TOWN OF CALEDON
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AGNES STREET SUBDIVISION, TOWN OF ALTON, ON

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

FEBRUARY 9, 2026
PROJECT 20-731



PREPARED BY
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PREPARED FOR
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Prepared and Reviewed by:





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1.0 INTRODUCTION

Greck and Associates Limited has been retained by The Alton Development Inc. (The Client) to prepare a Functional Servicing and Stormwater Management Report (FSSR) for a proposed subdivision on Agnes Street located in village of Alton, ON (Subject Property) in support of the proposed development of a condominium townhouse complex with 14 residential blocks and 65 units.

This report provides an overview of the proposed development plans and examines their functional serviceability, including requirements and proposed design works related to:

- General site grading
- Water distribution
- Sanitary Servicing
- Major and minor stormwater drainage systems
- Stormwater management; and
- Construction erosion and sediment control

This functional servicing report has been prepared in accordance with accepted engineering practices and criteria from the governing approval agencies, including the Town of Caledon (Town), Region of Peel (Region), Credit Valley Conservation (CVC), and Ministry of Environment, Conservation & Parks (MECP). Following the submission and review of this document, and approval of the current re-zoning and Draft Plan of Subdivision applications, detailed design plans, including supporting reports and drawings, will be prepared and submitted to the above-noted agencies for review and approvals, as required.

In summary, from the completed site servicing, grading, and stormwater management engineering designs, it has been determined that the development can be serviced with existing and proposed infrastructure in accordance with policies and guidelines required by the regulating agencies.

1.1 BACKGROUND

1.1.1 SITE LOCATION AND DESCRIPTION

The subject property is located in Alton, Ontario, southwest of the Queen Street West and Agnes Street intersection. The subject property is 4.05ha in size and is mainly comprised of undeveloped grass fields.

The subject property is an infill development that is bound by the residential dwellings along Queen Street West, Agnes Street, Davis Drive and Emeline Street to the north, east, south, and west respectively. Overall access to the subject property is currently via

an existing driveway on Agnes Street. Tree lines exist along portions of the south and north limits of the property.

A topographic survey conducted by Van Harten Surveying was completed for the proposed development on July 25th, 2018. The existing property slopes from the south limit to the north at an average slope of approximately 2.8%, directing most of the major overland flow towards Agnes Street right-of-way.

The concept plan and topographic survey are provided in **Appendix A**. Please see **Figure 1** for the site location plan.

1.1.2 SOIL CONDITIONS

Englobe (previously Terraprobe) prepared a Geotechnical Investigation dated December 5, 2024, and a Hydrogeological Investigation Septic Impact Assessment dated October 15, 2025. The work included drilling eight (8) boreholes equipped with monitoring wells to boreholes 2, 5, and 8 spread throughout the subject property. The soil conditions within the limits of the subject property consist primarily of the following:

- A surficial topsoil layer with a measured thickness of 150mm to 600mm.
- Fill consisting predominantly of silt fine sand with trave gravel and topsoil was encountered immediately beneath the ground covers in Boreholes 2,5,6,7, and 8. The fill extended to a depth generally varying from 0.8m to 2.1m below ground.
- Boreholes 1,5, and 6 penetrated a stratum of silty fine sand to depths ranging from 2.1m to 4.0m below ground.
- A deposit of silt sand and gravel with cobbles and boulders was encountered in all boreholes beneath the filly and silty fine sand to depths of about 2.5m to 6.7m below ground.

As shown within the Hydrogeological Investigation, monitoring wells were installed in boreholes 2, 5, and 8, and groundwater measurements were taken from March 4, 2019, to August 9, 2019. The seasonal high groundwater table at the site ranged from 1.1m to 6.4m below ground surface. The groundwater flow direction is easterly towards Shaw's Creek. The groundwater elevation considered for the stormwater design is 414.20m.

The geotechnical report and hydrogeological report both prepared by Englobe are submitted under separate cover and included in the submission package.

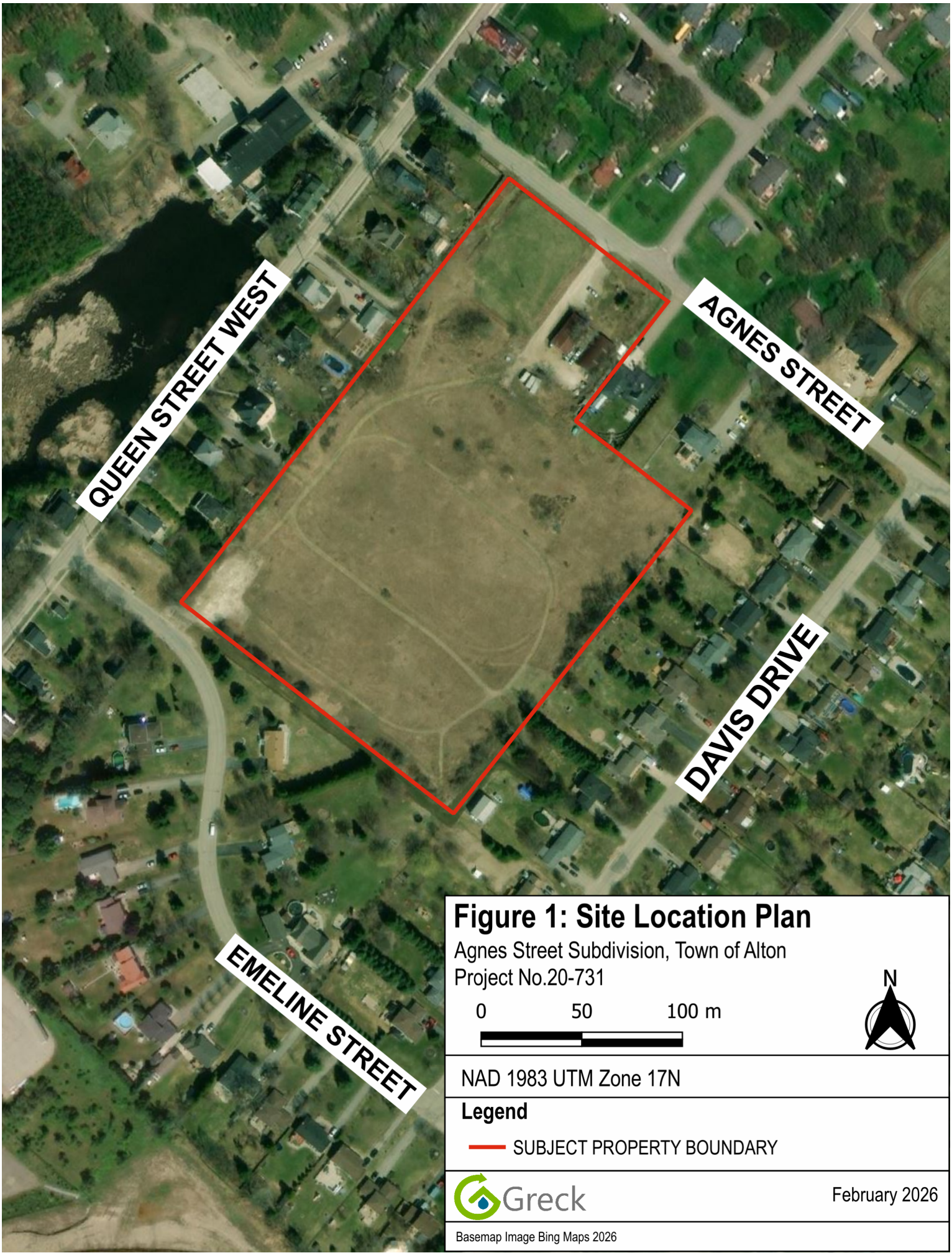


Figure 1: Site Location Plan

Agnes Street Subdivision, Town of Alton
Project No.20-731

0 50 100 m

N

NAD 1983 UTM Zone 17N

Legend

SUBJECT PROPERTY BOUNDARY

Greck

February 2026

Basemap Image Bing Maps 2026

2.0 PROPOSED DEVELOPMENT

The proposed development consists of fourteen (14) blocks of townhomes with a total of sixty-five (65) townhouse units and one common elements block consisting of a 6.0m wide private roadway, 16 above ground visitor parking spaces, combined common amenity/stormwater management (SWM) area and open space area. The proposed development will be built on 4.047ha of vacant land. A concept plan of the proposed development prepared by Orchard Design Studio Inc. can be found in **Appendix A**.

As per Region of Peel criteria, the proposed development design population is considered based on the number of units provided in **Table 2-1.**

TABLE 2-1: PROPOSED DEVELOPMENT POPULATION BREAKDOWN

Type of Development	Population Density * (cap/unit)	No. Units	Equivalent Population
Townhouse	3.328	65	217
Total	-	65	217

* As per Region of Peel Development Charged Background Study, December 2020

The total design population is based on the number of units and was calculated to be 217 provided in **Appendix B**.

Currently, there is an existing 150mm diameter watermain located on Agnes Street and Emeline Street. The proposed development will be serviced internally by a new 200mm diameter PVC looped watermain connecting to the existing 150mm watermain on Emeline Street and to an upgraded 300mm watermain on Agnes Street. Refer to **Drawing SSP** provided in **Appendix F.**

Currently, there is no existing sanitary sewer infrastructure within the municipal right-of-way of the neighboring streets that bound the subject property. The proposed development will be serviced by septic beds and treatment system, for information regarding the sanitary servicing please refer to the septic design prepared by Gunnell Engineering (Gunnell) as shown in **Appendix C**.

For more details on the proposed water and sanitary services, please see Sections 5.0 and 6.0 below. Refer to the preliminary drawings provided in **Appendix F** and the Sewage System Report prepared by Gunnell Engineering in **Appendix C**.

As per the Town of Caledon's Consolidated Linear Infrastructure Environmental Compliant Approval (CLI ECA), a portion of Agnes Street will be urbanized to a 15m right-of-way (ROW). A separate design brief for the urbanization of Agnes Street has been submitted under separate cover.

3.0 SITE GRADING

As is typical with all development projects, earthmoving is required, to varying degrees, to achieve the municipal design criteria and accommodate the development form.

A significant amount of fill is required due to the varying grade changes across the limits of the site, the amount of cover required for the underground infrastructure, and the grading requirements. Surface runoff from the site will drain overland to catch basins into the proposed storm sewer system, ultimately discharging into the existing storm sewer system located on Agnes Street near the Queen Street and Agnes Street intersection. In order to accommodate the proposed development and adhere to municipal standards, the proposed grades will match to existing grades at the development limits.

A grading plan has been provided in **Drawing SGP**; see **Appendix F**. The plan will follow municipal design standards, as required considering the following key design factors:

- Provide positive drainage from above ground structures/buildings,
- Match external grades,
- Meet minimum and maximum grades for landscape, hardscape, and roadways.
- Achieve municipal lot grading criteria,
- Provide safe overland flow relief,
- Provide sufficient cover for underground infrastructure,
- Minimize grading and earthworks where necessary.

4.0 ROAD ACCESS

The proposed development will have two road access points: one from Agnes Street and another from Emeline Street. The Agnes access features a 6.0m wide two-way private roads connecting to a two-way internal P-loop. The second access is a 6.0m wide private road from Emeline Street. These roads will also function as fire routes for the development. A Traffic Impact Assessment (TIA) by Paradigm Engineering, which reviews traffic impacts and internal circulation, is submitted separately and included in the submission package.

The proposed development will have sidewalks on one side of the road and sidewalk connections to both Agnes Street and Emeline Street. The plan includes connecting the Agnes Street entrance with a sidewalk that extends north to Queen Street and south to the southern limit of the property on Agnes Street. The proposed infrastructure aims to provide accessibility and connectivity for pedestrians. Refer to **Drawing SGP**; see **Appendix F.**

Englobe has recommended a pavement design in the Geotechnical Investigation dated December 5, 2024; this report is submitted under separate cover and included in the

submission package. The minimum pavement structure for light duty and the heavy-duty pavement will be as follows in **Table 4-1: .**

TABLE 4-1: PAVEMENT STRUCTURE

	Light Duty	Heavy Duty
Material	**Thickness (mm)**	
Asphalt		
Surface Course (HL3)	40	45
Basecourse (HL8)	50	60
Total Asphalt Depth	90	105
Base		
Granular A Base (OPSS 1010) or 19mm Crusher Limestone	150	150
Granular B Type II Sub-Base (OPSS 1010) or 50mm Crusher Run Limestone	300	350
Total Depth	**540**	**605**

5.0 WATER SERVICING

This section serves to provide anticipated water demands and required fire flow calculations in support of functional servicing.

Greck obtained as-built drawings from the Region for the areas adjacent to the subject property. Based on the as-built information, the existing municipal watermain infrastructure is as follows:

- 150mm diameter watermain located in the Agnes Street right-of-way, approximately 1.8 m west from the centerline of the road.
- 150mm diameter watermain located along the south limit of the Emeline Street right-of-way

Existing fire hydrant locations near to the subject property are as follows:

- The nearest existing fire hydrant is located directly in front of subject property on the west side of Agnes Street.

5.1 WATER SUPPLY AND APPURTENANCES

The Region's as-built records indicate that there are 150mm diameter watermains within both the Agnes Street and Emeline Street right-of-ways. As mentioned in Section 2.0, water servicing for the proposed development will be supplied by a new 200mm diameter PVC looped watermain. The existing watermain from the proposed development to

Queen Street will be upgraded from 150mm to 300mm diameter following recommendations of the Region of Peel and connected to an existing 250mm watermain on Queen Street. At the subdivision entrance the replacement watermain will be connected to the more southerly stretch of the Agnes Street watermain with a 300x150 reducer.

The proposed 200mm PVC internal watermain will be connected to the upgraded 300mm watermain on Agnes Street and to the existing watermain on Emeline Street via a 250mm watermain under the proposed private road. The two new watermain connections will be accomplished by 250x300mm and 250x150mm cut-in-place tees on Agnes Street and Emeline Street respectively. The new set of 250mm valves to comply with Region's standards for valves at each tee-intersection. Water valves will be provided at the property line for the proposed development.

Four new hydrants are being proposed for 75m radius (minimum) hydrant coverage to provide fire protection for the development. The proposed hydrants will be connected to the proposed 200mm diameter looped internal watermain.

The nearest existing hydrant is located approximately 12m from the principal entrance of the proposed developed on the west side of Agnes Street. Please see **Drawing SSP** for the Servicing Plan provided in **Appendix F**, for the proposed watermain and hydrant layout.

5.1.1 DOMESTIC WATER DEMANDS

The design criteria used to determine the water demands were based on the Region of Peel Watermain Design Criteria, June 2010 and the Fire Underwriters Survey of Canada, 2020, as required.

Average Day Demand (ADD), Maximum Day Demand (MDD) and Peak Hour Demand (PHD) factors were calculated using demand peaking factors as per Region of Peel, Watermain Design Criteria, Section 2.3 Table 2.

Population values for the proposed development were based on Region of Peel Development Charges Background Study, December 2020, which outlines a population density of 3.328 per townhouse unit.

The estimated domestic water system demands for the proposed development of the subject property are summarized below in **Table 5-1**.

TABLE 5-1: PROJECT DOMESTIC WATER DEMANDS

Water Demand Rate	280L/capita/day
Theoretical Population	217
Maximum Day Factor	1.8
Peak Hour Factor	3
Average Daily Demand (ADD)	40.69L/min (0.68L/s)
Maximum Daily Demand (MDD)	73.24L/min (1.22L/s)
Peak Hour Daily Demand (PHD)	122.06L/min (2.03L/s)

A detailed breakdown of the calculated demands can be found in **Appendix B**.

5.1.2 FIRE FLOW DEMANDS

Fire demands have been calculated using the *Water Supply for Public Fire Protection* (2020) prepared by Fire Underwriters survey (FUS). In order to keep demand in line with available flows (195L/s) provided by the Region of Peel's hydraulic modeling assessment, a maximum gross floor area of the buildings between fire breaks or firewalls will be limited to 510m^2. The calculated fire flow demand has been established at 183.33L/s.

Detailed fire flow calculations are provided in **Appendix B**, and the results are summarized below in **Table 5-2**.

TABLE 5-2: RECOMMENDED FIRE FLOW

Proposed Building	Recommended Fire Flow (L/s)
Residential	183.33

From the fire flow calculations, it was determined that the recommended fire flow of 250.0L/s is required for the proposed development.

5.1.3 WATERMAIN HYDRAULIC ANALYSIS

Hydrant flow tests were conducted by BA Fire Safety at Agnes Street on August 22, 2022, and at Emeline Street on September 07, 2022. The results indicate an actual available maximum flow of 4182GPM (263.84L/s) at a residual pressure of 20psi. The results of the hydrant flow tests can be found in **Appendix B**.

A hydraulic analysis report (dated November 23, 2022) was completed by WSP to achieve the hydraulic requirements as prescribed by the MECP and the Region of Peel's design criteria. The report recommends upsizing of the existing 150mm watermain on Agnes Street that connects the proposed development to Queen Street to the proposed 250mm watermain. The assessment also recommends an additional 250mm connection from Emeline Street to the proposed 200mm looped watermain. The Watermain Hydraulic Analysis report is provided under a separate cover with this submission.

Peel Region's internal modeling with the recommended upgrades indicates a theoretical maximum available fire flow within the system of 195 L/s.

Based on the hydraulic analysis for the watermain network, it is confirmed that the existing 150mm watermain on Emeline Street and upgraded 250mm watermain on Agnes Street will provide sufficient pressure and flow to service the proposed development. Both actual measured flow and the calculated theoretical maximum available flow of 195 L/s are higher than the required fire flow demand of 183.33 L/s and total demand of 184.55 L/s. Therefore, the upgraded watermain network's capacity will be sufficient to meet the proposed development's water demands.

Following the Region's recent review, the existing watermain on Agnes Street will be upgraded from 150mm to 300mm, instead of 250mm, to meet the Region's requirements. The revised design drawings and the FSSR included in this submission reflect the upgraded 300mm watermain. However, the updated hydraulic assessment report will be provided during the detailed design stage.

6.0 SANITARY SERVICING

This section summarizes the existing and the proposed sanitary servicing systems in support of functional servicing.

6.1 EXISTING SANITARY SYSTEM

As-built drawings indicate that currently there is no existing sanitary sewer infrastructure within the municipal right-of-way of the neighboring streets that bound the subject property. There is no existing sanitary sewage collection or treatment infrastructure in any part of the village.

6.2 PROPOSED SANITARY SERVICING

Sanitary servicing for the proposed development will be accomplished by individual on-site sewage treatment systems and absorption beds serving each block of townhomes. The sewage treatment design has been completed by Gunnell Engineering for the proposed development. A Sewage System Design Report prepared by Gunnell Engineering, and the Hydrogeological Investigation and Septic Impact Assessment prepared by Englobe will be submitted under separate cover.

Refer to **Drawing SSP** for the Servicing Plan provided in **Appendix F** and the proposed sanitary layout is provided in **Drawing SP-1** by Gunnell for the septic design in **Appendix C**.

7.0 UTILITIES

The proposed development is located within the serviced area of the Village of Alton. Electrical, natural gas, and telecommunications infrastructure is available from the adjacent public road allowances. Existing overhead electrical lines traversing the property will need to be relocated as part of the development process. The developer has initiated the process with Hydro One Networks to relocate the overhead line to the public ROW and to close an existing easement that will no longer be required.

During the detailed engineering design stage, consultation with each of the service providers will be undertaken to provide them with specific load requirements for the development and proposed service entry locations. Detailed electrical, gas and utility design and coordination will be managed by a qualified engineer.

8.0 FOUNDATION DRAINAGE

A Hydrogeological Investigation Septic Impact Assessment was prepared by Englobe (October 15, 2025). As per the investigation, eight (8) boreholes were drilled on site to determine the underlying soils and four (4) of the eight boreholes were used for groundwater monitoring. The groundwater table is measured to be between an elevation of 409.8m – 415.8m. Depending on the season and location of the borehole, the groundwater was found range between 1.1m to 6.4m below the existing ground surface.

To keep the proposed block's footings dry from seepage, Englobe's geotechnical investigation (December 5, 2024) recommends perimeter foundation drains consisting of perforated pipe surrounded by a granular filter (minimum 150mm thick). The granular filter should consist of OPSS HL 8 Coarse Aggregate.

Additionally, this foundation drainage system may consist of perforated pipes, and an appropriately sized sump pump should be provided to accommodate water seepage. The sump pump completed with backflow preventor for each residential unit is to discharge foundation drainage into the storm sewer system via storm lateral proposed for each block.

Foundation dewatering (if any) and groundwater quality are to be confirmed during the detailed design stage of this project when foundation elevations are established.

9.0 SURFACE DRAINAGE

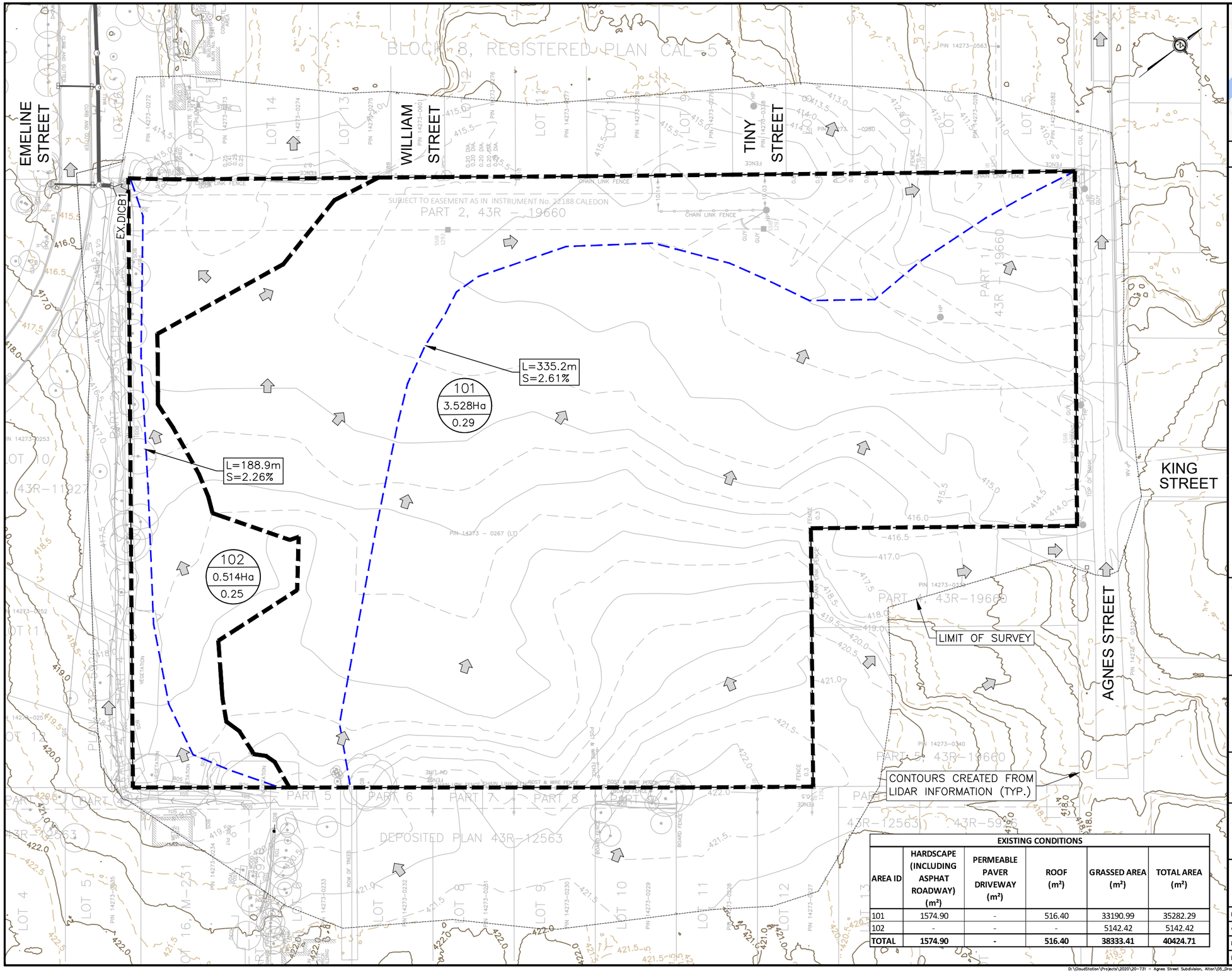
This section provides an outline of the preliminary drainage proposal strategy for the proposed site plan and areas affected by the development. The proposed design will be in accordance with the Town, CVC, and MECP standards and guidelines.

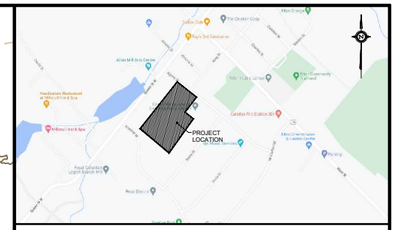
9.1 EXISTING DRAINAGE

Under existing conditions, the subject site has been delineated into two (2) drainage areas - Area 101 and Area 102:

- Area 101 (3.53ha) consists primarily of grassed open field and a driveway area. This catchment drains in the north direction towards Agnes Street and has an average slope of 2.6% along the longest drainage path. Runoff from this catchment discharges to a roadside ditch parallel to Agnes Street. The ditch ultimately discharges to Shaws Creek, downstream of Alton Mill Pond.
- Area 102 (0.51ha) consists of grassed open field. This catchment drains west towards Emeline Street and has an average slope of 2.3% along the longest drainage path. Runoff from this catchment drains to the ditch inlet catchbasin, the runoff is then piped along Queen Street and ultimately discharges to Shaws Creek, downstream of Alton Mill Pond.

Note that Shaws Creek is located approximately 122m north of the site. Please see **Figure 2** below for the pre-development drainage area plan.





KEY PLAN
N.T.S.

LEGEND

EXISTING	PROPOSED	
MH1	MH1	STORM MANHOLE
CBMH1	CBMH1	STORM CATCHBASIN MANHOLE
CB	CB	SINGLE CATCHBASIN
DCB	DCB	DOUBLE CATCHBASIN
FD	FD	SINGLE FLOOR DRAIN
		STORM SEWER
		STORM SEWER SYSTEM TO CONCRETE CISTERN AND OUTLET
		STORM SEWER SYSTEM TO GREENSTORM STORAGE
		LIMIT OF SUBJECT PROPERTY
		EASEMENT
		RIGHT OF WAY
		LOT LINE
		FENCE LINE
		CURB/SIDEWALK
		BUILDING
		RETAINING WALL
		MAJOR CONTOUR LABEL
		MINOR CONTOUR LABEL
		ASPHALT
		PAVING STONE
		1.5m WIDE CONCRETE SIDEWALK
		OVERLAND FLOW
		TREE
		TREE – TO REMAIN
		STORM DRAINAGE BOUNDARY
		LONGEST TRAVEL PATH
	3	DENOTES AREA NUMBER
	0.023Ha	DENOTES AREA IN HECTARES
	0.40	DENOTES RUNOFF COEFFICIENT

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONTOUR INTERVAL IS 0.50m.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
4. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT TOWN OF CALEDON STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
5. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY TOWN OF CALEDON, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

BENCHMARK

BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM. WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018

DEM SOURCE:
LIDAR DTM PEEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

EXISTING CONDITIONS

AREA ID	HARDSCAPE (INCLUDING ASPHAT ROADWAY) (m^2)	PERMEABLE PAVER DRIVEWAY (m^2)	ROOF (m^2)	GRASSED AREA (m^2)	TOTAL AREA (m^2)
101	1574.90	-	516.40	33190.99	35282.29
102	-	-	-	5142.42	5142.42
TOTAL	**1574.90**	**-**	**516.40**	**38333.41**	**40424.71**

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5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

CLIENT NAME:
THE ALTON DEVELOPMENTS INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:
AGNES STREET SUBDIVISION
AGNES STREET CALEDON, ON

DRAINAGE PLAN EXISTING CONDITIONS

DESIGNED BY: C.M.	SCALES:		PROJECT No. 20-731
CHECKED BY: J.C.	HORIZONTAL:	1:1000	DRAWING No. FIG. 2
DRAWN BY: C.M.	VERTICAL:	N/A	SHEET No.
DATE: FEB 10, 2026	SHEET SIZE:	11"x17"	

A summary of the pre-development land cover is provided below in **Table 9-1**.

TABLE 9-1: PREDEVELOPMENT LAND-USE SUMMARY

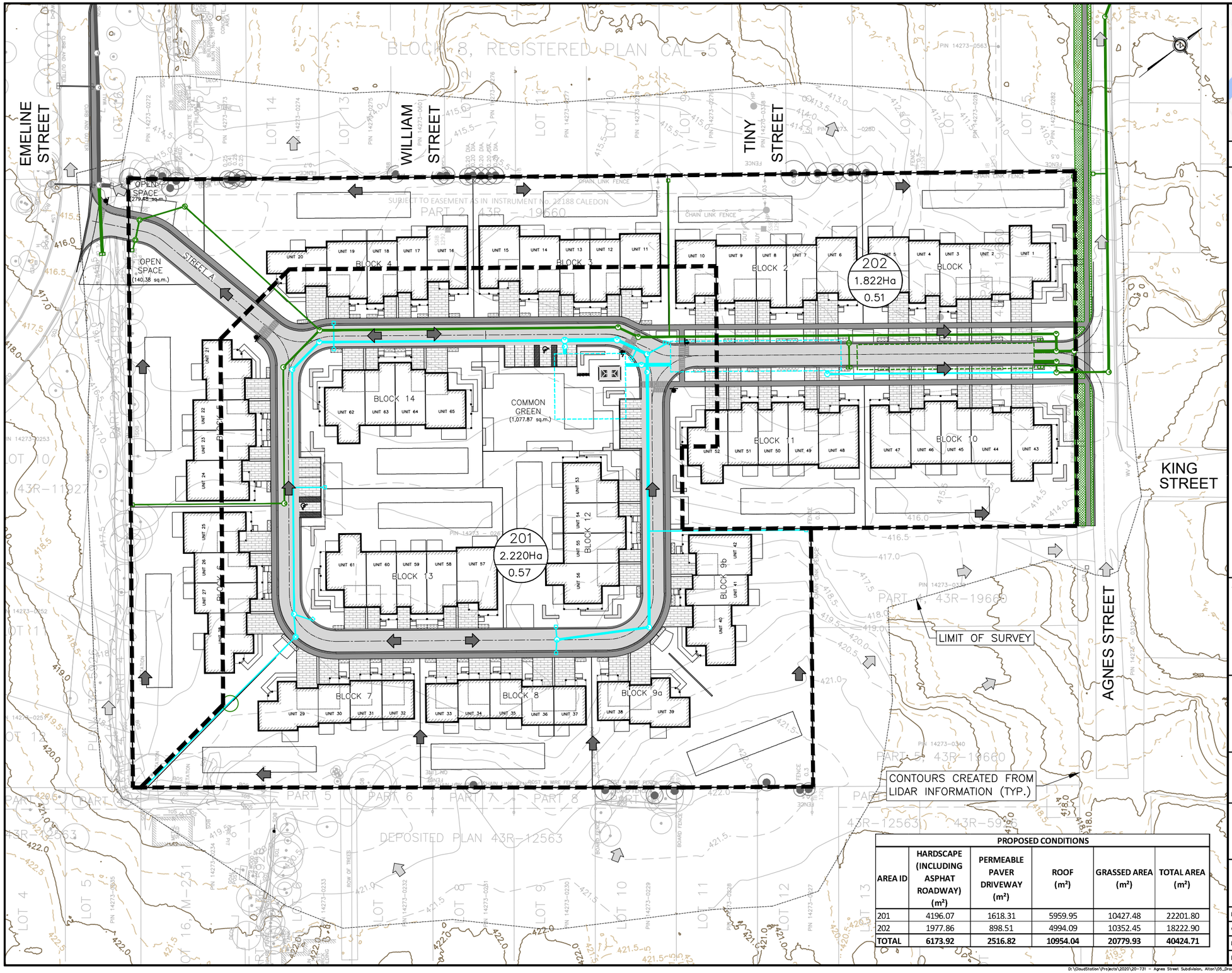
Surface	Area 101 (m^2)	Area 102 (m^2)	Total (m^2)	Coverage
Driveway & Hardscape	2,091	0	2,091	5%
Grassed	33,191	5,142	38,333	95%
Total	35,282	5,142	40,425	100%
% Impervious	5.9%	0.0%	5.2%	-
Runoff Coefficient	0.29	0.25	0.28	-

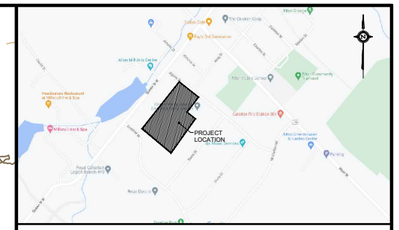
The total imperviousness of the existing site was calculated to be 5.2%, and the corresponding runoff coefficient was calculated to be 0.28. The driveway and hardscape were assigned a percent impervious of 100%. The grassed area was assigned a percent impervious of 0%. For detailed calculations, please see **Appendix D**.

The site currently does not have any internal storm servicing and the portion of Agnes Street adjacent to the site is serviced by a roadside ditch. At detailed design, a subsurface utility investigation will be conducted to determine the location of existing subsurface utilities and pipes.

9.2 PROPOSED DRAINAGE

Under proposed conditions, the subject site has been delineated into two (2) drainage areas: Area 201 and Area 202. Both areas will consist of the right-of-way, townhomes, parking areas, sidewalks and landscaped areas. Area 201 and Area 202 will be serviced by the proposed storm sewer system. Area 201 will first drain to an infiltration facility and then to a quantity storage chamber. Area 202 will drain directly into a second quantity storage chamber. Please see **Figure 3** below for the post-development drainage area plan.





KEY PLAN
N.T.S.

LEGEND

EXISTING	PROPOSED	
MH1	MH1	STORM MANHOLE
CBMH1	CBMH1	STORM CATCHBASIN MANHOLE
CB	CB	SINGLE CATCHBASIN
DCB	DCB	DOUBLE CATCHBASIN
FD	FD	SINGLE FLOOR DRAIN
		STORM SEWER
		STORM SEWER SYSTEM TO CONCRETE CISTERN AND OUTLET
		STORM SEWER SYSTEM TO GREENSTORM STORAGE
		LIMIT OF SUBJECT PROPERTY
		EASEMENT
		RIGHT OF WAY
		LOT LINE
		FENCE LINE
		CURB/SIDEWALK
		BUILDING
		RETAINING WALL
		MAJOR CONTOUR LABEL
		MINOR CONTOUR LABEL
		ASPHALT
		PAVING STONE
		1.5m WIDE CONCRETE SIDEWALK
		OVERLAND FLOW
		TREE
		TREE – TO REMAIN
		STORM DRAINAGE BOUNDARY
		LONGEST TRAVEL PATH
	3	DENOTES AREA NUMBER
	0.023Ha	DENOTES AREA IN HECTARES
	0.40	DENOTES RUNOFF COEFFICIENT

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONTOUR INTERVAL IS 0.50m.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
4. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT TOWN OF CALEDON STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
5. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY TOWN OF CALEDON, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

BENCHMARK

BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVGD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.
COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018
DEM SOURCE:
LIDAR DTM PEEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

PROPOSED CONDITIONS

AREA ID	HARDSCAPE (INCLUDING ASPHAT ROADWAY) (m^2)	PERMEABLE PAVER DRIVEWAY (m^2)	ROOF (m^2)	GRASSED AREA (m^2)	TOTAL AREA (m^2)
201	4196.07	1618.31	5959.95	10427.48	22201.80
202	1977.86	898.51	4994.09	10352.45	18222.90
TOTAL	6173.92	2516.82	10954.04	20779.93	40424.71

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

CLIENT NAME:
THE ALTON DEVELOPMENTS INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:
AGNES STREET SUBDIVISION
AGNES STREET CALEDON, ON

DRAINAGE PLAN PROPOSED CONDITIONS

DESIGNED BY: C.M.	SCALES:		PROJECT No. 20-731
CHECKED BY: J.C.	HORIZONTAL:	1:1000	DRAWING No. FIG. 3
DRAWN BY: C.M.	VERTICAL:	N/A	SHEET No.
DATE: FEB 10, 2026	SHEET SIZE:	11"x17"	

Permeable pavers are proposed for the driveways and visitor's parking areas. A summary of the post-development land cover is provided below in **Table 9-2.**

TABLE 9-2: POST-DEVELOPMENT LAND-USE SUMMARY

Surface	Area 201 (m^2)	Area 202 (m^2)	Total (m^2)	Coverage
Asphalt	2,375	859	3,234	8%
Permeable Pavers	1,618	899	2,517	6%
Hardscape	1,821	1,119	2,940	7%
Roof	5,960	4,994	10,954	27%
Landscaped Area	10,427	10,352	20,780	51%
Total	22,202	18,223	40,425	100%
% Impervious	49.4%	40.7%	45.5%	-
Runoff Coefficient	0.57	0.51	0.55	-
Impervious Area	10,965	7,421	18,386	-
Pervious Area	11,237	10,802	22,038	-

The total imperviousness of the proposed site was calculated to be 45.5%, and the overall runoff coefficient of the proposed site was calculated to be 0.55. The proposed permeable pavers allow for runoff to infiltrate between gaps and are assigned a percent impervious of 50%. The roof, asphalt, and hardscape areas are assigned a percent impervious of 100%, and the vegetated or lawn areas are assigned a percent impervious of 0%. For detailed calculations, please see **Appendix D**.

The proposed development's storm sewer is to tie into a proposed storm sewer on Agnes Street. The proposed storm sewer on Agnes Street will then tie into an existing 600mm diameter storm sewer located northeast of the property. At detailed design, the proposed storm sewer connection to the existing storm sewer system will be confirmed.

Note that a 152m portion of Agnes Street, south of Queen Street will be reconstructed into an Urban Cross Section. A Stormwater Management Design Brief for the urbanization of Agnes Street has been submitted under separate cover.

9.2.1 PROPOSED DRAINAGE SYSTEM

Two (2) drainage systems are proposed to service the development. For clarity, both systems are identified by colour on the drawings.

The drainage system from Area 201 conveys site runoff to an oil grit separator (OGS), the treated runoff is then conveyed to a subsurface storage facility with infiltration capability to satisfy the development's water balance requirement and Area 201's water

quality requirement. This facility will also provide a portion of the quantity storage for Area 201 and will be made up of GreenStorm ST units. Overflow from this system will be directed to a second subsurface storage facility, which is intended for stormwater quantity control only and will also utilize GreenStorm ST units. A see-saw roadway profile is proposed to maintain a minimum vertical clearance of 1.0 m between the bottom of the infiltration chambers and the groundwater elevation. Stormwater runoff will pond at roadway low points, spill over high points, and be conveyed to the infiltration gallery without causing flooding within the townhouse blocks. The roadway design follows the Town's Standard No. 233, as shown on the engineering drawings in **Appendix F.**

The second drainage system for Area 202 directs site runoff to a subsurface stormwater storage system consisting of a concrete cistern, which is proposed to address stormwater quantity control only. Refer to grading and servicing plans provided in **Appendix F.**

Catchbasins are proposed for both drainage systems at each roadway low point along the see-saw profile to intercept runoff and convey flows to the stormwater management facilities via the proposed storm sewer system. During major storm events, runoff will be conveyed via overland flow to designated capture points, where catchbasins will be appropriately sized to accommodate flows up to and including the 100-year storm event. Catchbasin sizing at these capture points will be confirmed at the detailed design stage and will account for 50% inlet blockage. During the 100-year storm, limited inlet ponding will provide sufficient hydraulic head to convey flows through the storm sewer network under surcharged conditions. A hydraulic grade line (HGL) analysis will be completed at the detailed design stage to confirm system performance in accordance with the Town's major/minor drainage design criteria.

10.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria is to be addressed in accordance with regulatory policy:

- Water Quality
- Water Quantity
- Erosion Control
- Water Balance

The proposed SWM strategy for Area 201 and Area 202 includes considerations for water quantity control, water quality control, erosion control, and water balance for the site. The proposed SWM strategy includes a treatment train approach featuring the following SWM controls:

- Area 201 will drain to an oil grit separator (OGS) unit, then to a subsurface quantity storage facility with infiltration capability. Once this facility fills, runoff will then be piped into a second quantity storage chamber.

- Area 202 will drain to a filter-based OGS unit, then into a quantity storage chamber.

Downstream of both quantity storage chambers will be a control manhole. Control MH14 will be fitted with an orifice to provide flow control for Area 201 and Control MH4 will be fitted with an orifice to provide flow control for Area 202. A water quality unit will be provided in MH16 and MH5 for Area 201 and Area 202 respectively.

10.1 WATER QUALITY

The required suspended solids removal treatment is MECP Enhanced Protection Level (Level 1). This corresponds to a long-term average removal of 80% total suspended solids (TSS).

Stormwater from the development will be characterized by runoff from roofs, pavers, landscape, and roadway surfaces. The main contaminants of concern are:

- Suspended sediments
- Other (oil, grease, gas, temperature)

Water quality controls were considered for both Area 201 and Area 202. The following is proposed for capturing and treating contaminated runoff:

For Area 201, runoff will first be treated by an OGS unit, providing stormwater treatment by trapping free oils, floatable solids and settling any captured sediment prior to discharge towards the underground infiltration facility. The OGS unit has been sized to provide a TSS removal of 60% and will be installed upstream of the infiltration facility; note that the Town credits a maximum TSS removal of 50% for manufactured OGS devices. The infiltration facility will provide stormwater treatment by filtering suspended solids, most metals and hydrocarbons via infiltration. According to the MECP's Stormwater Management Planning and Design Manual (SWMPD, March 2003), infiltration facilities provide 80% TSS removal.

The infiltration facility is sized to accommodate the water quality volume (WQV) to achieve 80% TSS removal. WQV was determined as per Table 3.2 of the MECP SWMPD. The infiltration facility will have a provided infiltration volume of 138.5m^3 and a footprint of 412m^2; it will be located within the common amenity space. The infiltration facility is to be lined with a geotextile. The inlet and outlet pipes will be set at the top of the provided infiltration volume. Note that there will be quantity storage provided on top of the infiltration volume which will accommodate the height of the inlet and outlet pipes. The modular units and pipe configuration will be finalized during detailed design.

A calculation showing that the treatment train provides enhanced level of protection is included in **Appendix D**.

As per Englobe's Hydrogeological Investigation Septic Impact Assessment dated October 15, 2025, the site's groundwater elevation ranges from 409.8m– 415.8m. As

per the groundwater contours shown on the Groundwater Flow Direction Plan, the groundwater at the location of the infiltration gallery is 414.20m. The bottom elevation of the infiltration volume is 415.20m. As such, the minimum 1m separation from the groundwater table requirement is satisfied.

A summary of the required and design WQV is provided below in **Table 10-1**.

TABLE 10-1: WATER QUALITY CONTROL SUMMARY

Drainage Area 201	22,201.8m^2
Unitary Water Quality Volume (WQV)	28.9m^3/ha
Required WQV	64.2m^3
WQV Provided By Infiltration Facility	138.5m^3

For Area 202, runoff will drain to a filter-based OGS unit specified to provide 80% TSS removal. Due to the higher groundwater elevation and grading constraints, infiltration is not possible for Area 202.

Water quality calculations are provided in **Appendix D**. Manufacturer's details regarding the water quality units, ETV certification and infiltration facility can be found in **Appendix E**. The servicing drawing is located in **Appendix F**.

10.2 WATER QUANTITY

The proposed storm sewer system will drain to a proposed municipal storm sewer along Agnes Street to service the subject property. As per the Town of Caledon's Development Standards Manual (2019), storm pipes shall be sized to accommodate the 10-year storm event as foundation drains will be connected to the storm sewer system. Foundation drain requirements and hydraulic grade line analysis of the storm sewers will be provided in detailed design. The proposed SWM facilities will control the 2-year to 100-year post development flow rates down to the 2-year pre-development flow rate.

In existing conditions, Area 102 drains overland to Emeline Street and Area 101 drains overland to Agnes Street. As such, the 2-year pre-development flow rate for Area 101 will dictate the allowable flow rate.

A summary of peak flows and the target release rate is provided in **Table 10-2**, detailed flow calculations can be found in **Appendix D**.

TABLE 10-2: PEAK FLOW RATES

Storm Event	Pre-Development Runoff Rate (L/s)	Post-Development Uncontrolled Peak Runoff Rate (L/s)			Controlled Post-Development Runoff Rate (L/S)
Area ID	101	201	202	Total	201+202
2-year	111.9	301.9	223.4	525.2	102.5
5-year	154.8	386.3	285.8	672.1	102.5
10-year	189.4	472.5	349.6	822.1	102.5
25-year	253.5	606.2	448.5	1,054.7	102.5
50-year	313.7	744.6	550.9	1,295.5	102.5
100-year	367.8	865.2	640.1	1,505.4	102.5

Runoff from Area 201 will first drain into the subsurface quantity storage facility with infiltration capability in the amenity area, after this facility fills, runoff will be piped to a second quantity storage chamber. Both storage chambers will be built using the GreenStorm product. The second quantity storage chamber is to be wrapped in an impermeable layer to prevent groundwater from seeping in. Runoff will be attenuated with a 125mm diameter orifice plate fitted in Control MH14. As a conservative measure, the infiltration storage is excluded from the quantity storage and is effectively considered as full at the start of each storm event.

Runoff from Area 202 will drain into a third quantity storage chamber. Due to the site's grading and groundwater conditions, the third storage chamber will be a concrete cistern. This is to ensure that the cistern can withstand the depth of cover and the lateral forces from the groundwater. Runoff will be attenuated with a 100mm diameter orifice plate fitted in Control MH4.

For clarity, the quantity storage and infiltration facility located in the common amenity area will be referred to as SWMF1, the second quantity storage chamber servicing Area 201 will be referred to as SWMF2, and the concrete quantity storage chamber servicing Area 202 will be referred to as SWMF3.

Attenuated flows from Area 201 and Area 202 will then be piped to MH3 where the site's storm sewer system connects to the proposed storm sewer on Agnes Street. The total provided quantity storage is 1,886m^3 and the total controlled discharge rate leaving the site is 102.5L/s which is less than the Area 101 2-year pre-development flow of 111.9L/s.

A summary of the quantity storage chambers is provided in **Table 10-3.**

TABLE 10-3: WATER QUANTITY STORAGE SUMMARY

Drainage Area	201	202
Footprint (m^2)	412.2 (SWMF1) 384.0 (SWMF2)	353.7 (SWMF3)
Storage Provided (m^3)	522.3 (SWMF1) 615.6 (SWMF2) 1137.9 (total)	747.7 (SWMF3)
100-year Storage Required (m^3)	939.3	681.5
Orifice Plate Size (mm)	125 (MH14)	100 (MH4)
Orifice Discharge (L/s)	57.2 (MH14)	45.3 (MH4)
Maximum Depth of Cover (m)	1.77 (SWMF1) 2.47 (SWMF2)	4.11 (SWMF3)

The provided quantity control storages exceed the required storages. The sizing and configuration of the quantity storage chambers, and the orifices will be confirmed and further optimized during detailed design.

Water quantity control calculations are provided in **Appendix D**. The GreenStorm and concrete cistern product sheet is provided in in **Appendix E**. Note that for the storage system in the amenity area, the infiltration and quantity storage tables have been separated for ease of reviewing. The servicing drawing and layout of the storage facilities can be found in **Appendix F**.

10.3 EROSION CONTROL

The CVC Stormwater Management Guidelines (July 2022) state that “the minimum erosion control requirement for all watercourses within CVC’s jurisdiction is retention of the first 5mm of every rainfall event. Industry-standard storage volumes for pervious areas of 5mm were applied, therefore, the erosion control storage volume requirement will be characterized by impervious surfaces.

It is proposed to capture the equivalent of the 5mm event on the impervious areas within Area 201 and Area 202. See **Table 10-4** below for a summary of erosion control volume requirements and the storage provided by the infiltration facility during the 5mm storm event.

TABLE 10-4: EROSION CONTROL VOLUME SUMMARY

Post Dev. Impervious Area (m^2)	Required Volume (m^3)	Proposed Volume (m^3)
18,386.4	91.9	138.5

During the 5mm event, the proposed infiltration facility will provide 138.5m^3 of subsurface storage. The erosion control storage within the infiltration facility will be provided within the plastic chamber units below the invert elevation of the inlet and outlet pipe. A total erosion control storage of 138.5m^3 is provided, exceeding the required 91.0m^3.

A maximum 48-hour drawdown time is required for the underground infiltration facility as per MECP criteria. Based on the Hydrogeological Investigation Septic Impact Assessment dated October 15, 2025, by Englobe, the underground infiltration facility will infiltrate into a layer of silt fine sand. Based on the grain size analysis testing, the percolation rate is 12min/cm which is equivalent to an infiltration rate of 50mm/hr.

A drawdown time of 17.5 hours was calculated for the underground infiltration facility with a 2.5 factor of safety. As such, the underground infiltration facility will achieve a maximum drawdown time of less than 48 hours. Erosion control, infiltration facility sizing, and drawdown calculations are provided in **Appendix D**.

10.4 PRELIMINARY STORMWATER MANAGEMENT DESIGN

A summary of the stormwater management facilities servicing Area 201 and Area 202 is provided below:

- Underground quantity storage chambers with a total volume of 1,886m^3 and orifice plates will be used to provide quantity control.
- An OGS unit upstream of the infiltration facility and a filter-based OGS unit upstream of both the quantity storage chambers will be used to satisfy the water quality requirement.
- The infiltration facility will provide an infiltration volume of 138.5m^3 which will satisfy the water quality and erosion control volume requirements.
- The design groundwater elevation is 414.2m. The bottom elevation of the infiltration facility is 415.2m. Therefore, the infiltration facility achieves a groundwater separation of 1m.

The proposed infiltration facility and quantity storage design details will be confirmed in detail design.

10.5 WATER BALANCE AND SOURCE WATER PROTECTION

Urbanization increases impervious cover, which, if left unmitigated, results in a decrease in infiltration. This infiltration reduces groundwater recharge and soil moisture replenishment. It also reduces stream baseflow needed for sustaining aquatic life. Therefore, it is important to maintain the natural hydrologic cycle. Groundwater recharge helps maintain aquifer water levels and supports significant watershed features that are necessary components to the maintenance of a healthy watershed. As a result, a water balance analysis is required to estimate the pre-development and post-development infiltration and runoff.

For water balance criteria, the CVC requires that pre-development infiltration volumes are maintained in the post-development conditions. This typically approximately equates to the retention of the 5mm storm event.

A Hydrogeological Investigation Septic Assessment prepared by Englobe dated October 15, 2025, details the Source Water Protection Areas; that report has been submitted under separate cover. In summary: as per the Source Water Information Atlas provided by the MECP, the subject property is within the Credit Valley Source Protection Area. Specifically, the property is located in a designated *Groundwater Under the Direct Influence of Surface Water* (GUDI) or Wellhead Protection Area (WHPA) – E with a vulnerability score of 8. Credit Valley, Toronto and Region, and Central Lake Ontario (CTC) mapping indicates that the subject property falls outside of the significant groundwater quality threat areas.

Land use for the proposed development is medium density residential only. Stormwater from Area 201 will pass through an OGS prior to infiltration, and stormwater from Area 202 will pass through a filter-based water quality unit. As such, the stormwater runoff will be treated before leaving the site.

Further, email correspondence from the Town of Caledon received during the Town's pre-consultation planning process (DART) states that the Region has advised that there are no concerns with the proposed infiltration practices. Stormwater runoff will not directly discharge to surface water without treatment.

A site-specific water balance was completed for the development area using the MECP's SWMPD (March 2003). This approach uses the method developed by Thornthwaite and Mather.

A summary of the previous and impervious areas is provided below in **Table 10-5**. To be conservative, the proposed permeable pavers were considered as impervious area and will not contribute to water balance targets.

TABLE 10-5: EXISTING AND PROPOSED LAND COVER

Area	Existing (m^2)	Proposed (m^2)
Pervious	38,333	20,780
Impervious	2,091	19,645
Total	40,425	40,425

The parameters used for the water balance analysis are provided in **Table 10-6**.

TABLE 10-6: MECP WATER BALANCE INFILTRATION PARAMETERS

	Comment	Factor
Topography	Hilly Land	0.1
Soils	Open Sandy Loam	0.4
Cover	Cultivated Land	0.1

A total deficit volume of 3,494.1m^3/year will not be infiltrated into the ground given the proposed development plan and resulting change in pervious cover. As such, this annual volume must be balanced and infiltrated back into the ground under proposed conditions.

The water balance target of 3,494.1m^3/year will be provided through the subsurface infiltration facility for the property.

The infiltration facility has been sized to capture the 5mm rainfall event to meet erosion control requirements, which represents approximately 55% of all rainfall events in a given year (City of Toronto WWFMG Figure 1b, November 2006).

An annual precipitation of 902mm was determined (MECP's Orangeville MOE climate station). Assuming that 10% of the rainfall is evaporated, an impervious annual surplus of 811mm was determined and directed towards the infiltration chambers.

Based on an annual impervious surplus of 811mm per year, and assuming 50% of all rainfall events are infiltrated, the annual infiltration volume towards the infiltration facility equates to 8,767m^3, for a total site-wide infiltration of 12,904m^3.

However, for design and conservative purposes, a factor of safety of 1.5 was applied to the total infiltration facility infiltrated volume in the event that infiltration does not occur as efficiently due to soil saturation, partially full infiltration facility from previous rainfall events, or unexpected in-situ soil conditions. This equates to an annual infiltration volume of 5,845m^3, for a total site-wide infiltration of 9,981m^3, therefore exceeding pre-development conditions.

A summary of the infiltration volumes is provided in **Figure 4**.

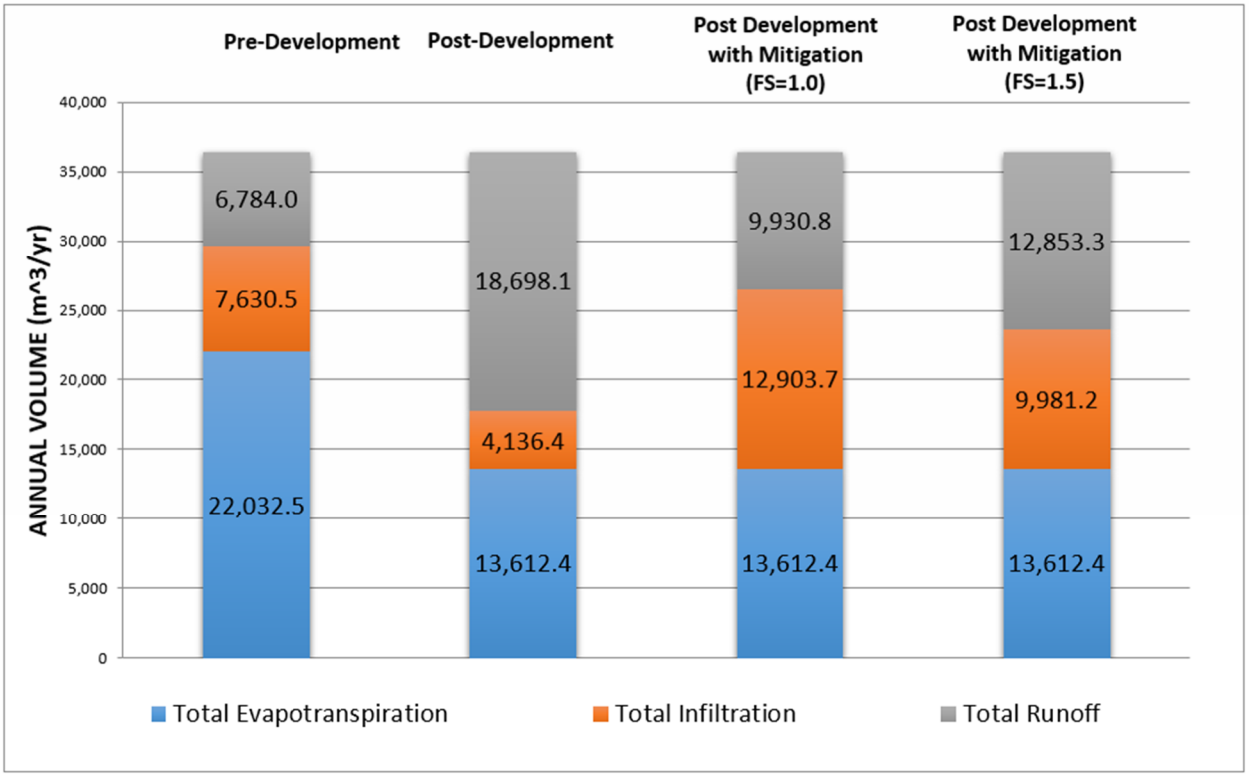


FIGURE 4: WATER BALANCE SUMMARY

As such, the application of the infiltration facility achieves a net increase in overall infiltration, which meets the CVC criteria of maintaining pre-development infiltration levels and providing 5mm of on-site retention. For water balance calculations, please see **Appendix D**.

11.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls (ESC) will be implemented for all construction activities, including topsoil striping, material stockpiling, pavement construction, and grading operations. Design details will include a phased approach to minimize disturbance including considerations for restoration. Refer to the Erosion and Sediment Control Plan and Details provided in **Appendix F**.

12.0 CONCLUSIONS

As presented in this report, the proposed development will meet the following municipal and provincial standards and regulations specified for:

- General site grading;
- Water distribution;

- Sanitary sewer servicing;
- Utilities
- Stormwater management; and
- Construction erosion and sediment controls

In summary, it has been determined that the development can be serviced with existing and proposed infrastructure that is in accordance with policies and guidelines required by the Town of Caledon, CVC and other regulating agencies.

13.0 REFERENCES

Credit Valley Conservation – Stormwater Management Guidelines, July 2022

Fire Underwriters Survey – Water Supply for Public Fire Protection – 2020

Ministry of the Environment, Conservation and Parks – Stormwater Management Planning and Design Manual – March 2003

Ministry of the Environment, Conservation and Parks – Design Guidelines for Drinking Water Systems – 2008

Ministry of the Environment, Conservation and Parks – Design Guidelines for Sewage Works – 2008

Region of Peel Development Charges Background Study, December 2020

Region of Peel Watermain Design Criteria, June 2010

Town of Caledon – Development Standards Manual, 2019

APPENDIX A

Site Plan, Concept Plan, Topographic Survey and As-Built Records

QUEEN STREET W.

EMELINE STREET

1.5m WIDE WALKWAY EXTENDED TO QUEEN ST.

LOT 16 | LOT 15 | LOT 14 | LOT 13 | LOT 12 | LOT 11 | LOT 10 | LOT 9 | LOT 8 | LOT 7 | LOT 6 | LOT 5

OPEN SPACE (279.48 sq.m.)

OPEN SPACE (140.38 sq.m.)

SNOW STORAGE

STREET A

1.5m SIDEWALK

FIRE ROUTE

BLOCK 1 | BLOCK 2 | BLOCK 3 | BLOCK 4 | BLOCK 5 | BLOCK 6 | BLOCK 7 | BLOCK 8 | BLOCK 9a | BLOCK 9b | BLOCK 10 | BLOCK 11 | BLOCK 12 | BLOCK 13 | BLOCK 14

COMMON GREEN (1,077.87 sq.m.)

POTENTIAL PLAY STRUCTURE LOCATION

CMB

LOW WALL

STREET B

AGNES STREET

KING ST.

EX FH

PRIVACY SCREEN

LOT COVERAGE	
BLOCK	COVERAGE
1	33.3%
2	37.0%
3	39.1%
4	29.8%
5	29.3%
6	26.5%
7	22.6%
8	28.4%
9	21.7%
10	35.7%
11	37.7%
12	32.2%
13	37.8%
14	32.8%

LEGEND

- PROPERTY LINE
- 6.0m WIDE FIRE ROUTE
- STOP SIGN (SS)
- EXISTING TOPOGRAPHY
- PAINTED STOP BAR
- EXISTING TREE TO REMAIN
- DISPERSAL BED
- PEDESTRIAN CROSSING
- PROPOSED STONE WALL
- PROPOSED 1mX3m WASTE COLLECTION POINT

NOTES:

1. THIS IS A CONCEPT PLAN FOR THE PURPOSE OF GUIDING THE DESIGN OF THE DRAFT PLAN OF SUBDIVISION AND ZONING BY-LAW AMENDMENT. DETAILED SITE PLANS WILL BE PREPARED FOR THE INDIVIDUAL BLOCKS FOR INCLUSION IN BUILDING PERMIT APPLICATIONS. DETAILED ENGINEERING AND LANDSCAPE PLANS WILL BE PREPARED AS PART OF THE DETAILED SUBDIVISION / CONDOMINIUM APPROVAL PROCESS.
2. A MODIFIED RT (RESIDENTIAL TOWNHOUSE) ZONE IS PROPOSED BASED ON THE CONCEPT PLAN CONTAINING SITE-SPECIFIC STANDARDS WHERE NECESSARY. SEE THE PROPOSED ZONING MATRIX OUTLINING ALL PROPOSED ZONING STANDARDS.
3. TOPOGRAPHICAL INFORMATION INCLUDING TREE LOCATIONS TAKEN FROM VANHARTEN SURVEY PLAN DATED SEPTEMBER 16, 2022.
4. TREE INVENTORY INFORMATION FROM WILLIAMS & ASSOCIATES ARBORISTS REPORT FEB. 16, 2023 AND UPDATED OCT. 16, 2023. 29 TREES ARE IDENTIFIED FOR RETENTION. GRADING PLAN WILL PROVIDE DETAILS ABOUT TREE PROTECTION MEASURES AT DETAILED DESIGN STAGE.
5. 3-WAY STOP, STOP BARS, PEDESTRIAN CROSSING PAVEMENT MARKINGS AS RECOMMENDED IN TRAFFIC IMPACT STUDY BY PARADIGM ENGINEERING. TO BE DETAILED DURING DETAILED DESIGN IN ACCORDANCE WITH ONTARIO TRAFFIC MANUAL BOOK 11. STOP SIGNS TO BE INSTALLED AS PER OTM BOOK 5.
6. ACCESSIBLE SPACES INCLUDE ONE TYPE 'A' SPACE AND ONE TYPE 'B' SPACE.

SITE DATA

REGULATION	PROPOSED
LOT FRONTAGE (ON AGNES STREET)	99.90 m
SITE AREA (ha)	40,445.80 sq.m. (4.04ha)
# UNITS WITH DOUBLE GARAGES	40
# UNITS WITH SINGLE GARAGEGS	25
TOTAL UNITS	65
DENSITY	16.58 Upha
# OF RESIDENTIAL BLOCKS	14
# OF UNITS PER BLOCK (MAX.)	5
BUILDING HEIGHT	10.5 m
MINIMUM SETBACK TO AGNES STREET	6.0 m
MIM. SETBACK FROM REAR OF DWELLINGS TO ABUTTING RESIDENTIAL PROPERTIES	13.07 m
AREA TABLE	
RESIDENTIAL BLOCKS	3.301 ha
ROAD, PARKING, SIDEWALKS & CURBS	0.504ha
COMMON AMENITY & OPEN SPACE (AMENITY AREA, OPEN SPACE AND LANDSCAPED AND DRIVE ENTRANCE BOULEVARD)	0.240 ha
TOTAL	4.045 ha
OPEN SPACE & COVERAGE	
YARDS, ABSORPTION BEDS, COMMON GREEN, OPEN SPACE AREAS	2.062 ha (50.98%)
HARD SURFACE AREAS (BUILDINGS, PATIOS, ROADS, WALKWAYS, SIDEWALKS, DRIVWAYS)	1.983 ha (49.02%)
TOTAL	4.045 ha
PARKING PROVIDED	**TOTAL**
PRIVATE PARKING WITHIN GARAGES	105
PRIVATE PARKING IN DRIVEWAYS	105
COMMON VISITOR PARKING	16
TOTAL	226

ORCHARD DESIGN STUDIO INC.
marketingmeetsarchitecture

User Defined

Project Information

SEATON GROUP
AGNES STREET TOWNHOMES
Village of Alton, Caledon, ON.

