FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

In Support of Rezoning



490-508 Walkers Line, City of Burlington
Proposed Residential Development

Report Prepared for:

2381792 Ontario Ltd.

Report Prepared by:

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KWA Project#: 23911

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This report reflects best engineering judgment based on the material available at the time of its preparation. KWA Site Development Consulting Inc. accepts no responsibility for any damages to a third party that may arise as a result of decisions made or actions taken based on this report.

Table of Contents

1.0 Introduction 1
2.0 Background Information 1
3.0 Design Population 1
4.0 Sanitary Demand 2
4.1 Existing Sanitary Servicing 2
4.2 Proposed Sanitary Servicing 2
4.2.1 Sanitary Flow 2
4.2.2 Outlet and Downstream Capacity 3
5.0 Water Demand 3
5.1 Existing Water Servicing 3
5.2 Proposed Water Servicing 3
5.2.1 Domestic Demand 3
5.2.2 Fire Demand 4
6.0 Stormwater Management 4
6.1 Existing Conditions 4
6.1.1 Predevelopment Drainage 4
6.2 Proposed Drainage Conditions 5
6.3 Stormwater Management Criteria 5
6.3.1 Quantity Control 6
6.3.1.1 Design 6
6.3.2 Water Balance 6
6.3.3 Water Quality 7
7.0 Conclusion 9

List of Tables

- Table 1 – Water Demand
- Table 2 – Predevelopment Peak Flow Rates, 5 and 100-year event
- Table 3 – Summary of the 100-year Modified Rational Method Calculations
- Table 4 – Treatment Train for Outlet 1 - Clean

List of Appendices

- Appendix A – Sanitary Demand Calculations
- Appendix B – Water Demand Calculations
- Appendix C – Stormwater Management Calculations
- Appendix D – Drawings

List of Drawings

- SGP – Site Grading Plan
- SSP – Site Servicing Plan
- EDP – Existing Drainage Plan
- PDP – Proposed Drainage Plan

1.0 INTRODUCTION

KWA Site Development Consulting Inc. ("KWA") has been retained by 2381792 Ontario Ltd. ('proponent') to prepare this Functional Servicing and Stormwater Management Report in support of a Rezoning Application ("ZBA") for the development of private townhouses and historic residential building along Walkers Line in the City of Burlington, herein referred to as the "Subject Site".

The subject site is approximately 0.40 hectares (0.99 acres) and is presently occupied by the three (3) residential homes.

Surrounding land uses include:

- Residential land to the north, south, and west.
- Walkers Line to the east.

The site is within the Shoreacres Creek Subwatershed. Drainage at the front and side lots of the homes generally drains east to Walkers Line, and any rear yard drainage is directed southwest.

The proponent intends to re-zone the property to allow higher densities for combined properties of 490, 496, and 508 Walkers Line. A **Site Plan (A1.1)** has been developed by VG Architects Group Ltd. and provides the basis for this Report.

The site plan proposes 16 townhouses and one (1) historical property. An existing historic building will remain at 496 Walker's Line and will be flanked by two (2) blocks of townhouses to the north and south along the Walkers Line frontage. The third townhouse block will be located to the southwest, within the existing backyards of the 496 and 490 Walkers Line. A 6-metre drive aisle will enter from Walkers Line south of the historic home and bisect the development between the townhouse blocks and will provide access to parking at the rear of the residential units. This development will include an amenity space in the southwest corner and provide pedestrian access to Walkers Line via a network of concrete walkways.

2.0 BACKGROUND INFORMATION

This Functional Servicing and Stormwater Management Report has been prepared in coordination and regarding the following documents and drawings:

- Architectural Site Plan prepared by VGA Inc.
- Topographic Survey by Tham Surveying Ltd.
- Geotechnical Engineering Report by Azure Group Inc., dated March 14, 2024
- Infiltration Test Memo Prepared by Azure Group, dated March 14, 2024
- Record Drawings from the City of Burlington
- Record Drawings from the Region of Halton
- Regional Municipality of Halton–Water and Wastewater Linear Design Manual (October 2019 Version 5)
- City of Burlington - Stormwater Management Design Guidelines (May 21, 2020 Edition)
- PreConsultation Comments from the City of Burlington and Region of Halton, updated document dated October 20, 2023
- Zoning By-Law Pre-Consultation comments from the City of Burlington and Region of Halton, June 28, 2024

3.0 DESIGN POPULATION

There are 16 Townhouse Units and 1 Detached Historic Home contemplated for the proposed development. Conservatively, the equivalent population of this development type is calculated using the Region of Halton's Water and Wastewater Linear Design Manual (WWLDM). Using a population density factor of 135 people per hectare (table 2-1 of Halton WWLDM), the equivalent population is **54 people**. Please see **Site Plan** prepared by VG Architects Inc. on the following page.

4.0 SANITARY DEMAND

4.1 EXISTING SANITARY SERVICING

An existing 250mm diameter vitrified clay sanitary sewer is located east of the Walkers Line pavement centreline and drains south with a slope of 0.96% from existing manhole MH2A. The sewer depth is approximately 2.7 metres to obvert.

Three existing service connections provide an outlet for the existing dwellings within the subject site.

4.2 PROPOSED SANITARY SERVICING

It is proposed that a new 200 mm diameter PVC sanitary service connection be connected to the existing sanitary manhole MH2A, see **Site Servicing Plan** in **Appendix D**. The service connection will be extended to the subject site property line at a minimum 2% slope to MH1A. Within the property limits, 200 mm and 150 mm diameter sanitary sewers are extended at a minimum 1.0% slope with individual service connections to each Townhouse Block and Detached House.

Three existing sanitary service connections will be removed to the main and plugged with a spot repair liner to be selected in future applications and approved by the Region of Halton.

4.2.1 SANITARY FLOW

In the existing condition, the three (3) existing homes within the subject site drain to the 250 mm diameter sanitary sewer within Walkers Line. Based on a conservative population estimate of 4 people per detached home and an average residential flow rate of 275 L/person/day as per the Region of Halton WWLDM, the existing sanitary wastewater flow (without peaking factors or extraneous flows) is:

$$Q_{avg} = Population * Residential\ Flow\ Rate$$

$$= (4\ people \times 3\ homes) \times 275\ L\ per \frac{person}{day} = \frac{\mathbf{3300}\boldsymbol{L}}{\boldsymbol{day}} = \mathbf{0.04}\ \boldsymbol{L/s}$$

In the proposed condition, the sanitary design flows for the subject site are calculated using the Region of Halton WWLDM. The design population for the proposed development is **54 people** as per **Section 3.0**.

The average daily flow of 275 litres/capita/day equates to **0.17 L/s** for the proposed development. Peak flows are determined by applying the Harmon's Peaking Factor, which is calculated to be 4.3. Infiltration is based on 0.286 litres/s/ha of total site area, resulting in **0.11 L/s** for the Site.

The total sanitary sewer flow for the Site is:

$$Q_{san} = Average\ Flow * Harmon\ Peaking\ Factor + Infiltration =$$

$$= (0.17 * 4.3) + 0.11 = \mathbf{0.85}\ \boldsymbol{L/s}$$

Where:

- Q = Peak Sanitary Flow (L/s)
- Population = 54 people [As calculated in Section 3.0]
- Per Capita Flow = 275 L/capita/day
- Peaking Factor $M = 1 + (\frac{14}{4 + P^{\frac{1}{2}}})$ [4.3]
    - Where M = ratio of peak flow to average flow
      P = tributary population in thousands [0.054]
- Infiltration = 0.286 L/s/ha

This results in a peak sanitary demand of **0.85 L/s**, including extraneous flows.

Refer to **Appendix A** for sanitary flow calculations.

4.2.2 Outlet and Downstream Capacity

Sanitary flows will outlet to the existing 250 mm diameter sanitary sewer on Walkers Line. The sanitary sewer on Walkers Line drains south with a pipe slope of 0.96%. The pipe capacity of this sanitary sewer is **58.3 L/s.** Based on the sanitary design flow calculated for the Site, 0.85 L/s, the peak sanitary design flow would equate to **1.5%** of the capacity of the 250mm sanitary sewer on Walkers Line

Additionally, Halton Region has requested that a downstream sanitary analysis be completed as part of the application for the proposed development. As such, plan and profiles and sanitary sewer maps have been provided by the Region to investigate the impact of the additional sewage flow on the municipal sewer system.

As shown in the sanitary design sheet in **Appendix A**, the existing 250 mm diameter vitrified clay sanitary sewer services Walker's Line north of New Street and increases to a 300 mm diameter sewer south of that to the Regional Trunk sewer on Lakeshore Road. In total, the existing sewer to MH11175 at the corner of Walker's Line and Lakeshore Road services 20.65 ha of residential area for an equivalent population of 796 people, and 6.90 ha of commercial and community services land for an equivalent population of 506 people. For the purpose of this sanitary analysis, the area considered for infiltration to the sanitary sewer is the entire lot boundaries plus the municipal road allowance in between. The total existing land area is 35.77 ha.

The proposed development adds sewage flows for 0.40 ha of residential land, equivalent to 54 people as per section 4.2.1. As per the sanitary sewer design sheet, the proposed sewage flows + existing flows is a maximum 45.2% of available sanitary sewer capacity at region manhole 10904 on Walker's Line.

Based on the provided data and the provided calculations, the municipal sewage system to the regional trunk sewer can accommodate the proposed development without the need for upgrades. Refer to Sanitary Design Sheet and Drainage Plans in **Appendix A.**

5.0 Water Demand

5.1 Existing Water Servicing

An existing 300mm diameter PVC SDR 18 watermain located within the west boulevard of Walkers Line services the three existing residential homes at 490, 496, and 508 Walkers Line.

5.2 Proposed Water Servicing

The waterman design proposes a new 150 mm diameter PVC connection to the existing 300 mm PVC watermain via tapping sleeve and valve within the new drive aisle at the north end of the subject site. The watermain extends west and south within the drive aisle to provide individual 1" copper Type K service connections to all proposed townhouse units. A new hydrant is proposed to the southwest of the existing heritage building which will provide fire protection to the rear Townhouse Block C. A 150x100 reducer is proposed to downsize the watermain beyond the proposed hydrant.

5.2.1 Domestic Demand

In the existing condition, the average water demand is equal to the average existing sanitary wastewater flow calculated in **Section 4.2.1**, **0.04 L/s**.

In the proposed condition, the watermain design flows for the Site have been calculated using the Region of Halton WWLDM. The design population for the proposed development is 54 people as per **Section 3.0**.

The average daily flow of 275 litres/capita/day equates to **0.17 L/s**.

The water demand for the Site is summarized in **Table 1**.

Table 1: Water Demand

Condition	Non-Residential Peaking Factors	Flow (L/s)
Max Daily Demand	2	0.34
Max Hour	4	0.69

5.2.2 Fire Demand

In accordance with the City's criteria, fire flow demands are determined using the Fire Underwriters Survey methodology. The townhouse blocks and historic home fire flow demands were reviewed, and a value of **169 L/s** was calculated for the SW Townhouse block as the greatest for the subject site. This is based on the following inputs:

- NBC Occupancy 'C'
- Construction class: Wood Framed
- Limited-combustible contents factor
- Applicable exposure charges based on distance to adjacent buildings.

As per Region of Halton's design criteria, watermains shall be sized to meet the greater of either:

- Maximum day demand plus fire flow or
- Maximum hour demand

Therefore, the overall water demand for the development is maximum day plus fire flow, **169.34 L/s** (169 L/s + 0.34 L/s).

The Region of Halton WWLDM specifies maximum recommended static pressure to be 700 kPa (100 psi). Additionally, the pressure during normal operation should be between 350 kPa to 550 kPa (50 to 80 psi) and not less than 275 kPa (40 psi). The pressure during simultaneous maximum day demand & fire flow must be above 140 KPa (20 psi).

A hydrant flow test was conducted by Classic Fire Life + Safety on November 23, 2023. The static pressure was found to be 58 psi. The results indicate that there is an available flow rate of approximately 470 L/s (7449 iGPM) while maintaining a pressure of 20 psi. Additionally, at the maximum day plus fire flow rate of 169.34 L/s, a pressure of 52.5 psi will be observed. Therefore, the conditions specified in the design criteria will be satisfied as the pressure at maximum day demand & fire flow will exceed 20 psi.

Refer to **Appendix B** for Water Demand, Fire Flow, and Hydrant Flow Test calculations.

6.0 Stormwater Management

6.1 Existing Conditions

The site is comprised of 3 existing residential properties totalling an area of 0.40 ha. Runoff from the subject site is conveyed either directly to Walkers Line from partial roof and front lot drainage, or to the southwest corner of site from the remainder of roof and backyards. Drainage sent directly to Walker's Line is captured within the right-of-way by catchbasins and conveyed south via the 675 mm diameter concrete storm sewer. Walker's Line drainage then is directed southwest onto New Street via 825 mm diameter sewers and larger box culverts until discharge into Tuck Creek. Existing drainage from the subject site that drains to the southwest corner is conveyed south via a collection of roughly defined rear yard swales to New Street where it combines with the same municipal drainage system until outlet into Tuck Creek. Additionally, 0.18 ha of external drainage from properties north and west of the existing properties, identified and delineated during site investigation and LIDAR mapping review, drain into the subject site. The highest elevations are generally observed along the North property line (approximately 93.30 m) and the lowest in the Southwest corner (approximately 91.85). Refer to the **Existing Drainage Plan (EDP)** in **Appendix D**.

6.1.1 Predevelopment Drainage

The pre-development flow rates were determined using the Rational Method and are summarized in **Table 2** below. The inputs were:

- Pre-development Time of Concentration (T_c): 10 minutes minimum
  - The City's design criteria specifies Tc to be a minimum of 10 minutes. As recommended for longer drainage paths, an empirical calculation (such as the Airport Method) for overland flow can be used to determine the T_c
- Pre-development Runoff Coefficient: 0.33 to 0.50 as per the Existing Drainage Plan
- Rainfall intensity parameters A, B, and C were taken from the City's design criteria for the corresponding rainfall Intensity-Duration-Frequency ('IDF') curves.

