

# STORMWATER MANAGEMENT AND FUNCTIONAL SERVICING REPORT

IN SUPPORT OF OPA & ZBA SUBMISSION

**129 Collier Street**  
**Mixed Use Development**  
Barrie, Ontario



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File Number: 20019

**Prepared For:**

**129 Collier LP**

|            |                                   |                   |
|------------|-----------------------------------|-------------------|
|            |                                   |                   |
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## Executive Summary

This Stormwater Management and Functional Servicing Report has been prepared on behalf of 129 Collier LP in support of the OPA and ZBA applications for the proposed 0.61 ha Mixed Use Development, which consists of two buildings connected with a podium. The north building will consist of four levels of underground parking, and twelve floors containing 118 residential units. The south building will host twelve floors containing 175 residential units.

The purpose of this report is to demonstrate that the proposed stormwater management controls achieve all the City of Barrie and Lake Simcoe Region Conservation Authority ('LSRCA') design criteria. In addition, this report outlines the sanitary and water demands from the development and illustrates that the surrounding infrastructure has capacity to accommodate the re-development.

### Watermain Servicing:

Two new connections are proposed to service this development. The North Building will be serviced with a new 200 mm diameter P.V.C. connection to the existing 200 mm diameter P.V.C. watermain along Collier Street. The South building will be serviced with a 200 mm diameter P.V.C. connection to the existing 200 mm diameter P.V.C. watermain along Dunlop Street. The combined fire flow and maximum day demand is 8,085 L/min and 11,126 L/min for north and south building respectively.

Hydrant flow tests have been completed and indicate that there is sufficient capacity in the existing watermains.

### Sanitary Servicing:

The site will be serviced with a single 200 mm diameter connection to the existing 400 mm diameter sanitary sewer along Dunlop Street. The north and south tower, combined, will contribute **5.2 L/s** into the municipal sewer system on Dunlop Street as per Municipal Standards. The sanitary drainage flows west towards Poyntz Street. Since the connection sewer is 400 mm diameter and 5.2 L/s represents only 5% of the capacity of this pipe. The proposed sanitary design flow from the site is within the existing sanitary design flow under current zoning so capacity concerns are not expected.

### Stormwater Servicing:

A 375mm storm connection to the existing 600mm diameter storm sewer along Dunlop Street is proposed. An internal storm network is proposed along the east side of the building, providing a stub at the southeast corner of the building. A stormwater management tank is located on the



underground level of south building to provide the required quantity control for the entire development.

**Quantity Control:**

To achieve Conservation Authority and Municipal standards, the post development release rates are to be restricted to the 5-year pre-development release rate. To achieve this, a stormwater management tank has been sized below the first level of underground of the south tower. An orifice plate will be required to restrict runoff to the 5 year release rate for the site. A total of 170 cu.m. of storage is provided for in the underground tank.

**Volume Control and Water Balance:**

As per the Conservation Authority design guidelines, a post to pre-development water assessment is required to determine the infiltration deficit created from the increase of impervious cover. Due to site layout being primarily covered by a building, infiltration is not feasible. The water balance deficit of 484 m<sup>3</sup> will need to be addressed by a one-time cash contribution in accordance with the LSRCA water balance offsetting policy. The onetime cash payment is calculated as follows:

$$484 \text{ m}^3/\text{year} \times \$44.97 \text{ costs/m}^3 \text{ based on deficit volume} = \$21,765.48$$

$$\text{Administration Fee} = 15\% \times 21765.48 = \$3264.82$$

$$\text{Total Fee} = \$21,765.48 + \$3264.82 = \textbf{\$25,030.30}$$

In addition, the minimum volume of 5mm from all impervious site area is to be retained or treated to meet the volume control target. To meet this target a total of 25.3 m<sup>3</sup> of water is to be retained onsite. Due to limited setbacks and the limited space for conventional infiltration measures, a water cistern tank is proposed within the stormwater management tank, and the water is to be re-used for methods such as irrigation. Conversations are ongoing with the building team and landscape architect to ensure this volume can be appropriately re-used. Should the on-site retention and re-use volume potential of site be less than the 25.3 m<sup>3</sup> target, alternatives such as directing a portion of roof drainage from the north building to the vegetated area on the east side of the building.

**Quality Control:**

As per the Conservation Authority, the site is to achieve 80% TSS removal. As such, an oil grit separator has been sized and is proposed downstream of the building. It has been sized to reduce the full 80% of TSS removal from the entire site. It is noted that most of the site is covered with roof, which is considered clean runoff, and a minimal portion of the site will experience vehicular traffic.



In addition to the TSS removal, the site is to achieve approximately 80% phosphorus removal as per the conservation authority. Phosphorus control will be provided by a Stormfilter unit which has a minimum removal efficiency of 79% per ETV testing. The balance of phosphorus loading will be offset in accordance with the LSRCA Phosphorus Offsetting Policy. The one time cash payment calculation is as follows:

$$\begin{aligned} 0.18 \text{ kg/yr} \times 2.5 \text{ offset ratio} \times \$35,000 \text{ kg/yr} &= \$15,750.00 \\ \text{Administration Fee (15\%)} &= \$2,362.50 \\ \text{Total Cost} &= \mathbf{\$18,112.50} \end{aligned}$$

As only the greater of the Water Balance Offset and Phosphorus Offset is payable, it is anticipated that the Water Balance offsetting fee will be governing and payable.





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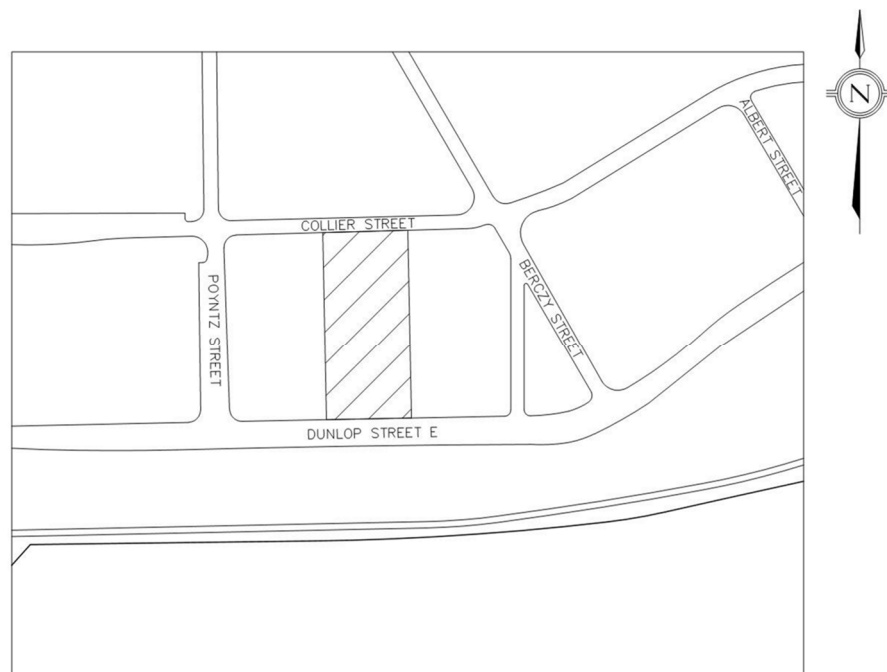


## 1.0 INTRODUCTION

This Stormwater Management and Functional Servicing Report has been prepared on behalf of 129 Collier LP in support of the OPA and ZBA applications for the proposed 0.61 ha Mixed Use Development. The purpose of this report is to demonstrate that the proposed stormwater management controls achieve all the City of Barrie and Lake Simcoe Region Conservation Authority ('LSRCA') design criteria. In addition, this report is to prove that the existing municipal services have adequate size and capacity to convey the domestic demands of the development.

The subject site lies within the City of Barrie. It is located on the south side of Collier Street, between Poyntz Street to the west and Berczy Street to the east. The site is bounded by Dunlop Street to the south, and residential and commercial units to the east and west. **Figure 1 – Site Location** illustrates the subject site within the context of its surroundings.

**Figure 1 – Site Location Plan**





The existing zoning for this development is Transition Centre Commercial (C2-1). The current zoning permits for various land uses such as commercial, institutional as well as residential. However, to accommodate for a larger building height or any other required variances, a zoning by-law amendment is proposed.

The proposed Mixed Use Development consists of two buildings. The north building, located on the northern half of the development will consist of four levels of underground parking, and twelve floors containing 118 residential units.

The south building of the development will host twelve floors containing 175 residential units. Refer to the architectural site plan for details.

## 2.0 STUDY PARAMETERS

This servicing assessment is based on:

- “Water Transmission and Distribution Policies and Design Guidelines”, prepared by City of Barrie Engineering Department, December 2017
- “Sanitary Sewage Collection System Policies and Design Guidelines, prepared by City of Barrie Engineering Department, December 2017
- “Storm Drainage and Stormwater Management Policies and Design Guidelines”, prepared by City of Barrie, August 2020
- “Low Impact Development Interim Guidance”, prepared by City of Barrie, 2019.
- “Lot Grading and Drainage Standards and Design”, prepared by City of Barrie, 2019.
- “LSRCA Technical Guidelines for Stormwater Management Submissions”, prepared by Lake Simcoe Region Conservation Authority, 2016.
- Architectural Site Plan, prepared by RAW design, December 24, 2020
- Geotechnical Investigation prepared by Landtek Limited, September 25, 2019.



### 3.0 WATERMAIN SERVICING

#### 3.1 Existing Water Servicing

Under existing conditions there is a 200 mm diameter P.V.C watermain along Collier Street, with an existing fire hydrant on the south side of the boulevard. There is another 200 mm diameter P.V.C. watermain on Dunlop Street with an existing hydrant on the north side of the boulevard. There are currently no service connections to the proposed development. Refer to drawing **C2** in **Appendix B** for the existing water servicing.

Under existing conditions, the site is vacant. Therefore, there is no existing water demand generated by the site. However, as per the current designated zoning, a Gross Floor Area of 4.0 is allowed.

#### 3.2 Proposed Water Servicing Strategy

The development will be serviced with two new connections to the existing water infrastructure. Due to the landscape characteristics of the north and south area, they will need to be serviced independently from one another. The north building will be serviced with a 200 mm PVC pipe to the existing 200 mm PVC pipe on Collier Street. The south building will be serviced with a 200 mm PVC pipe to the existing 200 mm PVC pipe on Dunlop Street. Refer to drawing **C2** in **Appendix B** for the conceptual servicing plan.

In accordance with the City of Barrie Engineering standards, watermains shall be sized to meet the greater of either the maximum hour demand or the maximum day demand plus fire flow. Based on equivalent population of 1.67 persons per unit, the population density is **198 persons** for north building and **293 persons** for south building. Therefore, using the average residential daily consumption rate of **225 L/c/day** and peaking factors of **2.75** and **4.13** for maximum daily and maximum hourly demand, respectively, the resultant flows are as follows:



- North Tower
  - o Maximum Day Demand = **85.1 L/min**
  - o Maximum Hour Demand = **127.8 L/min**
- South Tower
  - o Maximum Day Demand = **125.9 L/min**
  - o Maximum Hour Demand = **189.1 L/min**

Fire flow demand, as per the Fire Underwriters Survey (FUS) have been calculated for each building. Assuming fire resistive construction, limited combustibility contents and a fully supervised and sprinklered building, the resultant fire demand for each of the building is 5,000 L/min and 6,000 L/min for the north and south buildings respectively.

Therefore, Maximum Day + Fire Flow, which governs the water demand for the proposed development, is **8,085 L/min** for north tower and **11,126 L/min** for south tower. Refer to **Appendix B** for detailed water service calculations.

The City of Barrie Watermain guidelines sets out watermain pressure requirements for residential developments, and are summarized as follows:

- Under normal conditions, the static shall not exceed 700 kPa (100 psi)
- Under maximum hourly demand, the pressure shall not fall below 275 kPa (40 psi)
- Under maximum day demand + fire flow conditions, the pressure shall not fall below 140 kPa (20 psi).

Two hydrant flow tests were conducted by Lozzi Aqua check on June 9, 2021 – one on Collier Street for the north tower and one on Dunlop Street for the south tower. Copies of these tests have been included in **Appendix B**

It is noted that the available capacity on Collier Street of **8,775 L/min** (obtained from the hydrant flow test and NFPA calculations) is more than the required maximum day + fire flow demand of **8,085 L/min** of North tower. Also, the available capacity on Dunlop Street of **11,073 L/min** (obtained from Hydrant Flow Test and NFPA calculations) are generally equivalent to the required



maximum day + fire flow demand of **11,126 L/min** of the South tower. Therefore, there is adequate capacity to service the development. Refer to **Appendix B** for fire flow calculations.

In addition to the hydrant flow tests, it is understood that the existing land usage is designated for Transition Centre Commercial development. The zoning by-law has a maximum gross floor area of 4.0, which the proposed site is within (3.79). The site usage and density is within the permissible zoning and therefore within the contemplated water servicing demand for the site.



## 4.0 SANITARY SERVICING

### 4.1 Existing Sanitary Servicing

The subject site has an existing 400 mm diameter sanitary sewer that drains west along Dunlop Street towards Poyntz Street. North of the site, there is an existing 200 mm diameter sanitary sewer that drains west along Collier Street, which is tributary to the same system.

The existing site does not generate sanitary flow and there are no existing servicing connections. However, the site is currently zoned for a Transition Centre Commercial development. This allows for various usages including commercial, institutional, and residential developments with a Ground Floor Area of 4.0. It is anticipated that the sewers are adequately sized to expect a sanitary flow from the site based on the current zoning, regardless of whether it is currently contributing to the existing system. Refer to drawing **C2** for the conceptual servicing plan included in **Appendix B**.

### 4.2 Proposed Sanitary Servicing

The proposed development will be serviced by one new 300 mm diameter connection to the existing 400 mm diameter sanitary sewer along Dunlop Street. A plug has been provided on the south-east side of the building. Only one connection is provided for the two towers. Due to cover restraints, the sanitary connection is proposed under the P4 slab, as per coordination with the architect. Refer to drawing **C2** for the conceptual servicing plan included in **Appendix B**.

Contributing sanitary flows from the proposed development were calculated based on City of Barrie Sanitary Guidelines. Equivalent population and institutional design flows were determined based on the Ministry of the Environment and Climate Change (MOECC) Guidelines. According to site statistics as provided by the architect, the proposed population of this residential development is 198 and 293 persons for north and south tower, respectively. Based on the City of Barrie Sanitary Guidelines and MOECC criteria, the average daily flow for a residential development is 225 L/c/day. With a peaking factor of 4 and an infiltration rate of 0.1 L/s/ha, the





resultant sanitary design flow is 1.9 L/s and 3.1 L/s for north and south tower respectively. Therefore, in total, 5.2 L/s is contributing to the 300mm diameter connection. Refer to **Appendix D** for detailed calculations.

As the existing sewer is 400 mm in diameter, it is assumed that the domestic demand generated from the site is negligible compared to the capacity of the infrastructure. When analyzed, this represents 5% of the capacity of the existing sewer. In addition, as with the watermain demand, the zoning by-law has a maximum gross floor area of 4.0, which the proposed site is within (3.79). The proposed sanitary design flow from the site is within the existing sanitary design flow under current zoning so capacity concerns are not expected.



## 5.0 STORMWATER MANAGEMENT

### 5.1 Existing Site Conditions

The existing 0.61 ha site is vacant with some asphalt parking. As such, there are no stormwater management controls currently present on site. Additionally, there is no existing storm connection to the site.

The existing storm infrastructure on the adjacent streets are as follows:

- 600 mm diameter storm sewer running west along Dunlop Street
- 300 mm diameter storm sewer running west along Collier Street

As per existing topographic information, there is a near ten-meter drop from the north property line to the south property line. As such, all the existing runoff on site drains south towards Dunlop Street in existing conditions. In addition, there is some external drainage from the east property.

For this report, the pre-development drainage area encompasses the entire site area. Refer to **Appendix A, Figure 2- Pre-Development Drainage Boundary** for details.

Based on run-off coefficients prescribed by the City of Barrie, and the Municipality's specified IDF curves, rational method has been utilized to determine the pre-development release rates for the site. The corresponding pre-development release rate the entire site is detailed below in **Table 1**.

**Table 1 – Pre-Development Drainage Areas**

| ID    | Area | Runoff Coefficient | 5-Yr Peak Flow (L/s) | 100-Yr Peak Flow (L/s) |
|-------|------|--------------------|----------------------|------------------------|
| Total | 0.61 | 0.41               | 75.7                 | 156.4                  |



## 5.2 Allowable Release Rate

As per the City of Barrie's design criteria, the storm sewers are to be designed to convey the 5-year storm event and controls are required to restrict all post-development flows to pre-development release rates. Therefore, the subject site is to restrict all post-development flow to the 5-year pre-development release rate.

The allowable discharge from the subject site is shown on **Table 2** below.

**Table 2 – Allowable Release Rates**

| ID    | Area | 5-Yr Peak Flow (L/s) |
|-------|------|----------------------|
| Total | 0.61 | 75.7                 |

Refer to **Appendix E** for allowable release rate calculations.

## 5.3 Proposed Stormwater Servicing

The proposed mixed-use development will be serviced with a single 375 mm diameter connection to the existing 600 mm diameter storm sewer along Dunlop Street. An internal sewer system is proposed along the east side of the site, providing connection to the south building as well as providing catch basins for the landscape area along the east boundary of the site.

As most of the site is covered by building area including underground parking. Rooftop drains and area drains will capture most of the surface flow. All internal plumbing is to be coordinated and designed by building mechanical, once engaged. At this stage, it has been assumed that the roof will drain uncontrolled. During detailed design, there is an opportunity to further refine the quantity control provided.

At the east section of the south building, a stormwater management tanks has been preliminarily sized. As per discussions with the architect, the SWM tank is proposed under the grade level slab



fronting Dunlop Street. Access to the SWM tank is proposed be made outside the limits of the building envelope.

Refer to **C2- Conceptual Site Servicing Plan** for the existing and proposed storm sewer layout. Refer to **Appendix F** for the storm sewer design sheet.

## 5.4 Quantity Control

The 5-year and 100-year post-development peak run-off rates will be controlled to the 5-year pre-development peak run-off rates. Refer to **Appendix A, Figure 3- Post Development Drainage Plan** for details.

As per the allowable release rates, the site is to control post-development flows to **76 L/s**. **Table 3** outlines the summary of the storage requirements for this building.

**Table 3a – North Building Quantity Control**

| ID     | Area (ha) | 5-Yr Flow (L/s) | 100-Yr Flow (L/s) | Storage Required (cu.m) | Description                                                            |
|--------|-----------|-----------------|-------------------|-------------------------|------------------------------------------------------------------------|
| POST-1 | 0.49      | 42.0            | 42.0              | 159                     | Roof Drains and Area Drains. To be controlled in underground SWM tank. |
| POST-2 | 0.02      | 4.2             | 8.8               | -                       | Uncontrolled to Collier Street                                         |
| POST-3 | 0.10      | 12.1            | 25.0              | -                       | Uncontrolled to Dunlop Street                                          |
| Total  | 0.61      | 58.3            | 75.8              | 159                     |                                                                        |

Both the north and south building will be controlled with a stormwater management tank and orifice plate under the lowest building slab at the south-east corner of the site. As per coordination with the architect, a 170 m<sup>3</sup> tank has been designated in this corner, with access ports outside the footprint of the underground for ease of maintenance. As per the allowable release rates, the building is to control post-development flows to **42 L/s**. The orifice plate will be located at the outlet of the tank. Excess storage can be used for a water cistern tank during detailed design.

Refer to **Appendix F** for storage volume calculations.



## 5.5 Water Balance

The Lake Simcoe Region Conservation Authority (LSRCA) Watershed Development Policies has indicated that a water balance assessment is required as per the LSRCA “Hydrogeological Assessment Submissions” document. As specified, a site assessment is required to determine the annual infiltration volume lost from pre- to post-development. Infiltration techniques are required to compensate for the calculated loss of infiltration.

To achieve this water balance objective, the annual site infiltration volume (pre and post development) was calculated using data outlined in Table 5-2 from the “City of Barrie Tier Three Recharge Estimation” memorandum and applying infiltration factors from Table 2 “MOEE Hydrogeological Technical Information Requirements for Land Development Applications”. It was determined through the annual assessment that the pre-development and post development infiltration volumes were 690 m<sup>3</sup>/year and 206 m<sup>3</sup>/year respectfully. Therefore, a deficit of 484 m<sup>3</sup>/year which will need to be compensated.

As this is a minimal setback site with underground parking, conventional infiltration galleries or LIDs are not proposed. Therefore, water balance will primarily need to be achieved the LSRCA offsetting policy. The calculation for the offsetting fee is shown below:

$$484 \text{ m}^3/\text{year} \times \$44.97 \text{ costs/m}^3 \text{ based on deficit volume} = \$21,765.48$$

$$\text{Administration Fee} = 15\% \times 21765.48 = \$3264.82$$

$$\text{Total Fee} = \$21,765.48 + \$3264.82 = \mathbf{\$25,030.30}$$

## 5.6 Quality Control

### 5.6.1 Total Suspended Solids

As per the LSRCA criteria, enhanced level quality control is to be achieved onsite. To achieve the 80% TSS removal target, an OGS unit has been preliminary sized (Stormceptor EF06). Refer to **Appendix H** for the product data sheet. It is noted that in certain applications, the OGS system



can only claim a maximum credit of 50% TSS, regardless of the specifications. However, since most of the site is considered “clean”, i.e., roof, grass, or pedestrian use, the 80% target is still achieved.

Quality control will be provided by the proposed Stormfilter cartridge system that is equipped with PhosphoSorb media that shall provide the necessary stormwater treatment, including 80% TSS, phosphorus, oil, grease, and heavy metal pollutant removal. The Stormfilter SFPD 0811 vault system is proposed downstream of the storage tank that will provide the required 80% TSS removal from the stormwater runoff. Refer to **Appendix H** for the specifications on the Stormfilter system.

Due to grading restraints, there will be two uncontrolled areas that will not be able to be treated by Stormceptor and the Storm Filter System. The uncontrolled area is primarily a landscape and sidewalk strip along Collier Street and Dunlop Street East located between the building and the municipals rights of way.

Along the east boundary of the site is a landscape area with a proposed sidewalk connection Collier Street to Dunlop Street east. The runoff from the sidewalk will travel over landscape area to a grass / vegetated swale which provides a TSS removal benefit. There are catch basins and catch basin manholes located along this east section which will help capture runoff directed through the swale. The portion of runoff captured by these catch basins will be directed downstream into the Stormceptor then will exit the site into the municipal sewers.

### **5.6.2 Phosphorus Control**

The LSRCA requires a phosphorous loading study to be completed for all major developments. The study is required to determine the phosphorous loading under pre-development conditions, and post development conditions with or without quality controls. Best efforts shall be employed such that any increase in loading is kept to a minimum.



