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Lockhart Innisfil Investments Limited

Lockhart I Subdivision

Preliminary Stormwater Management Report

October 2021

The Jones Consulting Group Ltd.
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Disclaimer

This Report was prepared by **The Jones Consulting Group Ltd.** for **Lockhart Innisfil Investments 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 Limited
Lockhart I Subdivision, City of Barrie

1. Introduction

1.1. Appointment

The Jones Consulting Group Ltd. (TJCG) was retained by Lockhart Innisfil Investments 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 I 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 L-shaped and comprises of approximately 19.72 hectares (ha) of land. The subject property is legally described as South Halves of Lots 13 and 14, 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 Lockhart Innisfil Investments (II) Subdivision, to the east by the proposed Mattamy Lands, and to the south by Lockhart Road. The location of the subject property is shown in **Figure 1**.

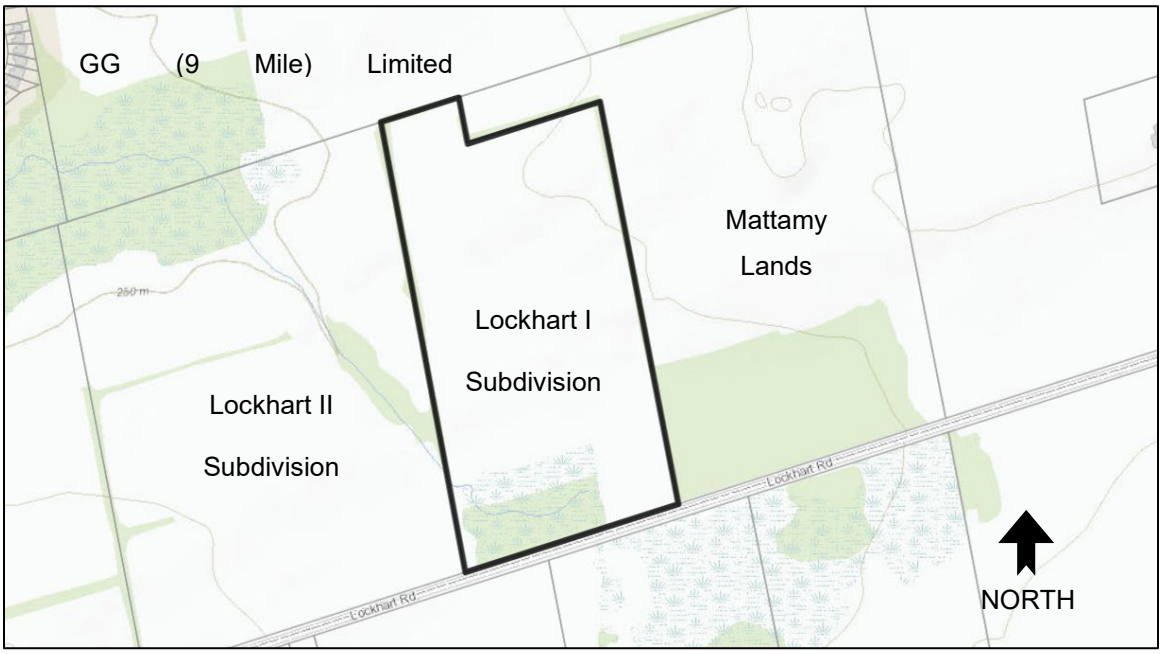


Figure 1 - Site Location

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 west property line before turning west into the Lockhart II 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 northeast to southwest. Elevations range from 251 metres along the northern limits to 264 metres at the south-west property limit with slopes from 0% to 10%. 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 198 units based on single family residential 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, a 24.0m wide minor collector road 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 (September 2016), as well as Regional Flood Lines and Set Back requirements established by the Lake Simcoe Region Conservation Authority. The *Hewitt's 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 east include areas associated with the Mattamy Lands and Rainsong Subdivision.

The site topography ranges in elevation from a maximum elevation of 264 meters at the southwest property limit to 251 along the north property boundary adjacent to Mattamy Lands. The site drains generally from northeast to southwest. Existing Slopes range from 0% to 10%.

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 Dundonald Sandy Loam (Ds). The Alliston Sandy Loam and Smithfield Silty Clay Loam soils have imperfect drainage characteristics while the Bondhead Sandy Loam and Dundonald Sandy Loam soils have good drainage characteristics. 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.**

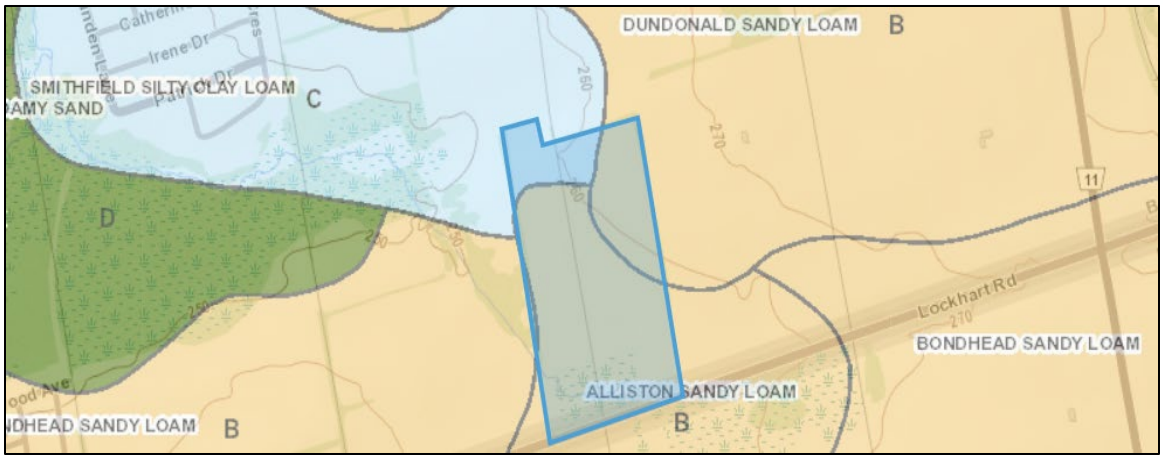


Figure 2 - Site Soils Identification

Table 1 - Soil Type Distribution

Soil Type	Soil Name	SCS Group	Total Area (ha)	Percentage Area (%)
Ans	Alliston Sandy Loam	Group B	13.13	66.5
Smsc	Smithfield Sandy Clay Loam	Group C	2.67	13.5
Ds	Dundonald Sandy Loam	Group B	3.86	19.6
Bs	Bondhead Sandy Loam	Group B	0.07	0.4

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 1 - 21, 55, 59 & 60, 71 - 74, 80 - 84, 112, 133, 136 - 150, 152 - 168, 176, 179 - 183, & 186 - 190)	3.13 ha.	79 units
■ 11.0m Singles (LOTS 24 - 32, 35 - 38, 54, 56 - 58, 61 - 64, 75 - 79, 85 - 94, 101 - 111, 113 - 123, 125 - 132, 134 & 135, 151, 169 - 175, 177 & 178, 184 & 185)	2.54 ha.	79 units
☼ 9.15m Singles (LOTS 22 & 23, 33 & 34, 39 - 53, 65 - 70, 95 - 100, & 124)	0.89 ha.	32 units
Future Lots (LOTS 125 - 146)	0.38 ha.	8 units
Environmental Protection (BLOCKS 147 & 148)	3.96 ha.	
Stormwater Management (BLOCKS 149 & 150)	5.08 ha.	
Future Road (BLOCKS 151)	0.07 ha.	
Reserves & Widenings (BLOCK 152 - 159)	0.38 ha.	
Roads Major Collector - Fenchurch Manor Minor Collector - Lower Street Local Roads - Streets 'G', 'H', 'I', 'J', & 'K',	3.29 ha.	
TOTAL	19.72 ha.	198 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

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 follow 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 (MOE) 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 MOE's Stormwater Management Planning and Design Manual (March 2003).

3. Site Physiography

3.1. Existing Drainage Conditions

The subject site consists of approximately 19.72 hectares of land which is primarily used for agricultural purposes. The site's topography contains average slopes ranging from 0-10%, generally draining from the southeast to the southwest, towards Lover's Creek. Lover's Creek traverses part of the west property boundary, flowing north, before tuning into the neighbouring lands to the west.

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 I Lands are encompassed within Catchment 112. The catchment also includes existing lands associated with the Lockhart Innisfil Investments (II) 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 density residential lots, an internal looped roadway to be built to City of Barrie standards, an Environmentally Protected area adjacent to Lover's Creek, and two (2) Stormwater Management extended detention constructed wetlands (SWM facilities).

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 one of the two (2) proposed stormwater management facilities. The roads are also utilized to convey the major overland flow (>5 Year event) within the right-of-way to one of the two (2) proposed stormwater management facilities. The proposed end-of-pipe SWM facilities are extended detention constructed wetlands, 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 5.6**.

The post development drainage conditions were derived from the proposed General Servicing and Lot Grading Plans accompanying this report. The overall post development drainage patterns are shown on **Drawings SWM-1**, which includes the Lockhart Development Lands, Mattamy and Rainsong Lands. **Drawings SWM-1** identifies the catchments draining to each of the communal SWM facilities located within the Lockhart I Subdivision, denoted SWM Facility No. 4C and SWMF 3. Refer to **Appendix E**.

In accordance with the SIS, the proposed grading and drainage design includes the construction of a storm sewer system to convey flows up to and including the 5 year event. The Storm sewers have been designed to accommodate external drainage associated with the Mattamy Lands and Rainsong Lands and will drain to the proposed stormwater management facilities denoted SWMF2 and SWMF4C, where captured runoff is treated for quality and quantity control before discharging to Lover's Creek

All proposed stormwater management facilities will be designed to meet the quality and quantity requirements outlined the *Hewitt's Secondary Plan Area Subwatershed Impact Study* prepared by RJ Burnside (November 2017), 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 as part of the detailed design stage of approvals and should include the construction and staging requirements at various phases of the development.

The Post-Development Storm Drainage Plan (**Drawing SWM-1** in **Appendix E**) illustrate the proposed drainage scenario.

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 can 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 Lover's Creek Tributary. 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 Dundonald Sandy Loam (Ds). 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.

Dundonald sandy loam is generally described as grey calcareous loam or sandy loam till, generally having good drainage features. The underlying topography is smooth and gently sloping, is generally stone free, is slightly acidic 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.

Alliston sandy loam is generally described as being similar to Tioga soils and having Podzol Great Soil Group characteristics with evidence of Grey-Brown Podzolic development in the lower part of the profile, and drain imperfectly. 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 area 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 to this report 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 where the area consists of rear-yards that cannot be graded to the facility. 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 facility numbering system presented in the SIS. For example, SWMF3 accepts drainage from Areas 3, 3a and 3-EXT. As all catchments ultimately drain to Lover's Creek, this schematic difference does not impact overall flows, but allows allowable versus post development flows to be easily identified.

The imperviousness of the subdivision catchment areas has 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 SWMF 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** in **Appendix E**. The PCSWMM model schematic is provided in **Appendix C** along with the model output.

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.)**
3	35.1981	40	8799.525	2	65	109.98	10.92	0.368
3A	1.1822	26	454.692	2	54	109.98	10.92	0.368
3-EXT	1.2803	25	512.12	2	50	109.98	10.92	0.368
4C	15.8217	45	3515.933	2	65	109.98	10.92	0.368
4C-1	0.5448	22	247.636	2	30	109.98	10.92	0.368

The infiltration parameters summarized in **Table 3** are used in the model. Green Ampt parameters have been taken 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 *Nottawasaga Valley Conservation Authority Stormwater Technical Guide* 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 = 0.150

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. **Tables 6 & 7** summarizes the resulting allowable peak flow rates along with the post development peak flow rates computed by the PCSWMM model for the development lands draining to SWMF3 prior to release to the Lover's Creek Tributary and Outlet OF-3 inclusive and exclusive of Catchment 3A. **Table 9** summarizes the allowable peak flow model rates which were established in the GG (9 mile) Subdivision DSWMR along with the post-development peak flow rates computed by the PCSWMM model for the development lands draining to SWMF4C. **Table 8** summarizes the Catchment 3A Target Release Rates in order to match post-development peak flows to the allowable pre-development peak flows. Refer to OF-3, OF-4C and HW-SWMF3 in the PCSWMM models. 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: Hydrologic Model Results – SWMF3 Lockhart 1 (Including Catchment 3A)

Storm Peak Event Flow (m^3/s) – SWMF3 Lockhart 1							
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	37.66	0.226	0.527	0.791	1.130	1.431	1.732
Target Erosion Control	37.66	0.041					
Post Development Condition – (OF-3 inclusive of uncontrolled area 3A)							
4-hour Chicago Storm Distribution	37.66	0.142	0.249	0.328	0.434	0.512	0.594
6-hour SCS Type II Storm Distribution	37.66	0.190	0.362	0.485	0.629	0.723	0.812
12-hour SCS Type II Storm Distribution	37.66	0.180	0.332	0.442	0.575	0.660	0.739
24-hour SCS Type II Storm Distribution	37.66	0.195	0.358	0.472	0.600	0.684	0.764
25mm 4-Hr CHI Water Quality Event	37.66	0.070					
Hazel Storm	37.66	2.912					

Table 7: Hydrologic Model Results – SWMF3 Lockhart 1 (Excluding Catchment 3A)

Storm Peak Event Flow (m^3/s) – SWMF3 Lockhart 1							
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	**36.48**	0.219	0.511	0.766	1.094	1.386	1.678
Target Erosion Control	**36.48**	0.040					
Post Development Condition – (HW-SWMF3) (Excluding catchment area 3A)							
4-hour Chicago Storm Distribution	36.48	0.071	0.160	0.232	0.293	0.329	0.363
6-hour SCS Type II Storm Distribution	36.48	0.095	0.224	0.284	0.344	0.383	0.418
12-hour SCS Type II Storm Distribution	36.48	0.092	0.206	0.269	0.326	0.363	0.396
24-hour SCS Type II Storm Distribution	36.48	0.107	0.230	0.285	0.342	0.379	0.412
25mm 4-Hr CHI Water Quality Event	36.48	0.027					
Hazel Storm	36.48	2.823					

The results demonstrate that the proposed stormwater management facility 3 will provide the required quantity control to reduce captured post-development peak flows to the allowable release rates. The function of the proposed extended detention constructed wetlands is discussed in further detail in **Section 5**. Further analysis was conducted to set the post-development targets for Catchment 3A as shown below in **Table 8**.

Table 8: Hydrologic Model Results - Catchment 3A Target Release Rates

Post Development Condition Targets - Catchment 3A							
Storm Distribution	**Area (ha)**	**Return Period (years)**					
		2	**5**	**10**	**25**	**50**	**100**
4-hour Chicago Storm Distribution	1.18	0.155	0.367	0.559	0.837	1.102	1.370
6-hour SCS Type II Storm Distribution	1.18	0.131	0.303	0.507	0.785	1.048	1.314
12-hour SCS Type II Storm Distribution	1.18	0.134	0.321	0.522	0.804	1.068	1.336
24-hour SCS Type II Storm Distribution	1.18	0.119	0.297	0.505	0.787	1.052	1.320
25mm 4-Hr CHI Water Quality Event	1.18	0.015					
Hazel Storm	1.18	Safe Conveyance					

Table 9: Hydrologic Model Results – SWMF4C Lockhart 1

Storm Peak Event Flow (m^3/s) – SWMF4C Lockhart 1							
Storm Distribution	**Area (ha)**	**Return Period (years)**					
		2	**5**	**10**	**25**	**50**	**100**
Unitary Discharge Rates ($m^3/s/ha$) per GG (9 Mile) Subdivision DSWMR		0.004	0.011	0.019	0.019	0.026	0.044
Erosion Control Unitary Discharge Rate		0.0011					
Target Flow Rates	**16.37**	0.065	0.179	0.318	0.316	0.419	0.718
Target Erosion Control	**16.37**	0.018					
Post Development Condition – (OF-4C)							
4-hour Chicago Storm Distribution	16.37	0.041	0.090	0.122	0.165	0.201	0.240
6-hour SCS Type II Storm Distribution	16.37	0.064	0.134	0.192	0.271	0.318	0.363
12-hour SCS Type II Storm Distribution	16.37	0.059	0.120	0.172	0.244	0.289	0.328
24-hour SCS Type II Storm Distribution	16.37	0.065	0.133	0.188	0.260	0.302	0.342
25mm 4-Hr CHI Water Quality Event	16.37	0.011					
Hazel Storm	16.37	0.390					

The results demonstrate that the proposed stormwater management facility 4C will provide the required quantity control to reduce captured post-development peak flows to the allowable release rates.

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) extended detention constructed wetlands 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.

This PSWMR will outline a proposed design for the Lockhart I 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 SWM facilities 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 3 - Overview

The proposed extended detention constructed wetland facilities have 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-4 and PND-6**, located in **Appendix E**.

The bottom elevation of SWMF 3's main cell & forebay are 254.15m and 253.30m, respectively. A permanent pool elevation of 253.55m has been provided, making the main cell and forebay static water levels 0.15m and 1.2m. A low flow channel has been provided within the main cell to direct storm water towards the main cell plunge pool. The top of facility elevation is 255.85m, providing a total active storage depth of 2.3m. 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 6H:1V 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 254.80m. The forebay berm has a top width of 3.0m. At the inlet of the SWM facility 6 (six) Jellyfish Filtration units will be utilized in parallel to treat run-off entering the facility. The Jellyfish units (model JF12-20-5) will be placed in an offline configuration and details for this configuration and the required by-pass structures will be determined 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 200mm and 400mm diameter corresponding to invert elevations of 253.55m and 253.80m, 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 253.75m.

The facility includes a 14.0m 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 255.30m 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 255.59m.

5.3. SWM Facility 4C - Overview

The preliminary design of the facility is outlined on Drawings **PND-1 and PND-3**, located in **Appendix E**.

The bottom elevation of SWMF4's main cell & forebay are 252.85m and 251.80m, respectively. A permanent pool elevation of 253.00m has been provided, making the main cell and forebay static water levels 0.15m and 1.20m. A low flow channel has been provided within the main cell to direct storm water towards the main cell plunge pool. The top of facility elevation is 255.30m, providing a total active storage depth of 2.3m. 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 6H:1V 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 253.50m. The forebay berm has a top width of 2.0m At the inlet of the SWM facility 3 (three) Jellyfish Filtration units will be utilized in parallel to treat run-off entering the facility. The Jellyfish units (model JF12-20-5) will be placed in an offline configuration and details for this configuration and the required by-pass structures will be determined 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 125mm and 300mm diameter corresponding to invert elevations of 253.00m and 253.30m, respectively. Flows enter the control manhole by one 450mm diameter reverse sloped drain and one 1200mm x 600mm ditch inlet catchbasin with 450mm lead connected to the control maintenance hole. The sill invert of the ditch inlet catch basin is set at an elevation of 253.25m.

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 254.80m 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 254.10m.

5.4. Stormwater Quality Control

As per the City and LSRCA requirements, *Enhanced* (Level 1) stormwater quality control is required for the site. The two (2) proposed SWMFs will provide the required level of SWM quality control, as demonstrated in the calculations below. In addition to the typical quality control requirements, the incorporation of Low Impact Development (LID) measures will provide 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 5.8** below.

A plan view and section drawing has been provided for each SWMF. Refer to **Drawings PND-1** through **PND-6** in **Appendix E**.

5.4.1. SWMF 3

The total land draining to SWMF 3 includes Catchments 3 and 3-EXT, totaling an area of 36.48 hectares. The total imperviousness used to size the SWMF is approximately 64.5% given that catchment 3-EXT is an external area with low overall imperviousness. Based on the MOE requirements (extrapolation of Table 3.2), 114.5 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 (74.5 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 SWMF for quality control = 36.48 ha
(64.5% Net Impervious Area), (114.5 m^3/ha)
36.48 ha * 74.5 m^3/ha = 2,717 m^3 (permanent pool)
36.48 ha * 40 m^3/ha = 1,459 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 3,148 m^3 (8.63 mm * 36.48 ha). Therefore, the runoff volume from the 4-hour 25 mm Chicago storm event will govern.

	Required:	Provided:
Permanent Pool	2,717 m^3	3,943 m^3
Extended Detention	3,148 m^3	3,761 m^3

The 24 hour extended detention release rate is the maximum target flow rate to ensure that 24 hour settling occurs in the SWMF. The extended detention outlet is 200 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 (5,594.9)

C_3 = intercept from the area-depth linear regression (14,343.5)

A_0 = cross-sectional area of the extended detention orifice (0.0314 m^2)

h = maximum water elevation above the orifice, taken from the extended detention elevation to centroid of orifice (0.095 m)

Given the above information, the actual extended detention storage time was determined to be approximately 28.8 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 facility 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 forebay (5.6:1)

Q_p = the peak flow rate exiting the facility during the 4 hour 25 mm Chicago quality storm event (0.027 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 22.3 metres.

Forebay Dispersion Length

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

Where:

Dist = the minimum forebay length (m)

Q = the 5-year peak inlet flow rate (8.715 m^3/s)

d = the depth of the permanent pool in the forebay (1.2 m)

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

The required dispersion length of the forebay is 116.2 metres.

The proposed forebay accommodates both the settling and dispersion lengths. The average provided length is approximately 140 m measured from the inlet headwall to the forebay overflow weir.

5.4.2. SWMF 4C

The total land draining to SWMF4C includes Catchment 4C, totaling an area of 15.84 hectares. The total imperviousness used to the size the facility is 65%. Based on the MOE requirements (extrapolation of Table 3.2), 115.0 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 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 SWMF for quality control = 15.84 ha

(65% Net Impervious Area), (115 m^3/ha)

15.84 ha * 75 m^3/ha = 1,188 m^3 (permanent pool)

15.84 ha * 40 m^3/ha = 634 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 1,339 m^3 (8.45 mm * 15.84 ha). Therefore, the runoff volume from the 4-hour 25 mm Chicago storm event will govern.

	Required:	Provided:
Permanent Pool	1,188 m^3	2,183 m^3
Extended Detention	1,339 m^3	2,356 m^3

The 24 hour extended detention release rate is the maximum target flow rate to ensure that 24 hour settling occurs in the facility. The extended detention outlet is 125 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 (3,235)

C_3 = intercept from the area-depth linear regression (7,367.6)

A_0 = cross-sectional area of the extended detention orifice (0.0123 m^2)

h = maximum water elevation above the orifice, taken from the extended detention elevation to centroid of orifice (0.100 m)

Given the above information, the actual extended detention storage time was determined to be approximately 38.8 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 SWMF was designed according to the following criteria (MOE, 2003):

Forebay Settling Length

$$Dist = \sqrt{\frac{rQp}{Vs}}$$

Where:

Dist = the minimum forebay length (m)

r = the length to width ratio of forebay (2.1:1)

Q_p = the peak flow rate exiting the facility during the 4 hour 25 mm Chicago quality storm event (0.01081 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 8.7 meters.

Forebay Dispersion Length

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

Where:

Dist = the minimum forebay length (m)

Q = the 5-year peak inlet flow rate (3.702 m^3/s)

d = the depth of the permanent pool in the forebay (1.2 m)

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

The required dispersion length of the forebay is 49.4 metres.

The proposed forebay accommodates both the settling and dispersion lengths. The shortest length is approximately 54.8 m measured from the inlet headwall to the forebay overflow weir.

5.5. Stormwater 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 wetlands' 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 SWMF3 and SWMF4C from two (2) wet ponds into two (2) constructed wetlands. Adjusting the facilities from wet ponds to constructed wetlands will provide more opportunity for quality control and provide a higher overall Total Phosphorus removal efficiency. SWMF3 & SWMF4C will be

utilized as end-of-pipe stormwater management facilities, which are sized to provide the required quantity control for all design storms up to the 100-year event. Each of 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 facility and the Hazel storm event's ponding elevation. The SWMF 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 SWMF3 and SWMF4C stage-storage-discharge tables are presented in **Tables 10 & 11** below. The full tables are provided in **Appendix B**. The values for storage and facility outflow result from the proposed design height and dimensions for the orifices and overflow weir.

Table 10: SWMF3 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.)
252.80	0	0	0.00	0.000	Bottom of Plunge Pool
253.30	15	0	0.50	0.000	Bottom of Forebay
254.15	1,853	0	1.35	0.000	Bottom of Main Cell
254.30	3,943	0	1.50	0.000	Permanent Pool
254.50	6,924	2,980	1.70	0.028	25mm Water Quality (254.495m)
254.55	7,704	3,761	1.75	0.034	Extended Detention / Secondary Orifice
254.75	10,966	7,023	1.95	0.096	2-Year 24-Hour (254.750m)
254.95	14,506	10,562	2.15	0.164	5-Year 24-Hour (254.969m)
255.10	17,272	13,328	2.30	0.198	10-Year 24-Hour (255.113m)
255.30	21,082	17,139	2.50	0.343	25-Year 6-Hour (255.304m)
255.45	24,032	20,089	2.65	0.383	50-Year 6-Hour (255.450m)
255.60	27,063	23,119	2.80	0.419	100-Year 6-Hour (255.594m)
256.10	37,746	33,803	3.30	0.522	Overflow Weir
256.30	42,274	38,330	3.50	3.060	Regional (Hazel - 256.299m)
256.60	49,510	45,567	3.80	11.770	Top of Facility

Table 11: SWMF4C 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.)
251.50	0	0	0.00	0.000	Bottom of Plunge Pool
251.80	7	0	0.30	0.000	Bottom of Forebay
252.85	1,125	0	1.35	0.000	Bottom of Main Cell
253.00	2,183	0	1.50	0.000	Permanent Pool
253.15	3,325	1,142	1.65	0.010	25mm Water Quality (253.162m)
253.30	4,539	2,356	1.80	0.017	Extended Detention / Secondary Orifice
253.40	5,389	3,206	1.90	0.029	2-Year 24-Hour (253.389m)
253.60	7,188	5,005	2.10	0.101	5-Year 24-Hour (253.573m)
253.70	8,130	5,946	2.20	0.126	10-Year 24-Hour (253.694m)
253.85	9,592	7,408	2.35	0.155	25-Year 6-Hour (253.855m)
254.00	11,113	8,930	2.50	0.179	50-Year 6-Hour (253.977m)
254.10	12,162	9,978	2.60	0.194	100-Year 6-Hour (254.097m)
254.80	20,263	18,080	3.30	0.274	Overflow Weir
254.85	20,894	18,711	3.35	0.476	Regional (Hazel – 254.834m)
255.30	27,022	24,839	3.80	8.469	Top of Facility

5.6. 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 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 8 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 1.18m and 2.3m deep. The depth was determined based on providing a minimum of 1.0m clearance from the high groundwater table. The LIDs will consist of a trench comprised of Engineered Soil Blend 'B' (void ratio of 0.35) wrapped in filter cloth on all sides. The length of the LIDs vary from approximately 23m to 50m.

Using the above standards and information the site's proposed LID cross-sectional details are summarized in the following **Table 12:**

Table 12: LID Summary & Cross-Section Details

LID Summary									
LID Name (Dwg. GOL-14193 LID-1)	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-4C-1	4C-501	0.12	65%	23.00	2.00	1.30	27.83	663%	143%
LID-4C-2	4C-502	0.09	65%	50.00	2.00	1.30	60.50	1921%	414%
LID-4C-3	4C-503	0.14	65%	25.00	2.00	1.18	28.38	579%	125%
LID-4C-4	4C-504	0.20	65%	25.00	2.00	1.30	30.25	432%	93%
LID-4C-5	4C-505	0.18	65%	25.00	2.00	2.00	40.75	647%	139%
LID-4C-6	4C-506	0.45	65%	50.00	2.00	2.20	87.50	556%	120%
LID-4C-7	4C-507	0.06	65%	25.30	2.00	2.30	45.79	2181%	470%
LID-4C-8	4C-508	0.09	65%	25.00	2.00	1.93	39.63	1258%	271%
	Total:	1.33					Average:	1029%	222%

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 1.33 ha. For the 25mm storm, the rainfall volume over this area is 332m^3 (1.33ha x 25mm). Given the total LID trench volume in the ROW is 361m^3, the Proposed LID facilities provide sufficient storage to achieve the 25mm target. Refer to supporting calculations in **Appendix D**.

5.7. 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 13** outlines the constraints restricting the implementation of LIDs.

Table 13 – 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. A "Best Effort" approach was selected, to achieve the maximum volume reduction practicable, providing filtration for the remainder of the 25mm event. This approach is consistent with the findings of the SIS.

Based on a total catchment area of 15.76 ha and an imperviousness 65%, the impervious area associated with the development is 10.24ha. If 5 mm is applied to this impervious surface, the target run-off control volume is determined to be 512 m^3 (10.24 ha x 5mm).

The total proposed run-off volume control (capture and infiltration) provided by the proposed dry swale LIDs equates to 361 m^3 or approximately 3.5mm across the developments impervious

surfaces. The remainder of the site is filtered by the proposed Jellyfish units at the upstream inlet of SWMF3 and SWMF 4C. Therefore, through the combination of LIDs and jelly fish 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 of runoff.

5.8. 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 (19.72ha – 3.96 ha = 15.76 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/filtration trenches complete with a perforated pipe system and overflow catchbasin. The overflow catchbasin will collect ponding stormwater and convey it to the respective storm system. The SWMF will have Jellyfish Filters 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 Loading Tool* and *LSRCA SWM Guidelines*. Phosphorus removal rates are summarized below:

- Perforated Pipe Infiltration Galleries 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 Perforated Pipe Infiltration 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: 2.52 kg/year

Post-Development Loading: 15.42 kg/year

Post-Development with BMPs: 2.42 kg/year

The calculation shows a 0.11 kg/year, or 4% 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**.

5.9. 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 14** below and Tables G-1 to G-4 of the RJB study are provided in **Appendix D**.

Table 14 – 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 one (1) LID fell short of this requirement, the remaining 7 LID's exceeded this requirement. The average percent capture of the 25mm run-off depth for all LID's corresponded to 222%. 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 1.33 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 6,855m^3/a. Assuming 56% of the average annual runoff is captured the total infiltration from the proposed LIDs is calculated to be 3,839m^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 15** below.

Table 15 – 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)	3,839
Total Infiltration Volume from Disconnected Roof Leaders (m^3/a)	24,632
Total Infiltration Volume Deficit after LID's (m^3/a)	**-4,669**

In summary, the proposed stormwater management plan results in a decrease in infiltration in the post development condition over the pre-development condition. It is important to recognize that Deficit is based on both the Lockhart Innisfil Investments Limited Subdivision and Lockhart Innisfil Investments II Limited subdivisions. When the LIDs proposed on Lockhart Innisfil Investments II Limited are accounted for in the water balance calculations, the post development infiltration is greater than the pre-development infiltration. *Refer to Lockhart Innisfil Investments II Limited Subdivision Preliminary Stormwater Management Report, October 2021*, provided under separate cover.

5.10. 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 Hewitt's Gate 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) extended detention wet ponds. These facilities, 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 5.10** 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.

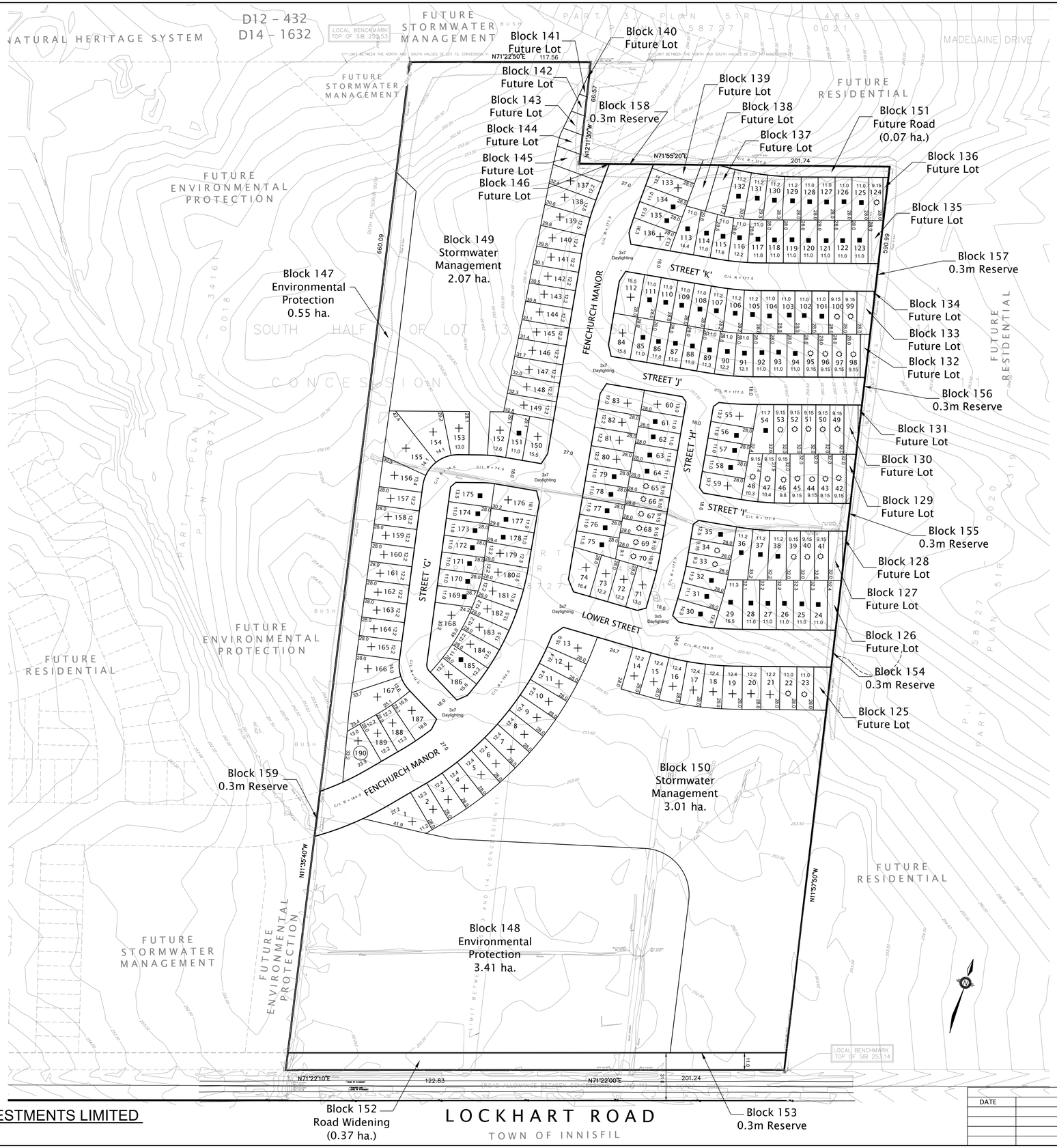
All of which is respectfully submitted,

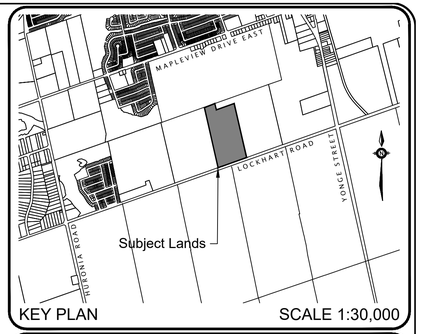
THE JONES CONSULTING GROUP LTD.

Appendix A

External Information

- Proposed Draft Plan of Subdivision by TJCG signed and dated July 16th, 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





Draft Plan of Subdivision

Part of The South Halves of Lots 13 and 14, 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 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	g) SHOWN ON DRAFT PLAN
b) SHOWN ON DRAFT PLAN	h) MUNICIPAL PIPED WATER TO BE PROVIDED
c) SHOWN ON KEY PLAN	i) SANDY CLAY LOAM
d) RESIDENTIAL, SWM, EP	j) SHOWN ON DRAFT PLAN
e) SHOWN ON DRAFT PLAN	k) ALL MUNICIPAL SERVICES TO BE PROVIDED
f) SHOWN ON DRAFT PLAN	l) SHOWN ON DRAFT PLAN

STATISTICS	Area (ha.)	Units
+ 12.2m Singles (LOTS 1 - 21, 55, 59 & 60, 71 - 74, 80 - 84, 112, 133, 136 - 150, 152 - 168, 176, 179 - 183, & 186 - 190)	3.13 ha.	79 units
■ 11.0m Singles (LOTS 24 - 32, 35 - 38, 54, 56 - 58, 61 - 64, 75 - 79, 85 - 94, 101 - 111, 113 - 123, 125 - 132, 134 & 135, 151, 169 - 175, 177 & 178, 184 & 185)	2.54 ha.	79 units
☼ 9.15m Singles (LOTS 22 & 23, 33 & 34, 39 - 53, 65 - 70, 95 - 100, & 124)	0.89 ha.	32 units
Future Lots (LOTS 125 - 146)	0.38 ha.	8 units
Environmental Protection (BLOCKS 147 & 148)	3.96 ha.	
Stormwater Management (BLOCKS 149 & 150)	5.08 ha.	
Future Road (BLOCKS 151)	0.07 ha.	
Reserves & Widenings (BLOCK 152 - 159)	0.38 ha.	
Roads Major Collector - Fenchurch Manor Minor Collector - Lower Street Local Roads - Streets 'G', 'H', 'I', 'J', & 'K',	3.29 ha.	
TOTAL	19.72 ha.	198 units

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

Lockhart Innisfil Investments Limited

Draft Plan of Subdivision

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

Date Issued:	JULY 13, 2021
Checked By:	RD
Project No.:	GOL-14193
Drawn By:	m.c.r.
Drawing Name:	GOL-14193-PH-1-DP-3c-SIGNED

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

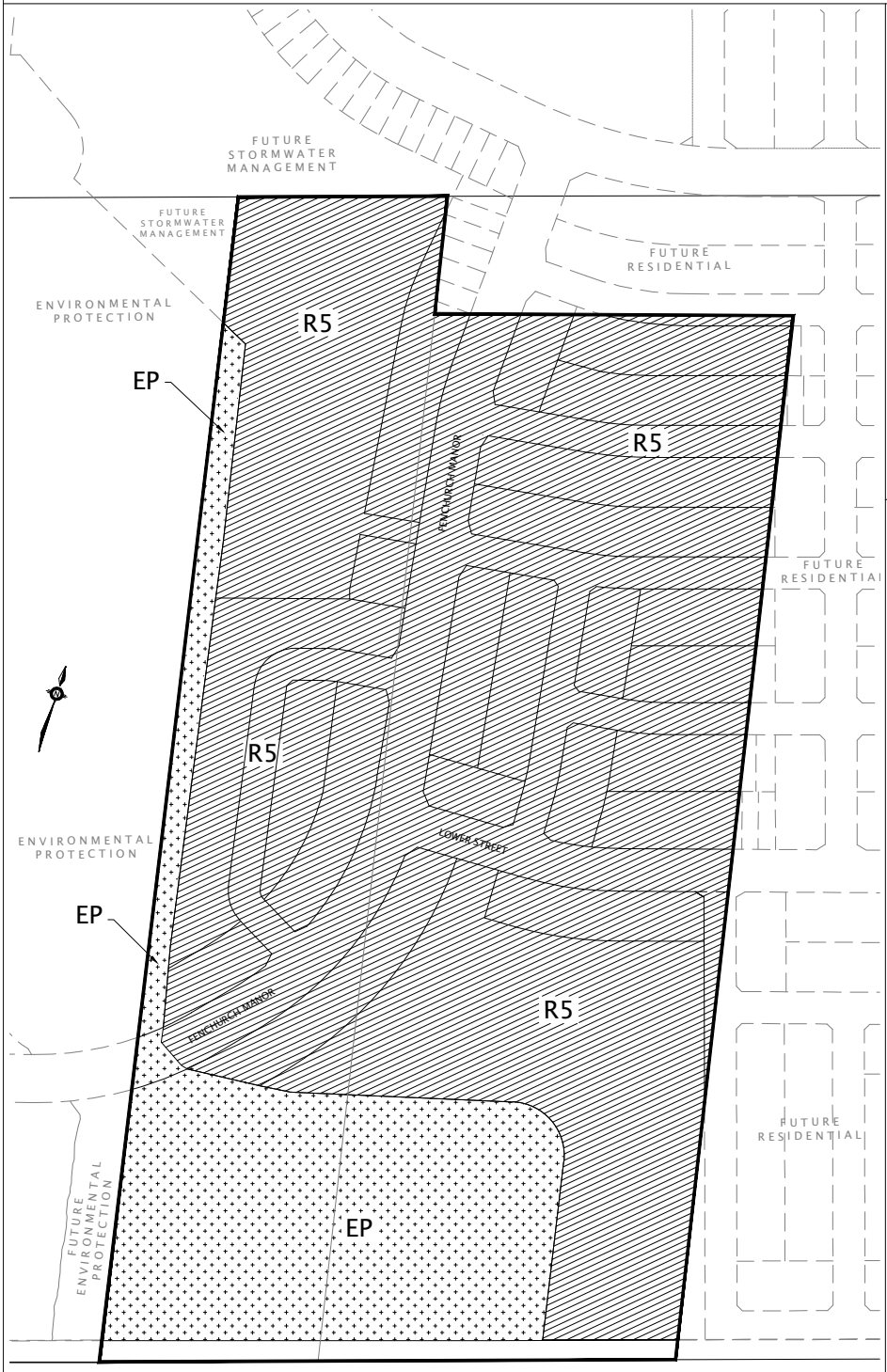
SCHEDULE OF REVISIONS

DATE	DESCRIPTION	DRAWN

LOCKHART INNISFIL INVESTMENTS LIMITED
CITY OF BARRIE

C:_TJCE\Planning Drawings\2021\July 2021\21-07-16\GOL-14193\GOL-14193-PH-1-DP-3c-SIGNED.dwg Layout:DP Plotted: Jul 16, 2021 @ 10:11am by marlchards The Jones Consulting Group Ltd.

Schedule 'A'
Proposed Zoning By-Law Amendment
Part of the South Halves of Lot 13 and Lot 14, Concession 11,
Geographic Township of Innisfil
Now in the City of Barrie, County of Simcoe
2021



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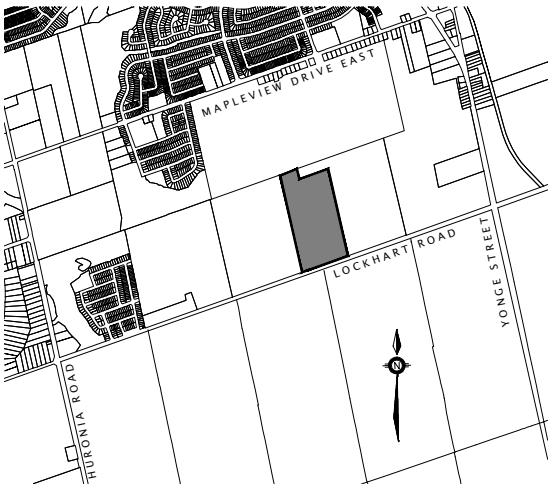

Scale 1:50,000 (8.5x11)

- Lands Subject to Zoning By-Law Amendment
- Lands to be Zoned Neighbourhood Residential (R5) Zone
- Lands to be Zoned Environmental Protection (EP)

GOL-14493-PH-1-ZBLA-1.dwg
21-06-02

JONES
CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Drive East, Unit 1, Barrie, Ontario, L4N 0W5
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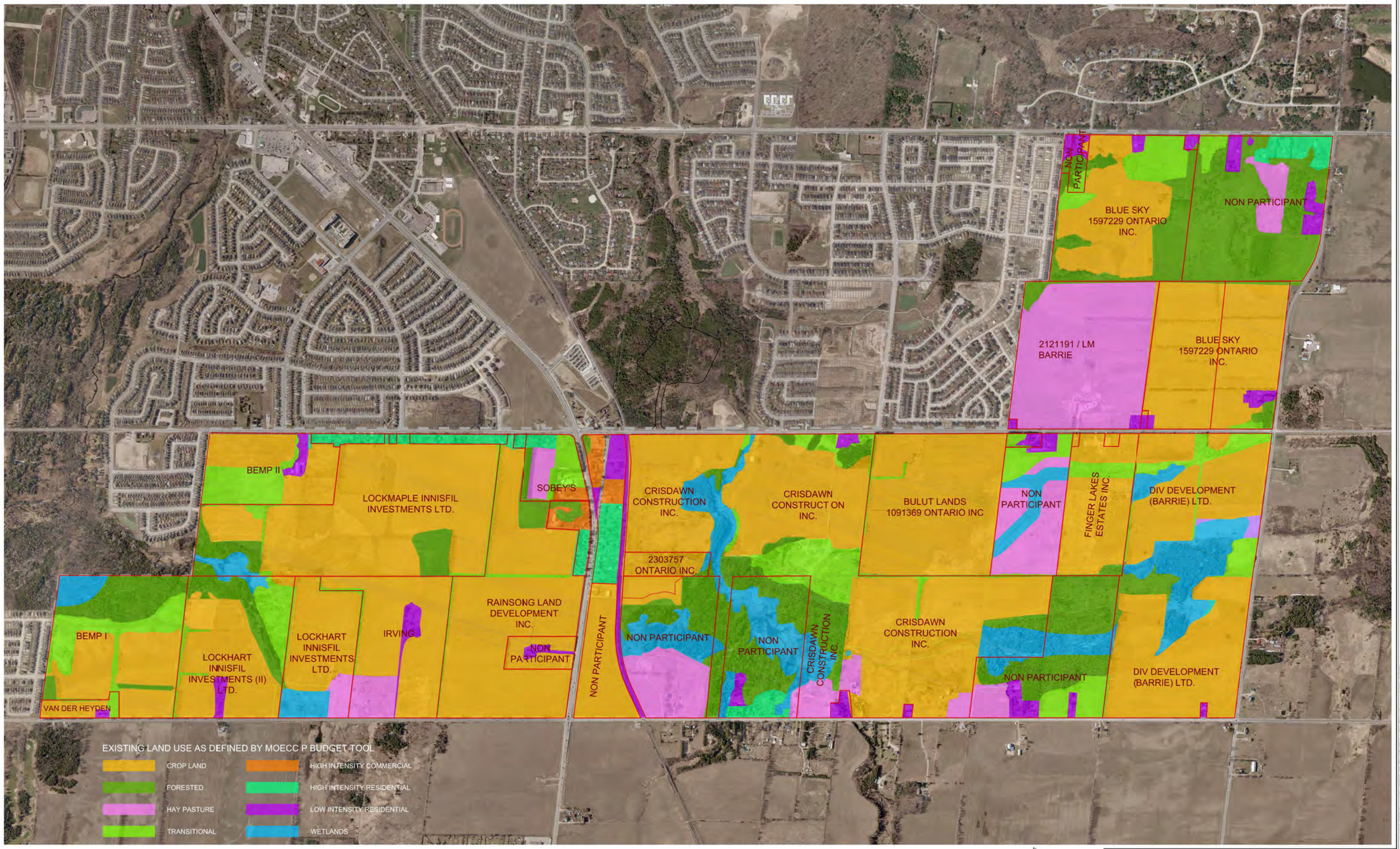


N

0 100 200 400 600
Metres

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

BURNSIDE

Client: HEWITT'S CREEK LANDOWNERS GROUP INC.

