0.25	15.18	80%
HENLOW TRAIL	DDLVS5944	DDLVS5991	3.07	0.70	0.05	6.42	86.55	1.544	1.544	30.5	0.50	1050	1.930	2.230	0.23	15.37	80%
HENLOW TRAIL	DDLVS5991	DDLVS5946	3.00	0.70	0.00	6.42	85.86	1.530	1.530	6.2	0.50	1050	1.930	2.230	0.05	15.42	79%
MILADY GROVE	DDLVS5945	DDLVS5946	1.21	0.70	0.85	0.85	108.92	0.256	0.256	94.6	3.00	375	0.304	2.750	0.57	10.57	84%
MILADY GROVE	DDLVS5946	DDLB5947	3.18	0.70	0.13	7.39	85.65	1.759	1.759	25.7	0.50	1050	1.930	2.230	0.19	15.61	91%
MILADY GROVE	DDLVS5947	DDLVS5948	3.00	0.70	0.00	0.30	108.92	0.000	0.000	16.8	0.50	1050	1.930	2.230	0.13	10.13	0%
MILADY GROVE	DDLVS5948	DDLVS5949	3.50	0.70	0.35	0.35	108.21	0.105	0.105	7.4	0.30	1621	4.759	2.307	0.05	10.18	2%
BLOCK 126A	DDLVS5949 NORTE	DDLVS6001	3.00	0.70	0.00	0.30	108.92	0.000	0.000	11.8	1.00	300	0.097	1.368	0.14	10.14	0%
THICKETWOOD A VENUE	DDLVS5949	DDLVS5951	3.00	0.70	0.00	0.35	107.92	0.105	0.105	29.9	0.30	1621	4.759	2.307	0.15	10.33	2%
THICKETWOOD A VENUE	DDLVS5951	DDLVS5953	3.00	0.70	0.00	0.35	107.09	0.104	0.104	34.0	0.30	1621	4.759	2.307	0.25	10.58	2%
THICKETWOOD A VENUE	DDLVS5953	DDLVS5954	3.14	0.70	0.10	1.31	105.75	0.385	0.385	43.3	0.30	1621	4.759	2.307	0.31	10.89	8%
THICKETWOOD A VENUE	DDLVS5954	DDLVS5973	3.07	0.70	0.05	1.36	104.12	0.393	0.393	24.6	0.29	1621	4.679	2.268	0.18	11.07	8%

5-Year Storm Design
BARRIE LOCKHART ROAD GP INC.
CITY OF BARRIE

Rainfall Intensity (i) = $\frac{A}{(Tc+B)^C}$ A= 853.61 B= 4.699 c= 0.766

Starting Tc (min)= 10

Legend:
- 1821 — Equivalent pipe diameter for 1800x1200 box culvert, based on hydraulic capacity with same slope
- 1859 — Equivalent pipe diameter for 2400x1200 box culvert, based on hydraulic capacity with same slope
- Pipe sized for 100 Year Storm

Project: BARRIE LOCKHART ROAD GP INC.
Project No. 2000
Date: 6-Nov-20
Designed By: R.S.H/M.A.M
Reviewed By: P.S

LOCATION			5 YEAR							TOTAL FLOW	PIPE DATA								
STREET	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	5-YEAR AREA (ha)	RUNOFF COEFF. (R)	"AR"	ACCUM. "AR"	RAINFALL INTENSITY (mm/hr)	ACCUM. FLOW (m3/s)	TOTAL (Q dev) (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	TIME OF CONC. (min)	ACCUM. TIME OF CONC. (min)	CAPACITY (% FULL) Qdev/Qcap
SHIPLEY CRESENT	DDLVS5959	DDLVS5960	0.68	0.77	0.52	0.52	108.92	0.158	0.158	66.1	1.40	375	0.207	1.878	0.59	10.59	76%
SHIPLEY CRESENT	DDLVS5960	DDLVS5961	0.11	0.70	0.08	0.60	105.70	0.176	0.176	12.1	0.50	450	0.201	1.268	0.16	10.75	88%
BLOCK 18A (REAR LOT AREA)	DDLVS6125	DDLVS5961	0.14	0.70	0.10	0.10	108.92	0.030	0.030	10.2	0.50	250	0.042	0.857	0.20	10.20	71%
FENCHURCH MANOR	DDLVS5961	DDLVS5962	0.24	0.74	0.18	0.88	104.83	0.255	0.255	60.1	0.50	525	0.304	1.485	0.72	11.47	84%
FENCHURCH MANOR	DDLVS5962	DDLVS5965	0.02	0.74	0.01	0.89	101.23	0.251	0.251	12.8	0.50	525	0.304	1.485	0.14	11.62	82%
BLOCK 16A (REAR LOT AREA)	DDLVS6126	DDLVS5963	0.10	0.70	0.07	0.07	108.92	0.021	0.021	34.0	0.50	250	0.042	0.857	0.66	10.66	50%
SHIPLEY CRESENT	DDLVS5965	DDLVS5964	0.66	0.70	0.46	0.53	105.31	0.156	0.156	53.8	1.00	375	0.175	1.587	0.56	11.22	89%
SHIPLEY CRESENT	DDLVS5964	DDLVS5965	0.17	0.70	0.12	0.65	102.48	0.185	0.185	55.2	2.00	375	0.248	2.245	0.41	11.63	75%
ABBEY CRESENT	DDLVS5965	DDLVS5966	0.63	0.70	0.44	1.98	100.50	0.554	0.554	55.1	1.95	600	0.857	3.033	0.53	12.15	65%
ABBEY CRESENT	DDLVS5966	DDLVS5967	0.27	0.70	0.19	2.17	98.09	0.592	0.592	17.7	2.00	600	0.868	3.071	0.10	12.25	68%
ABBEY CRESENT	DDLVS5967	DDLVS5968	0.21	0.70	0.15	2.32	97.66	0.629	0.629	73.6	2.00	600	0.868	3.071	0.29	12.54	72%
ABBEY CRESENT	DDLVS5968	DDLVS5973	0.00	0.70	0.00	2.32	96.40	0.623	0.621	11.6	3.00	600	1.063	3.761	0.05	12.59	58%
LOT XX (REAR LOT AREA)	DDLVS5988	DDLVS5988	0.07	0.70	0.05	0.05	108.92	0.015	0.015	33.7	0.50	250	0.042	0.857	0.66	10.66	35%
BLOCK 130A (REAR LOT AREA)	DDLVS6129	DDLVS5988	0.14	0.70	0.10	0.10	108.92	0.030	0.030	37.4	0.50	250	0.042	0.857	0.73	10.73	71%
REDHILL CRESENT	DDLVS5988	DDLVS5969	0.32	0.70	0.22	0.37	104.96	0.108	0.108	27.7	1.00	375	0.175	1.587	0.29	11.02	62%
BLOCK 131A (REAR LOT AREA)	DDLVS6130	DDLVS5969	0.09	0.70	0.06	0.06	108.92	0.019	0.019	37.4	0.50	250	0.042	0.857	0.73	10.73	45%
BLOCK 49B (REAR LOT AREA)	DDLVS6131	DDLVS5969	0.12	0.70	0.08	0.08	108.92	0.025	0.025	33.7	0.50	250	0.042	0.857	0.66	10.66	60%
BLOCK 132A (REAR LOT AREA)	DDLVS6127	DDLVS5969	0.15	0.70	0.11	0.11	108.92	0.032	0.032	37.6	0.50	250	0.042	0.857	0.73	10.73	76%
REDHILL CRESENT	DDLVS5969	DDLVS5970	0.70	0.71	0.56	1.18	103.47	0.340	0.340	100.0	1.70	525	0.560	2.590	0.64	11.66	61%
KINGSBURY TRAIL	DDLVS5970	DDLVS5971	0.61	0.70	0.43	1.61	100.34	0.449	0.449	100.0	3.00	525	0.745	3.441	0.48	12.15	60%
KINGSBURY TRAIL	DDLVS5971	DDLVS5972	0.38	0.70	0.27	4.20	96.18	1.121	1.121	59.1	2.50	675	1.328	3.714	0.27	12.86	84%
KINGSBURY TRAIL	DDLVS5972	DDLVS5973	0.19	0.70	0.13	4.33	95.06	1.143	1.143	28.3	2.40	750	1.724	3.904	0.12	12.98	66%
THICKETWOOD A VENUE	DDLVS5973	DDLVS5974	0.21	0.70	0.15	5.83	94.56	1.532	1.532	63.2	0.29	1859	6.743	2.485	0.42	13.40	23%
THICKETWOOD A VENUE	DDLVS5974	DDLVS5975	0.04	0.70	0.03	5.86	92.86	1.512	1.512	12.4	0.30	1859	6.858	2.528	0.08	13.49	22%
THICKETWOOD A VENUE	DDLVS5975	DDLVS5976	0.06	0.70	0.04	5.90	92.53	1.518	1.518	50.7	0.30	1859	6.858	2.528	0.39	13.87	22%
PARK (BLOCK 122A)	DDLVS5977	DDLVS5976	0.56	0.30	0.17	0.17	102.72	0.048	0.048	80.2	3.00	300	0.167	2.370	0.67	11.24	29%
THICKETWOOD A VENUE	DDLVS5976	DDLVS5978	0.00	0.70	0.00	6.07	98.05	1.536	1.536	86.7	0.30	1859	6.858	2.528	0.11	13.98	22%
THICKETWOOD A VENUE	DDLVS5978	DDLVS5982	0.33	0.70	0.23	6.30	96.64	1.587	1.587	71.7	0.30	1859	6.858	2.528	0.21	14.19	23%
LOCKHART ROAD	EXT 2	DDLVS5992	0.44	0.73	0.32	0.32	108.92	0.097	0.097	1.0	0.50	375	0.124	1.123	0.01	10.01	78%
BALL GATE	DDLVS5992	DDLVS5993	0.30	0.84	0.25	0.57	108.84	0.173	0.173	89.0	0.50	525	0.304	1.485	1.06	11.07	57%
BALL GATE	DDLVS5993	DDLVS5990	0.51	0.84	0.43	1.00	103.21	0.287	0.287	74.8	2.25	525	0.645	2.980	0.41	11.48	45%
MIXED USE (BLOCK 121A)	DDLVS5957	DDLVS5958	0.55	0.74	0.46	0.46	101.93	0.131	0.131	15.6	1.00	375	0.175	1.587	0.16	11.49	75%
FENCHURCH MANOR	DDLVS5958	DDLVS5956	0.33	0.74	0.24	0.71	101.14	0.198	0.198	56.4	1.15	450	0.306	1.922	0.49	11.98	65%
MIXED USE (BLOCK 121A)	DDLVS5955	DDLVS5956	0.62	0.84	0.52	0.52	101.93	0.147	0.147	15.1	1.00	375	0.175	1.587	0.16	11.49	84%
FENCHURCH MANOR	DDLVS5956	DDLVS5960	0.12	0.74	0.09	1.32	98.86	0.361	0.361	40.9	1.00	525	0.430	1.987	0.34	12.33	84%
BLOCK 127A (REAR LOT AREA)	DDLVS6133	DDLVS5990	0.07	0.70	0.05	0.05	108.92	0.015	0.015	11.4	1.00	250	0.059	12.1	0.16	10.16	25%
BALL GATE	DDLVS5990	DDLVS5995	0.48	0.74	0.36	2.72	97.33	0.736	0.736	83.1	2.30	600	0.931	3.293	0.42	12.75	79%
STREET C	DDLVS5994	DDLVS5995	0.16	0.74	0.12	0.12	108.92	0.036	0.036	8.8	0.50	450	0.201	1.268	0.12	10.12	18%
BALL GATE	DDLVS5995	DDLVS5997	0.25	0.74	0.19	3.03	95.53	0.803	0.803	34.2	2.00	600	0.868	3.071	0.40	13.15	92%
STREET B	DDLVS5996	DDLVS5997	0.16	0.74	0.12	0.12	108.92	0.036	0.036	8.8	0.50	450	0.201	1.268	0.12	10.12	18%
BALL GATE	DDLVS5997	DDLVS5998	0.14	0.74	0.10	3.25	93.87	0.847	0.847	64.8	1.45	675	1.012	2.829	0.38	13.53	84%
BALL GATE	DDLVS5998	DDLVS5979	0.00	0.30	0.00	3.25	92.36	0.833	0.833	8.3	1.45	675	1.012	2.829	0.05	13.58	82%
THICKETWOOD A VENUE	EXT 3	DDLVS5979	0.21	0.74	0.17	0.17	108.92	0.051	0.051	12.9	2.00	450	0.403	2.515	0.08	10.08	13%
THICKETWOOD A VENUE	DDLVS5979	DDLVS5999	0.16	0.70	0.11	3.53	92.17	0.904	0.904	51.3	2.00	675	1.188	3.322	0.26	13.84	70%
THICKETWOOD A VENUE	DDLVS5999	DDLVS5981	0.33	0.70	0.23	3.76	91.19	0.952	0.952	51.3	2.00	675	1.188	3.322	0.26	14.10	80%
SCHOOL (BLOCK 123A)	BLK123A	DDLVS5980	2.43	0.76	1.85	1.85	98.02	0.503	0.503	80.6	1.00	675	0.840	2.349	0.08	12.25	60%
THICKETWOOD A VENUE	DDLVS5980	DDLVS5981	0.12	0.70	0.08	1.93	97.69	0.524	0.524	8.0	1.00	675	0.840	2.349	0.06	12.25	62%
THICKETWOOD A VENUE	DDLVS5981	DDLVS5982	0.00	0.70	0.00	5.69	90.23	1.426	1.426	4.2	0.70	900	1.514	2.381	0.03	14.12	94%
SWM POND (BLOCK 124A)	DDLVS5982	DDLVS5983	0.00	0.70	0.00	11.99	89.87	2.994	2.994	30.7	0.30	1859	6.858	2.528	0.20	14.40	44%
SWM POND (BLOCK 124A)	DDLVS5983	DDLVS5984	0.00	0.70	0.00	11.99	89.14	2.970	2.970	22.1	0.30	1859	6.858	2.528	0.15	14.55	43%
SWM POND (BLOCK 124A)	DDLVS5984	HW1	0.00	0.70	0.00	11.99	88.61	2.952	2.952	30.2	0.30	1859	6.858	2.528	0.20	14.75	43%
THICKETWOOD A VENUE	DDLVS5985	DDLVS5986	0.45	0.70	0.32	0.32	108.92	0.095	0.095	22.1	6.50	300	0.246	3.488	0.11	10.11	39%
THICKETWOOD A VENUE	DDLVS5986	DDLVS5987	0.34	0.70	0.24	0.55	108.32	0.166	0.166	57.8	4.25	375	0.361	3.273	0.29	10.40	46%
LOT 158 (REAR LOT AREA)	DDLVS6132	DDLVS5987	0.16	0.70	0.11	0.11	108.92	0.034	0.034	38.9	5.00	250	0.133	2.709	0.24	10.24	25%
THICKETWOOD A VENUE	DDLVS5987	EXS1H1	0.17	0.70	0.12	0.78	106.69	0.232	0.232	36.1	2.35	375	0.269	2.434	0.25	10.65	86%
THICKETWOOD A VENUE	EXMH1	EXS1H2	0.17	0.70	0.12	0.90	105.37	0.264	0.264	36.1	1.20	525	0.471	2.176	0.28	10.93	56%

5-Year Storm Design
BARRIE LOCKHART ROAD GP INC.
CITY OF BARRIE
DOWNSTREAM CAPACITY ANALYSIS

Rainfall Intensity (i) = $\frac{A}{(Tc+B)^C}$ A= 853.61 B= 4.699 c= 0.766

Starting Tc (min)= 10

Legend:
- Existing sewers

Project: BARRIE LOCKHART ROAD GP INC.
Project No. 2000
Date: 11-Nov-20
Designed By: J.F
Reviewed By: P.S

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LOCATION			5 YEAR						TOTAL FLOW	PIPE DATA							
STREET	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	5-YEAR AREA (ha)	RUNOFF COEFF. (R)	"AR"	ACCUM. "AR"	RAINFALL INTENSITY (mm/hr)	ACCUM. FLOW (m3/s)	TOTAL (Q dev) (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	TIME OF CONC. (min)	ACCUM. TIME OF CONC. (min)	CAPACITY (% FULL) Qdev/Qcap
THICKETWOOD A VENUE	DDLVS5985	DDLVS5986	0.45	0.70	0.32	0.32	108.92	0.095	0.095	22.5	6.50	300	0.246	3.488	0.11	10.11	39%
THICKETWOOD A VENUE	DDLVS5986	DDLVS5987	0.34	0.70	0.24	0.55	108.32	0.166	0.166	57.8	4.35	375	0.365	3.311	0.29	10.40	46%
LOT 158 (REAR LOT AREA)	DDLVS6132	DDLVS5987	0.16	0.70	0.11	0.11	108.92	0.034	0.034	38.9	5.00	250	0.133	2.709	0.24	10.24	25%
THICKETWOOD A VENUE	DDLVS5987	EXMH23	0.17	0.70	0.12	0.78	106.71	0.232	0.232	36.3	2.35	375	0.269	2.434	0.25	10.65	87%
THICKETWOOD A VENUE	EXMH23	EXMH22	0.12	0.48	0.06	0.84	105.39	0.246	0.246	39.5	1.20	450	0.312	1.964	0.34	10.98	79%
INTERNAL BNDY 3 (SE)	INT3	EXMH18	0.63	0.40	0.25	0.25	104.63	0.073	0.073	1.0	3.80	300	0.188	2.667	0.01	10.80	39%
EXTERNAL BNDY 1	EXT1	EXMH19	0.14	0.70	0.10	0.10	108.92	0.030	0.030	1.0	1.00	375	0.175	1.587	0.01	10.01	17%
FENCHURCH MANOR	EXMH19	EXMH18	0.15	0.40	0.06	0.16	108.86	0.048	0.048	40.2	0.82	375	0.159	1.438	0.47	10.48	30%
EXTERNAL BNDY 2	RLCB2	EXMH18	0.09	0.70	0.06	0.06	108.92	0.019	0.019	37.7	3.50	300	0.181	2.559	0.25	10.25	11%
BARTOR BOULEVARD	EXMH18	EXMH20	0.48	0.40	0.19	0.67	104.60	0.193	0.193	88.5	2.60	450	0.459	2.891	0.51	11.31	42%
EXTERNAL BNDY 3	RLCB3	EXMH20	0.11	0.70	0.08	0.08	108.92	0.023	0.023	37.7	6.90	300	0.254	3.594	0.17	10.17	9%
BARTOR BOULEVARD	EXMH20	EXMH21	0.57	0.40	0.23	0.97	102.04	0.275	0.275	88.5	3.50	450	0.533	3.354	0.44	11.75	52%
EXTERNAL BNDY 4	RLCB4	EXMH21	0.10	0.70	0.07	0.07	108.92	0.021	0.021	39.5	4.70	300	0.210	2.966	0.22	10.22	10%
BARTOR BOULEVARD	EXMH21	EXMH22	0.60	0.40	0.24	1.28	99.94	0.355	0.355	88.4	3.70	450	0.548	3.448	0.43	12.18	65%
THICKETWOOD A VENUE	EXMH22	EXMH24	0.47	0.40	0.19	2.31	98.00	0.629	0.629	92.8	0.54	900	1.330	2.091	0.74	12.91	47%
INTERNAL BNDY 2 (EAST)	INT2	EXMH24	4.18	0.40	1.67	1.67	98.41	0.457	0.457	1.0	2.50	525	0.680	3.141	0.01	12.09	67%
THICKETWOOD A VENUE	EXMH24	EXMH29	0.25	0.40	0.10	4.08	94.83	1.075	1.075	70.0	0.28	900	0.957	1.506	0.77	13.69	112%
THICKETWOOD A VENUE	EXMH29	EXMH30	0.78	0.40	0.

THICKETWOOD AVENUE

MICHELLE DRIVE

BARTER BOULEVARD

HENLOW TRAIL

WEMBLEY GATE

MILADY GROVE

ASCOT LANE

KINGSBURY TRAIL

ABBEY CRESCENT

BALL GATE

FENCHURCH MANOR

WATFORD CRESCENT

ADDINGTON HEIGHTS

REDHILL CRESCENT

SHIPLEY CRESCENT

PRISCILLAS PLACE

LOCKHART ROAD

HYBRID BIOSWALE/INFILTRATION TRENCH
337.0 m LONG, 4.0 m WIDE
DEPTH VARIES (SEE DETAIL ON DWG SWM3)

STORMCEPTOR
EF08

JF10-17-4(3000mmØ)
JELLYFISH SYSTEM

STORMWATER MANAGEMENT FACILITY

FUTURE RESIDENTIAL

FUTURE SWMF #1

BUSH

REMAINS OF RAIL AND WIRE FENCE

1.22ha	501	72%
0.40ha	404	67%
2.84ha	405	50%
0.35ha	409	72%
6.18ha	408	72%
22.61ha	401	71%
0.34ha	502	72%
0.23ha	406	74%
2.99ha	402	72%
0.61ha	407	74%
1.26ha	403	74%

LEGEND:

- PROPERTY LIMIT
- HYBRID BIOSWALE
- PROPOSED STORM DRAINAGE BOUNDARY
- EXISTING CONTOUR AND ELEVATION
- PROPOSED STORM SEWER/MANHOLE
- DRAINAGE AREA (HECTARES)
- % IMPERVIOUS
- CATCHMENT ID
- MINOR SYSTEM FLOW
- MAJOR SYSTEM OVERLAND FLOW ROUTE

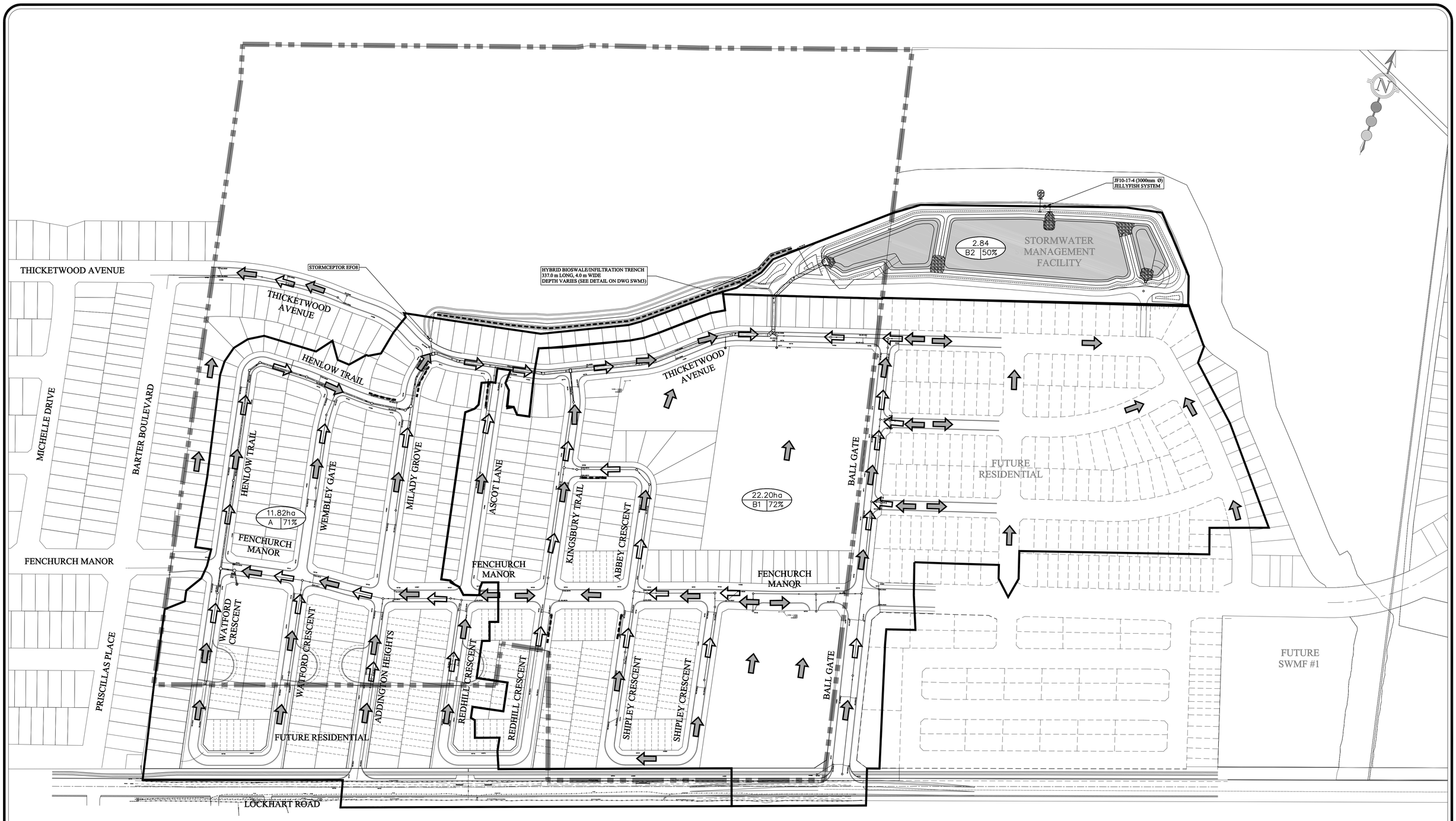
SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

BARRIE LOCKHART ROAD - SORBARA

PROPOSED STORM DRAINAGE PLAN

DESIGNED BY: M.T.T.	CHECKED BY: J.M.P.	PROJECT No: 2000	FIGURE No: 4.1
SCALE: 1:1500	DATE: NOVEMBER 2020		

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MARKHAM, ONTARIO L3R 8B8
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LEGEND:

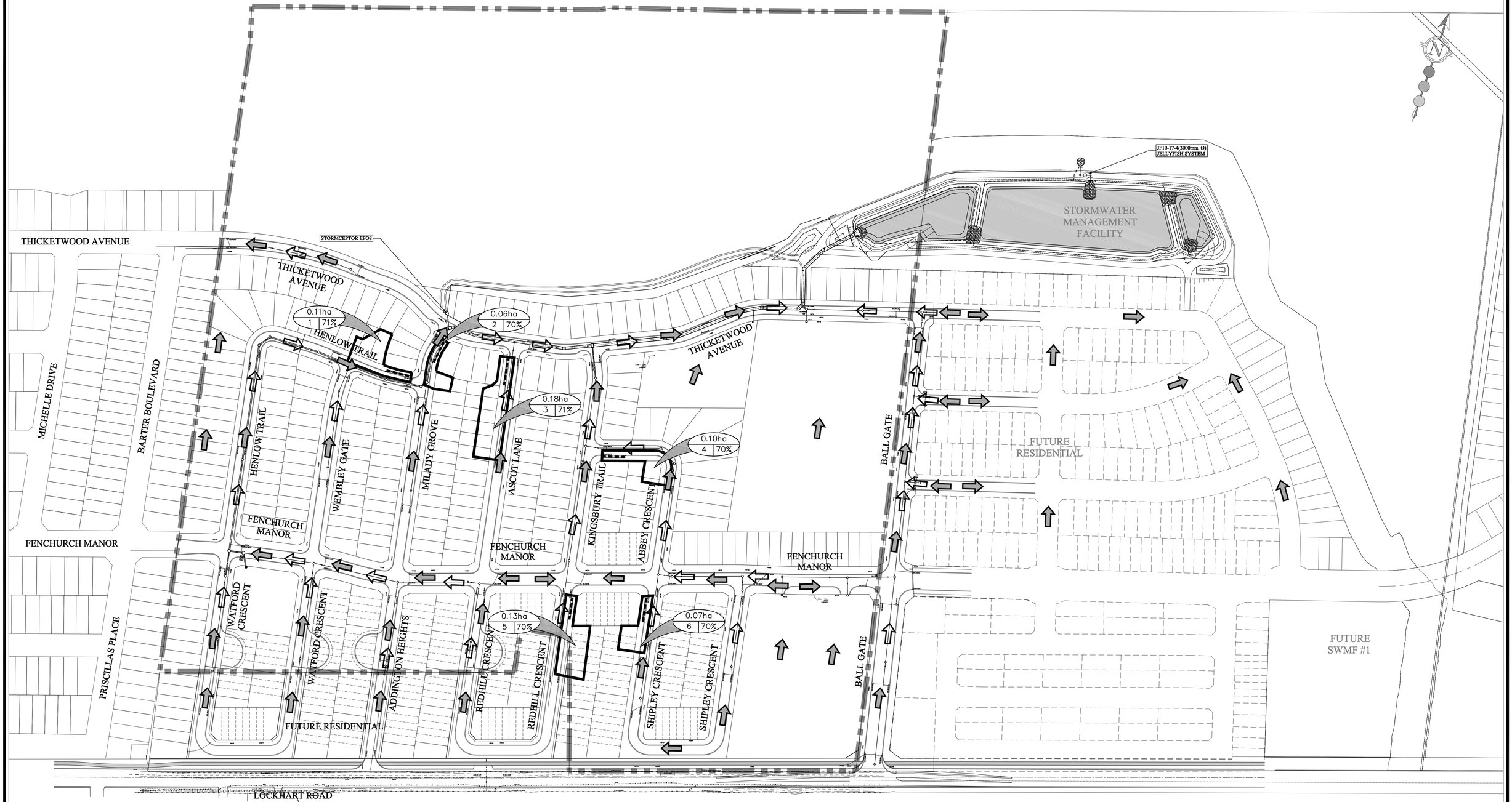
- PROPERTY LIMIT
- PROPOSED STORM SEWER/MANHOLE
- PROPOSED STORM DRAINAGE BOUNDARY
- HYBRID BIOSWALE
- DRAINAGE AREA (HECTARES)
- % IMPERVIOUS
- CATCHMENT ID (e.g. 11.82ha / A / 71%)
- MINOR SYSTEM FLOW
- MAJOR SYSTEM OVERLAND FLOW ROUTE
- PROPOSED RAIN GARDEN (SEE FIGURE 4.3 FOR DRAINAGE BOUNDARIES)

BARRIE LOCKHART ROAD - SORBARA

HYBRID BIOSWALE AND WETLAND DRAINAGE PLAN

DESIGNED BY: M.T.T.	CHECKED BY: J.M.P.	PROJECT No: 2000	FIGURE No: 4.2
SCALE: 1:1500	DATE: NOVEMBER 2020		

File: P:\2000 Barrie Lockhart Road – Sorbara\Drawings\Phase 1\Swm\Report Figures\2000-25 mm VOLUME CONTROL.dwg – Revised by <SVRBAN> : Mon, Nov 16 2020 – 10:39am



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TEL: (905) 475-1900
FAX: (905) 475-8335

LEGEND:

- PROPERTY LIMIT
- PROPOSED STORM SEWER/MANHOLE
- DRAINAGE AREA TO RAIN GARDEN
- PROPOSED RAIN GARDEN
- DRAINAGE AREA (HECTARES)
- % IMPERVIOUS
- CATCHMENT ID
- MINOR SYSTEM FLOW
- MAJOR SYSTEM OVERLAND FLOW ROUTE

BARRIE LOCKHART ROAD - SORBARA

PROPOSED RAIN GARDEN LOCATION AND DRAINAGE AREA PLAN

DESIGNED BY: M.T.T.	CHECKED BY: J.M.P.	PROJECT No: 2000	FIGURE No: 4.3
SCALE: 1:1500	DATE: NOVEMBER 2020		

File: P:\2000 Barrie Lockhart Road - Sorbara\Drawings\Phase 1\Swm\Report Figures\2000-SWMN-RAIN-GRDN-PROP-4.3.dwg - Revised by <SVRBAN> : Mon, Nov 16 2020 - 10:41am

Appendix B

Stormwater Management Calculations & Design Charts

- Area-Depth Curve for Quality and Drawdown Time Calculations for SWMF1
- Detailed Stage-Storage-Discharge Table for SWMF1
- SWMF1 Peak Flow Model Performance Summary
- Hydraulic Conveyance Calculations
    - SWMF1 Inlet Overland Flow Conveyance
    - SWMF2 Inlet Overland Flow Conveyance
- 5-year Storm Sewer Design Sheet
- Sanitary Sewer Design Sheet
- SWMF1 Jellyfish Filter Sizing Report
- Jellyfish Filter ETV Verification Statement

Storm Water Management Facility 1
SWMF1 Quality Design Notes

CLIENT: Lockhart Innisfil Investments (II) Limited

PROJECT: Lockhart Innisfil II

FILE: GOL-20538 (50)

DATE: Oct. 2021

DESIGN: MG

CHECKED: JWI

	Area (ha)	TIMP(%)
Total - Area 1	7.47	65.7%
Post Development Drainage Area	7.47	65.7%

Permanent Pool and Extended Detention Volumes:

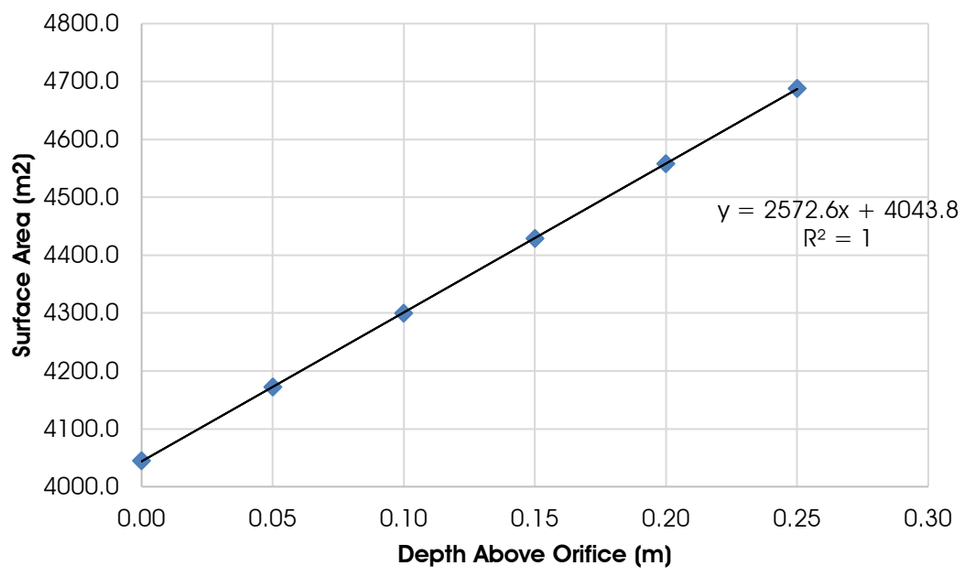
Drainage Area	7.47	ha
Imperviousness	65.7%	

Wet Pond

Imperviousness	Storage Vol.
0%	m^3/ha
35%	80 m^3/ha
55%	105 m^3/ha
70%	120 m^3/ha
85%	140 m^3/ha
100%	m^3/ha

Excerpt - MOE Table 3.2, March 2003

DRAWDOWN TIME



Volumetric Criteria:

Total Water Quality Volumetric Criteria	115.7	m^3/ha
Extended Detention Volumetric Criteria	40.0	m^3/ha
Permanent Pool Volumetric Criteria	75.7	m^3/ha

Source & Notes:

Conducted linear interpolation from MOE Table 3.2 for Enhanced Protection level wetland.

MOE Section 3.3.2

MOE Section 3.3.2

SWMF Volume Requirements:

Total Water Quality Volume (WQV) Required	864	m^3
Extended Detention Storage Volume Required	299	m^3/s
Permanent Pool Storage Volume Required	565	m^3
Extended Detention Volume Provided	1091	m^3
Permanent Pool Storage Volume Provided	1020	m^3
Total Water Quality Volume Provided	2111	m^3
PCSWMM 25mm 4hr CHI Water Quality Volume	698.4	m^3

Based on Eqn. 4.11 MOE SWM Planning and Design Manual

Hydraulic Detention Time		
Intercept of Regression, C3	4043.8	
Slope of Regression, C2	2572.6	
Orifice Area	0.0079	m^2
Invert Secondary Orifice Elevation	252.75	m
Depth over Primary Orifice Centroid (WQV WL)	0.200	m
Drawdown Time - Ultimate Ponding Level	174,490	Sec
	48.5	Hours
25mm Event Elevation	252.65	m
Depth over Orifice (WQV WL)	0.100	m
Drawdown Time - 25mm Event Ponding Level	120,897	Sec
	33.6	Hours

SWMF Drawdown Requirements:

Minimum Drawdown Time, MOE Table 4.7	24	Hours

Forebay Calculations:

Maximum Forebay Permanent Pool Area	809	m²
Total Permanent Pool Area Provided	4045	m²
Max. Percentage of total Permanent Pool Area	20	%

SWMF Forebay Requirements:

Forebay Width Provided	16	m
Forebay Length Provided	49	m
Forebay Depth Provided	1.00	m
Forebay Length : Width Ratio Provided	3.0	:1
Forebay Area Provided	762.35	m²
Minimum Forebay Length, MOE Table 4.7	31.0	m
Minimum Forebay Depth, MOE Table 4.7	1.00	m
Maximum Forebay Area, MOE Table 4.7	20	% of total
Minimum Forebay L : W, MOE Table 4.7	2.00	:1
Preferred Forebay L : W, MOE Table 4.7	3.00	:1

Maximum 1.0m ponding above permanent pool elevation during 10 year event.

MOE Equation 4.5 - Forebay Settling Length

Dist = SQRT((r*Q_p)/V_s)

Forebay Length Required	Dist	8.4	m
Length-to-width ratio of forebay	r	3.0	:1
Q_p from the pond during design quality storm	Q_p	0.007	m^3/s
Settling velocity	V_s	0.0003	m/s

MOE Equation 4.6 - Dispersion Length

Dist = (8*Q)/(d*Vf)

Length of dispersion	Dist	31.0	m
Inlet (Pipe Capacity) flowrate-5 yr	Q	1.937	m^3/s
Depth of the permanent pool in the forebay	d	1.00	m
Desired velocity in the forebay	Vf	0.50	m/s

Design Criteria Check:

Is Max. Required WQV Met?	YES
Is Min. Required Drawdown Time Met?	YES
Is Required Forebay Length Provided?	YES
Is Minimum Forebay Depth Provided?	YES
Is Maximum Forebay Area Provided?	YES
Is Minimum L : W Ratio Provided?	YES
Is Preferred L : W Ratio Provided?	YES

Additional Notes:

The 5 year inlet pipe capacity flow rate has been referenced from the governing 5 year storm events PCSWMM PF model.

Storm Water Management Facility 1
Hydraulic Calculation Sheet: Stage-Storage-Discharge

CLIENT: Lockhart Innisfil Investments (II) Limited

DATE: Oct. 2021

PROJECT: Lockhart Innisfil II

DESIGN: MG

FILE: GOL-20538 (50)

CHECKED: JWI

Extended Detention Orifice		
RADIUS	0.050	m
Outlet Diameter	100.0	mm
Invert Elevation	252.50	m

Tertiary Orifice		
RADIUS	0.000	m
Outlet Dia		mm
Invert Elevation		m

Weir 1 Details - Rectangular Section		
Invert Elevation	254.20	m
Length	10.00	m
Coefficient	1.705 (Broad-Crested)	

Secondary Orifice		
RADIUS	0.150	m
Outlet Diameter	300.0	mm
Invert Elevation	252.75	m

Weir 1 Details - Triangular Section		
Invert Elevation	254.20	m
Sideslope	10	H:1V
Coefficient	1.2 (MTO DC 2.46)	

	Minimum		Provided		Elevation	
Total Permanent Pool Volume:	565	m^3	1020	m^3	252.50	m
Extended Detention Volume:	299	m^3	1091	m^3	252.75	m

POND AREA	TOTAL STORAGE	ACTIVE DETENTION STORAGE	WATER DEPTH	EXT. DET. ORIFICE FLOW	SECONDARY ORIFICE FLOW	TERTIARY ORIFICE FLOW	TRAPEZOIDAL WEIR WITH 4H:1V SIDESLOPES			TOTAL OUTFLOW	ELEVATION	
							TRIANGULAR SECTION	RECTANGULAR SECTION	TOTAL WEIR FLOW			
m^2	m^3	m^3	m	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m	
17	0	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.20	**Bottom of Plunge Pool**
19	1	0	0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.25	
22	2	0	0.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.30	
25	3	0	0.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.35	
27	4	0	0.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.40	
30	6	0	0.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.45	
309	7	0	0.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.50	**Bottom of Forebay**
326	23	0	0.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.55	
344	40	0	0.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.60	
361	58	0	0.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.65	
379	76	0	0.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.70	
398	96	0	0.55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.75	
416	116	0	0.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.80	
435	137	0	0.65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.85	
454	159	0	0.70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.90	
474	183	0	0.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.95	
494	207	0	0.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.00	
529	232	0	0.85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.05	
566	260	0	0.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.10	
603	289	0	0.95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.15	
641	320	0	1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.20	
791	356	0	1.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.25	
968	400	0	1.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.30	
1595	451	0	1.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.35	Bottom of Wetland Main Cell
3735	634	0	1.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.40	
3859	824	0	1.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.45	
4045	1,020	0	1.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.50	**Permanent Pool**
4172	1,226	205	1.35	0.001	0.000	0.000	0.000	0.000	0.000	0.001	252.55	
4300	1,437	417	1.40	0.005	0.000	0.000	0.000	0.000	0.000	0.005	252.60	
4429	1,656	635	1.45	0.007	0.000	0.000	0.000	0.000	0.000	0.007	252.65	25mm WQE (252.650m)
4558	1,880	860	1.50	0.008	0.000	0.000	0.000	0.000	0.000	0.008	252.70	
4688	2,111	1,091	1.55	0.010	0.000	0.000	0.000	0.000	0.000	0.010	252.75	**Extended Detention**
4818	2,349	1,329	1.60	0.011	0.006	0.000	0.000	0.000	0.000	0.017	252.80	
4950	2,593	1,573	1.65	0.012	0.009	0.000	0.000	0.000	0.000	0.021	252.85	2Yr 24Hr SCS (252.837m)
5081	2,844	1,824	1.70	0.013	0.014	0.000	0.000	0.000	0.000	0.027	252.90	
5214	3,101	2,081	1.75	0.014	0.044	0.000	0.000	0.000	0.000	0.058	252.95	
5483	3,365	2,345	1.80	0.015	0.062	0.000	0.000	0.000	0.000	0.077	253.00	5Yr 24Hr SCS (252.985m)
5561	3,642	2,621	1.85	0.015	0.076	0.000	0.000	0.000	0.000	0.092	253.05	
5639	3,922	2,901	1.90	0.016	0.088	0.000	0.000	0.000	0.000	0.104	253.10	10Yr 24Hr SCS (253.077m)
5717	4,205	3,185	1.95	0.017	0.099	0.000	0.000	0.000	0.000	0.116	253.15	
5796	4,493	3,473	2.00	0.018	0.108	0.000	0.000	0.000	0.000	0.126	253.20	25Yr 6Hr SCS (253.198m)
5875	4,785	3,765	2.05	0.018	0.117	0.000	0.000	0.000	0.000	0.135	253.25	
5954	5,081	4,061	2.10	0.019	0.125	0.000	0.000	0.000	0.000	0.144	253.30	50Yr 6Hr SCS (253.292m)
6034	5,380	4,360	2.15	0.020	0.132	0.000	0.000	0.000	0.000	0.152	253.35	
6114	5,684	4,664	2.20	0.020	0.139	0.000	0.000	0.000	0.000	0.160	253.40	100Yr 6Hr SCS (253.385m)
6195	5,992	4,972	2.25	0.021	0.146	0.000	0.000	0.000	0.000	0.167	253.45	
6276	6,304	5,283	2.30	0.021	0.153	0.000	0.000	0.000	0.000	0.174	253.50	
6357	6,619	5,599	2.35	0.022	0.159	0.000	0.000	0.000	0.000	0.181	253.55	
6439	6,939	5,919	2.40	0.022	0.165	0.000	0.000	0.000	0.000	0.187	253.60	
6522	7,263	6,243	2.45	0.023	0.171	0.000	0.000	0.000	0.000	0.194	253.65	
6604	7,592	6,571	2.50	0.023	0.176	0.000	0.000	0.000	0.000	0.200	253.70	
6687	7,924	6,904	2.55	0.024	0.182	0.000	0.000	0.000	0.000	0.206	253.75	
6771	8,260	7,240	2.60	0.024	0.187	0.000	0.000	0.000	0.000	0.212	253.80	
6854	8,601	7,581	2.65	0.025	0.192	0.000	0.000	0.000	0.000	0.217	253.85	
6938	8,946	7,926	2.70	0.025	0.197	0.000	0.000	0.000	0.000	0.223	253.90	Hazel (253.892m)
7023	9,295	8,275	2.75	0.026	0.202	0.000	0.000	0.000	0.000	0.228	253.95	
7108	9,648	8,628	2.80	0.026	0.207	0.000	0.000	0.000	0.000	0.233	254.00	
7193	10,006	8,985	2.85	0.027	0.211	0.000	0.000	0.000	0.000	0.238	254.05	
7279	10,367	9,347	2.90	0.027	0.216	0.000	0.000	0.000	0.000	0.243	254.10	
7365	10,733	9,713	2.95	0.028	0.220	0.000	0.000	0.000	0.000	0.248	254.15	
7452	11,104	10,084	3.00	0.028	0.225	0.000	0.000	0.000	0.000	0.253	254.20	**Overflow Weir**
7539	11,479	10,458	3.05	0.029	0.229	0.000	0.007	0.191	0.197	0.455	254.25	
7626	11,858	10,838	3.10	0.029	0.233	0.000	0.038	0.539	0.577	0.839	254.30	
7714	12,241	11,221	3.15	0.029	0.237	0.000	0.105	0.991	1.095	1.362	254.35	
7802	12,629	11,609	3.20	0.030	0.241	0.000	0.215	1.525	1.740	2.011	254.40	
7890	13,021	12,001	3.25	0.030	0.245	0.000	0.375	2.131	2.506	2.782	254.45	
7979	13,418	12,398	3.30	0.031	0.249	0.000	0.592	2.802	3.393	3.673	254.50	
8068	13,819	12,799	3.35	0.031	0.253	0.000	0.870	3.530	4.400	4.684	254.55	
8158	14,225	13,205	3.40	0.031	0.257	0.000	1.214	4.313	5.528	5.816	254.60	
9079	14,656	13,636	3.45	0.032	0.261	0.000	1.630	5.147	6.777	7.070	254.65	
10013	15,134	14,113	3.50	0.032	0.265	0.000	2.121	6.028	8.149	8.446	254.70	**Top of Pond**

Storm Water Management Facility 1
Hydraulic Calculation Sheet: Stage-Storage-Discharge

CLIENT: Lockhart Innisfil Investments (II) Limited

PROJECT: Lockhart Innisfil II

FILE: GOL-20538 (50)

DATE: Oct. 2021

DESIGN: MG

CHECKED: JWI

Extended Detention Orifice		
RADIUS	0.050	m
Outlet Diameter	100.0	mm
Invert Elevation	252.50	m

Tertiary Orifice		
RADIUS	0.000	m
Outlet Dia		mm
Invert Elevation		m

Weir 1 Details - Rectangular Section		
Invert Elevation	254.20	m
Length	10.00	m
Coefficient	1.705 (Broad-Crested)	

Secondary Orifice		
RADIUS	0.150	m
Outlet Diameter	300.0	mm
Invert Elevation	252.75	m

Weir 1 Details - Triangular Section		
Invert Elevation	254.20	m
Sideslope	10	H:1V
Coefficient	1.2 (MTO DC 2.46)	

	Minimum		Provided		Elevation	
Total Permanent Pool Volume:	565	m^3	1020	m^3	252.50	m
Extended Detention Volume:	299	m^3	1091	m^3	252.75	m

POND AREA	TOTAL STORAGE	ACTIVE DETENTION STORAGE	WATER DEPTH	EXT. DET. ORIFICE FLOW	SECONDARY ORIFICE FLOW	TERTIARY ORIFICE FLOW	TRAPEZOIDAL WEIR WITH 4H:1V SIDESLOPES			TOTAL OUTFLOW	ELEVATION
							TRIANGULAR SECTION	RECTANGULAR SECTION	TOTAL WEIR FLOW		
m^2	m^3	m^3	m	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m

Orifice Outflow equation is for orifice flow given by: $Q=0.63A(2gH)^{0.5}$ Where ponding elevation is above orifice centroid

$Q=1.65\{[(\pi D^2/4)([2\cos^{-1}\{[(D/2)-H]/[D/2]\}\{180/\pi\}]/360)-([\{D/2\}-H][DH-H^2]\ \hat{}\ [1/2])/H]\}H\ \hat{}\ (1.5)$ Where ponding elevation is at or below orifice centroid

Flow over the top of the weir is given by weir flow $Q=1.705LH^{1.5}$ Where the weir is rectangular in shape

$Q=1.2*\tan(angle/2)*H^{2.5}$ Where the weir is triangular in shape

Where: Q=flow m^3/s

H=head m

Orifice head measured from water depth to orifice centroid (where ponding elevation is above orifice centroid).
Orifice head measured from water depth to orifice invert (where ponding elevation is at or below orifice centroid).