Set Issuance

No.	Date	Description
1	2023.02.08	FIRST SUBMISSION
2	2023.11.21	SECOND SUBMISSION
3	2024.04.02	UPDATE COMMON AMENITY
4	2024.07.24	UPDATE ROADWAY, COMMON AMENITY AREA
5	2024.07.30	UPDATE ROADWAY, COMMON AMENITY AREA
6	2024.08.05	UPDATE ROADWAY, COMMON AMENITY AREA
7	2026.01.13	UPDATE ROADWAY, COMMON AMENITY AREA

Sheet Information

CONCEPT PLAN

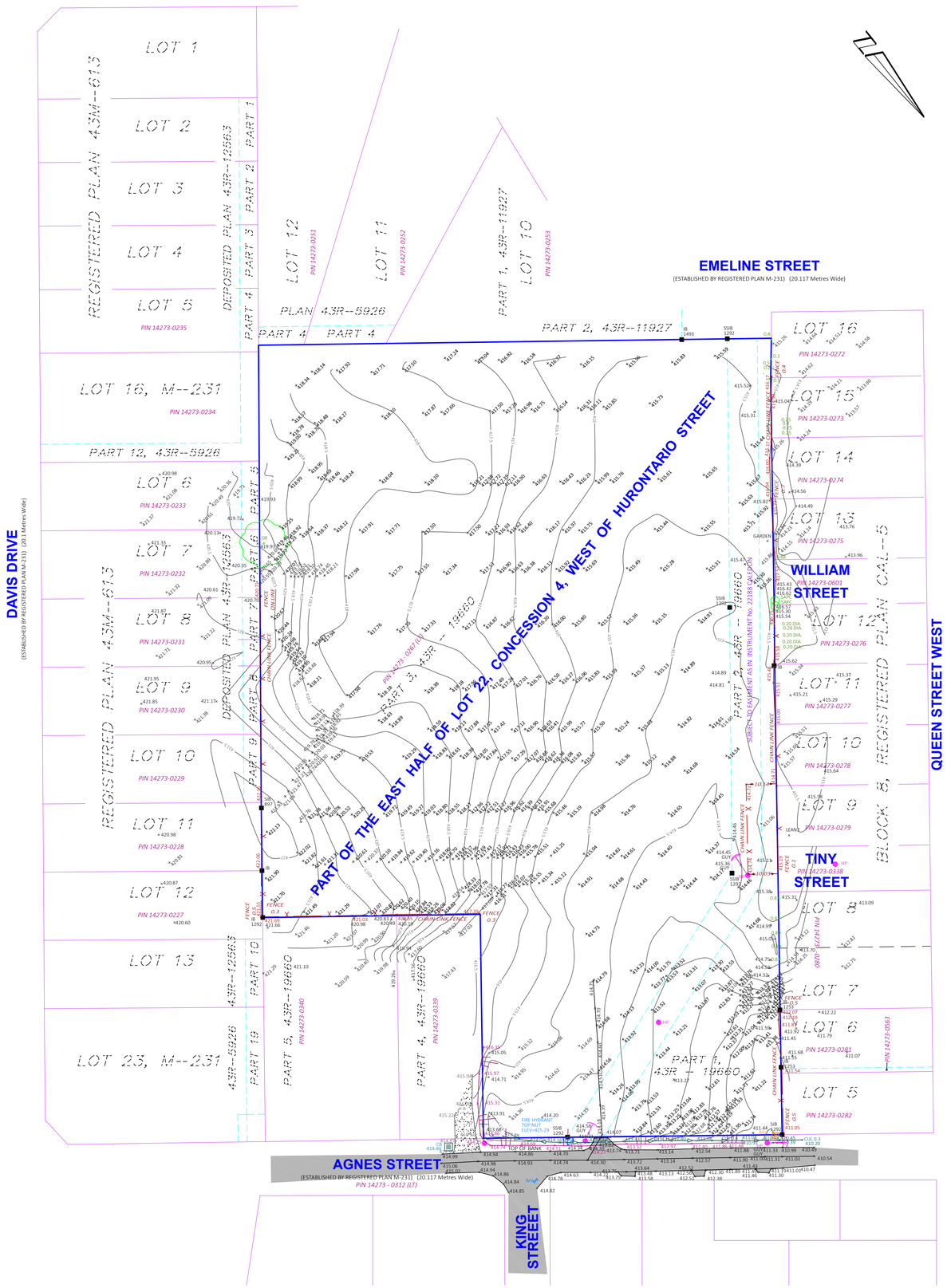
Project No. 14948
Project Start Date: 2023.11.01
File: Agnes Street - Site Plan.dwg
Drawn by: KBR
Scale: 1:400

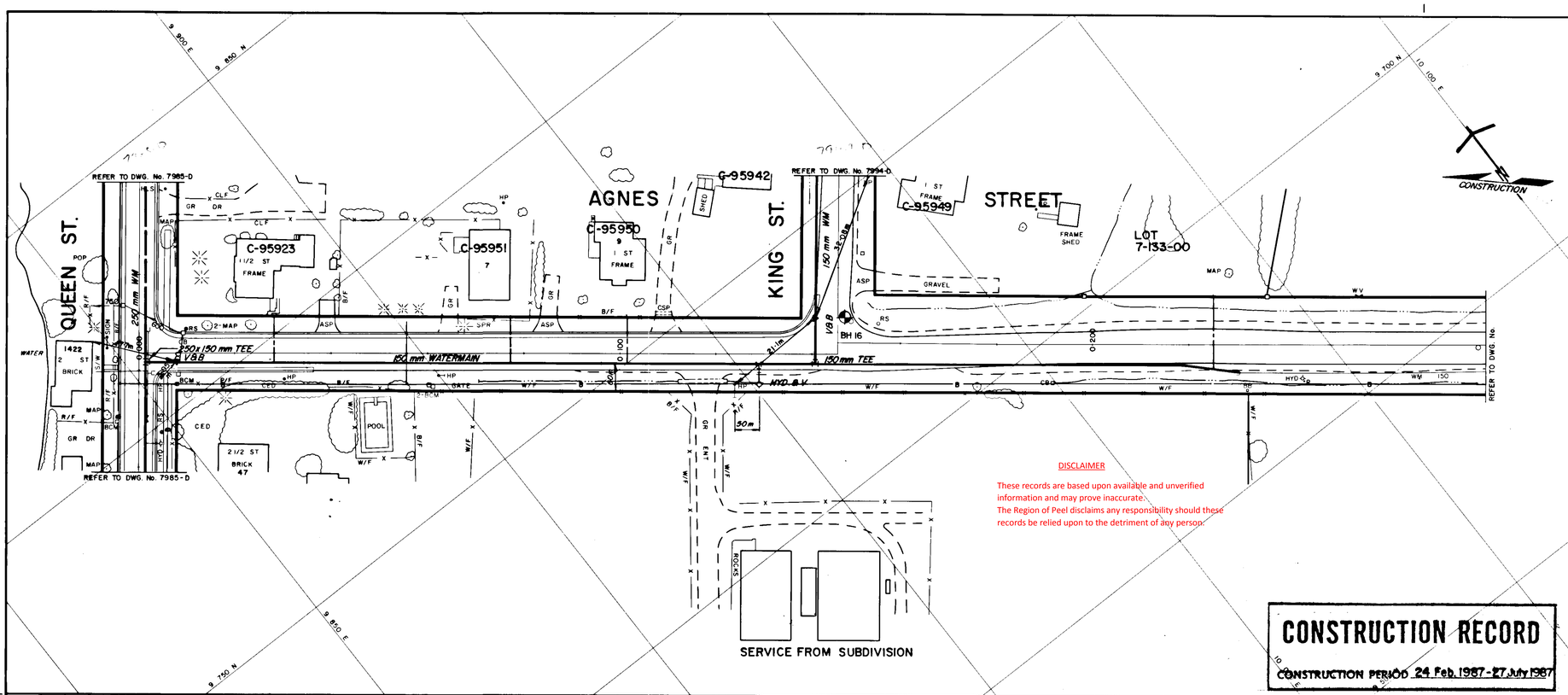
PRELIMINARY

A1.01

Plot Date|Time - 1/13/2026 4:05:14 PM

P:\1-Projects\Seaton Group\14948 Agnes st\2-Drawings\


LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
REGISTERED PLAN 43M--613
DEPOSITED PLAN 43R-12563
PART 1
PART 2
PART 3
PART 4
PIN 14273-0235
LOT 16, M--231
PIN 14273-0234
PART 12, 43R--5926
PLAN 43R--5926
PART 4
PART 4
LOT 12
PIN 14273-0251
LOT 11
PIN 14273-0252
PART 1, 43R--11927
LOT 10
PIN 14273-0253
PART 2, 43R--11927
EMELINE STREET
(ESTABLISHED BY REGISTERED PLAN M-231) (20.117 Metres Wide)
DAVIS DRIVE
(ESTABLISHED BY REGISTERED PLAN M-231) (20.1 Metres Wide)
LOT 6
PIN 14273-0233
LOT 7
PIN 14273-0232
LOT 8
PIN 14273-0231
LOT 9
PIN 14273-0230
LOT 10
PIN 14273-0229
LOT 11
PIN 14273-0228
LOT 12
PIN 14273-0227
LOT 13
LOT 23, M--231
43R--5926
PART 13
PART 10
43R--12563
PART 9
PART 8
PART 7
PART 6
PART 5
PART 4
PART 3
PART 2
PART 1
PART 5, 43R--19660
PART 4, 43R--19660
PART 3, 43R--19660
PART 2, 43R--19660
PART 1, 43R--19660
PART 6, 43R--19660
PART 7, 43R--19660
PART 8, 43R--19660
PART 9, 43R--19660
PART 10, 43R--19660
PART 11, 43R--19660
PART 12, 43R--19660
PART 13, 43R--19660
PART 14, 43R--19660
PART 15, 43R--19660
PART 16, 43R--19660
PART 17, 43R--19660
PART 18, 43R--19660
PART



DISCLAIMER

These records are based upon available and unverified information and may prove inaccurate.
The Region of Peel disclaims any responsibility should these records be relied upon to the detriment of any person.

CONSTRUCTION RECORD

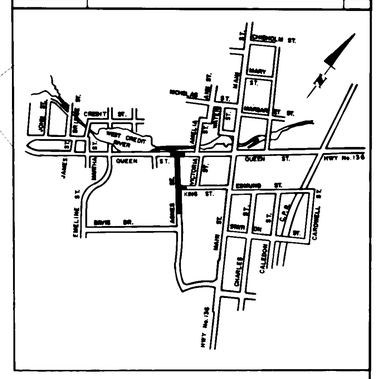
CONSTRUCTION PERIOD 24 Feb. 1987 - 27 July 1987

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN. SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		

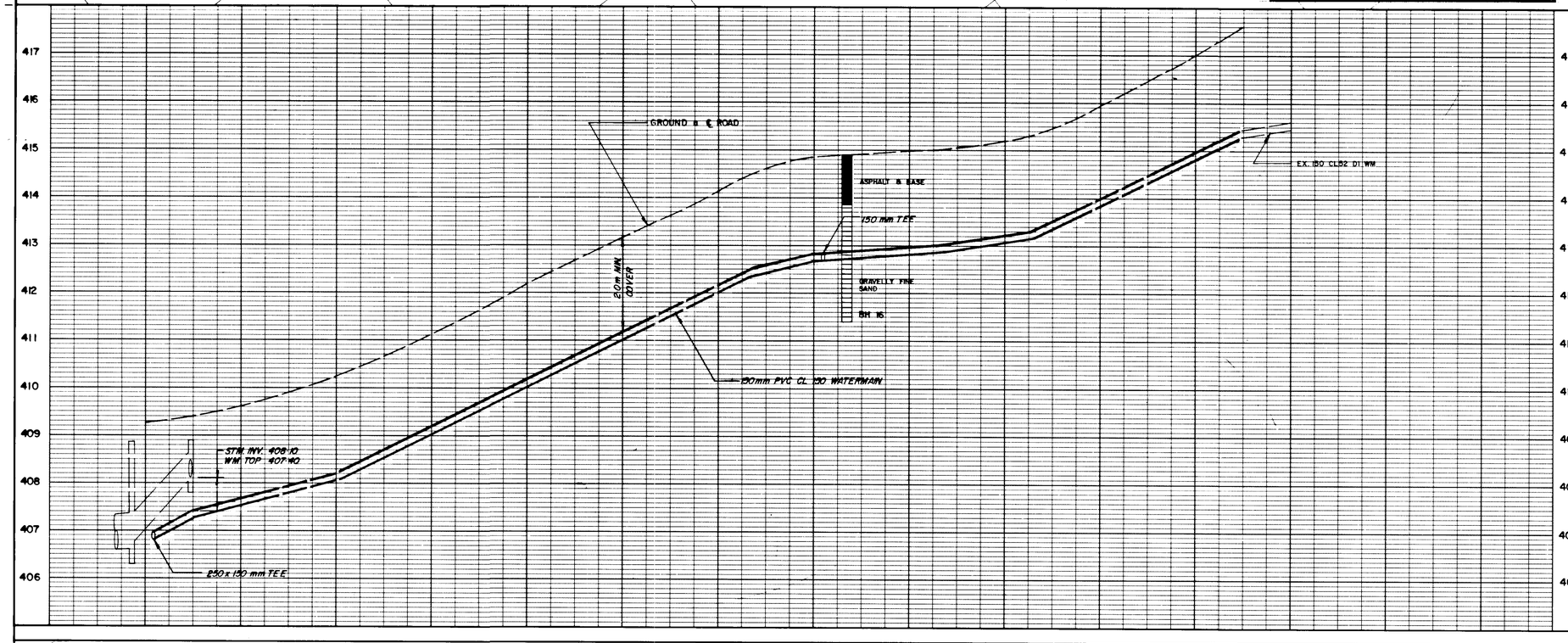
REVISIONS

DATE	DETAILS	INIT.
18 NOV. '87	CONSTRUCTION RECORD	C.O.



GENERAL NOTES

1. INSTALL 14 GUAGE TRACING WIRE ALONG TOP OF ALL PLASTIC PIPE.
2. MIN. ROAD RESTORATION TO BE 40 mm HL3, 50 mm HL8, 150 mm GRAN. 'A', 300 mm GRAN. 'B' ON ROADS WITH PRIME AND SURFACE TREATMENT DELETE ASPHALT REQUIREMENTS AND PLACE PRIME & SURFACE TREATMENT FULL WIDTH OF ROAD.
3. ALL BEDDING TO BE AS PER REGION STANDARDS. WITH GRAN. 'D' LIMESTONE SCREENED 150 mm ABOVE OBVERT.
4. ALL AREAS DISTURBED ARE TO BE RESTORED TO ORIGINAL CONDITIONS.
5. ALL MATERIALS AND CONSTRUCTION TO BE AS PER REGION STANDARDS.
6. ALL BENDS, HYDRANTS, VALVES, FITTINGS ETC. SHALL BE SUPPLIED WITH CATHODIC PROTECTION.
7. EXACT LOCATIONS OF HYDRANTS, SERVICES AND APPURTENANCES SHALL BE DETERMINED IN FIELD DURING CONSTRUCTION.



General Notes

- - All Driveways Gravel Unless Otherwise Noted.
- - All Service Locations Are Approximate And Must Be Located Accurately In Field.
- ● Denotes Building - Not Located
- ▭ Denotes Building Located
- Type 'B' Bedding Unless Otherwise Noted (SAN)

B.M. Nº Elev.

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

knox martin kretch limited
bramalea, ontario 459-4780

Project 1487-A-32

REGISTERED PROFESSIONAL ENGINEER R. D. BEETON PROVINCE OF ONTARIO

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL TELEPHONE COMPANY
CONSUMERS GAS COMPANY
MINISTRY OF TRANSPORTATION
MINISTRY OF ENVIRONMENT
HYDRO ELECTRIC POWER COMM. OF ONTARIO
HYDRO ELECTRIC COMM. CITY OF MISSISSAUGA
HYDRO ELECTRIC COMM. CITY OF BRAMPTON
HYDRO ELECTRIC COMM. PORT CREDIT
HYDRO ELECTRIC COMM. STREETSVILLE
CABLE TELEVISION

Region of Peel

Department of Public Works

ALTON WATER DISTRIBUTION SYSTEM

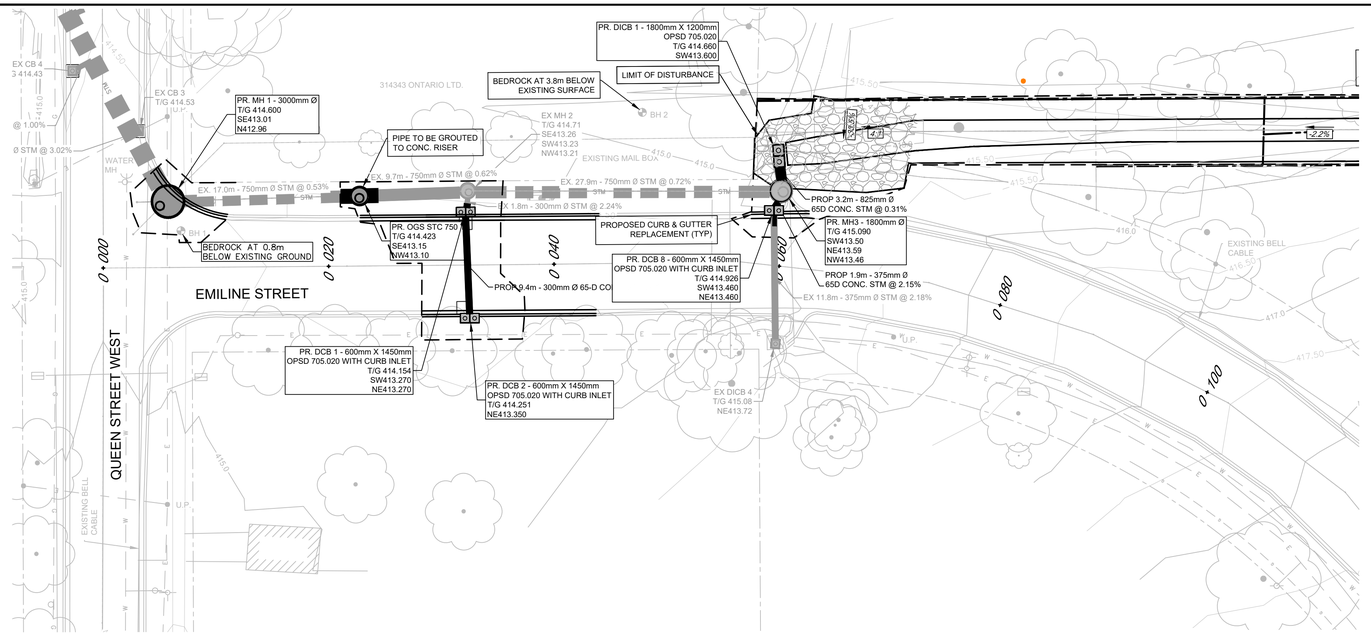
AGNES STREET

Sta. 0+000 **To Sta.** 0+260

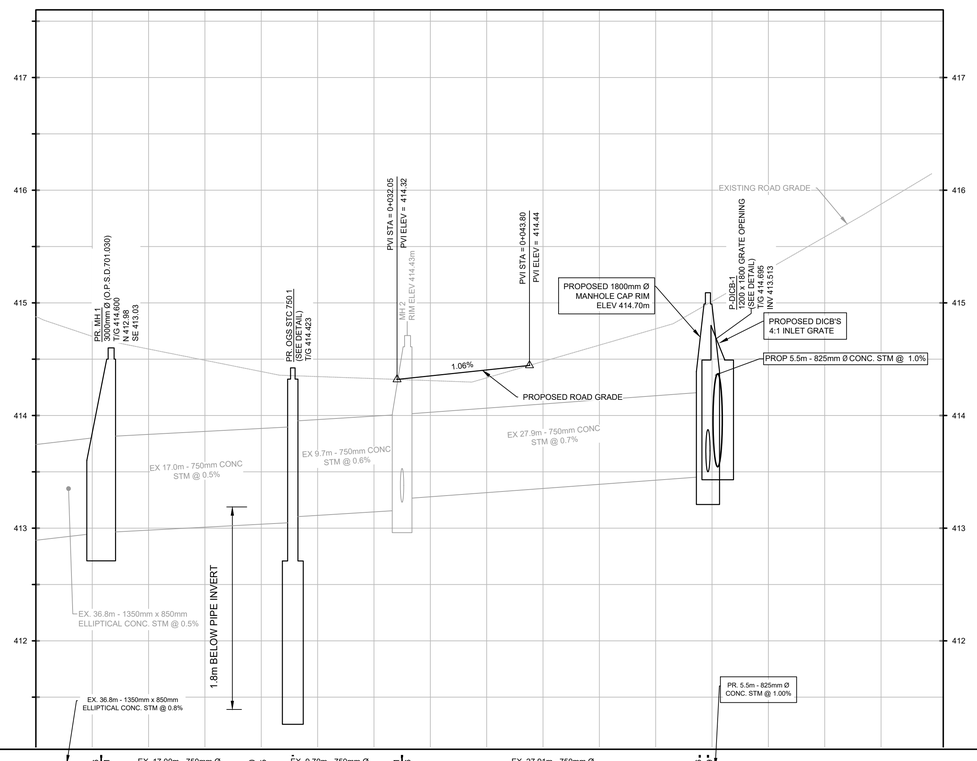
Lots	Area C-80	Project No. 86-1010
Scale Hor. 1:500 Vert. 1:50	Drawn by	Checked by R.F.
Date 11 JULY 86	Sheet 1 of 1	Plan No. 7995-D

1487-A-32 7995-D

7995-D


PR. DICB 1 - 1800mm X 1200mm
OPSD 705.020
T/G 414.660
SW413.600
BEDROCK AT 3.8m BELOW EXISTING SURFACE
LIMIT OF DISTURBANCE
314343 ONTARIO LTD.
EX CB 4
3 414.43
EX CB 3
T/G 414.53
PR. MH 1 - 3000mm Ø
T/G 414.600
SE413.01
N412.96
@ 1.00%
Ø STM @ 3.02%
WATER MH
PIPE TO BE GROUTED TO CONC. RISER
EX MH 2
T/G 414.71
SE413.26
SW413.23
NW413.21
EXISTING MAIL BOX
EX. 17.0m - 750mm Ø STM @ 0.53%
EX. 9.7m - 750mm Ø STM @ 0.62%
EX. 27.9m - 750mm Ø STM @ 0.72%
EX 1.8m - 300mm Ø STM @ 2.24%
STM
BH 1
BEDROCK AT 0.8m BELOW EXISTING GROUND
PR. OGS STC 750
T/G 414.423
SE413.15
NW413.10
PROPOSED CURB & GUTTER REPLACEMENT (TYP)
PROP 3.2m - 825mm Ø
65D CONC. STM @ 0.31%
PR. MH3 - 1800mm Ø
T/G 415.090
SW413.50
NE413.59
NW413.46
PR. DCB 8 - 600mm X 1450mm
OPSD 705.020 WITH CURB INLET
T/G 414.926
SW413.460
NE413.460
PROP 1.9m - 375mm Ø
65D CONC. STM @ 2.15%
EX 11.8m - 375mm Ø STM @ 2.18%
PROP 9.4m - 300mm Ø 65-D CO
0+000
0+020
0+040
0+060
0+080
0+100
EMILINE STREET
QUEEN STREET WEST
EXISTING BELL CABLE
U.P.
PR. DCB 1 - 600mm X 1450mm
OPSD 705.020 WITH CURB INLET
T/G 414.154
SW413.270
NE413.270
PR. DCB 2 - 600mm X 1450mm
OPSD 705.020 WITH CURB INLET
T/G 414.251
NE413.350
EX DICB 4
T/G 415.08
NE413.72
EXISTING BELL CABLE
-2.2%
4.2

PLAN
1:250


417
416
415
414
413
412
PR. MH 1
3000mm Ø (O.P.S.D.701.030)
T/G 414.600
N 412.96
SE 413.03
PR. OGS STC 750.1
(SEE DET'AL)
T/G 414.423
MH 2
RIM ELEV 414.43m
PVI STA = 0+012.05
PVI ELEV = 414.32
PVI STA = 0+043.80
PVI ELEV = 414.44
1.06%
PROPOSED 1800mm Ø
MANHOLE CAP RIM
ELEV 414.70m
PROPOSED ROAD GRADE
EXISTING ROAD GRADE
P-DICB-1
(SEE 2 - 600 GRATE OPENING
(SEE DET'AIL)
T/G 414.696
INV 413.513
PROPOSED DICB'S
4:1 INLET GRATE
PROP 5.5m - 825mm Ø CONC. STM @ 1.0%
EX 17.0m - 750mm CONC
STM @ 0.5%
EX 9.7m - 750mm CONC
STM @ 0.6%
EX 27.9m - 750mm CONC
STM @ 0.7%
EX. 36.8m - 1350mm x 850mm
ELLIPTICAL CONC. STM @ 0.5%
1.8m BELOW PIPE INVERT
EX. 36.8m - 1350mm x 850mm
ELLIPTICAL CONC. STM @ 0.8%
PR. 5.5m - 825mm Ø
CONC. STM @ 1.00%

| | | |

APPENDIX B

Watermain Calculations and Hydrant Flow Test

THEORETCIAL FIRE FLOW CALCULATIONS

PROJECT: Agnes Street Subdivision
PROJECT No: 20-731
LOCATION: Caledon, ON
DATE: October 18, 2023

DESIGNED BY: Deven Verma, EIT.
REVIEWED BY:Khalid Mahmood, P. Eng

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

F = The required Fire Flow in litres per minute

C = Coefficient related to the type of construction

A = The tatal floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered

Total Floor Area (A) considered for fire flow (m2) 510.0

NOTES

- Table below is based on procedures and figures from the Water Supply for Public Fire Protection - Fire Underwriters Survey of Canada, 2020.
- Exposure distance factor max adjustment is 75%.
- Type of building construction is wood frame as confirmed by the architect.

Manual Input

PROPOSED RESIDENTIAL UNIT

Step	Description	Term	Options		Multiplier Associated with Option	Value used	Unit	Total Fire Flow (L/min)
1	Frame Use for Construction of Unit	**Building Material**						
		Coefficient related to type of construction (C)	Wood Frame		1.5	1.5	N/A	N/A
			Ordinary Construction		1			
			Non-Combustible Construction		0.8			
			Fire Resistive materials (<2hrs)		0.7			
			Fire Resistive materials (>2hrs)		0.6			
2	Number of Storeys	Number of floors not inlcuding basement				2	N/A	N/A
3	Floor Area (A)	Total Floor Area (A) - for all stories exluding basement (m²)				510.0	(m²)	N/A
		Average Floor Measurements	Square Feet (ft²)		0.093	255.0		
			Square Metres (m²)		1			
			Hectares (ha)		10,000			
4	Fire Flow	Required fire flow without reductions or increases (rounded to the nearest 1000 L/min:					L/min	7,000
5	Combustibility of Building Contents	**Reductions / Increases From Factors Affecting Burning**						
		Occupancy content hazard reduction or surcharge Factor	Non-Combustible		-0.25	-0.15	N/A	-1,050
			Limited Combustible		-0.15			
			Combustible		0.00			
			Free Burning		0.15			
			Rapid Burning		0.25			
6	Building Equipped with Sprinklers	Sprinkler Reduction Factor	Complete Automatic Sprinklers		-0.50	0.00	N/A	0
			Adequate Automatic Sprinklers		-0.30			
			None		0.00			
7	Separation Distance Between Buildings	Exposure Distance Factor *	North Separation	20.1 - 30m	0.10	0.65	N/A	4,550
			South Separation	20.1 - 30m	0.10			
			East Separation	0 to 3m	0.25			
			West Separation	3.1 to 10m	0.20			
8	Required Fire Flow						**Total Required Fire Flow Rounded to the Nearest 1000 L/min:**	**11,000**
							Total Required Fire Flow in L/s:	183.3
							Duration of Fire Flow (hrs):	2
							Required Volume of Fire Flow (m³):	1,485

*Floor areas confirmed with the architect (ORCHARD Design Studio Inc.). Coefficient for type of construciton (C) is for non-conbustible construction as confimred by the architect.

Separation Distance Factor as per Fire Underwriters Survey of Canada, 2020

Seperation	*Charge*	*Seperation*	*Charge*
0 to 3m	*25%*	*20.1 to 30m*	*10%*
3.1 to 10m	*20%*	*30.1 to 45m*	*5%*
10.1m to 20m	*15%*		

Acceptable Fire Flow ranges as per Fire Underwriters Survey of Canada, 2020

2,000 Lpm < F < 45,000 Lpm; therefore acceptable

Note: For types of construction that do not fall within the categories given, coefficients shall not be greater than 1.5 nor less than 0.6 and may be determined by interpolation between consecutive construction types as listed above. Construction types are defined in the Appendix.

NOTE: THIS IS ONLY PRELIMINARY AND SUBJECT TO CHANGE BASED ON ARCHITECTURAL AND MECHANICAL DESIGN. THIS IS ONLY FOR AN ESTIMATE AS WE DO NOT CLAIM TO BE FIRE PROTECTION EXPERTS.

THEORETICAL WATER DEMAND CALCULATIONS

PROJECT: Agnes Street Subdivision
PROJECT No: 20-731
LOCATION: Caledon, ON
DATE: September 30, 2024

DESIGNED BY: Deven Verma, EIT.
REVIEWED BY: Khalid Mahmood, P. Eng

Manual Input
Automatic Output
Total Demand

Design Parameters

Residential		
Persons Per Unit (Townhouses):	3.328	(Region of Peel, Development Charges Background Study, December 2020)
Townhouse Units (ea.)	65	
Total Population	217	
Average Day Residential flow (L/cap/day):	270	(Region of Peel, Development Charges Background Study, December 2020)
Maximum Day Factor:	1.8	(Region of Peel, Development Charges Background Study, December 2020)
Peak Hour Factor:	3	(Region of Peel, Watermain Design Criteria, June 2010)
Fire Flow for Single detached dwelling: (L/min)	11000	Calculated (Fire underwriters survey, 2000)
Fire Flow for Single detached dwelling: (L/s)	183.33	

Total Water Demands (TWD):

Total Population	Average Daily Demand (ADD)		Max. Daily Demand (MDD)		Peak Hour Demand (PHD)		Fire Flow Demand (FFD)		MDD +FFD	Total Water Demand*	
#	(L/day)	(L/min)	(L/day)	(L/min)	(L/day)	(L/min)	(L/Min)	(L/s)	(L/min)	(L/min)	(L/s)
217	**58,590.00**	**40.69**	**105,462.00**	**73.24**	**175,770.00**	**122.06**	**11,000.00**	**183.33**	**11,073.24**	**11,073.24**	**184.55**

* Total water demand is the higher of MDD+Fire flow or Peak Hour Demand

HYDRANT FLOW TEST REPORT

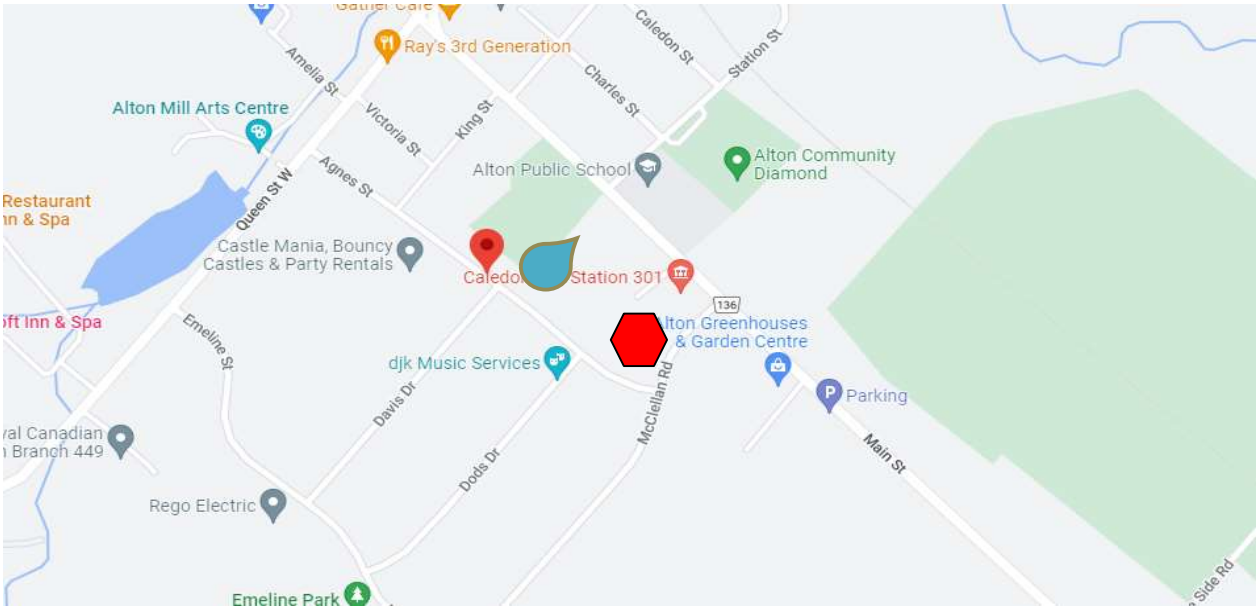
GENERAL INFORMATION:

PROJECT ID	**105-22**	TESTED BY:	AA/RS
PROJECT NAME	**Agnes Street - Hydrant Flow Test #1**	DATE	**August 22-22**
BUILDING ADDRESS	**Agnes Street**	TIME	**2:00:00 PM**
	Alton, Ontario		

WATER MAIN INFORMATION:

MAIN SIZE / MATERIAL	**150MM**
CONFIGURATION	**Looped**

HYDRANT LOCATION:



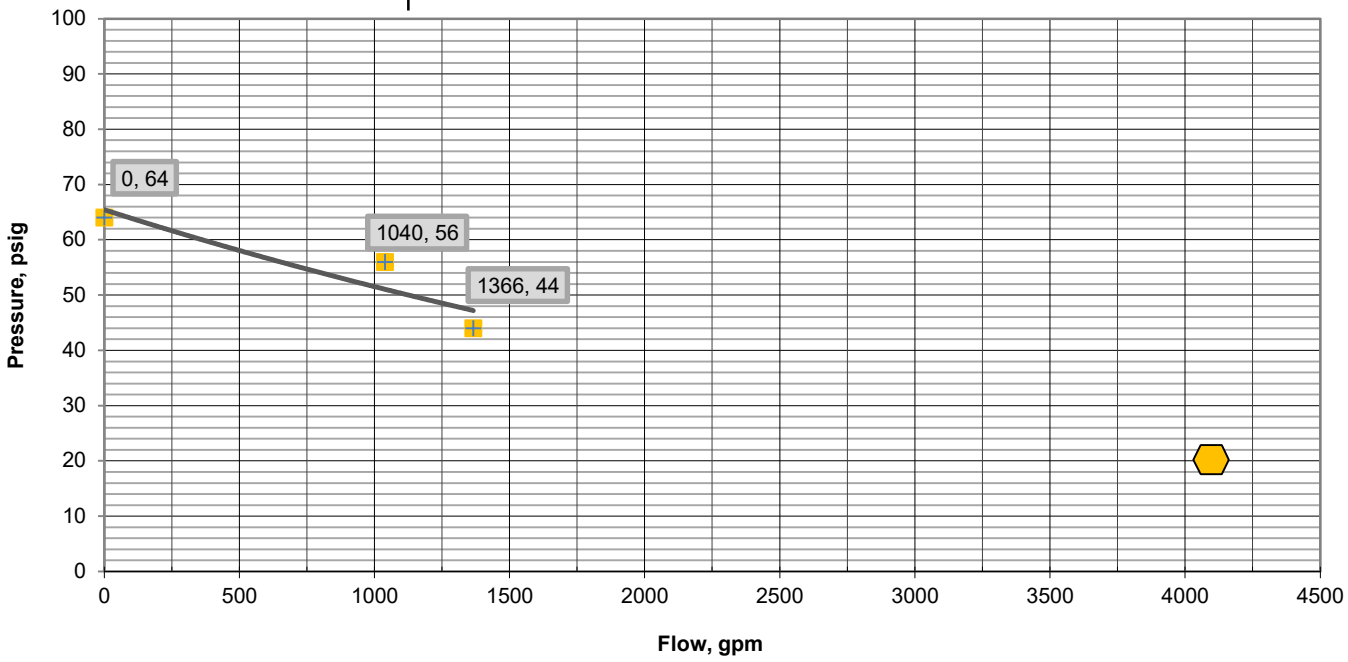
LEGEND: STATIC HYDRANT RESIDUAL HYDRANT

FINAL RESULTS:

Test #	Number of Outlets	Orifice Size (in)	Pitot Reading (psig)	EquivInt Flow (usgpm)	Total Flow (usgpm)	Projected flow at 20psi	Gauge Pressure (psig)	Discharge Coef'nt
Static	N/A	N/A	N/A	N/A	**0**	N/A	**64**	N/A
1	1	2.47	51	1040	**1040**	2610	**56**	0.8
2	2	2.47	22	683	**1366**	2091	**44**	0.8

FLOW AT 20PSI (140kPa) :

SINGLE OUTLET **2610 GPM (2 1/2 NOZZLE)**
DOUBLE OUTLET **2091 GPM (2 1/2 NOZZLE) - Combined = 4182 GPM**



HYDRANT INFORMATION:

HYDRANT DETAILS **CLASS C (RED)**
LISTED FLOW **500GPM @ 20PSI**

HYDRANT FLOW TEST REPORT

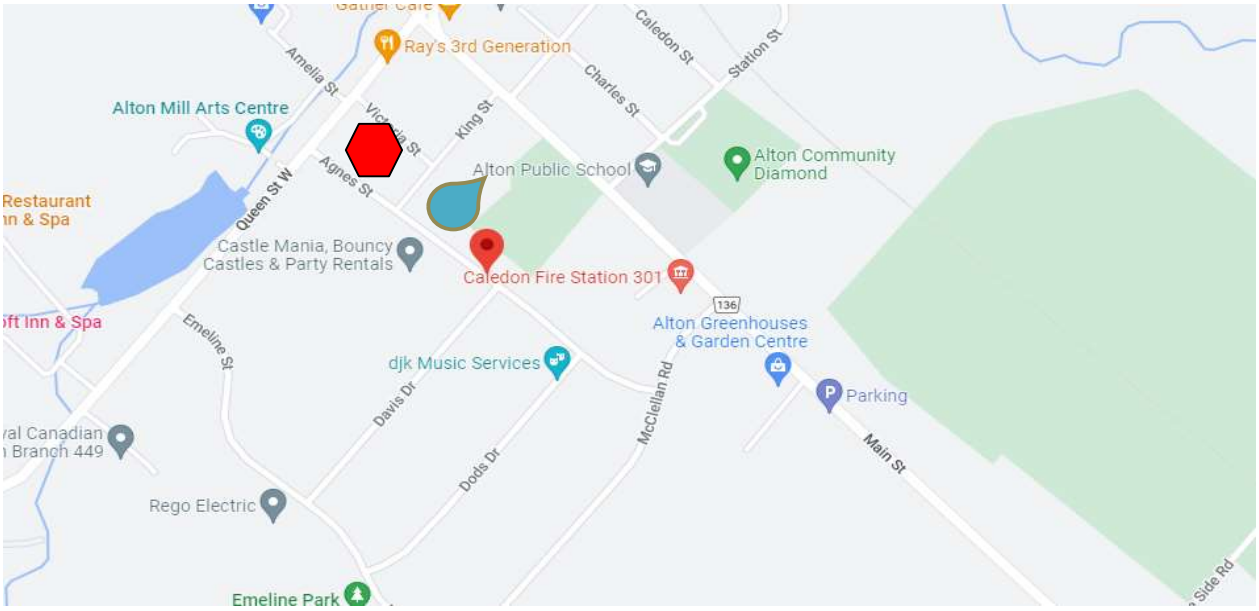
GENERAL INFORMATION:

PROJECT ID	**105-22**	TESTED BY:	AA/RS
PROJECT NAME	**Agnes Street - Hydrant Flow Test #2**	DATE	**August 22-22**
BUILDING ADDRESS	**Agnes Street**	TIME	**2:00:00 PM**
	Alton, Ontario		

WATER MAIN INFORMATION:

MAIN SIZE / MATERIAL	**150MM**
CONFIGURATION	**Looped**

HYDRANT LOCATION:



LEGEND: STATIC HYDRANT RESIDUAL HYDRANT

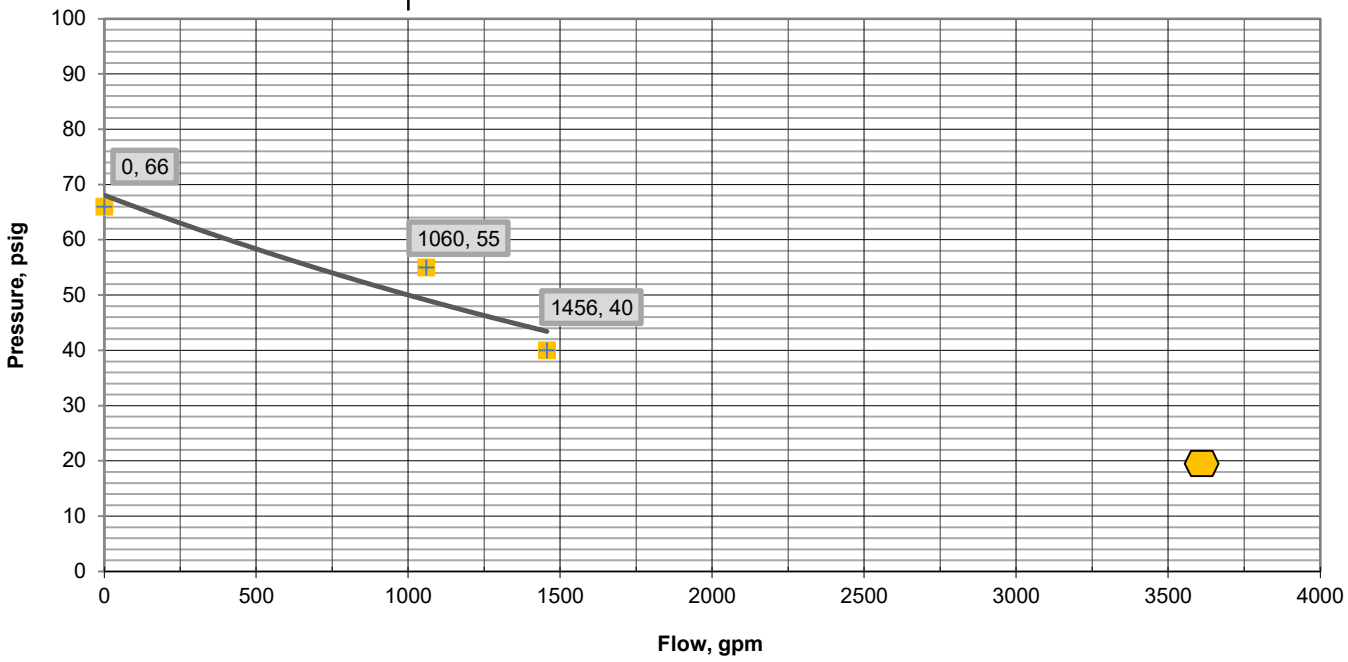
FINAL RESULTS:

Test #	Number of Outlets	Orifice Size (in)	Pitot Reading (psig)	EquivInt Flow (usgpm)	Total Flow (usgpm)	Projected flow at 20psi	Gauge Pressure (psig)	Discharge Coef'nt
Static	N/A	N/A	N/A	N/A	**0**	N/A	**66**	N/A
1	1	2.47	53	1060	**1060**	2295	**55**	0.8
2	2	2.47	25	728	**1456**	1981	**40**	0.8

FLOW AT 20PSI (140kPa) :

SINGLE OUTLET **2295 GPM (2 1/2 NOZZLE)**

DOUBLE OUTLET **1981 GPM (2 1/2 NOZZLE) Combined = 3962 GPM**



HYDRANT INFORMATION:

HYDRANT DETAILS **CLASS C (RED)**

LISTED FLOW **500GPM @ 20PSI**

HYDRANT FLOW TEST REPORT

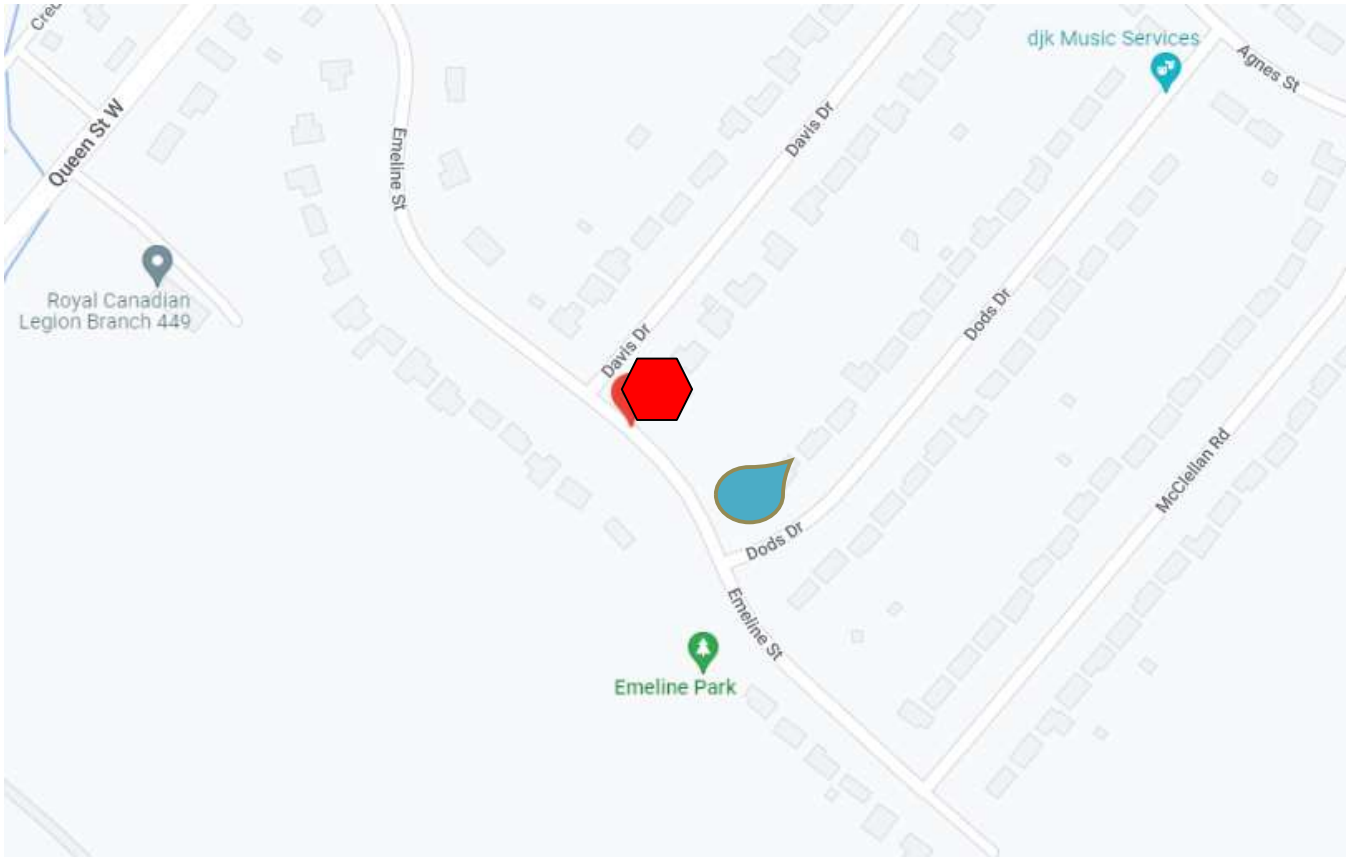
GENERAL INFORMATION:

PROJECT ID	**116-22**	TESTED BY:	RS
PROJECT NAME	**Emeline Street Flow Test**	DATE	**Sept 7-22**
BUILDING ADDRESS	**Emeline Street and Dods Drive Alton, Ontario**	TIME	**2:00:00 PM**

WATER MAIN INFORMATION:

MAIN SIZE / MATERIAL	**150MM**
CONFIGURATION	**Looped**

HYDRANT LOCATION:



LEGEND: STATIC HYDRANT RESIDUAL HYDRANT

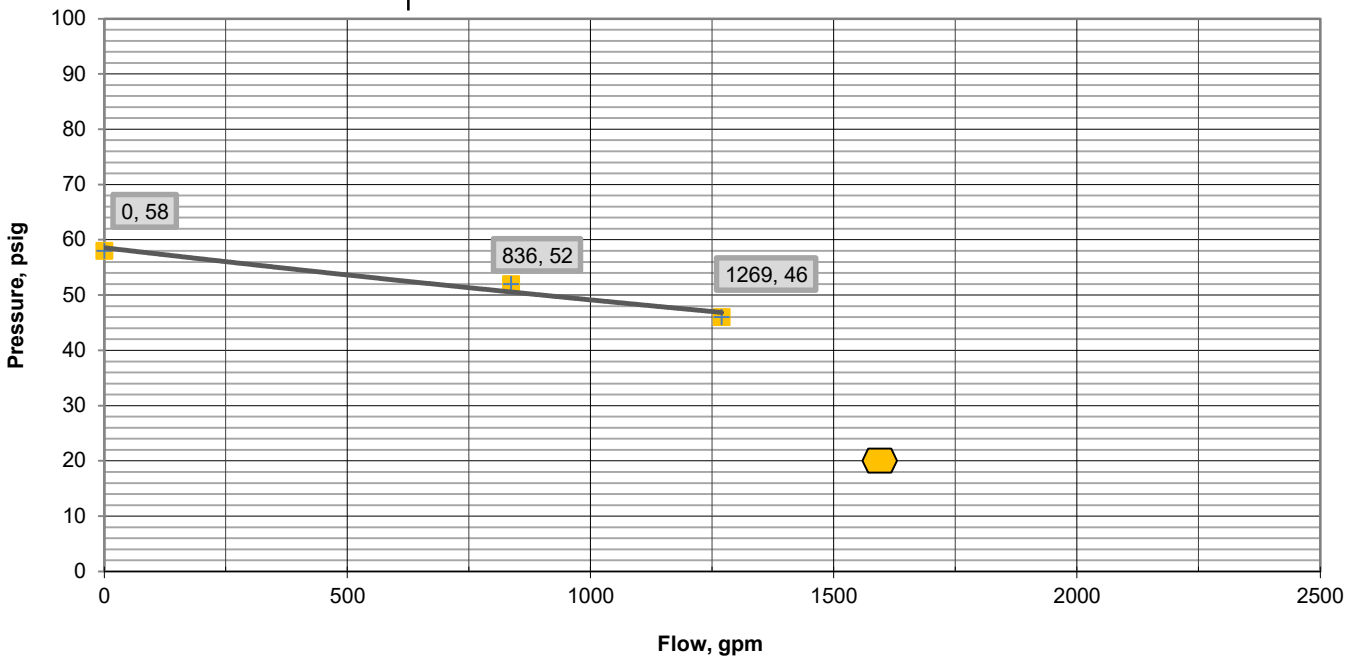
FINAL RESULTS:

Test #	Number of Outlets	Orifice Size (in)	Pitot Reading (psig)	EquivInt Flow (usgpm)	Total Flow (usgpm)	Projected flow at 20psi	Gauge Pressure (psig)	Discharge Coef'nt
Static	N/A	N/A	N/A	N/A	**0**	N/A	**58**	N/A
1	1	2.47	33	836	**836**	2266	**52**	0.8
2	2	2.47	19	635	**1269**	2365	**46**	0.8

FLOW AT 20PSI (140kPa) :

SINGLE OUTLET **1269 GPM (2 1/2 NOZZLE)**

DOUBLE OUTLET **836 GPM (2 1/2 NOZZLE)- Combined = 1672 GPM**



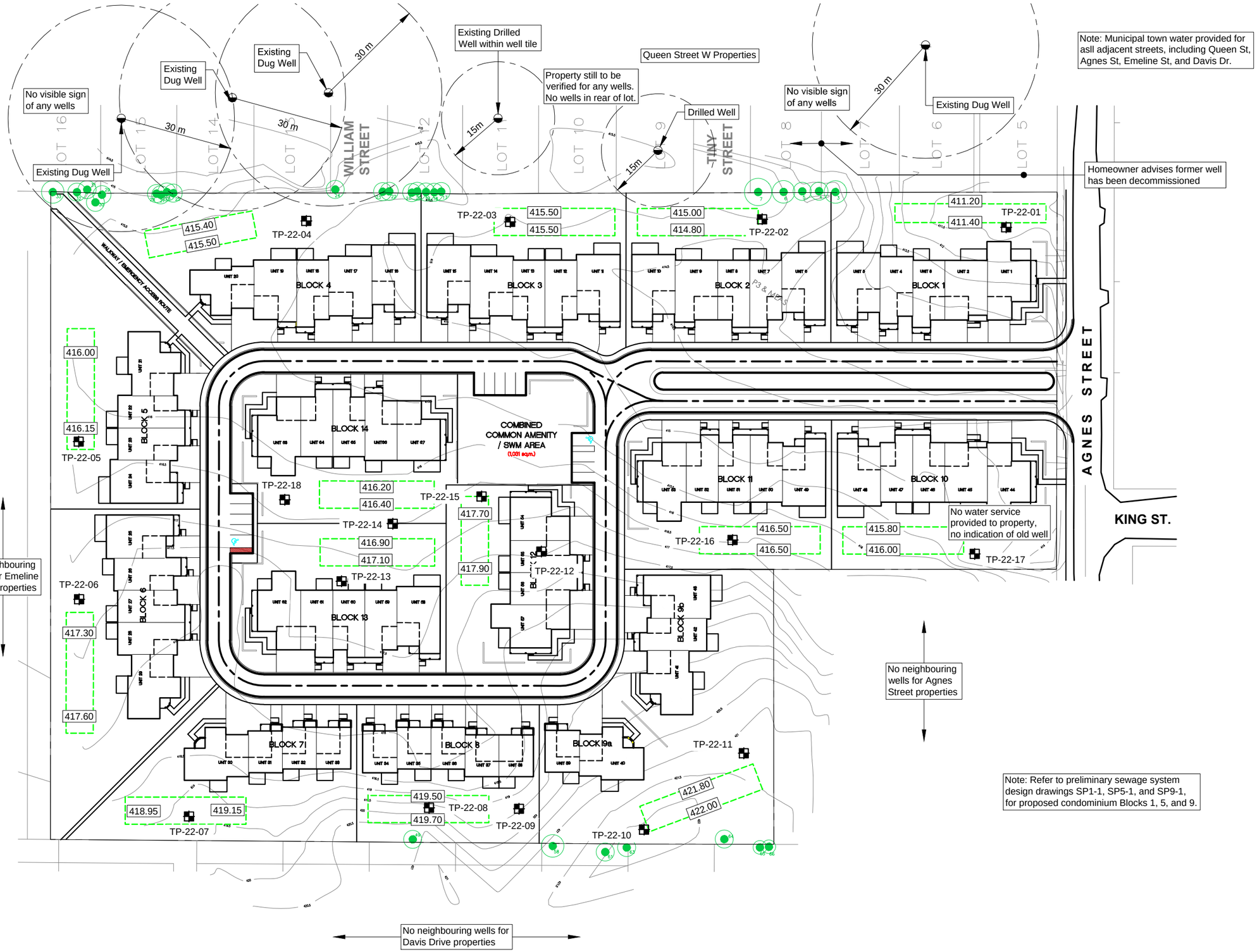
HYDRANT INFORMATION:

HYDRANT DETAILS **CLASS C (RED)**

LISTED FLOW **500GPM @ 20PSI**

APPENDIX C

Sanitary Design (By Others)



Gunnell Engineering Ltd.
1110 Stellar Drive, Unit 106
Newmarket, ON L3Y 7B7
bus: 905-868-9400
fax: 905-853-5734
www.septicdesign.ca

LEGEND

- Existing Known Wells
- Test Pit Locations
- Type 'A' Dispersal Beds (14)

Preliminary

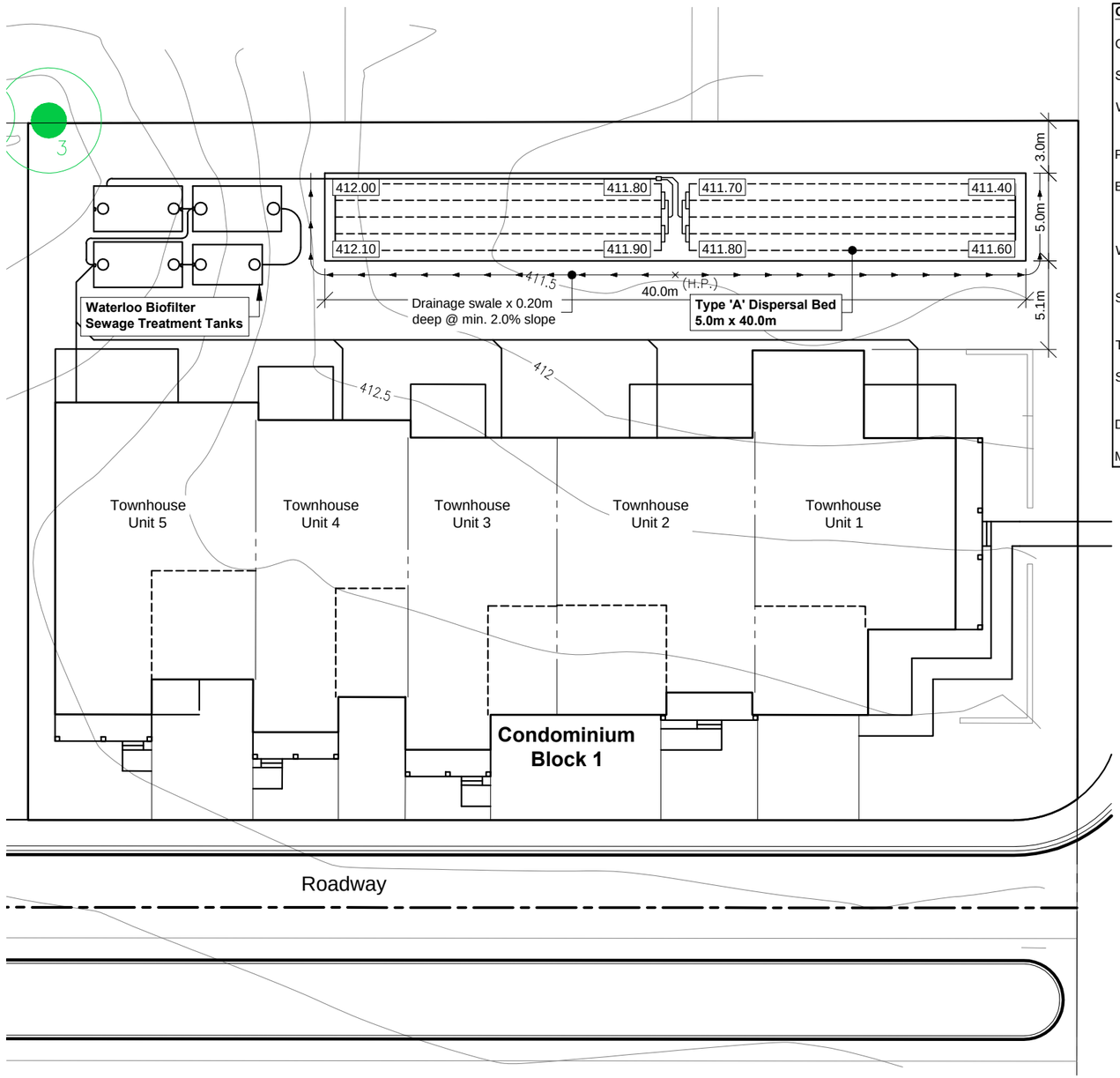
Rev. No.	Date	Description	CAD
Rev. 1	25-Jul-2022	Updated Well Locations	KD
Rev. 2	7-Mar-2023	Updated Site Plan	JK

Agnes Street Townhouse Residential Development Town of Caledon

Overall Site Plan: Neighbouring Well Locations Test Pit Locations Septic Field Locations

Scale: 1:1,000	Designed By: EG
Date: 21-JUL-2022	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP-1

File: Z:\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\~BB~ Updated Site Plan\D3082BB-SP1.dwg
Plotted On: Thu, 16 Mar 2023 - 2:48pm



Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 1

Q = 9,900 L/day (Five 3-bedroom, 3-bathroom Townhouses, each at 1,980 L/day)

Sewage Treatment: CBOD5 ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 9,900 L = 18,711 L
Provide Waterloo Biofilter Anaerobic Digester: 22,500 L (5,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 9,000 L (PT-9000) pump tank to time dose to BT-22500 Biofilter Tank.

Biofilter Tank: Provide 22,500 L (5,000 gal.) BT22500 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand dose to WaterNox Tank (advanced nitrate treatment).

WaterNox-LS Tank: Provide 18,000 L (4,000 gal.) LS-18000 Tank (to Waterloo Biofilter Specifications), to dose on a demand basis to Type 'A' Dispersal bed.

Soil Percolation: T = 6 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 9,900 L/day & T = 6 min/cm)

Stone Layer: Maximum loading = 50 L/sm/day (i.e.: Q ≥ 3,000 L/day); 9,900 / 50 = 198.0 sm.
Provide Stone Layer Area = 200.0 sm. (5.0m x 40.0m)

Dispersal Bed Area: QT/850: 9,900 x 6 / 850 = 69.8m^2. Provide Dispersal Bed Area: 5.0m x 40.0m = 200 m^2

Mantle - N/A (i.e. T < 15 min/cm).

Stone Layer (c/w distribution piping) is to be a minimum of:
- 15.0m from drilled wells
- 30.0m from dug wells
- 3.0m from property lines
- 5.0m from townhouses

Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

Sewage System / Adjacent Grading Design Criteria:

1. 4:1 max. down slopes away from septic field.
2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
5. Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
6. No retaining walls constructed adjacent to septic fields.

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www.septicdesign.ca

LEGEND

Preliminary

Agnes Street Townhouse Residential Development Town of Caledon

Typical Sewage System Layout: Block 1

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP1-1

File: Z:\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-BB- Updated Site Plan\D3082BB-SP1-1.dwg
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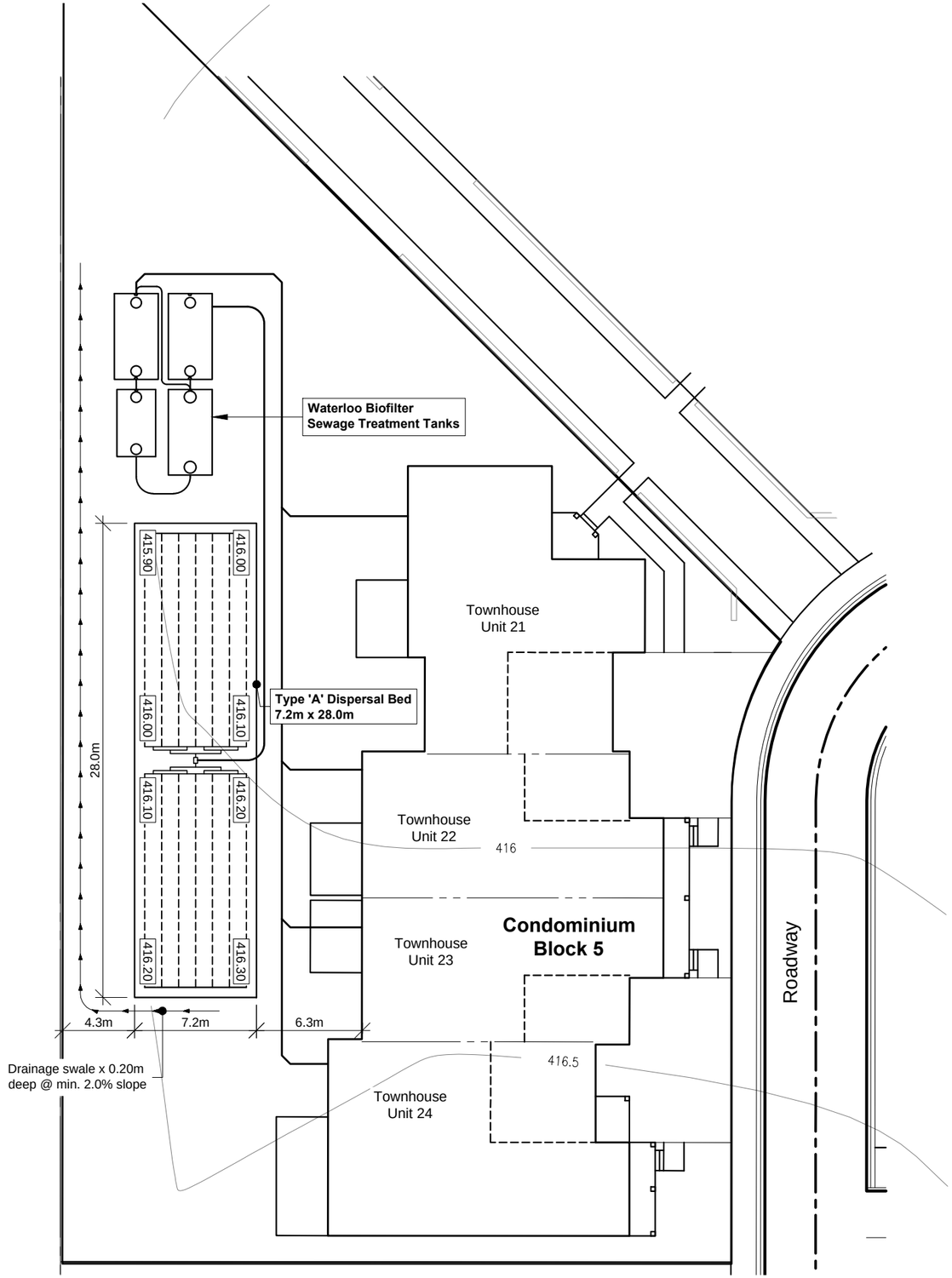

Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 5

Q = 8,000 L/day (Four 3-bedroom, 3-bathroom Townhouses, each at 2,000 L/day)

Sewage Treatment: CBOD5 ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 8,000 L = 15,120 L
Provide Waterloo Biofilter Anaerobic Digester: 18,000 L (4,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 6,800 L (PT-6800) pump tank to time dose to BT-18000 Biofilter Tank.

Biofilter Tank: Provide 18,000 L (4,000 gal.) BT-18000 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand dose to WaterNox Tank (advanced nitrate treatment).

WaterNox-LS Tank: Provide 13,500 L (3,000 gal.) LS-13500 Tank (to Waterloo Biofilter Specifications), to dose on a demand basis to Type 'A' Dispersal bed.

Soil Percolation: T = 6 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 8,000 L/day & T = 6 min/cm)

Stone Layer: Maximum loading = 50 L/sm/day (i.e.: Q ≥ 3,000 L/day); 8,000 / 50 = 160.0 sm.
Provide Stone Layer Area = 201.6 sm. (7.2m x 28.0m)

Dispersal Bed Area: QT/850: 8,000 x 6 / 850 = 56.5m^2. Provide Dispersal Bed Area: 7.2m x 28.0m = 201.6 m^2

Mantle - N/A (i.e. T < 15 min/cm).