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

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

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133

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

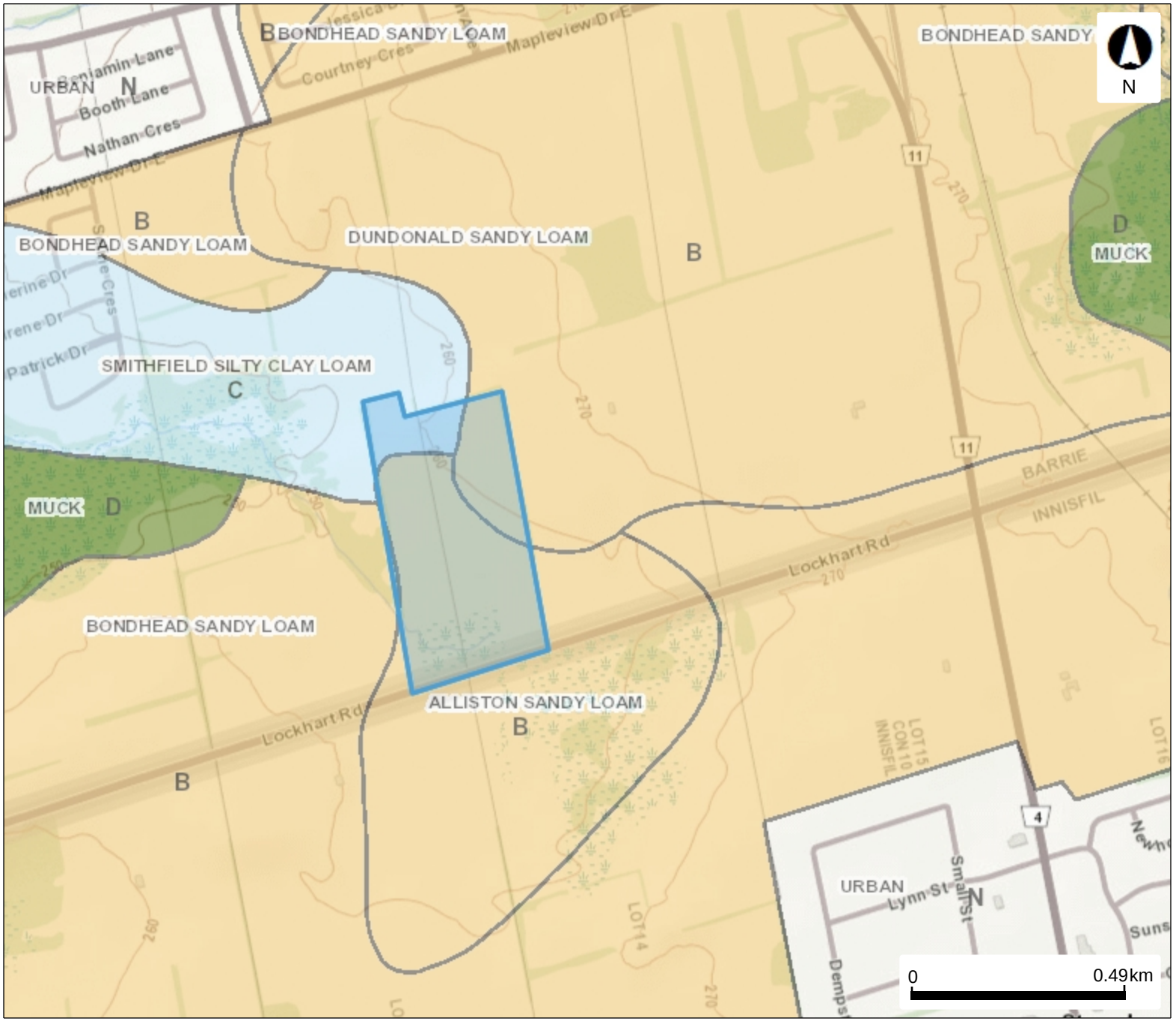
Client
HEWITT'S CREEK LANDOWNERS GROUP INC.

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

Figure No.
FIG 5

M:\Drafting\Drawing Files\Assessments\300032860 - Watershed Level\FIG 5 - Existing Conditions\300032860_FIG5.dwg - Date Plotted: September 14, 2017 - 11:44 AM

LOCKHART I SUBDIVISION SOILS



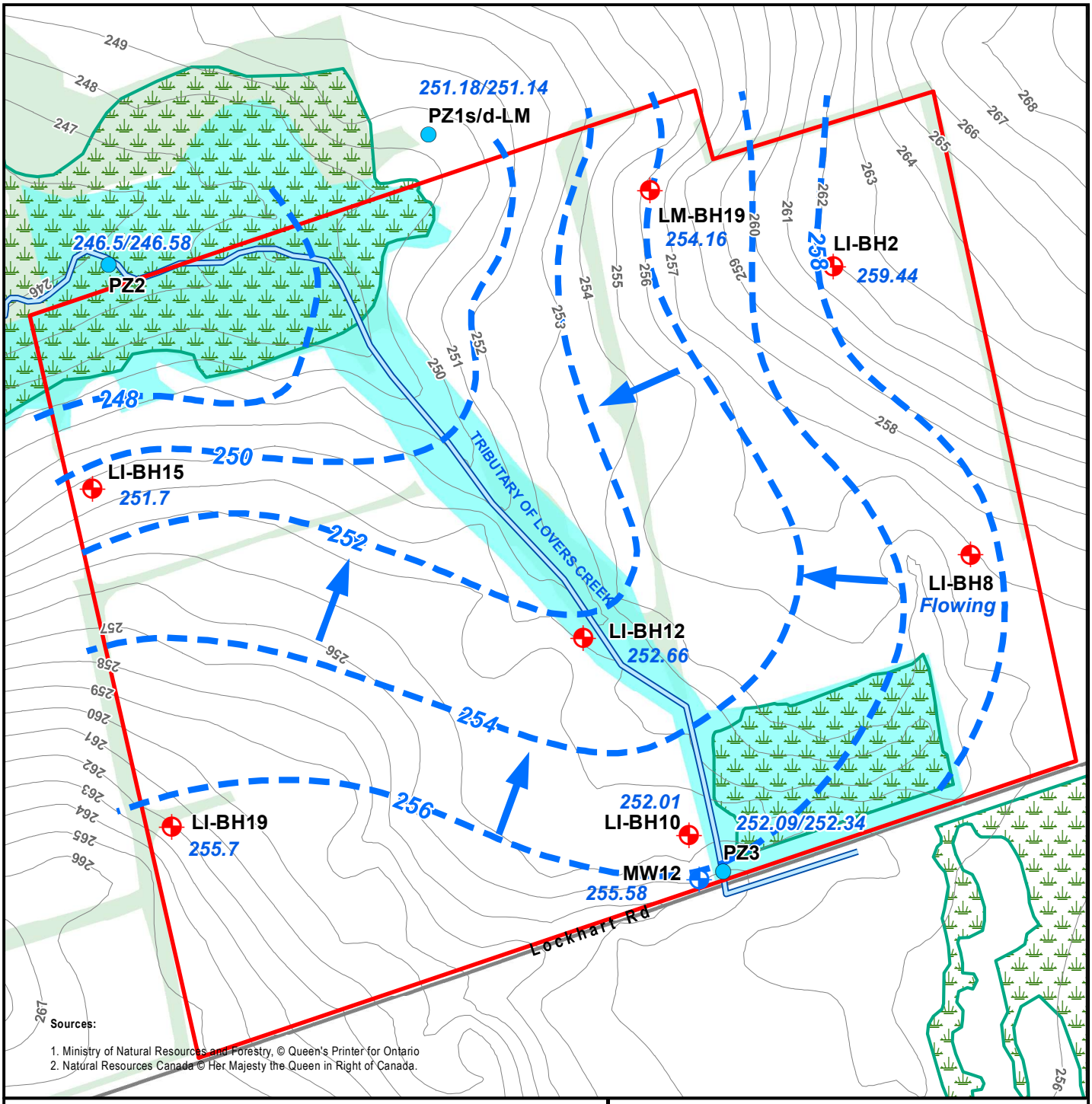
Legend

- @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: 44.33698 N, -79.63387 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

Appendix B

Stormwater Management Calculations & Design Charts

- Area-Depth Curves for Quality and Drawdown Time Calculations for SWMF3 & SWMF4C
- Detailed Stage-Storage-Discharge Table for SWMF3 & SWMF4C
- SWMF3 & SWMF4C Peak Flow Model Performance Summary
- Hydraulic Conveyance Calculations
    - SWMF3 Inlet Overland Flow Conveyance
    - SWMF4C Inlet Overland Flow Conveyance
- 5-year Storm Sewer Design Sheet
- Sanitary Sewer Design Sheet
- SWMF3 Jellyfish Filter Sizing Report
- SWMF4C Jellyfish Filter Sizing Report
- Jellyfish Filter ETV Verification Statement

Storm Water Management Facility 3
SWMF3 Quality Design Notes

CLIENT: Lockhart Innisfil Investments Limited
DATE: Oct. 2021
PROJECT: Lockhart Innisfil
DESIGN: MG
FILE: GOL-14193 (50)
CHECKED: JWI

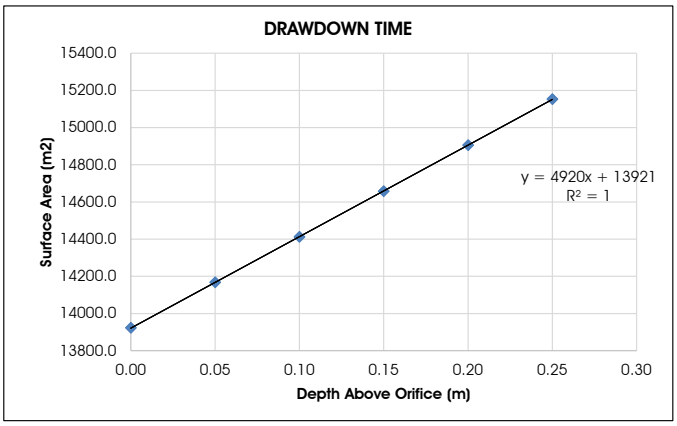
	Area (ha)	TIMP(%)
Total - Area 3	36.48	64.5%
Post Development Drainage Area	36.48	64.5%

Permanent Pool and Extended Detention Volumes:

Drainage Area	36.48	ha
Imperviousness	64.5%	

Imperviousness	Constructed Wetlands 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



Volumetric Criteria:

			Source & Notes:
Total Water Quality Volumetric Criteria	114.5	m^3/ha	*Conducted linear interpolation from MOE Table 3.2 for Enhanced Protection level wetland.*
Extended Detention Volumetric Criteria	40.0	m^3/ha	*MOE Section 3.3.2*
Permanent Pool Volumetric Criteria	74.5	m^3/ha	*MOE Section 3.3.2*

SWMF Volume Requirements:

Total Water Quality Volume (WQV) Required	4176	m^3
Extended Detention Storage Volume Required	1459	m^3/s
Permanent Pool Storage Volume Required	2717	m^3
Extended Detention Volume Provided	3634	m^3
Permanent Pool Storage Volume Provided	4082	m^3
Total Water Quality Volume Provided	7716	m^3
PCSWMM 25mm 4hr CHI Water Quality Volume	3148	m^3

SWMF Drawdown Requirements:

Minimum Drawdown Time, MOE Table 4.7	24	Hours

SWMF Forebay Requirements:

Forebay Width Provided	21	m
Forebay Length Provided	117	m
Forebay Depth Provided	1.20	m
Forebay Length : Width Ratio Provided	5.6	:1
Forebay Area Provided	2648.6	m²
Minimum Forebay Length, MOE Table 4.7	116.2	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.

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

Based on Eqn. 4.11 MOE SWM Planning and Design Manual

Hydraulic Detention Time		
Intercept of Regression, C3	13921.3	
Slope of Regression, C2	4920.0	
Orifice Area	0.0314	m^2
Invert Secondary Orifice Elevation	253.80	m
Depth over Primary Orifice Centroid (WQV WL)	0.150	m
Drawdown Time - Ultimate Ponding Level	127,001	Sec
	35.3	Hours
25mm Event Elevation (PCSWMM)	253.751	m
Depth over Orifice (WQV WL)	0.101	m
Drawdown Time - 25mm Event Ponding Level	103,627	Sec
	28.8	Hours

Forebay Calculations:

Maximum Forebay Permanent Pool Area	2784.6	m²
Total Permanent Pool Area Provided	13923	m²
Max. Percentage of total Permanent Pool Area	20	%

MOE Equation 4.5 - Forebay Settling Length

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

Forebay Length Required	Dist	22.3	m
Length-to-width ratio of forebay	r	5.6	:1
Q_p from the pond during design quality storm	Q_p	0.027	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	116.2	m
Inlet (Pipe Capacity) flowrate-5 yr	Q	8.715	m^3/s
Depth of the permanent pool in the forebay	d	1.20	m
Desired velocity in the forebay	Vf	0.50	m/s

Additional Notes:

The storm sewer infrastructure has been designed to convey the 5 year design storm as per the COB Design Guidelines. 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 3
Hydraulic Calculation Sheet: Stage-Storage-Discharge

CLIENT: Lockhart Innisfil Investments Limited **DATE:** Oct. 2021

PROJECT: Lockhart Innisfil **DESIGN:** MG

FILE: GOL-14193 (50) **CHECKED:** JWI

Extended Detention Orifice		
RADIUS	0.100	m
Outlet Diameter	200.0	mm
Invert Elevation	253.55	m

Tertiary Orifice		
RADIUS	0.000	m
Outlet Dia		mm
Invert Elevation		m

Weir 1 Details - Rectangular Section		
Invert Elevation	255.30	m
Length	14.00	m
Coefficient	1.705	(Broad-Crested)

Secondary Orifice		
RADIUS	0.200	m
Outlet Diameter	400.0	mm
Invert Elevation	253.80	m

Weir 1 Details - Triangular Section		
Invert Elevation	255.30	m
Sideslope	10	H:1V
Coefficient	1.2	(MTO DC 2.46)

	Minimum		Provided		Elevation	
Total Permanent Pool Volume:	2717	m^3	4082	m^3	253.55	m
Extended Detention Volume:	1459	m^3	3634	m^3	253.80	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	252.05	**Bottom of Plunge Pool**
19	1	0	0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.10	
22	2	0	0.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.15	
25	3	0	0.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.20	
27	4	0	0.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.25	
30	6	0	0.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.30	
33	7	0	0.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.35	**Bottom of Forebay**
1373	75	0	0.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.40	
1414	145	0	0.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.45	
1455	216	0	0.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.50	
1496	290	0	0.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.55	
1537	366	0	0.55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.60	
1579	444	0	0.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.65	
1621	524	0	0.65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.70	
1663	606	0	0.70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.75	
1706	690	0	0.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.80	
1749	777	0	0.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.85	
1792	865	0	0.85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.90	
1835	956	0	0.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.95	
1879	1,049	0	0.95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.00	
1923	1,144	0	1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.05	
2012	1,242	0	1.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.10	
2102	1,345	0	1.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.15	
2193	1,452	0	1.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.20	
2549	1,571	0	1.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.25	
2959	1,708	0	1.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.30	
3462	1,868	0	1.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.35	
13167	2,053	0	1.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.40	Bottom of Wetland Main Cell
13407	2,718	0	1.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.45	
13647	3,394	0	1.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.50	
13923	4,082	0	1.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.55	**Permanent Pool**
14167	4,785	702	1.55	0.003	0.000	0.000	0.000	0.000	0.000	0.003	253.60	
14412	5,499	1,417	1.60	0.005	0.000	0.000	0.000	0.000	0.000	0.005	253.65	
14658	6,226	2,143	1.65	0.020	0.000	0.000	0.000	0.000	0.000	0.020	253.70	
14905	6,965	2,883	1.70	0.028	0.000	0.000	0.000	0.000	0.000	0.028	253.75	25mm WQE (253.751m)
15153	7,716	3,634	1.75	0.034	0.000	0.000	0.000	0.000	0.000	0.034	253.80	**Extended Detention**
15402	8,480	4,398	1.80	0.039	0.013	0.000	0.000	0.000	0.000	0.052	253.85	
15652	9,257	5,174	1.85	0.044	0.015	0.000	0.000	0.000	0.000	0.059	253.90	
15902	10,045	5,963	1.90	0.048	0.020	0.000	0.000	0.000	0.000	0.068	253.95	
16154	10,847	6,765	1.95	0.052	0.030	0.000	0.000	0.000	0.000	0.081	254.00	2yr 24hr (254.750m)
16667	11,661	7,578	2.00	0.055	0.078	0.000	0.000	0.000	0.000	0.134	254.05	
16830	12,498	8,416	2.05	0.059	0.111	0.000	0.000	0.000	0.000	0.170	254.10	
16994	13,344	9,262	2.10	0.062	0.136	0.000	0.000	0.000	0.000	0.198	254.15	
17158	14,198	10,115	2.15	0.065	0.157	0.000	0.000	0.000	0.000	0.222	254.20	5yr 24hr (254.969m)
17322	15,060	10,977	2.20	0.068	0.175	0.000	0.000	0.000	0.000	0.243	254.25	
17487	15,930	11,848	2.25	0.071	0.192	0.000	0.000	0.000	0.000	0.263	254.30	
17652	16,808	12,726	2.30	0.073	0.207	0.000	0.000	0.000	0.000	0.281	254.35	10yr 24hr (255.113m)
17818	17,695	13,613	2.35	0.076	0.222	0.000	0.000	0.000	0.000	0.298	254.40	
17984	18,590	14,508	2.40	0.078	0.235	0.000	0.000	0.000	0.000	0.314	254.45	
18151	19,494	15,411	2.45	0.081	0.248	0.000	0.000	0.000	0.000	0.329	254.50	
18318	20,405	16,323	2.50	0.083	0.260	0.000	0.000	0.000	0.000	0.343	254.55	25yr 6hr (225.304m)
18486	21,325	17,243	2.55	0.085	0.272	0.000	0.000	0.000	0.000	0.357	254.60	
18654	22,254	18,172	2.60	0.088	0.283	0.000	0.000	0.000	0.000	0.370	254.65	
18823	23,191	19,108	2.65	0.090	0.293	0.000	0.000	0.000	0.000	0.383	254.70	50yr 6hr (255.450m)
18992	24,136	20,054	2.70	0.092	0.304	0.000	0.000	0.000	0.000	0.396	254.75	
19161	25,090	21,008	2.75	0.094	0.314	0.000	0.000	0.000	0.000	0.408	254.80	
19331	26,052	21,970	2.80	0.096	0.323	0.000	0.000	0.000	0.000	0.419	254.85	100yr 6hr (255.594m)
19502	27,023	22,941	2.85	0.098	0.333	0.000	0.000	0.000	0.000	0.431	254.90	
19673	28,002	23,920	2.90	0.100	0.342	0.000	0.000	0.000	0.000	0.442	254.95	
19846	28,990	24,908	2.95	0.102	0.351	0.000	0.000	0.000	0.000	0.453	255.00	
20018	29,987	25,905	3.00	0.104	0.359	0.000	0.000	0.000	0.000	0.463	255.05	
20191	30,992	26,910	3.05	0.106	0.368	0.000	0.000	0.000	0.000	0.473	255.10	
20364	32,006	27,924	3.10	0.107	0.376	0.000	0.000	0.000	0.000	0.483	255.15	
20538	33,029	28,946	3.15	0.109	0.384	0.000	0.000	0.000	0.000	0.493	255.20	
20712	34,060	29,978	3.20	0.111	0.392	0.000	0.000	0.000	0.000	0.503	255.25	
20887	35,100	31,018	3.25	0.113	0.400	0.000	0.000	0.000	0.000	0.512	255.30	**Overflow Weir**
21061	36,149	32,066	3.30	0.114	0.407	0.000	0.007	0.267	0.274	0.795	255.35	
21237	37,206	33,124	3.35	0.116	0.415	0.000	0.038	0.755	0.793	1.324	255.40	
21412	38,272	34,190	3.40	0.118	0.422	0.000	0.105	1.387	1.491	2.031	255.45	
21589	39,347	35,265	3.45	0.119	0.429	0.000	0.215	2.135	2.350	2.898	255.50	

Storm Water Management Facility 3
Hydraulic Calculation Sheet: Stage-Storage-Discharge

CLIENT: Lockhart Innisfil Investments Limited
DATE: Oct. 2021
PROJECT: Lockhart Innisfil
DESIGN: MG
FILE: GOL-14193 (50)
CHECKED: JWI

Extended Detention Orifice		
RADIUS	0.100	m
Outlet Diameter	200.0	mm
Invert Elevation	253.55	m

Tertiary Orifice		
RADIUS	0.000	m
Outlet Dia		mm
Invert Elevation		m

Weir 1 Details - Rectangular Section		
Invert Elevation	255.30	m
Length	14.00	m
Coefficient	1.705 (Broad-Crested)	

Secondary Orifice		
RADIUS	0.200	m
Outlet Diameter	400.0	mm
Invert Elevation	253.80	m

Weir 1 Details - Triangular Section		
Invert Elevation	255.30	m
Sideslope	10	H:1V
Coefficient	1.2 (MTO DC 2.46)	

	Minimum		Provided		Elevation	
Total Permanent Pool Volume:	2717	m^3	4082	m^3	253.55	m
Extended Detention Volume:	1459	m^3	3634	m^3	253.80	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	
21765	40,431	36,349	3.50	0.121	0.437	0.000	0.375	2.984	3.359	3.916	255.55	Hazel (256.299m)
21942	41,524	37,441	3.55	0.122	0.444	0.000	0.592	3.922	4.514	5.080	255.60	
22119	42,625	38,543	3.60	0.124	0.450	0.000	0.870	4.943	5.812	6.387	255.65	
22297	43,736	39,653	3.65	0.126	0.457	0.000	1.214	6.039	7.253	7.836	255.70	
22498	44,855	40,773	3.70	0.127	0.464	0.000	1.630	7.206	8.836	9.427	255.75	
24277	46,024	41,942	3.75	0.129	0.470	0.000	2.121	8.439	10.561	11.160	255.80	
26094	47,283	43,201	3.80	0.130	0.477	0.000	2.692	9.736	12.428	13.035	255.85	**Top of SWMF**

Orifice Outflow equation is for orifice flow given by:

$Q=0.63A(2gH)^{0.5}$ Where ponding elevation is above orifice centroid

$Q=1.65\{[(\pi D^2/4)([2\cos^{-1}\{[(D/2)-H]/[D/2]\}\{180/\pi\}]/360)-([\{D/2\}-H][DH-H^2]\ ^\ [1/2])/H]\}H\ ^\ (1.5)$ 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 4C
SWMF4C Quality Design Notes

CLIENT: Lockhart Innisfil Investments Limited
DATE: Oct. 2021
PROJECT: Lockhart Innisfil
DESIGN: MG
FILE: GOL-14193 (50)
CHECKED: JWI

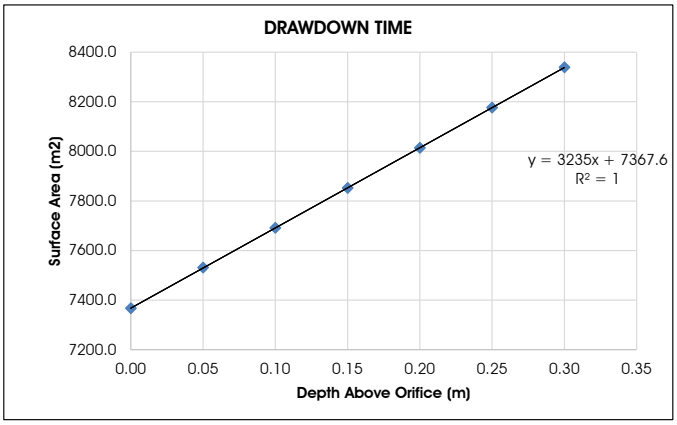
	Area (ha)	TIMP(%)
Total - Area 3	15.84	65.0%
Post Development Drainage Area	15.84	65.0%

Permanent Pool and Extended Detention Volumes:

Drainage Area	15.84	ha
Imperviousness	65.0%	

Imperviousness	Constructed Wetlands 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



Volumetric Criteria:

			Source & Notes:
Total Water Quality Volumetric Criteria	115.0	m^3/ha	*Conducted linear interpolation from MOE Table 3.2 for Enhanced Protection level wetland.*
Extended Detention Volumetric Criteria	40.0	m^3/ha	*MOE Section 3.3.2*
Permanent Pool Volumetric Criteria	75.0	m^3/ha	*MOE Section 3.3.2*

SWMF Volume Requirements:

Total Water Quality Volume (WQV) Required	1822	m^3
Extended Detention Storage Volume Required	634	m^3/s
Permanent Pool Storage Volume Required	1188	m^3
Extended Detention Volume Provided	2356	m^3
Permanent Pool Storage Volume Provided	2183	m^3
Total Water Quality Volume Provided	4539	m^3
PCSWMM 25mm 4hr CHI Water Quality Volume	1339	m^3

SWMF Drawdown Requirements:

Minimum Drawdown Time, MOE Table 4.7	24	Hours

SWMF Forebay Requirements:

Forebay Width Provided	25.9	m
Forebay Length Provided	54.8	m
Forebay Depth Provided	1.00	m
Forebay Length : Width Ratio Provided	2.1	:1
Forebay Area Provided	1412.6	m²
Minimum Forebay Length, MOE Table 4.7	49.4	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.

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?	NO

Based on Eqn. 4.11 MOE SWM Planning and Design Manual

Hydraulic Detention Time		
Intercept of Regression, C3	7367.6	
Slope of Regression, C2	3235.0	
Orifice Area	0.0123	m^2
Invert Secondary Orifice Elevation	253.30	m
Depth over Primary Orifice Centroid (WQV WL)	0.238	m
Drawdown Time - Ultimate Ponding Level	220,110	Sec
	61.1	Hours
25mm Event Elevation (PCSWMM)	253.162	m
Depth over Orifice (WQV WL)	0.100	m
Drawdown Time - 25mm Event Ponding Level	139,715	Sec
	38.8	Hours

Forebay Calculations:

Maximum Forebay Permanent Pool Area	1473.4	m²
Total Permanent Pool Area Provided	7367	m²
Max. Percentage of total Permanent Pool Area	20	%

MOE Equation 4.5 - Forebay Settling Length

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

Forebay Length Required	Dist	8.7	m
Length-to-width ratio of forebay	r	2.1	:1
Q_p from the pond during design quality storm	Q_p	0.011	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	49.4	m
Inlet (Pipe Capacity) flowrate-5 yr	Q	3.702	m^3/s
Depth of the permanent pool in the forebay	d	1.20	m
Desired velocity in the forebay	Vf	0.50	m/s

Additional Notes:

The storm sewer infrastructure has been designed to convey the 5 year design storm as per the COB Design Guidelines. 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 4C
Hydraulic Calculation Sheet: Stage-Storage-Discharge

CLIENT: Lockhart Innisfil Investments Limited

DATE: Oct. 2021

PROJECT: Lockhart Innisfil

DESIGN: MG

FILE: GOL-14193 (50)

CHECKED: JWI

Extended Detention Orifice		
RADIUS	0.063	m
Outlet Diameter	125.0	mm
Invert Elevation	253.00	m

Tertiary Orifice		
RADIUS	0.000	m
Outlet Dia		mm
Invert Elevation		m

Weir 1 Details - Rectangular Section		
Invert Elevation	254.80	m
Length	10.00	m
Coefficient	1.705	(Broad-Crested)

Secondary Orifice		
RADIUS	0.150	m
Outlet Diameter	300.0	mm
Invert Elevation	253.30	m

Weir 1 Details - Triangular Section		
Invert Elevation	254.80	m
Sideslope	10	H:1V
Coefficient	1.2	(MTO DC 2.46)

	Minimum		Provided		Elevation	
Total Permanent Pool Volume:	1188	m^3	2183	m^3	253.00	m
Extended Detention Volume:	634	m^3	2356	m^3	253.30	m

POND AREA	TOTAL STORAGE	ACTIVE DETENTION STORAGE	WATER DEPTH	EXT. DET. ORIFICE FLOW	SECONDARY ORIFICE FLOW	TERTIARY ORIFICE FLOW	TRAPEZOIDAL WEIR WITH 10H: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	
6	0	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.50	**Bottom of Plunge Pool**
19	1	0	0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.55	
22	2	0	0.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.60	
25	3	0	0.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.65	
27	4	0	0.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.70	
30	6	0	0.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.75	
510	7	0	0.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.80	**Bottom of Forebay**
760	45	0	0.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.85	
782	83	0	0.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.90	
804	123	0	0.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	251.95	
826	164	0	0.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.00	
849	206	0	0.55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.05	
872	249	0	0.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.10	
895	293	0	0.65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.15	
919	338	0	0.70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.20	
942	385	0	0.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.25	
966	433	0	0.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.30	
991	481	0	0.85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.35	
1015	532	0	0.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.40	
1040	583	0	0.95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.45	
1066	636	0	1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.50	
1117	690	0	1.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.55	
1170	747	0	1.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.60	
1224	807	0	1.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.65	
1279	870	0	1.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.70	
1544	940	0	1.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.75	
1845	1,025	0	1.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.80	
3210	1,125	0	1.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.85	Bottom of Wetland Main Cell
6972	1,470	0	1.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.90	
7131	1,823	0	1.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.95	
7367	2,183	0	1.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	253.00	**Permanent Pool**
7531	2,556	373	1.55	0.001	0.000	0.000	0.000	0.000	0.000	0.001	253.05	
7691	2,936	753	1.60	0.007	0.000	0.000	0.000	0.000	0.000	0.007	253.10	
7852	3,325	1,142	1.65	0.010	0.000	0.000	0.000	0.000	0.000	0.010	253.15	25mm WQE (253.162m)
8014	3,722	1,538	1.70	0.013	0.000	0.000	0.000	0.000	0.000	0.013	253.20	
8176	4,126	1,943	1.75	0.015	0.000	0.000	0.000	0.000	0.000	0.015	253.25	
8339	4,539	2,356	1.80	0.017	0.000	0.000	0.000	0.000	0.000	0.017	253.30	**Extended Detention**
8502	4,960	2,777	1.85	0.018	0.006	0.000	0.000	0.000	0.000	0.025	253.35	
8666	5,389	3,206	1.90	0.020	0.009	0.000	0.000	0.000	0.000	0.029	253.40	2yr 24hr (253.389m)
8830	5,827	3,644	1.95	0.021	0.014	0.000	0.000	0.000	0.000	0.036	253.45	
9021	6,272	4,089	2.00	0.023	0.044	0.000	0.000	0.000	0.000	0.067	253.50	
9155	6,727	4,544	2.05	0.024	0.062	0.000	0.000	0.000	0.000	0.086	253.55	
9286	7,188	5,005	2.10	0.025	0.076	0.000	0.000	0.000	0.000	0.101	253.60	5yr 24hr (253.573m)
9417	7,655	5,472	2.15	0.026	0.088	0.000	0.000	0.000	0.000	0.114	253.65	
9549	8,130	5,946	2.20	0.027	0.099	0.000	0.000	0.000	0.000	0.126	253.70	10yr 24hr (253.694m)
9681	8,610	6,427	2.25	0.028	0.108	0.000	0.000	0.000	0.000	0.136	253.75	
9813	9,098	6,914	2.30	0.029	0.117	0.000	0.000	0.000	0.000	0.146	253.80	
9946	9,592	7,408	2.35	0.030	0.125	0.000	0.000	0.000	0.000	0.155	253.85	25yr 6hr (253.855m)
10079	10,092	7,909	2.40	0.031	0.132	0.000	0.000	0.000	0.000	0.164	253.90	
10213	10,600	8,416	2.45	0.032	0.139	0.000	0.000	0.000	0.000	0.172	253.95	
10347	11,113	8,930	2.50	0.033	0.146	0.000	0.000	0.000	0.000	0.179	254.00	50yr 6hr (253.977m)
10481	11,634	9,451	2.55	0.034	0.153	0.000	0.000	0.000	0.000	0.187	254.05	
10616	12,162	9,978	2.60	0.035	0.159	0.000	0.000	0.000	0.000	0.194	254.10	100yr 6hr (254.097m)
10751	12,696	10,513	2.65	0.036	0.165	0.000	0.000	0.000	0.000	0.201	254.15	
10887	13,237	11,054	2.70	0.037	0.171	0.000	0.000	0.000	0.000	0.207	254.20	
11023	13,784	11,601	2.75	0.037	0.176	0.000	0.000	0.000	0.000	0.214	254.25	
11159	14,339	12,156	2.80	0.038	0.182	0.000	0.000	0.000	0.000	0.220	254.30	
11296	14,900	12,717	2.85	0.039	0.187	0.000	0.000	0.000	0.000	0.226	254.35	
11433	15,469	13,285	2.90	0.040	0.192	0.000	0.000	0.000	0.000	0.232	254.40	
11571	16,044	13,861	2.95	0.040	0.197	0.000	0.000	0.000	0.000	0.237	254.45	
11709	16,626	14,443	3.00	0.041	0.202	0.000	0.000	0.000	0.000	0.243	254.50	
11847	17,215	15,031	3.05	0.042	0.207	0.000	0.000	0.000	0.000	0.249	254.55	
11986	17,810	15,627	3.10	0.042	0.211	0.000	0.000	0.000	0.000	0.254	254.60	
12125	18,413	16,230	3.15	0.043	0.216	0.000	0.000	0.000	0.000	0.259	254.65	
12264	19,023	16,840	3.20	0.044	0.220	0.000	0.000	0.000	0.000	0.264	254.70	
12404	19,640	17,456	3.25	0.044	0.225	0.000	0.000	0.000	0.000	0.269	254.75	
12544	20,263	18,080	3.30	0.045	0.229	0.000	0.000	0.000	0.000	0.274	254.80	**Overflow Weir**
12685	20,894	18,711	3.35	0.046	0.233	0.000	0.007	0.191	0.197	0.476	254.85	Hazel (254.834m)
12826	21,532	19,349	3.40	0.046	0.237	0.000	0.038	0.539	0.577	0.861	254.90	
12968	22,177	19,993	3.45	0.047	0.241	0.000	0.105	0.991	1.095	1.384	254.95	

Storm Water Management Facility 4C
Hydraulic Calculation Sheet: Stage-Storage-Discharge

CLIENT: Lockhart Innisfil Investments Limited
DATE: Oct. 2021
PROJECT: Lockhart Innisfil
DESIGN: MG
FILE: GOL-14193 (50)
CHECKED: JWI

Extended Detention Orifice		
RADIUS	0.063	m
Outlet Diameter	125.0	mm
Invert Elevation	253.00	m

Tertiary Orifice		
RADIUS	0.000	m
Outlet Dia		mm
Invert Elevation		m

Weir 1 Details - Rectangular Section		
Invert Elevation	254.80	m
Length	10.00	m
Coefficient	1.705 (Broad-Crested)	

Secondary Orifice		
RADIUS	0.150	m
Outlet Diameter	300.0	mm
Invert Elevation	253.30	m

Weir 1 Details - Triangular Section		
Invert Elevation	254.80	m
Sideslope	10	H:1V
Coefficient	1.2 (MTO DC 2.46)	

	Minimum		Provided		Elevation	
Total Permanent Pool Volume:	1188	m^3	2183	m^3	253.00	m
Extended Detention Volume:	634	m^3	2356	m^3	253.30	m

POND AREA	TOTAL STORAGE	ACTIVE DETENTION STORAGE	WATER DEPTH	EXT. DET. ORIFICE FLOW	SECONDARY ORIFICE FLOW	TERTIARY ORIFICE FLOW	TRAPEZOIDAL WEIR WITH 10H: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	
13109	22,829	20,645	3.50	0.048	0.245	0.000	0.215	1.525	1.740	2.033	255.00	
13252	23,488	21,304	3.55	0.048	0.249	0.000	0.375	2.131	2.506	2.804	255.05	
13394	24,154	21,971	3.60	0.049	0.253	0.000	0.592	2.802	3.393	3.695	255.10	
13537	24,827	22,644	3.65	0.049	0.257	0.000	0.870	3.530	4.400	4.707	255.15	
13681	25,508	23,324	3.70	0.050	0.261	0.000	1.214	4.313	5.528	5.839	255.20	
15139	26,228	24,045	3.75	0.051	0.265	0.000	1.630	5.147	6.777	7.092	255.25	
16619	27,022	24,839	3.80	0.051	0.268	0.000	2.121	6.028	8.149	8.469	255.30	**Top of SWMF**

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

$Q=1.65\{[(\pi D^2/4)([2\cos^{-1}\{[(D/2)-H]/[D/2]\}\{180/\pi\}]/360)-([\{D/2\}-H][DH-H^2]\ ^\wedge\ [1/2])/H]\}H\ ^\wedge\ (1.5)$ 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 3 & 4C
PF Model Performance Summary

CLIENT: Lockhart Innisfil Investments Limited

DATE: Oct. 2021

PROJECT: Lockhart Innisfil

DESIGN: MG

FILE: GOL-14193 (50)

CHECKED: JWI

Storm Peak Event Flow (m^3/s) - SWMF3 Lockhart Innisfil							
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	0.03	0.038	0.046
Erosion Control Unitary Discharge Rate		0.0011					
Target Flow Rate	**37.66**	0.226	0.527	0.791	1.130	1.431	1.732
Target Erosion Control Discharge Rate	**37.66**	0.041					
Post Development Condition (OF-3 inclusive of uncontrolled area 3A)							
CHI 4-Hr Storm Distribution	37.66	0.143	0.251	0.333	0.441	0.521	0.605
SCS 6-Hr Storm Distribution	37.66	0.193	0.371	0.499	0.640	0.735	0.824
SCS 12-Hr Storm Distribution	37.66	0.183	0.340	0.455	0.586	0.671	0.750
SCS 24-Hr Storm Distribution	37.66	0.199	0.367	0.487	0.611	0.696	0.775
25mm 4-Hr Storm Distribution	37.66	0.071					
Hazel Storm	37.66	3.193					

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	0.03	0.038	0.046
Erosion Control Unitary Discharge Rate		0.0011					
Target Flow Rate	**36.48**	0.219	0.511	0.766	1.094	1.386	1.678
Target Erosion Control Discharge Rate	**36.48**	0.040					
Post Development Condition (HW-SWMF3) (Excluding Catchment 3A)							
CHI 4-Hr Storm Distribution	36.48	0.076	0.171	0.242	0.304	0.340	0.375
SCS 6-Hr Storm Distribution	36.48	0.101	0.235	0.295	0.356	0.396	0.431
SCS 12-Hr Storm Distribution	36.48	0.098	0.221	0.279	0.337	0.375	0.409
SCS 24-Hr Storm Distribution	36.48	0.114	0.241	0.296	0.354	0.391	0.425
25mm 4-Hr Storm Distribution	36.48	0.028					
Hazel Storm	36.48	3.097					

Post Development Condition Targets - Catchment 3A							
CHI 4-Hr Storm Distribution	1.18	0.150	0.357	0.549	0.826	1.091	1.358
SCS 6-Hr Storm Distribution	1.18	0.125	0.293	0.496	0.774	1.035	1.302
SCS 12-Hr Storm Distribution	1.18	0.128	0.306	0.511	0.793	1.056	1.324
SCS 24-Hr Storm Distribution	1.18	0.112	0.286	0.495	0.776	1.040	1.308
25mm 4-Hr Storm Distribution	1.18	0.014					
Hazel Storm	1.18	Safe Conveyance					

Maximum Ponding Depth above Permanent Pool (m) - SWMF3 Lockhart Innisfil						
Storm Distribution	**Return Period (years)**					
	2	**5**	**10**	**25**	**50**	**100**
CHI 4-Hr Storm Distribution	0.380	0.506	0.697	0.868	0.989	1.116
SCS 6-Hr Storm Distribution	0.437	0.679	0.841	1.046	1.200	1.350
SCS 12-Hr Storm Distribution	0.431	0.648	0.796	0.979	1.117	1.253
SCS 24-Hr Storm Distribution	0.461	0.694	0.846	1.038	1.182	1.323
25mm 4-Hr Storm Distribution	0.201					
Hazel Storm	1.975					

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.

