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SERVICING AND STORMWATER MANAGEMENT REPORT

841 GRENON AVENUE
OTTAWA, ONTARIO

Prepared For:
Building Investment Inc.
205 - 1320 Carling Avenue
Ottawa Ontario
K1Z 7K8

PROJECT #: 180966

DISTRIBUTION
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1 INTRODUCTION

Kollaard Associates was retained by Building Investments Inc. to complete a Site Servicing and Stormwater Management Report for a new residential development in the City of Ottawa, Ontario.

This report will address the serviceability of the proposed site, specifically relating to the adequacy of the existing municipal storm sewer, sanitary sewer, and watermains to hydraulically convey the necessary storm runoff, sanitary sewage and water demands that will be placed on the existing system as a result of the proposed development located at 841 Grenon Avenue, Ottawa, Ontario. The report shall summarize the stormwater management (SWM) design requirements and proposed works that will address stormwater flows arising from the site under post-development conditions. The report and will identify and address any stormwater servicing concerns and also describe any measures to be taken during construction to minimize erosion and sedimentation.

The development being proposed by Building Investments Inc. is located on the east side of Grenon Avenue between Michele Drive and Carling Avenue within the City of Ottawa.

The site has a total area of 0.142 hectares divided between the properties currently known as 855(A), 845 and 841 Grenon Avenue. The property known as 841 Grenon Avenue is currently occupied by an existing single family residential dwelling. It is understood that the owner of the subject site intends to demolish the existing building and legally combine the three properties into one. The proposed development is to consist of a residential apartment building with 4 storeys having a total of 33 residential units and a one level of underground parking.

2 STORMWATER DESIGN

2.1 Stormwater Management Design Criteria

Design of the storm sewer system was completed in conformance with the City of Ottawa Design Guidelines. (October 2012). Section 5 "Storm and Combined Sewer Design".

The storm sewer in Grenon Avenue has been designed to accommodate the demand from a 2 year storm event under free flow conditions. In accordance with the SWM design criteria provided by the City, 100 year post development flow from the proposed development to Grenon Avenue will be restricted to 2 year pre-development flow from the site assuming the lesser of the actual pre-development runoff coefficient or a pre-development runoff coefficient of C = 0.5.

A time of concentration is to be calculated and to be no less than 10 minutes. Alternatively a pre-development time of concentration of 20 minutes could be used without calculation or engineered justification.

2.1.1 Minor System Design Criteria

The storm sewers have been designed and sized based on the rational formula and the Manning's Equation under free flow conditions for the 5-year storm using a 10-minute inlet time.

2.1.2 Major System Design Criteria

The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the runoff generated onsite during a 100-year design storm to 2 year pre-development conditions.

On site storage is provided and calculated for up to the 100-year design storm. Calculations of the required storage volumes have been prepared based on the Modified Rational Method as identified in Section 8.3.10.3 of the City's Sewer Guidelines and have been provided in Appendix A.

The proposed ramp to the underground parking is to slope upward onto the site in order to form a high point in the ramp that is at least 0.3 metres above the spill elevation on Grenon Avenue. This is to protect the underground parking garage from flooding during a Major System on Grenon Avenue.

2.1.3 Quality Control

Quality control for the Site is expected to be provided by conveyance in the City of Ottawa's stormwater system. Best management practices will be incorporated at the site to reduce potential suspended solid contamination. Snow and Ice control management practices will be incorporated to reduce contamination from winter snow and ice removal.

2.2 Stormwater Quantity Control

Peak Flow for runoff quantities for the Pre-Development and Post-Development stages of the project were calculated using the rational method. The rational method is a common and straightforward calculation, which assumes that the entire drainage area is subject to uniformly distributed rainfall. The formula is:

$$Q = \frac{CiA}{360}$$

Where
Q is the Peak runoff measured in ***m^3/s***
C is the Runoff Coefficient, **Dimensionless**
A is the runoff area in ***hectares***
i is the storm intensity measure in ***mm/hr***

All values for intensity, i, for this project were derived from IDF curves provided by the City of Ottawa for data collected at the Ottawa International airport. For this project three return periods were considered, 2, 5 and 100-year events. The formulas for each are:

2-Year Event

$$i = \frac{732.951}{(t_c + 6.199)^{0.810}}$$

5-Year Event

$$i = \frac{998.071}{(t_c + 6.053)^{0.814}}$$

100-Year Event

$$i = \frac{1735.071}{(t_c + 6.014)^{0.82}}$$

where t_c is time of concentration

For a 10 minute time of concentration the above formula provide the following intensities: 2-year = 76.81; 5-year = 104.19; 100 year = 178.56.

2.2.1 Runoff Coefficients

Runoff coefficients for impervious surfaces (roofs, asphalt, and concrete) were taken as 0.90, permeable paver areas were taken as 0.25 and pervious surfaces (grass) were taken as 0.25.

A 25% increase for the post development 100-year runoff coefficients was used as per City of Ottawa guidelines. Refer to Appendix A for pre-development and post development runoff coefficients.

2.2.2 Time of Concentration

The time of concentration for pre-development was calculated using the FAA method or Airport Formula to be 7.13 minutes.

$$t_c = \frac{3.26\ x\ (1.1 - C)\ x\ {l_c}^{0.5}}{S^{0.33}}$$

Where: t_c = time of concentration
C = Runoff coefficient = 0.34
l_c = length of flow path = 29.8
S = slope of flow path = 6.9

t_c = 7.13 minutes.

The minimum time of concentration to be used in accordance with the City of Ottawa Guidelines is 10 minutes. Therefore, a pre-development time of concentration of 10 minutes was used.

2.2.3 Pre-development Site Conditions

As previously indicated, the site is located along the east side of Grenon Avenue within the City of Ottawa. The site has a total area of about 1421 square metres and is partially developed. The site is currently occupied by a single family residential dwelling with a footprint of about 88 square metres and a gravel surface driveway with a surface area of about 100 square metres. The site is within a residential area with a rowhouse development immediately south of the proposed site. The area immediately north and east of the site is zoned as open space and Community Leisure and is currently occupied by a walking path and park area.