The subject site has two outlet directions as described in **Section 6.1**. The pre-development release rate is calculated using the rational method for the 3 existing tributary areas delineated on the **Existing Drainage Plan**:

Table 2: Predevelopment Peak Flow Rates, 5 and 100-year event

Area ID	Area (ha)	Runoff Coefficient	Time of Concentration (min)	5-Year Release Rate (L/s)	100-Year Release Rate (L/s)
EXT	0.18	0.37	44	8	15
101	0.28	0.33	38	12	23
100	0.12	0.50*	10	17	34

*max runoff coefficient of 0.50 utilized as requested by City of Burlington Development Engineering.

Refer to **Appendix C** for rational method calculations.

6.2 Proposed Drainage Conditions

The proposed development consists of 3 distinct Townhouse Blocks and the existing Heritage Home, with a private laneway providing vehicular access and bisecting the property in a North-South direction. In the proposed condition, stormwater flows are captured within a private storm sewer network and attenuated onsite to the allowable release rate. The storm sewer outlet will connect directly into the existing 675 mm diameter concrete sewer within Walkers Line. Refer to the **Proposed Drainage Plan (PDP)** in **Appendix D** that depicts the following drainage areas:

- **Area EXT1:** This area consists of 0.15 ha of external drainage from the north that is captured within CB5.
- **Area EXT2:** This area consists of 0.03 ha of external drainage from the west that is captured within CBMH1.
- **Area CBMH1, CBMH2, and FDHC-4:** These areas consist of 0.35 ha of subject site drainage captured either overland or by roof drains and conveyed to the stormwater sewer system.
- **Area WL:** The remaining 0.05 ha of subject site drains uncontrolled to the Walkers Line right of way. Based on conversations with City of Burlington Development Engineering, this area may drain overland without impact to the proposed development allowable release rate.

Refer to the **Site Servicing Plan (SSP)** in **Appendix D** for the layout and sizing of the on-site storm sewers. Storm sewer outlets and sewers will be sized appropriately to capture and convey the 100-year storm event to the stormwater management tanks.

6.3 Stormwater Management Criteria

Based on the City's Stormwater Management Design Guidelines, the stormwater management objectives are:

- **Quantity Control:** Control the post-development peak flows up to the 100-year event to the 5-year pre-development level.

- **Water Balance:** Minimize impact on the natural water balance through use of Low Impact Development (LID)
- **Quality Control:** Enhanced protection level corresponding to the removal of 80% of total suspended solids (TSS)

6.3.1 QUANTITY CONTROL

The City of Burlington's storm sewer infrastructure is sized to convey the 5-year storm. Based on direction from the City of Burlington Development Engineering, only drainage currently going to Walkers Line can be considered when determining the subject site's allowable release rate. Therefore, post development drainage must be attenuated to the pre-development 5-year release rate of Area 100 + EXT (external drainage from the north), please refer to the Existing Drainage Plan **EDP** in **Appendix D** for the tributary area limits. Therefore, the target release rate is **25 L/s** (17 L/s + 8 L/s), see **Table 2** for the summary of the 5-year release rates calculated in **Section 6.1.1**.

6.3.1.1 DESIGN

Drainage from 0.35 ha of the subject site and 0.18 ha of external lands is captured within the onsite storm system and conveyed to Walkers Line. Onsite storm inlets and sewers are sized to capture the 100-year storm event and convey it to the onsite storage devices for attenuation prior to draining to the municipal storm sewer in Walkers Line. Roof drainage from the Townhouse blocks shall be directly connected to the private storm sewer via service connections as shown on the **Site Servicing Plan** in **Appendix D**.

Modified rational calculations are completed in order to determine the storage required to attenuate these flows to the allowable 25 L/s:

Table 3: Summary of the 100-year Modified Rational Method Calculations

Area ID	Area (ha)	Runoff Coefficient	Tc (min)	Storage Available (m^3)	Storage Required (m^3)	Release Rate (m^3/s)	Description
COMBINED	0.53	0.79	10	140	137	0.025	All drainage controlled to Walkers line

The storage requirement is 132 m^3, which is provided on site by the following.

- Underground pipe storage = 19.6 m^3
- Manhole storage = 5.4 m^3
- Storage Tanks = 115 m^3 in two (2) tanks

An orifice plate of 105 mm in diameter located downstream of both tanks will attenuate flows to this allowable release rate of **25 L/s**.

Therefore, the 100-year peak stormwater release rate for the subject site is 25 L/s which matches the target release rate calculated in **Section 6.3.1**.

Refer to **Appendix C** for modified rational, storages, and orifice control calculations.

6.3.2 WATER BALANCE

The City of Burlington prefers that low impact developments (LID's) be proposed on all sites to minimize the impact of development to groundwater.

In order to determine possible locations for LID's on the subject site, a geotechnical analysis reviewing groundwater levels and soils infiltration rates was completed by Azure Group. Three (3) monitoring wells were installed on the subject site and water table readings were obtained on December 18th, 2023. The groundwater level on the subject site is generally observed between **3.3m** and **4.4 m below the existing ground surface** (see Geotechnical Investigation

Report by Azure Group, dated March 14, 2024 under separate cover). Infiltration rates of the soils between 1.57 and 1.85 mbgs were obtained at three (3) percolation test pits on December 8, 2023. As per Table 1 of the Infiltration Test Memo prepared by Azure Group, the infiltration rate of the sandy silt soils is found to be above **100 mm/hr** in all locations.

The proposed development includes an outdoor amenity space located in the southwest corner of the site. A bioswale is proposed at the west property limit to capture and infiltrate drainage from 0.09 ha of site area and 0.03 of external drainage, see areas CBMH1 and EXT2 on the **Proposed Drainage Plan**, **PDP**, in **Appendix D**. Using the first 25 mm of rain as a target, the following depth of infiltration media (washed clear stone or similar) is required:

$$\text{Required Depth} = \frac{(Tributary\ Area\ \times Target\ Rain\ Event) \div Bioswale\ Area}{Void\ Space}$$

$$= \frac{(0.12\ ha\ \times 25mm) \div 85m2}{40\%}$$

$$= 0.88\ m$$

Therefore, the proposed bioswale will require infiltration media depth of 0.88 metres, corresponding to 30 m^3 of infiltration.

The proposed catchbasin manhole grate elevation at the low point of the bioswale is approximately 0.25 metres below existing ground, therefore the groundwater table is estimated to be approximately 3.0 metres below the proposed ground surface at this location. The proposed bioswale media depth appears to have adequate separation from the measured groundwater levels on site.

In addition, Stormwater Tank #1 was reviewed as a possible infiltration location. The proposed storm sewer outlet invert of the storage tank is 90.36 masl which is approximately 1.90 metres below existing grade in this area. Based on the current groundwater readings completed by Azure Group, the shallow groundwater is a minimum of 3.3m below existing ground and therefore the proposed stormwater tank design can include a 0.40m infiltration sump below the outlet (3.3 metres – 1.9 metres – 1.0 m [minimum separation from high groundwater]). The 0.40 m sump can capture and infiltrate the first 5 mm of rain for the 0.41 ha tributary area:

$$\text{Required Depth} = (Tributary\ Area\ \times Target\ Rain\ Event) \div Bioswale\ Area$$

$$= (0.41\ ha \times 5mm) \div 51m2$$

$$= 0.40\ m$$

Therefore, the proposed Infiltration Gallery will provide 0.40 metres depth of infiltration within the stormwater tank, corresponding to 20 m^3 of infiltration.

Assuming a 100 mm/hr infiltration rate of the receiving soils and a factor of safety of 2.5, the adjusted infiltration rate is 40 mm/hr. Using a max drawdown time of 48 hours for the proposed LID's, the maximum depth of infiltration measures is 1.92 metres (40 mm/hr * 48 hours). The proposed Bioswale and Gallery sump infiltration media is less than 1.92 metres, and therefore the drawdown time is acceptable.

Further groundwater readings will be completed through the Spring and Early Summer to confirm high groundwater levels within the subject site.

6.3.3 WATER QUALITY

The quality control objective is to provide an enhanced protection level, which corresponds to the removal of 80% TSS. The proposed quality control design for the 0.35 ha of captured subject site drainage consists of two treatment trains:

1) 0.26 ha from CBMH2 and FDHC-4 will be treated by an Oil-Grit Separator ('OGS') prior to infiltration within SWM Tank #1.

2) 0.09 ha of clean drainage will be treated by the proposed bioswale.

An **FD-4HC** inlet OGS model by ADS Canada will be provided directly upstream of SWM Tank #1. The OGS will treat runoff collected from the 0.26 ha of subject site and 0.15 ha of external drainage. The **FD-4HC** is sized to provides 86% TSS removal, with 90% of rainfall volume treated. Refer to **Appendix C** for OGS specifications and the ETV verification statement. As per the City of Burlington Stormwater Management Guidelines, the OGS unit will only be credited for 50% removal. Refer to **Appendix C** for OGS specifications and the ETV verification statement.

Additional TSS removal will be provided by the two infiltration locations as described in **Section 6.3.2**. As per Table 3.2 Water Quality Storage Requirements based on Receiving Water from the MOE Stormwater Management Planning and Design Manual ('MOE SWMPDM'), sizing requirements for infiltration facilities are provided in order to achieve 80% TSS removal. For a maximum site impervious level of 85%, the infiltration facility must have a storage volume of 40 m^3/ha. Two (2) infiltration locations are proposed for the subject site. These infiltration facilities have been designed to infiltrate a minimum of 5 mm of rainfall over the entire drainage area, which is equivalent to 50 m^3/ha. Given that some catchment areas have imperviousness less than 85% and infiltration greater than the conservative 40 m^3/ha is provided, these proposed infiltration devices can achieve the 80% TSS removal. Detailed design of these infiltration devices will be provided in future applications.

Clean roof and landscaped flows have been assumed as having a removal efficiency of 80%. The treatment train approach calculates the composite TSS removal for TSS removal LID's in series. For example, roof and landscaped flows that are also treated by the FD-4HC and Infiltration Tank are provided with a TSS removal efficiency of 98% as summarized in Table 4:

Table 4: Treatment Train for Outlet 1 - Clean

Low Impact Developments (LIDs)	Starting TSS Load [1]	Removal Rate [2]	TSS Removed [3]
Clean Roof/Landscape	100%	80%	20%
OGS	20 %	50%	10%
Infiltration Facility	10%	80%	2%
TOTAL %TSS Removal [4]			**98%**

[1] Starting TSS load is the % remaining to be treated

[2] Removal rates as per literature

[3] The TSS % removed after each LID is implemented

[4] The summation of TSS % removed by each LID

Based on the treatment train rationale above, TSS removal for Laneway drainage through the same LID's and clean drainage going to the bioswale have been calculated. The composite removal efficiency for the entire subject site is calculated to be **94%** (note: Area WID as per SWM-2 has been ignored as the drainage is not captured and is from clean sources). Therefore, the proposed quality control design is acceptable and meets enhanced level 1 required TSS removal.

7.0 CONCLUSION

Sanitary Demand:

- Using an equivalent population of **54 people**, the peak sanitary sewer flow for the Site is **0.85 L/s.**
- The Site sanitary flows will outlet from the drive aisle south of the existing heritage building to a new MH1A in Walkers Line.
- The new sanitary manhole in the right-of-way will be installed on the existing 250mm sanitary sewer sloped at 0.84%. The sewer capacity of this sanitary sewer is **58.3 L/s.**
- A downstream analysis was completed for the sanitary sewer in Walker's Line down to the Trunk on Lakeshore Road. The analysis shows no capacity constraints within the existing sewer, including peak sanitary flows from the proposed development.

Watermain Demand:

- Using an equivalent population of **54 people**, the water supply demand for the Site is as follows:
    - Average Daily Demand = **0.17 L/s**
    - Max Daily Demand = **0.34 L/s**
    - Peak Hour Demand = **0.69 L/s**
- The overall water demand for the development is maximum day plus fire flow, **169.34 L/s**.
- The Site will be serviced by the existing 300mm watermain on Walkers Line. A new 150 mm diameter watermain connection will be installed at the Walkers Line watermain and will extend service connections to individual townhouse units.
- The Region of Halton WWLDM specifies maximum recommended static pressure to be 700 kPa (100 psi). Also, the pressure during normal operation should be between 350 kPa to 550 kPa (50 to 80 psi) and not less than 275 kPa (40 psi). The pressure during simultaneous maximum day demand & fire flow must be above 140 KPa (20 psi). A hydrant flow test was performed to ensure these criteria are met.

Quantity Control:

- The quantity control criteria specified for the City of Burlington is to control post-development peak flows to pre-development 5-year storm event. Quantity control is provided such that the 100-year post-development peak flows are controlled to the 5-year pre-development peak flow of **25 L/s** for the Site and External Drainage captured.
    - Two underground storage tanks with a combined volume of **115 m³** of storage are provided upstream of the proposed 105 mm diameter orifice plate.
    - Underground pipe and structure storage of **25 m³** is also provided for a total of **140 m³** of storage volume.

Water Balance:

- Stormwater Management Tank #1 is proposed as an "open bottom" storage tank with 0.40 m of sump for infiltration. The tank will provide infiltration for the first 5 mm of rain for the 0.41 ha tributary area.
- A bioswale is proposed along the west side of the subject site to infiltrate the first 25 mm of rain for the 0.12 ha tributary area.

Quality Control:

- An **FD-4HC** OGS unit providing 86% TSS removal (credited for 50%) is proposed to collect and treat runoff from a combined site and external drainage area of 0.41 ha.
- The proposed infiltration devices provide an additional 80% TSS removal as per MOE SWMPDM specifications.
- The composite removal efficiency for the entire subject site is calculated to be 94%.

We trust that this report sufficiently addresses the site servicing requirements and that the proposed development is feasible from a municipal servicing and stormwater management perspective.

Please do not hesitate to contact the undersigned if you have any questions or concerns.

Regards,

KWA Site Development Consulting Inc.