Storm Water Management Facility 3 & 4C
PF Model Performance Summary

CLIENT: Lockhart Innisfil Investments Limited

DATE: Oct. 2021

PROJECT: Lockhart Innisfil

DESIGN: MG

FILE: GOL-14193 (50)

CHECKED: JWI

Storm Peak Event Flow (m^3/s) - SWMF4C Lockhart Innisfil							
Storm Distribution	**Area (ha)**	**Return Period (years)**					
		2	**5**	**10**	**25**	**50**	**100**
Unitary Discharge Rates ($m^3/s/ha$) for 4C		0.004	0.011	0.019	0.019	0.026	0.044
Erosion Control Unitary Discharge Rate		0.0011					
Target Flow Rate	**16.37**	0.065	0.179	0.318	0.316	0.419	0.718
Target Erosion Control Discharge Rate	**16.37**	0.018					
Post Development Condition (OF-4C)							
CHI 4-Hr Storm Distribution	16.37	0.041	0.090	0.122	0.165	0.201	0.240
SCS 6-Hr Storm Distribution	16.37	0.064	0.134	0.192	0.271	0.318	0.363
SCS 12-Hr Storm Distribution	16.37	0.059	0.120	0.172	0.244	0.289	0.328
SCS 24-Hr Storm Distribution	16.37	0.065	0.133	0.188	0.260	0.302	0.342
25mm 4-Hr Storm Distribution	16.37	0.011					
Hazel Storm	16.37	0.390					

Maximum Ponding Depth above Permanent Pool (m) - SWMF4C Lockhart Innisfil						
Storm Distribution	**Return Period (years)**					
	2	**5**	**10**	**25**	**50**	**100**
CHI 4-Hr Storm Distribution	0.323	0.476	0.579	0.714	0.810	0.911
SCS 6-Hr Storm Distribution	0.370	0.562	0.691	0.855	0.977	1.097
SCS 12-Hr Storm Distribution	0.364	0.537	0.654	0.801	0.912	1.019
SCS 24-Hr Storm Distribution	0.389	0.573	0.694	0.848	0.963	1.075
25mm 4-Hr Storm Distribution	0.162					
Hazel Storm	1.834					

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-14193 Lockhart I SWMF3 Overland Flow Inlet Channel

Rectangular

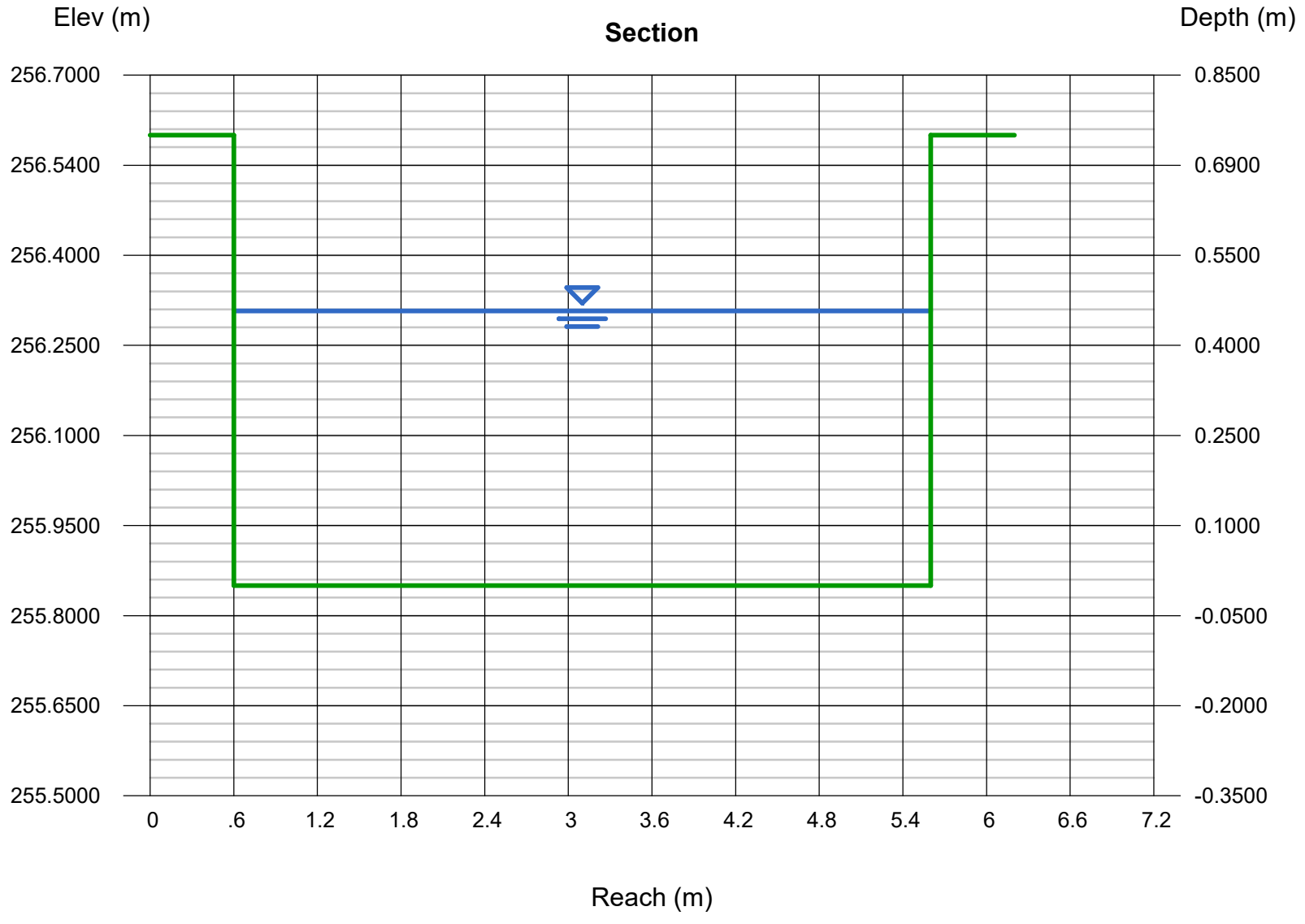
Bottom Width (m)	= 5.0000
Total Depth (m)	= 0.7500
Invert Elev (m)	= 255.8500
Slope (%)	= 2.0000
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cms)	= 11.3750

Highlighted

Depth (m)	= 0.4572
Q (cms)	= 11.3750
Area (sqm)	= 2.2860
Velocity (m/s)	= 4.9759
Wetted Perim (m)	= 5.9144
Crit Depth, Yc (m)	= 0.7500
Top Width (m)	= 5.0000
EGL (m)	= 1.7201



Channel Report

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

GOL-14193 Lockhart I SWMF4C Overland Flow Inlet Channel

Rectangular

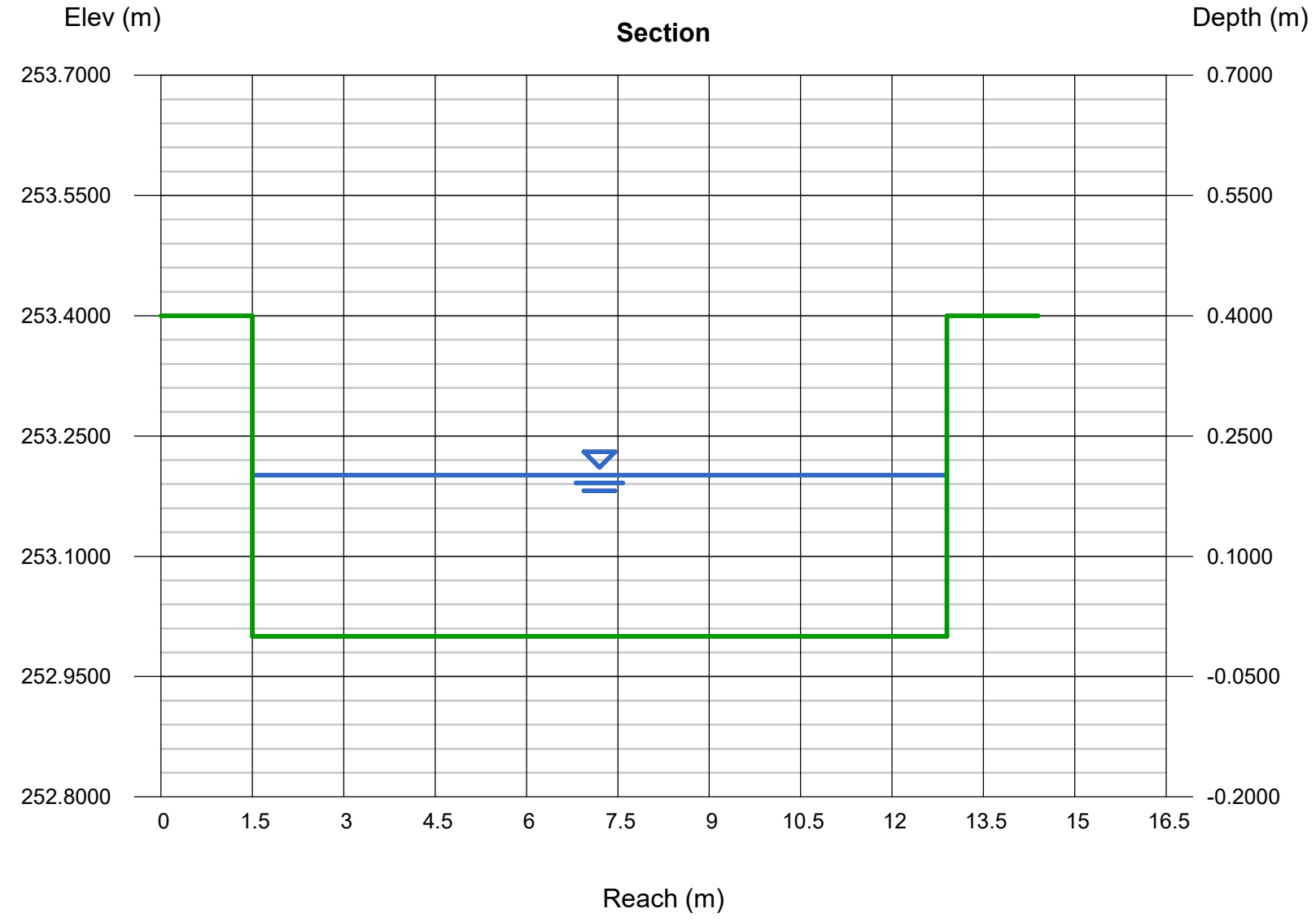
Bottom Width (m)	= 11.4000
Total Depth (m)	= 0.4000
Invert Elev (m)	= 253.0000
Slope (%)	= 1.2000
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cms)	= 5.5040

Highlighted

Depth (m)	= 0.2012
Q (cms)	= 5.5040
Area (sqm)	= 2.2933
Velocity (m/s)	= 2.4000
Wetted Perim (m)	= 11.8023
Crit Depth, Yc (m)	= 0.2896
Top Width (m)	= 11.4000
EGL (m)	= 0.4950



GOL-14193 Lockhart I

5 Year Storm Sewer Sizing

October 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)	
From Mattamy to GG 9 Mile ↓									450mmØ shown in GG (9 Mile)								
101	Street 'D'	STM 22	STM DDLV5555	85.5	0.65	1.17	0.76	0.76	10.00	0.93	109	0.230	0.60	525	0.333	1.5	***69.0***
From Mattamy to GG 9 Mile ↓																	
102	Street 'E'	STM 23	STM 24	55.2	0.65	0.49	0.32	0.32	10.00	0.46	109	0.097	2.10	300	0.140	2.0	***69.2***
103	Street 'E'	STM 24	STM 25	79.1	0.65	0.68	0.44	0.76	10.46	0.48	106	0.224	3.00	375	0.304	2.7	***73.9***
104	Fenchurch Manor	STM 25	STM DDLV5563	84.8	0.65	0.52	0.34	1.10	10.94	0.85	104	0.318	0.70	525	0.360	1.7	***88.3***
From Mattamy to Lockhart ↓																	
105	Street 'K'	STM 10	STM 11		0.65	1.85	1.20										
106	Street 'K'	STM 10	STM 11	77.5	0.65	0.11	0.07	1.28	10.00	0.48	109	0.386	1.80	525	0.577	2.7	***66.9***
107	Street 'K'	STM 11	STM 12	62.5	0.65	0.19	0.12	1.40	10.48	0.39	106	0.413	1.80	525	0.577	2.7	***71.6***
108	Street 'K'	STM 12	STM 13	80.5	0.65	0.37	0.24	1.64	10.88	0.38	104	0.475	3.20	525	0.769	3.6	***61.7***
109	Fenchurch Manor	STM 13	STM 9	75.0	0.65	0.21	0.14	1.78	11.25	0.47	102	0.506	1.80	525	0.577	2.7	***87.7***
110	Street 'J'	STM 6	STM 7	84.5	0.65	1.32	0.86	0.86	10.00	0.44	109	0.259	4.00	375	0.351	3.2	***73.8***
111	Street 'J'	STM 7	STM 8	69.7	0.65	0.75	0.49	1.34	10.44	0.46	106	0.397	1.60	525	0.544	2.5	***73.0***
112	Street 'H'	STM DCB	STM 8	9.8	0.65	0.32	0.20	0.20	10.00	0.08	109	0.062	2.00	300	0.137	1.9	***45.4***
113	Street 'J'	STM 8	STM 9	78.5	0.65	0.53	0.35	1.89	10.91	0.49	104	0.547	1.50	600	0.752	2.7	***72.8***
114	Fenchurch Manor	STM 9	STM 5	74.1	0.65	0.71	0.46	4.14	11.72	0.35	100	1.150	2.20	675	1.247	3.5	***92.3***
115	Street 'I'	STM 1	STM 2	63.2	0.65	1.10	0.72	0.72	10.00	0.49	109	0.217	1.80	375	0.235	2.1	***92.3***
116	Street 'H'	STM 2	STM 3	87.4	0.65	0.39	0.25	0.97	10.49	0.82	106	0.286	0.80	525	0.385	1.8	***74.4***
117	Lower Street	STM 30	STM 3	66.3	0.65	0.69	0.45	0.45	10.00	0.49	109	0.135	2.00	375	0.248	2.2	***54.6***
118	Lower Street	STM 3	STM 4	75.2	0.65	0.32	0.21	1.63	11.31	0.65	102	0.461	0.80	600	0.549	1.9	***84.0***
119	Fenchurch Manor	STM 4	STM 5	82.1	0.65	0.39	0.25	1.88	11.96	0.63	99	0.517	1.00	600	0.614	2.2	***84.2***
	*Street 'G'	STM 5	STM 14	59.4				6.02	12.59	0.44	96	1.609	0.50	1050	1.931	2.2	***83.3***
120	Street 'G'	STM 15	STM 16	51.3	0.65	0.80	0.52	0.52	10.00	0.67	109	0.158	0.50	450	0.202	1.3	***78.3***
121	Street 'G'	STM 16	STM 17	70.4	0.65	0.41	0.27	0.79	10.67	0.84	105	0.231	0.50	525	0.304	1.4	***75.8***
	Street 'G'	STM 17	STM 18	56.4				0.79	11.51	0.67	101	0.221	0.50	525	0.304	1.4	***72.8***
	Street 'G'	STM 18	STM 19	12.6				0.79	12.18	0.15	98	0.215	0.50	525	0.304	1.4	***70.6***
	Street 'G'	STM 19	STM 14	10.9				0.79	12.33	0.13	97	0.213	0.50	525	0.304	1.4	***70.1***
122	**EASEMENT	STM 14	STM 20	45.9	0.65	0.78	0.51	7.32	13.03	0.41	94	1.917	**0.30**	1200	2.135	1.9	***89.8***
	**SWMF4	STM 20	STM HW 21	14.0				7.32	13.44	0.12	93	1.884	**0.30**	1200	2.135	1.9	***88.2***
Areas and runoff coefficients taken from PF PCSWMM modeling ↓																	
3-EXT					0.56	1.28	0.71										
3	***SWMF3	STM 43 (B.O.)	STM HW 38 (B.O.)	6.5	0.67	35.20	23.71	24.42	15.00	0.04	87	5.903	**0.50**	1650	6.445	3.0	***91.6***
Q= 0.0028*C*I*A (cms);					C=RUNOFF COEFFICIENT;				I-RAINFALL INTENSITY (5 Year) =853.608/(T.C. + 4.699)^0.766;						A=AREA (ha)		

Note: * Circular pipe diameter matches an equivalent area of 865 x 1345mm elliptical pipe. (DECAST Reinforced Concrete Elliptical Pipe)
** Circular pipe diameter matches an equivalent area of 965 x 1525mm elliptical pipe. (DECAST Reinforced Concrete Elliptical Pipe)
*** Circular pipe diameter matches an equivalent area of 1829x 1219mm box culvert. (DECAST Precast Box Culvert)

SANITARY SEWER DESIGN - LOCAL SEWER

Development Details Basis

DESIGN SHEET 1 of 1
FILE NO GOL-14193
CONTRACT / PROJECT

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	1	1A	2A	9	9	3.25	29	29	10.133	4.356	10.133	0.772	0.66	0.66	0.066	0.838	71.9	200	2.00	46.384	0.093	Ok	1.476	0.550	Check
Fenchurch Manor	2	2A	31A	7	16	3.25	23	52	9.032	4.311	9.032	1.223	0.38	1.04	0.104	1.327	48.8	200	1.80	44.004	0.119	Ok	1.401	0.610	Ok
Fenchurch Manor	3	31A	3A	7	23	3.25	23	75	8.399	4.276	8.399	1.635	0.40	1.44	0.144	1.779	48.3	200	1.40	38.808	0.145	Ok	1.235	0.609	Ok
Lower Street	EXT1		12A	280		3.25	910																		
Lower Street	EXT1		12A	408		2.57	1049						24.05	24.05											
Lower Street	5 (Trunk)	12A	13A		688			1959	4.371	3.593	4.371	22.294	0.79	24.84	2.484	24.778	110.0	375	0.50	123.977	0.303	Ok	1.123	0.850	Ok
Lower Street	5A (Local)	12A	13A	13		3.25	42																		
Lower Street	5B (Local)	12A	13A	5	18	2.57	13	55	8.928	4.306	8.928	1.281		0.79	0.079	1.360	110.0	200	1.70	42.764	0.122	Ok	1.361	0.606	Ok
Lower Street	6 (Trunk)	13A	14A		706			2014	4.347	3.583	4.347	22.794	0.50	25.34	2.534	25.328	75.8	375	0.50	123.977	0.306	Ok	1.123	0.855	Ok
Lower Street	6 (Local)	13A	14A	9	9	3.25	29	29	10.133	4.356	10.133	0.772		0.50	0.050	0.822	75.8	200	2.00	46.384	0.092	Ok	1.476	0.550	Check
Street I	7	15A	16A	16	16	3.25	52	52	9.032	4.311	9.032	1.223	0.68	0.68	0.068	1.291	104.4	200	1.80	44.004	0.117	Ok	1.401	0.610	Ok
Street I	8	16A	17A	5	21	3.25	16	68	8.554	4.285	8.554	1.520	0.28	0.96	0.096	1.616	62.5	200	1.50	40.170	0.136	Ok	1.279	0.611	Ok
Street H	9	17A	14A	11	32	3.25	36	104	7.863	4.239	7.863	2.129	0.47	1.43	0.143	2.272	87.0	200	1.10	34.399	0.174	Ok	1.095	0.606	Ok
Lower Street	10 (Trunk)	14A	3A		747			2147	4.291	3.562	4.291	23.993	0.35	27.12	2.712	26.705	75.4	375	0.50	123.977	0.315	Ok	1.123	0.868	Ok
Lower Street	10 (Local)	14A	3A	5	5	3.25	16	16	11.397	4.392	11.397	0.482		0.35	0.035	0.517	75.4	200	2.00	46.384	0.074	Ok	1.476	0.476	Check
Fenchurch Manor	11 (Trunk)	3A	4A		775			2238	4.256	3.547	4.256	24.803	0.51	29.07	2.907	27.710	81.5	375	0.50	123.977	0.321	Ok	1.123	0.876	Ok
Fenchurch Manor	11 (Local)	3A	4A	9	9	3.25	29	29	10.133	4.356	10.133	0.772		0.51	0.051	0.823	81.5	200	2.00	46.384	0.092	Ok	1.476	0.550	Check
Street G	4	9A	8A	10	10	3.25	33	33	9.922	4.349	9.922	0.840	0.62	0.62	0.062	0.902	74.3	200	2.00	46.384	0.096	Ok	1.476	0.566	Check
Street G	12	8A	10A	10	20	3.25	33	65	8.637	4.290	8.637	1.462	0.45	1.07	0.107	1.569	56.9	200	1.50	40.170	0.134	Ok	1.279	0.605	Ok
Street G	13	10A	11A	2	22	3.25	7	72	8.474	4.281	8.474	1.578	0.16	1.23	0.123	1.701	18.0	200	1.40	38.808	0.142	Ok	1.235	0.604	Ok
Street G	14	11A	4A	4	26	3.25	13	85	8.196	4.263	8.196	1.804	0.31	1.54	0.154	1.958	65.4	200	1.30	37.396	0.155	Ok	1.190	0.613	Ok
Fenchurch Manor	15 (Trunk)	4A	5A		810			2352	4.214	3.530	4.214	25.807	0.48	31.1	3.109	28.916	74.4	375	0.50	123.977	0.328	Ok	1.123	0.885	Ok
Fenchurch Manor	15 (Local)	4A	5A	8	8	3.25	26	26	10.375	4.364	10.375	0.702		0.48	0.048	0.750	74.4	200	2.00	46.384	0.088	Ok	1.476	0.534	Check
Street J	16	18A	19A	2	2	3.25	7	7	13.689	4.431	13.689	0.232	0.15	0.15	0.015	0.247	50.3	200	4.00	65.597	0.044	Ok	2.088	0.486	Check
Street J	17	19A	20A	16	18	3.25	52	59	8.821	4.300	8.821	1.344	0.65	0.80	0.080	1.424	103.5	200	2.70	53.893	0.111	Ok	1.715	0.722	Ok
Street H	18	17A	20A	11	11	3.25	36	36	9.735	4.342	9.735	0.906	0.49	0.49	0.049	0.955	77.5	200	2.00	46.384	0.099	Ok	1.476	0.577	Check
Street J	19	20A	5A	6	35	3.25	20	114	7.723	4.228	7.723	2.288	0.33	1.62	0.162	2.450	78.5	200	1.10	34.399	0.180	Ok	1.095	0.619	Ok
Fenchurch Manor	20 (Trunk)	5A	6A		853			2491	4.166	3.510	4.166	27.027	0.41	33.12	3.312	30.339	76.0	375	0.50	123.977	0.336	Ok	1.123	0.898	Ok
Fenchurch Manor	20 (Local)	5A	6A	6	6	3.25	20	20	10.989	4.382	10.989	0.558		0.41	0.041	0.599	76.0	200	2.00	46.384	0.079	Ok	1.476	0.501	Check
Street K	21	4A	22A	18	18	3.25	59	59	8.821	4.300	8.821	1.344	0.78	0.78	0.078	1.422	93.6	200	2.20	48.648	0.117	Ok	1.549	0.675	Ok
Street K	22	22A	6A	9	27	3.25	29	88	8.134	4.259	8.134	1.859	0.44	1.22	0.122	1.981	84.3	200	3.20	58.672	0.125	Ok	1.868	0.849	Ok
Fenchurch Manor	23 (Trunk)	6A	7A		886			2599	4.131	3.495	4.131	27.954	0.76	35.10	3.510	31.464	86.7	375	0.50	123.977	0.343	Ok	1.123	0.905	Ok
Fenchurch Manor	23 (Local)	6A	7A	13	13	3.25	42	42	9.415	4.329	9.415	1.036		0.76	0.076	1.112	86.7	200	2.00	46.384	0.106	Ok	1.476	0.603	Ok
Street D	EXT.2			24		3.25	78						1.29												
Street D	EXT.3			74		3.25	241						3.43												
Street D	EXT.4			50		3.25	163						2.30												
Street E	EXT.5			87		3.25	283						3.71												
Street E	24	23A	24A	17	252	3.25	55	819	5.204	3.854	5.204	11.099	0.70	11.43	1.143	12.242	110.0	200	0.60	25.406	0.489	Ok	0.809	0.781	Ok
Street E	25	24A	7A	9	261	3.25	29	848	5.167	3.845	5.167	11.415	0.46	11.89	1.189	12.604	84.9	200	1.70	42.764	0.371	Ok	1.361	1.151	Ok
Fenchurch Manor	26 (Trunk)	7A	SAP33794		1160			3489	3.894	3.386	3.894	35.385	0.28	47.27	4.727	40.112	77.4	375	0.50	123.977	0.391	Ok	1.123	0.967	Ok
Fenchurch Manor	26 (Local)	7A	SAP33794	3	3	3.25	10	10	12.623	4.416	12.623	0.321		0.28	0.028	0.349	77.4	200	3.00	56.809	0.056	Ok	1.808	0.482	Check

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Saturday, July 17, 2021
Project Name	Lockhart I Subdivision - SWMF3 (Split 6)
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 JF12-20-5 is recommended to meet the water quality objective by treating a flow of 113.6 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 1280 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)
JF12-20-5	20	5	3.6	113.6	1280

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:

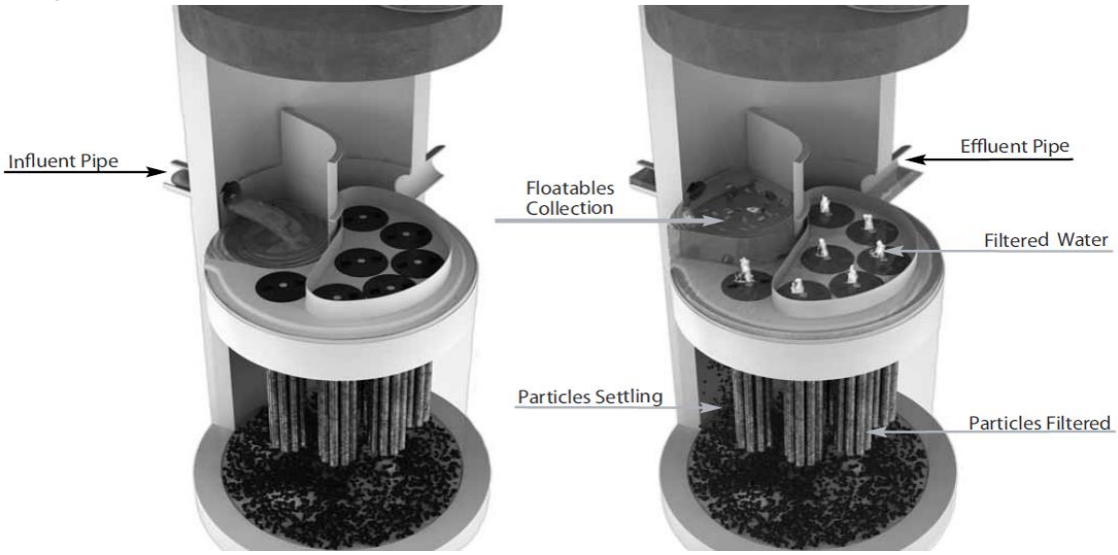
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash 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 I Subdivision - SWMF3 (Split 6)
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:	6.08 ha
Imperviousness:	64.5%

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:	**97.4 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 11378 m³, with a suspended sediment concentration of 60 mg/L.	**683 kg**

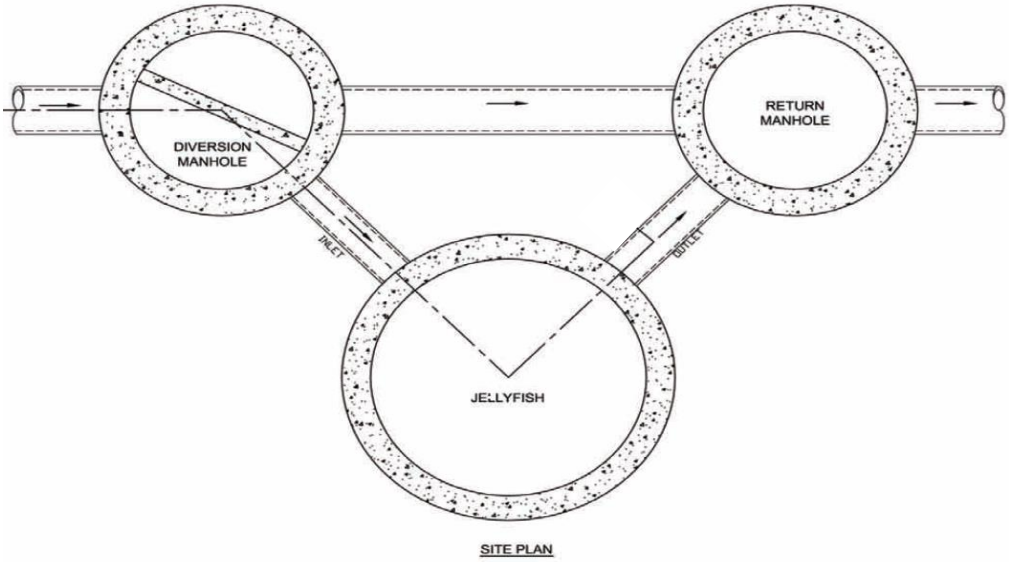
Recommendation

The Jellyfish Filter model JF12-20-5 is recommended to meet the water quality objective by treating a flow of 113.6 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 1280 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

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Saturday, July 17, 2021
Project Name	Lockhart I Subdivision - SWMF4C (Split 3)
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 JF12-20-5 is recommended to meet the water quality objective by treating a flow of 113.6 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 1280 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)
JF12-20-5	20	5	3.6	113.6	1280

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:

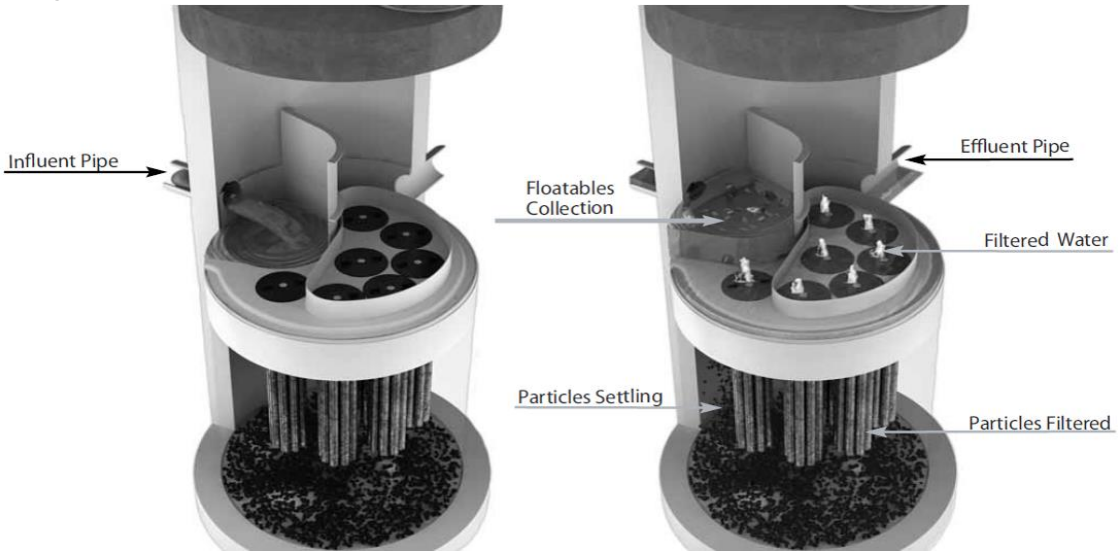
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash 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 I Subdivision - SWMF4C (Split 3)
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:	5.28 ha
Imperviousness:	65%

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:	**86.1 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 9968 m³, with a suspended sediment concentration of 60 mg/L.	**598 kg**

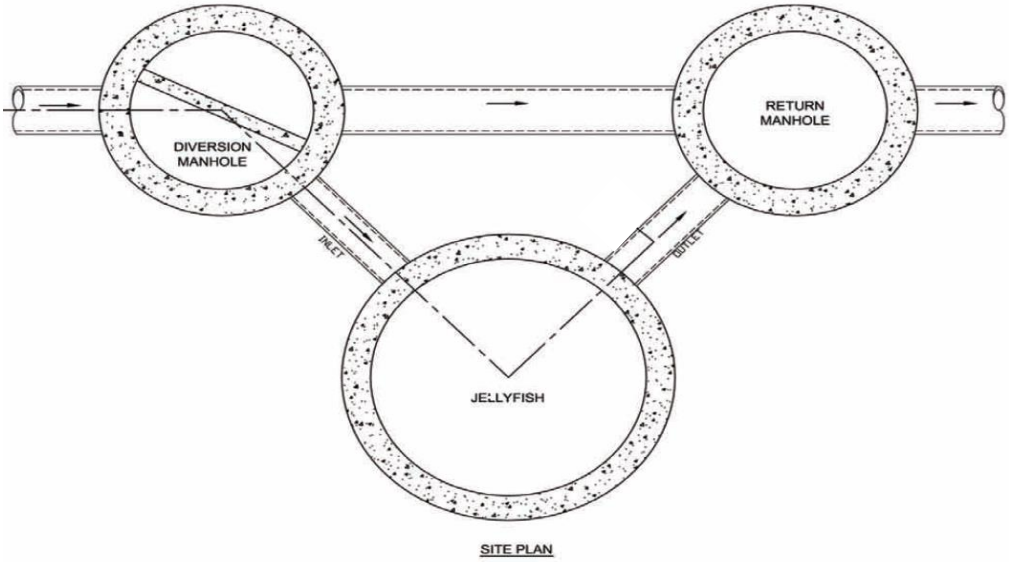
Recommendation

The Jellyfish Filter model JF12-20-5 is recommended to meet the water quality objective by treating a flow of 113.6 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 1280 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.
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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.

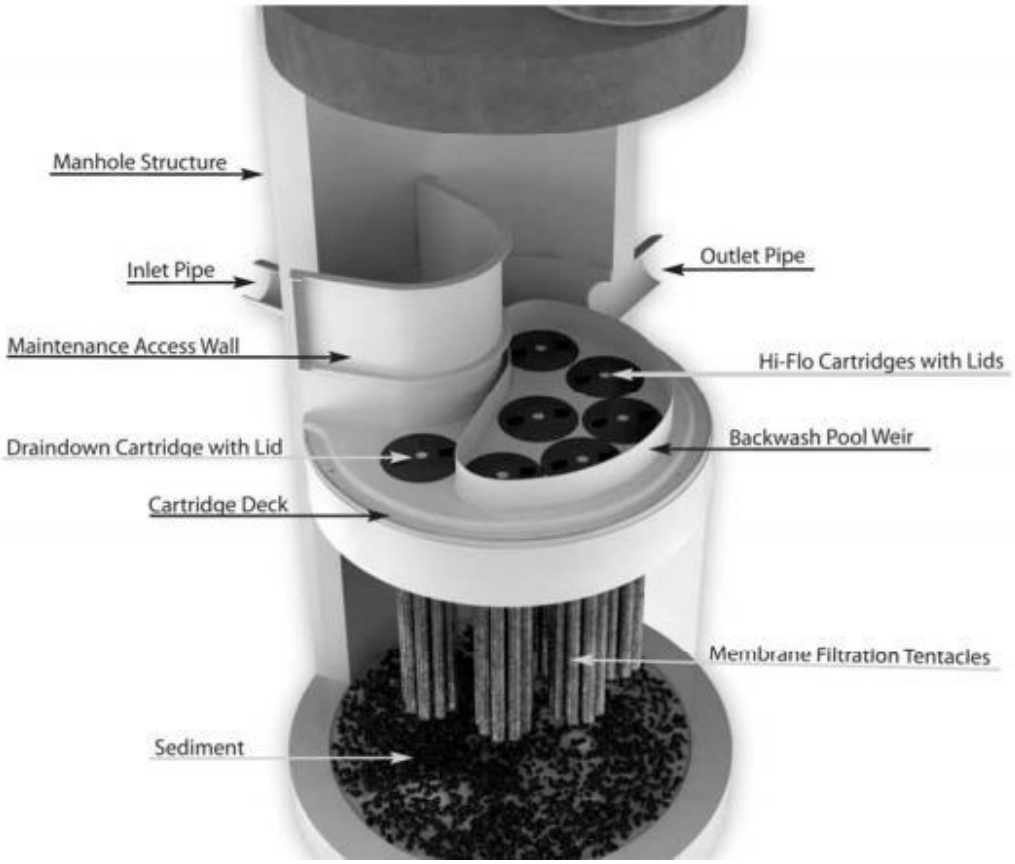

Figure 1. Cut-away graphic of a Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge

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.

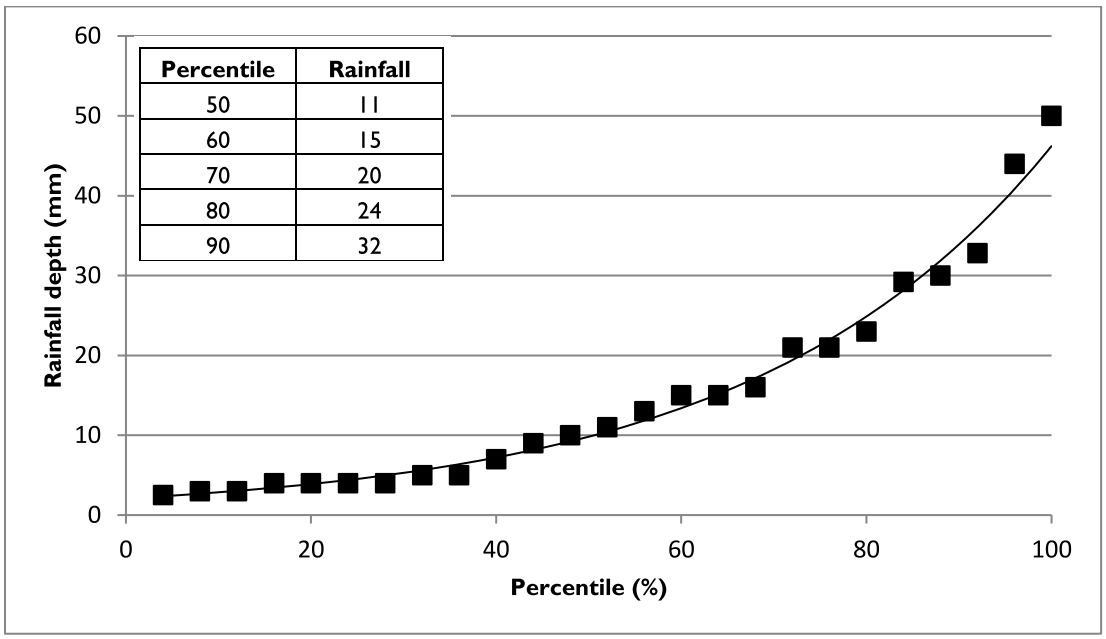

Figure 2. Rainfall depth frequency curve

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.

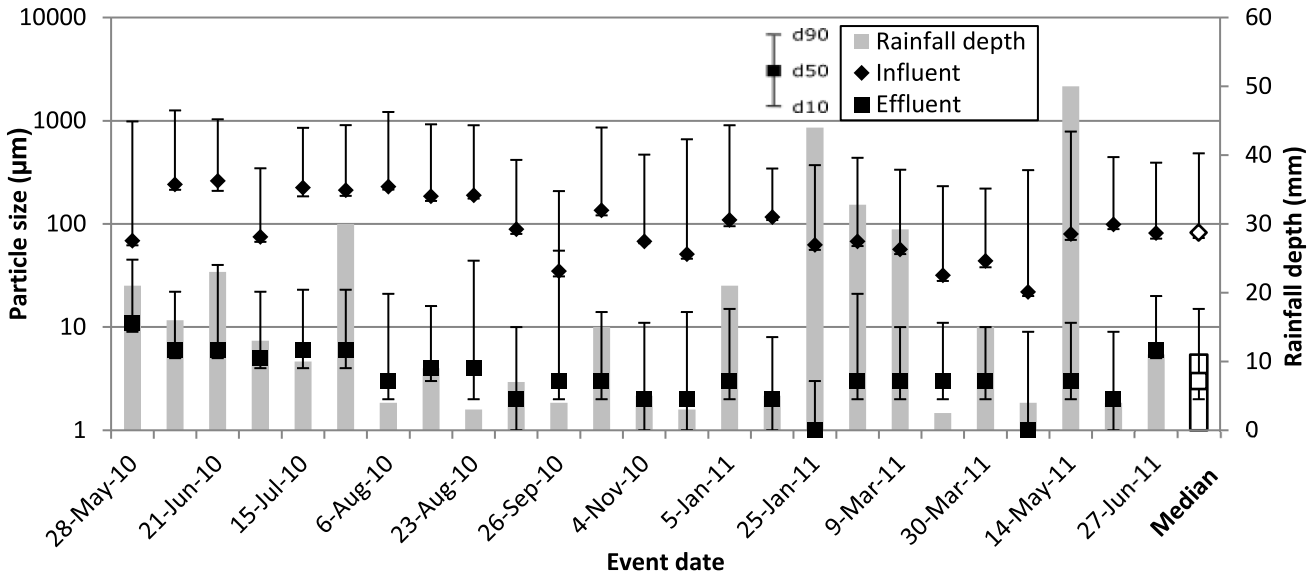

Figure 3. The rainfall depth and d10, d50, and d90 particle sizes of the influent and effluent composite samples for each monitored storm event over the 13-month testing period

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	

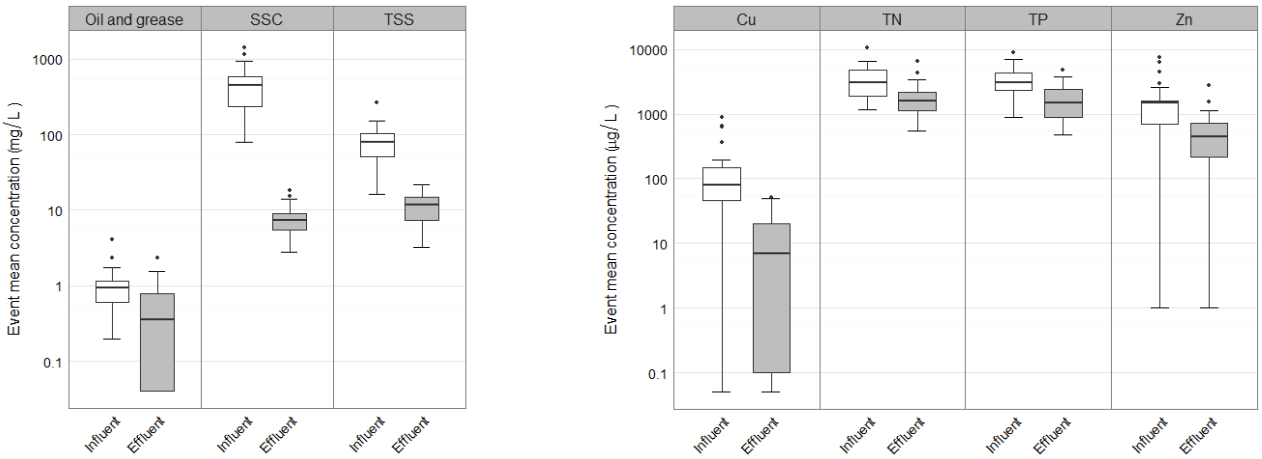

Figure 4. Boxplots showing the distribution of influent and effluent event mean concentrations (EMC) for selected stormwater constituents over the study period

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:

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

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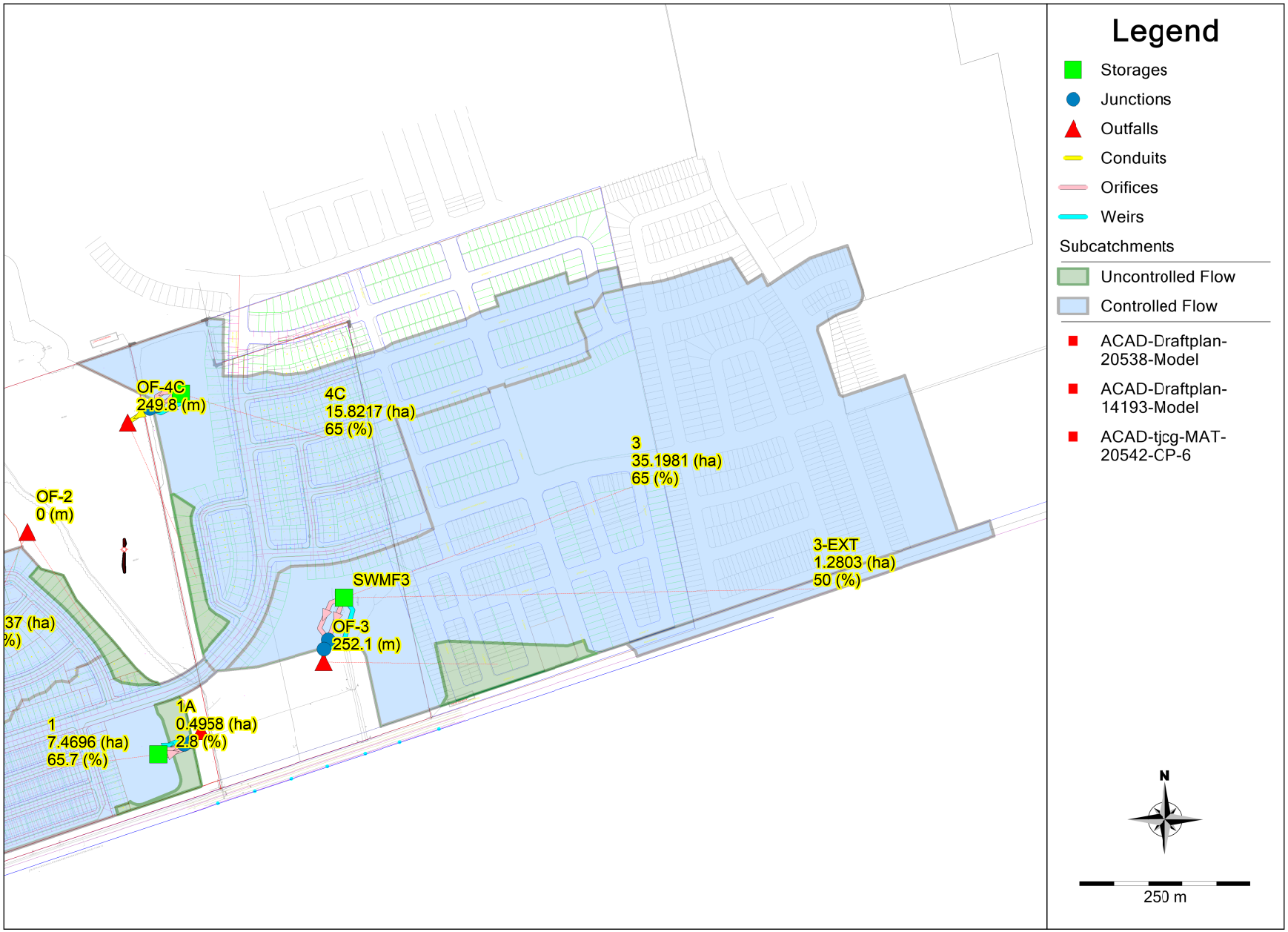
Limitation of verification - Registration: GPS-ETV_VR2020-08-15_Imbrium-JF
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the 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
    - SWMF3: Depth vs. Time – 24hr SCS Type II
    - SWMF4C: Depth vs. Time – 24hr SCS Type II
    - SWMF3: Storage Volume vs. Time – 24hr SCS Type II
    - SWMF4C: Storage Volume vs. Time – 24hr SCS Type II
    - HW-SWMF3: Flow vs. Time – 24hr SCS Type II
    - HW-SWMF4C: Flow vs. Time – 24hr SCS Type II
    - OF-3: Flow vs. Time – 6hr SCS Type II
    - OF-4C: Flow vs. Time – 6hr SCS Type II
    - OF-3: Flow vs. Time – 24hr SCS Type II
    - OF-4C: Flow vs. Time – 24hr SCS Type II
- Digital Modeling Files and PDFs of Model Output

GOL-14193 Lockhart II Post-Dev-PF Model Schematic



GOL-14193 - 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.)
3	SWMF3	WQE-4HR-CHI	SWMF3	35.1981	8799.5	40	2	65.0	0.013	0.15	2	5	0	PERVIOUS	50		0		109.98	10.92	0.368
3A	Uncontrolled	WQE-4HR-CHI	OF-3	1.1822	454.69	26	2	54.0	0.013	0.15	2	5	0	PERVIOUS	50		0		109.98	10.92	0.368
3-EXT	SWMF3	WQE-4HR-CHI	SWMF3	1.2803	512.12	25	2	50.0	0.013	0.15	2	5	0	OUTLET	100		0		109.98	10.92	0.368
4C	SWMF4C	WQE-4HR-CHI	SWMF4C	15.8217	3515.9	45	2	65.0	0.013	0.15	2	5	0	PERVIOUS	50		0		109.98	10.92	0.368
4C-1	Uncontrolled	WQE-4HR-CHI	OF-4C	0.5448	247.64	22	2	30.0	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								
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	0.18	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
****

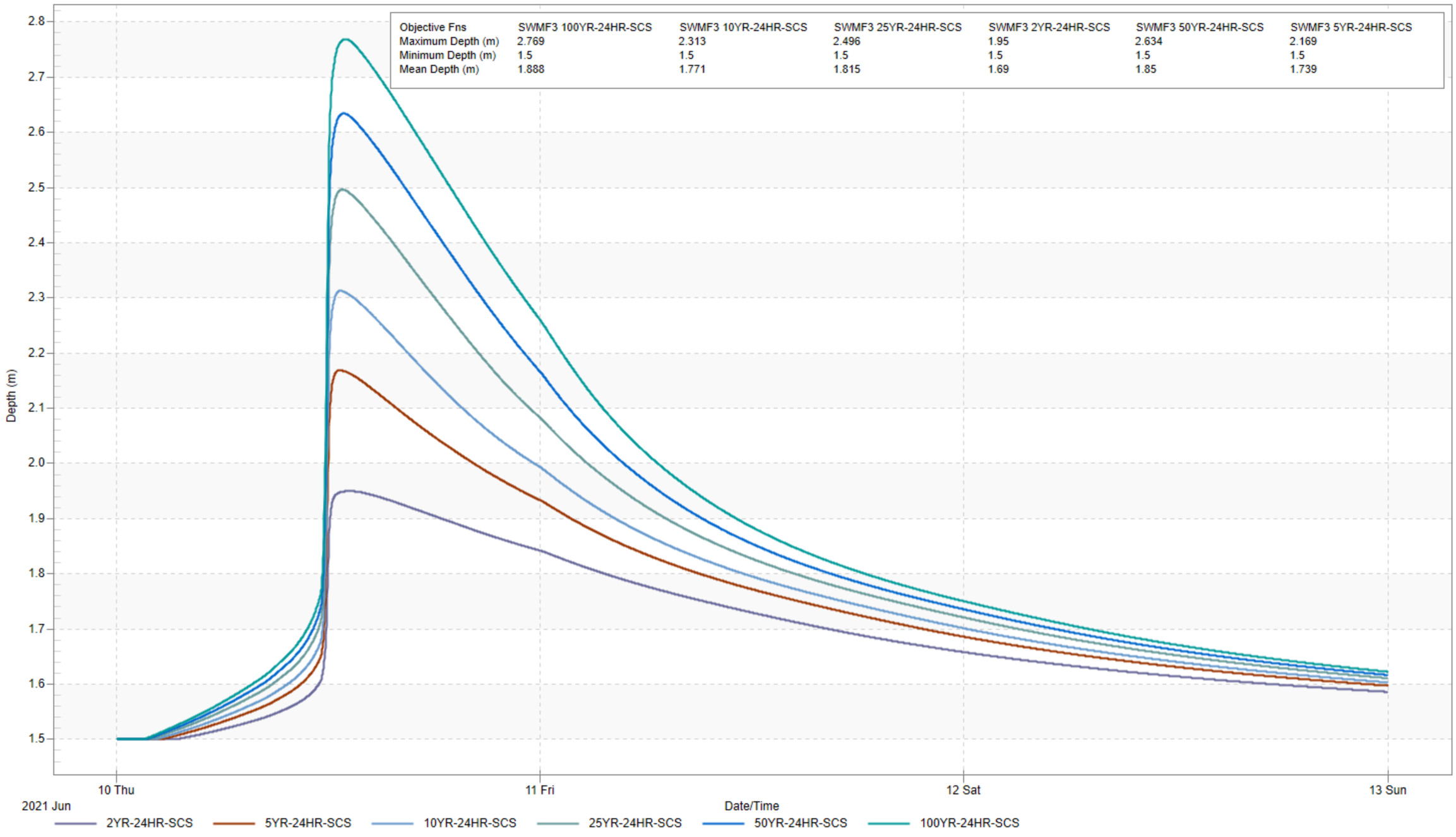
No conduits were surcharged.