There is a decrease in ground surface elevation from south to north across the site of about 2.1 metres. As indicated on drawing 180966-PRE, runoff from about 545 square metres of the site

is directed by sheet flow to the park area and from about 876 square metres of the site is directed to Grenon Avenue.

2.2.3.1 Pre-development Runoff Coefficients

The predevelopment runoff coefficient for the site was calculated using weighted average based on the existing ground surface conditions as follows:

$$C = \frac{\left(A_{imp}\ x\ 0.9 + A_{gravel} x\ 0.7 + A_{soft}\ x\ 0.25\right)}{A_{total}}$$

$$C = \frac{(0.0088\ x\ 0.9 + 0.01 x\ 0.7 + 0.133\ x\ 0.25)}{0.1421} = 0.34$$

Based on the existing ground cover the pre-development runoff coefficient was calculated to be 0.34.

The predevelopment runoff coefficient for the portion of the site directing runoff to the park was taken as C = 0.25 as there were no impervious or gravel surfaces within the area.

2.2.3.2 Pre-development Runoff Rate

Using the City of Ottawa IDF curve for a 2-year storm event, the storm intensity at a 10 minute time of concentration is 76.81 mm/hr. Using the Rational Method with a time of concentration of 10 minutes, and the previously calculated runoff coefficient, the pre-development runoff rate for the 2-year design storm for the site is:

2 year = 0.34 x 76.81 x 0.1421 / 360 = 10.3 L/s

The pre-development runoff rate during a 2 year storm event for the portion of the site outletting to the open space / park lands was calculated as follows:

2 year = 0.25 x 76.81 x 0.0545 / 360 = 2.9 L/s

The pre-development runoff rate during the 5 year and 100 year storm events for the portion of the site outletting to the open space / park lands were calculated as follows:

5 year = 0.25 x 104.19 x 0.0545 / 360 = 3.9 L/s
100 year = 0.31 x 178.56 x 0.0545 / 360 = 8.4 L/s

2.2.4 Controlled and Uncontrolled Areas

For the purposes of this storm water management design, the site has been divided into uncontrolled and controlled areas as outlined on drawing 180966-POST. The controlled areas are defined as area CA1 and CA2 and uncontrolled areas are defined as UA1 and UA2. CA1 consists of the upper roof area. CA2 consists of the area above the basement / below grade parking area between the building and the south property line. UA1 consists of the area along the north and east sides of the site which directs runoff to the parkland. UA2 consists of the visitor parking area and ground surface between the building and front of the lot.

Run-off from the upper roof will be restricted by means of WATTS Small Area Roof Drains with Adjustable Flow Control which will outlet to a proposed storm sewer. Runoff from the ground surface above the parking area between the building and the south property line will be captured by trench drains and directed to a shallow storage tank located on top of the parking structure roof slab. The discharge from the storage tank will be controlled by means of a Hydrovex Flow Regulator. Runoff from the uncontrolled area between the building Grenon Avenue will be directed by means of sheet flow to the street. Runoff from the uncontrolled area along the east and north sides of the site will consist of uncontrolled sheet flow. Post-development site conditions are summarized in the following Table 2.1.

The post-development runoff conditions are dependent on the following requirements:

- The ramp to the parking garage will be surfaced with either asphaltic concrete pavement or portland cement concrete pavement.
- The walkways along the side of the building will be surfaced with permeable pavers placed on a permeable pavement structure.
- The amenity area will consist of a mixture of up to a maximum of 35 percent impervious surfaces.
- The visitor parking area will be provided with a permeable pavement surface placed on a permeable pavement structure.

Table 2.1 - Post Development Site Conditions

Total Site Area 0.1421 hectares					
Event Frequency		2,5 Year Return Period		100 year Return Period	
Surface Covering	Area of surface ha	Runoff Coef. C	C avg.	Runoff Coef. C	C avg.
Controlled Area CA1 – 0.0649 hectares					
Roof	0.0649	0.9	0.9	1.0	1.0
Controlled Area CA2 – 0.0312 hectares					
Landscape	0.0	0.9	0.39	1.0	0.49
Building Walkway	0.0049	0.25		0.31	
Building Amenity	0.0170	0.50		0.63	
Building Landscape	0.0093	0.25		0.31	
Uncontrolled Area UA1 – 0.0166 hectares					
Landscape	0.0057	0.25	0.31	1.0	0.39
Building Walkway	0.0	0.25		0.31	
Building Amenity	0.0040	0.50		0.63	
Building Landscape	0.0069	0.25		0.31	
Uncontrolled Area UA2 – 0.0294 hectares					
Asphalt/Roof	0.0028	0.9	0.31	1.0	0.38
Landscape	0.0083	0.25		0.31	
Building Walkway	0.0037	0.25		0.31	
Building Parking	0.0111	0.25		0.31	
Building Landscape	0.0035	0.25		0.31	

2.2.5 Uncontrolled Area Runoff

The runoff from the uncontrolled areas was determined using the rational method for a time of concentration of 10 minutes using the above calculated runoff coefficients.

The uncontrolled runoff from UA1 directed to the Park Land / Open space is:

2 year = 0.31 x 76.81 x 0.0166 / 360 = 1.1 L/s
5 year = 0.31 x 104.19 x 0.0166 / 360 = 1.5 L/s
100 year = 0.39 x 178.56 x 0.0166 / 360 = 3.2 L/s

The uncontrolled runoff from UA2 directed to Grenon Avenue is:

5 year = 0.31 x 104.19 x 0.0294 / 360 = 2.6 L/s
100 year = 0.38 x 178.56 x 0.0294 / 360 = 5.5 L/s

2.2.6 Allowable Release Rate to Grenon Avenue

As previously indicated, the City of Ottawa has indicated that the storm sewer along Grenon Avenue has been designed to have capacity for a 2 year storm event. As such, the stormwater management criteria requires that the maximum runoff rate from the site directed towards Grenon Avenue during a 100 year storm is to be restricted to that of the 2 year pre-development storm conditions.