H = Weir head = depth from weir crest to water level
D=orifice diameter m
L=weir length m
g=9.81 m/s^2
A=Area of orifice opening m^2

Shaded rows were entered into PCSWMM pond rating curve.

Storm Water Management Facility 1
PF Model Performance Summary

CLIENT: Lockhart Innisfil Investments (II) Limited

DATE: Oct. 2021

PROJECT: Lockhart Innisfil II

DESIGN: MG

FILE: GOL-20538 (50)

CHECKED: JWI

Storm Peak Event Flow (m^3/s) - SWMF1 Lockhart Innisfil II							
Storm Distribution	**Area (ha)**	**Return Period (years)**					
		2	**5**	**10**	**25**	**50**	**100**
Unitary Discharge Rates ($m^3/s/ha$) from SIS		0.006	0.014	0.021	0.030	0.038	0.046
Erosion Control Unitary Discharge Rate		0.0011					
Target Flow Rate	**7.97**	0.048	0.112	0.167	0.239	0.303	0.366
Target Erosion Control Discharge Rate	**7.97**	0.009					
Post Development Condition (OF-1)							
CHI 4-Hr Storm Distribution	7.97	0.013	0.046	0.072	0.112	0.143	0.177
SCS 6-Hr Storm Distribution	7.97	0.026	0.100	0.154	0.222	0.263	0.303
SCS 12-Hr Storm Distribution	7.97	0.022	0.089	0.137	0.198	0.238	0.271
SCS 24-Hr Storm Distribution	7.97	0.029	0.102	0.152	0.214	0.250	0.287
25mm 4-Hr Storm Distribution	7.97	0.007					
Hazel Storm	7.97	0.253					

Maximum Ponding Depth above Permanent Pool (m) - SWMF1 Lockhart Innisfil II						
Storm Distribution	**Return Period (years)**					
	2	**5**	**10**	**25**	**50**	**100**
CHI 4-Hr Storm Distribution	0.284	0.403	0.484	0.583	0.654	0.728
SCS 6-Hr Storm Distribution	0.320	0.475	0.573	0.698	0.792	0.885
SCS 12-Hr Storm Distribution	0.316	0.456	0.547	0.658	0.743	0.826
SCS 24-Hr Storm Distribution	0.337	0.485	0.577	0.695	0.784	0.870
25mm 4-Hr Storm Distribution	0.150					
Hazel Storm	1.392					

MOE criteria stipulates wetlands shall have 1.0 m maximum ponding above the permanent pool elevation for storms less than or equal to the 10 year event.

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 6 2021

GOL-20538 Lockhart II SWMF1 Overland Flow Inlet Channel

Trapezoidal

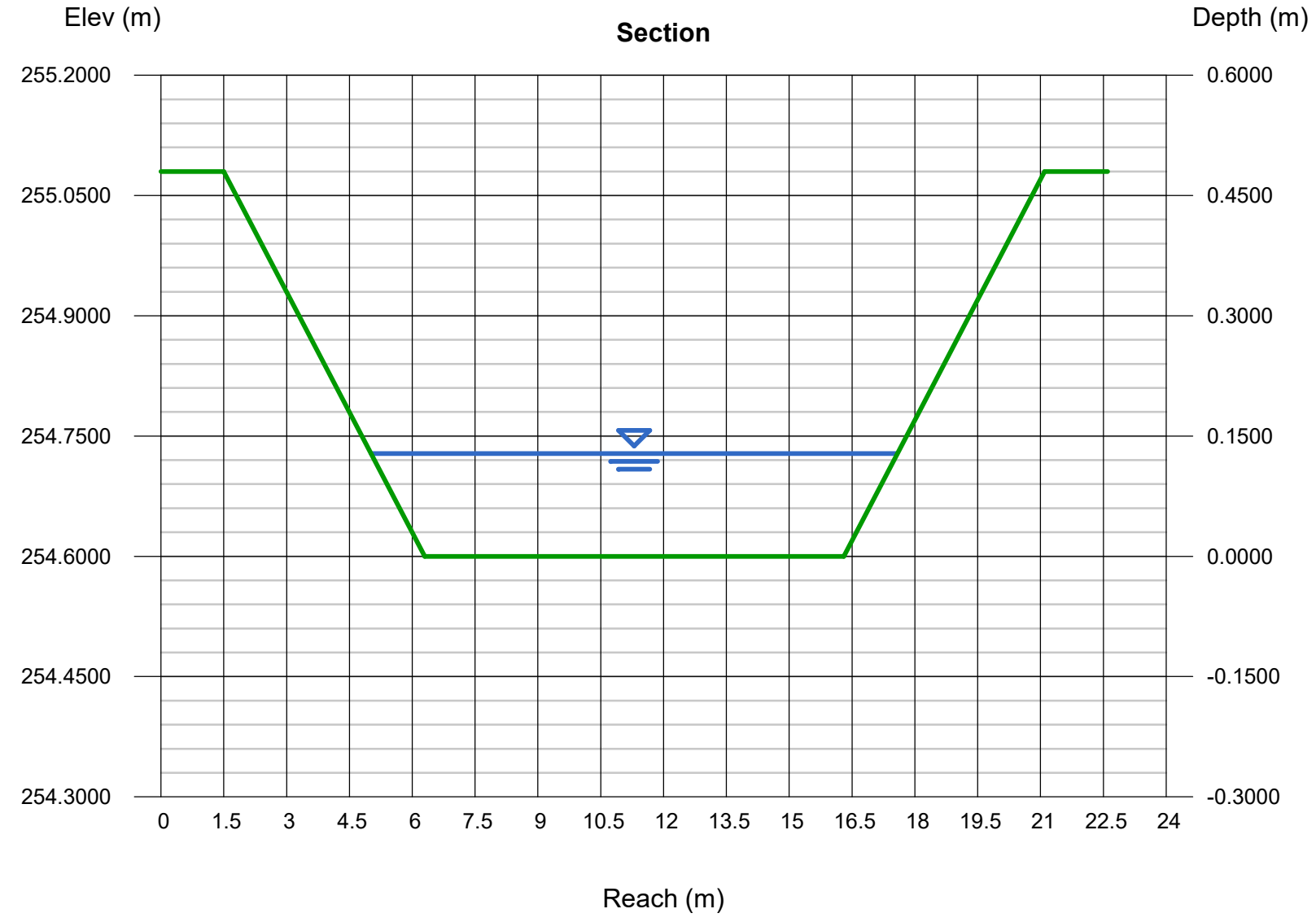
Bottom Width (m)	= 10.0000
Side Slopes (z:1)	= 10.0000, 10.0000
Total Depth (m)	= 0.4800
Invert Elev (m)	= 254.6000
Slope (%)	= 2.0000
N-Value	= 0.020

Calculations

Compute by:	Known Q
Known Q (cms)	= 2.3750

Highlighted

Depth (m)	= 0.1280
Q (cms)	= 2.3750
Area (sqm)	= 1.4440
Velocity (m/s)	= 1.6447
Wetted Perim (m)	= 12.5731
Crit Depth, Yc (m)	= 0.1707
Top Width (m)	= 12.5603
EGL (m)	= 0.2660



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 6 2021

GOL-20538 Lockhart II SWMF2 Overland Flow Inlet Channel

Rectangular

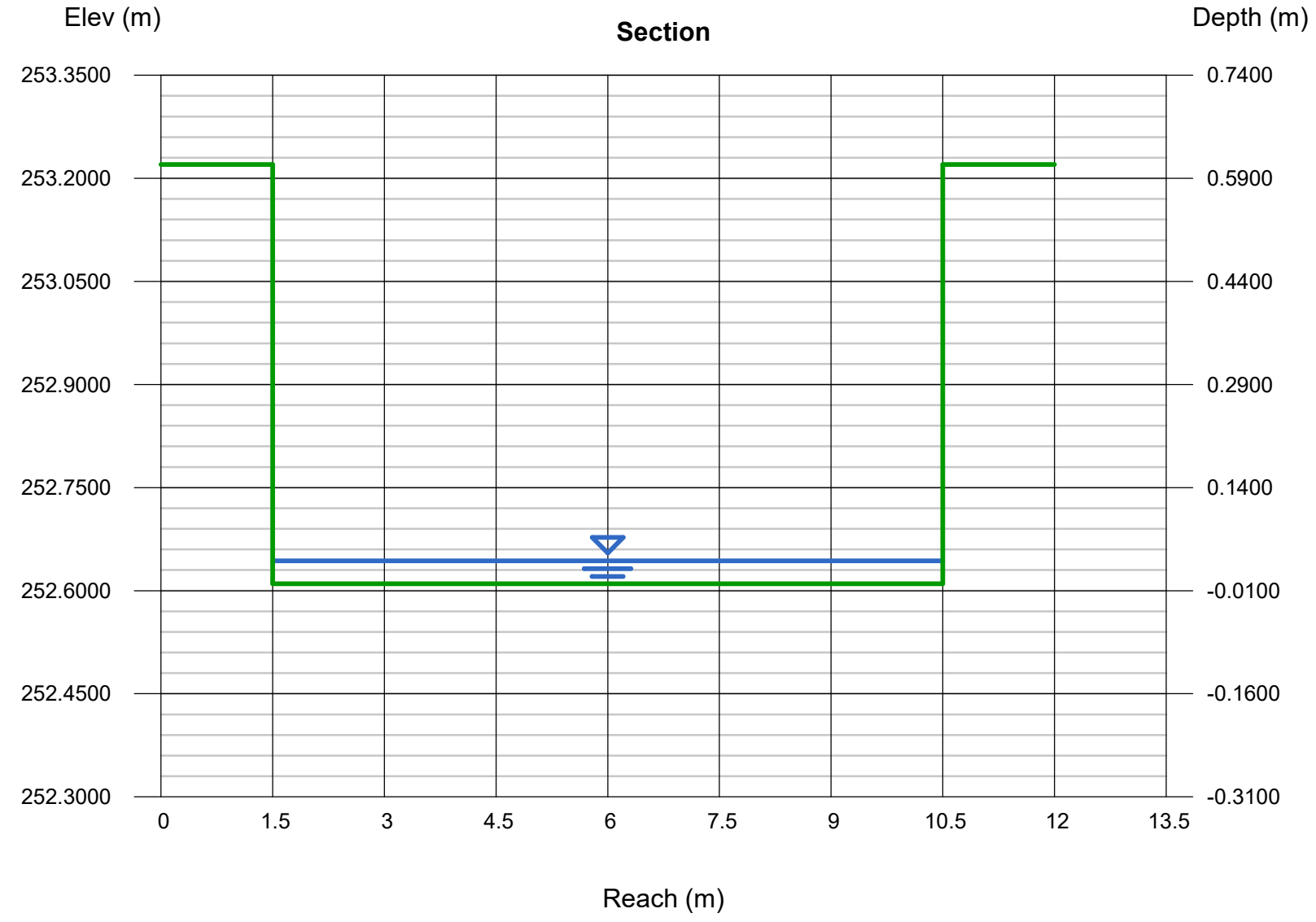
Bottom Width (m)	= 9.0000
Total Depth (m)	= 0.6100
Invert Elev (m)	= 252.6100
Slope (%)	= 9.4000
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.6180

Highlighted

Depth (m)	= 0.0335
Q (cms)	= 0.6180
Area (sqm)	= 0.3018
Velocity (m/s)	= 2.0480
Wetted Perim (m)	= 9.0671
Crit Depth, Yc (m)	= 0.0792
Top Width (m)	= 9.0000
EGL (m)	= 0.2475



GOL-20538 Lockhart II

5 Year Storm Sewer Sizing

June 2021

AREAS	Street	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S	D	Q FULL	V FULL	% FULL
		FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)	(mm)	(cms)	(m/s)	
201	Street 'E'	STM 1	STM 2	80.2	0.77	0.30	0.23	0.23	10.00	0.56	109	0.070	3.00	300	0.167	2.37	***41.7***
202	Street 'E'	STM 2	STM 3	66.3	0.83	0.28	0.23	0.46	10.56	0.48	106	0.135	2.80	300	0.162	2.29	***83.6***
	Street 'E'	STM 3	STM 4	19.0			0	0.46	11.05	0.25	103	0.132	0.50	450	0.202	1.27	***65.5***
203	Street 'E'	STM 4	STM 5	32.0	0.78	0.29	0.23	0.69	11.30	0.38	102	0.195	0.50	525	0.304	1.40	***64.2***
204	Street 'F'	STM 6	STM 7	81.2	0.83	0.70	0.58	0.58	10.00	0.50	109	0.175	2.90	375	0.299	2.70	***58.6***
205	Street 'F'	STM 7	STM 5	67.8	0.83	0.33	0.27	0.85	10.50	0.47	106	0.250	1.80	450	0.383	2.41	***65.5***
206	Street 'E'	STM 5	STM 8	46.0	0.71	0.12	0.08	1.62	11.68	0.42	100	0.451	0.60	675	0.651	1.82	***69.3***
207	Street 'E'	STM 9	STM 10	38.8	0.69	0.15	0.10	0.10	10.00	0.34	109	0.031	1.90	300	0.133	1.89	***23.2***
	Street 'E'	STM 10	STM 11	9.3			0	0.10	10.34	0.08	107	0.030	1.90	300	0.133	1.89	***22.8***
208	Street 'E'	STM 11	STM 12	78.9	0.73	0.45	0.33	0.43	10.43	0.55	107	0.128	2.30	375	0.266	2.41	***48.2***
209	Street 'E'	STM 12	STM 13	71.5	0.83	0.61	0.50	0.94	10.97	0.44	104	0.269	2.90	375	0.299	2.70	***90.2***
210	Street 'E'	STM 13	STM 8	81.8	0.83	0.39	0.33	1.26	11.41	0.54	102	0.356	2.00	450	0.403	2.54	***88.3***
211	Street 'E'	STM 8	STM 14	50.9	0.72	0.18	0.13	3.01	12.10	0.40	98	0.823	0.70	750	0.931	2.11	***88.3***
212	FENCHURCH	STM 15	STM 16	93.5	0.76	0.35	0.26	0.26	10.00	0.66	109	0.080	3.00	300	0.167	2.37	***47.5***
213	FENCHURCH	STM 16	STM 14	85.1	0.72	0.85	0.61	0.87	10.66	0.53	105	0.256	2.80	375	0.293	2.66	***87.2***
	FENCHURCH	STM 14	STM 18	54.3			0	3.89	12.50	0.45	97	1.042	0.50	900	1.280	2.01	***81.4***
214	FENCHURCH	STM 17	STM 18	74.0	0.65	0.19	0.12	0.12	10.00	0.82	109	0.037	1.20	300	0.106	1.50	***35.0***
215	SWMF BLK 219	STM 18	STM 19	16.9	0.65	0.89	0.58	4.59	12.95	0.15	95	1.207	**0.40**	975	1.417	1.90	***85.1***
	SWMF BLK 219	STM 19	STM HW 20	18.4			0	4.59	13.10	0.16	94	1.199	**0.40**	975	1.417	1.90	***84.6***
- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
301	Street 'C'	STM 21	STM 22	84.9	0.65	0.81	0.52	0.52	10.00	0.68	109	0.158	1.70	375	0.229	2.07	***69.3***
302	Street 'C'	STM 22	STM 23	44.7	0.65	0.52	0.34	0.86	10.68	0.32	105	0.252	1.70	450	0.372	2.34	***67.9***
303	Street 'C'	STM 23	STM 24	67.4	0.65	0.48	0.31	1.18	11.00	0.50	104	0.339	1.60	450	0.361	2.27	***94.0***
304	THICKETWOOD	STM 24	STM 25	48.5	0.65	0.15	0.10	1.27	11.50	0.53	101	0.358	0.50	600	0.434	1.54	***82.4***
305	THICKETWOOD	STM 25	STM 26	50.5	0.65	0.40	0.26	1.53	12.02	0.50	99	0.421	0.60	600	0.476	1.68	***88.4***
306	Street 'B'	STM 27	STM 28	29.1	0.65	0.75	0.49	0.49	10.00	0.23	109	0.147	1.70	375	0.229	2.07	***64.5***
307	Street 'B'	STM 28	STM 29	46.3	0.65	0.48	0.31	0.80	10.23	0.32	108	0.239	1.80	450	0.383	2.41	***62.5***
	Street 'B'	STM 29	STM 30	41.5			0	0.80	10.56	0.29	106	0.235	1.80	450	0.383	2.41	***61.5***
308	Street 'B'	STM 30	STM 26	39.0	0.65	0.60	0.39	1.19	10.84	0.31	104	0.344	1.10	525	0.451	2.08	***76.3***
	THICKETWOOD	STM 26	STM 31	34.7			0	2.72	12.52	0.32	96	0.729	0.50	750	0.787	1.78	***92.6***
	THICKETWOOD	STM 31	STM 34	18.2			0	2.72	12.85	0.17	95	0.719	0.50	750	0.787	1.78	***91.3***
309	THICKETWOOD	STM 32	STM 33	58.3	0.65	0.85	0.55	0.55	10.00	0.77	109	0.167	0.50	450	0.202	1.27	***83.0***
	THICKETWOOD	STM 33	STM 34	54.0			0	0.55	10.77	0.71	105	0.161	0.50	450	0.202	1.27	***79.9***
310	SWMF BLK 221	STM 34	STM 35	35.0	0.65	0.62	0.40	3.68	13.02	0.10	94	0.965	5.00	750	2.489	5.63	***38.7***
	SWMF BLK 221	35	HW 36	20.6			0	3.68	13.12	0.06	94	0.960	5.00	750	2.489	5.63	***38.6***

Q= C*I*A/360 (cms); C=RUNOFF COEFFICIENT; I-RAINFALL INTENSITY (5 Year) =853.608/(T.C. + 4.699)^0.766; A=AREA (ha)

Note:

SANITARY SEWER DESIGN - LOCAL SEWER

Development Details Basis

DESIGN SHEET

FILE NO GOL-20538

CONTRACT / PROJECT LOCKHART INNISFIL INVESTMENTS (II) LIMITED

n ≥ 0.013
M = 5/P^0.2 Babbit
M=1+[14/(4+P^0.5)] Harmon
Q_p = P*q*M/86.4
Q_i = I*A
$Q_{tot} = Q_p + Q_i$

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

(Peak population flow where; q = 225 L/day/person; P = population in thousands) 225 litres/person/day
(Peak extraneous flow: I= 0.1L/s/ha over development area)
(Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET	AREA	MAINTENANCE HOLE		DWELL UNITS	DWELL (ACC) UNITS	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ha)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.7	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
		FROM	TO																						
Street E	3	SAN 01A	SAN 02A	6	6	2.57	15.42	15.42	11.517	4.395	11.517	0.462	0.20	0.20	0.020	0.482	38.8	200	2.00	46.384	0.071	Ok	1.476	0.472	Check
Street E	4	SAN 02A	SAN 03A	2	8	2.57	5.14	20.56	10.873	4.379	10.873	0.582	0.09	0.29	0.029	0.611	15.8	200	2.00	46.384	0.080	Ok	1.476	0.506	Check
Street E	5	SAN 03A	SAN 04A	16	24	2.57	41.12	61.68	8.729	4.295	8.729	1.402	0.34	0.63	0.063	1.465	110.0	200	1.70	42.764	0.126	Ok	1.361	0.625	Ok
Street E	6	SAN 04A	SAN 05A	14	38	2.57	35.98	97.66	7.962	4.246	7.962	2.025	0.31	0.94	0.094	2.119	102.0	200	2.90	55.854	0.133	Ok	1.778	0.841	Ok
Street E	7	SAN 05A	SAN 06A	1	39	2.57	2.57	100.23	7.921	4.243	7.921	2.067	0.03	0.97	0.097	2.164	15.2	200	1.10	34.399	0.170	Ok	1.095	0.602	Ok
Street E	8	SAN 06A	SAN 07A	5	44	3.25	16.25	116.48	7.686	4.225	7.686	2.332	0.20	1.17	0.117	2.449	34.5	200	1.10	34.399	0.180	Ok	1.095	0.624	Ok
Street F	9	SAN 01A	SAN 08A	16	16	2.57	41.12	41.12	9.466	4.331	9.466	1.014	0.30	0.30	0.030	1.044	70.0	200	3.00	56.809	0.094	Ok	1.808	0.688	Ok
Street F	10	SAN 08A	SAN 09A	32	48	2.57	82.24	123.36	7.599	4.217	7.599	2.441	0.50	0.80	0.080	2.521	110.0	200	3.00	56.809	0.143	Ok	1.808	0.900	Ok
Street F	11	SAN 09A	SAN 07A	14	62	2.57	35.98	159.34	7.219	4.182	7.219	2.996	0.24	1.04	0.104	3.100	57.7	200	2.20	48.648	0.171	Ok	1.549	0.858	Ok
Street E	12	SAN 07A	SAN 10A	5	111	3.25	16.25	292.07	6.395	4.083	6.395	4.864	0.20	2.41	0.241	5.105	46.0	200	0.60	25.406	0.304	Ok	0.809	0.623	Ok
Street E	13	SAN 01A	SAN 11A	6	6	2.57	15.42	15.42	11.517	4.395	11.517	0.462	0.19	0.19	0.019	0.481	37.0	200	2.00	46.384	0.071	Ok	1.476	0.472	Check
Street E	14	SAN 11A	SAN 12A	2	8	2.57	5.14	20.56	10.873	4.379	10.873	0.582	0.09	0.28	0.028	0.610	11.8	200	2.00	46.384	0.080	Ok	1.476	0.506	Check
Street E	15	SAN 12A	SAN 13A	20	28	2.57	51.40	71.96	8.464	4.280	8.464	1.586	0.38	0.66	0.066	1.652	76.2	200	2.20	48.648	0.126	Ok	1.549	0.708	Ok
Street E	16	SAN 13A	SAN 14A	29	57	2.57	74.53	146.49	7.342	4.194	7.342	2.801	0.51	1.17	0.117	2.918	110.0	200	2.90	55.854	0.155	Ok	1.778	0.926	Ok
Street E	17	SAN 14A	SAN 10A	10	67	2.57	25.70	172.19	7.108	4.171	7.108	3.187	0.18	1.35	0.135	3.322	43.4	200	2.20	48.648	0.176	Ok	1.549	0.873	Ok
Street E	18	SAN 10A	SAN 15A	4	182	3.25	13.00	477.26	5.797	3.985	5.797	7.205	0.20	3.96	0.396	7.601	50.8	200	0.50	23.192	0.393	Ok	0.738	0.651	Ok
Fenchurch Manor	19A			9		3.25	29.25																		
Fenchurch Manor	19B	SAN 16A	SAN 17A	14	23	2.57	35.98	65.23	8.631	4.290	8.631	1.466	0.84	0.84	0.084	1.550	100.0	200	2.00	46.384	0.125	Ok	1.476	0.668	Ok
Fenchurch Manor	20A			7		3.25	22.75																		
Fenchurch Manor	20B	SAN 17A	SAN 18A	10	40	2.57	25.70	113.68	7.724	4.228	7.724	2.287	0.65	1.49	0.149	2.436	100.0	200	3.00	56.809	0.141	Ok	1.808	0.880	Ok
Fenchurch Manor	21A			8		3.25	26.00																		
Fenchurch Manor	21B	SAN 18A	SAN 15A	8	56	2.57	20.56	160.24	7.211	4.182	7.211	3.009	0.48	1.97	0.197	3.206	67.5	200	3.50	61.360	0.155	Ok	1.953	1.009	Ok
Fenchurch Manor	22	SAN 15A	SAN 19A	4	242	3.25	13.00	650.50	5.449	3.913	5.449	9.231	0.26	6.19	0.619	9.850	55.8	200	0.50	23.192	0.454	Ok	0.738	0.696	Ok
Fenchurch Manor	23	SAN 20A	SAN 19A	4	4	3.25	13.00	13.00	11.917	4.403	11.917	0.403	0.32	0.32	0.032	0.435	54.2	200	2.00	46.384	0.068	Ok	1.476	0.454	Check
Thicketwood Avenue	25	SAN 19A	SAN 22A	4	250	3.25	13.00	676.50	5.407	3.903	5.407	9.525	0.28	6.79	0.679	10.204	68.9	200	0.40	20.744	0.495	Ok	0.660	0.646	Ok
Thicketwood Avenue	26	SAN 22A	SAN 23A	6	256	3.25	19.50	696.00	5.376	3.896	5.376	9.744	0.33	7.12	0.712	10.456	40.8	250	0.40	37.611	0.360	Ok	0.766	0.643	Ok
Street C	27	SAN 24A	SAN 25A	14	14	3.25	45.50	45.50	9.276	4.323	9.276	1.099	0.76	0.76	0.076	1.175	106.3	200	2.00	46.384	0.109	Ok	1.476	0.615	Ok
Street C	28	SAN 25A	SAN 26A	18	32	3.25	58.50	104.00	7.863	4.239	7.863	2.129	0.76	1.52	0.152	2.281	98.5	200	1.40	38.808	0.164	Ok	1.235	0.662	Ok
Street C	29	SAN 26A	SAN 23A	7	39	3.25	22.75	126.75	7.558	4.214	7.558	2.495	0.38	1.90	0.190	2.685	68.8	200	2.80	54.882	0.150	Ok	1.747	0.884	Ok
Thicketwood Avenue	30	SAN 23A	SAN 27A	7	302	3.25	22.75	845.50	5.171	3.846	5.171	11.385	0.34	9.36	0.936	12.321	50.3	250	0.40	37.611	0.393	Ok	0.766	0.671	Ok
Thicketwood Avenue	31	SAN 27A	SAN 28A	7	309	3.25	22.75	868.25	5.143	3.839	5.143	11.629	0.37	9.73	0.973	12.602	49.2	250	0.40	37.611	0.398	Ok	0.766	0.675	Ok
Street B	32	SAN 29A	SAN 30A	14	14	3.25	45.50	45.50	9.276	4.323	9.276	1.099	0.75	0.75	0.075	1.174	105.4	200	2.00	46.384	0.109	Ok	1.476	0.615	Ok
Street B	33	SAN 30A	SAN 31A	7	21	3.25	22.75	68.25	8.554	4.285	8.554	1.520	0.33	1.08	0.108	1.628	42.6	200	1.90	45.210	0.129	Ok	1.439	0.664	Ok
Street B	34	SAN 31A	SAN 32A	4	25	3.25	13.00	81.25	8.260	4.267	8.260	1.748	0.28	1.36	0.136	1.884	37.2	200	1.90	45.210	0.139	Ok	1.439	0.694	Ok
Street B	35	SAN 32A	SAN 28A	1	26	3.25	3.25	84.50	8.196	4.263	8.196	1.804	0.11	1.47	0.147	1.951	39.7	200	1.90	45.210	0.141	Ok	1.439	0.700	Ok
Thicketwood Avenue	36	SAN 28A	SAN 33A	3	338	3.25	9.75	962.50	5.038	3.811	5.038	12.629	0.17	11.37	1.137	13.766	30.9	250	0.40	37.611	0.418	Ok	0.766	0.690	Ok
Thicketwood Avenue	37	SAN 33A	SAN 34A	2	340	3.25	6.50	969.00	5.032	3.809	5.032	12.697	0.16	11.53	1.153	13.850	12.3	250	0.40	37.611	0.420	Ok	0.766	0.691	Ok
Thicketwood Avenue	38	SAN 34A	SAN 35A	14	354	3.25	45.50	1014.50	4.986	3.796	4.986	13.172	0.64	12.17	1.217	14.389	86.3	250	0.40	37.611	0.429	Ok	0.766	0.698	Ok
Thicketwood Avenue	39	SAN 35A	SAN 36	12	366	3.25	39.00	1053.50	4.948	3.785	4.948	13.575	0.60	12.77	1.277	14.852	77.1	250	0.40	37.611	0.436	Ok	0.766	0.704	Ok
Thicketwood Avenue	40 (Trunk)	SAN 36	SAP33945		366			1053.50	4.948	3.785	4.948	13.575	0.38	13.15	1.315	14.890	55.5	250	0.40	37.611	0.437	Ok	0.766	0.704	Ok
Thicketwood Avenue	40 (Local)	SAN 36	SAP33945	9	9	3.25	29.25	29.25	10.133	4.356	10.133	0.772		0.38	0.038	0.810	55.5	200	2.00	46.384	0.091	Ok	1.476	0.550	Check
Thicketwood Avenue	41 (Trunk)	SAP33945	SAP33921		375			1082.75	4.921	3.777	4.921	13.876	0.14	13.29	1.329	15.205	16.2	250	0.50	42.050	0.415	Ok	0.857	0.768	Ok
Thicketwood Avenue	41 (Local)	SAP33945	SAP33921	3	3	3.25	9.75	9.75	12.623	4.416	12.623	0.321		0.14	0.014	0.335	16.2	200	2.00	46.384	0.060	Ok	1.476	0.422	Check

SANITARY SEWER DESIGN - LOCAL SEWER

Development Details Basis

DESIGN SHEET

FILE NO GOL-20538

CONTRACT / PROJECT LOCKHART INNISFIL INVESTMENTS (II) LIMITED

n ≥ 0.013
M = 5/P^0.2 Babbit
M=1+[14/(4+P^0.5)] Harmon
$Q_p = P*q*M/86.4$
$Q_i = I*A$
$Q_{tot} = Q_p + Q_i$

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

(Peak population flow where; q = 225 L/day/person; P = population in thousands) 225 litres/person/day
(Peak extraneous flow: I= 0.1L/s/ha over development area)
(Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET	AREA	MAINTENANCE HOLE		DWELL UNITS	DWELL (ACC) UNITS	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ha)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.7	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
		FROM	TO																						
Fenchurch Manor	EXT1	SAP33905	SAP33903	4	55	3.25	13.00	147.47	7.332	4.193	7.332	2.816	0.20	1.35	0.135	2.951	40.5	200	0.60	25.406	0.230	Ok	0.809	0.532	Check
Ball Gate	2	SAP33903	SAP33971		55			147.47	7.332	4.193	7.332	2.816	0.14	1.49	0.149	2.965	83.1	200	2.00	46.384	0.171	Ok	1.476	0.815	Ok
Street C	42	SAN 24A	PLUG	7	7	3.25	22.75	22.75	10.655	4.373	10.655	0.631	0.26	0.26	0.026	0.657	33.3	200	2.00	46.384	0.083	Ok	1.476	0.518	Check
Street C	43	PLUG	SAP33970	1	8	3.25	3.25	26.00	10.375	4.364	10.375	0.702	0.05	0.31	0.031	0.733	8.0	200	2.00	46.384	0.087	Ok	1.476	0.534	Check
Street C	44	SAP33970	SAP33971		8			26.00	10.375	4.364	10.375	0.702	0.01	0.32	0.032	0.734	8.8	200	1.00	32.798	0.103	Ok	1.044	0.421	Check
Ball Gate	45	SAP33971	SAP33973		63			173.47	7.098	4.170	7.098	3.206	0.13	1.81	0.181	3.387	74.2	200	2.00	46.384	0.182	Ok	1.476	0.847	Ok
Street B	46	SAN 29A	PLUG	7	7	3.25	22.75	22.75	10.655	4.373	10.655	0.631	0.28	0.28	0.028	0.659	34.3	200	2.00	46.384	0.083	Ok	1.476	0.518	Check
Street B	47	PLUG	SAP33972	1	8	3.25	3.25	26.00	10.375	4.364	10.375	0.702	0.05	0.33	0.033	0.735	8.0	200	2.00	46.384	0.087	Ok	1.476	0.534	Check
Street B	48	SAP33972	SAP33973		8			26.00	10.375	4.364	10.375	0.702	0.01	0.34	0.034	0.736	8.8	200	1.00	32.798	0.103	Ok	1.044	0.421	Check
Ball Gate	49	SAP33973	SAP33974		71			199.47	6.902	4.148	6.902	3.585	0.11	2.26	0.226	3.811	64.3	200	1.15	35.172	0.222	Ok	1.120	0.719	Ok
Ball Gate	50	SAP33974	SAP33921		71			199.47	6.902	4.148	6.902	3.585	0.01	2.27	0.227	3.812	8.8	200	0.65	26.443	0.256	Ok	0.842	0.587	Check
Thicketwood Avenue	51 (Trunk)	SAP33921	SAP33923		449			1291.97	4.750	3.726	4.750	15.982	0.41	16.11	1.611	17.593	94.5	250	0.40	37.611	0.480	Ok	0.766	0.735	Ok
Thicketwood Avenue	51 (Local)	SAP33921	SAP33923	7	7	3.25	22.75	22.75	10.655	4.373	10.655	0.631		0.41	0.041	0.672	94.5	200	2.00	46.384	0.084	Ok	1.476	0.518	Check

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Saturday, July 17, 2021
Project Name	Lockhart II Subdivision - SWMF1 (Split 2)
Project Number	14193
Location	Barrie

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF10-11-3 is recommended to meet the water quality objective by treating a flow of 63.1 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 711 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF10-11-3	11	3	3.0	63.1	711

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

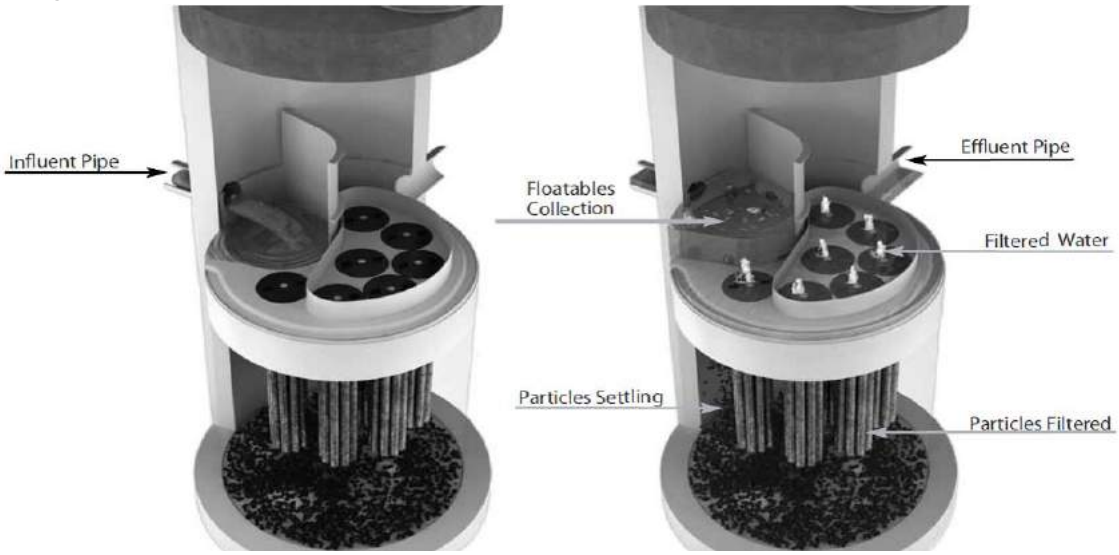
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 59%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	Saturday, July 17, 2021
Project Name:	Lockhart II Subdivision - SWMF1 (Split 2)
Project Number:	14193
Location:	Barrie

Designer Information

Company:	The Jones Consulting Group Ltd.
Contact:	Michael Gallant
Phone #:	

Notes

Rainfall

Name:	BARRIE WPCC
State:	ON
ID:	557
Record:	1968 to 2003
Co-ords:	44°23'N, 79°41'W

Drainage Area

Total Area:	3.74 ha
Imperviousness:	65.7%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 36 years of BARRIE WPCC rainfall data:	**62.4 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 7156 m³, with a suspended sediment concentration of 60 mg/L.	**429 kg**

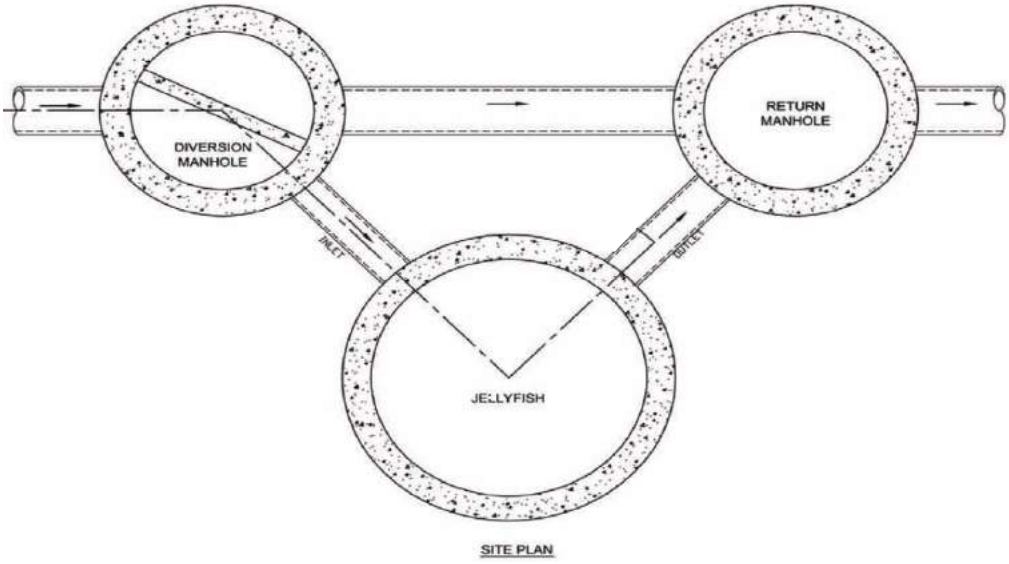
Recommendation

The Jellyfish Filter model JF10-11-3 is recommended to meet the water quality objective by treating a flow of 63.1 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 711 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	**11**	**3**	**3.0**	**14456**	**2.21**	**2302**	**63.1**	**711**
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	62º	150	200
1.8	59º	200	250
2.4	52º	250	300
3.0	**48º**	**300**	**450**
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

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

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Jellyfish® Filter

Developed by Imbrium Systems, Inc.,
Whitby, Ontario, Canada

Registration: GPS-ETV_VR2020-08-15_Imbrium-JF

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

August 15, 2020
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The Jellyfish® Filter is an engineered stormwater quality treatment technology designed to remove a variety of stormwater pollutants including floatable trash and debris, oil, coarse and fine suspended sediments, and particulate-bound pollutants such as nutrients, heavy metals, and hydrocarbons. The Jellyfish Filter combines gravitational pre-treatment (sedimentation and floatation) and membrane filtration in a single compact structure. The system utilizes membrane filtration cartridges comprised of multiple pleated filter elements ("filtration tentacles") that provide high filtration surface area with the associated advantages of high flow rate, high sediment capacity, and low filtration flux rate.

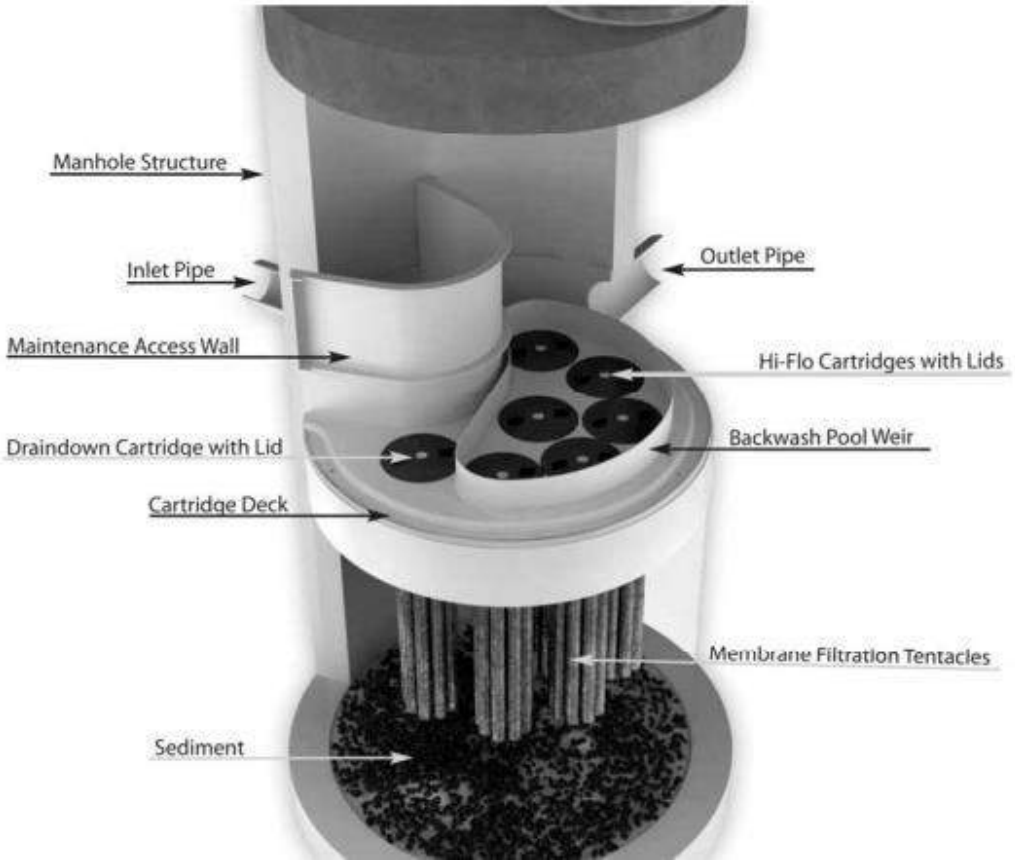


Figure 1. Cut-away graphic of a Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge

Figure 1 depicts a cut-away graphic of a typical 6-ft diameter Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge (JF6-6-1). Stormwater influent enters the system through the inlet pipe and builds a pond behind the maintenance access wall, with the pond elevation providing driving head. Flow is channeled downward into the lower chamber beneath the cartridge deck. A flexible separator skirt (not shown in the graphic) surrounds the filtration zone where the filtration tentacles of each cartridge are suspended, and the volume between the vessel wall and the outside surface of the separator skirt comprises a pretreatment channel. As flow spreads throughout the pretreatment channel, floatable pollutants accumulate at the surface of the pond behind the maintenance access wall and also beneath the cartridge deck in the pretreatment channel, while coarse sediments settle to the sump. Flow proceeds under the separator skirt and upward into the filtration zone, entering each filtration tentacle and depositing fine suspended sediment and associated particulate-bound pollutants on the outside surface of the membranes. Filtered water proceeds up the center tube of each tentacle, with the flow from each tentacle combining under the cartridge lid, and discharging to the top of the

cartridge deck through the cartridge lid orifice. Filtered effluent from the hi-flo cartridges enters a pool enclosed by a 15-cm high weir, and if storm intensity and resultant driving head is sufficient, filtered water overflows the weir and proceeds across the cartridge deck to the outlet pipe. Filtered effluent discharging from the draindown cartridge(s) passes directly to the outlet pipe, and requires only a minimal amount of driving head (2.5 cm) to provide forward flow. As storm intensity subsides and driving head drops below 15 cm, filtered water within the backwash pool reverses direction and passes backward through the hi-flo cartridges, and thereby dislodges sediment from the membranes which subsequently settles to the sump below the filtration zone. During this passive backwashing process, water in the lower chamber is displaced only through the draindown cartridge(s). Additional self-cleaning processes include gravity, as well as vibrational pulses emitted when flow exits the orifice of each cartridge lid, and these combined processes significantly extend the cartridge service life and maintenance cleaning interval. Sediment removal from the sump by vacuum is required when sediment depths reach 30 cm, and cartridges are typically removed, externally rinsed, and recommissioned on an annual basis, or as site-specific maintenance conditions require. Filtration tentacle replacement is typically required every 3 – 5 years.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from a field monitoring program conducted on a Jellyfish® Filter JF4-2-1 (4-ft diameter manhole with 2 hi-flo cartridges and 1 draindown cartridge), in accordance with the provisions of the TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements—Amendments to TARP Tier II Protocol (NJDEP, 2009). Testing was completed by researchers led by Dr. John Sansalone at the University of Florida's Engineering School of Sustainable Infrastructure and Environment. The drainage area providing stormwater runoff to the test unit varied between 502 m^2 and 799 m^2 (5400 ft^2 to 8600 ft^2) depending on storm intensity and wind direction. The unit was monitored for a total of 25 TARP qualifying storm events (i.e. $\geq$ 2.5 mm of rainfall) contributing cumulative rainfall of 381 mm (15 in) over the 13-month period between May 28, 2010 and June 27, 2011. Only TARP-qualified storms were routed through the unit, and maintenance was not required during the testing period based on sediment accumulation less than the depth indicated for maintenance, and also based on hydraulic testing performed on the system after the conclusion of monitoring.

Table 1 shows the specified and achieved amended TARP criteria for storm selection and sampling.
Table 2 shows the observed ranges of operational conditions that occurred over the testing period.