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 SWMF3

SWMF3: Depth vs. Time - 24 hour SCS Type II

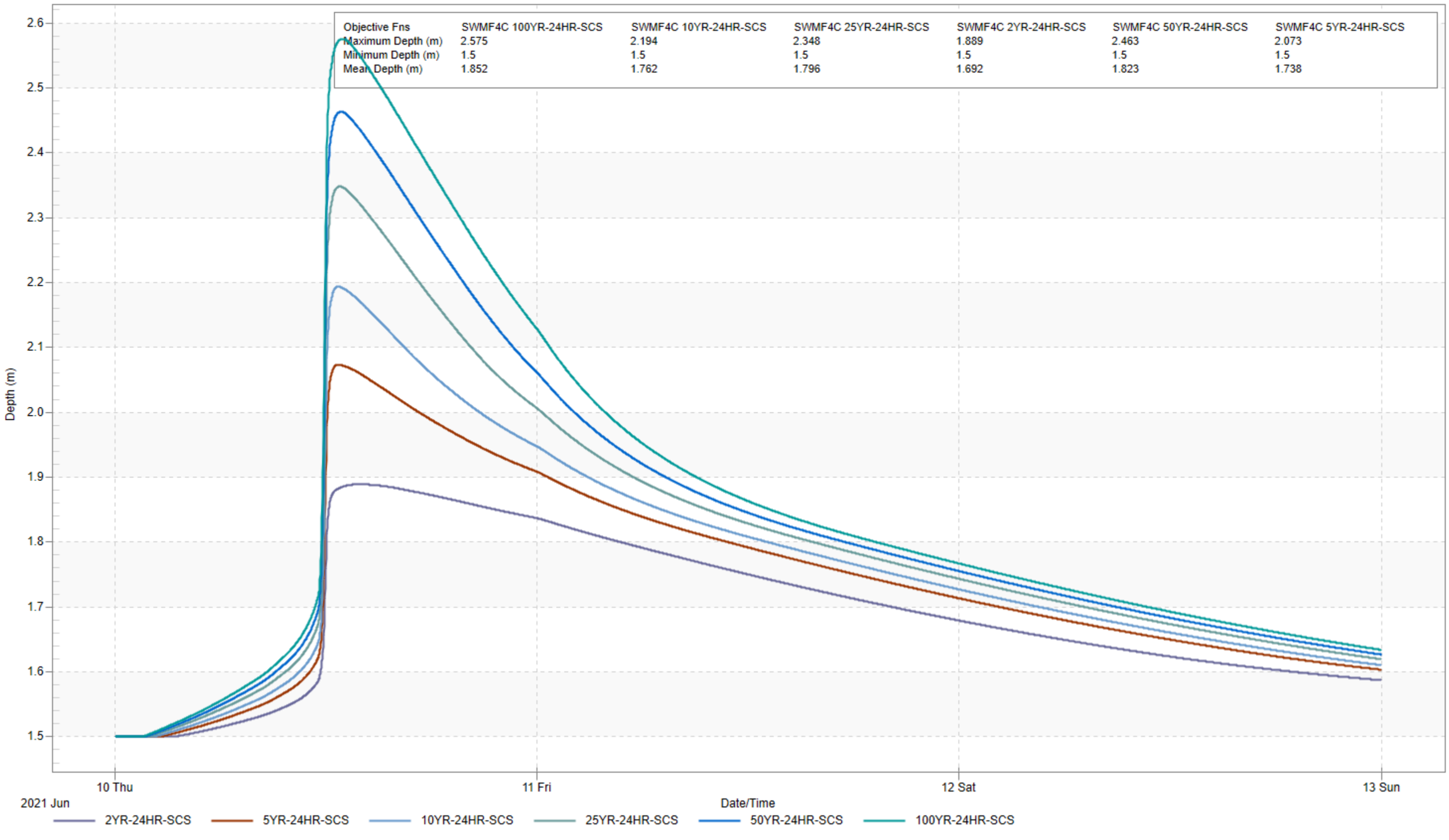
Objective Fns	SWMF3 100YR-24HR-SCS	SWMF3 10YR-24HR-SCS	SWMF3 25YR-24HR-SCS	SWMF3 2YR-24HR-SCS	SWMF3 50YR-24HR-SCS	SWMF3 5YR-24HR-SCS
Maximum Depth (m)	2.769	2.313	2.496	1.95	2.634	2.169
Minimum Depth (m)	1.5	1.5	1.5	1.5	1.5	1.5
Mean Depth (m)	1.888	1.771	1.815	1.69	1.85	1.739



Node SWMF4C

SWMF4C: Depth vs. Time - 24 hour SCS Type II

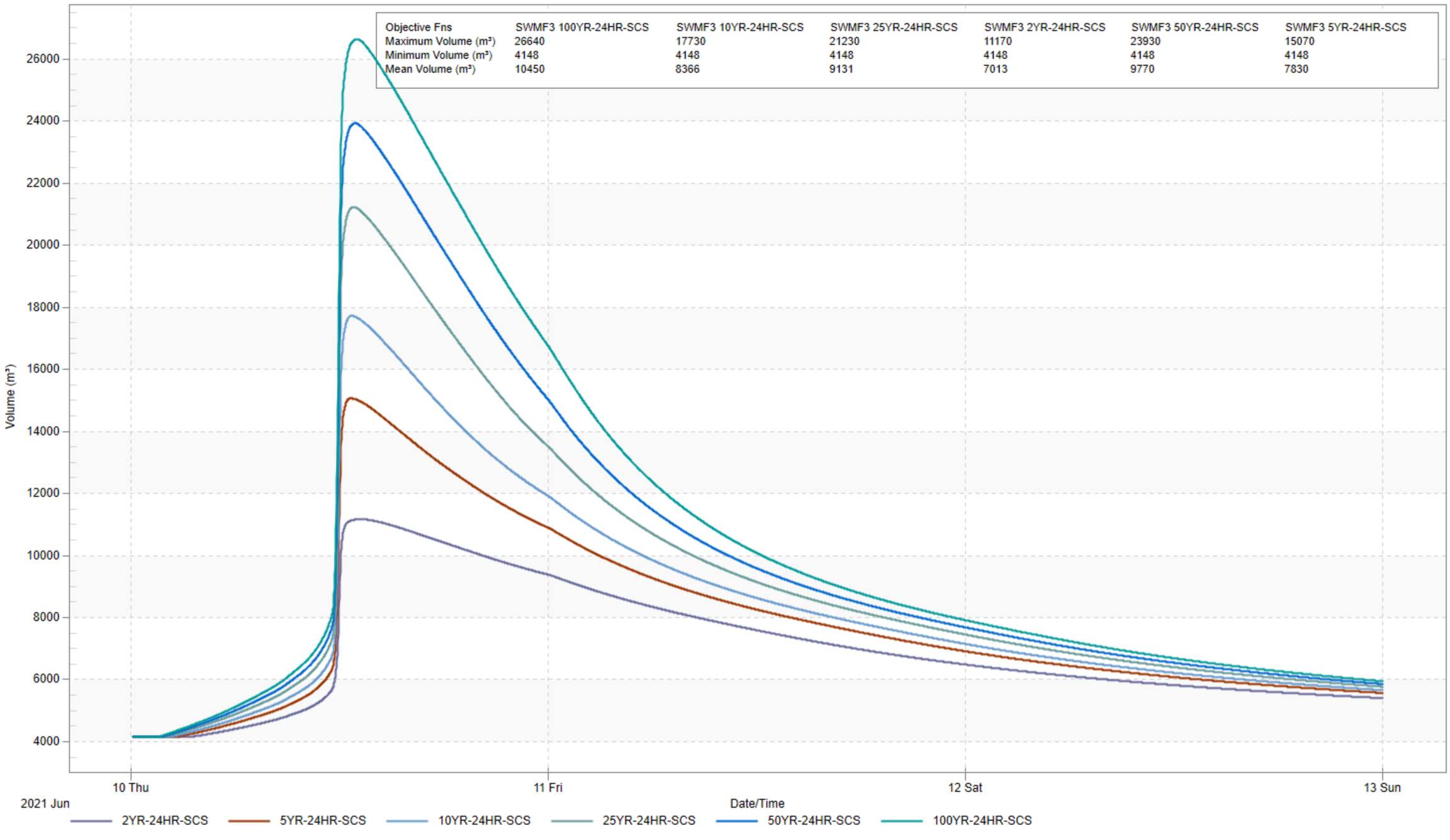
Objective Fns	SWMF4C 100YR-24HR-SCS	SWMF4C 10YR-24HR-SCS	SWMF4C 25YR-24HR-SCS	SWMF4C 2YR-24HR-SCS	SWMF4C 50YR-24HR-SCS	SWMF4C 5YR-24HR-SCS
Maximum Depth (m)	2.575	2.194	2.348	1.889	2.463	2.073
Minimum Depth (m)	1.5	1.5	1.5	1.5	1.5	1.5
Mean Depth (m)	1.852	1.762	1.796	1.692	1.823	1.738



Node SWMF3

SWMF3: Storage Volume vs. Time - 24 hour SCS Type II

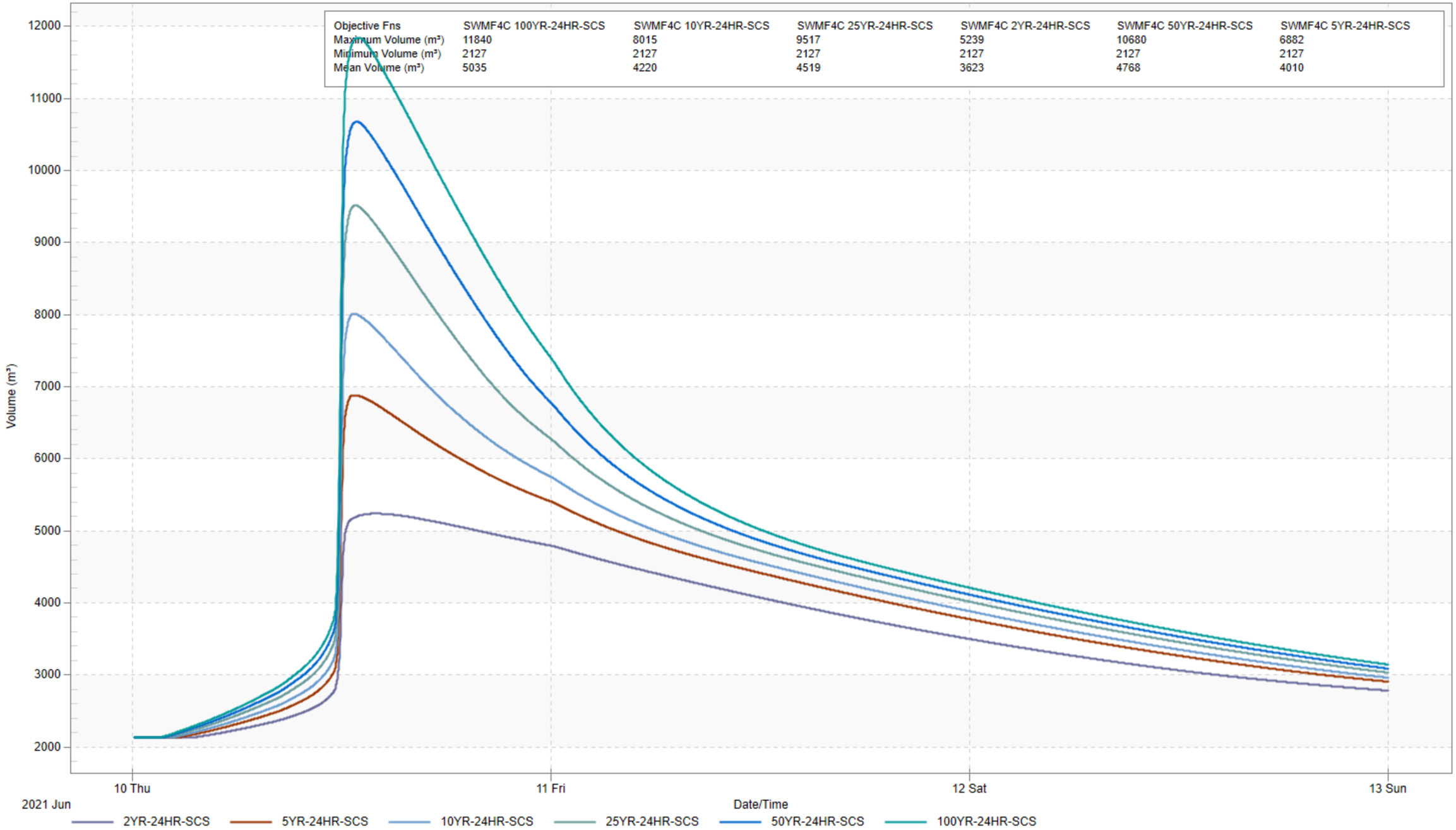
Objective Fns	SWMF3 100YR-24HR-SCS	SWMF3 10YR-24HR-SCS	SWMF3 25YR-24HR-SCS	SWMF3 2YR-24HR-SCS	SWMF3 50YR-24HR-SCS	SWMF3 5YR-24HR-SCS
Maximum Volume (m³)	26640	17730	21230	11170	23930	15070
Minimum Volume (m³)	4148	4148	4148	4148	4148	4148
Mean Volume (m³)	10450	8366	9131	7013	9770	7830



Node SWMF4C

SWMF4C: Storage Volume vs. Time - 24 hour SCS Type II

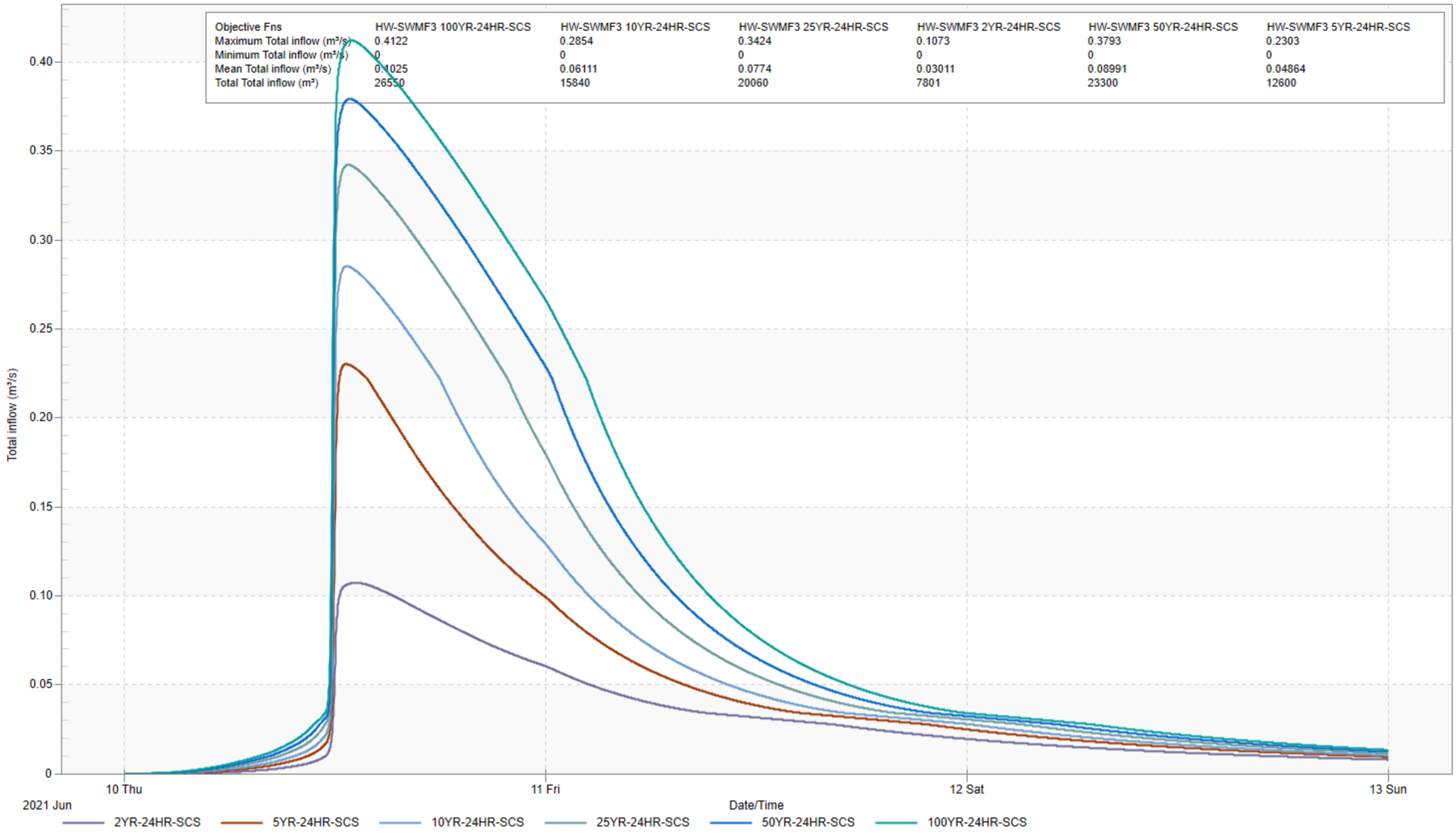
Objective Fns	SWMF4C 100YR-24HR-SCS	SWMF4C 10YR-24HR-SCS	SWMF4C 25YR-24HR-SCS	SWMF4C 2YR-24HR-SCS	SWMF4C 50YR-24HR-SCS	SWMF4C 5YR-24HR-SCS
Maximum Volume (m³)	11840	8015	9517	5239	10680	6882
Minimum Volume (m³)	2127	2127	2127	2127	2127	2127
Mean Volume (m³)	5035	4220	4519	3623	4768	4010



Node HW-SWMF3

HW-SWMF3: Flow vs. Time - 24 hour SCS Type II

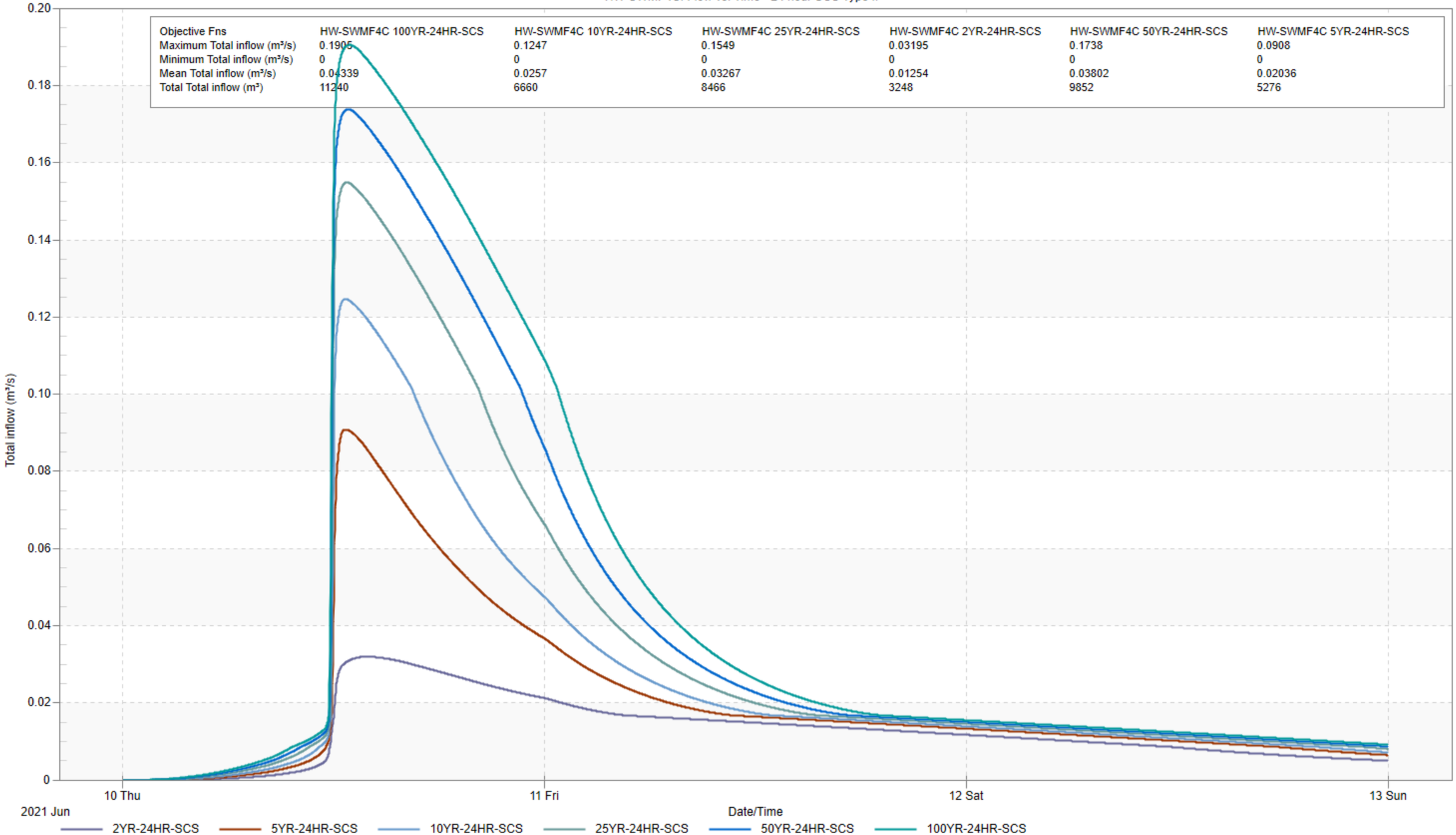
Objective Fns	HW-SWMF3 100YR-24HR-SCS	HW-SWMF3 10YR-24HR-SCS	HW-SWMF3 25YR-24HR-SCS	HW-SWMF3 2YR-24HR-SCS	HW-SWMF3 50YR-24HR-SCS	HW-SWMF3 5YR-24HR-SCS
Maximum Total inflow (m³/s)	0.4122	0.2854	0.3424	0.1073	0.3793	0.2303
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.1025	0.06111	0.0774	0.03011	0.08991	0.04864
Total Total inflow (m³)	26550	15840	20060	7801	23300	12600



Node HW-SWMF4C

HW-SWMF4C: Flow vs. Time - 24 hour SCS Type II

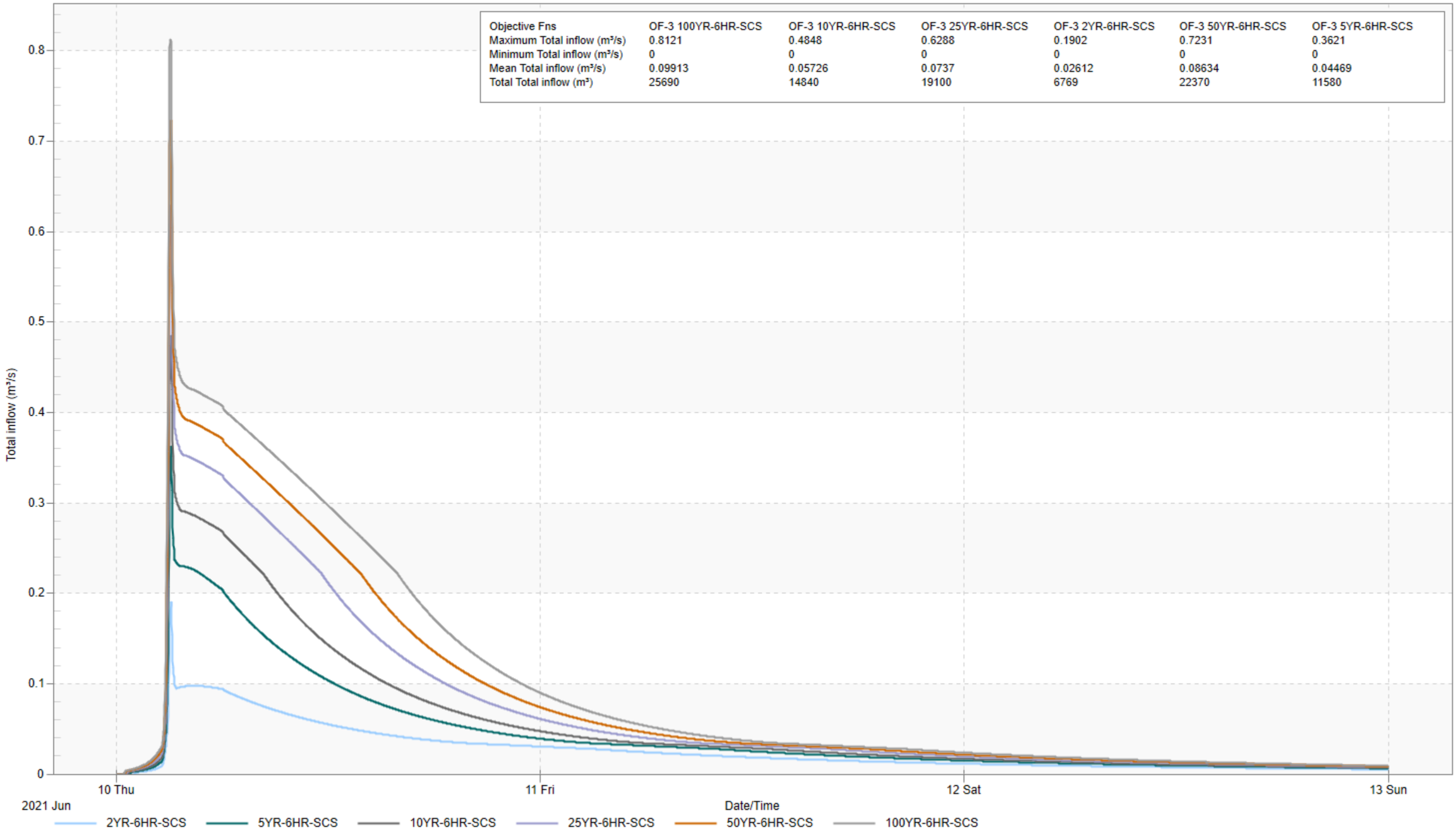
Objective Fns	HW-SWMF4C 100YR-24HR-SCS	HW-SWMF4C 10YR-24HR-SCS	HW-SWMF4C 25YR-24HR-SCS	HW-SWMF4C 2YR-24HR-SCS	HW-SWMF4C 50YR-24HR-SCS	HW-SWMF4C 5YR-24HR-SCS
Maximum Total inflow (m³/s)	0.1905	0.1247	0.1549	0.03195	0.1738	0.0908
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.04339	0.0257	0.03267	0.01254	0.03802	0.02036
Total Total inflow (m³)	11240	6660	8466	3248	9852	5276



Node OF-3

OF-3: Flow vs. Time - 6 hour SCS Type II

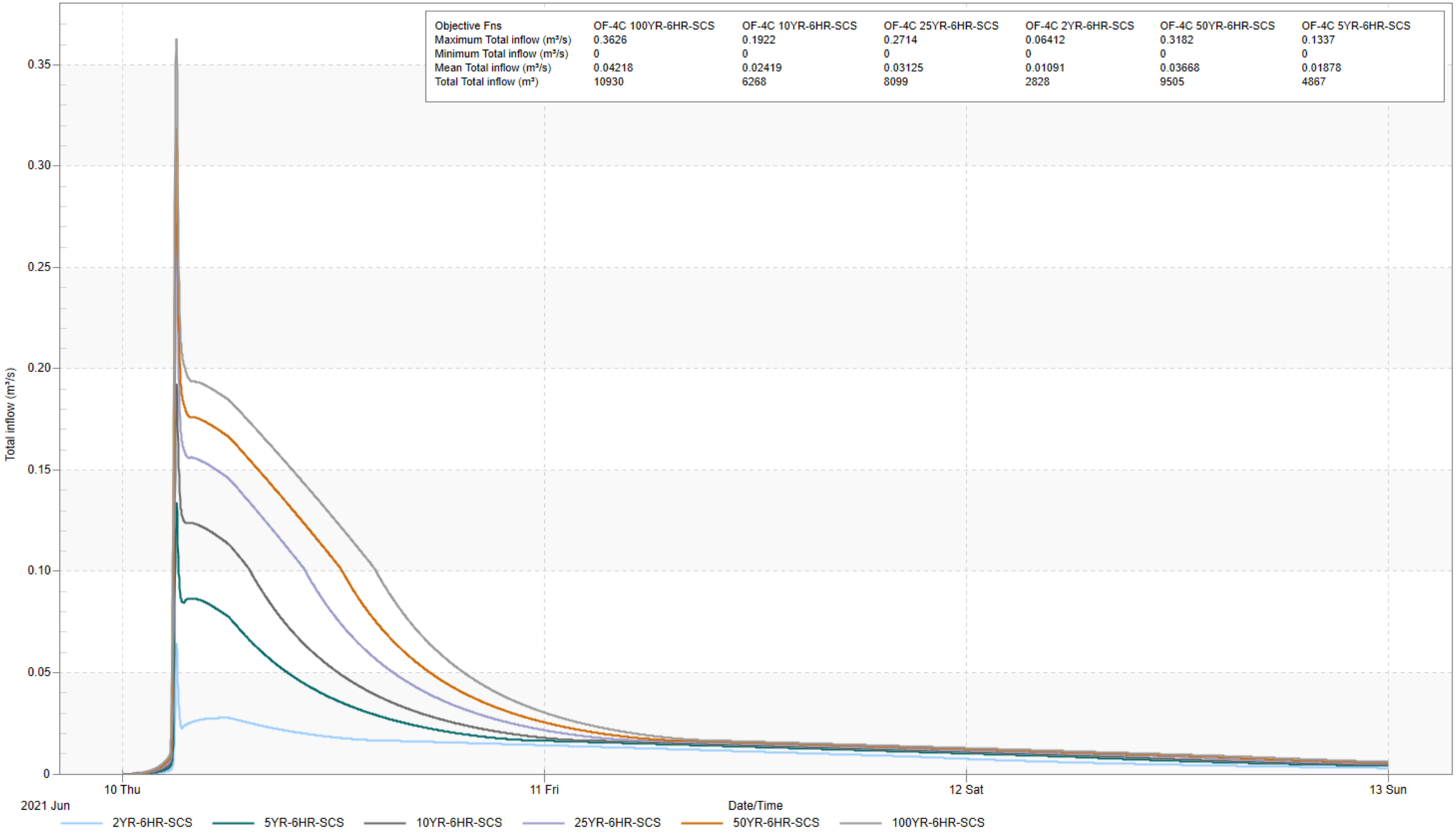
Objective Fns	OF-3 100YR-6HR-SCS	OF-3 10YR-6HR-SCS	OF-3 25YR-6HR-SCS	OF-3 2YR-6HR-SCS	OF-3 50YR-6HR-SCS	OF-3 5YR-6HR-SCS
Maximum Total inflow (m³/s)	0.8121	0.4848	0.6288	0.1902	0.7231	0.3621
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.09913	0.05726	0.0737	0.02612	0.08634	0.04469
Total Total inflow (m³)	25690	14840	19100	6769	22370	11580



Node OF-4C

OF-4C: Flow vs. Time - 6 hour SCS Type II

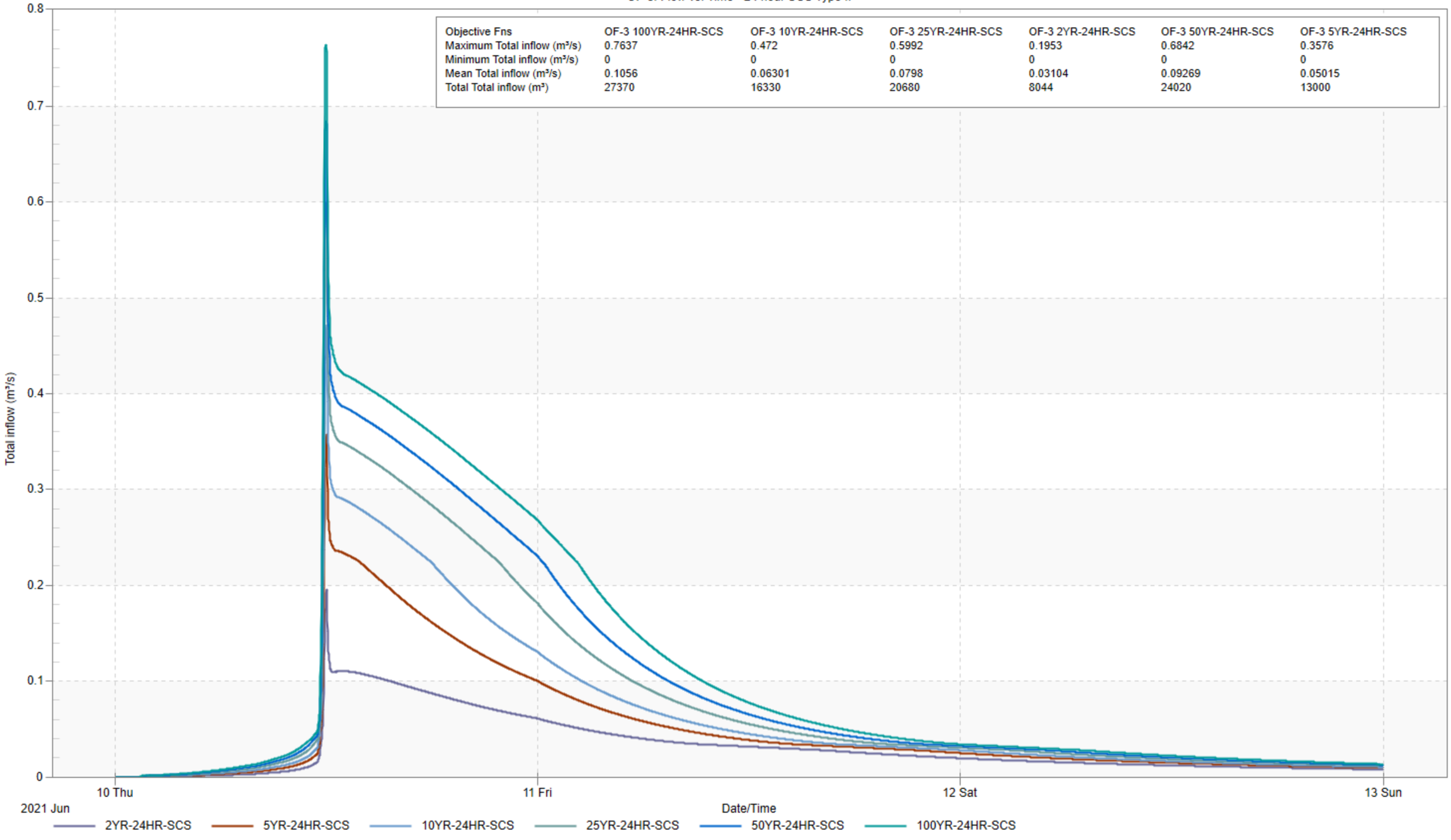
Objective Fns	OF-4C 100YR-6HR-SCS	OF-4C 10YR-6HR-SCS	OF-4C 25YR-6HR-SCS	OF-4C 2YR-6HR-SCS	OF-4C 50YR-6HR-SCS	OF-4C 5YR-6HR-SCS
Maximum Total inflow (m³/s)	0.3626	0.1922	0.2714	0.06412	0.3182	0.1337
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.04218	0.02419	0.03125	0.01091	0.03668	0.01878
Total Total inflow (m³)	10930	6268	8099	2828	9505	4867



Node OF-3

OF-3: Flow vs. Time - 24 hour SCS Type II

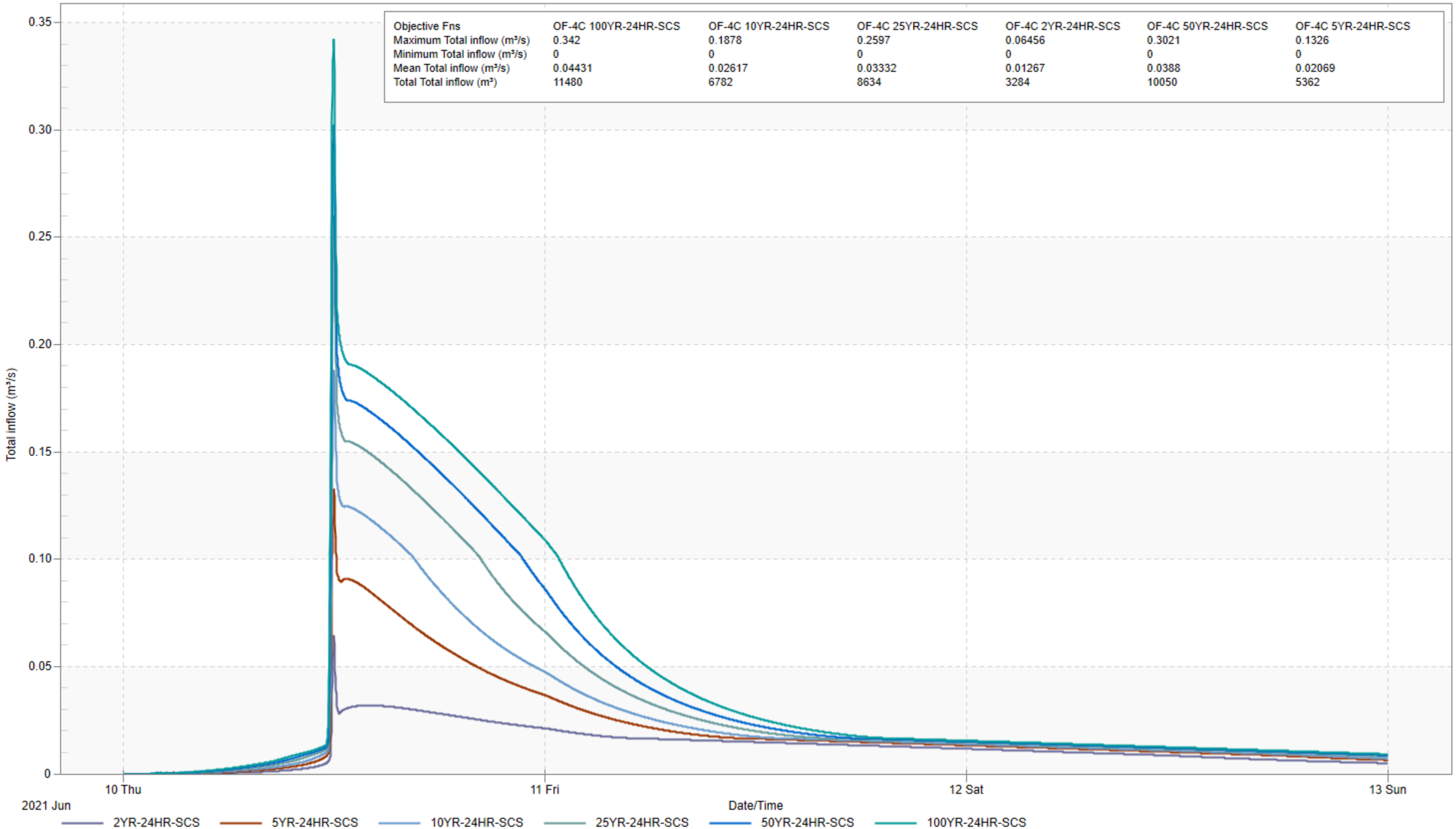
Objective Fns	OF-3 100YR-24HR-SCS	OF-3 10YR-24HR-SCS	OF-3 25YR-24HR-SCS	OF-3 2YR-24HR-SCS	OF-3 50YR-24HR-SCS	OF-3 5YR-24HR-SCS
Maximum Total inflow (m³/s)	0.7637	0.472	0.5992	0.1953	0.6842	0.3576
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.1056	0.06301	0.0798	0.03104	0.09269	0.05015
Total Total inflow (m³)	27370	16330	20680	8044	24020	13000



Node OF-4C

OF-4C: Flow vs. Time - 24 hour SCS Type II

Objective Fns	OF-4C 100YR-24HR-SCS	OF-4C 10YR-24HR-SCS	OF-4C 25YR-24HR-SCS	OF-4C 2YR-24HR-SCS	OF-4C 50YR-24HR-SCS	OF-4C 5YR-24HR-SCS
Maximum Total inflow (m³/s)	0.342	0.1878	0.2597	0.06456	0.3021	0.1326
Minimum Total inflow (m³/s)	0	0	0	0	0	0
Mean Total inflow (m³/s)	0.04431	0.02617	0.03332	0.01267	0.0388	0.02069
Total Total inflow (m³)	11480	6782	8634	3284	10050	5362



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 I Subdivision	Date:	Oct-21
	File No.:	GOL-14193	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-4C-1	4C-501	50	20	950	285.00	0	0	0	0	1300	OK	605.00
LID-4C-2	4C-502	50	20	950	285.00	0	0	0	0	1300	OK	605.00
LID-4C-3	4C-503	50	20	825	247.50	0	0	0	0	1175	OK	567.50
LID-4C-4	4C-504	50	20	950	285.00	0	0	0	0	1300	OK	605.00
LID-4C-5	4C-505	50	20	1650	495.00	0	0	0	0	2000	OK	815.00
LID-4C-6	4C-506	50	20	1850	555.00	0	0	0	0	2200	OK	875.00
LID-4C-7	4C-507	50	20	1950	585.00	0	0	0	0	2300	OK	905.00
LID-4C-8	4C-508	50	20	1575	472.50	0	0	0	0	1925	OK	792.50

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS	Project:	Lockhart I Subdivision	Date:	Oct-21
	File No.:	GOL-14193	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 RequiredVolume (cu.m)
LID-4C-1	4C-501	0.12	65%	13	23.00	2.00	1.30	50.0	0.35	11.50	4.20
LID-4C-2	4C-502	0.09	65%	13	50.00	2.00	1.30	104.0	0.35	25.00	3.15
LID-4C-3	4C-503	0.14	65%	13	25.00	2.00	1.18	54.0	0.35	12.50	4.90
LID-4C-4	4C-504	0.20	65%	13	25.00	2.00	1.30	54.0	0.35	12.50	7.00
LID-4C-5	4C-505	0.18	65%	13	25.00	2.00	2.00	54.0	0.35	12.50	6.30
LID-4C-6	4C-506	0.45	65%	13	50.00	2.00	2.20	104.0	0.35	25.00	15.75
LID-4C-7	4C-507	0.06	65%	13	25.30	2.00	2.30	54.6	0.35	12.65	2.10
LID-4C-8	4C-508	0.09	65%	13	25.00	2.00	1.93	54.0	0.35	12.50	3.15

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 Investments Limited Subdivison (GOL-14193) drawings LID-1 and LID-2 for details.