The total allowable runoff rate to be directed to Grenon Avenue from the site was determined to be 10.3 L/s based on the 2 year pre-development runoff rate.

Storm water runoff from the controlled areas CA1 and CA2 as well as the uncontrolled area UA2 is directed to Grenon Avenue. The combined allowable release rate from the controlled areas CA1 and CA2 is equal to the total allowable runoff rate less the runoff rate from the uncontrolled area UA2.

$$Q_{controlled} = Q_{total\ allowable} - Q_{uncontrolled}$$

For the 5-year Storm event
$Q_{controlled}$ = 10.3 – 2.6 = 7.7 L/s

For the 100-year Storm event
$Q_{controlled}$ = 10.3 – 5.5 = 4.8 L/s

Since the allowable release rate during the 100-year storm is more restrictive than the allowable release rate during the 5-year storm event, the allowable release rate for the 100 year storm event is the governing criteria.

2.2.7 Runoff to Park Land / Open Space

The total combined uncontrolled runoff rate from the site is equal to 8.7 L/s during a 100-year storm event. Subtracting this rate from the total allowable runoff rate from the site would leave an allowable release rate from all of the controlled area of only 1.6 L/s. This level of control is not realistically feasible. This storm water management design is predicated on the presented design criteria which limits runoff to Grenon Avenue.

Runoff from the uncontrolled area UA1 will be allowed to flow in accordance with the existing pre-development drainage patterns to the adjacent Park Land / Open Space with the following justification.

The pre-development runoff rate directed to the park land / open space as calculated above is 2.9 L/s, 3.9 L/s and 8.4 L/s during the 2-year, 5-year and 100-year storm events respectively.

The uncontrolled flow rate directed to the park land / open space as calculated above is 1.5 L/s and 3.2 L/s during the 5-year and 100 year storm events respectively.

The post-development runoff rates directed to the park have been compared to the runoff rates directed to the park during pre-development conditions in the following Table 2.2

Table 2.2 Comparison of Flows to the Park Land / Open Space

Storm Event	Runoff During Pre-Development Conditions	Runoff During Post-Development Conditions	Difference in Runoff Rate	Percent Decrease in Runoff Rate
2 – year	2.9 L/s	1.1 L/s	-1.8 L/s	62 %
5 – year	3.9 L/s	1.5 L/s	-2.4 L/s	62 %
100 – year	8.4 L/s	3.2 L/s	-5.2 L/s	62 %

From the above table, the proposed development will result in a reduction in flow to the park of 62 percent for all storm events. The 5 year post-development flow rate to the park will be less than the 2 year pre-development rate and the 100 year post-development flow rate to the park will be less than the 5-year pre-development rate.

2.2.8 Post Development Restricted Flow and Storage

In order to meet the stormwater quantity control restriction, the post development runoff rate cannot exceed the 2 year predevelopment runoff rate. Runoff generated on site in excess of the allowable release rate will be temporarily stored on the upper roof (catchment CA1) and within undersurface storage tanks placed on top of the parking area (catchment CA2). The stored water will be released at a controlled rate during and following the storm event.

2.2.8.1 Catchment CA1 - Roof

In order to achieve the allowable controlled area storm water release rate, storm water runoff from the roof will be controlled by six roof drains fitted with flow control. The drains will discharge to an uncontrolled stormwater lead which in turn will discharge to the storm service on the west side of the building. The roof drains will consist of WATTS Small Area Roof Drain

with Adjustable Flow Control. RD-200-A-ADJ – set with a closed Weir opening exposure. The closed Weir opening setting on the drain allows the drain to discharge a constant rate of 5 US gallons per minute or about 0.3 L/s over a change in head on the weir between 1 and 6 inches (25 to 152 mm). During both the 5 year and 100 year storm events, the roof drains will release at a combined discharge rate of 1.9 L/s Design information for the Roof Drain is provided in Appendix B.

2.2.8.2 Catchment CA2 – South Side of Building Above the Basement / Below Grade Parking

The stormwater runoff originating from the south side of the building above the basement / below grade parking roof deck will be directed to storage tanks placed on the parking roof deck along the south side of the site. The runoff from the proposed amenity area will be directed by sheet flow to a trench drain located along the walkway adjacent the building. The trench drain will outlet to the storage tanks. The ground surface along the walkway will be landscaped with permeable pavers set on a permeable structure above the tanks. Rainfall and runoff will simply infiltrate through the pavers and underlying stone and will be collected by a perforated pipe which will direct the runoff to the tanks. The tanks will discharge by means of a 200 mm diameter storm sewer to a maintenance hole placed on the parking deck adjacent the tank. This storm sewer will have an invert elevation at the tanks of 73.15 metres. Release from the tanks to the maintenance hole will be controlled by a Hydrovex Flow Regulator Model 75 SVHV-1. A second storm pipe will be connected between the tanks and the maintenance hole with an invert elevation at the tanks of 73.45 metres. The second pipe will be connected without flow restriction and is intended to provide an overflow outlet in case the ICD is compromised, limiting the storage depth within the tanks to 0.3 metres. Discharge from the maintenance hole will be by means of a WATTS Small Area Roof Drain RD-200. The Roof Drain will discharge through the roof deck into a storm service pipe which in turn will discharge to the storm service north of the building.

The Hydrovex Flow Regulator can be order using the following specification:

Model	75-SVHV-1
Pipe Outlet	200 mm PVC SDR 35
Discharge	2 L/s
Upstream Head	0.4 m
Maintenance Hole Diameter	1.2 metres
Minimum Clearance	0.15 m

The above outlet restrictions from the roof and parking roof deck storage tanks result in the storage requirements as summarized the following Table 2.1.