Under pre-development conditions, the site is categorized as transitional land use with a phosphorous coefficient of 0.06 kg/ha/yr. Given the entire site area of 0.61 ha, the total pre-development loading is 0.037 kg/year.

For the purposes of a phosphorus loading calculation, the proposed development is classified as high intensity residential with a phosphorous coefficient of 1.32 kg/ha/yr. The total phosphorous loading without BMP's results in **0.81kg/year**.

With the treatment mitigation provided by the Stormfilter system with Phosphosorb media, which is expected to treat at least 79% of the phosphorus concentration as per ETV Testing Results included in **Appendix H**. This will be able to treat the controlled area of the site which consist of mostly pavement and roofs of the buildings. For the uncontrolled areas, the landscape area has been coded as a vegetative filter strip along the natural grass area of the site located along the east property line will account for 65% of the phosphorus removal. The resulting phosphorus loading is **0.22 kg/yr**. 0.59 kg/yr of phosphorus is removed which is approximately **80%** phosphorus removal. As per the LSRCA's Lake Simcoe Phosphorus Offsetting Policy, a cash-in-lieu is proposed for the development based on the net pre- and post-development phosphorus loading. The net increase in phosphorus loading for the proposed site is **0.18 kg/yr**. Refer to **Appendix H** for the phosphorus loading calculations. Therefore, the cash-in-lieu calculation is as follows:

$$0.18 \text{ kg/yr} \times 2.5 \text{ offset ratio} \times \$35,000 \text{ kg/yr} = \$15,750.00$$

$$\text{Administration Fee (15\%)} = \$2,362.50$$

$$\text{Total Cost} = \mathbf{\$18,112.50}$$

### 5.6.3 Winter Salt

The proposed site is comprised of two tall towers, with low traffic and salt pollution risk. As the proposed parking for the site is internal to the building, salt use is inherently reduced by the built form of the development. In addition, all controlled stormwater flows shall be treated by the proposed Stormfilter Cartridge system with Phosphosorb media. Based on documentation



regarding the Stormfilter cartridges, the system can provide treatment for pollutants such as soluble metals and nutrients as well, therefore, some salt shall also be removed from the runoff prior to discharge to the wetland, further reducing concern for salt pollution. Refer to **Appendix H** for documentation and specifications on the Stormfilter Cartridge System.

#### **5.6.4 Temperature**

The proposed development shall consist of underground storm infrastructure to convey captured drainage. All flows will be conveyed in the piping towards the treatment system, reducing the exposure of the runoff to heat. The underground conveyance will contribute to cooling the runoff if temperature increased during overland drainage of the stormwater.

#### **5.6.5 Other Contaminants**

The stormwater shall be treated by the proposed Stormfilter Cartridge system, as stated previously, which can provide treatment for oil, grease and gas pollutants.

Similarly, heavy metals can also be treated by the Stormfilter Cartridge system, as indicated in the documentation for the Stormfilter system. Refer to **Appendix H** for documentation and specifications on the Stormfilter Cartridge System. Heavy metals are also recognized to adsorb to suspended sediment particles in runoff and therefore, are also removed when treating the TSS. Therefore, the system shall provide treatment for these pollutants. Regular inspection and maintenance of the Stormfilter Cartridge system is required to ensure ongoing removal of accumulated sediment and maintain optimal function of the treatment system.

It is also notable that the site shall be a relatively low traffic area and poses low risk of contaminants being discharged from the site.

#### **5.6.6 Volume Control**

Options for volume control according to the LSRCA include: 25mm volume control target as well as alternatives for constrained sites. Alternative #1 allows for 12.5mm on-site retention, and





Alternative #2 allows for the minimum of 5mm on-site retention. Our site is proposed to capture the 5mm target for volume control to retain and reuse.

The primary constraints to further on-site retention is:

- Property, Spatial and Infrastructure restrictions

Most of the site is proposed to be impervious due to coverage area of both roofs of the buildings and the road/walkways. Workable landscape area with respect to LID's is located on a portion of the uncontrolled area located along the east perimeter of the site. This area is narrow with an average slope in excess of 10% from Collier Street to Dunlop Street with sections of 3:1 sloping. In addition the space between the building foundations and the property line is constrained to allow for typical LIDs options that allow infiltration.

To capture/retain the 5mm water depth target, a cistern will be used within our proposed stormwater management tank to retain and reuse the water. This cistern will also be used for irrigation purposes. The cistern is to be sized to retain **25.3 m<sup>3</sup>** of water, see **Appendix G** for volume control calculations. The building team will need to advise on the ability to reuse this volume of water for irrigation purposes within 2 to 3 days at the detailed design stage. If the irrigation requirements are less, alternatives such as filtration LIDs in the eastern landscape area will need to be explored at detailed design.

### **5.6.7 Overland Flow Considerations**

Emergency flows exceeding the conveyance and capture capacity of the proposed minor storm system will be safely directed overland towards Collier Street for the exposed drive aisle and parking. In addition, the underground stormwater management tank will have an overflow spill point located outside of the building area at the tank access point. Emergency flows in excess of the tank capacity would be directed to Dunlop Street located south of the site. Refer to **Appendix B, Drawing C1** – Grading Plan for the grading plan and overland flow concept. Emergency overland flow calculations evaluating critical overland flow route areas will be included at detailed design.



## 6.0 CONCLUSIONS

Based on the assessment provided above, the engineering criteria for the City of Barrie and the Lake Simcoe Region Conservation authority have been addressed for this development.

We trust the information provided in the report meets with your requirements. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

**Counterpoint Engineering Inc.**



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**Prince Trinidad-Rhodium, E.I.T.**  
PTrinidad-Rhodium@counterpointeng.com



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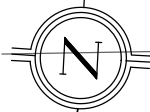
# APPENDIX A

## Figures

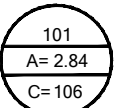
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T/G=235.02  
V/N/A

P.L.N. 58818-0078(LT)

235.25



LEGEND



AREA ID

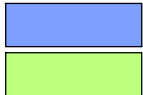
AREA (HA)

RUNOFF COEFFICIENT

DRAINAGE DIVIDE



OVERLAND FLOW ROUTE



PRE-ASPHALT AREA

PRE-GRASS AREA

TOTAL

PERVIOUS SURFACE 0.52 ha

IMPERVIOUS SURFACE 0.09 ha

TOTAL AREA 0.61 ha

PERCENT IMPERVIOUS 15%

RUNOFF COEFFICIENT 0.41

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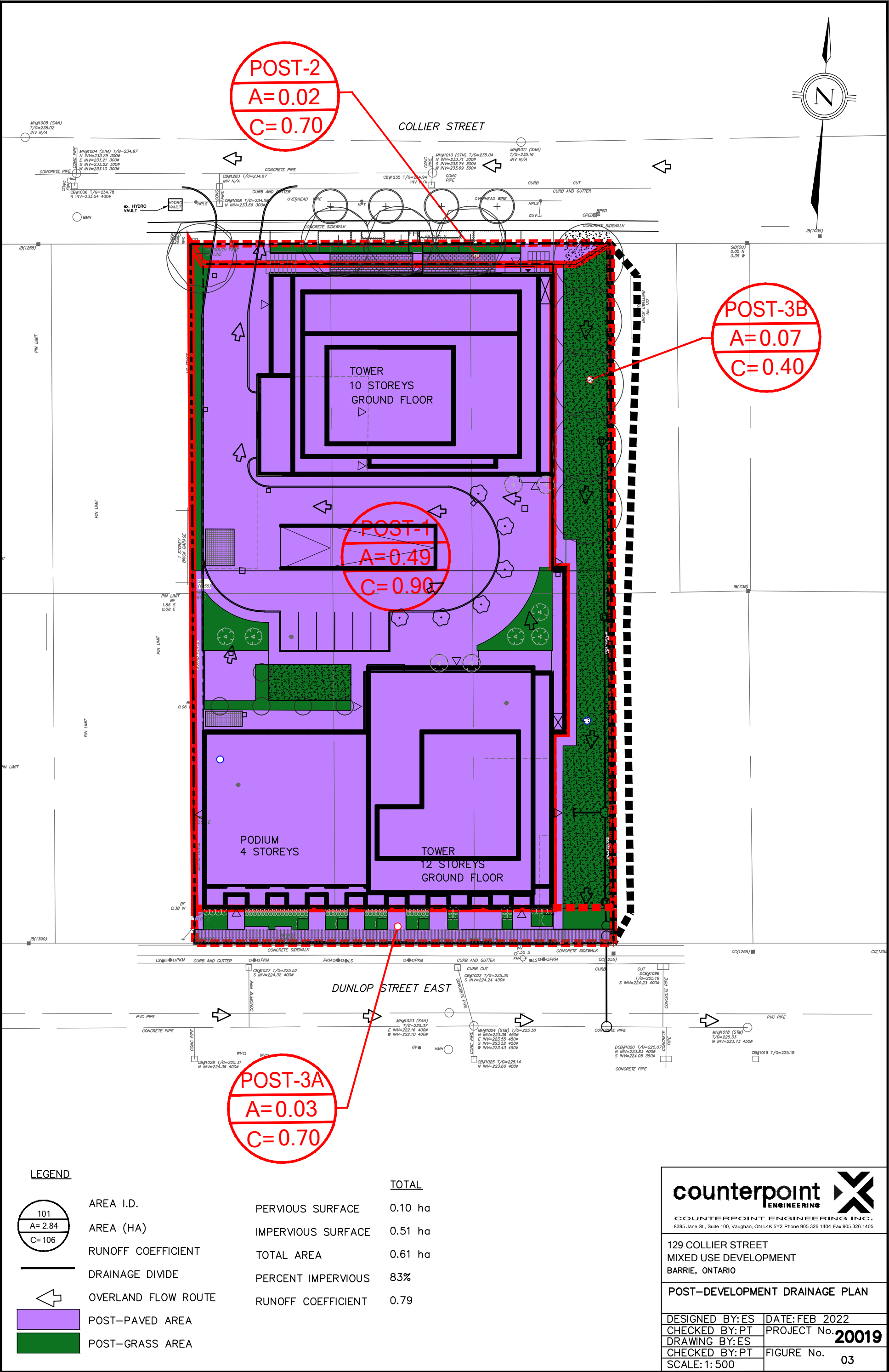


COUNTERPOINT ENGINEERING INC.  
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

129 COLLIER STREET  
MIXED USE DEVELOPMENT  
BARRIE, ONTARIO

PRE-DEVELOPMENT DRAINAGE PLAN

|                |                          |
|----------------|--------------------------|
| DESIGNED BY:ES | DATE:FEB 2022            |
| CHECKED BY:PT  | PROJECT No. <b>20019</b> |
| DRAWING BY:ES  |                          |
| CHECKED BY:PT  | FIGURE No.               |
| SCALE: 1: 500  | 02                       |

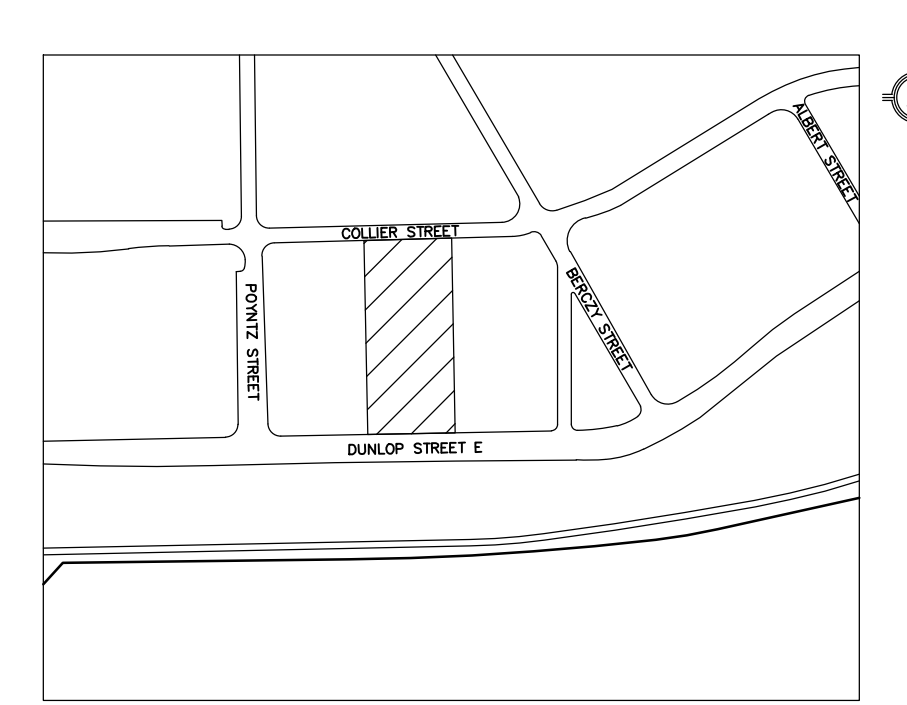
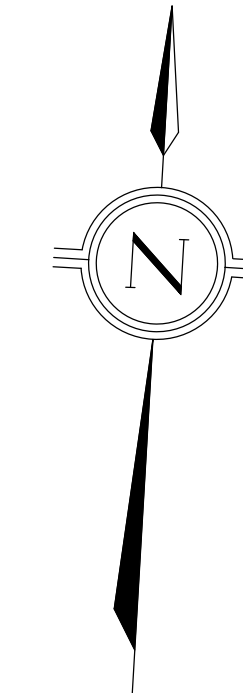




# APPENDIX B

## Drawings





LEGEND

- |    |                                 |
|----|---------------------------------|
|    | EXISTING ELEVATION              |
|    | EXISTING CONTOUR                |
|    | PROPOSED ELEVATION              |
| TC | TOP OF CURB ELEVATION           |
| TW | TOP OF WALL ELEVATION           |
| BW | BOTTOM OF WALL ELEVATION        |
|    | EMERGENCY OVERLAND FLOW         |
|    | EXISTING FIRE HYDRANT           |
|    | EXISTING STORM MANHOLE          |
|    | EXISTING SANITARY MANHOLE       |
|    | PROPOSED FIRE HYDRANT AND VALVE |
|    | PROPOSED VALVE AND BOX          |
|    | PROPOSED STORM MANHOLE          |
|    | PROPOSED CATCHBASIN             |
|    | PROPOSED SANITARY MANHOLE       |
|    | SWALE                           |
|    | PROPOSED SLOPE                  |
|    | 3:1 GRADING                     |

## LEGAL & TOPOGRAPHY

PROVIDED BY: LAND SURVEY GROUP  
777 THE QUEENSWAY, UNIT 1  
TORONTO, ONTARIO  
(416) 252-2511

## ELEVATION NOTE

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM THE CITY OF BARRIE BENCHMARK  
0011968U502 HAVING A PUBLISHED ELEVATION OF 237.27m (CGVD-1928; PRE-1978)

## BEARING NOTE

BEARINGS ARE ASTRONOMIC AND ARE REFERRED TO THE NORTHERLY LIMIT OF DUNLOP STREET EAST HAVING A BEARING OF N89° 58'55"E AS SHOWN ON PLAN 51R-13463.

|     |                                   |            |    |     |  |
|-----|-----------------------------------|------------|----|-----|--|
|     |                                   |            |    |     |  |
|     |                                   |            |    |     |  |
|     |                                   |            |    |     |  |
|     |                                   |            |    |     |  |
|     |                                   |            |    |     |  |
|     |                                   |            |    |     |  |
|     |                                   |            |    |     |  |
| 3.  | ISSUED FOR OPA AND ZBA SUBMISSION | 2022-02-17 | PT |     |  |
| 2.  | ISSUED FOR COORDINATION           | 2022-02-08 | PT |     |  |
| 1.  | ISSUED FOR REZONING APPLICATION   | 2022-01-07 | ES |     |  |
| No. | REVISIONS ISSUED                  | DATE       | BY | APP |  |

**counterpoint**  
ENGINEERING



**COUNTERPOINT ENGINEERING INC.**  
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

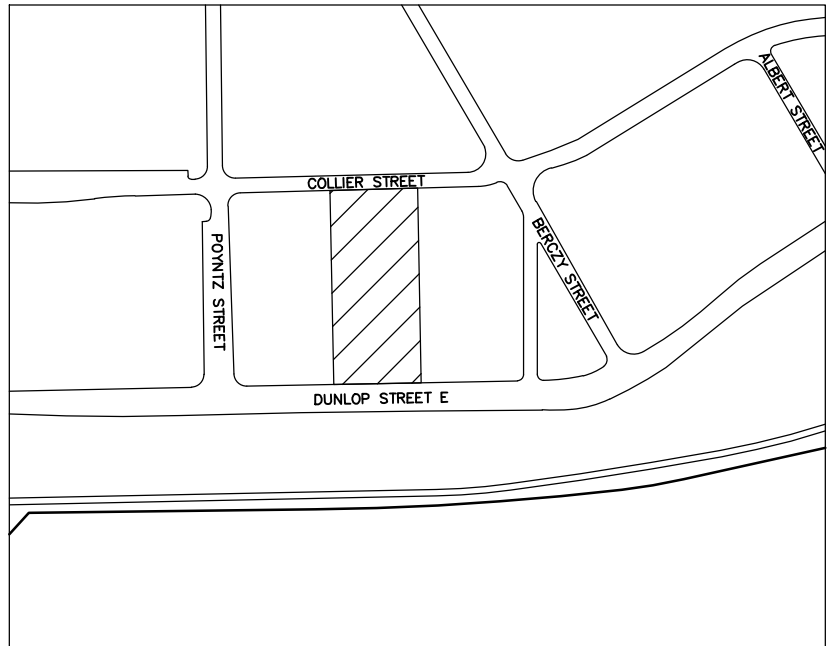
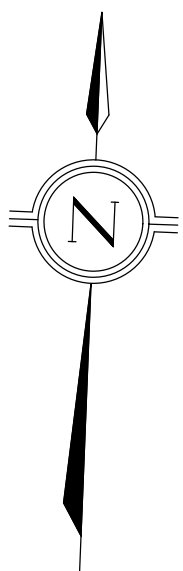
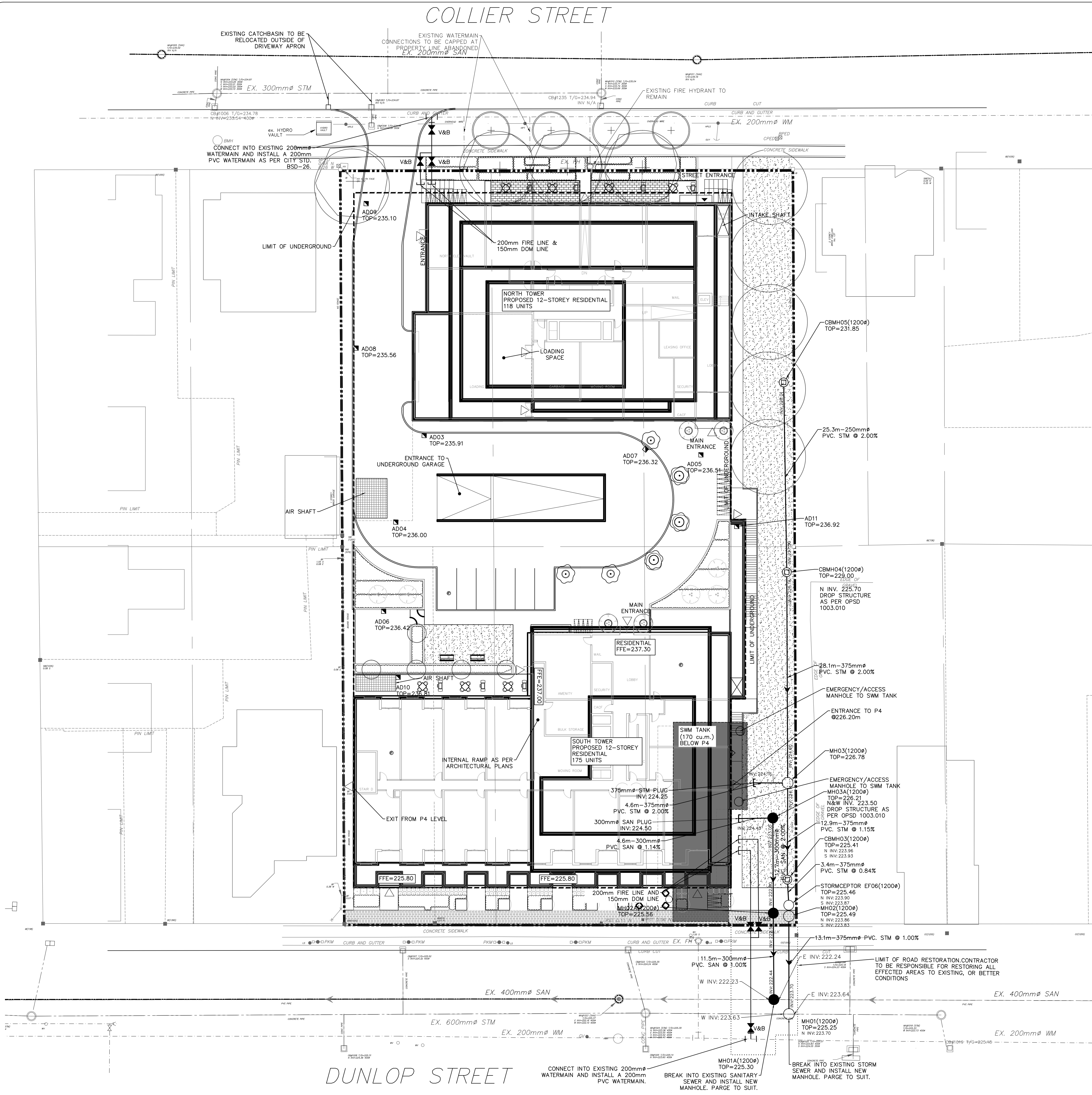
ENGINEER'S STAMP

## SITE GRADING PLAN

|                                                                                                        |                |                   |
|--------------------------------------------------------------------------------------------------------|----------------|-------------------|
| DESIGNED BY: ES                                                                                        | CHECKED BY: JY | DATE: JAN 2022    |
| DRAWING BY: ES                                                                                         | CHECKED BY: JY | PROJECT NO. 20019 |
| SWM BY: ES                                                                                             | CHECKED BY: JY |                   |
| SCALE: 1:250m<br> |                | DRAWING NO. C1    |

REGION FILE No.:





KEY PLAN

LEGEND

- EXISTING HYDRANT
- EXISTING STORM SEWER
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- PROPOSED STORM SEWER AND MH
- PROPOSED SANITARY SEWER AND MH
- PROPOSED HYDRANT AND VALVE
- PROPOSED VALVE AND BOX
- PROPOSED WATERMAIN
- PROPERTY LINE

LEGAL & TOPOGRAPHY

PROVIDED BY: LAND SURVEY GROUP  
777 THE QUEENSWAY, UNIT 1  
TORONTO, ONTARIO  
(416) 252-2511

ELEVATION NOTE

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM THE CITY OF BARRIE BENCHMARK 0011968U502 HAVING A PUBLISHED ELEVATION OF 237.27m (CGVD-1928; PRE-1978)