Table 1. Specified and achieved amended TARP criteria for storm selection and sampling

Description	Criteria value	Achieved value
Total rainfall	$\geq$ 2.5 mm (0.1 in)	> 2.5 mm (0.1 in)
Minimum inter-event period	6 hrs	10 hrs
Minimum flow-weighted composite sample storm coverage	70% including as much of the first 20% of the storm	100%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	Minimum of 8 subsamples for composite samples
Total sampled rainfall	Minimum 381 mm (15 in)	384 mm (15.01 in)
Number of storms	Minimum 20	25

Table 2. Observed operational conditions for events monitored over the study period

Operational condition	Observed range
Storm durations	26 – 691 min
Previous dry hours	10 - 910 hrs
Rainfall depth	3 – 50 mm
Initial rainfall to runoff lag time	1 – 34 min
Runoff volume	206 – 13,229 L
Peak rainfall intensity	5 – 137 mm/hr
Peak runoff flow rate	0.5 – 14.3 L/s
Event median flow rate	0.01 – 5.5 L/s

The 4-ft diameter test unit has sedimentation surface area of 1.17 m^2 (12.56 ft^2). Each of the three filter cartridges employed in the test unit uses filtration tentacles of 137 cm (54 in) length, with filter surface area of 35.4 m^2 (381 ft^2) per cartridge, and total filter surface area of 106.2 m^2 (1143 ft^2) for the three cartridges combined. The design treatment flow rate is 5 L/s (80 gal/min) for each of the two hi-flo cartridges and 2.5 L/s (40 gal/min) for the single draindown cartridge, for a total design treatment flow rate of 12.6 L/s (200 gal/min) at design driving head of 457 mm (18 in). This translates to a filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) for the draindown cartridge. The design flow rate for each cartridge is controlled by the sizing of the orifice in the cartridge lid. The distance from the bottom of the filtration tentacles to the sump is 61 cm (24 in).

Performance claims

The Jellyfish® Filter demonstrated the removal efficiencies indicated in **Table 3** for respective constituents during field monitoring of 25 TARP qualified storm events with cumulative rainfall of 381 mm, conducted in accordance with the provisions of the TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements—Amendments to TARP Tier II Protocol (NJDEP, 2009), and using the following design parameters:

- System hydraulic loading rate (system treatment flow rate per unit of sedimentation surface area) of 10.8 L/s/m^2 (15.9 gal/min/ft^2) or lower
- Filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) or lower for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) or lower for each draindown cartridge
- Distance from the bottom of the filtration tentacles to the sump of 61 cm (24 in) or greater
- Driving head of 457 mm (18 in) or greater

Table 3. Mean, median and 95% confidence interval (median) for removal efficiencies of selected stormwater constituents

Parameter	Mean	Median	Median - 95% Lower Limit	Median - 95% Upper Limit
TSS	84.7	85.6	82.8	89.8
SSC	97.5	98.3	97.1	98.7
Total phosphorus	48.8	49.1	43.3	60.1
Total nitrogen	37.9	39.3	31.2	54.6
Zinc	55.3	69	39	75
Copper	83.0	91.7	75.1	98.9
Oil and grease	60.1	60	42.7	100

N.B. As with any field test of stormwater treatment devices, removal efficiencies will vary based on pollutant influent concentrations and other site specific conditions.

❖The performance claims can be applied to other Jellyfish® Filter models smaller or larger than the tested model as long as the untested models are designed in accordance with the design parameters specified in the performance claims.

Performance results

The frequency of rainfall depths monitored during the study is presented in **Figure 2**. The median and 90th percentile rainfall depths were 11 mm and 31.7 mm, respectively. These values represent the depth of rainfall that is not exceeded in 50 and 90 percent of the monitored rainfall events.

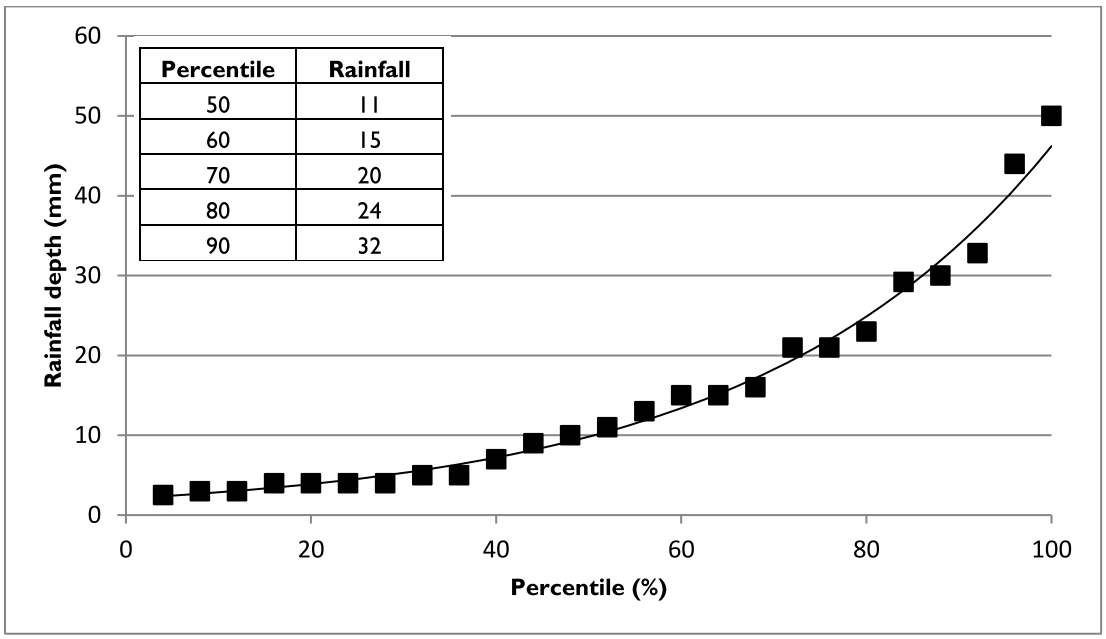


Figure 2. Rainfall depth frequency curve

Sediment removal performance was assessed by measuring the event mean concentration and mass of suspended sediment entering and leaving the unit during runoff events. This involved sampling the full cross-section of influent and effluent flows manually at 2 - 10 minute intervals for the full duration of each storm event and combining discrete samples into flow-weighted composites. Comparing the theoretical mass recovery from the sump calculated by the difference between the influent and effluent mass to the actual dry weight of the recovered sump mass showed an overall mass balance recovery of 94.5% over the study period.

The median d50 particle size (i.e. 50th percentile particle size) of the influent and effluent was 82 and 3 µm, respectively (**Figure 3**). The median influent particles sizes ranged between 22 and 263 µm, whereas median effluent particle sizes ranged between 1 and 11 µm.

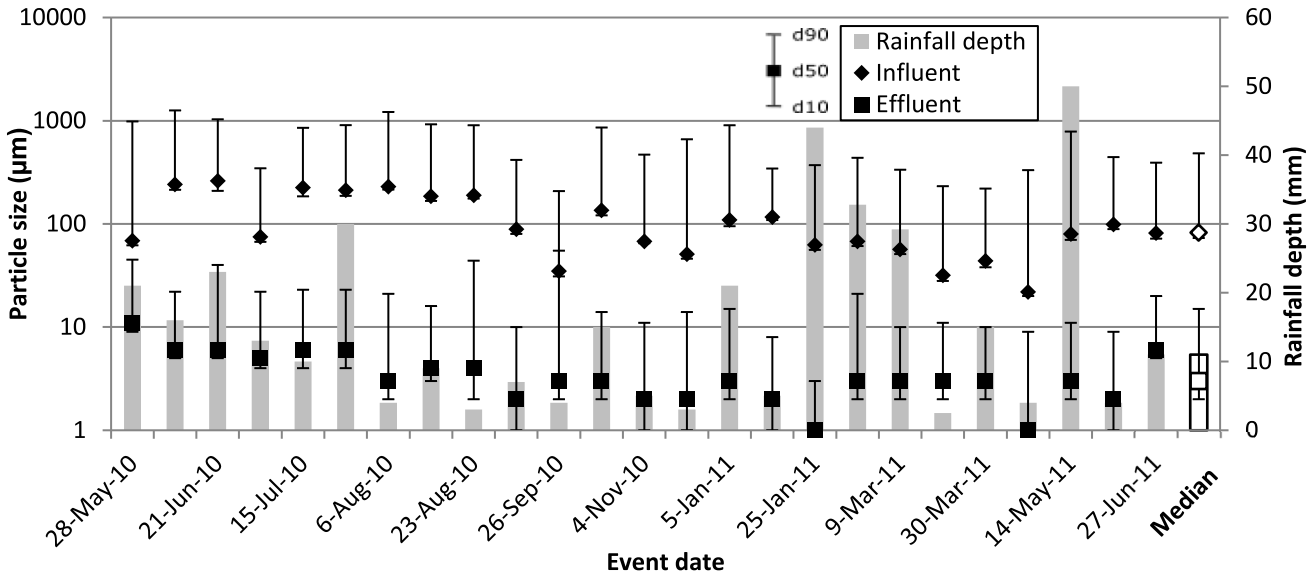


Figure 3. The rainfall depth and d10, d50, and d90 particle sizes of the influent and effluent composite samples for each monitored storm event over the 13-month testing period

Sampling of flows into and out of the Jellyfish Filter over the testing period showed statistically significant reductions ($p < 0.05$; Wilcoxon signed-rank test) in influent event mean concentrations for all selected stormwater constituents (**Table 4** and **Figure 4**). Effluent event mean Suspended Sediment Concentrations (SSC) were below 19 mg/L during all monitored events. Load-based removal rates were also calculated based on the sum of loads over the study period. These removal rages ranged from 46.3 for Total Nitrogen to 98.6 for SSC (**Table 4**).

Table 4. Summary statistics for influent and effluent event mean concentrations for selected constituents

Water Quality Variable	Sampling Location	Min	Max	Median	Range	Mean	SD	Load based removal efficiency (%)
TSS	Influent (mg/L)	16.30	261.00	79.30	244.70	86.26	51.37	87.2
	Effluent (mg/L)	3.20	21.70	11.80	18.50	10.99	4.79	
SSC	Influent (mg/L)	78.20	1401.70	444.50	1323.50	482.26	338.34	98.6
	Effluent (mg/L)	2.80	18.10	7.30	15.30	7.88	3.77	
TP	Influent (µg/L)	887.00	8793.00	3063.00	7906.00	3550.20	1914.50	64.2
	Effluent (µg/L)	472.00	4769.00	1480.00	4297.00	1688.08	1059.98	
TN	Influent (µg/L)	1170.00	10479.00	3110.00	9309.00	3519.32	2161.47	46.3
	Effluent (µg/L)	553.00	6579.00	1610.00	6026.00	2091.76	1613.61	
Zn	Influent (µg/L)	0.005	7600.00	1500.00	7600.00	1792.00	1852.91	76.1
	Effluent (µg/L)	0.005	2760.00	450.00	2760.00	561.64	594.70	
Cu	Influent (µg/L)	0.001	880.40	79.50	880.40	171.28	229.33	92.1
	Effluent (µg/L)	0.001	51.30	6.90	51.30	14.36	17.22	
Oil and Grease	Influent (mg/L)	0.20	4.06	0.93	3.86	1.07	0.82	46.4
	Effluent (mg/L)	0.00	2.32	0.35	2.32	0.50	0.60	

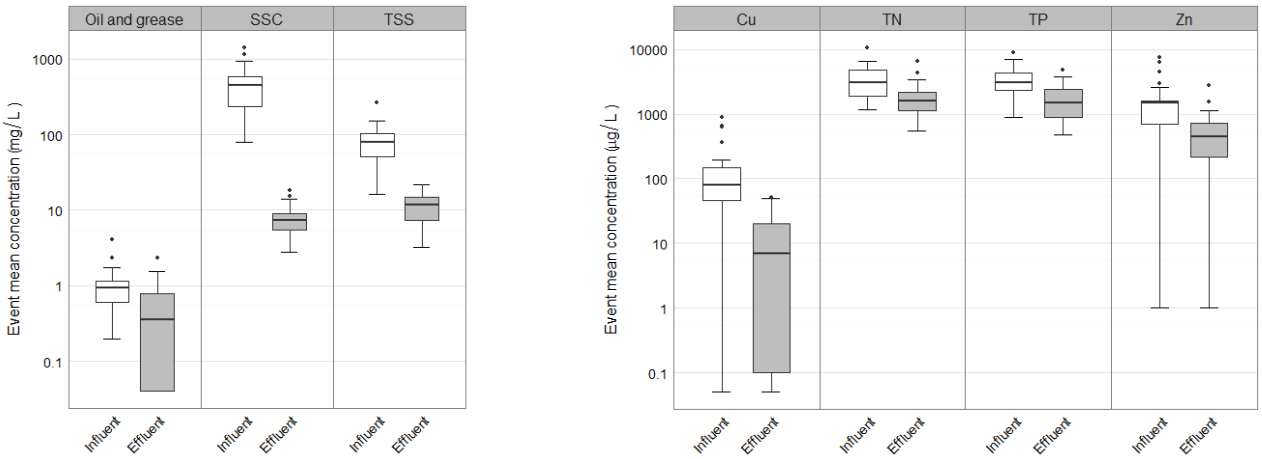


Figure 4. Boxplots showing the distribution of influent and effluent event mean concentrations (EMC) for selected stormwater constituents over the study period

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental Management -- Environmental Technology Verification (ETV)***. Data and information provided by Imbrium Systems to support the performance claim included the performance monitoring report prepared by University of Florida, Engineering School of Sustainable Infrastructure and Environment, and dated November 2011. This report is based on testing completed in accordance with the Technology Acceptance Reciprocity Partnership (TARP) Tier II Protocol (2003) and New Jersey Tier II Stormwater Test Requirements--Amendments to TARP Tier II Protocol (NJDEP, 2009).

What is ISO14034:2016 Environmental Management – Environmental Technology Verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for Environmental Technology Verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the Jellyfish® Filter please contact:

Imbrium Systems, Inc.
407 Fairview Drive
Whitby, ON
L1N 3A9, Canada
Tel: 416-960-9900
info@imbriumsystems.com

For more information on ISO 14034:2016 / ETV please contact:

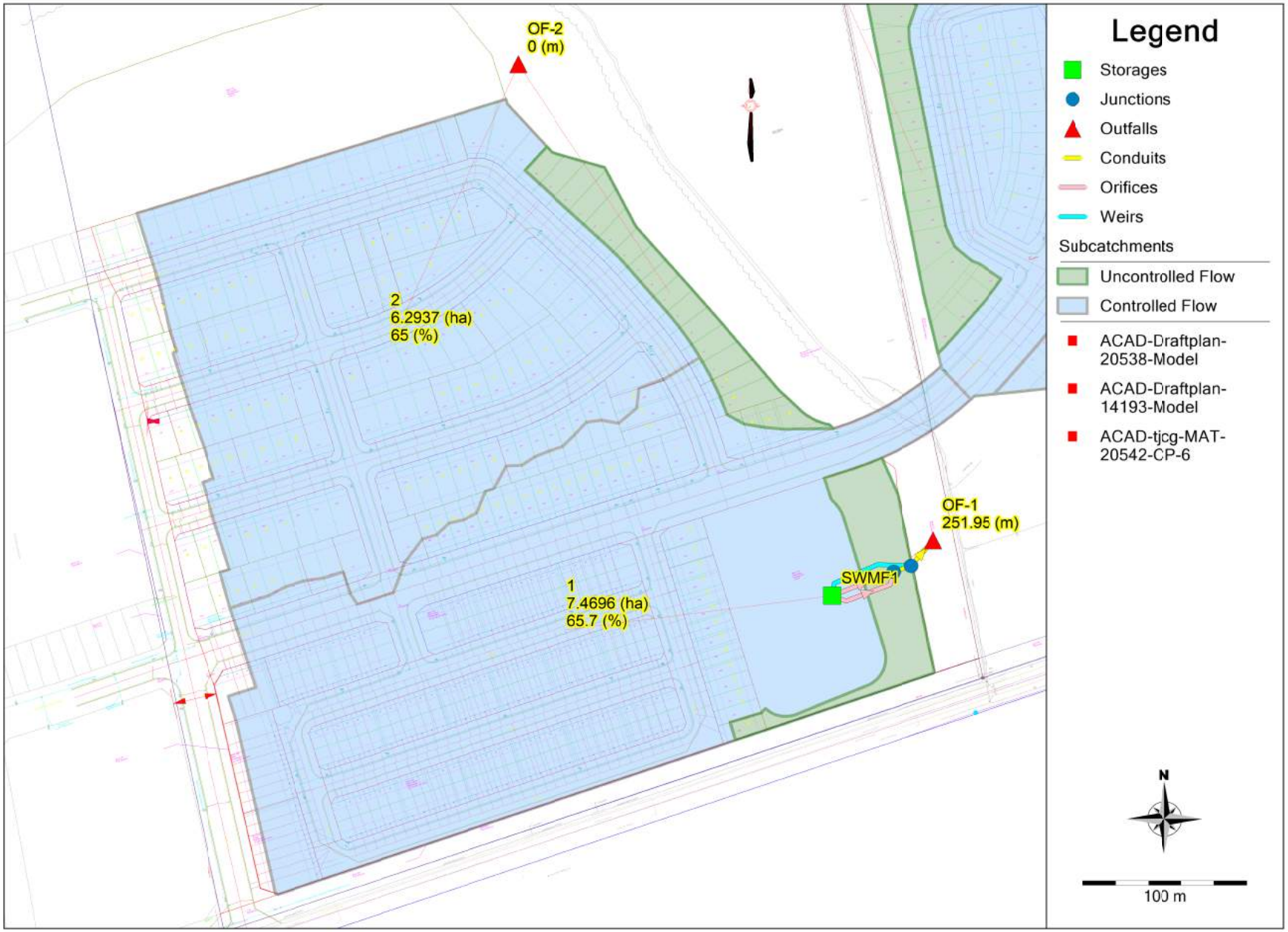
GLOBE Performance Solutions
404 – 999 Canada Place
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V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com

Limitation of verification - Registration: GPS-ETV_VR2020-08-15_Imbrium-JF
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

Appendix C

PCSWMM Schematic & Model Output

- PCSWMM Model Schematics
    - Post-Dev-PF
- PCSWMM Model Input Parameters
- PCSWMM Detailed Status Reports
    - Post-Dev-PF 25mm4Hr CHI (WQE) Status Report
    - Post-Dev-PF 100yr6hrSCS Status Report
    - Post-Dev-PF Hazel Status Report
- Graphical Model Output
    - SWMF1: Depth vs. Time – 24hr SCS Type II
    - SWMF1: Storage Volume vs. Time – 24hr SCS Type II
    - HW-SWMF1: Flow vs. Time – 24hr SCS Type II
    - OF-1: Flow vs. Time – 24hr SCS Type II
    - OF-1: Flow vs. Time – 6hr SCS Type II
    - Subcatchment 2: Flow vs. Time – 24hr SCS Type II
    - Subcatchment 2: Flow vs. Time – 6hr SCS Type II
- Digital Modeling Files and PDFs of Model Output


OF-2
0 (m)
2
6.2937 (ha)
65 (%)
1
7.4696 (ha)
65.7 (%)
SWMF1
OF-1
251.95 (m)
Legend
Storages
Junctions
Outfalls
Conduits
Orifices
Weirs
Subcatchments
Uncontrolled Flow
Controlled Flow
ACAD-Draftplan-20538-Model
ACAD-Draftplan-14193-Model
ACAD-tjcg-MAT-20542-CP-6
N
100 m

GOL-20538 - Post-Dev-PF Subcatchment Parameters																				
Name	Tag	Rain Gage	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)	Subarea Routing	Percent Routed (%)	Snow Pack	LID Controls	LID Names	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (frac.)
1	SWMF1	WQE-4HR-CHI	SWMF1	7.4696	2987.8	25	2	65.7	0.013	0.15	2	5	0	PERVIOUS	44		0		109.98	10.92	0.368
1A	Uncontrolled	WQE-4HR-CHI	OF-1	0.4958	165.27	30	10	2.8	0.013	0.15	2	5	0	PERVIOUS	100		0		109.98	10.92	0.368
2	SWMF2	WQE-4HR-CHI	OF-2	6.2937	1798.2	35	2	65.0	0.013	0.15	2	5	0	PERVIOUS	50		0		109.98	10.92	0.368
2A	Uncontrolled	WQE-4HR-CHI	OF-2	0.5300	230.44	23	2	40.0	0.013	0.15	2	5	0	PERVIOUS	100		0		109.98	10.92	0.368

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------

PROJECT MANAGER: JWI
MODELLING COMPLETED BY: MG
WORK COMPLETED:

WARNING 02: maximum depth increased for Node HW-SWMF3

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 9
Number of nodes ........... 13
Number of links ........... 15
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
100YR-12HR-SCS       100YR-12HR-SCS              INTENSITY    6 min.
100YR-24HR-SCS       100YR-24HR-SCS              INTENSITY    6 min.
100YR-4HR-CHI        100YR-4HR-CHI               INTENSITY    5 min.
100YR-6HR-SCS        100YR-6HR-SCS               INTENSITY    6 min.
10YR-12HR-SCS        10YR-12HR-SCS               INTENSITY    6 min.
10YR-24HR-SCS        10YR-24HR-SCS               INTENSITY    6 min.
10YR-4HR-CHI         10YR-4HR-CHI                INTENSITY    5 min.
10YR-6HR-SCS         10YR-6HR-SCS                INTENSITY    6 min.
25YR-12HR-SCS        25YR-12HR-SCS               INTENSITY    6 min.
25YR-24HR-SCS        25YR-24HR-SCS               INTENSITY    6 min.
25YR-4HR-CHI         25YR-4HR-CHI                INTENSITY    5 min.
25YR-6HR-SCS         25YR-6HR-SCS                INTENSITY    6 min.
2YR-12HR-SCS         2YR-12HR-SCS                INTENSITY    6 min.
2YR-24HR-SCS         2YR-24HR-SCS                INTENSITY    6 min.
2YR-4HR-CHI          2YR-4HR-CHI                 INTENSITY    5 min.
2YR-6HR-SCS          2YR-6HR-SCS                 INTENSITY    6 min.
50YR-12HR-SCS        50YR-12HR-SCS               INTENSITY    6 min.
```

50YR-24HR-SCS	50YR-24HR-SCS	INTENSITY	6 min.
50YR-4HR-CHI	50YR-4HR-CHI	INTENSITY	5 min.
50YR-6HR-SCS	50YR-6HR-SCS	INTENSITY	6 min.
5YR-12HR-SCS	5YR-12HR-SCS	INTENSITY	6 min.
5YR-24HR-SCS	5YR-24HR-SCS	INTENSITY	6 min.
5YR-4HR-CHI	5YR-4HR-CHI	INTENSITY	5 min.
5YR-6HR-SCS	5YR-6HR-SCS	INTENSITY	6 min.
Hurricane_Hazel	Hurricane_Hazel	INTENSITY	60 min.
WQE-4HR-CHI	WQE-4HR-CHI	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
1	7.47	2987.84	65.70	2.0000	WQE-4HR-CHI	SWMF1
1A	0.50	165.27	2.80	10.0000	WQE-4HR-CHI	OF-1
2	6.29	1798.20	65.00	2.0000	WQE-4HR-CHI	OF-2
2A	0.53	230.44	40.00	2.0000	WQE-4HR-CHI	OF-2
3	35.20	8799.52	65.00	2.0000	WQE-4HR-CHI	SWMF3
3A	1.18	454.69	54.00	2.0000	WQE-4HR-CHI	OF-3
3-EXT	1.28	512.12	50.00	2.0000	WQE-4HR-CHI	SWMF3
4C	15.82	3515.93	65.00	2.0000	WQE-4HR-CHI	SWMF4C
4C-1	0.54	247.64	30.00	2.0000	WQE-4HR-CHI	OF-4C

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CtrlMH-SWMF1	JUNCTION	251.91	2.50	0.0	
CtrlMH-SWMF3	JUNCTION	252.40	4.20	0.0	
CtrlMH-SWMF4C	JUNCTION	250.17	5.13	0.0	
HW-SWMF1	JUNCTION	252.00	1.00	0.0	
HW-SWMF3	JUNCTION	252.40	0.70	0.0	
HW-SWMF4C	JUNCTION	250.10	1.00	0.0	
OF-1	OUTFALL	251.95	1.00	0.0	
OF-2	OUTFALL	0.00	0.00	0.0	
OF-3	OUTFALL	252.10	0.70	0.0	
OF-4C	OUTFALL	249.80	1.00	0.0	
SWMF1	STORAGE	251.20	3.50	0.0	

SWMF3	STORAGE	252.80	3.80	0.0
SWMF4C	STORAGE	251.50	3.80	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	HW-SWMF3	OF-3	CONDUIT	15.0	2.0004	0.0350
C2	CtrlMH-SWMF4C	HW-SWMF4C	CONDUIT	18.6	1.9896	0.0130
C3	CtrlMH-SWMF1	HW-SWMF1	CONDUIT	10.6	1.9815	0.0130
C4	HW-SWMF1	OF-1	CONDUIT	5.0	1.0001	0.0130
C5	CtrlMH-SWMF3	HW-SWMF3	CONDUIT	15.2	2.6325	0.0130
C6	HW-SWMF4C	OF-4C	CONDUIT	10.0	3.0014	0.0350
SWMF1_Primary	SWMF1	CtrlMH-SWMF1	ORIFICE			
SWMF1_Secondary	SWMF1	CtrlMH-SWMF1	ORIFICE			
SWMF3_Primary	SWMF3	CtrlMH-SWMF3	ORIFICE			
SWMF3_Secondary	SWMF3	CtrlMH-SWMF3	ORIFICE			
SWMF4C_Primary	SWMF4C	CtrlMH-SWMF4C	ORIFICE			
SWMF4C_Secondary	SWMF4C	CtrlMH-SWMF4C	ORIFICE			
1-EOW	SWMF1	HW-SWMF1	WEIR			
SWMF3_EOW	SWMF3	HW-SWMF3	WEIR			
SWMF4C_EOW	SWMF4C	HW-SWMF4C	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.70	8.47	0.59	14.20	1	24.00
C2	CIRCULAR	0.60	0.28	0.15	0.60	1	0.87
C3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.86
C4	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	85.93
C5	CIRCULAR	0.60	0.28	0.15	0.60	1	1.00
C6	TRAPEZOIDAL	1.00	18.00	0.84	21.00	1	79.59

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,

```
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... MODIFIED_GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 06/10/2021 00:00:00
Ending Date .............. 06/13/2021 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         1.720        25.000
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         1.070        15.544
Surface Runoff ...........         0.580         8.429
Final Storage ............         0.088         1.274
Continuity Error (%) .....        -0.989


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
```

**************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.580	5.800
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.485	4.851
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.727	7.265
Final Stored Volume	0.821	8.215
Continuity Error (%)	-0.001	

****
Time-Step Critical Elements
****
Link C5 (24.72%)

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	4.16 sec
Average Time Step	:	4.88 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	-0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %
1.991 - 1.256 sec	:	0.00 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
1	25.00	0.00	0.00	14.57	15.19	0.84	9.35	0.70	0.59	0.374
1A	25.00	0.00	0.00	24.95	0.65	0.00	0.00	0.00	0.00	0.000
2	25.00	0.00	0.00	15.38	15.06	1.06	8.59	0.54	0.43	0.344
2A	25.00	0.00	0.00	24.04	9.23	0.24	0.24	0.00	0.00	0.009
3	25.00	0.00	0.00	15.45	15.08	0.99	8.52	3.00	2.41	0.341
3A	25.00	0.00	0.00	17.73	12.48	0.01	6.25	0.07	0.07	0.250
3-EXT	25.00	0.00	0.00	12.50	11.55	0.00	11.55	0.15	0.14	0.462
4C	25.00	0.00	0.00	15.48	15.09	0.92	8.46	1.34	1.08	0.338
4C-1	25.00	0.00	0.00	24.41	6.91	0.00	0.00	0.00	0.00	0.000

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CtrlMH-SWMF1	JUNCTION	0.33	0.35	252.26	0 04:03	0.35
CtrlMH-SWMF3	JUNCTION	0.45	0.48	252.88	0 04:04	0.48
CtrlMH-SWMF4C	JUNCTION	0.33	0.36	250.53	0 04:05	0.36
HW-SWMF1	JUNCTION	0.00	0.00	252.00	0 04:03	0.00
HW-SWMF3	JUNCTION	0.01	0.01	252.41	0 04:05	0.01
HW-SWMF4C	JUNCTION	0.00	0.01	250.11	0 04:05	0.01
OF-1	OUTFALL	0.00	0.00	251.95	0 04:03	0.00
OF-2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-3	OUTFALL	0.00	0.01	252.11	0 04:05	0.01
OF-4C	OUTFALL	0.00	0.00	249.80	0 04:05	0.00
SWMF1	STORAGE	1.36	1.45	252.65	0 04:03	1.45
SWMF3	STORAGE	1.60	1.70	254.50	0 04:04	1.70
SWMF4C	STORAGE	1.58	1.66	253.16	0 04:05	1.66

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CtrlMH-SWMF1	JUNCTION	0.000	0.007	0	04:03	0	0.616	0.002
CtrlMH-SWMF3	JUNCTION	0.000	0.027	0	04:04	0	2.52	0.001
CtrlMH-SWMF4C	JUNCTION	0.000	0.011	0	04:05	0	1.1	0.002
HW-SWMF1	JUNCTION	0.000	0.007	0	04:03	0	0.616	0.002
HW-SWMF3	JUNCTION	0.000	0.027	0	04:04	0	2.52	0.014
HW-SWMF4C	JUNCTION	0.000	0.011	0	04:05	0	1.1	0.006
OF-1	OUTFALL	0.000	0.007	0	04:03	0	0.616	0.000
OF-2	OUTFALL	0.434	0.434	0	01:25	0.542	0.542	0.000
OF-3	OUTFALL	0.069	0.071	0	01:25	0.0739	2.59	0.000
OF-4C	OUTFALL	0.000	0.011	0	04:05	0	1.1	0.000
SWMF1	STORAGE	0.590	0.590	0	01:25	0.698	1.69	0.001
SWMF3	STORAGE	2.550	2.550	0	01:25	3.15	7.29	0.001
SWMF4C	STORAGE	1.076	1.076	0	01:25	1.34	3.47	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SWMF1	1.244	8	0	0	1.626	11	0 04:03	0.007
SWMF3	5.558	11	0	0	7.058	14	0 04:04	0.027
SWMF4C	2.704	10	0	0	3.364	12	0 04:05	0.011

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF-1	98.46	0.003	0.007	0.616
OF-2	8.00	0.027	0.434	0.542
OF-3	98.75	0.010	0.071	2.595
OF-4C	98.40	0.004	0.011	1.099
System	75.90	0.044	0.507	4.851

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.027	0 04:05	0.23	0.00	0.02
C2	CONDUIT	0.011	0 04:05	1.94	0.01	0.05
C3	CONDUIT	0.007	0 04:03	1.77	0.01	0.04
C4	CONDUIT	0.007	0 04:03	0.19	0.00	0.00
C5	CONDUIT	0.027	0 04:04	2.65	0.03	0.08
C6	CONDUIT	0.011	0 04:05	0.15	0.00	0.00
SWMF1_Primary	ORIFICE	0.007	0 04:03			1.00
SWMF1_Secondary	ORIFICE	0.000	0 00:00			0.00
SWMF3_Primary	ORIFICE	0.027	0 04:04			0.98

SWMF3_Secondary	ORIFICE	0.000	0	00:00	0.00
SWMF4C_Primary	ORIFICE	0.011	0	04:05	1.00
SWMF4C_Secondary	ORIFICE	0.000	0	00:00	0.00
1-EOW	WEIR	0.000	0	00:00	0.00
SWMF3_EOW	WEIR	0.000	0	00:00	0.00
SWMF4C_EOW	WEIR	0.000	0	00:00	0.00

****
Flow Classification Summary
****

	Adjusted	---------- Fraction of Time in Flow Class ----------							
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.01	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C4	1.00	0.01	0.00	0.00	0.54	0.44	0.00	0.00	0.00	0.00
C5	1.00	0.01	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
C6	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Oct 6 12:00:45 2021
Analysis ended on: Wed Oct 6 12:00:51 2021
Total elapsed time: 00:00:06

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------

PROJECT MANAGER: JWI
MODELLING COMPLETED BY: MG
WORK COMPLETED:

WARNING 02: maximum depth increased for Node HW-SWMF3

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 9
Number of nodes ........... 13
Number of links ........... 15
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
100YR-12HR-SCS       100YR-12HR-SCS              INTENSITY    6 min.
100YR-24HR-SCS       100YR-24HR-SCS              INTENSITY    6 min.
100YR-4HR-CHI        100YR-4HR-CHI               INTENSITY    5 min.
100YR-6HR-SCS        100YR-6HR-SCS               INTENSITY    6 min.
10YR-12HR-SCS        10YR-12HR-SCS               INTENSITY    6 min.
10YR-24HR-SCS        10YR-24HR-SCS               INTENSITY    6 min.
10YR-4HR-CHI         10YR-4HR-CHI                INTENSITY    5 min.
10YR-6HR-SCS         10YR-6HR-SCS                INTENSITY    6 min.
25YR-12HR-SCS        25YR-12HR-SCS               INTENSITY    6 min.
25YR-24HR-SCS        25YR-24HR-SCS               INTENSITY    6 min.
25YR-4HR-CHI         25YR-4HR-CHI                INTENSITY    5 min.
25YR-6HR-SCS         25YR-6HR-SCS                INTENSITY    6 min.
2YR-12HR-SCS         2YR-12HR-SCS                INTENSITY    6 min.
2YR-24HR-SCS         2YR-24HR-SCS                INTENSITY    6 min.
2YR-4HR-CHI          2YR-4HR-CHI                 INTENSITY    5 min.
2YR-6HR-SCS          2YR-6HR-SCS                 INTENSITY    6 min.
50YR-12HR-SCS        50YR-12HR-SCS               INTENSITY    6 min.
```

50YR-24HR-SCS	50YR-24HR-SCS	INTENSITY	6 min.
50YR-4HR-CHI	50YR-4HR-CHI	INTENSITY	5 min.
50YR-6HR-SCS	50YR-6HR-SCS	INTENSITY	6 min.
5YR-12HR-SCS	5YR-12HR-SCS	INTENSITY	6 min.
5YR-24HR-SCS	5YR-24HR-SCS	INTENSITY	6 min.
5YR-4HR-CHI	5YR-4HR-CHI	INTENSITY	5 min.
5YR-6HR-SCS	5YR-6HR-SCS	INTENSITY	6 min.
Hurricane_Hazel	Hurricane_Hazel	INTENSITY	60 min.
WQE-4HR-CHI	WQE-4HR-CHI	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
1	7.47	2987.84	65.70	2.0000	100YR-6HR-SCS	SWMF1
1A	0.50	165.27	2.80	10.0000	100YR-6HR-SCS	OF-1
2	6.29	1798.20	65.00	2.0000	100YR-6HR-SCS	OF-2
2A	0.53	230.44	40.00	2.0000	100YR-6HR-SCS	OF-2
3	35.20	8799.52	65.00	2.0000	100YR-6HR-SCS	SWMF3
3A	1.18	454.69	54.00	2.0000	100YR-6HR-SCS	OF-3
3-EXT	1.28	512.12	50.00	2.0000	100YR-6HR-SCS	SWMF3
4C	15.82	3515.93	65.00	2.0000	100YR-6HR-SCS	SWMF4C
4C-1	0.54	247.64	30.00	2.0000	100YR-6HR-SCS	OF-4C

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CtrlMH-SWMF1	JUNCTION	251.91	2.50	0.0	
CtrlMH-SWMF3	JUNCTION	252.40	4.20	0.0	
CtrlMH-SWMF4C	JUNCTION	250.17	5.13	0.0	
HW-SWMF1	JUNCTION	252.00	1.00	0.0	
HW-SWMF3	JUNCTION	252.40	0.70	0.0	
HW-SWMF4C	JUNCTION	250.10	1.00	0.0	
OF-1	OUTFALL	251.95	1.00	0.0	
OF-2	OUTFALL	0.00	0.00	0.0	
OF-3	OUTFALL	252.10	0.70	0.0	
OF-4C	OUTFALL	249.80	1.00	0.0	
SWMF1	STORAGE	251.20	3.50	0.0	

SWMF3	STORAGE	252.80	3.80	0.0
SWMF4C	STORAGE	251.50	3.80	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	HW-SWMF3	OF-3	CONDUIT	15.0	2.0004	0.0350
C2	CtrlMH-SWMF4C	HW-SWMF4C	CONDUIT	18.6	1.9896	0.0130
C3	CtrlMH-SWMF1	HW-SWMF1	CONDUIT	10.6	1.9815	0.0130
C4	HW-SWMF1	OF-1	CONDUIT	5.0	1.0001	0.0130
C5	CtrlMH-SWMF3	HW-SWMF3	CONDUIT	15.2	2.6325	0.0130
C6	HW-SWMF4C	OF-4C	CONDUIT	10.0	3.0014	0.0350
SWMF1_Primary	SWMF1	CtrlMH-SWMF1	ORIFICE			
SWMF1_Secondary	SWMF1	CtrlMH-SWMF1	ORIFICE			
SWMF3_Primary	SWMF3	CtrlMH-SWMF3	ORIFICE			
SWMF3_Secondary	SWMF3	CtrlMH-SWMF3	ORIFICE			
SWMF4C_Primary	SWMF4C	CtrlMH-SWMF4C	ORIFICE			
SWMF4C_Secondary	SWMF4C	CtrlMH-SWMF4C	ORIFICE			
1-EOW	SWMF1	HW-SWMF1	WEIR			
SWMF3_EOW	SWMF3	HW-SWMF3	WEIR			
SWMF4C_EOW	SWMF4C	HW-SWMF4C	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.70	8.47	0.59	14.20	1	24.00
C2	CIRCULAR	0.60	0.28	0.15	0.60	1	0.87
C3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.86
C4	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	85.93
C5	CIRCULAR	0.60	0.28	0.15	0.60	1	1.00
C6	TRAPEZOIDAL	1.00	18.00	0.84	21.00	1	79.59

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,

```
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ..............  CMS
Process Models:
  Rainfall/Runoff ........  YES
  RDII ...................  NO
  Snowmelt ...............  NO
  Groundwater ............  NO
  Flow Routing ...........  YES
  Ponding Allowed ........  NO
  Water Quality ..........  NO
Infiltration Method ......  MODIFIED_GREEN_AMPT
Flow Routing Method ......  DYNWAVE
Surcharge Method .........  EXTRAN
Starting Date ............  06/10/2021 00:00:00
Ending Date ..............  06/13/2021 00:00:00
Antecedent Dry Days ......  0.0
Report Time Step .........  00:01:00
Wet Time Step ............  00:05:00
Dry Time Step ............  00:05:00
Routing Time Step ........  5.00 sec
Variable Time Step .......  YES
Maximum Trials ...........  8
Number of Threads ........  1
Head Tolerance ...........  0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         7.329       106.500
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         2.352        34.174
Surface Runoff ...........         4.928        71.608
Final Storage ............         0.088         1.274
Continuity Error (%) .....        -0.521


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
```

**************************	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	4.924	49.245
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	4.694	46.938
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.727	7.265
Final Stored Volume	0.957	9.573
Continuity Error (%)	-0.001	

****
Time-Step Critical Elements
****
Link C5 (77.69%)
Link C3 (8.61%)

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	1.67 sec
Average Time Step	:	3.21 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	48.89 %
3.155 - 1.991 sec	:	26.24 %
1.991 - 1.256 sec	:	24.87 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
1	106.50	0.00	0.00	32.13	68.76	35.08	73.59	5.50	3.80	0.691
1A	106.50	0.00	0.00	67.91	2.93	39.44	39.44	0.20	0.22	0.370
2	106.50	0.00	0.00	33.55	68.06	38.16	72.19	4.54	3.11	0.678
2A	106.50	0.00	0.00	53.87	41.84	52.52	52.52	0.28	0.24	0.493
3	106.50	0.00	0.00	33.60	68.08	38.11	72.15	25.40	17.21	0.677
3A	106.50	0.00	0.00	40.26	56.50	37.45	65.70	0.78	0.58	0.617
3-EXT	106.50	0.00	0.00	34.39	52.31	19.34	71.65	0.92	0.66	0.673
4C	106.50	0.00	0.00	33.64	68.10	38.07	72.12	11.41	7.66	0.677
4C-1	106.50	0.00	0.00	58.22	31.38	48.32	48.32	0.26	0.24	0.454

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CtrlMH-SWMF1	JUNCTION	0.37	0.48	252.39	0 03:42	0.48
CtrlMH-SWMF3	JUNCTION	0.55	0.69	253.09	0 04:07	0.69
CtrlMH-SWMF4C	JUNCTION	0.41	0.51	250.68	0 04:05	0.51
HW-SWMF1	JUNCTION	0.01	0.02	252.02	0 03:42	0.02
HW-SWMF3	JUNCTION	0.03	0.07	252.47	0 04:07	0.07
HW-SWMF4C	JUNCTION	0.01	0.03	250.13	0 04:05	0.03
OF-1	OUTFALL	0.01	0.02	251.97	0 03:42	0.02
OF-2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-3	OUTFALL	0.02	0.06	252.16	0 04:07	0.06
OF-4C	OUTFALL	0.01	0.03	249.83	0 04:05	0.03
SWMF1	STORAGE	1.59	2.18	253.38	0 03:42	2.18
SWMF3	STORAGE	2.00	2.79	255.59	0 04:07	2.79
SWMF4C	STORAGE	1.95	2.60	254.10	0 04:05	2.60

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CtrlMH-SWMF1	JUNCTION	0.000	0.157	0 03:42	0	5.31	0.001
CtrlMH-SWMF3	JUNCTION	0.000	0.418	0 04:07	0	24.9	0.000
CtrlMH-SWMF4C	JUNCTION	0.000	0.194	0 04:05	0	10.7	0.001
HW-SWMF1	JUNCTION	0.000	0.157	0 03:42	0	5.31	0.001
HW-SWMF3	JUNCTION	0.000	0.418	0 04:07	0	24.9	0.002
HW-SWMF4C	JUNCTION	0.000	0.194	0 04:05	0	10.7	0.002
OF-1	OUTFALL	0.225	0.303	0 03:01	0.196	5.5	0.000
OF-2	OUTFALL	3.345	3.345	0 03:00	4.82	4.82	0.000
OF-3	OUTFALL	0.578	0.812	0 03:03	0.777	25.7	0.000
OF-4C	OUTFALL	0.241	0.363	0 03:05	0.264	10.9	0.000
SWMF1	STORAGE	3.802	3.802	0 03:00	5.49	6.49	0.000
SWMF3	STORAGE	17.864	17.864	0 03:00	26.3	30.4	0.001
SWMF4C	STORAGE	7.659	7.659	0 03:00	11.4	13.5	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SWMF1	2.337	15	0	0	5.565	37	0 03:42	0.157
SWMF3	12.466	25	0	0	27.161	55	0 04:07	0.418
SWMF4C	5.884	22	0	0	12.077	45	0 04:05	0.194

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF-1	99.45	0.034	0.303	5.504
OF-2	15.62	0.176	3.345	4.818
OF-3	99.64	0.149	0.812	25.685
OF-4C	99.40	0.063	0.363	10.930
System	78.53	0.422	4.753	46.938

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.418	0 04:07	0.67	0.02	0.09
C2	CONDUIT	0.194	0 04:05	4.74	0.22	0.20
C3	CONDUIT	0.157	0 03:42	4.77	0.18	0.17
C4	CONDUIT	0.157	0 03:42	0.64	0.00	0.02
C5	CONDUIT	0.418	0 04:07	5.99	0.42	0.30
C6	CONDUIT	0.194	0 04:05	0.47	0.00	0.03
SWMF1_Primary	ORIFICE	0.020	0 03:42			1.00
SWMF1_Secondary	ORIFICE	0.137	0 03:42			1.00

SWMF3_Primary	ORIFICE	0.096	0	04:07	1.00
SWMF3_Secondary	ORIFICE	0.322	0	04:07	1.00
SWMF4C_Primary	ORIFICE	0.035	0	04:05	1.00
SWMF4C_Secondary	ORIFICE	0.159	0	04:05	1.00
1-EOW	WEIR	0.000	0	00:00	0.00
SWMF3_EOW	WEIR	0.000	0	00:00	0.00
SWMF4C_EOW	WEIR	0.000	0	00:00	0.00

****
Flow Classification Summary
****

	Adjusted	---------- Fraction of Time in Flow Class ----------								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C4	1.00	0.00	0.00	0.00	0.30	0.69	0.00	0.00	0.25	0.00
C5	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C6	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Oct 6 12:00:29 2021
Analysis ended on: Wed Oct 6 12:00:36 2021
Total elapsed time: 00:00:07

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------

PROJECT MANAGER: JWI
MODELLING COMPLETED BY: MG
WORK COMPLETED:

WARNING 02: maximum depth increased for Node HW-SWMF3

*************
Element Count
*************
Number of rain gages ...... 27
Number of subcatchments ... 9
Number of nodes ........... 13
Number of links ........... 15
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
100YR-12HR-SCS       100YR-12HR-SCS              INTENSITY    6 min.
100YR-24HR-SCS       100YR-24HR-SCS              INTENSITY    6 min.
100YR-4HR-CHI        100YR-4HR-CHI               INTENSITY    5 min.
100YR-6HR-SCS        100YR-6HR-SCS               INTENSITY    6 min.
10YR-12HR-SCS        10YR-12HR-SCS               INTENSITY    6 min.
10YR-24HR-SCS        10YR-24HR-SCS               INTENSITY    6 min.
10YR-4HR-CHI         10YR-4HR-CHI                INTENSITY    5 min.
10YR-6HR-SCS         10YR-6HR-SCS                INTENSITY    6 min.
25YR-12HR-SCS        25YR-12HR-SCS               INTENSITY    6 min.
25YR-24HR-SCS        25YR-24HR-SCS               INTENSITY    6 min.
25YR-4HR-CHI         25YR-4HR-CHI                INTENSITY    5 min.
25YR-6HR-SCS         25YR-6HR-SCS                INTENSITY    6 min.
2YR-12HR-SCS         2YR-12HR-SCS                INTENSITY    6 min.
2YR-24HR-SCS         2YR-24HR-SCS                INTENSITY    6 min.
2YR-4HR-CHI          2YR-4HR-CHI                 INTENSITY    5 min.
2YR-6HR-SCS          2YR-6HR-SCS                 INTENSITY    6 min.
50YR-12HR-SCS        50YR-12HR-SCS               INTENSITY    6 min.
```

50YR-24HR-SCS	50YR-24HR-SCS	INTENSITY	6	min.
50YR-4HR-CHI	50YR-4HR-CHI	INTENSITY	5	min.
50YR-6HR-SCS	50YR-6HR-SCS	INTENSITY	6	min.
5YR-12HR-SCS	5YR-12HR-SCS	INTENSITY	6	min.
5YR-24HR-SCS	5YR-24HR-SCS	INTENSITY	6	min.
5YR-4HR-CHI	5YR-4HR-CHI	INTENSITY	5	min.
5YR-6HR-SCS	5YR-6HR-SCS	INTENSITY	6	min.
HAZEL	HAZEL	INTENSITY	60	min.
Hurricane_Hazel	Hurricane_Hazel	INTENSITY	60	min.
WQE-4HR-CHI	WQE-4HR-CHI	INTENSITY	5	min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
1	7.47	2987.84	65.70	2.0000	HAZEL	SWMF1
1A	0.50	165.27	2.80	10.0000	HAZEL	OF-1
2	6.29	1798.20	65.00	2.0000	HAZEL	OF-2
2A	0.53	230.44	40.00	2.0000	HAZEL	OF-2
3	35.20	8799.52	65.00	2.0000	HAZEL	SWMF3
3A	1.18	454.69	54.00	2.0000	HAZEL	OF-3
3-EXT	1.28	512.12	50.00	2.0000	HAZEL	SWMF3
4C	15.82	3515.93	65.00	2.0000	HAZEL	SWMF4C
4C-1	0.54	247.64	30.00	2.0000	HAZEL	OF-4C

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CtrlMH-SWMF1	JUNCTION	251.91	2.50	0.0	
CtrlMH-SWMF3	JUNCTION	252.40	4.20	0.0	
CtrlMH-SWMF4C	JUNCTION	250.17	5.13	0.0	
HW-SWMF1	JUNCTION	252.00	1.00	0.0	
HW-SWMF3	JUNCTION	252.40	0.70	0.0	
HW-SWMF4C	JUNCTION	250.10	1.00	0.0	
OF-1	OUTFALL	251.95	1.00	0.0	
OF-2	OUTFALL	0.00	0.00	0.0	
OF-3	OUTFALL	252.10	0.70	0.0	
OF-4C	OUTFALL	249.80	1.00	0.0	

SWMF1	STORAGE	251.20	3.50	0.0
SWMF3	STORAGE	252.80	3.80	0.0
SWMF4C	STORAGE	251.50	3.80	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	HW-SWMF3	OF-3	CONDUIT	15.0	2.0004	0.0350
C2	CtrlMH-SWMF4C	HW-SWMF4C	CONDUIT	18.6	1.9896	0.0130
C3	CtrlMH-SWMF1	HW-SWMF1	CONDUIT	10.6	1.9815	0.0130
C4	HW-SWMF1	OF-1	CONDUIT	5.0	1.0001	0.0130
C5	CtrlMH-SWMF3	HW-SWMF3	CONDUIT	15.2	2.6325	0.0130
C6	HW-SWMF4C	OF-4C	CONDUIT	10.0	3.0014	0.0350
SWMF1_Primary	SWMF1	CtrlMH-SWMF1	ORIFICE			
SWMF1_Secondary	SWMF1	CtrlMH-SWMF1	ORIFICE			
SWMF3_Primary	SWMF3	CtrlMH-SWMF3	ORIFICE			
SWMF3_Secondary	SWMF3	CtrlMH-SWMF3	ORIFICE			
SWMF4C_Primary	SWMF4C	CtrlMH-SWMF4C	ORIFICE			
SWMF4C_Secondary	SWMF4C	CtrlMH-SWMF4C	ORIFICE			
1-EOW	SWMF1	HW-SWMF1	WEIR			
SWMF3_EOW	SWMF3	HW-SWMF3	WEIR			
SWMF4C_EOW	SWMF4C	HW-SWMF4C	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.70	8.47	0.59	14.20	1	24.00
C2	CIRCULAR	0.60	0.28	0.15	0.60	1	0.87
C3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.86
C4	TRAPEZOIDAL	1.00	13.00	0.80	16.00	1	85.93
C5	CIRCULAR	0.60	0.28	0.15	0.60	1	1.00
C6	TRAPEZOIDAL	1.00	18.00	0.84	21.00	1	79.59

****
NOTE: The summary statistics displayed in this report are

```
based on results found at every computational time step,
not just on results from each reporting time step.
*****************************************************

***************
Analysis Options
***************
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... MODIFIED_GREEN_AMPT
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date ..... 06/10/2021 00:00:00
Ending Date ..... 06/13/2021 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......        14.520       211.000
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         4.536        65.920
Surface Runoff ...........         9.914       144.060
Final Storage ............         0.088         1.274
Continuity Error (%) .....        -0.121