Per:

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APPENDIX A

Sanitary Demand Calculations

Proposed Sanitary Demand

Project Name:	490-508 Walkers Line
Project Number:	23911
Location:	City of Burlington
Date:	11/6/2024
Prepared By:	BJ

Average Daily Domestic Flow	275	litres / capita / day
Land Area	0.4	ha
Population		
Equivalent Population Density	135	ppl / ha
Resulting Population:	54	persons
Peaking Factor	Harmons Equation	
Harmon's Equation:	4.3	
Min. Harmon's Value (typ. 2.0)	2.0	
Peak Dry Weather Flow	0.74	Litres / second
Extraneous Flows	0.11	Litres / second
Extraneous Flow Rate	0.286	Litres / second / ha
Peak Flow (incl. extraneous)	0.85	Litres / second

Sanitary Sewer Design Sheet

Project Name: 496 Walkers Line Burlington
Project Number: 23911
Location: Burlington, ON
Date: 20241025

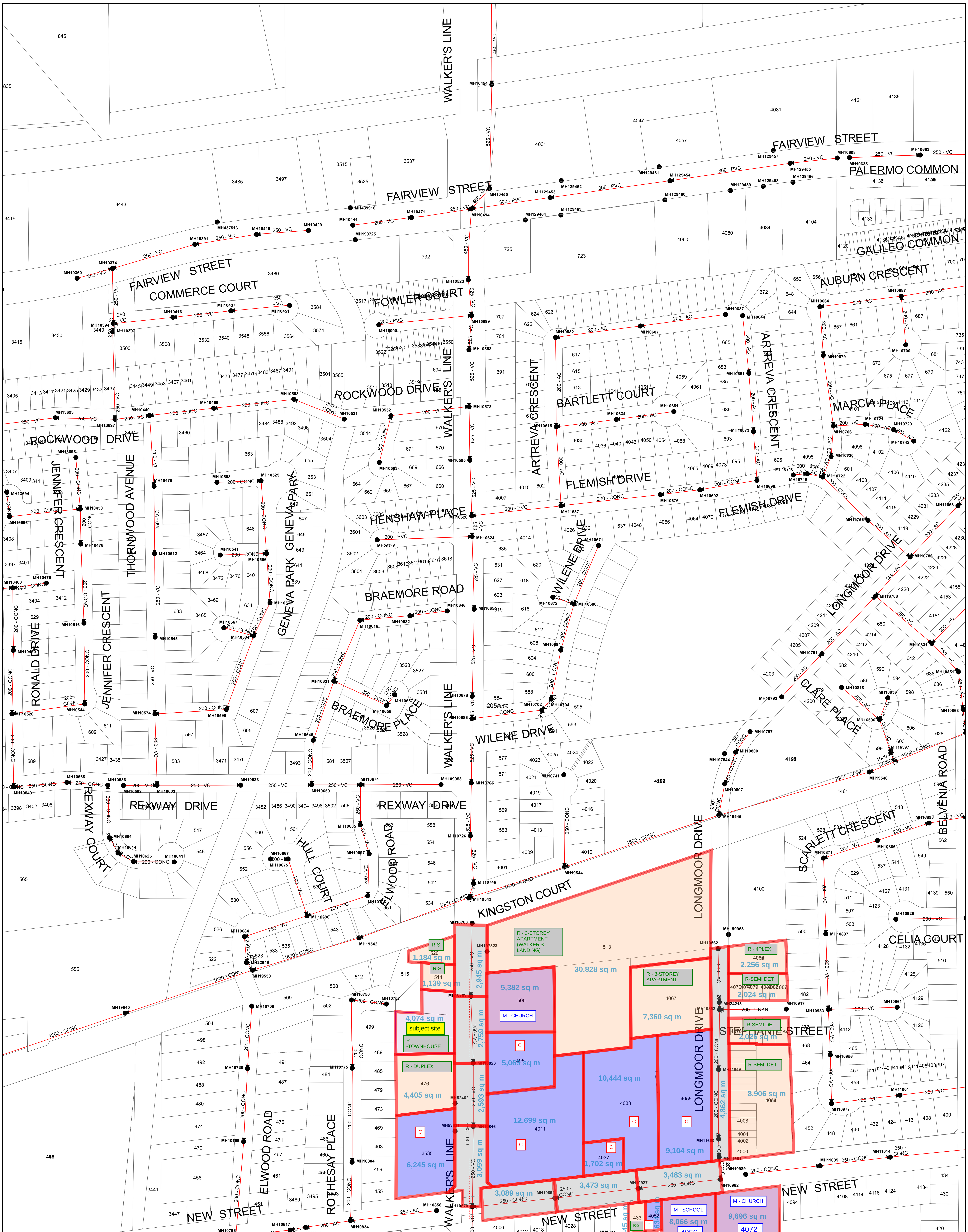
Prepared By: {Initials}
Checked By: {Initials}

Manning's Roughness Coefficient 0.013

FLOW DATA

Type of Development	Equivalent Population (ppl / ha)	Rate	Units
Existing Residential (single Family)	93	0.0032	L/s/person
Existing Residential (Semi-detached, duplex & 4-plex)	100	0.0032	L/s/person
Existing Residential (Townhouse, Maisonette (6 storey apt. or less))	135	0.0032	L/s/person
Existing Residential (Apartment over 6 stories high)	285	0.0032	L/s/person
Proposed Residential	135	0.0032	L/s/person
Existing Commercial	90	0.2865	L/s/ha
Community Services	40	0.1273	L/s/ha
Proposed Industrial	125	0.0032	L/s/ha
Proposed Hospitals	4	0.0127	L/s/bed
ICI Floor Space Index		0.5	
Proposed Industrial, Commercial, Institutional (ICI) by Building Area		5	L/day/m2
Infiltration Factor by Land Area		0.286	L/s/ha

1	2	3	4	5	6				11	12	13			16	18	19	20	21	22	23	24	25	26	27	28	29					35		37					44	45	46	47	48	49	50
	SEWER INPUT					Information Source			TRIBUTARY RESIDENTIAL DRAINAGE AREAS (ha)						EXISTING RESIDENTIAL (SINGLE FAMILY)		Existing Residential (Semi-detached, duplex & 4-plex)		Existing Residential (Townhouse, Maisonette (6 storey apt. or less))		Existing Residential (Apartment over 6 stories high)		Proposed Residential		RESIDENTIAL POPULATION FLOW		EXISTING COMMUNITY SERVICES				EXISTING COMMERCIAL				EXISTING COMMUNITY & COMMERCIAL FLOWS	Road Drainage Area (ha)		Accumulated Area	Peaking Factor		TOTAL		SEWER OUTPUT					
Description	Upstream node	Downstream Node	Length (m)	Pipe Size (mm)	Slope (%)	Upstream MH Invert	Downstream MH invert	Record Drawing Referenced	Existing Residential (single Family)	Existing Residential (Semi-detached, duplex & 4-plex)	Existing Residential (Townhouse, Maisonette (6 storey apt. or less))	Existing Residential (Apartment over 6 stories high)	Proposed Residential	Total Area	Accumulated TRIBUTARY AREA (ha)	Equivalent Population	Total Persons	Equivalent Population	Total Persons	Equivalent Population	Total Persons	Equivalent Population	Total Persons	Equivalent Population	Total Persons	Accumulated Residential Population	Accumulated Total Average Flow (L/s)	TRIBUTARY AREA (ha)	Equivalent Population	Accumulated TRIBUTARY AREA (ha)	Accumulated Total Persons	TRIBUTARY AREA (ha)	Equivalent Population	Accumulated TRIBUTARY AREA (ha)	Accumulated Total Persons	Accumulated Total Average Flow (L/s)	Road	Accumulated Road	Total	Kw	Peak Factor (M)	Extraneous Flows (L/s)	Peak Design Flow (L/s)	Capacity (L/s)	Full-Flow Velocity (m/s)	Actual Velocity (m/s)	Flow Depth (%)	Qa/Qf (%)
WALKERS LINE	MH10763	MH10789	58.5	250	1.01	90.13	89.54	Walkers line P&P #1	1989	0.23		3.08			3.32	3.32	13	13	0	0	416	416	0	0	0	0	429	1.37		0.00		0	0.00	0	0.00	0	0.00	0.29	0.29	3.61	1.000	4.01	1.03	6.50	59.8	1.22	0.791	22.0%	10.9%
WALKERS LINE	MH10789	MH10823	90.8	250	0.84	89.53	88.77	Walkers line P&P #1	1989				0.40	0.40	3.72	0	13	0	0	0	416	0	0	54	54	483	1.54	0.54	21.53	0.54	22	0.51	46	0.51	46	0.21	0.28	0.57	5.33	0.956	3.78	1.52	8.14	54.5	1.11	0.795	26.0%	14.9%
WALKERS LINE	MH10823	MH10846	93.1	250	0.96	88.76	87.86	Walkers line P&P #1	1989		0.44				0.44	4.16	0	13	44	44	0	416	0	0	0	54	527	1.68		0.00	0.54	22		0	0.51	46	0.21	0.26	0.83	6.03	0.960	3.78	1.72	8.87	58.3	1.19	0.850	26.0%	15.2%
WALKERS LINE	MH10846	MH10870	90.9	250	0.91	87.86	87.03	Walkers line P&P #2	1989					0.00	4.16	0	13	0	44	0	416	0	0	0	54	527	1.68		0.00	0.54	22	1.89	170	2.40	216	0.76	0.31	1.14	8.23	0.917	3.55	2.35	11.00	56.7	1.16	0.888	29.5%	19.4%
NEW STREET	MH10962	MH10927	93.4	250	0.50				0.00	1.52		0.74		2.26	2.26	0	0	152	152	0	0	210	210	0	0	362	1.15	1.78	71.05	1.78	71	0.97	88	0.97	88	0.51	0.83	0.83	5.84	0.890	3.53	1.67	7.52	42.0	0.86	0.646	28.5%	17.9%
NEW STREET	MH10927	MH10891	95.6	250	0.50				0.26					0.26	2.51	14	14	0	152	0	0	0	210	0	0	376	1.20			1.78	71	1.21	109	2.19	197	0.85	0.35	1.18	7.66	0.878	3.44	2.19	9.23	42.0	0.86	0.682	31.5%	22.0%
NEW STREET	MH10891	MH10870	93.9	250	0.47	87.49 (approx.)	87.05 (approx.)	New St Dwg #1	2016	0.19				0.19	2.70	11	25	0	152	0	0	0	210	0	0	386	1.23			1.78	71		0	2.19	197	0.85	0.31	1.49	8.16	0.881	3.45	2.33	9.51	40.7	0.83	0.671	32.5%	23.4%
WALKERS LINE	MH10870	MH10894	69.0	300	0.51	87.03	86.68	Walkers line P&P #2	1989	0.22				0.22	7.08	12	50	0	196	0	416	0	210	0	54	926	2.95			2.31	93		0	4.59	413	1.61	0.25	2.87	16.86	0.901	3.33	4.82	19.99	69.1	0.98	0.841	36.5%	28.9%
WALKERS LINE	MH10894	MH10904	29.2	300	0.22	86.68	86.62	Walkers line P&P #2	1989	0.52				0.52	7.60	29	78	0	196	0	416	0	210	0	54	954	3.04			2.31	93		0	4.59	413	1.61	0.10	2.97	17.48	0.905	3.34	5.00	20.51	45.4	0.64	0.624	47.0%	45.2%
WALKERS LINE	MH10904	MH10939	83.6	300	0.45	86.62	86.24	Walkers line P&P #2	1989	0.28				0.28	7.88	15	94	0	196	0	416	0	210	0	54	970	3.09			2.31	93		0	4.59	413	1.61	0.27	3.25	18.04	0.907	3.34	5.16	20.85	64.9	0.92	0.817	39.0%	32.1%
WALKERS LINE	MH10939	MH10971	83.2	300	0.40	86.35	86.01	Walkers line P&P #3	1962	0.54				0.54	8.42	30	123	0	196	0	416	0	210	0	54	999	3.18			2.31	93		0	4.59	413	1.61	0.22	3.46	18.79	0.910	3.35	5.37	21.41	61.2	0.87	0.785	40.5%	35.0%
WALKERS LINE	MH10971	MH10995	89.0	300	0.40	86.01	85.66	Walkers line P&P #3	1962	0.57				0.57	8.99	31	154	0	196	0	416	0	210	0	54	1031	3.28			2.31	93		0	4.59	413	1.61	0.22	3.69	19.58	0.913	3.35	5.60	21.99	61.2	0.87	0.789	41.0%	36.0%
WALKERS LINE	MH10995	MH11020	74.7	300	0.40	85.66	85.36	Walkers line P&P #3	1962	0.58				0.58	9.57	32	187	0	196	0	416	0	210	0	54	1063	3.38			2.31	93		0	4.59	413	1.61	0.25	3.94	20.41	0.916	3.36	5.84	22.60	61.2	0.87	0.799	42.0%	37.0%
WALKERS LINE	MH11020	MH11042	76.2	300	0.40	85.36	85.06 (approx)	Walkers line P&P #3	1962	0.51				0.51	10.08	28	215	0	196	0	416	0	210	0	54	1091	3.47			2.31	93		0	4.59	413	1.61	0.21	4.15	21.14	0.919	3.36	6.04	23.13	61.2	0.87	0.803	42.5%	37.8%
WALKERS LINE	MH11042	MH11058	80.0	300	0.32	85.06 (approx)	84.81 (approx)	N/A	N/A	0.45				0.45	10.54	25	240	0	196	0	416	0	210	0	54	1116	3.55			2.31	93		0	4.59	413	1.61	0.20	4.35	21.79	0.921	3.37	6.23	23.60	54.3	0.77	0.739	46.0%	43.5%
WALKERS LINE	MH11058	MH11068	22.5	300	0.32	84.81 (approx)	84.74 (approx)	N/A	N/A	0.07				0.07	10.61	4	244	0	196	0	416	0	210	0	54	1120	3.56			2.31	93		0	4.59	413	1.61	0.27	4.62	22.14	0.921	3.37	6.33	23.75	54.3	0.77	0.739	46.0%	43.8%
WALKERS LINE	MH11068	MH11079	73.2	300	0.60	84.73	84.30	Walkers line P&P #5	N/A	1.48				1.48	12.09	81	325	0	196	0	416	0	210	0	54	1201	3.82			2.31	93		0	4.59	413	1.61	0.28	4.90	23.90	0.927	3.37	6.83	25.16	74.9	1.06	0.949	39.5%	33.6%
WALKERS LINE	MH11079	MH11109	75.7	300	0.60	84.30	83.84	Walkers line P&P #5	N/A	0.45				0.45	12.54	25	350	0	196	0	416	0	210	0	54	1226	3.90			2.31	93		0	4.59	413	1.61	0.20	5.11	24.55	0.929	3.38	7.02	25.63	74.9	1.06	0.955	40.0%	34.2%
WALKERS LINE	MH11109	MH11133	79.8	300	0.60	83.84	83.36	Walkers line P&P #5	N/A	0.55				0.55	13.09	30	380	0	196	0	416	0	210	0	54	1256	4.00			2.31	93		0	4.59	413	1.61	0.22	5.33	25.33	0.931	3.38	7.24	26.19	74.9	1.06	0.961	40.5%	35.0%
WALKERS LINE	MH11133	MH11158	78.0	300	1.00	83.36	82.58	Walkers line P&P #5	N/A	0.48				0.48	13.57	26	407	0	196	0	416	0	210	0	54	1283	4.08			2.31	93		0	4.59	413	1.61	0.23	5.56	26.04	0.933	3.38	7.45	26.68	96.7	1.37	1.161	35.5%	27.6%
APPLE VALLEY	MH11195	MH11158	93.9	200	0.40	82.75	82.57	Apple Valley Lane Dwg #1	1969	4.04				4.04	4.04	222	222	0	0	0	0	0	0	0	0	222	0.71			0.00	0		0		0	0.00	1.37	1.37	5.41	1.000	4.13	1.55	4.47	20.7	0.66	0.526	31.5%	21.5%
WALKERS LINE	MH11158	MH11175	59.7	300	0.60	82.13	81.78	Walkers line P&P #5	N/A	0.23				0.23	17.84	13	641	0	196	0	416	0	210	0	54	1517	4.83			2.31	93		0	4.59	413	1.61	0.18	7.11	31.85	0.944	3.38	9.11	30.89	74.9	1.06	1.005	44.5%	41.2%
LAKESHORE + WALKERS	MH11184	MH11175	23.4	200	0.50				2.74					2.74	2.74	150	150	0	0	0	0	0	0	0	0	150	0.48			0.00	0		0		0	0.00	0.91	0.91	3.65	1.000	4.19	1.04	3.05	23.2	0.74	0.511	24.5%	13.1%
LAKESHORE ROAD	MH11175	MH11159	78.3	375	1.30	81.53 (approx)	80.52	Lakeshore Rd P&P #2	N/A	0.08				0.08	20.65	4	796	0	196	0	416	0	210	0	54	1672	5.32			2.31	93		0	4.59	413	1.61	0.19	8.21	35.77	0.950	3.38	10.23	33.65	199.9	1.81	1.337	27.5%	16.8%