BEARING NOTE

BEARINGS ARE ASTRONOMIC AND ARE REFERRED TO THE NORTHERLY LIMIT OF DUNLOP STREET EAST HAVING A BEARING OF N89° 58'55"E AS SHOWN ON PLAN 51R-13463.

| No. | REVISIONS/ISSUED                  | DATE       | BY | APP |
|-----|-----------------------------------|------------|----|-----|
| 3.  | ISSUED FOR OPA AND ZBA SUBMISSION | 2022-02-17 | PT |     |
| 2.  | ISSUED FOR COORDINATION           | 2022-02-08 | PT |     |
| 1.  | ISSUED FOR REZONING APPLICATION   | 2022-01-07 | ES |     |



ENGINEER'S STAMP

CONCEPTUAL SITE SERVICING PLAN

|                 |                |                   |
|-----------------|----------------|-------------------|
| DESIGNED BY: ES | CHECKED BY: JY | DATE: JAN 2022    |
| DRAWING BY: ES  | CHECKED BY: JY | PROJECT NO. 20019 |
| SWM BY: ES      | CHECKED BY: JY | DRAWING NO. C2    |

SCALE: 1:250m



# APPENDIX C

Water

# Counterpoint Engineering Inc.

## Water Demand Design Calculations

**Project:** 129 Collier Street  
**Project No:** 20019  
**Location:** Barrie, ON  
**Site Area:** 0.61 ha  
**Date:** 2022-02-08

### Population

|             |      |     |
|-------------|------|-----|
| Residential | 1.67 | ppu |
|-------------|------|-----|

|                     | North Building | South Building | Total |
|---------------------|----------------|----------------|-------|
| Residential (Units) | 118            | 175            | 293   |

|                                    | North Building | South Building | Total      |
|------------------------------------|----------------|----------------|------------|
| Residential (population)           | 198            | 293            | 491        |
| Commercial (ha)                    | 0              | 0              | 0          |
| <b>Total Equivalent Population</b> |                |                | <b>491</b> |

### Per Capita Demand

|                    |     |                        |
|--------------------|-----|------------------------|
| Residential Demand | 225 | (l/capita/day)         |
| Commercial Demand  | 28  | m <sup>3</sup> /ha/day |

### Peaking Factors

| Land Use    | Minimum Hour | Maximum Hour | Maximum Day |
|-------------|--------------|--------------|-------------|
| Residential | 0.40         | 4.13         | 2.75        |
| Retail      | 0.40         | 4.13         | 2.75        |

### Water Demand based on Equivalent Population (North Building)

| Land Use                 | Population | Average Daily Demand (l/min) | Peak Hour (l/min) | Maximum Day (l/min) | Fire Flow Required (l/min) | Max Day + Fire Flow (l/min) |
|--------------------------|------------|------------------------------|-------------------|---------------------|----------------------------|-----------------------------|
| Commercial/Institutional | N/A        | 0.0                          | 0.0               | 0.0                 | 5,000                      | 5,085                       |
| Residential              | 198        | 30.9                         | 127.8             | 85.1                |                            |                             |
| <b>Totals</b>            | <b>198</b> | <b>30.9</b>                  | <b>127.8</b>      | <b>85.1</b>         |                            |                             |

\*As per FUS calculations

### Water Demand based on Equivalent Population (South Building)

| Land Use                 | Population | Average Daily Demand (l/min) | Peak Hour (l/min) | Maximum Day (l/min) | Fire Flow Required (l/min) | Max Day + Fire Flow (l/min) |
|--------------------------|------------|------------------------------|-------------------|---------------------|----------------------------|-----------------------------|
| Commercial/Institutional | N/A        | 0.0                          | 0.0               | 0.0                 | 6,000                      | 6,126                       |
| Residential              | 293        | 45.8                         | 189.1             | 125.9               |                            |                             |
| <b>Totals</b>            | <b>293</b> | <b>45.8</b>                  | <b>189.1</b>      | <b>125.9</b>        |                            |                             |

\*As per FUS calculations

# Counterpoint Engineering Inc.

## REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT (North Building)

Fire Underwriters Survey

Project : 129 Collier Street

Project No: 20019

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$

where

- F = the required fire flow in litres per minute.  
 C = coefficient related to the type of construction.  
 = 1.5 for wood frame construction (structure essentially all combustible).  
 = 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).  
 = 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).  
 = 0.6 for fire-resistive construction (fully protected frame, floors, roof).  
 A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Office/Commercial

| Type of Construction     | Class Factor |
|--------------------------|--------------|
| WF Wood Frame            | 1.5          |
| OC Ordinary Construction | 1.0          |
| NC Non-Combustible       | 0.8          |
| FC Fire-Resistive        | 0.6          |

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

| Contents               | % Reduction |
|------------------------|-------------|
| NC Non-Combustible     | 25          |
| LC Limited Combustible | 15          |
| C Combustible          | 0           |
| FB Free Burning        | 15          |
| RB Rapid Burning       | 25          |

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1)

### Fire Flow

Type of Construction:

C=

A\*=

L/sec/ha

4,963 L/min

Note: Assuming Vertical Openings are adequately protected.

Area is the total of the largest floor (level 1) plus 25% of the next 2 adjoining floors above.

2)

### Occupancy Reduction/Surcharge

Contents Factor:

Reduction/Surcharge of

F=

4963L/min +

0

= 0 L/min

L/min = 4,963 L/min

3)

### System Type Reduction

NFPA 13 Sprinkler:

Standard Water Supply:

Fully Supervised:

Total

Reduction of

F=

4963L/min -

2,481

= 2,481 L/min

L/min = 2,481 L/min

4)

### Separation Charge

Building Face

North

East

South

West

Total

Dist(m) Charge

30

10%

(> 45m - No nearby building)

12

15%

(> 45m - No nearby building)

26

10%

13

15%

50%

of 4962.7 L/min = 2,481 L/min

(max exposure charge can be 75%)

| Separation  | Charge | Separation   | Charge |
|-------------|--------|--------------|--------|
| 0 to 3m     | 25%    | 20.1 to 30 m | 10%    |
| 3.1 to 10m  | 20%    | 30.1 to 45m  | 5%     |
| 10.1 to 20m | 15%    |              |        |

F=

2481L/min +

2481L/min

=

4,963 L/min

(2,000L/min<F<45,000L/min)

F=

5,000

L/min

(round up to the nearest 1,000L/min, Minimum 8000 L/min for apartments)

F=

83

L/s

F=

1,321

gpm



# Counterpoint Engineering Inc.

## REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT (South Building)

Fire Underwriters Survey

Project : 129 Collier Street  
Project No: 20019

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$

where

F = the required fire flow in litres per minute.  
C = coefficient related to the type of construction.  
= 1.5 for wood frame construction (structure essentially all combustible).  
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).  
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).  
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).  
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Office/Commercial

| Type of Construction     | Class Factor |
|--------------------------|--------------|
| WF Wood Frame            | 1.5          |
| OC Ordinary Construction | 1.0          |
| NC Non-Combustible       | 0.8          |
| FC Fire-Resistive        | 0.6          |

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

| Contents               | % Reduction |
|------------------------|-------------|
| NC Non-Combustible     | 25          |
| LC Limited Combustible | 15          |
| C Combustible          | 0           |
| FB Free Burning        | 15          |
| RB Rapid Burning       | 25          |

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1)

### Fire Flow

Type of Construction:

C=

A\*=

L/sec/ha

5,438 L/min

Note: Assuming Vertical Openings are adequately protected.

Area is the total of the largest floor (level 1) plus 25% of the next 2 adjoining floors above.

2)

### Occupancy Reduction/Surcharge

Contents Factor:

Reduction/Surcharge of

F=

5438L/min +

0

= 0 L/min

L/min = 5,438 L/min

3)

### System Type Reduction

NFPA 13 Sprinkler:

Standard Water Supply:

Fully Supervised:

Total

Reduction of

F=

5438L/min -

2,719

= 2,719 L/min

L/min = 2,719 L/min

4)

### Separation Charge

Building Face

North

East

South

West

Total

Dist(m) Charge

30

10%

12

15%

26

10%

13

15%

50%

(> 45m - No nearby building)

(> 45m - No nearby building)

of 5438.5 L/min = 2,719 L/min

(max exposure charge can be 75%)

| Separation  | Charge | Separation   | Charge |
|-------------|--------|--------------|--------|
| 0 to 3m     | 25%    | 20.1 to 30 m | 10%    |
| 3.1 to 10m  | 20%    | 30.1 to 45m  | 5%     |
| 10.1 to 20m | 15%    |              |        |

F=

2719L/min +

2719L/min

=

5,438 L/min

(2,000L/min < F < 45,000L/min)

F=

6,000

L/min

(round up to the nearest 1,000L/min, Minimum 8000 L/min for apartments)

F=

100

L/s

F=

1,585

gpm

## counterpoint engineering

### NFPA Theoretical Flow Calculations: Collier Street (North Building)

Project Name: 129 Collier Street

Project Number: 20019

Based on National Fire Protection Association Guidelines, the available flow at the minimum residual pressure of 20psi can be calculated based on the observed flow at the observed pressure readings, as follows:

$$Q_F = 29.83 \times c \times d^2 \times p^{0.5}, \text{ where}$$

$Q_F$  = observed flow (US GPM)

$c$  = hydrant nozzle coefficient (0.90 - 0.95)

$d$  = nozzle diameter (in) n/a

$p$  = observed pitot pressure n/a

$$Q_R = Q_F \times h_F^{0.54} / h_R^{0.54}, \text{ where}$$

$Q_R$  = available flow

$Q_F$  = observed flow (US GPM)

$h_F$  = drop from measured static to desired baseline pressure

$h_R$  = drop from measured static to measured residual pressure

Based on flow test results obtained by **Lozzi Aqua Check**, June 9, 2021

|                   |        |
|-------------------|--------|
| $c$ =             | 0.9    |
| $d$ =             | 2.5 in |
| number of ports = | 1      |
| $p$ =             | 52     |

$$Q_F = 1210 \text{ US GPM}$$

|                              |        |                                              |
|------------------------------|--------|----------------------------------------------|
| Measured Static Pressure =   | 70 psi |                                              |
| Measured Residual Pressure = | 55 psi |                                              |
| Desired Residual Pressure =  | 20 psi | , minimum per City of Barrie design criteria |

$$Q_R = 2318 \text{ US GPM} \quad \text{per fire connection}$$

8,775 L/min

## counterpoint engineering

### NFPA Theoretical Flow Calculations: Dunlop Street (South Building)

Project Name: 129 Collier Street

Project Number: 20019

Based on National Fire Protection Association Guidelines, the available flow at the minimum residual pressure of 20psi can be calculated based on the observed flow at the observed pressure readings, as follows:

$$Q_F = 29.83 \times c \times d^2 \times p^{0.5}, \text{ where}$$

$Q_F$  = observed flow (US GPM)

$c$  = hydrant nozzle coefficient (0.90 - 0.95)

$d$  = nozzle diameter (in) n/a

$p$  = observed pitot pressure n/a

$$Q_R = Q_F \times h_F^{0.54} / h_R^{0.54}, \text{ where}$$

$Q_R$  = available flow

$Q_F$  = observed flow (US GPM)

$h_F$  = drop from measured static to desired baseline pressure

$h_R$  = drop from measured static to measured residual pressure

Based on flow test results obtained by **Lozzi Aqua Check**, June 9, 2021

|                   |        |
|-------------------|--------|
| $c$ =             | 0.9    |
| $d$ =             | 2.5 in |
| number of ports = | 1      |
| $p$ =             | 68     |

$$Q_F = 1384 \text{ US GPM}$$

|                              |        |                                              |
|------------------------------|--------|----------------------------------------------|
| Measured Static Pressure =   | 80 psi |                                              |
| Measured Residual Pressure = | 65 psi |                                              |
| Desired Residual Pressure =  | 20 psi | , minimum per City of Barrie design criteria |

$$Q_R = 2925 \text{ US GPM} \quad \text{per fire connection}$$

11,073 L/min

Lozzi Aqua Check

Massimo Lozzi

12307 Woodbine Ave, P.O. Box 519

Cell: 416 990-2131

Gormley, ON L0H 1G0

E-mail: lozziaquacheck@gmail.com

### Hydrant Flow Test Form

Job Location: 127 Collier St., Barrie

Date: June 9, 2021

Time of Test: 10:00 am

Location of Flow Hydrant: 127 Collier St., Barrie

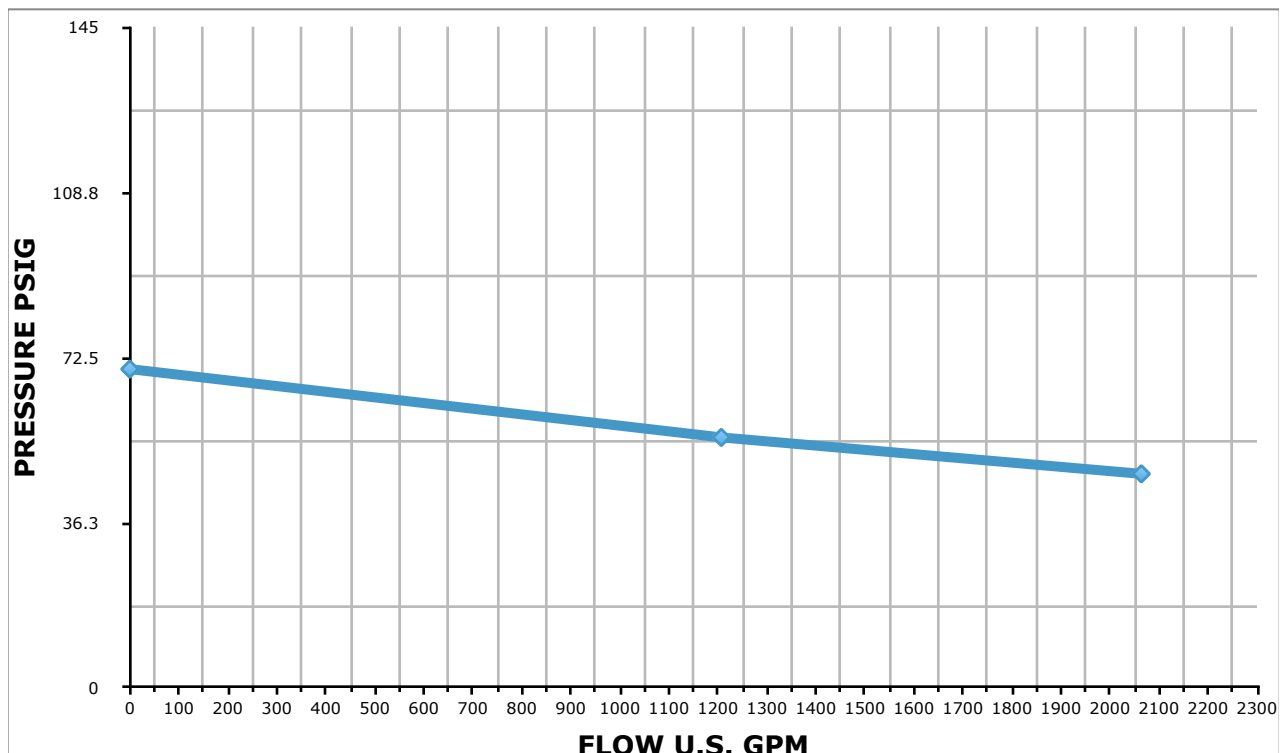
Residual : 140 Collier St., Barrie

Main Size: N/A

Static Pressure: 70 psi

|    | Number of Outlets & Orifice Size | Pitot Pressure (psi) | Flow (U.S. G.P.M.) | Residual Pressure (psi) |
|----|----------------------------------|----------------------|--------------------|-------------------------|
| 1. | Static                           | 0                    | 0                  | 70                      |
| 2. | 1 x 2 ½                          | 52                   | 1207               | 55                      |
| 3. | 2 x 2 ½                          | 38                   | 2064               | 47                      |

Note: Flow test conducted in accordance with NFPA 291





Lozzi Aqua Check

Massimo Lozzi

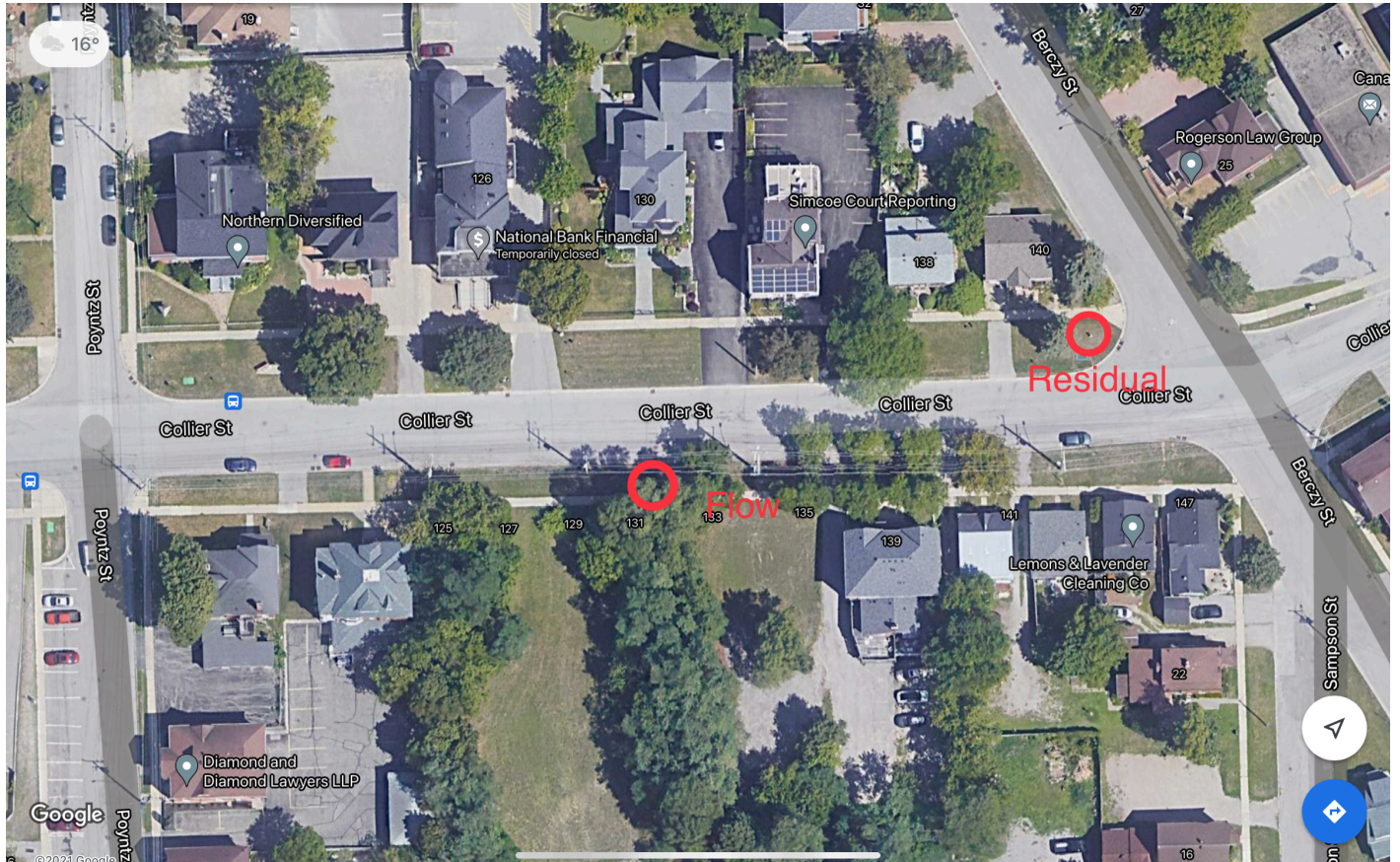
12307 Woodbine Ave, P.O. Box 519

Cell: 416 990-2131

Gormley, ON L0H 1G0

E-mail: lozziaquacheck@gmail.com

Site Map:



Lozzi Aqua Check

Massimo Lozzi

12307 Woodbine Ave, P.O. Box 519

Cell: 416 990-2131

Gormley, ON L0H 1G0

E-mail: lozziaquacheck@gmail.com

### Hydrant Flow Test Form

Job Location: 172 Dunlop St. E, Barrie

Date: June 9, 2021

Time of Test: 10:30 am

Location of Flow Hydrant: 172 Dunlop St. E, Barrie

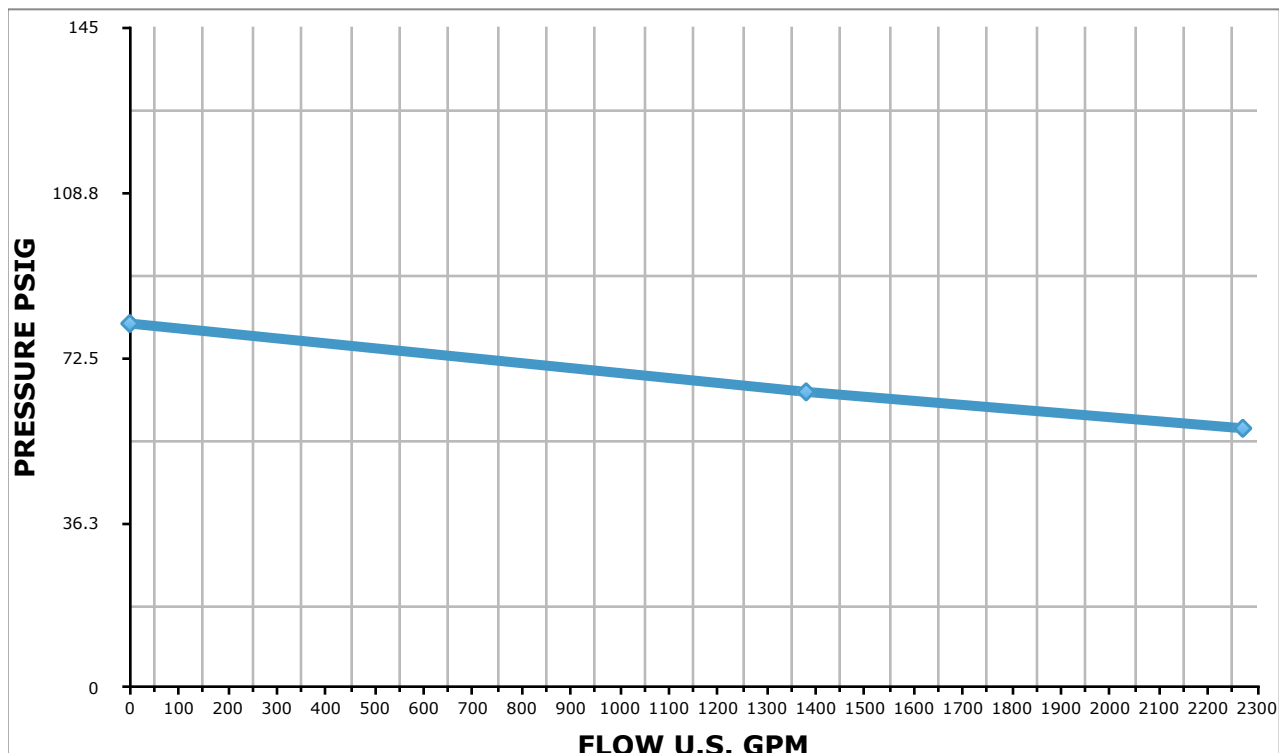
Residual : 194 Dunlop St. E, Barrie

Main Size: N/A

Static Pressure: 80 psi

|    | Number of Outlets & Orifice Size | Pitot Pressure (psi) | Flow (U.S. G.P.M.) | Residual Pressure (psi) |
|----|----------------------------------|----------------------|--------------------|-------------------------|
| 1. | Static                           | 0                    | 0                  | 80                      |
| 2. | 1 x 2 ½                          | 68                   | 1380               | 65                      |
| 3. | 2 x 2 ½                          | 46                   | 2271               | 57                      |

Note: Flow test conducted in accordance with NFPA 291





Lozzi Aqua Check

Massimo Lozzi

12307 Woodbine Ave, P.O. Box 519

Cell: 416 990-2131

Gormley, ON L0H 1G0

E-mail: lozziaquacheck@gmail.com

Site Map:





# APPENDIX D

Sanitary

Counterpoint Engineering Inc.