Stone Layer (c/w distribution piping) is to be a minimum of:
- 15.0m from drilled wells
- 30.0m from dug wells
- 3.0m from property lines
- 5.0m from townhouses

Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

Sewage System / Adjacent Grading Design Criteria:

1. 4:1 max. down slopes away from septic field.
2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
5. Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
6. No retaining walls constructed adjacent to septic fields.

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Preliminary

Agnes Street Townhouse Residential Development Town of Caledon

Typical Sewage System Layout: Block 5

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP5-1

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www.septicdesign.ca

Stone Layer (c/w distribution piping) is to be a minimum of:
- 15.0m from drilled wells
- 30.0m from dug wells
- 3.0m from property lines
- 5.0m from townhouses

Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

Sewage System / Adjacent Grading Design Criteria:

1. 4:1 max. down slopes away from septic field.
2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
5. Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
6. No retaining walls constructed adjacent to septic fields.

Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 9

Q = 9,900 L/day (Five 3-bedroom, 3-bathroom Townhouses, each at 1,980 L/day)

Sewage Treatment: CBOD5 ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 9,900 L = 18,711 L
Provide Waterloo Biofilter Anaerobic Digester: 22,500 L (5,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 9,000 L (PT-9000) pump tank to time dose to BT-22500 Biofilter Tank.

Biofilter Tank: Provide 22,500 L (5,000 gal.) BT22500 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand dose to WaterNox Tank (advanced nitrate treatment tank).

WaterNox-LS Tank: Provide 18,000 L (4,000 gal.) LS-18000 Tank (to Waterloo Biofilter Specifications), to dose on a demand basis to Type 'A' Dispersal bed.

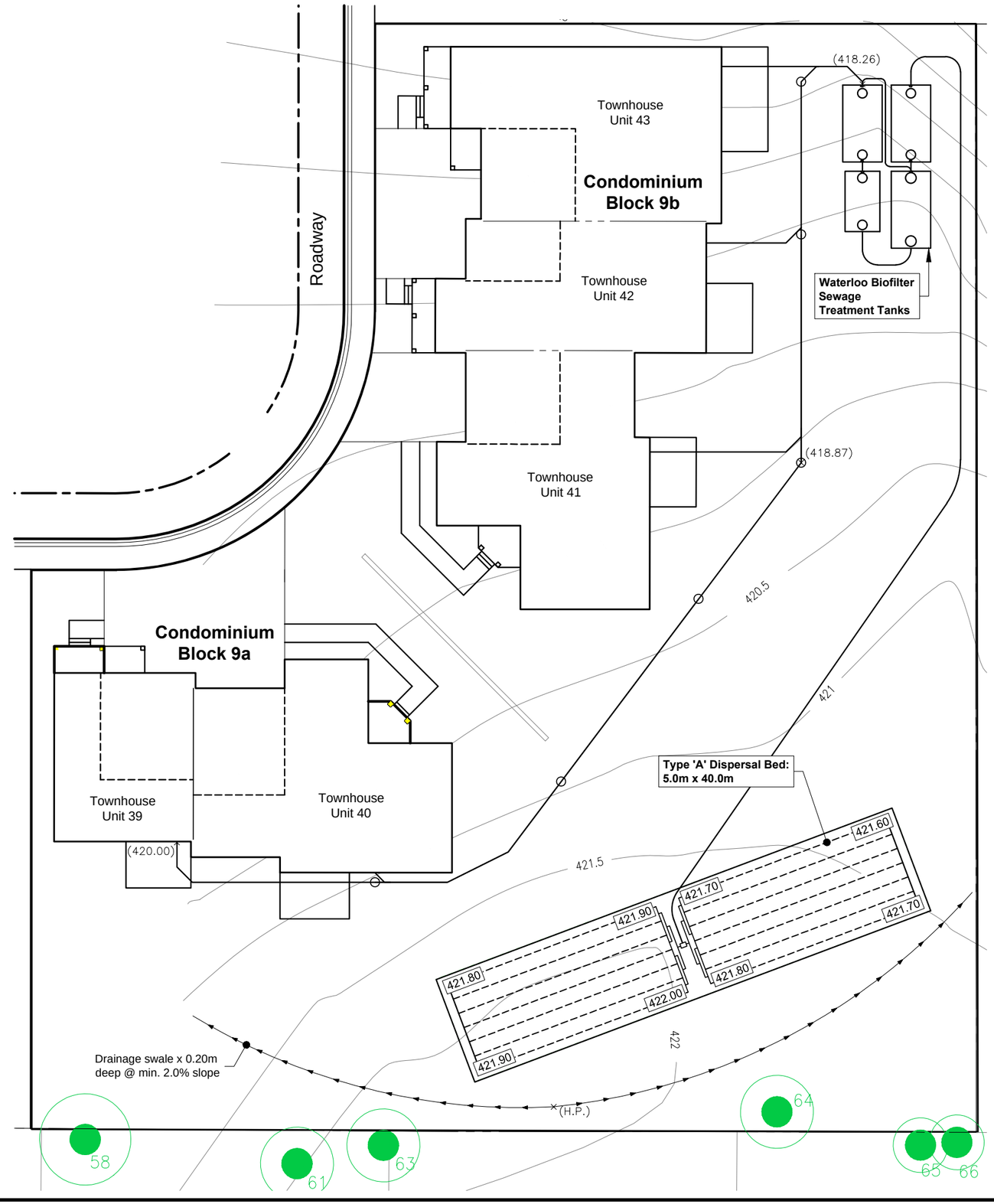
Soil Percolation: T = 8 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 9,900 L/day & T = 8 min/cm)

Stone Layer: Maximum loading = 50 L/sm/day (i.e.: Q ≥ 3,000 L/day); 9,900 / 50 = 198.0 sm.
Provide Stone Layer Area = 200.0 sm. (5.0m x 40.0m)

Dispersal Bed Area: QT/850: 9,900 x 8 / 850 = 93.2m^2. Provide Dispersal Bed Area: 5.0m x 40.0m = 200 m^2

Mantle - N/A (i.e. T < 15 min/cm).



LEGEND

Preliminary

Agnes Street Townhouse Residential Development Town of Caledon

Typical Sewage System Layout: Block 9

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP9-1

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Plotted On: Thu, 16 Mar 2023 - 2:48pm

GUNNELL ENGINEERING LTD.
Municipal & Environmental Engineering

March 14, 2023
(Revised December 7, 2023)

Mr. Jeremy Grant
The Alton Development Inc.
1402 Queen Street
Caledon, Ontario
L7K 0C3

Re: Agnes Street Residential Development – Town of Caledon
Functional Servicing Report: Ontario Building Code Sewage Systems
Our File: D3082

Dear Mr. Grant,

The proposed residential development is to consist of 67 townhouse units, which are to be developed into fourteen (14) condominium blocks, with each condominium block under separate land ownership. Each condominium block will include for 4 or 5 townhouse units.

Municipal sanitary sewers are not available to service the proposed development, however municipal water is to be provided. Wastewater servicing for each residential block (4 or 5 townhouse units) will be serviced with an on-site sewage system. Each condominium Townhouse Block (Blocks 1 to 14) will each be serviced by one Ontario Building Code (OBC) compliant Class IV Tertiary Sewage Treatment System and a Type 'A' Dispersal Bed, with each of the 14 sewage systems having a daily design sewage flow of less than 10,000 L/day. Refer to attached Drawing SP-1 for the Townhouse Condominium Block layout and dispersal / septic bed locations. The permitting jurisdiction for these proposed Ontario Building Code (OBC) sewage systems will fall under the jurisdiction of the Town of Caledon Building Department (i.e. not the Ministry of the Environment, Conservation and Parks). In addition, and since the maximum number of residential units for each condominium block / land ownership is five, a Municipal Responsibility Assessment (MRA) in not required. We note that condominium townhouse blocks will be managed by the respective condominium association, to include for on-going service and maintenance, and funding for upgrades and component replacement within their designated reserve funds.

A septic test pit investigation was undertaken on August 11, 2022, with test pit locations shown on attached Drawing SP-1. The scope of the test pit investigation included identification of native soil type & percolation rate, as well as groundwater elevation observations in the area of each sewage system Type 'A' Dispersal Bed. The test pit results concluded that the native soils were coarse sand, with a percolation rate ranging between 6-10 mins/cm. Groundwater was not encountered in any test pit during the investigation. In addition, there was no soil staining that would be indicative of a seasonal high groundwater elevation. Preliminary design drawings have been prepared for the proposed on-site sewage treatment and effluent dispersal systems for the proposed Agnes Street residential development, Town of Caledon. Based on the soil percolation rates of the native soil, site topography and layout, and absence of groundwater, soil staining that would be indicative of a seasonal high groundwater elevation, in the septic test pits; Waterloo Biofilter tertiary treatment sewage systems, complete with Type 'A' Dispersal Beds, for each residential Condominium Block, has been proposed. There are 14 on-site sewage systems in total.

The configuration of the typical proposed sanitary servicing system is shown on the attached preliminary site plan Drawings, SP1-1, SP5-1 and SP9-1, as described below:

Design Sanitary Flows

The sewage treatment plant and effluent dispersal system servicing each of the 14 residential Blocks will have daily design flow sewage capacities ranging from 7,700 to of 9,900 L/day. Each Block includes 4 or 5 three (3)-bedroom townhouse units.

Individual townhouse daily design sewage flows for these 3-bedroom units are based on OBC Table 8.2.1.3.A. The size of the Type 'A' Dispersal Beds is based on OBC Section 8.7.7. Detailed calculations are illustrated on the preliminary sewage system layouts (Drawings SP1-1, SP5-1 and SP9-1), complete with our Ontario Building Code Compliance Analysis.

Proposed Sewage Treatment System

The proposed sewage treatment system for each residential townhouse condominium Block will include a Class IV tertiary treatment system (Waterloo Biofilter). The Waterloo Biofilter sewage treatment system meets Ontario Building Code Level IV (tertiary) quality effluent ($CBOD_5 \leq 10$ mg/L and TSS $\leq$ 10 mg/L), and is certified under the CAN/BNQ 3680-600 testing protocol per OBC Table 8.6.2.2. The Waterloo Biofilter sewage treatment system will each consist of a 22,500 L (5,000 gal) W.B. Anaerobic Digester with gravity flow to a 9,000 L Pump Station. Sewage effluent will be time dosed to a BT-22500 22,500 L (5,000 gal.) basket Biofilter tank. The Biofilter tank, c/w two (2) pumps; one pump to re-circulate to the W.B. Anaerobic Digester, the second pump to demand dose to the 18,000 L (4,000 gal.) WaterNox Tank (LS-18000), for nitrate treatment to 5 mg/L, as detailed in the Terraprobe hydro-geological report. Sewage from the WaterNox Tank will be demand dosed to the Type 'A' Dispersal Bed (timed dosed via the Pump Station).

The Waterloo Biofilter WaterNOx-LS Denitrification Unit underwent BNQ 3680-600 testing in 2016 for nitrogen removal. The test results are attached to this report. During the CAN/BNQ 3680-600 protocol Period A (based on NSF-40), the total nitrogen removal of the system was 92% with an average effluent concentration of 4.8 mg/L (TKN was 4.6 mg/L and NO3-N + NO2-N was 0.20 mg/L). During the CAN/BNQ 3680-600 protocol Period B (strenuous working parent schedule), the total nitrogen removal of the system was 80% with an average effluent concentration of 11.9 mg/L (TKN was 8.5 mg/L and NO3-N + NO2-N was 3.38 mg/L). The testing results indicated that the WaterNOx-LS system can successfully remove very high levels of total nitrogen passively, while buffering pH to neutral and keeping $CBOD_5$ and TSS levels below 10 mg/L.

Effluent Dispersal Systems

Treated effluent from the sewage treatment plant, servicing each townhouse Block, will be discharged to a Type 'A' Dispersal Bed, with a daily design sewage flow ranging from 7,700 to 9,900 L/day. Preliminary design calculations for the effluent dispersal systems are outlined on the sewage system design details on attached site plan drawings (i.e. typical sewage system preliminary layouts for Townshouse Blocks 1, 5, and 9). Specified OBC clearance distances for

the Type 'A' dispersal bed stone layers are shown on the attached drawings. The native sand soils were assessed with a soil percolation rate of T = 6 – 10 min/cm.

Summary

In summary, the property is able to accommodate the proposed domestic sewage treatment and on-site disposal from the proposed residential townhouse development, with the detailed 14 sewage treatment / dispersal bed systems. The sewage systems will be designed in accordance with the Ontario Building Code (OBC), to treat the effluent from the proposed residential development, for each of the 14 townhouse condominium block sewage systems.

We trust that the above description of the on-site sewage systems meets your requirements. Please do not hesitate to contact us if you have any questions.



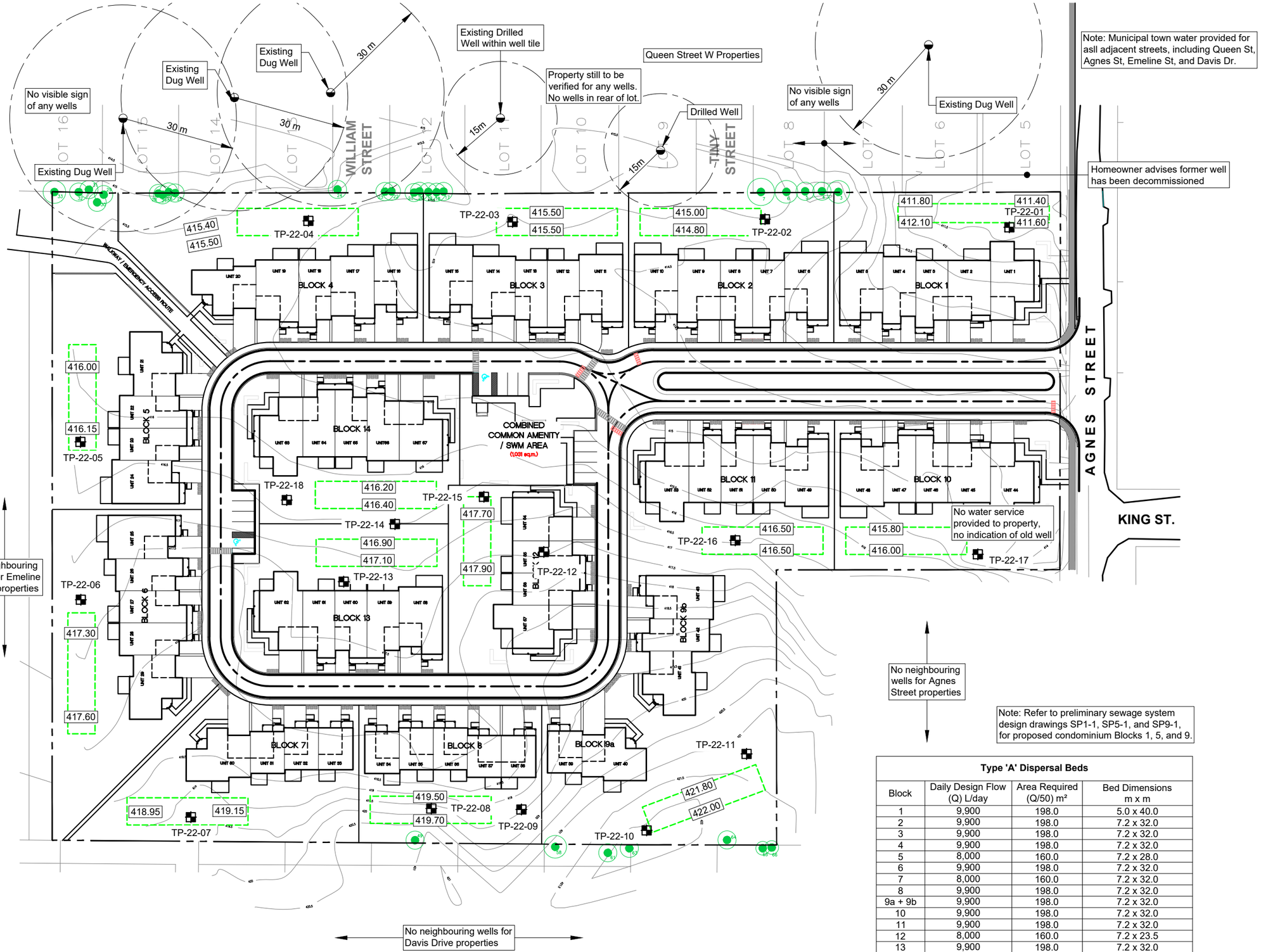
Yours truly,
GUNNELL ENGINEERING LTD.

Teika Zilans
Environmental Technician

Eric Gunnell, P.Eng

Attachments:

- Gunnell Engineering Ltd Preliminary. Drawings SP-1, SP1-1, SP5-1, SP9-1, DT-1, DT-2 and DT-3
- Waterloo Biofilter WaterNOx-LS Third Party Testing Summary



Note: Refer to preliminary sewage system design drawings SP1-1, SP5-1, and SP9-1, for proposed condominium Blocks 1, 5, and 9.

Type 'A' Dispersal Beds

Block	Daily Design Flow (Q) L/day	Area Required (Q/50) m²	Bed Dimensions m x m
1	9,900	198.0	5.0 x 40.0
2	9,900	198.0	7.2 x 32.0
3	9,900	198.0	7.2 x 32.0
4	9,900	198.0	7.2 x 32.0
5	8,000	160.0	7.2 x 28.0
6	9,900	198.0	7.2 x 32.0
7	8,000	160.0	7.2 x 32.0
8	9,900	198.0	7.2 x 32.0
9a + 9b	9,900	198.0	7.2 x 32.0
10	9,900	198.0	7.2 x 32.0
11	9,900	198.0	7.2 x 32.0
12	8,000	160.0	7.2 x 23.5
13	9,900	198.0	7.2 x 32.0
14	9,900	198.0	7.2 x 32.0

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LEGEND

- Existing Known Wells
- Test Pit Locations
- Type 'A' Dispersal Beds (14)

Preliminary

Rev. No.	Date	Description	CAD
Rev. 1	25-Jul-2022	Updated Well Locations	KD
Rev. 2	7-Mar-2023	Updated Site Plan	JK
Rev. 3	28-NOV-2023	Town Comments	JK

Agnes Street Townhouse Residential Development Town of Caledon

Overall Site Plan: Neighbouring Well Locations Test Pit Locations Septic Field Locations

Scale: 1:1,000	Designed By: EG
Date: 21-JUL-2022	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP-1

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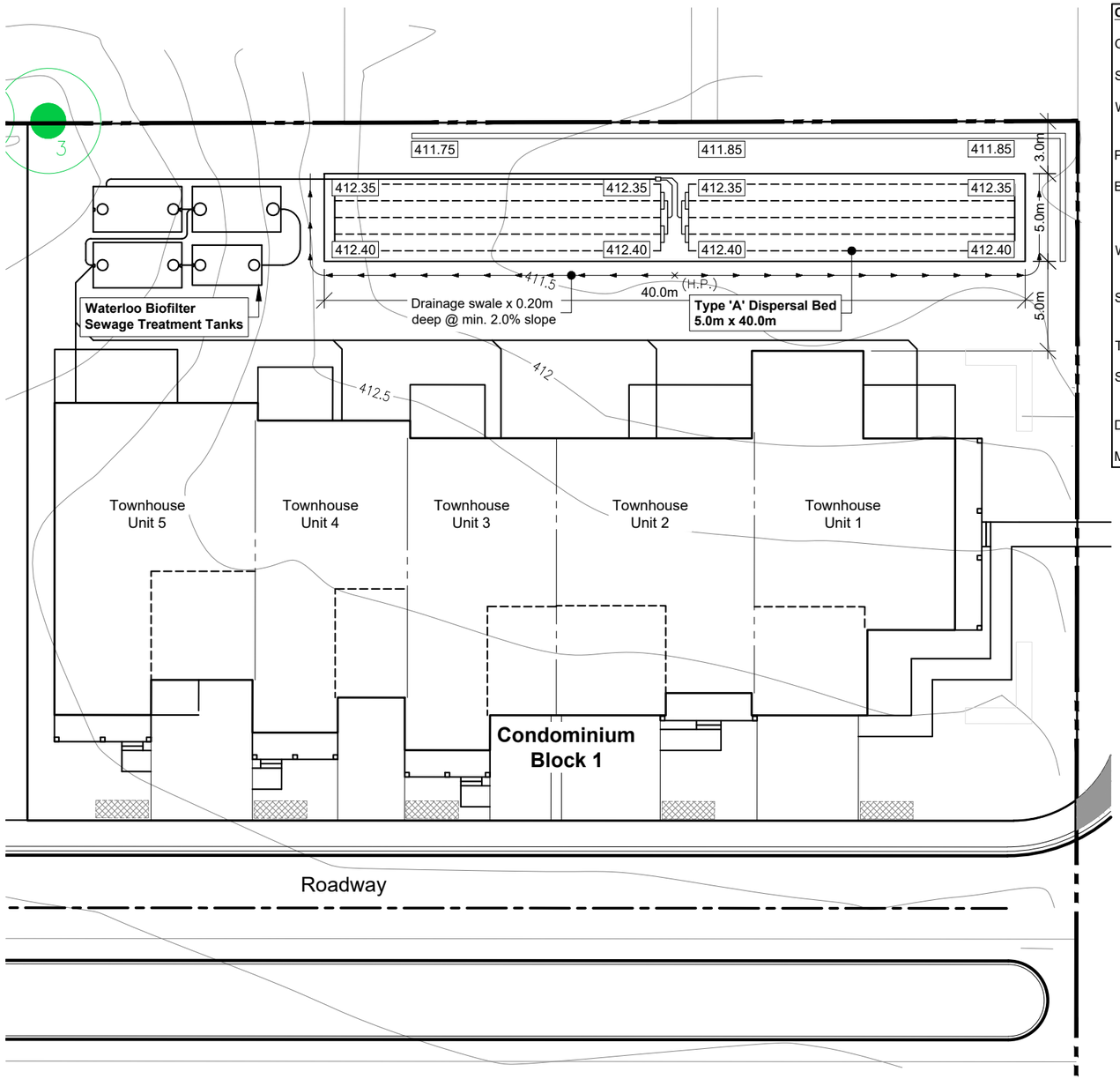

Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 1

Q = 9,900 L/day (Five 3-bedroom, 3-bathroom Townhouses, each at 1,980 L/day)

Sewage Treatment: CBOD5 ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 9,900 L = 18,711 L
Provide Waterloo Biofilter Anaerobic Digester: 22,500 L (5,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 9,000 L (PT-9000) pump tank to time dose to BT-22500 Biofilter Tank.

Biofilter Tank: Provide 22,500 L (5,000 gal.) BT22500 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand dose to WaterNox Tank (advanced nitrate treatment).

WaterNox-LS Tank: Provide 18,000 L (4,000 gal.) LS-18000 Tank (to Waterloo Biofilter Specifications), to dose on a demand basis to Type 'A' Dispersal bed.

Soil Percolation: T = 6 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 9,900 L/day & T = 6 min/cm)

Stone Layer: Maximum loading = 50 L/sm/day (i.e.: Q ≥ 3,000 L/day); 9,900 / 50 = 198.0 sm.
Provide Stone Layer Area = 200.0 sm. (5.0m x 40.0m)

Dispersal Bed Area: QT/850: 9,900 x 6 / 850 = 69.8m^2. Provide Dispersal Bed Area: 5.0m x 40.0m = 200 m^2

Mantle - N/A (i.e. T < 15 min/cm).

Stone Layer (c/w distribution piping) is to be a minimum of:
- 15.0m from drilled wells
- 30.0m from dug wells
- 3.0m from property lines
- 5.0m from townhouses

Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

Sewage System / Adjacent Grading Design Criteria:

1. 4:1 max. down slopes away from septic field.
2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
5. Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
6. No retaining walls constructed adjacent to septic fields.

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LEGEND

Preliminary

Agnes Street Townhouse Residential Development Town of Caledon

Typical Sewage System Layout: Block 1

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP1-1

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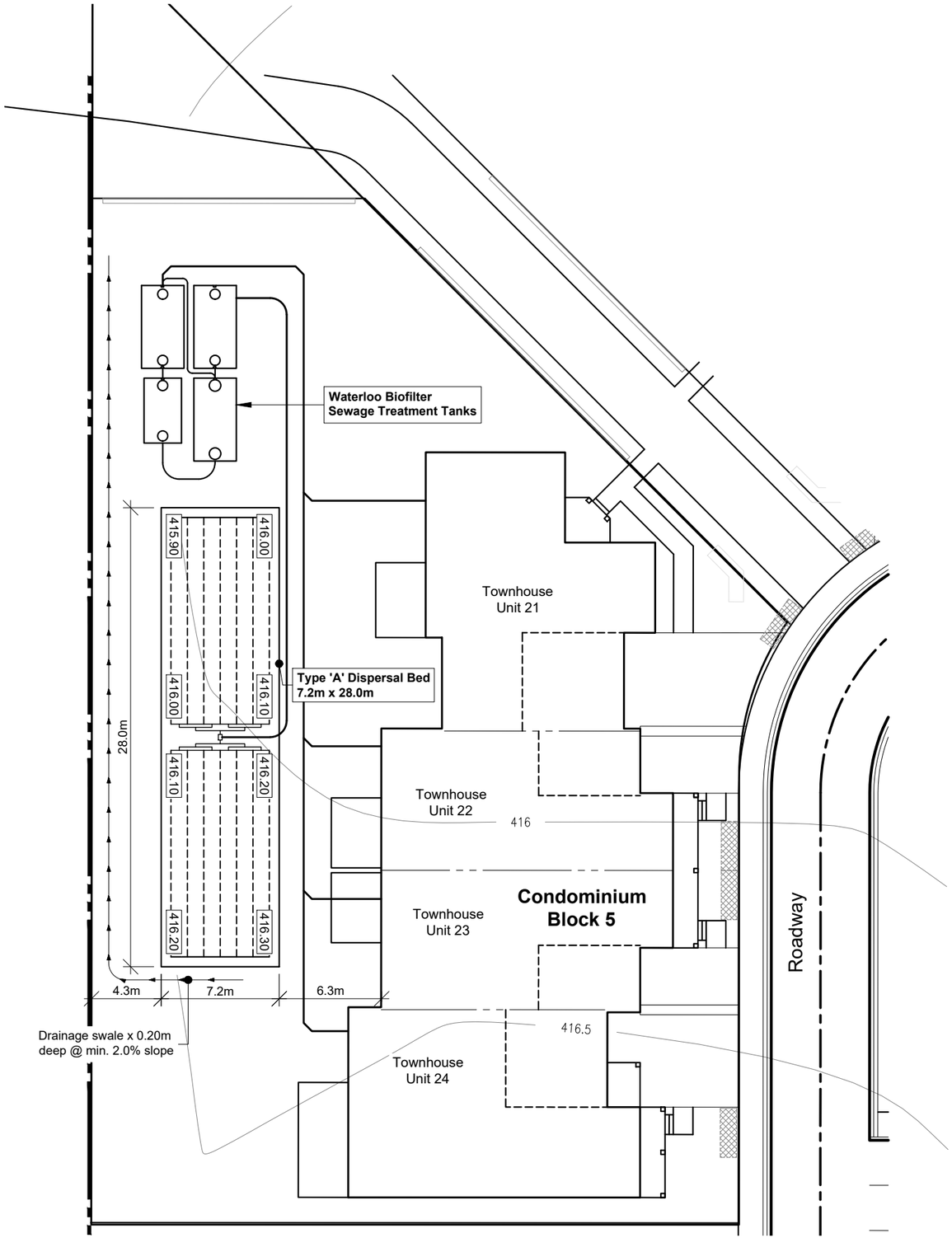

Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 5

Q = 8,000 L/day (Four 3-bedroom, 3-bathroom Townhouses, each at 2,000 L/day)

Sewage Treatment: CBOD5 ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 8,000 L = 15,120 L
Provide Waterloo Biofilter Anaerobic Digester: 18,000 L (4,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 6,800 L (PT-6800) pump tank to time dose to BT-18000 Biofilter Tank.

Biofilter Tank: Provide 18,000 L (4,000 gal.) BT-18000 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand dose to WaterNox Tank (advanced nitrate treatment).

WaterNox-LS Tank: Provide 13,500 L (3,000 gal.) LS-13500 Tank (to Waterloo Biofilter Specifications), to dose on a demand basis to Type 'A' Dispersal bed.

Soil Percolation: T = 6 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 8,000 L/day & T = 6 min/cm)

Stone Layer: Maximum loading = 50 L/sm/day (i.e.: Q ≥ 3,000 L/day); 8,000 / 50 = 160.0 sm.
Provide Stone Layer Area = 201.6 sm. (7.2m x 28.0m)

Dispersal Bed Area: QT/850: 8,000 x 6 / 850 = 56.5m^2. Provide Dispersal Bed Area: 7.2m x 28.0m = 201.6 m^2

Mantle - N/A (i.e. T < 15 min/cm).

Stone Layer (c/w distribution piping) is to be a minimum of:
- 15.0m from drilled wells
- 30.0m from dug wells
- 3.0m from property lines
- 5.0m from townhouses

Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

Sewage System / Adjacent Grading Design Criteria:

1. 4:1 max. down slopes away from septic field.
2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
5. Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
6. No retaining walls constructed adjacent to septic fields.

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Preliminary

Rev. No.	Date	Description	CAD
Rev. 1	28-NOV-2023	Town Comments	JK

Agnes Street Townhouse Residential Development Town of Caledon

Typical Sewage System Layout: Block 5

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP5-1

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Plotted On: Thu, 30 Nov 2023 - 4:26pm

Sewage System / Adjacent Grading Design Criteria:

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2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
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Stone Layer (c/w distribution piping) is to be a minimum of:
- 15.0m from drilled wells
- 30.0m from dug wells
- 3.0m from property lines
- 5.0m from townhouses

Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 9

Q = 9,900 L/day (Five 3-bedroom, 3-bathroom Townhouses, each at 1,980 L/day)

Sewage Treatment: CBOD5 ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 9,900 L = 18,711 L
Provide Waterloo Biofilter Anaerobic Digester: 22,500 L (5,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 9,000 L (PT-9000) pump tank to time dose to BT-22500 Biofilter Tank.

Biofilter Tank: Provide 22,500 L (5,000 gal.) BT22500 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand dose to WaterNox Tank (advanced nitrate treatment tank).

WaterNox-LS Tank: Provide 18,000 L (4,000 gal.) LS-18000 Tank (to Waterloo Biofilter Specifications), to dose on a demand basis to Type 'A' Dispersal bed.

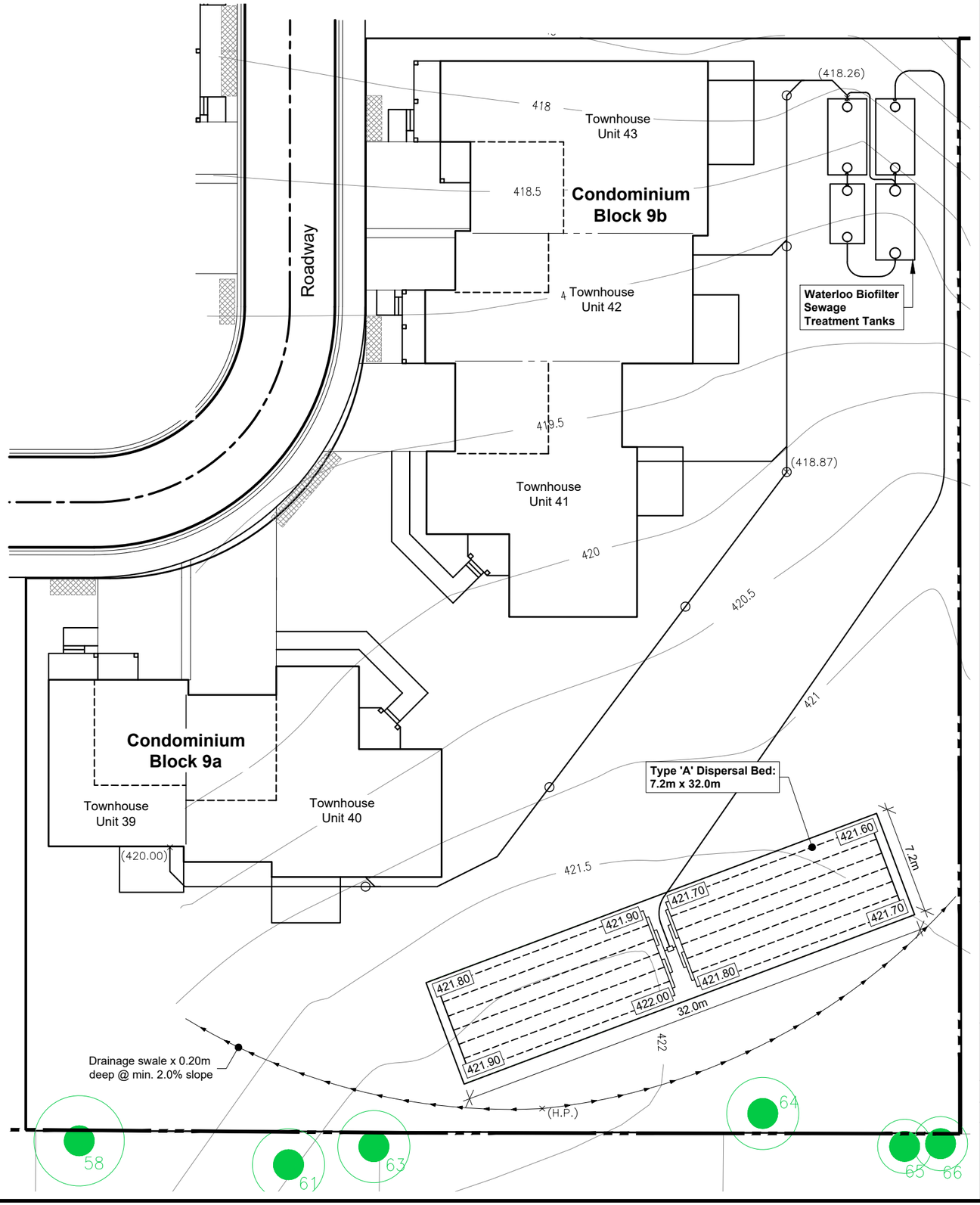
Soil Percolation: T = 8 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 9,900 L/day & T = 8 min/cm)

Stone Layer: Maximum loading = 50 L/sm/day (i.e.: Q ≥ 3,000 L/day); 9,900 / 50 = 198.0 sm.
Provide Stone Layer Area = 200.0 sm. (5.0m x 40.0m)

Dispersal Bed Area: QT/850: 9,900 x 8 / 850 = 93.2m^2. Provide Dispersal Bed Area: 7.2m x 32.0m = 230.4 m^2

Mantle - N/A (i.e. T < 15 min/cm).



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fax: 905-853-5734
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LEGEND

Preliminary

Rev. No.	Date	Description	CAD
Rev. 1	28-NOV-2023	Town Comments	JK

Agnes Street Townhouse Residential Development Town of Caledon

Typical Sewage System Layout: Block 9

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP9-1

File: \\Gunnell\QNAP\Shared\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-BC- Updated Site Plan\D3082BC-SP1-9.dwg
Plotted On: Thu, 30 Nov 2023 - 4:26pm

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Test Pit
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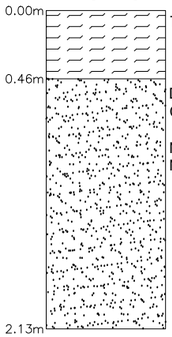

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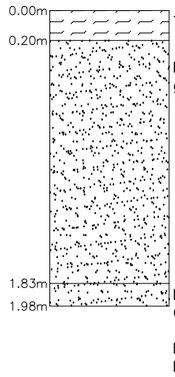

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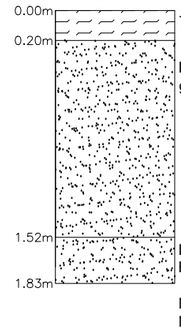

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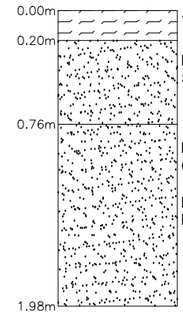

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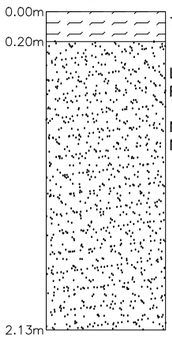

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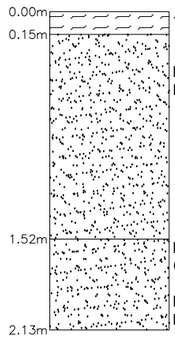

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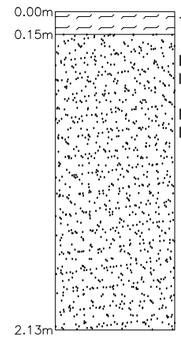

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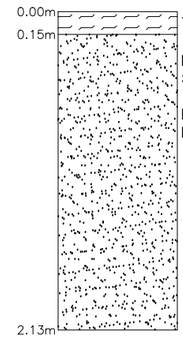

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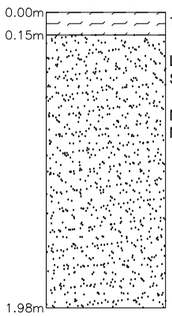

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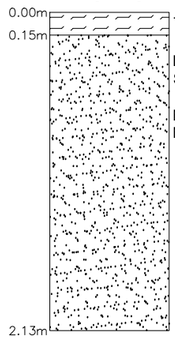

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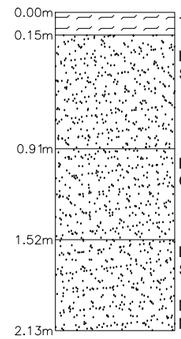

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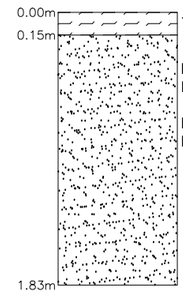

Alton Residential Infill
Agnes Street
Town of Caledon

Test Pit Soil Profiles

Scale: N.T.S.	Designed By: KD
Date: 19-AUG-2022	Drawn By: KD
Project No.: **D3082**	Checked By: EG
	Drawing No.: **DT-1**

File: \\Gunnell\ONAP\Shared\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-BC- Updated Site Plan\D3082BC-DT1.dwg
Plotted On: Thu, 30 Nov 2023 - 4:26pm

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www.septicdesign.ca

Test Pit
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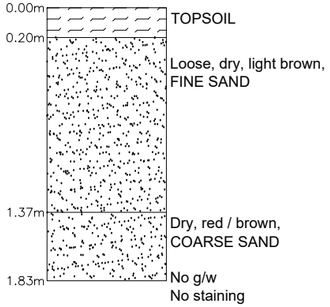

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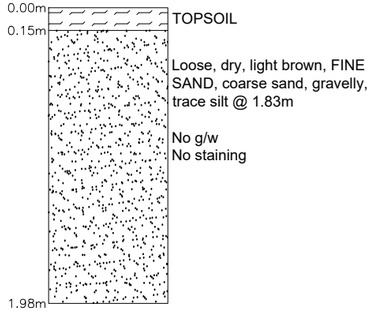

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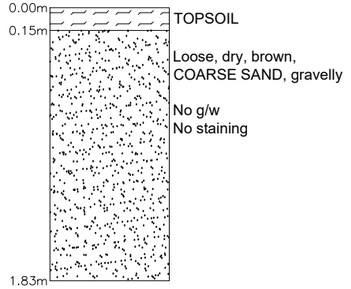

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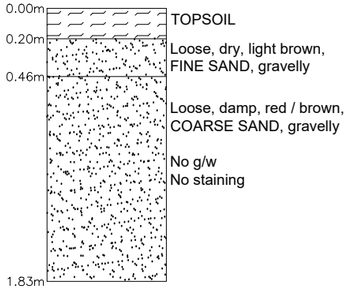

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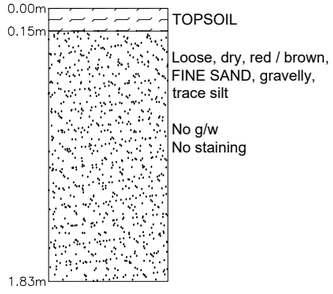

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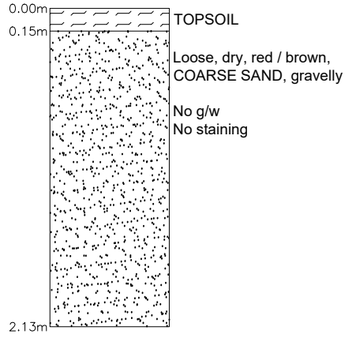

Alton Residential Infill
Agnes Street
Town of Caledon

Test Pit Soil Profiles

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Date: 19-AUG-2022	Drawn By: KD
Project No.: D3082	Checked By: EG
	Drawing No.: DT-2

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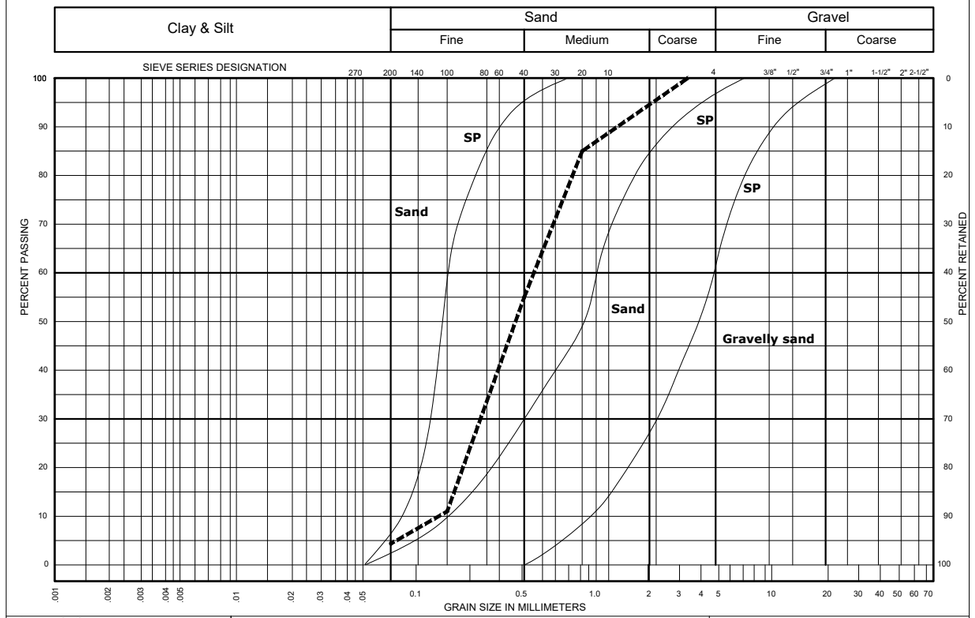
Plotted On: Thu, 30 Nov 2023 - 4:26pm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

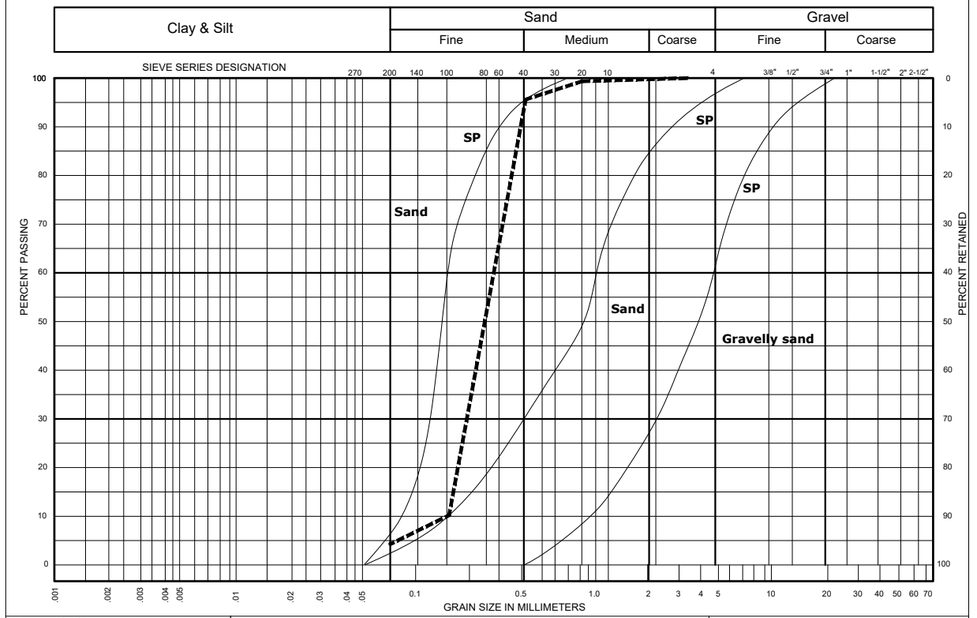
Project: D3082
Sample: TP22-1
Depth: 2.13m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

Percolation Time
: T = 6 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

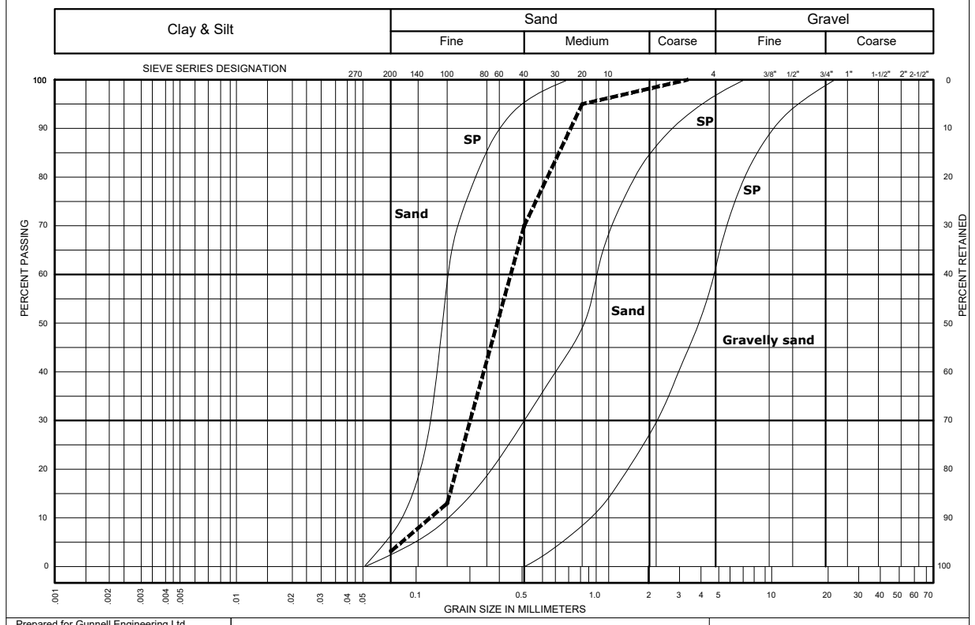
Project: D3082
Sample: TP22-7
Depth: 2.13m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

Percolation Time
: T = 8 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

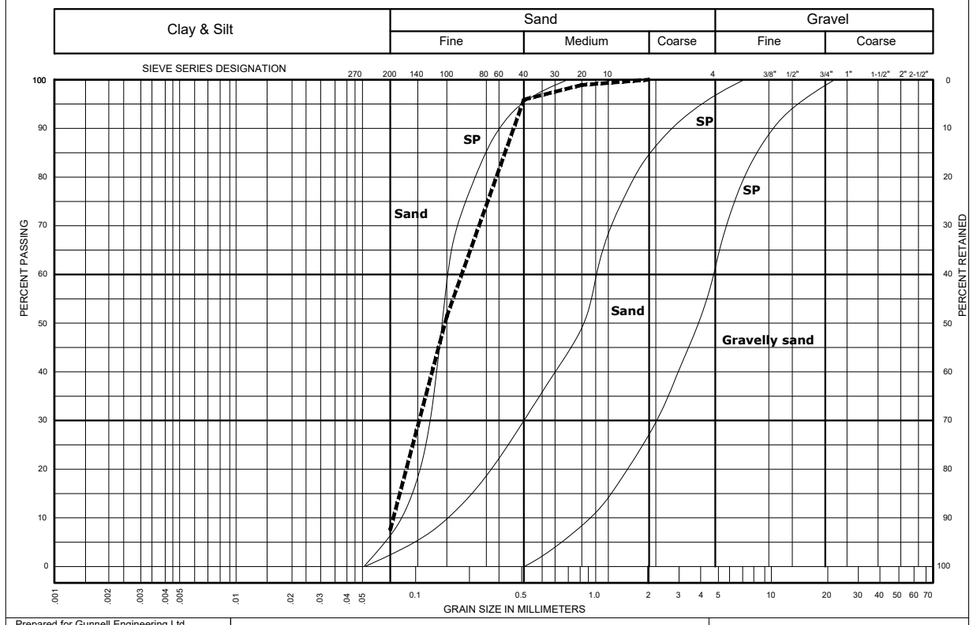
Project: D3082
Sample: TP22-13
Depth: 1.83m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

Percolation Time
: T = 6 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

Project: D3082
Sample: TP22-4
Depth: 1.98m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

Percolation Time
: T = 10 mins/cm

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Alton Residential Infill
Agnes Street
Town of Caledon

Soil Laboratory Analysis

Scale: N.T.S.	Designed By: --
Date: 7-MAR-2023	Drawn By: JK
Project No.: D3082	Checked By: --
	Drawing No.: DT-3

File: \\Gunnell\QNAP\Shared\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-BC- Updated Site Plan\D3082BC-DT3.dwg
Plotted On: Thu, 30 Nov 2023 - 4:26pm

WaterNOx-LS Third Party Testing Summary

In the fall of 2016, Waterloo Biofilter Systems Inc. installed their WaterNOx-LS™ denitrification unit at the Bureau de Normalisation du Quebec (BNQ) test site located in Quebec City. The system underwent BNQ 3680-600 test protocol which includes two parts - Period A and Period B. Period A is based on the methodology of NSF/ANSI Standards 40 and 245, containing the same flow patterns and stress tests. Period B provides for a further 6 months of seasonal reliability testing to ensure that the test includes cold weather results.

The WaterNOx-LS is a passive autotrophic denitrification process using sulphur-limestone minerals in a submerged, up-flow configuration. The WaterNOx-LS, which was sized for 1,600 L/day (350 gpd) followed a Waterloo Biofilter nitrifying treatment unit.

Period A Test Results

During Period A wastewater is dosed according to the hydraulic loading specified in NSF-40. Period A includes the wash-day, working-parent, power failure, and vacation period stress tests. All sample results taken during stress tests are included in the analysis. Influent wastewater temperature values ranged from 10.0 °C (50 °F) to 16.5 °C (62 °F) with an average value of 13.3 °C (56 °F). Influent pH averaged 7.9 and effluent pH averaged 7.2.

Table 1 – Period A Results for the WaterNOx-LS

Parameters	Influent	Effluent	Removal
(c)BOD_5	260	6	97.6%
TSS	312	3	99.2%
Fecal Coliforms	2,403,000	4,900	99.8%
$NO_{2,3}$	0.08	0.20	
TKN	57.1	4.6	92.0%
TN	57.1	4.8	91.6%

n = 123; n = 357 for fecals

All parameters in mg/L except Fecal Coliforms in cfu/100mL

All values arithmetic averages except Fecal Coliforms in geometric average

Weekly influent total nitrogen concentrations ranged from 43.0 mg/L to 68.8 mg/L with a six-month average concentration of 57.1 mg/L.

Weekly effluent $NO_{2,3}$ concentrations ranged from < 0.02 mg/L to 3.33 mg/L with a six-month average of 0.20 mg/L. Weekly effluent TKN concentrations ranged from 1.5 mg/L to 16.9 mg/L with a six-month average of 4.6 mg/L. Weekly effluent total nitrogen concentrations ranged from 1.7 mg/L to 17.1 mg/L with a six-month average of 4.8 mg/L. The total nitrogen reduction over the six-month period was 91.6%.

65 Massey Road, Suite C, Guelph ON N1H 7M6 T: 519 856-0757 1-866-366-4329 F: 519 856-0759 www.waterloo-biofilter.com

Period B Test Results

Weekday hydraulic loading is modified during Period B to a strenuous 'working parent' schedule where 40% of the flow is delivered over three hours in the morning, and 60% is delivered over three hours in the evening. All samples taken during Period B are included in the analysis. Influent wastewater temperature values ranged from 10.1 °C (50 °F) to 15.8 °C (60 °F) with an average value of 12.3 °C (54 °F). Influent pH averaged 8.0 and effluent pH averaged 7.1.

Table 2 – Period B Results for the WaterNOx-LS

Parameters	Influent	Effluent	Removal
(c)BOD_5	248	4	98.2%
TSS	304	3	99.1%
Fecal Coliforms	2,142,000	2,800	99.9%
$NO_{2,3}$	0.17	3.38	
TKN	60.3	8.5	85.9%
TN	60.4	11.9	80.3%

n = 59 except Fecal Coliforms n = 118

All parameters in mg/L except Fecal Coliforms in cfu/100mL

All values arithmetic averages except Fecal Coliforms in geometric average

Weekly influent total nitrogen concentrations ranged from 21.2 mg/L to 85.6 mg/L with a six-month average concentration of 60.4 mg/L.

Weekly effluent $NO_{2,3}$ concentrations ranged from < 0.04 mg/L to 15.2 mg/L with a six-month average of 3.38 mg/L. Weekly effluent TKN concentrations ranged from 1.2 mg/L to 21.2 mg/L with a weekly average of 8.5 mg/L. Weekly effluent total nitrogen concentrations ranged from 3.7 mg/L to 22.2 mg/L with a six-month average of 11.9 mg/L. The total nitrogen reduction over the six-month period was 80.3%.

Conclusion

In summary, the WaterNOx-LS system can successfully remove very high levels of total nitrogen passively, while buffering pH to neutral and keeping $cBOD_5$ and TSS levels below 10 mg/L.

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APPENDIX D

Stormwater Management Calculations

Site Characteristics
Site: Agnes Street Infill Subdivision, Alton, Ontario
February 3, 2026

Pre-Development

Land-Use	Impervious Ratio	Area 101 (m^2)	Area 102 (m^2)	Total (m^2)	Coverage
Driveway & Hardscape	1.00	2,091.3	0.0	2,091.3	5%
Grassed Area	0.00	33,191.0	5,142.4	38,333.4	95%
Total		35,282.3	5,142.4	40,424.7	100%
	% Impervious =	5.9%	0.0%	5.2%	
	Runoff Coefficient* =	0.29	0.25	0.28	

*Pervious areas were assigned a runoff coefficient of 0.25 and impervious areas were assigned a runoff coefficient of 0.90

Post-Development

Land-Use	Impervious Ratio	Area 201 (m^2)	Area 202 (m^2)	Total (m^2)	Coverage
Asphalt	1.00	2,375.1	858.7	3,233.8	8%
Permeable Pavers	0.50	1,618.3	898.5	2,516.8	6%
Hardscape	1.00	1,821.0	1,119.2	2,940.1	7%
Roof	1.00	5,960.0	4,994.1	10,954.0	27%
Grassed Area	0.00	10,427.5	10,352.5	20,779.9	51%
Total		22,201.8	18,222.9	40,424.7	100%
	% Impervious =	49.4%	40.7%	45.5%	
	Runoff Coefficient* =	0.57	0.51	0.55	
	Total Impervious Area (m^2) =	10,965.2	7,421.2	18,386.4	
	Total Pervious Area (m^2) =	11,236.6	10,801.7	22,038.3	

*Pervious areas were assigned a runoff coefficient of 0.25 and impervious areas were assigned a runoff coefficient of 0.90

Peak Runoff Assessment
Site: Agnes Street Infill Subdivision, Alton, Ontario
February 3, 2026

The subject property is part of the Shaw's Creek subwatershed in the CVC's jurisdiction which requires post-development flows to be controlled to pre-development levels for the 2-100year storm events.

Peak Runoff Assessment

Town of Caledon Intensity-Duration Frequency Curves (from Development Standards Manual 2019)

$$I = \frac{A}{(t+C)^B}$$

a, b, c = IDF Parameters
I = Intensity (mm/h)
t = Storm Duration, 10 minutes minimum (min)

Return Period	A	B	C
2	1,070	0.8759	7.85
5	1,593	0.8789	11
10	2,221	0.908	12
25	3,158	0.9335	15
50	3,886	0.9495	16
100	4,688	0.9624	17

Time of Concentration
Airport
If Runoff Coefficient < 0.4

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

where, L = Flow length (m)
Sw = slope (%)
C = Runoff Coefficient

Bransby
If Runoff Coefficient > 0.4

$$T_c = \frac{0.057\ L}{S_w^{0.2}\ A^{0.1}}$$

where, L = Flow length (m)
Sw = slope (%)

Parameter	Existing 101	Existing 102	Proposed 201	Proposed 202
C	0.29	0.25	0.57	0.51
L	335.2	188.9	233.5	194
A	3.528	0.514	2.220	1.822
S_w	2.61	2.26	0.81	2.74
Method	Airport	Airport	Bransby	Bransby
T =	35	29	10	10

**10 minute time of concentration used for proposed catchments as a conservative measure*

Rational Method $Q = 0.0028CIA$

Return Period	Existing 101		Existing 102		Proposed 201		Proposed 202		Total Proposed Runoff (L/s)
	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	Intensity (mm/hr)	Runoff (L/s)	
2	39.6	111.9	45.3	16.2	85.7	301.9	85.7	223.4	525.2
5	54.8	154.8	62.1	22.2	109.7	386.3	109.7	285.8	672.1
10	67.0	189.4	76.1	27.2	134.2	472.5	134.2	349.6	822.1
25*	81.5	253.5	92.1	36.2	156.5	606.2	156.5	448.5	1,054.7
50*	92.4	313.7	104.4	44.8	176.2	744.6	176.2	550.9	1,295.5
100*	104.0	367.8	117.4	52.4	196.5	865.2	196.5	640.1	1,505.4

*Incorporates Runoff coefficient adjustment factor of: 25 year = 1.1, 50 year = 1.2, 100 year = 1.25

Area 201 Chamber Storage Calculations (100 year post to 2 year pre)

The quantity storage chamber will provide quantity control for Area 201

100-Year Post Development Required Discharge = 61.5 L/s *Area 201 occupies 55% of the total site, required discharge is 55% of 2-year existing peak flow for Area 101*
Outlet Discharge= 57.2 L/s

Starting Time 70 min
Time Step 1 min
Area 201, A 2.22 ha
Runoff Coefficient 0.71 (including 1.25 Correction factor)

Time (min)	100 Year Intensity (mm/h)	Inflow (m^3/s)	Outflow (m^3/s)	Storage Required (m^3)
70	64	0.281	0.057	938.4
71	63	0.278	0.057	938.7
72	62	0.275	0.057	939.0
73	62	0.272	0.057	939.2
74	61	0.269	0.057	939.3
75	60	0.266	0.057	939.3
76	60	0.263	0.057	939.3
77	59	0.260	0.057	939.2
78	59	0.258	0.057	939.0
79	58	0.255	0.057	938.8
80	57	0.253	0.057	938.5
81	57	0.250	0.057	938.2
82	56	0.248	0.057	937.8
83	56	0.245	0.057	937.4
84	55	0.243	0.057	936.9
85	55	0.241	0.057	936.4
86	54	0.239	0.057	935.8
87	54	0.236	0.057	935.1
88	53	0.234	0.057	934.4
89	53	0.232	0.057	933.7
90	52	0.230	0.057	932.9

Therefore the storage required to attenuate peak flows = **939.3** m^3 *Active storage*

Quantity Control Orifice Sizing for Area 201

Orifice Equation: $Q = C\ A\ (2\ g\ h)^{0.5}$
Orifice Diameter = 125 mm
Orifice Invert = 413.93 m
Maximum Head = 416.87 m *Assuming a maximum head is from the top of the storage in the amenity area since the chamber system is sized for the 100-year event volume.*
Orifice Coefficient, C = 0.62 *0.62 for plate, 0.83 for tube*
Orifice Area, A = 0.0123 m^2
g = 9.81 m/s^2
h = 2.88 m
Orifice Q = 0.057 m^3/s
Orifice Q = 57.2 L/s

Area 202 Chamber Storage Calculations (100 year post to 2 year pre)

The quantity storage chamber will provide quantity control for Area 202

100-Year Post Development Required Discharge =	50.4	L/s	Area 202 occupies 45% of the total site, required discharge is 45% of 2-year existing peak flow of Area 101
Outlet Discharge=	45.3	L/s	

Starting Time	60	min	Area 202, A	1.82	ha
Time Step	1	min	Runoff Coefficient	0.64	(including 1.25 Correction factor)

Time (min)	100 Year Intensity (mm/h)	Inflow (m^3/s)	Outflow (m^3/s)	Storage Required (m^3)
60	72	0.233	0.045	677.3
61	71	0.231	0.045	678.0
62	70	0.228	0.045	678.7
63	69	0.225	0.045	679.3
64	68	0.222	0.045	679.8
65	67	0.220	0.045	680.2
66	67	0.217	0.045	680.6
67	66	0.215	0.045	680.9
68	65	0.212	0.045	681.1
69	64	0.210	0.045	681.3
70	64	0.208	0.045	681.4
71	63	0.205	0.045	681.5
72	62	0.203	0.045	681.5
73	62	0.201	0.045	681.5
74	61	0.199	0.045	681.4
75	60	0.197	0.045	681.2
76	60	0.195	0.045	681.0
77	59	0.193	0.045	680.8
78	59	0.191	0.045	680.5
79	58	0.189	0.045	680.1
80	57	0.187	0.045	679.7

Therefore the storage required to attenuate peak flows = **681.5** m^3 *required quantity control storage*

Quantity Control Orifice Sizing for Area 202

Orifice Equation:	$Q = C A (2 g h)^{0.5}$		
Orifice Diameter =	100	mm	
Orifice Invert =	409.18	m	
HGL =	413.65	m	*Assuming a maximum head is from the RIM of the control MH.*
Orifice Coefficient, C =	0.62		*0.62 for plate, 0.83 for tube*
Orifice Area, A =	0.0079	m^2	
g =	9.81	m/s^2	
h =	4.42	m	
Orifice Q =	0.0453	m^3/s	
Orifice Q =	45.3	L/s	

Water Balance/Infiltration Targets
Site: Agnes Street Infill Subdivision, Alton, Ontario
February 3, 2026

Infiltration Target Volume

Controlled at-grade areas are to be directed to the subsurface infiltration facility which are sized to meet the water quality and balance targets.

Development Area 201 =	22,201.8	m^2
% Impervious =	49.4%	
Impervious Area =	10,965.2	m^2

Table 3.2 of the MECP Stormwater Management Planning and Design Manual will guide the required water quality volume. Subject property is required to provide an Enhanced Protection Level.

Impervious Level (%)	35	55	70	85
Storage Volume (m^3/ha)	25	30	35	40

Required Unitary Quality Volume =	28.9	m^3/ha
Required Quality Volume =	64.2	m^3

As per the Town of Caledon Design Standards Manual 2019, the infiltration chamber should be sized to infiltrate the 5 mm event for water balance over impervious surfaces as pervious surfaces have an initial abstraction of 5mm.

Development Area (201+202) =	40,424.7	m^2
% Impervious =	45.5%	
Impervious Area =	18,386.4	m^2
Rainfall Depth =	5	mm
Required Infiltration Volume =	91.9	m^3

Therefore the infiltration gallery will be designed to infiltrate 91.9 m3. This will be the minimum void volume in the base stone.