*************************        Volume        Volume
```

Flow Routing Continuity	hectare-m	10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	9.913	99.130
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	9.563	95.627
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.727	7.265
Final Stored Volume	1.077	10.769
Continuity Error (%)	-0.000	

Time-Step Critical Elements

Link C5 (74.03%)
Link C3 (23.61%)

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.40 sec
Average Time Step	:	2.66 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	31.92 %
3.155 - 1.991 sec	:	24.65 %
1.991 - 1.256 sec	:	43.43 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
1	211.00	0.00	0.00	62.25	137.43	70.75	147.70	11.03	0.99	0.700
1A	211.00	0.00	0.00	153.92	5.86	57.35	57.35	0.28	0.05	0.272
2	211.00	0.00	0.00	64.02	135.98	77.93	145.92	9.18	0.83	0.692
2A	211.00	0.00	0.00	107.59	83.65	102.84	102.84	0.55	0.06	0.487
3	211.00	0.00	0.00	64.11	135.98	77.85	145.84	51.33	4.67	0.691
3A	211.00	0.00	0.00	81.71	112.95	71.98	128.45	1.52	0.15	0.609
3-EXT	211.00	0.00	0.00	77.97	104.57	27.67	132.24	1.69	0.16	0.627
4C	211.00	0.00	0.00	64.19	135.99	77.77	145.77	23.06	2.10	0.691
4C-1	211.00	0.00	0.00	122.25	62.74	88.40	88.40	0.48	0.06	0.419

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CtrlMH-SWMF1	JUNCTION	0.40	0.52	252.43	0 11:11	0.52
CtrlMH-SWMF3	JUNCTION	0.59	0.72	253.12	0 10:14	0.72
CtrlMH-SWMF4C	JUNCTION	0.45	0.55	250.72	0 11:02	0.55
HW-SWMF1	JUNCTION	0.01	0.03	252.03	0 11:11	0.03
HW-SWMF3	JUNCTION	0.05	0.20	252.60	0 11:01	0.20
HW-SWMF4C	JUNCTION	0.02	0.04	250.14	0 11:23	0.04
OF-1	OUTFALL	0.01	0.03	251.98	0 11:11	0.03
OF-2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF-3	OUTFALL	0.04	0.20	252.30	0 11:01	0.20
OF-4C	OUTFALL	0.02	0.04	249.84	0 11:23	0.04
SWMF1	STORAGE	1.76	2.69	253.89	0 11:11	2.69
SWMF3	STORAGE	2.28	3.50	256.30	0 11:01	3.50
SWMF4C	STORAGE	2.27	3.33	254.83	0 11:23	3.33

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CtrlMH-SWMF1	JUNCTION	0.000	0.222	0 11:11	0	10.8	0.000
CtrlMH-SWMF3	JUNCTION	0.000	0.557	0 11:01	0	42.4	0.000
CtrlMH-SWMF4C	JUNCTION	0.000	0.278	0 11:23	0	21.4	0.001
HW-SWMF1	JUNCTION	0.000	0.222	0 11:11	0	10.8	0.001
HW-SWMF3	JUNCTION	0.000	2.823	0 11:01	0	51	0.002
HW-SWMF4C	JUNCTION	0.000	0.383	0 11:23	0	21.8	0.002
OF-1	OUTFALL	0.053	0.253	0 11:00	0.284	11	0.000
OF-2	OUTFALL	0.900	0.900	0 10:00	9.73	9.73	0.000
OF-3	OUTFALL	0.151	2.912	0 11:01	1.52	52.6	0.000
OF-4C	OUTFALL	0.064	0.390	0 11:21	0.482	22.3	0.000
SWMF1	STORAGE	0.993	0.993	0 09:55	11	12	0.000
SWMF3	STORAGE	4.829	4.829	0 10:00	53	57.2	0.000
SWMF4C	STORAGE	2.098	2.098	0 10:00	23.1	25.2	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SWMF1	3.293	22	0	0	8.867	59	0 11:11	0.222
SWMF3	17.815	36	0	0	42.461	85	0 11:01	2.823
SWMF4C	9.163	34	0	0	20.632	77	0 11:23	0.383

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF-1	99.64	0.065	0.253	11.045
OF-2	23.25	0.234	0.900	9.728
OF-3	99.81	0.299	2.912	52.562
OF-4C	99.60	0.123	0.390	22.291
System	80.57	0.722	4.094	95.626

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	2.823	0 11:01	1.34	0.12	0.28
C2	CONDUIT	0.278	0 11:23	5.26	0.32	0.25
C3	CONDUIT	0.222	0 11:11	5.33	0.26	0.20
C4	CONDUIT	0.222	0 11:11	0.74	0.00	0.03
C5	CONDUIT	0.557	0 11:01	6.36	0.56	0.43
C6	CONDUIT	0.383	0 11:23	0.61	0.00	0.04
SWMF1_Primary	ORIFICE	0.025	0 11:11			1.00

SWMF1_Secondary	ORIFICE	0.197	0	11:11	1.00
SWMF3_Primary	ORIFICE	0.121	0	11:01	1.00
SWMF3_Secondary	ORIFICE	0.437	0	11:01	1.00
SWMF4C_Primary	ORIFICE	0.046	0	11:23	1.00
SWMF4C_Secondary	ORIFICE	0.232	0	11:23	1.00
1-EOW	WEIR	0.000	0	00:00	0.00
SWMF3_EOW	WEIR	2.266	0	11:01	0.40
SWMF4C_EOW	WEIR	0.105	0	11:23	0.07

****
Flow Classification Summary
****

	Adjusted	Fraction of Time in Flow Class								
	/Actual		Up	Down	Sub	Sup	Up	Down	Norm	Inlet
Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd	Ctrl
C1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C4	1.00	0.00	0.00	0.00	0.18	0.82	0.00	0.00	0.30	0.00
C5	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
C6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

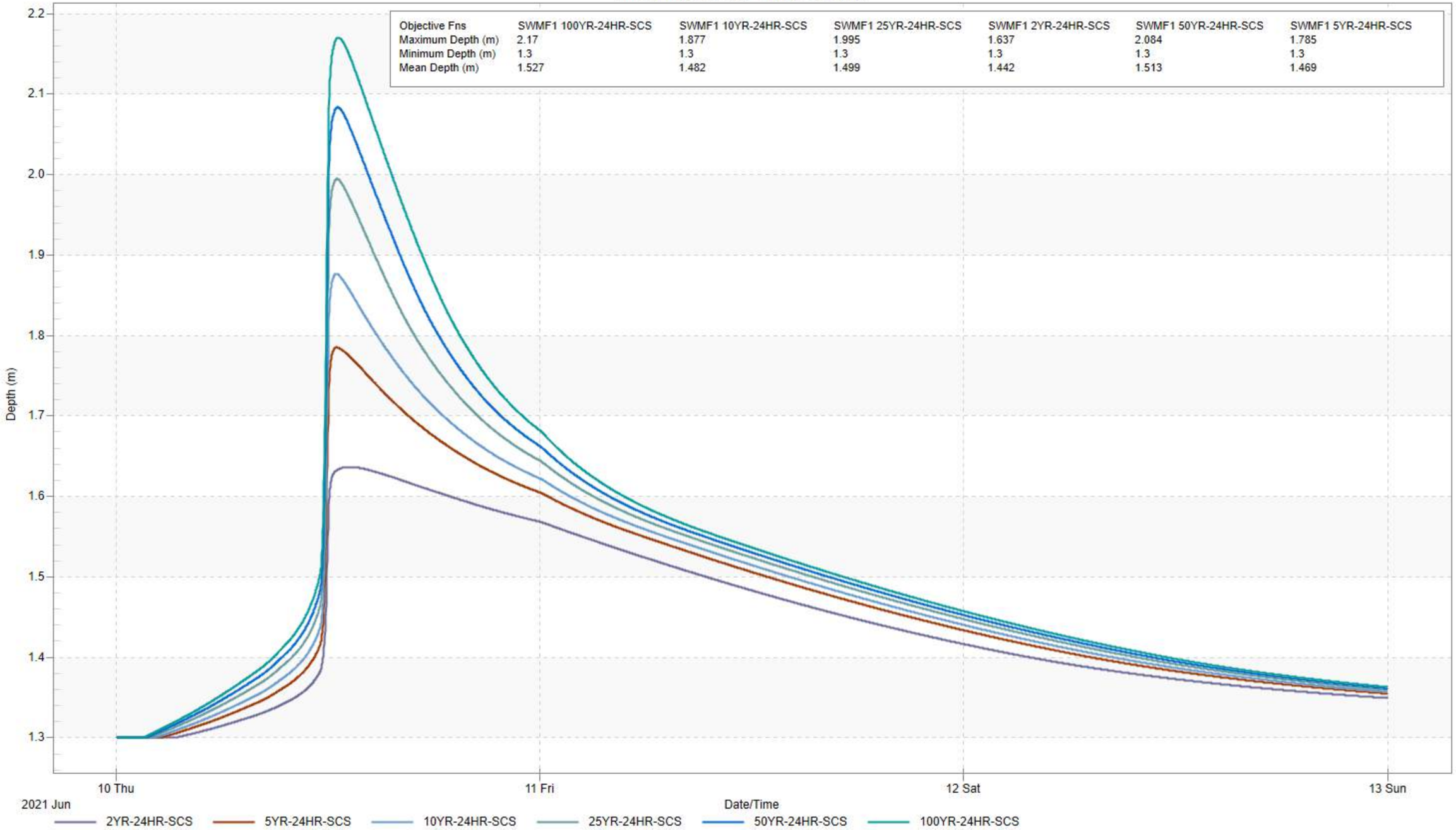
No conduits were surcharged.

Analysis begun on: Wed Oct 6 12:00:41 2021
Analysis ended on: Wed Oct 6 12:00:49 2021
Total elapsed time: 00:00:08

Node SWMF1

SWMF1: Depth vs. Time - 24 hour SCS Type II

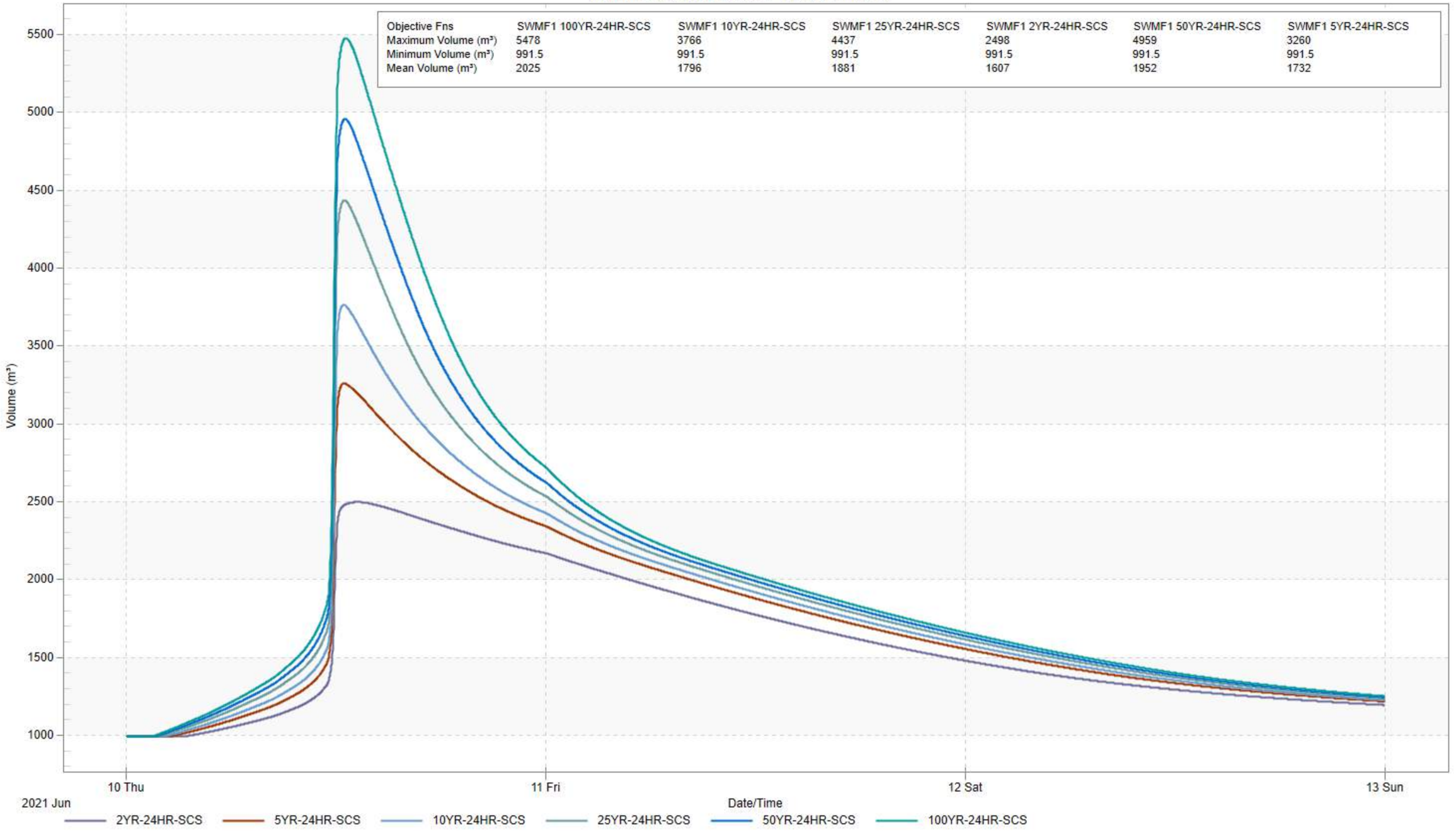
Objective Fns	SWMF1 100YR-24HR-SCS	SWMF1 10YR-24HR-SCS	SWMF1 25YR-24HR-SCS	SWMF1 2YR-24HR-SCS	SWMF1 50YR-24HR-SCS	SWMF1 5YR-24HR-SCS
Maximum Depth (m)	2.17	1.877	1.995	1.637	2.084	1.785
Minimum Depth (m)	1.3	1.3	1.3	1.3	1.3	1.3
Mean Depth (m)	1.527	1.482	1.499	1.442	1.513	1.469



Node SWMF1

SWMF1: Storage Volume vs. Time - 24 hour SCS Type II

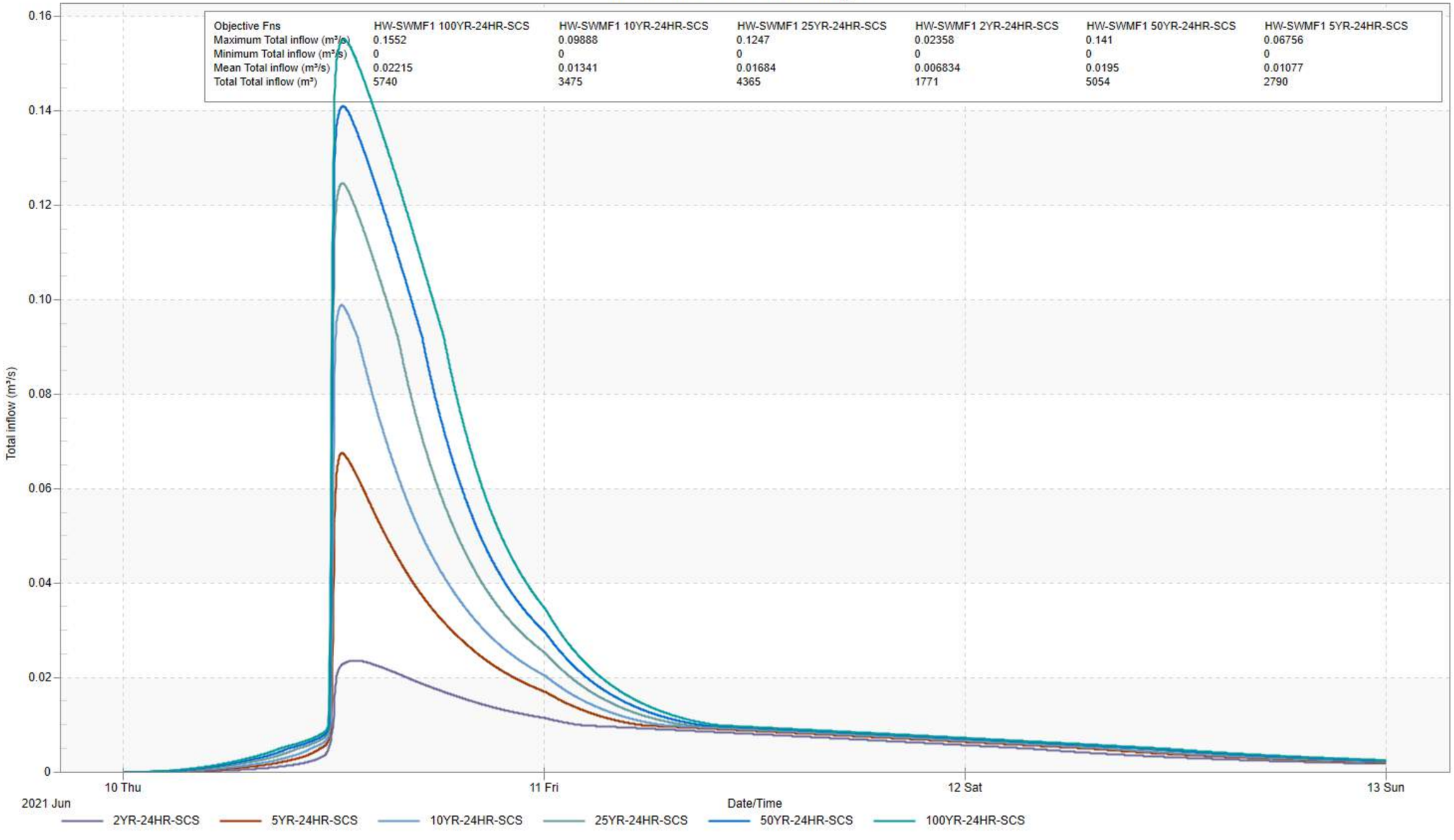
Objective Fns	SWMF1 100YR-24HR-SCS	SWMF1 10YR-24HR-SCS	SWMF1 25YR-24HR-SCS	SWMF1 2YR-24HR-SCS	SWMF1 50YR-24HR-SCS	SWMF1 5YR-24HR-SCS
Maximum Volume (m³)	5478	3766	4437	2498	4959	3260
Minimum Volume (m³)	991.5	991.5	991.5	991.5	991.5	991.5
Mean Volume (m³)	2025	1796	1881	1607	1952	1732



Node HW-SWMF1

HW-SWMF1: Flow vs. Time - 24 hour SCS Type II

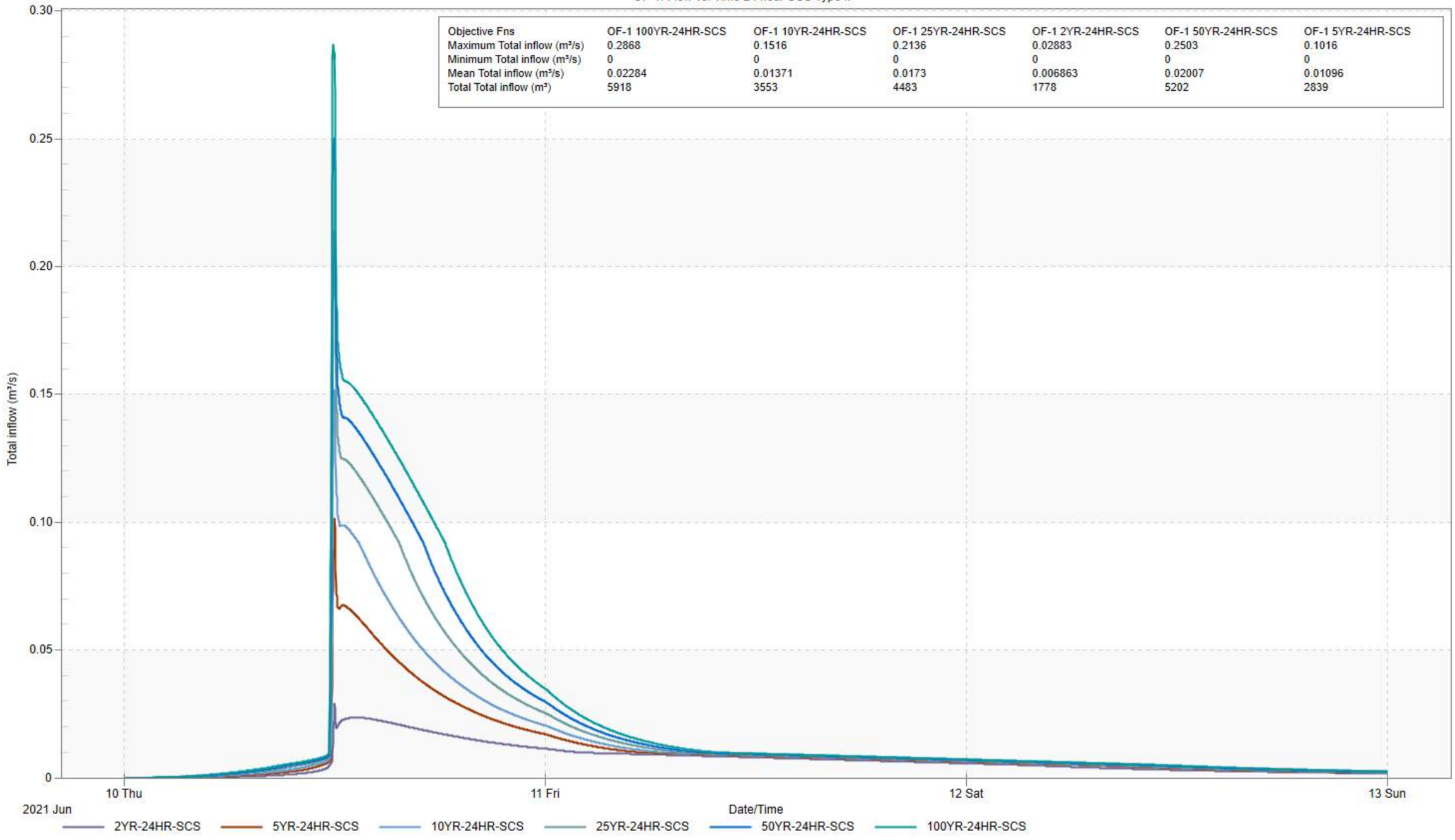
Objective Fns	HW-SWMF1 100YR-24HR-SCS	HW-SWMF1 10YR-24HR-SCS	HW-SWMF1 25YR-24HR-SCS	HW-SWMF1 2YR-24HR-SCS	HW-SWMF1 50YR-24HR-SCS	HW-SWMF1 5YR-24HR-SCS
Maximum Total inflow (m³/s)	0.1552	0.09888	0.1247	0.02358	0.141	0.06756
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.02215	0.01341	0.01684	0.006834	0.0195	0.01077
Total Total inflow (m³)	5740	3475	4365	1771	5054	2790



Node OF-1

OF-1: Flow vs. Time 24 hour SCS Type II

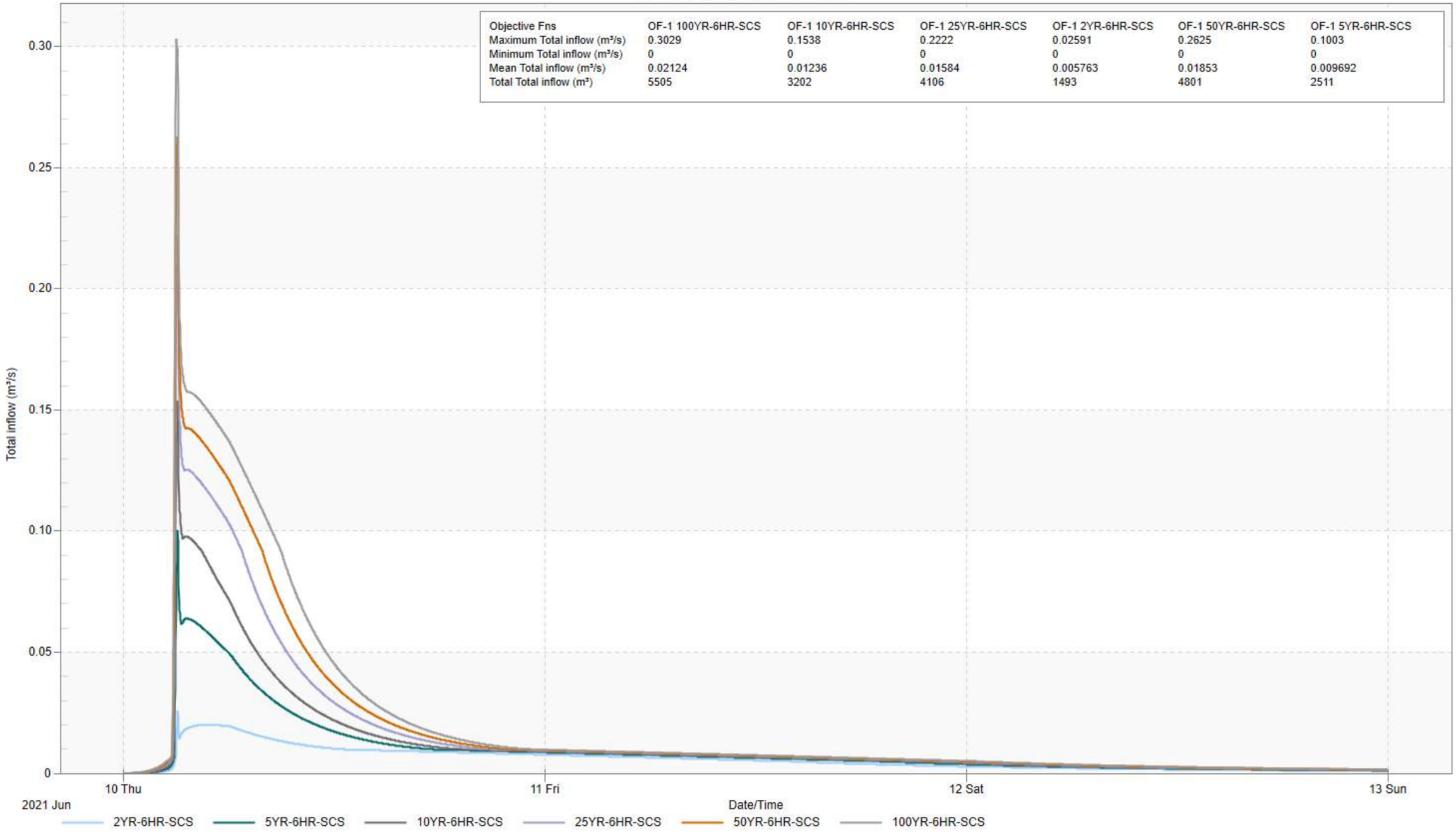
Objective Fns	OF-1 100YR-24HR-SCS	OF-1 10YR-24HR-SCS	OF-1 25YR-24HR-SCS	OF-1 2YR-24HR-SCS	OF-1 50YR-24HR-SCS	OF-1 5YR-24HR-SCS
Maximum Total inflow (m³/s)	0.2868	0.1516	0.2136	0.02883	0.2503	0.1016
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.02284	0.01371	0.0173	0.006863	0.02007	0.01096
Total Total inflow (m³)	5918	3553	4483	1778	5202	2839



Node OF-1

OF-1: Flow vs. Time 6 hour SCS Type II

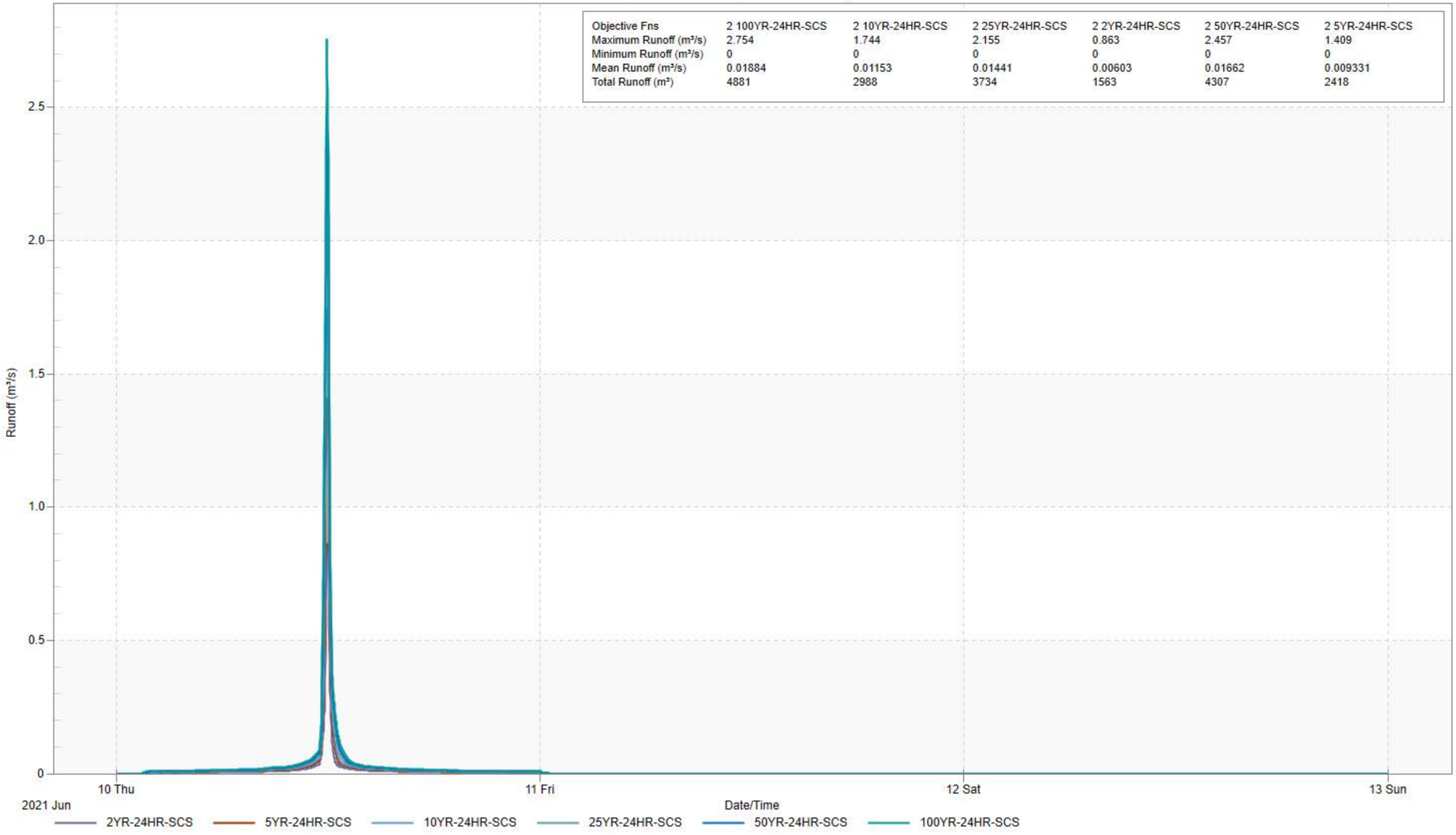
Objective Fns	OF-1 100YR-6HR-SCS	OF-1 10YR-6HR-SCS	OF-1 25YR-6HR-SCS	OF-1 2YR-6HR-SCS	OF-1 50YR-6HR-SCS	OF-1 5YR-6HR-SCS
Maximum Total inflow (m³/s)	0.3029	0.1538	0.2222	0.02591	0.2625	0.1003
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.02124	0.01236	0.01584	0.005763	0.01853	0.009692
Total Total inflow (m³)	5505	3202	4106	1493	4801	2511



Subcatchment 2

Catchment 2: Flow vs. Time - 24 hour SCS Type II

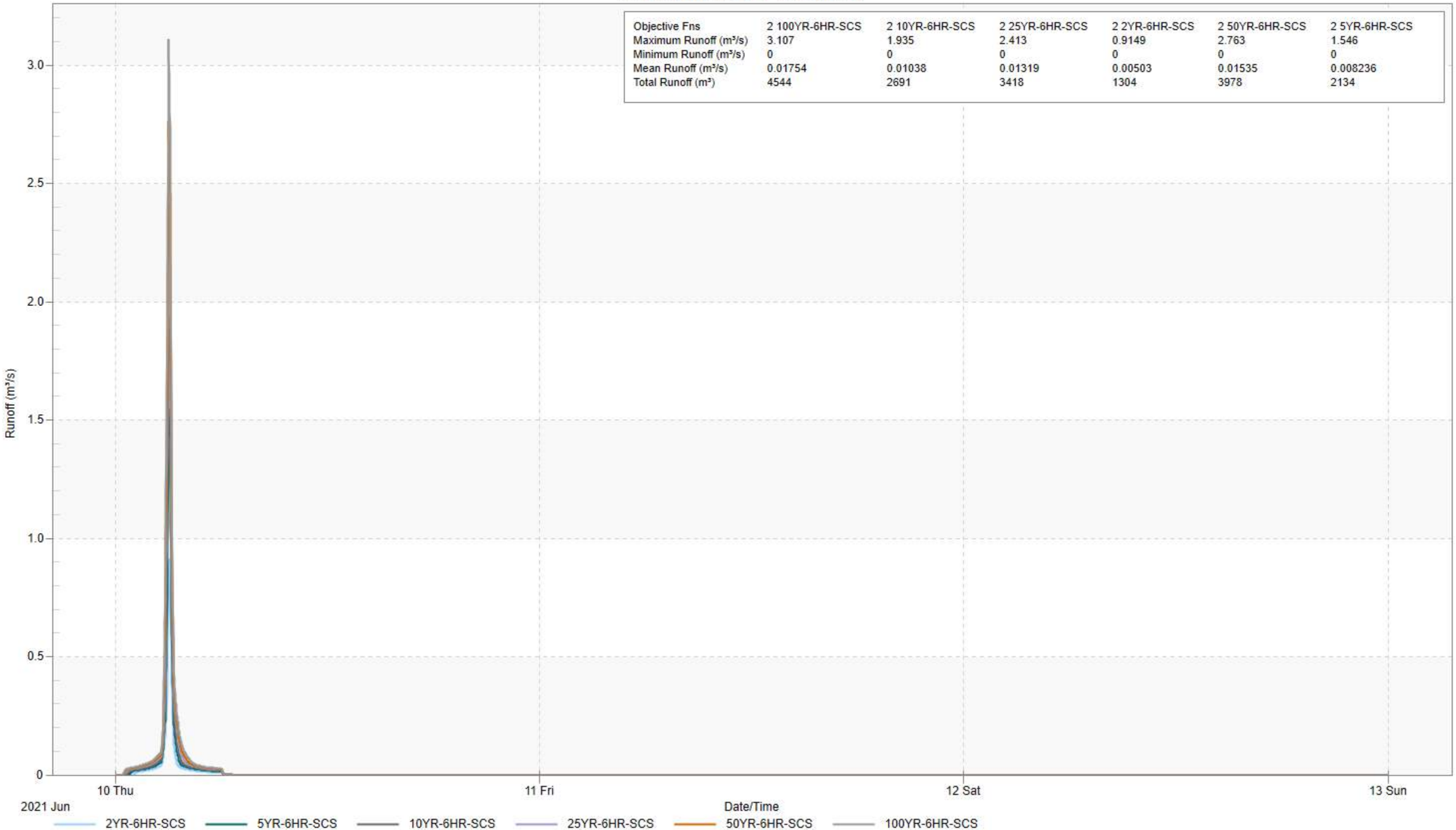
Objective Fns	2 100YR-24HR-SCS	2 10YR-24HR-SCS	2 25YR-24HR-SCS	2 2YR-24HR-SCS	2 50YR-24HR-SCS	2 5YR-24HR-SCS
Maximum Runoff (m³/s)	2.754	1.744	2.155	0.863	2.457	1.409
Minimum Runoff (m³/s)	0	0	0	0	0	0
Mean Runoff (m³/s)	0.01884	0.01153	0.01441	0.00603	0.01662	0.009331
Total Runoff (m³)	4881	2988	3734	1563	4307	2418



Subcatchment 2

Catchment 2: Flow vs. Time - 6hr SCS Type II

Objective Fns	2 100YR-6HR-SCS	2 10YR-6HR-SCS	2 25YR-6HR-SCS	2 2YR-6HR-SCS	2 50YR-6HR-SCS	2 5YR-6HR-SCS
Maximum Runoff (m³/s)	3.107	1.935	2.413	0.9149	2.763	1.546
Minimum Runoff (m³/s)	0	0	0	0	0	0
Mean Runoff (m³/s)	0.01754	0.01038	0.01319	0.00503	0.01535	0.008236
Total Runoff (m³)	4544	2691	3418	1304	3978	2134



Appendix D

Supporting Water Balance and Phosphorous Budget Calculations

- LID Sizing Calculations
- Phosphorus Loading Calculations
- Excerpts from RJB's Water Balance Calculations – Tables G-1, G-2, G-3 & G-4

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS	Project:	Lockhart II Subdivision	Date:	Oct-21
	File No.:	GOL-20538	Designed:	KC
	Subject:	LID Sizing	Checked:	JI
	Revisions:			

BMP Sizing Calculations

Constants			
Layer	Depth (mm)	Void Ratio	1D Stoarage (mm)
Freeboard	150	1.0	150
Ponding	150	1.0	150
Mulch / Stone	-	0.4	-
Filter Media	-	0.3	-
Choker	0	0.4	0
Underdrain Dia.	-	0.4	-
Storage Layer	-	0.4	-

LID Sizing												
LID Name	Drainage Area ID	Mulch / Stone (mm)	1D Storage (mm)	Filter Media	1D Storage (mm)	Underdrain Dia. (mm)	1D Storage (mm)	Stoarage Layer	1D Storage (mm)	Total Depth	Check Available Depth	1D Storage Total (mm)
LID-2-1	2-501	50	20	1350	405.00	0	0	0	0	1700	OK	725.00
LID-2-2	2-502	50	20	1450	435.00	0	0	0	0	1800	OK	755.00
LID-2-3	2-503	50	20	2725	817.50	0	0	0	0	3075	OK	1137.50
LID-2-4	2-504	50	20	2800	840.00	0	0	0	0	3150	OK	1160.00
LID-2-5	2-505	50	20	3350	1005.00	0	0	0	0	3700	OK	1325.00
LID-2-6	2-506	50	20	3500	1050.00	0	0	0	0	3850	OK	1370.00
LID-2-7	2-507	50	20	425	127.50	0	0	0	0	775	OK	447.50
LID-2-8	2-508	50	20	1200	360.00	0	0	0	0	1550	OK	680.00
LID-2-9	2-509	50	20	1450	435.00	0	0	0	0	1800	OK	755.00
LID-2-10	2-510	50	20	1350	405.00	0	0	0	0	1700	OK	725.00
LID-1-1	1-601	50	20	1400	420.00	0	0	0	0	1750	OK	740.00
LID-1-2	1-602	50	20	1375	412.50	0	0	0	0	1725	OK	732.50
LID-1-3	1-603	50	20	3600	1080.00	0	0	0	0	3950	OK	1400.00
LID-1-4	1-604	50	20	3850	1155.00	0	0	0	0	4200	OK	1475.00
LID-1-5	1-605	50	20	3725	1117.50	0	0	0	0	4075	OK	1437.50
LID-1-6	1-606	50	20	3850	1155.00	0	0	0	0	4200	OK	1475.00
LID-1-7	1-607	50	20	2400	720.00	0	0	0	0	2750	OK	1040.00
LID-1-8	1-608	50	20	2525	757.50	0	0	0	0	2875	OK	1077.50
LID-1-9	1-609	50	20	2625	787.50	0	0	0	0	2975	OK	1107.50
LID-1-10	1-610	50	20	3200	960.00	0	0	0	0	3550	OK	1280.00
LID-1-11	1-611	50	20	1875	562.50	0	0	0	0	2225	OK	882.50
LID-1-12	1-612	50	20	1525	457.50	0	0	0	0	1875	OK	777.50

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS	Project:	Lockhart II Subdivision	Date:	Oct-21
	File No.:	GOL-20538	Designed:	KC
	Subject:	LID Sizing	Checked:	JI
	Revisions:			

LID Sizing											
LID Name	Drainage Area ID	Catchment Area (ha)	Percent Impervious	[1] f' (mm/hr)	Length (m)	Width (m)	Depth (m)	[2] Perimeter (m)	[3] Void Ratio	Aspect Ratio :1	[4] MOE Required Volume (cu.m)
LID-2-1	2-501	0.16	65%	13	50.00	2.00	1.70	104.0	0.35	25.00	5.60
LID-2-2	2-502	0.10	65%	13	50.00	2.00	1.80	104.0	0.35	25.00	3.50
LID-2-3	2-503	0.15	65%	13	50.00	2.00	3.08	104.0	0.35	25.00	5.25
LID-2-4	2-504	0.09	65%	13	50.00	2.00	3.15	104.0	0.35	25.00	3.15
LID-2-5	2-505	0.21	65%	13	53.00	2.00	3.70	110.0	0.35	26.50	7.35
LID-2-6	2-506	0.11	65%	13	53.00	2.00	3.85	110.0	0.35	26.50	3.85
LID-2-7	2-507	0.45	65%	13	25.00	2.00	0.78	54.0	0.35	12.50	15.75
LID-2-8	2-508	0.19	65%	13	25.00	2.00	1.55	54.0	0.35	12.50	6.65
LID-2-9	2-509	0.27	65%	13	26.50	2.00	1.80	57.0	0.35	13.25	9.45
LID-2-10	2-510	0.10	65%	13	19.00	2.00	1.70	42.0	0.35	9.50	3.50
LID-1-1	1-601	0.37	65%	13	25.00	2.00	1.75	54.0	0.35	12.50	12.95
LID-1-2	1-602	0.25	65%	13	25.00	2.00	1.73	54.0	0.35	12.50	8.75
LID-1-3	1-603	0.21	65%	13	24.00	2.00	3.95	52.0	0.35	12.00	7.35
LID-1-4	1-604	0.06	65%	13	24.00	2.00	4.20	52.0	0.35	12.00	2.10
LID-1-5	1-605	0.02	65%	13	21.00	2.00	4.08	46.0	0.35	10.50	0.70
LID-1-6	1-606	0.03	65%	13	22.50	2.00	4.20	49.0	0.35	11.25	1.05
LID-1-7	1-607	0.14	65%	13	21.00	2.00	2.75	46.0	0.35	10.50	4.90
LID-1-8	1-608	0.05	65%	13	22.00	2.00	2.88	48.0	0.35	11.00	1.75
LID-1-9	1-609	0.08	65%	13	22.50	2.00	2.98	49.0	0.35	11.25	2.80
LID-1-10	1-610	0.07	65%	13	70.00	2.00	3.55	144.0	0.35	35.00	2.45
LID-1-11	1-611	0.17	65%	13	88.00	2.00	2.23	180.0	0.35	44.00	5.95
LID-1-12	1-612	0.16	65%	13	49.00	2.00	1.88	102.0	0.35	24.50	5.60

Notes:
1. Based on Table 7.8: Typical Parameter Values for Greem-Apmt Infiltration Method for Hydologic Soil Group B, from the City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines, dated October 22, 2020.
2. Assumed rectangular shape.
3. Weighted average.
4. MOE Required Volume, 35 cu.m/ha, is based on the largest volume requirement for an infiltration SWMP Type in MOE Table 3.2 Water Quality Storage Requiremetns based on Receiving Waters, Stormwater Management Planning and Design Manual, March 2003.
5. Refer to Lockhart Innisfil Investmetns (II) Limited Subdivision (GOL-20538) Drawings LID-1 and LID-2 for details.

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS	Project:	Lockhart II Subdivision	Date:	Oct-21
	File No.:	GOL-20538	Designed:	KC
	Subject:	LID Sizing	Checked:	JI
	Revisions:			

LID Sizing							
LID Name	Drainage Area ID	[1] Runoff Volume (25mm Over TIMP)	[1] Runoff Volume (5mm Over TIMP)	Footprint Area Required (sq.m)	Footprint Area Provided (sq.m)	Volume of LID (cu.m)	Drawdown Time (t_D) (hr)
LID-2-1	2-501	26.00	5.20	12.50	100.00	72.50	14.55
LID-2-2	2-502	16.25	3.25	12.50	100.00	75.50	15.00
LID-2-3	2-503	24.38	4.88	12.50	100.00	113.75	20.21
LID-2-4	2-504	14.63	2.93	12.50	100.00	116.00	20.49
LID-2-5	2-505	34.13	6.83	13.25	106.00	140.45	22.44
LID-2-6	2-506	17.88	3.58	13.25	106.00	145.22	22.95
LID-2-7	2-507	73.13	14.63	6.25	50.00	22.38	9.83
LID-2-8	2-508	30.88	6.18	6.25	50.00	34.00	13.73
LID-2-9	2-509	43.88	8.78	6.63	53.00	40.02	14.88
LID-2-10	2-510	16.25	3.25	4.75	38.00	27.55	14.34
LID-1-1	1-601	60.13	12.03	6.25	50.00	37.00	14.64
LID-1-2	1-602	40.63	8.13	6.25	50.00	36.63	14.53
LID-1-3	1-603	34.13	6.83	6.00	48.00	67.20	22.94
LID-1-4	1-604	9.75	1.95	6.00	48.00	70.80	23.73
LID-1-5	1-605	3.25	0.65	5.25	42.00	60.38	23.25
LID-1-6	1-606	4.88	0.98	5.63	45.00	66.38	23.68
LID-1-7	1-607	22.75	4.55	5.25	42.00	43.68	18.69
LID-1-8	1-608	8.13	1.63	5.50	44.00	47.41	19.18
LID-1-9	1-609	13.00	2.60	5.63	45.00	49.84	19.56
LID-1-10	1-610	11.38	2.28	17.50	140.00	179.20	21.99
LID-1-11	1-611	27.63	5.53	22.00	176.00	155.32	16.93
LID-1-12	1-612	26.00	5.20	12.25	98.00	76.20	15.34

Notes:
1. Requirement of 25mm is from the LSRCA Technical Guidelines for Stormwater Management Submissions, dated September 2016, Section 2.2.2 Volume Control.
2. Refer to Lockhart Innisfil Investmetns (II) Limited Subdivision (GOL-20538) Drawings LID-1 and LID-2 for details.

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS	Project:	Lockhart II Subdivision	Date:	Oct-21
	File No.:	GOL-20538	Designed:	KC
	Subject:	LID Sizing	Checked:	JI
	Revisions:			

LID Summary									
LID Name	Drainage Area ID	Catchment Area (ha)	Percent Impervious	Length (m)	Width (m)	Depth (m)	Volume of LID (cu.m)	% of MOE Required Volume Captured	% of LSRCA Required 25mm Volume Captured
LID-2-1	2-501	0.16	65%	50.00	2.00	1.70	72.50	1295%	279%
LID-2-2	2-502	0.10	65%	50.00	2.00	1.80	75.50	2157%	465%
LID-2-3	2-503	0.15	65%	50.00	2.00	3.08	113.75	2167%	467%
LID-2-4	2-504	0.09	65%	50.00	2.00	3.15	116.00	3683%	793%
LID-2-5	2-505	0.21	65%	53.00	2.00	3.70	140.45	1911%	412%
LID-2-6	2-506	0.11	65%	53.00	2.00	3.85	145.22	3772%	812%
LID-2-7	2-507	0.45	65%	25.00	2.00	0.78	22.38	142%	31%
LID-2-8	2-508	0.19	65%	25.00	2.00	1.55	34.00	511%	110%
LID-2-9	2-509	0.27	65%	26.50	2.00	1.80	40.02	423%	91%
LID-2-10	2-510	0.10	65%	19.00	2.00	1.70	27.55	787%	170%
LID-1-1	1-601	0.37	65%	25.00	2.00	1.75	37.00	286%	62%
LID-1-2	1-602	0.25	65%	25.00	2.00	1.73	36.63	419%	90%
LID-1-3	1-603	0.21	65%	24.00	2.00	3.95	67.20	914%	197%
LID-1-4	1-604	0.06	65%	24.00	2.00	4.20	70.80	3371%	726%
LID-1-5	1-605	0.02	65%	21.00	2.00	4.08	60.38	8625%	1858%
LID-1-6	1-606	0.03	65%	22.50	2.00	4.20	66.38	6321%	1362%
LID-1-7	1-607	0.14	65%	21.00	2.00	2.75	43.68	891%	192%
LID-1-8	1-608	0.05	65%	22.00	2.00	2.88	47.41	2709%	584%
LID-1-9	1-609	0.08	65%	22.50	2.00	2.98	49.84	1780%	383%
LID-1-10	1-610	0.07	65%	70.00	2.00	3.55	179.20	7314%	1575%
LID-1-11	1-611	0.17	65%	88.00	2.00	2.23	155.32	2610%	562%
LID-1-12	1-612	0.16	65%	49.00	2.00	1.88	76.20	1361%	293%
	Total:	3.44					Average:	2430%	523%

Ontario

MINISTRY OF THE ENVIRONMENT

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Project DEVELOPMENT Summary

DEVELOPMENT: Lockhart Innisfil II Subdivision
Subwatershed: Lovers Creek

Total Pre-Development Area (ha):	**19.670**	Total Pre-Development Phosphorus Load (kg/yr):	**3.15**

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Cropland	19.67	0.16	3.15

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Residential	3.95	1.32	Other	99%	0.08
Treatment Train: Perforated Pipe LID @ 87%, Jellyfish filter @ 49%, wetland pond @ 77% = 98.5% efficiency					
High Intensity - Residential	11.05	1.32	Treatment Train Approach	88%	1.72
Treatment Train: Jellyfish filter @ 49%, wetland pond @ 77% = 88.2% efficiency					
High Intensity - Residential	0.63	1.32	NONE	0%	0.83
uncontrolled/untreated flow					
Open Water	4.04	0.26	Constructed Wetlands	77%	0.24
SWM pond					

		P Load (kg/yr)
Post-Development Area Altered:	**19.67**	
Total Pre-Development Area:	**19.67**	
Unaffected Area:	**0**	
Pre-Development:		**3.15**
Post-Development:		**21.68**
Change (Pre - Post):		**-18.53**
589% Net Increase in Load		
Post-Development (with BMPs):		**2.87**
Change (Pre - Post):		**0.27**
9% Net Reduction in Load		

DEVELOPMENT: **Lockhart Innisfil II Subdivision**
Subwatershed: **Lovers Creek**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	**P Load (kg/yr)**
Pre-Development:	**3.15**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**2.87**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**0.27**
Conclusion:	**9% Reduction in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

WATER BALANCE CALCULATIONS
Lockhart Innisfil Investments Limited
Barrie, ON

PROJECT No.300043818

BURNSIDE

TABLE G-1

Water Balance Components

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 200 mm (moderately-rooted vegetation in sandy clay loam soils)

Precipitation data from Barrie WPCC Climate Station (1981 - 2010)

Potential Evapotranspiration Calculation	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Average Temperature (Degree C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	**6.9**
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	**36.8**
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	**499**
Adjusting Factor for U (Latitude 44° 20' N)	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
WATER BALANCE COMPONENTS	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	**933**
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	**340**
Change in Soil Moisture Storage	0	0	0	0	0	-29	-57	-27	17	39	58	0	**0**
Soil Moisture Storage max 200 mm	200	200	200	200	200	171	114	87	103	142	200	200	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
Soil Moisture Deficit max 200 mm	0	0	0	0	0	29	86	113	97	58	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	22	74	**340**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	37	28	26	15	3	0	0	0	0	0	10	33	**153**
Potential Direct Surface Water Runoff (independent of temperature)	45	34	32	19	4	0	0	0	0	0	12	40	**187**
IMPERVIOUS AREA WATER SURPLUS													
Precipitation (P)	933	mm/year											
Potential Evaporation (PE) from impervious areas (assume 15%)	140	mm/year											
P-PE (surplus available for runoff from impervious areas)	793	mm/year											

Assume January storage is 100% of Soil Moisture Storage		
Soil Moisture Storage	200 mm	<-- See "Water Holding Capacity" values in Table 3.1, MOE SWMPDM, 2003
*MOE SWM infiltration calculations		
topography - hilly	0.1	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
soils - sandy clay loam	0.25	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
cover - predominantly cultivated land	0.1	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
Infiltration factor	**0.45**	
Latitude of site (or climate station)	44 ° N.	

WATER BALANCE CALCULATIONS
Lockhart Innisfil Investments Limited
Barrie, ON

PROJECT No.300043818

BURNSIDE

TABLE G-2

Water Balance Components

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 300 mm (wooded areas in sandy clay loam soils)

Precipitation data from Barrie WPCC Climate Station (1981 - 2010)

Potential Evapotranspiration Calculation	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Average Temperature (Degree C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	**6.9**
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	**36.8**
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	**499**
Adjusting Factor for U (Latitude 44° 20' N)	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
WATER BALANCE COMPONENTS	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	**933**
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	**340**
Change in Soil Moisture Storage	0	0	0	0	0	-29	-57	-27	17	39	58	0	**0**
Soil Moisture Storage max 400 mm	400	400	400	400	400	371	314	287	303	342	400	400	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
Soil Moisture Deficit max 400 mm	0	0	0	0	0	29	86	113	97	58	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	22	74	**340**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	45	34	32	19	4	0	0	0	0	0	12	40	**187**
Potential Direct Surface Water Runoff (independent of temperature)	37	28	26	15	3	0	0	0	0	0	10	33	**153**
IMPERVIOUS AREA WATER SURPLUS													
Precipitation (P)	933	mm/year											
Potential Evaporation (PE) from impervious areas (assume 15%)	140	mm/year											
P-PE (surplus available for runoff from impervious areas)	793	mm/year											

Assume January storage is 100% of Soil Moisture Storage		