Sanitary Demand Design Calculations:

Project:

Project No:

Client:

Location:

Site Area:

Building:

129 Collier Street

20019

129 Collier LP

Barrie, ON

0.28

ha

North

Equivalent Population as per City of Barrie Standards

|               |      |     |
|---------------|------|-----|
| Singles/Semis | 3.13 | ppu |
| Row Housing   | 2.34 | ppu |
| Apartments    | 1.67 | ppu |

Demands as per City of Barrie Standards

|                                |        |              |
|--------------------------------|--------|--------------|
| Residential Average Day Demand | 225.00 | L/person/day |
| Residential Peaking Factor     | 4.00   |              |
| Commercial Average Day Demand  | 28.00  | m^3/day/ha   |
| Commercial Peaking Factor      | 2.00   |              |
| Extraneous Flows               | 0.10   | L/s/ha       |

Residential Demand:

|                       |        |                    |
|-----------------------|--------|--------------------|
| Apartment Units       | 118.00 | Apartment Units    |
| Equivalent Population | 198.00 | persons            |
| Peaking Factor        | 4.00   | (Max 4.0, Min 2.0) |
| Residential Demand:   | 2.06   | L/s                |

Commercial Demand:

|                    |      |     |
|--------------------|------|-----|
| Total Area         | 0.00 | ha  |
| Peaking Factor     | 2.00 |     |
| Commercial Demand: | 0.00 | L/s |

Infiltration Allowance:

|                         |      |     |
|-------------------------|------|-----|
| Total Area              | 0.28 | ha  |
| Infiltration Allowance: | 0.03 | L/s |

|                                                                              |     |
|------------------------------------------------------------------------------|-----|
| Total Sanitary Demand (Residenital + Commercial + Industrial + Infiltration) |     |
| 2.09                                                                         | L/s |

Counterpoint Engineering Inc.

Sanitary Demand Design Calculations:

Project:

Project No:

Client:

Location:

Site Area:

Building:

129 Collier Street

20019

129 Collier LP

Barrie, ON

0.33

ha

South

Equivalent Population as per City of Barrie Standards

|               |      |     |
|---------------|------|-----|
| Singles/Semis | 3.13 | ppu |
| Row Housing   | 2.34 | ppu |
| Apartments    | 1.67 | ppu |

Demands as per City of Barrie Standards

|                                |        |              |
|--------------------------------|--------|--------------|
| Residential Average Day Demand | 225.00 | L/person/day |
| Residential Peaking Factor     | 4.00   |              |
| Commercial Average Day Demand  | 28.00  | m^3/day/ha   |
| Commercial Peaking Factor      | 2.00   |              |
| Extraneous Flows               | 0.10   | L/s/ha       |

Residential Demand:

|                       |        |                    |
|-----------------------|--------|--------------------|
| Apartment Units       | 175.00 | Apartment Units    |
| Equivalent Population | 293.00 | persons            |
| Peaking Factor        | 4.00   | (Max 4.0, Min 2.0) |
| Residential Demand:   | 3.05   | L/s                |

Commercial Demand:

|                    |      |     |
|--------------------|------|-----|
| Total Area         | 0.00 | ha  |
| Peaking Factor     | 2.00 |     |
| Commercial Demand: | 0.00 | L/s |

Infiltration Allowance:

|                         |      |     |
|-------------------------|------|-----|
| Total Area              | 0.33 | ha  |
| Infiltration Allowance: | 0.03 | L/s |

|                                                                              |     |
|------------------------------------------------------------------------------|-----|
| Total Sanitary Demand (Residenital + Commercial + Industrial + Infiltration) |     |
| 3.09                                                                         | L/s |





# APPENDIX E

## Allowable Release Rates



Rational Method  
Pre-Development Release Rates

Project No: 20019  
Project Name: 129 Collier Street, Barrie  
Date: 2022-02-08 0:00

|                 |   |                       |
|-----------------|---|-----------------------|
| Event:          | 2 | years                 |
| ABC's:          | a | 678.085               |
|                 | b | 4.699                 |
|                 | c | 0.781                 |
| Time of Concer  | t | 10min                 |
| Runoff Coeffick | C | 0.41                  |
| Site Area       | A | 0.61ha                |
| Intensity [i=a  | i | 83.11mm/hr            |
| Flow [Q=(       | Q | 0.06m <sup>3</sup> /s |
|                 |   | 57.7l/s               |

|                                     |   |                       |
|-------------------------------------|---|-----------------------|
| Event:                              | 5 | years                 |
| ABC's:                              | a | 853.608               |
|                                     | b | 4.699                 |
|                                     | c | 0.766                 |
| Time of Concentration:              | t | 10min                 |
| Runoff Coefficient:                 | C | 0.41                  |
| Site Area                           | A | 0.61ha                |
| Intensity [i=a/(t+b) <sup>2</sup> ] | i | 108.92mm/hr           |
| Flow [Q=CiA/360]                    | Q | 0.08m <sup>3</sup> /s |
|                                     |   | 75.7l/s               |

|                 |    |                       |
|-----------------|----|-----------------------|
| Event:          | 10 | years                 |
| ABC's:          | a  | 975.865               |
|                 | b  | 4.699                 |
|                 | c  | 0.760                 |
| Time of Concer  | t  | 10min                 |
| Runoff Coeffick | C  | 0.41                  |
| Site Area       | A  | 0.61ha                |
| Intensity [i=a  | i  | 126.55mm/hr           |
| Flow [Q=(       | Q  | 0.09m <sup>3</sup> /s |
|                 |    | 87.9l/s               |

|                                     |    |                       |
|-------------------------------------|----|-----------------------|
| Event:                              | 25 | years                 |
| ABC's:                              | a  | 1146.275              |
|                                     | b  | 4.922                 |
|                                     | c  | 0.757                 |
| Time of Concentration:              | t  | 10min                 |
| Runoff Coefficient:                 | C  | 0.45                  |
| Site Area                           | A  | 0.61ha                |
| Intensity [i=a/(t+b) <sup>2</sup> ] | i  | 148.15mm/hr           |
| Flow [Q=CiA/360]                    | Q  | 0.11m <sup>3</sup> /s |
|                                     |    | 113.2l/s              |

|                 |    |                       |
|-----------------|----|-----------------------|
| Event:          | 50 | years                 |
| ABC's:          | a  | 1236.152              |
|                 | b  | 4.699                 |
|                 | c  | 0.751                 |
| Time of Concer  | t  | 10min                 |
| Runoff Coeffick | C  | 0.49                  |
| Site Area       | A  | 0.61ha                |
| Intensity [i=a  | i  | 164.22mm/hr           |
| Flow [Q=(       | Q  | 0.14m <sup>3</sup> /s |
|                 |    | 136.9l/s              |

|                                     |     |                       |
|-------------------------------------|-----|-----------------------|
| Event:                              | 100 | years                 |
| ABC's:                              | a   | 1426.408              |
|                                     | b   | 5.273                 |
|                                     | c   | 0.759                 |
| Time of Concentration:              | t   | 10min                 |
| Runoff Coefficient:                 | C   | 0.51                  |
| Site Area                           | A   | 0.61ha                |
| Intensity [i=a/(t+b) <sup>2</sup> ] | i   | 180.15mm/hr           |
| Flow [Q=CiA/360]                    | Q   | 0.16m <sup>3</sup> /s |
|                                     |     | 156.4l/s              |



# APPENDIX F

## Stormwater Quantity Control Calculations



**SWM DESIGN CALCULATIONS**  
**Storage Calculations for 5-Year Storm Event**

**Project Name:** 129 Collier Street

**Municipality:** Barrie, ON

**Project No.:** 20019

**Date:** 8-Feb-22

**Prepared by:** E.S.

**Last Revised:** 8-Feb-22

**Rainfall Data**

|           |                       |   |         |
|-----------|-----------------------|---|---------|
| Location: | City of Barrie,<br>ON | a | 853.608 |
| Event     | 5-Year                | b | 4.699   |
|           |                       | c | 0.766   |

**Site Data**

|                                    |      |
|------------------------------------|------|
| Area (ha)                          | 0.49 |
| Runoff Coefficient                 | 0.90 |
| AC                                 | 0.44 |
| Tc (min)                           | 10   |
| Time Increment (min)               | 5    |
| Release Rate (l/s)                 | 42   |
| Storage Required (m <sup>3</sup> ) | 58   |

**The Rational Equation:**

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m<sup>3</sup>/s)  
C = the site specific runoff coefficient  
A = the drainage area (ha)  
i = rainfall intensity (mm/hr)

| Time  | Rainfall Intensity | Storm Runoff        | Runoff Volume     | Released Volume   | Storage Volume    |
|-------|--------------------|---------------------|-------------------|-------------------|-------------------|
| (min) | (mm/hr)            | (m <sup>3</sup> /s) | (m <sup>3</sup> ) | (m <sup>3</sup> ) | (m <sup>3</sup> ) |
| 10    | 109                | 0.13                | 80                | 25                | 55                |
| 15    | 87                 | 0.11                | 96                | 38                | 58                |
| 20    | 73                 | 0.09                | 108               | 50                | 57                |
| 25    | 64                 | 0.08                | 117               | 63                | 54                |
| 30    | 56                 | 0.07                | 124               | 75                | 49                |
| 35    | 51                 | 0.06                | 131               | 88                | 43                |
| 40    | 46                 | 0.06                | 137               | 101               | 36                |
| 45    | 43                 | 0.05                | 142               | 113               | 29                |
| 50    | 40                 | 0.05                | 146               | 126               | 21                |
| 55    | 37                 | 0.05                | 151               | 138               | 12                |
| 60    | 35                 | 0.04                | 154               | 151               | 4                 |
| 65    | 33                 | 0.04                | 158               | 163               | 0                 |
| 70    | 31                 | 0.04                | 161               | 176               | 0                 |
| 75    | 30                 | 0.04                | 165               | 189               | 0                 |
| 80    | 28                 | 0.03                | 168               | 201               | 0                 |
| 85    | 27                 | 0.03                | 170               | 214               | 0                 |
| 90    | 26                 | 0.03                | 173               | 226               | 0                 |
| 95    | 25                 | 0.03                | 176               | 239               | 0                 |
| 100   | 24                 | 0.03                | 178               | 251               | 0                 |
| 105   | 23                 | 0.03                | 180               | 264               | 0                 |
| 110   | 23                 | 0.03                | 183               | 276               | 0                 |
| 115   | 22                 | 0.03                | 185               | 289               | 0                 |
| 120   | 21                 | 0.03                | 187               | 302               | 0                 |

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**Counterpoint Engineering Inc.**

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[www.counterpointeng.com](http://www.counterpointeng.com)



**SWM DESIGN CALCULATIONS**  
**Storage Calculations for 100-Year Storm Event**

**Project Name:** 129 Collier Street

**Prepared by:** E.S.

**Municipality:** Barrie, ON

**Project No.:** 20019

**Last Revised:** 8-Feb-22

**Date:** 8-Feb-22

**Rainfall Data**

|           |                       |   |          |
|-----------|-----------------------|---|----------|
| Location: | City of Barrie,<br>ON | a | 1426.408 |
| Event     | 100-year              | b | 5.273    |
|           |                       | c | 0.759    |

**Site Data**

|                                    |      |
|------------------------------------|------|
| Area (ha)                          | 0.49 |
| Runoff Coefficient                 | 1.00 |
| AC                                 | 0.49 |
| Tc (min)                           | 10   |
| Time Increment (min)               | 5    |
| Release Rate (l/s)                 | 42   |
| Storage Required (m <sup>3</sup> ) | 159  |

**The Rational Equation:**

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m<sup>3</sup>/s)  
C = the site specific runoff coefficient  
A = the drainage area (ha)  
i = rainfall intensity (mm/hr)

| Time  | Rainfall Intensity | Storm Runoff        | Runoff Volume     | Released Volume   | Storage Volume    |
|-------|--------------------|---------------------|-------------------|-------------------|-------------------|
| (min) | (mm/hr)            | (m <sup>3</sup> /s) | (m <sup>3</sup> ) | (m <sup>3</sup> ) | (m <sup>3</sup> ) |
| 10    | 180                | 0.25                | 147               | 25                | 122               |
| 15    | 145                | 0.20                | 178               | 38                | 140               |
| 20    | 123                | 0.17                | 201               | 50                | 151               |
| 25    | 107                | 0.15                | 219               | 63                | 156               |
| 30    | 95                 | 0.13                | 234               | 75                | 159               |
| 35    | 86                 | 0.12                | 247               | 88                | 159               |
| 40    | 79                 | 0.11                | 258               | 101               | 158               |
| 45    | 73                 | 0.10                | 268               | 113               | 155               |
| 50    | 68                 | 0.09                | 277               | 126               | 152               |
| 55    | 64                 | 0.09                | 286               | 138               | 147               |
| 60    | 60                 | 0.08                | 293               | 151               | 143               |
| 65    | 57                 | 0.08                | 300               | 163               | 137               |
| 70    | 54                 | 0.07                | 307               | 176               | 131               |
| 75    | 51                 | 0.07                | 313               | 189               | 125               |
| 80    | 49                 | 0.07                | 319               | 201               | 118               |
| 85    | 47                 | 0.06                | 325               | 214               | 111               |
| 90    | 45                 | 0.06                | 330               | 226               | 104               |
| 95    | 43                 | 0.06                | 335               | 239               | 97                |
| 100   | 42                 | 0.06                | 340               | 251               | 89                |
| 105   | 40                 | 0.05                | 345               | 264               | 81                |
| 110   | 39                 | 0.05                | 349               | 276               | 73                |
| 115   | 38                 | 0.05                | 354               | 289               | 65                |
| 120   | 36                 | 0.05                | 358               | 302               | 56                |

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### Rational Method

#### Post-Development Release Rates POST-2

Project No: 20019  
 Project Name: 129 Collier Street, Barrie  
 Date: 2022-02-08 0:00

|                  |   |                        |
|------------------|---|------------------------|
| Event:           | 2 | years                  |
| ABC's:           | a | 678.085                |
|                  | b | 4.699                  |
|                  | c | 0.781                  |
| Time of Concer   | t | 10 min                 |
| Runoff Coefficie | C | 0.70                   |
| Site Area        | A | 0.02 ha                |
| Intensity [i=a   | i | 83.11 mm/hr            |
| Flow [Q=C        | Q | 0.00 m <sup>3</sup> /s |
|                  |   | 3.2 l/s                |

|                                   |   |                        |
|-----------------------------------|---|------------------------|
| Event:                            | 5 | years                  |
| ABC's:                            | a | 853.608                |
|                                   | b | 4.699                  |
|                                   | c | 0.766                  |
| Time of Concentration:            | t | 10 min                 |
| Runoff Coefficient:               | C | 0.70                   |
| Site Area                         | A | 0.02 ha                |
| Intensity [i=a/(t+b) <sup>2</sup> | i | 108.92 mm/hr           |
| Flow [Q=CiA/360]                  | Q | 0.00 m <sup>3</sup> /s |
|                                   |   | 4.2 l/s                |

|                  |    |                        |
|------------------|----|------------------------|
| Event:           | 10 | years                  |
| ABC's:           | a  | 975.865                |
|                  | b  | 4.699                  |
|                  | c  | 0.760                  |
| Time of Concer   | t  | 10 min                 |
| Runoff Coefficie | C  | 0.70                   |
| Site Area        | A  | 0.02 ha                |
| Intensity [i=a   | i  | 126.55 mm/hr           |
| Flow [Q=C        | Q  | 0.00 m <sup>3</sup> /s |
|                  |    | 4.9 l/s                |

|                                   |    |                        |
|-----------------------------------|----|------------------------|
| Event:                            | 25 | years                  |
| ABC's:                            | a  | 1146.275               |
|                                   | b  | 4.922                  |
|                                   | c  | 0.757                  |
| Time of Concentration:            | t  | 10 min                 |
| Runoff Coefficient:               | C  | 0.77                   |
| Site Area                         | A  | 0.02 ha                |
| Intensity [i=a/(t+b) <sup>2</sup> | i  | 148.15 mm/hr           |
| Flow [Q=CiA/360]                  | Q  | 0.01 m <sup>3</sup> /s |
|                                   |    | 6.3 l/s                |

|                  |    |                        |
|------------------|----|------------------------|
| Event:           | 50 | years                  |
| ABC's:           | a  | 1236.152               |
|                  | b  | 4.699                  |
|                  | c  | 0.751                  |
| Time of Concer   | t  | 10 min                 |
| Runoff Coefficie | C  | 0.84                   |
| Site Area        | A  | 0.02 ha                |
| Intensity [i=a   | i  | 164.22 mm/hr           |
| Flow [Q=C        | Q  | 0.01 m <sup>3</sup> /s |
|                  |    | 7.7 l/s                |

|                                   |     |                        |
|-----------------------------------|-----|------------------------|
| Event:                            | 100 | years                  |
| ABC's:                            | a   | 1426.408               |
|                                   | b   | 5.273                  |
|                                   | c   | 0.759                  |
| Time of Concentration:            | t   | 10 min                 |
| Runoff Coefficient:               | C   | 0.88                   |
| Site Area                         | A   | 0.02 ha                |
| Intensity [i=a/(t+b) <sup>2</sup> | i   | 180.15 mm/hr           |
| Flow [Q=CiA/360]                  | Q   | 0.01 m <sup>3</sup> /s |
|                                   |     | 8.8 l/s                |

### Rational Method

#### Post-Development Release Rates POST-3

Project No: 20019  
 Project Name: 129 Collier Street, Barrie  
 Date: 2022-02-08 0:00

|                  |   |                        |
|------------------|---|------------------------|
| Event:           | 2 | years                  |
| ABC's:           | a | 678.085                |
|                  | b | 4.699                  |
|                  | c | 0.781                  |
| Time of Concer   | t | 10 min                 |
| Runoff Coefficie | C | 0.40                   |
| Site Area        | A | 0.10 ha                |
| Intensity [i=a   | i | 83.11 mm/hr            |
| Flow [Q=C        | Q | 0.01 m <sup>3</sup> /s |
|                  |   | 9.2 l/s                |

|                                   |   |                        |
|-----------------------------------|---|------------------------|
| Event:                            | 5 | years                  |
| ABC's:                            | a | 853.608                |
|                                   | b | 4.699                  |
|                                   | c | 0.766                  |
| Time of Concentration:            | t | 10 min                 |
| Runoff Coefficient:               | C | 0.40                   |
| Site Area                         | A | 0.10 ha                |
| Intensity [i=a/(t+b) <sup>2</sup> | i | 108.92 mm/hr           |
| Flow [Q=CiA/360]                  | Q | 0.01 m <sup>3</sup> /s |
|                                   |   | 12.1 l/s               |

|                  |    |                        |
|------------------|----|------------------------|
| Event:           | 10 | years                  |
| ABC's:           | a  | 975.865                |
|                  | b  | 4.699                  |
|                  | c  | 0.760                  |
| Time of Concer   | t  | 10 min                 |
| Runoff Coefficie | C  | 0.40                   |
| Site Area        | A  | 0.10 ha                |
| Intensity [i=a   | i  | 126.55 mm/hr           |
| Flow [Q=C        | Q  | 0.01 m <sup>3</sup> /s |
|                  |    | 14.1 l/s               |

|                                   |    |                        |
|-----------------------------------|----|------------------------|
| Event:                            | 25 | years                  |
| ABC's:                            | a  | 1146.275               |
|                                   | b  | 4.922                  |
|                                   | c  | 0.757                  |
| Time of Concentration:            | t  | 10 min                 |
| Runoff Coefficient:               | C  | 0.44                   |
| Site Area                         | A  | 0.10 ha                |
| Intensity [i=a/(t+b) <sup>2</sup> | i  | 148.15 mm/hr           |
| Flow [Q=CiA/360]                  | Q  | 0.02 m <sup>3</sup> /s |
|                                   |    | 18.1 l/s               |

|                  |    |                        |
|------------------|----|------------------------|
| Event:           | 50 | years                  |
| ABC's:           | a  | 1236.152               |
|                  | b  | 4.699                  |
|                  | c  | 0.751                  |
| Time of Concer   | t  | 10 min                 |
| Runoff Coefficie | C  | 0.48                   |
| Site Area        | A  | 0.10 ha                |
| Intensity [i=a   | i  | 164.22 mm/hr           |
| Flow [Q=C        | Q  | 0.02 m <sup>3</sup> /s |
|                  |    | 21.9 l/s               |

|                                   |     |                        |
|-----------------------------------|-----|------------------------|
| Event:                            | 100 | years                  |
| ABC's:                            | a   | 1426.408               |
|                                   | b   | 5.273                  |
|                                   | c   | 0.759                  |
| Time of Concentration:            | t   | 10 min                 |
| Runoff Coefficient:               | C   | 0.50                   |
| Site Area                         | A   | 0.10 ha                |
| Intensity [i=a/(t+b) <sup>2</sup> | i   | 180.15 mm/hr           |
| Flow [Q=CiA/360]                  | Q   | 0.03 m <sup>3</sup> /s |
|                                   |     | 25.0 l/s               |

Counterpoint Engineering Inc.