Infiltration Facility Drawdown

Req. Water Balance Volume (5mm Event)	91.9	m^3
Req. Water Quality Volume:	64.2	m^3
Target volume is the greater of water balance and quality, V =	**91.9**	m^3

Maximum Allowable Depth

$d_{c\,max}$ =	$i\,(t_s-d_p/i)\,/\,V_r$		Percolation Time =	12	min/cm **from Englobe HydroG Report*
$d_{c\,max}$ =	6000	mm	I = infiltration rate =	50	mm/hr
			Safety Factor =	2.5	
Height of Infiltration Gallery =	350	mm	Design Infiltration Rate =	20	mm/hr
Proposed Depth =	350	mm	ts = time to drain =	48	hours
			Vr = void ratio =	0.4	
Prop. Drawdown (Subsurface)=	17.50	hours	Groundwater Elevation =	414.2	m **from Englobe HydroG Report*
			dp = Depth of ponding =	0	

Required Footprint

Af =	V / d Vr	
WQV	91.9	m^3
d =	0.35	m
Required Footprint =	262.7	m^2
Proposed Footprint =	412.2	m^2
Provided Infiltration Volume =	138.5	m^3
Separation from GW table =	1.00	m

Climate Data								Pervious Area			Impervious Area		
Month	**Days in the month**	**Hours of Sunlight* ****	**Mean Temperature ****	**Heat Index**	**Potential Evapo-transpiration***	**Daylight Correction Value**	**Total Precipitation* ***	**Adjusted Potential Evapo-transpiration**	**Surplus**	**Deficit**	**Evaporation**	**Surplus**	**Deficit**
			(T) #	**I**	**mm/month**		**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**
January	31	9.3	-7.5	0.00	0.0	0.80	64.3	0.00	64.3	0.0	6.4	57.9	0.0
February	28	10.5	-6.5	0.00	0.0	0.82	54.5	0.00	54.5	0.0	5.5	49.1	0.0
March	31	12.1	-2.1	0.00	0.0	1.04	60.9	0.00	60.9	0.0	6.1	54.8	0.0
April	30	13.6	5.3	1.09	25.9	1.13	70.1	29.36	40.7	0.0	7.0	63.1	0.0
May	31	14.7	11.7	3.62	58.4	1.27	86.6	73.91	12.7	0.0	8.7	77.9	0.0
June	30	15.0	16.9	6.32	85.1	1.25	81.3	106.44	0.0	25.1	8.1	73.2	0.0
July	31	14.8	19.4	7.79	98.1	1.27	80.8	125.02	0.0	44.2	8.1	72.7	0.0
August	31	14.2	18.4	7.19	92.9	1.22	88.2	113.61	0.0	25.4	8.8	79.4	0.0
September	30	13.1	14.3	4.91	71.7	1.09	87.0	78.31	8.7	0.0	8.7	78.3	0.0
October	31	10.7	7.8	1.96	38.5	0.92	76.6	35.49	41.1	0.0	7.7	68.9	0.0
November	30	9.7	2.0	0.25	9.5	0.81	87.1	7.70	79.4	0.0	8.7	78.4	0.0
December	31	8.8	-4.1	0.00	0.0	0.76	64.2	0.00	64.2	0.0	6.42	57.8	0.0
TOTAL	365			33.1	480.2		**901.6**	**570**	**426.5**	**95**	**90.2**	**811.4**	**0**

Notes

* PET = 16 [10 T / I]$^{\alpha}$

where, $\alpha = (675 * 10^{-9} * I^3) - (771 * 10^{-7} * I^2) + (1792 * 10^{-5} * I) + 0.49239 = 1.112$

**Canadian Climate Normals 1981-2010 Station Data - Orangeville MOE - located 9 km nor th of the site
https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=orangeville&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=4991&dispBack=1

***Canadian Climate Normals 1981-2010 Station Data - Toronto Lester B Pearson Int'l A -located 59 km southwest of the site
https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=pearson&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=5097&dispBack=1

Pervious Surplus: **331.8** **mm**

Impervious Surplus: **811.4** **mm**

Assumes 10% of rainfall is evaporated (no evapotranspiration occurs)

Impervious Factor = 0.10

Water Balance Design Sheet — **Pre-Development**

Site: Agnes Street Infill Subdivision, Alton, ON

February 3, 2026

Existing Drainage Area 101+102

Catchment Parameter	Units	Perv	Imperv	Total
Area	m^2	38,333	2,091	40,425
Pervious Area	m^2	38,333	0	38,333
Impervious Area	m^2	0	2,091	2,091
Infiltration Factors				
Topography		0.1	0.1	0.10
Soil		0.4	0.4	0.40
Land Cover		0.1	0.1	0.10
MECP Infiltration Factor		0.60	0.60	0.60
Actual Infiltration Factor		0.60	0.00	0.57
Runoff Coefficient		0.25	0.95	0.29
Runoff from Impervious Surfaces*		0%	0%	0%
Inputs (per Unit Area)				
Precipitation	mm/yr	902	902	902
Run- on	mm/yr	0	0	0
Other	mm/yr	0	0	0
Total Inputs	mm/yr	902	902	902
Outputs (per Unit Area)				
Precipitation Surplus	mm/yr	332	811	
Net Surplus	mm/yr	0	0	
Total Evapotranspiration	**mm/yr**	**570**	**90**	
Infiltration	mm/yr	199	0	
Rooftop Infiltration	mm/yr	0	0	
Total Infiltration	**mm/yr**	**199**	**0**	
Runoff Pervious Areas	mm/yr	133	811	
Runoff Impervious Areas	mm/yr	0	0	
Total Runoff	**mm/yr**	**133**	**811**	
Total Outputs	**mm/yr**	**902**	**902**	
Difference (input - output)	mm/yr	0	0	
Inputs (Volumes)				
Precipitation	m^3/yr	34,561	1,886	36,447
Run-on	m^3/yr	0	0	0
Other Inputs	m^3/yr	0	0	0
Total Inputs	m^3/yr	34,561	1,886	36,447
Outputs (Volumes)				
Precipitation Surplus	m^3/yr	12,717	1,697	14,414
Net Surplus	m^3/yr	0	0	0
Total Evapotranspiration	**m^3/yr**	**21,844**	**189**	**22,032**
Infiltration	m^3/yr	7,630	0	7,630
Rooftop Infiltration	m^3/yr	0	0	0
Total Infiltration	**m^3/yr**	**7,630**	**0**	**7,630**
Runoff Pervious Areas	m^3/yr	5,087	1,697	6,784
Runoff Impervious Areas	m^3/yr	0	0	0
Total Runoff	**m^3/yr**	**5,087**	**1,697**	**6,784**
Total Outputs	**m^3/yr**	**34,561**	**1,886**	**36,447**
Difference (input - output)	m^3/yr	0	0	0

Water Balance Design Sheet — **Post Development**

Site: Agnes Street Infill Subdivision, Alton, ON

February 3, 2026

Proposed Drainage Area 201+202

Catchment Parameter	Units	Perv	Imperv	Total
Area	m^2	20,780	19,645	40,425
Pervious Area	m^2	20,780	0	20,780
Impervious Area	m^2	0	19,645	19,645
Infiltration Factors				
Topography		0.1	0.1	0.10
Soil		0.4	0.4	0.40
Land Cover		0.1	0.1	0.10
MECP Infiltration Factor		0.60	0.60	0.60
% Impervious		0%	100%	49%
Actual Imperv Factor		0.60	0.00	0.31
Inputs (per Unit Area)				
Precipitation	mm/yr	902	902	
Run- on	mm/yr	0	0	
Other	mm/yr	0	0	
Total Inputs	mm/yr	902	902	
Outputs (per Unit Area)				
Precipitation Surplus	mm/yr	332	811	
Net Surplus	mm/yr	332	811	
Total Evapotranspiration	**mm/yr**	**570**	**90**	
Infiltration	mm/yr	199	0	
LID Infiltration	mm/yr	0	0	
Total Infiltration	**mm/yr**	**199**	**0**	
Runoff Pervious Areas	mm/yr	133	0	
Runoff Impervious Areas	mm/yr	0	811	
Total Runoff	**mm/yr**	**133**	**811**	
Total Outputs	**mm/yr**	**902**	**902**	
Difference (input - output)	mm/yr	0	0	
Inputs (Volumes)				
Precipitation	m^3/yr	18735	17712	36447
Run-on	m^3/yr	0	0	0
Other Inputs	m^3/yr	0	0	0
Total Inputs	m^3/yr	18,735	17,712	36,447
Outputs (Volumes)				
Precipitation Surplus	m^3/yr	6,894	15,941	22,834
Net Surplus	m^3/yr	6,894	15,941	22,834
Total Evapotranspiration	**m^3/yr**	**11,841**	**1,771**	**13,612**
Infiltration	m^3/yr	4,136	0	4,136
Rooftop Infiltration	m^3/yr	0	0	0
Total Infiltration	**m^3/yr**	**4,136**	**0**	**4,136**
Runoff Pervious Areas	m^3/yr	2,758	0	2,758
Runoff Impervious Areas	m^3/yr	0	15,941	15,941
Total Runoff	**m^3/yr**	**2,758**	**15,941**	**18,698**
Total Outputs	**m^3/yr**	**18,735**	**17,712**	**36,447**
Difference (input - output)	m^3/yr	0	0	0

Water Balance Design Sheet — **Post Development with SWM, FS = 1.0**

Site: Agnes Street Infill Subdivision, Alton, ON

February 3, 2026

Proposed Drainage Area 201+202

Catchment Parameter	Units	Perv	Imperv	Total
Area	m^2	20,780	19,645	40,425
Pervious Area	m^2	20,780	0	20,780
Impervious Area	m^2	0	19,645	19,645
Infiltration Factors				
Topography		0.1	0.1	0.10
Soil		0.4	0.4	0.40
Land Cover		0.1	0.1	0.10
MECP Infiltration Factor		0.60	0.60	0.60
% Impervious		0%	100%	49%
Actual Imperv Factor		0.60	0.00	0.31
Inputs (per Unit Area)				
Precipitation	mm/yr	902	902	
Run- on	mm/yr	0	0	
Other	mm/yr	0	0	
Total Inputs	mm/yr	902	902	
Outputs (per Unit Area)				
Precipitation Surplus	mm/yr	332	811	
Net Surplus	mm/yr	332	811	
Total Evapotranspiration	**mm/yr**	**570**	**90**	
Infiltration	mm/yr	199	0	
LID Infiltration*	mm/yr	0	446	
Total Infiltration	**mm/yr**	**199**	**446**	
Runoff Pervious Areas	mm/yr	133	0	
Runoff Impervious Areas	mm/yr	0	365	
Total Runoff	**mm/yr**	**133**	**365**	
Total Outputs	**mm/yr**	**902**	**902**	
Difference (input - output)	mm/yr	0	0	
Inputs (Volumes)				
Precipitation	m^3/yr	18,735	17,712	36,447
Run-on	m^3/yr	0	0	0
Other Inputs	m^3/yr	0	0	0
Total Inputs	m^3/yr	18,735	17,712	36,447
Outputs (Volumes)				
Precipitation Surplus	m^3/yr	6,894	15,941	22,834
Net Surplus	m^3/yr	6,894	15,941	22,834
Total Evapotranspiration	**m^3/yr**	**11,841**	**1,771**	**13,612**
Infiltration	m^3/yr	4,136	0	4,136
LID Infiltration*	m3/yr	0	8,767	8,767
Total Infiltration	**m^3/yr**	**4,136**	**8,767**	**12,904**
Runoff Pervious Areas	m^3/yr	2,758	0	2,758
Runoff Impervious Areas	m^3/yr	0	7,173	7,173
Total Runoff	**m^3/yr**	**2,758**	**7,173**	**9,931**
Total Outputs	**m^3/yr**	**18,735**	**17,712**	**36,447**
Difference (input - output)	m^3/yr	0	0	0

*5mm of rainfall to be retained. 55% of rainfall events are less than 5mm, therefore it is assumed 55% of annual precipitation surplus is infiltrated

Water Balance Design Sheet		**Post Development with SWM, FS = 1.5**		
Site: Agnes Street Infill Subdivision, Alton, ON				
February 3, 2026				
		Proposed Drainage Area 201+202		
Catchment Parameter	**Units**	**Perv**	**Imperv**	**Total**
Area	m^2	20,780	19,645	40,425
Pervious Area	m^2	20,780	0	20,780
Impervious Area	m^2	0	19,645	19,645
Infiltration Factors				
Topography		0.1	0.1	0.10
Soil		0.4	0.4	0.40
Land Cover		0.1	0.1	0.10
MECP Infiltration Factor		0.60	0.60	0.60
% Impervious		0%	100%	49%
Actual Imperv Factor		0.60	0.00	0.31
Inputs (per Unit Area)				
Precipitation	mm/yr	902	902	
Run- on	mm/yr	0	0	
Other	mm/yr	0	0	
Total Inputs	mm/yr	902	902	
Outputs (per Unit Area)				
Precipitation Surplus	mm/yr	332	811	
Net Surplus	mm/yr	332	811	
Total Evapotranspiration	**mm/yr**	**570**	**90**	
Infiltration	mm/yr	199	0	
LID Infiltration*	mm/yr	0	298	
Total Infiltration	**mm/yr**	**199**	**298**	
Runoff Pervious Areas	mm/yr	133	0	
Runoff Impervious Areas	mm/yr	0	514	
Total Runoff	**mm/yr**	**133**	**514**	
Total Outputs	**mm/yr**	**902**	**902**	
Difference (input - output)	mm/yr	0	0	
Inputs (Volumes)				
Precipitation	m^3/yr	18,735	17,712	36,447
Run-on	m^3/yr	0	0	0
Other Inputs	m^3/yr	0	0	0
Total Inputs	m^3/yr	18,735	17,712	36,447
Outputs (Volumes)				
Precipitation Surplus	m^3/yr	6,894	15,941	22,834
Net Surplus	m^3/yr	6,894	15,941	22,834
Total Evapotranspiration	**m^3/yr**	**11,841**	**1,771**	**13,612**
Infiltration	m^3/yr	4,136	0	4,136
LID Infiltration*	m3/yr	0	5,845	5,845
Total Infiltration	**m^3/yr**	**4,136**	**5,845**	**9,981**
Runoff Pervious Areas	m^3/yr	2,758	0	2,758
Runoff Impervious Areas	m^3/yr	0	10,096	10,096
Total Runoff	**m^3/yr**	**2,758**	**10,096**	**12,853**
Total Outputs	**m^3/yr**	**18,735**	**17,712**	**36,447**
Difference (input - output)	m^3/yr	0	0	0

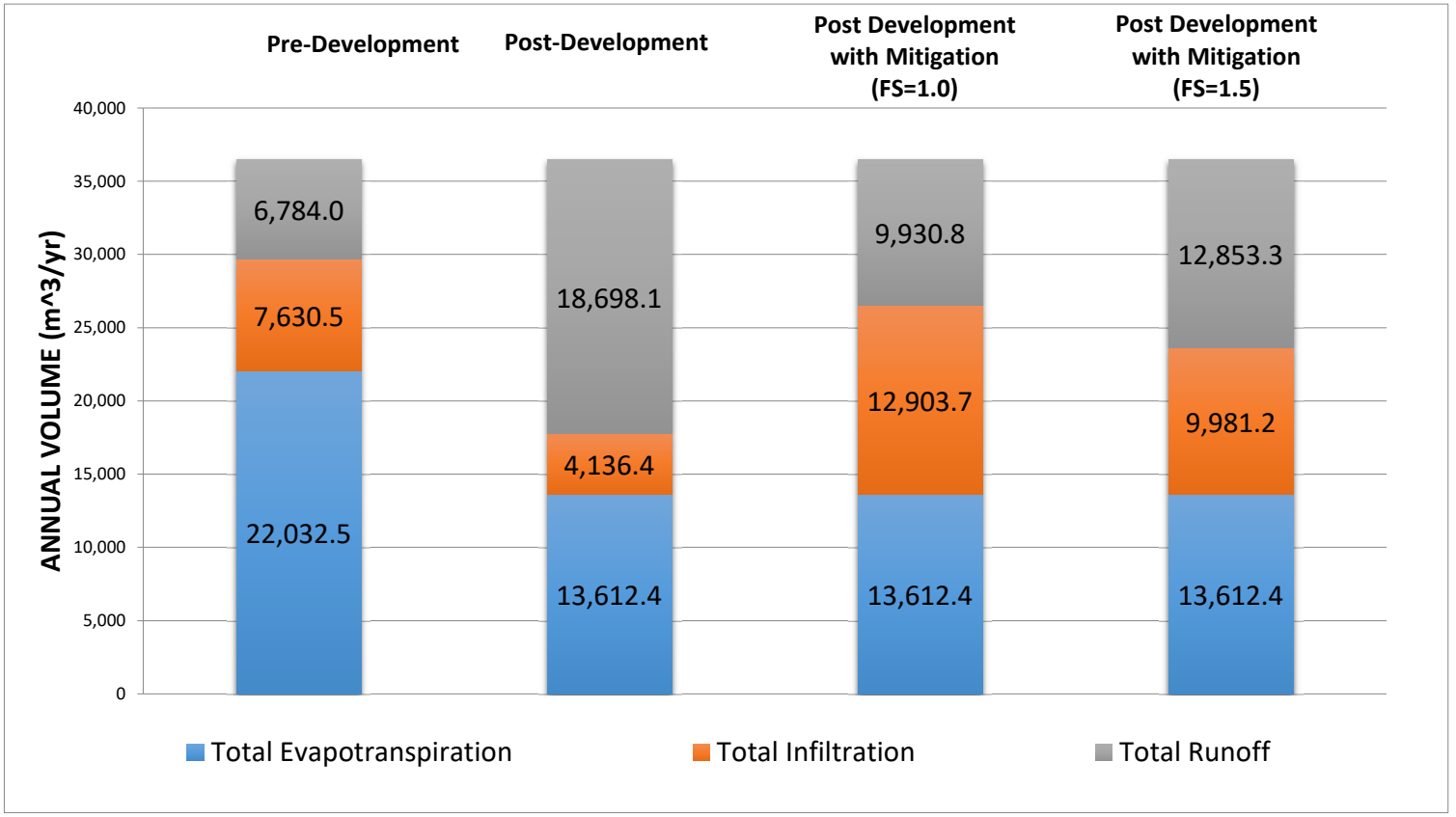
*5mm of rainfall to be retained. 55% of rainfall events are less than 5mm, therefore it is assumed 55% of annual precipitation surplus is infiltrated. Assuming a factor of safety of 1.5, this equates to 37% of rainfall events

Water Balance Summary Sheet
Site: Agnes Street Infill Subdivision, Alton, ON
February 3, 2026

Mean Temperature **

Potential Evapo-transpiration*

	Units	Pre-Development	Post-Development	Change (Pre- to Post-)	Post Development with Mitigation (FS=1.0)	Post Development with Mitigation (FS=1.5)	Change (Pre- to Post-Mitigation)
Inputs (Volumes)							
Precipitation	m^3/yr	36,446.9	36,446.9	0%	36,446.9	36,446.9	0%
Run-on	m^3/yr	0.0	0.0	0%	0.0	0.0	0%
Other Inputs	m^3/yr	0.0	0.0	0%	0.0	0.0	0%
Total Inputs		**36,446.95**	**36,446.89**	0%	**36,446.9**	**36,446.9**	0%
Outputs (Volumes)							
Precipitation Surplus	m^3/yr	14,414.5	22,834.5	58%	22,834.5	22,834.5	58%
Net Surplus	m^3/yr	0.0	22,834.5	0%	22,834.5	22,834.5	0%
Total Evapotranspiration	**m^3/yr**	22,032.5	13,612.4	-38%	13,612.4	13,612.4	-38%
Infiltration	m^3/yr	7,630.5	4,136.4	-46%	4,136.4	4,136.4	-46%
LID Infiltration	m^3/yr	0.0	0.0	0%	8,767.3	5,844.9	0%
Total Infiltration	**m^3/yr**	**7,630.5**	**4,136.4**	-46%	**12,903.7**	**9,981.2**	69%
Runoff Pervious Areas	m^3/yr	6,784.0	2,757.6	-59%	2,757.6	2,757.6	-59%
Runoff Impervious Areas	m^3/yr	0.0	15,940.6	0%	7,173.3	10,095.7	0%
Total Runoff	**m^3/yr**	**6,784.0**	**18,698.1**	176%	**9,930.8**	**12,853.3**	46%
Total Outputs	**m^3/yr**	36,446.9	36,446.9	0%	36,446.9	36,446.9	0%



TOWN OF CALEDON
STORM SEWER DESIGN SHEET - 10 YEAR STORM

Project / Subdivision : Agnes Street Subdivision

Consulting Engineer : Greck and Associates
Project No.: 20-731

Prepared by: Carlos Meschgrahw

Checked by: Khalid Mahmood

Last Revised: February 10, 2026

Design Parameters (5 Year Storm)

A = drainage area (ha)	T_{init}(hr)= 0.167
C = runoff coefficient	A= 1593
T_c = time of concentration	B= 11.000
	C= 0.879

Manning's (n): 0.013
System to be Designed for: 5 Year Storm

Design Parameters (10 Year Storm)

A = drainage area (ha)	T_{init}(hr)= 0.167
C = runoff coefficient	A= 2221
T_c = time of concentration	B= 12.000
	C= 0.908

Design Equations

$$I = \frac{A}{(t + B)^C}$$

$$Q = 2.78 \times A \times C \times I$$

Location			Drainage Area Characteristics						Rainfall / Runoff			Sewer Data								
Street	From	To	Area	Area	Cum. Area	Runoff Coeff. R	AR in Section	Cum. AR	Time of Concentration	Rainfall Intensity	Runoff Q	Pipe Diameter	Pipe Length	Grade	Material	Total Flow (Q Max)	% FULL	Full Flow Velocity	V (Actual)	Sect. Time	Accum. Time
	MH #	MH #	(m^2)	(ha)	(ha)				(min)	(mm/hr)	m^3/sec	(mm)	(m)	(%)		(m^3/s)	%	(m/s)	(m/s)	(min)	(min)
	CBMH15	CBMH14	3580	0.358	0.358	0.43	0.154	0.154	10.00	134.16	0.057	300	5.78	0.50	PVC	0.071	80.4%	0.98	1.11	0.09	10.09
	CBMH14	DICBMH13	0	0.000	0.358	0.43	0.000	0.154	10.09	133.69	0.057	300	13.29	0.50	PVC	0.071	80.1%	0.98	1.11	0.20	10.29
	DICBMH13	MH9	0	0.000	0.358	0.43	0.000	0.154	10.29	132.60	0.057	300	51.55	0.50	PVC	0.071	79.5%	0.98	1.11	0.77	11.06
	MH12	MH11	1969	0.197	0.197	0.43	0.084	0.084	10.00	134.16	0.031	300	38.37	0.50	PVC	0.071	43.8%	0.98	0.92	0.69	10.69
	MH11	MH9	0	0.000	0.197	0.00	0.000	0.084	10.69	130.43	0.030	450	14.60	0.50	PVC	0.210	14.5%	1.28	0.64	0.38	11.07
	MH9	MH10	0	0.000	0.555	0.00	0.154	0.391	11.06	128.57	0.140	525	84.05	0.50	PVC	0.317	44.1%	1.42	1.34	1.04	12.10
	MH10	MH8	0	0.000	0.555	0.00	0.000	0.391	12.10	123.50	0.134	525	6.33	0.50	PVC	0.317	42.4%	1.42	1.32	0.08	12.18
	MH8	MH28	4910	0.491	1.046	0.61	0.299	0.690	12.18	123.12	0.236	525	117.69	2.10	PVC	0.470	50.3%	2.91	2.92	0.67	12.85
	MH28	MH5-OGS	3651	0.365	1.411	0.56	0.203	0.893	12.85	120.09	0.298	600	4.85	0.50	PVC	0.453	65.8%	1.55	1.71	0.05	12.90
	MH5-OGS	SWM FACILITY202	4128	0.413	1.824	0.55	0.227	1.120	12.90	119.89	0.373	750	6.29	0.50	PVC	0.821	45.5%	1.80	1.72	0.06	12.96
	CBMH27	MH26	1552	0.155	0.155	0.38	0.059	0.059	10.00	134.16	0.022	300	6.43	0.50	PVC	0.071	30.9%	0.98	0.77	0.14	10.14
	MH26	MH25	3620	0.362	0.517	0.64	0.232	0.291	10.14	133.39	0.108	375	68.85	0.50	PVC	0.129	83.4%	1.13	1.29	0.89	11.03
	MH25	MH24	0	0.000	0.517	0.00	0.000	0.291	11.03	128.72	0.104	525	10.69	0.50	PVC	0.317	32.8%	1.42	1.16	0.15	11.18
	MH24	MH17	3571	0.357	0.874	0.76	0.270	0.561	11.18	127.94	0.199	525	69.13	0.50	PVC	0.317	62.9%	1.42	1.54	0.75	11.93
	MH22	MH21	6176	0.618	0.618	0.59	0.365	0.365	10.00	134.16	0.136	450	26.19	0.50	PVC	0.210	64.7%	1.28	1.41	0.31	10.31
	MH21	MH20	3406	0.341	0.958	0.43	0.148	0.513	10.31	132.46	0.189	525	71.87	0.50	PVC	0.317	59.5%	1.42	1.52	0.79	11.10
	MH20	MH5	0	0.000	0.958	0.00	0.000	0.513	11.10	128.35	0.183	600	5.06	0.50	PVC	0.453	40.4%	1.55	1.40	0.06	11.16
	MH5	MH18	3858	0.386	1.344	0.67	0.259	0.772	11.16	128.05	0.275	600	9.41	0.50	PVC	0.453	60.6%	1.55	1.67	0.09	11.25
	MH18	MH17	0	0.000	1.344	0.00	0.000	0.772	11.25	127.58	0.274	750	14.72	0.50	PVC	0.821	33.3%	1.80	1.48	0.17	11.42
	MH17	MH16-OGS	0	0.000	2.218	0.00	0.000	1.332	11.93	124.31	0.460	750	1.79	0.50	PVC	0.821	56.1%	1.80	1.88	0.02	11.94
	MH16-OGS	INFILTRATION FACILITY	0	0.000	2.218	0.00	0.000	1.332	11.94	124.24	0.460	750	2.00	0.50	PVC	0.821	56.0%	1.80	1.88	0.02	11.96

Location			Drainage Area Characteristics						Rainfall / Runoff			Sewer Data								
Street	From	To	Area	Area	Cum. Area	Runoff Coeff. R	AR in Section	Cum. AR	Time of Concentration	Rainfall Intensity	Runoff Q	Pipe Diameter	Pipe Length	Grade	Material	Total Flow (Q Max)	% FULL	Full Flow Velocity	V (Actual)	Sect. Time	Accum. Time
	MH #	MH #	(m^2)	(ha)	(ha)				(min)	(mm/hr)	m^3/sec	(mm)	(m)	(%)		(m^3/s)	%	(m/s)	(m/s)	(min)	(min)
	INFILTRATION FACILITY	MH15	0	0.000	2.218	0.00	0.000	1.332	11.96	124.15	0.460	750	4.50	2.00	PVC	1.100	41.8%	3.60	3.32	0.02	11.98
	MH15	SWM FACILITY201	0	0.000	2.218	0.00	0.000	1.332	11.98	124.05	0.459	750	8.22	2.00	PVC	1.100	41.8%	3.60	3.32	0.04	12.03
	SWM FACILITY201	MH14-CONTROL	0	0.000	2.218	0.00	0.000	1.332	12.03	123.85	0.459	750	1.00	2.00	PVC	1.100	41.7%	3.60	3.31	0.01	12.03
	MH14-CONTROL	MH3	0	0.000	2.218	0.00	0.000	1.332	12.03	123.83	0.062	375	64.55	7.35	PVC	0.200	30.8%	4.35	3.41	0.32	12.35
	SWM FACILITY202	MH4-CONTROL	0	0.000	1.824	0.00	0.000	1.120	12.35	122.37	0.381	750	6.29	0.50	PVC	0.821	46.4%	1.80	1.74	0.06	12.41
	MH4-CONTROL	MH3	0	0.000	1.824	0.00	0.000	1.120	-	-	0.050	300	3.01	0.50	PVC	0.071	70.7%	0.98	1.10	0.05	-
	MH3	MH2	0	0.000	4.042	0.00	0.000	2.453	-	-	0.112	450	14.70	0.50	PVC	0.210	53.2%	1.28	1.31	0.19	-
	MH2	MH1	17374	1.737	5.779	0.42	0.730	3.182	-	-	0.295	600	100.05	0.30	PVC	0.351	84.1%	1.20	1.37	1.22	-
	MH1	MH27-OGS	0	0.000	5.779	0.00	0.000	3.182	-		0.295	600	8.63	0.30	PVC	0.351	84.1%	1.20	1.37	0.11	-

Orifice Discharge

Includes 10-year flows from urbanized portion of Agnes St (Area 203 and 204a), and capacity for future Area 204b and 205 connections shown in Urbanization Memo

APPENDIX E

Stormwater Management Product Specifications

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

02/05/2026

Province:	Ontario
City:	Alton
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
Climate Station Id:	6149387
Years of Rainfall Data:	34

Site Name:	Area 201

Drainage Area (ha):	2.22018
Runoff Coefficient 'c':	0.57

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0
Required Water Quality Runoff Volume Capture (%):	90.0

Estimated Water Quality Flow Rate (L/s):	47.95
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	852
Estimated Average Annual Sediment Volume (L/yr):	693

Project Name:	Agnes St.
Project Number:	-
Designer Name:	Brandon O'Leary
Designer Company:	Forterra
Designer Email:	brandon.oleary@forterrabp.com
Designer Phone:	905-630-0359
EOR Name:	Jennifer Chan
EOR Company:	Greck and Associates Ltd.
EOR Email:	jchan@greck.ca
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	42
EFO5	48
EFO6	52
EFO8	58
EFO10	61
EFO12	64

Recommended Stormceptor EFO Model: EFO10

Estimated Net Annual Sediment (TSS) Load Reduction (%): 61

Water Quality Runoff Volume Capture (%): > 90

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

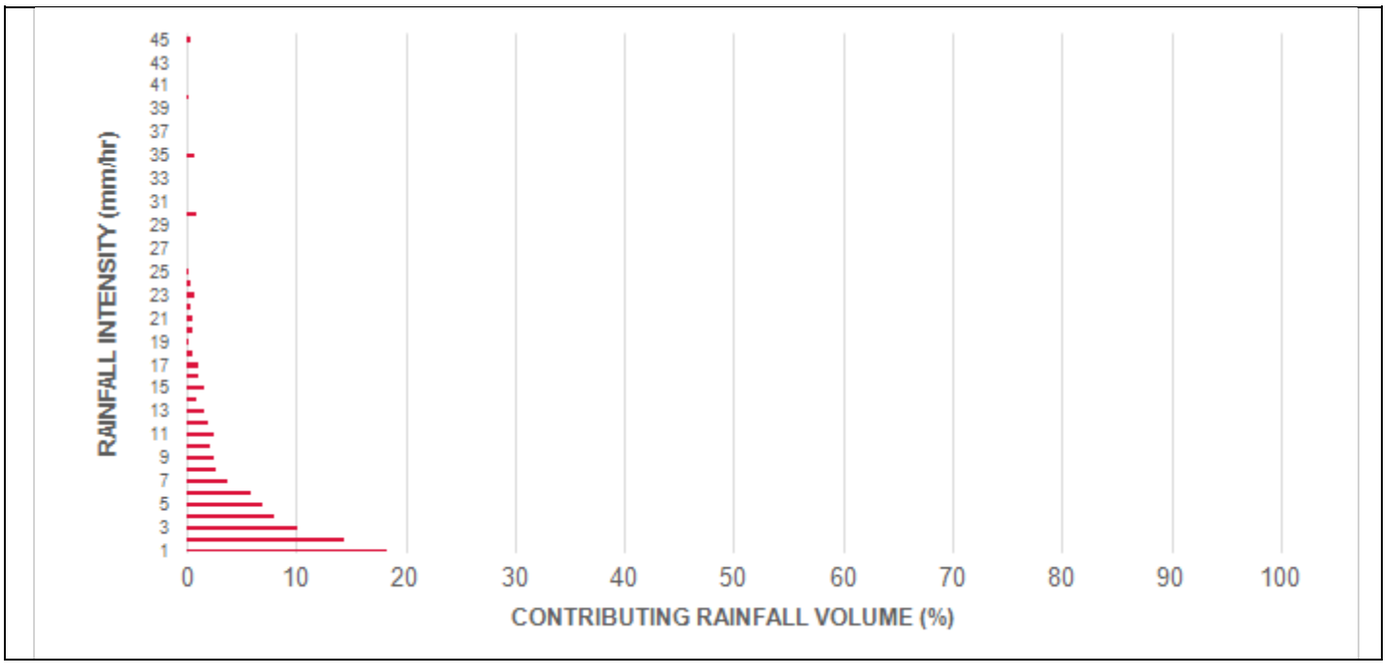
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a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

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

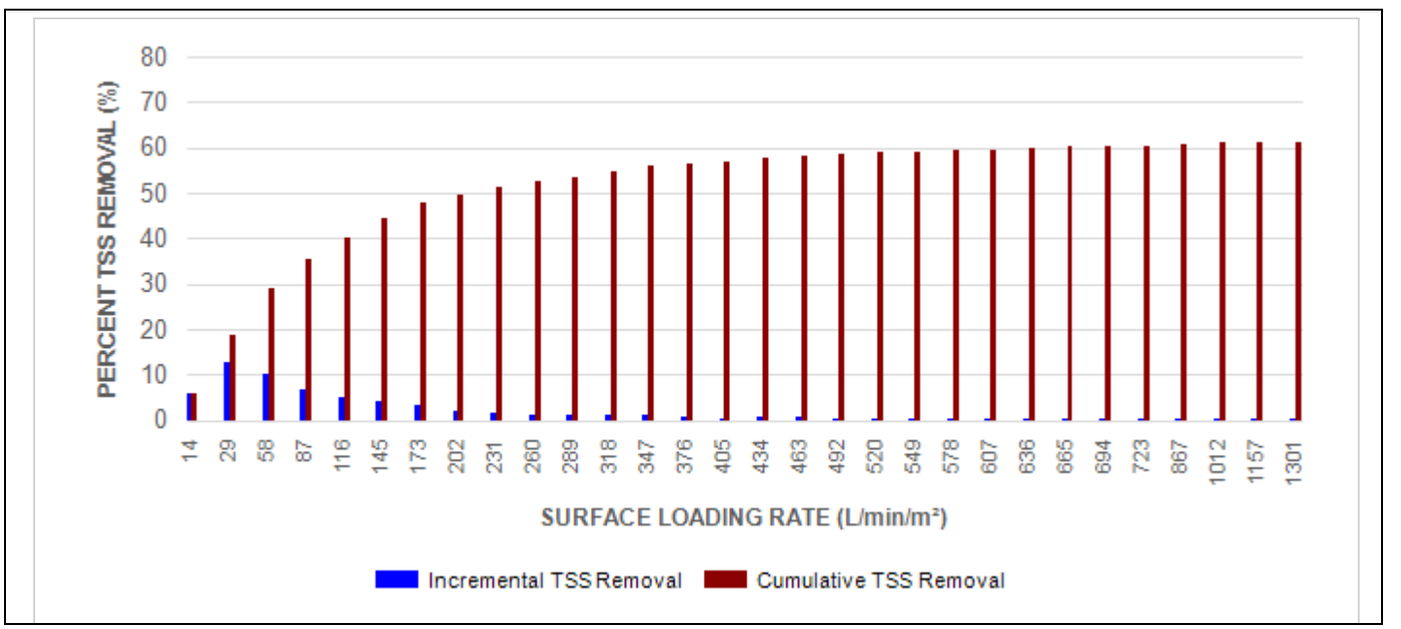
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	1.76	106.0	14.0	70	6.0	6.0
1.00	18.3	26.8	3.52	211.0	29.0	70	12.9	18.9
2.00	14.4	41.3	7.04	422.0	58.0	69	9.9	28.8
3.00	10.2	51.5	10.55	633.0	87.0	64	6.5	35.4
4.00	8.0	59.5	14.07	844.0	116.0	62	4.9	40.3
5.00	6.9	66.4	17.59	1055.0	145.0	59	4.1	44.4
6.00	5.9	72.3	21.11	1267.0	173.0	57	3.3	47.7
7.00	3.8	76.1	24.63	1478.0	202.0	54	2.0	49.7
8.00	2.6	78.7	28.14	1689.0	231.0	53	1.4	51.1
9.00	2.5	81.1	31.66	1900.0	260.0	52	1.3	52.4
10.00	2.2	83.3	35.18	2111.0	289.0	51	1.1	53.5
11.00	2.5	85.8	38.70	2322.0	318.0	51	1.3	54.8
12.00	2.0	87.8	42.22	2533.0	347.0	50	1.0	55.8
13.00	1.6	89.4	45.74	2744.0	376.0	49	0.8	56.6
14.00	0.9	90.4	49.25	2955.0	405.0	48	0.5	57.0
15.00	1.6	91.9	52.77	3166.0	434.0	47	0.7	57.7
16.00	1.1	93.0	56.29	3377.0	463.0	46	0.5	58.2
17.00	1.0	94.0	59.81	3588.0	492.0	45	0.5	58.7
18.00	0.5	94.6	63.33	3800.0	520.0	44	0.2	59.0
19.00	0.2	94.8	66.84	4011.0	549.0	44	0.1	59.1
20.00	0.6	95.4	70.36	4222.0	578.0	43	0.3	59.3
21.00	0.6	96.1	73.88	4433.0	607.0	42	0.3	59.6
22.00	0.3	96.4	77.40	4644.0	636.0	42	0.1	59.7
23.00	0.8	97.2	80.92	4855.0	665.0	42	0.4	60.1
24.00	0.4	97.6	84.43	5066.0	694.0	42	0.2	60.2
25.00	0.2	97.8	87.95	5277.0	723.0	41	0.1	60.3
30.00	0.9	98.7	105.54	6333.0	867.0	41	0.4	60.7
35.00	0.8	99.5	123.13	7388.0	1012.0	40	0.3	61.0
40.00	0.2	99.7	140.72	8443.0	1157.0	38	0.1	61.1
45.00	0.3	100.0	158.31	9499.0	1301.0	36	0.1	61.2
Estimated Net Annual Sediment (TSS) Load Reduction =								**61 %**

Climate Station ID: 6149387 *Years of Rainfall Data*: 34

RAINFALL DATA FROM WATERLOO WELLINGTON AP 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
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
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

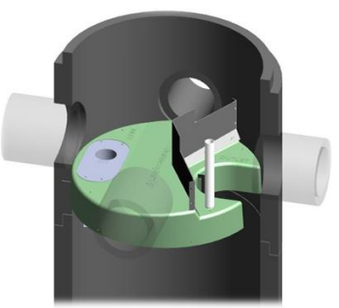
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

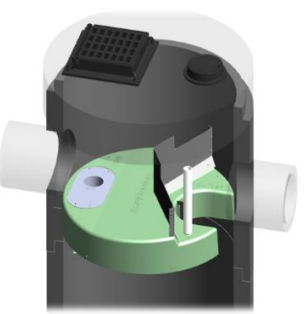
DESIGN FLEXIBILITY

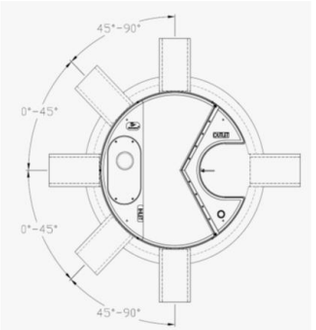
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EFO

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	42	1320	35	1980	24
30	70	690	42	1350	35	2010	24
60	67	720	41	1380	34	2040	23
90	63	750	41	1410	34	2070	23
120	61	780	41	1440	33	2100	23
150	58	810	41	1470	32	2130	22
180	56	840	41	1500	32	2160	22
210	54	870	41	1530	31	2190	22
240	53	900	41	1560	31	2220	21
270	52	930	40	1590	30	2250	21
300	51	960	40	1620	29	2280	21
330	50	990	40	1650	29	2310	21
360	49	1020	40	1680	28	2340	20
390	48	1050	39	1710	28	2370	20
420	47	1080	39	1740	27	2400	20
450	47	1110	38	1770	27	2430	20
480	46	1140	38	1800	26	2460	19
510	45	1170	37	1830	26	2490	19
540	44	1200	37	1860	26	2520	19
570	43	1230	37	1890	25	2550	19
600	42	1260	36	1920	25	2580	18
630	42	1290	36	1950	24	2600	26

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420 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.

STANDARD SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE WITH THIRD-PARTY VERIFIED LIGHT LIQUID RE-ENTRAINMENT SIMULATION PERFORMANCE TESTING RESULTS

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, designing, maintaining, and constructing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, **specifically an OGS device that has been third-party tested for oil and fuel retention capability using a protocol for light liquid re-entrainment simulation testing, with testing results and a Statement of Verification in accordance with all the provisions of ISO 14034 Environmental Management – Environmental Technology Verification (ETV)**. Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with OGS internal components correctly installed within the system, watertight sealed to the precast concrete prior to arrival to the project site.

1.2 REFERENCE STANDARDS

1.2.1 For Canadian projects only, the following reference standards apply:

CAN/CSA-A257.4-14: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets
CAN/CSA-A257.4-14: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings
CAN/CSA-S6-00: Canadian Highway Bridge Design Code

1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM D2563: Standard Practice for Classification of Visual Defects in Reinforced Plastics

1.3 SHOP DRAWINGS

1.3.1 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 the precast concrete components and OGS internal components prior to shipment, including the sequence for installation.

1.3.2 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 based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 OGS internal components supplied by the Manufacturer for attachment to the precast concrete vessel shall be pre-fabricated, bolted to the precast and watertight sealed to the precast vessel surface prior to site delivery to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent materials damage on site.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The OGS vessel shall be cylindrical and constructed from precast concrete riser and slab components.

2.1.2 The precast concrete OGS internal components shall include a fiberglass insert bolted and watertight sealed inside the precast concrete vessel, prior to site delivery. Primary internal components that are to be anchored and watertight sealed to the precast concrete vessel shall be done so only by the Manufacturer prior to arrival at the job site to ensure product quality.

2.1.3 The OGS shall be allowed to be specified and have the ability to function as a 240-degree bend structure in the stormwater drainage system, or as a junction structure.

2.1.4 The OGS to be specified shall have the capability to accept influent flow from an inlet grate and an inlet pipe.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

2.3 GASKETS

Only profile neoprene or nitrile rubber gaskets that are oil resistant shall be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.4-14. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials.

2.4 JOINTS

The concrete joints shall be watertight and meet the design criteria according to ASTM C-990. For projects where joints require gaskets, the concrete joints shall be watertight and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

2.5 FRAMES AND COVERS

Frames and covers shall be manufactured in accordance with State/Provincial or local requirements for inspection and maintenance access purposes. A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

2.6 PRECAST CONCRETE

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

2.7 FIBERGLASS

The fiberglass portion of the OGS device shall be constructed in accordance with ASTM D2563, and in accordance with the PS15-69 manufacturing standard, and shall only be installed, bolted and watertight sealed to the precast concrete by the Manufacturer prior to arrival at the project site to ensure product quality.

2.8 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a fiberglass insert for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The total sediment storage capacity shall be a minimum 40 ft^3 (1.1 m^3). The total petroleum hydrocarbon storage capacity shall be a minimum 50 gallons (189 liters). The access opening to the sump of the OGS device for periodic inspection and maintenance purposes shall be a minimum 16 inches (406 mm) in diameter.

2.9 LADDERS

Ladder rungs shall be provided upon request or to comply with State/Provincial or local requirements.

2.10 INSPECTION

All precast concrete sections shall be level and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

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 HYDROLOGY AND RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the average annual runoff volume, unless otherwise stated by the Engineer of Record, using historical rainfall data. Rainfall data sets should be comprised of a minimum 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases a minimum 5-year period of rainfall data.

3.3 ANNUAL (TSS) SEDIMIMENT LOAD AND STORAGE CAPACITY

The OGS device shall be capable of removing and have sufficient storage capacity for the calculated annual total suspended solids (TSS) mass load and volume without scouring previously captured pollutants prior to maintenance being required. The annual (TSS) sediment load and volume transported from the drainage area should be calculated and compared to the OGS device's available storage capacity by the specifying Engineer to ensure adequate capacity between maintenance cycles. Sediment loadings shall be determined by land use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater based on land use, as noted in Table 1 below.

Annual sediment volume calculations shall be performed using the projected average annual treated runoff volume, a typical sediment bulk density of 1602 kg/m^3 (100 lbs/ft^3) and an assumed Event Mean Concentration (EMC) of 125 mg/L TSS in the runoff, or as otherwise determined by the Engineer of Record.

Example calculation for a 1.3-hectares parking lot site:

- 1.28 meters of rainfall depth, per year
- 1.3 hectares of 100% impervious drainage area
- EMC of 125 mg/L TSS in runoff
- Treatment of 90% of the average annual runoff volume
- Target average annual TSS removal rate of 60% by OGS

Annual Runoff Volume:

- 1.28 m rain depth x 1.3 ha x 10,000 m^2/ha= 16,640 m^3 of runoff volume
- 16,640 m^3 x 1000 L/m^3 = 16,640,000 L of runoff volume
- 16,640,000 L x 0.90 = 14,976,000 L to be treated by OGS unit

Annual Sediment Mass and Sediment Volume Load Calculation:

- 14,976,000 L x 125 mg/L x kg/1,000,000 mg = 1,872 kg annual sediment mass
- 1,872 kg x m^3/1602 kg = 1.17 m^3 annual sediment volume
- 1.17 m^3 x 60% TSS removal rate by OGS = 0.70 m^3 minimum expected annual storage requirement in OGS

As a guideline, the U.S. EPA has determined typical annual sediment loads per drainage area for various sites by land use (see Table 1). Certain States, Provinces and local jurisdictions have also established such guidelines.

Table 1 – Annual Mass Sediment Loading by Land Use

	Commercial	Parking Lot	Residential			Highways	Industrial	Shopping Center
			High	Med.	Low			
(lbs/acre/yr)	1,000	400	420	250	10	880	500	440
(kg/hectare/yr)	1,124	450	472	281	11	989	562	494

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

3.4 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 Table 2, Section 3.5, and based on third-party performance testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. 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:

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 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 3.3.

3.4.5 The Peclet Number is not an approved method or model for calculating TSS removal, sizing, or scaling OGS devices.

3.4.6 If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates:

- Canadian ETV or ISO 14034 ETV Verification Statement which verifies third-party performance testing conducted in accordance with the **Procedure for Laboratory Testing of Oil-Grit Separators,** including the Light Liquid Re-entrainment Simulation Testing.
- Equal or better sediment (TSS) removal of the PSD specified in Table 2 at equivalent surface loading rates, as compared to the OGS device specified herein.
- Equal or better Light Liquid Re-entrainment Simulation Test results (using low-density polyethylene beads as a surrogate for light liquids such as oil and fuel) at equivalent surface loading rates, as compared to the OGS device specified herein. However, an alternative OGS device shall not be allowed as a substitute if the Light Liquid Re-entrainment Simulation Test was performed with screening components within the OGS device that are effective at retaining the low-density polyethylene beads, but would not be expected to retain light liquids such as oil and fuel.
- Equal or greater sediment storage capacity, as compared to the OGS device specified herein.
- Supporting documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall be sized to achieve the Engineer-specified average annual percent sediment (TSS) removal based solely on the test sediment used in the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** This test sediment is comprised of inorganic ground silica with a specific gravity of 2.65, uniformly mixed, and containing a broad range of particle sizes as specified in Table 2. No alternative PSDs or deviations from Table 2 shall be accepted.

Table 2
Canadian ETV Program Procedure for Laboratory Testing of Oil-Grit Separators
Particle Size Distribution (PSD) of Test Sediment

Particle Diameter (Microns)	% by Mass of All Particles	Specific Gravity
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

3.6 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party scour testing conducted and have in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This scour testing is conducted with the device pre-loaded with test sediment comprised of the particle size distribution (PSD) illustrated in Table 2.

3.6.1 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.

Data generated from laboratory scour testing performed with an OGS device pre-loaded with a coarser PSD than in Table 2 (i.e. the coarser PSD has no particles in the 1-micron to 50-micron size range, or the D_{50} of the test sediment exceeds 75 microns) shall not be acceptable for the determination of the device's suitability for on-line installation.

3.7 DESIGN ACCOUNTING FOR BYPASS

3.7.1 The OGS device shall be specified to achieve the TSS removal performance and water quality objectives without washout of previously captured pollutants. The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. To ensure this is achieved, there are two design options with associated requirements:

3.7.1.1 The OGS device shall be placed **off-line** with an upstream diversion structure (typically in an upstream manhole) that only allows the water quality volume to be diverted to the OGS device, and excessive flows diverted downstream around the OGS device to prevent high flow washout of pollutants previously captured. This design typically incorporates a triangular layout including an upstream bypass manhole with an appropriately engineered weir wall, the OGS device, and a downstream junction manhole, which is connected to both the OGS device and bypass structure. In this case with an external bypass required, the OGS device manufacturer must provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

3.7.1.2 Alternatively, OGS devices in compliance with Section 3.6 shall be acceptable for an **on-line** design configuration, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole.

3.7.2 The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates equal or better hydraulic conveyance capacity as compared to the OGS device specified herein. This documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.8 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.

3.8.1 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.

3.9 PETROLEUM HYDROCARBONS AND FLOATABLES STORAGE CAPACITY

Petroleum hydrocarbons and floatables storage capacity in the OGS device shall be a minimum 50 gallons (189 Liters), or more as specified.

3.9.1 The OGS device shall have gasketed precast concrete joints that are watertight, and oil resistant and meet the design criteria according to ASTM C-443 to provide safe oil and other hydrocarbon materials storage and ground water protection. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

3.10 SURFACE LOADING RATE SCALING OF DIFFERENT MODEL SIZES

The reference device for scaling shall be an OGS device that has been third-party tested in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Other model sizes of the tested device shall only be scaled such that the claimed TSS removal efficiency of the scaled device shall be no greater than the TSS removal efficiency of the tested device at identical **surface loading rates** (flow rate divided by settling surface area). The depth of other model sizes of the tested device shall be scaled in accordance with the depth scaling provisions within Section 6.0 of the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.10.1 The Peclet Number and volumetric scaling are not approved methods for scaling OGS devices.

PART 4 – INSPECTION & MAINTENANCE

The OGS manufacturer shall provide an Owner's Manual upon request.
Maintenance shall be performed by a professional service provider who has experience in cleaning OGS devices and has been trained and certified in applicable health and safety practices, including confined space entry procedures.

4.1 A Quality Assurance Plan that provides inspection for a minimum of 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.

4.2 OGS device inspection shall include determination of sediment depth and presence of petroleum hydrocarbons below the insert. Inspection shall be easily conducted from finished grade through a frame and cover of at least 22 inch (560 mm) in diameter.

4.3 Inspection and pollutant removal shall be conducted periodically. For routine maintenance cleaning activities, pollutant removal shall typically utilize a truck equipped with vacuum apparatus, and shall be easily conducted from finished grade through a frame and cover of at least 22-inches (560 mm) in diameter.

4.4 Diameter of the maintenance access opening to the lower chamber and sump shall be scaled consistently across all model sizes, and shall be 1/3 the inside diameter of the OGS structure, or larger.

4.5 No confined space entry shall be required for routine inspection and maintenance cleaning activities.

4.6 For OGS model sizes of diameter 72 inches (1828 mm) and greater, the access opening to the OGS device's lower chamber and sump shall be large enough to allow a maintenance worker to enter the lower chamber to facilitate non-routine maintenance cleaning activities and repairs, as needed.

4.7 The orifice-containing component (i.e. drop pipe, duct, chute, etc.) of the OGS device used to control flow rate into the lower chamber shall be removable from the insert to facilitate cleaning, repair, or replacement of the orifice-containing component, as needed.

PART 5 – EXECUTION

5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS stormwater quality treatment device shall conform to ASTM C 891, ASTM C 478, ASTM C 443, CAN/CSA-A257.4-14, CAN/CSA-A257.4-14, CAN/CSA-S6-00 and all highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below. The Contractor shall furnish all labor, equipment and materials necessary to offload, assemble as needed the OGS internal components as specified in the Shop Drawings.

5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS stormwater quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS stormwater quality treatment device is installed and leveled in sections in the following sequence:

- aggregate base
- base slab, or base
- riser section(s) (if required)
- riser section w/ pre-installed fiberglass insert
- upper riser section(s)
- internal OGS device components
- connect inlet and outlet pipes
- riser section, top slab and/or transition (if required)
- frame and access cover

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

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

5.5 DROP PIPE AND OIL INSPECTION PIPE

Once the upper precast concrete riser has been attached to the lower precast concrete riser section, the OGS device Drop Pipe and Oil Inspection Pipe must be attached, and watertight sealed to the fiberglass insert using Sikaflex 1a. Installation instructions and required materials shall be provided by the OGS manufacturer.

5.6 INLET AND OUTLET PIPES

Inlet and outlet pipes shall be securely set using grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Non-secure inlets and outlets will result in improper performance.

5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

Precast concrete adjustment units shall be installed to set the frame and cover/grate at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover/grate should be set in a full bed of mortar at the elevation specified.

5.7.1 A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS device brand or product name to properly identify this asset's purpose is for stormwater quality treatment.

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_VR2023-11-15_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, 2023
Vancouver, BC, Canada

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.

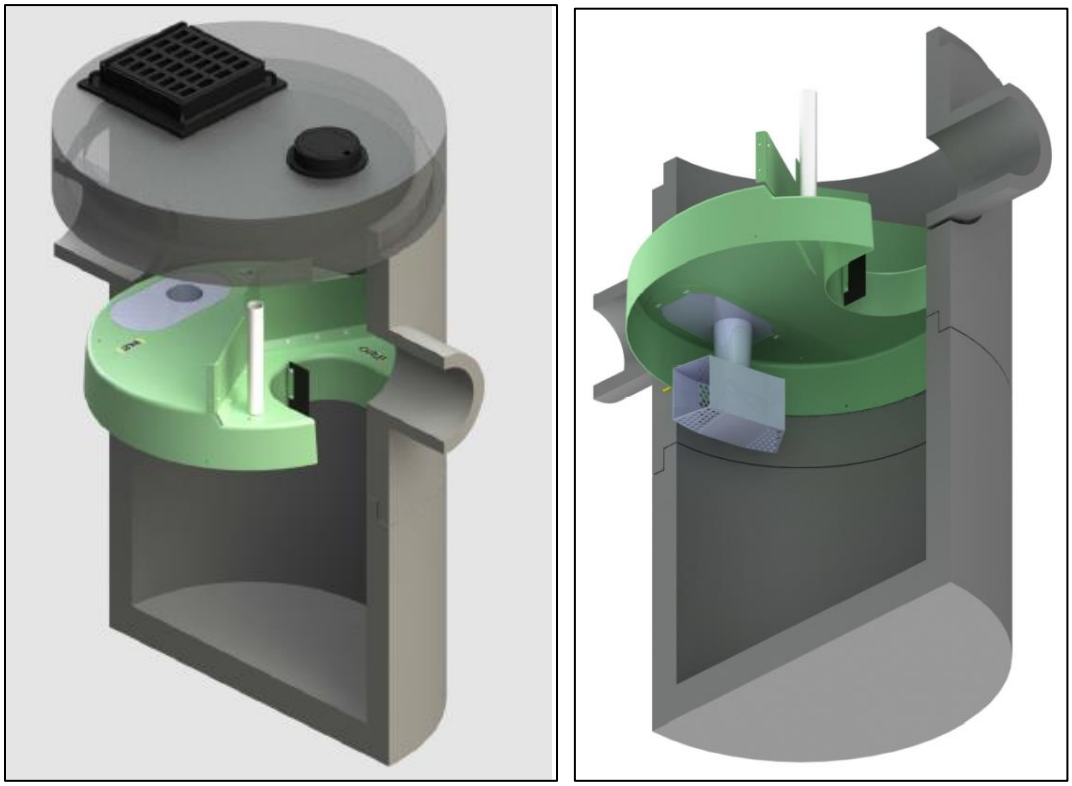


Figure 1. Graphic of typical inline Stormceptor® unit and core components.

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.

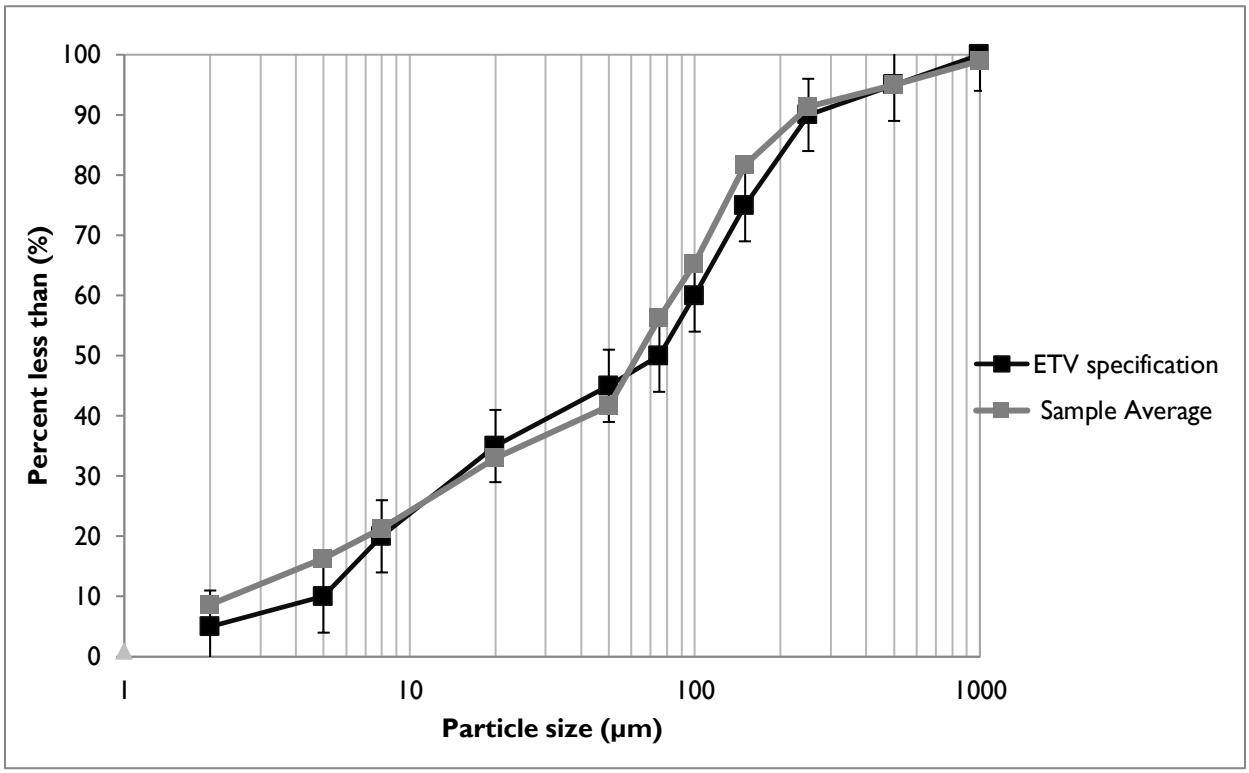


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

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.

As expected, the capture efficiency for fine particles in both units was generally found to decrease as surface loading rates increased.

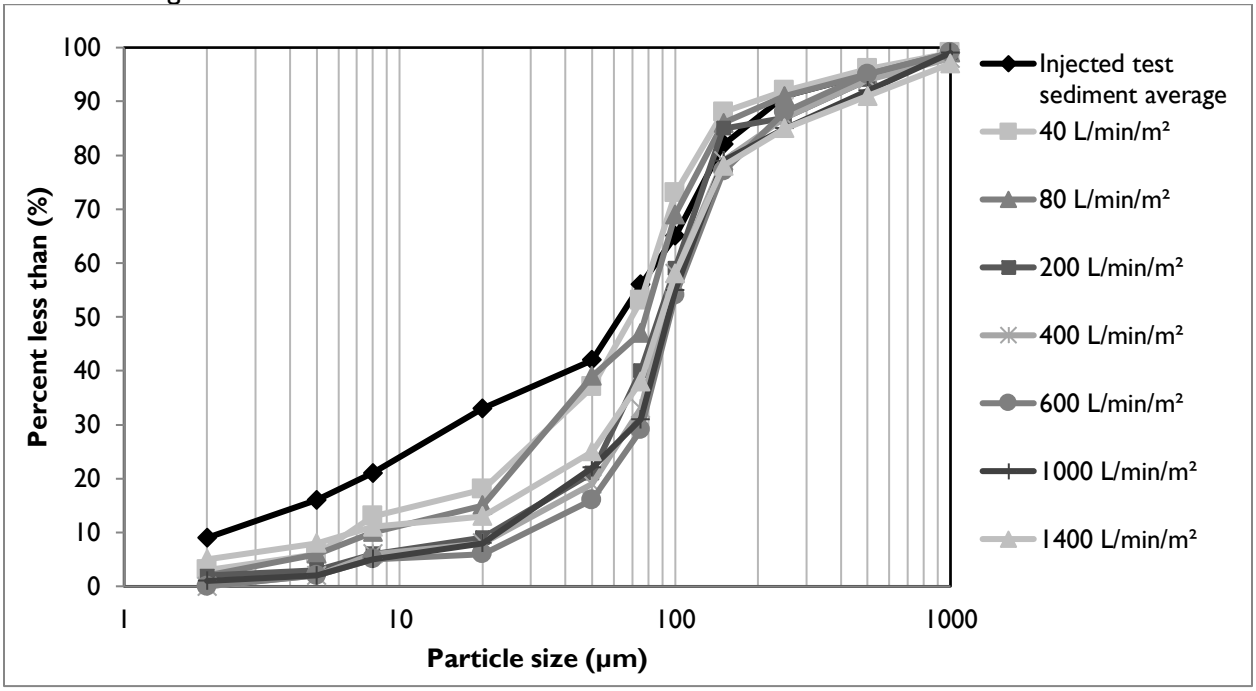


Figure 3. Particle size distribution of sediment retained in the EF4 in relation to the injected test sediment average.

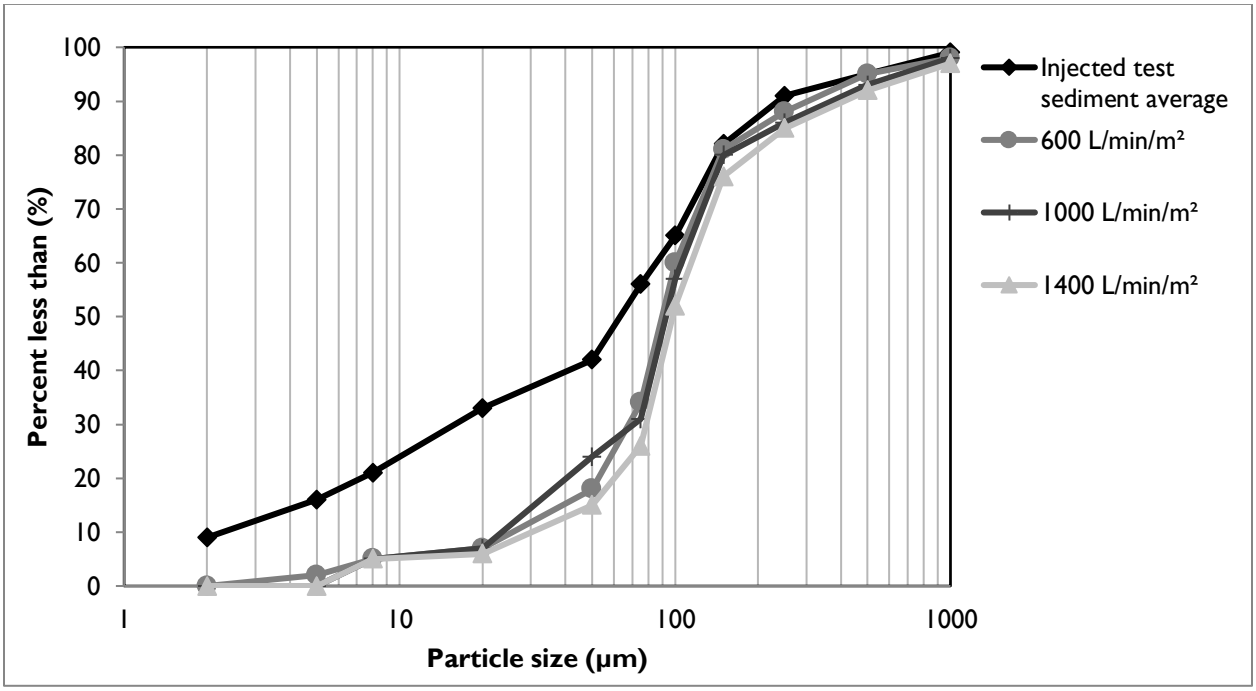


Figure 4. Particle size distribution of sediment retained in the EFO4 in relation to the injected test sediment average at surface loading rates above the bypass rate of 535 L/min/m²

Table 4 shows the results of the sediment scour and re-suspension test for the EF4 unit. The EFO4 was not tested as it was reasonably assumed that scour rates would be lower given that flow bypass occurs at a lower surface loading rate. The scour test involved preloading 10.2 cm of fresh test sediment into

the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. Typically, the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test is also used to adjust the concentration, as per the method described in Bulletin # CETV 2016-09-0001. However, since the composites of effluent concentrations were below the Reporting Detection Limit of the Laser Diffraction PSD methodology, this adjustment was not made. Results showed average adjusted effluent sediment concentrations below 5 mg/L at all tested surface loading rates.

It should be noted that the EF4 starts to internally bypass water at 1135 L/min/m^2, potentially resulting in the dilution of effluent concentrations, which would not normally occur under typical field conditions because the field influent concentration would contain a much higher sediment concentration than during the lab test. Recalculation of effluent concentrations to account for dilution at surface loading rates above the bypass rate showed sediment effluent concentrations to be below 1.6 mg/L.

Table 4. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m^2)	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L) [a]	Average (mg/L)
1	200	1:00	<RDL	11.9	4.6
		2:00		7.0	
		3:00		4.4	
		4:00		2.2	
		5:00		1.0	
		6:00		1.2	
2	800	7:00	<RDL	1.1	0.7
		8:00		0.9	
		9:00		0.6	
		10:00		1.4	
		11:00		0.1	
		12:00		0	
3	1400	13:00	<RDL	0	0
		14:00		0.1	
		15:00		0	
		16:00		0	
		17:00		0	
		18:00		0	
4	2000	19:00	1.2	0.2	0.2
		20:00		0	
		21:00		0	
		22:00		0.7	
		23:00		0	
		24:00		0.4	

5	2600	25:00	1.6	0.3	0.4
		26:00		0.4	
		27:00		0.7	
		28:00		0.4	
		29:00		0.2	
		30:00		0.4	

[a] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 5. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device continuously at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2). Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test.

Table 5. Light liquid re-entrainment test results for the EFO4.

Surface Loading Rate (L/min/m2)	Time Stamp	Amount of Beads Re-entrained			
		Mass (g)	Volume (L)[a]	% of Pre-loaded Mass Re-entrained	% of Pre-loaded Mass Retained
200	62	0	0	0.00	100
800	247	168.45	0.3	0.52	99.48
1400	432	51.88	0.09	0.16	99.83
2000	617	55.54	0.1	0.17	99.84
2600	802	19.73	0.035	0.06	99.94
Total Re-entrained		295.60	0.525	0.91	--
Total Retained		32403	57.78	--	99.09
Total Loaded		32699	58.3	--	--

[a] Determined from bead bulk density of 0.56074 g/cm^3

Variances from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. During the capture test, the 40 L/min/m^2 and 80 L/min/m^2 surface loading rates were evaluated over 3 and 2 days respectively due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit at these lower flow rates. Pumps were shut down at the end of each intermediate day, and turned on again the following morning. The target flow rate was re-established within 30 seconds of switching on the pump. This procedure may have allowed sediments to be captured that otherwise may have exited the unit if the test was continuous. On the basis of practical considerations, this variance was approved by the verifier prior to testing.