Sewer Types

- Treated Discharge Sewer
- Untreated Discharge Sewer
- ForceMain
- Proposed ForceMain
- Gravity Sewer (In Service)
- Gravity Sewer (Out of Service)
- Proposed Gravity Sewer

Maintenance Hole Types

- Maintenance Hole
- Chamber
- Drainage Area - Residential
- Drainage Area - Community Services
- Drainage Area - Commercial
- Drainage Area - Roadway

Major System Facilities

- Wastewater Storage Tank
- Wastewater Treatment Plant
- Pumping Station
- Municipal Boundary
- Residential Property (Single Family, Semi-detached, Duplex, Apartment..etc)
- Community Services Property
- Commercial Property

Halton REGION

REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

SANITARY OPERATING MAPS

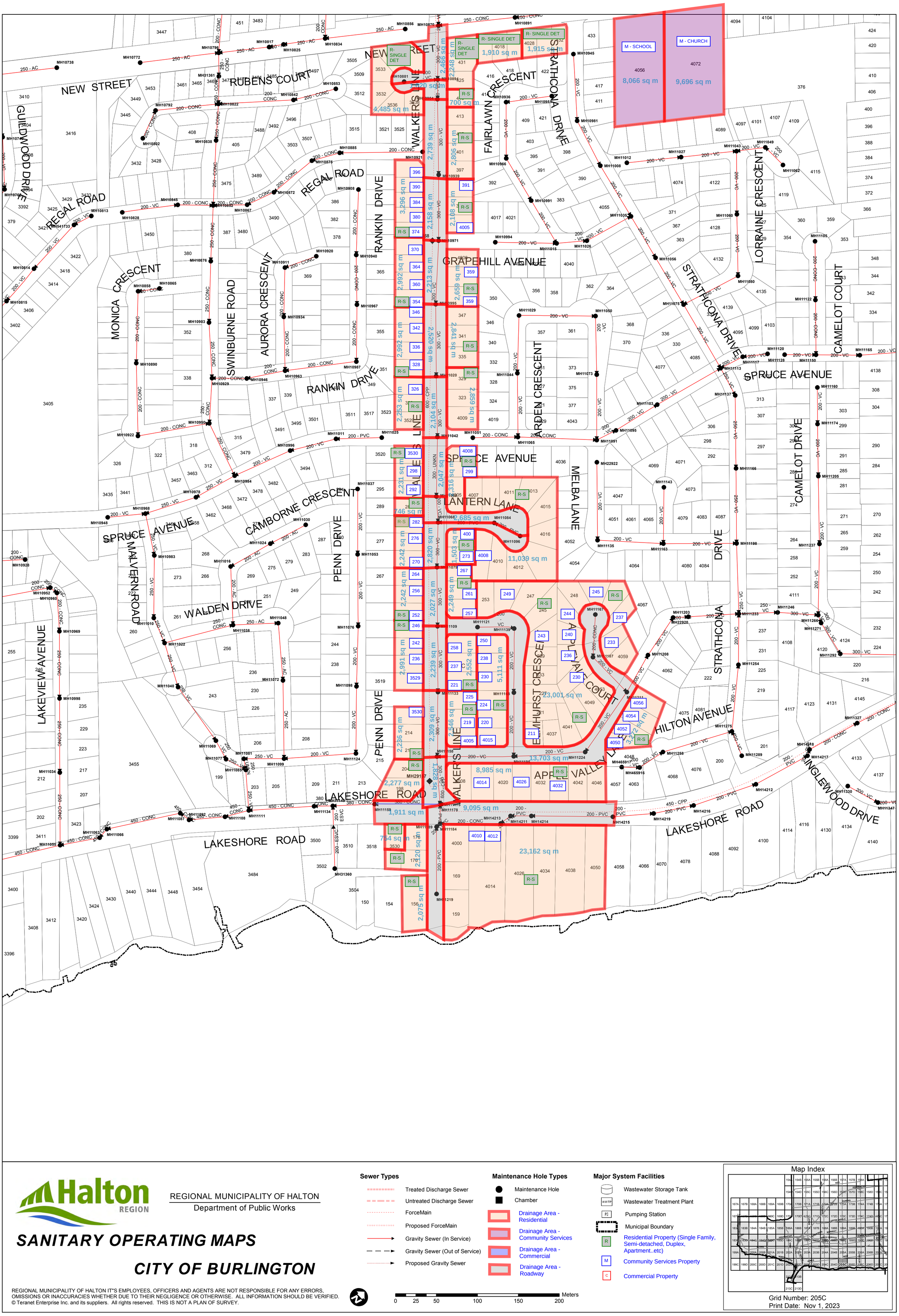
CITY OF BURLINGTON

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0 25 50 100 150 200 Meters

Map Index

Grid Number: 205A
Print Date: Nov 1, 2023



SANITARY OPERATING MAPS

CITY OF BURLINGTON

REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

Sewer Types

- Treated Discharge Sewer
- Untreated Discharge Sewer
- ForceMain
- Proposed ForceMain
- Gravity Sewer (In Service)
- Gravity Sewer (Out of Service)
- Proposed Gravity Sewer

Maintenance Hole Types

- Maintenance Hole
- Chamber
- Drainage Area - Residential
- Drainage Area - Community Services
- Drainage Area - Commercial
- Drainage Area - Roadway

Major System Facilities

- Wastewater Storage Tank
- Wastewater Treatment Plant
- Pumping Station
- Municipal Boundary
- Residential Property (Single Family, Semi-detached, Duplex, Apartment..etc)
- Community Services Property
- Commercial Property

Map Index

Grid Number: 205C
Print Date: Nov 1, 2023

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APPENDIX B

Water Demand and FUS Calculations

Proposed Water Demand

Project Name:	490-508 Walkers Line	
Project Number:	23911	
Location:	City of Burlington	
Date:	11/6/2024	
Prepared By:	BJ	
Average Daily Domestic Flow	275	litres / capita / day
Land Area	0.4	ha
Population		
Equivalent Population Density	135	ppl / ha
Resulting Population:	54	persons
Peaking Factor	Constant	
Max Day Factor:	2	
Max Hour Factor	4	
Average Daily Demand	0.17	Litres / second
Max Daily Demand	0.34	Litres / second
Max Hourly Demand	0.69	Litres / second

Fire Underwriters Survey - Fire Demand Calculations

Project Name: 490-508 Walkers Line
Project Number: 23911
Location: City of Burlington
Date: Nov-24
Prepared By: BJ

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

Building Information					System Type							Contents Information		Exposure Charge												Unadjusted Flow (F=220C sqrt A)			Correction Factors				Required Flow	
														East			West			North			South										
Building	NBC Occupancy	Total Floor Area (m^2)	# of Storeys	Construction Class	NFPA 13 Sprinkler	Credit	Standard Water Supply	Credit	Fully Supervised	Credit	**Total Credits**	Contents Factor	**Contents Charge**	Distance (m)	L-Ht^2 (ft)	Charge	Distance (m)	L-Ht^2 (ft)	Charge	Distance (m)	L-Ht^2 (ft)	Charge	Distance (m)	L-Ht^2 (ft)	Charge	**Total Charges (Maximum 75%)**	C	A (m^2)	F (L/min)	Occupancy	FF Adjusted for Occupancy	Sprinkler Decrease	Exposure Charge	**L/min**	**L/s**
BLDG - NE	C	245	3	WF	NO	0%	NO	0%	NO	0%	**0%**	LC	**-15%**	over 45	over 120	0%	16	over 120	15%	14	over 120	15%	1	over 120	25%	55%	1.5	245	**5000**	-750	4250	0	55%	**6588**	**110**
BLDG - SE	C	245	3	WF	NO	0%	NO	0%	NO	0%	**0%**	LC	**-15%**	over 45	over 120	0%	16	over 120	15%	4.4	over 120	20%	6	over 120	20%	55%	1.5	245	**5000**	-750	4250	0	55%	**6588**	**110**
BLDG - SW	C	460	3	WF	NO	0%	NO	0%	NO	0%	**0%**	LC	**-15%**	16	over 120	15%	19	over 120	15%	6	over 120	20%	6	over 120	20%	70%	1.5	460	**7000**	-1050	5950	0	70%	**10115**	**169**

Total: 169

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

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.

Legend

Construction Class
- WF wood frame construction
- OC ordinary construction
- NC non-combustible construction
- FC fire-resistive construction

Contents Factor
- NC non-combustible
- LC limited combustible
- C combustible
- FB free burning
- RB rapid burning

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

Calculation Notes: 1 Includes all storeys, but excluding basements at least 50% below grade in the building being
2 Length - Height of Facing Wall of Exposure Building determined by multiplying the length of the facing wall of the exposure in feet by the height of the exposure in stories.
3 Maximum exposure charge = 75%
4 Round to Nearest 1,000 L/min

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%		

CLASSIC FIRE + LIFE SAFETY

FLOW TEST REPORT

Form SD-003B RevDate: Nov 29, 2021

PROJECT INFORMATION			
Project Name:	Hydrant Flow Test	Const. Project #:	N/A
Site Address:	490-508 Walkers Line Burlington	Design Project #:	N/A
City Contact:	Halton Region	Phone #:	
CFLS Contact:	John Morton	Phone #:	6476211540
Technical Contact:	Justin Da Silva	Phone #:	

SITE INFORMATION

SITE MAP



Note: If the main is a dead end, the flowing hydrant shall be closest to the dead end

ITEMS TO LABEL ON MAP	HYDRANTS USED	MAIN SIZE
☑ Static / Residual & Flow Hydrants	☑ City Hydrant(s)	City:
☐ Flow Direction (if the main is dead end)	☐ Site Hydrant(s)	Site:

SITE NOTES

CLASSIC FIRE + LIFE SAFETY

FLOW TEST REPORT

Form SD-003B RevDate: Nov 29, 2021

TEST INFORMATION			
Minimum Required Flow:		Min Ports:	
CFLS Personnel Present:	John Morton	Test Date:	Nov 23/23
City / External Company:	Halton Region	Test Time:	11:45am

TEST EQUIPMENT	
☑ Hose Monsters with built in Pitot	Hose length used: 25'
☐ Hand held pitot gauge	☐ Pollard diffuser elbow with built in Pitot
☐ Other:	

TEST RESULTS

Number of Ports	Outlet Size (IN)	Discharge Coefficient	Pitot Reading (PSI)				Total Flow (GPM)	Static / Residual Pressure (PSI)
0 Ports								58
1 Port	2.5	0.9	30				919	58
2 Ports	2.5	0.9	22	19			1,519	56
3 Ports	2.5	0.9					0	
4 Ports	2.5	0.9					0	
0 Ports	STATIC RE-CHECK							

TEST NOTES

HYDRAULIC ADJUSTMENTS (FOR OFFICE USE ONLY)

ADJUSTMENTS FOR HYDRAULIC GRADE LINE (HGL)

Reservoir HGL (m):		Site Elevation (m):	
Theoretical Static Head (PSI):	0	PSI to subtract from test pressures:	58

OTHER HYDRAULIC ADJUSTMENTS

Other adjustment as required by the City / AHJ:	

3 Point Hydrant Test Calculator

Project Name:	490-508 Walkers Line
Project Number:	23911
Location:	Burlington, ON
Date:	21-Mar-24
Prepared By:	BJ