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS	Project:	Lockhart I Subdivision	Date:	Oct-21
	File No.:	GOL-14193	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-4C-1	4C-501	19.50	3.90	3.23	46.00	27.83	12.52
LID-4C-2	4C-502	14.63	2.93	2.42	100.00	60.50	12.64
LID-4C-3	4C-503	22.75	4.55	4.17	50.00	28.38	11.92
LID-4C-4	4C-504	32.50	6.50	5.38	50.00	30.25	12.54
LID-4C-5	4C-505	29.25	5.85	3.15	50.00	40.75	15.74
LID-4C-6	4C-506	73.13	14.63	7.16	100.00	87.50	16.75
LID-4C-7	4C-507	9.75	1.95	0.91	50.60	45.79	17.00
LID-4C-8	4C-508	14.63	2.93	1.64	50.00	39.63	15.42

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. Volume from PCSWMM model results.
3. Refer to Lockhart Innisfil Investments Limited Subdivison (GOL-14193) drawings LID-1 and LID-2 for details.

LID Summary									
LID Name (Dwg. GOL-14193 LID-1)	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-4C-1	4C-501	0.12	65%	23.00	2.00	1.30	27.83	663%	143%
LID-4C-2	4C-502	0.09	65%	50.00	2.00	1.30	60.50	1921%	414%
LID-4C-3	4C-503	0.14	65%	25.00	2.00	1.18	28.38	579%	125%
LID-4C-4	4C-504	0.20	65%	25.00	2.00	1.30	30.25	432%	93%
LID-4C-5	4C-505	0.18	65%	25.00	2.00	2.00	40.75	647%	139%
LID-4C-6	4C-506	0.45	65%	50.00	2.00	2.20	87.50	556%	120%
LID-4C-7	4C-507	0.06	65%	25.30	2.00	2.30	45.79	2181%	470%
LID-4C-8	4C-508	0.09	65%	25.00	2.00	1.93	39.63	1258%	271%
	Total:	1.33					Average:	1029%	222%

Ontario
MINISTRY OF THE ENVIRONMENT

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

Project DEVELOPMENT Summary

DEVELOPMENT: Lockhart Innisfil I Development
Subwatershed: Lovers Creek

Total Pre-Development Area (ha):	**15.760**	Total Pre-Development Phosphorus Load (kg/yr):	**2.52**

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Cropland	15.76	0.16	2.52

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	0.54	1.32	NONE	0%	0.71
			uncontrolled/untreated flow		
High Intensity - Residential	1.33	1.32	Treatment Train Approach	99%	0.03
			Perforated Pipe infiltration @87%, Jellyfish Filter @49%, Wet pond @77% = 98.5% efficiency		
High Intensity - Residential	8.81	1.32	Other	88%	1.37
			Treatment Train: Jellyfish Filter @ 49%, Wet Pond @ 77% = 88.2% efficiency		
Open Water	5.08	0.26	Constructed Wetlands	77%	0.30
			Pond block		

		P Load (kg/yr)
Post-Development Area Altered:	**15.76**	
Total Pre-Development Area:	**15.76**	
Unaffected Area:	**0**	
Pre-Development:		**2.52**
Post-Development:		**15.42**
Change (Pre - Post):		**-12.90**
511% Net Increase in Load		
Post-Development (with BMPs):		**2.42**
Change (Pre - Post):		**0.11**
4% Net Reduction in Load		

DEVELOPMENT: **Lockhart Innisfil I Development**
Subwatershed: **Lovers Creek**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	**P Load (kg/yr)**
Pre-Development:	**2.52**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**2.42**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**0.11**
Conclusion:	**4% 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

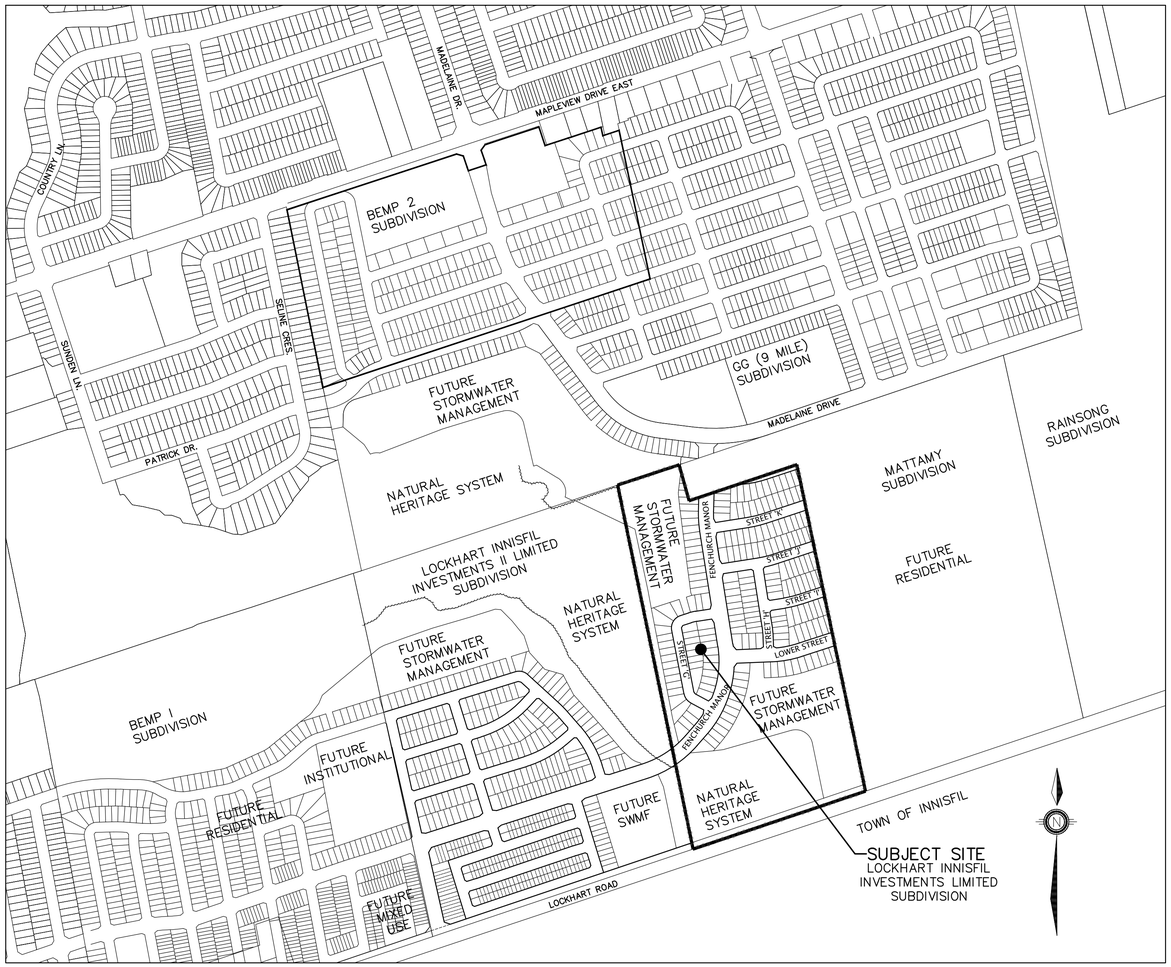
Stormwater Management Drawings

- G-1 General Servicing Plan
- G-2 General Servicing Plan
- GP-1 Grading Plan
- GP-2 Grading Plan
- GP-3 Grading Plan
- GP-4 Grading Plan
- GP-5 Grading Plan
- GP-6 Grading Plan
- STM-1 Storm Sewer Sub-Catchment Plan
- STM-2 Storm Sewer Sub-Catchment Plan
- SWM-1 Post-Development Drainage Area Plan SWM Facilities 3& 4C
- LID-1 LID Sub-Catchment Plan
- LID-2 LID Sections and Details Dry Swales
- SAN-1 Sanitary Drainage Area Plan
- SAN-2 Sanitary Drainage Area Plan
- DS-1 Design Sheets
- PND-1 SWM Facility No. 4C Plan View
- PND-2 SWM Facility No. 4C Sections
- PND-3 SWM Facility No. 4C Details
- PND-4 SWM Facility No. 3 Plan View
- PND-5 SWM Facility No. 3 Sections
- PND-6 SWM Facility No. 3 Details
- PP-1 Plan and Profile Fenchurch Manor STA 1+540 To 1+740
- PP-2 Plan and Profile Fenchurch Manor STA 1+740 To 1+980
- PP-3 Plan and Profile Fenchurch Manor STA 1+980 To 2+212
- PP-4 Plan and Profile Lower Street STA 0+000 To 0+280
- PP-5 Plan and Profile Street 'G' STA 0+000 To 0+274
- PP-6 Plan and Profile Street 'H' STA 0+000 To 0+174
- PP-7 Plan and Profile Street 'I' STA 0+000 To 0+200
- PP-8 Plan and Profile Street 'J' STA 0+000 To 0+260
- PP-9 Plan and Profile Street 'K' STA 0+000 To 0+240
- PP-10 Plan and Profile External Street 'E' STA 0+000 To 0+220

LOCKHART INNISFIL INVESTMENTS LIMITED.
560 LOCKHART ROAD, CITY OF BARRIE
CITY FILE: D28-023-2020

DRAWING LEGEND

TITLE	TITLE PAGE
G-1	GENERAL SERVICING PLAN
G-2	GENERAL SERVICING PLAN
GP-1	GRADING PLAN
GP-2	GRADING PLAN
GP-3	GRADING PLAN
GP-4	GRADING PLAN
GP-5	GRADING PLAN
GP-6	GRADING PLAN
STM-1	STORM SEWER SUB-CATCHMENT PLAN
STM-2	STORM SEWER SUB-CATCHMENT PLAN
SWM-1	POST-DEVELOPMENT DRAINAGE AREA PLAN SWM FACILITIES 3 & 4C
LID-1	LID SUB-CATCHMENT PLAN
LID-2	LID SECTIONS AND DETAILS DRY SWALES
SAN-1	SANITARY DRAINAGE AREA PLAN
SAN-2	SANITARY DRAINAGE AREA PLAN
DS-1	DESIGN SHEETS
PND-1	SWM FACILITY NO. 4C PLAN VIEW
PND-2	SWM FACILITY NO. 4C SECTIONS
PND-3	SWM FACILITY NO. 4C DETAILS
PND-4	SWM FACILITY NO. 3 PLAN VIEW
PND-5	SWM FACILITY NO. 3 SECTIONS
PND-6	SWM FACILITY NO. 3 DETAILS
PP-1	PLAN AND PROFILE FENCHURCH MANOR STA 1+540 TO 1+740
PP-2	PLAN AND PROFILE FENCHURCH MANOR STA 1+740 TO 1+980
PP-3	PLAN AND PROFILE FENCHURCH MANOR STA 1+980 TO 2+212
PP-4	PLAN AND PROFILE LOWER STREET STA 0+000 TO 0+280
PP-5	PLAN AND PROFILE STREET 'G' STA 0+000 TO 0+274
PP-6	PLAN AND PROFILE STREET 'H' STA 0+000 TO 0+174
PP-7	PLAN AND PROFILE STREET 'I' STA 0+000 TO 0+200
PP-8	PLAN AND PROFILE STREET 'J' STA 0+000 TO 0+260
PP-9	PLAN AND PROFILE STREET 'K' STA 0+000 TO 0+240
PP-10	PLAN AND PROFILE EXTERNAL STREET 'E' STA 0+000 TO 0+220



MUNICIPALITY:

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BARRIE, ON L4M 4T5
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CLIENT:

LOCKHART INNISFIL INVESTMENTS LIMITED

DEVELOPER'S ENGINEER:

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229 Mapleview Dr. E, Unit 1
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TJCG PROJECT # GOL-14193

SUBMISSION FOR DRAFT PLAN APPROVAL - OCTOBER 2021

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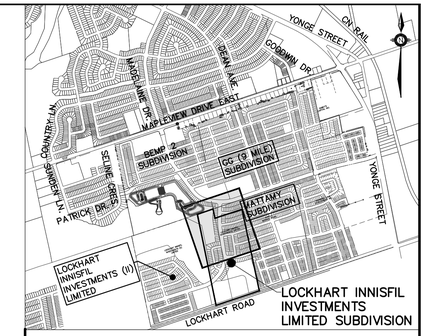

KEY PLAN
NTS

LEGEND

- SANITARY MAINTENANCE HOLE (B.O.)
- SANITARY SEWER & DIRECTION OF FLOW (B.O.)
- STORM MAINTENANCE HOLE (B.O.)
- STORM SEWER & DIRECTION OF FLOW (B.O.)
- HYDRANT AND VALVE
- VALVE AND BOX
- WATER SERVICE
- PROPOSED WATERMAIN
- SANITARY MAINTENANCE HOLE
- SANITARY SERVICE
- SANITARY SEWER & DIRECTION OF FLOW
- STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- STORM SEWER & DIRECTION OF FLOW
- DEPRESSED CURB
- 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

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

LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

GENERAL SERVICING PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
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DESIGN	VBS	SCALE: 1:1000	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-14193	DWG. Nº G-1
CHECKED	JWI		

G:\Eng_JOY\GOL-14193-JL\Production DWGS\GOL-14193-GENERAL SERVICING.dwg Layout: G-1 Plotted: Oct 05, 2021 @ 2:04pm by jherrmann The Jones Consulting Group Ltd

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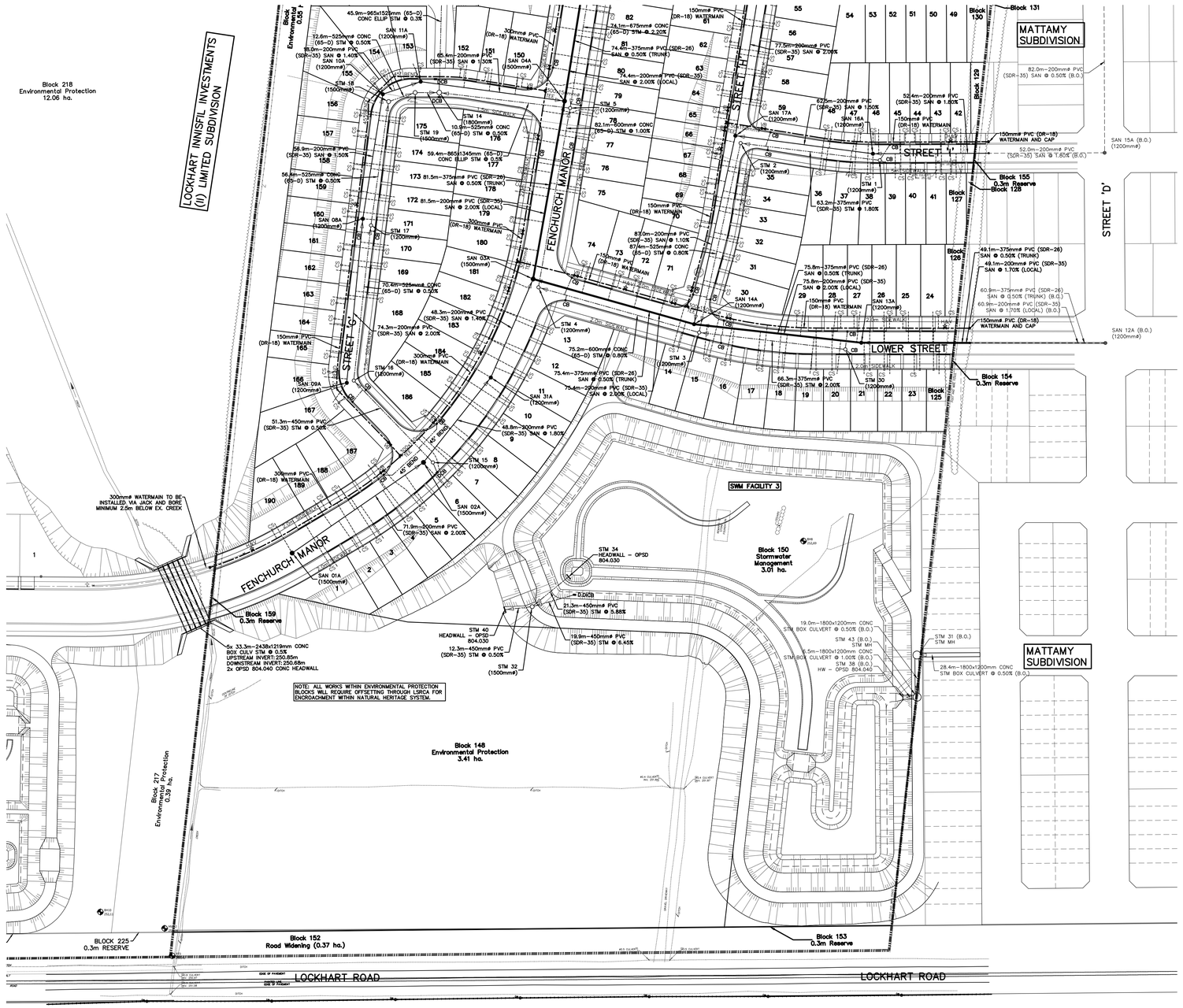
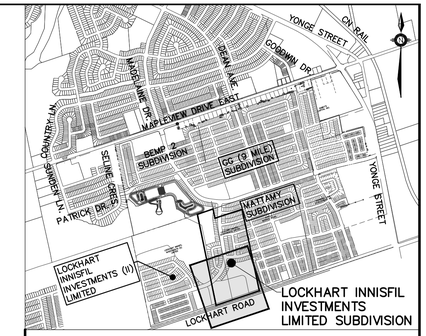




KEY PLAN
NTS

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.)
- 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 "Y" 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

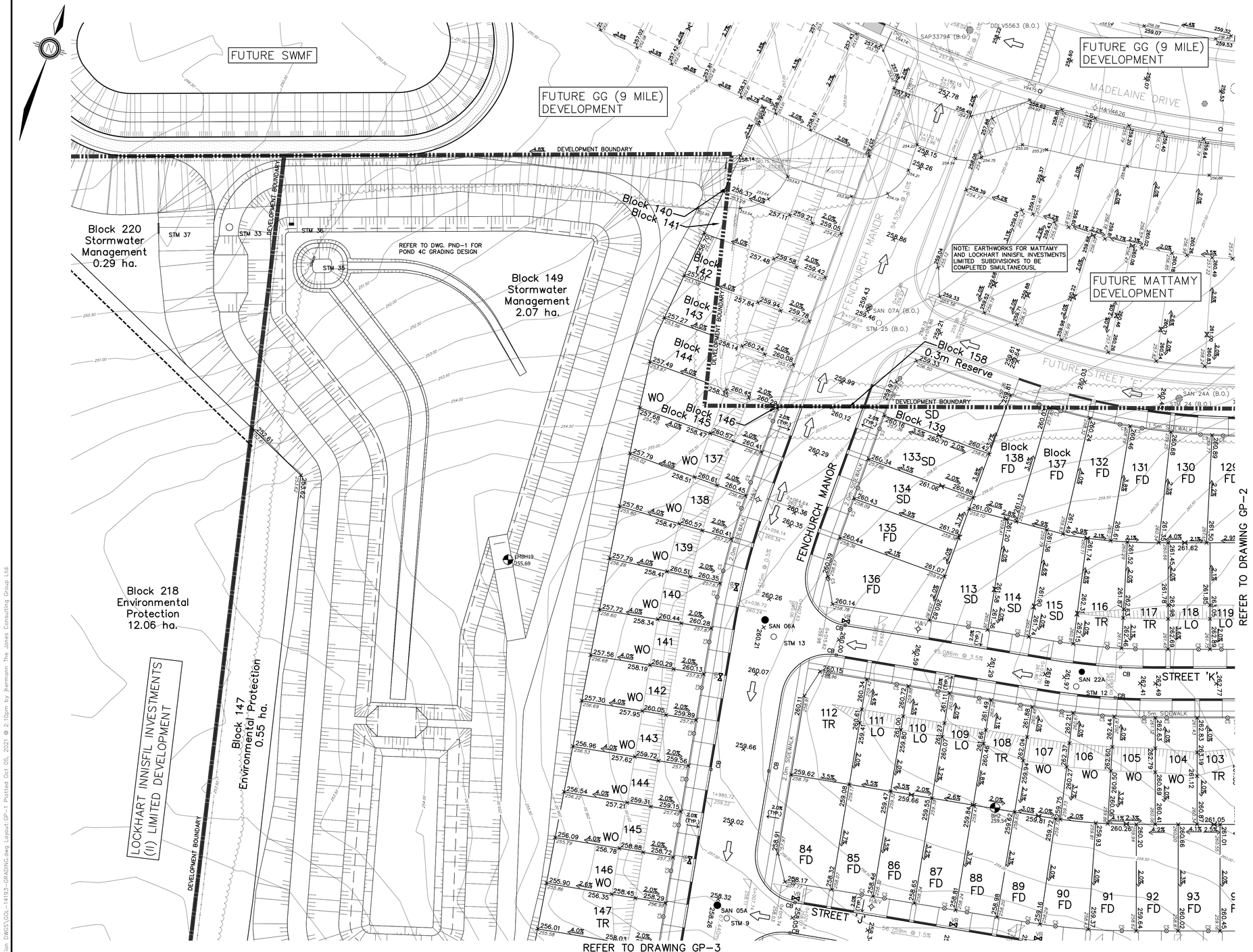
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

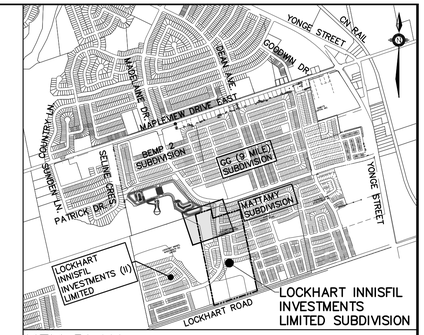
GENERAL SERVICING PLAN

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	VBS	SCALE: 1:1000	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-14193	DWG. Nº G-2
CHECKED	JWI		

G:\Eng_JD\GOL-14193-LK\Production DWGS\GOL-14193-GENERAL SERVICING.dwg Layout:G-2 Plotted: Oct 06, 2021 @ 2:13pm by Jhenmark The Jones Consulting Group Ltd



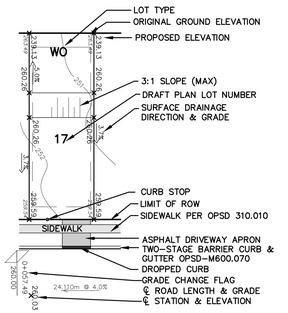


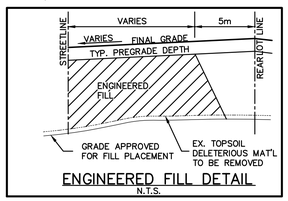
KEY PLAN

NTS

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 — V
- 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: 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 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.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 INVESTIMENTS 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-14193	DWG. Nº GP-1
CHECKED	JWI		

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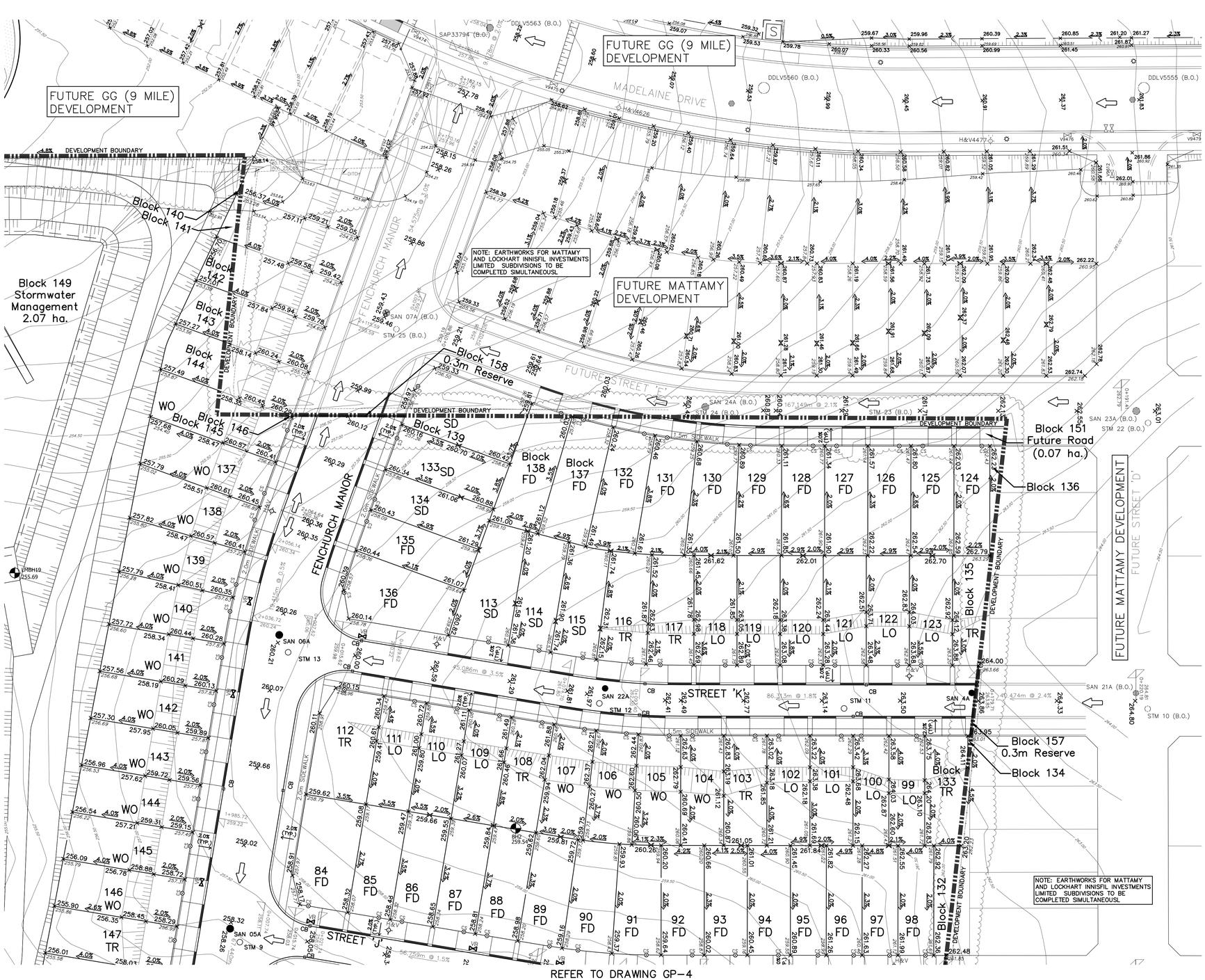
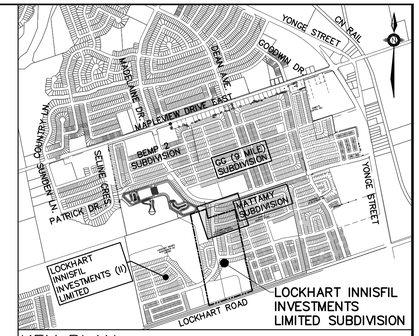


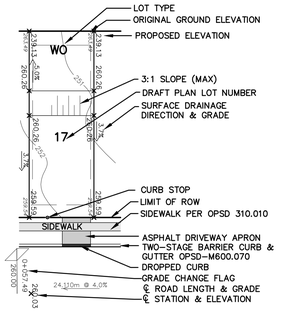


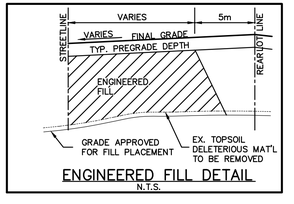
KEY PLAN

NTS

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 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 INVESTIMENTS 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. 705.734.1066

DESIGN	VBS	SCALE: 1:500	DATE JULY 2021
DRAWN	VBS	PROJECT GOL-14193	DWG. Nº GP-2
CHECKED	JWI		

G:\Eng_3D\GOL-14193-EV\Production DWGS\GOL-14193-GRADING.dwg Layout: GP-2 Plotted: Oct 05, 2021 @ 3:35pm by jhermann The Jones Consulting Group Ltd.

REFER TO DRAWING GP-1

REFER TO DRAWING GP-4

REFER TO DRAWING GP-5

Block 218
Environmental
Protection
12.06 ha.

LOCKHART INNISFIL INVESTMENTS
(II) LIMITED DEVELOPMENT

Block 147
Environmental Protection
0.55 ha.

DEVELOPMENT BOUNDARY

Block 150
Stormwater
Management
3.01 ha.

REFER TO DWG. PND-1 FOR
POND 3 GRADING DESIGN

STREET 'G'

STREET 'H'

STREET 'I'

STREET 'J'

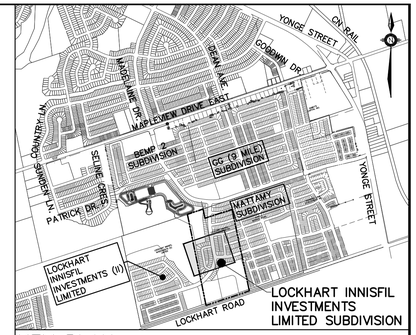
FENCHURCH MANOR

LOWER STREET

EASEMENT BLOCK

EMERGENCY ACCESS ONLY FROM POND 3

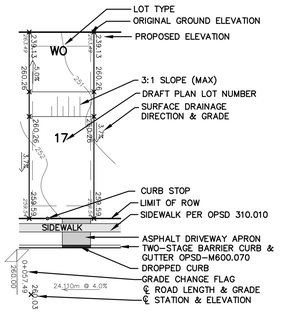
ROAD ACCESS ENTRANCE

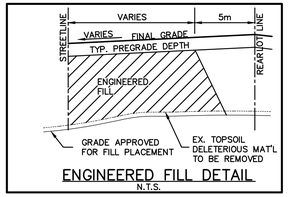


KEY PLAN
NTS

LEGEND

LIMIT OF SUBDIVISION	
LSRCA REGULATED BOUNDARY	
EX. CONTOUR	260.00
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.)	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
WALK OUT LOT	WO
LOOK OUT LOT	LO
FRONT DRAINING LOT	FD
TRANSITION LOT	TR





ENGINEERED FILL DETAIL
N.T.S.

BENCHMARK:

BENCHMARK NO: 0011931U4605 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, 0.63km 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.491199.897 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 INVESTIMENTS 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-14193	DWG. Nº GP-3
CHECKED	JWI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-GRADING.dwg Layout:GP-3 Plotted: Oct 05, 2021 @ 3:38pm by jhemmon The Jones Consulting Group Ltd.

REFER TO DRAWING GP-2

REFER TO DRAWING GP-3

REFER TO DRAWING GP-6

STREET 'G'

STREET 'H'

STREET 'I'

STREET 'J'

LOWER STREET

FENCHURCH MANOR

FUTURE STREET 'D'

FUTURE MATTAMY DEVELOPMENT

FUTURE STREET 'D'

FUGURE STREET 'L'

HWY#400 INTERCHANGE DEVELOPMENT

Block 156
0.3m Reserve
Block 131

Block 155
0.3m Reserve
Block 128

Block 154
0.3m Reserve

Block 150
Stormwater
Management
3.01 ha.

Block 130 SD

Block 129 FD

Block 127 FD

Block 126

Block 125 WO

NOTE: EARTHWORKS FOR MATTAMY AND LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISIONS TO BE COMPLETED SIMULTANEOUSL

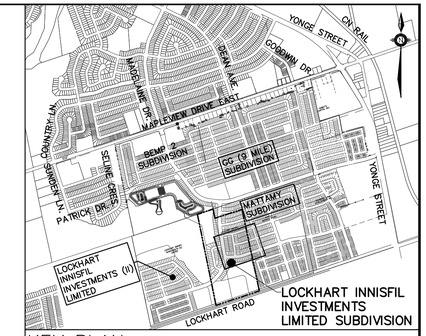
EASEMENT BLOCK

POND ROAD ACCESS ENTRANCE 25.65m

REFER TO DWG. PND-1 FOR POND 3 GRADING DESIGN

KEY PLAN

NTS



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
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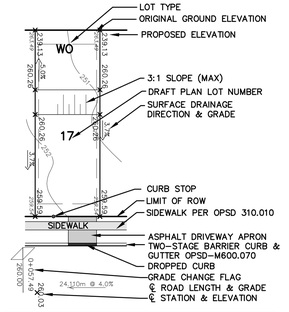
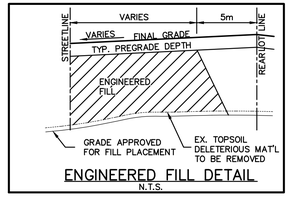




ENGINEERED FILL DETAIL

N.T.S.

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 0.2m 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 INVESTIMENTS 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-14193	DWG. Nº GP-4
CHECKED	JWI		

G:\Eng_3D\GOL-14193-EV\Production DWGS\GOL-14193-GRADING.dwg Layout: GP-4 Plotted: Oct 05, 2021 @ 3:40pm by Jhermon The Jones Consulting Group Ltd.

REFER TO DRAWING GP-3

REFER TO DWG. PND-1 FOR POND 3 GRADING DESIGN

Block 218
Environmental Protection
12.03 ha.

Block 150
Stormwater Management
3.01 ha.

Block 159
0.3m Reserve

Block 148
Environmental Protection
3.41 ha.

Block 217
Environmental Protection
0.39 ha.

Block 152
Road Widening (0.37 ha.)

Block 153
0.3m Reserve

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

LOCKHART INNISFIL INVESTMENTS (II) LIMITED DEVELOPMENT

DEVELOPMENT BOUNDARY

FENCHURCH MANOR

LOCKHART ROAD

EDGE OF PAVEMENT

PAINTED LINE
EDGE OF PAVEMENT

DITCH

CENTRELINE OF DITCH

2.0m SIDEWALK

GRAVEL DRIVEWAY

RIVIAN STORAGE FACILITY

SAN 01A

MW12
252.14

PZ3
251.41

BLK 225
0.3m RESERVE

STM 34

STM 39

STM 40

STM 32

#0.4 CULVERT
INV. 251.84

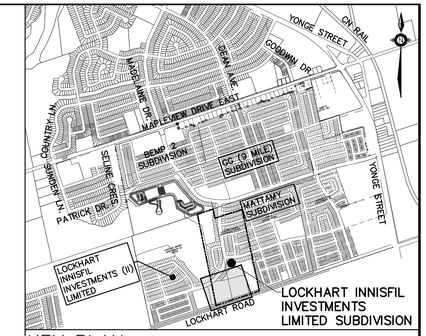
#0.4 CULVERT
INV. 251.87

#0.9 CULVERT
INV. 250.97

#0.9 CULVERT
INV. 251.08

#0.5 CULVERT

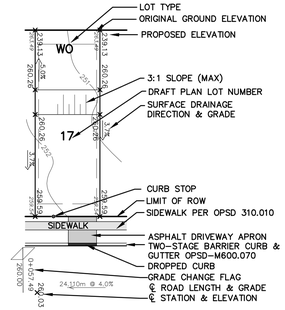
REFER TO DRAWING GP-6

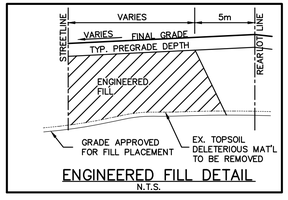


KEY PLAN
NTS

LEGEND

LIMIT OF SUBDIVISION	
LSRCA REGULATED BOUNDARY	
EX. CONTOUR	260.00
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	V
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: 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 9.0m 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 INVESTIMENTS 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-14193	DWG. Nº GP-5
CHECKED	JWI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-GRADING.dwg, Layout: GP-5, Plotted: Oct 05, 2021 @ 3:42pm by jbennann, The Jones Consulting Group Ltd.

REFER TO DRAWING GP-4

REFER TO DRAWING GP-5

REFER TO DWG. PND-1 FOR POND 3 GRADING DESIGN

FENCHURCH MANOR

7 SD
6 SD
5 SD
4 TR
3 LO
2 TR

Block 150
Stormwater Management
3.01 ha.

Block 148
Environmental Protection
3.41 ha.

Block 152
Road Widening (0.37 ha.)

Block 153
0.3m Reserve

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

NOTE: EARTHWORKS FOR MATTAMY AND LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISIONS TO BE COMPLETED SIMULTANEOUSL

FUTURE MATTAMY DEVELOPMENT

FUTURE STREET 'M'

DEVELOPMENT BOUNDARY

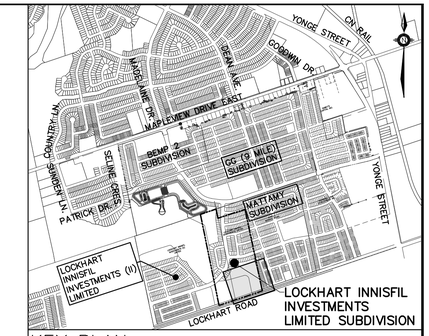
LOCKHART ROAD

STM 31 (B.O.)
STM 34
STM 38 (B.O.)
STM 39
STM 40
STM 32
STM 43 (B.O.)