2. During the scour test, the coefficient of variation (COV) for the lowest flow rate tested (200 L/min/m^2) was 0.07, which exceeded the specified limit of 0.04 target specified in the OGS Procedure. A pump capable of attaining the highest flow rate of 3036 L/min had difficulty maintaining the lowest flow of 234 L/min but still remained within +/- 10% of the target flow and is viewed as having very little impact on the observed results. Similarly, for the light liquid re-entrainment test the COV for the flow rate of the 200 L/min/m^2 run was 0.049, exceeding the limit of 0.04, but is believed to introduce negligible bias.

3. Due to pressure build up in the filters, the runs at 1000 L/min/m^2 for the Stormceptor® EF4 and 1000 and 1400 L/min/m^2 for the Stormceptor® EFO4 were slightly shorter than the target. The run times were 54, 59 and 43 minutes respectively, versus targets of 60 and 50 minutes. The final feed samples were timed to coincide with the end of the run. Since >25 lbs of sediment was fed, the shortened time did not invalidate the runs.

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems Inc. to support the performance claim included the following: Performance test report prepared by Good Harbour Laboratories, and dated September 8, 2017; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

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

For more information on the Stormceptor® EF and EFO OGS please contact:

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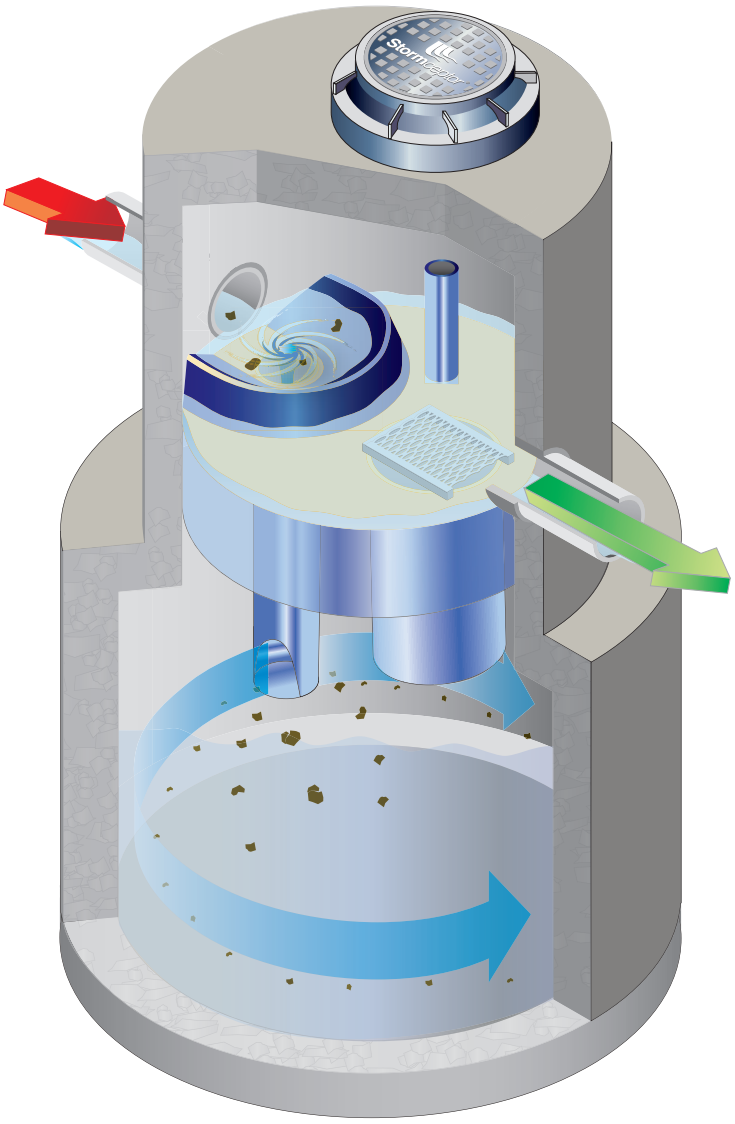
Limitation of verification - Registration: GPS-ETV_VR2023-11-15_Imbrium-SC
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

1 – Stormceptor Overview

2 – Stormceptor Operation & Components

3 – Stormceptor Identification

4 – Stormceptor Inspection & Maintenance
    Recommended Stormceptor Inspection Procedure
    Recommended Stormceptor Maintenance Procedure

5 – Contact Information (Stormceptor Licensees)

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

Inline Stormceptor

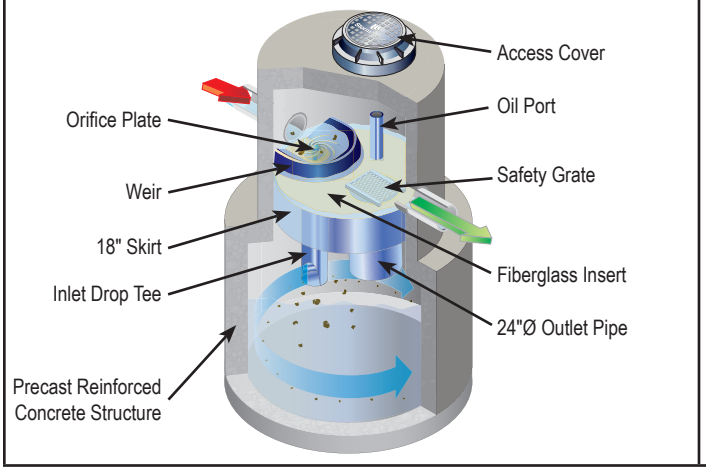
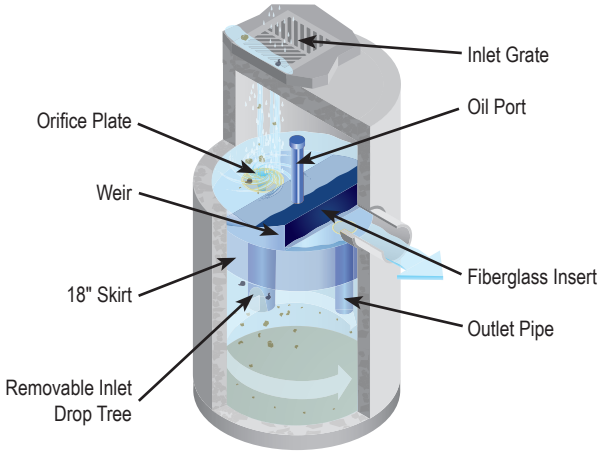


Figure 2.

Inlet Stormceptor



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

EOS Model	Insert to Base (in.)
4-175	60
9-365	55
12-590	71
18-1000	105
24-1400	94
36-1700	134
48-2000	128
60-2500	150
72-3400	134
110-5000*	128
130-6000*	150
160-7800*	134

OSR Model	Insert to Base (in.)
65	60
140	55
250	94
390	128
560	134
780*	128
1125*	134

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
1500	2.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
11000*	4.0
14000*	3.7

EOS Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
10000*	4.0
14000*	3.7

OSR Model	Insert to Base (m)
300	1.7
750	1.6
2000	2.6
4000	3.6
6000	3.7
9000*	3.6
14000*	3.7

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3	**EOS Model**	Hydrocarbon Storage Capacity gal	**OSR Model**	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3
450	86	46	**4-175**	175	**065**	115	46
900	251	89	**9-365**	365	**140**	233	58
1200	251	127	**12-590**	591			
1800	251	207	**18-1000**	1198			
2400	840	205	**24-1400**	1457	**250**	792	156
3600	840	373	**36-1700**	1773			
4800	909	543	**48-2000**	2005	**390**	1233	465
6000	909	687	**60-2500**	2514			
7200	1059	839	**72-3400**	3418	**560**	1384	690
11000*	2797	1089	**110-5000***	5023	**780***	2430	930
13000*	2797	1374	**130-6000***	6041			
16000*	3055	1677	**160-7800***	7850	**1125***	2689	1378

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

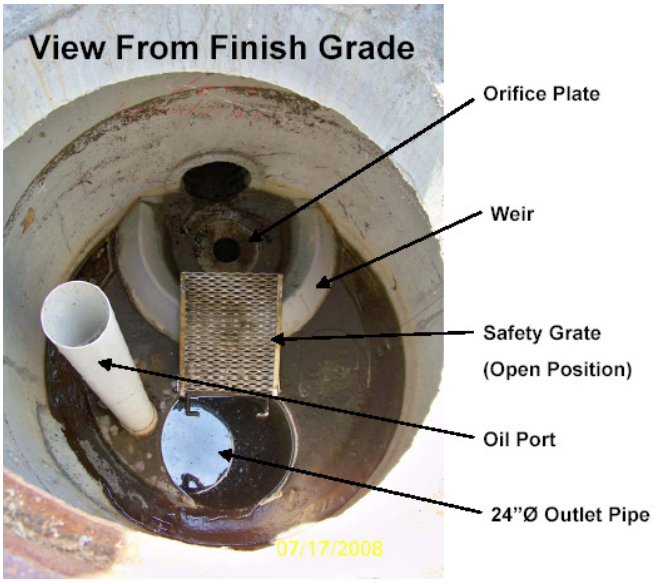
Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.



Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

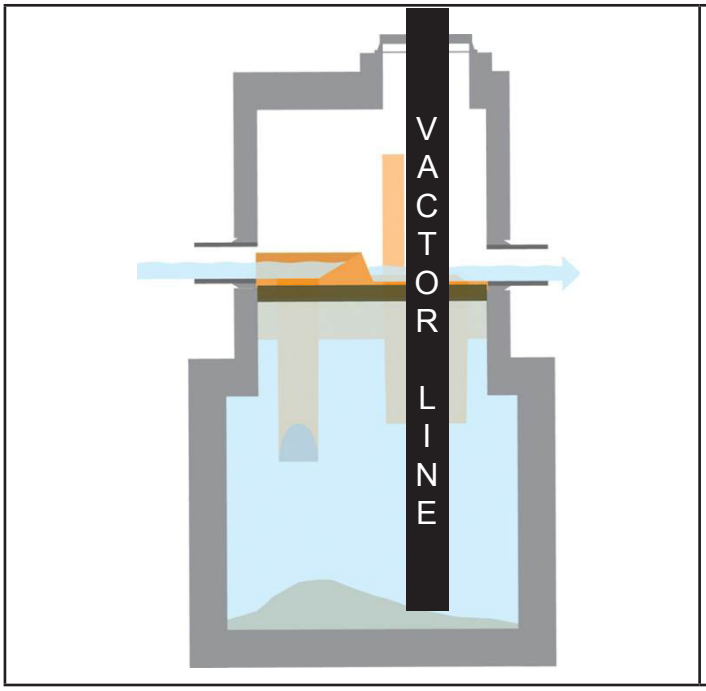
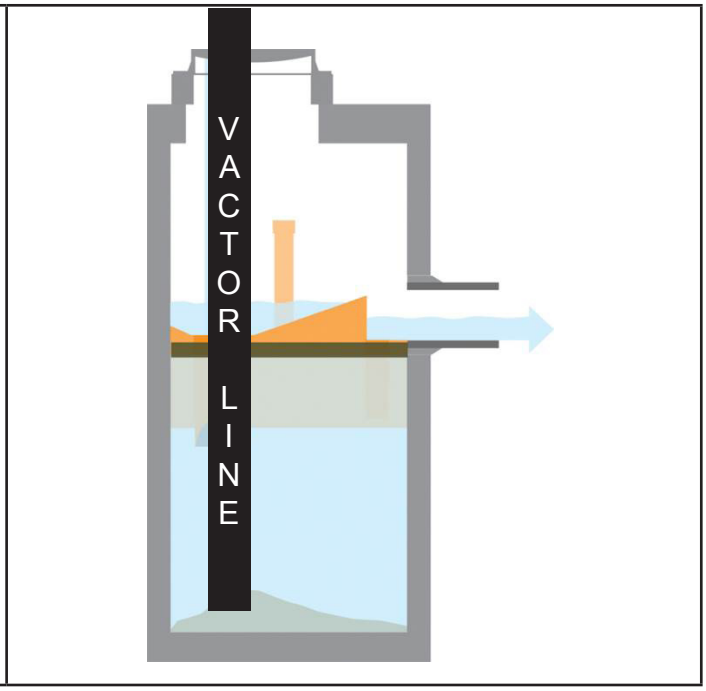


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.



Figure 8.



A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at

very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?
The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?
Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:

1. *The values above are for typical standard units.*

**Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com

403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretegroup.com

604-502-5236	BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com

519-622-7574 / 1-888-888-3222	ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com

450-454-3928 / 1-800-561-0970	QC

Strescon Limited
www.strescon.com

902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827
Email	info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Thursday, February 5, 2026
Project Name	Agnes St.
Project Number	Area 202
Location	Alton

Jellyfish Filter Design Overview

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

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

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF6-5-1 is recommended to meet the water quality objective by treating a flow of 27.8 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 33 years of WATERLOO WELLINGTON A rainfall data for this site. This model has a sediment capacity of 313 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF6-5-1	5	1	1.8	27.8	313

The Jellyfish Filter System

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

Maintenance

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

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

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

Performance

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

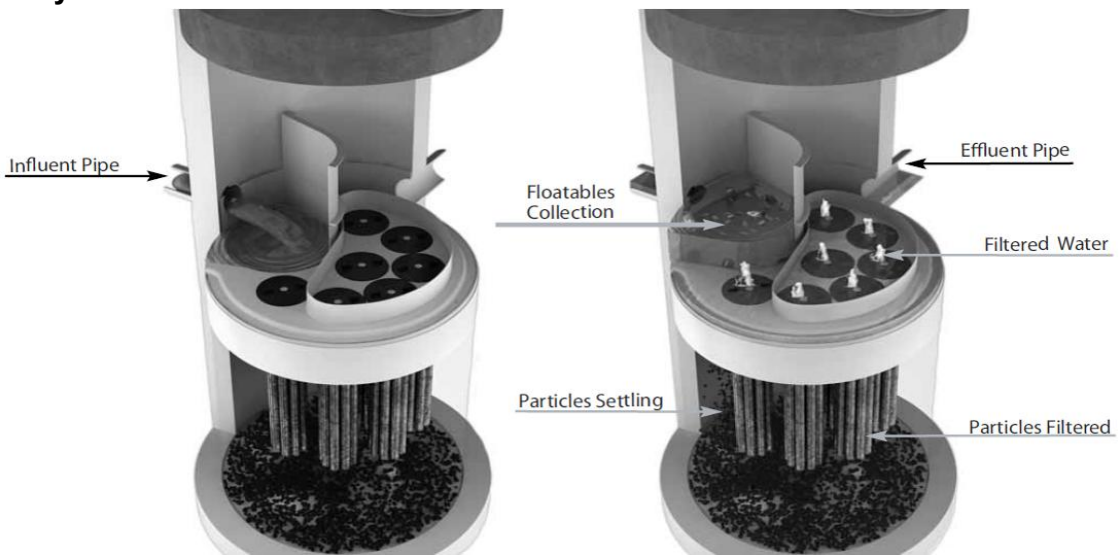
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

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

- A median TSS removal efficiency of 90%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	Thursday, February 5, 2026
Project Name:	Agnes St.
Project Number:	Area 202
Location:	Alton

Designer Information

Company:	Greck and Associates Ltd.
Contact:	Jennifer Chan
Phone #:	

Notes

Rainfall

Name:	WATERLOO WELLINGTON A
State:	ON
ID:	9387
Record:	1970 to 2003
Co-ords:	43°27'N, 80°23'W

Drainage Area

Total Area:	1.82229 ha
Imperviousness:	41%

Upstream Detention

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

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 33 years of WATERLOO WELLINGTON A rainfall data:	**24.5 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 3059 m³, with a suspended sediment concentration of 60 mg/L.	**184 kg**

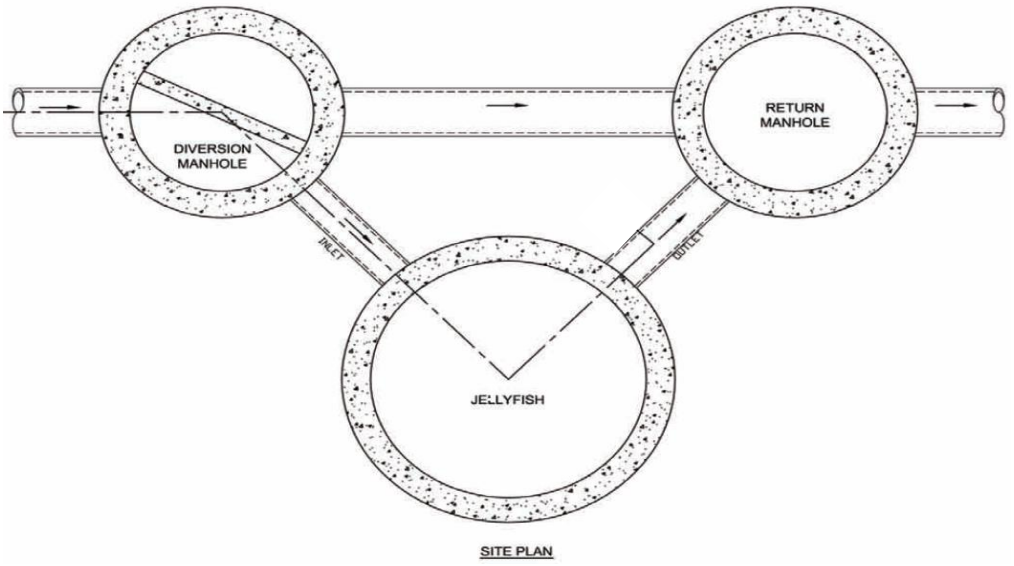
Recommendation

The Jellyfish Filter model JF6-5-1 is recommended to meet the water quality objective by treating a flow of 27.8 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 33 years of WATERLOO WELLINGTON A rainfall data for this site. This model has a sediment capacity of 313 kg, which meets or exceeds the estimated average annual sediment load.

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

Jellyfish Filter Design Notes

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



Jellyfish Filter Typical Layout

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

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

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

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS

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

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

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

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

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

1.4 PRODUCT SUBSTITUTIONS

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

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

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

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

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

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

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

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

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

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

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

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

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

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

2.2 PRECAST CONCRETE SECTIONS

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

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

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

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

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

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

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

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

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

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

PART 3 – PERFORMANCE

3.1 GENERAL

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

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

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

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

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

3.2 FIELD TEST PERFORMANCE

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

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

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

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

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

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

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

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

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

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

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

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

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

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

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

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

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

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

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

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

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

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

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

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

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

PART 5 – QUALITY ASSURANCE

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

5.2 INSPECTION AND MAINTENANCE

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

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

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

END OF SECTION

STANDARD PERFORMANCE SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV)

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: filtration surface area, 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, filtration treatment device 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 GENERAL

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

2.1.2 Pollutant Storage: The Filter device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter treatment device shall have been field tested in accordance with either TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements – Amendments to TARP Tier II Protocol (NJDEP, 2009) or Washington State Technology Assessment Protocol – Ecology (TAPE), 2011 or later version. The field test shall have been verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV). See Section 3.2 of this specification for field test performance requirements.

3.2 FIELD TEST PERFORMANCE

The field test (as specified in section 3.1.1)shall have monitored a minimum of twenty (20) TARP or TAPE qualifying storm events, and report at **minimum** the following results:

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.

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

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

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce turbidity such that effluent turbidity is 15 NTU or lower.

3.2.5 Nutrients & Metals – The stormwater quality filter treatment device shall have ISO 14034 ETV Verified minimum load based removal efficiencies for the following:

3.2.5.1 Total Phosphorus (TP) Removal - Median TP removal efficiency of at least 49%.

3.2.5.2 Total Nitrogen (TN) Removal - Median TN removal efficiency of at least 39%.

3.2.5.3 Total Zinc (Zn) Removal - Median Zn removal efficiency of at least 69%.

3.2.5.4 Total Copper (Cu) Removal - Median Cu removal efficiency of at least 91%.

END OF SECTION

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Jellyfish® Filter

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

Registration: GPS-ETV_VR2025-03-15

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 15, 2025
Vancouver, BC, Canada

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

Technology description and application

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

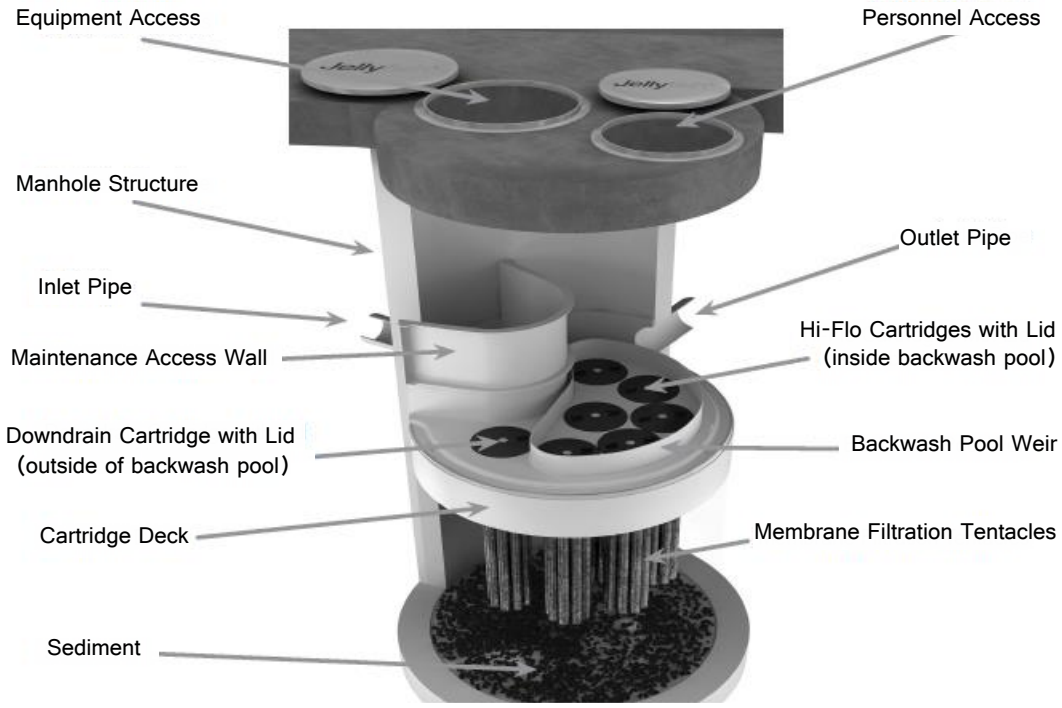


Figure 1. Cut-away graphic of a Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge

Figure 1 depicts a cut-away graphic of a typical 6-ft diameter Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge (JF6-6-1). Stormwater influent enters the system through the inlet pipe and builds a pond behind the maintenance access wall, with the pond elevation providing driving head. Flow is channeled downward into the lower chamber beneath the cartridge deck. A flexible separator skirt surrounds the filtration zone where the filtration tentacles of each cartridge are suspended, and the volume between the vessel wall and the outside surface of the separator skirt comprises a pre-treatment channel. As flow spreads throughout the pre-treatment channel, floatable pollutants accumulate at the surface of the pond behind the maintenance access wall and also beneath the cartridge deck in the pre-treatment channel, while coarse sediments settle to the sump. Flow proceeds under the separator skirt and upward into the filtration zone, entering each filtration tentacle and depositing fine suspended sediment and associated particulate-bound pollutants on the outside surface of the membranes. Filtered water proceeds up the center tube of each tentacle, with the flow from each tentacle combining under the cartridge lid, and discharging to the top of the cartridge deck through the cartridge lid orifice. Filtered effluent from the hi-flo cartridges enters a pool enclosed by a 15-cm high weir, and if storm intensity and resultant driving head is sufficient, filtered water overflows the weir and proceeds across the cartridge deck to the outlet pipe. Filtered effluent discharging from the draindown cartridge(s) passes directly to the outlet pipe, and requires only a minimal amount of driving head (2.5 cm) to provide forward flow. As

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

Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on a Jellyfish Filter JF6-6-1 (6-ft diameter manhole with 6 hi-flo cartridges and 1 draindown cartridge), in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). The drainage area providing stormwater runoff to the test unit was 86 acres and was 32% impervious. Throughout the monitoring period (March 2017 – April 2020), a total of 25 individual storm events were sampled. The Basic Treatment standard outlined in the TAPE requires ≥ 80% total suspended solids (TSS) removal at influent TSS concentrations ranging from 100 to 200 mg/L. In addition, the Phosphorus Treatment standard outlined in the TAPE requires ≥ 50% removal of total phosphorus (TP) at influent concentrations ranging from 0.10 to 0.5 mg/L. For this verification, the performance claim for TSS removal is for influent TSS concentration ≥ 100 mg/L, and the performance claim for TP removal is for influent TP concentration ≥ 0.1 mg/L. Based on these requirements, 15 and 18 sample pairs deemed qualified for evaluating the removal performance of TSS and TP, respectively. Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

Table 1 shows the specified and achieved TAPE criteria for storm selection and sampling.

Table 1. Specified and achieved TAPE criteria for storm selection and sampling

Description	TAPE criteria value	Achieved value
Total rainfall	> 3.8 mm (0.15 in)	> 3.8 mm (0.15 in)[1]
Minimum inter-event period	6 hours	6 hours
Minimum flow-weighted composite sample storm coverage	Minimum 70% including as much of the first 20% of the storm	> 70%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	10, except for two events that had 9 aliquots
Total sampled rainfall	N/A	8.29 in
Number of storms	Minimum 15 (preferably 20)	25

[1]N.B. Storm event depth was greater than the TAPE rainfall depth guideline of 0.15 inches for all events sampled, except for the 3/21/2017, 3/22/2019, 3/26/2019, and 04/13/2019 events. Given the size of the drainage basin, storm events below this threshold produced adequate runoff volume for sampling. Only two of these events were used to evaluate performance, and all had rainfall depths of 0.11 inches or greater. These events were included as their runoff volumes, precipitation durations, and influent TSS concentrations were all within range of the total data set.

The 6-ft diameter test unit has sedimentation surface area of 2.62 m2 (28.26 ft2). Each of the seven filter cartridges employed in the test unit uses filtration tentacles of 137 cm (54 in) length, with filter surface area of 35.4 m2 (381 ft2) per cartridge, and total filter surface area of 247.8 m2 (2667 ft2) for the seven cartridges combined. The design treatment flow rate is 5 L/s (80 gal/min) for each of the six hi-flo

cartridges and 2.5 L/s (40 gal/min) for the single draindown cartridge, for a total design treatment flow rate of 32.5 L/s (520 gal/min) at design driving head of 457 mm (18 in). This translates to a filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m² (0.21 gal/min/ft²) for each hi-flo cartridge and 0.07 L/s/m² (0.11 gal/min/ft²) for the draindown cartridge. The design flow rate for each cartridge is controlled by the sizing of the orifice in the cartridge lid. The distance from the bottom of the filtration tentacles to the sump is 61 cm (24 in).

Performance claim(s)

The Jellyfish® Filter demonstrated the removal efficiencies indicated in **Table 2** for TSS and TP during field monitoring conducted in accordance with the Washington State Department of Ecology's Technology Assessment Protocol – Ecology (TAPE), and using the following design parameters:

- System hydraulic loading rate (system treatment flow rate per unit of sedimentation surface area) of 12.5 L/s/m² (18.4 gal/min/ft²) or lower
- Filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m² (0.21 gal/min/ft²) or lower for each hi-flo cartridge and 0.07 L/s/m² (0.11 gal/min/ft²) or lower for each draindown cartridge
- Distance from the bottom of the filtration tentacles to the sump of 61 cm (24 in) or greater
- Driving head of 457 mm (18 in) or greater

Table 2. Bootstrapped mean, median, and 95% confidence interval (median) for removal efficiencies of Total Suspended Solids (TSS) and Total Phosphorus (TP)

Parameter	Mean (%)	Median (%)	Median – 95% Lower Limit	Median – 95% Upper Limit
TSS [1]	87.6	90.1	85.1	91.6
TP [2]	77.3	77.5	70.8	85.6

[1] TSS influent concentration ≥ 100 mg/L
[2] TP influent concentration ≥ 0.1 mg/L

N.B. As with any field test of stormwater treatment devices, removal efficiencies will vary based on pollutant influent concentrations and other site-specific conditions.
The performance claims can be applied to other Jellyfish® Filter models smaller or larger than the tested model as long as the untested models are designed in accordance with the design parameters specified in the performance claims.

Performance results

Performance Claims – Removal Efficiency for Total Suspended Solids

Raw data summarizing the percent removal of total suspended solids (TSS) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m² (18.4 gal/min/ft²) for 15 sample pairs deemed qualified are presented in **Table 3**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 3. Raw data summarizing the percent removal of total suspended solids (TSS)

Event ID	TSS Influent (mg/L)	TSS Effluent (mg/L)	TSS Removal (%) (Inf ≥ 100 mg/L)
3/21/2017	102.0	22.0	78.4
4/7/2017	201.0	30.8	84.7
4/12/2017	108.0	24.4	77.4
4/19/2017	452.0	44.6	90.1
4/26/2017	257.0	10.0	96.1

6/15/2017	134.0	10.4	92.2
3/8/2018	755.0	47.2	93.8
3/14/2018	181.0	27.0	85.1
3/22/2018	224.0	20.0	91.1
4/5/2019	171.0	23.0	86.6
4/13/2019	117.0	25.0	78.6
5/18/2019	254.0	20.0	92.1
12/7/2019	200.0	17.0	91.5
3/30/2020	605.0	51.0	91.6
4/20/2020	210.0	29.0	86.2
n	15	15	15
Min	102.0	10.0	77.4
Max	755.0	51.0	96.1
Median	201.0	24.4	90.1
Mean	264.7	26.8	87.7
SD	190.9	12.3	5.9

Performance Claims – Removal Efficiency for Total Phosphorus

Raw data summarizing the percent removal of total phosphorus (TP) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m^2 (18.4 gal/min/ft^2) for 18 sample pairs deemed qualified are presented in **Table 4**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 4. Raw data summarizing the percent removal of total phosphorus (TP)

Event ID	TP Influent (mg/L)	TP Effluent (mg/L)	TP Removal (%) (Inf ≥ 0.1 mg/L)
4/7/2017	0.706	0.092	87.0
4/12/2017	0.338	0.076	77.5
4/19/2017	0.500	0.036	92.8
4/26/2017	0.504	0.042	91.7
5/13/2017	0.256	0.110	57.0
6/8/2017	0.256	0.104	59.4
6/15/2017	0.362	0.052	85.6
3/8/2018	1.75	0.130	92.6
3/14/2018	0.652	0.094	85.6
3/22/2018	0.364	0.072	80.2
3/27/2019	0.226	0.070	69.1
4/5/2019	0.337	0.092	72.9
4/13/2019	0.249	0.087	65.1
5/18/2019	1.09	0.173	84.1
12/7/2019	0.335	0.105	68.7
12/19/2019	0.211	0.093	56.2
3/30/2020	1.05	0.092	91.2
4/20/2020	0.451	0.112	75.2
n	18	18	18
Min	0.211	0.036	56.2
Max	1.75	0.173	92.8
Median	0.363	0.092	78.9
Mean	0.535	0.091	77.3
SD	0.400	0.032	12.5

Verification

The verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies ("CAWT"), contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems to support the performance claim included the performance monitoring report "General Use Level Designation Technical Evaluation Report" prepared by CONTECH Engineered Solutions, Portland, OR, USA, and dated December 28, 2020. This report is based on a field testing completed by CONTECH personnel at a site in Dundee, Oregon between March 2017 and April 2020 in accordance with the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology (WADOE, 2011).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

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

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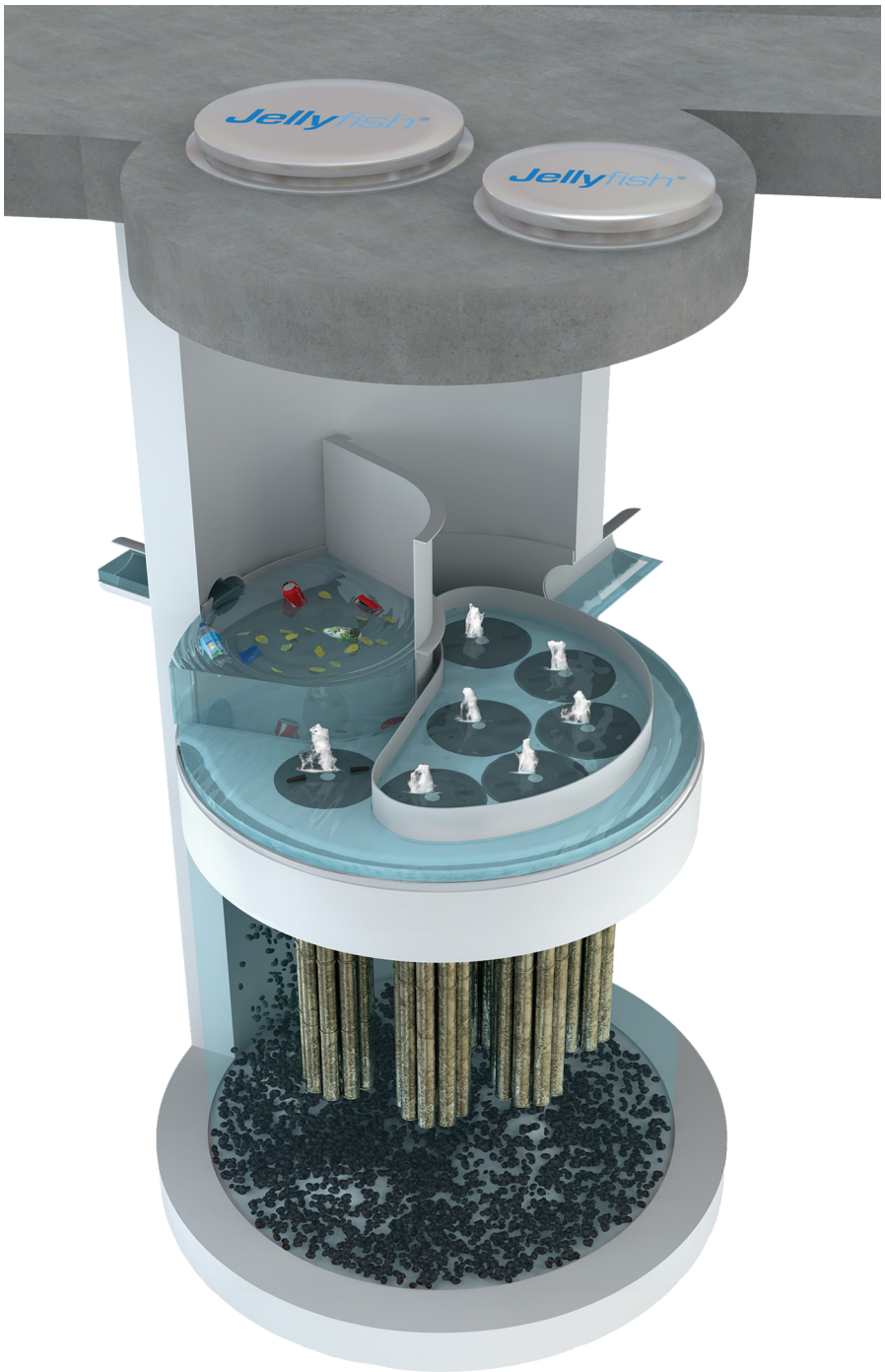
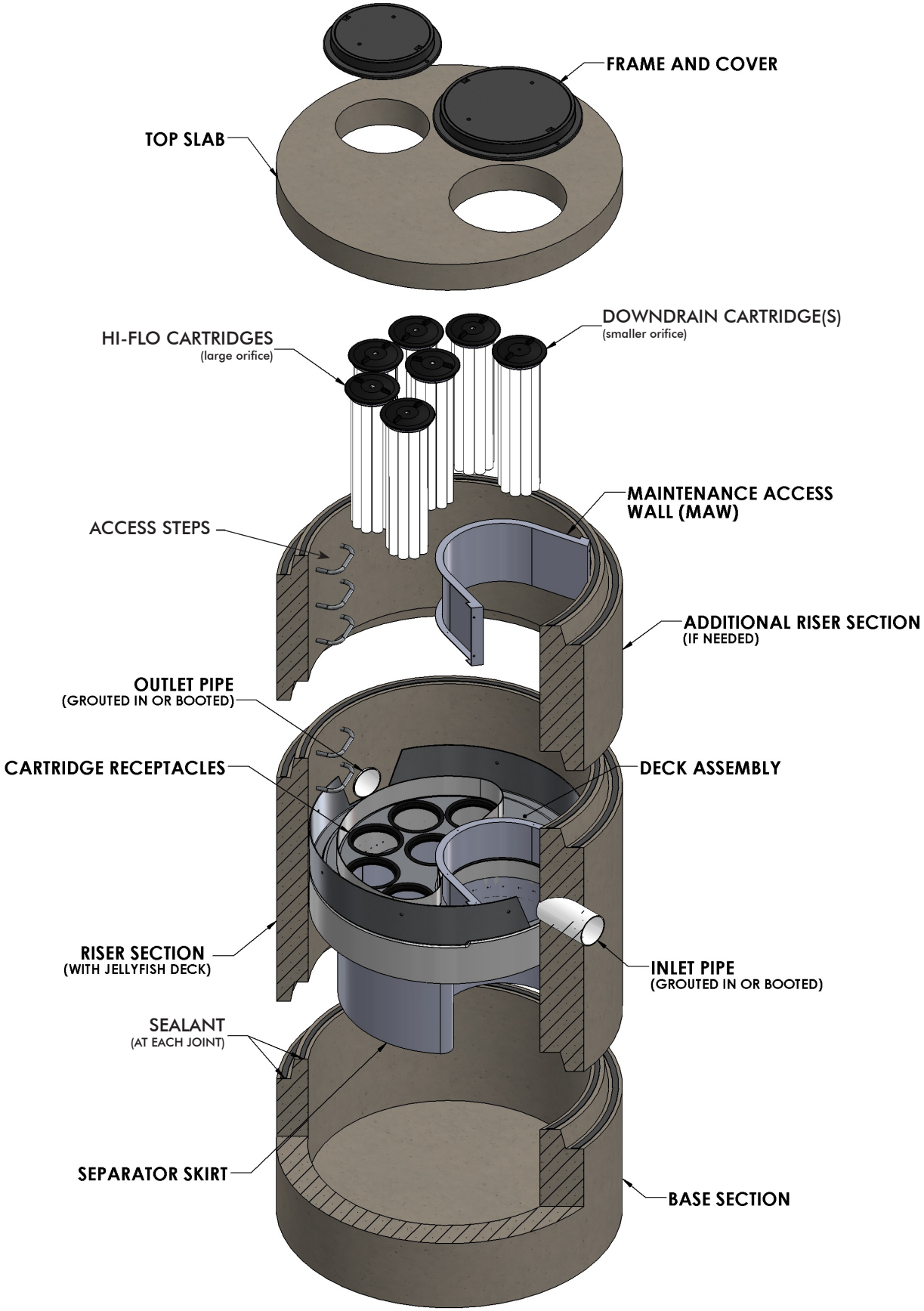
etv@globeperformance.com
www.globeperformance.com

Limitation of verification - Registration: GPS-ETV_VR2025-03-15
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

Jellyfish® Filter
Owner's Manual



imbrium®


FRAME AND COVER
TOP SLAB
DOWNDRAIN CARTRIDGE(S)
(smaller orifice)
HI-FLO CARTRIDGES
(large orifice)
MAINTENANCE ACCESS
WALL (MAW)
ACCESS STEPS
ADDITIONAL RISER SECTION
(IF NEEDED)
OUTLET PIPE
(GROUTED IN OR BOOTED)
CARTRIDGE RECEPTACLES
DECK ASSEMBLY
RISER SECTION
(WITH JELLYFISH DECK)
INLET PIPE
(GROUTED IN OR BOOTED)
SEALANT
(AT EACH JOINT)
SEPARATOR SKIRT
BASE SECTION

WARNINGS / CAUTION

1. FALL PROTECTION may be required.
2. WATCH YOUR STEP if standing on the Jellyfish Filter Deck at any time; Great care and safety must be taken while walking or maneuvering on the Jellyfish Filter Deck. Attentive care must be taken while standing on the Jellyfish Filter Deck at all times to prevent stepping onto a lid, into or through a cartridge hole or slipping on the deck.
3. The Jellyfish Filter Deck can be SLIPPERY WHEN WET.
4. If the Top Slab, Covers or Hatches have not yet been installed, or are removed for any reason, great care must be taken to NOT DROP ANYTHING ONTO THE JELLYFISH FILTER DECK. The Jellyfish Filter Deck and Cartridge Receptacle Rings can be damaged under high impact loads. *This type of activity voids all warranties. All damaged items to be replaced at owner's expense*.
5. Maximum deck load 2 persons, total weight 250 lbs. per person.

Safety Notice

Jobsite safety is a topic and practice addressed comprehensively by others. The inclusions here are intended to be reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s) and Contractor(s). OSHA and Canadian OSH, and Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Contractor's responsibility and outside the scope of Imbrium® Systems.

Confined Space Entry

Secure all equipment and perform all training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to proceed safely at all times.

Personal Safety Equipment

Contractor is responsible to provide and wear appropriate personal protection equipment as needed including, but not limited to safety boots, hard hat, reflective vest, protective eyewear, gloves and fall protection equipment as necessary. Make sure all equipment is **staffed with trained and/or certified personnel**, and all equipment is checked for proper operation and safety features prior to use.

- Fall protection equipment
- Eye protection
- Safety boots
- Ear protection
- Gloves
- Ventilation and respiratory protection
- Hard hat
- Maintenance and protection of traffic plan

Thank You for purchasing the Jellyfish® Filter!

Imbrium® Systems would like to thank you for selecting the Jellyfish Filter to meet your project's stormwater treatment needs. With proper inspection and maintenance, the Jellyfish Filter is designed to deliver ongoing, high levels of stormwater pollutant removal.

If you have any questions, please feel free to call us or e-mail us at info@imbriumsystems.com.

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Jellyfish Filter Patents

The Jellyfish Filter is protected by one or more of the following patents:

U.S. Patent No. 8,123,935; U.S. Patent No. 8,287,726; U.S. Patent No. 8,221,618
Australia Patent No. 2008,286,748
Canadian Patent No. 2,696,482
Korean Patent No. 10-1287539
New Zealand Patent No. 583,461; New Zealand Patent No. 604,227
South African Patent No. 2010,01068
**other patents pending*

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Chapter 1

1.0 – Owner Specific Jellyfish Filter Product Information

Below you will find your specific Jellyfish Filter unit information to help you easily inspect, maintain and order parts for your system.

Owner Name:	
Phone Number:	
Site Address:	
Site GPS Coordinates/unit location:	
Unit Location Description:	
Jellyfish Filter Model No.:	
Cartridge Installation Date:	
No. of Hi-Flo Cartridges	
Length of Hi-Flo Cartridges:	
Lid Orifice Diameter on Hi-Flo Cartridge:	
No. of Draindown Cartridges:	
Length of Draindown Cartridges:	
Lid Orifice Diameter on Draindown Cartridge:	
No. of Blank Cartridge Lids:	
Online System (Yes/No):	
Offline System (Yes/No):	

Notes:

Chapter 2

2.0 – Jellyfish Filter System Operations and Functions

The Jellyfish Filter is an engineered stormwater quality treatment technology that removes a high level and wide variety of stormwater pollutants. Each Jellyfish Filter cartridge consists of multiple membrane - encased filter elements ("filtration tentacles") attached to a cartridge head plate. The filtration tentacles provide a large filtration surface area, resulting in high flow and high pollutant removal capacity.

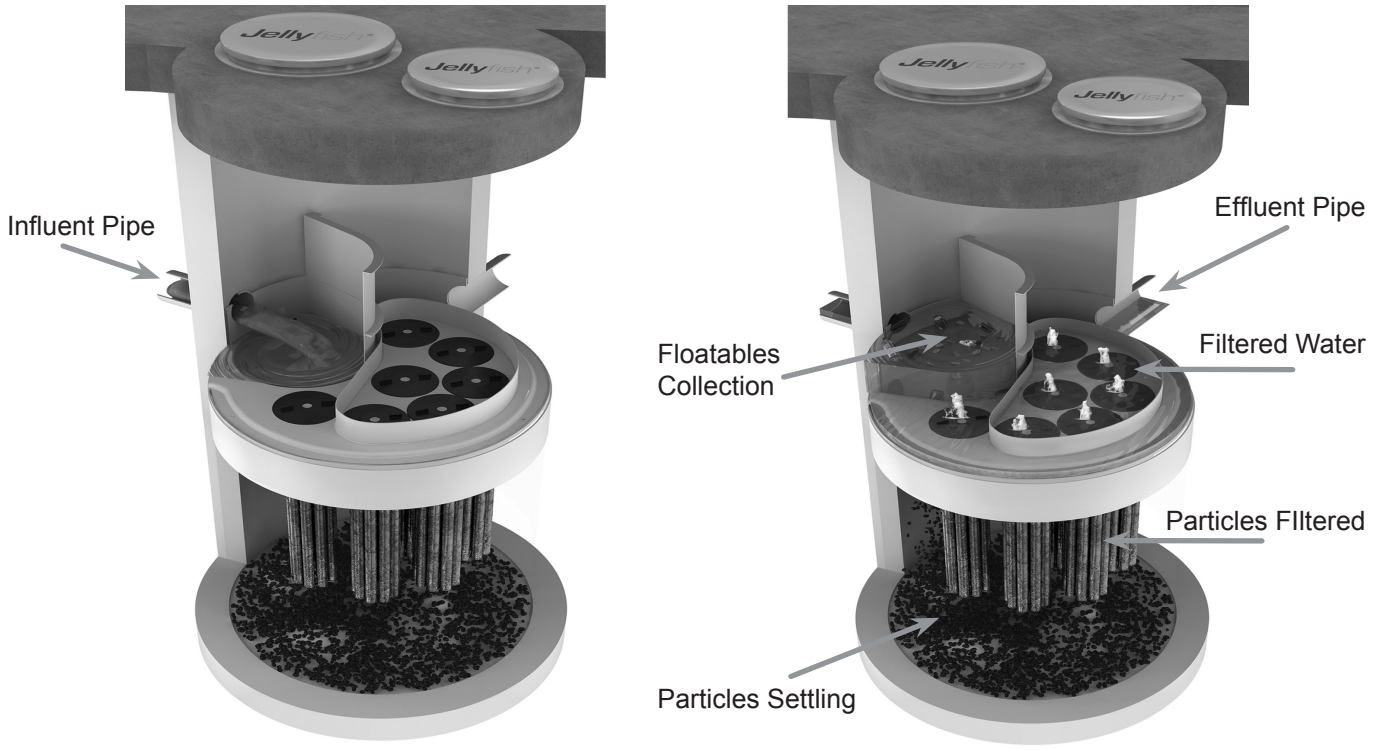
The Jellyfish Filter functions are depicted in **Figure 1** below.

FIGURE 1

Jellyfish Filter Treatment Functions

Membrane Filtration

Section View with Maintenance Access Wall (MAW) Cutaway



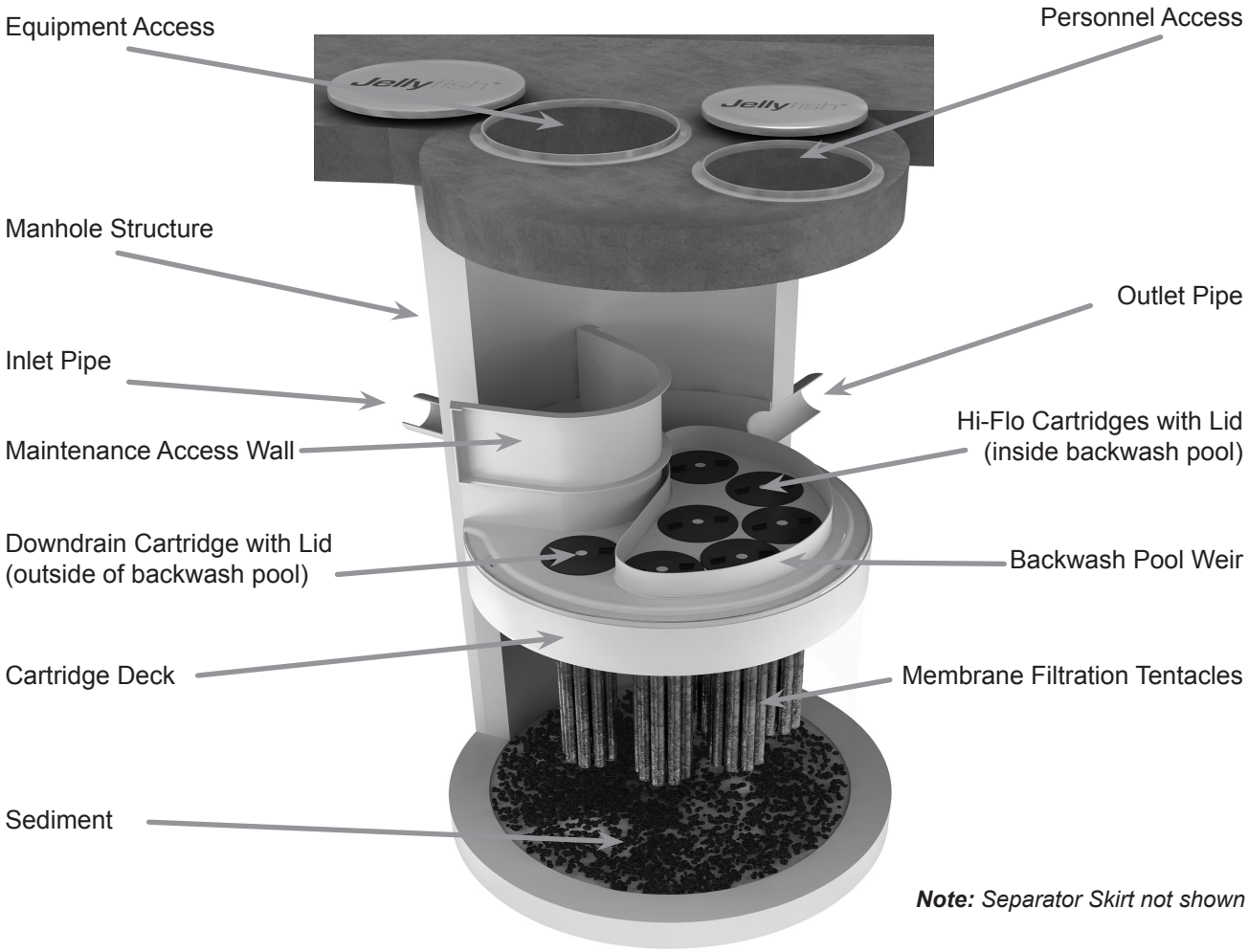
Jellyfish Filter cartridges are backwashed after each peak storm event, which removes accumulated sediment from the membranes. This backwash process extends the service life of the cartridges and increases the time between maintenance events.

For additional details on the operation and pollutant capabilities of the Jellyfish Filter please refer to additional details on our website at www.imbriumsystems.com.

2.1 – Components and Cartridges

The Jellyfish Filter and components are depicted in Figure 2 below.

FIGURE 2 **Jellyfish Filter Components**



Note: *Separator Skirt not shown*

Tentacles are available in various lengths as depicted in Table 1 below.

Table 1 – Cartridge Lengths / Weights and Cartridge Lid Orifice Diameters

Cartridge Lengths	Dry Weight	Hi-Flo Orifice Diameter	Draindown Orifice Diameter
15 inches (381 mm)	10 lbs (4.5 kg)	35 mm	20 mm
27 inches (686 mm)	14.5 lbs (6.6 kg)	45 mm	25 mm
40 inches (1,016 mm)	19.5 lbs (8.9 kg)	55 mm	30 mm
54 inches (1,372 mm)	25 lbs (11.4 kg)	70 mm	35 mm

A Jellyfish membrane filtration cartridge is depicted in Figure 3 below.

FIGURE 3

Jellyfish Membrane Filtration Cartridge



2.2 – Jellyfish Membrane Filtration Cartridge Assembly

The Jellyfish Filter utilizes multiple membrane filtration cartridges. Each cartridge consists of removable cylindrical filtration "tentacles" attached to a cartridge head plate. Each filtration tentacle has a threaded pipe nipple and o-ring. To attach, insert the top pipe nipples with the o-ring through the head plate holes and secure with locking nuts. Locking nuts to be hand tighten and checked with a wrench as shown below.

2.3 – Jellyfish Membrane Filtration Cartridge Installation

- After the upstream catchment and site have stabilized, remove any accumulated sediment and debris from the Jellyfish Filter structure and upstream diversion structure (if applicable). Failure to address this step completely will reduce the time between required maintenance.
- Descend to the cartridge deck (see Safety Notice and page 3).
- Lower the Jellyfish membrane filtration cartridges into the cartridge receptacles within the cartridge deck. A filter cartridge should be placed into each of the draindown cartridge receptacles outside the backwash pool weir. It is possible dependent on the Jellyfish Filter model purchased that not all cartridge receptacles will be filled with a filter cartridge. In that case, a blank headplate and blank cartridge lid (has no orfice) would be installed.



Cartridge Assembly

Avoid snagging the cartridge membranes on the recpticle lip when inserting the Jellyfish membrane filtration cartridges into the cartridge receptacles. Use a gentle twisting or sideways motion to clear any potential snag. Do not force the tentacles down into the cartridge receptacle, as this may damage the membranes. Apply downward pressure on the cartridge head plate to seat the rim gasket (thick circular gasket surrounding the circumference of the head plate) into the cartridge receptacle.

- Examine the cartridge lids to differentiate lids with a small orifice, a large orifice, and no orifice.
  - Lids with a small orifice are to be inserted into the draindown cartridge receptacles, outside of the backwash pool weir.
  - Lids with a large orifice are to be inserted into the hi-flo cartridge receptacles within the backwash pool weir.
  - Lids with no orifice (blank cartridge lids) and a blank headplate are to be inserted into unoccupied cartridge receptacles.
- **To install a cartridge lid, align the cartridge lid male threads with the cartridge receptacle female threads. Firmly twist the cartridge lid clockwise a minimum 110º to seat the filter cartridge snugly in place, with a proper watertight seal.**

Chapter 3

3.0 – Inspection and Maintenance Overview

The primary purpose of the Jellyfish Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, captured pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Maintenance activities may be required in the event of an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

Inspection activities are typically conducted from surface observations and include:

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW)

Maintenance activities typically include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments from manhole sump
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed.

It is recommended that Jellyfish Filter inspection and maintenance be performed by professionally trained individuals, with experience in stormwater maintenance and disposal services. Maintenance procedures may require manned entry into the Jellyfish structure. Only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Procedures, safety and damage prevention precautions, and other information, included in these guidelines, should be reviewed and observed prior to all inspection and maintenance activities.

3.1 – Inspection

3.1.1 – Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent.*

- Post-construction inspection is required prior to putting the Jellyfish Filter into service. All construction debris or construction-related sediment within the device must be removed, and any damage to system components repaired.
- A minimum of two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.

- Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
- Inspection is recommended after each major storm event.
- Immediately after an upstream oil, fuel or other chemical spill.

3.1.2 – Inspection Tools and Equipment

The following equipment and tools are typically required when performing a Jellyfish Filter inspection:

- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

3.1.3 – Inspection Procedure

The following procedure is recommended when performing inspections:

- Provide traffic control measures as necessary.
- Inspect the MAW for floatable pollutants such as trash, debris, and oil sheen.
- Measure oil and sediment depth by lowering a sediment probe through the MAW opening until contact is made with the floor of the structure. Retrieve the probe, record sediment depth, and presences of any oil layers and repeat in multiple locations within the MAW opening. **Sediment depth of 12 inches or greater indicates maintenance is required**.
- Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
- Inspect the MAW, cartridge deck, and backwash pool weir for cracks or broken components. If damaged, repair is required.
- **Dry weather inspections:** inspect the cartridge deck for standing water.
  - No standing water under normal operating condition.
  - Standing water **inside** the backwash pool, but not outside the backwash pool, this condition indicates that the filter cartridges need to be rinsed.
  - Standing water **outside** the backwash pool may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- **Wet weather inspections:** observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW.
  - **Less than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
  - **Greater than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
  - **18 inches or greater** and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges are occluded with sediment and need to be rinsed.



The depth of sediment and oil can be measured from the surface by using a sediment probe or dipstick tube equipped with a ball check valve and inserted through the Jellyfish Filter's maintenance access wall opening. The large opening provides convenient access for inspection and vacuum removal of water and pollutants.

3.2 – Maintenance

3.2.1 – Maintenance Requirements

Required maintenance for Jellyfish Filter units is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

- **Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.**
- Floatable trash, debris, and oil must be removed.
- Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs first.
- Replace filter cartridge if rinsing does not remove accumulated sediment from the tentacles, or if tentacles are damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
- Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
- The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged by the spill.

3.2.2 – Maintenance Tools and Equipment

The following equipment and tools are typically required when performing Jellyfish Filter maintenance:

- Vacuum truck
- Ladder
- Garden hose and low pressure sprayer
- Rope or cord to lift filter cartridges from the cartridge deck to the surface
- Adjustable pliers for removing filter cartridge tentacles from cartridge head plate
- Plastic tub or garbage can for collecting effluent from rinsed filter cartridge tentacles
- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Proper safety equipment for confined space entry
- Replacement filter cartridge tentacles if required

3.2.3 – Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

- Provide traffic control measures as necessary.
- Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures.
- **Caution:** Dropping objects onto the cartridge deck may cause damage.
- Perform **Inspection Procedure** prior to maintenance activity.
- To access the cartridge deck for filter cartridge service, descend the ladder and step directly onto the deck. **Caution:** Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.

3.2.4 – Filter Cartridge Rinsing Procedure

- Remove a cartridge lid.
- Remove the cartridge from the receptacle using the lifting loops in the cartridge head plate. **Caution:** Should

a snag occur, do not force the cartridge upward as damage to the tentacles may result. Rotate the cartridge with a slight sideways motion to clear the snag and continue removing the cartridge.

- Thread a rope or cord through the lifting loops and lift the filter cartridge from the cartridge deck to the top surface outside the structure.
- **Caution:** Immediately replace and secure the lid on the exposed empty receptacle as a safety precaution. Never expose more than one empty cartridge receptacle.
- Repeat the filter cartridge removal procedure until all of the cartridges are located at the top surface outside the structure.
- Disassemble the tentacles from each filter cartridge by rotating counter-clockwise. Remove the tentacles from the cartridge head plate.
- Position a receptacle in a plastic tub or garbage can such that the rinse water is captured. Using a low-pressure garden hose sprayer, direct a wide-angle water spray at a downward 45° angle onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. **Caution:** Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane. Turn membran upside down and pour out any residual rinsewater to ensure center of tentacle is clear of any sediment.



Rinsing of dirty filter cartridge tentacles with a low-pressure garden hose sprayer, and using a plastic garbage container to capture rinse water.

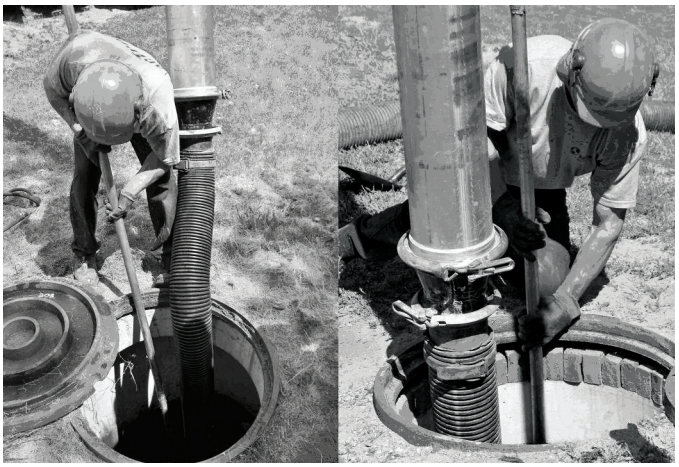
- Remove rinse water from rinse tub or garbage can using a vacuum hose as needed.
- Slip the o-ring over the tentacle nipple and reassemble onto the cartridge head plate; hand-tighten.
- If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Imbrium Systems to order replacement tentacles.
- Lower a rinsed filter cartridge to the cartridge deck. Remove the cartridge lid on a receptacle and carefully lower the filter cartridge into the receptacle until the head plate gasket is seated squarely on the lip of the receptacle. **Caution:** Should a snag occur when lowering the cartridge into the receptacle, do not force the cartridge downward; damage may occur. Rotate the cartridge with a slight sideways motion to clear the snag and complete the installation.
- Replace the cartridge lid on the exposed receptacle. Rinse away any accumulated grit from the receptacle threads if needed to get a proper fit. **Align the cartridge lid male threads with the cartridge receptacle female threads. Firmly twist the cartridge lid clockwise a minimum 110º to seat the filter cartridge snugly in place, with a proper watertight seal**.
- Repeat cartridge installation until all cartridges are installed.

3.2.5 – Vacuum Cleaning Procedure

- **Caution:** Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning **only through the maintenance access wall (MAW) opening**, being careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck. The separator skirt surrounds the filter cartridge zone, and could be torn if contacted by the wand. **Do not lower the vacuum wand through a cartridge receptacle**, as damage to the receptacle will result.
  - To remove floatable trash, debris, and oil, lower the vacuum hose into the MAW opening and vacuum floatable pollutants off the surface of the water. Alternatively, floatable solids may be removed by a net or skimmer.
  - Using a vacuum hose, remove the water from the lower chamber to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank.
  - Remove the sediment from the bottom of the unit through the MAW opening.
  - For larger diameter Jellyfish Filter manholes (8-ft, 10-ft, 12-ft diameter), complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle..
  - After the unit is clean, re-fill the lower chamber with water if required by the local jurisdiction, and re-install filter cartridges.
  - Dispose of sediment, floatable trash and debris, oil, spent tentacles, and water according to local regulatory requirements.

3.2.6 – Chemical Spills

- **Caution**: If a chemical spill has been captured by the Jellyfish Filter, do not attempt maintenance. Immediately contact the local hazard response agency.



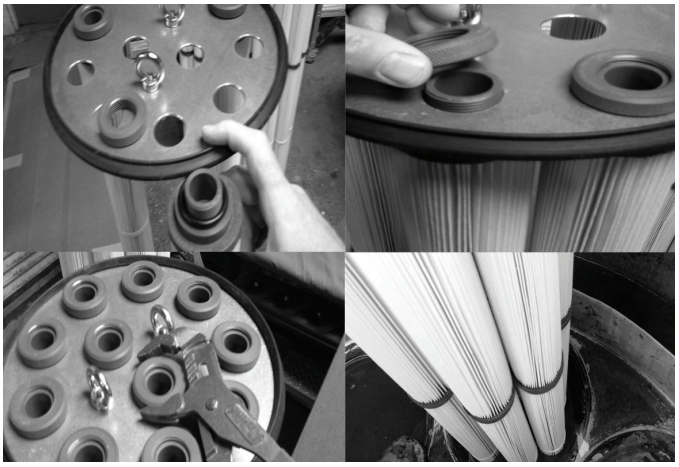


A maintenance worker stationed on the surface uses a vacuum hose to evacuate water, sediment, and floatables from the Jellyfish Filter by inserting the vacuum wand through the maintenance access wall opening.





A view of a Jellyfish Filter cartridge deck from the surface showing all the cartridge lids intact and no standing water on the deck (left image), and inspection of the flexible separator skirt from inside the maintenance access wall opening (right image).





Assembly of a Jellyfish Filter cartridge (left) and installation of a filter cartridge into a cartridge receptacle in the deck (right).

3.3 – Disposal Procedures

Disposal requirements for recovered pollutants and spent filtration tentacles may vary depending on local guidelines. In most areas the sediment and spent filtration tentacles, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.

Petroleum-based pollutants captured by the Jellyfish Filter, such as oil and fuels, should be removed and disposed of by a licensed waste management company.

Although the Jellyfish Filter captures virtually all free oil, a sheen may still be present at the MAW. A rainbow or sheen can be visible at oil concentrations of less than 10 mg/L (ppm).

Chapter 4

4.0 – Recommended Safety Procedures

Jobsite safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s) and Contractor(s). OSHA and Canadian OSH, and Federal, State/Provincial, and Local Jurisdiction Safety Standards apply.

4.1 – Confined Space/Personal Safety Equipment/Warning and Cautions

Please see reference on Page 3.