GPM to L/s Conversion Factor	0.063090197
PSI to kPA Conversion Factor	6.89476
PSI to Head (ft)	2.31
kPa to Head (m)	0.101997733

Flow Data

GPM	L/s	PSI	kPa	Head (ft)	Head (m)
0	0	58	400	133.98	40.79
7449	470	20	138	46.2	14.06
1519	96	56	386	129.36	39.38

$$Q_r = Q_f x \left[\left(\frac{H_r}{H_f}\right)^{0.54}\right]$$

7449 GPM = 470 L/s

where:
Qr = Flow available at the desired fire flow residual pressure
Qf = Flow during test
Hr = Pressure drop to desired residual pressure (Static Pressure - Chosen Design Pressure)
Hf = Pressure drop during fire flow test (Static Pressure - Residual Pressure)

APPENDIX C

Stormwater Management Calculations

Time of Concentration - Airport Method (EXT)

Project Name:	Burlington	
Project Number:	23911	
Location:	Burlington	
Date:	15-Nov-24	
Prepared By:	BJ	
Catchment Area	0.18	ha
Catchment Length	286.00	m
Catchment Slope	0.750	%
Runoff Coefficient, C	0.37	dimensionless
Time of Concentration (T_c)	44.25	min
Time of Concentration (T_c)	0.74	hr
Time to Peak (T_p)	0.49	hr

$T_p = 2/3\ T_c$

$$T_c = \left(\frac{3.26(1.1 - C)L^{0.5}}{S_w^{0.33}}\right)$$

Time of Concentration - Airport Method (101)

Project Name:	Burlington	
Project Number:	23911	
Location:	Burlington	
Date:	25-Mar-24	
Prepared By:	BJ	
Catchment Area	0.28	ha
Catchment Length	189.00	m
Catchment Slope	0.750	%
Runoff Coefficient, C	0.33	dimensionless
Time of Concentration (T_c)	37.95	min
Time of Concentration (T_c)	0.63	hr
Time to Peak (T_p)	0.42	hr

$T_p = 2/3\ T_c$

$$T_c = \left(\frac{3.26(1.1 - C)L^{0.5}}{S_w^{0.33}}\right)$$

Rational Method

Project No: 23911
Project Name: Burlington

Pre-Development Release Rates

Area EXT

Storm Event:		5	years
ABC's:	a	802.04	
	b	5	
	c	0.764	
Time of Concentration:	t	44	min
Runoff Coefficient:	C	0.37	
Site Area	A	0.18	ha
Intensity [i=a/(t+b)c] or [i=a*tb] if B=0	i	41.01	mm/hr
Flow [Q=CiA/360]	Q	0.01	m^3/s
		8	l/s
Storm Event:		100	years
ABC's:	a	1281.34	
	b	5	
	c	0.761	
Time of Concentration:	t	44	min
Runoff Coefficient:	C	0.46	
Site Area	A	0.18	ha
Intensity [i=a/(t+b)c] or [i=a*tb] if B=0	i	66.29	mm/hr
Flow [Q=CiA/360]	Q	0.02	m^3/s
		15	l/s

Area 100 - To Walkers Line

Storm Event:		5	years
ABC's:	a	802.04	
	b	5	
	c	0.764	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.50	
Site Area	A	0.12	ha
Intensity [i=a/(t+b)c] or [i=a*tb] if B=0	i	101.31	mm/hr
Flow [Q=CiA/360]	Q	0.02	m^3/s
		17	l/s
Storm Event:		100	years
ABC's:	a	1281.34	
	b	5	
	c	0.761	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.63	
Site Area	A	0.12	ha
Intensity [i=a/(t+b)c] or [i=a*tb] if B=0	i	163.18	mm/hr
Flow [Q=CiA/360]	Q	0.03	m^3/s
		34	l/s

Area 101 - To Southwest Corner

Storm Event:		5	years
ABC's:	a	802.04	
	b	5	
	c	0.764	
Time of Concentration:	t	38	min
Runoff Coefficient:	C	0.33	
Site Area	A	0.28	ha
Intensity [i=a/(t+b)c] or [i=a*tb] if B=0	i	45.31	mm/hr
Flow [Q=CiA/360]	Q	0.01	m^3/s
		12	l/s
Storm Event:		100	years
ABC's:	a	1281.34	
	b	5	
	c	0.761	
Time of Concentration:	t	38	min
Runoff Coefficient:	C	0.41	
Site Area	A	0.28	ha
Intensity [i=a/(t+b)c] or [i=a*tb] if B=0	i	73.21	mm/hr
Flow [Q=CiA/360]	Q	0.02	m^3/s
		23	l/s

Modified Rational Calculation

Project Name: 496 Walkers Line
Project Number: 23911

Rainfall Data			
Location:	City of Burlington	a	1281.34
Event	100	b	5
		c	0.761

Area ID	Area (ha)	Runoff Coefficient	t_c (min)	Storage Available (m3)	Storage Required (m3)	Release Rate (m3/s)	Description	Orifice Size (mm)	Orifice Release Rate (m3/s)
COMBINED	0.53	0.79	10	140	137	0.025	Controlled to Walkers Line	105	0.025
	0.53			140	137	0.025			

NOTES:
5 Year Allowable Release Rate to Walkers Line = 25 L/s

Composite RC Value	Area [ha]	RC	RC * Area
EXT1	0.15	0.37	0.0555
EXT2	0.03	0.37	0.0111
CBMH1	0.09	0.38	0.0342
CBMH2	0.16	0.90	0.1440
CBMH3	0.10	0.90	0.0900
	0.53	Total	0.3348
	Divided by Total Area =		0.63
	Multiplied by 1.25 =		0.79

Modified Rational **Area:** **COMBINED**

Project Name: 496 Walkers Line
Project Number: 23911

Rainfall Data			
Location:	City of Burlington	a	1281.340
Event	100	b	5.000
		c	0.761

Site Data		
Area	0.53	ha
Runoff Coefficient	0.79	
AC	0.42	
Tc	10	
Time Increment	5	
Release Rate	25	l/s
Storage Required	137	m^3

Time (min)	Rainfall Intensity (mm/hr)	Storm Runoff (m3/s)	Runoff Volume (m3)	Released Volume (m3)	Storage Volume (m3)
10	163	0.19	114	15	99
15	131	0.15	137	23	115
20	111	0.13	154	30	124
25	96	0.11	168	38	130
30	86	0.10	179	45	134
35	77	0.09	189	53	136
40	71	0.08	197	60	137
45	65	0.08	205	68	137
50	61	0.07	212	75	137
55	57	0.07	218	83	136
60	53	0.06	224	90	134
65	51	0.06	229	98	132
70	48	0.06	234	105	129
75	46	0.05	239	113	126
80	44	0.05	243	120	123
85	42	0.05	248	128	120
90	40	0.05	252	135	116
95	39	0.04	255	143	113
100	37	0.04	259	150	109
105	36	0.04	263	158	105
110	35	0.04	266	165	101

Orifice Control &
Detention Storage

Job 496 Walkers Line
Job No. 23911

Area: **COMBINED**

Orifice Diameter: 105 mm

Orifice Equation: $Q = C_d A(2gh)^{1/2}$

Area 0.01 m^2

g = 9.81 m/s^2

C_d = 0.62

	Stage	Head (m)	Storage (m3)	Discharge (m3/s)
Invert E.L.	90.34	0.00	0	0.00
Ground E.L.	92.10	1.71	0.0	0.031
100 year Ponding E.L.	91.50	1.11	125.0	0.025

	PIPE AND MANHOLE STORAGE			
	Diameter (mm)	**Length (m)**	**Volume (m^3)**	**Cum_Vol (m^3)**
PIPE	250	9.40	0.46	0.46
	300	0	0.00	0.46
	450	0	0.00	0.46
	600	68	19.14	19.60
	825	0	0.00	19.60
	1050	0	0.00	19.60
MH	1200	2	5.43	25.03
	1800	0	0.00	25.03
	2400	0	0.00	25.03
	Totals ->	79	25.03	25.03

Note: Volumes calculated on nominal pipe sizes not metric equivalent.

Total Pipe & Manhole Storage = 25 m^3

Total Parking Storage = 0 m^3

Total Site Storage = 25 m^3

Composite %TSS Removal

Project Name: 490-508 Walkers Line
Project Number: 23911
Location: Burlington, ON
Date: 11/15/2024

Prepared By: B.J.
Checked By: R.A.

OGS + Inf. - Clean		
Area =	0.11	ha
%TSS Removal of OGS+Clean Roof Area	98.00	

Area is clean roof drainage (considered 80% TSS removed) and is conveyed to OGS and Infiltration Tank #1 (see Table 4 in section 6.3.3 of Report)

OGS + Inf. - Laneway		
Area =	0.15	ha
%TSS Removal of OGS	90.00	

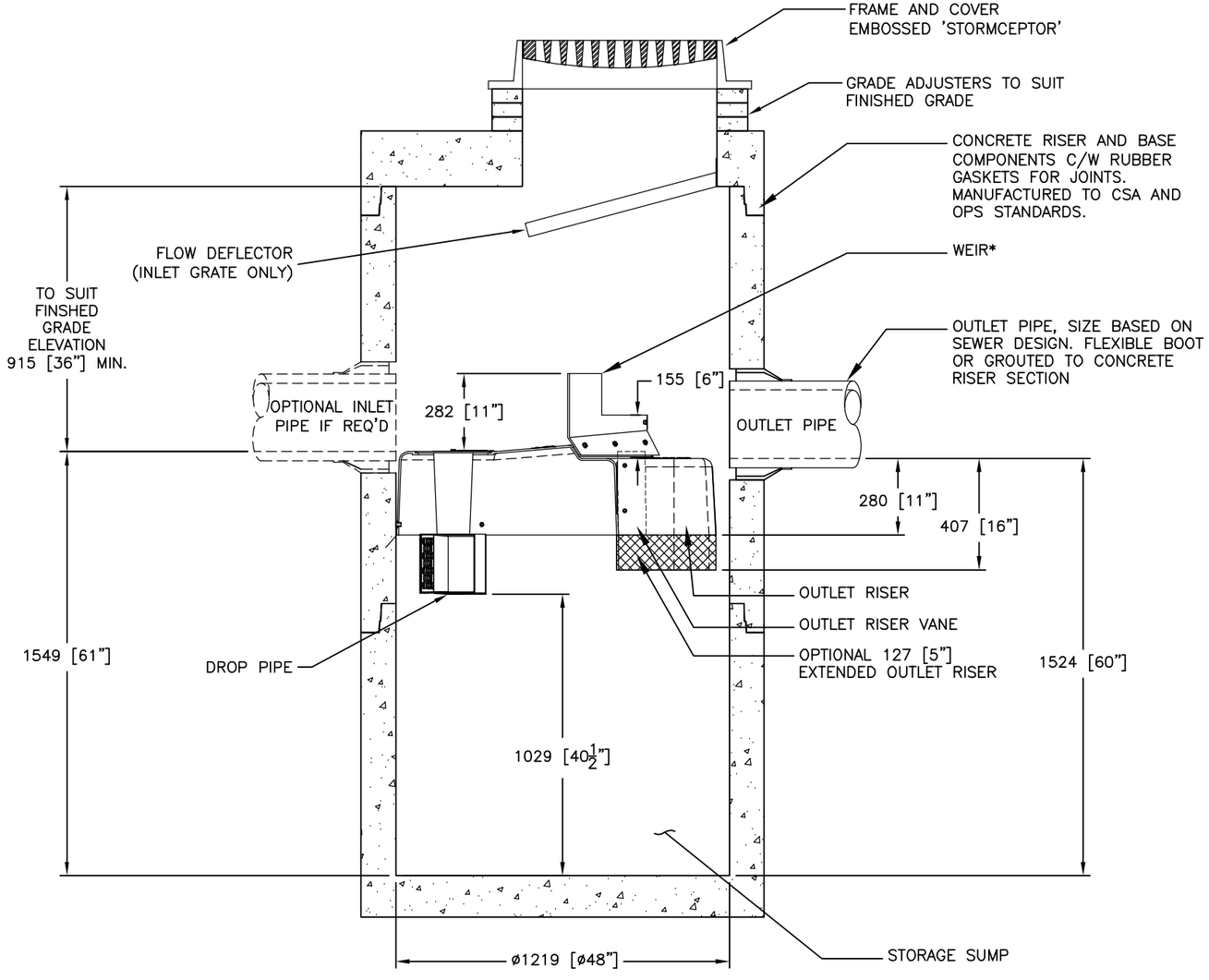
Areais conveyed to OGS that provides 50% TSS removal and Infiltration Tank #1 for additional 80% removal

Bioswale		
Area =	0.09	ha
%TSS Removal of OGS	96.00	

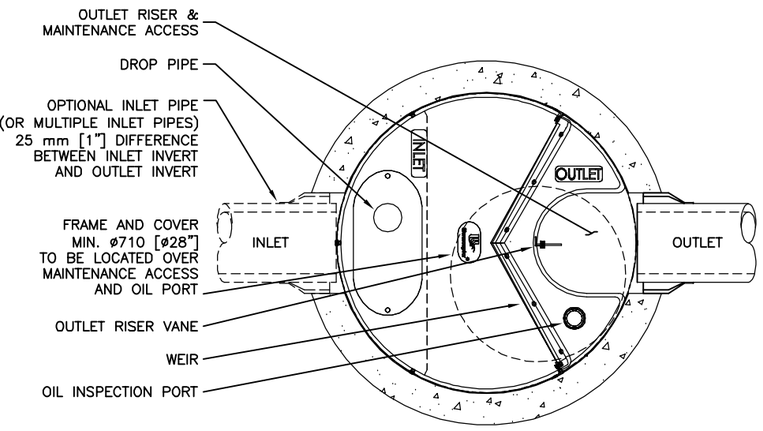
Area is clean roof and landscaped drainage (considered 80% TSS removed) and is conveyed to Bioswale for additional 80% removal

Area (ha)	LID Train	%TSS Removal	Area * %TSS Removal
0.110	Clean+OGS+Infiltration	0.98	0.108
0.150	OGS+Infiltration	0.90	0.135
0.090	Clean + Bioswale	0.96	0.086
0.350			**0.329**

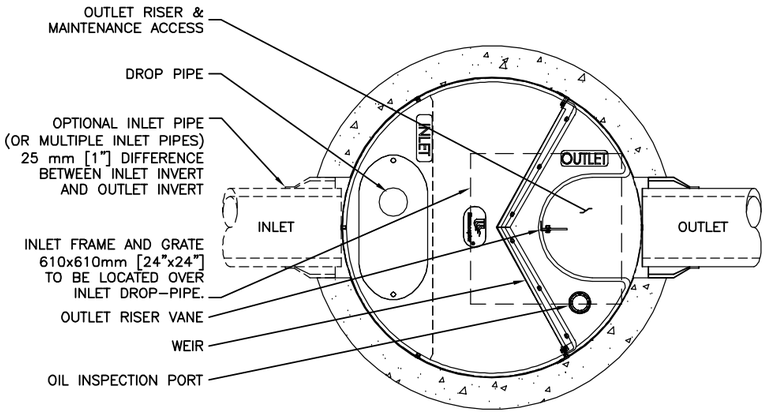
Total %TSS Removal	**94%**



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF4 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO4 (OIL CAPTURE CONFIGURATION). WEIR HEIGHT IS 150 mm (6 INCH) FOR EF04.