AS-BUILT STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Project: 129 Collier Street  
Project No: 20019  
Client: 129 Collier LP  
Location: Barrie, ON  
Prepared by: PT  
Checked by: JY  
Date: 02-08-22

Rainfall Data: a, b, c Values

|   |         |
|---|---------|
| a | 853.608 |
| b | 4.699   |
| c | 0.766   |

Manning's Roughness Coefficient (All pipes)= 0.013  
Design Return Frequency (years)= 5

| 1        | 2         | 4        | 7               | 8           | 9          | 10    | 11   | 12    | 13        | 14                 | 15                 | 16          | 17          | 18         | 19              | 20        | 21               | 22        | 23            | 24       | 25           | 26             | 27         |
|----------|-----------|----------|-----------------|-------------|------------|-------|------|-------|-----------|--------------------|--------------------|-------------|-------------|------------|-----------------|-----------|------------------|-----------|---------------|----------|--------------|----------------|------------|
| Location | From Node | To Node  | Diam. (nominal) | Length Pipe | Slope Pipe | Area  | C    | A x C | Accum AxC | Rainfall Intensity | Time of Conc. (Tc) | Area Flow Q | Other Flows | Total Flow | Diameter Actual | Pipe Area | Hydraulic Radius | Pipe Mat. | Pipe Capacity | Velocity | Time of Flow | Ratio Q/Q full | Cap. Check |
|          |           |          | (mm)            | (m)         | (%)        | (ha)  |      | (ha)  | (ha)      | mm/hr              | (min)              | (l/s)       | (l/s)       | (l/s)      | (m)             | (sq.m)    | (m)              |           | (l/s)         | (m/s)    | (min)        |                |            |
|          | CBMH05    | CBMH04   | 250             | 25.3        | 2.00%      | 0.016 | 0.30 | 0.005 | 0.005     | 108.9              | 10.00              | 1.4         | 0.0         | 1.4        | 0.251           | 0.05      | 0.063            | PVC       | 85.0          | 1.72     | 0.25         | 0.02           | OK         |
|          | CBMH04    | MH03     | 375             | 28.1        | 2.00%      | 0.019 | 0.30 | 0.006 | 0.010     | 107.5              | 10.25              | 3.1         | 0.0         | 3.1        | 0.381           | 0.11      | 0.095            | PVC       | 258.7         | 2.27     | 0.21         | 0.01           | OK         |
|          | PLUG      | MH03     | 375             | 4.6         | 2.00%      |       |      |       | 0.010     | 108.9              | 10.00              | N/A         | 54.0        | 54.0       | 0.381           | 0.11      | 0.095            | PVC       | 258.7         | 2.27     | 0.03         | 0.21           | OK         |
|          | MH03      | CBMH03   | 375             | 12.9        | 1.00%      |       |      |       | 0.010     | 106.4              | 10.45              | 3.1         | 54.0        | 57.1       | 0.381           | 0.11      | 0.095            | PVC       | 182.9         | 1.60     | 0.13         | 0.31           | OK         |
|          | CBMH03    | OGS Unit | 375             | 3.4         | 2.00%      | 0.037 | 0.30 | 0.011 | 0.022     | 105.7              | 10.59              | 6.3         | 54.0        | 60.3       | 0.381           | 0.11      | 0.095            | PVC       | 258.7         | 2.27     | 0.02         | 0.23           | OK         |
|          | OGS Unit  | MH02     | 375             | 1.5         | 1.00%      |       |      |       | 0.022     | 105.6              | 10.61              | 6.3         | 54.0        | 60.3       | 0.381           | 0.11      | 0.095            | PVC       | 182.9         | 1.60     | 0.02         | 0.33           | OK         |
|          | MH02      | MH01     | 375             | 13.1        | 1.00%      |       |      |       | 0.022     | 105.5              | 10.63              | 6.3         | 54.0        | 60.3       | 0.381           | 0.11      | 0.095            | PVC       | 182.9         | 1.60     | 0.14         | 0.33           | OK         |

Definitions:  
Q = 2.78 AIR, where  
Q = Peak Flow in Litres per second (L/s)  
Tc= Time of concentration  
A = Areas in hectares (ha)  
I = Rainfall Intensity (mm/h)  
 $I = a / (Td + b)^c$  (see above for regression constants)  
Tc= Time of concentration  
C = Runoff Coefficient  
A = Areas in hectares (ha)



# APPENDIX G

## Water Balance



**Table: A**  
**Summary of Inputs for Water Balance Calculation**

|                                |             |                                     |
|--------------------------------|-------------|-------------------------------------|
| Precipitation (mm/yr)          | <b>889</b>  | Sand From Table 5-2 below           |
| Evapotranspiration (mm/yr)     | <b>561</b>  | Sand estimated from Table 5-2 below |
| Topography Infiltration Factor | <b>0.1</b>  | Pre-development site (Grass)        |
| Soil Infiltration Factor       | <b>0.2</b>  | Pre-development site (Grass)        |
| Land Cover Infiltration Factor | <b>0.1</b>  | Pre-development site (Grass)        |
| MOE Infiltration Factor        | <b>0.4</b>  | Pre-development site (Grass)        |
| Topography Infiltration Factor | <b>0.30</b> | Post- Development (Grass)           |
| Soil Infiltration Factor       | <b>0.20</b> | Post- Development (Grass)           |
| Land Cover Infiltration Factor | <b>0.10</b> | Post- Development (Grass)           |
| MOE Infiltration Factor        | <b>0.60</b> | Post- Development (Grass)           |

**TABLE 5-2 Summary of Key Hydrologic Processes by Soil Class (1990-2009)**

| Soil Class | Total Area (km <sup>2</sup> ) | Percent of Study Area (%) | Precipitation (mm/yr) | Evapotranspiration (mm/yr) | Groundwater Recharge (mm/yr) | Groundwater Discharge (mm/yr) |
|------------|-------------------------------|---------------------------|-----------------------|----------------------------|------------------------------|-------------------------------|
| Gravel     | 168                           | 21                        | 899                   | 546                        | 370                          | 5                             |
| Sand       | 238                           | 30                        | 889                   | 561                        | 351                          | 249                           |
| Silt/Till  | 241                           | 30                        | 899                   | 523                        | 181                          | 26                            |
| Clay       | 151                           | 19                        | 892                   | 576                        | 30                           | 241                           |
| Study Area | 797                           | 100                       | 895                   | 549                        | 243                          | 129                           |

Table extracted from chapter 5 of "City of Barrie Tier Three Recharge Estimations Using Mike SHE, Technical Memorandum" Prepared for Lake Simcoe Conservation Authority, by AquaResource, June 2012.

| Table 2: Infiltration Factors                          |                              |
|--------------------------------------------------------|------------------------------|
| Description of Area/Development Site                   | Value of Infiltration Factor |
| <b>TOPOGRAPHY</b>                                      |                              |
| ■ Flat land, average slope not exceeding 0.6 m per km  | 0.30                         |
| ■ Rolling land, average slope of 2.8 m to 3.8 m per km | 0.20                         |
| ■ Hilly land, average slope of 28 m to 47 m per km     | 0.10                         |
| <b>SOIL</b>                                            |                              |
| ■ High permeability soil                               |                              |
| ■ Medium permeability soil                             |                              |
| ■ Clay or very low                                     |                              |
| <b>COVER</b>                                           |                              |
| ■ Cultivated land                                      |                              |
| ■ Forested                                             |                              |

Table extracted from chapter 4 of "MOEE Hydrogeological technical Information requirements for Land Development Applications" MOE, April 1995.

# Counterpoint Engineering

## Water Balance - 5mm Target

### As per LSRCA Standards

20019\_Collier

|                                            |   |    |
|--------------------------------------------|---|----|
| Initial Abstraction Asphalt/Roof, I        | 0 | mm |
| Initial Abstraction Pervious and Gravel, P | 5 | mm |
| As per LSRCA guidelines                    |   |    |

| Type of Area                       | Area | Units | %<br>Redevelopment<br>Area |
|------------------------------------|------|-------|----------------------------|
| Impervious Asphalt/Paved Area/Roof | 0.51 | ha    | 100%                       |

Required Development Retention = (Excess Rainfall- Initial Abstraction) \* (Total Development Area)

Required Development Retention = (5.0mm) \* (0.61ha)

**Required Development Retention (debit)= 25.3 m<sup>3</sup>**

# Counterpoint Engineering

## Water Balance - 25mm Target

### As per LSRCA Standards

20019\_Collier

|                                            |    |    |
|--------------------------------------------|----|----|
| Initial Abstraction Asphalt/Roof, I        | 0  | mm |
| Initial Abstraction Pervious and Gravel, P | 25 | mm |
| As per LSRCA guidelines                    |    |    |

| Type of Area                       | Area | Units | %<br>Redevelopment<br>Area |
|------------------------------------|------|-------|----------------------------|
| Impervious Asphalt/Paved Area/Roof | 0.51 | ha    | 100%                       |

Required Development Retention = (Excess Rainfall- Initial Abstraction) \* (Total Development Area)

Required Development Retention = (25.0mm) \* (0.61ha)

**Required Development Retention (debit)= 126.3 m<sup>3</sup>**

**Table: 5**  
**Water Budget Summary**  
**Water Balance/Water Budget Assessment**

| Catchment Designation                        | Site            |                  |                        |                                  |                                        |
|----------------------------------------------|-----------------|------------------|------------------------|----------------------------------|----------------------------------------|
|                                              | Pre-Development | Post-Development | Change (Pre- to Post-) | Post-Development with Mitigation | Change (Pre- to Post- with Mitigation) |
| <b>Inputs (Volumes)</b>                      |                 |                  |                        |                                  |                                        |
| Precipitation (m <sup>3</sup> /yr)           | 5,429           | 5,429            | 0.0%                   | 5,429                            | 0.0%                                   |
| Run-on (m <sup>3</sup> /yr)                  | 0               | 0                | 0.0%                   | 0                                | 0.0%                                   |
| Other Inputs (m <sup>3</sup> /yr)            | 0               | 0                | 0.0%                   | 0                                | 0.0%                                   |
| <b>Total Inputs (m<sup>3</sup>/yr)</b>       | <b>5,429</b>    | <b>5,429</b>     | <b>0.0%</b>            | <b>5,429</b>                     | <b>0.0%</b>                            |
| <b>Outputs (Volumes)</b>                     |                 |                  |                        |                                  |                                        |
| Precipitation Surplus (m <sup>3</sup> /yr)   | 2,368           | 3,951            | 66.8%                  | 3,951                            | 66.8%                                  |
| Net Surplus (m <sup>3</sup> /yr)             | 2,368           | 3,951            | 66.8%                  | 3,951                            | 66.8%                                  |
| Evapotranspiration (m <sup>3</sup> /yr)      | 3,061           | 1,478            | -51.7%                 | 1,478                            | -51.7%                                 |
| Infiltration (m <sup>3</sup> /yr)            | 690             | 206              | -70.2%                 | 206                              | -70.2%                                 |
| Retention and Re-use (m <sup>3</sup> /yr)    | 0               | 0                | 0.0%                   | 505                              | 0.0%                                   |
| Total Infiltration (m <sup>3</sup> /yr)      | 690             | 206              | -70.2%                 | 711                              | 3.0%                                   |
| Runoff Pervious Areas (m <sup>3</sup> /yr)   | 1,035           | 137              | -86.8%                 | 137                              | -86.8%                                 |
| Runoff Impervious Areas (m <sup>3</sup> /yr) | 642             | 3,608            | N/A                    | 3,608                            | N/A                                    |
| Total Runoff (m <sup>3</sup> /yr)            | 1,678           | 3,745            | 123.2%                 | 3,745                            | 123.2%                                 |
| <b>Total Outputs (m<sup>3</sup>/yr)</b>      | <b>5,429</b>    | <b>5,429</b>     | <b>0.0%</b>            | <b>5,934</b>                     | <b>9.3%</b>                            |

**Table: 3**  
**Water Budget - Pre-Development**  
**Water Balance/Water Budget Assessment**

| Catchment Designation                        | North Building  |                    |              | South Building   |                 |              |          |          |          | Totals       |
|----------------------------------------------|-----------------|--------------------|--------------|------------------|-----------------|--------------|----------|----------|----------|--------------|
|                                              | NB-<br>Pervious | NB -<br>Impervious | Totals NB    | SB -<br>Pervious | SB-<br>Impervio | Total SB     |          |          |          | Site         |
| Area (m <sup>2</sup> )                       | 2,170           | 600                | 2,770        | 3,000            | 300             | 3,300        | 0        | 0        | 0        | 6,070        |
| Pervious Area (m2)                           | 2,170           | 0                  | 2170         | 3,000            | 0               | 3,000        | 0        | 0        | 0        | 5,170        |
| Impervious Area (m2)                         | 0               | 600                | 600          | 0                | 300             | 300          | 0        | 0        | 0        | 900          |
| Infiltration Factors                         |                 |                    |              |                  |                 |              |          |          |          |              |
| Topography Infiltration Factor               | 0.10            |                    |              | 0.10             |                 |              |          |          |          |              |
| Soil Infiltration Factor                     | 0.20            |                    |              | 0.20             |                 |              |          |          |          |              |
| Land Cover Infiltration Factor               | 0.10            |                    |              | 0.10             |                 |              |          |          |          |              |
| MOE Infiltration Factor                      | 0.40            |                    |              | 0.40             |                 |              |          |          |          |              |
| Run-off Coefficient                          | 0.30            |                    |              | 0.30             |                 |              |          |          |          |              |
| Run-off from Impervious Surfaces             | 0               |                    |              | 0                |                 |              |          |          |          |              |
| Inputs (per Unit Area)                       |                 |                    |              |                  |                 |              |          |          |          |              |
| Precipitation (mm/yr)                        | 889             | 889                | 889          | 899              | 899             | 899          |          |          |          | 899          |
| Run-on (mm/yr)                               | 0               | 0                  | 0            | 0                | 0               | 0            |          |          |          | 0            |
| Other Inputs (mm/yr)                         | 0               | 0                  | 0            | 0                | 0               | 0            |          |          |          | 0            |
| Outputs (per Unit Area)                      |                 |                    |              |                  |                 |              |          |          |          |              |
| Precipitation Surplus (mm/yr)                | 328             | 711                | 411          | 338              | 719             | 373          | 0        | 0        | 0        | 390          |
| Net Surplus (mm/yr)                          | 328             | 711                | 411          | 338              | 719             | 373          | 0        | 0        | 0        | 390          |
| Evapotranspiration (mm/yr)                   | 561             | 178                | 478          | 561              | 180             | 526          |          | 0        | 0        | 504          |
| Infiltration (mm/yr)                         | 131             | 0                  | 103          | 135              | 0               | 123          | 0        | 0        | 0        | 114          |
| Infiltration Gallery (mm/yr)                 | 0               | 0                  | 0            | 0                | 0               | 0            | 0        | 0        | 0        | 0            |
| Total Infiltration (mm/yr)                   | 131             | 0                  | 103          | 135              | 0               | 123          | 0        | 0        | 0        | 114          |
| Runoff Pervious Areas (mm/yr)                | 197             | 0                  | 154          | 203              | 0               | 184          | 0        | 0        | 0        | 171          |
| Runoff Impervious Areas (mm/yr)              | 0               | 711                | 154          | 0                | 719             | 65           | 0        | 0        | 0        | 106          |
| Total Runoff (mm/yr)                         | 197             | 711                | 308          | 203              | 719             | 250          | 0        | 0        | 0        | 276          |
| <b>Total Outputs (mm/yr)</b>                 | <b>889</b>      | <b>889</b>         | <b>889</b>   | <b>899</b>       | <b>899</b>      | <b>899</b>   | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b>     |
| <b>Difference (Inputs-Outputs)</b>           | <b>0</b>        | <b>0</b>           | <b>0</b>     | <b>0</b>         | <b>0</b>        | <b>0</b>     | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b>     |
| Inputs (Volumes)                             |                 |                    |              |                  |                 |              |          |          |          |              |
| Precipitation (m <sup>3</sup> /yr)           | 1,929           | 533                | 2,463        | 2,697            | 270             | 2,967        | 0        | 0        | 0        | 5,429        |
| Run-on (m <sup>3</sup> /yr)                  | 0               | 0                  | 0            | 0                | 0               | 0            | 0        | 0        | 0        | 0            |
| Other Inputs (m <sup>3</sup> /yr)            | 0               | 0                  | 0            | 0                | 0               | 0            | 0        | 0        | 0        | 0            |
| <b>Total Inputs (m3/yr)</b>                  | <b>1,929</b>    | <b>533</b>         | <b>2,463</b> | <b>2,697</b>     | <b>270</b>      | <b>2,967</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>5,429</b> |
| Outputs (Volumes)                            |                 |                    |              |                  |                 |              |          |          |          |              |
| Precipitation Surplus (m <sup>3</sup> /yr)   | 712             | 427                | 1,138        | 1,014            | 216             | 1,230        | 0        | 0        | 0        | 2,368        |
| Net Surplus (m <sup>3</sup> /yr)             | 712             | 427                | 1,138        | 1,014            | 216             | 1,230        | 0        | 0        | 0        | 2,368        |
| Evapotranspiration (m <sup>3</sup> /yr)      | 1,217           | 107                | 1,324        | 1,683            | 54              | 1,737        | 0        | 0        | 0        | 3,061        |
| Infiltration (m <sup>3</sup> /yr)            | 285             | 0                  | 285          | 406              | 0               | 406          | 0        | 0        | 0        | 690          |
| Infiltration Gallery (m <sup>3</sup> /yr)    | 0               | 0                  | 0            | 0                | 0               | 0            | 0        | 0        | 0        | 0            |
| Total Infiltration (m <sup>3</sup> /yr)      | 285             | 0                  | 285          | 406              | 0               | 406          | 0        | 0        | 0        | 690          |
| Runoff Pervious Areas (m <sup>3</sup> /yr)   | 427             | 0                  | 427          | 608              | 0               | 608          | 0        | 0        | 0        | 1,035        |
| Runoff Impervious Areas (m <sup>3</sup> /yr) | 0               | 427                | 427          | 0                | 216             | 216          | 0        | 0        | 0        | 642          |
| Total Runoff (m <sup>3</sup> /yr)            | 427             | 427                | 854          | 608              | 216             | 824          | 0        | 0        | 0        | 1,678        |
| <b>Total Outputs (m<sup>3</sup>/yr)</b>      | <b>1,929</b>    | <b>533</b>         | <b>2,463</b> | <b>2,697</b>     | <b>270</b>      | <b>2,967</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>5,429</b> |
| <b>Difference (Inputs-Outputs)</b>           | <b>0</b>        | <b>0</b>           | <b>0</b>     | <b>0</b>         | <b>0</b>        | <b>0</b>     | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b>     |

Note:  
- Evaporation from impervious area assumed to be 20% of precipitation.

**Table: 3**  
**Water Budget - Post-Development**  
**Water Balance/Water Budget Assessment**

| Catchment Designation                        | North Building  |                   |           | South Building   |                 |          |   |   |   | Totals |
|----------------------------------------------|-----------------|-------------------|-----------|------------------|-----------------|----------|---|---|---|--------|
|                                              | NB-<br>Pervious | NB-<br>Impervious | Totals NB | SB -<br>Pervious | SB-<br>Impervio | Total SB |   |   |   | Site   |
| Area (m <sup>2</sup> )                       | 417             | 2,414             | 2,831     | 610              | 2,629           | 3,239    | 0 | 0 | 0 | 6,070  |
| Pervious Area (m2)                           | 417             | 0                 | 417       | 610              | 0               | 610      | 0 | 0 | 0 | 1,027  |
| Impervious Area (m2)                         | 0               | 2,414             | 2,414     | 0                | 2,629           | 2,629    | 0 | 0 | 0 | 5,043  |
| Infiltration Factors                         |                 |                   |           |                  |                 |          |   |   |   |        |
| Topography Infiltration Factor               | 0.30            |                   |           | 0.30             |                 |          |   |   |   |        |
| Soil Infiltration Factor                     | 0.20            |                   |           | 0.20             |                 |          |   |   |   |        |
| Land Cover Infiltration Factor               | 0.10            |                   |           | 0.10             |                 |          |   |   |   |        |
| MOE Infiltration Factor                      | 0.60            |                   |           | 0.60             |                 |          |   |   |   |        |
| Run-off Coefficient                          | 0.30            |                   |           | 0.30             |                 |          |   |   |   |        |
| Run-off from Impervious Surfaces             | 0               |                   |           | 0                |                 |          |   |   |   |        |
| Inputs (per Unit Area)                       |                 |                   |           |                  |                 |          |   |   |   |        |
| Precipitation (mm/yr)                        | 889             | 889               | 889       | 899              | 899             | 899      |   |   |   | 899    |
| Run-on (mm/yr)                               | 0               | 0                 | 0         | 0                | 0               | 0        |   |   |   | 0      |
| Other Inputs (mm/yr)                         | 0               | 0                 | 0         | 0                | 0               | 0        |   |   |   | 0      |
| Outputs (per Unit Area)                      |                 |                   |           |                  |                 |          |   |   |   |        |
| Precipitation Surplus (mm/yr)                | 328             | 711               | 655       | 338              | 719             | 647      | 0 | 0 | 0 | 651    |
| Net Surplus (mm/yr)                          | 328             | 711               | 655       | 338              | 719             | 647      | 0 | 0 | 0 | 651    |
| Evapotranspiration (mm/yr)                   | 561             | 178               | 234       | 561              | 180             | 252      |   | 0 | 0 | 243    |
| Infiltration (mm/yr)                         | 197             | 0                 | 29        | 203              | 0               | 38       | 0 | 0 | 0 | 34     |
| Infiltration Gallery (mm/yr)                 | 0               | 0                 | 0         | 0                | 0               | 0        | 0 | 0 | 0 | 0      |
| Total Infiltration (mm/yr)                   | 197             | 0                 | 29        | 203              | 0               | 38       | 0 | 0 | 0 | 34     |
| Runoff Pervious Areas (mm/yr)                | 131             | 0                 | 19        | 135              | 0               | 25       | 0 | 0 | 0 | 23     |
| Runoff Impervious Areas (mm/yr)              | 0               | 711               | 606       | 0                | 719             | 584      | 0 | 0 | 0 | 594    |
| Total Runoff (mm/yr)                         | 131             | 711               | 626       | 135              | 719             | 609      | 0 | 0 | 0 | 617    |
| Total Outputs (mm/yr)                        | 889             | 889               | 889       | 899              | 899             | 899      | 0 | 0 | 0 | 0      |
| Difference (Inputs-Outputs)                  | 0               | 0                 | 0         | 0                | 0               | 0        | 0 | 0 | 0 | 0      |
| Inputs (Volumes)                             |                 |                   |           |                  |                 |          |   |   |   |        |
| Precipitation (m <sup>3</sup> /yr)           | 371             | 2,146             | 2,517     | 548              | 2,364           | 2,912    | 0 | 0 | 0 | 5,429  |
| Run-on (m <sup>3</sup> /yr)                  | 0               | 0                 | 0         | 0                | 0               | 0        | 0 | 0 | 0 | 0      |
| Other Inputs (m <sup>3</sup> /yr)            | 0               | 0                 | 0         | 0                | 0               | 0        | 0 | 0 | 0 | 0      |
| Total Inputs (m3/yr)                         | 371             | 2,146             | 2,517     | 548              | 2,364           | 2,912    | 0 | 0 | 0 | 5,429  |
| Outputs (Volumes)                            |                 |                   |           |                  |                 |          |   |   |   |        |
| Precipitation Surplus (m <sup>3</sup> /yr)   | 137             | 1,717             | 1,854     | 206              | 1,891           | 2,097    | 0 | 0 | 0 | 3,951  |
| Net Surplus (m <sup>3</sup> /yr)             | 137             | 1,717             | 1,854     | 206              | 1,891           | 2,097    | 0 | 0 | 0 | 3,951  |
| Evapotranspiration (m <sup>3</sup> /yr)      | 234             | 429               | 663       | 342              | 473             | 815      | 0 | 0 | 0 | 1,478  |
| Infiltration (m <sup>3</sup> /yr)            | 82              | 0                 | 82        | 124              | 0               | 124      | 0 | 0 | 0 | 206    |
| Infiltration Gallery (m <sup>3</sup> /yr)    | 0               | 0                 | 0         | 0                | 0               | 0        | 0 | 0 | 0 | 0      |
| Total Infiltration (m <sup>3</sup> /yr)      | 82              | 0                 | 82        | 124              | 0               | 124      | 0 | 0 | 0 | 206    |
| Runoff Pervious Areas (m <sup>3</sup> /yr)   | 55              | 0                 | 55        | 82               | 0               | 82       | 0 | 0 | 0 | 137    |
| Runoff Impervious Areas (m <sup>3</sup> /yr) | 0               | 1,717             | 1,717     | 0                | 1,891           | 1,891    | 0 | 0 | 0 | 3,608  |
| Total Runoff (m <sup>3</sup> /yr)            | 55              | 1,717             | 1,772     | 82               | 1,891           | 1,974    | 0 | 0 | 0 | 3,745  |
| Total Outputs (m <sup>3</sup> /yr)           | 371             | 2,146             | 2,517     | 548              | 2,364           | 2,912    | 0 | 0 | 0 | 5,429  |
| Difference (Inputs-Outputs)                  | 0               | 0                 | 0         | 0                | 0               | 0        | 0 | 0 | 0 | 0      |

Note:  
 - Evaporation from impervious area assumed to be 20% of precipitation.