Table 2.3 – Summary of Post-Development Release rates and Storage Requirements.

Return period	Allowable Release Rate	Actual Release rate	Required Storage	Available Storage	Required Storage Depth	Available Storage Depth
(years)	(L/s)	(L/s)	(m^3)	(m^3)	(m)	(m)
Catchment Area CA1 – Upper Roof						
5	--	1.9	12.7	32.45	0.1	0.15
100	--	1.9	29.8	32.45	0.14	0.15
Catchment Area CA2 – Underground Storage Tanks						
5	--	0.9	1.9	7.6	0.08	0.3
100	--	1.9	3.7	7.6	0.14	0.3
Combined						
5	7.7	2.8	--	--	--	--
100	4.8	3.8	--	--	--	--

2.2.9 Roof Top Storage

Roof Top Storage will be provided on the upper roof of the proposed building. The roof will be provided with a low slope towards the roof top drains by means of a Tapered Roofing System Product. The minimum slope on the roof will be 1 percent and will be as much as 2 percent. The roof will be fitted with overflow scuppers 0.15 metres above the lowest point on the roof.

It is assumed that about 60 percent of the roof surface will be used for stormwater storage. This will result in a ponding depth of about 0.14 metres on the roof deck.

Outlet will be controlled by the roof drains which will discharge to a storm water lead. The maximum flow through the storm water lead during a 100 year event will be 1.9 L/s. A 135 mm diameter storm sewer at a 1 percent slope has a capacity of 11.51 L/s. A storm sewer lead with a minimum diameter of 135 mm is recommended and will have sufficient capacity for the roof discharge. The storm sewer lead will be installed near vertical or with a slope exceeding 1 percent within the building.

2.2.10 Parking Deck Storage Tanks

The parking deck storage will be provided using Brentwood StormTank Modular Tanks. A Brentwood StormTank Module is a subsurface storage unit load-rated for use under surfaces such as parking lots, athletic fields, and parks as well as landscaped areas. Design information for the Brentwood StormTanks is provided in Appendix B.

The underground tanks proposed for the site are comprised of ST-18 Modular Units. Each unit has a height of 0.457 m, a width of 0.457 m and a length of 0.914 m. The modules will be placed adjacent along the south side of the site above the parking deck. The tanks will be placed with a bottom of tank elevation of 73.15 metres. The tanks will be wrapped in an impervious geotextile fabric to reduce the infiltration into the foundation drainage layer and weeping tile.

2.3 Protection of Underground Parking From Major System Flooding

The existing road surface has a continuous downward slope for a minimum distance of 10 metres past the parking garage ramp entrance. The elevation at this distance is about 72.05 metres which is about 0.4 metres lower than the grade at the entrance to the parking ramp. The proposed parking ramp will slope upward to the high point in the ramp at an elevation of 72.82 metres or 0.4 metres above the entrance elevation. This maintains a minimum clearance of 0.3 metre with a flow depth of 0.1 metres along Grenon Avenue.

2.4 Stormwater Quality Control

Given the distance from the site to the existing storm sewer outlet it is expected that quality control will be provided within storm sewer conveyance system.
The following Best Management Practices are incorporated into the design.

- The additional runoff generated on the site during post development conditions originates on the roof of the building, on the entrance way to the below grade parking area and on the exterior parking area.
- The runoff from the building roof is typically not considered to be a source of significant contamination and will be released to the storm sewer without treatment.
- The runoff from surface area of the below grade parking area driveway is limited to a short section not covered by the building. The remainder of the driveway is covered and not subject to precipitation.
- The proposed exterior parking area and walkway areas will be constructed with permeable pavers. The used of permeable pavers allows for infiltration reducing surface water which intern reduces the quantity of salt needed to prevent ice forming on the sidewalk and parking area. Reduced salt and sand during winter significantly reduces potential stormwater runoff contamination.
- Proper timing of the application of salt and sand also reduces the quantity of sand and salt required.

These best management practices will provide quality control at the site by either reducing the initial source of potential contamination or by directing potential contaminated water from vehicles to the sanitary sewer where it will be treated.

2.5 Stormwater System Operation and Maintenance

2.5.1 Inlet Control Device (ICD) and Roof Drains

The inlet control device (ICD) and Roof Drains should be inspected on a semi-annual basis and following major storm events. Any blockages, trash or debris should be removed. The Roof Drains should be inspected before winter to ensure they have not be clogged with leafs.

2.5.2 Catchbasin/ Manhole, Trench Drain, and Inspection Ports

The catchbasin / manhole and inspection ports (including sediment traps in storm tanks) should be cleaned with a hydrovac excavation truck following completion of construction, paving of the asphaltic concrete surface, placement of the walkway and exterior parking pavers and establishment of adequate grass cover on the landscaped areas.

Following the initial cleaning these structures should be inspected on a semi-annual basis and following major storm events. Any blockages, trash or debris should be removed. Once the sediment accumulation in the catchbasin / manhole has reached a level equal to 0.15 metres below the outlet invert of the structure, or a thickness of 0.15 metres in the sediment traps, the sediment should be removed by hydro excavation.

2.5.3 Brentwood StormTank Storage Tanks

Detailed installation, operation and maintenance guidelines are provided in the StormTank Module Design Guide included in Appendix B. In general maintenance procedures consist of Inspection and cleaning as follows:
Inspection:

- Inspect all observation ports, inflow and outflow connections, and the discharge area.
- Identify and log any sediment and debris accumulation, system backup, or discharge rate changes.
- If there is a sufficient need for cleanout, contact a local cleaning company for assistance.

Cleaning:

- If a pretreatment device is installed, follow manufacturer recommendations.
- Using a vacuum pump truck, evacuate debris from the inflow and outflow points.
- Flush the system with clean water, forcing debris from the system.
- Repeat steps 2 and 3 until no debris is evident.