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

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 STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO4
STRUCTURE ID	*
HYDROCARBON STORAGE REQ'D (L)	*
WATER QUALITY FLOW RATE (L/s)	*
PEAK FLOW RATE (L/s)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
DRAINAGE AREA (HA)	*
DRAINAGE AREA IMPERVIOUSNESS (%)	*

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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MARK	DATE	REVISION DESCRIPTION	BY
1	6/8/18	UPDATES	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON, L1N 9A9
TF 800-565-4501 CA 416-800-9000 INTL +1-416-800-9000

DATE: 10/13/2017

DESIGNED:	DRAWN:
JSK	JSK
CHECKED:	APPROVED:
BSF	SP
PROJECT No.:	SEQUENCE No.:
EFO4	*

SHEET: 1 OF 1

Stormceptor®

Rinker MATERIALS™

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/21/2024

Province:	Ontario
City:	Burlington
Nearest Rainfall Station:	HAMILTON RBG CS
Climate Station Id:	6153301
Years of Rainfall Data:	20

Site Name:	

Drainage Area (ha):	0.41
% Imperviousness:	100.00

Runoff Coefficient 'c': 0.90

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

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	11.55
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	167.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	503
Estimated Average Annual Sediment Volume (L/yr):	409

Project Name:	490-508 Walkers Line
Project Number:	23911
Designer Name:	Ben Jackson
Designer Company:	KWA
Designer Email:	ben.cale.jackson@gmail.com
Designer Phone:	416-984-0970
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	86
EFO6	94
EFO8	97
EFO10	99
EFO12	100

Recommended Stormceptor EFO Model: EFO4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 86

Water Quality Runoff Volume Capture (%): > 90

imbrium

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 waterwavs.

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

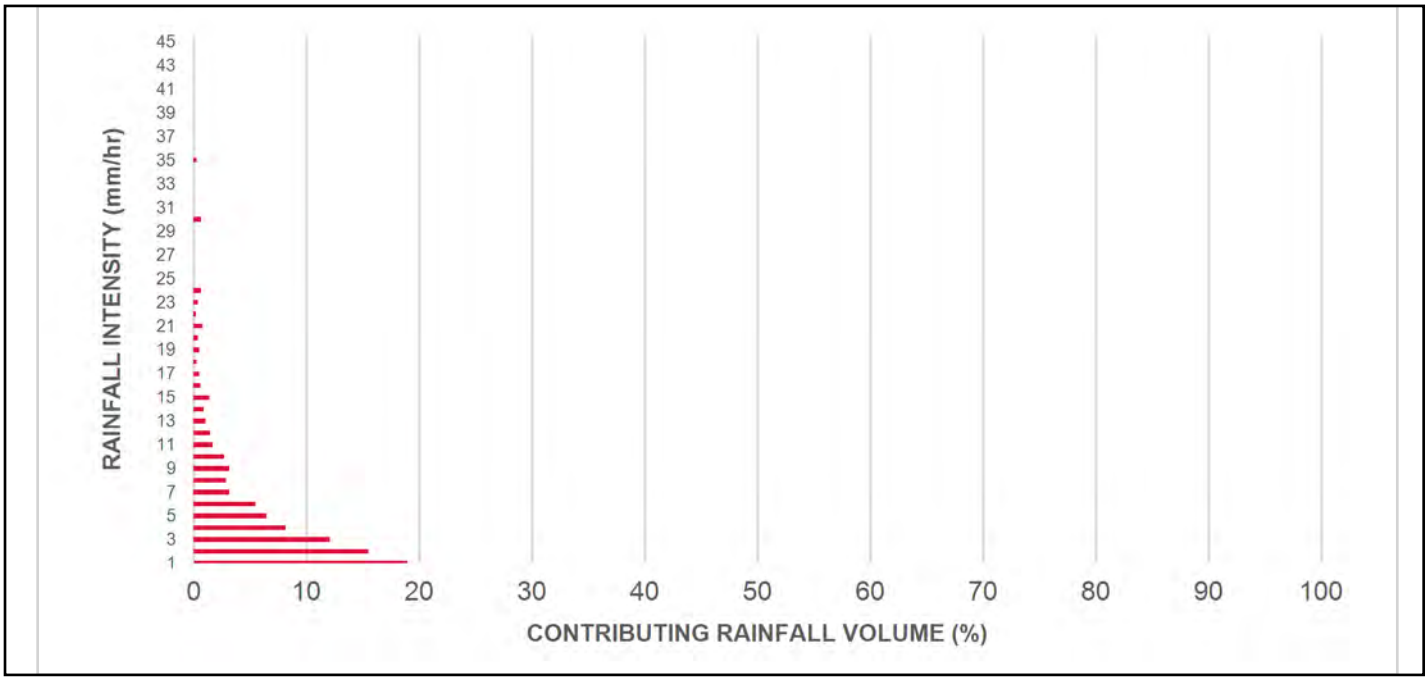
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Stormceptor® EF Sizing Report

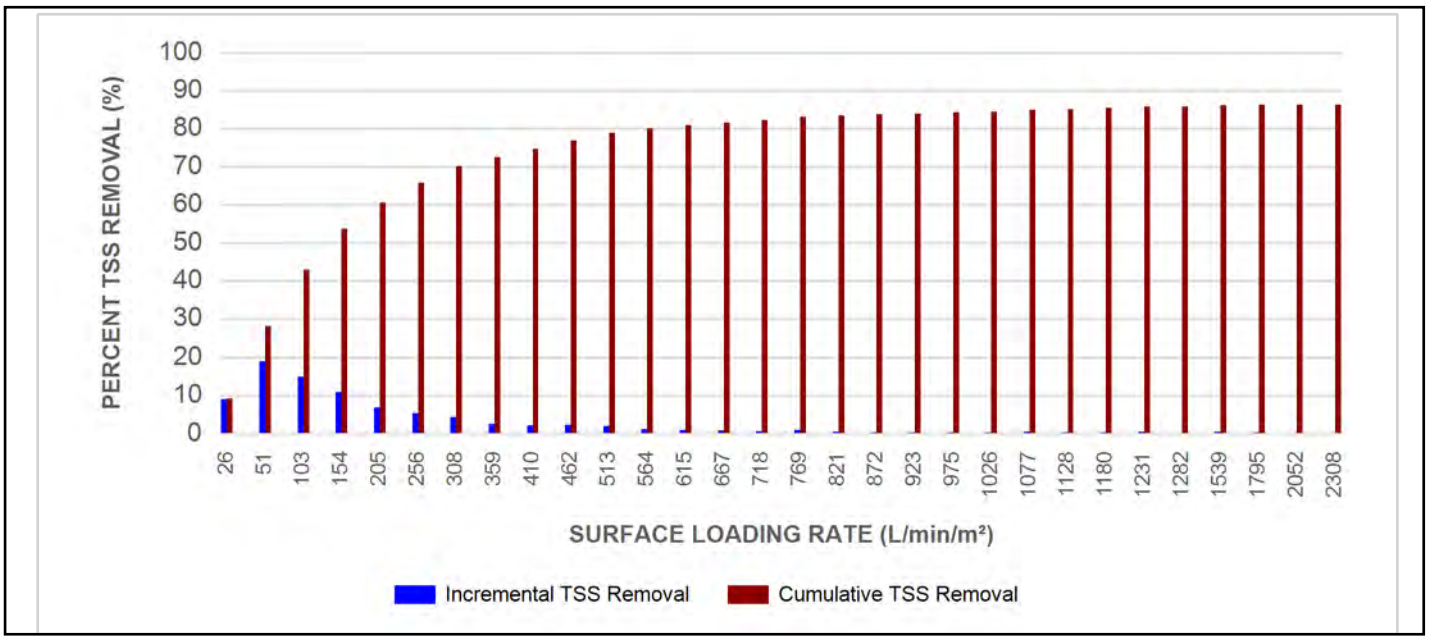
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.1	9.1	0.51	31.0	26.0	100	9.1	9.1
1.00	19.0	28.0	1.03	62.0	51.0	100	19.0	28.0
2.00	15.5	43.5	2.05	123.0	103.0	96	14.9	42.9
3.00	12.1	55.6	3.08	185.0	154.0	89	10.8	53.7
4.00	8.2	63.8	4.10	246.0	205.0	83	6.8	60.5
5.00	6.5	70.4	5.13	308.0	256.0	81	5.3	65.8
6.00	5.5	75.9	6.15	369.0	308.0	78	4.3	70.1
7.00	3.2	79.0	7.18	431.0	359.0	76	2.4	72.5
8.00	2.9	81.9	8.21	492.0	410.0	73	2.1	74.6
9.00	3.2	85.2	9.23	554.0	462.0	71	2.3	76.9
10.00	2.7	87.9	10.26	615.0	513.0	69	1.9	78.8
11.00	1.7	89.6	11.28	677.0	564.0	66	1.2	80.0
12.00	1.5	91.1	12.31	739.0	615.0	65	0.9	80.9
13.00	1.1	92.2	13.34	800.0	667.0	64	0.7	81.6
14.00	0.9	93.1	14.36	862.0	718.0	64	0.6	82.2
15.00	1.4	94.5	15.39	923.0	769.0	63	0.9	83.1
16.00	0.6	95.1	16.41	985.0	821.0	63	0.4	83.5
17.00	0.5	95.6	17.44	1046.0	872.0	63	0.3	83.8
18.00	0.3	95.9	18.46	1108.0	923.0	62	0.2	84.0
19.00	0.5	96.4	19.49	1169.0	975.0	62	0.3	84.3
20.00	0.4	96.8	20.52	1231.0	1026.0	61	0.2	84.5
21.00	0.8	97.6	21.54	1293.0	1077.0	60	0.5	85.0
22.00	0.2	97.8	22.57	1354.0	1128.0	59	0.1	85.1
23.00	0.4	98.2	23.59	1416.0	1180.0	57	0.2	85.4
24.00	0.7	98.9	24.62	1477.0	1231.0	56	0.4	85.8
25.00	0.0	98.9	25.65	1539.0	1282.0	55	0.0	85.8
30.00	0.7	99.7	30.77	1846.0	1539.0	48	0.4	86.1
35.00	0.3	100.0	35.90	2154.0	1795.0	41	0.1	86.3
40.00	0.0	100.0	41.03	2462.0	2052.0	36	0.0	86.3
45.00	0.0	100.0	46.16	2770.0	2308.0	32	0.0	86.3
Estimated Net Annual Sediment (TSS) Load Reduction =								**86 %**

Climate Station ID: 6153301 *Years of Rainfall Data*: 20

RAINFALL DATA FROM HAMILTON RBG CS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL
FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance 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

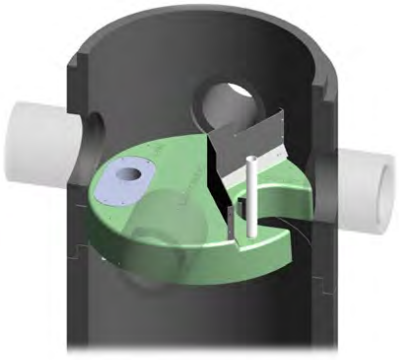
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

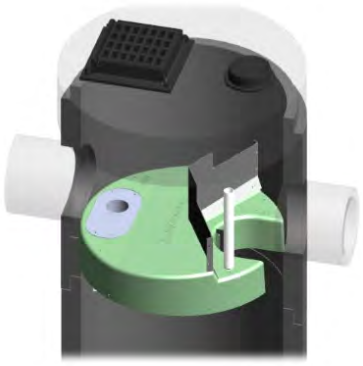
DESIGN FLEXIBILITY

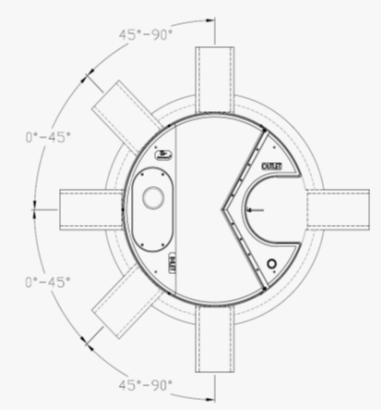
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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







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 EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(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/ft^3)

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

imbrium

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** S**eparators**

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^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 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

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 of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

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^2.

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^2 to 2600 L/min/m^2) 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.

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Stormceptor® EF and EFO Oil-Grit Separators

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

Registration: GPS-ETV_VR2020-11-15_Imbrium-SC

In accordance with

ISO 14034:2016

Environmental management —
Environmental technology verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

November 15, 2020
Vancouver, BC, Canada

GLOBE PERFORMANCE SOLUTIONS

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

Technology description and application

The Stormceptor® EF and EFO are treatment devices designed to remove oil, sediment, trash, debris, and pollutants attached to particulates from Stormwater and snowmelt runoff. The device takes the place of a conventional manhole within a storm drain system and offers design flexibility that works with various site constraints. The EFO is designed with a shorter bypass weir height, which accepts lower surface loading rate into the sump, thereby reducing re-entrainment of captured free floating light liquids.