Chapter 5

5.0 – Jellyfish Filter Replacement Parts

Jellyfish membrane filtration cartridges, cartridge components, cartridge lids, other replacement parts can be ordered by contacting Imbrium Systems at:

United States: 888-279-8826 or 301-279-8827

Canada/International: 800-565-4801 or +1-416-960-9900

info@imbriumsystems.com

5.1 – Jellyfish Filter Replacement Parts List

Note: Jellyfish Cartridges and/or Filtration tentacles are available in the following lengths:

• 15 Inch (381 mm) • 27 Inch (686 mm) • 40 Inch (1,016 mm) • 54 Inch (1,372 mm)

- Jellyfish Cartridge (specify length). Includes head plate with lifting loops, rim gasket, eleven (11) filtration tentacles, eleven (11) o-rings, and eleven (11) locking nuts
- Standard Head plate
- Blank head plate
- Rim gasket (for head plate)
- Locking nuts (for tentacles)
- O-rings (for tentacles)
- Cartridge lids are available with the following orifice sizes: 70mm, 55mm, 45mm, 35mm, 30mm, 25mm, 30mm, blank lid (no orifice)
- Maintenance Access Wall (MAW) extension (18-inch segment)

** Nothing in this catalog should be construed as an expressed warranty or implied warranties, including the warranties of merchantability and of fitness for any particular purpose.*

Jellyfish Filter Inspection and Maintenance Log

Owner: _____ Jellyfish Model No.:_____

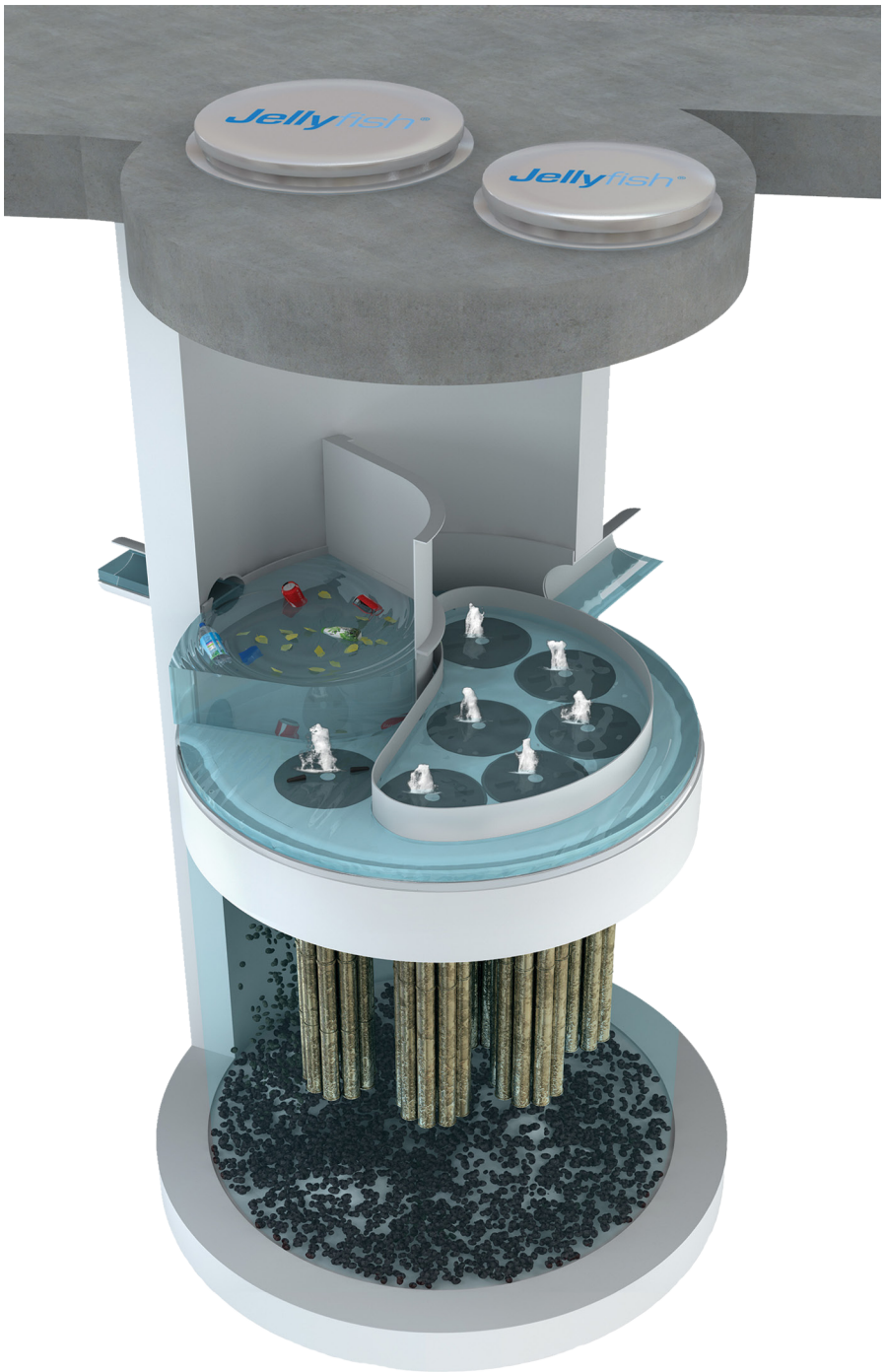
Location: _____ GPS Coordinates: _____

Land Use: Commercial:_____ Industrial: _____ Service Station:_____

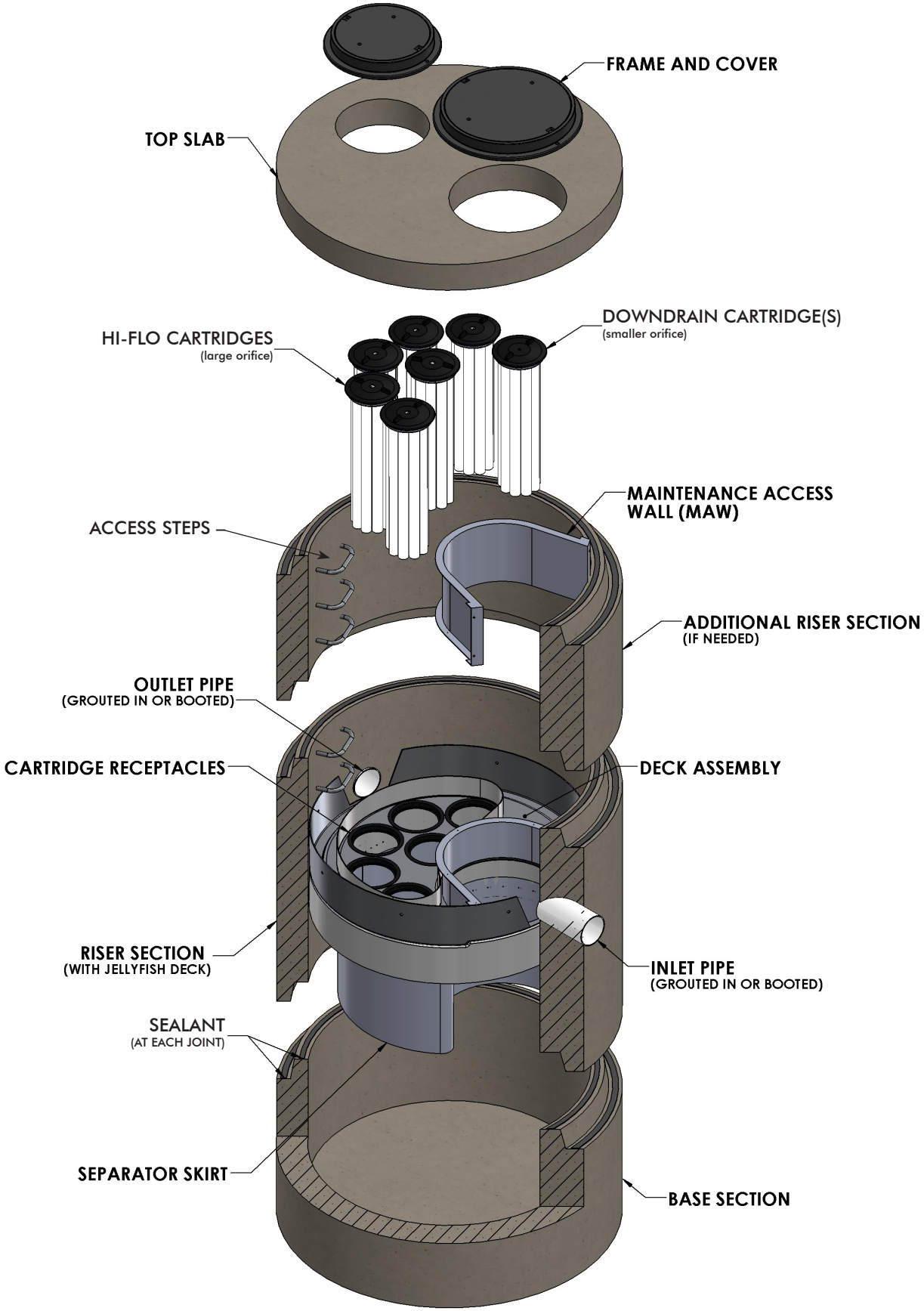
Road/Highway:____ Airport: _____ Residential: _____ Parking Lot:_____

Date/Time:						
Inspector:						
Maintenance Contractor:						
Visible Oil Present: (Y/N)						
Oil Quantity Removed						
Floatable Debris Present: (Y/N)						
Floatable Debris removed: (Y/N)						
Water Depth in Backwash Pool						
Draindown Cartridges externally rinsed and re-commissioned: (Y/N)						
New tentacles put on Cartridges: (Y/N)						
Hi-Flo cartridges externally rinsed and recommissioned (Y/N):						
New tentacles put on Hi-Flo Cartridges: (Y/N)						
Sediment Depth Measured: (Y/N)						
Sediment Depth (inches or mm):						
Sediment Removed: (Y/N)						
Cartridge Lids intact: (Y/N)						
Observed Damage:						
Comments:						

Jellyfish® Filter
Owner's Manual



imbrium®


FRAME AND COVER
TOP SLAB
DOWNDRAIN CARTRIDGE(S)
(smaller orifice)
HI-FLO CARTRIDGES
(large orifice)
MAINTENANCE ACCESS
WALL (MAW)
ACCESS STEPS
ADDITIONAL RISER SECTION
(IF NEEDED)
OUTLET PIPE
(GROUTED IN OR BOOTED)
CARTRIDGE RECEPTACLES
DECK ASSEMBLY
RISER SECTION
(WITH JELLYFISH DECK)
INLET PIPE
(GROUTED IN OR BOOTED)
SEALANT
(AT EACH JOINT)
SEPARATOR SKIRT
BASE SECTION

WARNINGS / CAUTION

1. FALL PROTECTION may be required.
2. WATCH YOUR STEP if standing on the Jellyfish Filter Deck at any time; Great care and safety must be taken while walking or maneuvering on the Jellyfish Filter Deck. Attentive care must be taken while standing on the Jellyfish Filter Deck at all times to prevent stepping onto a lid, into or through a cartridge hole or slipping on the deck.
3. The Jellyfish Filter Deck can be SLIPPERY WHEN WET.
4. If the Top Slab, Covers or Hatches have not yet been installed, or are removed for any reason, great care must be taken to NOT DROP ANYTHING ONTO THE JELLYFISH FILTER DECK. The Jellyfish Filter Deck and Cartridge Receptacle Rings can be damaged under high impact loads. *This type of activity voids all warranties. All damaged items to be replaced at owner's expense*.
5. Maximum deck load 2 persons, total weight 250 lbs. per person.

Safety Notice

Jobsite safety is a topic and practice addressed comprehensively by others. The inclusions here are intended to be reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s) and Contractor(s). OSHA and Canadian OSH, and Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Contractor's responsibility and outside the scope of Imbrium® Systems.

Confined Space Entry

Secure all equipment and perform all training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to proceed safely at all times.

Personal Safety Equipment

Contractor is responsible to provide and wear appropriate personal protection equipment as needed including, but not limited to safety boots, hard hat, reflective vest, protective eyewear, gloves and fall protection equipment as necessary. Make sure all equipment is **staffed with trained and/or certified personnel**, and all equipment is checked for proper operation and safety features prior to use.

- Fall protection equipment
- Eye protection
- Safety boots
- Ear protection
- Gloves
- Ventilation and respiratory protection
- Hard hat
- Maintenance and protection of traffic plan

Thank You for purchasing the Jellyfish® Filter!

Imbrium® Systems would like to thank you for selecting the Jellyfish Filter to meet your project's stormwater treatment needs. With proper inspection and maintenance, the Jellyfish Filter is designed to deliver ongoing, high levels of stormwater pollutant removal.

If you have any questions, please feel free to call us or e-mail us at info@imbriumsystems.com.

Imbrium Systems
USA: 301.279.8827 | 888.279.8826
CAD: 416.960.9900 | 800.565.4801
INT'L: +1.416.960.9900

Jellyfish Filter Patents

The Jellyfish Filter is protected by one or more of the following patents:

U.S. Patent No. 8,123,935; U.S. Patent No. 8,287,726; U.S. Patent No. 8,221,618
Australia Patent No. 2008,286,748
Canadian Patent No. 2,696,482
Korean Patent No. 10-1287539
New Zealand Patent No. 583,461; New Zealand Patent No. 604,227
South African Patent No. 2010,01068
**other patents pending*

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Chapter 1

1.0 – Owner Specific Jellyfish Filter Product Information

Below you will find your specific Jellyfish Filter unit information to help you easily inspect, maintain and order parts for your system.

Owner Name:	
Phone Number:	
Site Address:	
Site GPS Coordinates/unit location:	
Unit Location Description:	
Jellyfish Filter Model No.:	
Cartridge Installation Date:	
No. of Hi-Flo Cartridges	
Length of Hi-Flo Cartridges:	
Lid Orifice Diameter on Hi-Flo Cartridge:	
No. of Draindown Cartridges:	
Length of Draindown Cartridges:	
Lid Orifice Diameter on Draindown Cartridge:	
No. of Blank Cartridge Lids:	
Online System (Yes/No):	
Offline System (Yes/No):	

Notes:

Chapter 2

2.0 – Jellyfish Filter System Operations and Functions

The Jellyfish Filter is an engineered stormwater quality treatment technology that removes a high level and wide variety of stormwater pollutants. Each Jellyfish Filter cartridge consists of multiple membrane - encased filter elements ("filtration tentacles") attached to a cartridge head plate. The filtration tentacles provide a large filtration surface area, resulting in high flow and high pollutant removal capacity.

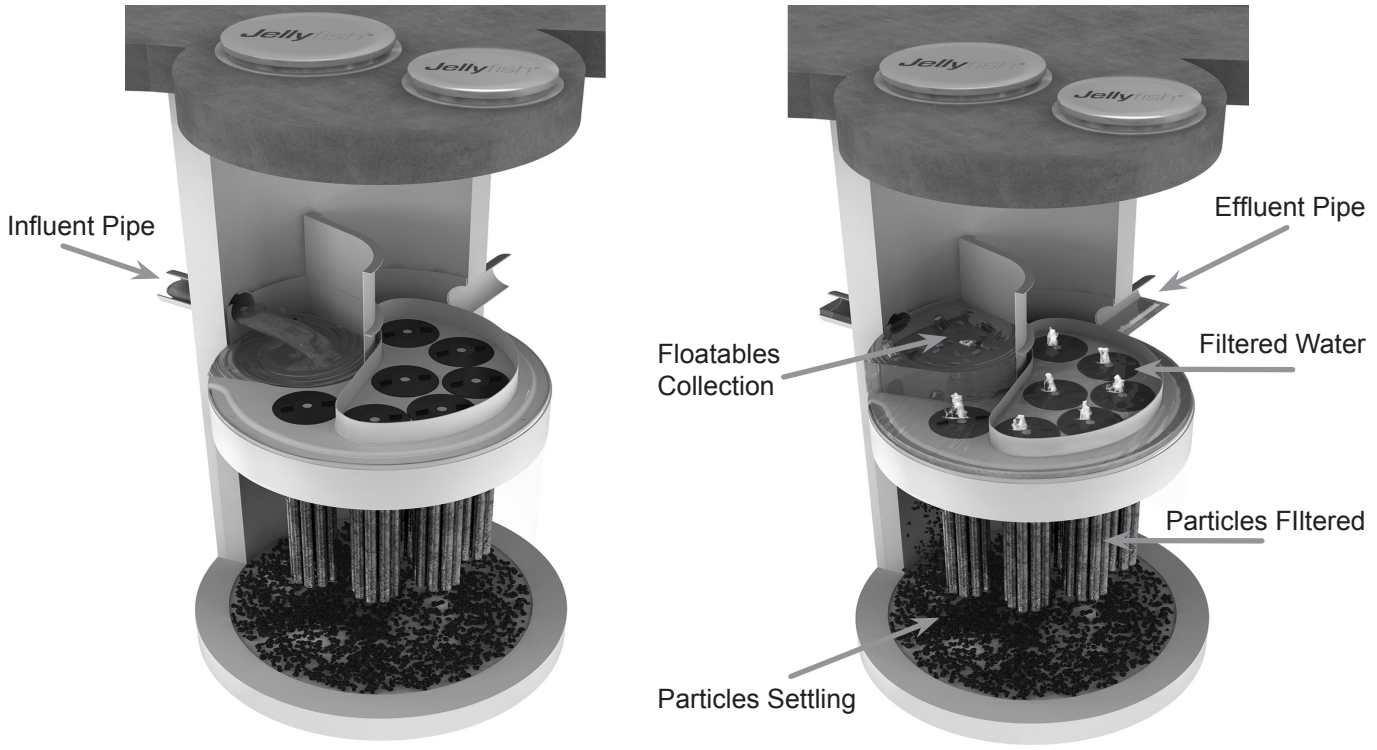
The Jellyfish Filter functions are depicted in **Figure 1** below.

FIGURE 1

Jellyfish Filter Treatment Functions

Membrane Filtration

Section View with Maintenance Access Wall (MAW) Cutaway



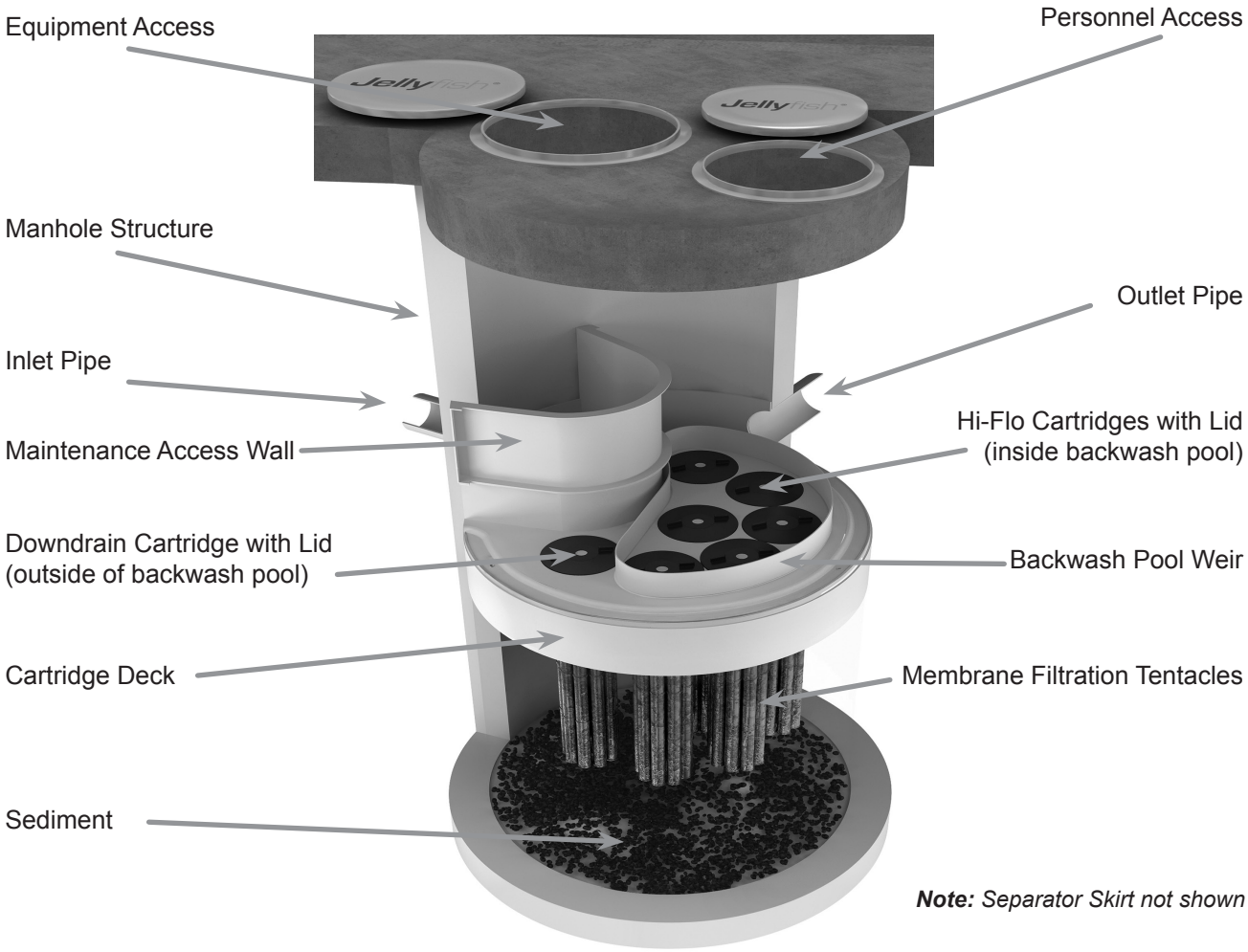
Jellyfish Filter cartridges are backwashed after each peak storm event, which removes accumulated sediment from the membranes. This backwash process extends the service life of the cartridges and increases the time between maintenance events.

For additional details on the operation and pollutant capabilities of the Jellyfish Filter please refer to additional details on our website at www.imbriumsystems.com.

2.1 – Components and Cartridges

The Jellyfish Filter and components are depicted in Figure 2 below.

FIGURE 2 **Jellyfish Filter Components**



Note: *Separator Skirt not shown*

Tentacles are available in various lengths as depicted in Table 1 below.

Table 1 – Cartridge Lengths / Weights and Cartridge Lid Orifice Diameters

Cartridge Lengths	Dry Weight	Hi-Flo Orifice Diameter	Draindown Orifice Diameter
15 inches (381 mm)	10 lbs (4.5 kg)	35 mm	20 mm
27 inches (686 mm)	14.5 lbs (6.6 kg)	45 mm	25 mm
40 inches (1,016 mm)	19.5 lbs (8.9 kg)	55 mm	30 mm
54 inches (1,372 mm)	25 lbs (11.4 kg)	70 mm	35 mm

A Jellyfish membrane filtration cartridge is depicted in Figure 3 below.

FIGURE 3

Jellyfish Membrane Filtration Cartridge



2.2 – Jellyfish Membrane Filtration Cartridge Assembly

The Jellyfish Filter utilizes multiple membrane filtration cartridges. Each cartridge consists of removable cylindrical filtration "tentacles" attached to a cartridge head plate. Each filtration tentacle has a threaded pipe nipple and o-ring. To attach, insert the top pipe nipples with the o-ring through the head plate holes and secure with locking nuts. Locking nuts to be hand tighten and checked with a wrench as shown below.

2.3 – Jellyfish Membrane Filtration Cartridge Installation

- After the upstream catchment and site have stabilized, remove any accumulated sediment and debris from the Jellyfish Filter structure and upstream diversion structure (if applicable). Failure to address this step completely will reduce the time between required maintenance.
- Descend to the cartridge deck (see Safety Notice and page 3).
- Lower the Jellyfish membrane filtration cartridges into the cartridge receptacles within the cartridge deck. A filter cartridge should be placed into each of the draindown cartridge receptacles outside the backwash pool weir. It is possible dependent on the Jellyfish Filter model purchased that not all cartridge receptacles will be filled with a filter cartridge. In that case, a blank headplate and blank cartridge lid (has no orfice) would be installed.



Cartridge Assembly

Avoid snagging the cartridge membranes on the recpticle lip when inserting the Jellyfish membrane filtration cartridges into the cartridge receptacles. Use a gentle twisting or sideways motion to clear any potential snag. Do not force the tentacles down into the cartridge receptacle, as this may damage the membranes. Apply downward pressure on the cartridge head plate to seat the rim gasket (thick circular gasket surrounding the circumference of the head plate) into the cartridge receptacle.

- Examine the cartridge lids to differentiate lids with a small orifice, a large orifice, and no orifice.
  - Lids with a small orifice are to be inserted into the draindown cartridge receptacles, outside of the backwash pool weir.
  - Lids with a large orifice are to be inserted into the hi-flo cartridge receptacles within the backwash pool weir.
  - Lids with no orifice (blank cartridge lids) and a blank headplate are to be inserted into unoccupied cartridge receptacles.
- **To install a cartridge lid, align the cartridge lid male threads with the cartridge receptacle female threads. Firmly twist the cartridge lid clockwise a minimum 110º to seat the filter cartridge snugly in place, with a proper watertight seal.**

Chapter 3

3.0 – Inspection and Maintenance Overview

The primary purpose of the Jellyfish Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, captured pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Maintenance activities may be required in the event of an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

Inspection activities are typically conducted from surface observations and include:

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW)

Maintenance activities typically include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments from manhole sump
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed.

It is recommended that Jellyfish Filter inspection and maintenance be performed by professionally trained individuals, with experience in stormwater maintenance and disposal services. Maintenance procedures may require manned entry into the Jellyfish structure. Only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Procedures, safety and damage prevention precautions, and other information, included in these guidelines, should be reviewed and observed prior to all inspection and maintenance activities.

3.1 – Inspection

3.1.1 – Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent.*

- Post-construction inspection is required prior to putting the Jellyfish Filter into service. All construction debris or construction-related sediment within the device must be removed, and any damage to system components repaired.
- A minimum of two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.

- Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
- Inspection is recommended after each major storm event.
- Immediately after an upstream oil, fuel or other chemical spill.

3.1.2 – Inspection Tools and Equipment

The following equipment and tools are typically required when performing a Jellyfish Filter inspection:

- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

3.1.3 – Inspection Procedure

The following procedure is recommended when performing inspections:

- Provide traffic control measures as necessary.
- Inspect the MAW for floatable pollutants such as trash, debris, and oil sheen.
- Measure oil and sediment depth by lowering a sediment probe through the MAW opening until contact is made with the floor of the structure. Retrieve the probe, record sediment depth, and presences of any oil layers and repeat in multiple locations within the MAW opening. **Sediment depth of 12 inches or greater indicates maintenance is required**.
- Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
- Inspect the MAW, cartridge deck, and backwash pool weir for cracks or broken components. If damaged, repair is required.
- **Dry weather inspections:** inspect the cartridge deck for standing water.
  - No standing water under normal operating condition.
  - Standing water **inside** the backwash pool, but not outside the backwash pool, this condition indicates that the filter cartridges need to be rinsed.
  - Standing water **outside** the backwash pool may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- **Wet weather inspections:** observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW.
  - **Less than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
  - **Greater than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
  - **18 inches or greater** and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges are occluded with sediment and need to be rinsed.



The depth of sediment and oil can be measured from the surface by using a sediment probe or dipstick tube equipped with a ball check valve and inserted through the Jellyfish Filter's maintenance access wall opening. The large opening provides convenient access for inspection and vacuum removal of water and pollutants.

3.2 – Maintenance

3.2.1 – Maintenance Requirements

Required maintenance for Jellyfish Filter units is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

- **Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.**
- Floatable trash, debris, and oil must be removed.
- Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs first.
- Replace filter cartridge if rinsing does not remove accumulated sediment from the tentacles, or if tentacles are damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
- Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
- The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged by the spill.

3.2.2 – Maintenance Tools and Equipment

The following equipment and tools are typically required when performing Jellyfish Filter maintenance:

- Vacuum truck
- Ladder
- Garden hose and low pressure sprayer
- Rope or cord to lift filter cartridges from the cartridge deck to the surface
- Adjustable pliers for removing filter cartridge tentacles from cartridge head plate
- Plastic tub or garbage can for collecting effluent from rinsed filter cartridge tentacles
- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Proper safety equipment for confined space entry
- Replacement filter cartridge tentacles if required

3.2.3 – Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

- Provide traffic control measures as necessary.
- Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures.
- **Caution:** Dropping objects onto the cartridge deck may cause damage.
- Perform **Inspection Procedure** prior to maintenance activity.
- To access the cartridge deck for filter cartridge service, descend the ladder and step directly onto the deck. **Caution:** Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.

3.2.4 – Filter Cartridge Rinsing Procedure

- Remove a cartridge lid.
- Remove the cartridge from the receptacle using the lifting loops in the cartridge head plate. **Caution:** Should

a snag occur, do not force the cartridge upward as damage to the tentacles may result. Rotate the cartridge with a slight sideways motion to clear the snag and continue removing the cartridge.

- Thread a rope or cord through the lifting loops and lift the filter cartridge from the cartridge deck to the top surface outside the structure.
- **Caution:** Immediately replace and secure the lid on the exposed empty receptacle as a safety precaution. Never expose more than one empty cartridge receptacle.
- Repeat the filter cartridge removal procedure until all of the cartridges are located at the top surface outside the structure.
- Disassemble the tentacles from each filter cartridge by rotating counter-clockwise. Remove the tentacles from the cartridge head plate.
- Position a receptacle in a plastic tub or garbage can such that the rinse water is captured. Using a low-pressure garden hose sprayer, direct a wide-angle water spray at a downward 45° angle onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. **Caution:** Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane. Turn membran upside down and pour out any residual rinsewater to ensure center of tentacle is clear of any sediment.



Rinsing of dirty filter cartridge tentacles with a low-pressure garden hose sprayer, and using a plastic garbage container to capture rinse water.

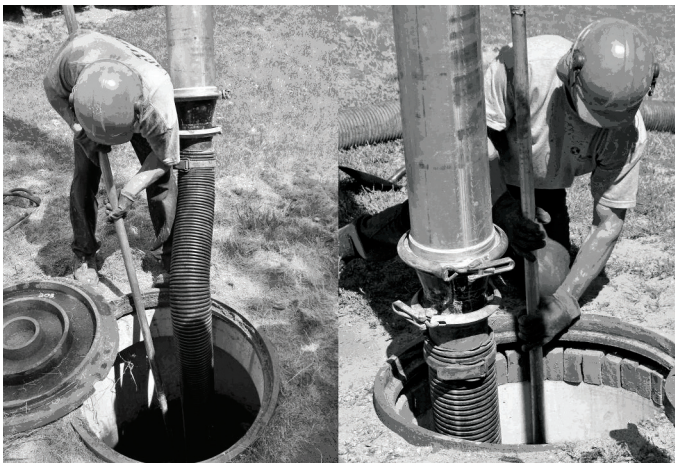
- Remove rinse water from rinse tub or garbage can using a vacuum hose as needed.
- Slip the o-ring over the tentacle nipple and reassemble onto the cartridge head plate; hand-tighten.
- If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Imbrium Systems to order replacement tentacles.
- Lower a rinsed filter cartridge to the cartridge deck. Remove the cartridge lid on a receptacle and carefully lower the filter cartridge into the receptacle until the head plate gasket is seated squarely on the lip of the receptacle. **Caution:** Should a snag occur when lowering the cartridge into the receptacle, do not force the cartridge downward; damage may occur. Rotate the cartridge with a slight sideways motion to clear the snag and complete the installation.
- Replace the cartridge lid on the exposed receptacle. Rinse away any accumulated grit from the receptacle threads if needed to get a proper fit. **Align the cartridge lid male threads with the cartridge receptacle female threads. Firmly twist the cartridge lid clockwise a minimum 110º to seat the filter cartridge snugly in place, with a proper watertight seal**.
- Repeat cartridge installation until all cartridges are installed.

3.2.5 – Vacuum Cleaning Procedure

- **Caution:** Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning **only through the maintenance access wall (MAW) opening**, being careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck. The separator skirt surrounds the filter cartridge zone, and could be torn if contacted by the wand. **Do not lower the vacuum wand through a cartridge receptacle**, as damage to the receptacle will result.
  - To remove floatable trash, debris, and oil, lower the vacuum hose into the MAW opening and vacuum floatable pollutants off the surface of the water. Alternatively, floatable solids may be removed by a net or skimmer.
  - Using a vacuum hose, remove the water from the lower chamber to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank.
  - Remove the sediment from the bottom of the unit through the MAW opening.
  - For larger diameter Jellyfish Filter manholes (8-ft, 10-ft, 12-ft diameter), complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle..
  - After the unit is clean, re-fill the lower chamber with water if required by the local jurisdiction, and re-install filter cartridges.
  - Dispose of sediment, floatable trash and debris, oil, spent tentacles, and water according to local regulatory requirements.

3.2.6 – Chemical Spills

- **Caution**: If a chemical spill has been captured by the Jellyfish Filter, do not attempt maintenance. Immediately contact the local hazard response agency.



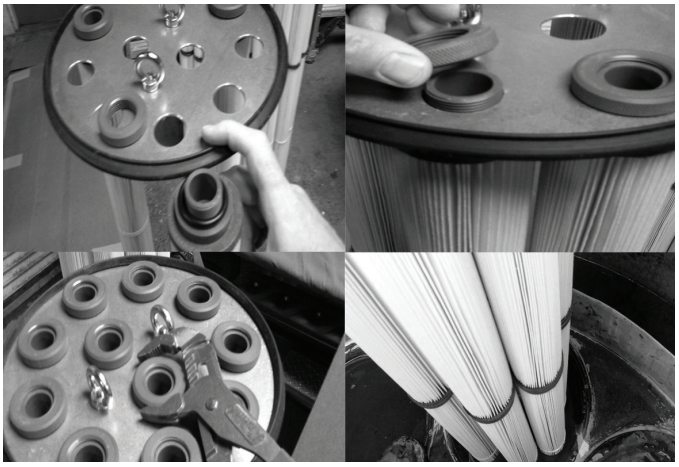


A maintenance worker stationed on the surface uses a vacuum hose to evacuate water, sediment, and floatables from the Jellyfish Filter by inserting the vacuum wand through the maintenance access wall opening.





A view of a Jellyfish Filter cartridge deck from the surface showing all the cartridge lids intact and no standing water on the deck (left image), and inspection of the flexible separator skirt from inside the maintenance access wall opening (right image).





Assembly of a Jellyfish Filter cartridge (left) and installation of a filter cartridge into a cartridge receptacle in the deck (right).

3.3 – Disposal Procedures

Disposal requirements for recovered pollutants and spent filtration tentacles may vary depending on local guidelines. In most areas the sediment and spent filtration tentacles, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.

Petroleum-based pollutants captured by the Jellyfish Filter, such as oil and fuels, should be removed and disposed of by a licensed waste management company.

Although the Jellyfish Filter captures virtually all free oil, a sheen may still be present at the MAW. A rainbow or sheen can be visible at oil concentrations of less than 10 mg/L (ppm).

Chapter 4

4.0 – Recommended Safety Procedures

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4.1 – Confined Space/Personal Safety Equipment/Warning and Cautions

Please see reference on Page 3.

Chapter 5

5.0 – Jellyfish Filter Replacement Parts

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United States: 888-279-8826 or 301-279-8827

Canada/International: 800-565-4801 or +1-416-960-9900

info@imbriumsystems.com

5.1 – Jellyfish Filter Replacement Parts List

Note: Jellyfish Cartridges and/or Filtration tentacles are available in the following lengths:

• 15 Inch (381 mm) • 27 Inch (686 mm) • 40 Inch (1,016 mm) • 54 Inch (1,372 mm)

- Jellyfish Cartridge (specify length). Includes head plate with lifting loops, rim gasket, eleven (11) filtration tentacles, eleven (11) o-rings, and eleven (11) locking nuts
- Standard Head plate
- Blank head plate
- Rim gasket (for head plate)
- Locking nuts (for tentacles)
- O-rings (for tentacles)
- Cartridge lids are available with the following orifice sizes: 70mm, 55mm, 45mm, 35mm, 30mm, 25mm, 30mm, blank lid (no orifice)
- Maintenance Access Wall (MAW) extension (18-inch segment)

** Nothing in this catalog should be construed as an expressed warranty or implied warranties, including the warranties of merchantability and of fitness for any particular purpose.*

Jellyfish Filter Inspection and Maintenance Log

Owner: _____ Jellyfish Model No.:_____

Location: _____ GPS Coordinates: _____

Land Use: Commercial:_____ Industrial: _____ Service Station:_____

Road/Highway:____ Airport: _____ Residential: _____ Parking Lot:_____

Date/Time:						
Inspector:						
Maintenance Contractor:						
Visible Oil Present: (Y/N)						
Oil Quantity Removed						
Floatable Debris Present: (Y/N)						
Floatable Debris removed: (Y/N)						
Water Depth in Backwash Pool						
Draindown Cartridges externally rinsed and re-commissioned: (Y/N)						
New tentacles put on Cartridges: (Y/N)						
Hi-Flo cartridges externally rinsed and recommissioned (Y/N):						
New tentacles put on Hi-Flo Cartridges: (Y/N)						
Sediment Depth Measured: (Y/N)						
Sediment Depth (inches or mm):						
Sediment Removed: (Y/N)						
Cartridge Lids intact: (Y/N)						
Observed Damage:						
Comments:						

STORMCON
STORMWATER MANAGEMENT SOLUTIONS.



GreenStorm ST

Rigofill ST product by FRÄNKISCHE

Underground storage infiltration modules

www.stormcon.ca

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Storing stormwater with storage/infiltration systems

Basic element for underground water storage facilities

GreenStorm ST* are plastic tanks to be installed underground (storage/ infiltration modules) in which water is collected and stored. Storage/infiltration systems temporarily collect stormwater and discharge it later. In addition to infiltration using underdrained swale systems, pipe swales, and gravel swales common in the past, increasingly more storage/infiltration systems are being built today.

The storage space of the storage/ infiltration system consists of numerous GreenStorm ST* modules which can be combined three-dimensionally to form large systems.

The advantage of this method is that the void ratio is up to three times larger in these infiltration systems than in gravel swales which saves space and excavation work.

GreenStorm ST* is a modular system which is characterised by high flexibility, rapid installation and a high level of user-friendliness.



*Rigofill ST product by FRÄNKISCHE

Application – infiltration

Stormwater infiltration – giving back to nature

Large amounts of stormwater can reduce the performance of wastewater treatment systems. Infiltrating unpolluted stormwater nearby has therefore several advantages.

A constant growth in built-up areas and increase in impervious surfaces prevent natural infiltration of stormwater into the soil. Special infiltration systems are used in order to discharge it to the water cycle. In addition to infiltration using pipe swales, increasingly more storage/infiltration systems are being built.

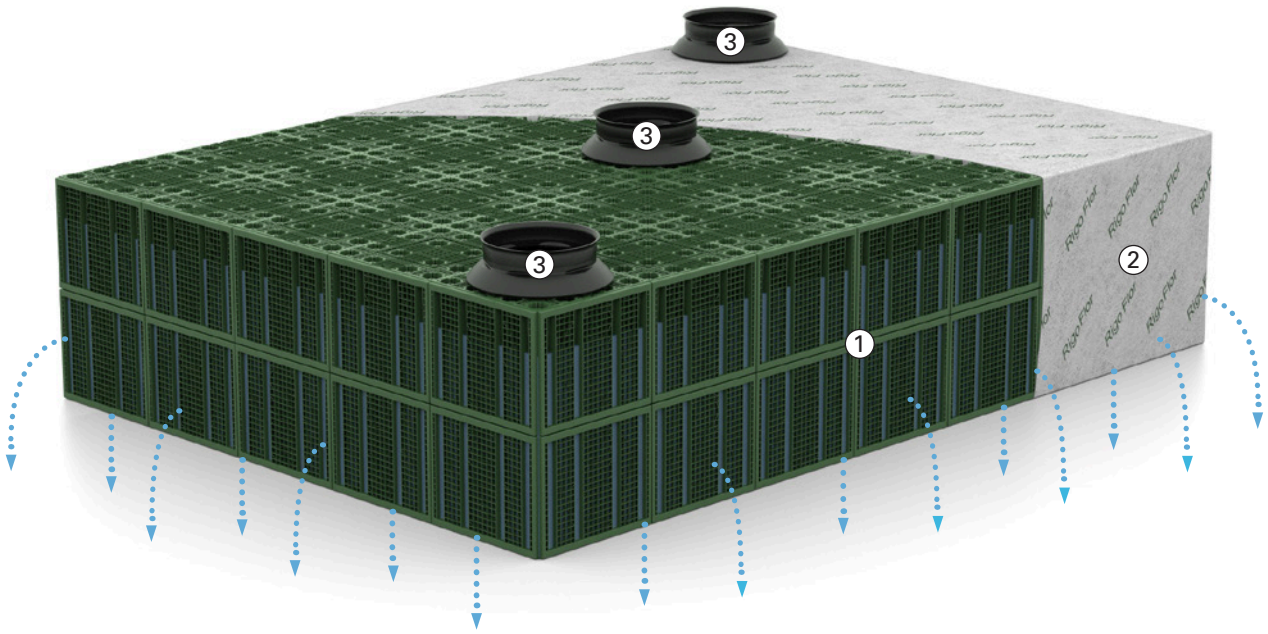
The advantage of this method is that the storage volume of the infiltration system is increased, and space and excavation are saved as compared to gravel swales. Stormwater is thus returned to the natural water cycle and can contribute to producing new groundwater. Infiltration systems are subject to very high requirements. Consequently, they have become an important component of urban drainage.

Storage/infiltration systems considerably increase the underground storage volume. High-performance storage/infiltration systems can be installed even in confined space.

In particular in urban construction no additional space is required and precious building ground is saved.

Légende

1. GreenStorm ST* storage /infiltration module
2. Geotextile
3. QuadroControl ST system shaft



*Rigofill ST product by FRÄNKISCHE

Application – retention

Retaining stormwater – instead of flooding

If subsoil conditions are unfavourable to infiltration, the goal is to retain the stormwater and ensure a retarded, timelagged discharge. Exposure to impulsive stress can be eliminated or reduced in sewer networks, wastewater treatment systems and waterbodies.

Stormwater retention systems retard the infiltration of stormwater. They are comprised of a watertight retaining element, an inlet and a vortex outlet.

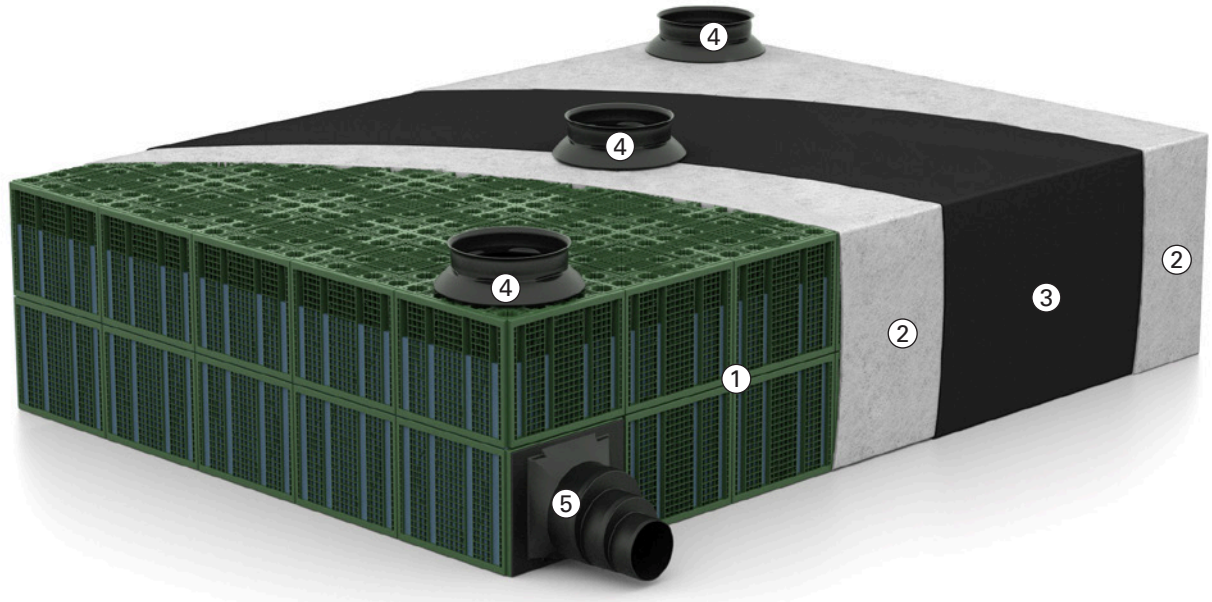
The stormwater distributes evenly in the system where it can be stored and is then discharged in a controlled manner through throttle shafts. If infiltration must be avoided or to prevent unintended discharge of groundwater or strata water (e.g., in case of contaminated soil), it is necessary to waterproof the retention system.

Stormwater runoff from impervious surfaces that cannot infiltrate naturally leads to peak loads in sewer systems.

Stormwater retention facilities collect stormwater in an underground storage tank and discharge it in a retarded manner but continuously. Their very short construction times make storage/ infiltration systems an inexpensive alternative to conventional retention facilities such as retention channels or underground concrete tanks.

Légende

1. GreenStorm ST* storage /infiltration module
2. Geotextile
3. Impermeable membrane
4. QuadroControl ST system shaft
5. Adapter



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Application – harvesting / fire water storage

Harvesting stormwater – saving drinking water

Water – particularly drinking water – is a priceless resource which should be treated responsibly and used sparingly. It is therefore wise to collect, store and use stormwater if the water must not necessarily be suitable for drinking purposes, instead of allowing the water to infiltrate into the soil unused or diverting it into the sewer system.

There are many examples: irrigation for greens, car wash, use in toilets, etc.

Water is diverted into a waterproof storage/infiltration system and can be supplied for use via a pumping system.

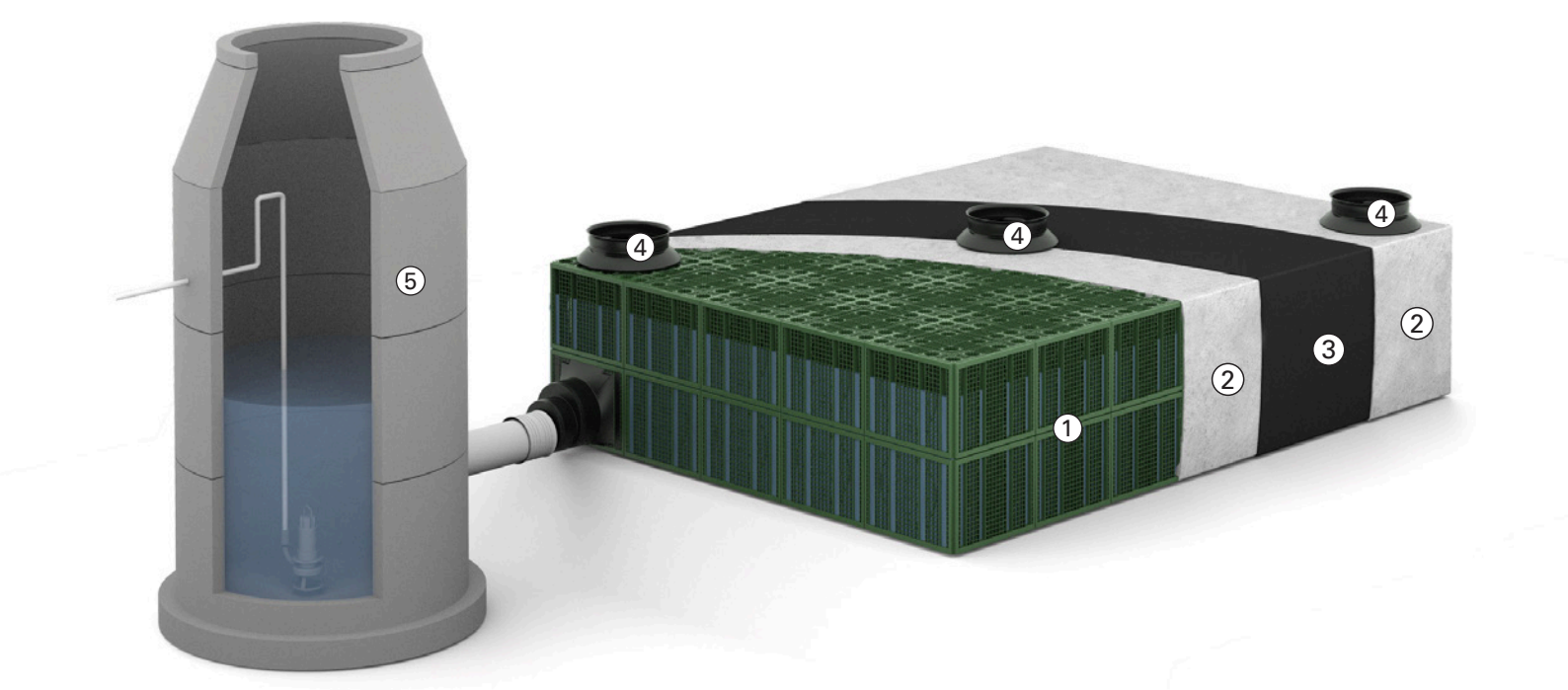
The use of the GreenStorm inspect system allows for finding solutions that fit project-specific requirements – even under the most difficult conditions such as very tight space, narrow conditions, low cover, high groundwater level, etc.

Stormwater harvesting systems provide water for different domestic and industrial water uses. They comprise a watertight retaining element, an inlet with upstream stormwater treatment system, a pump shaft and a system control.

Using GreenStorm ST* for fire water storage also saves water, since system checks can be made in a filled state and water does not have to be pumped out as is the case with conventional concrete tanks.

Légende

1. GreenStorm ST* storage/infiltration module
2. Geotextile
3. Impermeable membrane
4. QuadroControl ST system shaft
5. Tapping shaft (on-site)



*Rigofill ST product by FRÄNKISCHE

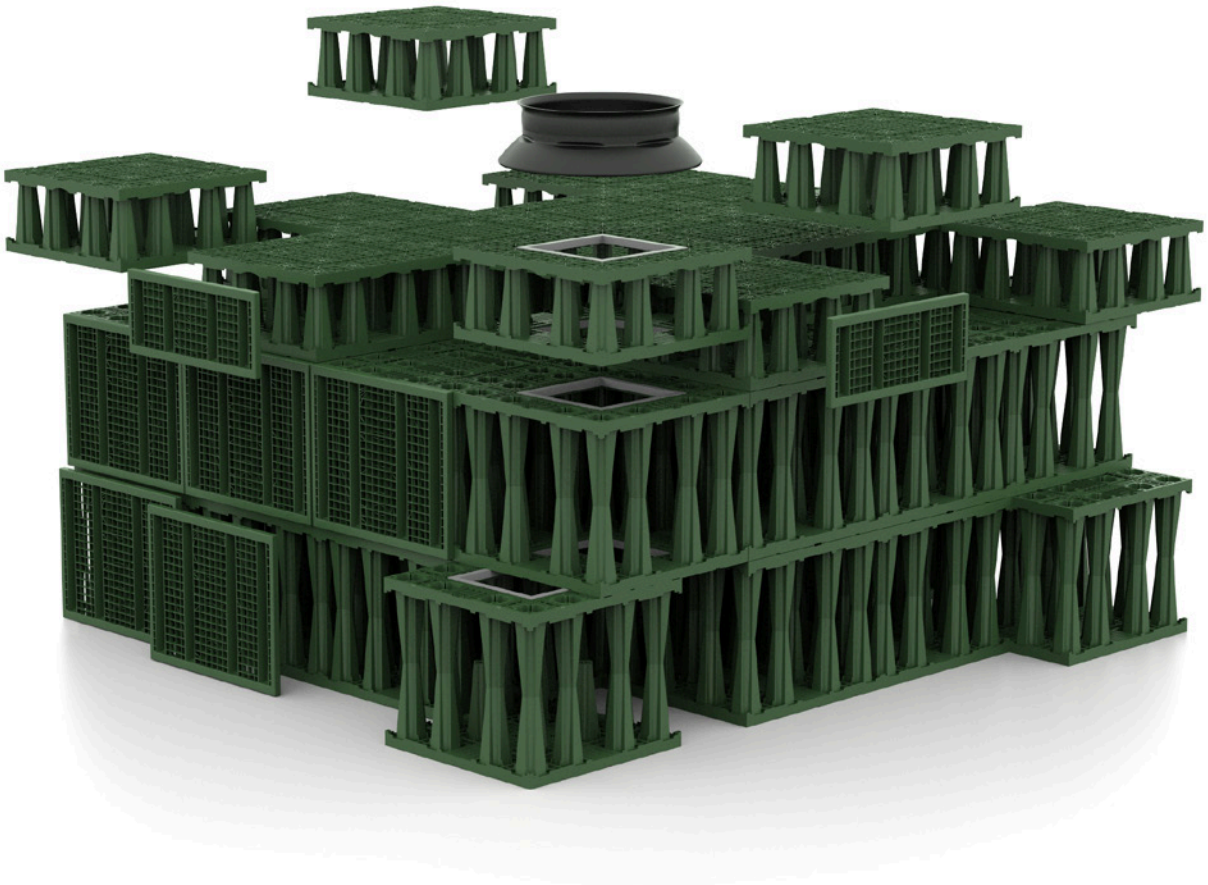
Modular design

Individual system geometries due to modular design

Sizes (length and width) of GreenStorm ST*orage/infiltration systems can be freely designed with hardly any limitations. The 800 mm cellular block type structure can easily be adapted to fit nearly any layout.

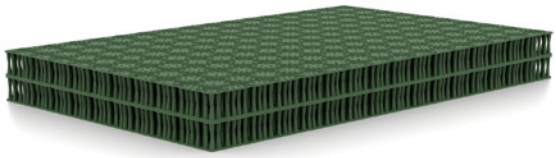
With heights of 660 mm (full block) and 350 mm (half block), systems can be built in various sizes to accommodate any single- or multi-layer combination. Therefore, the system can very easily be adapted to on-site requirements. Under high groundwater conditions or low permeability of backfill soil, for example, rather shallow depth systems are to be preferred.

For soils with good permeability, however, high and compact systems are favourable and may be built accordingly. The maximum space available is used.

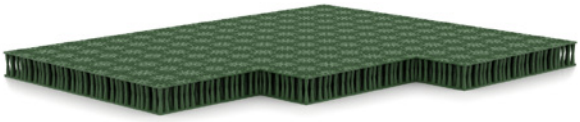


*Rigofill ST product by FRÄNKISCHE

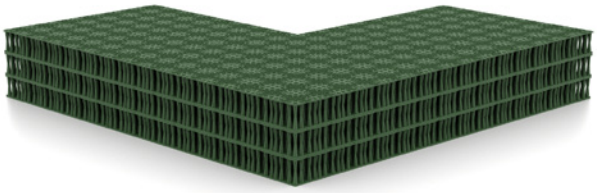
Possible system geometries



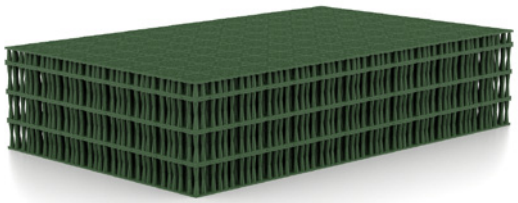
GreenStorm ST*
2-layer



GreenStorm ST*
1-layer



GreenStorm ST*
3-layer



GreenStorm ST*
3 1/2-layer

*Rigofill ST product by FRÄNKISCHE

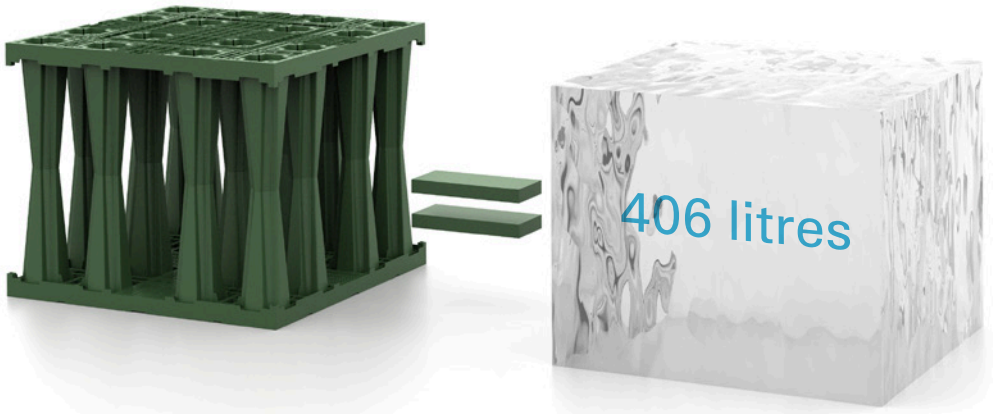
Storage volume

Extremely high volume

The GreenStorm ST* full block provides a storage volume of 406 litres with a gross volume of 422 litres. With a storage volume of more than 96 %, it stores three times as much water as gravel swales.

The half block has a height of 350 mm and is used if shallow systems are required, e.g., in case of high groundwater levels. With a gross volume of 224 litres, it offers a storage volume of 212 litres.

Column void
The column void of the storage/infiltration module is 100 % available as storage space. Large openings at the column base and at the column connection allow unrestricted filling and emptying of the columns.

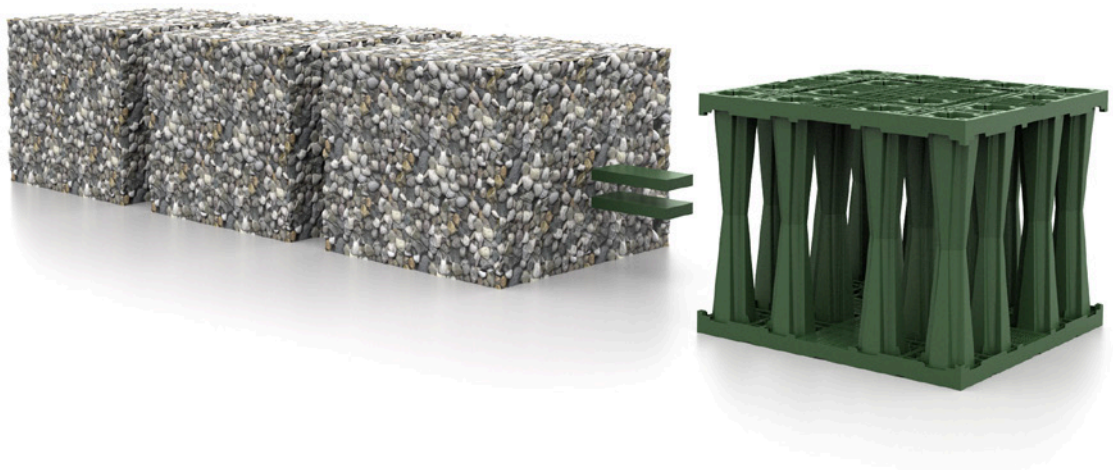


Storage/infiltration systems as compared to gravel swales

Pipe and gravel swales only use approx. 30 % of their volume to store water. Therefore, three times the required water storage volume must be provided by excavation. This requires lots of space which is frequently not available in urban areas.

GreenStorm ST* storage/infiltration systems save an enormous amount of space and excavation work. Thus, subsoil storage spaces for stormwater can be built in a very efficient and cost-saving way.

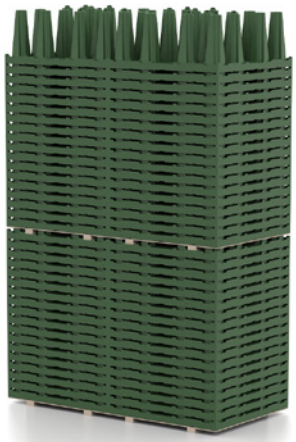
Storage/infiltration systems considerably increase the storage space. High-performance storage/infiltration systems can be installed even in confined space.



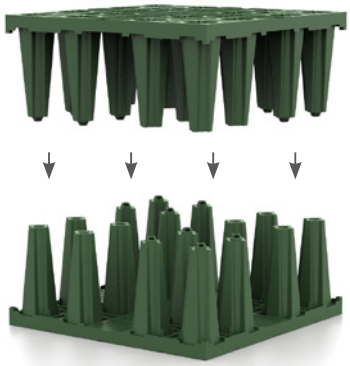
*Rigofill ST product by FRÄNKISCHE

Installation

Easy construction site handling



Requires little space for storage
The storage/infiltration modules are delivered in compact, stacked units with 17 modules per pallet.
The easy stackability of the GreenStorm ST* and ST-B modules allows them to be stored even in confined construction space, even outside the excavation pit.
This facilitates installation, since no additional storage space must be provided in the excavation pit. Installation is neither impeded nor constrained.



Pre-assembly
Depending on the requirements, GreenStorm
ST and GreenStorm ST*-B modules can be pre-assembled in no time at all, both outside and inside the excavation pit with just one easy move. Easy high tensile strength snap connections allow for combining two half elements to create a reliable unit in only a short period of time. This can easily be done by one person alone without requiring any additional tools. The moveable parts of the snap connection are recessed and thus protected from damage.



Easy assembly
There is no need to adhere to any complex installation pattern – the pre-assembled modules or half blocks can just as well be connected to create a single unit.
The low weight allows this to be done by one person only. Connectors establish firm connections between the individual modules. The surface can be accessed immediately without any risk of accidents, since the hole size of the columns is dimensioned respectively (< 100 mm). Thus, no additional covers of column holes are required.



Montage dans la fouille

Up to

88 %

storage space saved as compared to unstackable storage/infiltration modules

*Rigofill ST product by FRÄNKISCHE

Inspection

CCTV inspection even when filled

Storage/infiltration systems are durable structures for urban drainage; they must work reliably for decades. Durability and reliability are essential requirements.
The best way to inspect the state of a system using state-of-the-art technology is CCTV inspection. Thus, a storage/infiltration system can be inspected excellently – for final acceptance or later. This provides safety for authorities, engineers, construction companies, customers, and operators.

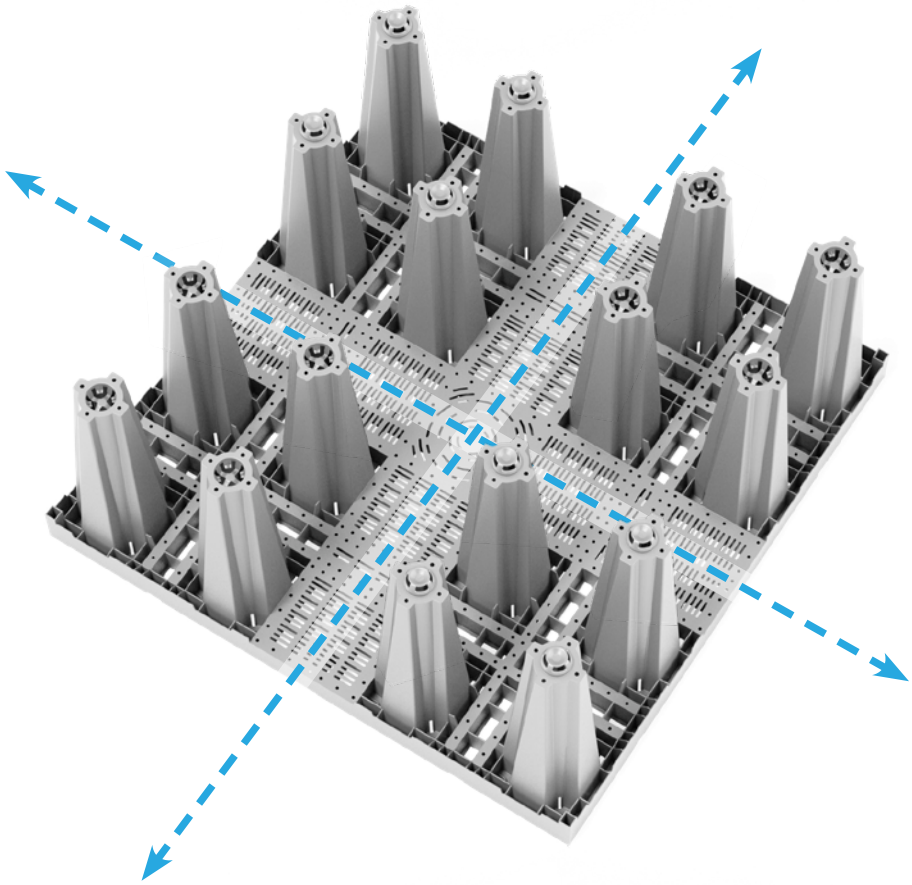
Cross-shaped inspection tunnel

GreenStorm ST* modules have a cross-shaped tunnel which makes the storage/infiltration system camera-accessible and flushable in two axes and thus in four dimensions.
The special and open design of the inspection tunnel allows for an unobstructed view of the entire interior and not only the inspection tunnel.

For example, the statically relevant load-bearing elements, the condition of the geotextile and the entire soil area can be viewed. GreenStorm ST* and GreenStorm ST*-B thus provide excellent options to control the "inner life" of a storage/infiltration system at any time.

The ideal, level and vibration-free running surface and the slim column structure allow for an unobstructed view of the entire module volume. The Quadro Control ST shaft for GreenStorm ST*, which can be integrated, allows for easy access of the automotive dolly for both professional final acceptance inspection and flushing technology.

100 %
inspectable



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Inspection

Recommended camera equipment

A standard sewer camera is sufficient for camera inspection.
A rotatable and height-adjustable camera head allows for an optimal view of the lateral soil area, a controllable carriage ensures a centred positioning, and high-performance optics together with lighting allow for a perfect picture.





Certified CCTV accessibility

GreenStorm ST* has been designed for the use of modern CCTV inspection technology.
The inspectability of the GreenStorm ST* and QuadroControl ST system unit has been tested and confirmed by leading manufacturers of pipe CCTV inspection technology!



Recommended: tender invitation for final acceptance inspection

Final acceptance of sewers using camera inspection has long since become a matter of course in sewer construction.
Also in the construction of storage/infiltration systems, the final acceptance inspection is important! Planning engineers should absolutely include this in their tender documents. For instructions on the professional system configuration of the CCTV inspection technology, please refer to **www.fraenkische.com**



*Rigofill ST product by FRÄNKISCHE

Loading



GreenStorm ST* Heavy traffic

Storage/infiltration systems are subsoil structures and must have sufficient load-carrying capacity against impacting soil and traffic loads.

GreenStorm ST* storage/ infiltration systems are extremely strong and have been designed with various applications in mind:
While GreenStorm ST* has been designed in
particular for traffic loads of up to 13 tons axle load.

Certification CSTB



High resistance

When installed under traffic areas, relevant national guidelines must be observed.