2.6 Storm Sewer Design

The on-site storm sewers were designed to be in general conformance with the City of Ottawa Sewer Design Guidelines (October 2012). Specifically, storm sewers were sized using Manning's

Equation, assuming a roughness coefficient N = 0.013, to accommodate the uncontrolled runoff from the 5-year storm, under 'open-channel' conditions. The uncontrolled runoff was determined using the rational method and the City of Ottawa IDF curve for a 10-minute time of concentration. Refer to Storm Sewer Design Sheets in Appendix A.

3 SANITARY SEWER DESIGN

The existing residential sanitary service is connected to the existing 9 inch (225 mm) diameter concrete sanitary sewer which is located slightly west of the center of road along Grenon Avenue.

Sewage discharges will be domestic in type and in compliance with the City of Ottawa Sewer Use By-law. The anticipated peak sanitary flow from the building will be a total of approximately 1.58 L/s.

The sanitary sewage flow for the proposed building was calculated based on the City of Ottawa Sewer Design Guidelines (Section 4.4.1.2) and incorporated Technical Bulletin ISTB-2018-01.

3.1 Design Flows

Residential

Total domestic pop:
1 Bedroom units (11) x 1.4 ppu: 15.4
2 Bedroom units (22) x 2.1 ppu: 46.2
Total: 61.6

$Q_{Domestic}$ = 61.6 x 280 L/person/day x (1/86,400 sec/day) = 0.20 L/sec

$$\text{Peaking Factor} = 1 + \frac{61.6}{4 + (61.6/1000)^{0.5}} = 3.64 \text{ - maximum } 4.0$$

$Q_{Peak\ Domestic}$ = 0.20 L/sec x 3.64 = 0.73 L/sec

Infiltration

$Q_{Infiltration}$ = 0.33 L/ha/sec x 0.1421 ha = 0.05 L/sec

Total Peak Sanitary Flow = 0.73 + 0.05 = 0.78 L/sec

3.2 Sanitary Service Lateral

The Ontario Building Code specifies minimum pipe size and maximum hydraulic loading for sanitary sewer pipe. OBC 7.4.10.8 (2) states "Horizontal sanitary drainage pipe shall be designed to carry no more than 65% of its full capacity." A 135 mm diameter sanitary service with a minimum slope of 1.0% has a capacity of 11.51 Litres per second.

The maximum peak sanitary flows for the site is 0.78 L/sec. Since 0.78 L/sec is much less than 0.65 x 11.51 = 7.48 L/s, the sanitary service would be properly sized if greater than or equal to 135 mm in diameter.

Table 3.1 Fixture Unit Consideration

Apartment Unit Type	Number of Apartments	Number of fixture units per apartment	Total number of Fixture Units.
• 1 Bedroom	11	10.0	110
• 2 Bedroom	22	10.0	220
• Total fixtures			330

However, from Table 7.4.10.8, the allowable number of fixture units for a 135 mm diameter sanitary service pipe at 1.0% slope is 390. There are approximately 330 fixtures in the building. As such a 135 mm diameter sanitary service will be adequate for the proposed sanitary flow.

3.3 Sanitary Main

The existing sanitary sewer along Grenon Avenue downstream of the site consists of a 9 inch (225 mm) diameter concrete pipe at a slope of 2.72 percent. The capacity of this section of sewer is 74 Litres per second. The sewer along Grenon Avenue originates about 81 metres south of the site and discharges into the sanitary sewer main along Carling Avenue about 155 metres downstream of the site. The sewer along Carling Avenue consists of a 225 mm diameter concrete sewer with a slope of about 1.53 percent and a capacity of 55 Litres per second.

The demand on the existing sanitary sewer along Grenon Avenue was calculated based on the occupation and contributing area estimated from geoOttawa Mapping. The sanitary sewer calculation sheet is attached in Appendix C From the attached sheet, the calculated peak demand on the existing sanitary sewer main is 3.5 L/sec.

The additional peak demand resulting from the proposed development consists of 0.78 L/sec or about a 22.2 percent increase. This additional demand represents 1 percent of the capacity of the sanitary sewer. The total demand on the sanitary sewer along Grenon Avenue will be 4.3

L/s after the proposed development. This total demand represents only 5.7 percent of the capacity of the Sanitary Sewer along Grenon Avenue. Therefore, it is considered that there is sufficient capacity in the existing sanitary sewer for the proposed development.

4 WATERMAIN DESIGN

4.1 Water Demand

The water demand for the proposed development was calculated based on the City of Ottawa Water Distribution Design Guidelines as follows:

Residential

Total domestic pop:	
1 Bedroom units (11) x 1.4 ppu:	15.4
2 Bedroom units (22) x 2.1 ppu:	46.2
Total:	61.6

Residential Average Daily Demand = 350 L/c/d.

- Average daily demand of 350 L/c/day x 61.6 persons = 21,560 Litres/day or 0.25 L/s
- Maximum daily demand (factor of 2.5) is 0.25 L/s x 2.5 = 0.62 L/s
- Peak hourly demand (factor of 2.2) = 0.62 L/s x 2.2 = 1.37 L/s

4.2 Fire Flow

Fire flow protection requirements were calculated as per the Fire Underwriter's Survey (FUS) taking into account the methodology provided in Technical Bulletin ISTB-2018-02. Calculations of the fire flow required are provided in Appendix D.

Fire protection will be provided by an existing fire hydrant located on Hamilton Avenue North about 40m south of the property on the east side of the road. In addition, the proposed development will have an automatic sprinkler system. As such, the minimum service diameter required for the proposed development is 150 mm.

4.3 Sufficiency of Existing Infrastructure

A previously calculated residential water supply requirement and Fire Fighting Requirement were provided to the City of Ottawa for boundary conditions. The correspondence is attached

in Appendix D. These requirements consisted of a average daily demand of 0.25 L/sec, a maximum daily demand of 0.62 L/s and a Maximum hourly demand of 1.37 L/sec. The fire flow requirement was 116.7 L/s.