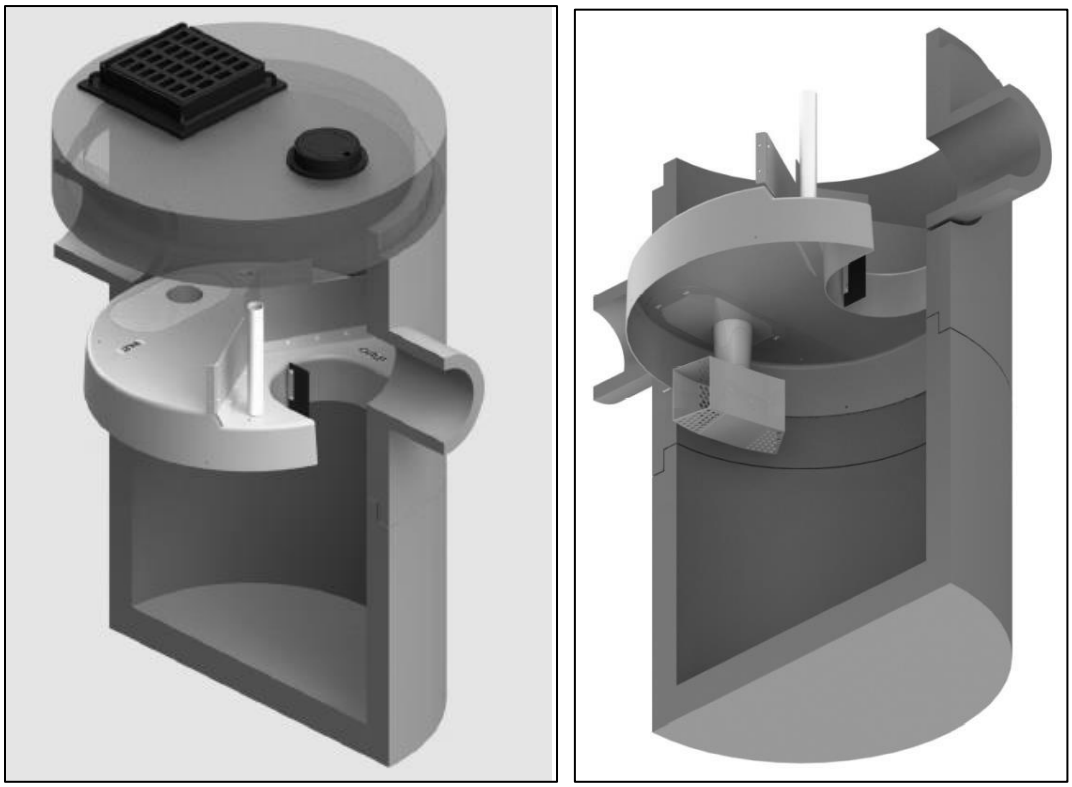


Figure 1. Graphic of typical inline Stormceptor® unit and core components.

Stormwater and snowmelt runoff enters the Stormceptor® EF/EFO's upper chamber through the inlet pipe(s) or a surface inlet grate. An insert divides the unit into lower and upper chambers and incorporates a weir to reduce influent velocity and separate influent (untreated) from effluent (treated) flows. Influent water ponds upstream of the insert's weir providing driving head for the water flowing downwards into the drop pipe where a vortex pulls the water into the lower chamber. The water diffuses at lower velocities in multiple directions through the drop pipe outlet openings. Oil and other floatables rise up and are trapped beneath the insert, while sediments undergo gravitational settling to the sump's bottom. Water from the sump can exit by flowing upward to the outlet riser onto the top side of the insert and downstream of the weir, where it discharges through the outlet pipe.

Maximum flow rate into the lower chamber is a function of weir height and drop pipe orifice diameter. The Stormceptor® EF and EFO are designed to allow a surface loading rate of 1135 L/min/m^2 (27.9 gal/min/ft^2) and 535 L/min/m^2 (13.1 gal/min/ft^2) into the lower chamber, respectively. When prescribed surface loading rates are exceeded, ponding water can overtop the weir height and bypass the lower treatment chamber, exiting directly through the outlet pipe. Hydraulic testing and scour testing demonstrate that the internal bypass effectively prevents scour at all bypass flow rates. Increasing the bypass flow rate does not increase the orifice-controlled flow rate into the lower treatment chamber where sediment is stored. This internal bypass feature allows for in-line installation, avoiding the cost of

additional bypass structures. During bypass, treatment continues in the lower chamber at the maximum flow rate. The Stormceptor® EFO's lower design surface loading rate is favorable for minimizing re-entrainment and washout of captured light liquids. Inspection of Stormceptor® EF and EFO devices is performed from grade by inserting a sediment probe through the outlet riser and an oil dipstick through the oil inspection pipe. The unit can be maintained by using a vacuum hose through the outlet riser.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Imbrium Systems Inc.'s Stormceptor® EF4 and EFO4 Oil-Grit Separators, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test[a]:

During the capture test, the Stormceptor® EF4 OGS device, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 46, 44, and 49 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Stormceptor® EFO4, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 42, 40, and 34 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Scour test[a]:

During the scour test, the Stormceptor® EF4 and Stormceptor® EFO4 OGS devices, with 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, generate corrected effluent concentrations of 4.6, 0.7, 0, 0.2, and 0.4 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test[a]:

During the light liquid re-entrainment test, the Stormceptor® EFO4 OGS device with surrogate low-density polyethylene beads preloaded within the lower chamber oil collection zone, representing a floating light liquid volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.5, 99.8, 99.8, and 99.9 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2.

[a] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition.

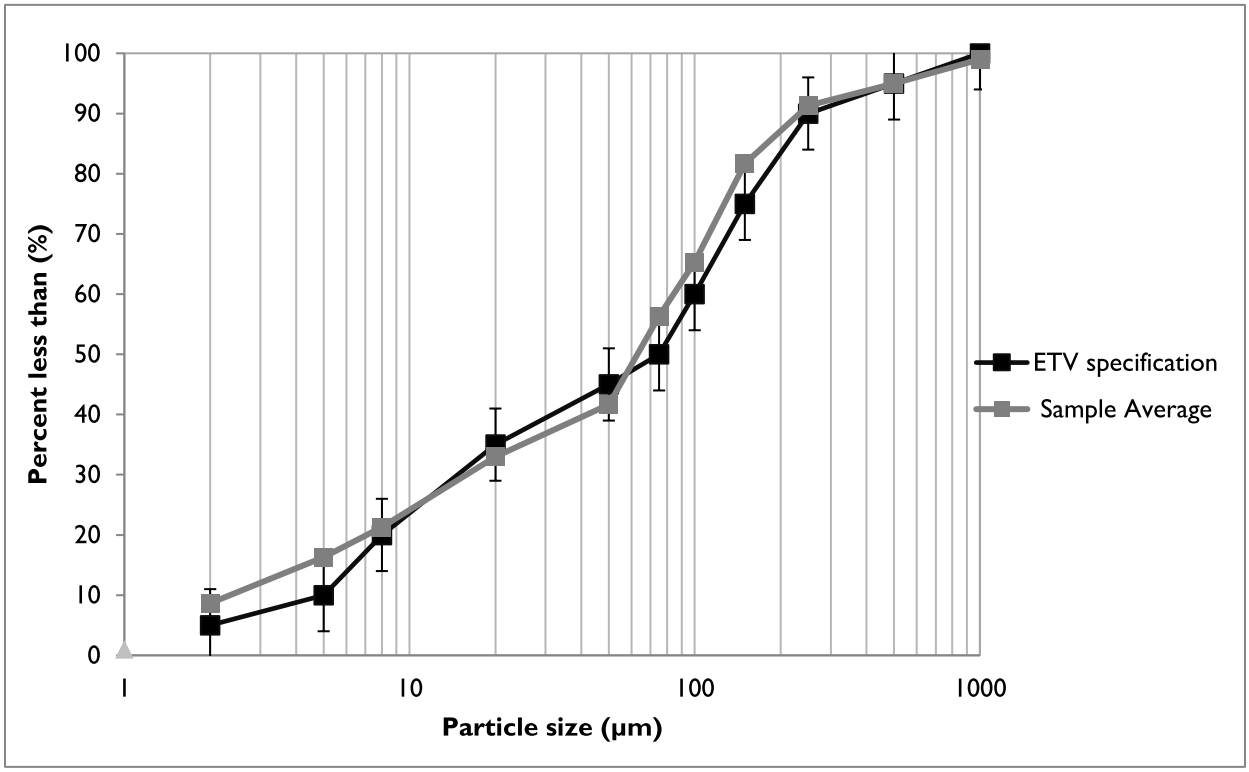


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1). Since the EF and EFO models are identical except for the weir height, which bypasses flows from the EFO model at a surface loading rate of 535 L/min/m^2 (13.1 gpm/ft^2), sediment capture tests at surface loading rates from 40 to 400 L/min/m^2 were only performed on the EF unit. Surface loading rates of 600, 1000, and 1400 L/min/m^2 were tested on both units separately. Results for the EFO model at these higher flow rates are presented in Table 2.

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and may be attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory

analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" (see Table 1 and 2) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) of the EF4 at specified surface loading rates

Particle size fraction (µm)	**Surface loading rate (L/min/m²)**						
	40	80	200	400	600	1000	1400
>500	90	58	58	100*	86	72	100*
250 - 500	100*	100*	100	100*	100*	100*	100*
150 - 250	90	82	26	100*	100*	67	90
105 - 150	100*	100*	100*	100*	100*	100*	100
75 - 105	100*	92	74	82	77	68	76
53 - 75	Undefined [a]	56	100*	72	69	50	80
20 - 53	54	100*	54	33	36	40	31
8 - 20	67	52	25	21	17	20	20
5 – 8	33	29	11	12	9	7	19
<5	13	0	0	0	0	0	4
All particle sizes by mass balance	**70.4**	**63.8**	**53.9**	**47.5**	**46.0**	**43.7**	**49.0**

[a] An outlier in the feed sample sieve data resulted in a negative removal efficiency for this size fraction.
* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 171% (average 128%). See text and Bulletin # CETV 2016-11-0001 for more information.

Table 2. Removal efficiencies (%) of the EFO4 at surface loading rates above the bypass rate of 535 L/min/m²

Particle size fraction (µm)	**Surface loading rate (L/min/m²)**		
	600	1000	1400
>500	89	83	100*
250 - 500	90	100*	92
150 - 250	90	67	100*
105 - 150	85	92	77
75 - 105	80	71	65
53 - 75	60	31	36
20 - 53	33	43	23
8 - 20	17	23	15
5 – 8	10	3	3
<5	0	0	0
All particle sizes by mass balance	**41.7**	**39.7**	**34.2**

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 103 and 111% (average 107%). See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the EF4 at each of the tested surface loading rates. Figure 4 shows the same graph for the EFO4 unit at surface loading rates above the bypass rate of 535 L/min/m².

APPENDIX D

Design Drawings

WALKERS LINE

EX. CENTRELINE

EX. MH 1
INV N: 90.403
INV S: 90.283

675mm DIA. CONC (65-D) STM. @ 0.54%

EX. MH 2
INV N: 89.917
INV S: 89.917

675mm DIA. CONC (65-D) STM. @ 0.66%

EX. CURB

EX. CONCRETE SIDEWALK

LIMIT OF DEVELOPMENT

EX. GRAVEL DRIVEWAY

EX. 1 STOREY BRICK DWELLING NO. 508

EX. 2 STOREY BRICK DWELLING NO. 496

EX. ASPHALT DRIVEWAY

EX. 1 STOREY BRICK DWELLING NO. 490

EX. DECK

EX. PERGOLA

EX. CONCRETE PAD

EX. SHED

EXT
A= 0.18
C= 0.37

100
A= 0.12
C= 0.50

101
A= 0.28
C= 0.33

DRAINAGE FROM TRIBUTARY 101 IS CONVEYED TO SOUTHWEST CORNER OF EXISTING 490 WALKERS LINE

LEGEND

- EXISTING STORM SEWER
- EXISTING STORM MANHOLE
- EXISTING CATCHBASIN
- EXISTING DOUBLE CATCHBASIN
- TRIBUTARY NAME
- AREA (HA)
- RUNOFF COEFFICIENT
- DRAINAGE BOUNDARY
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING GROUND CONTOUR
- PROPERTY BOUNDARY