# APPENDIX H

## Water Quality

## Project DEVELOPMENT Summary

DEVELOPMENT: 129 Collier Street

Subwatershed: Barrie Creeks

|                                  |               |                                                |             |
|----------------------------------|---------------|------------------------------------------------|-------------|
| Total Pre-Development Area (ha): | <b>0.6100</b> | Total Pre-Development Phosphorus Load (kg/yr): | <b>0.04</b> |
|----------------------------------|---------------|------------------------------------------------|-------------|

| Pre-Development Land Use | Area (ha) | P coeff. (kg/ha) | P Load (kg/yr) |
|--------------------------|-----------|------------------|----------------|
| Transition               | 0.61      | 0.06             | 0.04           |

### 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 | 0.05      | 1.32             | NONE                                                       | 0.07           |

|                              |      |      |       |     |      |
|------------------------------|------|------|-------|-----|------|
| High Intensity - Residential | 0.56 | 1.32 | Other | 79% | 0.16 |
|------------------------------|------|------|-------|-----|------|

*Storm Filter sytemFor a 1.67gpm/ft2 design. SFPD 0811 vault with a total of 17 18in tall Phosphosorb cartridges. This allows for 79% Phosphorus removal*

|                                |             |                |
|--------------------------------|-------------|----------------|
| Post-Development Area Altered: | <b>0.61</b> | P Load (kg/yr) |
| Total Pre-Development Area:    | <b>0.61</b> |                |
| Unaffected Area:               | <b>0</b>    |                |

Pre-Development: **0.04**  
Post-Development: **0.81**  
Change (Pre - Post): **-0.77**

**2100% Net Increase in Load**

Post-Development (with BMPs): **0.22**  
Change (Pre - Post): **-0.18**

**504.46% Net Increase in Load**



**DEVELOPMENT: 129 Collier Street**  
**Subwatershed: Barrie Creeks**

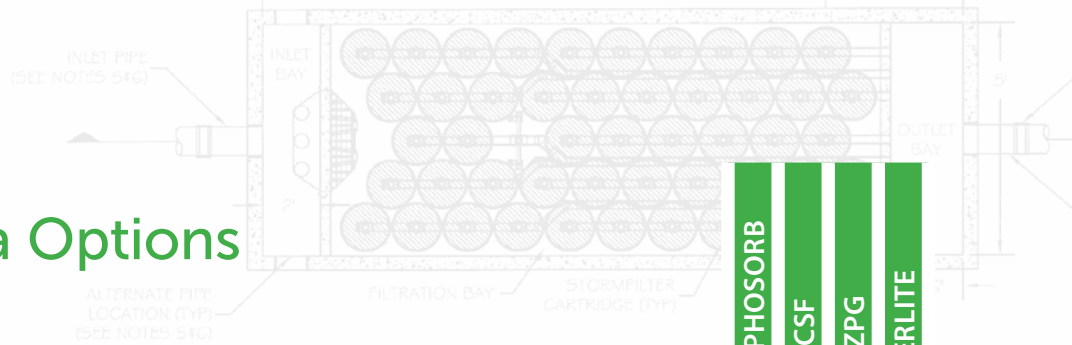
**CONSTRUCTION PHASE LOAD**

| <b>SUMMARY WITH IMPLEMENTATION OF BMPs</b>                                                                                                                                      |  | <b>P Load<br/>(kg/yr)</b>    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------|
| Pre-Development:                                                                                                                                                                |  | <b>0.04</b>                  |
| Construction Phase Amortized Over 8 Years :                                                                                                                                     |  | to be determined             |
| Post-Development:                                                                                                                                                               |  | <b>0.22</b>                  |
| Post-Development + Amortized Construction:                                                                                                                                      |  | <b>to be determined</b>      |
| <b>Pre-Development Load - Post-Development Load:</b>                                                                                                                            |  | <b>-0.18</b>                 |
| <b>Conclusion:</b>                                                                                                                                                              |  | <b>504% Increase in Load</b> |
| <b>Pre-Development Load - (Post-Development + Amortized Construction Load):</b>                                                                                                 |  | <b>to be determined</b>      |
| <b>Conclusion:</b>                                                                                                                                                              |  | <b>to be determined</b>      |
| <b>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:</b> |  |                              |
| <b>Not approve development as site specific appropriate</b>                                                                                                                     |  |                              |

# Recharge Compensation Form

| Application Details                         |                    |
|---------------------------------------------|--------------------|
| Site Name (Developer):                      |                    |
| Site Location:                              | 129 Collier Street |
| File/APID #                                 |                    |
| Anticipated Construction Start:             |                    |
| Subwatershed:                               | Barries Creek      |
| Phosphorous Balance                         |                    |
| Kg/year                                     | 0.18               |
| Compensation Costs                          |                    |
| Offsetting Value                            | 2.5                |
| Compensation Cost (P load<br>*2.5*\$35,000) | \$15,750.00        |
| Administration Fee (15%)                    | \$2,362.50         |
| Total                                       | \$18,112.50        |

# StormFilter Media Options



## Flexibility to target site-specific pollutants ...

- PhosphoSorb® is a lightweight media built from a Perlite-base that removes total phosphorus (TP) by adsorbing dissolved-P and filtering particulate-P simultaneously.
- CSF® Leaf Media is created from deciduous leaves processed into granular, organic media. CSF is most effective for removing soluble metals, TSS, oil and grease, and buffering acid rain.
- Perlite is naturally occurring puffed volcanic ash. Effective for removing TSS, oil, and grease.
- Zeolite is a naturally occurring mineral used to remove soluble metals, ammonium, and some organics.
- GAC (Granular Activated Carbon) has a micro-porous structure with an extensive surface area to provide high levels of adsorption. It is primarily used to remove oil and grease and organics such as PAHs and phthalates.

|                  | PHOSPHOSORB | CSF | ZPG | PERLITE |
|------------------|-------------|-----|-----|---------|
| Sediments        | ✓           | ✓   | ✓   | ✓       |
| Oil and Grease   | ✓           | ✓   | ✓   | ✓       |
| Soluble Metals   | ✓           | ✓   | ✓   |         |
| Organics         |             | ✓   | ✓   |         |
| Nutrients        | ✓           | ✓   | ✓   |         |
| Total Phosphorus | ✓           |     |     |         |

*Note: Indicated media are most effective for associated pollutant type. Other media may treat pollutants, but to a lesser degree.*

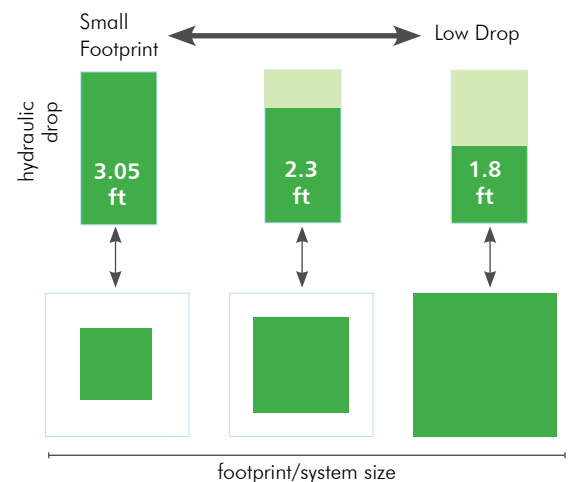
*ZPG™ media is a proprietary blend of zeolite, perlite, and GAC, and is also available.*

# Cartridge Options

## Flexibility to reduce size and costs ...

Every site is different, and one size does not fit all. Multiple cartridge heights give you design flexibility to design the StormFilter specifically for your site and reduce the cost of the system for the owner.

- 27" cartridge – Capitalizing on sites with at least 3.05 feet of available driving head, media surface area is maximized to allow the greatest treatment rate per cartridge; best for sites with footprint constraints
- 18" cartridge - The original StormFilter cartridge size provides a middle ground and operates with 2.3 feet of driving head
- Low Drop – Provides filtration treatment with only 1.8 feet of headloss; best for sites with limited by hydraulic constraints



| CARTRIDGE FLOW RATES |                       |                           |                       |
|----------------------|-----------------------|---------------------------|-----------------------|
| Cartridge Height     | 2 gpm/ft <sup>2</sup> | 1.67* gpm/ft <sup>2</sup> | 1 gpm/ft <sup>2</sup> |
| 12" LD               | 10 gpm                | 8.35 gpm                  | 5 gpm                 |
| 18"                  | 15 gpm                | 12.53 gpm                 | 7.5 gpm               |
| 27"                  | 22.5 gpm              | 18.79 gpm                 | 11.25 gpm             |

| MASS LOAD CAPACITY |                       |                           |                       |
|--------------------|-----------------------|---------------------------|-----------------------|
| Cartridge Height   | 2 gpm/ft <sup>2</sup> | 1.67* gpm/ft <sup>2</sup> | 1 gpm/ft <sup>2</sup> |
| 12" LD             | 15 lbs                | 18 lbs                    | 24 lbs                |
| 18"                | 22.5 lbs              | 27 lbs                    | 36 lbs                |
| 27"                | 33.8 lbs              | 40.45 lbs                 | 54 lbs                |

\* For use with Phosphosorb media as per WA DOE GULD approval.

\* For use with Phosphosorb media as per WA DOE GULD approval.

# VERIFICATION STATEMENT

## GLOBE Performance Solutions

Verifies the performance of

### The Stormwater Management StormFilter®

Developed by CONTECH Engineered Solutions LLC  
Scarborough, Maine, USA

Registration: GPS-ETV\_2020-06-15\_TAPE

In accordance with

**ISO 14034:2016**

**Environmental Management —  
Environmental Technology Verification (ETV)**



John D. Wiebe, PhD  
Executive Chairman  
GLOBE Performance Solutions

June 15, 2020  
Vancouver, BC, Canada



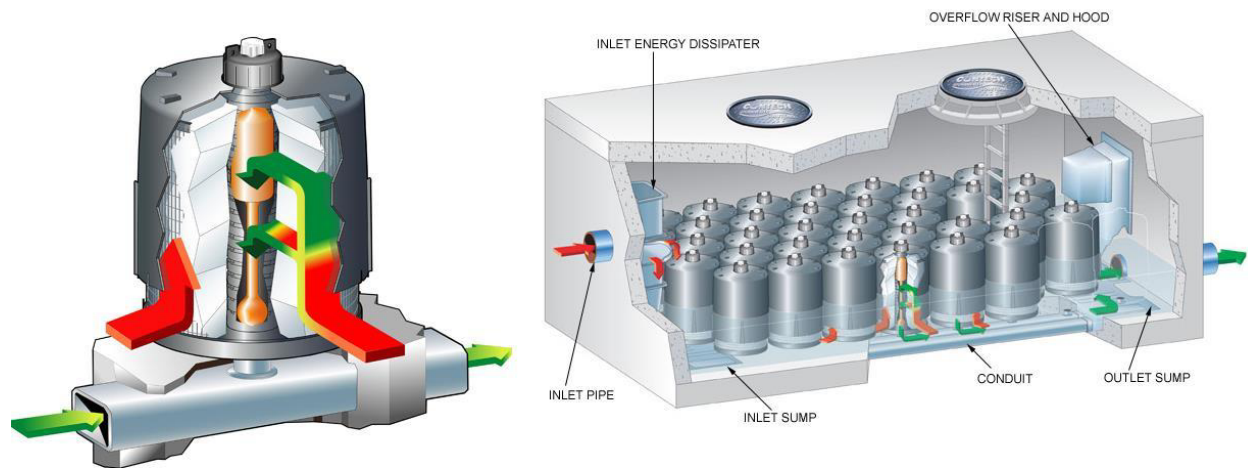
Verification Body  
GLOBE Performance Solutions  
404 – 999 Canada Place | Vancouver, B.C | Canada | V6C 3E2

## Verification Overview

This Environmental Technology Verification (ETV) of The Stormwater Management StormFilter® (StormFilter) is the second part of a two-part verification process and entails the verification of performance claims (#3 – 9) based on field testing data collected in accordance with The Washington State Department of Ecology emerging stormwater treatment technologies, in accordance with guidelines identified by Ecology (2011) in the Technology Assessment Protocol – Ecology (TAPE). This complements the first part of the verification which verifies performance test data collected in accordance with the New Jersey Department of Environmental Protection (NJDEP) *Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device* (January, 2013).

## Technology description and application

The Stormwater Management StormFilter® (StormFilter) is a manufactured treatment device that is provided by Contech Engineered Solutions LLC (Contech). The StormFilter improves the quality of stormwater runoff before it enters receiving waterways through the use of its customizable filter media, which removes non-point source pollutants. As illustrated in **Figure I**, the StormFilter is typically comprised of a vault or manhole structure that houses rechargeable, media-filled filter cartridges. Stormwater entering the system percolates through these media-filled cartridges, which trap particulates and remove pollutants. Once filtered through the media, the treated stormwater is discharged through an outlet pipe to a storm sewer system or receiving water.



**Figure I Individual StormFilter Cartridge (Left) and Typical Vault StormFilter Installation (Right)**

Depending on the treatment requirements and expected pollutant characteristics at an individual site, the per cartridge filtration flow rate and driving head can be adjusted. The flow rate is individually controlled for each cartridge by a restrictor disc located at the connection point between the cartridge and the underdrain manifold.

Driving head is managed by positioning of the inlet, outlet, and overflow elevations. The StormFilter is typically designed so that the restrictor disc passes the design treatment rate once the water surface reaches the shoulder of the cartridge which is equivalent to the cartridge height. Since the StormFilter uses a restrictor disc to restrict treatment flows below the hydraulic capacity of the media the system

typically operates under consistent driving head for the useful life of the media. Site specific head constraints are also addressed by three different cartridge heights (low drop (effective height of 12 inches), 18, and 27 inches) which operate on the same principal and surface area specific loading rates.

The StormFilter requires a minimum of 1.8 ft, 2.3 ft and 3.05 ft of drop between inlet invert and outlet invert to accommodate the low drop, 18 and 27 inch cartridges, respectively, without backing up flow into the upstream piping during operation. When site conditions limit the amount of drop available across the StormFilter then flow is typically backed up into the upstream piping during operation to ensure sufficient driving head is provided. If desirable the StormFilter can be designed to operate under additional driving head.

The StormFilter is offered in multiple configurations including plastic, steel, and concrete catch basins; and precast concrete manholes, and vaults. Other configurations include panel vaults, CON/SPAN®, box culverts, and curb inlets. The filter cartridges operate consistently and act independently regardless of housing which enables linear scaling.

The StormFilter cartridge can house different types of media including perlite, zeolite, granular activated carbon (GAC), CSF® leaf media, MetalRx™, PhosphoSorb® or various media blends such as ZPG™ (perlite, zeolite and GAC). All of the media use processes associated with depth filtration to remove solids. Some media configurations also provide additional treatment mechanisms such as cation exchange, and/or adsorption, chelation, and precipitation. This verification is specific to a field evaluation of the StormFilter with PhosphoSorb® media.

## Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on The Stormwater Management StormFilter® device, in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

## Performance claim(s)

### Performance Claim 3 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 89% removal of total suspended solids at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 4 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 79% removal of total phosphorus at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 5 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 56% removal of total nitrogen at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 6 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 77% removal of total copper at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 7 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 75% removal of total zinc at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 8 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 70% removal of total lead at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 9 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 80% removal of total aluminium at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

## Performance results

### Performance Claim 3 (TAPE):

Raw data summarizing the percent removal of total suspended solids (TSS) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| Sample ID                  | Average Influent TSS (mg/L) | Average Effluent TSS (mg/L) | Percent Removal (%) |
|----------------------------|-----------------------------|-----------------------------|---------------------|
| LPR021012                  | 182                         | 63.0                        | 65.4                |
| LPR021412                  | 539                         | 32.0                        | 94.1                |
| LPR021712                  | 387                         | 48.0                        | 87.6                |
| LPR022012                  | 246                         | 5.0                         | 98.0                |
| LPR022412                  | 512                         | 43.0                        | 91.6                |
| LPR031012                  | 360                         | 27.0                        | 92.5                |
| LPR031212a                 | 150                         | 18.0                        | 88.0                |
| LPR032912b                 | 370                         | 47.0                        | 87.3                |
| LPR052412                  | 510                         | 43.0                        | 91.6                |
| LPR060112                  | 780                         | 16.0                        | 98.0                |
| LPR060412                  | 580                         | 32.0                        | 94.5                |
| LPR060712                  | 570                         | 120.0                       | 79.0                |
| LPR110612                  | 40.0                        | 10.0                        | 75.0                |
| LPR112312                  | 110                         | 5.0                         | 95.5                |
| LPR113012                  | 230                         | 17.0                        | 92.6                |
| LPR051713                  | 94.0                        | 6.0                         | 93.6                |
| LPR052113                  | 389                         | 24.0                        | 93.8                |
| LPR062513                  | 308                         | 21.0                        | 93.2                |
| LPR013014                  | 170                         | 17.0                        | 90.0                |
| LPR030314                  | 280                         | 95.0                        | 66.1                |
| LPR030814a                 | 173                         | 26.0                        | 85.0                |
| LPR011815                  | 529                         | 72.8                        | 86.2                |
| LPR020215                  | 397                         | 67.0                        | 83.1                |
| <b>Sum</b>                 | 2022                        |                             |                     |
| <b>N (COUNT)</b>           | 23                          |                             |                     |
| <b>Median</b>              | 91.6                        |                             |                     |
| <b>STDEV.s</b>             | 8.99                        |                             |                     |
| <b>VAR.s</b>               | 80.7                        |                             |                     |
| <b>Z (alpha)</b>           | 1.65                        |                             |                     |
| <b>Z (beta)</b>            | 1.29                        |                             |                     |
| <b>Hypothesized median</b> | 89.0                        |                             |                     |



**Performance Claim 4 (TAPE):**

Raw data summarizing the percent removal of total phosphorus (TP) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| <b>Sample ID</b>           | <b>Average Influent TP (mg/L)</b> | <b>Average Effluent TP (mg/L)</b> | <b>Percent Removal (%)</b> |
|----------------------------|-----------------------------------|-----------------------------------|----------------------------|
| LPR021012                  | 0.141                             | 0.104                             | 26.2                       |
| LPR021412                  | 0.220                             | 0.062                             | 71.8                       |
| LPR021712                  | 0.310                             | 0.067                             | 78.3                       |
| LPR022012                  | 0.163                             | 0.026                             | 84.1                       |
| LPR022412                  | 0.424                             | 0.070                             | 83.5                       |
| LPR031012                  | 0.140                             | 0.049                             | 65.0                       |
| LPR031212a                 | 0.150                             | 0.037                             | 75.3                       |
| LPR032912b                 | 0.280                             | 0.081                             | 71.1                       |
| LPR052412                  | 0.170                             | 0.070                             | 58.8                       |
| LPR060112                  | 0.200                             | 0.035                             | 82.5                       |
| LPR060412                  | 0.210                             | 0.043                             | 79.5                       |
| LPR060712                  | 0.170                             | 0.140                             | 17.6                       |
| LPR110612                  | 0.068                             | 0.025                             | 63.2                       |
| LPR112312                  | 0.082                             | 0.025                             | 69.5                       |
| LPR113012                  | 0.170                             | 0.025                             | 85.3                       |
| LPR051713                  | 0.282                             | 0.029                             | 89.9                       |
| LPR052113                  | 0.558                             | 0.050                             | 91.1                       |
| LPR062513                  | 0.583                             | 0.045                             | 92.2                       |
| LPR013014                  | 0.317                             | 0.053                             | 83.3                       |
| LPR030314                  | 0.417                             | 0.133                             | 68.1                       |
| LPR030814a                 | 0.261                             | 0.051                             | 80.3                       |
| LPR011815                  | 0.649                             | 0.124                             | 80.9                       |
| LPR020215                  | 0.693                             | 0.100                             | 85.6                       |
| <b>Sum</b>                 | 1683                              |                                   |                            |
| <b>N (COUNT)</b>           | 23                                |                                   |                            |
| <b>Median</b>              | 79.5                              |                                   |                            |
| <b>STDEV.s</b>             | 18.5                              |                                   |                            |
| <b>VAR.s</b>               | 343.7                             |                                   |                            |
| <b>Z (alpha)</b>           | 1.65                              |                                   |                            |
| <b>Z (beta)</b>            | 1.29                              |                                   |                            |
| <b>Hypothesized median</b> | 79.0                              |                                   |                            |