The following are boundary conditions, HGL, for hydraulic analysis at 841 Grenon Avenue (zone 1W) assumed to be connected to the 152mm on Grenon were based on the above requirements.
Minimum HGL = 107.2 m
Maximum HGL = 115.7 m
MaxDay + FireFlow (117 L/s) = 96.5 m

Based on the existing ground surface elevation of the roadway over the watermain at the site, an HGL of 96.5 at the site indicates a residual pressure at the adjacent fire hydrants to the site of about 230 kPa under fire flow conditions. Since the required fire flow rate is above 5700 L/min at a residual pressure above 140 kPa (20 psi), the hydrants are considered to be Class AA.

4.3.1 Existing Water Service

The site is currently occupied by a single family dwelling which has a residential water service connected to the 150 mm water main along Grenon Avenue. This water service will not be sufficient for the proposed development and must be capped at the water main to the satisfaction of City of Ottawa Staff.

4.3.2 Existing Fire Hydrants

The fire hydrants within the vicinity of the site are located as follows: At the intersection of Grenon Avenue and Carling Avenue 144 metres north of the site; At 855 Grenon Avenue 80 metres south of the site.

City of Ottawa Technical Bulletin ISTB-2018-02 Appendix I Table 1 provides guidance with respect to maximum flow from to be considered from a given hydrant. From this table, a Class AA hydrant can contribute a maximum flow of 5,700 L/min when located less than 75 metres from the building and 3,800 L/min when located between 75 and 150 metres from the building.

Since both of the above hydrants are between 75 and 150 metres from the proposed building, these hydrants can be expected to both provide a contribution of 3,800 L/min to the required fire flow for a total combined flow of 7600 L/min. As previously indicated, the required fire flow is 116.7 L/sec x 60 sec/min = 7002 L/min. The existing hydrants are considered to be sufficient to meet the required fire flow without needing an additional hydrant at the site.

4.4 Proposed Service

The proposed building is a 4 storey residential building with a ground floor elevation of 73.8 metres. The existing ground surface elevation adjacent at the street adjacent the site is 72.4 metres. Assuming a height of 3 metres per floor, the fourth floor fixtures will have a maximum elevation of about 84.5 metres.

Using the above minimum HGL, a 50 mm service diameter would result in a residual pressure during maximum hourly demand on the ground floor of about 325 kPa. Due to the height of the proposed building a hydraulic grade line of 107.2 results in residual pressure on the top floor of the proposed building of about 220 kPa using a 50 mm diameter service and about 223 kPa using a 150 mm diameter service during maximum hourly demand. It is noted that 223 kPa is below the minimum allowable pressure of 275 kPa. As such a booster pump will be required to provide adequate pressure at the top floor of the building regardless of the service size used.

The proposed building will be equipped with sprinklers. In order to meet the required fire flow at the building, a minimum service diameter of 150 mm would be required in order to ensure the pressure at the building on the ground floor is above the minimum residual pressure of 140 kPa. A service diameter of 100 mm would provide a minimum residual pressure of above 140 kPa at the ground floor elevation assuming a flow demand of 58 L/sec. A service diameter of 50 mm would provide a minimum residual pressure of above 140 kPa at the ground floor elevation assuming a flow demand of 12 L/sec.

The water demand of a sprinkler system is based on the design of the sprinkler system. The mechanical engineer designing the sprinkler system must determine the actual required fire flow for the sprinkler system at the building in order to verify the required service diameter. A booster pump will be required in order to provide adequate pressure for the sprinkler system on the upper floors.

5 EROSION AND SEDIMENT CONTROL

The owner (and/or contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current best management practices for erosion and sediment control. It is considered to be the owners and/or contractors responsibility to ensure that the erosion control measures are implemented and maintained.

In order to limit the amount of sediment carried in stormwater runoff from the site during construction, it is recommended to install a silt fence along the property, as shown in Kollaard Associates Inc. Drawing #180966-ECP Erosion Control Plan. The silt fence may be polypropylene, nylon, and polyester or ethylene yarn.

If a standard filter fabric is used, it must be backed by a wire fence supported on posts not over 2.0 m apart. Extra strength filter fabric may be used without a wire fence backing if posts are not over 1.0 m apart. Fabric joints should be lapped at least 150 mm (6") and stapled. The bottom edge of the filter fabric should be anchored in a 300 mm (1 ft) deep trench, to prevent flow under the fence. Sections of fence should be cleaned, if blocked with sediment and replaced if torn.

Filter socks should be installed across existing storm manhole and catch basin lids. As well, filter socks should be installed across the proposed catch basin lids immediately after the catch basins are placed. The filter socks should only be removed once the asphaltic concrete is installed and the site is cleaned.

The proposed landscaping works should be completed as soon as possible. The proposed granular and asphaltic concrete surfaced areas should be surfaced as soon as possible.

The silt fences should only be removed once the site is stabilized and landscaping is completed.

These measures will reduce the amount of sediment carried from the site during storm events that may occur during construction.

6 CONCLUSIONS

This report addresses the adequacy of the existing municipal storm and sanitary sewer system and watermains to service the proposed development of an apartment building on Grenon Avenue. Based on the analysis provided in this report, the conclusions are as follows:

SWM for the proposed development will be achieved by restricting the 100 year post development flow to Grenon Avenue to the 2 year pre-development flow rate from the site. Uncontrolled runoff directed to the adjacent parkland / open will be reduced during post development condition to less than 40 percent of the current flow directed to the park.

The peak sewage flow rate from the proposed development will be 0.78 L/sec. The existing municipal sanitary sewer will have adequate capacity to accommodate the minimal increase in peak flow. The City has not identified any capacity issues in the existing sanitary sewer system and the calculation indicate sufficient capacity.

The existing municipal watermain along Grenon Avenue will have adequate capacity to service the proposed development for both domestic and fire protection. A booster pump will be needed within the building to ensure sufficient pressure on the upper floors.

During all construction activities, erosion and sedimentation shall be controlled.