REVISION BLOCK

#	DATE	DESCRIPTION
1.	03/28/24	ISSUED FOR ZBA
2.	11/15/24	ISSUED FOR ZBA

REGISTERED PROFESSIONAL ENGINEER
B.JACKSON
100210382
Nov. 15, 2024
PROVINCE OF ONTARIO

KWA SITE DEVELOPMENT CONSULTING INC.
4063 Mainway Drive
Burlington, ON L7L 7A9

NORTH ARROW

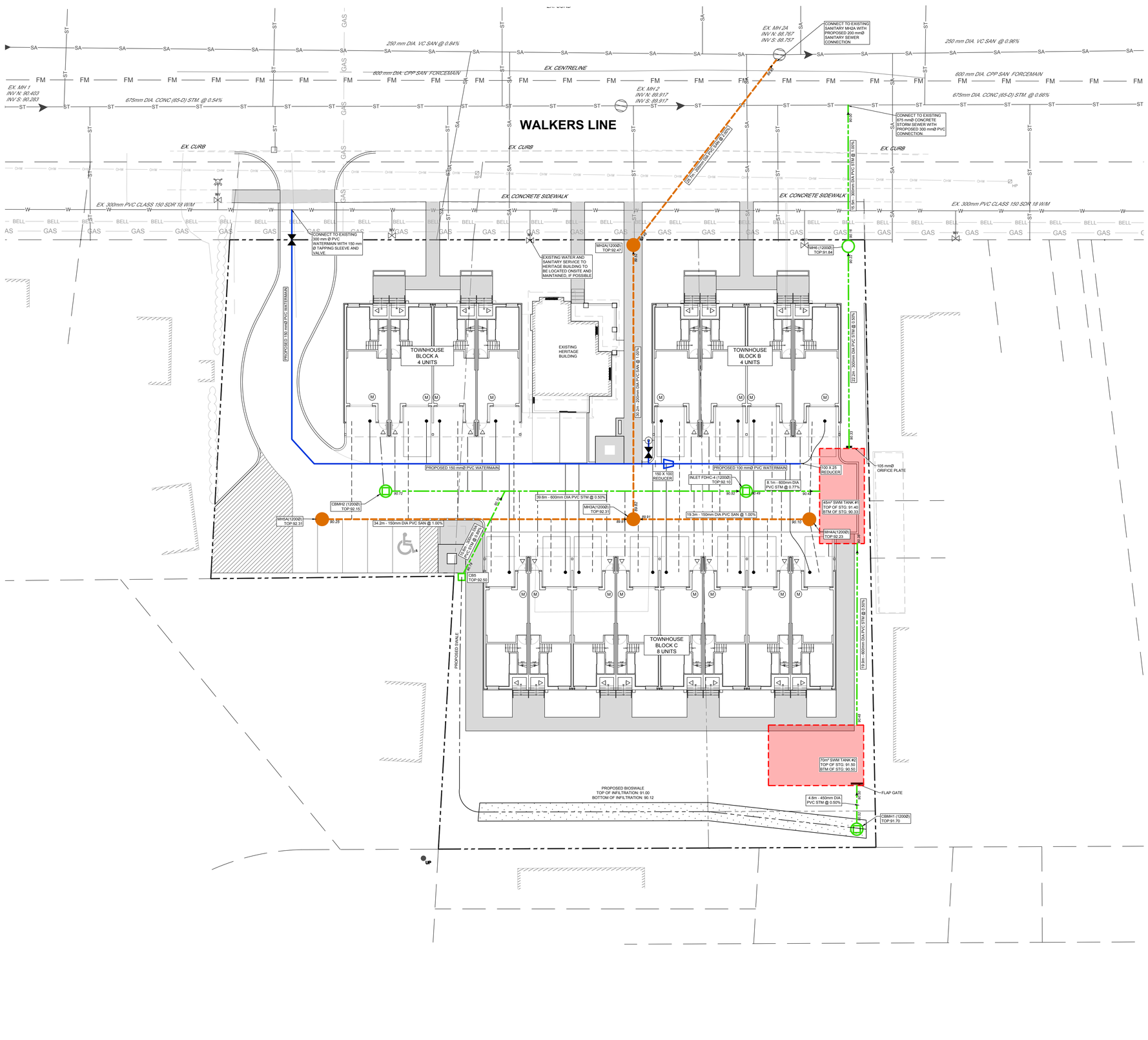
METRIC SCALE
0 5 10 Meters
1:200

EXISTING DRAINAGE PLAN

HAIDER AL-DABBAGH
2381792 ONTARIO LTD.
490-508 WALKERS LINE
BURLINGTON, ON

PROJECT No: 2311 | DRAWN BY: BJ | CHECKED BY: RA

EDP



LEGEND

- PROPOSED STORM SEWER (INVERTS AS SHOWN)
- PROPOSED STORM MANHOLE (SIZE AS SHOWN)
- PROPOSED STORM CATCHBASIN MANHOLE (SIZE AS SHOWN)
- PROPOSED CATCHBASIN
- PROPOSED STORM SERVICE CONNECTION
- EXISTING STORM SEWER
- EXISTING STORM MANHOLE
- EXISTING CATCHBASIN
- PROPOSED SANITARY SEWER (INVERTS AS SHOWN)
- PROPOSED SANITARY MANHOLE (SIZE AS SHOWN)
- PROPOSED SANITARY SERVICE CONNECTION (5" DR 28)
- EXISTING SANITARY SEWER
- EXISTING SANITARY MANHOLE
- PROPOSED WATERMAIN
- PROPOSED WATER SERVICE CONNECTION WITH CURB STOP(1" TYPE K)
- PROPOSED VALVE AND BOX
- PROPOSED HYDRANT
- EXISTING WATERMAIN
- EXISTING HYDRANT
- EXISTING VALVE AND BOX
- WATER METER (ACTUAL LOCATION MAY DIFFER)
- PROPERTY LIMIT
- PROPOSED SWALE

REVISION BLOCK

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REGISTERED PROFESSIONAL ENGINEER
B.JACKSON
100210382
Nov. 15, 2024
PROVINCE OF ONTARIO

KWA SITE DEVELOPMENT CONSULTING INC.
2263 Meadowpine Blvd
Burlington, ON L7L 7A9

NORTH ARROW

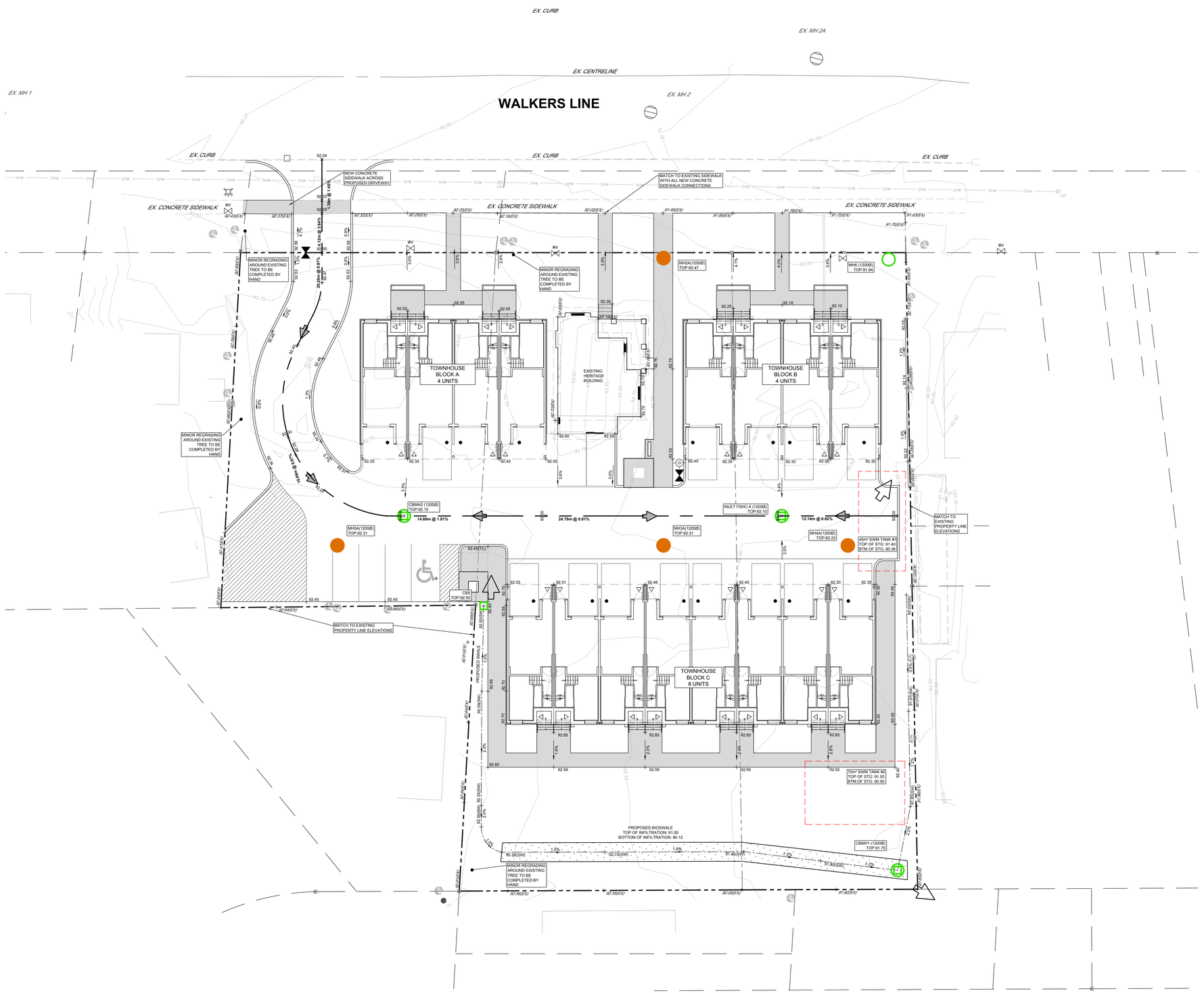
METRIC SCALE
0 5 10
1:200
Meters

SITE SERVICING PLAN

HAIDER AL-DABBAGH
2381792 ONTARIO LTD.
490-508 WALKERS LINE
BURLINGTON, ON

CHECKED BY: RA
DRAWN BY: BJ
PROJECT No: 23911

SSP



LEGEND

- 100.00 — PROPOSED ELEVATION
- 100.00 (TC) — PROPOSED TO OF CURB ELEVATION
- 100.00(SW) — PROPOSED SWALE ELEVATION
- *100.00(EX)* — EXISTING ELEVATION
- PROPOSED STORM MANHOLE (SIZE AS SHOWN)
- PROPOSED STORM CATCHBASIN MANHOLE (SIZE AS SHOWN)
- PROPOSED CATCHBASIN
- PROPOSED OVERLAND FLOW ALONG CENTRELINE
- EMERGENCY OVERLAND FLOW DIRECTION
- MAXIMUM 3:1 SLOPE (UNLESS OTHERWISE NOTED)
- EXISTING STORM MANHOLE (SIZE AS SHOWN)
- EXISTING CATCHBASIN
- PROPOSED SANITARY MANHOLE (SIZE AS SHOWN)
- EXISTING SANITARY MANHOLE
- PROPOSED HYDRANT AND VALVE
- PROPOSED VALVE AND BOX
- EXISTING HYDRANT
- EXISTING VALVE AND BOX
- 100.00 — EXISTING CONTOUR
- PROPOSED BOTTOM OF SWALE
- PROPERTY LIMIT

REVISION BLOCK

#	DATE	DESCRIPTION
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REGISTERED PROFESSIONAL ENGINEER
B.JACKSON
100210382
Nov. 15, 2024
PROVINCE OF ONTARIO

KWA SITE DEVELOPMENT CONSULTING INC.
2055 Appleby Line, Unit 1
Burlington, ON L7L 7A9

NORTH ARROW

METRIC SCALE
0 5 10 Meters
1:200

SITE GRADING PLAN

HAIDER AL-DABBAGH
2381792 ONTARIO LTD.
490-508 WALKERS LINE
BURLINGTON, ON

CHECKED BY: RA
DRAWN BY: BJ
PROJECT No: 23811

SGP

EX. CENTRELINE

EX. MH 1
INV.IN: 90.403
INV.S: 90.283

0.54%

675mm DIA. CONC (65-D) STM. @ 0.54%

EX. MH 2
INV.IN: 89.917
INV.S: 89.917

675mm DIA. CONC (65-D) STM. @ 0.66%

WALKERS LINE

CONNECT TO EXISTING 675 mmØ CONCRETE STORM SEWER WITH PROPOSED 300 mmØ PVC CONNECTION.

EX. CURB

EX. CONCRETE SIDEWALK

WL
A= 0.05
C= 0.60

MH6 (1200Ø)
TOP:91.84

15.9m - 300mm DIA PVC STM @ 1.06%

22.2m - 300mm DIA PVC STM @ 0.50%

FDHC-4
A= 0.10
C= 0.90

105 mmØ ORIFICE PLATE

INLET FDHC-4 (1200Ø)
TOP:92.15

8.1m - 600mm DIA PVC STM @ 0.77%

45m³ SWM TANK
TOP OF STG: 91.40
BTM OF STG: 90.

EXT 1
A= 0.15
C= 0.37

CBMH2
A= 0.16
C= 0.90

CBMH2 (1200Ø)
TOP:92.15

39.6m - 600mm DIA PVC STM @ 0.50%

CB1
TOP:92.50

CB2
TOP:92.50

0.15 HA OF EXTERNAL AREA FROM EXT1 IS CAPTURED WITHIN CB5 AND CONTROLLED VIA ONSITE SEWERS.

PROPOSED BIOSWALE

15.9m - 600mm DIA PVC STM @ 0.50%

CBMH1
A= 0.09
C= 0.38

70m³ SWM TANK #2
TOP OF STG: 91.50
BTM OF STG: 90.50

PROPOSED BIOSWALE
TOP OF INFILTRATION: 91.00
BOTTOM OF INFILTRATION: 90.12

4.8m - 450mm DIA PVC STM @ 0.50%

FLAP GATE

CBMH1 (1200Ø)
TOP:91.70

EXT 2
A= 0.03
C= 0.37

UP

0.03 HA OF EXTERNAL AREA FROM EXT2 IS CAPTURED WITHIN CBMH1 AND CONTROLLED VIA ONSITE SEWERS.

LEGEND

- PROPOSED STORM SEWER (INVERTS AS SHOWN) — 100.00 / 100.00
- PROPOSED STORM MANHOLE (SIZE AS SHOWN)
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCHBASIN
- EXISTING STORM SEWER — ST — ST
- EXISTING STORM MANHOLE
- EXISTING CATCHBASIN
- EXISTING DOUBLE CATCHBASIN
- TRIBUTARY NAME — CBMH1
- AREA (HA) — A= 0.09
- RUNOFF COEFFICIENT — C= 0.38
- DRAINAGE BOUNDARY
- PROPERTY BOUNDARY

REVISION BLOCK

#	DATE	DESCRIPTION
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2.	11/15/24	ISSUED FOR ZBA

REGISTERED PROFESSIONAL ENGINEER
B.JACKSON
100210382
Nov. 15, 2024
PROVINCE OF ONTARIO

KWA SITE DEVELOPMENT CONSULTING INC.
2233 Argentia Rd, Suite 201
Burlington, ON L7L 7A9

NORTH ARROW

METRIC SCALE
0 5 10 Meters
1:200

PROPOSED DRAINAGE PLAN

HAIDER AL-DABBAGH
2381792 ONTARIO LTD.
490-508 WALKERS LINE
BURLINGTON, ON

PROJECT No: 23911 | DRAWN BY: BJ | CHECKED BY: RA

PDP