BH8
252.69

#0.4 CULVERT INV. 251.84
#0.4 CULVERT INV. 251.87
#0.5 CULVERT
#0.5 CULVERT

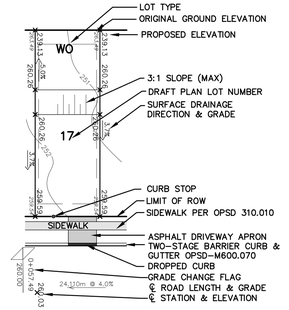
DITCH
GRAVEL DRIVEWAY
REMOVE STOCK PONDING
CEDARS
FENCE

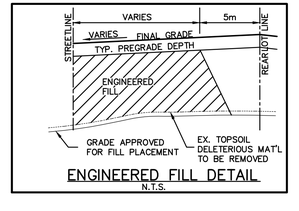


KEY PLAN
NTS

LEGEND

LIMIT OF SUBDIVISION	
LSRCA REGULATED BOUNDARY	
EX. CONTOUR	260.00
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	V
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, 0.65m 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.4910727.588 E.607083.531

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

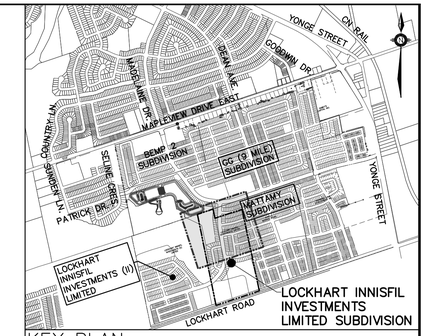
LOCKHART INNISFIL INVESTIMENTS LIMITED SUBDIVISION

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-14193	DWG. Nº GP-6
CHECKED	JWI		

G:\Eng_JOY\GOL-14193-E\Production DWGS\GOL-14193-GRADING.dwg Layout:GP-6 Plotted: Oct 05, 2021 @ 3:44pm by jhermann The Jones Consulting Group Ltd



KEY PLAN
NTS

LEGEND

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

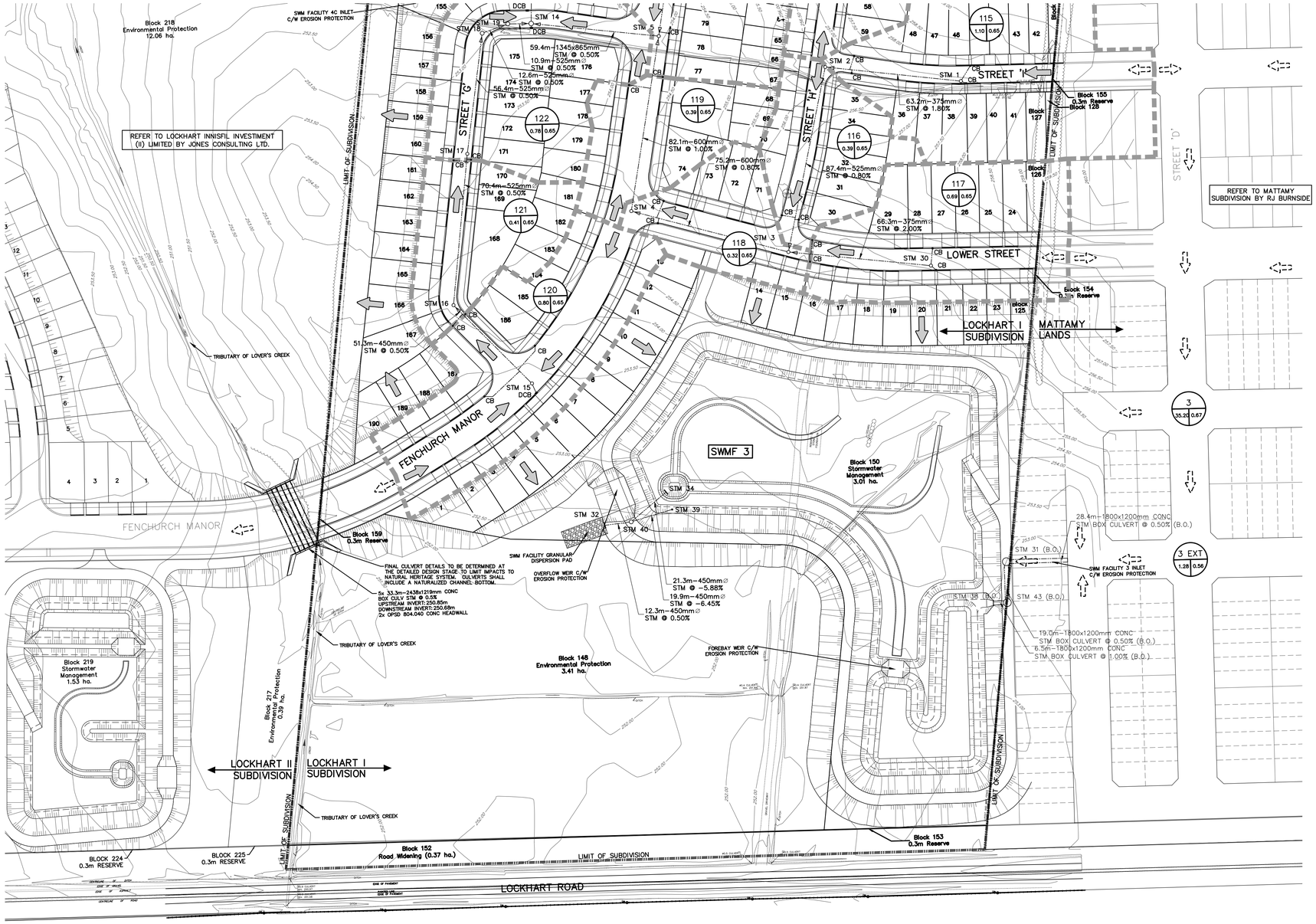
STORM SEWER SUB–CATCHMENT PLAN

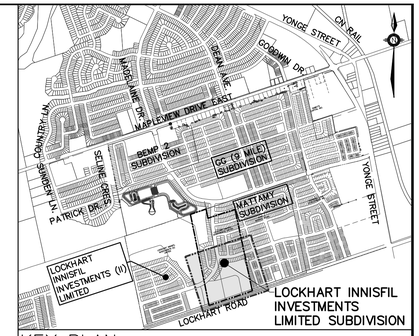
JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN VS	SCALE: 1:1000	DATE JULY 2021
DRAWN KC/VS	PROJECT GOL–14193	DWG. Nº STM–1
CHECKED JI		

G:\Eng_3D\GOL–14193–C\Production DWGS\GOL–14193–STORM DRAINAGE.dwg, Layout:STM–1 Plotted: Oct 06, 2021 @ 8:34am by Jeremson The Jones Consulting Group Ltd

REFER TO DRAWING STM-1





KEY PLAN
NTS

LEGEND

- STM 01 — STORM MAINTENANCE HOLE
- CB — STORM DOUBLE CATCHBASIN
- DCB — STORM CATCHBASIN
- PROP. STORM SEWER & DIRECTION OF FLOW
- STM 01 (B.O.) — STORM MAINTENANCE HOLE (BY OTHERS)
- PROP. STORM SEWER & DIRECTION OF FLOW (BY OTHERS)
- CATCHMENT BOUNDARY
- 109 / 0.22 / 0.65 — CATCHMENT AREA ID NUMBER; RUN-OFF COEFFICIENT; AREA (ha.)
- DIRECTION OF POST DEVELOPMENT 100 YEAR STORM EVENT OVERLAND FLOW
- DIRECTION OF EXTERNAL POST DEVELOPMENT 100 YEAR STORM EVENT OVERLAND FLOW
- 253.00 — EXISTING CONTOUR AND ELEVATION
- LIMIT OF SUBDIVISION
- LID CATCHMENT BOUNDARY
- LID DRY SWALE

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

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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.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

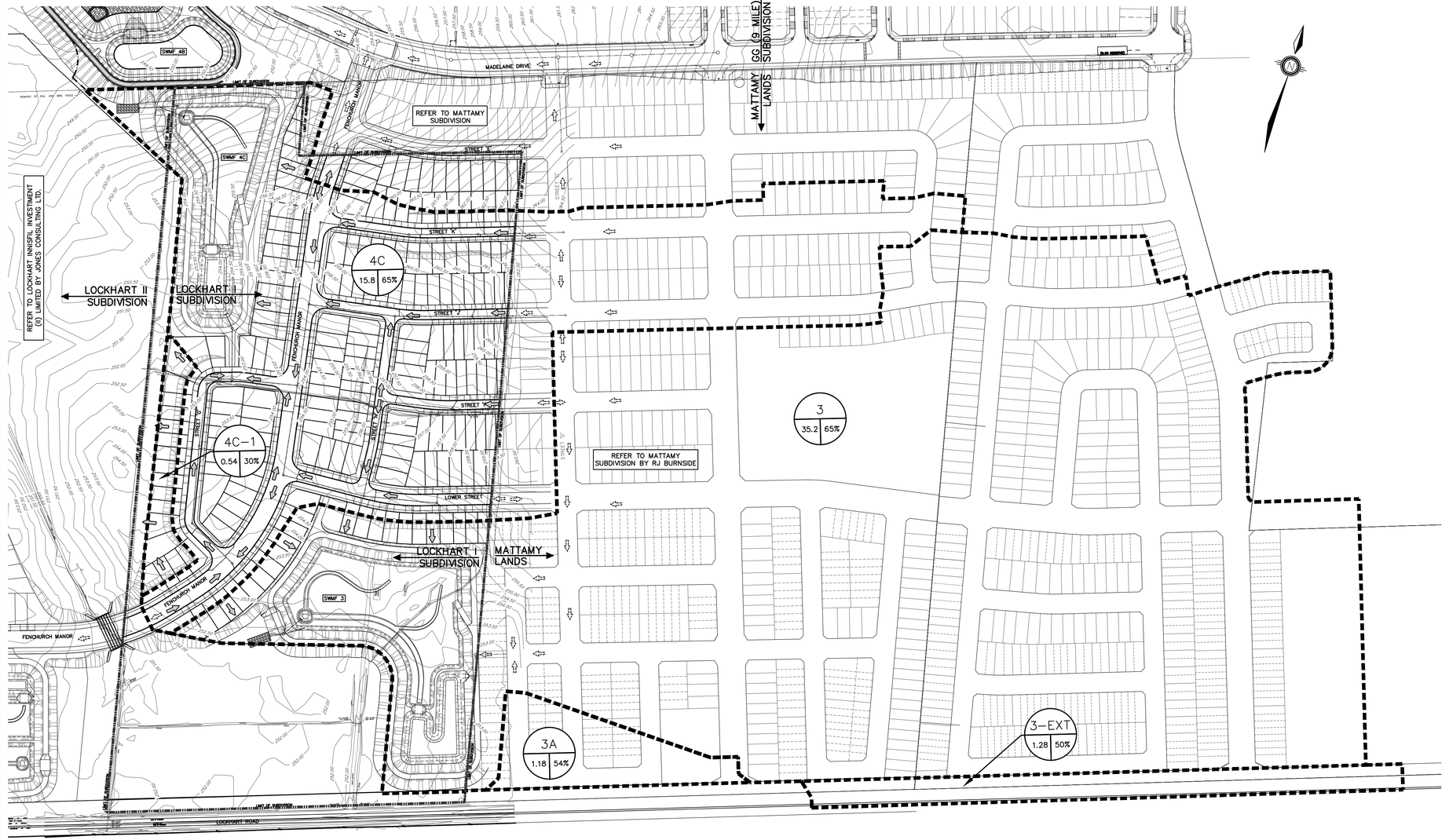
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

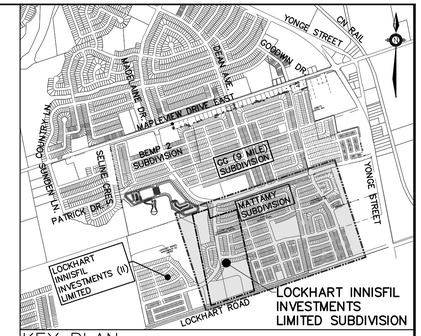
STORM SEWER SUB-CATCHMENT PLAN

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	VI	SCALE: 1:1000	DATE JULY 2021
DRAWN	KC/VS	PROJECT GOL-14193	DWG. Nº STM-2
CHECKED	JI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-STORM DRAINAGE.dwg Layout:STM-2 Plotted Oct 07, 2021 @ 10:55am by jhermann The Jones Consulting Group Ltd.





KEY PLAN
NTS

LEGEND

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

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, 0.69m 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.607083.531

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 LIMITED SUBDIVISION

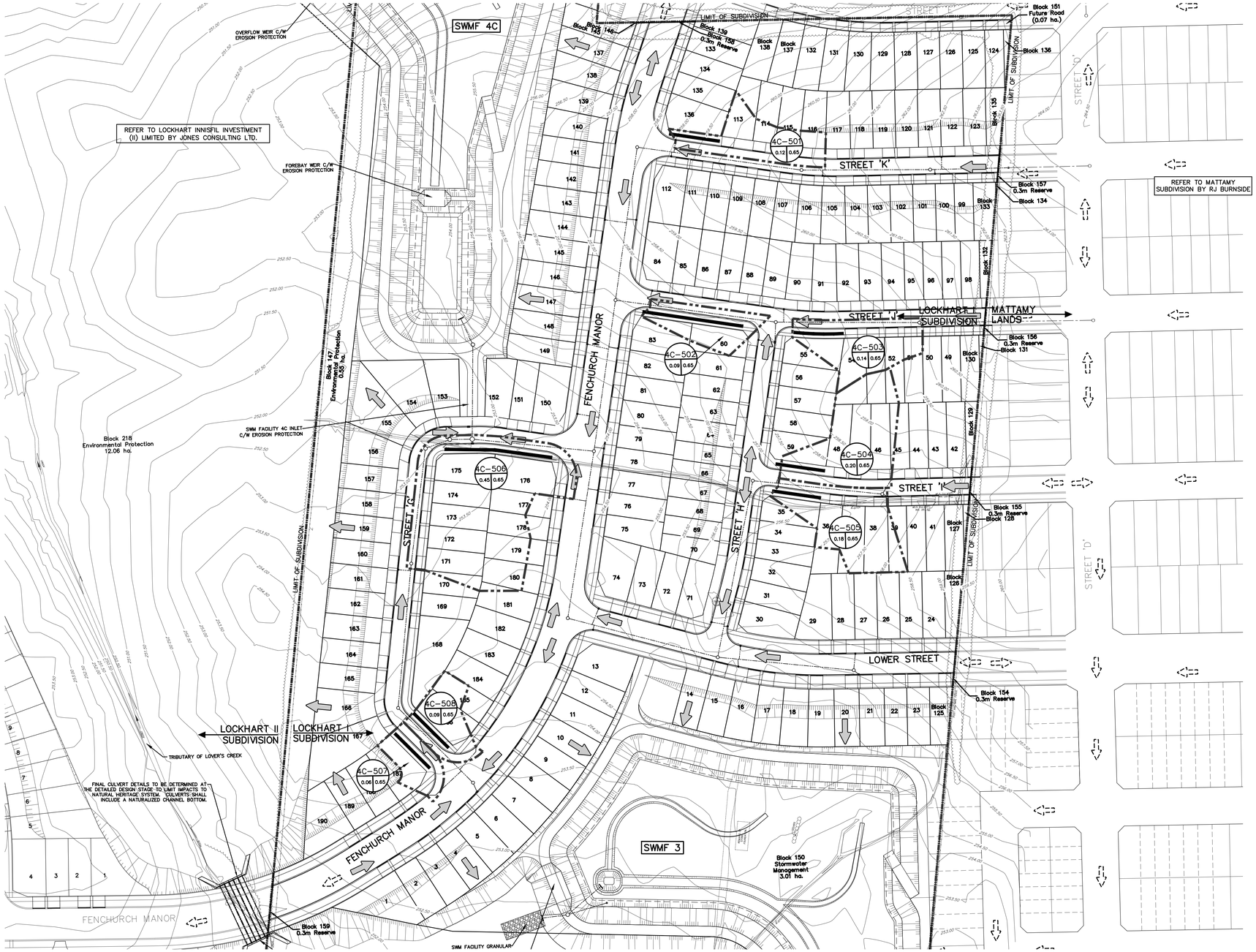
POST-DEVELOPMENT DRAINAGE AREA PLAN SWM FACILITIES 3 & 4C

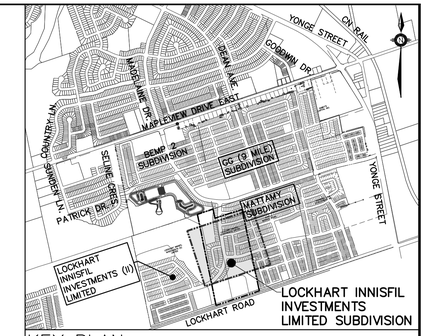
JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VS	SCALE: 1:2000	DATE AUGUST 2021
DRAWN	KC/VS	PROJECT GOL-14193	DWG. Nº SWM-1
CHECKED	JI		

G:\Eng_3D\GOL-14193-LP\Production DWGS\GOL-14193-POST-DEVELOPMENT.dwg Layout: SWM-1 Plotted: Oct 05, 2021 @ 3:35pm by Brennan The Jones Consulting Group Ltd

REFER TO DRAWING STM-1





KEY PLAN
NTS

LEGEND

- STM 01 — STORM MAINTENANCE HOLE
- CB — STORM DOUBLE CATCHBASIN
- DCB — STORM CATCHBASIN
- PROP. STORM SEWER & DIRECTION OF FLOW
- STM 01 (B.O.) — STORM MAINTENANCE HOLE (BY OTHERS)
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- LIMIT OF SUBDIVISION
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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, 0.65km 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.606513.316

NO.	REVISIONS	DATE	INITIAL
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LICENSED PROFESSIONAL ENGINEER — J. W. INGRAM — 100143779 — 21-10-06 — PROVINCE OF ONTARIO

LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

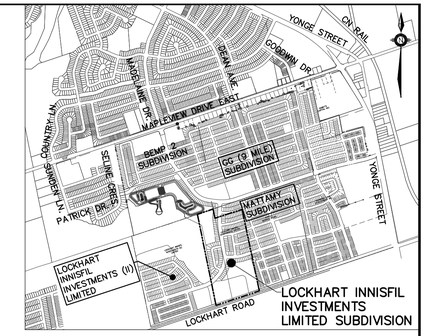
LID SUB-CATCHMENT PLAN

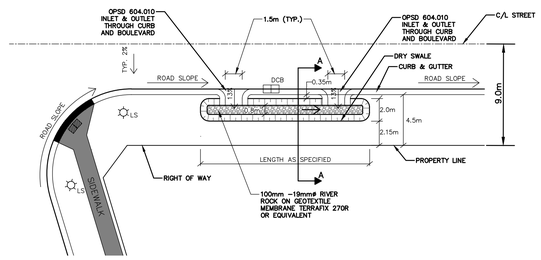
JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VI	SCALE: 1:1000	DATE JULY 2021
DRAWN	KC/VS	PROJECT GOL-14193	DWG. Nº LID-1
CHECKED	JI		

G:\Eng_3D\GOL-14193-EV\Production DWGS\GOL-14193-STORM DRAINAGE.dwg Layout:LID-1 Plotted Oct 06, 2021 @ 9:06am by Jhermann The Jones Consulting Group Ltd.

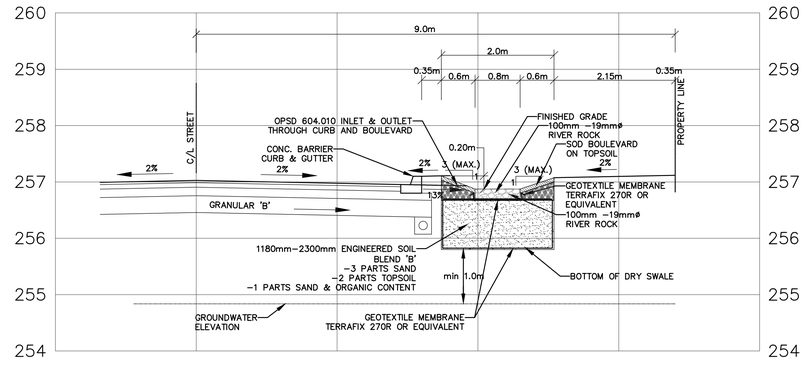
Location	Catchment ID	Area (ha)	Infiltration Rate (mm/hr)	Percent Impervious	Length (m)	Width (m)	Total Depth (m)	North/West End			South/East End		
								Ground Elevation	Water Table Elevation	Distance from Bottom of Swale to Water Table Elevation	Ground Elevation	Water Table Elevation	Distance from Bottom of Swale to Water Table Elevation
Street E	4C-501	0.12	13	65%	23.00	2.00	1.30	260.36	257.69	1.36	260.80	258.49	1.00
Street J	4C-502	0.09	13	65%	50.00	2.00	1.30	260.36	257.69	1.36	260.80	258.49	1.00
Street J	4C-503	0.14	13	65%	25.00	2.00	1.18	259.25	257.07	1.00	259.73	257.29	1.26
Street I	4C-504	0.20	13	65%	25.00	2.00	1.30	258.99	256.66	1.01	259.30	256.98	1.00
Street I	4C-505	0.18	13	65%	25.00	2.00	2.00	258.99	255.97	1.00	259.30	256.20	1.08
Street G	4C-506	0.45	13	65%	50.00	2.00	2.20	255.97	252.44	1.32	256.22	253.01	1.00
Street G	4C-507	0.06	13	65%	25.30	2.00	2.30	256.85	253.53	1.00	257.00	253.31	1.37
Street G	4C-508	0.09	13	65%	25.00	2.00	1.93	256.85	253.91	1.00	257.14	253.76	1.44





NO SIDEWALK – PLAN VIEW

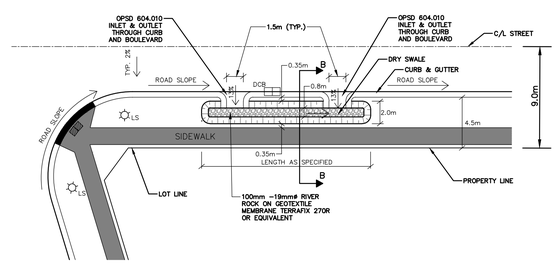
1:250



SECTION A–A

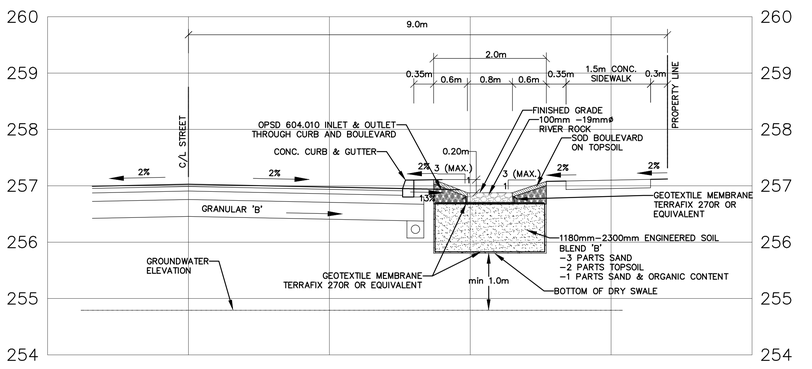
1:50

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: 0011931U4605 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: 0101986S454 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. 0101986O407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 0101986O404 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 LIMITED SUBDIVISION

LID SECTIONS 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

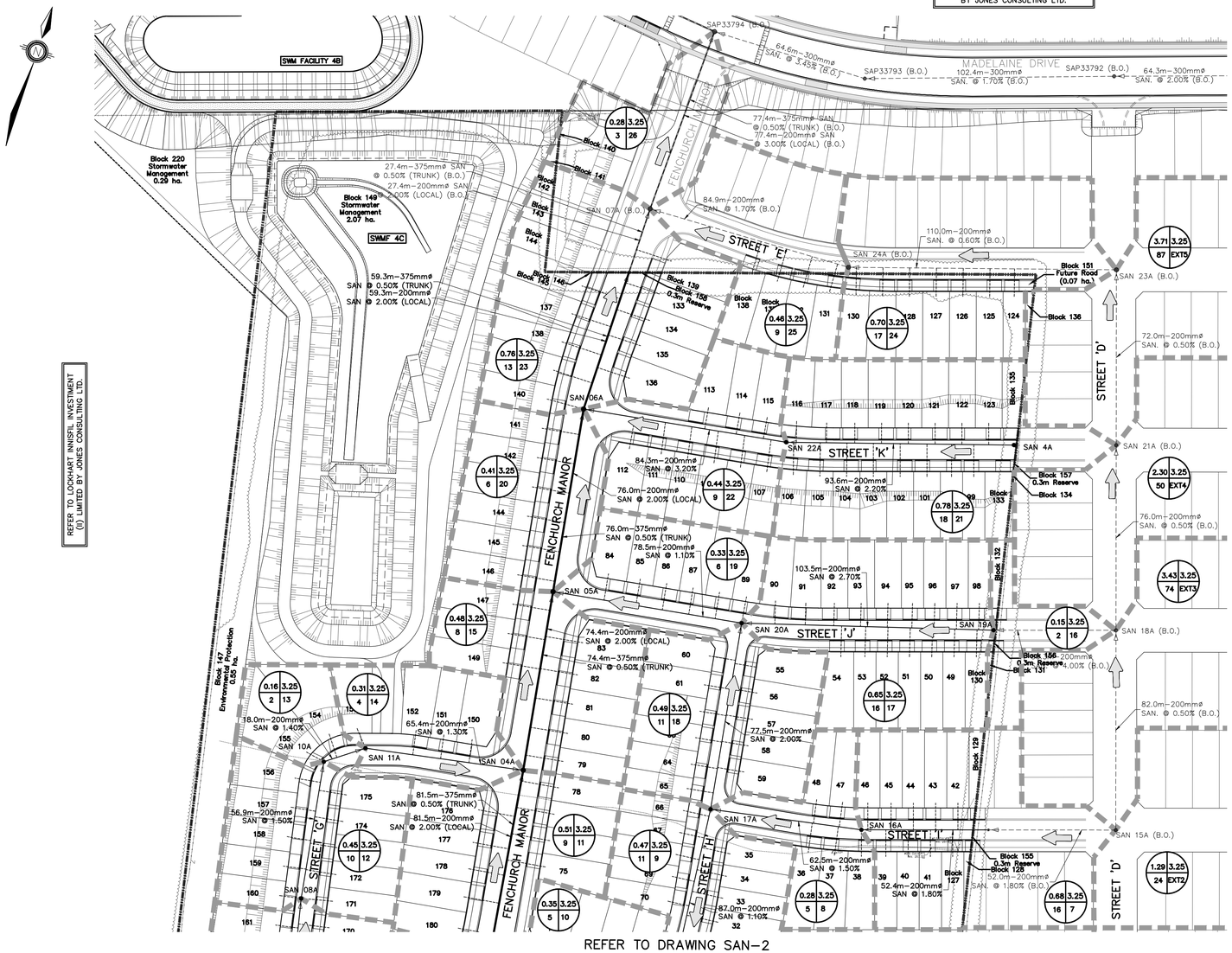
DESIGN	VI	SCALE: 1:1000	DATE JULY 2021
DRAWN	KC/VS	PROJECT GOL-14193	DWG. Nº LID-1
CHECKED	JI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-STORM DRAINAGE.dwg, Layout:LID-2, Plotted: Oct 06, 2021 @ 9:46am by jhermann The Jones Consulting Group Ltd.

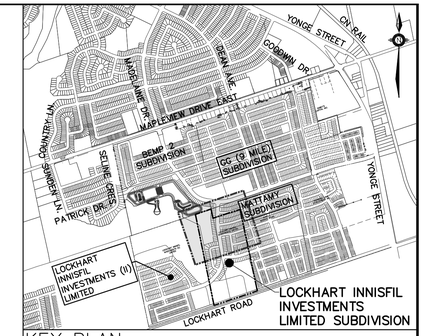
REFER TO GG (9 MILE) LTD. SUBDIVISION BY JONES CONSULTING LTD.

REFER TO LOCKHART INNISFIL INVESTMENT (II) LIMITED BY JONES CONSULTING LTD.

REFER TO MATTAMY SUBDIVISION BY RJ BURNSIDE



REFER TO DRAWING SAN–2



KEY PLAN
NTS

LEGEND

- MH89A — SANITARY MAINTENANCE HOLE
- MH89A — SANITARY SEWER & DIRECTION OF FLOW
- SANITARY SERVICE
- SAN 54A (B.O.) — SANITARY SEWER DIRECTION OF FLOW (BY OTHERS)
- SAN 54A (B.O.) — SANITARY MAINTENANCE HOLE (BY OTHERS)
- SUB CATCHMENT BOUNDARY
- LIMIT OF SUBDIVISION
- DIRECTION OF FLOW
- AREA (ha.) / PERSONS PER UNIT (0.42 3.13; 10 13) — No. OF UNITS / CATCHMENT AREA ID NUMBER

BENCHMARK:

BENCHMARK NO: 0011931U4605 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 LIMITED SUBDIVISION

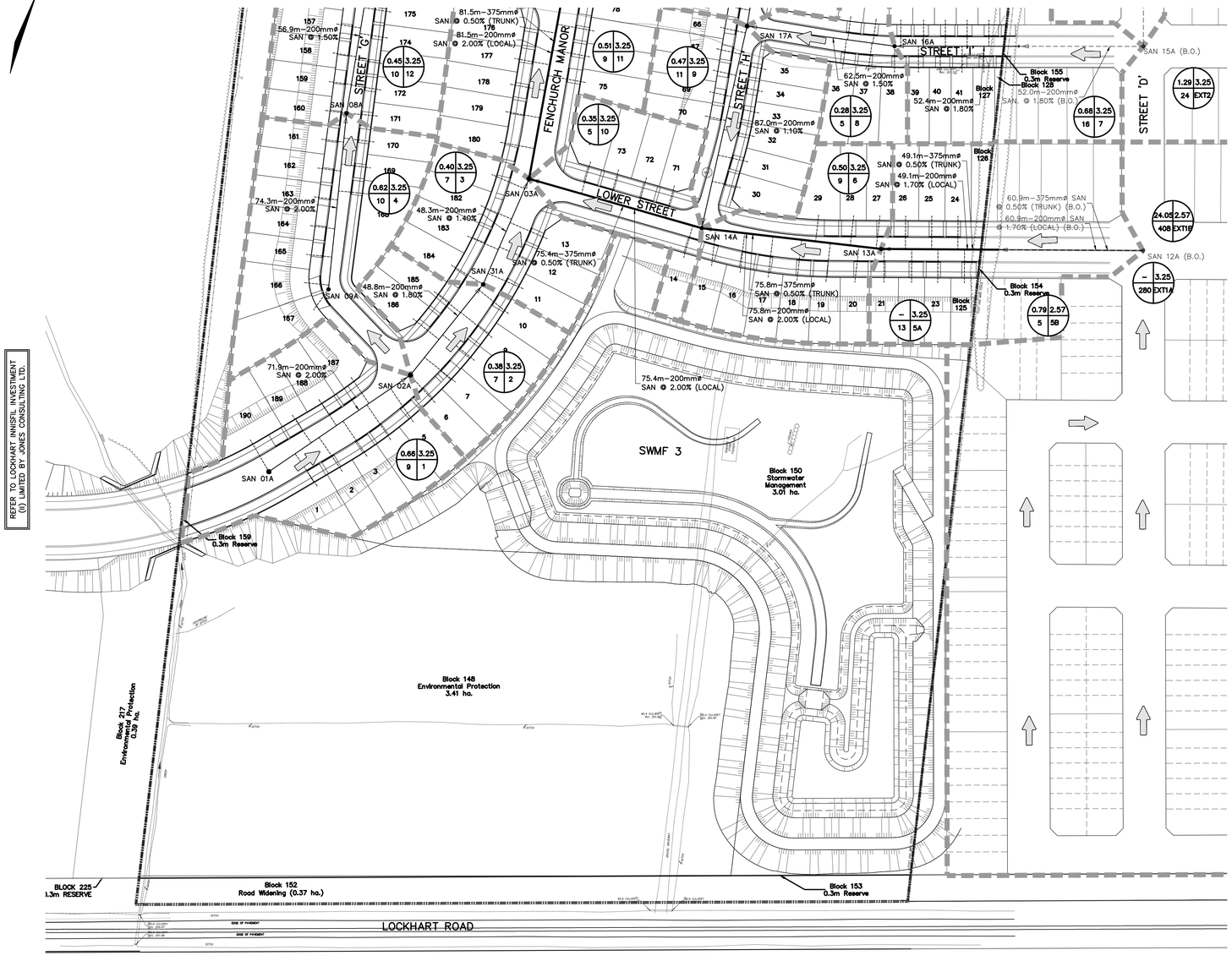
SANITARY DRAINAGE AREA PLAN

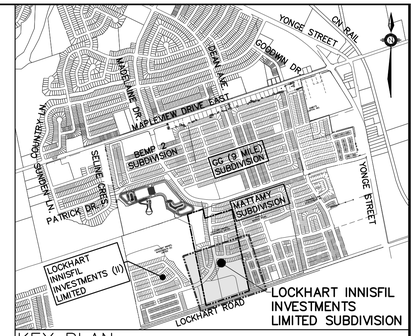
JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KC	SCALE: 1:1000	DATE MAY 2021
DRAWN	KC	PROJECT GOL–14193	DWG. Nº SAN–1
CHECKED	JI		

G:\Eng_3D\GOL–14193–E\Production DWGS\GOL–14193–SANITARY DRAINAGE.dwg, Layout: SAN–1 Plotted: Oct 05, 2021 @ 3:44pm by Jeermann The Jones Consulting Group Ltd.

REFER TO DRAWING SAN–1





KEY PLAN
NTS

LEGEND

- SANITARY MAINTENANCE HOLE (MH89A)
- SANITARY SEWER & DIRECTION OF FLOW (MH89A)
- SANITARY SERVICE
- SANITARY SEWER DIRECTION OF FLOW (BY OTHERS) (SAN 54A (B.O.))
- SANITARY MAINTENANCE HOLE (BY OTHERS) (SAN 54A (B.O.))
- SUB CATCHMENT BOUNDARY
- LIMIT OF SUBDIVISION
- DIRECTION OF FLOW

AREA (ha.) — PERSONS PER UNIT — No. OF UNITS — CATCHMENT AREA ID NUMBER

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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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 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. 705.734.1066

DESIGN	KC	SCALE: 1:1000	DATE MAY 2021
DRAWN	KC	PROJECT GOL–14193	DWG. Nº SAN–2
CHECKED	JI		

G:\Eng_3D\GOL–14193–EV\Production DWGS\GOL–14193–SANITARY DRAINAGE.dwg Layout:SAN–2 Plotted Oct 05, 2021 @ 3:43pm by jhermann The Jones Consulting Group Ltd.

SANITARY SEWER DESIGN - LOCAL SEWER

Development Details Basis

DESIGN SHEET 1 of 1
FILE NO GOL-14193
CONTRACT / PROJECT

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[2]	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	1	1A	2A	9	9	3.25	29	29	10.133	4.356	10.133	0.772	0.66	0.66	0.066	0.838	71.9	200	2.00	46.384	0.093	Ok	1.476	0.550	Check
Fenchurch Manor	2	2A	31A	7	16	3.25	23	52	9.032	4.311	9.032	1.223	0.38	1.04	0.104	1.327	48.8	200	1.80	44.004	0.119	Ok	1.401	0.610	Ok
Fenchurch Manor	3	31A	3A	7	23	3.25	23	75	8.399	4.276	8.399	1.635	0.40	1.44	0.144	1.779	48.3	200	1.40	38.808	0.145	Ok	1.235	0.609	Ok
Lower Street	EXT1		12A	280		3.25	910																		
Lower Street	EXT1		12A	408		2.57	1049						24.05	24.05											
Lower Street	5 (Trunk)	12A	13A		688			1959	4.371	3.593	4.371	22.294	0.79	24.84	2.484	24.778	110.0	375	0.50	123.977	0.303	Ok	1.123	0.850	Ok
Lower Street	5A (Local)	12A	13A	13		3.25	42																		
Lower Street	5B (Local)	12A	13A	5	18	2.57	13	55	8.928	4.306	8.928	1.281		0.79	0.079	1.360	110.0	200	1.70	42.764	0.122	Ok	1.361	0.606	Ok
Lower Street	6 (Trunk)	13A	14A		706			2014	4.347	3.583	4.347	22.794	0.50	25.34	2.534	25.328	75.8	375	0.50	123.977	0.306	Ok	1.123	0.855	Ok
Lower Street	6 (Local)	13A	14A	9	9	3.25	29	29	10.133	4.356	10.133	0.772		0.50	0.050	0.822	75.8	200	2.00	46.384	0.092	Ok	1.476	0.550	Check
Street I	7	15A	16A	16	16	3.25	52	52	9.032	4.311	9.032	1.223	0.68	0.68	0.068	1.291	104.4	200	1.80	44.004	0.117	Ok	1.401	0.610	Ok
Street I	8	16A	17A	5	21	3.25	16	68	8.554	4.285	8.554	1.520	0.28	0.96	0.096	1.616	62.5	200	1.50	40.170	0.136	Ok	1.279	0.611	Ok
Street H	9	17A	14A	11	32	3.25	36	104	7.863	4.239	7.863	2.129	0.47	1.43	0.143	2.272	87.0	200	1.10	34.399	0.174	Ok	1.095	0.606	Ok
Lower Street	10 (Trunk)	14A	3A		747			2147	4.291	3.562	4.291	23.993	0.35	27.12	2.712	26.705	75.4	375	0.50	123.977	0.315	Ok	1.123	0.868	Ok
Lower Street	10 (Local)	14A	3A	5	5	3.25	16	16	11.397	4.392	11.397	0.482		0.35	0.035	0.517	75.4	200	2.00	46.384	0.074	Ok	1.476	0.476	Check
Fenchurch Manor	11 (Trunk)	3A	4A		775			2238	4.256	3.547	4.256	24.803	0.51	29.07	2.907	27.710	81.5	375	0.50	123.977	0.321	Ok	1.123	0.876	Ok
Fenchurch Manor	11 (Local)	3A	4A	9	9	3.25	29	29	10.133	4.356	10.133	0.772		0.51	0.051	0.823	81.5	200	2.00	46.384	0.092	Ok	1.476	0.550	Check
Street G	4	9A	8A	10	10	3.25	33	33	9.922	4.349	9.922	0.840	0.62	0.62	0.062	0.902	74.3	200	2.00	46.384	0.096	Ok	1.476	0.566	Check
Street G	12	8A	10A	10	20	3.25	33	65	8.637	4.290	8.637	1.462	0.45	1.07	0.107	1.569	56.9	200	1.50	40.170	0.134	Ok	1.279	0.605	Ok
Street G	13	10A	11A	2	22	3.25	7	72	8.474	4.281	8.474	1.578	0.16	1.23	0.123	1.701	18.0	200	1.40	38.808	0.142	Ok	1.235	0.604	Ok
Street G	14	11A	4A	4	26	3.25	13	85	8.196	4.263	8.196	1.804	0.31	1.54	0.154	1.958	65.4	200	1.30	37.396	0.155	Ok	1.190	0.613	Ok
Fenchurch Manor	15 (Trunk)	4A	5A		810			2352	4.214	3.530	4.214	25.807	0.48	31.1	3.109	28.916	74.4	375	0.50	123.977	0.328	Ok	1.123	0.885	Ok
Fenchurch Manor	15 (Local)	4A	5A	8	8	3.25	26	26	10.375	4.364	10.375	0.702		0.48	0.048	0.750	74.4	200	2.00	46.384	0.088	Ok	1.476	0.534	Check
Street J	16	18A	19A	2	2	3.25	7	7	13.689	4.431	13.689	0.232	0.15	0.15	0.015	0.247	50.3	200	4.00	65.597	0.044	Ok	2.088	0.486	Check
Street J	17	19A	20A	16	18	3.25	52	59	8.821	4.300	8.821	1.344	0.65	0.80	0.080	1.424	103.5	200	2.70	53.883	0.111	Ok	1.715	0.722	Ok
Street H	18	17A	20A	11	11	3.25	36	36	9.735	4.342	9.735	0.906	0.49	0.49	0.049	0.955	77.5	200	2.00	46.384	0.099	Ok	1.476	0.577	Check
Street J	19	20A	5A	6	35	3.25	20	114	7.723	4.228	7.723	2.288	0.33	1.62	0.162	2.450	78.5	200	1.10	34.399	0.180	Ok	1.095	0.619	Ok
Fenchurch Manor	20 (Trunk)	5A	6A		853			2491	4.166	3.510	4.166	27.027	0.41	33.12	3.312	30.339	76.0	375	0.50	123.977	0.336	Ok	1.123	0.898	Ok
Fenchurch Manor	20 (Local)	5A	6A	6	6	3.25	20	20	10.989	4.382	10.989	0.558		0.41	0.041	0.599	76.0	200	2.00	46.384	0.079	Ok	1.476	0.501	Check
Street K	21	4A	22A	18	18	3.25	59	59	8.821	4.300	8.821	1.344	0.78	0.78	0.078	1.422	93.6	200	2.20	48.648	0.117	Ok	1.549	0.675	Ok
Street K	22	22A	6A	9	27	3.25	29	88	8.134	4.259	8.134	1.859	0.44	1.22	0.122	1.981	84.3	200	3.20	58.672	0.125	Ok	1.868	0.849	Ok
Fenchurch Manor	23 (Trunk)	6A	7A		886			2599	4.131	3.495	4.131	27.954	0.76	35.10	3.510	31.464	86.7	375	0.50	123.977	0.343	Ok	1.123	0.905	Ok
Fenchurch Manor	23 (Local)	6A	7A	13	13	3.25	42	42	9.415	4.329	9.415	1.036		0.76	0.076	1.112	86.7	200	2.00	46.384	0.106	Ok	1.476	0.603	Ok
Street D	EXT.2			24		3.25	78						1.29												
Street D	EXT.3			74		3.25	241						3.43												
Street D	EXT.4			50		3.25	163						2.30												
Street E	EXT.5			87		3.25	283						3.71												
Street E	24	23A	24A	17	252	3.25	55	819	5.204	3.854	5.204	11.099	0.70	11.43	1.143	12.242	110.0	200	0.60	25.406	0.489	Ok	0.809	0.781	Ok
Street E	25	24A	7A	9	261	3.25	29	848	5.167	3.845	5.167	11.415	0.46	11.89	1.189	12.604	84.9	200	1.70	42.764	0.371	Ok	1.361	1.151	Ok
Fenchurch Manor	26 (Trunk)	7A	SAP33794		1160			3489	3.894	3.386	3.894	35.385	0.28	47.27	4.727	40.112	77.4	375	0.50	123.977	0.391	Ok	1.123	0.967	Ok
Fenchurch Manor	26 (Local)	7A	SAP33794	3	3	3.25	10	10	12.623	4.416	12.623	0.321		0.28	0.028	0.349	77.4	200	3.00	56.809	0.056	Ok	1.808	0.482	Check

GOL-14193 Lockhart I
5 Year Storm Sewer Sizing
October 2021

AREAS	Street	MANHOLE FROM	MANHOLE TO	LENGTH (m)	INCREMENT C	INCREMENT A	INCREMENT CA	TOTAL CA	FLOW TIME (min) TO	FLOW TIME (min) IN	I (mm/h)	TOTAL Q (cms)	S (%)	D (mm)	Q FULL (cms)	V FULL (m/s)	% FULL
From Mattamy to GG 9 Mile ↓													450mmØ shown in GG (9 Mile)				
101	Street 'D'	STM 22	STM DDLV5555	85.5	0.65	1.17	0.76	0.76	10.00	0.93	109	0.230	0.60	525	0.333	1.5	***69.0***
From Mattamy to GG 9 Mile ↓																	
102	Street 'E'	STM 23	STM 24	55.2	0.65	0.49	0.32	0.32	10.00	0.46	109	0.097	2.10	300	0.140	2.0	***69.2***
103	Street 'E'	STM 24	STM 25	79.1	0.65	0.68	0.44	0.76	10.46	0.48	106	0.224	3.00	375	0.304	2.7	***73.9***
104	Fenchurch Manor	STM 25	STM DDLV5563	84.8	0.65	0.52	0.34	1.10	10.94	0.85	104	0.318	0.70	525	0.360	1.7	***88.3***
From Mattamy to Lockhart ↓																	
105	Street 'K'	STM 10	STM 11		0.65	1.85	1.20										
106	Street 'K'	STM 10	STM 11	77.5	0.65	0.11	0.07	1.28	10.00	0.48	109	0.386	1.80	525	0.577	2.7	***66.9***
107	Street 'K'	STM 11	STM 12	62.5	0.65	0.19	0.12	1.40	10.48	0.39	106	0.413	1.80	525	0.577	2.7	***71.6***
108	Street 'K'	STM 12	STM 13	80.5	0.65	0.37	0.24	1.64	10.88	0.38	104	0.475	3.20	525	0.769	3.6	***61.7***
109	Fenchurch Manor	STM 13	STM 9	75.0	0.65	0.21	0.14	1.78	11.25	0.47	102	0.506	1.80	525	0.577	2.7	***87.7***
110	Street 'J'	STM 6	STM 7	84.5	0.65	1.32	0.86	0.86	10.00	0.44	109	0.259	4.00	375	0.351	3.2	***73.8***
111	Street 'J'	STM 7	STM 8	69.7	0.65	0.75	0.49	1.34	10.44	0.46	106	0.397	1.60	525	0.544	2.5	***73.0***
112	Street 'H'	STM DCB	STM 8	9.8	0.65	0.32	0.20	0.20	10.00	0.08	109	0.062	2.00	300	0.137	1.9	***45.4***
113	Street 'J'	STM 8	STM 9	78.5	0.65	0.53	0.35	1.89	10.91	0.49	104	0.547	1.50	600	0.752	2.7	***72.8***
114	Fenchurch Manor	STM 9	STM 5	74.1	0.65	0.71	0.46	4.14	11.72	0.35	100	1.150	2.20	675	1.247	3.5	***92.3***
115	Street 'I'	STM 1	STM 2	63.2	0.65	1.10	0.72	0.72	10.00	0.49	109	0.217	1.80	375	0.235	2.1	***92.3***
116	Street 'H'	STM 2	STM 3	87.4	0.65	0.39	0.25	0.97	10.49	0.82	106	0.286	0.80	525	0.385	1.8	***74.4***
117	Lower Street	STM 30	STM 3	66.3	0.65	0.69	0.45	0.45	10.00	0.49	109	0.135	2.00	375	0.248	2.2	***54.6***
118	Lower Street	STM 3	STM 4	75.2	0.65	0.32	0.21	1.63	11.31	0.65	102	0.461	0.80	600	0.549	1.9	***84.0***
119	Fenchurch Manor	STM 4	STM 5	82.1	0.65	0.39	0.25	1.88	11.96	0.63	99	0.517	1.00	600	0.614	2.2	***84.2***
	*Street 'G'	STM 5	STM 14	59.4				6.02	12.59	0.44	96	1.609	0.50	1050	1.931	2.2	***83.3***
120	Street 'G'	STM 15	STM 16	51.3	0.65	0.80	0.52	0.52	10.00	0.67	109	0.158	0.50	450	0.202	1.3	***78.3***
121	Street 'G'	STM 16	STM 17	70.4	0.65	0.41	0.27	0.79	10.67	0.84	105	0.231	0.50	525	0.304	1.4	***75.8***
	Street 'G'	STM 17	STM 18	56.4				0.79	11.51	0.67	101	0.221	0.50	525	0.304	1.4	***72.8***
	Street 'G'	STM 18	STM 19	12.6				0.79	12.18	0.15	98	0.215	0.50	525	0.304	1.4	***70.6***
	Street 'G'	STM 19	STM 14	10.9				0.79	12.33	0.13	97	0.213	0.50	525	0.304	1.4	***70.1***
122	**EASEMENT	STM 14	STM 20	45.9	0.65	0.78	0.51	7.32	13.03	0.41	94	1.917	**0.30**	1200	2.135	1.9	***89.8***
	**SWMF4	STM 20	STM HW 21	14.0				7.32	13.44	0.12	93	1.884	**0.30**	1200	2.135	1.9	***88.2***
Areas and runoff coefficients taken from PF PCSWMM modeling ↓																	
3-EXT					0.56	1.28	0.71										
3	***SWMF3	STM 43 (B.O.)	STM HW 38 (B.O.)	6.5	0.67	35.20	23.71	24.42	15.00	0.04	87	5.903	**0.50**	1650	6.445	3.0	***91.6***