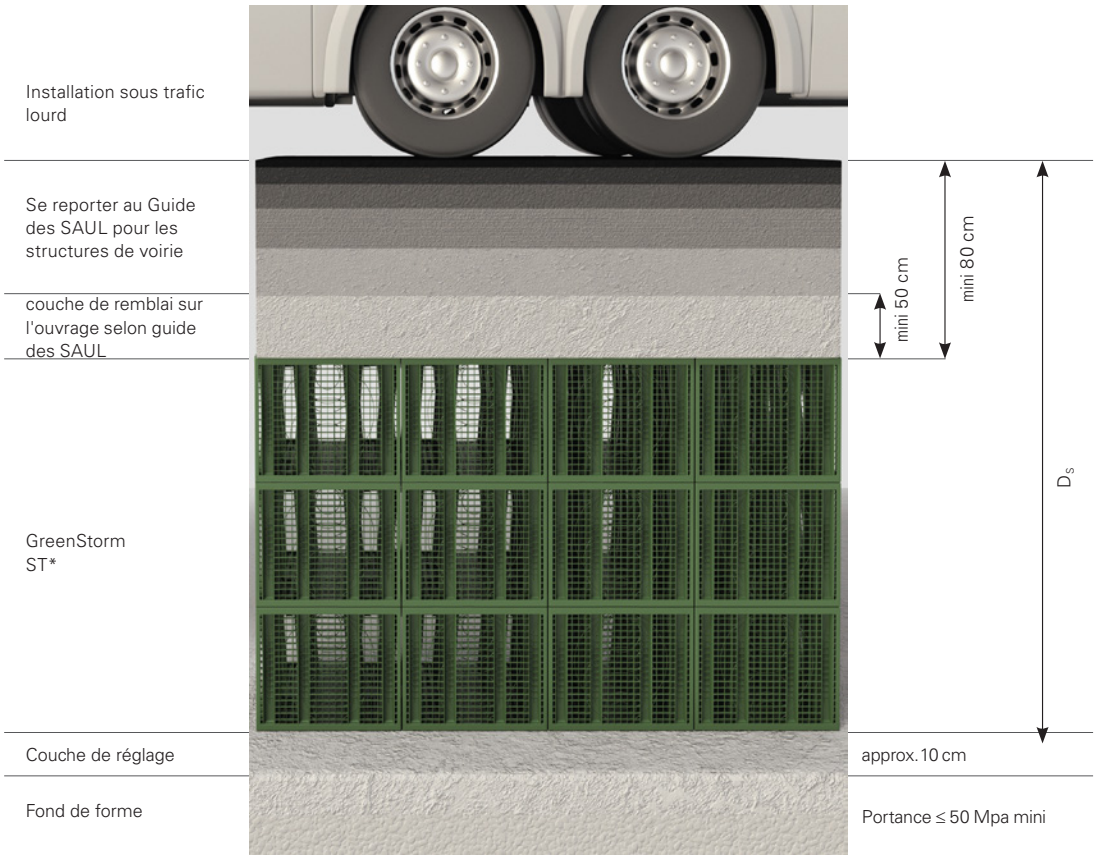
To build the planum for the road construction, an upper levelling layer must be provided. It should preferably be built as a gravel sub-base with a thickness of at least 350 mm, other materials usually result in larger covers.

Generally, a uniform modulus of deformation EV2 ≥ 45 MN/m² must be proven on the planum.

Installation under traffic area

The subsoil structures must have sufficient load-carrying capacity against impacting soil and traffic loads to ensure reliable stability.

This is why GreenStorm ST* is suitable for traffic loads of up to 15 tons axle load (20 tons possible, please refer to our technical department).





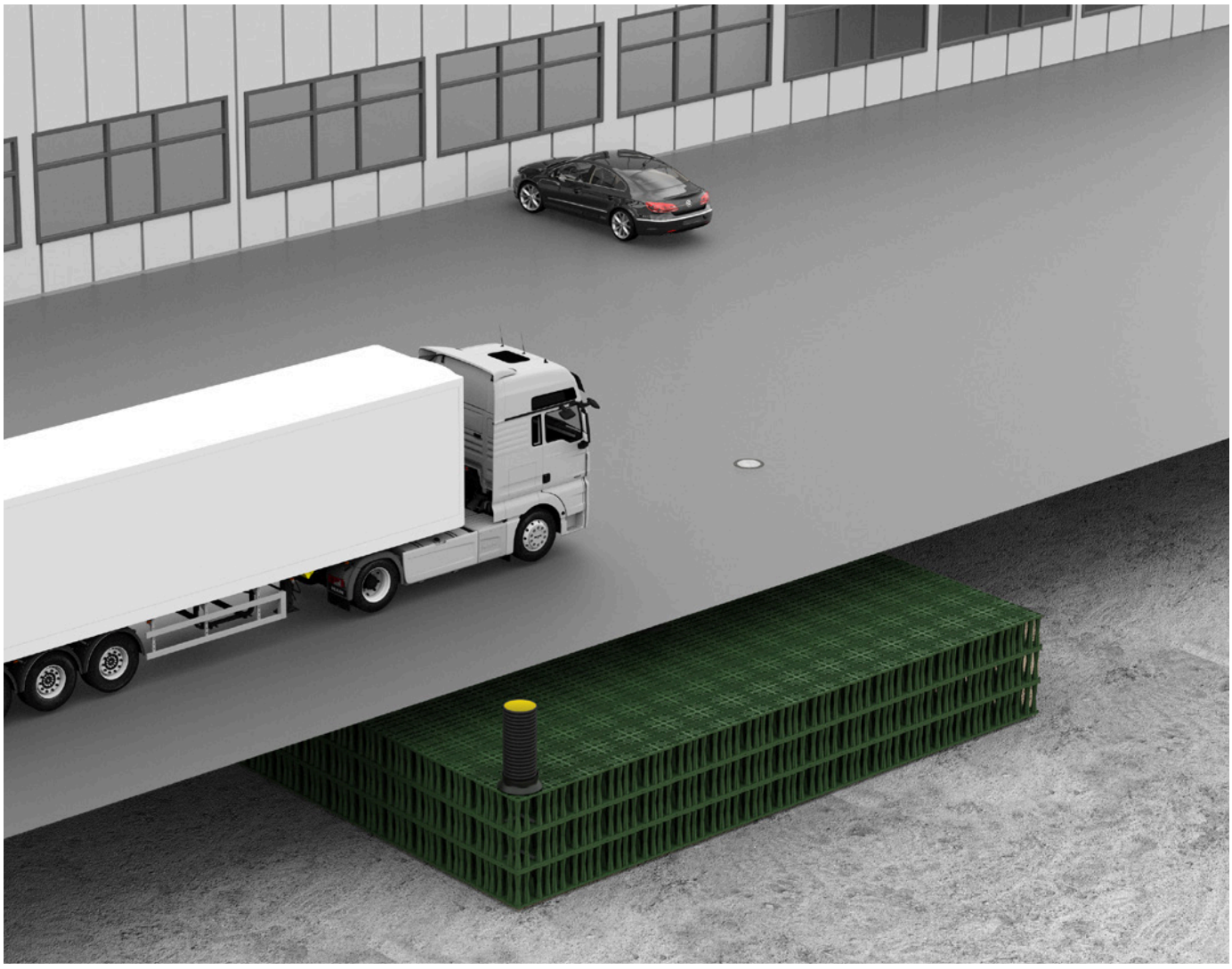
With conventional installation parameters*, depths of cover of DC 4 m and soil depths DSof 6 m are possible for infiltration systems. A project-specific stability analysis can be prepared by STORMCON.

*specific weight of soil 18 kN/m³
Mean soil temperature max. 23 °C,
6 m soil depth, = 0.3, 4-laye

*Rigofill ST product by FRÄNKISCHE

Example

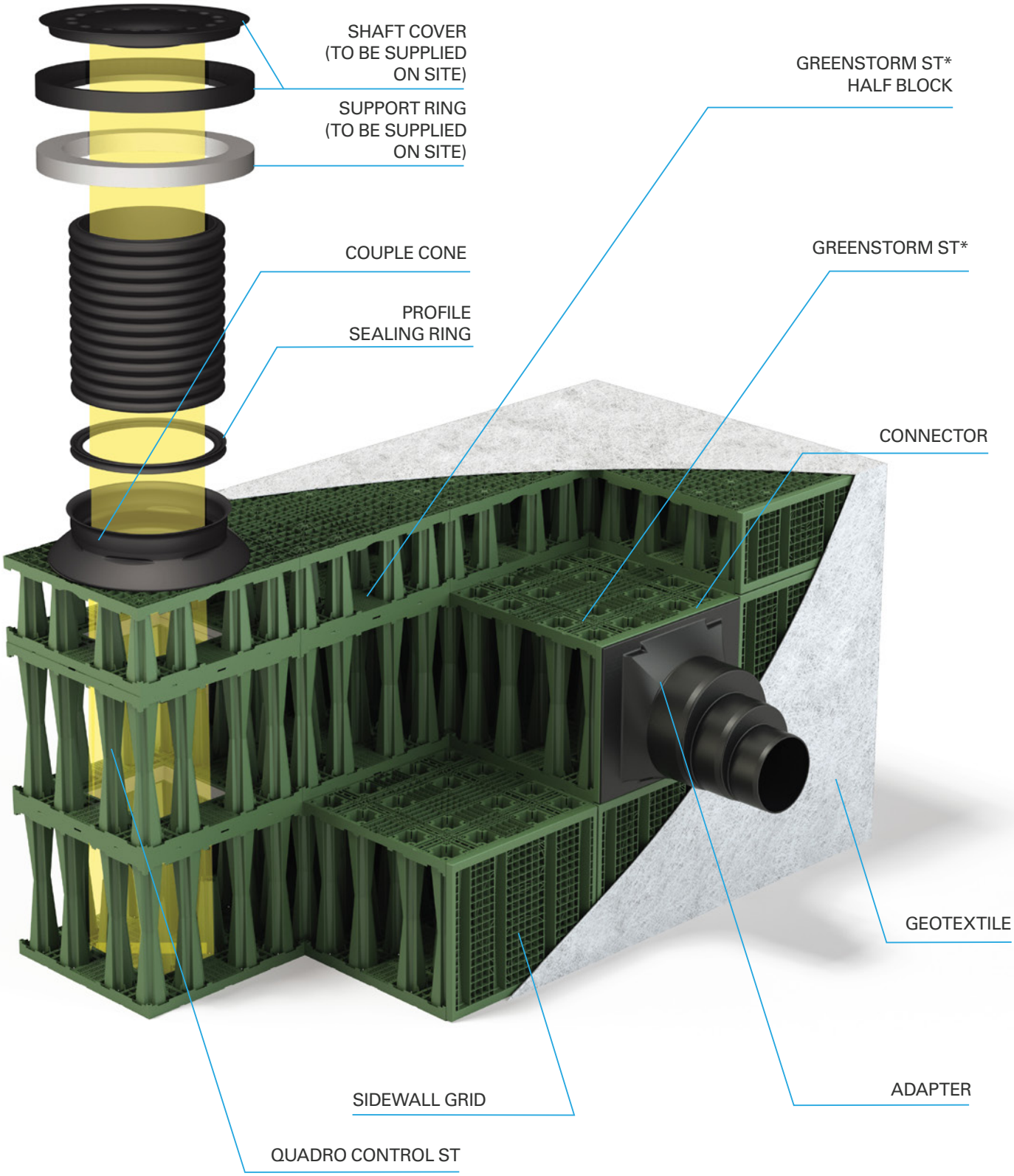
GreenStorm ST* Heavy traffic





*Rigofill ST product by FRÄNKISCHE

Quadro® Control ST – system shaft



*Rigofill ST product by FRÄNKISCHE

Quadro® Control ST – system shaft

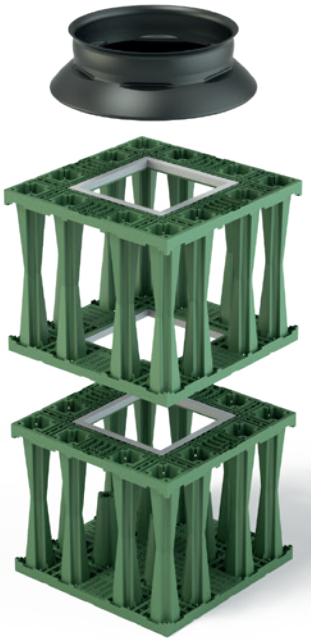
Integrated inspection shafts

Quadro® Control ST is a polypropylene inspection shaft which can be integrated in the storage/infiltration system.

It is square with a base of 800 x 800 mm and can be used in any position of the layout.

Its height results from the number of layers of the connected storage/infiltration system. The shaft allows for comfortable access to the inspection tunnel from aboveground. High-performance inspection and flushing equipment can easily be inserted into the inspection tunnel. The shaft is integrated in the storage/infiltration system and grows layer by layer as construction progresses. QuadroControl ST is delivered with all required components and will be assembled on site.

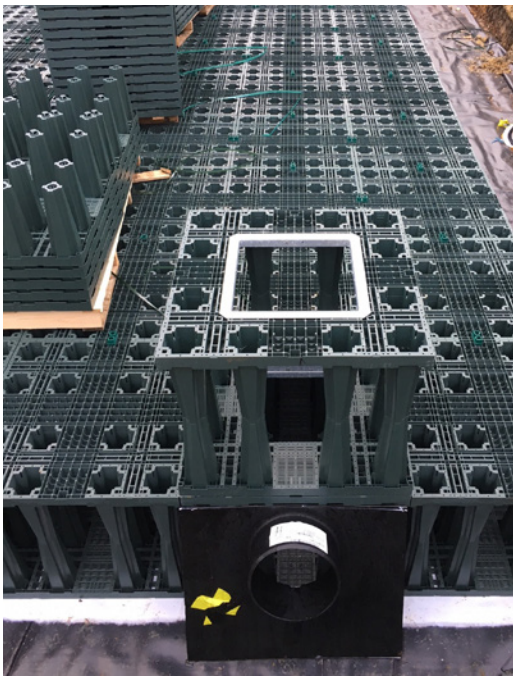
Structure



The shaft cone is the transition to the extension pipe. The length of the extension pipe is chosen depending on the installation depth.

The shaft is integrated in the storage/infiltration system and grows layer by layer as construction progresses.

The shaft components are stackable and delivery includes the cone with all required components as shaft package.

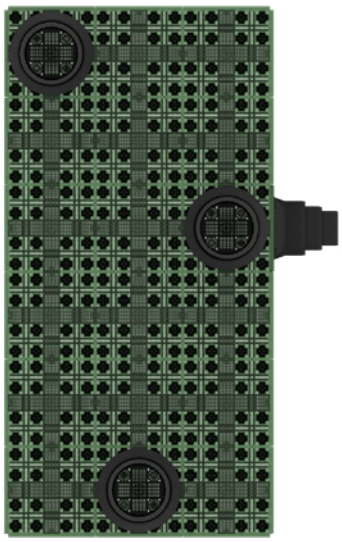


Arrangement of inspection shafts

Number of and position in the system are above all determined by the size of the system, access, pipe connections and design of the outdoor facilities.

In order to ensure that flushing of the complete system is possible, each module should comprise at least one inspection shaft. In addition, the shafts should be positioned such that the shaft covers do not interfere with the design of the outdoor facilities, but can easily be accessed by vehicles for maintenance purposes.

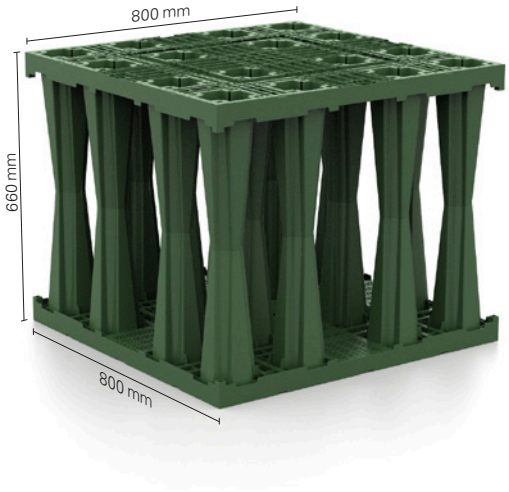
Adjacent shafts should be staggered in the layout.

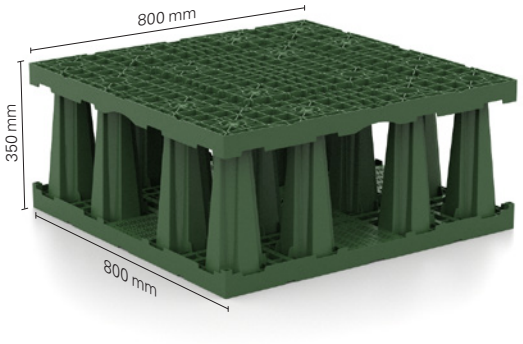


*Rigofill ST product by FRÄNKISCHE

GreenStorm ST* – Design-relevant dimensions

Dimensions





Sidewall grid connection options

Full block connection options
Dia 100 mm, 135 mm, 150 mm, 200 mm,
250 mm, 300 mm, 375 mm et 450 mm



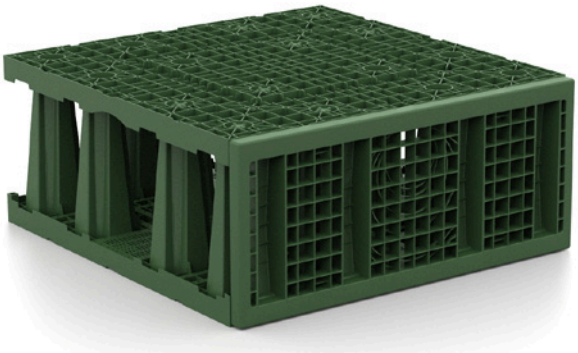
This allows all available nominal diameters to be realised both at the top and the bottom of the module.



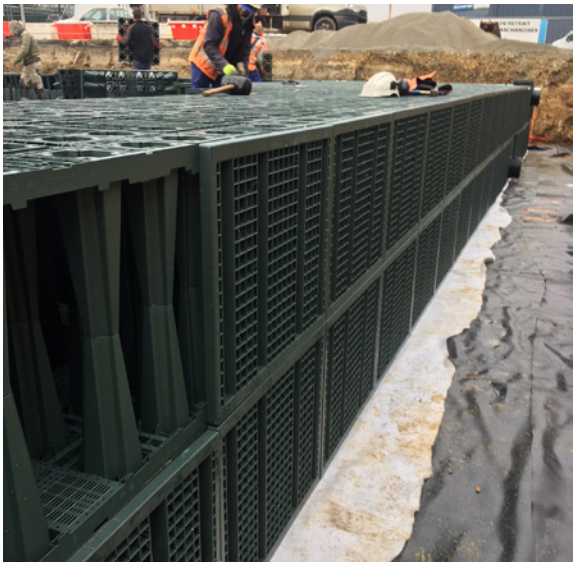
GreenStorm ST* – Design-relevant dimensions

Sidewall grid connection options

Half block connection options
Dia 100 mm, 135 mm, 150 mm, 200 mm
et 250 mm

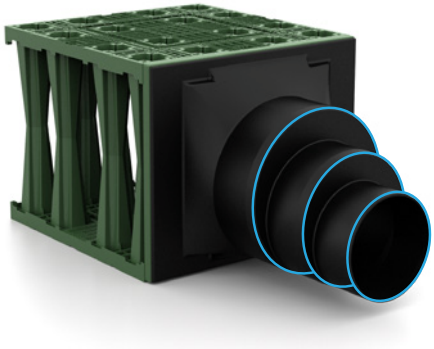


The side plates can be drilled to the height and desired position within the frame.

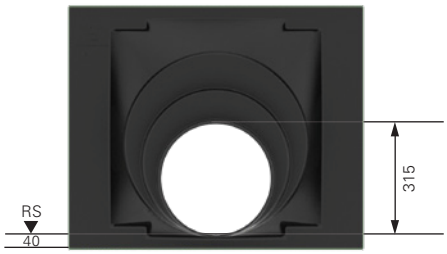


Adapter connection options

Connections:
Dia 300 mm, 450 mm
et 525 mm



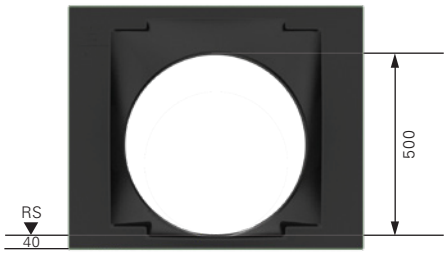
Outside diameter 315 mm for a pipe diameter 300 mm PVC



Outside diameter 400 mm for a pipe diameter 450 mm PVC. A flexible sleeve off center is required.



Outside diameter 500 mm for a pipe of diameter 525 mm. A flexible sleeve off center is required

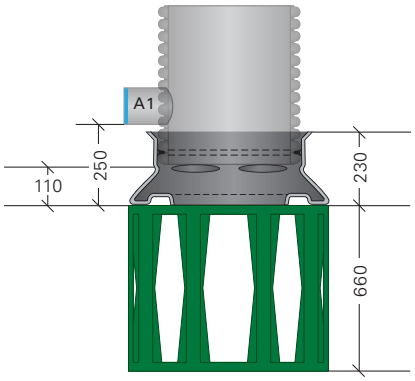


*Rigofill ST product by FRÄNKISCHE

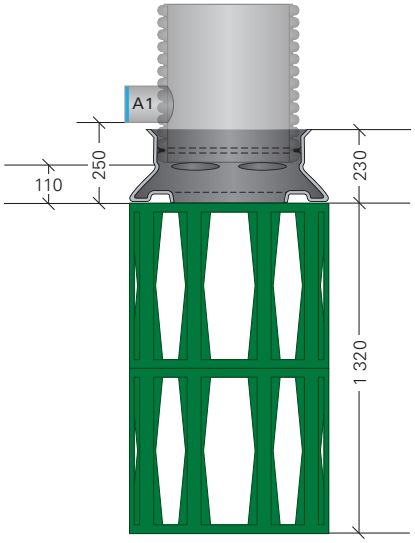
Quadro® Control ST – Design-relevant dimensions

Dimensions of Quadro® Control ST

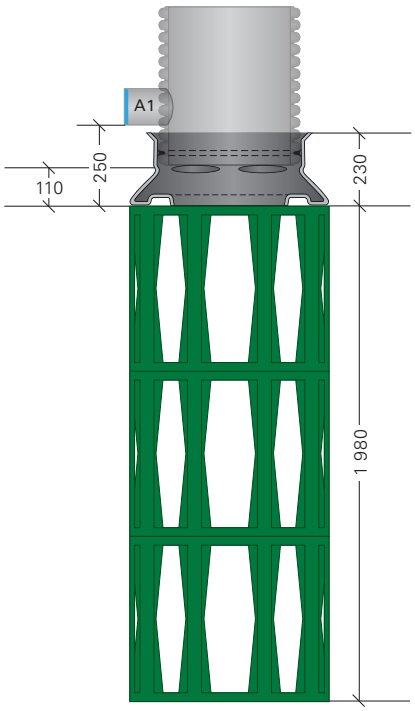
Connection options	
A1	DN/OD 200 or DN/OD 315 connection possible



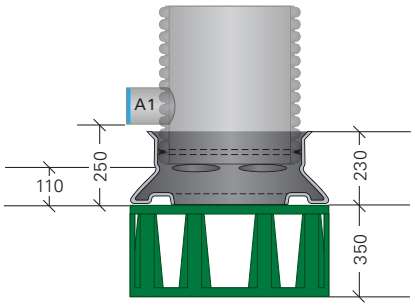
1-layer



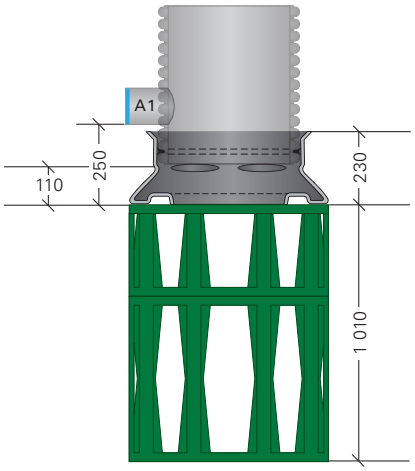
2-layer



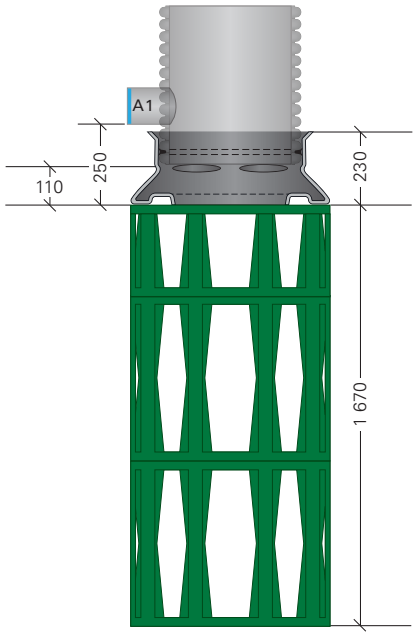
3-layer



1/2-layer



1 1/2-layer



2 1/2-layer

Quadro® Control ST – Design-relevant dimensions

Shaft design of Quadro® Control ST

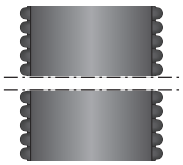
Structure of inspection shaft



Class B or D
shaft cover acc. to DIN EN 124,
CW 610

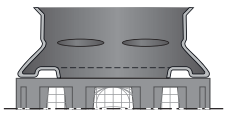


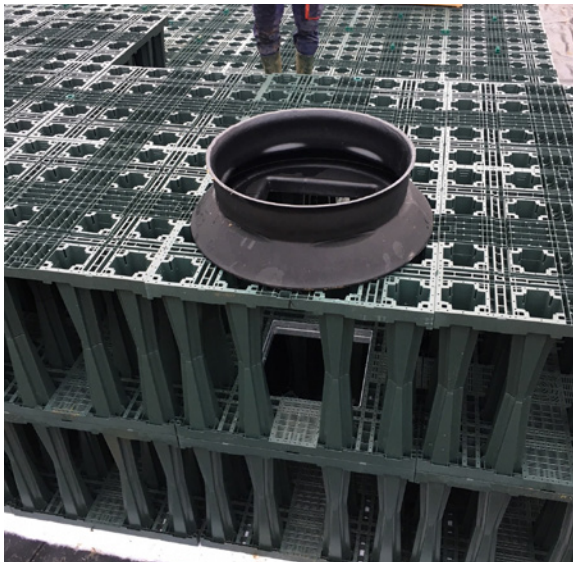
Support ring acc. to DIN 4034,
D_I = 625 mm

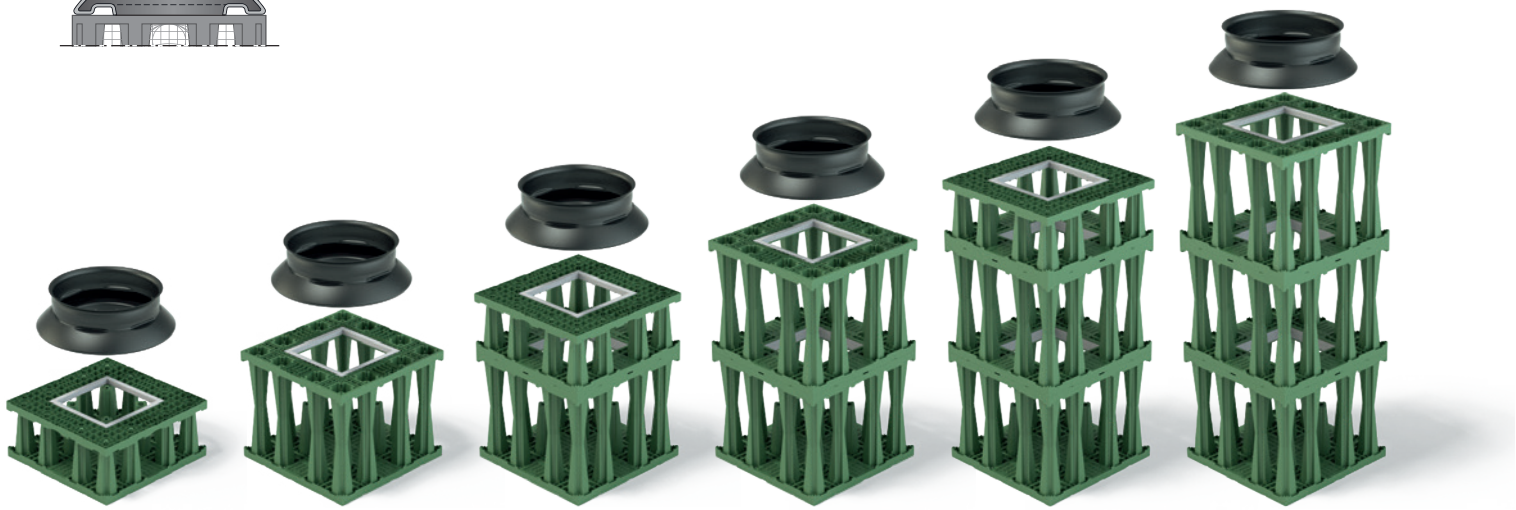


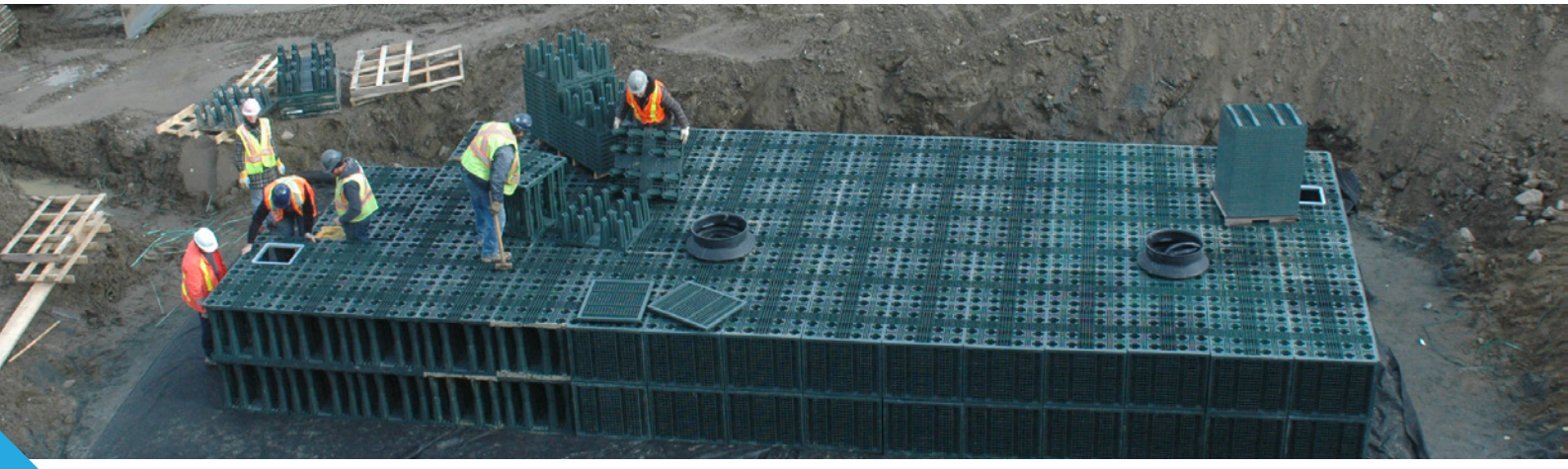
Extension pipe
D_O 600

Sealing ring









*Rigofill ST product by FRÄNKISCHE

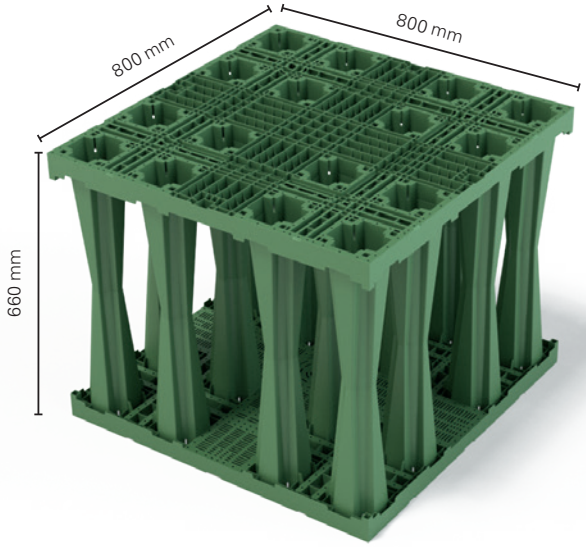
GreenStorm ST*

GreenStorm ST*

GreenStorm ST* IS highly durable and hard-wearing storage/infiltration module with a base of 800 x 800 mm and a height of 660 mm full blocks.

The polypropylene full block consists of two half elements to be installed on site and has a void ratio of more than 96 %. Water can flow through the module three-dimensionally almost without any obstacles. GreenStorm ST* allows for virtually any size and geometry of the systems.

The cross-shaped inspection tunnel in the storage/ infiltration modules has been designed for the use of automotive dollies. This allows the effective drainage surface and the entire system volume with all statically relevant bearing-type fixtures to be inspected.

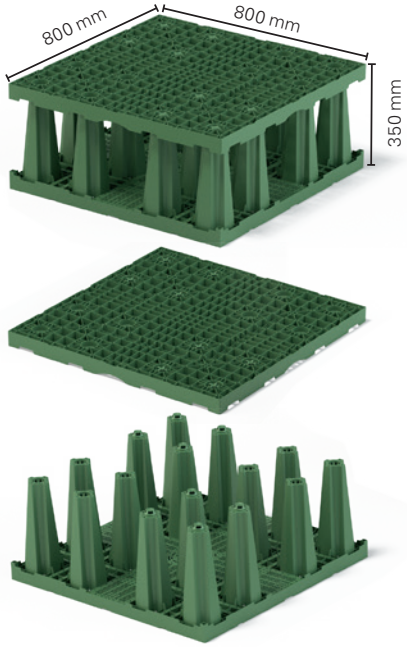


GreenStorm ST* – half block

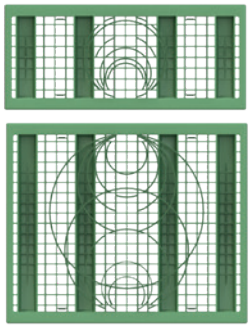
The GreenStorm ST* half block has a base of 800 x 800 mm and a height of 350 mm.

It consists of only one half element which must be assembled with a roof slab on site. This roof slab is only required for the half block. The GreenStorm ST* half block is used in particular for systems with shallow installation depths, e.g., in case of high groundwater levels.

Systems in various heights can be realised in 35 cm steps and adjusted to almost any layout in combination with the full block.



GreenStorm ST* – Accessories



Différentes hauteurs de connexion (indépendamment du diamètre nominal) sont requises au-dessus du fond selon le nombre d'étages :

Nombre d'étages	Hauteur de raccord
0.5-layer	40 mm
1-layer	40 mm
1.5-layer	700 mm
2-layer	700 mm
2.5-layer	1 360 mm
3-layer	1 360 mm

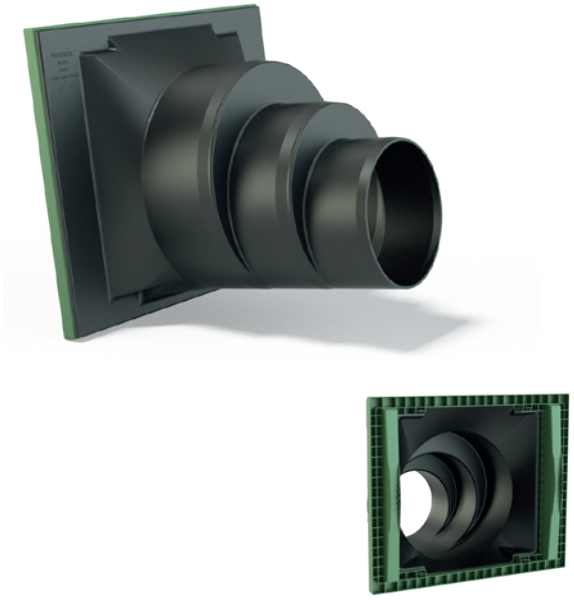
Sidewall grid

The sidewall grids serve as external boundary.

They can be assembled easily using snap connections. The predefined position of the connections at the sidewall grids guarantees that the connections of inlet pipe and outlet pipe and the tunnel are same level. The sidewall grids can be assembled easily also outside the excavation pit.

The sidewall grid for the full block and Quadro® Control ST has a size of W x D x H = 800 x 30 x 660 mm and is suited for connecting lateral solid wall pipes DN 110, 125, 160, 200, 225, 250, 315, 400 and 500.

The sidewall grid for the half block or the half-layer shaft has a size of W x D x H = 800 x 30 x 350 mm and is suited for connecting lateral solid wall pipes DN 110, 125, 160, 200, 225 and 250. In storage/infiltration designs with inside corners, shortened sidewall grids are used at one side.



Adapter

The adapter for GreenStorm ST* has a length of 800 mm and a height of 660 mm and serves as an inlet and outlet connection.

It provides an inlet connection with an optimised flow design with diffusor effect for solid wall pipes DN 315, 400 and 500. It can be connected to GreenStorm ST* easily and quickly thanks to the snap connection.

The predefined position of the snap connection at the module guarantees that inlet pipe and outlet pipe and tunnel connect same level.

The adapter ensures a connection with the same crown, as it is installed turned by 180°.

*Rigofill ST product by FRÄNKISCHE





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GREENSTORM Stage Storage Calculations

Project Details

Project Name	Agnes St Subdivision - SWMF1
Address	Agnes St
City	Caledon, ON
Country	Canada
Date	February 6, 2026

System Details

Chamber Model	**GreenStorm-ST**	
Number of Layers	**2.5**	
Height of Chambers	1.67	m
Chamber Length	22.40	m
Chamber Width	18.40	m
Storage Void Ratio	96%	
System Perimeter	81.60	m
GreenStorm Area	412.16	m^2
System Area	412.16	m^2
GreenStorm Base Elevation	**415.20**	m

Top Stone	**0.00**	m
Bottom Stone	**0.00**	m
Perimeter Stone	**0.00**	m
Stone Qty.	0.00	m^3
Stone Void Ratio	40%	
Impermeable Liner	**No**	
Middle Grids	**No**	
Highest Finished Grade	**418.17**	m
Lowest Finished Grade	**417.84**	m

Stage Storage

Height of System	GreenStorm Volume	Top Stone Volume	Bottom Stone Volume	Perimeter Stone Volume	Cumulative Storage Volume	Elevation
mm	m^3	m^3	m^3	m^3	m^3	m
1670	17.81	0.00	0.00	0.00	660.77	416.870
1625	9.89	0.00	0.00	0.00	642.97	416.825
1600	9.89	0.00	0.00	0.00	633.08	416.800
1575	9.89	0.00	0.00	0.00	623.19	416.775
1550	9.89	0.00	0.00	0.00	613.29	416.750
1525	9.89	0.00	0.00	0.00	603.40	416.725
1500	9.89	0.00	0.00	0.00	593.51	416.700
1475	9.89	0.00	0.00	0.00	583.62	416.675
1450	9.89	0.00	0.00	0.00	573.73	416.650
1425	9.89	0.00	0.00	0.00	563.83	416.625
1400	9.89	0.00	0.00	0.00	553.94	416.600
1375	9.89	0.00	0.00	0.00	544.05	416.575
1350	9.89	0.00	0.00	0.00	534.16	416.550
1325	9.89	0.00	0.00	0.00	524.27	416.525
1300	9.89	0.00	0.00	0.00	514.38	416.500
1275	9.89	0.00	0.00	0.00	504.48	416.475
1250	9.89	0.00	0.00	0.00	494.59	416.450
1225	9.89	0.00	0.00	0.00	484.70	416.425
1200	9.89	0.00	0.00	0.00	474.81	416.400
1175	9.89	0.00	0.00	0.00	464.92	416.375
1150	9.89	0.00	0.00	0.00	455.02	416.350
1125	9.89	0.00	0.00	0.00	445.13	416.325
1100	9.89	0.00	0.00	0.00	435.24	416.300
1075	9.89	0.00	0.00	0.00	425.35	416.275
1050	9.89	0.00	0.00	0.00	415.46	416.250
1025	9.89	0.00	0.00	0.00	405.57	416.225
1000	9.89	0.00	0.00	0.00	395.67	416.200
975	9.89	0.00	0.00	0.00	385.78	416.175
950	9.89	0.00	0.00	0.00	375.89	416.150
925	9.89	0.00	0.00	0.00	366.00	416.125
900	9.89	0.00	0.00	0.00	356.11	416.100
875	9.89	0.00	0.00	0.00	346.21	416.075
850	9.89	0.00	0.00	0.00	336.32	416.050
825	9.89	0.00	0.00	0.00	326.43	416.025

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GREENSTORM Stage Storage Calculations Cont.

800	9.89	0.00	0.00	0.00	316.54	416.000
775	9.89	0.00	0.00	0.00	306.65	415.975
750	9.89	0.00	0.00	0.00	296.76	415.950
725	9.89	0.00	0.00	0.00	286.86	415.925
700	9.89	0.00	0.00	0.00	276.97	415.900
675	9.89	0.00	0.00	0.00	267.08	415.875
650	9.89	0.00	0.00	0.00	257.19	415.850
625	9.89	0.00	0.00	0.00	247.30	415.825
600	9.89	0.00	0.00	0.00	237.40	415.800
575	9.89	0.00	0.00	0.00	227.51	415.775
550	9.89	0.00	0.00	0.00	217.62	415.750
525	9.89	0.00	0.00	0.00	207.73	415.725
500	9.89	0.00	0.00	0.00	197.84	415.700
475	9.89	0.00	0.00	0.00	187.94	415.675
450	9.89	0.00	0.00	0.00	178.05	415.650
425	9.89	0.00	0.00	0.00	168.16	415.625
400	9.89	0.00	0.00	0.00	158.27	415.600
375	9.89	0.00	0.00	0.00	148.38	415.575
350	9.89	0.00	0.00	0.00	138.49	415.550
325	9.89	0.00	0.00	0.00	128.59	415.525
300	9.89	0.00	0.00	0.00	118.70	415.500
275	9.89	0.00	0.00	0.00	108.81	415.475
250	9.89	0.00	0.00	0.00	98.92	415.450
225	9.89	0.00	0.00	0.00	89.03	415.425
200	9.89	0.00	0.00	0.00	79.13	415.400
175	9.89	0.00	0.00	0.00	69.24	415.375
150	9.89	0.00	0.00	0.00	59.35	415.350
125	9.89	0.00	0.00	0.00	49.46	415.325
100	9.89	0.00	0.00	0.00	39.57	415.300
75	9.89	0.00	0.00	0.00	29.68	415.275
50	9.89	0.00	0.00	0.00	19.78	415.250
25	9.89	0.00	0.00	0.00	9.89	415.225
0	0.00	0.00	0.00	0.00	0.00	415.200

Quantity Control Volume

Infiltration Volume

GREENSTORM Stage Storage Calculations

Project Details

Project Name	Agnes St Subdivision - SWMF2
Address	Agnes St
City	Caledon, ON
Country	Canada
Date	February 6, 2026

System Details

Chamber Model	**GreenStorm-ST**	
Number of Layers	**2.5**	
Height of Chambers	1.67	m
Chamber Length	48.00	m
Chamber Width	8.00	m
Storage Void Ratio	96%	
System Perimeter	112.00	m
GreenStorm Area	384.00	m^2
System Area	384.00	m^2
GreenStorm Base Elevation	**414.02**	m

Top Stone	**0.00**	m
Bottom Stone	**0.00**	m
Perimeter Stone	**0.00**	m
Stone Qty.	0.00	m^3
Stone Void Ratio	40%	
Impermeable Liner	**Yes**	
Middle Grids	**No**	
Highest Finished Grade	**418.05**	m
Lowest Finished Grade	**416.49**	m

Stage Storage

Height of System	GreenStorm Volume	Top Stone Volume	Bottom Stone Volume	Perimeter Stone Volume	Cumulative Storage Volume	Elevation
mm	m^3	m^3	m^3	m^3	m^3	m
1670	16.59	0.00	0.00	0.00	615.63	415.690
1625	9.22	0.00	0.00	0.00	599.04	415.645
1600	9.22	0.00	0.00	0.00	589.82	415.620
1575	9.22	0.00	0.00	0.00	580.61	415.595
1550	9.22	0.00	0.00	0.00	571.39	415.570
1525	9.22	0.00	0.00	0.00	562.18	415.545
1500	9.22	0.00	0.00	0.00	552.96	415.520
1475	9.22	0.00	0.00	0.00	543.74	415.495
1450	9.22	0.00	0.00	0.00	534.53	415.470
1425	9.22	0.00	0.00	0.00	525.31	415.445
1400	9.22	0.00	0.00	0.00	516.10	415.420
1375	9.22	0.00	0.00	0.00	506.88	415.395
1350	9.22	0.00	0.00	0.00	497.66	415.370
1325	9.22	0.00	0.00	0.00	488.45	415.345
1300	9.22	0.00	0.00	0.00	479.23	415.320
1275	9.22	0.00	0.00	0.00	470.02	415.295
1250	9.22	0.00	0.00	0.00	460.80	415.270
1225	9.22	0.00	0.00	0.00	451.58	415.245
1200	9.22	0.00	0.00	0.00	442.37	415.220
1175	9.22	0.00	0.00	0.00	433.15	415.195
1150	9.22	0.00	0.00	0.00	423.94	415.170
1125	9.22	0.00	0.00	0.00	414.72	415.145
1100	9.22	0.00	0.00	0.00	405.50	415.120
1075	9.22	0.00	0.00	0.00	396.29	415.095
1050	9.22	0.00	0.00	0.00	387.07	415.070
1025	9.22	0.00	0.00	0.00	377.86	415.045
1000	9.22	0.00	0.00	0.00	368.64	415.020
975	9.22	0.00	0.00	0.00	359.42	414.995
950	9.22	0.00	0.00	0.00	350.21	414.970
925	9.22	0.00	0.00	0.00	340.99	414.945
900	9.22	0.00	0.00	0.00	331.78	414.920
875	9.22	0.00	0.00	0.00	322.56	414.895
850	9.22	0.00	0.00	0.00	313.34	414.870
825	9.22	0.00	0.00	0.00	304.13	414.845

800	9.22	0.00	0.00	0.00	294.91	414.820
775	9.22	0.00	0.00	0.00	285.70	414.795
750	9.22	0.00	0.00	0.00	276.48	414.770
725	9.22	0.00	0.00	0.00	267.26	414.745
700	9.22	0.00	0.00	0.00	258.05	414.720
675	9.22	0.00	0.00	0.00	248.83	414.695
650	9.22	0.00	0.00	0.00	239.62	414.670
625	9.22	0.00	0.00	0.00	230.40	414.645
600	9.22	0.00	0.00	0.00	221.18	414.620
575	9.22	0.00	0.00	0.00	211.97	414.595
550	9.22	0.00	0.00	0.00	202.75	414.570
525	9.22	0.00	0.00	0.00	193.54	414.545
500	9.22	0.00	0.00	0.00	184.32	414.520
475	9.22	0.00	0.00	0.00	175.10	414.495
450	9.22	0.00	0.00	0.00	165.89	414.470
425	9.22	0.00	0.00	0.00	156.67	414.445
400	9.22	0.00	0.00	0.00	147.46	414.420
375	9.22	0.00	0.00	0.00	138.24	414.395
350	9.22	0.00	0.00	0.00	129.02	414.370
325	9.22	0.00	0.00	0.00	119.81	414.345
300	9.22	0.00	0.00	0.00	110.59	414.320
275	9.22	0.00	0.00	0.00	101.38	414.295
250	9.22	0.00	0.00	0.00	92.16	414.270
225	9.22	0.00	0.00	0.00	82.94	414.245
200	9.22	0.00	0.00	0.00	73.73	414.220
175	9.22	0.00	0.00	0.00	64.51	414.195
150	9.22	0.00	0.00	0.00	55.30	414.170
125	9.22	0.00	0.00	0.00	46.08	414.145
100	9.22	0.00	0.00	0.00	36.86	414.120
75	9.22	0.00	0.00	0.00	27.65	414.095
50	9.22	0.00	0.00	0.00	18.43	414.070
25	9.22	0.00	0.00	0.00	9.22	414.045
0	0.00	0.00	0.00	0.00	0.00	414.020

AGNES SUBDIVISION
AGNES ST., CALEDON, ON

DRAWING INDEX

TITLE	SHEET NO
COVER SHEET	1 OF 7
SYSTEM LAYOUT, SECTIONS & CALCULATION SHEET	2-4 OF 7
SYSTEM OVERLAY SHEET	5 OF 7
DETAILS & STANDARD SHEET	6-7 OF 7

	PROJECT INFORMATION		
SITE CONTACT	PHIL ALLEN	416-286-5990	PHILALLEN@STORMCON.CA
ENGINEER / TECHNICAL SPECIALIST	ERIC CUMISKEY	289-380-3742	ECUMISKEY@STORMCON.CA
SALES REP:	GREG DZIEWIECKI	437-231-6080	GREGD@STORMCON.CA
PROJECT NO:	2023-033		

COMMENTS:

REVISION	DATE	COMMENT	BY
01	03/09/2023	SYSTEM VOLUME INCREASED	JD
02	12/01/2023	REVISED PER UPDATED STORAGE VOLUME	JD
03	09/24/2024	NEW SITE PLAN & NEW STORAGE VOLUME	JD

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NOTE: THESE SHOP DRAWINGS MAY CONTAIN COMPONENTS INCLUDING BUT NOT LIMITED TO MANHOLES, CATCH BASINS, STORM PIPES AND FITTINGS, MANIFOLDS, CASTINGS AND OTHER NECESSARY APPURTENANCES THAT MAY NOT BE SUPPLIED BY STORMCRETE. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND/OR SUPPLIER TO CONFIRM THE MATERIALS PROVIDED.

THIS DRAWING WAS PREPARED TO SUPPORT THE PROJECT ENGINEER OF RECORD FOR THE PROPOSED SYSTEM. IT IS THE ULTIMATE RESPONSIBILITY OF THE PROJECT ENGINEER OF RECORD TO ENSURE THAT THE SYSTEM'S DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS. IT IS THE CONTRACTOR OF RECORD'S RESPONSIBILITY TO ENSURE THAT THE SYSTEM IS INSTALLED IN ACCORDANCE WITH STORMCON'S MINIMUM REQUIREMENTS. STORMCON DOES NOT APPROVE PLANS, SIZING, OR SYSTEM DESIGNS.

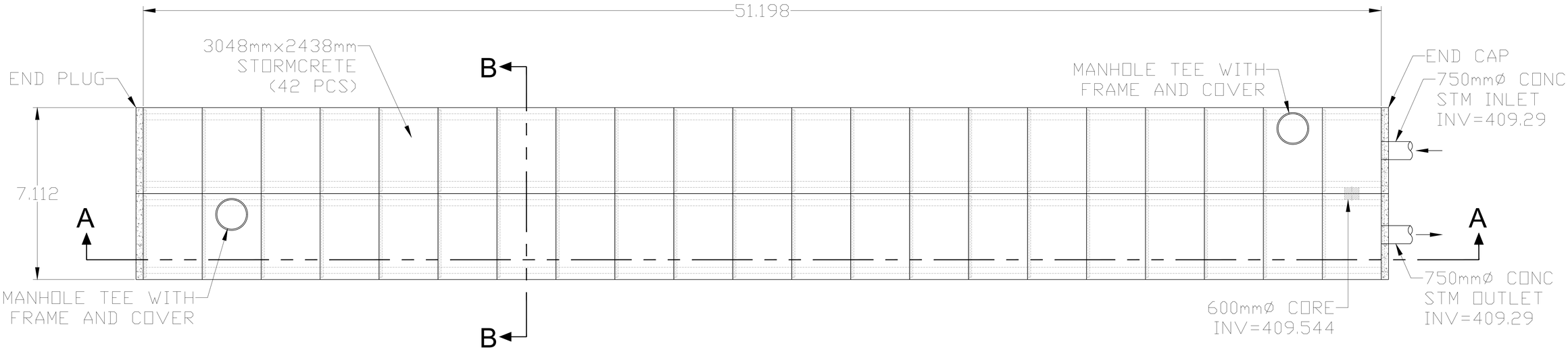
PROPOSED SYSTEM ELEVATIONS

(TO BE APPROVED BY ENGINEER)
***ENGINEER TO CONFIRM MINIMUM AND MAXIMUM BURIAL REQUIREMENTS ARE MET**

415.58	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED)
412.58	MINIMUM ALLOWABLE GRADE
<409.04	SEASONAL HIGH GROUNDWATER ELEVATION

STORMCRETE STORMWATER MANAGEMENT SYSTEM

TOTAL STORAGE PROVIDED: 747.69 m^3
SYSTEM AREA : 353.68 m^2



NOTE:*ALL EXTERNAL SYSTEM STRUCTURES, INLET/OUTLET PIPES, AND PROPOSED ELEVATIONS MUST BE DESIGNED AND APPROVED BY PROJECT ENGINEER OF RECORD. PROJECT ENGINEER OF RECORD MUST ENSURE CHAMBER BURIAL REQUIREMENTS ARE MET.

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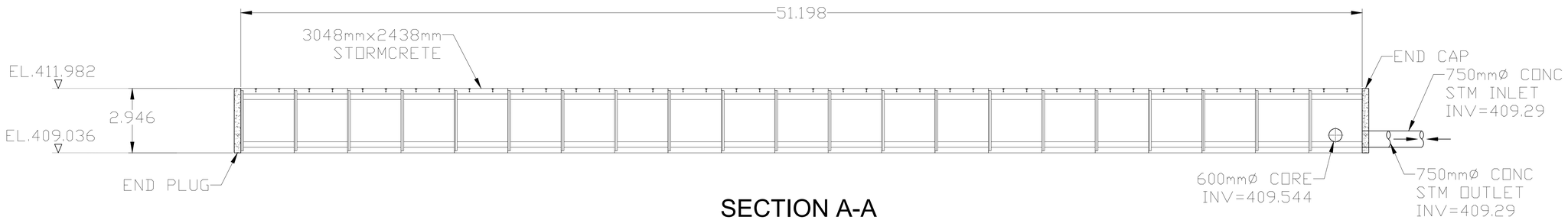
AGNES SUBDIVISION
AGNES ST., CALEDON, ON

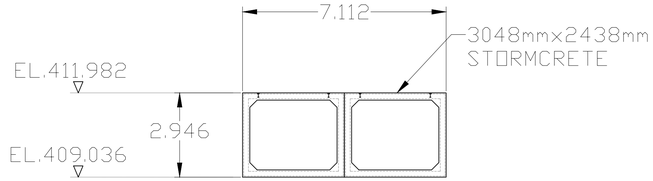
SYSTEM LAYOUT SHEET STORAGE TANK

STORMCRETE STORMWATER CHAMBER

PROJECT NO:	2023-033	DATE:	03/07/2023
DESIGNED BY:	JD	CHECKED BY:	EC
SCALE:	N.T.S.	SHEET NO:	2 OF 6



SECTION A-A



SECTION B-B

NOTE:*ALL EXTERNAL SYSTEM STRUCTURES, INLET/OUTLET PIPES, AND PROPOSED ELEVATIONS MUST BE DESIGNED AND APPROVED BY PROJECT ENGINEER OF RECORD. PROJECT ENGINEER OF RECORD MUST ENSURE CHAMBER BURIAL REQUIREMENTS ARE MET.

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L4K 1L3

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AGNES SUBDIVISION
AGNES ST., CALEDON, ON

SYSTEM SECTIONS & MANIFOLD DETAILS

STORMCRETE STORMWATER CHAMBER

PROJECT NO:	2023-033	DATE:	03/07/2023
DESIGNED BY:	JD	CHECKED BY:	EC
SCALE:	N.T.S.	SHEET NO:	3 OF 6

Project Name	Agnes Subdivision
Location	Agnes St., Caledon, ON
Date	September 24, 2024
Chamber Model	**StormCrete**
Height of System (m)	**2.438**
Area of System (m^2)	**353.68**
System Base Elevation (m)	**409.29**

Height of System	StormCrete Volume	Cumulative Storage Volume	Elevation				
mm	m^3	m^3	m				
2438	6.563584	747.69	411.728				
2413	6.691579	741.13	411.703	1188	7.802575	364.20	410.478
2388	6.819574	734.44	411.678	1163	7.802575	356.40	410.453
2363	6.947569	727.62	411.653	1138	7.802575	348.59	410.428
2338	7.075564	720.67	411.628	1113	7.802575	340.79	410.403
2313	7.203559	713.60	411.603	1088	7.802575	332.99	410.378
2288	7.331554	706.39	411.578	1063	7.802575	325.19	410.353
2263	7.459549	699.06	411.553	1038	7.802575	317.38	410.328
2238	7.587544	691.60	411.528	1013	7.802575	309.58	410.303
2213	7.715539	684.01	411.503	988	7.802575	301.78	410.278
2188	7.800527	676.30	411.478	963	7.802575	293.98	410.253
2163	7.802575	668.50	411.453	938	7.802575	286.17	410.228
2138	7.802575	660.70	411.428	913	7.802575	278.37	410.203
2113	7.802575	652.89	411.403	888	7.802575	270.57	410.178
2088	7.802575	645.09	411.378	863	7.802575	262.76	410.153
2063	7.802575	637.29	411.353	838	7.802575	254.96	410.128
2038	7.802575	629.49	411.328	813	7.802575	247.16	410.103
2013	7.802575	621.68	411.303	788	7.802575	239.36	410.078
1988	7.802575	613.88	411.278	763	7.802575	231.55	410.053
1963	7.802575	606.08	411.253	738	7.802575	223.75	410.028
1938	7.802575	598.28	411.228	713	7.802575	215.95	410.003
1913	7.802575	590.47	411.203	688	7.802575	208.15	409.978
1888	7.802575	582.67	411.178	663	7.802575	200.34	409.953
1863	7.802575	574.87	411.153	638	7.802575	192.54	409.928
1838	7.802575	567.07	411.128	613	7.802575	184.74	409.903
1813	7.802575	559.26	411.103	588	7.802575	176.94	409.878
1788	7.802575	551.46	411.078	563	7.802575	169.13	409.853
1763	7.802575	543.66	411.053	538	7.802575	161.33	409.828
1738	7.802575	535.85	411.028	513	7.802575	153.53	409.803
1713	7.802575	528.05	411.003	488	7.802575	145.73	409.778
1688	7.802575	520.25	410.978	463	7.802575	137.92	409.753
1663	7.802575	512.45	410.953	438	7.802575	130.12	409.728
1638	7.802575	504.64	410.928	413	7.802575	122.32	409.703
1613	7.802575	496.84	410.903	388	7.802575	114.52	409.678
1588	7.802575	489.04	410.878	363	7.802575	106.71	409.653
1563	7.802575	481.24	410.853	338	7.802575	98.91	409.628
1538	7.802575	473.43	410.828	313	7.802575	91.11	409.603
1513	7.802575	465.63	410.803	288	7.802575	83.31	409.578
1488	7.802575	457.83	410.778	263	7.778000	75.50	409.553
1463	7.802575	450.03	410.753	238	7.659221	67.72	409.528
1438	7.802575	442.22	410.728	213	7.531226	60.07	409.503
1413	7.802575	434.42	410.703	188	7.403231	52.53	409.478
1388	7.802575	426.62	410.678	163	7.275236	45.13	409.453
1363	7.802575	418.82	410.653	138	7.147241	37.86	409.428
1338	7.802575	411.01	410.628	113	7.019246	30.71	409.403
1313	7.802575	403.21	410.603	88	6.891251	23.69	409.378
1288	7.802575	395.41	410.578	63	6.763256	16.80	409.353
1263	7.802575	387.61	410.553	38	6.635261	10.04	409.328
1238	7.802575	379.80	410.528	13	3.399752	3.40	409.303
1213	7.802575	372.00	410.503	0	0.000000	0.00	409.278

SYSTEM STAGE-STORAGE TABLE

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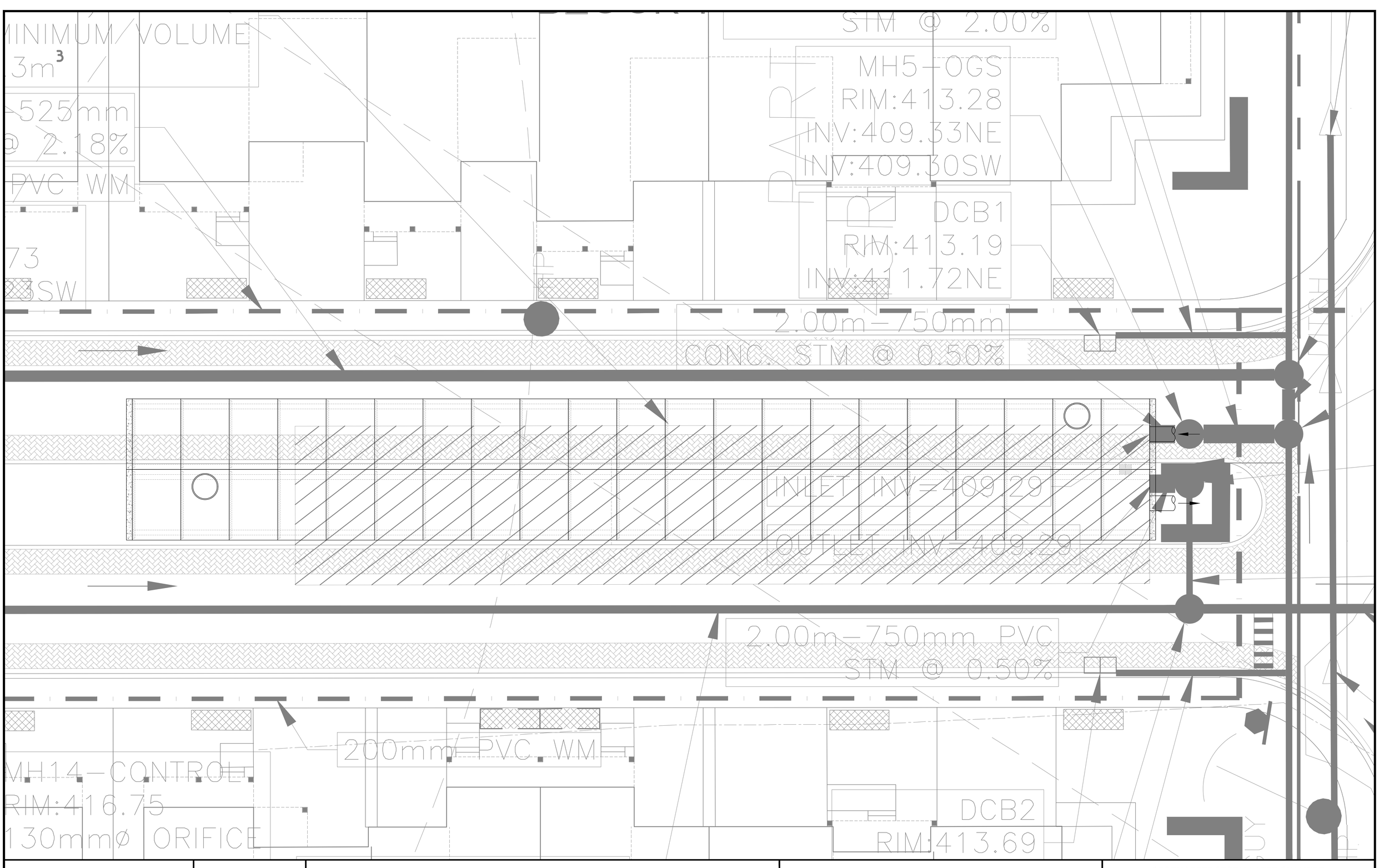
AGNES SUBDIVISION
AGNES ST., CALEDON, ON

SYSTEM CALCULATION SHEET

STORMCRETE STORMWATER CHAMBER

PROJECT NO:	2023-033	DATE:	03/07/2023
DESIGNED BY:	JD	CHECKED BY:	EC
SCALE:	N.T.S.	SHEET NO:	4 OF 6



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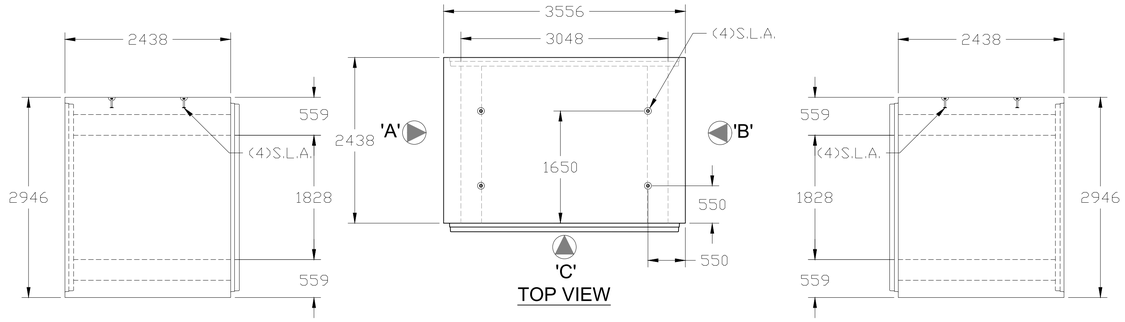
AGNES SUBDIVISION
AGNES ST., CALEDON, ON

SYSTEM OVERLAY SHEET

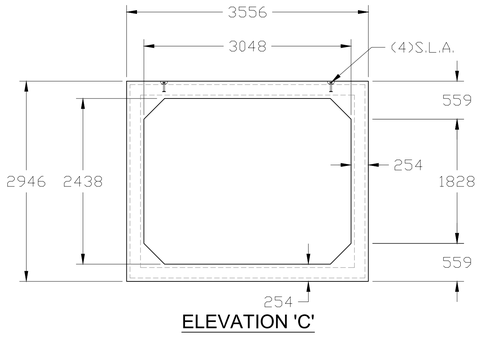
STORMCRETE STORMWATER CHAMBER

PROJECT NO:	2023-033	DATE:	03/07/2023
DESIGNED BY:	JD	CHECKED BY:	EC
SCALE:	N.T.S.	SHEET NO:	5 OF 6



ELEVATION 'A'

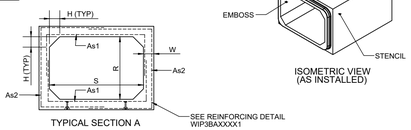
ELEVATION 'B'



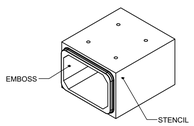
ELEVATION 'C'

STORMCRETE BOX (3048mmx2438) DETAILS

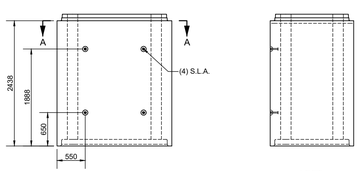
STENCIL	EMBOSS
CCP-GUELPH OPSS1821 (SIZE) STD (D.E.C) TYPE HSe (DATE OF MFG)	CC OPSS 1821 (D.E.C) (DATE OF MFG)



TYPICAL SECTION A



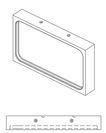
ISOMETRIC VIEW (AS INSTALLED)



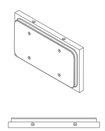
LEFT (RIGHT MIRRORED)

PRODUCT VARIABLES							
PART ID	VARIABLE DIMENSIONS				S.L.A.	MASS (kg)	D.E.C
	S	R	W	H			
BA18091	1800	900	200	200	4T x 5-1/2"	7960	0.6-5.5m
BA18121	1829	1219	203	203	4T x 5-1/2"	8953	0.6-5.5m
BA24121	2438	1219	203	203	4T x 5-1/2"	10444	0.6-3.6m
BA24151	2438	1524	203	203	4T x 5-1/2"	11191	0.6-3.6m
BA24181	2438	1829	203	203	4T x 5-1/2"	11938	0.6-3.6m
BA30151	3048	1524	254	254	8T x 7-1/8"	16347	0.6-3.6m
BA30181	3048	1829	254	254	8T x 7-1/8"	17282	0.6-3.6m
BA30211	3048	2134	254	254	8T x 7-1/8"	17750	0.6-3.6m
BA30241	3048	2438	254	254	8T x 7-1/8"	19148	0.6-3.6m

STANDARD BOX 2438 LAY LENGTH (WET CAST GASKETED)

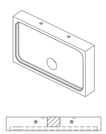


CAP

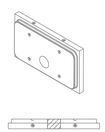


PLUG

- CAP INSTALLED ON SPIGOT END OF BOX UNIT.
- PLUG INSTALLED ON BELL END OF BOX UNIT (INCL. GASKET).
- MIN. THICKNESS = 300mm.
- CAP/PLUG STYLE TRANSITION TO SMALLER CIRCULAR, ELLIPTICAL, OR BOX UNIT AVAILABLE.
- CAP AND PLUG MADE OF WET CAST CONCRETE.