**Performance Claim 5 (TAPE):**

Raw data summarizing the percent removal of total nitrogen (TN) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| <b>Sample ID</b>           | <b>Average Influent TN (mg/L)</b> | <b>Average Effluent TN (mg/L)</b> | <b>Percent Removal (%)</b> |
|----------------------------|-----------------------------------|-----------------------------------|----------------------------|
| LPR021012                  | 1.06                              | 0.265                             | 75.1                       |
| LPR021412                  | 1.20                              | 0.531                             | 55.9                       |
| LPR021712                  | 1.58                              | 0.638                             | 59.5                       |
| LPR022012                  | 0.696                             | 0.265                             | 61.9                       |
| LPR022412                  | 1.11                              | 0.265                             | 76.0                       |
| LPR031012                  | 1.72                              | 0.265                             | 84.5                       |
| LPR031212a                 | 0.760                             | 0.400                             | 47.4                       |
| LPR032912b                 | 1.23                              | 0.265                             | 78.5                       |
| LPR052412                  | 1.85                              | 0.400                             | 78.4                       |
| LPR060112                  | 2.40                              | 0.872                             | 63.7                       |
| LPR060412                  | 1.06                              | 0.327                             | 69.1                       |
| LPR060712                  | 0.579                             | 0.555                             | 4.1                        |
| LPR110612                  | 0.569                             | 0.555                             | 2.5                        |
| LPR112312                  | 0.515                             | 0.515                             | 0.0                        |
| LPR113012                  | 1.22                              | 0.515                             | 57.6                       |
| LPR051713                  | 1.37                              | 0.250                             | 81.8                       |
| LPR052113                  | 0.531                             | 0.248                             | 53.4                       |
| LPR062513                  | 0.619                             | 0.253                             | 59.2                       |
| LPR013014                  | 0.240                             | 0.212                             | 11.8                       |
| LPR030314                  | 0.530                             | 0.230                             | 56.6                       |
| LPR030814a                 | 0.432                             | 0.080                             | 81.5                       |
| LPR011815                  | 0.180                             | 0.110                             | 38.9                       |
| LPR020215                  | 2.32                              | 0.370                             | 84.1                       |
| <b>Sum</b>                 | 1281                              |                                   |                            |
| <b>N (COUNT)</b>           | 23                                |                                   |                            |
| <b>Median</b>              | 59.5                              |                                   |                            |
| <b>STDEV.s</b>             | 27.0                              |                                   |                            |
| <b>VAR.s</b>               | 727                               |                                   |                            |
| <b>Z (alpha)</b>           | 1.65                              |                                   |                            |
| <b>Z (beta)</b>            | 1.29                              |                                   |                            |
| <b>Hypothesized median</b> | 56.0                              |                                   |                            |

**Performance Claim 6 (TAPE):**

Raw data summarizing the percent removal of total copper (Cu) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| <b>Sample ID</b>           | <b>Average Influent Cu (mg/L)</b> | <b>Average Effluent Cu (mg/L)</b> | <b>Percent Removal (%)</b> |
|----------------------------|-----------------------------------|-----------------------------------|----------------------------|
| LPR021012                  | No data                           | No data                           | -                          |
| LPR021412                  | No data                           | No data                           | -                          |
| LPR021712                  | 0.032                             | 0.006                             | 81.3                       |
| LPR022012                  | 0.014                             | 0.001                             | 92.9                       |
| LPR022412                  | 0.032                             | 0.005                             | 84.4                       |
| LPR031012                  | 0.019                             | 0.003                             | 84.2                       |
| LPR031212a                 | 0.012                             | 0.003                             | 75.0                       |
| LPR032912b                 | 0.023                             | 0.004                             | 82.6                       |
| LPR052412                  | 0.050                             | 0.050                             | 0.0                        |
| LPR060112                  | 0.040                             | 0.003                             | 92.5                       |
| LPR060412                  | 0.021                             | 0.003                             | 85.7                       |
| LPR060712                  | 0.028                             | 0.010                             | 64.3                       |
| LPR110612                  | 0.006                             | 0.003                             | 50.0                       |
| LPR112312                  | 0.006                             | 0.001                             | 83.3                       |
| LPR113012                  | 0.016                             | 0.002                             | 87.5                       |
| LPR051713                  | 0.016                             | 0.003                             | 81.3                       |
| LPR052113                  | 0.027                             | 0.006                             | 77.8                       |
| LPR062513                  | 0.029                             | 0.005                             | 82.8                       |
| LPR013014                  | 0.021                             | 0.004                             | 81.0                       |
| LPR030314                  | 0.019                             | 0.006                             | 68.4                       |
| LPR030814a                 | 0.018                             | 0.002                             | 88.9                       |
| LPR011815                  | 0.055                             | 0.010                             | 81.8                       |
| LPR020215                  | 0.044                             | 0.007                             | 84.1                       |
| <b>Sum</b>                 | 1610                              |                                   |                            |
| <b>N (COUNT)</b>           | 21                                |                                   |                            |
| <b>Median</b>              | 82.6                              |                                   |                            |
| <b>STDEV.s</b>             | 20.06                             |                                   |                            |
| <b>VAR.s</b>               | 403                               |                                   |                            |
| <b>Z (alpha)</b>           | 1.65                              |                                   |                            |
| <b>Z (beta)</b>            | 1.29                              |                                   |                            |
| <b>Hypothesized median</b> | 77.0                              |                                   |                            |

**Performance Claim 7 (TAPE):**

Raw data summarizing the percent removal of total zinc (Zn) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| <b>Sample ID</b>           | <b>Average Influent Zn (mg/L)</b> | <b>Average Effluent Zn (mg/L)</b> | <b>Percent Removal (%)</b> |
|----------------------------|-----------------------------------|-----------------------------------|----------------------------|
| LPR021012                  | No data                           | No data                           | -                          |
| LPR021412                  | No data                           | No data                           | -                          |
| LPR021712                  | 0.151                             | 0.034                             | 77.8                       |
| LPR022012                  | 0.076                             | 0.011                             | 85.8                       |
| LPR022412                  | 0.191                             | 0.031                             | 84.0                       |
| LPR031012                  | 0.120                             | 0.022                             | 81.7                       |
| LPR031212a                 | 0.068                             | 0.017                             | 75.0                       |
| LPR032912b                 | 0.160                             | 0.029                             | 81.9                       |
| LPR052412                  | 0.250                             | 0.250                             | 0.0                        |
| LPR060112                  | 0.230                             | 0.012                             | 94.8                       |
| LPR060412                  | 0.130                             | 0.015                             | 88.5                       |
| LPR060712                  | 0.170                             | 0.048                             | 71.8                       |
| LPR110612                  | 0.022                             | 0.014                             | 36.4                       |
| LPR112312                  | 0.049                             | 0.010                             | 79.6                       |
| LPR113012                  | 0.110                             | 0.016                             | 85.5                       |
| LPR051713                  | 0.068                             | 0.010                             | 85.2                       |
| LPR052113                  | 0.126                             | 0.021                             | 83.5                       |
| LPR062513                  | 0.120                             | 0.017                             | 85.5                       |
| LPR013014                  | 0.108                             | 0.026                             | 76.1                       |
| LPR030314                  | 0.095                             | 0.029                             | 69.8                       |
| LPR030814a                 | 0.088                             | 0.013                             | 84.8                       |
| LPR011815                  | 0.151                             | 0.039                             | 74.4                       |
| LPR020215                  | 0.192                             | 0.038                             | 80.2                       |
| <b>Sum</b>                 | 1582                              |                                   |                            |
| <b>N (COUNT)</b>           | 21                                |                                   |                            |
| <b>Median</b>              | 81.7                              |                                   |                            |
| <b>STDEV.s</b>             | 20.69                             |                                   |                            |
| <b>VAR.s</b>               | 428                               |                                   |                            |
| <b>Z (alpha)</b>           | 1.65                              |                                   |                            |
| <b>Z (beta)</b>            | 1.29                              |                                   |                            |
| <b>Hypothesized median</b> | 75.0                              |                                   |                            |

**Performance Claim 8 (TAPE):**

Raw data summarizing the percent removal of total lead (Pb) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| <b>Sample ID</b>           | <b>Average Influent Pb (mg/L)</b> | <b>Average Effluent Pb (mg/L)</b> | <b>Percent Removal (%)</b> |
|----------------------------|-----------------------------------|-----------------------------------|----------------------------|
| LPR021012                  | No data                           | No data                           | -                          |
| LPR021412                  | No data                           | No data                           | -                          |
| LPR021712                  | 0.013                             | 0.003                             | 73.7                       |
| LPR022012                  | 0.005                             | 0.001                             | 79.6                       |
| LPR022412                  | 0.015                             | 0.003                             | 77.3                       |
| LPR031012                  | 0.009                             | 0.002                             | 78.5                       |
| LPR031212a                 | 0.006                             | 0.002                             | 71.9                       |
| LPR032912b                 | 0.012                             | 0.003                             | 75.0                       |
| LPR052412                  | 0.025                             | 0.025                             | 0.00                       |
| LPR060112                  | 0.016                             | 0.005                             | 68.8                       |
| LPR060412                  | 0.013                             | 0.001                             | 90.8                       |
| LPR060712                  | 0.013                             | 0.005                             | 62.3                       |
| LPR110612                  | 0.001                             | 0.001                             | 0.0                        |
| LPR112312                  | 0.002                             | 0.001                             | 50.0                       |
| LPR113012                  | 0.005                             | 0.001                             | 80.0                       |
| LPR051713                  | 0.004                             | 0.001                             | 74.8                       |
| LPR052113                  | 0.009                             | 0.009                             | 0.336                      |
| LPR062513                  | 0.009                             | 0.002                             | 82.5                       |
| LPR013014                  | 0.006                             | 0.001                             | 80.5                       |
| LPR030314                  | 0.007                             | 0.003                             | 62.1                       |
| LPR030814a                 | 0.005                             | 0.001                             | 71.5                       |
| LPR011815                  | 0.015                             | 0.003                             | 81.4                       |
| LPR020215                  | 0.011                             | 0.002                             | 81.0                       |
| <b>Sum</b>                 | 1342                              |                                   |                            |
| <b>N (COUNT)</b>           | 21                                |                                   |                            |
| <b>Median</b>              | 74.8                              |                                   |                            |
| <b>STDEV.s</b>             | 28.05                             |                                   |                            |
| <b>VAR.s</b>               | 787                               |                                   |                            |
| <b>Z (alpha)</b>           | 1.65                              |                                   |                            |
| <b>Z (beta)</b>            | 1.29                              |                                   |                            |
| <b>Hypothesized median</b> | 70.0                              |                                   |                            |

**Performance Claim 9 (TAPE):**

Raw data summarizing the percent removal of total aluminium (Al) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

| <b>Sample ID</b>         | <b>Average Influent Pb (mg/L)</b> | <b>Average Effluent Pb (mg/L)</b> | <b>Percent Removal (%)</b> |
|--------------------------|-----------------------------------|-----------------------------------|----------------------------|
| LPR021012                | No data                           | No data                           | -                          |
| LPR021412                | No data                           | No data                           | -                          |
| LPR021712                | 9.15                              | 1.86                              | 79.7                       |
| LPR022012                | 2.62                              | 0.319                             | 87.8                       |
| LPR022412                | 9.65                              | 1.99                              | 79.4                       |
| LPR031012                | 6.20                              | 1.10                              | 82.3                       |
| LPR031212a               | 4.30                              | 0.810                             | 81.2                       |
| LPR032912b               | 6.40                              | 1.70                              | 73.4                       |
| LPR052412                | 9.70                              | 1.30                              | 86.6                       |
| LPR060112                | 11.0                              | 0.370                             | 96.6                       |
| LPR060412                | 12.0                              | 1.00                              | 91.7                       |
| LPR060712                | 9.60                              | 4.10                              | 57.3                       |
| LPR110612                | 1.30                              | 0.300                             | 76.9                       |
| LPR112312                | 1.20                              | 0.190                             | 84.2                       |
| LPR113012                | 3.00                              | 0.440                             | 85.3                       |
| LPR051713                | 1.44                              | 0.134                             | 90.7                       |
| LPR052113                | 3.24                              | 0.358                             | 89.0                       |
| LPR062513                | 3.94                              | 0.466                             | 88.2                       |
| LPR013014                | 3.45                              | 0.796                             | 76.9                       |
| LPR030314                | 2.64                              | 1.13                              | 57.2                       |
| LPR030814a               | 1.67                              | 0.342                             | 79.5                       |
| LPR011815                | 5.32                              | 1.17                              | 78.0                       |
| LPR020215                | 3.85                              | 1.20                              | 68.8                       |
| <b>Sum</b>               | 1691                              |                                   |                            |
| <b>N (COUNT)</b>         | 21                                |                                   |                            |
| <b>Mean (AVE)</b>        | 80.5                              |                                   |                            |
| <b>STDEV.s</b>           | 10.13                             |                                   |                            |
| <b>VAR.s</b>             | 103                               |                                   |                            |
| <b>Z (alpha)</b>         | 1.65                              |                                   |                            |
| <b>Z (beta)</b>          | 1.29                              |                                   |                            |
| <b>Hypothesized mean</b> | 80.0                              |                                   |                            |

## Verification

This verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies (“CAWT”), contracted by GLOBE Performance Solutions, applying the International Standard **ISO 14034:2016 Environmental management – Environmental technology verification (ETV)**. Data and information provided by Contech Engineered Solutions LLC to support the performance claim included the following:

- Performance test report “The Stormwater Management StormFilter®- PhosphoSorb® at a Specific Flow Rate of 1.67 gpm/ft<sup>2</sup> – Performance Evaluation Report” prepared by Contech Engineered Solutions, November 8, 2017. This report is based on a field testing program conducted by Contech personnel at a roadway site in Zigzag, Oregon between January 2012 and February 2015. Testing was conducted in accordance with the 2011 version of the Washington Department of Ecology TAPE (TAPE, 2011).

## What is ISO 14034:2016 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  
The Stormwater Management StormFilter®  
please contact:**

CONTECH Engineered Solutions LLC  
71 US Route 1, Suite F  
Scarborough, ME  
04074 USA  
Tel: 207-885-9830  
info@conteches.com  
www.conteches.com

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

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

### Limitation of verification - Registration: GPS-ETV\_2020-06-15\_TAPE

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.

## Determining Number of Cartridges for Flow Based Systems

Date

2/7/2022

Black Cells = Calculation

### Site Information

|                                               |                      |
|-----------------------------------------------|----------------------|
| Project Name                                  | 129 Collier Street   |
| Project Location                              | Barrie, ON           |
| OGS ID                                        | Stormfilter          |
| Drainage Area, Ad                             | 1.21 ac (0.49 ha)    |
| Impervious Area, Ai                           | 1.03 ac              |
| Pervious Area, Ap                             | 0.18                 |
| % Impervious                                  | 85%                  |
| Runoff Coefficient, Rc                        | 0.80                 |
| Treatment storm flow rate, $Q_{\text{treat}}$ | 0.46 cfs (13.11 L/s) |
| Peak storm flow rate, $Q_{\text{peak}}$       | TBD cfs              |

### Filter System

|                         |                          |
|-------------------------|--------------------------|
| Filtration brand        | StormFilter              |
| Cartridge height        | 18 in                    |
| Specific Flow Rate      | 1.67 gpm/ft <sup>2</sup> |
| Flow rate per cartridge | 12.53 gpm                |

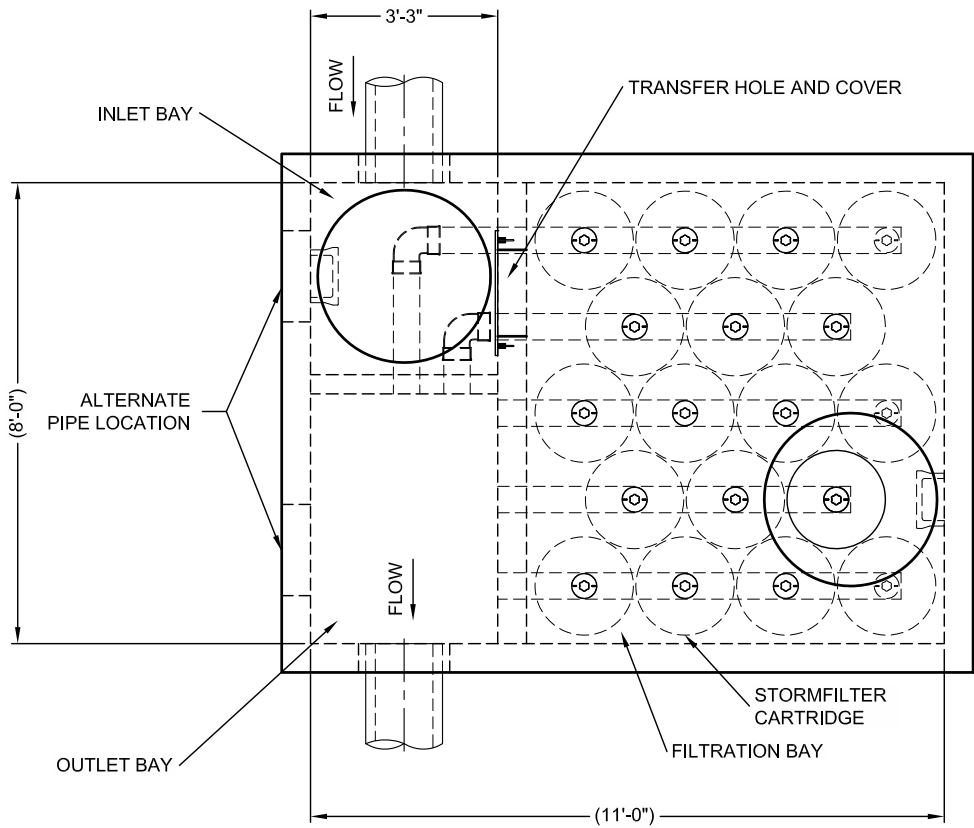
### SUMMARY

|                      |             |
|----------------------|-------------|
| Number of Cartridges | 17          |
| Media Type           | Phosphosorb |

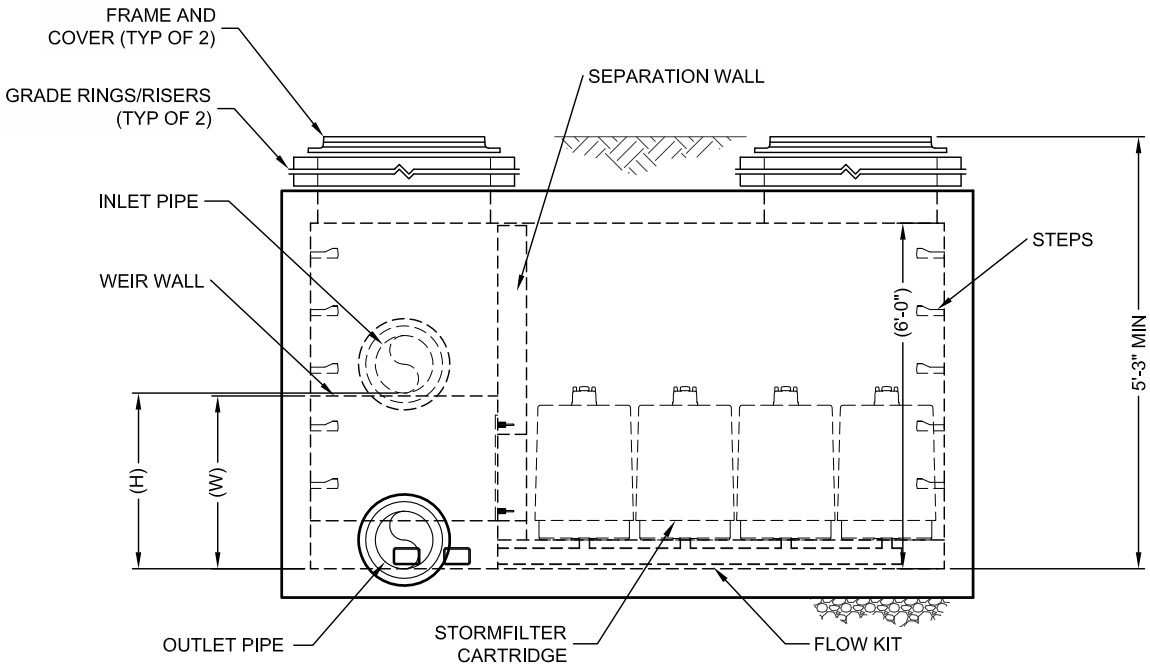
|                                |          |
|--------------------------------|----------|
| Event Mean Concentration (EMC) | 120 mg/L |
| Annual TSS Removal             | 80%      |
| Percent Runoff Capture         | 90%      |

Recommend SFPD 0816 vault or CIP





PLAN



ELEVATION



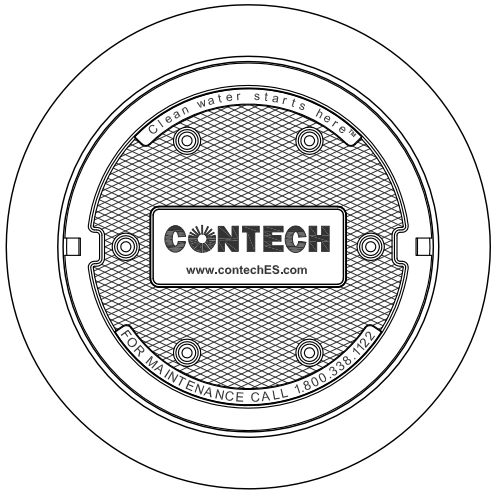
STORMFILTER DESIGN NOTES

- THE 8' x 11' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
- THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
- ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.

CARTRIDGE SELECTION

| CARTRIDGE HEIGHT               | 27"      |              |          | 18"      |              |          | LOW DROP |              |          |
|--------------------------------|----------|--------------|----------|----------|--------------|----------|----------|--------------|----------|
| RECOMMENDED HYDRAULIC DROP (H) | 3.05'    |              |          | 2.3'     |              |          | 1.8'     |              |          |
| HEIGHT OF WEIR (W)             | 3.00'    |              |          | 2.25'    |              |          | 1.75'    |              |          |
| SPECIFIC FLOW RATE (gpm/sf)    | 2 gpm/sf | 1.67* gpm/sf | 1 gpm/sf | 2 gpm/sf | 1.67* gpm/sf | 1 gpm/sf | 2 gpm/sf | 1.67* gpm/sf | 1 gpm/sf |
| CARTRIDGE FLOW RATE (gpm)      | 22.5     | 18.79        | 11.25    | 15       | 12.53        | 7.5      | 10       | 8.35         | 5        |

\* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER  
(DIAMETER VARIES)  
N.T.S.

SITE SPECIFIC  
DATA REQUIREMENTS

|                                           |       |          |          |
|-------------------------------------------|-------|----------|----------|
| STRUCTURE ID                              |       |          | *        |
| WATER QUALITY FLOW RATE (cfs)             |       |          | *        |
| PEAK FLOW RATE (cfs)                      |       |          | *        |
| RETURN PERIOD OF PEAK FLOW (yrs)          |       |          | *        |
| CARTRIDGE HEIGHT (27", 18", LOW DROP(LD)) |       |          | *        |
| NUMBER OF CARTRIDGES REQUIRED             |       |          | *        |
| CARTRIDGE FLOW RATE                       |       |          | *        |
| MEDIA TYPE (PERLITE, ZPG, PSORB)          |       |          | *        |
|                                           |       |          |          |
| PIPE DATA:                                | I.E.  | MATERIAL | DIAMETER |
| INLET PIPE                                | *     | *        | *        |
| OUTLET PIPE                               | *     | *        | *        |
|                                           |       |          |          |
| UPSTREAM RIM ELEVATION                    |       |          | *        |
| DOWNSTREAM RIM ELEVATION                  |       |          | *        |
|                                           |       |          |          |
| ANTI-FLOTATION BALLAST                    | WIDTH | HEIGHT   |          |
|                                           | *     | *        |          |
| NOTES/SPECIAL REQUIREMENTS:               |       |          |          |
|                                           |       |          |          |
| * PER ENGINEER OF RECORD                  |       |          |          |

PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **38 SECONDS**. SPECIFIC FLOW RATE SHALL BE **2 GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM)**.