Q= 0.0028*C*I*A (cms); C=RUNOFF COEFFICIENT; I-RAINFALL INTENSITY (5 Year) =853.608/(T.C. + 4.699)^0.766; A=AREA (ha)

Note: * Circular pipe diameter matches an equivalent area of 865 x 1345mm elliptical pipe. (DECAST Reinforced Concrete Elliptical Pipe)
** Circular pipe diameter matches an equivalent area of 965 x 1525mm elliptical pipe. (DECAST Reinforced Concrete Elliptical Pipe)
*** Circular pipe diameter matches an equivalent area of 1829x 1219mm box culvert. (DECAST Precast Box Culvert)

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, 0.65km 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

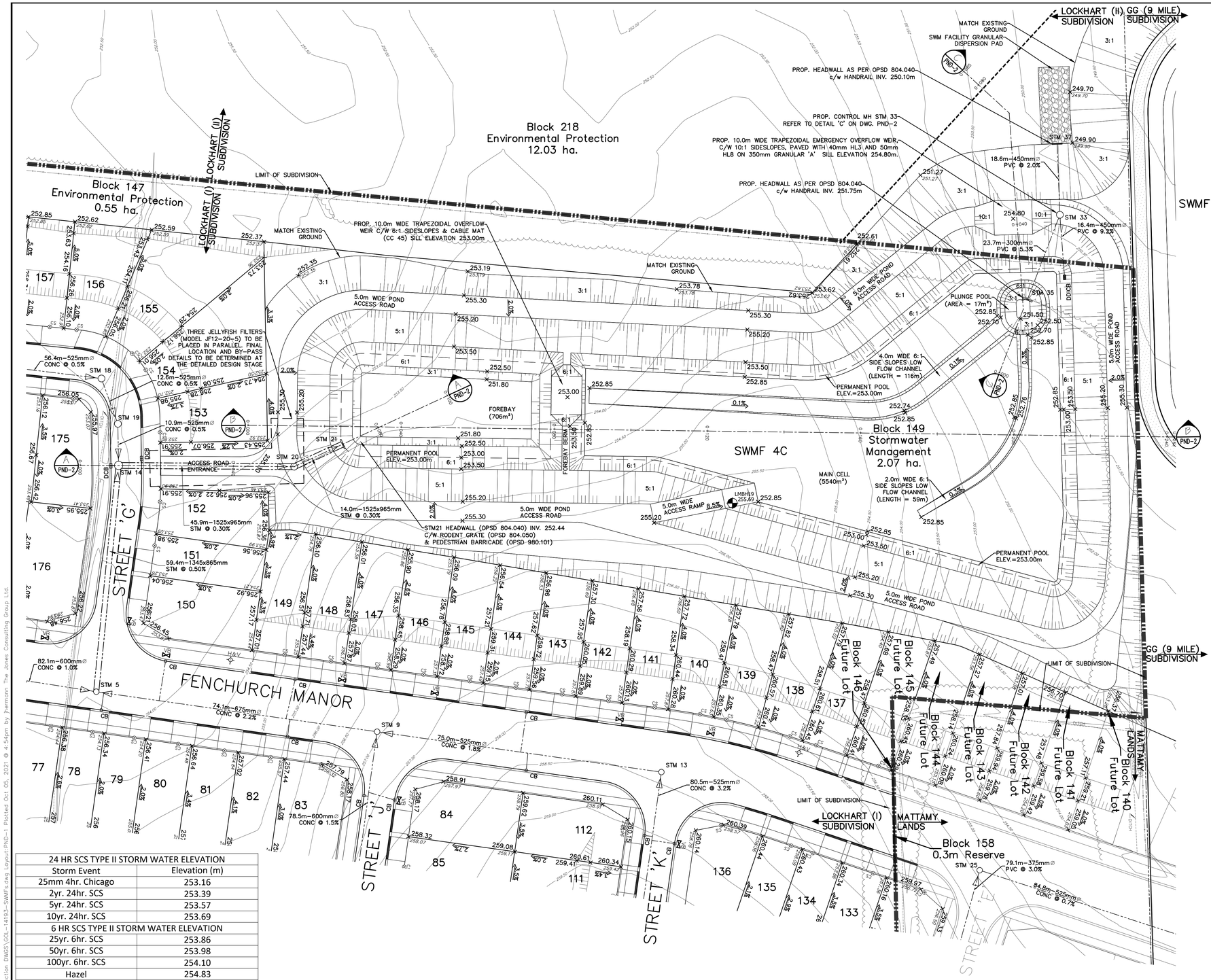
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

DESIGN SHEETS

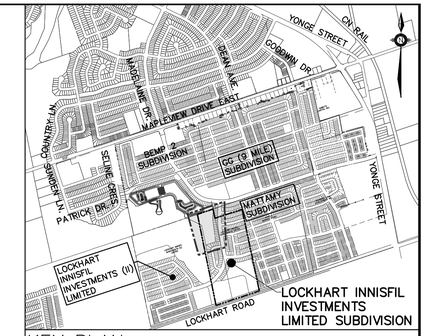
JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KC/VBS	SCALE: NTS	DATE JULY 2021
DRAWN	KC	PROJECT GOL-14193	DWG. Nº DS-1
CHECKED	JI		

G:\Eng_3D\GOL-14193-EV\Production DWGS\GOL-14193-SANITARY DRAINAGE.dwg, Layout: DS-1, Plotted: Oct 06, 2021 @ 2:30pm by jhermann, The Jones Consulting Group Ltd



24 HR SCS TYPE II STORM WATER ELEVATION	
Storm Event	Elevation (m)
25mm 4hr. Chicago	253.16
2yr. 24hr. SCS	253.39
5yr. 24hr. SCS	253.57
10yr. 24hr. SCS	253.69
6 HR SCS TYPE II STORM WATER ELEVATION	
25yr. 6hr. SCS	253.86
50yr. 6hr. SCS	253.98
100yr. 6hr. SCS	254.10
Hazel	254.83



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

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 "Y" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 010198654S4 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: 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.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

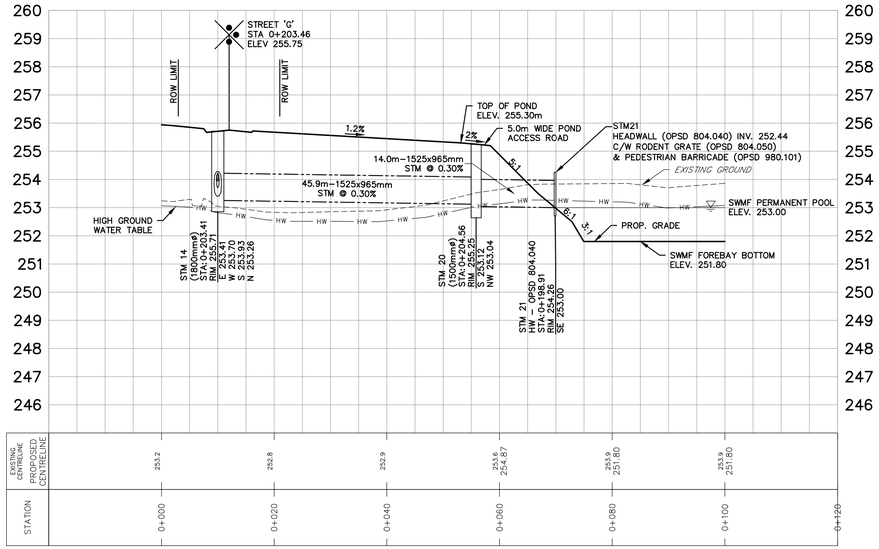
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

SWM FACILITY No. 4C PLAN VIEW

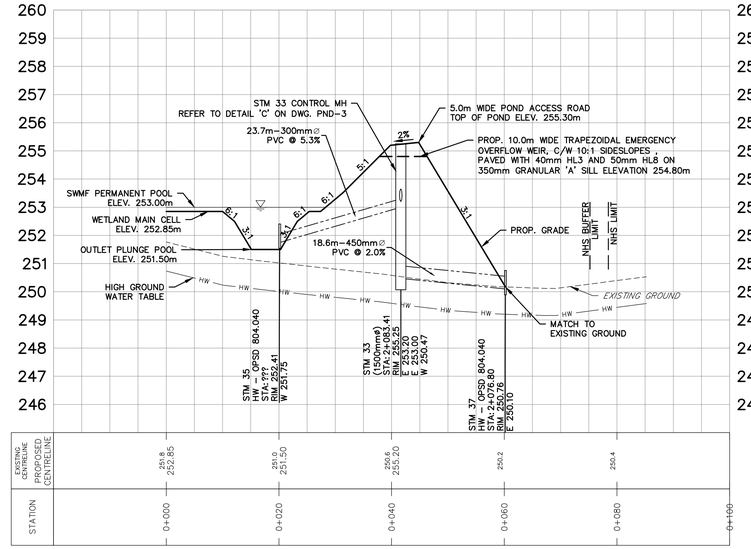
JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	MG	SCALE: 1:500	DATE JUNE 2021
DRAWN	MG/VBS	PROJECT GOL-14193	DWG. Nº PND-1
CHECKED	JI		

G:\Eng_3D\GOL-14193-EV\Production DWGS\GOL-14193-SWMFs.dwg Layout:PND-1 Plotted: Oct 05, 2021 @ 4:54pm by Jhermann The Jones Consulting Group Ltd.

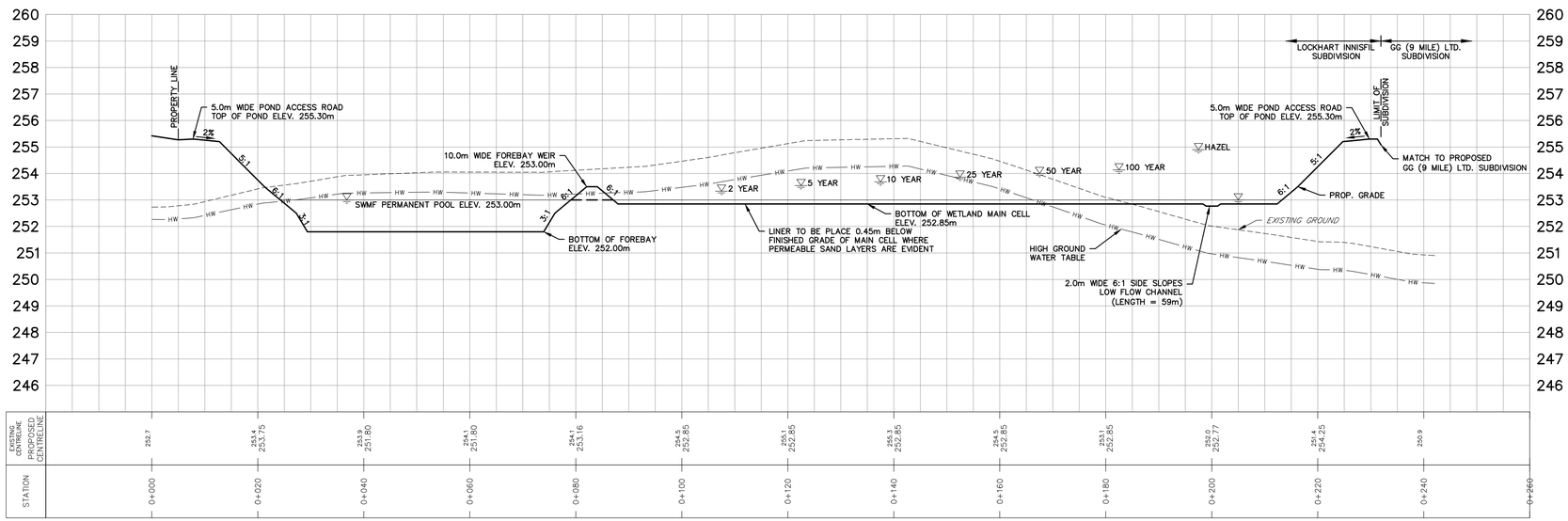


SECTION A–A
HOR. 1:500
VERT. 1:100



SECTION C–C
HOR. 1:500
VERT. 1:100

24 HR SCS TYPE II STORM WATER ELEVATION	
Storm Event	Elevation (m)
25mm 4hr. Chicago	253.16
2yr. 24hr. SCS	253.39
5yr. 24hr. SCS	253.57
10yr. 24hr. SCS	253.69
6 HR SCS TYPE II STORM WATER ELEVATION	
25yr. 6hr. SCS	253.86
50yr. 6hr. SCS	253.98
100yr. 6hr. SCS	254.10
Hazel	254.83



SECTION B–B
HOR. 1:500
VERT. 1:100

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, 0.65km 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 LIMITED SUBDIVISION

SWM FACILITY No. 4C SECTIONS

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

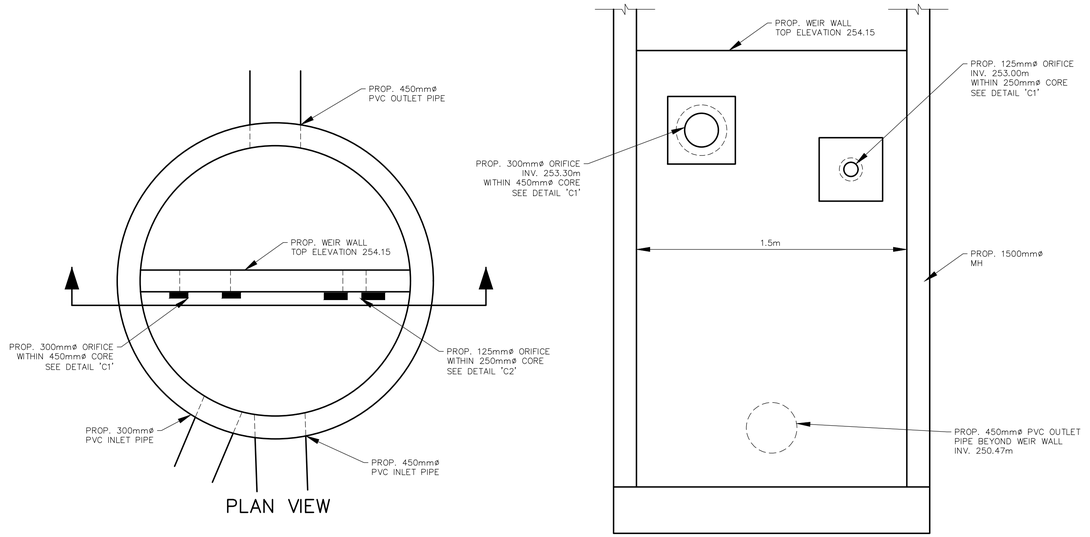
DESIGN	MG	SCALE: 1:500	DATE JUNE 2021
DRAWN	MG/VBS	PROJECT GOL–14193	DWG. Nº PND–2
CHECKED	JI		

G:\Eng_3D\GOL-14193-EV\Production DWGS\GOL-14193-SWMFx.dwg Layout:PND-2 Plotted Oct 05, 2021 @ 4:55pm by Jhermann The Jones Consulting Group Ltd

DETAIL 'C'

1500mm∅ CONTROL MANHOLE 33

N.T.S.

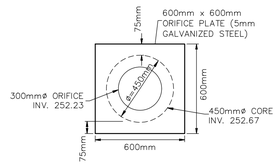


DETAIL 'C1'

300mmø ORIFICE PLATE

BOLTED TO THE WEST SIDE OF WEIR WALL

N.T.S.

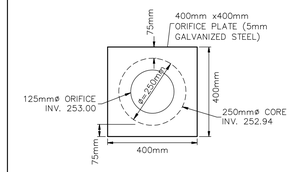


DETAIL 'C2'

100mmø ORIFICE PLATE

BOLTED TO THE WEST SIDE OF WEIR WALL

N.T.S.



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

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

LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

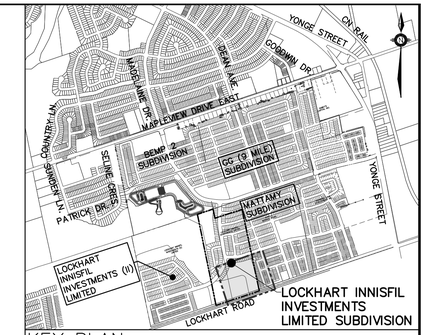
SWM FACILITY No. 4C DETAILS

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 MG	SCALE: 1:500	DATE JUNE 2021	
DRAWN MG	PROJECT GOL-14193	DWG. Nº PND-3	
CHECKED JI			

G:\Eng_3D\GOL-14193-EV\Production DWGS\GOL-14193-SWMFs.dwg Layout:PND-3 Plotted: Oct 07, 2021 @ 10:43am by jhermann The Jones Consulting Group Ltd.

24 HR SCS TYPE II STORM WATER ELEVATION	
Storm Event	Elevation (m)
25mm 4hr. Chicago	253.75
2yr. 24hr. SCS	254.01
5yr. 24hr. SCS	254.24
10yr. 24hr. SCS	254.40
25yr. 6hr. SCS	254.60
50yr. 6hr. SCS	254.75
100yr. 6hr. SCS	254.90
Hazel	255.53



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

BENCHMARK:

BENCHMARK NO: 001193U460S 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

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

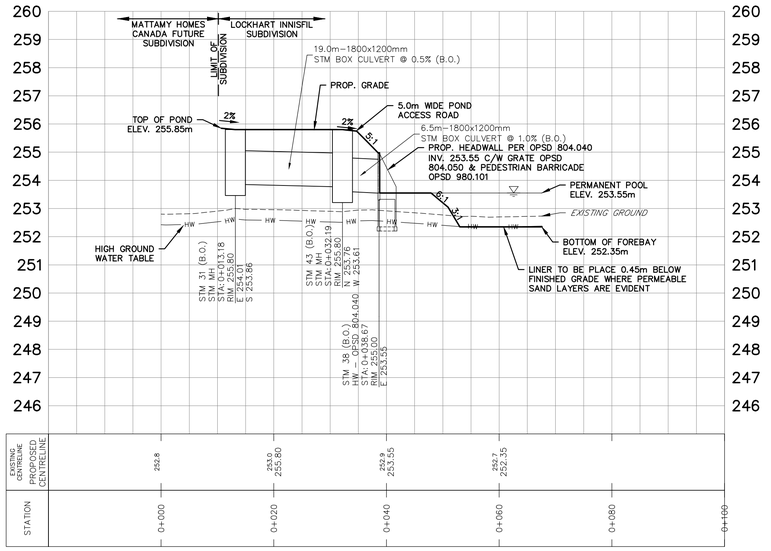
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

SWM FACILITY No. 3 PLAN VIEW

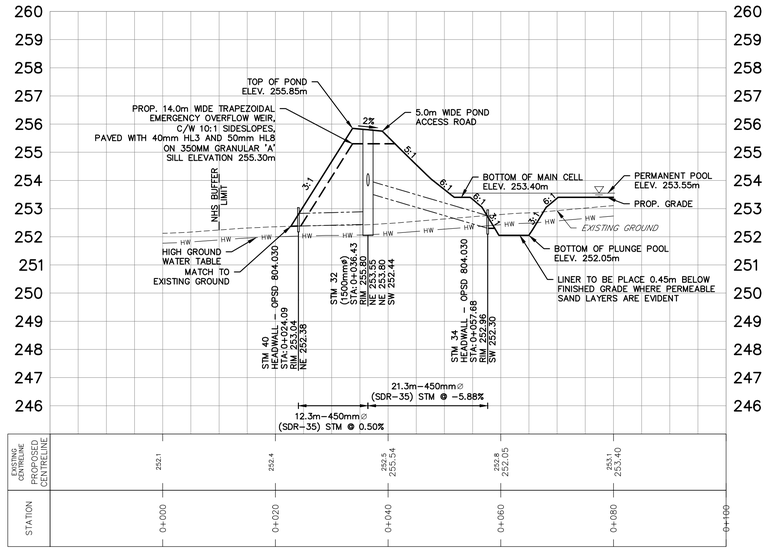
JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN MG	SCALE: 1:500	DATE JUNE 2021
DRAWN MG	PROJECT GOL-14193	DWG. Nº PND-4
CHECKED JI		

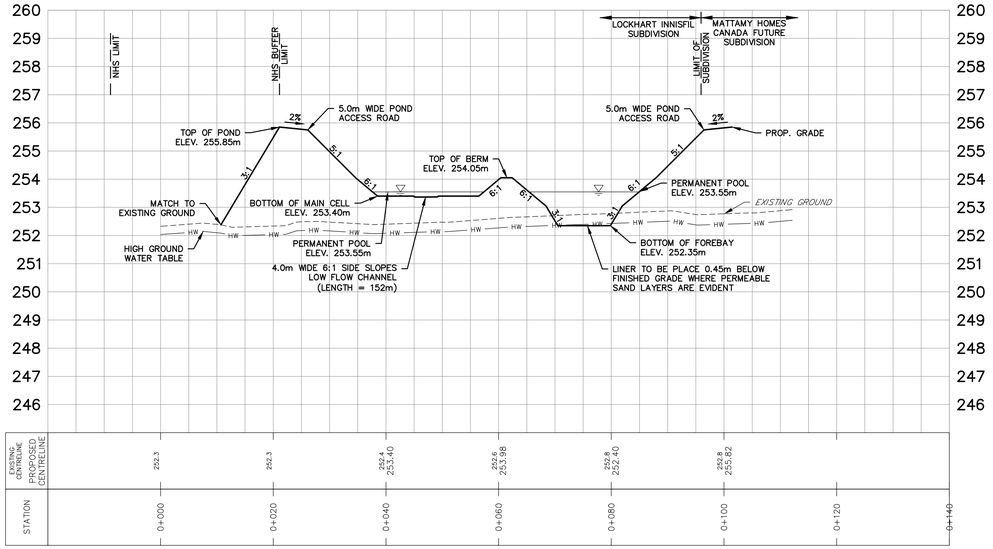
C:\Enn_3D\GOL-14193-F\Production DWGS\GOL-14193-SWMFs.dwg Layout: PND-4 Plotted Oct 06, 2021 @ 4:01pm by jhermann The Jones Consulting Group Ltd.



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



PND-1 SECTION C-C
HOR. 1:500
VERT. 1:100



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

24 HR SCS TYPE II STORM WATER ELEVATION	
Storm Event	Elevation (m)
25mm 4hr. Chicago	253.75
2yr. 24hr. SCS	254.01
5yr. 24hr. SCS	254.24
10yr. 24hr. SCS	254.40
25yr. 6hr. SCS	254.60
50yr. 6hr. SCS	254.75
100yr. 6hr. SCS	254.90
Hazel	255.53

BENCHMARK:

BENCHMARK NO: 001931U460G 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 253.480

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 LIMITED SUBDIVISION

SWM FACILITY No. 3 SECTIONS

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

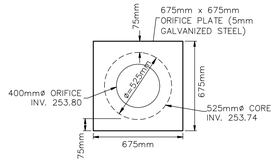
DESIGN	MG	SCALE: 1:500	DATE JUNE 2021
DRAWN	MG	PROJECT GOL-14193	DWG. Nº PND-5
CHECKED	JI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-SWMFs.dwg Layout:PND-5 Plotted Oct 06, 2021 @ 4:50pm by Jhermann The Jones Consulting Group Ltd.

DETAIL 'C1'

300mmø ORIFICE PLATE

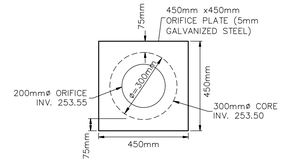
BOLTED TO THE WEST SIDE OF WEIR WALL N.T.S.



DETAIL 'C2'

100mmø ORIFICE PLATE

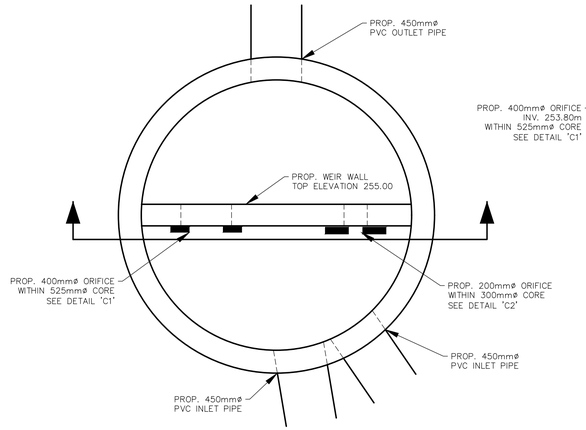
BOLTED TO THE WEST SIDE OF WEIR WALL N.T.S.



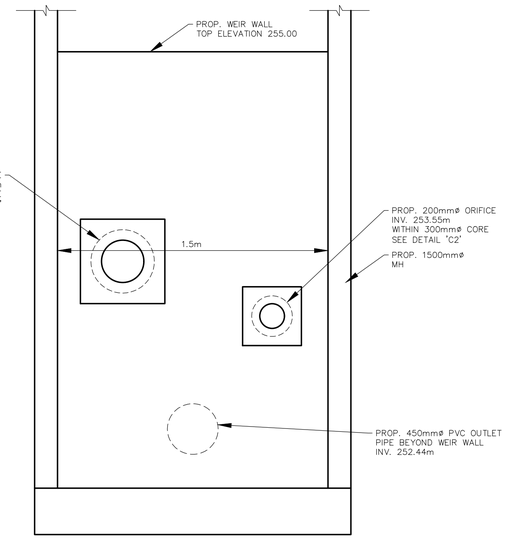
DETAIL 'C'

1500mm∅ CONTROL MANHOLE 32

N.T.S.



PLAN VIEW



SECTION VIEW

BENCHMARK:

BENCHMARK NO: 0011931U4605 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: 0101986S454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.63m 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: 0101986D407 LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE APPROXIMATELY 500m EAST OF HURONIA ROAD. N.4910727.688 E.607083.931

BENCHMARK NO: 0101986D404 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

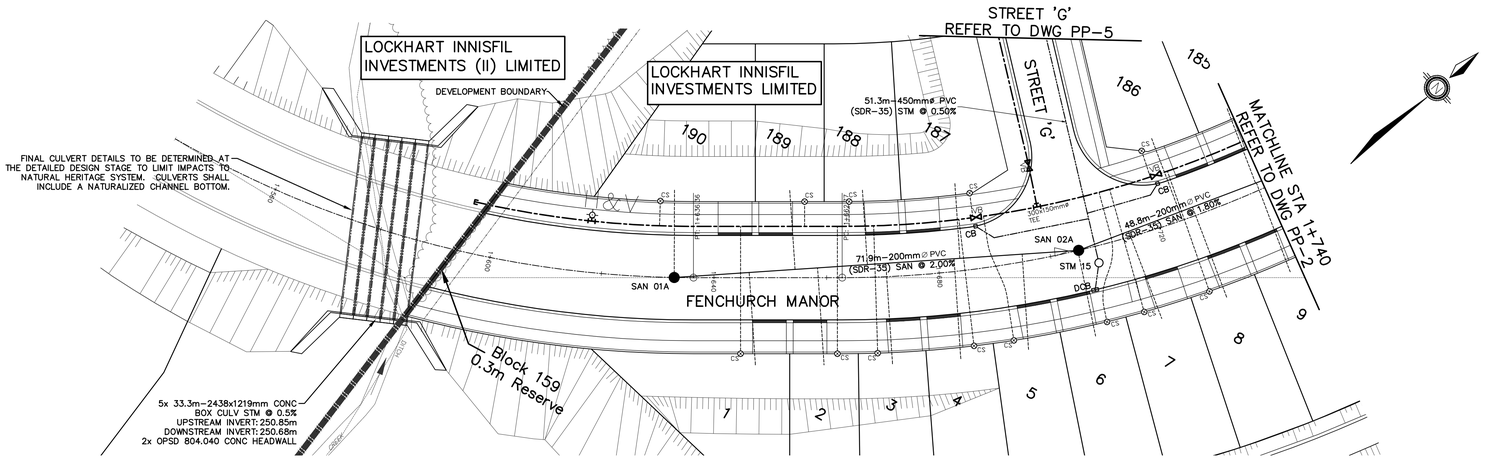
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

SWM FACILITY No. 3 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	MG	SCALE: 1:500	DATE JULY 2021
DRAWN	MG/VBS	PROJECT GOL-14193	DWG. Nº PND-6
CHECKED	JI		

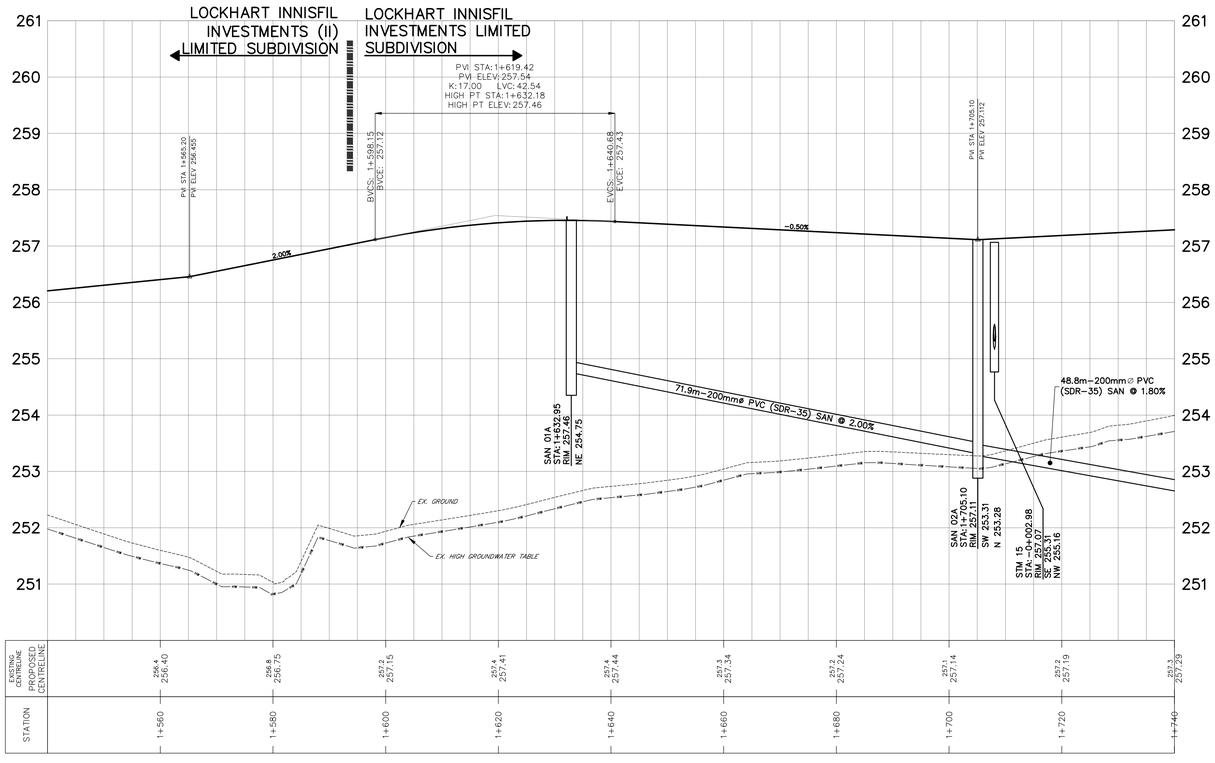
G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-SWMFs.dwg Layout:PND-6 Plotted Oct 07, 2021 @ 10:42pm by jhermann The Jones Consulting Group Ltd.



KEY PLAN
NTS

LEGEND

SAP.33921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB □	CATCHBASIN (BY OTHERS)
DCB ▭	DOUBLE CATCHBASIN (BY OTHERS)
V&V	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
V&B	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 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: 01019850404 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

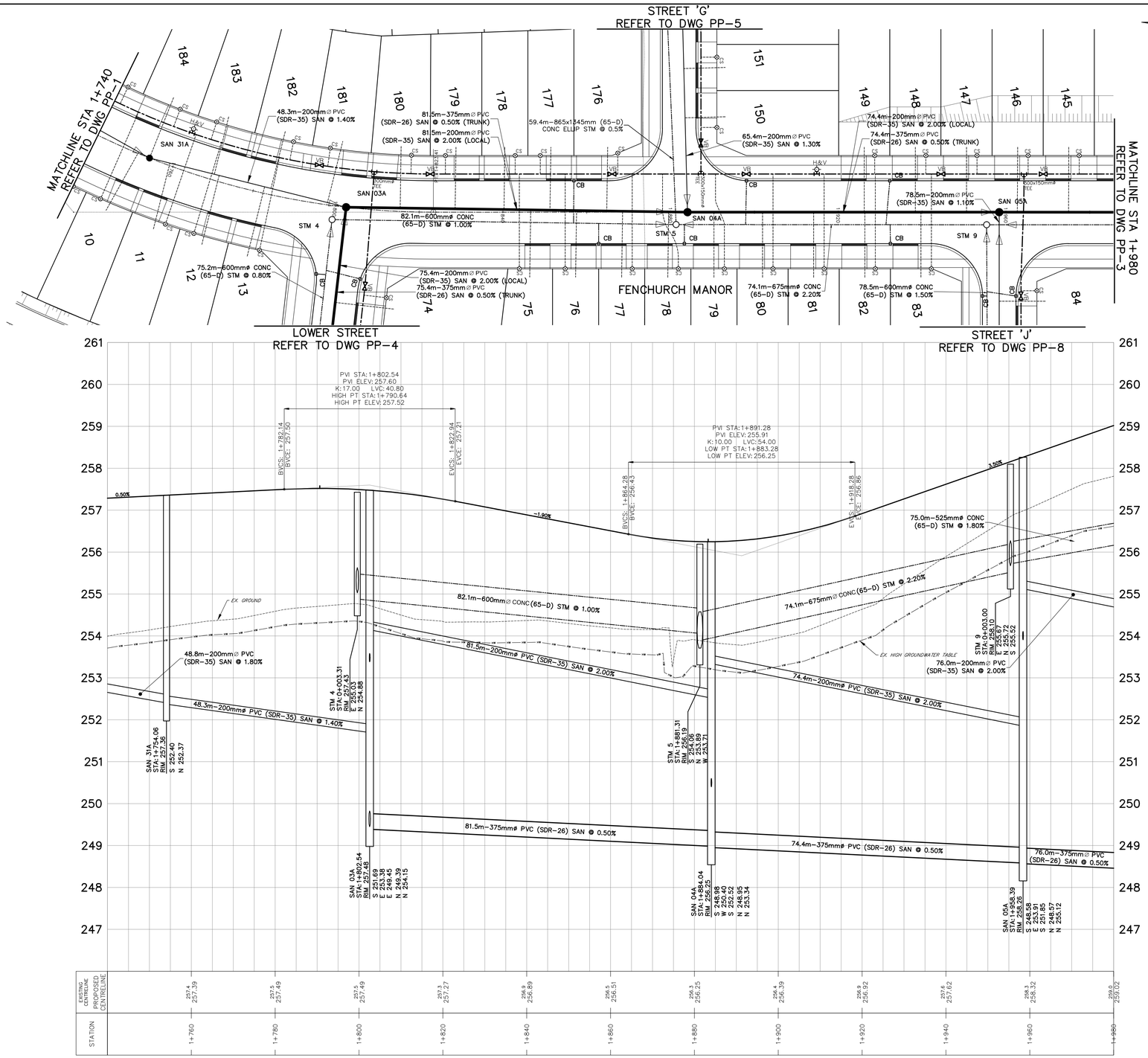
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

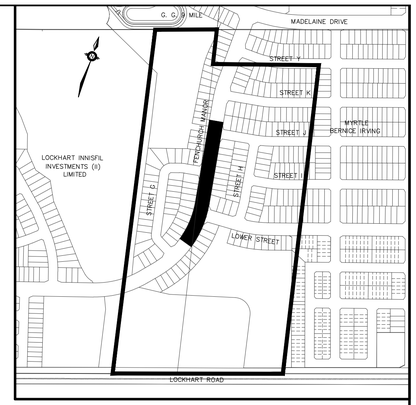
PLAN AND PROFILE FENCHURCH MANOR STA. 1+540 TO 1+740

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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL-14193	DWG. Nº PP-1
CHECKED	JWI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-PP_Fenchurch.dwg, Layout: PP-1 Plotted: Oct 05, 2021 @ 5:01pm by jhermon The Jones Consulting Group Ltd





KEY PLAN
NTS

LEGEND

- SAP.33921 — SANITARY MAINTENANCE HOLE (BY OTHERS)
- GDLV5979 — STORM MAINTENANCE HOLE (BY OTHERS)
- CB — CATCHBASIN (BY OTHERS)
- DCB — DOUBLE CATCHBASIN (BY OTHERS)
- V&V(B.O.) — VALVE & BOX (BY OTHERS)
- H&V(B.O.) — HYDRANT & VALVE (BY OTHERS)
- SAN 23A — SANITARY MAINTENANCE HOLE
- STM 24 — STORM MAINTENANCE HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- H&V — HYDRANT AND VALVE
- V&V — 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 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

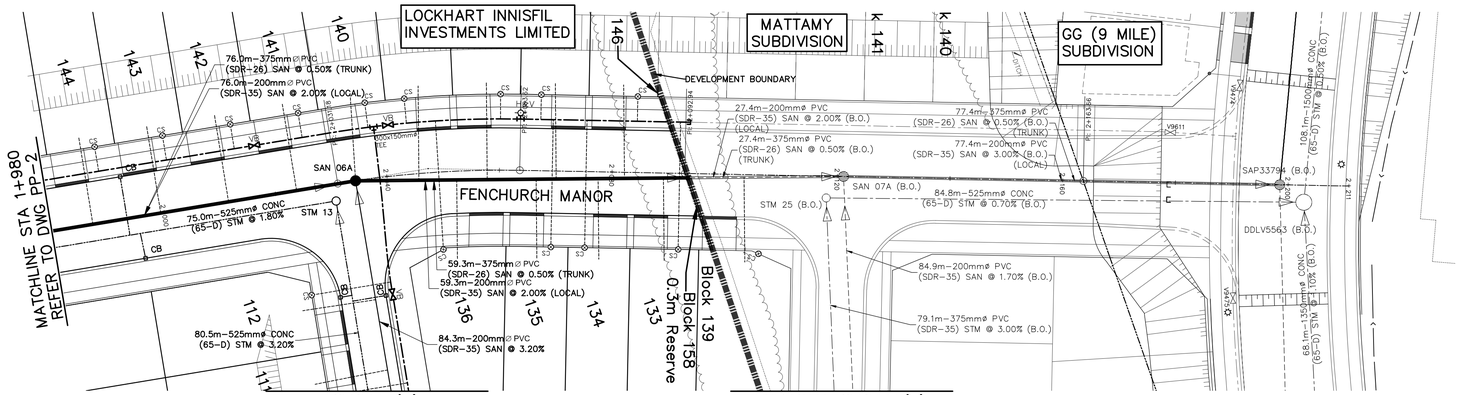
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

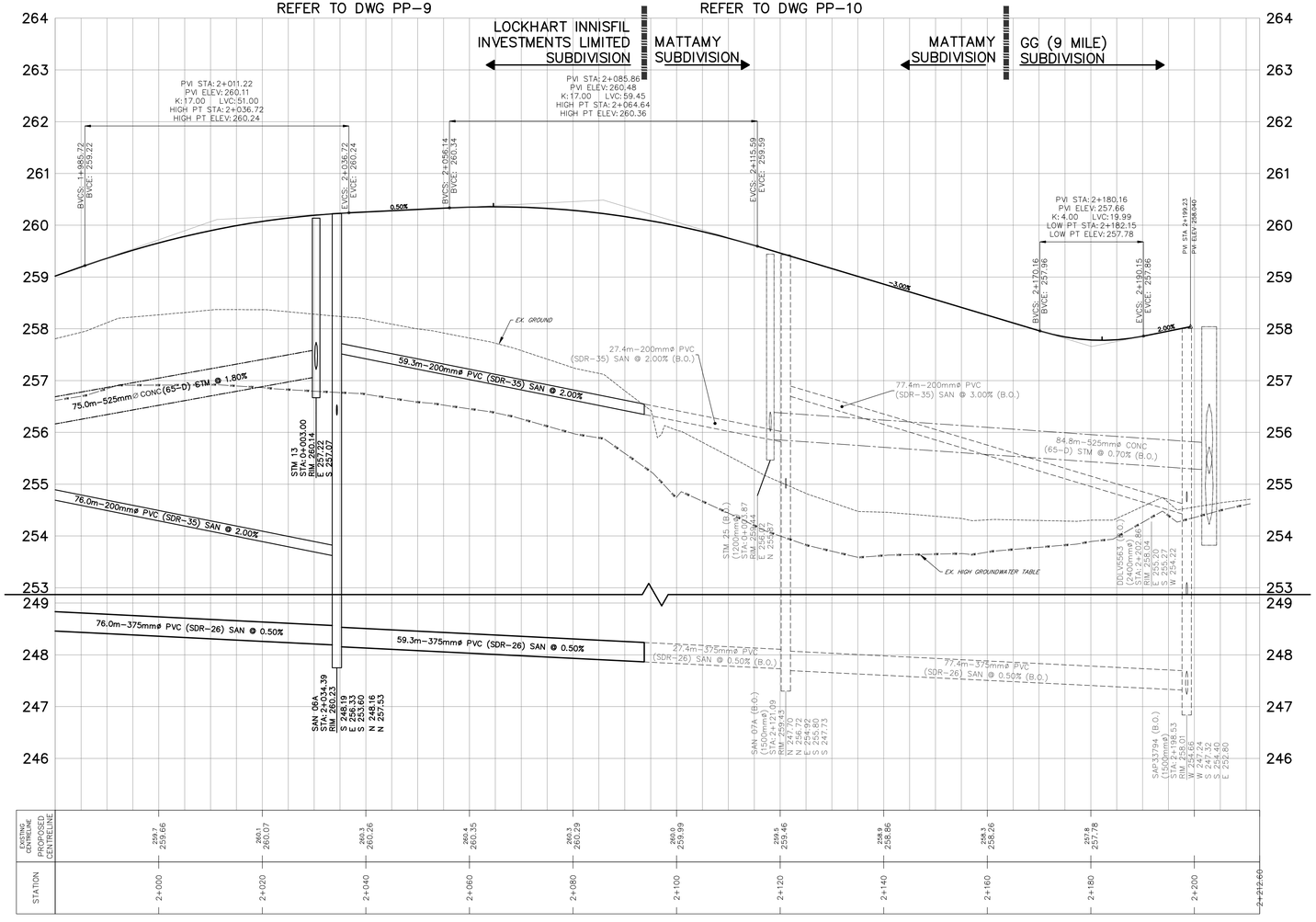
PLAN AND PROFILE FENCHURCH MANOR STA. 1+740 TO 1+980

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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL-14193	DWG. Nº PP-2
CHECKED	JWI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193_PP_Fenchurch.dwg Layout:PP-2 Plotted Oct 05, 2021 @ 5:09pm by jhermann The Jones Consulting Group Ltd.