Soil Moisture Storage	400 mm	<-- See "Water Holding Capacity" values in Table 3.1, MOE SWMPDM, 2003
*MOE SWM infiltration calculations		
topography - hilly land	0.1	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
soils - sandy clay loam	0.25	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
cover - woodlands	0.2	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
Infiltration factor	**0.55**	
Latitude of site (or climate station)	44 ° N.	

WATER BALANCE CALCULATIONS
Lockhart Innisfil Investments Limited
Barrie, ON

PROJECT No.300043818

BURNSIDE

TABLE G-3

Post-Development Water Balance Components

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 100 mm (urban lawn in sandy clay loam soils)

Precipitation data from Barrie WPCC Climate Station (1981 - 2010)

Potential Evapotranspiration Calculation	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Average Temperature (Degree C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	**6.9**
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	**36.8**
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	**499**
Adjusting Factor for U (Latitude 44° 20' N)	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
WATER BALANCE COMPONENTS	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	**933**
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	**340**
Change in Soil Moisture Storage	0	0	0	0	0	-29	-57	-14	17	39	44	0	**0**
Soil Moisture Storage max 100 mm	100	100	100	100	100	71	14	0	17	56	100	100	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	135	104	77	38	9	0	**580**
Soil Moisture Deficit max 100 mm	0	0	0	0	0	29	86	100	83	44	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	35	74	**353**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	37	28	26	15	3	0	0	0	0	0	16	33	**159**
Potential Direct Surface Water Runoff (independent of temperature)	45	34	32	19	4	0	0	0	0	0	20	40	**194**
IMPERVIOUS AREA WATER SURPLUS													
Precipitation (P)	933	mm/year											
Potential Evaporation (PE) from impervious areas (assume 15%)	140	mm/year											
P-PE (surplus available for runoff from impervious areas)	793	mm/year											

Assume January storage is 100% of Soil Moisture Storage		
Soil Moisture Storage	100 mm	<-- See "Water Holding Capacity" values in Table 3.1, MOE SWMPDM, 2003
*MOE SWM infiltration calculations		
topography - hilly land	0.1	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
soils - sandy clay loam	0.25	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
cover - urban lawn	0.1	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
Infiltration factor	**0.45**	
Latitude of site (or climate station)	44 ° N.	

WATER BALANCE CALCULATIONS
Lockhart Innisfil Investments Limited
Barrie, ON

PROJECT No.300043818

BURNSIDE

TABLE G-4

Water Balance for Pre- and Post-Development Land Use Conditions (with no SWM/LID measures in place)

Land Use Description	Approx. Land Area* (m^2)	Estimated Impervious Fraction for Land Use*	Estimated Impervious Area (m^2)	Runoff from Impervious Area** (m/a)	Runoff Volume from Impervious Area (m^3/a)	Estimated Pervious Area (m^2)	Runoff from Pervious Area** (m/a)	Runoff Volume from Pervious Area (m^3/a)	Infiltration from Pervious Area** (m/a)	Infiltration Volume from Pervious Area (m^3/a)	Total Runoff Volume (m^3/a)	Total Infiltration Volume (m^3/a)
Pre-Development Land Use												
Woodland/Wetland	146,800	0.00	0	0.793	0	146,800	0.153	22,442	0.187	27,429	22,442	27,429
Open Space /Agricultural	371,400	0.00	0	0.793	0	371,400	0.187	69,394	0.153	56,777	69,394	56,777
TOTAL PRE-DEVELOPMENT	**518,200**		**0**		**0**	**518,200**		**91,835**		**84,205**	**91,835**	**84,205**
Post-Development Land Use (with no LID measures in place)												
Single Residential	136,000	0.70	95,200	0.793	75,490	40,800	0.194	7,921	0.159	6,481	83,411	6,481
Townhouse	23,500	0.75	17,625	0.793	13,976	5,875	0.194	1,141	0.159	933	15,117	933
Roads	93,000	0.65	60,450	0.793	47,935	32,550	0.194	6,320	0.159	5,171	54,254	5,171
Reserves and Widenings	9,600	0.65	6,240	0.793	4,948	3,360	0.194	652	0.159	534	5,600	534
Stormwater Management	92,200	0.50	46,100	0.793	36,556	46,100	0.194	8,950	0.159	7,323	45,506	7,323
Environmental Protection	163,900	0.00	0	0.793	0	163,900	0.153	25,056	0.187	30,624	25,056	30,624
TOTAL POST-DEVELOPMENT	**518,200**		**225,615**		**178,905**	**292,585**		**50,040**		**51,065**	**228,944**	**51,065**
										% Change from Pre to Post	249	39
										Effect of development (with no mitigation)	2.5 times increase in runoff	39% reduction of infiltration

* data provided by Jones Consulting July 2021

** figures from Tables G-1, G-2 and G-3.

To balance pre- to post-,
the infiltration target (m^3/a)= **33,140**

Appendix E

Engineering Drawings

- G-1 General Servicing Plan
- GP-1 Grading Plan
- GP-2 Grading Plan
- GP-3 Grading Plan
- GP-4 Grading Plan
- GP-5 Grading Plan
- STM-1 Storm Sewer Subcatchment Plan
- SWM-1 Post-Development Drainage Area Plan SWM Facilities 1 & 2
- LID-1 LID Dry Swale Subcatchment Plan
- LID-2 LID Sections and Details Dry Swales
- SAN-1 Sanitary Drainage Area Plan
- DS-1 Storm Sewer Design Sheet
- DS-2 Sanitary Sewer Design Sheet
- PND-1 SWM Facility No. 1 Plan View
- PND-2 SWM Facility No. 1 Sections and Details
- PP-1 Plan and Profile Street 'B' STA 0+000 to 0+287
- PP-2 Plan and Profile Street 'C' STA 0+000 to 0+334
- PP-3 Plan and Profile Street 'D' STA 0+000 to 0+292
- PP-4 Plan and Profile Street 'E' STA 0+000 to 0+180
- PP-5 Plan and Profile Street 'E' STA 0+180 to 0+440
- PP-6 Plan and Profile Street 'E' STA 0+440 to 0+705
- PP-7 Plan and Profile Street 'F' STA 0+000 to 0+249
- PP-8 Plan and Profile Thicketwood Avenue STA 0+980 to 1+260
- PP-9 Plan and Profile Thicketwood Avenue STA 1+260 to 1+503
- PP-10 Plan and Profile Fenchurch Manor STA 0+960 to 1+240
- PP-11 Plan and Profile Fenchurch Manor STA 1+240 to 1+520

LOCKHART INNISFIL INVESTMENTS (II) LIMITED
460 LOCKHART ROAD, CITY OF BARRIE

DRAWING LEGEND

TITLE	TITLE PAGE
G-1	GENERAL SERVICING PLAN
GP-1	GRADING PLAN
GP-2	GRADING PLAN
GP-3	GRADING PLAN
GP-4	GRADING PLAN
GP-5	GRADING PLAN
STM-1	STORM SEWER SUBCATCHMENT PLAN
SWM-1	POST-DEVELOPMENT DRAINAGE AREA PLAN SWM FACILITIES 1 & 2
LID-1	LID DRY SWALE SUBCATCHMENT PLAN
LID-2	LID SECTIONS AND DETAILS DRY SWALES
SAN-1	SANITARY DRAINAGE AREA PLAN
DS-1	STORM SEWER DESIGN SHEET
DS-2	SANITARY SEWER DESIGN SHEET
PND-1	SWM FACILITY No. 1 PLAN VIEW
PND-2	SWM FACILITY NO. 1 SECTIONS AND DETAILS
PP-1	PLAN AND PROFILE STREET 'B' STA 0+000 TO 0+287
PP-2	PLAN AND PROFILE STREET 'C' STA 0+000 TO 0+334
PP-3	PLAN AND PROFILE STREET 'D' STA 0+000 TO 0+292
PP-4	PLAN AND PROFILE STREET 'E' STA 0+000 TO 0+180
PP-5	PLAN AND PROFILE STREET 'E' STA 0+180 TO 0+440
PP-6	PLAN AND PROFILE STREET 'E' STA 0+440 TO 0+705
PP-7	PLAN AND PROFILE STREET 'F' STA 0+000 TO 0+249
PP-8	PLAN AND PROFILE THICKETWOOD AVENUE STA 0+980 TO 1+260
PP-9	PLAN AND PROFILE THICKETWOOD AVENUE STA 1+260 TO 1+503
PP-10	PLAN AND PROFILE FENCHURCH MANOR STA 0+960 TO 1+240
PP-11	PLAN AND PROFILE FENCHURCH MANOR STA 1+240 TO 1+520



MUNICIPALITY:

CITY OF BARRIE
70 COLLIER STREET (BOX 400)
BARRIE, ON L4M 4T5
PH. 705.726.4242
FAX 705.739.4243

CLIENT:

LOCKHART INNISFIL INVESTMENTS (II) LIMITED

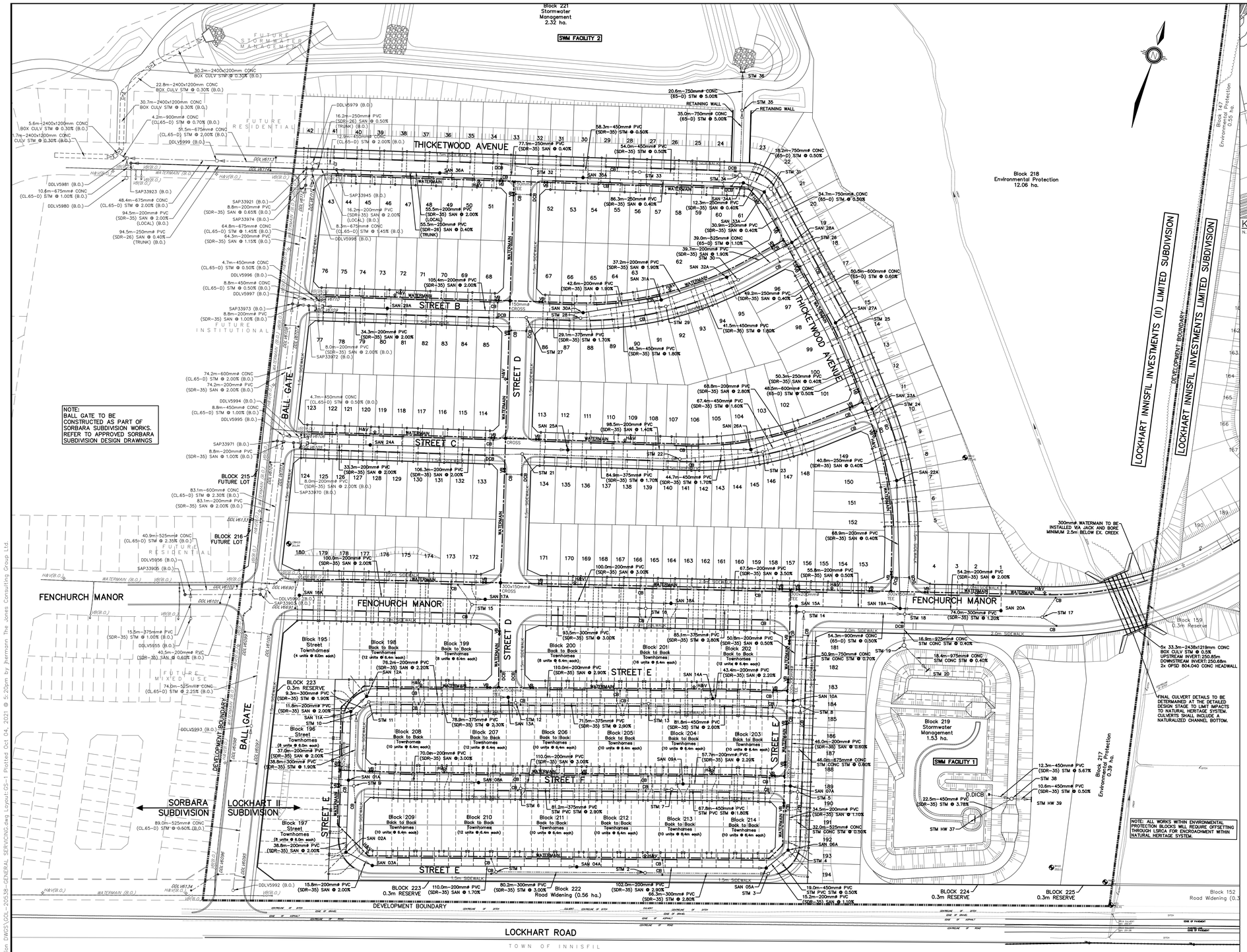
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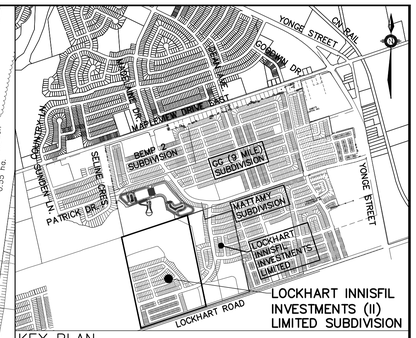
JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

TJCG PROJECT # GOL-20538

SUBMISSION FOR DRAFT PLAN APPROVAL - OCTOBER 2021

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LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

KEY PLAN
N.T.S.

LEGEND

- SAN 01A (B.O.) — SANITARY MAINTENANCE HOLE (B.O.)
- SANITARY SEWER & DIRECTION OF FLOW (B.O.)
- STM 01 (B.O.) — STORM MAINTENANCE HOLE (B.O.)
- STORM SEWER & DIRECTION OF FLOW (B.O.)
- H4692 (B.O.) — HYDRANT AND VALVE (B.O.)
- V9709 (B.O.) — VALVE AND BOX (B.O.)
- WATERMAIN (B.O.)
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- WATER SERVICE
- PROPOSED WATERMAIN
- SAN 10A — SANITARY MAINTENANCE HOLE
- SANITARY SERVICE
- SANITARY SEWER & DIRECTION OF FLOW
- STM 25 — STORM MAINTENANCE HOLE
- CB — CATCH BASIN
- DCB — DOUBLE CATCH BASIN
- STORM SEWER & DIRECTION OF FLOW
- DEPRESSED CURB
- BH 2 252.68 — BOREHOLE
- LIMIT OF SUBDIVISION

BENCHMARK:

BENCHMARK NO: 001193IU460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE, EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

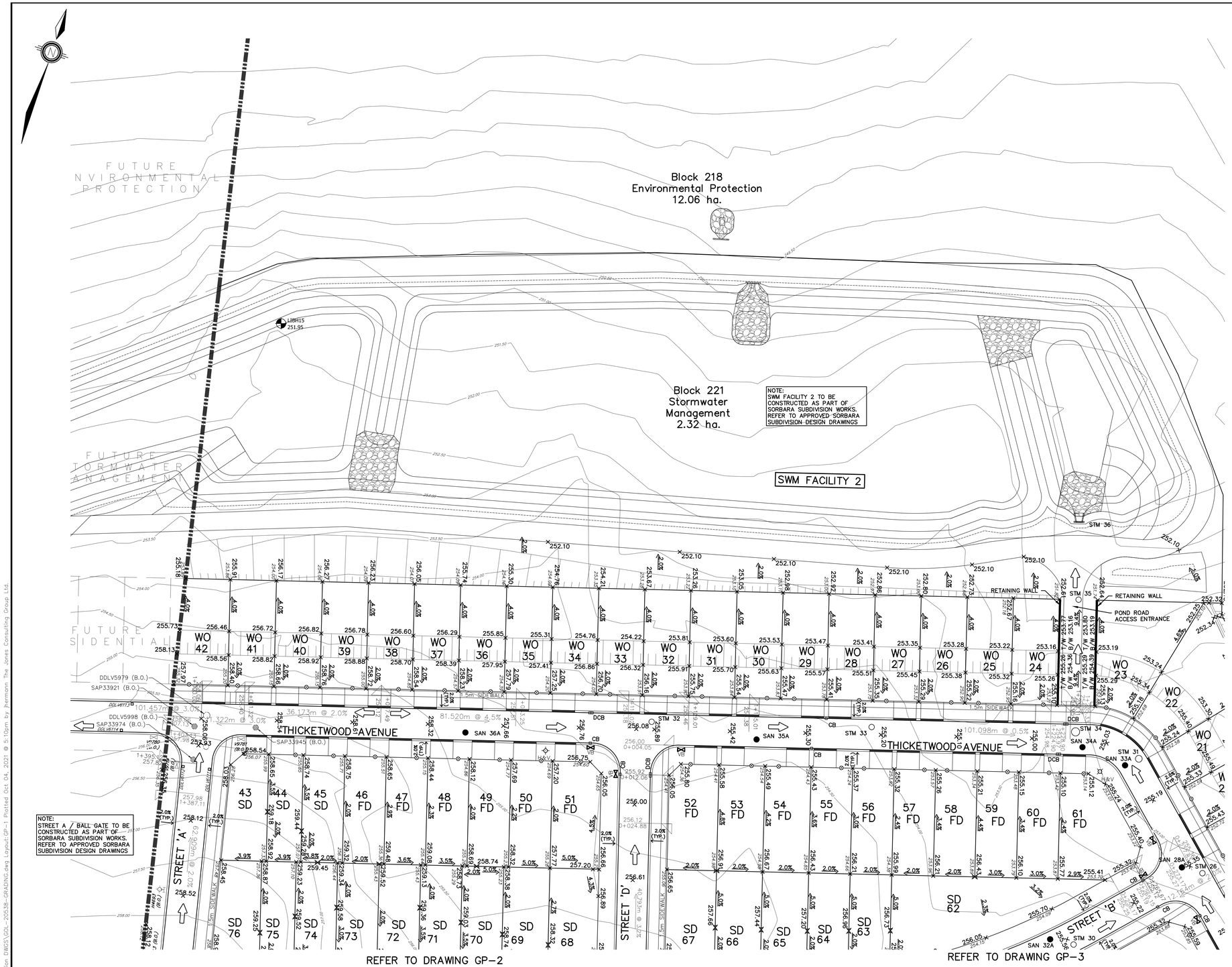
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

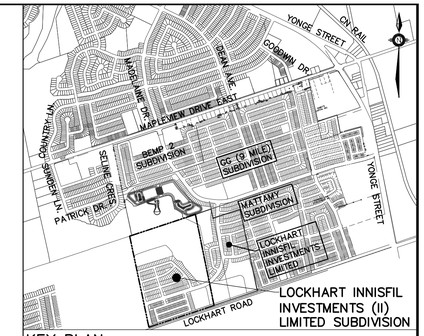
GENERAL SERVICING PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KC	SCALE: 1:1000	DATE MAY 2021
DRAWN	KC	PROJECT GOL-20538	DWG. Nº GS-1
CHECKED	JI		

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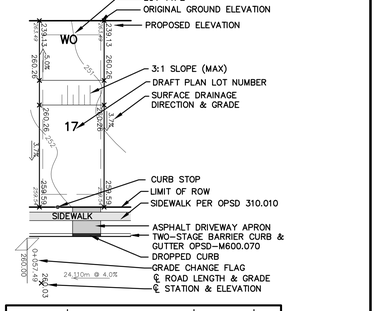


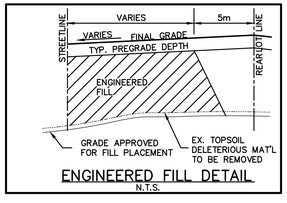


KEY PLAN
N.T.S.

LEGEND

- LIMIT OF SUBDIVISION
- LSRCA REGULATED BOUNDARY
- EX. CONTOUR
- EX. VEGETATION
- EX. DITCH
- SANITARY MANHOLE — SAN 5A
- STORM MANHOLE — STM 8
- DOUBLE DITCH INLET — DDI
- CATCHBASIN — CB
- DOUBLE CATCHBASIN — DCB
- TREE PRESERVATION FENCE
- SLOPE (3:1 MAX.)
- HYDRANT AND VALVE — H&V
- VALVE
- CURB STOP
- SIDEWALK TACTILE PLATES
- EX. BOREHOLE LOCATION ID# & GROUNDWATER ELEVATION — BH7 254.60
- TRANSFORMER
- SWITCHGEAR — S
- LIGHT STANDARD
- BELL/ROGERS — BPED
- MAJOR OVERLAND FLOW ROUTE
- LID DRY SWALE
- SPLIT DRAINAGE LOT — SD
- WALK OUT LOT — WO
- LOOK OUT LOT — LO
- FRONT DRAINING LOT — FD
- TRANSITION LOT — TR





ENGINEERED FILL DETAIL
N.T.S.

BENCHMARK:

BENCHMARK NO: 001193104605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BROK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.491072?.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.491189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENSED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

GRADING PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:500	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-20538	DWG. Nº GP-1
CHECKED	JWI		

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REFER TO DRAWING GP-1

REFER TO DRAWING GP-3

REFER TO DRAWING GP-4

FUTURE RESIDENTIAL

FUTURE THICKETWOOD AVENUE

FUTURE INSTITUTIONAL

FUTURE SORBARA DEVELOPMENT

THICKETWOOD AVENUE

STREET 'A'

STREET 'B'

STREET 'C'

STREET 'D'

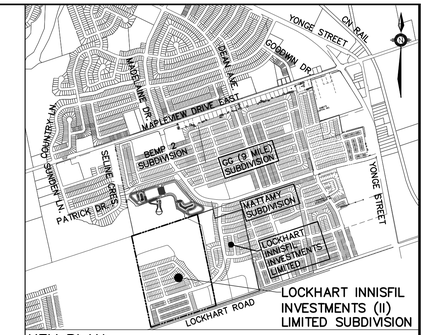
BLOCK 215 FUTURE LOT

NOTE:
BALL GATE TO BE CONSTRUCTED AS PART OF SORBARA SUBDIVISION WORKS. REFER TO APPROVED SORBARA SUBDIVISION DESIGN DRAWINGS

RETAINING WALL

1.5m SIDEWALK

5m SIDEWALK



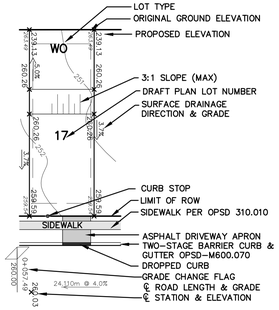
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

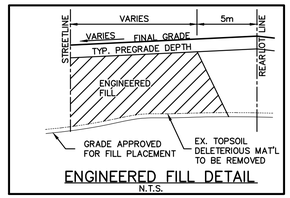
KEY PLAN

N.T.S.

LEGEND

- LIMIT OF SUBDIVISION
- LSRCA REGULATED BOUNDARY
- EX. CONTOUR
- EX. VEGETATION
- EX. DITCH
- SANITARY MANHOLE — SAN 5A
- STORM MANHOLE — STM 8
- DOUBLE DITCH INLET — DDI
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- DOUBLE CATCHBASIN — DCB
- TREE PRESERVATION FENCE
- SLOPE (3:1 MAX.)
- HYDRANT AND VALVE — H&V
- VALVE
- CURB STOP
- SIDEWALK TACTILE PLATES
- EX. BOREHOLE LOCATION ID# & GROUNDWATER ELEVATION — BH7 254.60
- TRANSFORMER
- SWITCHGEAR — S
- LIGHT STANDARD
- BELL/ROGERS — BPED
- MAJOR OVERLAND FLOW ROUTE
- LID DRY SWALE
- SPLIT DRAINAGE LOT — SD
- WALK OUT LOT — WO
- LOOK OUT LOT — LO
- FRONT DRAINING LOT — FD
- TRANSITION LOT — TR





ENGINEERED FILL DETAIL

N.T.S.

BENCHMARK:

BENCHMARK NO: 001193104605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

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BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911199.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

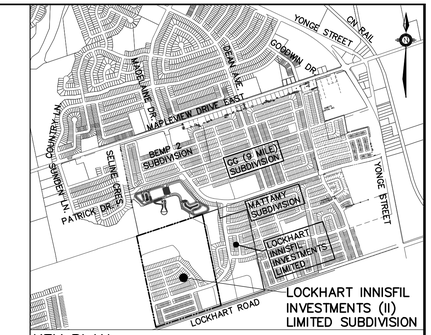
GRADING PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:500	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-20538	DWG. Nº GP-2
CHECKED	JWI		

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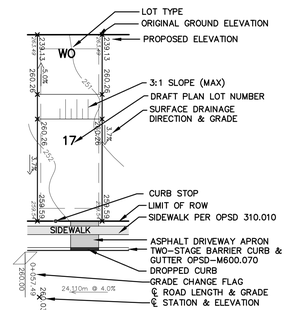


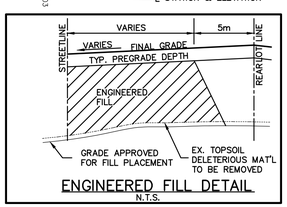


KEY PLAN
N.T.S.

LEGEND

- LIMIT OF SUBDIVISION
- LSRCA REGULATED BOUNDARY
- EX. CONTOUR
- EX. VEGETATION
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- SANITARY MANHOLE — SAN 5A
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- SLOPE (3:1 MAX.) — H&V
- HYDRANT AND VALVE
- VALVE
- CURB STOP
- SIDEWALK TACTILE PLATES
- EX. BOREHOLE LOCATION ID# & GROUNDWATER ELEVATION — BH7 254.60
- TRANSFORMER
- SWITCHGEAR — S
- LIGHT STANDARD
- BELL/ROGERS — BPED
- MAJOR OVERLAND FLOW ROUTE
- LID DRY SWALE
- SPLIT DRAINAGE LOT — SD
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ENGINEERED FILL DETAIL
N.T.S.

BENCHMARK:

BENCHMARK NO: 001193104605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

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BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608813.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENSED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

GRADING PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:500	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-20538	DWG. Nº GP-3
CHECKED	JWI		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-GRADING.dwg Layout:GP-3 Plotted: Oct 04, 2021 @ 5:05pm by Brennann The Jones Consulting Group Ltd

REFER TO DRAWING GP-2

REFER TO DRAWING GP-5

FUTURE RESIDENTIAL

FUTURE FENCHURCH MANOR

FUTURE MIXED USE

FUTURE SORBARA DEVELOPMENT

BLOCK 216
FUTURE LOT

STREET 'A'

FENCHURCH MANOR

STREET 'D'

STREET 'E'

STREET 'F'

BALL GATE

NOTE:
STREET A / BALL GATE TO BE CONSTRUCTED AS PART OF SORBARA SUBDIVISION WORKS. REFER TO APPROVED SORBARA SUBDIVISION DESIGN DRAWINGS

TR 180 | WO 179 | WO 178 | WO 177 | WO 176 | WO 175 | TR 174 | SD 173 | SD 172

SD 171 | SD 170 | SD 169 | SD 168 | SD 167 | SD 166 | FD 165

SD Block 195 Street Townhomes (4 units @ 6.0m each)

SD Block 196 Street Townhomes (8 units @ 6.0m each)

SD Block 197 Street Townhomes (8 units @ 6.0m each)

Block 198 Back to Back Townhomes (12 units @ 6.4m each)

Block 199 Back to Back Townhomes (8 units @ 6.4m each)

Block 200 Back to Back Townhomes (8 units @ 6.4m each)

Block 201 Back to Back Townhomes (16 units @ 6.4m each)

FD Block 208 Back to Back Townhomes (10 units @ 6.4m each)

FD Block 207 Back to Back Townhomes (12 units @ 6.4m each)

FD Block 206 Back to Back Townhomes (10 units @ 6.4m each)

FD Block 205 Back to Back Townhomes (10 units @ 6.4m each)

FD Block 209 Back to Back Townhomes (10 units @ 6.4m each)

FD Block 210 Back to Back Townhomes (12 units @ 6.4m each)

FD Block 211 Back to Back Townhomes (10 units @ 6.4m each)

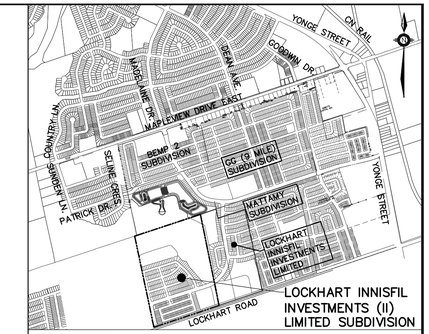
FD Block 212 Back to Back Townhomes (10 units @ 6.4m each)

BLOCK 223
0.3m RESERVE

Block 222
Road Widening (0.56 ha.)

LOCKHART ROAD

TOWN OF INNISFIL

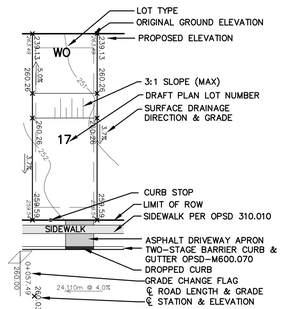


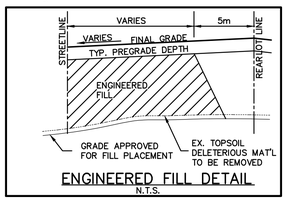
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

KEY PLAN
N.T.S.

LEGEND

- LIMIT OF SUBDIVISION
- LSRCA REGULATED BOUNDARY
- EX. CONTOUR
- EX. VEGETATION
- EX. DITCH
- SANITARY MANHOLE — SAN 5A
- STORM MANHOLE — STM 8
- DOUBLE DITCH INLET — DDI
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- EX. BOREHOLE LOCATION ID# & GROUNDWATER ELEVATION — BH7 254.60
- TRANSFORMER — T
- SWITCHGEAR — S
- LIGHT STANDARD
- BELL/ROGERS — BPED
- MAJOR OVERLAND FLOW ROUTE
- LID DRY SWALE
- SPLIT DRAINAGE LOT — SD
- WALK OUT LOT — WO
- LOOK OUT LOT — LO
- FRONT DRAINING LOT — FD
- TRANSITION LOT — TR





ENGINEERED FILL DETAIL
N.T.S.

BENCHMARK:

BENCHMARK NO: 001931U4605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV. 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.491189.897 E.608813.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENSED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

GRADING PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:500	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-20538	DWG. Nº GP-4
CHECKED	JWI		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-GRADING.dwg Layout: GP-4 Plotted: Oct 04, 2021 @ 5:04pm by Jhermann The Jones Consulting Group Ltd

REFER TO DRAWING GP-3

REFER TO DRAWING GP-4

TRIBUTARY TO LOVER'S CREEK

DEVELOPMENT BOUNDARY

THICKETWOOD AVENUE

FENCHURCH MANOR

MATCH EXISTING GROUND

POND ROAD ACCESS ENTRANCE

STREET 'E'

STREET 'F'

Block 201 Back to Back Townhomes (6 units @ 6.4m each)

Block 202 Back to Back Townhomes (12 units @ 6.4m each)

Block 203 Back to Back Townhomes (10 units @ 6.4m each)

Block 204 Back to Back Townhomes (10 units @ 6.4m each)

Block 213 Back to Back Townhomes (10 units @ 6.4m each)

Block 214 Back to Back Townhomes (10 units @ 6.4m each)

Block 219 Stormwater Management 1.53 ha.

SWM FACILITY 1

REFER TO DWG. PND-1 FOR POND 1 GRADING DESIGN

Block 217 Environmental Protection 0.39 ha.

Block 222 Road Widening (0.56 ha.)

BLOCK 224 0.3m RESERVE

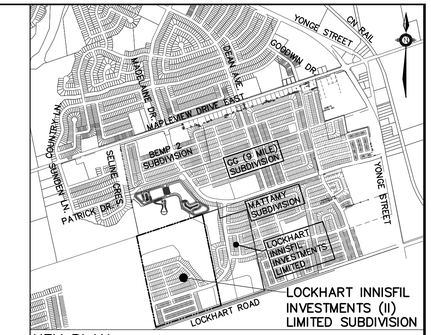
BLOCK 225 0.3m RESERVE

5x 33.3m-2438x1219mm CONC BOX CULV STM @ 0.5% UPSTREAM INVERT: 250.85m DOWNSTREAM INVERT: 250.68m
2x OPSD 804.040 CONC HEADWALL

NOTE: ALL WORKS WITHIN ENVIRONMENTAL PROTECTION BLOCKS WILL REQUIRE OFFSETTING THROUGH LSRCA FOR ENCROACHMENT WITHIN NATURAL HERITAGE SYSTEM.

NOTE: EARTHWORKS FOR LOCKHART INNISFIL INVESTMENTS LIMITED AND LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISIONS TO BE COMPLETED SIMULTANEOUSLY

LOCKHART INNISFIL INVESTMENTS LIMITED DEVELOPMENT

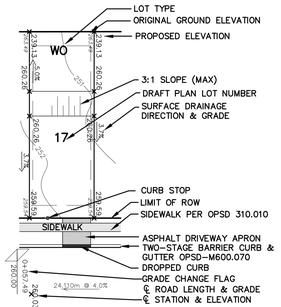


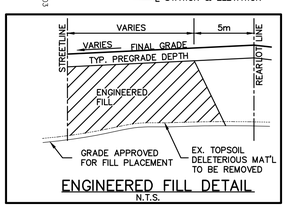
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

KEY PLAN
N.T.S.

LEGEND

- LIMIT OF SUBDIVISION
- LSRCA REGULATED BOUNDARY
- EX. CONTOUR
- EX. VEGETATION
- EX. DITCH
- SANITARY MANHOLE — SAN 5A
- STORM MANHOLE — STM 8
- DOUBLE DITCH INLET — DDI
- CATCHBASIN — CB
- DOUBLE CATCHBASIN — DCB
- TREE PRESERVATION FENCE
- SLOPE (3:1 MAX.)
- HYDRANT AND VALVE — H&V
- VALVE
- CURB STOP
- SIDEWALK TACTILE PLATES
- EX. BOREHOLE LOCATION ID# & GROUNDWATER ELEVATION — BH7 254.60
- TRANSFORMER
- SWITCHGEAR — S
- LIGHT STANDARD
- BELL/ROGERS — BPED
- MAJOR OVERLAND FLOW ROUTE
- LID DRY SWALE
- SPLIT DRAINAGE LOT — SD
- WALK OUT LOT — WO
- LOOK OUT LOT — LO
- FRONT DRAINING LOT — FD
- TRANSITION LOT — TR





ENGINEERED FILL DETAIL
N.T.S.

BENCHMARK:

BENCHMARK NO: 001931U4605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENSED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

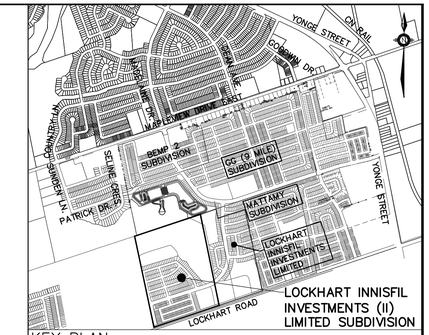
GRADING PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:500	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-20538	DWG. Nº GP-5
CHECKED	JWI		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-GRADING.dwg Layout: GP-5 Plotted: Oct 06, 2021 @ 1:47pm by Jhermann The Jones Consulting Group Ltd

Stormwater Management 2.32 ha.
SWMF 2
FUTURE STORMWATER MANAGEMENT
FUTURE RESIDENTIAL
FUTURE INSTITUTIONAL
FUTURE MIXED USE
30.2m–2400x1200mm STM CONC BOX CULV@ 0.30% (B.O.)
22.8m–2400x1200mm STM CONC BOX CULV@ 0.30% (B.O.)
30.7m–2400x1200mm STM CONC BOX CULV@ 0.30% (B.O.)
12.9m–450mmø STM @ 2.00% (B.O.)
58.3m–450mmø STM @ 0.50%
20.6m–750mmø STM @ 0.40%
35.0m–750mmø STM @ 5.00%
SWM FACILITY 12 INLET C/W EROSION PROTECTION
18.2m–750mmø STM @ 0.50%
TRIBUTARY TO LOVER'S CREEK
Block 218 Environmental Protection 12.06 ha.
50.5m–600mmø STM @ 0.60%
48.5m–600mmø STM @ 0.50%
THICKETWOOD AVENUE
STREET 'A'
STREET 'B'
STREET 'C'
STREET 'D'
STREET 'E'
STREET 'F'
STM 1 STM 2 STM 3 STM 4 STM 5 STM 6 STM 7 STM 8 STM 9 STM 10 STM 11 STM 12 STM 13 STM 14 STM 15 STM 16 STM 17 STM 18 STM 19 STM 20 STM 21 STM 22 STM 23 STM 24 STM 25 STM 26 STM 27 STM 28 STM 29 STM 30 STM 31 STM 32 STM 33 STM 34 STM 35 STM 36
DDLV5979 (B.O.) DDLV5980 (B.O.) DDLV5981 (B.O.) DDLV5993 (B.O.) DDLV5994 (B.O.) DDLV5995 (B.O.) DDLV5996 (B.O.) DDLV5997 (B.O.) DDLV5998 (B.O.) DDLV5999 (B.O.)
51.5m–675mmø STM @ 2.00% (B.O.)
8.3m–675mmø STM @ 1.45% (B.O.)
64.8m–675mmø STM @ 1.45% (B.O.)
4.7m–450mmø STM @ 0.50% (B.O.)
8.8m–450mmø STM @ 0.50% (B.O.)
4.7m–450mmø STM @ 0.50% (B.O.)
74.2m–600mmø STM @ 2.00% (B.O.)
8.8m–450mmø STM @ 1.00% (B.O.)
83.1m–600mmø STM @ 2.30% (B.O.)
40.9m–525mmø STM @ 2.35% (B.O.)
74.0m–525mmø STM @ 2.25% (B.O.)
89.0m–525mmø STM @ 0.50% (B.O.)
54.0m–450mmø STM @ 0.50%
34.7m–750mmø STM @ 0.50%
39.0m–525mmø STM @ 1.10%
41.5m–450mmø STM @ 1.80%
46.3m–450mmø STM @ 1.80%
29.1m–375mmø STM @ 1.70%
67.4m–450mmø STM @ 1.60%
44.7m–450mmø STM @ 1.70%
84.9m–375mmø STM @ 1.70%
93.5m–300mmø STM @ 3.00%
85.1m–375mmø STM @ 2.80%
54.3m–900mmø STM @ 0.50%
74.0m–300mmø STM @ 1.20%
16.9m–975mmø STM @ 0.40%
18.4m–975mmø STM @ 0.40%
FOREBAY WEIR C/W EROSION PROTECTION
5x 33.3m–2438x1219mm CONC BOX CULV STM @ 0.5% UPSTREAM INVERT: 250.85m DOWNSTREAM INVERT: 250.68m
2x OPSD 804.040 CONC HEADWALL