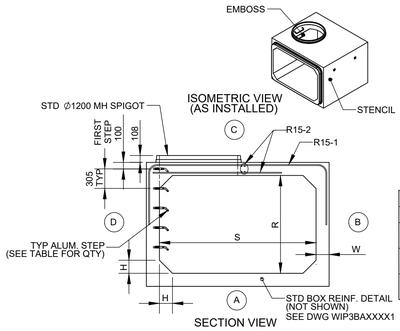
CAP WITH HOLE



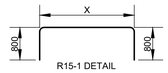
PLUG WITH HOLE

- CAP INSTALLED ON SPIGOT END OF BOX UNIT.
- PLUG INSTALLED ON BELL END OF BOX UNIT (INCL. GASKET).
- MIN. THICKNESS = 300mm.
- CAP/PLUG STYLE TRANSITION TO SMALLER CIRCULAR, ELLIPTICAL, OR BOX UNIT AVAILABLE.

STANDARD END TREATMENTS AND FITTINGS



ADDITIONAL REINFORCING LIST				
MARK	QTY	SIZE	LENGTH	SPACING
R15-1	4	15M	L	50
R15-2	8	15M	2000	50

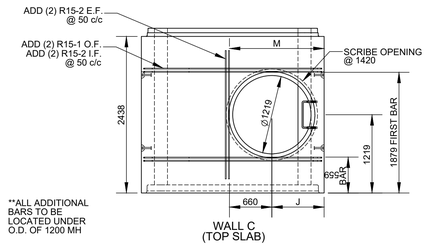


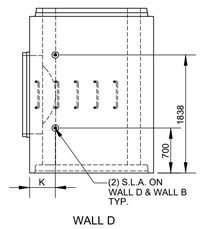
CAST IN MATERIAL LIST	
QTY	DESCRIPTION
4	SLA SEE PROD. VARIABLES TABLE FOR SIZE
SEE TABLE	16" HOLLOW ALUM. STEPS
1	STANDARD OPS BOX CULVERT CAGE (WIP3BAXXXX1)

OPS STENCIL	OPS EMBOSS
CCP-GUELPH OPSS1821 (SIZE) MHT-L (D.E.C) (DATE OF MFG) (MASS)KG	CC OPSS 1821 (D.E.C) (DATE OF MFG)

PRODUCT VARIABLES													
PART ID	VARIABLE DIMENSIONS									S.L.A.	STEPS	MASS (kg)	D.E.C
	S	R	W	H	J	K	M	X	L				
BOX1809MHT-001	1800	900	200	200	810	400	1470	2100	3700	4T x 5-1/2"	3	7358	0.6-5.5m
BOX1812MHT-001	1829	1219	203	203	813	400	1473	2135	3735	4T x 5-1/2"	4	8342	0.6-5.5m
BOX2412MHT-001	2438	1219	203	203	813	600	1473	2744	4344	4T x 5-1/2"	4	9830	0.6-3.6m
BOX2415MHT-001	2438	1524	203	203	813	600	1473	2744	4344	4T x 5-1/2"	5	10577	0.6-3.6m
BOX2418MHT-001	2438	1829	203	203	813	600	1473	2744	4344	4T x 5-1/2"	6	11323	0.6-3.6m
BOX3015MHT-001	3048	1524	254	254	864	900	1524	3456	5056	8T x 7-1/8"	5	15569	0.6-3.6m
BOX3018MHT-001	3048	1829	254	254	864	900	1524	3456	5056	8T x 7-1/8"	6	16506	0.6-3.6m
BOX3021MHT-001	3048	2134	254	254	864	900	1524	3456	5056	8T x 7-1/8"	7	17080	0.6-3.6m
BOX3024MHT-001	3048	2438	254	254	864	900	1524	3456	5056	8T x 7-1/8"	8	18372	0.6-3.6m

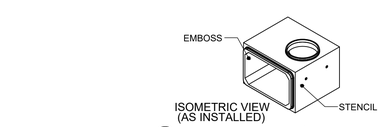
ALL DIMENSIONS ARE IN mm DRAWINGS ARE NOT TO SCALE WWF SHEETS TO CSA G.30.5 AND CSA G.30.15 WWF Fy = 500MPa REINFORCING TO CSA G.30.18 GRADE 400W WELD REINFORCING STEEL ACCORDING TO CWB APPROVED PROCEDURE CSA W186	MIN. CONC. STRENGTH 35MPa CLEAR COVER = 40mm ± 5mm TOLERANCE TO OPSS 1821 FOR BOX JOINT DETAIL, SEE DWG BXXXXX1-JOINT FOR MH JOINT, SEE DWG MX-JOINT



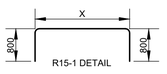


WALL D

LEFT



ADDITIONAL REINFORCING LIST				
MARK	QTY	SIZE	LENGTH	SPACING
R15-1	4	15M	L	50
R15-2	8	15M	2000	50

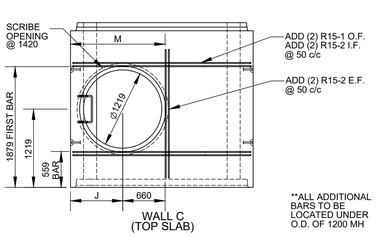


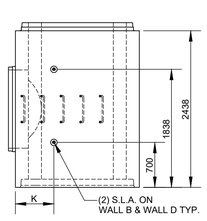
CAST IN MATERIAL LIST	
QTY	DESCRIPTION
4	SLA SEE PROD. VARIABLES TABLE FOR SIZE
SEE TABLE	16" HOLLOW ALUM. STEPS
1	STANDARD OPS BOX CULVERT CAGE (SEE WIP3BAXXXX1)

OPS STENCIL	OPS EMBOSS
CCP-GUELPH OPSS1821 (SIZE) MHT-R (D.E.C) (DATE OF MFG) (MASS)KG	CC OPSS 1821 (D.E.C) (DATE OF MFG)

PRODUCT VARIABLES													
PART ID	VARIABLE DIMENSIONS									S.L.A.	STEPS	MASS (kg)	D.E.C
	S	R	W	H	J	K	M	X	L				
BOX1809MHT-002	1800	900	200	200	810	400	1470	2100	3700	4T x 5-1/2"	3	7358	0.6-5.5m
BOX1812MHT-002	1829	1219	203	203	813	400	1473	2135	3735	4T x 5-1/2"	4	8342	0.6-5.5m
BOX2412MHT-002	2438	1219	203	203	813	600	1473	2744	4344	4T x 5-1/2"	4	9830	0.6-3.6m
BOX2415MHT-002	2438	1524	203	203	813	600	1473	2744	4344	4T x 5-1/2"	5	10577	0.6-3.6m
BOX2418MHT-002	2438	1829	203	203	813	600	1473	2744	4344	4T x 5-1/2"	6	11323	0.6-3.6m
BOX3015MHT-002	3048	1524	254	254	864	900	1524	3456	5056	8T x 7-1/8"	5	15569	0.6-3.6m
BOX3018MHT-002	3048	1829	254	254	864	900	1524	3456	5056	8T x 7-1/8"	6	16506	0.6-3.6m
BOX3021MHT-002	3048	2134	254	254	864	900	1524	3456	5056	8T x 7-1/8"	7	17080	0.6-3.6m
BOX3024MHT-002	3048	2438	254	254	864	900	1524	3456	5056	8T x 7-1/8"	8	18372	0.6-3.6m

ALL DIMENSIONS ARE IN mm DRAWINGS ARE NOT TO SCALE WWF SHEETS TO CSA G.30.5 AND CSA G.30.15 WWF Fy = 500MPa REINFORCING TO CSA G.30.18 GRADE 400W WELD REINFORCING STEEL ACCORDING TO CWB APPROVED PROCEDURE CSA W186	MIN. CONC. STRENGTH 35MPa CLEAR COVER = 40mm ± 5mm TOLERANCE TO OPSS 1821 FOR BOX JOINT DETAIL, SEE DWG BXXXXX1-JOINT FOR MH JOINT, SEE DWG MX-JOINT





WALL B

RIGHT

STANDARD BOX 2438 LAY LENGTH WITH MANHOLE TEE (DRY CAST)

STORMCON
69 CONNIE CRESCENT
CONCORD, ON
L4K 1L3

SALES@STORMCON.CA
www.STORMCON.CA

THIS DRAWING WAS PREPARED TO SUPPORT THE PROJECT ENGINEER OF RECORD FOR THE PROPOSED SYSTEM. IT IS THE ULTIMATE RESPONSIBILITY OF THE PROJECT ENGINEER OF RECORD TO ENSURE THAT THE SYSTEM'S DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS. IT IS THE CONTRACTOR OF RECORD'S RESPONSIBILITY TO ENSURE THAT THE SYSTEM IS INSTALLED IN ACCORDANCE WITH STORMCON'S MINIMUM REQUIREMENTS. STORMCON DOES NOT APPROVE PLANS, SIZING, OR SYSTEM DESIGNS.

AGNES SUBDIVISION
AGNES ST., CALEDON, ON

DETAILS

STORMCRETE STORMWATER CHAMBER

PROJECT NO:	2023-033	DATE:	03/07/2023
DESIGNED BY:	JD	CHECKED BY:	EC
SCALE:	N.T.S.	SHEET NO:	6 OF 6

APPENDIX F

Engineering Drawings

QUEEN STREET WEST

EMELINE STREET

WILLIAM STREET

TINY STREET

KING STREET

AGNES STREET

STREET A

STREET A1

STREET B

DETAILS OF CONNECTION FOR PROP. SIDEWALK ON EMELINE STREET TO EX. SIDEWALK ON QUEEN STREET WILL BE DETERMINED AT DETAILED DESIGN STAGE.

PROP. 1.5m CONC. SIDEWALK

13.75m ROW

20.0m ROW

GRADING LIMIT (TYP.) (TO BE CONFIRMED WHEN TREE PROTECTION ZONE AND LANDSCAPE PLANS ARE AVAIABLE AT DETAILED DESIGN STAGE)

PROPERTY LINE

PR. RETAINING WALL

DETAILS OF CONNECTION FOR PROP. SIDEWALK ON AGNES STREET TO EX. SIDEWALK ON QUEEN STREET WILL BE DETERMINED AT DETAILED DESIGN STAGE.

THE COMPLETE GRADING DETAILS FOR URBANIZATION AREAS ALONG AGNES STREET TO BE PROVIDED AT THE DETAIL DESIGN STAGE WHEN THE UPDATED TOPOGRAPHIC SURVEY IS AVAILABLE.

EX. CURB (LOCATION TO BE VERIFIED AT DETAILED DESIGN STAGE)

PROP. 1.5m CONC. SIDEWALK

PROP. CURB

EX.MH3 T/G:415.09

EX.DICB1 (TO BE RELOCATED AS DICB6) T/G:414.66

CBMH14 T/G:415.69

DICBMH13 T/G:415.01

APPROX. PONDING AREA ELEV: 415.78

DICB6 T/G:415.26

CBMH15 T/G:415.72

DICB5 T/G:415.24

PROP. RIP-RAP (DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE)

EX. C/L OF DITCH

OPEN SPACE (279.45 sq.m.)

OPEN SPACE (140.28 sq.m.)

SNOW STORAGE

UNDERGROUND STORAGE (GREENSTORM-ST) WRAPPED IN IMPERMEABLE LAYER 412.8m³ FOOTPRINT, 48.0x8.6m, MINIMUM VOLUME PROVIDED 1046.2m³

UNDERGROUND STORAGE (CONCRETE CISTERN) 353.7m³ FOOTPRINT, 49.8x7.1m, MINIMUM VOLUME PROVIDED 747.7m³

APPROX. PONDING AREA ELEV: 413.50

MH28 T/G:413.63

MH5-OGS T/G:413.49

DCB1 T/G:413.35

DCBMH1 T/G:416.14

APPROX. PONDING AREA ELEV: 418.05

MH14-CONTROL T/G:416.50

MH4-CONTROL T/G:413.46

DCB2 T/G:413.35

MH3 T/G:413.63

MH2 T/G:413.83

MH27-OGS (TO REPLACE EX. DICB) T/G:408.88

MH1 T/G:409.70

CB1 T/G:410.98

DICB2 T/G:411.07

DICB1 T/G:414.20

DICB9 T/G:417.10

DICB4 T/G:416.31

MH12 T/G:418.80

MH11 T/G:418.51

MH10 T/G:417.97

MH9 T/G:418.31

MH8 T/G:417.95

CB15 T/G:418.26

MH17 T/G:418.08

CB14 T/G:418.26

MH24 T/G:418.36

MH25 T/G:418.51

MH16-OGS T/G:418.17

MH18 T/G:417.98

DCB7 T/G:417.90

MH7 T/G:417.94

MH20 T/G:417.97

MH15 T/G:417.93

DCB3 T/G:417.92

DCB5 T/G:416.13

DICB16 T/G:419.02

CB11 T/G:418.28

MH26 T/G:418.84

CB17 T/G:418.75

APPROX. PONDING AREA ELEV: 418.89

CBMH27 T/G:418.75

CB12 T/G:418.28

MH22 T/G:418.35

MH21 T/G:418.44

APPROX. PONDING AREA ELEV: 418.43

PR. GARBAGE AREA (TYP.)

UNDERGROUND STORAGE AND INFILTRATION GALLERY (GREENSTORM-ST) 20.0x18.4m, MINIMUM VOLUME PROVIDED 123.7m³

COMMON GREEN (1,077.87 sq.m.)

POTENTIAL PLAY STRUCTURE LOCATION

BLOCK 1 BLOCK 2 BLOCK 3 BLOCK 5 BLOCK 6 BLOCK 7 BLOCK 8 BLOCK 9a BLOCK 9b BLOCK 10 BLOCK 11 BLOCK 12 BLOCK 13 BLOCK 14

PROP. LANDSCAPE WITH 300mm TOPSOIL DEPTH (TYP.)

MIN. 0.15m DEEP SWALE (TYP.)

LIMIT OF SURVEY (TYP.)

CONTOURS CREATED FROM LIDAR INFORMATION (TYP.)

PROPOSED SEPTIC SYSTEM. SEE DRAWINGS PREPARED BY GUNNELL ENGINEERING FOR DETAILS (TYP.)

SUBJECT TO EASEMENT IN INSTRUMENT No. 22188 CALEDON

BLOCK 8, REGISTERED PLAN CAL-5

PART OF THE ROAD ALLOWANCE BETWEEN LOTS 12 AND 13 CONCESSION 1 (ALBION)

PART 3, 43R-19660

PART 1, 43R-11927

PART 1, 43R-12563

DEPOSITED PLAN 43R-12563

REGISTERED PLAN 43M-913

NOTE:
EXISTING GRADES ON AGNES ST. AND EMELINE ST. ARE APPROXIMATE AND TO BE CONFIRMED AT THE DETAILED DESIGN STAGE ONCE THE UPDATED TOPOGRAPHIC SURVEY IS AVAILABLE.

NOTE:
THE ENGINEER'S PROFESSIONAL SEAL APPLIES SOLELY TO THE GRADING DESIGN AS SHOWN ON THIS PLAN ALL OTHER DESIGN ELEMENTS AND DISCIPLINES ARE OUTSIDE THE ENGINEER'S SCOPE OF RESPONSABILITY.

NOTE:
URBANIZATION DETAILS FOR AGNES STREET AND EMELINE STREET WILL BE PROVIDED AT THE DETAILED DESIGN STAGE ONCE THE TOWN REVIEWS AND APPROVES THE TYPICAL ROAD CROSS SECTIONS PROVIDED IN THIS SUBMISSION.

NOTE:
THE SUMP PUMP C/W BACKFLOW PREVENTOR FOR EACH RESIDENTIAL UNIT IS TO DISCHARGE INTO THE STORM SEWER SYSTEM VIA THE STORM LATERAL PROPOSED FOR EACH BLOCK.

NOTE:
STORMWATER CHAMBERS SIZING AND CONFIGURATIONS TO BE CONFIRMED DURING DETAILED DESIGN.

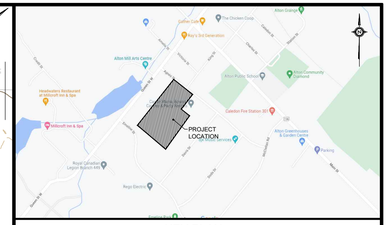
NOTES
1. ALL PR. CURB IS TO BE SEMI-MOUNTABLE CURBS AS PER OPSD 600.060, UNLESS NOTED OTHERWISE. TOP OF CURB TO BE 0.15m ABOVE SHOWN EDGE OF PAVEMENT ELEVATIONS
2. CONCRETE AND ASPHALT PAVEMENT STRUCTURES OVER SOIL SUB-GRADE TO BE AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER
3. ALL REQUIRED ASPHALT RESTORATION ON AGNES STREET TO BE AS PER TOWN STD.
4. ALL REQUIRED PAVEMENT MARKINGS RESTORATION ON AGNES STREET AS PER OTM BOOK 11.
5. THE MINIMUM COVER ON WATERMAINS SHALL NOT BE LESS THAN 1.8m.
6. THE MINIMUM COVER ON STORM SEWERS SHALL NOT BE LESS THAN 1.5m, OTHERWISE STORM SEWERS WILL BE INSULATED. THE INSULATION DETAILS WILL BE PROVIDED AT THE DETAILED DESIGN STAGE.

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES, INCLUDING THOSE NOT INCLUDED ON THIS DRAWING. GRECK AND ASSOCIATES LIMITED CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY, OR MAY NOT BE INDICATED ON THIS DRAWING.

DRAWING LIST
(GRECK AND ASSOCIATES LTD.)

01 SITE GRADING PLAN
02 SITE SERVICING PLAN
03 EROSION AND SEDIMENT CONTROL PLAN AND DETAILS
04 CROSS SECTIONS

SUBMISSION DRAWING
NOT TO BE USED FOR CONSTRUCTION



KEY PLAN
N.T.S.

LEGEND

EXISTING	PROPOSED	
MH	MH	STORM MANHOLE
CBMH	CBMH	STORM CATCHBASIN MANHOLE
CB	CB	SINGLE CATCHBASIN
DCB	DCB	DOUBLE CATCHBASIN
FD	FD	SINGLE FLOOR DRAIN
HYD	HYD	FIRE HYDRANT
VB	VB	VALVE & BOX
		LIMIT OF SUBJECT PROPERTY
		EASEMENT
		RIGHT OF WAY
		LOT LINE
		FENCE LINE
		CURB/SIDEWALK
		BUILDING
		RETAINING WALL
		MAJOR CONTOUR LABEL
		MINOR CONTOUR LABEL
		ASPHALT
		PAVING STONE
		1.5m WIDE CONCRETE SIDEWALK
×265.22EX	×265.22	ELEVATION
	×265.22SW	ELEVATION – SWALE
	×265.22LP	ELEVATION – LOW POINT
	×265.22HP	ELEVATION – HIGH POINT
		SWALE
		SEPTIC SYSTEM (BY OTHERS)
		OVERLAND FLOW
		TREE
		TREE – TO REMAIN

BENCHMARK

BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVGD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018

DEM SOURCE:
LIDAR DTM PEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

NO.	REVISION	DATE	BY	APPROVED
01	ISSUED FOR 1ST SUBMISSION	2023/03/20	K.M.	
02	ISSUED FOR 2ND SUBMISSION	2023/12/20	K.M.	
03	ISSUED FOR 3RD SUBMISSION	2024/10/08	K.M.	
04	ISSUED FOR COORDINATION	2024/11/12	K.M.	
05	RE-ISSUED FOR 3RD SUBMISSION	2025/12/23	K.M.	
06	ISSUED FOR 4TH SUBMISSION	2026/02/10	C.M.	

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

LICENSED PROFESSIONAL ENGINEER
K.MAHMOOD
100160233
Feb. 10, 2026
PROVINCE OF ONTARIO

CLIENT NAME:
THE ALTON DEVELOPMENT INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:
AGNES STREET SUBDIVISION
AGNES STREET CALEDON, ON

PRELIMINARY SITE GRADING PLAN

DESIGNED BY:	C.M.	SCALES:	
CHECKED BY:	K.M.	HORIZONTAL:	1:500
DRAWN BY:	C.M.	VERTICAL:	N/A
DATE:	MAR. 08, 2023	SHEET SIZE:	24"x36"

PROJECT No. 20-731
DRAWING No.
SHEET No. 01

D:\CloudStation\Projects\2020\20-731 - Agnes Street Subdivision, Alton\05_Drawings\CAD\GRADING\20-731_SGP.dwg

Date Plotted: Feb 9, 2026 - 10:06 PM

QUEEN STREET WEST

EMELINE STREET

WILLIAM STREET

TINY STREET

KING STREET

AGNES STREET

STREET A

STREET B

BLOCK 8, REGISTERED PLAN CALE-5

PART 1, 43R-11927

PART 2, 43R-11927

PART 3, 43R-11927

PART 4, 43R-5926

PART 5, 43R-19660

PART 11, 43R-19660

PLAN 43R-5926

PLAN 43R-12563

DEPOSITED PLAN 43R-12563

REGISTERED PLAN CALE-5

EX. 1350mm STM

EX. 300mm WM

EX. 300x250 REDUCER

EX. 750mm STM

EX. 300mm STM

EX. 250mm WM

EX. 600mm STM

EX. 150mm STM

EX. SIDEWALK

EX. 250mm WM

EX. CB4

EX. CB3

EX.CICB5

EX.MH1

EX.DICB2

EX.DICB1

EX.MH3

EX.MH2

EX.DICB4

EX.DICB3

EX.DICB5

EX.DICB6

EX.CICB4

EX.CICB3

EX.CICB2

EX.CICB1

EX.CICB6

EX.CICB7

EX.CICB8

EX.CICB9

EX.CICB10

EX.CICB11

EX.CICB12

EX.CICB13

EX.CICB14

EX.CICB15

EX.CICB16

EX.CICB17

EX.CICB18

DETAILS OF CONNECTION FOR PROP. SIDEWALK ON EMELINE STREET TO EX. SIDEWALK ON QUEEN STREET WILL BE DETERMINED AT DETAILED DESIGN STAGE.

PROP. 1.5m CONC. SIDEWALK

EX. 750mm STM

EX. 300mm STM

EX. 27.50m–750mm STM @ 0.72%

EX.MH3
RIM=415.09
INV=413.50SW
INV=413.51SE
INV=413.46NW
INV=413.59NE

EX. 825mm STM (TO BE REMOVED)

EX.DICB1
(TO BE RELOCATED AS DICB6)
RIM=414.66
INV=413.60SW

13.29m–300mm PVC STM @ 0.50%

FOR EXISTING INFORMATION REFER TO DRAWING No P-02 PROJECT No 11184780 (SEP. 9, 2020)

EX. 11.35m–375mm STM @ 1.52%

EX. 2.19m–375mm STM @ 2.15%

LOCATED EX. 150mm# WM AND CONNECT NEW 250mm# WM TO EXISTING 150mm# WM

250mm WM

EX. 150mm WM

19.02m–750mm PVC STM @ 0.50%

DICB6
RIM=415.26
INV=413.61NW

5.78m–300mm PVC STM @ 0.50%

3.42m–250mm PVC STM @ 0.50%

DICB5
RIM=415.24
INV=413.49NW

EX. C/L OF DITCH

OPEN SPACE (279.45 sq.m.)

OPEN SPACE (140.38 sq.m.)

SNOW STORAGE

CBMH14
RIM=415.69
INV=413.39SE
INV=413.34N

CBMH15
RIM=415.72
INV=413.47SE
INV=413.42NW

250mm WM

14.59m–450mm PVC STM @ 0.50%

10.87m–525mm PVC STM @ 0.50%

200mm WM

MH11
RIM=418.51
INV=414.03SE
INV=413.88N

MH25
RIM=418.51
INV=416.41SE
INV=416.26N

38.37m–300mm PVC STM @ 0.50%

MH24
RIM=418.36
INV=416.21S
INV=416.16NE

42.26m–250mm PVC STM @ 0.60%

DICB4
RIM=416.31
INV=414.56NE

MH12
RIM=418.80
INV=414.30SW
INV=414.22NW

DICBMH13
RIM=415.01
INV=413.28S
INV=413.20E

51.55m–300mm PVC STM @ 0.50%

MH9
RIM=418.31
C/W EXTERNAL DROP STRUCTURE
INV=413.81S
INV=412.94W
INV=412.71NE

CB15
RIM=418.26
INV=416.25SE

4.92m–250mm PVC STM @ 0.51%

84.05m–525mm PVC STM @ 0.50%

200mm WM

1.58m–250mm PVC STM @ 0.50%

69.13m–525mm PVC STM @ 0.50%

BLOCK 14

UNIT 62 UNIT 63 UNIT 64 UNIT 65

CB14
RIM=418.26
INV=416.24NW

9.40m–250mm PVC STM @ 0.50%

DICB16
RIM=419.02
INV=416.57SW

68.85m–375mm PVC STM @ 0.50%

MH26
RIM=418.84
INV=416.88NE
INV=416.83SE
INV=416.76NW

BLOCK 13

UNIT 61 UNIT 60 UNIT 59 UNIT 58 UNIT 57

PR. GARBAGE AREA (TYP.)

5.25m–250mm PVC STM @ 0.50%

CB17
RIM=418.75
INV=416.91SW

6.43m–300mm PVC STM @ 0.50%

CBMH27
RIM=418.75
INV=416.92S
INV=416.87NW

58.77m–250mm PVC STM @ 0.50%

DICB18
RIM=418.46
INV=417.21N

GRADING LIMIT (TYP.) (TO BE CONFIRMED WHEN TREE PROTECTION ZONE AND LANDSCAPE PLANS ARE AVAIABLE AT DETAILED DESIGN STAGE)

R75m HYDRANT COVERAGE (TYP.)

PR. RETAINING WALL

PROPERTY LINE

SUBJECT TO EASEMENT AS IN INSTRUMENT No. 221884 PART 2, 43R-10660

DICB3
RIM=414.44
INV=412.69SE

DCB3
RIM=416.16S
5.97m–300mm PVC STM @ 0.50%

MH7
RIM=417.94
INV=415.83SE
INV=416.13N
INV=415.83SW

MH8
RIM=417.95
INV=412.21SW
INV=412.12NE

6.33m–525mm PVC STM @ 0.50%

MH10
RIM=417.97
INV=412.29SW
INV=412.24NE

14.72m–750mm PVC STM @ 0.50%

MH17
RIM=418.08
INV=415.81SW
INV=415.59SE

1.79m–750mm PVC STM @ 0.50%

MH16–OGS
RIM=418.17
INV=415.58NW
INV=415.56SE

2.00m–750mm PVC STM @ 0.50%

INLET INV=415.55

MH18
RIM=417.98
INV=415.79NE
INV=415.71SW

9.41m–600mm PVC STM @ 0.50%

2.74m–250mm PVC STM @ 0.50%

DCB7
RIM=417.90
INV=416.16NW

OUTLET INV=415.55

4.50m–750mm PVC STM @ 2.00%

UNDERGROUND STORAGE AND INFILTRATION GALLERY (GREENSTORM–ST) 20.0x18.4m, MINIMUM VOLUME PROVIDED 123.7m³

71.87m–525mm PVC STM @ 0.50%

CB11
RIM=418.28
INV=416.72SE

MH22
RIM=418.35
INV=416.70NW
INV=416.80SE
INV=416.50NE

MH21
RIM=418.44
INV=416.37SW
INV=416.29NW

CB12
RIM=418.28
INV=416.81NW

3.32m–250mm PVC STM @ 0.50%

26.19m–450mm PVC STM @ 0.50%

UNDERGROUND STORAGE (GREENSTORM–ST) WRAPPED IN IMPERMEABLE LAYER 412.8m² FOOTPRINT, 48.0x8.6m, MINIMUM VOLUME PROVIDED 1046.2m³

CHAIN LINK FENCE

44.45m–250mm PVC STM @ 1.13%

200mm WM

117.69m–525mm PVC STM @ 2.10%

2.14m–300mm PVC STM @ 4.00%

DCBMH1
RIM=416.14
INV=411.76SE
INV=411.16NW

6.50m–300mm PVC STM @ 3.00%

DCB5
RIM=416.13
INV=411.96NW

49.63m–300mm PVC STM @ 0.50%

250mm WM

5.00m–450mm PVC STM @ 0.50%

MH28
RIM=413.63
INV=409.65SW
INV=409.58SE

4.85m–600mm PVC STM @ 0.50%

MH5–OGS
RIM=413.49
INV=409.62NE
INV=409.55NW
INV=409.32SW

4.49m–300mm PVC STM @ 4.00%

DCB1
RIM=413.35
INV=410.02NE

6.29m–750mm PVC STM @ 0.50%

200mm WM

DICB2
RIM=411.07
INV=410.05SE

64.55m–375mm PVC STM @ 7.35%

OUTLET INV=414.06

1.00m–750mm PVC STM @ 2.00%

INLET INV=414.06

OUTLET INV=409.29

INLET INV=409.29

200mm WM

DCB2
RIM=413.35
INV=409.19NE

6.29m–750mm PVC STM @ 0.50%

MH14–CONTROL
RIM=416.50
125mm⌀ ORIFICE
INV=414.04NW
INV=413.96NE

MH15
RIM=417.93
INV=415.46SW
INV=414.23NE

71.87m–525mm PVC STM @ 0.50%

UNDERGROUND STORAGE (CONCRETE CISTERN) 353.7m² FOOTPRINT, 49.8x7.1m, MINIMUM VOLUME PROVIDED 747.7m³

MH4–CONTROL
RIM=413.46
100mm⌀ ORIFICE
INV=409.26SW
INV=409.18SE

MH3
RIM=413.63
INV=409.16NW
INV=409.22SW
INV=408.72NE

9.49m–300mm PVC STM @ 2.17%

48.27m–300mm PVC STM @ 4.55%

44.85m–250mm PVC STM @ 0.50%

DICB9
RIM=417.10
INV=416.59SW

DICB1
RIM=414.20
INV=411.99NW

EX. 150mm WM

EX. 150mm WM (TO BE REMOVED)

4.24m–250mm PVC STM @ 4.00%

CB1
RIM=410.98
INV=408.83NE

300mm WM

LOCATED EX. 250mm# WM, REMOVE EX. 150mm# WM, REPLACE WITH NEW 300mm# PVC WM, CONNECT TO EXISTING 250mm# WM WITH NEW TEE

DETAILS OF CONNECTION FOR PROP. SIDEWALK ON AGNES STREET TO EX. SIDEWALK ON QUEEN STREET WILL BE DETERMINED AT DETAILED DESIGN STAGE

EX. DITCH INLET CATCHBASIN TO BE REMOVED AND REPLACED WITH NEW CATCHBASIN MANHOLE FOR EXISTING INFORMATION – REFER TO TOWN'S RECORD DRAWING No 7995–D UNDER PROJECT No 86–1010 (JULY 11, 1986)

EX. CURB (LOCATION TO BE VERIFIED AT DETAILED DESIGN STAGE)

PROP. 1.5m CONC. SIDEWALK

PROP. CURB

MH27–OGS (GRATE AS PER OPSD 403.010) (TO REPLACE EX. DICB) RIM=408.88 INV=408.55SW INV=408.12SE INV=408.10NW

6.63m–600mm PVC STM @ 0.30%

MH1
RIM=409.70
INV=408.20SE
INV=408.15NW

100.05m–600mm PVC STM @ 0.30%

CONNECT NEW 300mm# WM TO EXISTING 150mm# WM c/w 300 x150 REDUCER

PROP. CONTINUOUS SIDEWALK AT ENTRANCE PER OPSD 350.010

3.01m–300mm PVC STM @ 0.50%

MH2
RIM=413.83
INV=408.65SW
INV=408.50NW

14.70m–450mm PVC STM @ 0.50%

PROP. LANDSCAPE WITH 300mm TOPSOIL DEPTH (TYP.)

MIN. 0.15m DEEP SWALE (TYP.)

PROPOSED SEPTIC SYSTEM. SEE DRAWINGS PREPARED BY GUNNELL ENGINEERING FOR DETAILS (TYP.)

NOTE:
EXISTING GRADES ON AGNES ST. AND EMELINE ST. ARE APPROXIMATE AND TO BE CONFIRMED AT THE DETAILED DESIGN STAGE ONCE THE UPDATED TOPOGRAPHIC SURVEY IS AVAILABLE.

NOTE:
THE SUMP PUMP C/W BACKFLOW PREVENTOR FOR EACH RESIDENTIAL UNIT IS TO DISCHARGE INTO THE STORM SEWER SYSTEM VIA THE STORM LATERAL PROPOSED FOR EACH BLOCK.

NOTE:
STORMWATER CHAMBERS SIZING AND CONFIGURATIONS TO BE CONFIRMED DURING DETAILED DESIGN.

NOTE:
URBANIZATION DETAILS FOR AGNES STREET AND EMELINE STREET WILL BE PROVIDED AT THE DETAILED DESIGN STAGE ONCE THE TOWN REVIEWS AND APPROVES THE TYPICAL ROAD CROSS SECTIONS PROVIDED IN THIS SUBMISSION

NOTES
1. ALL PR. CURB IS TO BE SEMI–MOUNTABLE CURBS AS PER OPSD 600.060, UNLESS NOTED OTHERWISE. TOP OF CURB TO BE 0.15m ABOVE SHOWN EDGE OF PAVEMENT ELEVATIONS
2. CONCRETE AND ASPHALT PAVEMENT STRUCTURES OVER SOIL SUB–GRADE TO BE AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER
3. ALL REQUIRED ASPHALT RESTORATION ON AGNES STREET TO BE AS PER TOWN STD.
4. ALL REQUIRED PAVEMENT MARKINGS RESTORATION ON AGNES STREET AS PER OTM BOOK 11.
5. THE MINIMUM COVER ON WATERMAINS SHALL NOT BE LESS THAN 1.8m.
6. THE MINIMUM COVER ON STORM SEWERS SHALL NOT BE LESS THAN 1.5m, OTHERWISE STORM SEWERS WILL BE INSULATED. THE INSULATION DETAILS WILL BE PROVIDED AT THE DETAILED DESIGN STAGE.

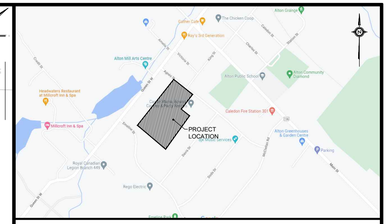
NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES, INCLUDING THOSE NOT INCLUDED ON THIS DRAWING. GRECK AND ASSOCIATES LIMITED CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY, OR MAY NOT BE INDICATED ON THIS DRAWING.

NOTE:
THE ENGINEER'S PROFESSIONAL SEAL APPLIES SOLELY TO THE SERVICING DESIGN AS SHOWN ON THIS PLAN ALL OTHER DESIGN ELEMENTS AND DISCIPLINES ARE OUTSIDE THE ENGINEER'S SCOPE OF RESPONSABILITY.

DRAWING LIST
(GRECK AND ASSOCIATES LTD.)

01 SITE GRADING PLAN
02 SITE SERVICING PLAN
03 EROSION AND SEDIMENT CONTROL PLAN AND DETAILS
04 CROSS SECTIONS

SUBMISSION DRAWING
NOT TO BE USED FOR CONSTRUCTION



KEY PLAN
N.T.S.

LEGEND

EXISTING	PROPOSED	
MH1	MH1	STORM MANHOLE
CBMH1	CBMH1	STORM CATCHBASIN MANHOLE
CB	CB	SINGLE CATCHBASIN
DCB	DCB	DOUBLE CATCHBASIN
FD	FD	SINGLE FLOOR DRAIN
HYD&V/B	HYD&V/B	FIRE HYDRANT
VB	VB	VALVE & BOX
		STORM SEWER
		STORM SEWER SYSTEM TO CONCRETE CISTERN AND OUTLET
		STORM SEWER SYSTEM TO GREENSTORM STORAGE
		WATERMAIN
		STORM SERVICE CONNECTION
		LIMIT OF SUBJECT PROPERTY
		EASEMENT
		RIGHT OF WAY
		LOT LINE
		FENCE LINE
		CURB/SIDEWALK
		BUILDING
		RETAINING WALL
		MAJOR CONTOUR LABEL
		MINOR CONTOUR LABEL
		ASPHALT
		PAVING STONE
		1.5m WIDE CONCRETE SIDEWALK
		SWALE
		SEPTIC SYSTEM (BY OTHERS)
		TREE
		TREE – TO REMAIN

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. CONTOUR INTERVAL IS 0.50m.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
4. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT TOWN OF CALEDON STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
5. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY TOWN OF CALEDON, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

BENCHMARK
BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS–2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.
COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018
DEM SOURCE:
LIDAR DTM PEEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

NO.	REVISION	DATE	BY	APPROVED
01	ISSUED FOR 1ST SUBMISSION	2023/03/20	K.M.	
02	ISSUED FOR 2ND SUBMISSION	2023/12/20	K.M.	
03	ISSUED FOR 3RD SUBMISSION	2024/10/08	K.M.	
04	ISSUED FOR COORDINATION	2024/11/12	K.M.	
05	RE–ISSUED FOR 3RD SUBMISSION	2025/12/23	K.M.	
06	ISSUED FOR 4TH SUBMISSION	2026/02/10	C.M.	

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

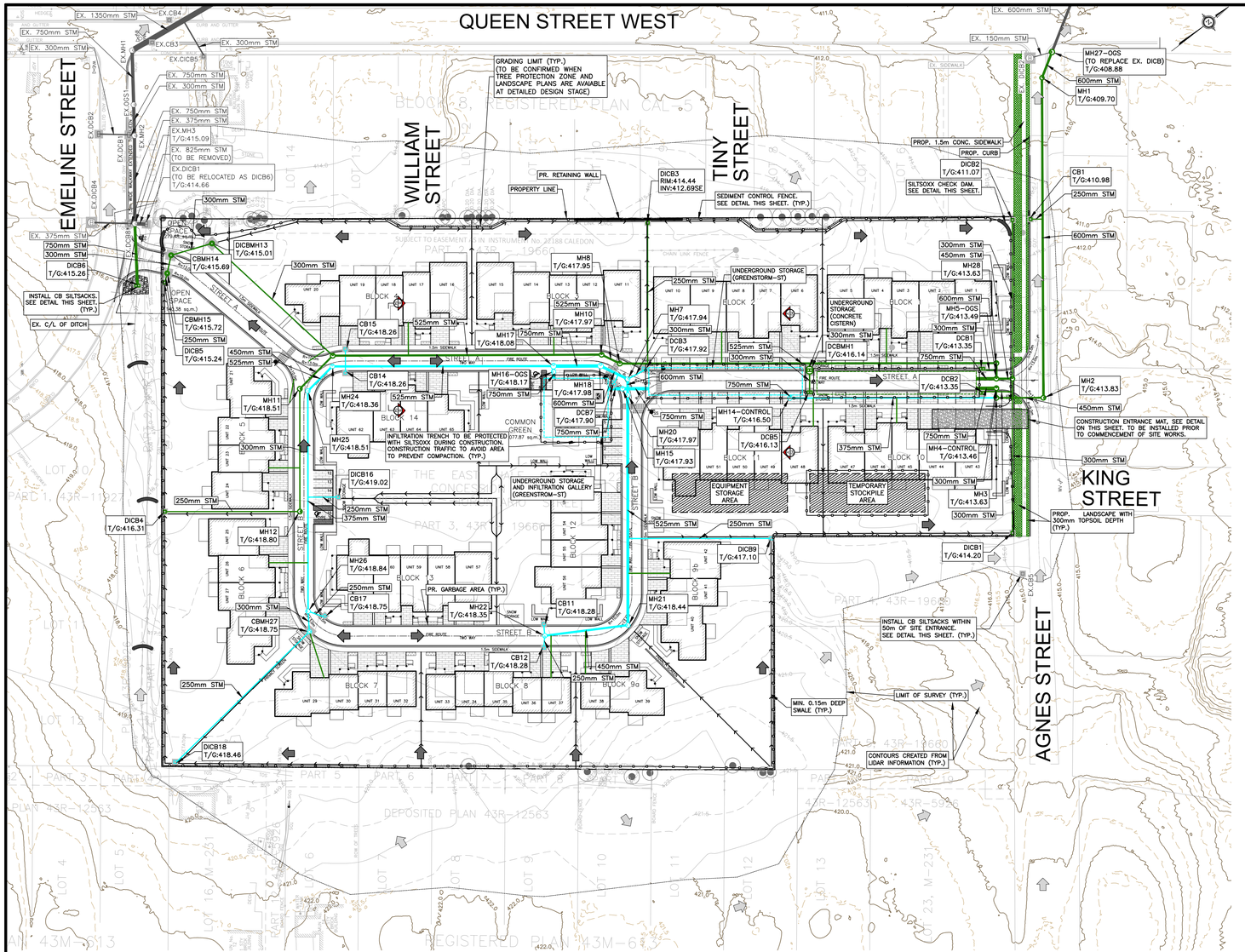
LICENSED PROFESSIONAL ENGINEER
K. MAHMOOD
100160233
Feb. 10, 2026
PROVINCE OF ONTARIO

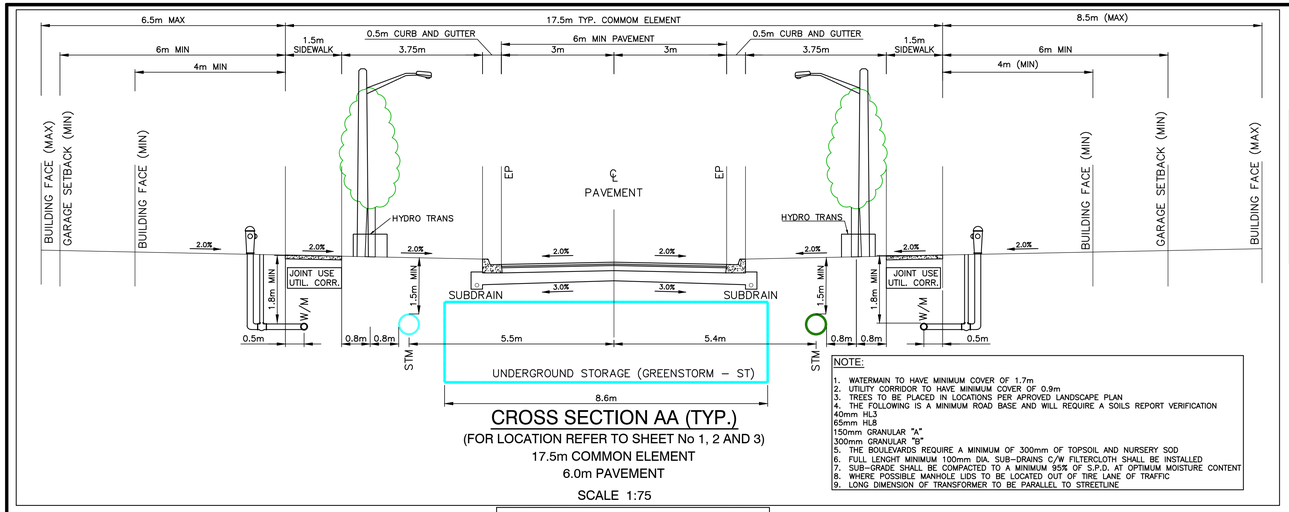
CLIENT NAME:
THE ALTON DEVELOPMENT INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:
AGNES STREET SUBDIVISION
AGNES STREET CALEDON, ON

PRELIMINARY SITE SERVICING PLAN

DESIGNED BY:	C.M.	SCALES:		PROJECT No.	20-731
CHECKED BY:	K.M.	HORIZONTAL:	1:500	DRAWING No.	
DRAWN BY:	C.M.	VERTICAL:	N/A	SHEET No.	02
DATE:	MAR. 08, 2023	SHEET SIZE:	24"x36"		


QUEEN STREET WEST
EMELINE STREET
WILLIAM STREET
TINY STREET
AGNES STREET
KING STREET
STREET A
STREET B
GRADING LIMIT (TYP.) (TO BE CONFIRMED WHEN TREE PROTECTION ZONE AND LANDSCAPE PLANS ARE AVAIABLE AT DETAILED DESIGN STAGE)
PROPERTY LINE
PR. RETAINING WALL
SEDIMENT CONTROL FENCE. SEE DETAIL THIS SHEET. (TYP.)
SILTSOXX CHECK DAM. SEE DETAIL THIS SHEET.
PROP. 1.5m CONC. SIDEWALK
PROP. CURB
INSTALL CB SILTSACKS. SEE DETAIL THIS SHEET. (TYP.)
EX. C/L OF DITCH
OPEN SPACE
COMMON GREEN
EQUIPMENT STORAGE AREA
TEMPORARY STOCKPILE AREA
UNDERGROUND STORAGE (GREENSTORM-ST)
UNDERGROUND STORAGE (CONCRETE CISTERN)
INFILTRATION TRENCH TO BE PROTECTED WITH SILTSOXX DURING CONSTRUCTION. CONSTRUCTION TRAFFIC TO AVOID AREA TO PREVENT COMPACTION. (TYP.)
UNDERGROUND STORAGE AND INFILTRATION GALLERY (GREENSTORM-ST)
PR. GARBAGE AREA (TYP.)
CONSTRUCTION ENTRANCE MAT, SEE DETAIL ON THIS SHEET. TO BE INSTALLED PRIOR TO COMMENCEMENT OF SITE WORKS.
PROP. LANDSCAPE WITH 300mm TOPSOIL DEPTH (TYP.)
INSTALL CB SILTSACKS WITHIN 50m OF SITE ENTRANCE. SEE DETAIL THIS SHEET. (TYP.)
MIN. 0.15m DEEP SWALE (TYP.)
LIMIT OF SURVEY (TYP.)
CONTOURS CREATED FROM LIDAR INFORMATION (TYP.)
MH27-OGS (TO REPLACE EX. DICB) T/G:408.88
MH1 T/G:409.70
CB1 T/G:410.98
MH28 T/G:413.63
MH5-OGS T/G:413.49
MH2 T/G:413.83
MH3 T/G:413.63
DICB1 T/G:414.20
DICB2 T/G:411.07
DICB3 RIM:414.44 INV:412.69SE
DICB4 T/G:416.31
DICB5 T/G:415.24
DICB6 T/G:415.26
DICB7 T/G:417.90
DICB8 T/G:413.35
DICB9 T/G:417.10
DICB16 T/G:419.02
DICB18 T/G:418.46
DCBMH1 T/G:416.14
MH1 T/G:418.51
MH2 T/G:418.36
MH3 T/G:418.26
MH4 T/G:417.95
MH5 T/G:417.97
MH6 T/G:417.94
MH7 T/G:417.92
MH8 T/G:417.98
MH9 T/G:417.97
MH10 T/G:417.97
MH11 T/G:418.51
MH12 T/G:418.80
MH13 T/G:415.01
MH14-CONTROL T/G:416.50
MH15 T/G:417.93
MH16-OGS T/G:418.17
MH17 T/G:418.08
MH18 T/G:417.98
MH20 T/G:417.97
MH21 T/G:418.44
MH22 T/G:418.35
MH24 T/G:418.36
MH25 T/G:418.51
MH26 T/G:418.84
MH4-CONTROL T/G:413.46
CB11 T/G:418.28
CB12 T/G:418.28
CB14 T/G:418.26
CB15 T/G:418.26
CB17 T/G:418.75
CBMH14 T/G:415.69
CBMH15 T/G:415.72
CBMH27 T/G:418.75
EX.MH1
EX.MH2
EX.MH3 T/G:415.09
EX.CB1
EX.CB2
EX.CB3
EX.CB4
EX.CB5
EX.DICB1 (TO BE RELOCATED AS DICB6) T/G:414.66
EX.DICB2
EX.DICB3
EX.DICB4
EX. 1350mm STM
EX. 750mm STM
EX. 300mm STM
EX. 375mm STM
EX. 825mm STM (TO BE REMOVED)
EX. 600mm STM
EX. 150mm STM
PART 3, 43R-1966
PART 4, 43R-12563
PART 5, 43R-12563
PART 6, 43R-12563
PART 7, 43R-12563
PART 8, 43R-12563
PART 9, 43R-12563
PART 10, 43R-12563
PART 11, 43R-12563
PART 12, 43R-12563
PART 13, 43R-12563
PART 14, 43R-12563
PART 15, 43R-12563
PART 16, 43R-12563
PART

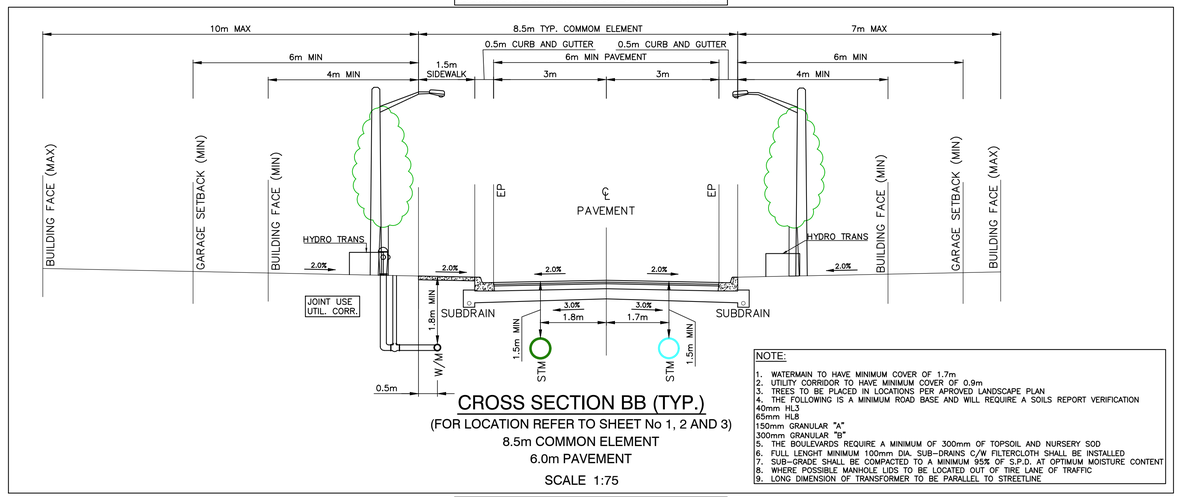


CROSS SECTION AA (TYP.)

(FOR LOCATION REFER TO SHEET No 1, 2 AND 3)
17.5m COMMON ELEMENT
6.0m PAVEMENT
SCALE 1:75

NOTE:
1. WATERMAIN TO HAVE MINIMUM COVER OF 1.7m
2. UTILITY CORRIDOR TO HAVE MINIMUM COVER OF 0.9m
3. TREES TO BE PLACED IN LOCATIONS PER APROVED LANDSCAPE PLAN
4. THE FOLLOWING IS A MINIMUM ROAD BASE AND WILL REQUIRE A SOILS REPORT VERIFICATION
40mm HL3
65mm HL8
150mm GRANULAR "A"
300mm GRANULAR "B"
5. THE BOULEVARDS REQUIRE A MINIMUM OF 300mm OF TOPSOIL AND NURSERY SOD
6. FULL LENGHT MINIMUM 100mm DIA. SUB-DRAINS C/W FILTERCLOTH SHALL BE INSTALLED
7. SUB-GRADE SHALL BE COMPACTED TO A MINIMUM 95% OF S.P.D. AT OPTIMUM MOISTURE CONTENT
8. WHERE POSSIBLE MANHOLE LIDS TO BE LOCATED OUT OF TIRE LANE OF TRAFFIC
9. LONG DIMENSION OF TRANSFORMER TO BE PARALLEL TO STREETLINE

MODIFIED PRIVATE ROAD CROSS SECTION
COMMON ELEMENT - CONDOMINIUM ROAD

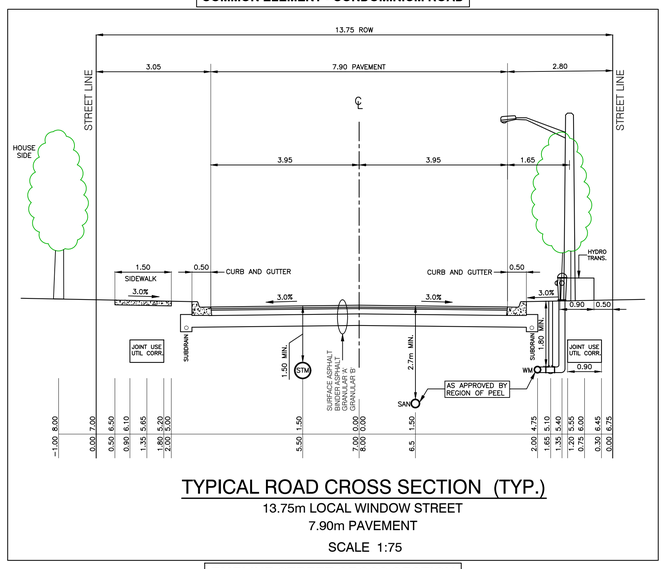


CROSS SECTION BB (TYP.)

(FOR LOCATION REFER TO SHEET No 1, 2 AND 3)
8.5m COMMON ELEMENT
6.0m PAVEMENT
SCALE 1:75

NOTE:
1. WATERMAIN TO HAVE MINIMUM COVER OF 1.7m
2. UTILITY CORRIDOR TO HAVE MINIMUM COVER OF 0.9m
3. TREES TO BE PLACED IN LOCATIONS PER APROVED LANDSCAPE PLAN
4. THE FOLLOWING IS A MINIMUM ROAD BASE AND WILL REQUIRE A SOILS REPORT VERIFICATION
40mm HL3
65mm HL8
150mm GRANULAR "A"
300mm GRANULAR "B"
5. THE BOULEVARDS REQUIRE A MINIMUM OF 300mm OF TOPSOIL AND NURSERY SOD
6. FULL LENGHT MINIMUM 100mm DIA. SUB-DRAINS C/W FILTERCLOTH SHALL BE INSTALLED
7. SUB-GRADE SHALL BE COMPACTED TO A MINIMUM 95% OF S.P.D. AT OPTIMUM MOISTURE CONTENT
8. WHERE POSSIBLE MANHOLE LIDS TO BE LOCATED OUT OF TIRE LANE OF TRAFFIC
9. LONG DIMENSION OF TRANSFORMER TO BE PARALLEL TO STREETLINE

MODIFIED PRIVATE ROAD CROSS SECTION
COMMON ELEMENT - CONDOMINIUM ROAD



TYPICAL ROAD CROSS SECTION (TYP.)

13.75m LOCAL WINDOW STREET
7.90m PAVEMENT
SCALE 1:75

EMELINE STREET CROSS SECTION
(QUEEN STREET TO DEVELOPMENT NORTH LIMIT)

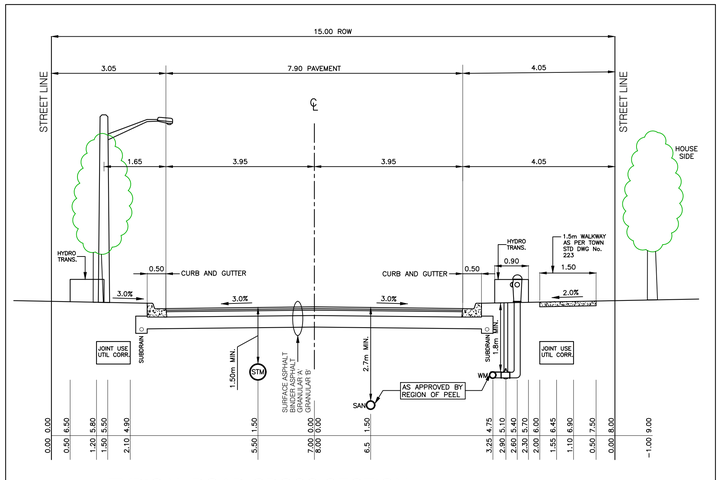
SUBMISSION DRAWING

NOT TO BE USED FOR CONSTRUCTION

DRAWING LIST
(GRECK AND ASSOCIATES LTD.)

01 SITE GRADING PLAN
02 SITE SERVICING PLAN
03 EROSION AND SEDIMENT CONTROL PLAN AND DETAILS
04 CROSS SECTIONS

NOTE:
THE CONTRACTOR IS CAUTIONED THAT ALL EXISTING UTILITIES ARE NOT INDICATED ON THIS DRAWING. THE CONTRACTOR MUST ARRANGE FOR LOCATES FROM EACH UTILITY COMPANY PRIOR TO ANY CONSTRUCTION OR EXCAVATION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES, INCLUDING THOSE NOT INCLUDED ON THIS DRAWING. GRECK AND ASSOCIATES LIMITED CAN NOT ACCEPT RESPONSIBILITY FOR DAMAGE TO ANY EXISTING UTILITY WHICH MAY, OR MAY NOT BE INDICATED ON THIS DRAWING.

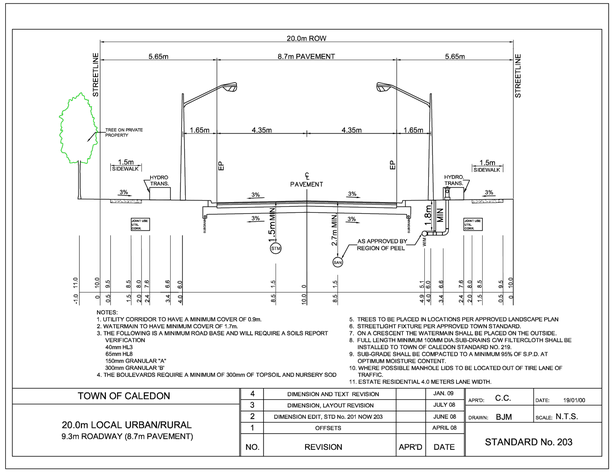


TYPICAL ROAD CROSS SECTION

15m LOCAL WINDOW STREET
7.90m PAVEMENT
SCALE 1:75

NOTE:
THIS CROSS SECTION IS BASED ON A STANDARD CROSS SECTION PROVIDED BY THE TOWN THAT INCLUDES A SANITARY SEWER. IN THIS PROJECT THERE IS NO SANITARY SEWER BENEATH AGNES STREET. THE LOCATION OF THE WATERMAIN IS TO BE CONFIRMED AT THE DETAILED DESIGN STAGE.

AGNES STREET CROSS SECTION
(QUEEN STREET WEST TO KING STREET)

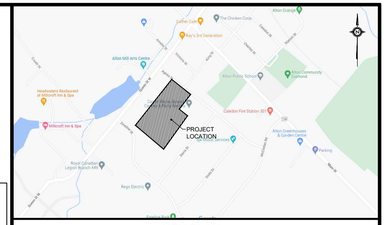


NOTES:
1. UTILITY CORRIDOR TO HAVE A MINIMUM COVER OF 0.9m.
2. WATERMAIN TO HAVE MINIMUM COVER OF 1.7m.
3. THE FOLLOWING IS A MINIMUM ROAD BASE AND WILL REQUIRE A SOILS REPORT VERIFICATION
   40mm HL3
   65mm HL8
   150mm GRANULAR "A"
   300mm GRANULAR "B"
4. THE BOULEVARDS REQUIRE A MINIMUM OF 300mm OF TOPSOIL AND NURSERY SOD
5. TREES TO BE PLACED IN LOCATIONS PER APPROVED LANDSCAPE PLAN
6. STREETLIGHT FIXTURE PER APPROVED TOWN STANDARD.
7. ON A CRESCENT THE WATERMAIN SHALL BE PLACED ON THE OUTSIDE.
8. FULL LENGTH MINIMUM 100MM DIA.SUB-DRAINS C/W FILTERCLOTH SHALL BE INSTALLED TO TOWN OF CALEDON STANDARD NO. 219.
9. SUB-GRADE SHALL BE COMPACTED TO A MINIMUM 95% OF S.P.D. AT OPTIMUM MOISTURE CONTENT.
10. WHERE POSSIBLE MANHOLE LIDS TO BE LOCATED OUT OF TIRE LANE OF TRAFFIC.
11. ESTATE RESIDENTIAL 4.0 METERS LANE WIDTH.

TOWN OF CALEDON	NO.	REVISION	APR'D	DATE
20.0m LOCAL URBAN/RURAL 9.3m ROADWAY (8.7m PAVEMENT)	4	DIMENSION AND TEXT REVISION		JAN. 09
	3	DIMENSION, LAYOUT REVISION		JULY 08
	2	DIMENSION EDIT, STD No. 201 NOW 203		JUNE 08
	1	OFFSETS		APRIL 08
		STANDARD No. 203		

APR'D: C.C. DATE: 19/01/00
DRAWN: BJM SCALE: N.T.S.

EMELINE STREET CROSS SECTION
(DEVELOPMENT NORTH LIMIT TO DAVIS DRIVE)



KEY PLAN
N.T.S.

BENCHMARK

BENCHMARK No. N/A
ELEVATION = N/A
DESCRIPTION:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATION ON THE CVD028 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTV2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

COMPLETED BY:
VAN HARTEN SURVEYING INC.
COMPLETED ON:
MAY 10, 2018

DEM SOURCE:
LIDAR DTM PEEL 2016 PACKAGE B AVAILABLE FROM LAND INFORMATION ONTARIO

NO.	REVISION	DATE	BY	APPROVED
01	ISSUED FOR 1ST SUBMISSION	2023/03/20	K.M.	
02	ISSUED FOR 2ND SUBMISSION	2023/12/20	K.M.	
03	ISSUED FOR 3RD SUBMISSION	2024/10/08	K.M.	
04	ISSUED FOR COORDINATION	2024/11/12	K.M.	
05	RE-ISSUED FOR 3RD SUBMISSION	2025/12/23	K.M.	
06	ISSUED FOR 4TH SUBMISSION	2026/02/10	C.M.	

Greck
5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck.ca

LICENSED PROFESSIONAL ENGINEER
K. MAHMOOD
100160239
Feb. 10, 2026
PROVINCE OF ONTARIO

CLIENT NAME:
THE ALTON DEVELOPMENT INC.
1402 QUEEN STREET
ALTON, ON
L7K 0C3

PROJECT NAME:
AGNES STREET SUBDIVISION
AGNES STREET CALEDON, ON

PRELIMINARY
CROSS SECTIONS

DESIGNED BY: C.M.	SCALES:	PROJECT No.	20-731
CHECKED BY: K.M.	HORIZONTAL: AS NOTED	DRAWING No.	
DRAWN BY: C.M.	VERTICAL: N/A	SHEET No.	04
DATE: MAR. 08, 2023	SHEET SIZE: 24"x36"		