KEY PLAN
NTS

LEGEND

SAP33921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
DDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB	CATCHBASIN (BY OTHERS)
DCB	DOUBLE CATCHBASIN (BY OTHERS)
VB(B.O.)	VALVE & BOX (BY OTHERS)
H&V(B.O.)	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	JWI

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

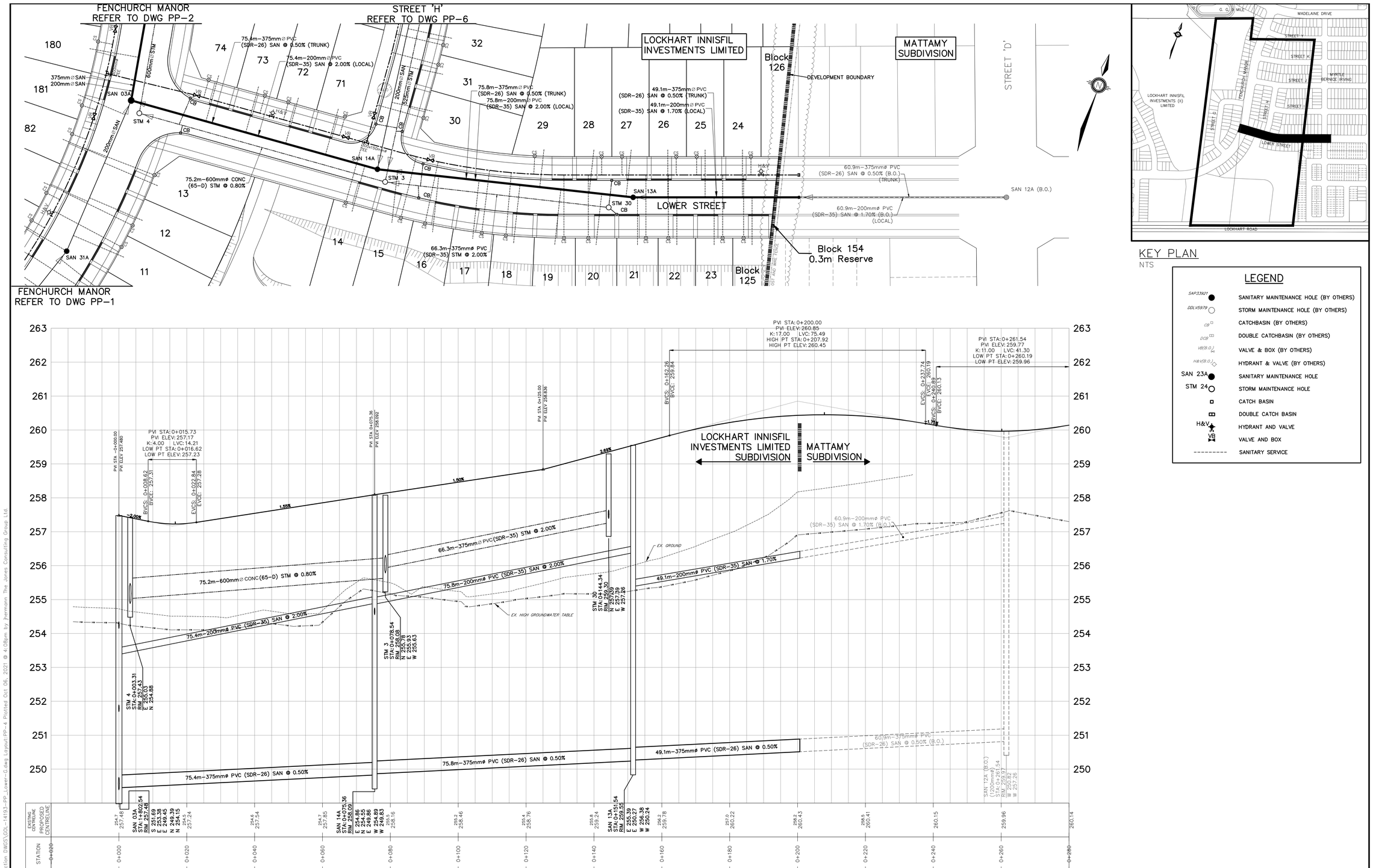
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

PLAN AND PROFILE FENCHURCH MANOR STA. 1+980 TO 2+212.6

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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL-14193	DWG. Nº PP-3
CHECKED	JWI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-PP_Fenchurch.dwg Layout:PP-3 Plotted Oct 05, 2021 @ 5:10pm by jherrmann The Jones Consulting Group Ltd



KEY PLAN
NTS

LEGEND

SAP.13921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB □	CATCHBASIN (BY OTHERS)
DCB □□	DOUBLE CATCHBASIN (BY OTHERS)
VB(B.O.) ⋈	VALVE & BOX (BY OTHERS)
H&V(B.O.) ⋈	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 TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.659m 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

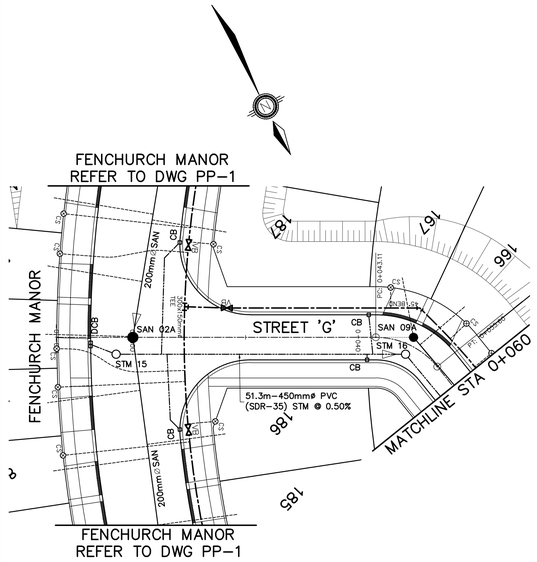
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

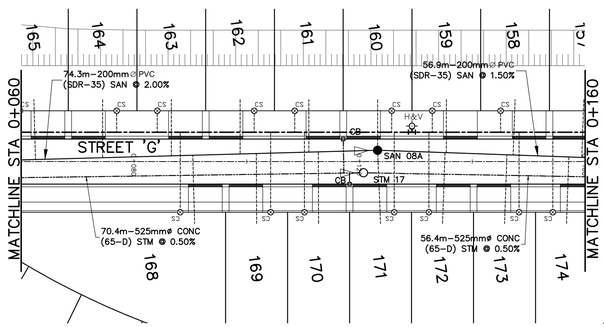
PLAN AND PROFILE LOWER STREET STA. -0+014 TO 0+280

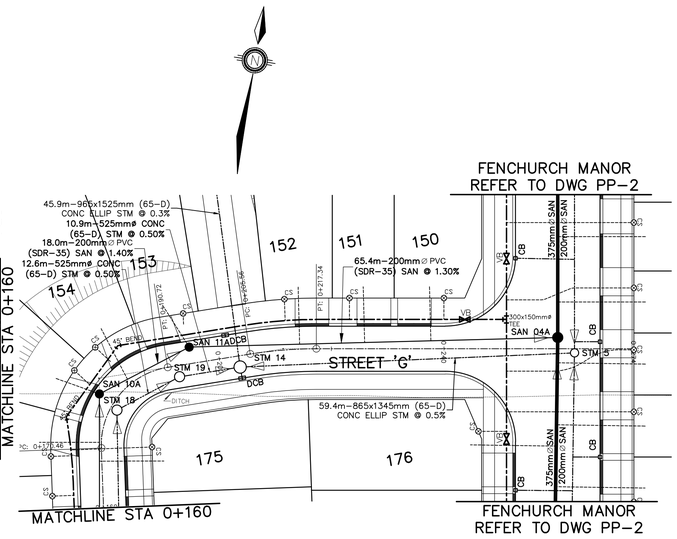
JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL-14193	DWG. Nº PP-4
CHECKED	JWI		

G:\Eng_3D\GOL-14193-EX\Production DWGS\GOL-14193-PP_Lower-G.dwg, Layout:PP-4 Plotted Oct 06, 2021 @ 4:08pm by jhermann The Jones Consulting Group Ltd.



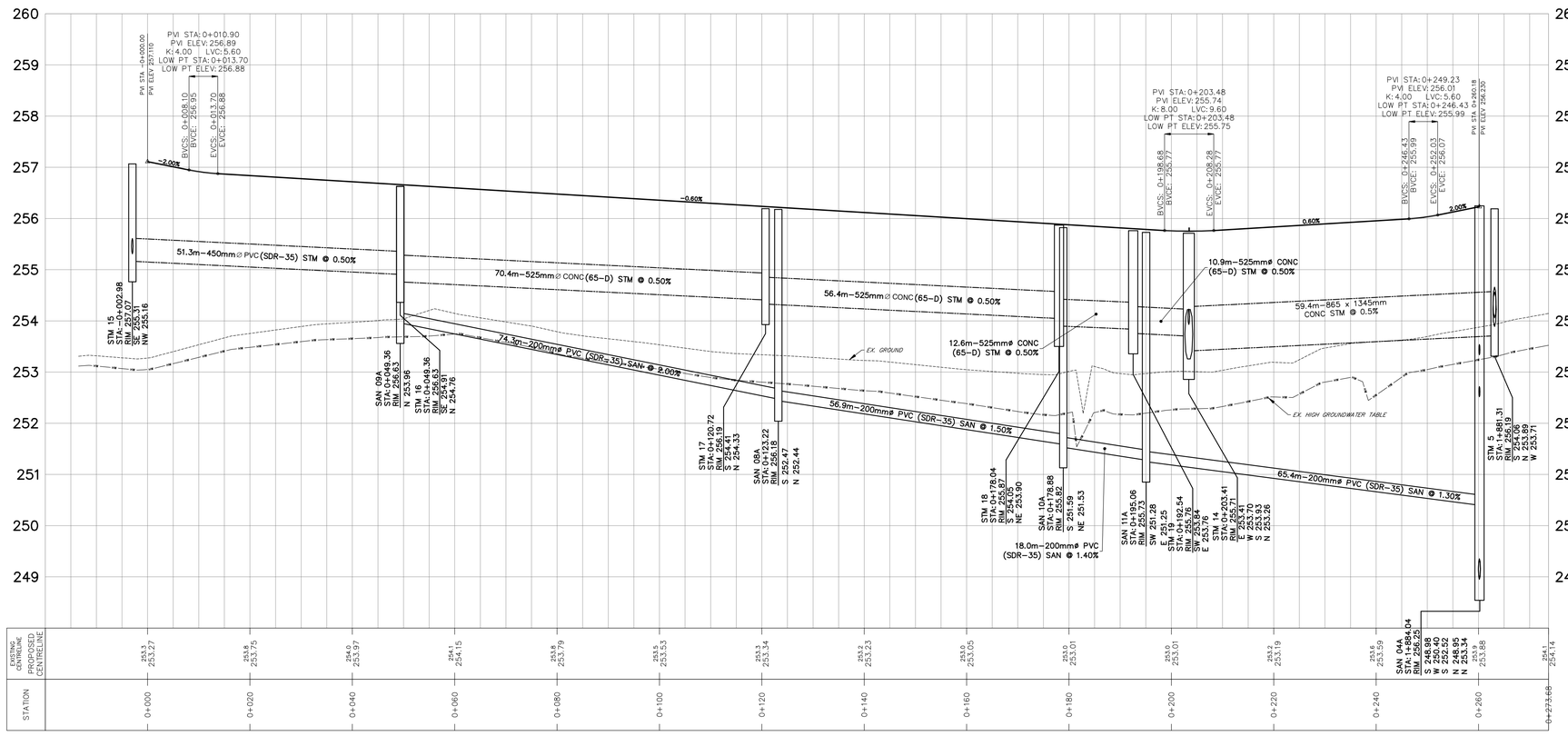




KEY PLAN
NTS

LEGEND

SAP133921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB	CATCHBASIN (BY OTHERS)
DCB	DOUBLE CATCHBASIN (BY OTHERS)
V&B	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
V&B	VALVE AND BOX
	SANITARY SERVICE



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 "Y" IN TWIN BIRCH TREES 15cm BELOW BROK. ELEV 263.480

BENCHMARK NO. 01019855454 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

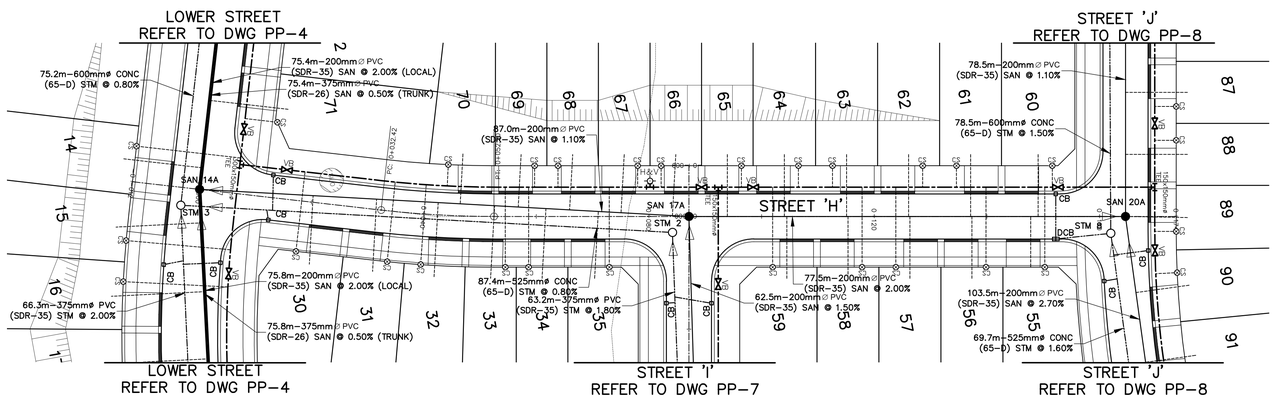
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

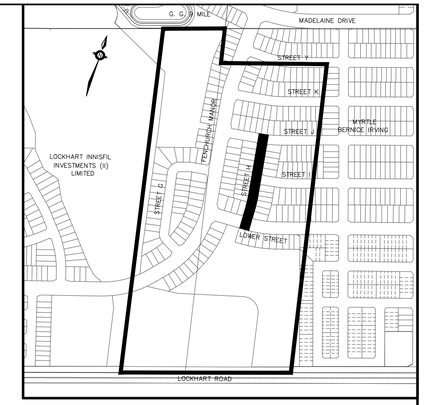
PLAN AND PROFILE STREET 'G' STA. -0+014 TO 0+273.68

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 JJH	SCALE: 1:500	DATE JUNE 2021	
DRAWN JJH	PROJECT GOL-14193	DWG. Nº PP-5	
CHECKED JWI			

C:\Eng_JOB\GOL-14193-E\Production DWGS\GOL-14193-PP_Lower-G.dwg Layout:PP-5 Plotted: Oct 06, 2021 @ 4:10pm by Jeremson The Jones Consulting Group Ltd

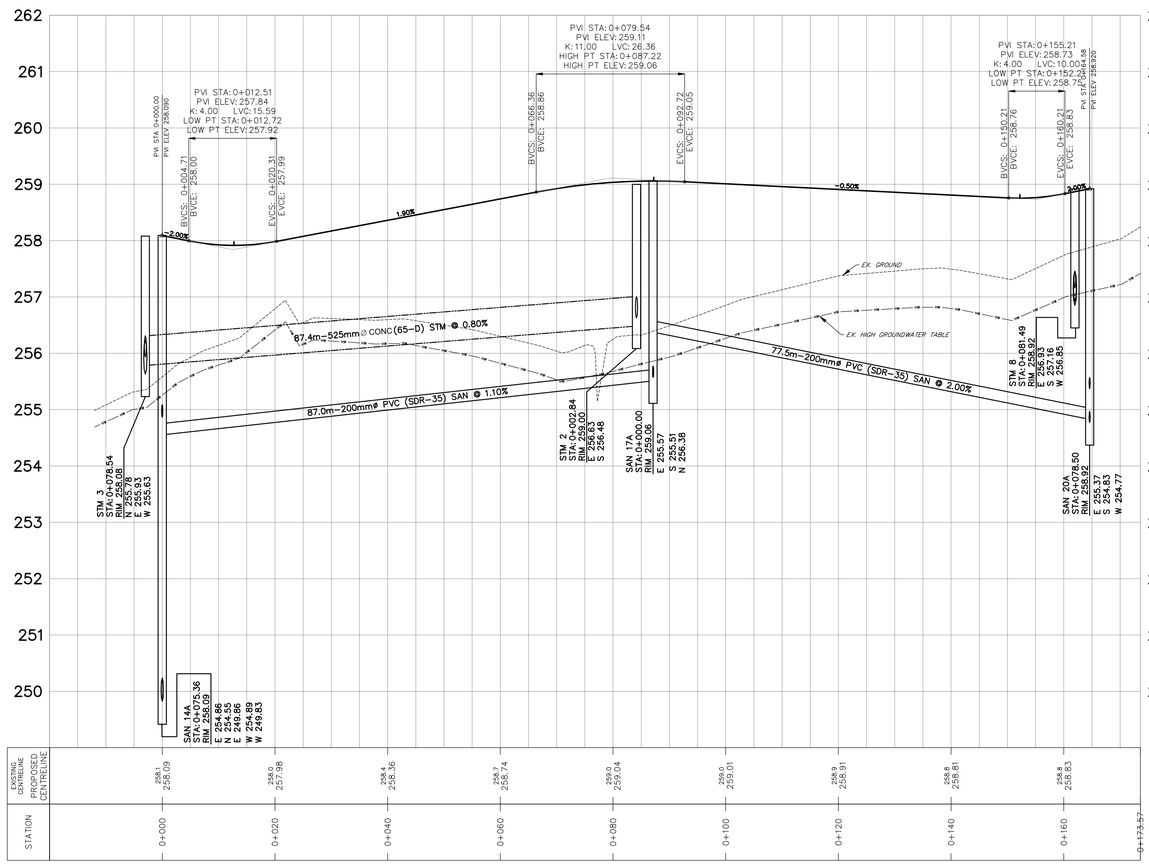




KEY PLAN
NTS

LEGEND

SAP.13921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB □	CATCHBASIN (BY OTHERS)
DCB □□	DOUBLE CATCHBASIN (BY OTHERS)
V&V(B.O.)	VALVE & BOX (BY OTHERS)
H&V(B.O.)	HYDRANT & VALVE (BY OTHERS)
SAN 23A ●	SANITARY MAINTENANCE HOLE
STM 24 ○	STORM MAINTENANCE HOLE
□	CATCH BASIN
□□	DOUBLE CATCH BASIN
H&V	HYDRANT AND VALVE
V&B	VALVE AND BOX
---------	SANITARY SERVICE



BENCHMARK:

BENCHMARK NO: 001193110460S 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 "Y" 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

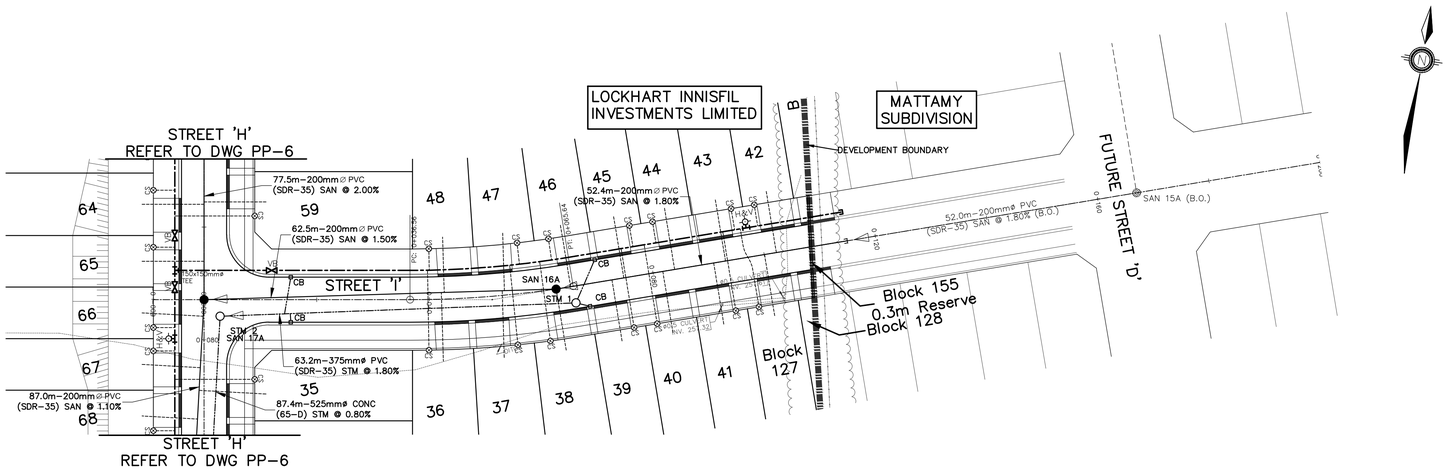
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

PLAN AND PROFILE
STREET 'H'
STA. -0+020 TO 0+173.57

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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL-14193	DWG. Nº PP-6
CHECKED	JWI		

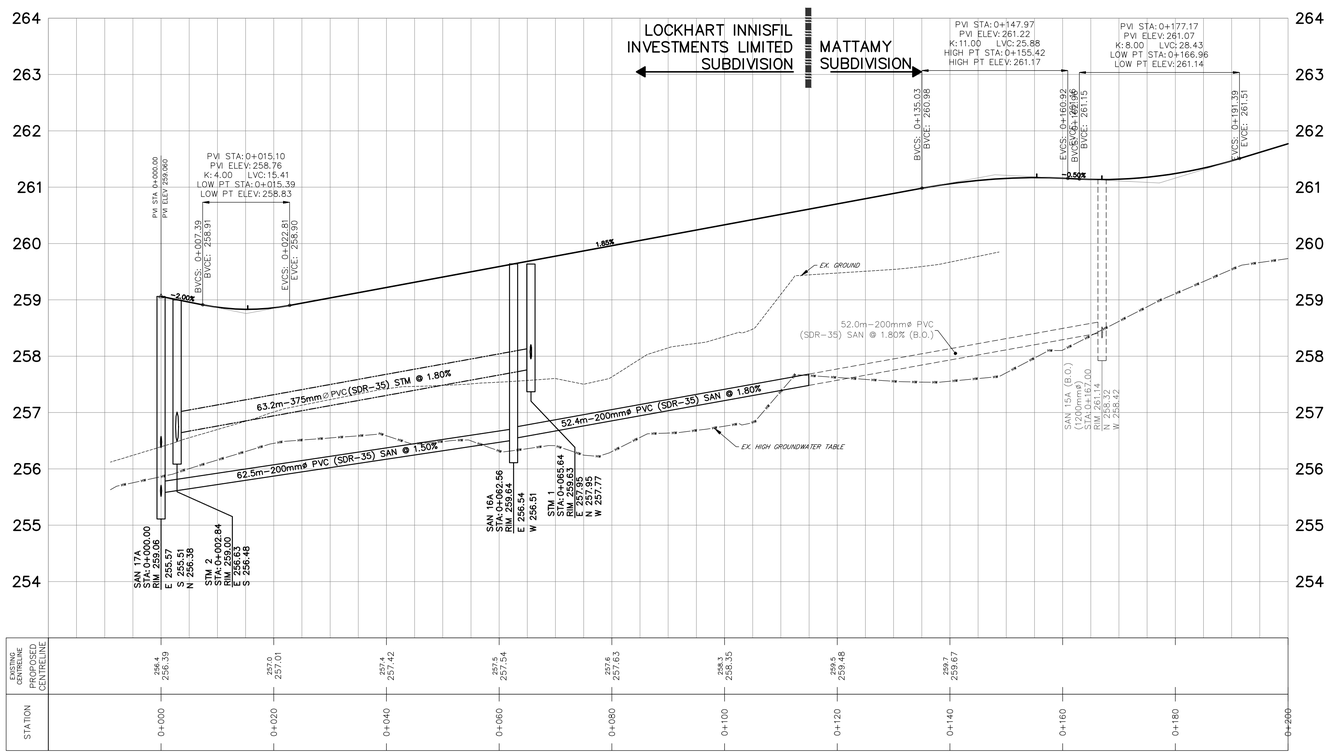
G:\Eng_JJ\GOL-14193-JJ\Production DWGS\GOL-14193-PP_H-Layout.PP-6 Plotted Oct 06, 2021 @ 4:10pm by jhermann The Jones Consulting Group Ltd.



KEY PLAN
NTS

LEGEND

SAP.33921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB	CATCHBASIN (BY OTHERS)
DCB	DOUBLE CATCHBASIN (BY OTHERS)
VB(B.O.)	VALVE & BOX (BY OTHERS)
H&V(B.O.)	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



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BENCHMARK:

BENCHMARK NO: 001183IU460S 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	JWI

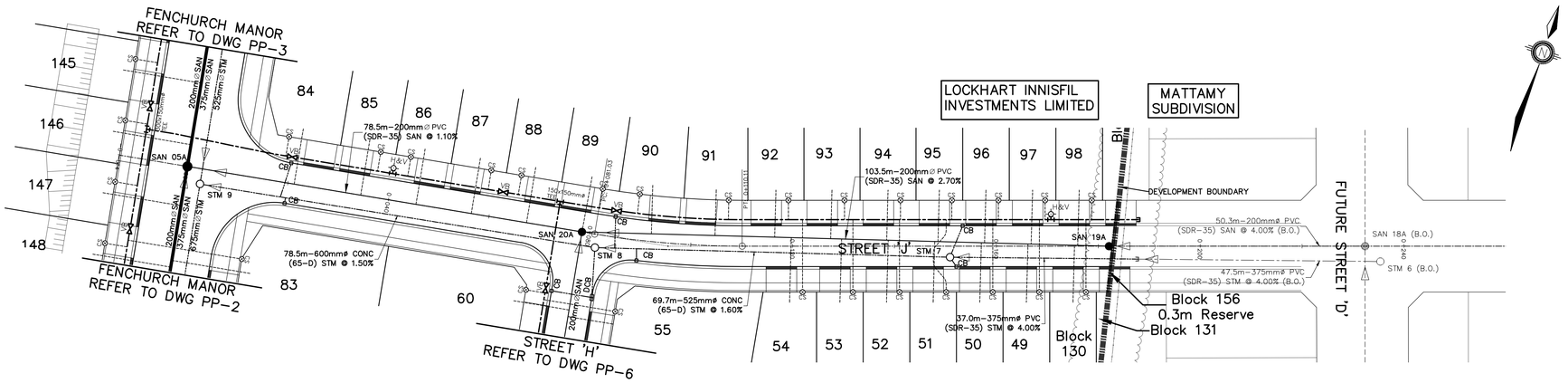
J. W. INGRAM
100143779
21-10-06
MCENEREY PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

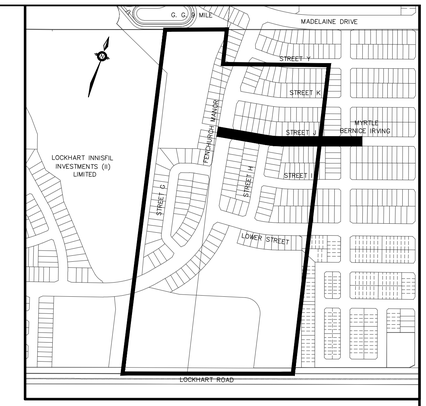
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

PLAN AND PROFILE STREET 'I' STA. -0+020 TO 0+200

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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GDL-14193	DWG. Nº PP-7
CHECKED	JWI		

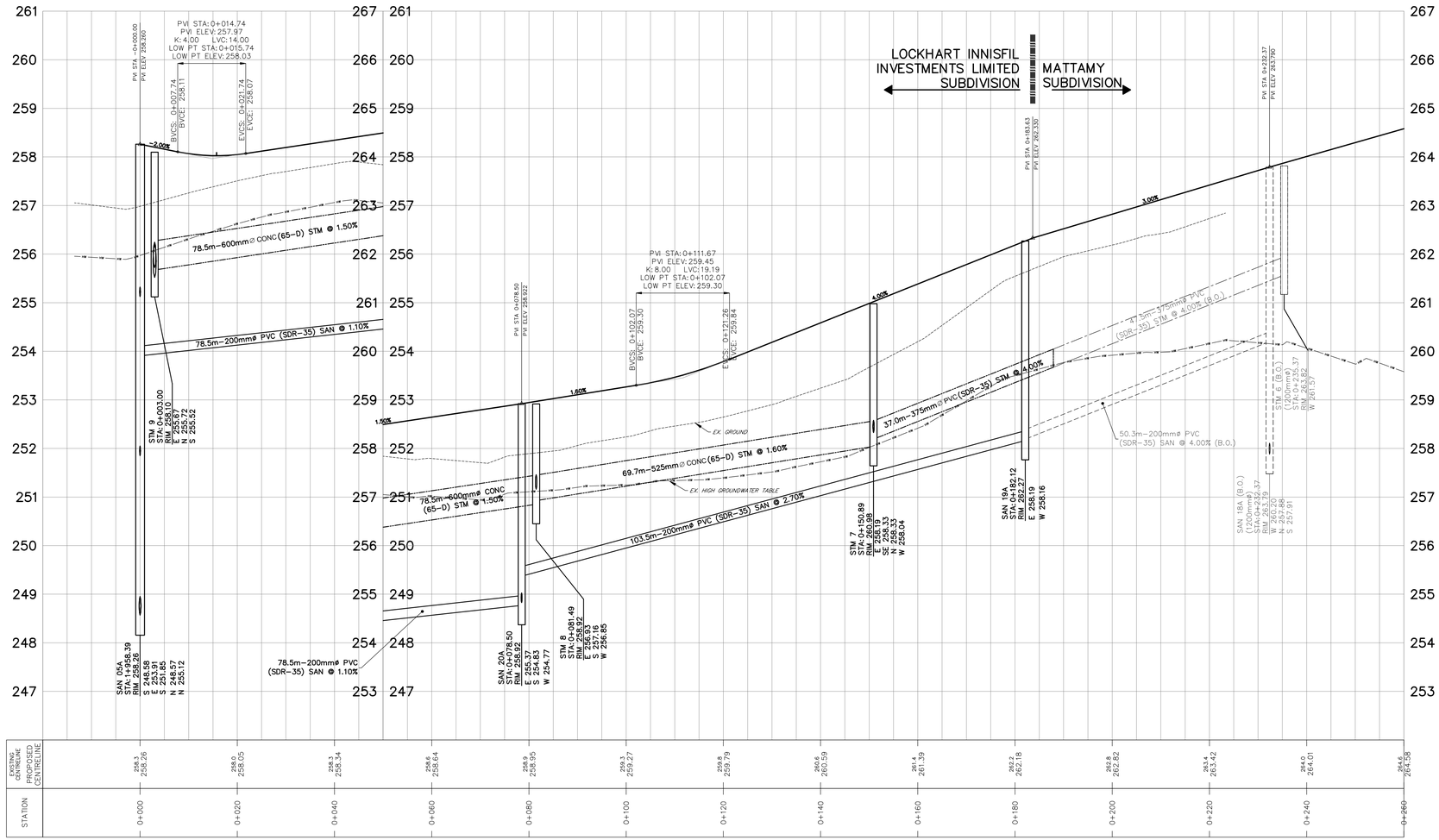




KEY PLAN
NTS

LEGEND

SAP.33921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB	CATCHBASIN (BY OTHERS)
DCB	DOUBLE CATCHBASIN (BY OTHERS)
VB(B.O.)	VALVE & BOX (BY OTHERS)
H&V(B.O.)	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: 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 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 LIMITED SUBDIVISION

PLAN AND PROFILE STREET 'J' STA. -0+020 TO 0+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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL-14193	DWG. Nº PP-8
CHECKED	JWI		

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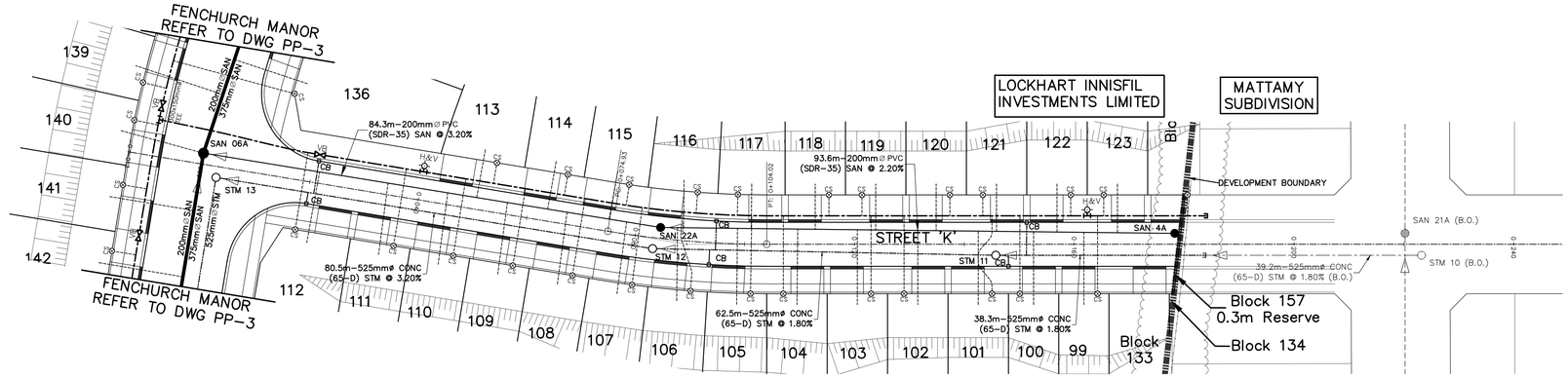
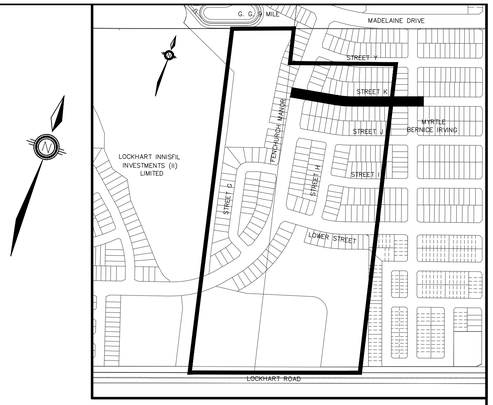
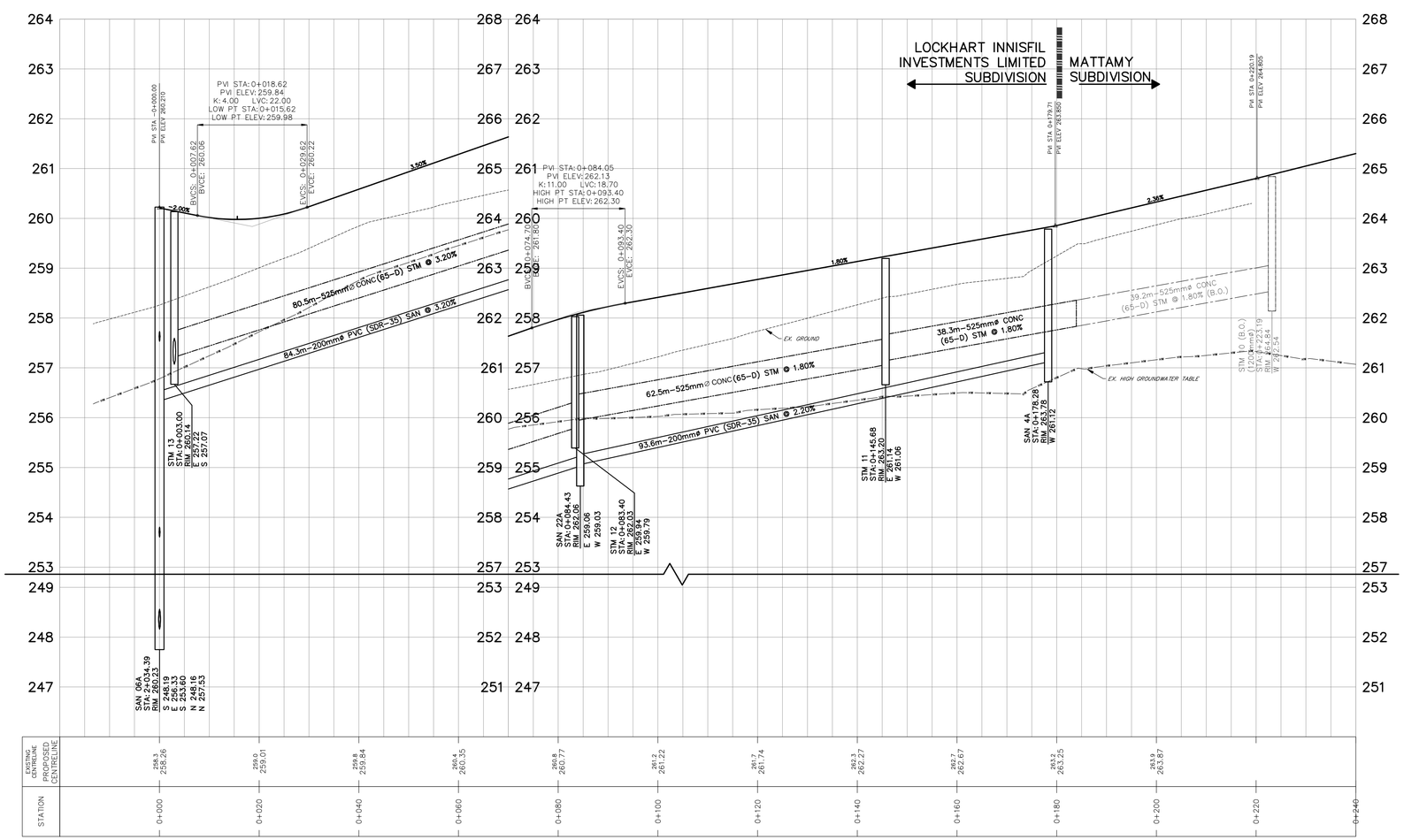




KEY PLAN
NTS

LEGEND

SAP.13921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB □	CATCHBASIN (BY OTHERS)
DCB □□	DOUBLE CATCHBASIN (BY OTHERS)
V&V(B.O.)	VALVE & BOX (BY OTHERS)
H&V(B.O.)	HYDRANT & VALVE (BY OTHERS)
SAN 23A ●	SANITARY MAINTENANCE HOLE
STM 24 ○	STORM MAINTENANCE HOLE
□	CATCH BASIN
□□	DOUBLE CATCH BASIN
H&V	HYDRANT AND VALVE
V&B	VALVE AND BOX
----------	SANITARY SERVICE



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 "Y" IN TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019855454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.659m 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

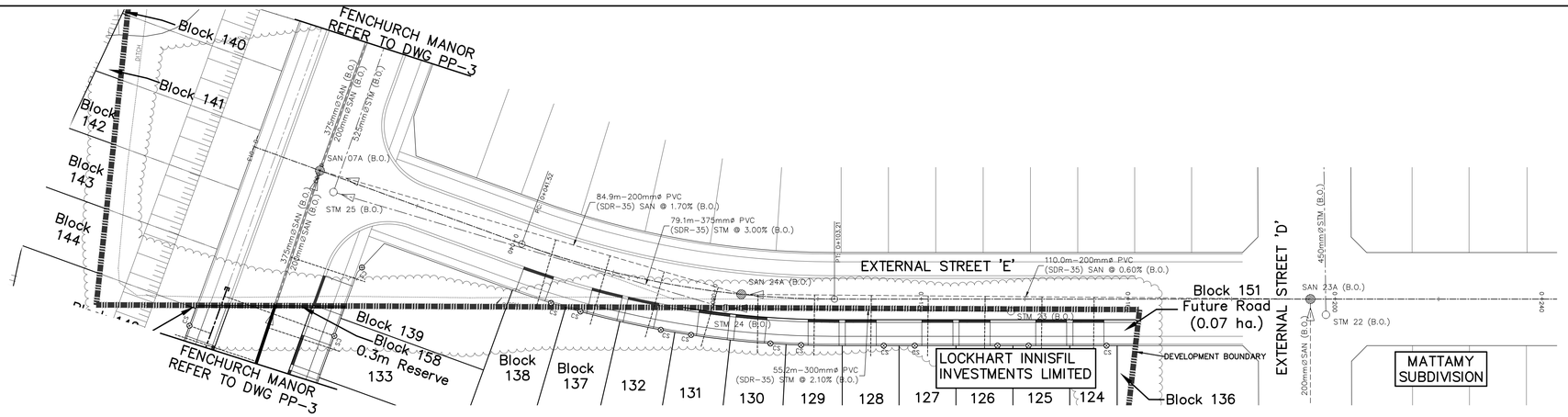
LOCKHART INNISFIL INVESTMENTS LIMITED SUBDIVISION

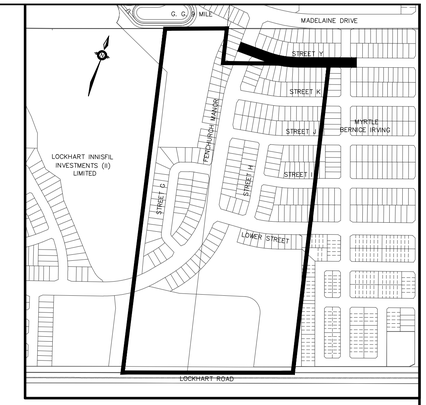
PLAN AND PROFILE STREET 'K' STA. -0+020 TO 0+240

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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL-14193	DWG. Nº PP-9
CHECKED	JWI		

C:\Eng_JD\GOL-14193-F\Production DWGS\GOL-14193-PP_J-K.dwg, Layout PP-9, Plotted Oct 06, 2021 @ 4:17pm by Jhermann The Jones Consulting Group Ltd.

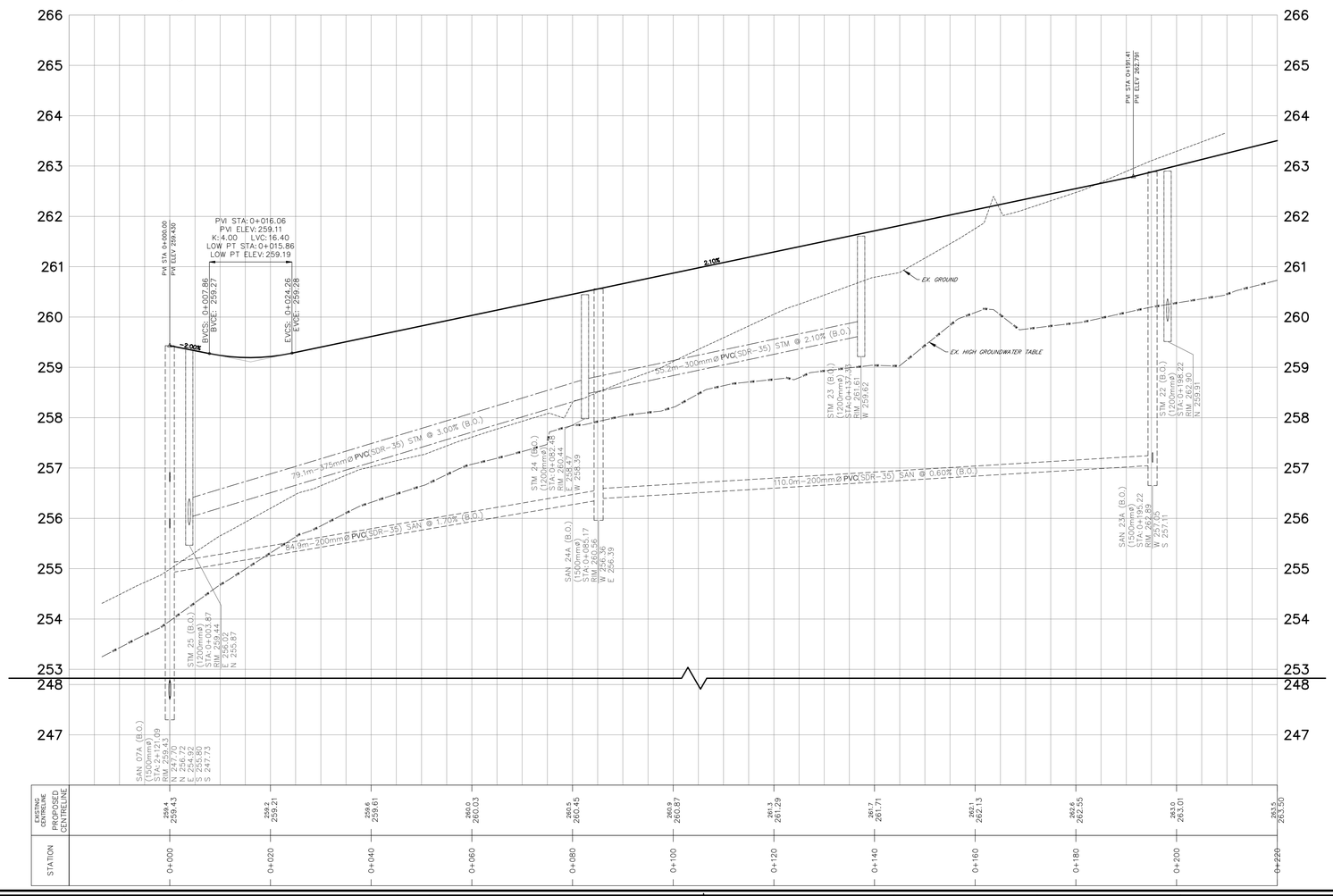




KEY PLAN
NTS

LEGEND

SAP.33921 ●	SANITARY MAINTENANCE HOLE (BY OTHERS)
GDLV5979 ○	STORM MAINTENANCE HOLE (BY OTHERS)
CB	CATCHBASIN (BY OTHERS)
DCB	DOUBLE CATCHBASIN (BY OTHERS)
VB(B.O.)	VALVE & BOX (BY OTHERS)
H&V(B.O.)	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 TWIN BIRCH TREES 15cm BELOW BRICK. ELEV 263.480

BENCHMARK NO: 01019865454 CONCRETE BRIDGE CARRYING MAPLEVIEW DRIVE EAST OVER LOVERS CREEK, 0.659m 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 LIMITED SUBDIVISION

PLAN AND PROFILE EXTERNAL STREET 'E' STA. −0+020 TO 0+220

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	JJH	SCALE: 1:500	DATE JUNE 2021
DRAWN	JJH	PROJECT GOL−14193	DWG. № PP−10
CHECKED	JWI		

G:\Eng_3D\GOL-14193-E\Production DWGS\GOL-14193-PP_Y.dwg Layout:10 Plotted: Oct 06, 2021 @ 4:17pm by jhermann The Jones Consulting Group Ltd.