Block 219 Stormwater Management 1.53 ha.
SWMF 1
12.3m–450mmø STM @ 5.67%
22.5m–450mmø STM @ –3.78%
SWM FACILITY GRANULAR DISPERSION PAD
10.6m–450mmø STM @ 0.50%
OVERFLOW WEIR C/W EROSION PROTECTION
Block 217 Environmental Protection 0.39 ha.
78.9m–375mmø STM @ 2.30%
71.5m–375mmø STM @ 2.90%
81.8m–450mmø STM @ 2.00%
46.0m–675mmø STM @ 0.60%
38.8m–300mmø STM @ 1.90%
81.2m–375mmø STM @ 2.90%
67.8m–450mmø STM @ 1.80%
32.0m–525mmø STM @ 0.50%
9.3m–300mmø STM @ 1.90%
50.9m–750mmø STM @ 0.70%
80.2m–300mmø STM @ 3.00%
66.3m–300mmø STM @ 2.80%
19.0m–450mmø STM @ 0.50%
309 0.85 0.65
310 0.62 0.65
308 0.60 0.65
305 0.40 0.65
306 0.75 0.65
307 0.48 0.65
303 0.48 0.65
304 0.15 0.65
301 0.81 0.65
302 0.52 0.65
215 0.89 0.65
212 0.35 0.76
213 0.85 0.72
214 0.19 0.65
211 0.18 0.72
210 0.39 0.83
209 0.61 0.83
208 0.45 0.73
204 0.70 0.83
205 0.33 0.83
206 0.12 0.71
207 0.15 0.69
202 0.28 0.83
203 0.29 0.78
201 0.30 0.77
Block 195 Street Townhomes (4 blks @ 6.0m each)
Block 196 Back to Back Townhomes (12 units @ 6.4m each)
Block 197 Street Townhomes (5 blks @ 6.0m each)
Block 198 Back to Back Townhomes (10 units @ 6.4m each)
Block 199 Back to Back Townhomes (8 units @ 6.4m each)
Block 200 Back to Back Townhomes (8 units @ 6.4m each)
Block 201 Back to Back Townhomes (10 units @ 6.4m each)
Block 202 Back to Back Townhomes (12 units @ 6.4m each)
Block 203 Back to Back Townhomes (10 units @ 6.4m each)
Block 204 Back to Back Townhomes (10 units @ 6.4m each)
Block 205 Back to Back Townhomes (10 units @ 6.4m each)
Block 206 Back to Back Townhomes (10 units @ 6.4m each)
Block 207 Back to Back Townhomes (12 units @ 6.4m each)
Block 208 Back to Back Townhomes (10 units @ 6.4m each)
Block 209 Back to Back Townhomes (10 units @ 6.4m each)
Block 210 Back to Back Townhomes (12 units @ 6.4m each)
Block 211 Back to Back Townhomes (10 units @ 6.4m each)
Block 212 Back to Back Townhomes (10 units @ 6.4m each)
Block 213 Back to Back Townhomes (10 units @ 6.4m each)
Block 214 Back to Back Townhomes (10 units @ 6.4m each)
BLOCK 215 FUTURE LOT
BLOCK 216 FUTURE LOT
BLOCK 223 0.3m RESERVE
BLOCK 224 0.3m RESERVE
BLOCK 225 0.3m RESERVE
Block 222 Road Widening (0.56 ha.)
FENCHURCH MANOR
BALL GATE
LOCKHART ROAD
TOWN OF INNISFIL
FINAL CULVERT DETAILS TO BE DETERMINED AT THE DETAILED DESIGN STAGE TO LIMIT IMPACTS TO NATURAL HERITAGE SYSTEM. CULVERTS SHALL INCLUDE A NATURALIZED CHANNEL BOTTOM.
REFER TO SORBARA BY SCS CONSULTING GROUP LTD.
REFER TO LOCKHART INNISFIL INVESTMENTS LIMITED BY JONES CONSULTING GROUP LTD.



LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

KEY PLAN
N.T.S.

LEGEND

- STM 01 — STORM MAINTENANCE HOLE
- CB — STORM SINGLE CATCHBASIN
- DCB — STORM DOUBLE CATCHBASIN
- STORM SEWER & DIRECTION OF FLOW
- STM 01 (B.O.) — STORM MAINTENANCE HOLE (BY OTHERS)
- PROP. STORM SEWER & DIRECTION OF FLOW (BY OTHERS)
- CATCHMENT BOUNDARY
- LIMIT OF SUBDIVISION
- CATCHMENT AREA ID NUMBER
- RUN-OFF COEFFICIENT
- AREA (ha.)
- DIRECTION OF POST DEVELOPMENT 100 YEAR STORM EVENT OVERLAND FLOW
- 253.00 — EX. CONTOUR AND ELEVATION
- DIRECTION OF EXISTING EXTERNAL OVERLAND FLOW

BENCHMARK:

BENCHMARK NO: 001193U460G SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH–EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH–EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019565454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH–EAST END OF BRIDGE, 19m BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER J. W. INGRAM 100143779 21-10-06 PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

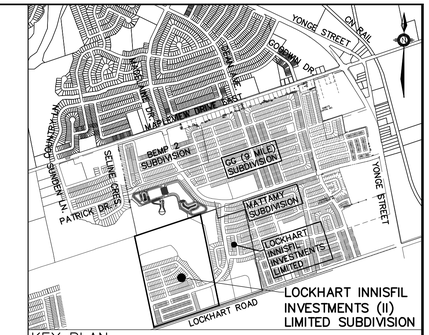
STORM SEWER SUBCATCHMENT PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:1000	DATE JUNE 2021
DRAWN	VBS	PROJECT GOL–20538	DWG. Nº STM–1
CHECKED	JI		

G:\Eng_3D\GOL–20538\Production DWGS\GOL–20538–STORM DRAINAGE.dwg Layout: STM–1 Plotted: Oct 04, 2021 @ 4:42pm by jhermann The Jones Consulting Group Ltd.

Stormwater Management 2.32 ha. Block 221
SWMF 2
FUTURE STORMWATER MANAGEMENT
FUTURE RESIDENTIAL
FUTURE INSTITUTIONAL
FUTURE MIXED USE
RETAINING WALL
SWM FACILITY 2 INLET C/W EROSION PROTECTION
TRIBUTARY TO LOVER'S CREEK
Block 218 Environmental Protection 12.06 ha.
THICKETWOOD AVENUE
STREET 'A'
STREET 'B'
STREET 'C'
STREET 'D'
STREET 'E'
STREET 'F'
THICKETWOOD AVENUE
LIMIT OF SORBARA CATCHMENT AREA 401 REFER TO PROPOSED STORM DRAINAGE PLAN FIGURE 4.1 PREPARED BY SCS CONSULTING DATED NOVEMBER 2020
0.28 HA CATCHMENT AREA OVERLAP DIRECTED TO SWMF2
AREA REDUCES TO 6.11 HA EXCLUDING AREAS THAT HAVE BEEN PREVIOUSLY ACCOUNTED FOR
AREA REDUCES TO 7.29 HA EXCLUDING AREAS THAT HAVE BEEN PREVIOUSLY ACCOUNTED FOR
0.06 HA CATCHMENT AREA OVERLAP DIRECTED TO SWMF2
0.04 HA CATCHMENT AREA OVERLAP DIRECTED TO SWMF2
REFER TO SORBARA PROPOSED STORMWATER DRAINAGE PLAN (FIG. 4.1) PREPARED BY SCS.
REFER TO SORBARA BY SCS CONSULTING GROUP LTD.
401 22.61 71%
2 6.29 65%
1 7.47 65.7%
2A 0.53 40%
1A 0.50 2.8%
BLOCK 215 FUTURE LOT
BLOCK 216 FUTURE LOT
FENCHURCH MANOR
BALL GATE
Block 198 Back to Back Townhomes (12 units @ 6.4m each)
Block 199 Back to Back Townhomes (8 units @ 6.4m each)
Block 200 Back to Back Townhomes (8 units @ 6.4m each)
Block 201 Back to Back Townhomes (16 units @ 6.4m each)
Block 202 Back to Back Townhomes (12 units @ 6.4m each)
Block 203 Back to Back Townhomes (10 units @ 6.4m each)
Block 204 Back to Back Townhomes (10 units @ 6.4m each)
Block 205 Back to Back Townhomes (10 units @ 6.4m each)
Block 206 Back to Back Townhomes (10 units @ 6.4m each)
Block 207 Back to Back Townhomes (12 units @ 6.4m each)
Block 208 Back to Back Townhomes (10 units @ 6.4m each)
Block 209 Back to Back Townhomes (10 units @ 6.4m each)
Block 210 Back to Back Townhomes (12 units @ 6.4m each)
Block 211 Back to Back Townhomes (10 units @ 6.4m each)
Block 212 Back to Back Townhomes (10 units @ 6.4m each)
Block 213 Back to Back Townhomes (10 units @ 6.4m each)
Block 214 Back to Back Townhomes (10 units @ 6.4m each)
Block 195 Street Townhomes (7 units @ 6.0m each)
Block 196 Street Townhomes (8 units @ 6.0m each)
Block 197 Street Townhomes (7 units @ 6.0m each)
BLOCK 223 0.3m RESERVE
BLOCK 223 0.3m RESERVE
Block 222 Road Widening (0.56 ha.)
Block 219 Stormwater Management 1.53 ha.
SWMF 1
Block 217 Environmental Protection 0.39 ha.
BLOCK 224 0.3m RESERVE
BLOCK 225 0.3m RESERVE
LIMIT OF SORBARA CATCHMENT AREA 401 REFER TO PROPOSED STORM DRAINAGE PLAN FIGURE 4.1 PREPARED BY SCS CONSULTING DATED NOVEMBER 2020
LIMIT OF SORBARA CATCHMENT AREA 407 REFER TO PROPOSED STORM DRAINAGE PLAN FIGURE 4.1 PREPARED BY SCS CONSULTING DATED NOVEMBER 2020
REFER TO LOCKHART INNISFIL INVESTMENTS LIMITED BY JONES CONSULTING GROUP LTD.
LOCKHART ROAD
TOWN OF INNISFIL



KEY PLAN
N.T.S.

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

LEGEND

- STM 01 — STORM MAINTENANCE HOLE
- CB — STORM SINGLE CATCHBASIN
- DCB — STORM DOUBLE CATCHBASIN
- STORM SEWER & DIRECTION OF FLOW
- STM 01 (B.O.) — STORM MAINTENANCE HOLE (BY OTHERS)
- PROP. STORM SEWER & DIRECTION OF FLOW (BY OTHERS)
- CATCHMENT BOUNDARY
- LIMIT OF SUBDIVISION
- CATCHMENT AREA ID NUMBER
- PERCENT IMPERVIOUS
- AREA (ha.)
- DIRECTION OF POST DEVELOPMENT 100 YEAR STORM EVENT OVERLAND FLOW
- EX. CONTOUR AND ELEVATION
- DIRECTION OF EXISTING EXTERNAL OVERLAND FLOW

BENCHMARK:

BENCHMARK NO: 001931U460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER J. W. INGRAM 100143779 21-10-06 PROVINCE OF ONTARIO

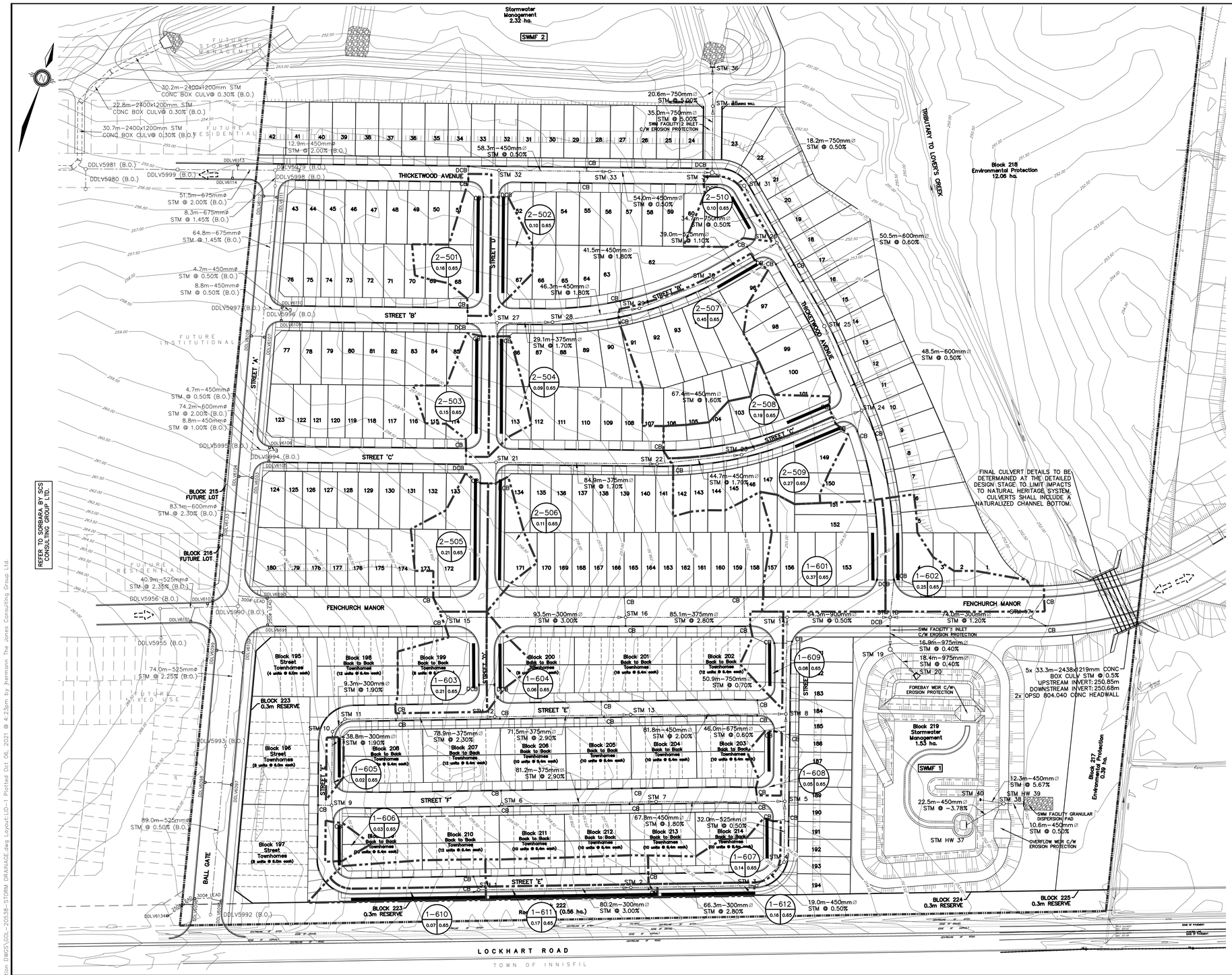
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

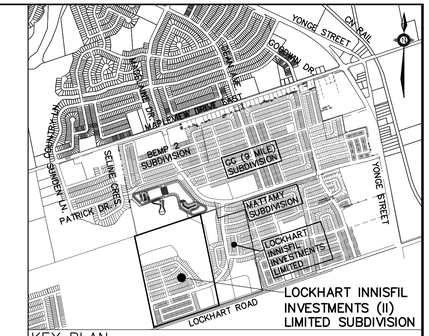
POST-DEVELOPMENT DRAINAGE AREA PLAN SWM FACILITIES 1 & 2

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1066

DESIGN	VBS	SCALE: 1:1000	DATE AUGUST 2021
DRAWN	VBS	PROJECT GOL-20538	DWG. Nº SWM-1
CHECKED	JI		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-POST-DEVELOPMENT.dwg Layout:SWM-1 Plotted Oct 06, 2021 @ 11:24am by mpollard The Jones Consulting Group Ltd.





LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

KEY PLAN
N.T.S.

LEGEND

- STM 01 — STORM MAINTENANCE HOLE
- CB — STORM SINGLE CATCHBASIN
- DCB — STORM DOUBLE CATCHBASIN
- STORM SEWER & DIRECTION OF FLOW
- STM 01 (B.O.) — STORM MAINTENANCE HOLE (BY OTHERS)
- PROP. STORM SEWER & DIRECTION OF FLOW (BY OTHERS)
- CATCHMENT BOUNDARY
- LIMIT OF SUBDIVISION
- CATCHMENT AREA ID NUMBER
- RUN-OFF COEFFICIENT
- AREA (ha.)
- DIRECTION OF POST DEVELOPMENT 100 YEAR STORM EVENT OVERLAND FLOW
- 253.00 — EX. CONTOUR AND ELEVATION
- DIRECTION OF EXISTING EXTERNAL OVERLAND FLOW
- LID CATCHMENT BOUNDARY
- LID DRY SWALE

BENCHMARK:

BENCHMARK NO: 001193104605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER J. W. INGRAM 100143779 21-10-06 PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

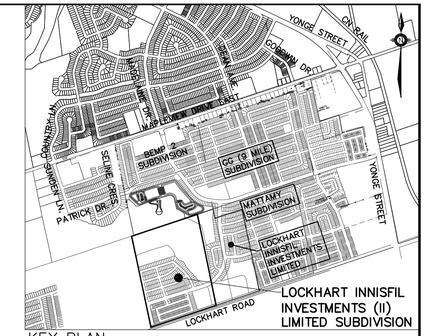
LID DRY SWALE SUBCATCHMENT PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
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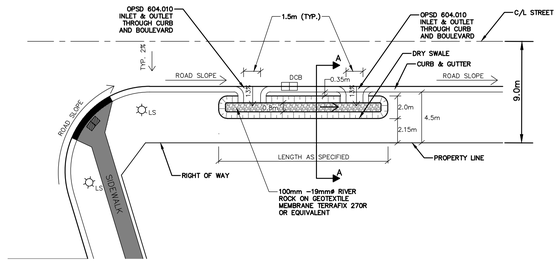
DESIGN	KC	SCALE: 1:1000	DATE JUNE 2021
DRAWN	KC	PROJECT GOL-20538	DWG. Nº LID-1
CHECKED	JI		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-STORM DRAINAGE.dwg Layout:LID-1 Plotted: Oct 06, 2021 @ 4:23pm by jhermmon The Jones Consulting Group Ltd.

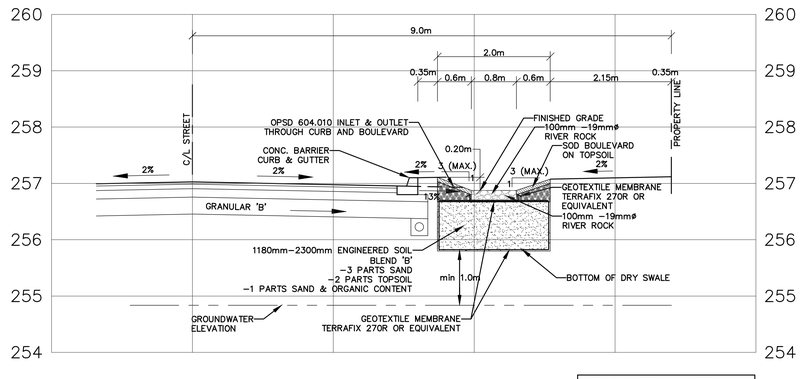
Location	Catchment ID	Area (ha)	Infiltration Rate (mm/hr)	Percent Impervious	Length (m)	Width (m)	Total Depth (m)	North/West End			South/East End		
								Ground Elevation	Water Table Elevation	Distance from Bottom of Swale to Water Table Elevation	Ground Elevation	Water Table Elevation	Distance from Bottom of Swale to Water Table Elevation
Street D	2-501	0.16	13	65%	50.00	2.00	1.70	256.05	253.28	1.00	257.47	253.64	2.06
Street D	2-502	0.10	13	65%	50.00	2.00	1.80	256.05	253.24	1.00	257.47	253.69	1.97
Street D	2-503	0.15	13	65%	50.00	2.00	3.08	257.64	253.56	1.00	258.90	254.11	1.71
Street D	2-504	0.09	13	65%	50.00	2.00	3.15	257.64	253.46	1.00	258.90	254.04	1.68
Street D	2-505	0.21	13	65%	53.00	2.00	3.70	258.99	254.27	1.00	260.01	254.67	1.62
Street D	2-506	0.45	13	65%	53.00	2.00	3.85	258.99	254.14	1.00	260.01	254.56	1.60
Street B	2-507	0.19	13	65%	25.00	2.00	0.78	255.67	253.89	1.00	255.32	253.43	1.11
Street C	2-508	0.27	13	65%	25.00	2.00	1.55	256.45	253.57	1.33	256.10	253.55	1.00
Street C	2-509	0.27	13	65%	26.50	2.00	1.80	256.47	253.37	1.30	256.10	253.30	1.00
Thicketwood	2-510	0.10	13	65%	19.00	2.00	1.70	255.24	252.46	1.07	255.40	252.69	1.00
Thicketwood	1-601	0.37	13	65%	25.00	2.00	1.75	255.99	253.17	1.07	255.34	252.59	1.00
Thicketwood	1-602	0.25	13	65%	25.00	2.00	1.73	255.96	253.12	1.10	255.34	252.60	1.00
Street D	1-603	0.21	13	65%	24.00	2.00	3.95	260.04	254.83	1.26	259.76	254.81	1.00
Street D	1-604	0.02	13	65%	24.00	2.00	4.20	260.05	254.66	1.18	259.76	254.55	1.00
Street E	1-605	0.03	13	65%	21.00	2.00	4.08	261.88	256.79	1.00	262.36	257.15	1.12
Street E	1-606	0.14	13	65%	22.50	2.00	4.20	262.81	257.30	1.30	263.04	257.83	1.00
Street E	1-607	0.14	13	65%	21.00	2.00	2.75	256.58	252.04	1.79	256.72	252.97	1.00
Street E	1-608	0.05	13	65%	22.00	2.00	2.88	255.79	251.91	1.00	256.43	252.05	1.50
Street E	1-609	0.08	13	65%	22.50	2.00	2.98	255.71	251.73	1.00	256.04	251.52	1.54
Street E	1-610	0.07	13	65%	70.00	2.00	3.55	262.82	257.68	1.57	260.84	256.27	1.00
Street E	1-611	0.17	13	65%	88.00	2.00	2.23	260.78	257.27	1.26	258.12	254.87	1.00
Street E	1-612	0.16	13	65%	49.00	2.00	1.88	258.06	254.83	1.33	256.76	253.86	1.00



KEY PLAN
N.T.S.

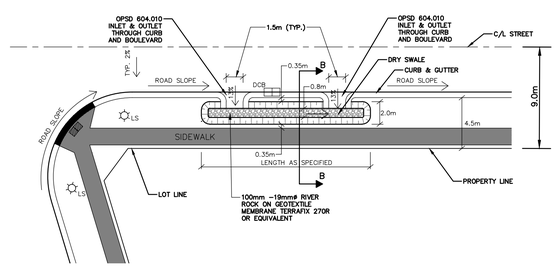


NO SIDEWALK – PLAN VIEW
1:250

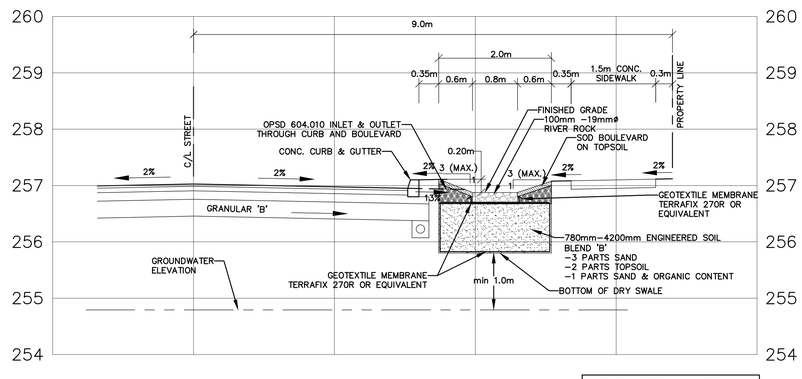


SECTION A–A
1:50

NOTE: ENGINEERED SOIL DEPTH VARIES TO MEET LID'S TOTAL DEPTH OUTLINED IN THE TABLE BELOW



SIDEWALK – PLAN VIEW
1:250



SECTION B–B
1:50

NOTE: ENGINEERED SOIL DEPTH VARIES TO MEET LID'S TOTAL DEPTH OUTLINED IN THE TABLE BELOW

BENCHMARK:

BENCHMARK NO: 001193104605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

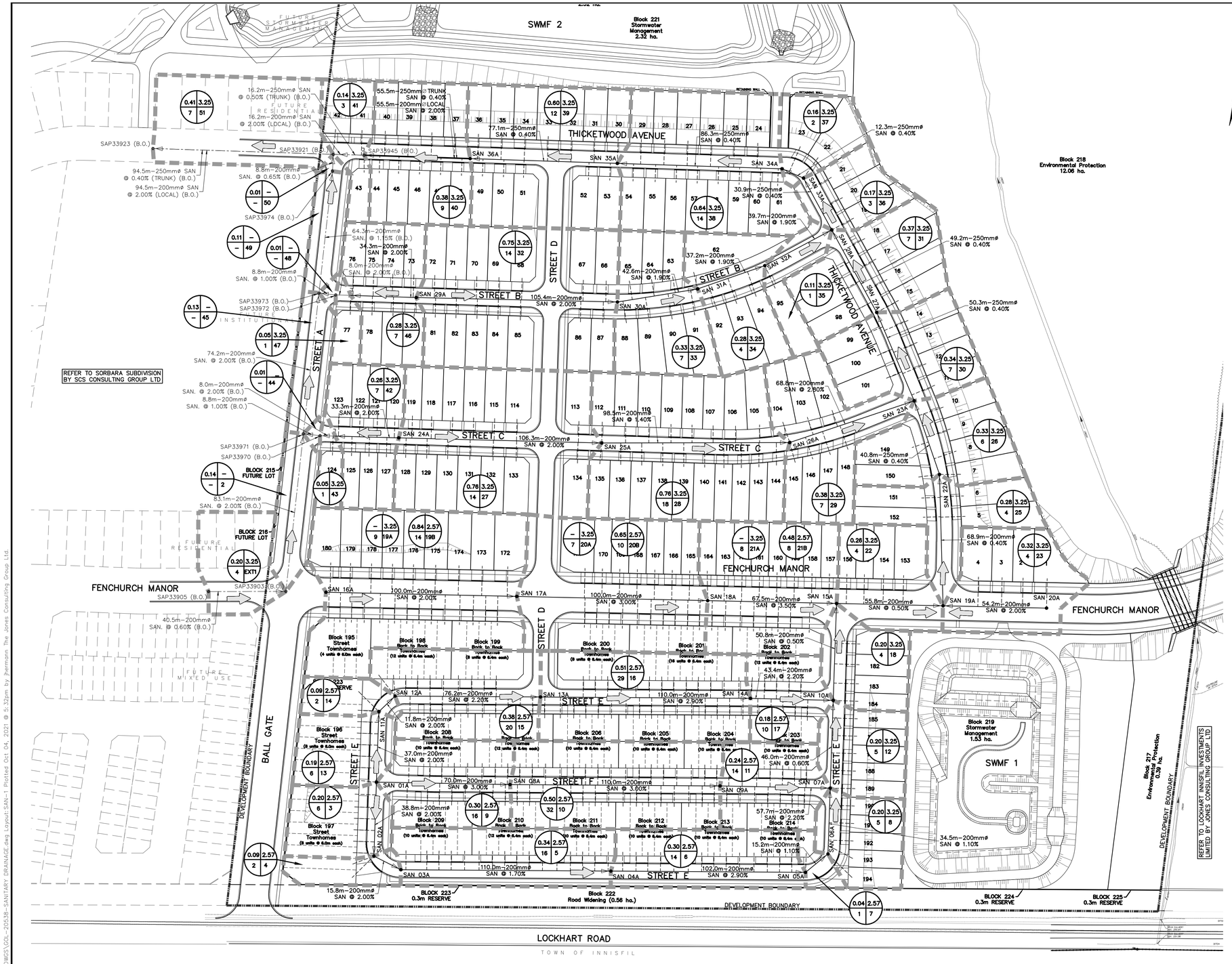
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

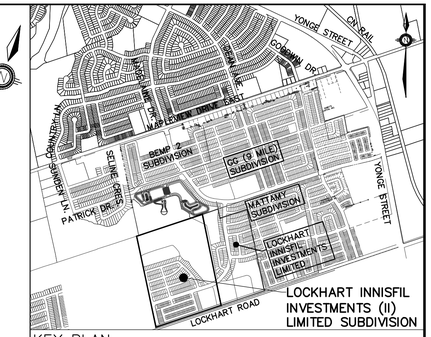
LID SECITIONS AND DETAILS DRY SWALES

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KC	SCALE: 1:1000	DATE JUNE 2021
DRAWN	KC	PROJECT GOL–20538	DWG. Nº LID–2
CHECKED	JI		

G:\Eng_JD\GOL-20538\Production DWGS\GOL-20538-STORM DRAINAGE.dwg Layout:LID-2 Plotted Oct 06, 2021 @ 4:24pm by jhermann The Jones Consulting Group Ltd.





LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

KEY PLAN
N.T.S.

LEGEND

- SAN 27A — SANITARY MAINTENANCE HOLE
- SANITARY SEWER & DIRECTION OF FLOW
- SANITARY SERVICE
- SANITARY SEWER DIRECTION OF FLOW (BY OTHERS)
- SAP33923 (B.O.) — SANITARY MAINTENANCE HOLE (BY OTHERS)
- SUB CATCHMENT BOUNDARY
- LIMIT OF SUBDIVISION
- DIRECTION OF FLOW
- AREA (ha.) — 0.42 3.13 — PERSONS PER UNIT
- No. OF UNITS — 10 13 — CATCHMENT AREA ID NUMBER

BENCHMARK:

BENCHMARK NO: 001193U1460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911169.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

SANITARY DRAINAGE AREA PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KC	SCALE: 1:1000	DATE MAY 2021
DRAWN	KC	PROJECT GOL-20538	DWG. Nº SAN-1
CHECKED	JI		

G:\Eng_3D\COL-20538\Production DWGS\COL-20538-SANITARY DRAINAGE.dwg Layout:SAN-1 Plotted Oct 04, 2021 @ 5:32pm by jhermann The Jones Consulting Group Ltd.

					GOL-20538 Lockhart II											June 2021
					5 Year Storm Sewer Sizing											
AREAS	Street	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S	D	Q FULL	V FULL	% FULL
		FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)	(mm)	(cms)	(m/s)	
201	Street 'E'	STM 1	STM 2	80.2	0.77	0.30	0.23	0.23	10.00	0.56	109	0.070	3.00	300	0.167	2.37	***41.7***
202	Street 'E'	STM 2	STM 3	66.3	0.83	0.28	0.23	0.46	10.56	0.48	106	0.135	2.80	300	0.162	2.29	***83.6***
	Street 'E'	STM 3	STM 4	19.0			0	0.46	11.05	0.25	103	0.132	0.50	450	0.202	1.27	***65.5***
203	Street 'E'	STM 4	STM 5	32.0	0.78	0.29	0.23	0.69	11.30	0.38	102	0.195	0.50	525	0.304	1.40	***64.2***
204	Street 'F'	STM 6	STM 7	81.2	0.83	0.70	0.58	0.58	10.00	0.50	109	0.175	2.90	375	0.299	2.70	***58.6***
205	Street 'F'	STM 7	STM 5	67.8	0.83	0.33	0.27	0.85	10.50	0.47	106	0.250	1.80	450	0.383	2.41	***65.5***
206	Street 'E'	STM 5	STM 8	46.0	0.71	0.12	0.08	1.62	11.68	0.42	100	0.451	0.60	675	0.651	1.82	***69.3***
207	Street 'E'	STM 9	STM 10	38.8	0.69	0.15	0.10	0.10	10.00	0.34	109	0.031	1.90	300	0.133	1.89	***23.2***
	Street 'E'	STM 10	STM 11	9.3			0	0.10	10.34	0.08	107	0.030	1.90	300	0.133	1.89	***22.8***
208	Street 'E'	STM 11	STM 12	78.9	0.73	0.45	0.33	0.43	10.43	0.55	107	0.128	2.30	375	0.266	2.41	***48.2***
209	Street 'E'	STM 12	STM 13	71.5	0.83	0.61	0.50	0.94	10.97	0.44	104	0.269	2.90	375	0.299	2.70	***90.2***
210	Street 'E'	STM 13	STM 8	81.8	0.83	0.39	0.33	1.26	11.41	0.54	102	0.356	2.00	450	0.403	2.54	***88.3***
211	Street 'E'	STM 8	STM 14	50.9	0.72	0.18	0.13	3.01	12.10	0.40	98	0.823	0.70	750	0.931	2.11	***88.3***
212	FENCHURCH	STM 15	STM 16	93.5	0.76	0.35	0.26	0.26	10.00	0.66	109	0.080	3.00	300	0.167	2.37	***47.5***
213	FENCHURCH	STM 16	STM 14	85.1	0.72	0.85	0.61	0.87	10.66	0.53	105	0.256	2.80	375	0.293	2.66	***87.2***
	FENCHURCH	STM 14	STM 18	54.3			0	3.89	12.50	0.45	97	1.042	0.50	900	1.280	2.01	***81.4***
214	FENCHURCH	STM 17	STM 18	74.0	0.65	0.19	0.12	0.12	10.00	0.82	109	0.037	1.20	300	0.106	1.50	***35.0***
215	SWMF BLK 219	STM 18	STM 19	16.9	0.65	0.89	0.58	4.59	12.95	0.15	95	1.207	**0.40**	975	1.417	1.90	***85.1***
	SWMF BLK 219	STM 19	STM HW 20	18.4			0	4.59	13.10	0.16	94	1.199	**0.40**	975	1.417	1.90	***84.6***
301	Street 'C'	STM 21	STM 22	84.9	0.65	0.81	0.52	0.52	10.00	0.68	109	0.158	1.70	375	0.229	2.07	***69.3***
302	Street 'C'	STM 22	STM 23	44.7	0.65	0.52	0.34	0.86	10.68	0.32	105	0.252	1.70	450	0.372	2.34	***67.9***
303	Street 'C'	STM 23	STM 24	67.4	0.65	0.48	0.31	1.18	11.00	0.50	104	0.339	1.60	450	0.361	2.27	***94.0***
304	THICKETWOOD	STM 24	STM 25	48.5	0.65	0.15	0.10	1.27	11.50	0.53	101	0.358	0.50	600	0.434	1.54	***82.4***
305	THICKETWOOD	STM 25	STM 26	50.5	0.65	0.40	0.26	1.53	12.02	0.50	99	0.421	0.60	600	0.476	1.68	***88.4***
306	Street 'B'	STM 27	STM 28	29.1	0.65	0.75	0.49	0.49	10.00	0.23	109	0.147	1.70	375	0.229	2.07	***64.5***
307	Street 'B'	STM 28	STM 29	46.3	0.65	0.48	0.31	0.80	10.23	0.32	108	0.239	1.80	450	0.383	2.41	***62.5***
	Street 'B'	STM 29	STM 30	41.5			0	0.80	10.56	0.29	106	0.235	1.80	450	0.383	2.41	***61.5***
308	Street 'B'	STM 30	STM 26	39.0	0.65	0.60	0.39	1.19	10.84	0.31	104	0.344	1.10	525	0.451	2.08	***76.3***
	THICKETWOOD	STM 24	STM 31	34.7			0	2.72	12.52	0.32	96	0.729	0.50	750	0.787	1.78	***92.6***
	THICKETWOOD	STM 31	STM 34	18.2			0	2.72	12.85	0.17	95	0.719	0.50	750	0.787	1.78	***91.3***
309	THICKETWOOD	STM 32	STM 33	58.3	0.65	0.85	0.55	0.55	10.00	0.77	109	0.167	0.50	450	0.202	1.27	***83.0***
	THICKETWOOD	STM 33	STM 34	54.0			0	0.55	10.77	0.71	105	0.161	0.50	450	0.202	1.27	***79.9***
310	SWMF BLK 221	STM 34	STM 35	35.0	0.65	0.62	0.40	3.68	13.02	0.10	94	0.965	5.00	750	2.489	5.63	***38.7***
	SWMF BLK 221	35	HW 36	20.6			0	3.68	13.12	0.06	94	0.960	5.00	750	2.489	5.63	***38.6***

Q= C*I*A/360 (cms); C=RUNOFF COEFFICIENT; I-RAINFALL INTENSITY (5 Year) =853.608/(T.C. + 4.699)^0.766; A=AREA (ha)

Note:

G:\Eng. 3D\GOL-20538\Production DWGS\GOL-20538-STORM DRAINAGE.dwg, Layout:DS-1 Plotted Oct 04, 2021 @ 4:41pm by jhermann The Jones Consulting Group Ltd.

BENCHMARK:

BENCHMARK NO: 001931U4605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER J. W. INGRAM 100143779 21-10-06 PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

STORM SEWER DESIGN SHEET

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
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DESIGN VBS	SCALE: NTS	DATE JUNE 2021	
DRAWN VBS	PROJECT GOL-20538	DWG. Nº DS-1	
CHECKED JI			

SANITARY SEWER DESIGN - LOCAL SEWER

Development Details Basis

DESIGN SHEET
FILE NO GOL-20538
CONTRACT / PROJECT LOCKHART INNISFIL INVESTMENTS (II) LIMITED

n ≥ 0.013
M = 5/P^0.2 Babbit
M=1+[14/(4+P^0.5)] Harmon
Q_p = P*q*M/86.4
Q_I = I*A
Q_{tot} = Q_p + Q_I

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

(Peak population flow where; q = 225 L/day/person; P = population in thousands) 225 litres/person/day
(Peak extraneous flow: I= 0.1L/s/ha over development area)
(Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET	AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	DWELL UNITS	DWELL (ACC) UNITS	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ha)	AREA (ACC) (ha)	Q_I (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[3]	d/D[3] >0.5 or >0.7	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
Street E	3	SAN 01A	SAN 02A	6	6	2.57	15.42	15.42	11.517	4.395	11.517	0.462	0.20	0.20	0.020	0.482	38.8	200	2.00	46.384	0.071	Ok	1.476	0.472	Check
Street E	4	SAN 02A	SAN 03A	2	8	2.57	5.14	20.56	10.873	4.379	10.873	0.582	0.09	0.29	0.029	0.611	15.8	200	2.00	46.384	0.080	Ok	1.476	0.506	Check
Street E	5	SAN 03A	SAN 04A	16	24	2.57	41.12	61.68	8.729	4.295	8.729	1.402	0.34	0.63	0.063	1.465	110.0	200	1.70	42.764	0.126	Ok	1.361	0.625	Ok
Street E	6	SAN 04A	SAN 05A	14	38	2.57	35.98	97.66	7.962	4.246	7.962	2.025	0.31	0.94	0.094	2.119	102.0	200	2.90	55.854	0.133	Ok	1.778	0.841	Ok
Street E	7	SAN 05A	SAN 06A	1	39	2.57	2.57	100.23	7.921	4.243	7.921	2.067	0.03	0.97	0.097	2.164	15.2	200	1.10	34.399	0.170	Ok	1.095	0.602	Ok
Street E	8	SAN 06A	SAN 07A	5	44	3.25	16.25	116.48	7.686	4.225	7.686	2.332	0.20	1.17	0.117	2.449	34.5	200	1.10	34.399	0.180	Ok	1.095	0.624	Ok
Street F	9	SAN 01A	SAN 08A	16	16	2.57	41.12	41.12	9.466	4.331	9.466	1.014	0.30	0.30	0.030	1.044	70.0	200	3.00	56.809	0.094	Ok	1.808	0.688	Ok
Street F	10	SAN 08A	SAN 09A	32	48	2.57	82.24	123.36	7.599	4.217	7.599	2.441	0.50	0.80	0.080	2.521	110.0	200	3.00	56.809	0.143	Ok	1.808	0.900	Ok
Street F	11	SAN 09A	SAN 07A	14	62	2.57	35.98	159.34	7.219	4.182	7.219	2.996	0.24	1.04	0.104	3.100	57.7	200	2.20	48.648	0.171	Ok	1.549	0.858	Ok
Street E	12	SAN 07A	SAN 10A	5	111	3.25	16.25	292.07	6.395	4.083	6.395	4.864	0.20	2.41	0.241	5.105	48.0	200	0.60	25.406	0.304	Ok	0.809	0.623	Ok
Street E	13	SAN 01A	SAN 11A	6	6	2.57	15.42	15.42	11.517	4.395	11.517	0.462	0.19	0.19	0.019	0.481	37.0	200	2.00	46.384	0.071	Ok	1.476	0.472	Check
Street E	14	SAN 11A	SAN 12A	2	8	2.57	5.14	20.56	10.873	4.379	10.873	0.582	0.09	0.28	0.028	0.610	11.8	200	2.00	46.384	0.080	Ok	1.476	0.506	Check
Street E	15	SAN 12A	SAN 13A	20	28	2.57	51.40	71.96	8.464	4.280	8.464	1.586	0.38	0.66	0.066	1.652	76.2	200	2.20	48.648	0.126	Ok	1.549	0.708	Ok
Street E	16	SAN 13A	SAN 14A	29	57	2.57	74.53	146.49	7.342	4.194	7.342	2.801	0.51	1.17	0.117	2.918	110.0	200	2.90	55.854	0.155	Ok	1.778	0.926	Ok
Street E	17	SAN 14A	SAN 10A	10	67	2.57	25.70	172.19	7.108	4.171	7.108	3.167	0.18	1.35	0.135	3.322	43.4	200	2.20	48.648	0.176	Ok	1.549	0.873	Ok
Street E	18	SAN 10A	SAN 15A	4	182	3.25	13.00	477.26	5.797	3.985	5.797	7.205	0.20	3.96	0.396	7.601	50.8	200	0.50	23.192	0.393	Ok	0.738	0.651	Ok