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. [www.contechES.com](http://www.contechES.com)
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.

INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
- C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.



[www.contechES.com](http://www.contechES.com)

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069

800-338-1122 513-645-7000 513-645-7993 FAX

THE STORMWATER MANAGEMENT STORMFILTER  
8' x 11' PEAK DIVERSION STORMFILTER  
STANDARD DETAIL

## Stormceptor®EF Sizing Report

## STORMCEPTOR®

## ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

09/17/2020

|                           |                    |                   |                               |
|---------------------------|--------------------|-------------------|-------------------------------|
| Province:                 | Ontario            | Project Name:     | 129 Collier Street            |
| City:                     | Barrie             | Project Number:   | 20019                         |
| Nearest Rainfall Station: | BARRIE WPCC        | Designer Name:    | Emma Shepherd                 |
| NCDC Rainfall Station Id: | 0557               | Designer Company: | Counterpoint Engineering      |
| Years of Rainfall Data:   | 36                 | Designer Email:   | eshepherd@counterpointeng.com |
|                           |                    | Designer Phone:   | 905-326-3042                  |
| Site Name:                | 129 Collier Street | EOR Name:         |                               |
|                           |                    | EOR Company:      |                               |
| Drainage Area (ha):       | 0.61               | EOR Email:        |                               |
| % Imperviousness:         | 80.00              | EOR Phone:        |                               |

Runoff Coefficient 'c': 0.78

|                             |      |
|-----------------------------|------|
| Particle Size Distribution: | Fine |
| Target TSS Removal (%):     | 80.0 |

|                                                   |       |
|---------------------------------------------------|-------|
| Required Water Quality Runoff Volume Capture (%): | 90.00 |
| Estimated Water Quality Flow Rate (L/s):          | 16.47 |
| Oil / Fuel Spill Risk Site?                       | Yes   |
| Upstream Flow Control?                            | No    |
| Peak Conveyance (maximum) Flow Rate (L/s):        |       |
| Site Sediment Transport Rate (kg/ha/yr):          |       |

**Net Annual Sediment  
(TSS) Load Reduction  
Sizing Summary**

| Stormceptor Model | TSS Removal Provided (%) |
|-------------------|--------------------------|
| EFO4              | 77                       |
| <b>EFO6</b>       | <b>84</b>                |
| EFO8              | 88                       |
| EFO10             | 90                       |
| EFO12             | 91                       |

**Recommended Stormceptor EFO Model:** **EFO6**  
**Estimated Net Annual Sediment (TSS) Load Reduction (%):** **84**  
**Water Quality Runoff Volume Capture (%):** **> 90**

## Stormceptor® EF Sizing Report

### THIRD-PARTY TESTING AND VERIFICATION

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

### PERFORMANCE

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

### PARTICLE SIZE DISTRIBUTION (PSD)

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

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

# Stormceptor®EF Sizing Report

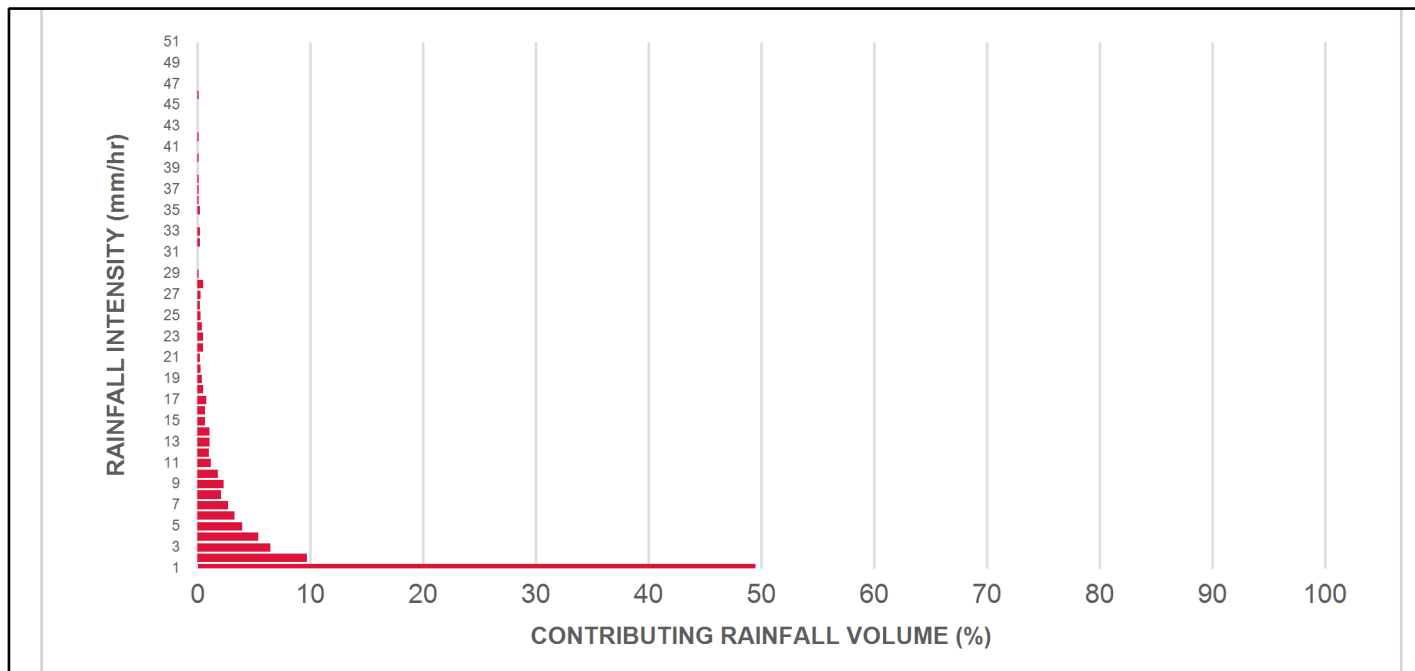
| Rainfall Intensity (mm / hr) | Percent Rainfall Volume (%) | Cumulative Rainfall Volume (%) | Flow Rate (L/s) | Flow Rate (L/min) | Surface Loading Rate (L/min/m²) | Removal Efficiency (%) | Incremental Removal (%) | Cumulative Removal (%) |
|------------------------------|-----------------------------|--------------------------------|-----------------|-------------------|---------------------------------|------------------------|-------------------------|------------------------|
| 1                            | 49.5                        | 49.5                           | 1.32            | 79.0              | 30.0                            | 93                     | 46.0                    | 46.0                   |
| 2                            | 9.7                         | 59.2                           | 2.65            | 159.0             | 60.0                            | 91                     | 8.8                     | 54.9                   |
| 3                            | 6.5                         | 65.7                           | 3.97            | 238.0             | 91.0                            | 88                     | 5.7                     | 60.6                   |
| 4                            | 5.4                         | 71.1                           | 5.29            | 317.0             | 121.0                           | 85                     | 4.6                     | 65.1                   |
| 5                            | 4.0                         | 75.1                           | 6.61            | 397.0             | 151.0                           | 81                     | 3.3                     | 68.4                   |
| 6                            | 3.3                         | 78.4                           | 7.94            | 476.0             | 181.0                           | 78                     | 2.6                     | 71.0                   |
| 7                            | 2.7                         | 81.1                           | 9.26            | 556.0             | 211.0                           | 75                     | 2.0                     | 73.0                   |
| 8                            | 2.1                         | 83.2                           | 10.58           | 635.0             | 241.0                           | 72                     | 1.5                     | 74.5                   |
| 9                            | 2.3                         | 85.5                           | 11.90           | 714.0             | 272.0                           | 70                     | 1.6                     | 76.1                   |
| 10                           | 1.8                         | 87.3                           | 13.23           | 794.0             | 302.0                           | 67                     | 1.2                     | 77.3                   |
| 11                           | 1.2                         | 88.5                           | 14.55           | 873.0             | 332.0                           | 64                     | 0.8                     | 78.1                   |
| 12                           | 1.0                         | 89.5                           | 15.87           | 952.0             | 362.0                           | 62                     | 0.6                     | 78.7                   |
| 13                           | 1.1                         | 90.6                           | 17.20           | 1032.0            | 392.0                           | 59                     | 0.6                     | 79.4                   |
| 14                           | 1.1                         | 91.7                           | 18.52           | 1111.0            | 422.0                           | 57                     | 0.6                     | 80.0                   |
| 15                           | 0.7                         | 92.4                           | 19.84           | 1190.0            | 453.0                           | 57                     | 0.4                     | 80.4                   |
| 16                           | 0.7                         | 93.1                           | 21.16           | 1270.0            | 483.0                           | 56                     | 0.4                     | 80.8                   |
| 17                           | 0.8                         | 93.9                           | 22.49           | 1349.0            | 513.0                           | 55                     | 0.4                     | 81.2                   |
| 18                           | 0.5                         | 94.4                           | 23.81           | 1429.0            | 543.0                           | 54                     | 0.3                     | 81.5                   |
| 19                           | 0.4                         | 94.8                           | 25.13           | 1508.0            | 573.0                           | 53                     | 0.2                     | 81.7                   |
| 20                           | 0.3                         | 95.1                           | 26.45           | 1587.0            | 604.0                           | 52                     | 0.2                     | 81.9                   |
| 21                           | 0.2                         | 95.3                           | 27.78           | 1667.0            | 634.0                           | 52                     | 0.1                     | 82.0                   |
| 22                           | 0.5                         | 95.8                           | 29.10           | 1746.0            | 664.0                           | 52                     | 0.3                     | 82.2                   |
| 23                           | 0.5                         | 96.3                           | 30.42           | 1825.0            | 694.0                           | 52                     | 0.3                     | 82.5                   |
| 24                           | 0.4                         | 96.7                           | 31.75           | 1905.0            | 724.0                           | 51                     | 0.2                     | 82.7                   |
| 25                           | 0.3                         | 97.0                           | 33.07           | 1984.0            | 754.0                           | 51                     | 0.2                     | 82.8                   |

## Stormceptor®EF Sizing Report

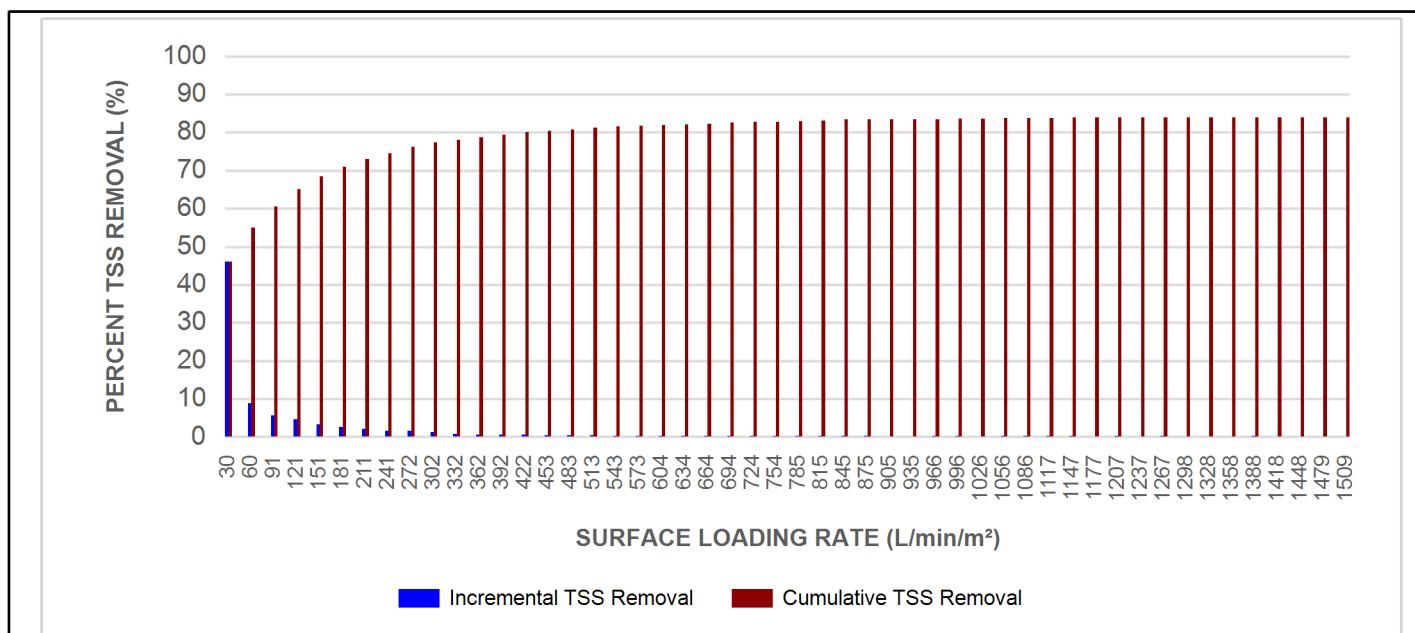
| Rainfall Intensity (mm / hr)                         | Percent Rainfall Volume (%) | Cumulative Rainfall Volume (%) | Flow Rate (L/s) | Flow Rate (L/min) | Surface Loading Rate (L/min/m²) | Removal Efficiency (%) | Incremental Removal (%) | Cumulative Removal (%) |
|------------------------------------------------------|-----------------------------|--------------------------------|-----------------|-------------------|---------------------------------|------------------------|-------------------------|------------------------|
| 26                                                   | 0.2                         | 97.2                           | 34.39           | 2063.0            | 785.0                           | 51                     | 0.1                     | 82.9                   |
| 27                                                   | 0.3                         | 97.5                           | 35.71           | 2143.0            | 815.0                           | 51                     | 0.2                     | 83.1                   |
| 28                                                   | 0.5                         | 98.0                           | 37.04           | 2222.0            | 845.0                           | 51                     | 0.3                     | 83.4                   |
| 29                                                   | 0.1                         | 98.1                           | 38.36           | 2302.0            | 875.0                           | 51                     | 0.1                     | 83.4                   |
| 30                                                   | 0.0                         | 98.1                           | 39.68           | 2381.0            | 905.0                           | 51                     | 0.0                     | 83.4                   |
| 31                                                   | 0.0                         | 98.1                           | 41.00           | 2460.0            | 935.0                           | 50                     | 0.0                     | 83.4                   |
| 32                                                   | 0.2                         | 98.3                           | 42.33           | 2540.0            | 966.0                           | 50                     | 0.1                     | 83.5                   |
| 33                                                   | 0.2                         | 98.5                           | 43.65           | 2619.0            | 996.0                           | 50                     | 0.1                     | 83.6                   |
| 34                                                   | 0.0                         | 98.5                           | 44.97           | 2698.0            | 1026.0                          | 50                     | 0.0                     | 83.6                   |
| 35                                                   | 0.2                         | 98.7                           | 46.30           | 2778.0            | 1056.0                          | 50                     | 0.1                     | 83.7                   |
| 36                                                   | 0.1                         | 98.8                           | 47.62           | 2857.0            | 1086.0                          | 49                     | 0.0                     | 83.8                   |
| 37                                                   | 0.1                         | 98.9                           | 48.94           | 2936.0            | 1117.0                          | 49                     | 0.0                     | 83.8                   |
| 38                                                   | 0.1                         | 99.0                           | 50.26           | 3016.0            | 1147.0                          | 49                     | 0.0                     | 83.9                   |
| 39                                                   | 0.0                         | 99.0                           | 51.59           | 3095.0            | 1177.0                          | 48                     | 0.0                     | 83.9                   |
| 40                                                   | 0.1                         | 99.1                           | 52.91           | 3175.0            | 1207.0                          | 48                     | 0.0                     | 83.9                   |
| 41                                                   | 0.0                         | 99.1                           | 54.23           | 3254.0            | 1237.0                          | 48                     | 0.0                     | 83.9                   |
| 42                                                   | 0.1                         | 99.2                           | 55.55           | 3333.0            | 1267.0                          | 47                     | 0.0                     | 83.9                   |
| 43                                                   | 0.0                         | 99.2                           | 56.88           | 3413.0            | 1298.0                          | 47                     | 0.0                     | 83.9                   |
| 44                                                   | 0.0                         | 99.2                           | 58.20           | 3492.0            | 1328.0                          | 47                     | 0.0                     | 83.9                   |
| 45                                                   | 0.0                         | 99.2                           | 59.52           | 3571.0            | 1358.0                          | 47                     | 0.0                     | 83.9                   |
| 46                                                   | 0.1                         | 99.3                           | 60.85           | 3651.0            | 1388.0                          | 46                     | 0.0                     | 84.0                   |
| 47                                                   | 0.0                         | 99.3                           | 62.17           | 3730.0            | 1418.0                          | 46                     | 0.0                     | 84.0                   |
| 48                                                   | 0.0                         | 99.3                           | 63.49           | 3809.0            | 1448.0                          | 45                     | 0.0                     | 84.0                   |
| 49                                                   | 0.0                         | 99.3                           | 64.81           | 3889.0            | 1479.0                          | 44                     | 0.0                     | 84.0                   |
| 50                                                   | 0.0                         | 99.3                           | 66.14           | 3968.0            | 1509.0                          | 43                     | 0.0                     | 84.0                   |
| Estimated Net Annual Sediment (TSS) Load Reduction = |                             |                                |                 |                   |                                 |                        |                         | 84 %                   |

## Stormceptor®EF Sizing Report

### RAINFALL DATA FROM BARRIE WPCC RAINFALL STATION



### INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



## Stormceptor® EF Sizing Report

### Maximum Pipe Diameter / Peak Conveyance

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

### SCOUR PREVENTION AND ONLINE CONFIGURATION

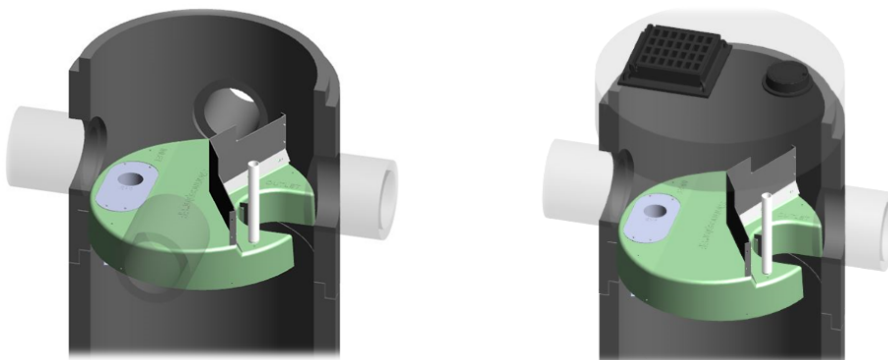
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

### DESIGN FLEXIBILITY

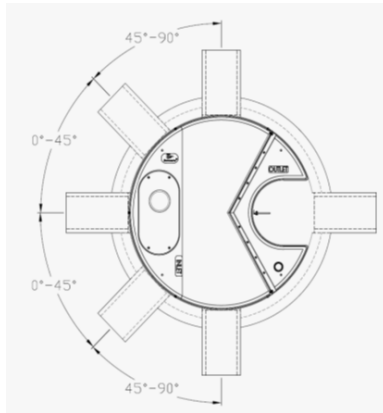
► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

### OIL CAPTURE AND RETENTION

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



## Stormceptor® EF Sizing Report



### INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

### HEAD LOSS

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

For submerged conditions the applicable K value is 3.0.

### Pollutant Capacity

| Stormceptor<br>EF / EFO | Model<br>Diameter |      | Depth (Outlet<br>Pipe Invert to<br>Sump Floor) |      | Oil Volume |       | Recommended<br>Sediment<br>Maintenance Depth * |      | Maximum Sediment<br>Volume * |       | Maximum<br>Sediment Mass ** |        |
|-------------------------|-------------------|------|------------------------------------------------|------|------------|-------|------------------------------------------------|------|------------------------------|-------|-----------------------------|--------|
|                         | (m)               | (ft) | (m)                                            | (ft) | (L)        | (Gal) | (mm)                                           | (in) | (L)                          | (ft³) | (kg)                        | (lb)   |
| EF4 / EFO4              | 1.2               | 4    | 1.52                                           | 5.0  | 265        | 70    | 203                                            | 8    | 1190                         | 42    | 1904                        | 5250   |
| EF6 / EFO6              | 1.8               | 6    | 1.93                                           | 6.3  | 610        | 160   | 305                                            | 12   | 3470                         | 123   | 5552                        | 15375  |
| EF8 / EFO8              | 2.4               | 8    | 2.59                                           | 8.5  | 1070       | 280   | 610                                            | 24   | 8780                         | 310   | 14048                       | 38750  |
| EF10 / EFO10            | 3.0               | 10   | 3.25                                           | 10.7 | 1670       | 440   | 610                                            | 24   | 17790                        | 628   | 28464                       | 78500  |
| EF12 / EFO12            | 3.6               | 12   | 3.89                                           | 12.8 | 2475       | 655   | 610                                            | 24   | 31220                        | 1103  | 49952                       | 137875 |

\*Increased sump depth may be added to increase sediment storage capacity

\*\* Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³ )

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

### STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

### STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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



## Stormceptor®EF Sizing Report

### STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

#### PART 1 – GENERAL

##### 1.1 WORK INCLUDED

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

##### 1.2 REFERENCE STANDARDS & PROCEDURES

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

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

##### 1.3 SUBMITTALS

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

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

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

#### PART 2 – PRODUCTS

##### 2.1 OGS POLLUTANT STORAGE

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

|       |                                     |                                             |
|-------|-------------------------------------|---------------------------------------------|
| 2.1.1 | 4 ft (1219 mm) Diameter OGS Units:  | 1.19 m <sup>3</sup> sediment / 265 L oil    |
|       | 6 ft (1829 mm) Diameter OGS Units:  | 3.48 m <sup>3</sup> sediment / 609 L oil    |
|       | 8 ft (2438 mm) Diameter OGS Units:  | 8.78 m <sup>3</sup> sediment / 1,071 L oil  |
|       | 10 ft (3048 mm) Diameter OGS Units: | 17.78 m <sup>3</sup> sediment / 1,673 L oil |
|       | 12 ft (3657 mm) Diameter OGS Units: | 31.23 m <sup>3</sup> sediment / 2,476 L oil |

#### PART 3 – PERFORMANCE & DESIGN

##### 3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

## Stormceptor®EF Sizing Report

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

### 3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

### 3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

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

### 3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

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

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