Fenchurch Manor	19A			9		3.25	29.25																		
Fenchurch Manor	19B	SAN 16A	SAN 17A	14	23	2.57	35.98	65.23	8.631	4.290	8.631	1.466	0.84	0.84	0.084	1.550	100.0	200	2.00	46.384	0.125	Ok	1.476	0.668	Ok
Fenchurch Manor	20A			7		3.25	22.75																		
Fenchurch Manor	20B	SAN 17A	SAN 18A	10	40	2.57	25.70	113.68	7.724	4.228	7.724	2.287	0.65	1.49	0.149	2.436	100.0	200	3.00	56.809	0.141	Ok	1.808	0.880	Ok
Fenchurch Manor	21A			8		3.25	26.00																		
Fenchurch Manor	21B	SAN 18A	SAN 15A	8	56	2.57	20.56	160.24	7.211	4.182	7.211	3.009	0.48	1.97	0.197	3.206	67.5	200	3.50	61.360	0.155	Ok	1.953	1.009	Ok
Fenchurch Manor	22	SAN 15A	SAN 19A	4	242	3.25	13.00	650.50	5.449	3.913	5.449	9.231	0.26	6.19	0.619	9.850	55.8	200	0.50	23.192	0.454	Ok	0.738	0.696	Ok
Fenchurch Manor	23	SAN 20A	SAN 19A	4	4	3.25	13.00	13.00	11.917	4.403	11.917	0.403	0.32	0.32	0.032	0.435	54.2	200	2.00	46.384	0.068	Ok	1.476	0.454	Check
Thicketwood Avenue	25	SAN 19A	SAN 22A	4	250	3.25	13.00	676.50	5.407	3.903	5.407	9.525	0.28	6.79	0.679	10.204	68.9	200	0.40	20.744	0.495	Ok	0.660	0.646	Ok
Thicketwood Avenue	26	SAN 22A	SAN 23A	6	256	3.25	19.50	696.00	5.376	3.896	5.376	9.744	0.33	7.12	0.712	10.456	40.8	250	0.40	37.611	0.360	Ok	0.766	0.643	Ok
Street C	27	SAN 24A	SAN 25A	14	14	3.25	45.50	45.50	9.276	4.323	9.276	1.099	0.76	0.76	0.076	1.175	106.3	200	2.00	46.384	0.109	Ok	1.476	0.615	Ok
Street C	28	SAN 25A	SAN 26A	18	32	3.25	58.50	104.00	7.863	4.239	7.863	2.129	0.76	1.52	0.152	2.281	98.5	200	1.40	38.809	0.184	Ok	1.235	0.662	Ok
Street C	29	SAN 26A	SAN 23A	7	39	3.25	22.75	126.75	7.558	4.214	7.558	2.465	0.38	1.90	0.190	2.685	68.8	200	2.80	54.882	0.150	Ok	1.747	0.884	Ok
Thicketwood Avenue	30	SAN 23A	SAN 27A	7	302	3.25	22.75	845.50	5.171	3.846	5.171	11.385	0.34	9.36	0.936	12.321	50.3	250	0.40	37.611	0.393	Ok	0.766	0.671	Ok
Thicketwood Avenue	31	SAN 27A	SAN 28A	7	309	3.25	22.75	868.25	5.143	3.839	5.143	11.629	0.37	9.73	0.973	12.602	49.2	250	0.40	37.611	0.398	Ok	0.766	0.675	Ok
Street B	32	SAN 29A	SAN 30A	14	14	3.25	45.50	45.50	9.276	4.323	9.276	1.099	0.75	0.75	0.075	1.174	105.4	200	2.00	46.384	0.109	Ok	1.476	0.615	Ok
Street B	33	SAN 30A	SAN 31A	7	21	3.25	22.75	68.25	8.554	4.285	8.554	1.520	0.33	1.08	0.108	1.628	42.6	200	1.90	45.210	0.129	Ok	1.439	0.664	Ok
Street B	34	SAN 31A	SAN 32A	4	25	3.25	13.00	81.25	8.260	4.267	8.260	1.748	0.28	1.36	0.136	1.884	37.2	200	1.90	45.210	0.139	Ok	1.439	0.694	Ok
Street B	35	SAN 32A	SAN 28A	1	26	3.25	3.25	84.50	8.196	4.263	8.196	1.804	0.11	1.47	0.147	1.951	39.7	200	1.90	45.210	0.141	Ok	1.439	0.700	Ok
Thicketwood Avenue	36	SAN 28A	SAN 33A	3	338	3.25	9.75	962.50	5.038	3.811	5.038	12.629	0.17	11.37	1.137	13.766	30.9	250	0.40	37.611	0.418	Ok	0.766	0.690	Ok
Thicketwood Avenue	37	SAN 33A	SAN 34A	2	340	3.25	6.50	969.00	5.032	3.809	5.032	12.697	0.16	11.53	1.153	13.850	12.3	250	0.40	37.611	0.420	Ok	0.766	0.691	Ok
Thicketwood Avenue	38	SAN 34A	SAN 35A	14	354	3.25	45.50	1014.50	4.986	3.796	4.986	13.172	0.64	12.17	1.217	14.389	86.3	250	0.40	37.611	0.429	Ok	0.766	0.698	Ok
Thicketwood Avenue	39	SAN 35A	SAN 36	12	366	3.25	39.00	1053.50	4.948	3.785	4.948	13.575	0.60	12.77	1.277	14.852	77.1	250	0.40	37.611	0.436	Ok	0.766	0.704	Ok
Thicketwood Avenue	40 (Trunk)	SAN 36	SAP33945		366			1053.50	4.948	3.785	4.948	13.575	0.38	13.15	1.315	14.890	55.5	250	0.40	37.611	0.437	Ok	0.766	0.704	Ok
Thicketwood Avenue	40 (Local)	SAN 36	SAP33945	9	9	3.25	29.25	29.25	10.133	4.356	10.133	0.772		0.38	0.038	0.810	55.5	200	2.00	46.384	0.091	Ok	1.476	0.550	Check
Thicketwood Avenue	41 (Trunk)	SAP33945	SAP33921		375			1082.75	4.921	3.777	4.921	13.876	0.14	13.29	1.329	15.205	16.2	250	0.50	42.050	0.415	Ok	0.857	0.768	Ok
Thicketwood Avenue	41 (Local)	SAP33945	SAP33923	3	3	3.25	9.75	9.75	12.623	4.416	12.623	0.321		0.14	0.014	0.335	16.2	200	2.00	46.384	0.093	Ok	1.476	0.422	Check

SANITARY SEWER DESIGN - LOCAL SEWER

Development Details Basis

DESIGN SHEET
FILE NO GOL-20538
CONTRACT / PROJECT LOCKHART INNISFIL INVESTMENTS (II) LIMITED

n ≥ 0.013
M = 5/P^0.2 Babbit
M=1+[14/(4+P^0.5)] Harmon
Q_p = P*q*M/86.4
Q_I = I*A
Q_{tot} = Q_p + Q_I

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

(Peak population flow where; q = 225 L/day/person; P = population in thousands) 225 litres/person/day
(Peak extraneous flow: I= 0.1L/s/ha over development area)
(Total peak flow as the sum of peak population flow and peak extraneous flow)

STREET	AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	DWELL UNITS	DWELL (ACC) UNITS	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ha)	AREA (ACC) (ha)	Q_I (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[3]	d/D[3] >0.5 or >0.7	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
Fenchurch Manor	EXT1	SAP33905	SAP33903	4	55	3.25	13.00	147.47	7.332	4.193	7.332	2.816	0.20	1.35	0.135	2.951	40.5	200	0.60	25.406	0.230	Ok	0.809	0.532	Check
Ball Gate	2	SAP33903	SAP33971		55			147.47	7.332	4.193	7.332	2.816	0.14	1.49	0.149	2.965	83.1	200	2.00	46.384	0.171	Ok	1.476	0.815	Ok
Street C	42	SAN 24A	PLUG	7	7	3.25	22.75	22.75	10.655	4.373	10.655	0.631	0.26	0.26	0.026	0.657	33.3	200	2.00	46.384	0.083	Ok	1.476	0.518	Check
Street C	43	PLUG	SAP33970	1	8	3.25	3.25	26.00	10.375	4.364	10.375	0.702	0.05	0.31	0.031	0.733	8.0	200	2.00	46.384	0.087	Ok	1.476	0.534	Check
Street C	44	SAP33970	SAP33971		8			26.00	10.375	4.364	10.375	0.702	0.01	0.32	0.032	0.734	8.8	200	1.00	32.798	0.103	Ok	1.044	0.421	Check
Ball Gate	45	SAP33971	SAP33973		63			173.47	7.098	4.170	7.098	3.206	0.13	1.81	0.181	3.387	74.2	200	2.00	46.384	0.182	Ok	1.476	0.847	Ok
Street B	46	SAN 29A	PLUG	7	7	3.25	22.75	22.75	10.655	4.373	10.655	0.631	0.28	0.28	0.028	0.659	34.3	200	2.00	46.384	0.083	Ok	1.476	0.518	Check
Street B	47	PLUG	SAP33972	1	8	3.25	3.25	26.00	10.375	4.364	10.375	0.702	0.05	0.33	0.033	0.735	8.0	200	2.00	46.384	0.087	Ok	1.476	0.534	Check
Street B	48	SAP33972	SAP33973		8			26.00	10.375	4.364	10.375	0.702	0.01	0.34	0.034	0.736	8.8	200	1.00	32.798	0.103	Ok	1.044	0.421	Check
Ball Gate	49	SAP33973	SAP33974		71			199.47	6.902	4.148	6.902	3.585	0.11	2.26	0.226	3.811	64.3	200	1.15	35.172	0.222	Ok	1.120	0.719	Ok
Ball Gate	50	SAP33974	SAP33921		71			199.47	6.902	4.148	6.902	3.585	0.01	2.27	0.227	3.812	8.8	200	0.65	26.443	0.256	Ok	0.842	0.587	Check
Thicketwood Avenue	51 (Trunk)	SAP33921	SAP33923		449			1291.97	4.750	3.726	4.750	15.982	0.41	16.11	1.611	17.593	94.5	250	0.40	37.611	0.480	Ok	0.766	0.735	Ok
Thicketwood Avenue	51 (Local)	SAP33921	SAP33923	7	7	3.25	22.75	22.75	10.655	4.373	10.655	0.631		0.41	0.041	0.672	94.5	200	2.00	46.384	0.084	Ok	1.476	0.518	Check

BENCHMARK:

BENCHMARK NO: 001193104605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV. 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

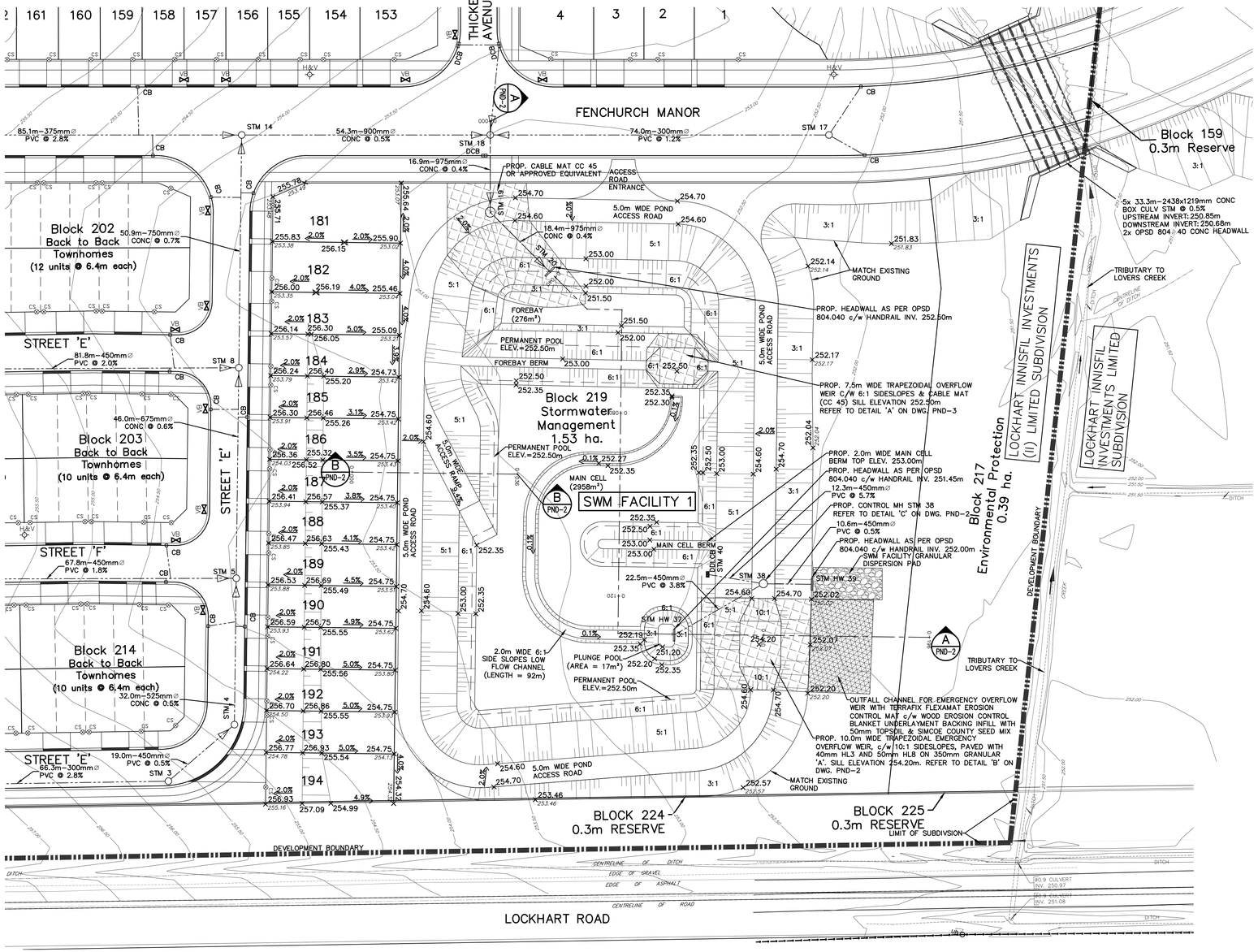
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

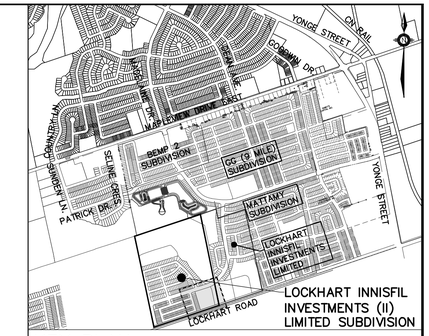
SANITARY SEWER DESIGN SHEET

JONES CONSULTING GROUP LTD.
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229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KC	SCALE: 1:1000	DATE MAY 2021
DRAWN	KC	PROJECT GOL-20538	DWG. Nº DS-2
CHECKED	JI		

G:\Eng_30\GOL-20538\Production DWGS\GOL-20538-SANITARY DRAINAGE.dwg Layout:DS-2 Plotted Oct 04, 2021 @ 5:35pm by Jhermann The Jones Consulting Group Ltd.





KEY PLAN
NTS

LEGEND

- STM MH — STORM MAINTENANCE HOLE
- DCB — STORM DOUBLE CATCHBASIN
- DI.CB — DOUBLE DITCH INLET CATCHBASIN
- CB — STORM CATCHBASIN
- PROP. STORM SEWER & DIRECTION OF FLOW
- LIMIT OF SUBDIVISION
- 253.00 — EXISTING CONTOUR AND ELEVATION

24 HR SCS TYPE II STORM WATER ELEVATION	
Storm Event	Elevation (m)
25mm 4hr. Chicago	252.65
2yr. 24hr. SCS	252.84
5yr. 24hr. SCS	252.99
10yr. 24hr. SCS	253.08
25yr. 6hr. SCS	253.20
50yr. 6hr. SCS	253.29
100yr. 6hr. SCS	253.39
Hazel	253.89

BENCHMARK:

BENCHMARK NO: 001193104605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 010198654S4 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28m WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 010198604O7 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 010198604O4 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER J. W. INGRAM 100143779 21-10-06 PROVINCE OF ONTARIO

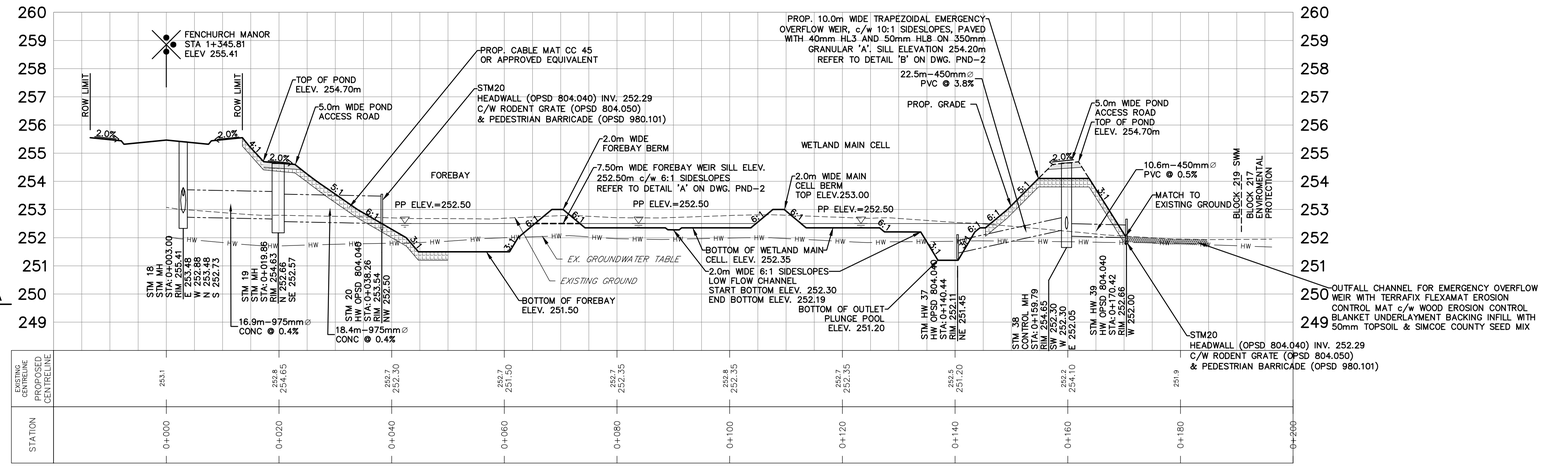
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

SWM FACILITY No. 1 PLAN VIEW

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

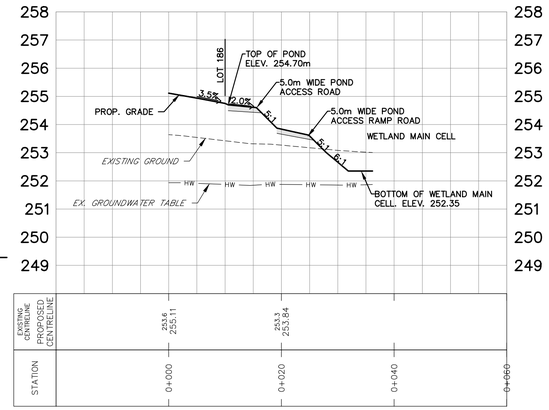
DESIGN	VBS	SCALE: 1:500	DATE JUNE 2021
DRAWN	VBS	PROJECT GOL-20538	DWG. Nº PND-1
CHECKED	JI		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-POND.dwg Layout:PND-1 Plotted: Oct 04, 2021 @ 5:09pm by Jhermann The Jones Consulting Group Ltd.



SECTION A–A
PND-1 HOR. 1:500 VERT. 1:100

24 HR SCS TYPE II STORM WATER ELEVATION	
Storm Event	Elevation (m)
25mm 4hr. Chicago	252.65
2yr. 24hr. SCS	252.84
5yr. 24hr. SCS	252.99
10yr. 24hr. SCS	253.08
25yr. 6hr. SCS	253.20
50yr. 6hr. SCS	253.29
100yr. 6hr. SCS	253.39
Hazel	253.89

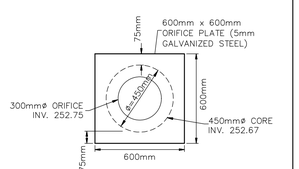


SECTION B–B
PND-1 HOR. 1:500 VERT. 1:100

DETAIL 'C1'

300mmØ ORIFICE PLATE

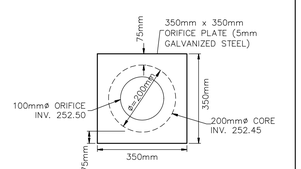
BOLTED TO THE WEST SIDE OF WEIR WALL — N.T.S.



DETAIL 'C2'

100mmØ ORIFICE PLATE

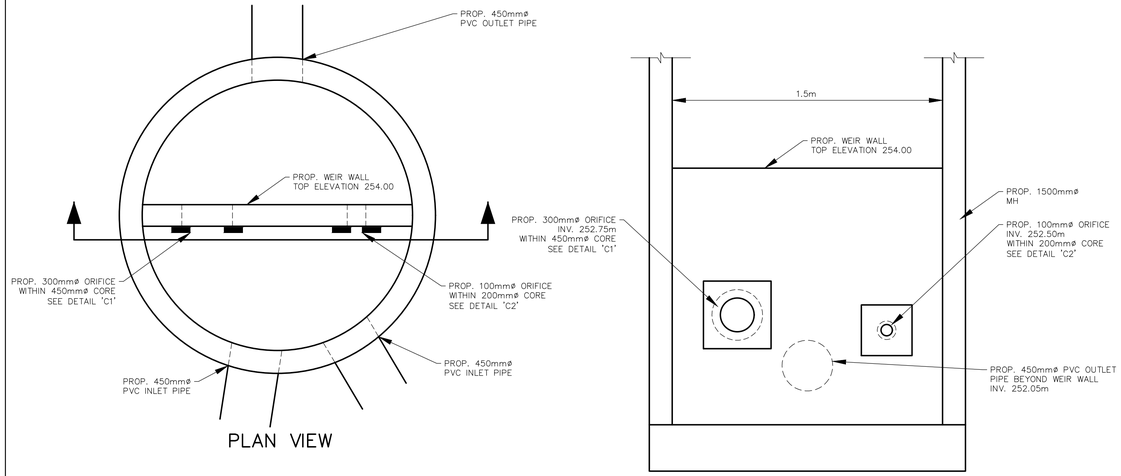
BOLTED TO THE WEST SIDE OF WEIR WALL — N.T.S.



DETAIL 'C'

1500mmØ CONTROL MANHOLE 38

N.T.S.



BENCHMARK:

BENCHMARK NO: 001931U4605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

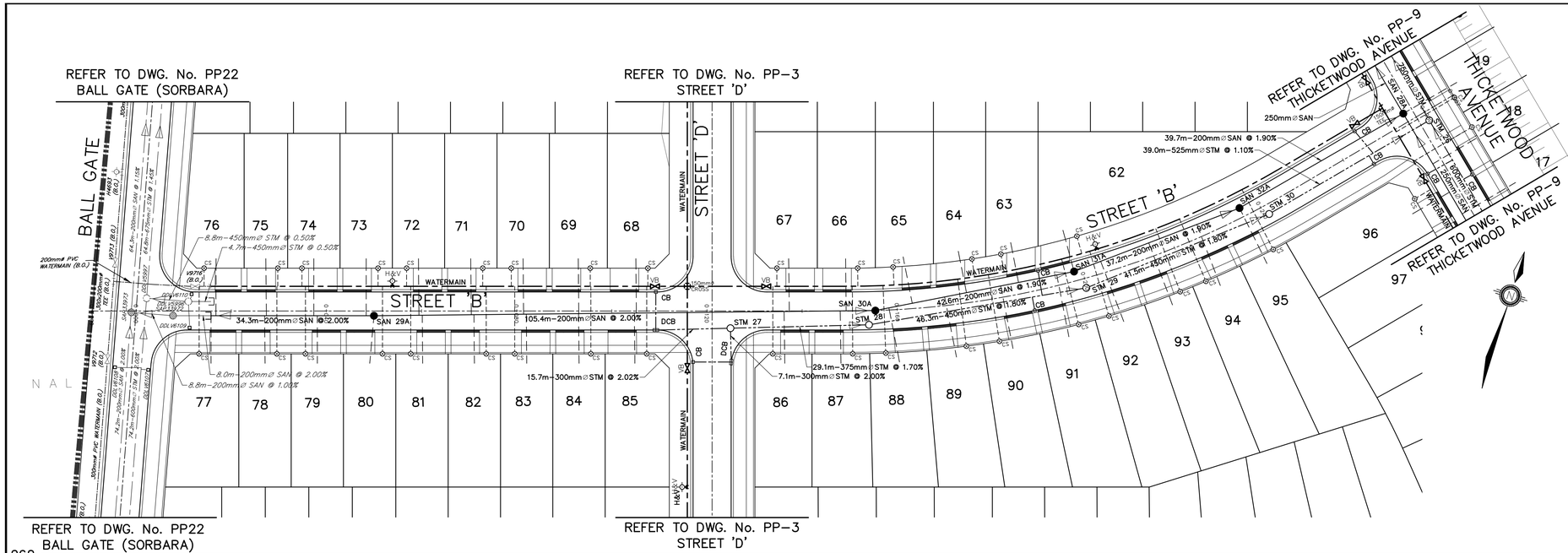
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

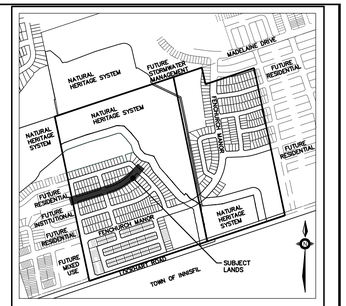
SWM FACILITY No. 1
SECTIONS AND DETAILS

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN VBS	SCALE: AS NOTED	DATE JUNE 2021	
DRAWN VBS	PROJECT GOL–20538	DWG. Nº PND–2	
CHECKED JI			

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-POND.dwg Layout:PND-2 Plotted Oct 07, 2021 @ 10:44am by jhermann The Jones Consulting Group Ltd.

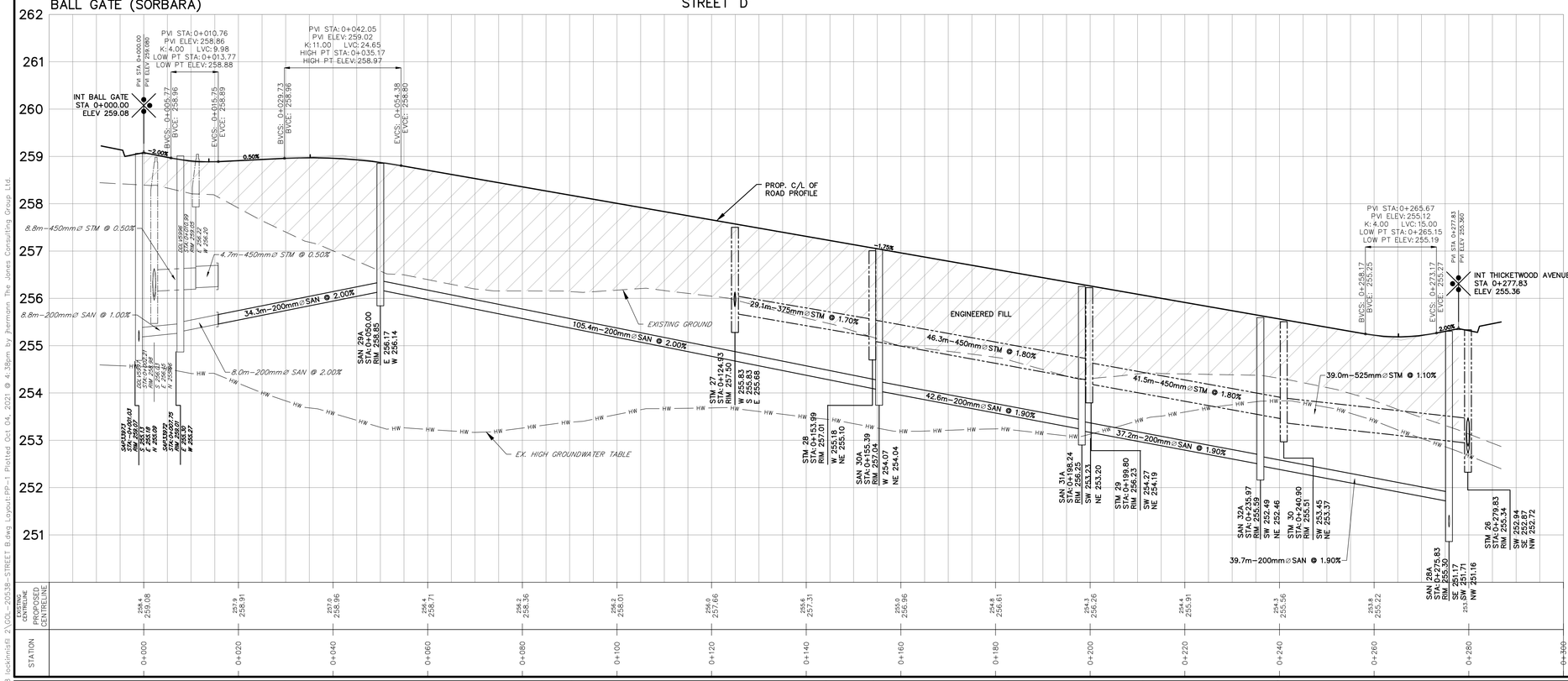




KEY PLAN N.T.S.

LEGEND

- SAN 1 3921 — SANITARY MAINTENANCE HOLE (BY OTHERS)
- DDL V5979 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB (2.0) — VALVE & BOX (BY OTHERS)
- H&V (2.0) — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193IU460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD, TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JW

LICENCED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

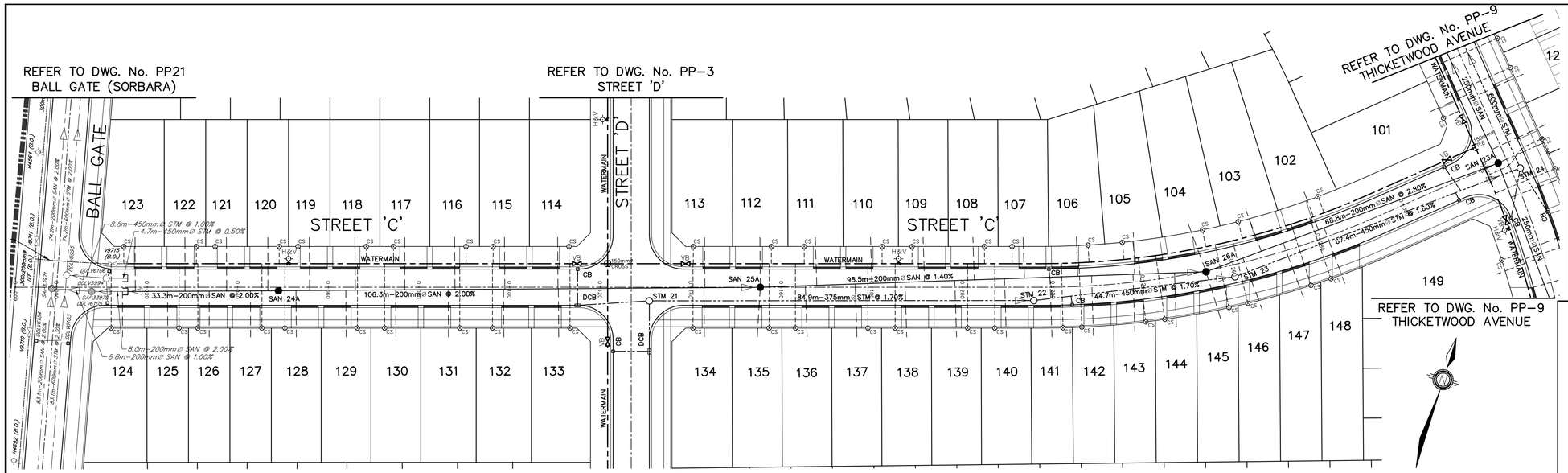
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

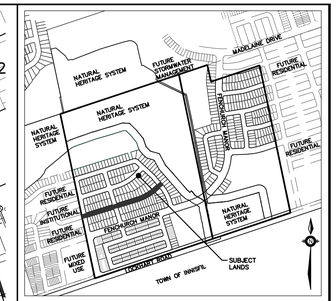
PLAN AND PROFILE STREET 'B' 0–009 TO 0+287

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KS/JW	SCALE: H=1:500 V=1:50	DATE	JUNE 2021
DRAWN	KS	PROJECT GOL–20538	DWG. Nº PP–1	
CHECKED	JW			

C:_TJCG\Eng_3D\GOL-20538_lockinnisfil 2\GOL-20538-STREET B.dwg Layout: PP-1 Plotted: Oct 04, 2021 @ 4:35pm by jhermann The Jones Consulting Group Ltd.

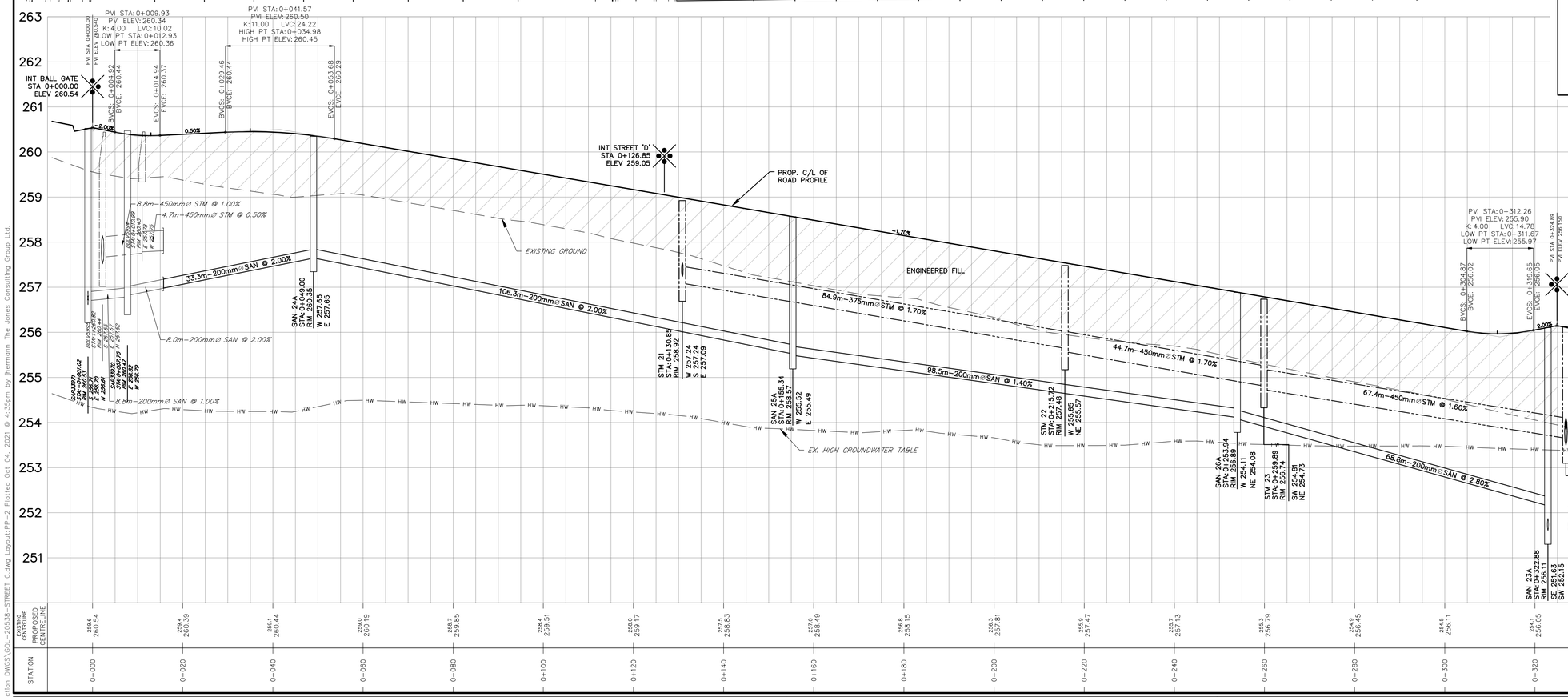




KEY PLAN N.T.S.

LEGEND

- SAN 13921 — SANITARY MAINTENANCE HOLE (BY OTHERS)
- DDL V5979 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB (12.0) — VALVE & BOX (BY OTHERS)
- H&V (12.0) — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001931IU4605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD, TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019865404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911159.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

J. W. INGRAM 100143779 21-10-06 — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

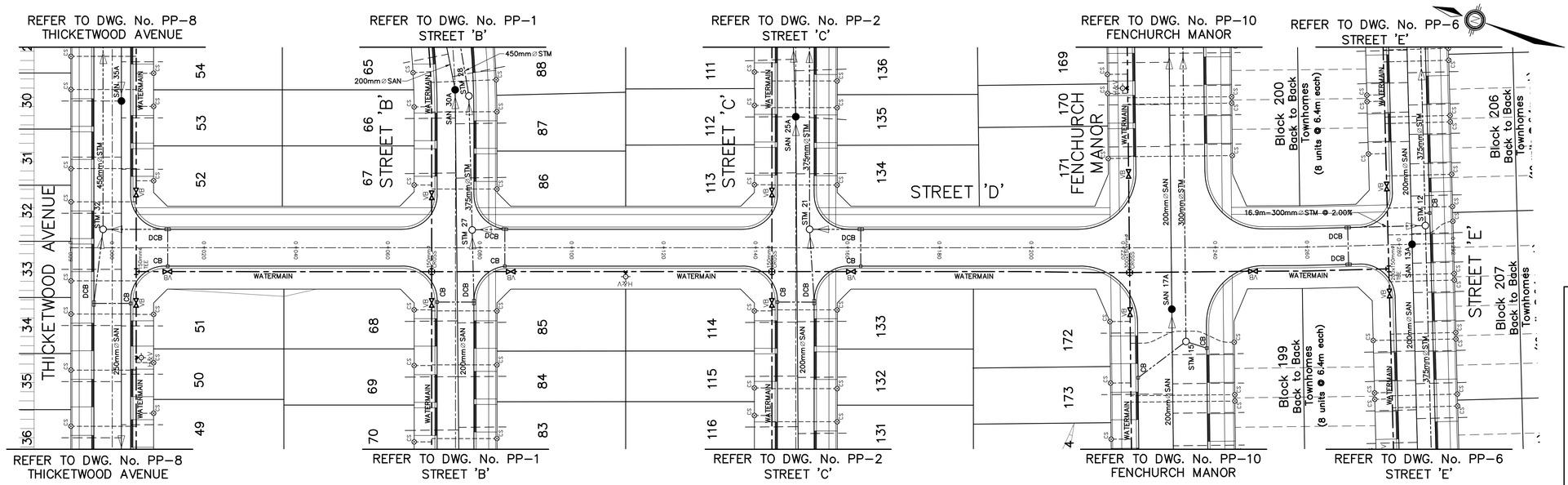
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

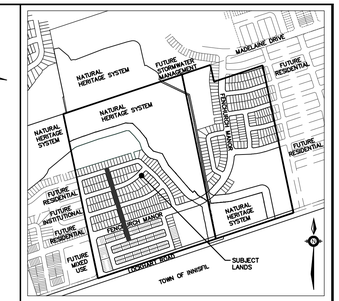
PLAN AND PROFILE STREET 'C' 0–009 TO 0+334

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN KS/JWI	SCALE: H=1:500 V=1:50	DATE JUNE 2021
DRAWN KS	PROJECT GOL–20538	DWG. Nº PP–2
CHECKED JWI		

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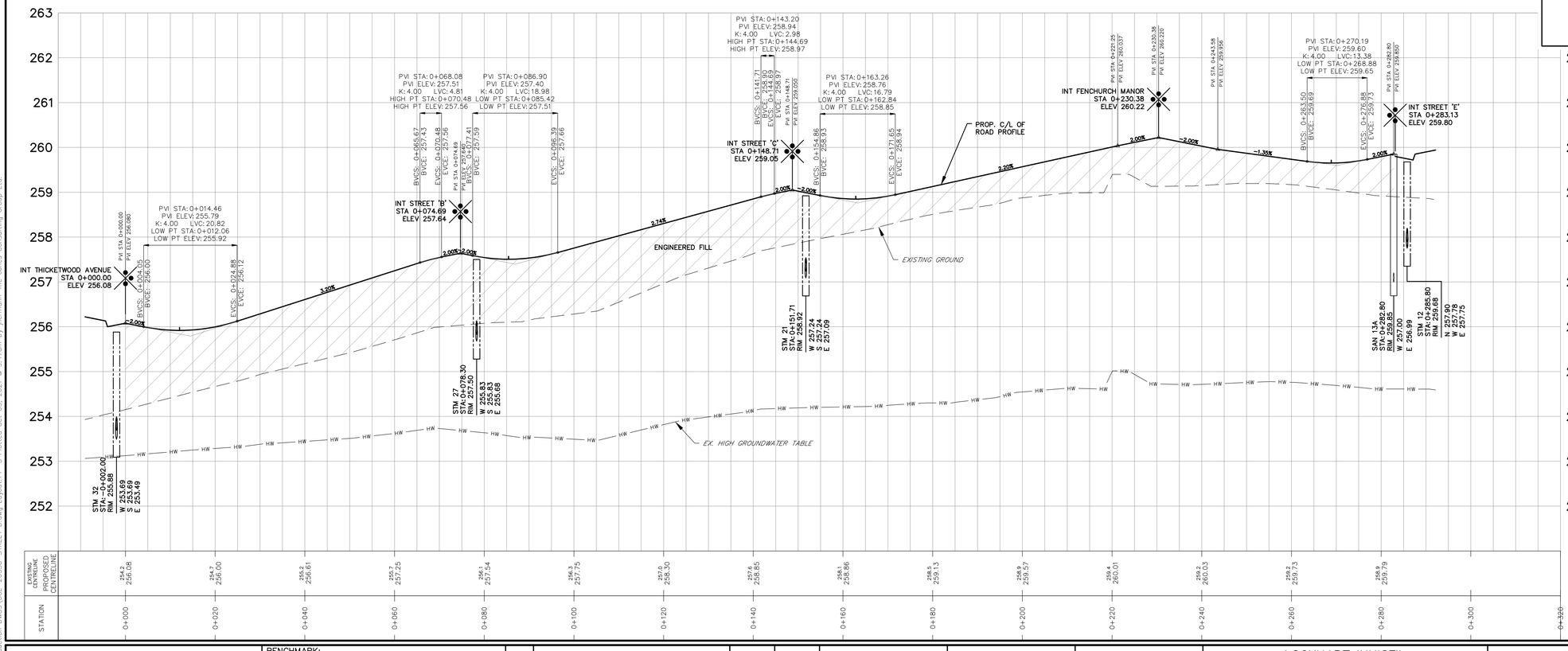




KEY PLAN N.T.S.

LEGEND

- SAN 3,5921 — SANITARY MAINTENANCE HOLE (BY OTHERS)
- DDL V5979 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB (2.0) — VALVE & BOX (BY OTHERS)
- H&V (2.0) — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193114605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER J. W. INGRAM 100143779 21-10-06 PROVINCE OF ONTARIO

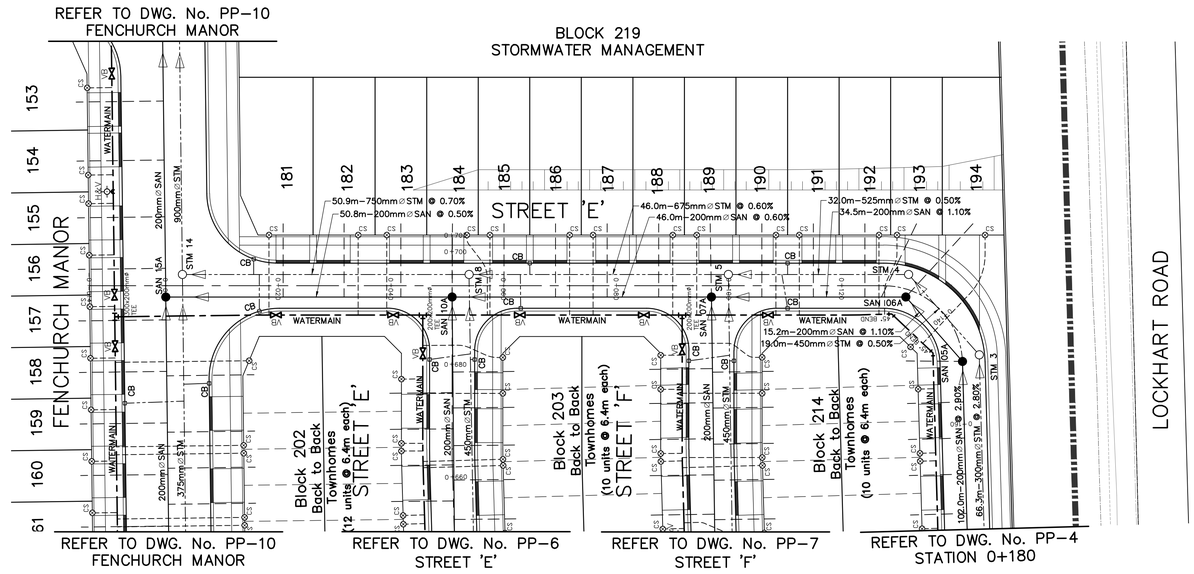
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

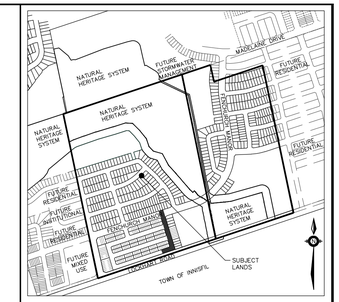
PLAN AND PROFILE STREET 'D' 0-009 TO 0+292

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN KS/JWI	SCALE: H=1:500 V=1:50	DATE JUNE 2021	
DRAWN KS	PROJECT GOL-20538	DWG. Nº PP-3	
CHECKED JWI			

G:\Eng. 3D\GOL-20538\Production DWGS\GOL-20538-STREET D.dwg Layout:PP-3 Plotted: Oct 05, 2021 @ 9:17am by Jherrmann The Jones Consulting Group Ltd

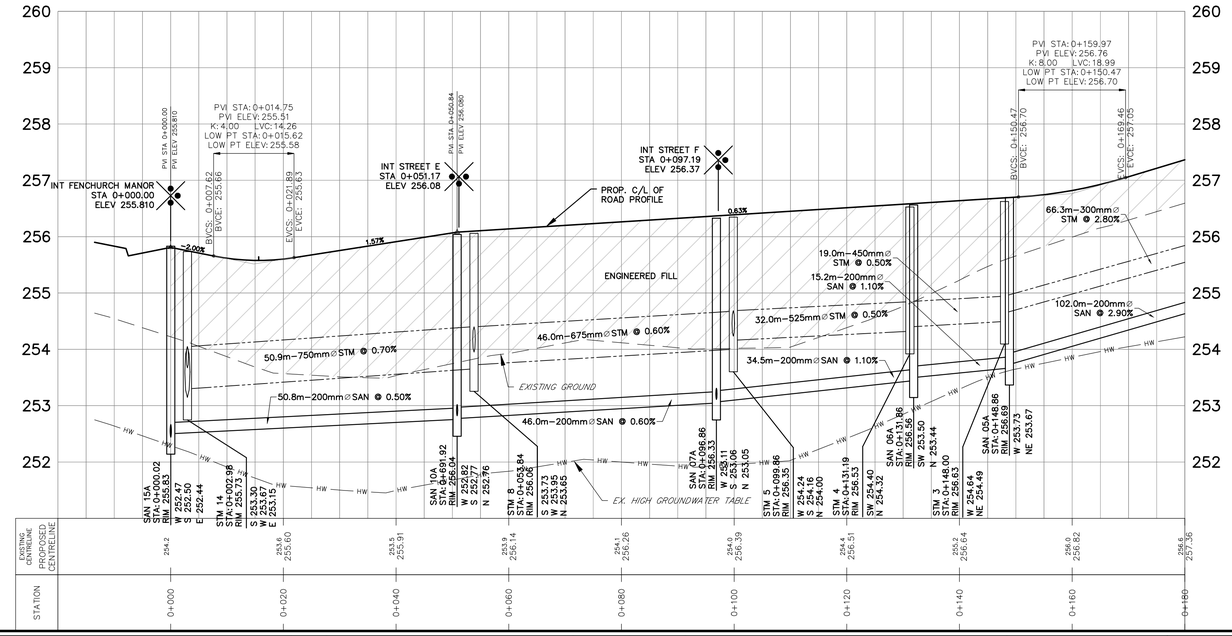




KEY PLAN N.T.S.

LEGEND

- SAP.13921 — SANITARY MAINTENANCE HOLE (BY OTHERS)
- DDL#5979 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- V&V(2.0) — VALVE & BOX (BY OTHERS)
- H&V(2.0) — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193111460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JW

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

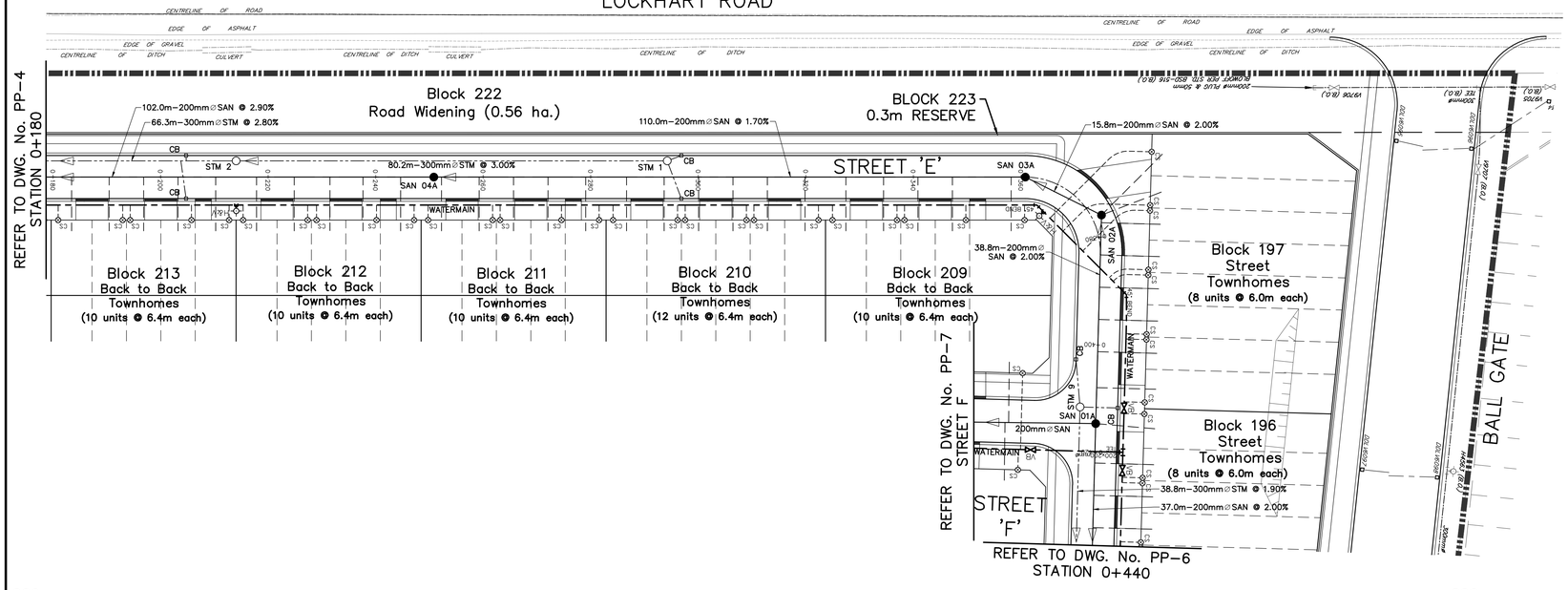
PLAN AND PROFILE STREET 'E' 0-014 TO 0+180

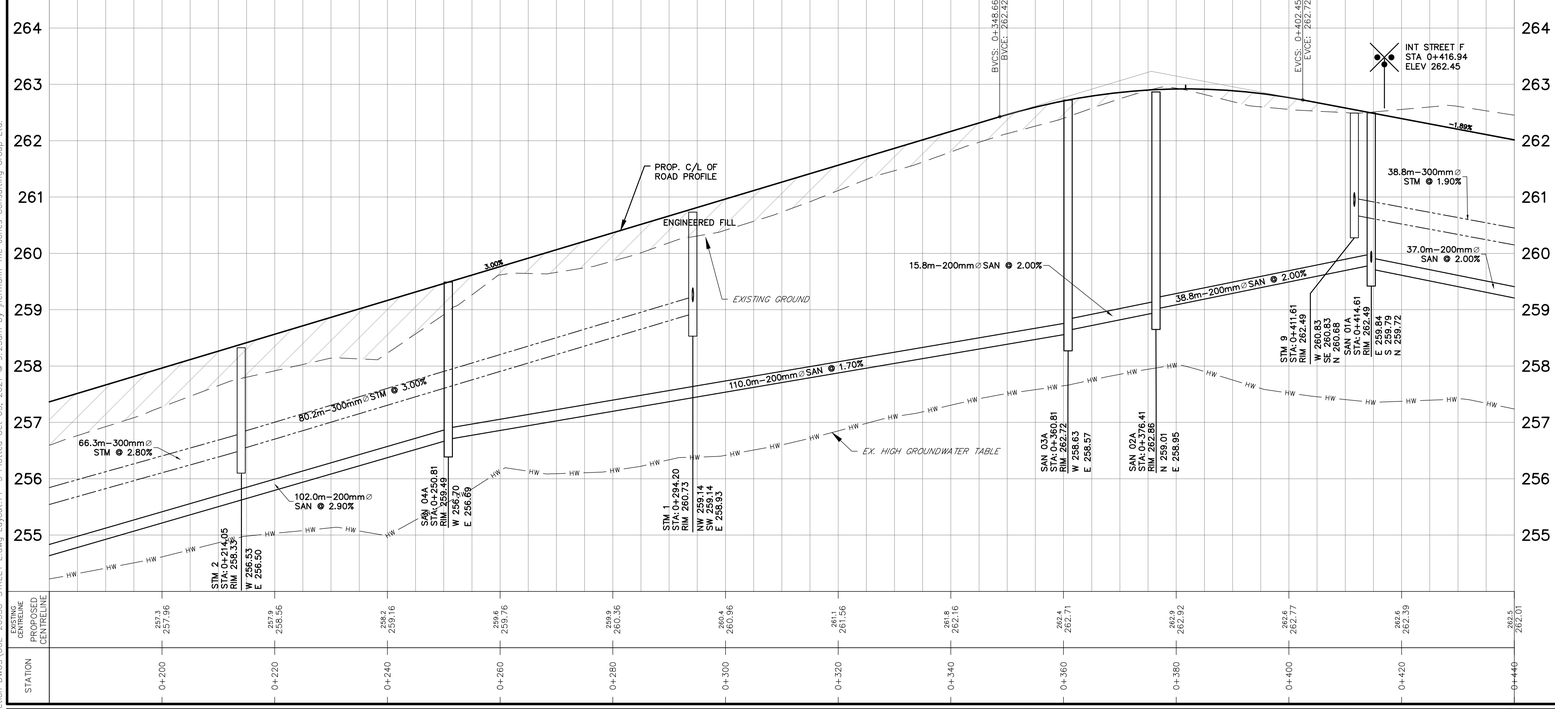
JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

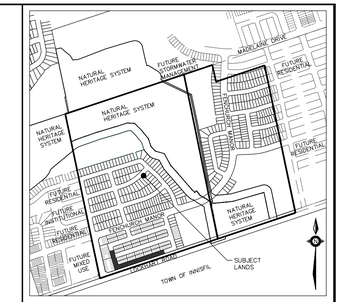
DESIGN	KS/JW	SCALE: H=1:500 V=1:50	DATE JUNE 2021
DRAWN	KS	PROJECT GOL-20538	DWG. Nº PP-4
CHECKED	JW		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-STREET E.dwg Layout:PP-4 Plotted: Oct 05, 2021 @ 9:25pm by Jeremiah The Jones Consulting Group Ltd.

LOCKHART ROAD







KEY PLAN N.T.S.

LEGEND

- SANITARY MAINTENANCE HOLE (BY OTHERS)
- STORM MAINTENANCE HOLE (BY OTHERS)
- CATCHBASIN (BY OTHERS)
- DOUBLE CATCHBASIN (BY OTHERS)
- VALVE & BOX (BY OTHERS)
- HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE

BENCHMARK:

BENCHMARK NO: 001103U460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.69km EAST OF HURONIA ROAD, TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

MCENREX PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

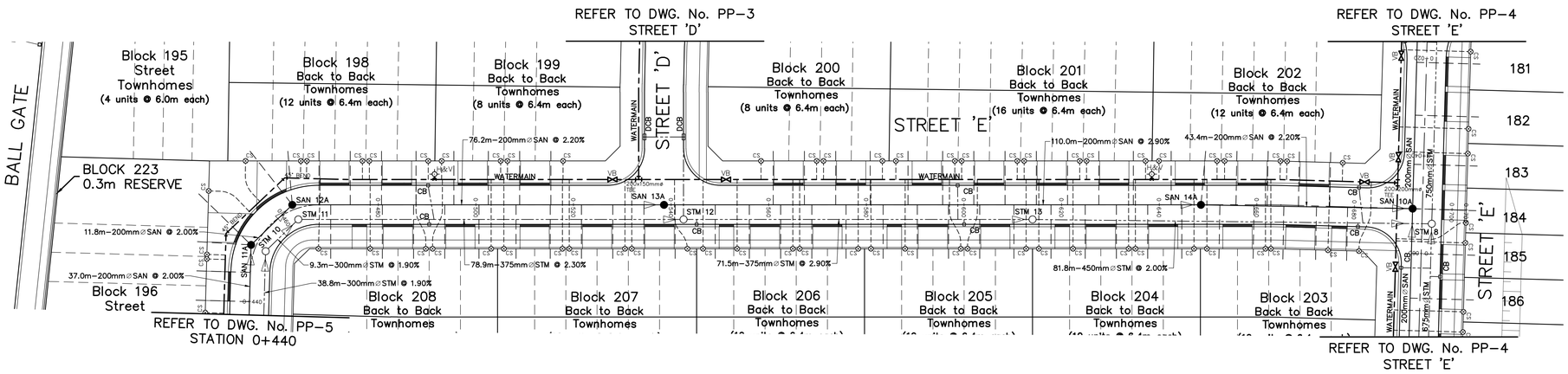
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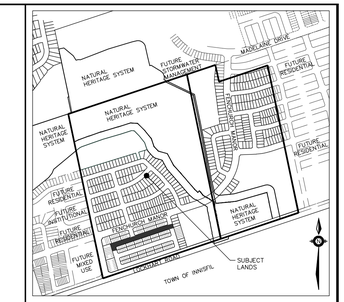
PLAN AND PROFILE
STREET 'E'
0+180 TO 0+440

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN KS/JWI	SCALE: H=1:500 V=1:50	DATE JUNE 2021	
DRAWN KS	PROJECT GOL-20538	DWG. Nº PP-5	
CHECKED JWI			

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-STREET E.dwg Layout:PP-5 Plotted Oct 05, 2021 @ 9:23am by jhermann The Jones Consulting Group Ltd.

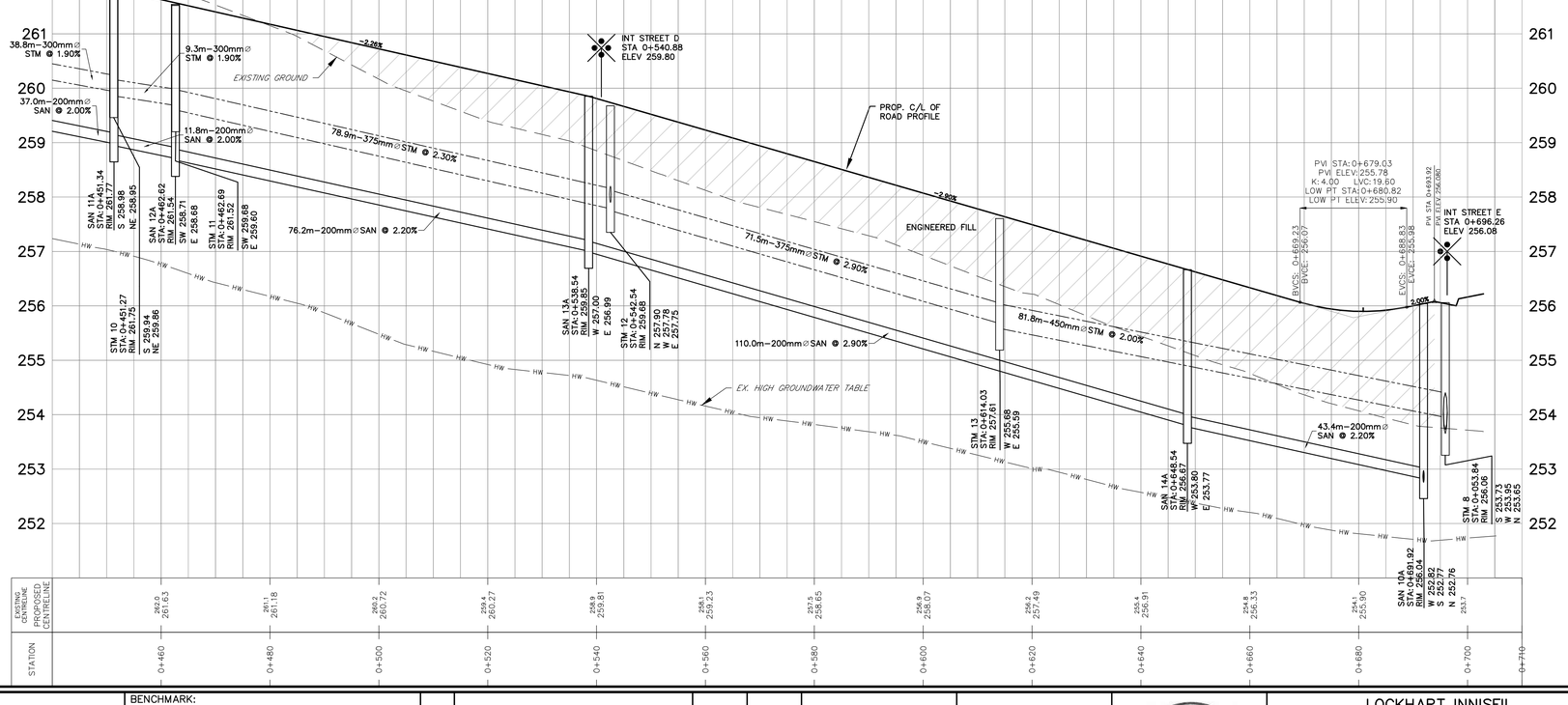




KEY PLAN N.T.S.

LEGEND

- SAN 13A21 ● — SANITARY MAINTENANCE HOLE (BY OTHERS)
- STM 12 ○ — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB — VALVE & BOX (BY OTHERS)
- H&V — HYDRANT & VALVE (BY OTHERS)
- SAN 23A ● — SANITARY MAINTENANCE HOLE
- STM 24 ○ — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193101460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911159.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

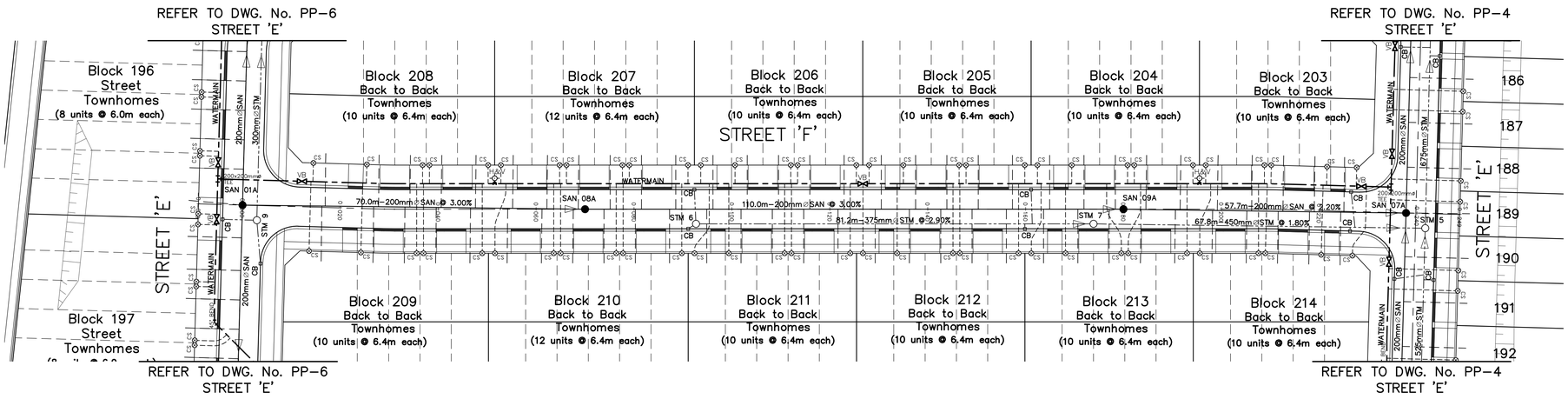
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

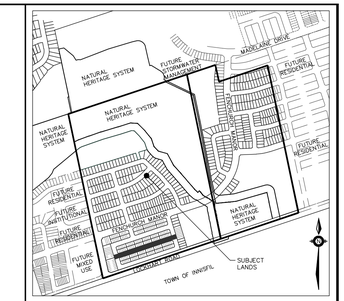
PLAN AND PROFILE STREET 'E' 0+440 TO 0+705

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN KS/JWI	SCALE: H=1:500 V=1:50	DATE JUNE 2021	
DRAWN KS	PROJECT GOL-20538	DWG. Nº PP-6	
CHECKED JWI			

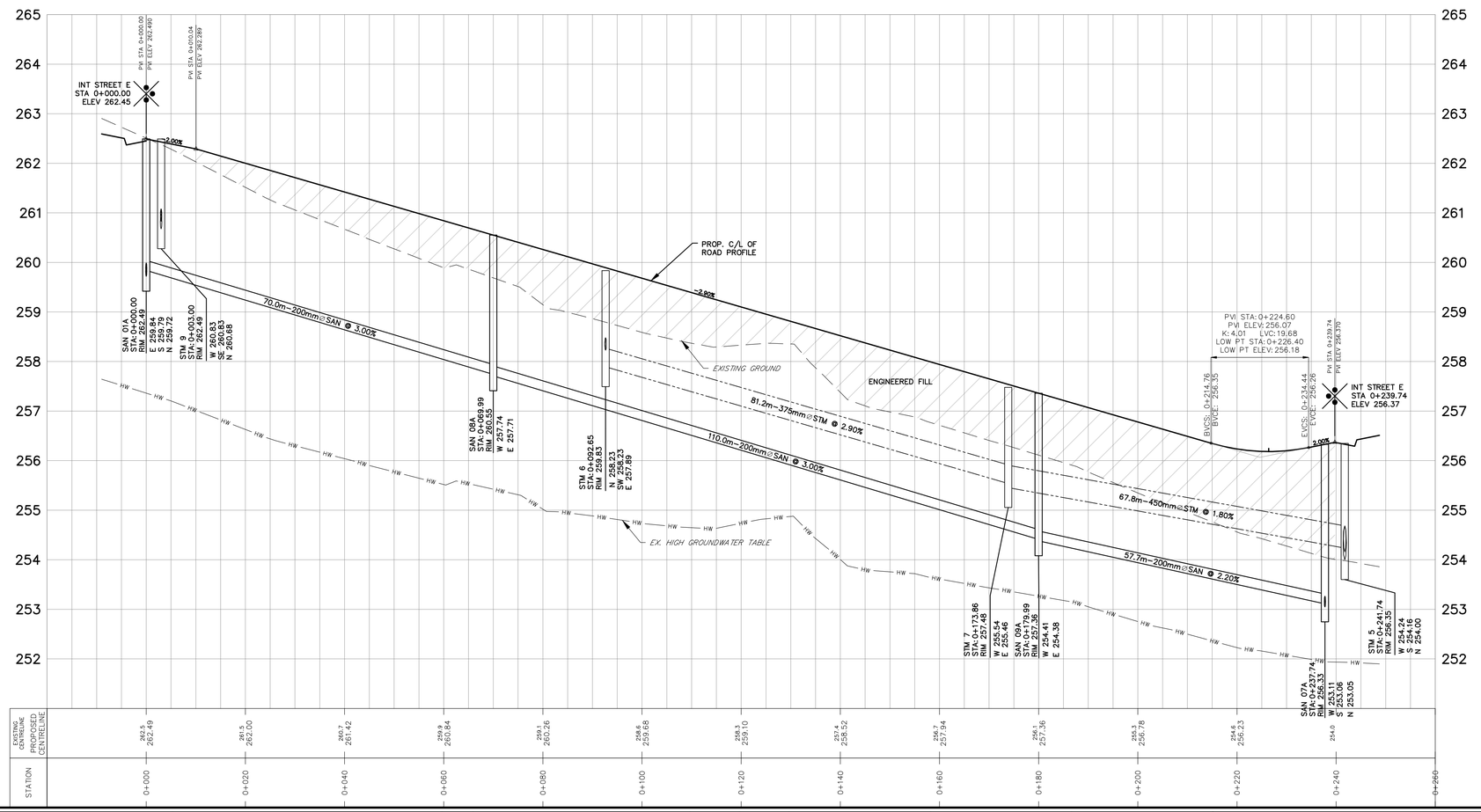
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LEGEND

- SAN 23A — SANITARY MAINTENANCE HOLE (BY OTHERS)
- STM 24 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB — VALVE & BOX (BY OTHERS)
- H&V — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193IU4460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD, TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

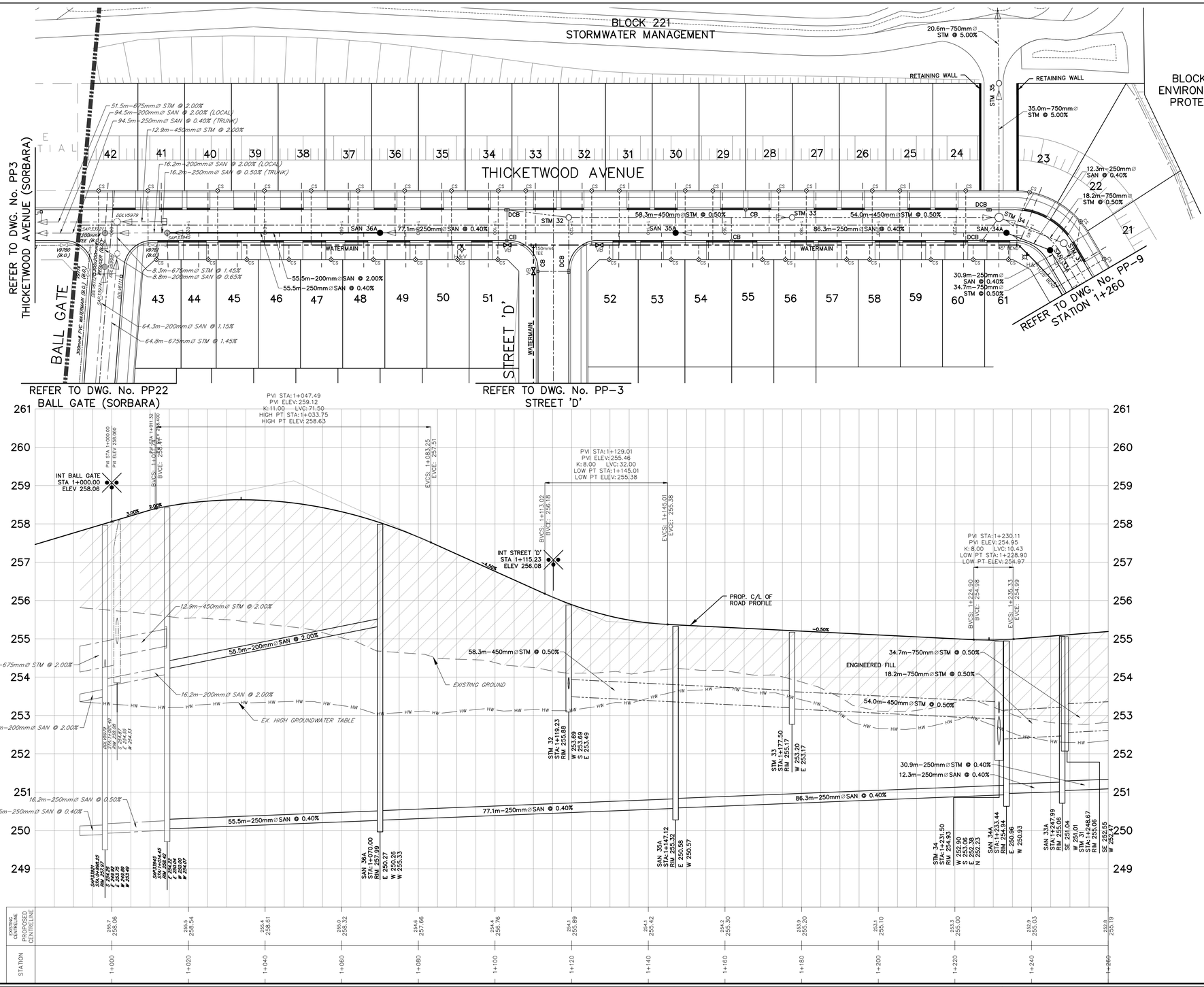
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

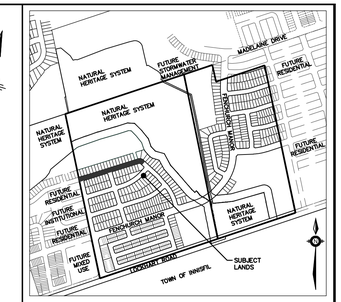
PLAN AND PROFILE
STREET 'F'
0–009 TO 0+249

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KS/JWI	SCALE: H=1:500 V=1:50	DATE JUNE 2021
DRAWN	KS	PROJECT GOL–20538	DWG. Nº PP–7
CHECKED	JWI		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-STREET F.dwg Layout:PP-7 Plotted Oct 05, 2021 @ 9:37am by Jhermann The Jones Consulting Group Ltd.





KEY PLAN N.T.S.

LEGEND

- SAN 23A — SANITARY MAINTENANCE HOLE (BY OTHERS)
- STM 24 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB — VALVE & BOX (BY OTHERS)
- H&V — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE

BENCHMARK:

BENCHMARK NO: 001193IU4605 SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65m EAST OF HURONIA ROAD, TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENCED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

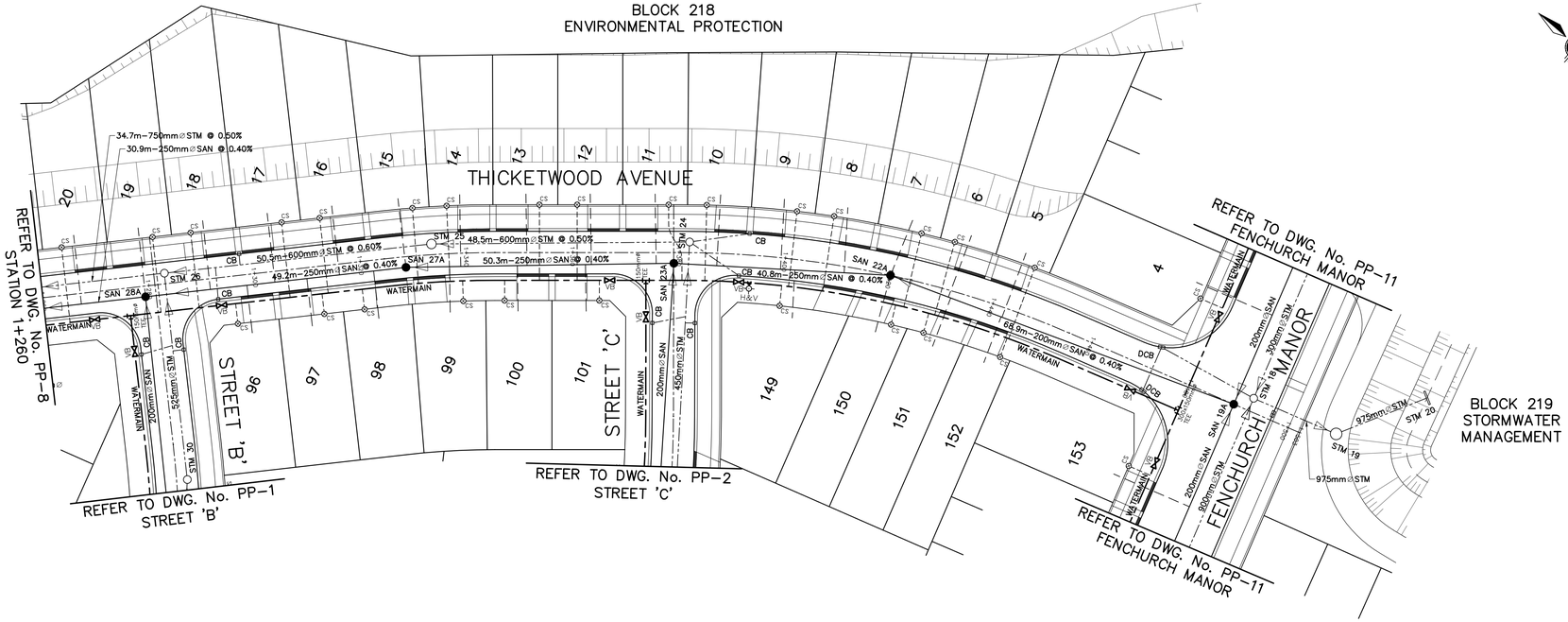
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

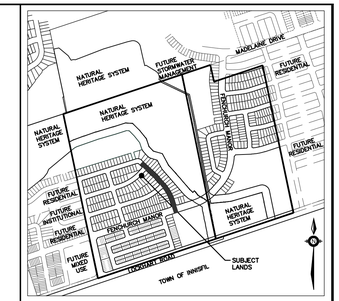
PLAN AND PROFILE
THICKETWOOD AVENUE
0+980 TO 1+260

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN KS/JW	SCALE: H=1:500 V=1:50	DATE JUNE 2021	
DRAWN KS	PROJECT GOL–20538	DWG. Nº PP–8	
CHECKED JWI			

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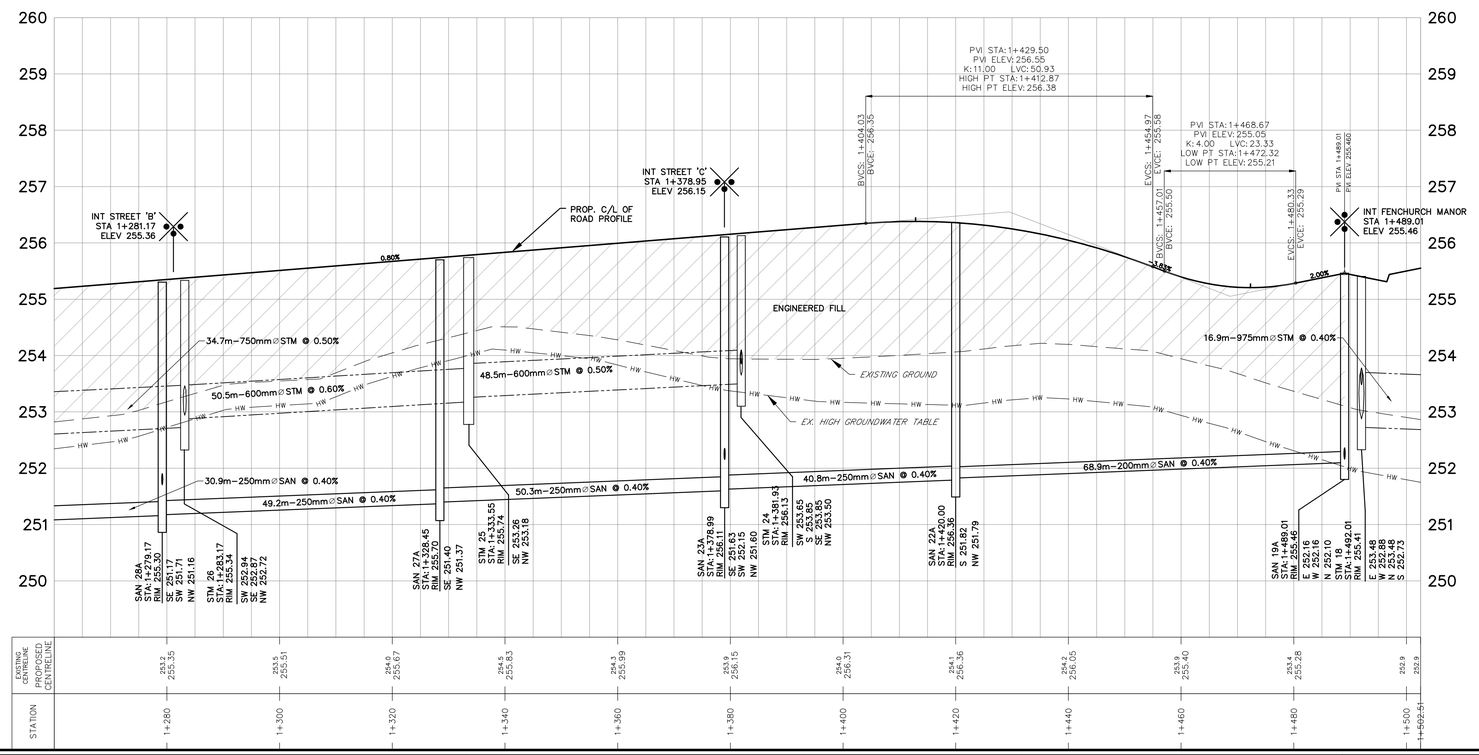




KEY PLAN N.T.S.

LEGEND

- SAN 1,3,9,21 — SANITARY MAINTENANCE HOLE (BY OTHERS)
- DDL V5,9,7,9 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- V8,12,0 — VALVE & BOX (BY OTHERS)
- H&V 12,0 — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193IU460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.69m EAST OF HURONIA ROAD, TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JW

LICENCED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

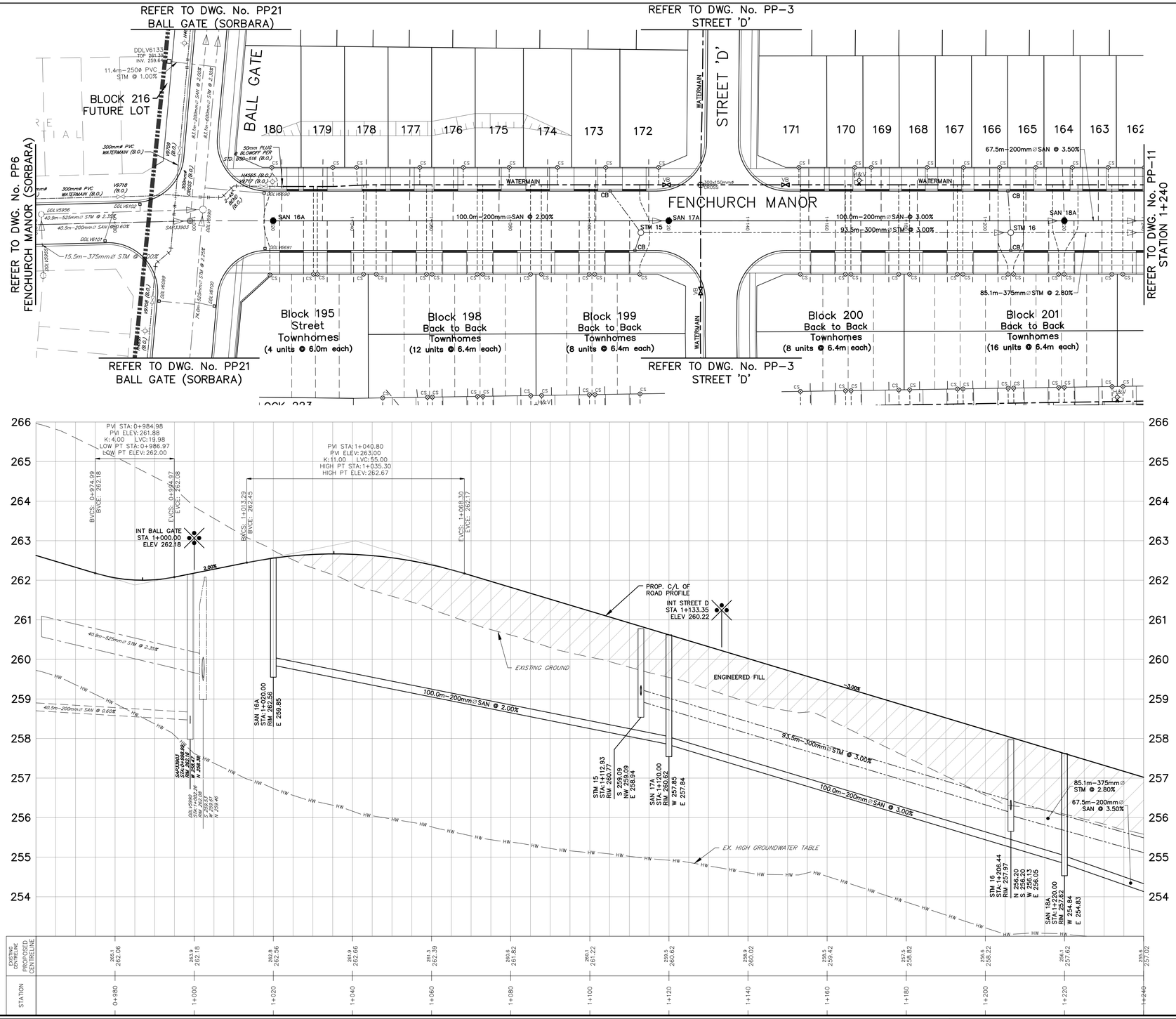
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

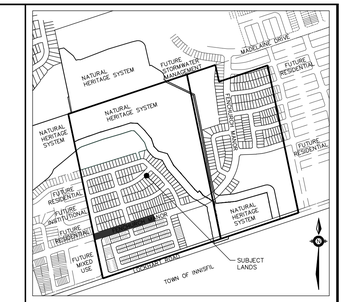
PLAN AND PROFILE
THICKETWOOD AVENUE
1+260 TO 1+503

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KS/JW	SCALE: H=1:500 V=1:50	DATE JUNE 2021
DRAWN	KS	PROJECT GOL-20538	DWG. Nº PP-9
CHECKED	JW		

G:\Eng_3D\GOL-20538\Production DWGS\GOL-20538-THICKETWOOD.dwg Layout: PP-9 Plotted: Oct 05, 2021 @ 9:47am by Jhermann The Jones Consulting Group Ltd.





KEY PLAN N.T.S.

LEGEND

- SAN 23A — SANITARY MAINTENANCE HOLE (BY OTHERS)
- STM 24 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB — VALVE & BOX (BY OTHERS)
- H&V — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE

BENCHMARK:

BENCHMARK NO: 001193IU460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE, EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD. TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911189.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JW

LICENCED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

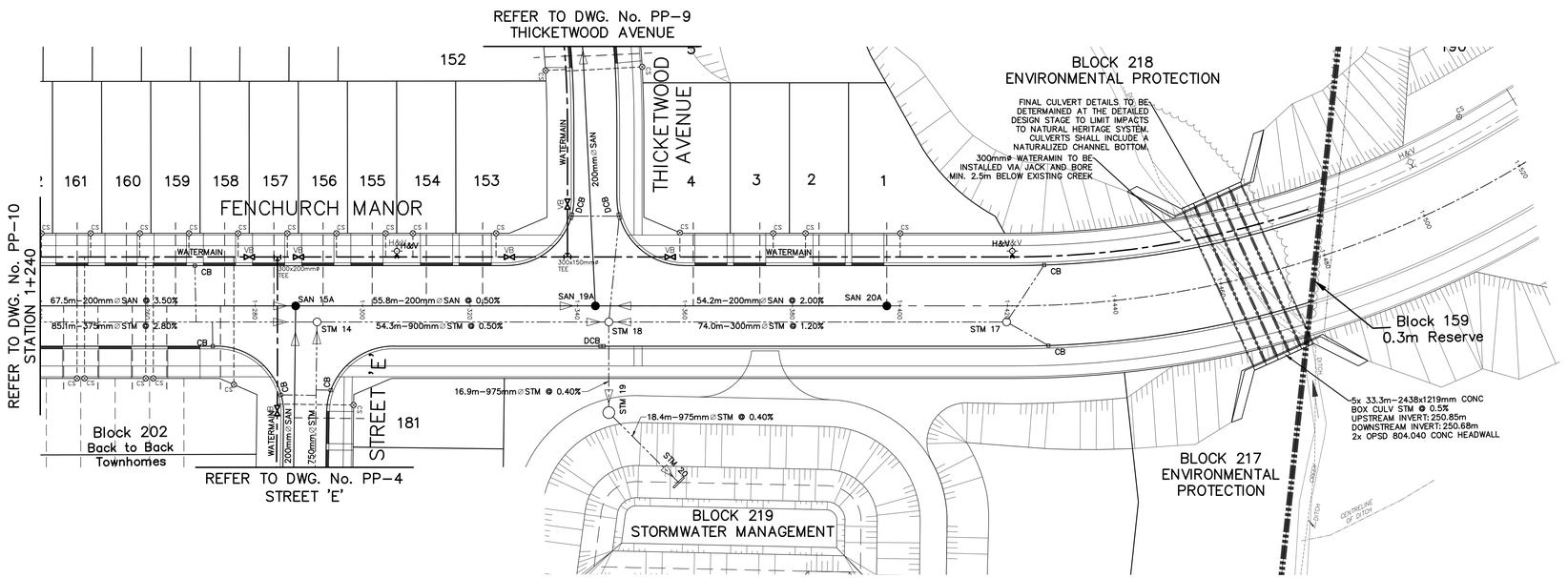
LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

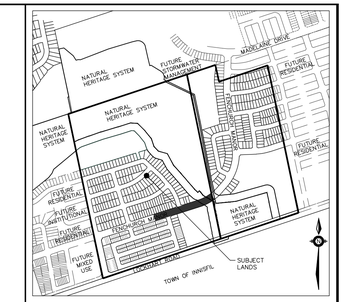
PLAN AND PROFILE
FENCHURCH MANOR
0+960 TO 1+240

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KS/JW	SCALE: H=1:500 V=1:50	DATE JUNE 2021
DRAWN	KS	PROJECT GOL–20538	DWG. Nº PP–10
CHECKED	JW		

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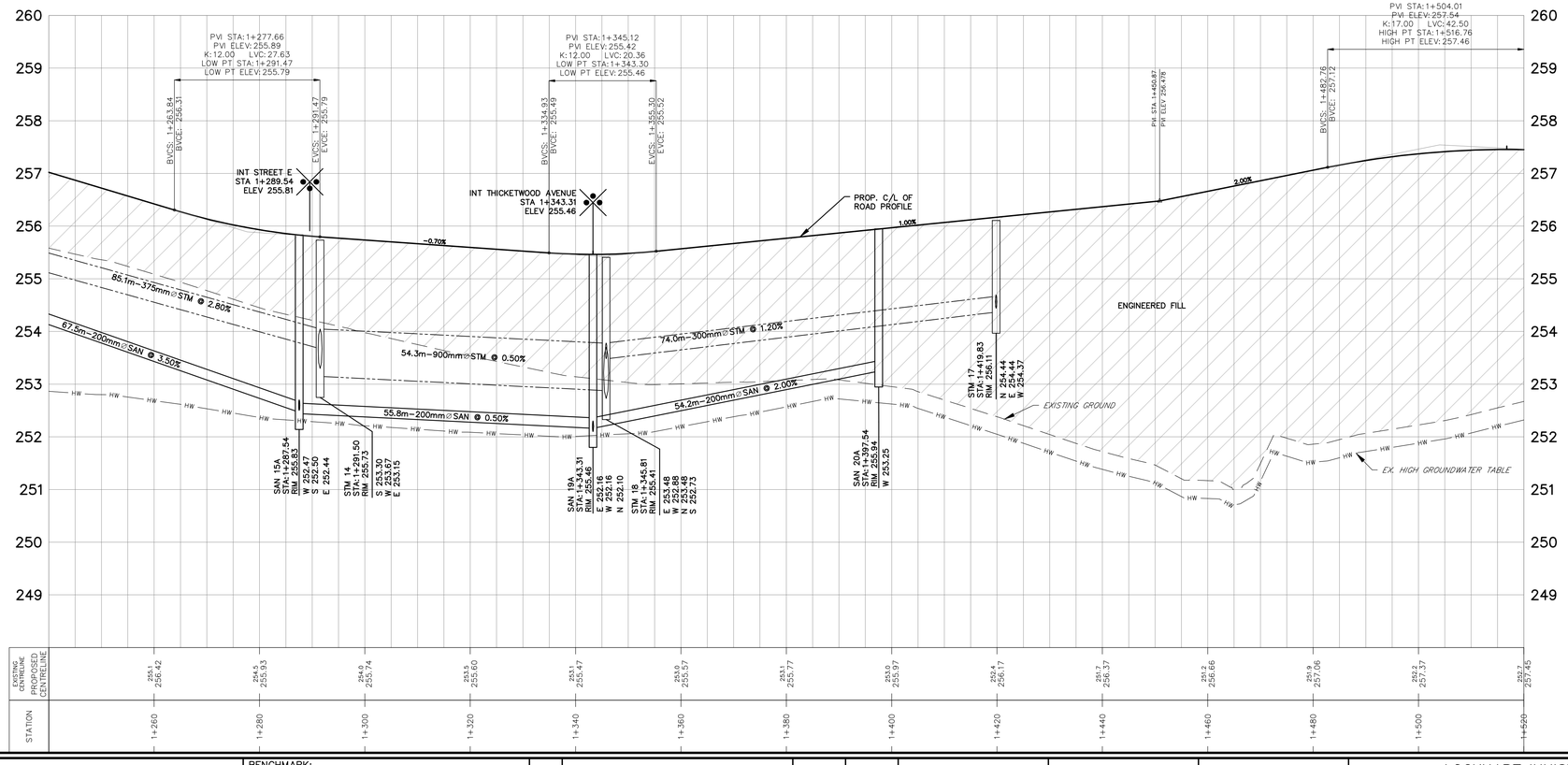




KEY PLAN N.T.S.

LEGEND

- SAN 23A — SANITARY MAINTENANCE HOLE (BY OTHERS)
- STM 24 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- VB — VALVE & BOX (BY OTHERS)
- H&V — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- VB — VALVE AND BOX
- SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193I1/460S SOUTHWEST CORNER OF ST. PAUL'S CRESCENT AND YONGE STREET, TABLET SET HORIZONTALLY IN NORTH FACE OF CONCRETE FOUNDATION OF ST. PAUL'S ANGLICAN CHURCH, AT NORTH-EAST CORNER (TOWER) 15.2m WEST OF BELL POLE AND 9.2m SOUTH-EAST OF "V" IN TWN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.65km EAST OF HURONIA ROAD, TABLET IS SET HORIZONTALLY IN THE NORTH FACE, 5.45m NORTH OF CENTRELINE OF ROAD, 28cm WEST OF THE NORTH-EAST END OF BRIDGE, 19cm BELOW TOP OF COPING. ELEV. 241.862

BENCHMARK NO: 01019860407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 01019860404 LOCATED ON THE SOUTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 930m WEST OF YONGE STREET. N.4911159.897 E.608513.316

NO.	REVISIONS	DATE	INITIAL
1.	SUBMISSION FOR DRAFT PLAN APPROVAL	OCT 2021	JWI

LICENSED PROFESSIONAL ENGINEER
J. W. INGRAM
100143779
21-10-06
PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS (II) LIMITED SUBDIVISION

PLAN AND PROFILE
FENCHURCH MANOR
1+240 TO 1+520

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DESIGN KS/JWI	SCALE: H=1:500 V=1:50	DATE JUNE 2021	
DRAWN KS	PROJECT GOL-20538	DWG. Nº PP-11	
CHECKED JWI			

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