We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we can be of any further assistance to you on this project, please do not hesitate to contact our office.

Sincerely,
Kollaard Associates, Inc.

Steven deWit, P.Eng.

Appendix A: Storm Design Information

- Allowable Release Rate and SWM Summary
- Pre-Development Runoff to Park Area
- Uncontrolled Area Runoff Calculations
- Actual Discharge Rate and Storage Volume Requirements
- Storage Volume Provided
- Sewer Design Sheet

APPENDIX A: STORMWATER MANAGEMENT MODEL
ALLOWABLE RELEASE RATE AND SWM SUMMARY

Client: **Building Investments Inc.**
Job No.: **180966**
Location: **841 Grenon Ave**
Date: **January 21, 2019**

Pre Dev run-off Coefficient "C"

Area	Surface	Ha	0.039	C_{avg}
Total	Gravel	0.010	0.70	**0.34**
0.1421	Building	0.0088	0.90	
	Landscaping	0.133	0.25	

PRE DEVELOPMENT FLOW

2 Year Event

Pre Dev.	C	Intensity	Area
2 Year	0.34	76.81	0.142
2.78CIA= 10.32			
	10.3 L/s		

Total Allowable Release: **10.3 L/s**

100 Year Event

Pre Dev.	C	Intensity	Area
100 Year	0.43	178.56	0.142
2.78CIA= 29.98			
	30.0 L/s		

Total Allowable Release: **30.0 L/s**

Pre Dev Time of Concentration "t_c"

From City of Ottawa Sewer Design Guidelines - Appendix 5 - D

Slope of Site = 6.9%
Distance Across Site = 29.8
Runoff Coefficient = 0.34

Inlet Time = less than 10 min
Therefore use a minimum Time of Concentration of 10 min

2 Year Event

**Use a 10 minute time of concentration for 2 year

100 Year Event

**Use a 10 minute time of concentration

Alternatively:

Pre Dev Time of Concentration "t_c"

$$t_{ca} = \frac{3.26\ x\ (1.1 - C)\ x\ l_c{}^{0.5}}{S^{0.33}}$$

Airport Formula

C = Runoff Coefficient	0.34
lc = length of flow path	29.8
Elevation Change	2.07
S = Slope of flow path	6.9

t_c = **7.13**

Total t_c **7.13** *min*
Minimum as per City Guidelines **10.00** *min*

STORMWATER MANAGEMENT SUMMARY

Sub Area I.D.	Sub Area (ha)	2,5 year C	100 year C	Outlet Location	5 Year Controlled Release (L/s)	Required 5 year Storage (m^3)	100 Year Controlled Release (L/s)	Required 100 year Storage (m^3)
Pre-Development Runoff to the Park Land					3.9		8.4	
Proposed Post-Development Runoff to the Park Land								
UA1	0.0166	0.31	0.39	PARK	1.5		3.2	
Total Allowable discharge to Grenon Avenue					**10.3**		**10.3**	
Actual Discharge to Grenon Avenue								
UA2	0.0294	0.31	0.38	GRENON	2.6		5.5	
CA1	0.0649	0.90	1.00	GRENON	1.9	9.8	1.9	22.9
CA2	0.0312	0.39	0.48	GRENON	1.7	4.1	2.0	10.1
TOTAL	**0.142**				**6.2**	**13.9**	**9.4**	**32.9**

Equations:

Flow Equation

Q = 2.78 x C x I x A

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

APPENDIX A: STORMWATER MANAGEMENT MODEL

Pre-Development Runoff Rate to Park Calculation

Client: **Building Investments Inc.**
Job No.: **180966**
Location: **841 Grenon Ave**
Date: **January 21, 2019**

PRE-DEVELOPMENT RUNOFF TO PARK AREA

Pre-Dev Run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C"**	**C_{avg}**
Total	Asphalt	0.0000	0.90	**0.25**	0.99	**0.31**
0.0545	Landscape	0.0545	0.25		0.31	
	Building	0.0000	0.90		0.99	

2 Year Event

Pre Dev.	**C**	**Intensity**	**Area**
2 Year	0.25	76.81	0.0545
2.78CIA=	2.91		
	2.9 L/s		

**Use a 10 minute time of concentration for 2 year

Post Dev Free Flow
5 Year Event

	C	**Intensity**	**Area**
5 Year	0.25	104.19	0.0545
2.78CIA=	3.95		
3.9	L/S		

**Use a 10 minute time of concentration for 5 year

100 Year Event

	10	**Intensity**	**Area**
100 Year	0.31	178.56	0.0545
2.78CIA=	8.39		
8.4	L/S		

**Use a 10 minute time of concentration for 100 year

Equations:

Flow Equation

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

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

APPENDIX A: STORMWATER MANAGEMENT MODEL

Uncontrolled Area Runoff Rate Calculation

Client: **Building Investments Inc.**
Job No.: **180966**
Location: **841 Grenon Ave**
Date: **January 21, 2019**

UA1 - UNCONTROLLED AREA DISCHARGE TO PARK LAND

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C"**	**C_{avg}**
Total	Asphalt	0.0000	0.90	**0.31**	1.00	**0.39**
0.0166	Landscape	0.0057	0.25		0.31	
	Building Walkway	0.0000	0.25		0.31	
	Building Ammenity	0.0040	0.50		0.63	
	Building Landscape	0.0069	0.25		0.31	

2 Year Event

	C	Intensity	Area
2 Year	0.31	76.81	0.0166
2.78CIA=	1.10		
	1.1	**L/s**	

**Use a 10 minute time of concentration for 2 year

Post Dev Free Flow

5 Year Event

	C	Intensity	Area
5 Year	0.31	104.19	0.0166
2.78CIA=	1.49		
1.5	L/S		

**Use a 10 minute time of concentration for 5 year

100 Year Event

	C	Intensity	Area
100 Year	0.39	178.56	0.0166
2.78CIA=	3.21		
3.2	L/S		

**Use a 10 minute time of concentration for 100 year

Equations:

Flow Equation

Q = 2.78 x C x I x A

Where:

C is the runoff coefficient

I is the intensity of rainfall, City of Ottawa IDF

A is the total drainage area

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

APPENDIX A: STORMWATER MANAGEMENT MODEL

Uncontrolled Area Runoff Rate Calculation

Client: **Building Investments Inc.**
Job No.: **180966**
Location: **841 Grenon Ave**
Date: **January 21, 2019**

UA2 - UNCONTROLLED AREA DISCHARGE TO GRENON AVE

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C"**	**C_{avg}**
Total	Asphalt/Roof	0.0028	0.90	**0.31**	1.00	**0.38**
0.0294	Landscape	0.0083	0.25		0.31	
	Building Walkway	0.0037	0.25		0.31	
	Building Parking	0.0111	0.25		0.31	
	Building Landscape	0.0035	0.25		0.31	

Post Dev Free Flow
5 Year Event

	C	Intensity	Area
5 Year	0.31	104.19	0.0294
2.78CIA=	2.64		
2.6	L/S		

**Use a 10 minute time of concentration for 5 year

100 Year Event

	10	Intensity	Area
100 Year	0.38	178.56	0.0294
2.78CIA=	5.55		
5.5	L/S		

**Use a 10 minute time of concentration for 100 year

Equations:

Flow Equation

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

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

APPENDIX A: STORMWATER MANAGEMENT MODEL
ACTUAL DISCHARGE RATE AND STORAGE VOLUME REQUIREMENTS

Client: Building Investments Inc.
Job No.: 180966
Location: 841 Grenon Ave
Date: January 21, 2019

**Use a 10 minute time of concentration

Roof Area (CA1)

Area ha	Surface	Ha	5 Year Event "C"	5 Year Event C_{avg}	5 Year Event Intensity (mm/hr)	5 Year Event Runoff Rate (L/s)	100 Year Event "C"	100 Year Event C_{avg}	100 Year Event Intensity (mm/hr)	100 Year Event Runoff Rate (L/s)
	Asphalt/ Concrete	0.0000	0.90	**0.90**	104.19	16.92	1.00	**1.00**	178.56	32.22
0.0649	Roof	0.0649	0.90				1.00			
	Building Amenity	0.0000	0.50				0.63			
	Landscape	0.0000	0.25				0.31			

Ground (CA2)

Area ha	Surface	Ha	5 Year Event "C"	5 Year Event C_{avg}	5 Year Event Intensity (mm/hr)	5 Year Event Runoff Rate (L/s)	100 Year Event "C" 10	100 Year Event C_{avg}	100 Year Event Intensity (mm/hr)	100 Year Event Runoff Rate (L/s)
	Landscape	0.0000	0.25	**0.39**	104.19	3.52	1.00	**0.48**	178.56	7.43
0.0312	Building Walkway	0.0049	0.25				0.31			
	Building Amenity	0.0170	0.50				0.63			
	Building Landscape	0.0093	0.25				0.31			

Total Allowable Release Rate 5 year 2.00 L/s
100 year 2.00 L/s

Storage Requirements for Roof Area (CA1)

Area = 0.0649 hectares
5-year Runoff Coefficient = 0.90 post development
100-year Runoff Coefficient = 1.00 post development

			Release Rate L/s	0.5	1	1.5	1.9	2.5	3.5	4.5	5.5
Return Period	**Time (min)**	**Intensity (mm/hr)**	**Flow Q (L/s)**	**Storage Required (m^3)**							
5 Year	10	104.19	16.92	9.9	9.6	9.3	9.0	8.7	8.1	7.5	6.9
	20	70.25	11.41	13.1	12.5	11.9	11.4	10.7	9.5	8.3	7.1
	30	53.93	8.76	14.9	14.0	13.1	12.3	11.3	9.5	7.7	5.9
	40	44.18	7.17	16.0	14.8	13.6	12.7	11.2	8.8	6.4	4.0
	50	37.65	6.11	16.8	15.3	13.8	12.6	10.8	7.8	4.8	1.8
	60	32.94	5.35	17.5	15.7	13.9	12.4	10.3	6.7	3.1	-0.5
	70	29.37	4.77	17.9	15.8	13.7	12.1	9.5	5.3	1.1	-3.1
			Maximum 5 year storage rate	17.9	15.8	13.9	12.7	11.3	9.5	8.3	7.1
			Release Rate L/s	0.5	1	1.5	1.9	2.5	3.5	4.5	5.5
	10	178.56	32.22	19.0	18.7	18.4	18.2	17.8	17.2	16.6	16.0
100 Year	20	119.95	21.64	25.4	24.8	24.2	23.7	23.0	21.8	20.6	19.4
	30	91.87	16.58	28.9	28.0	27.1	26.4	25.3	23.5	21.7	19.9
	40	75.15	13.56	31.3	30.1	28.9	28.0	26.5	24.1	21.7	19.3
	50	63.95	11.54	33.1	31.6	30.1	28.9	27.1	24.1	21.1	18.1
	60	55.89	10.08	34.5	32.7	30.9	29.5	27.3	23.7	20.1	16.5
	70	49.79	8.98	35.6	33.5	31.4	29.7	27.2	23.0	18.8	14.6
	80	44.99	8.12	36.6	34.2	31.8	29.8	27.0	22.2	17.4	12.6
	90	41.11	7.42	37.4	34.7	32.0	29.8	26.6	21.2	15.8	10.4
	100	37.90	6.84	38.0	35.0	32.0	29.6	26.0	20.0	14.0	8.0
	110	35.20	6.35	38.6	35.3	32.0	29.4	25.4	18.8	12.2	5.6
	120	32.89	5.93	39.1	35.5	31.9	29.1	24.7	17.5	10.3	3.1
	130	30.90	5.57	39.6	35.7	31.8	28.7	24.0	16.2	8.4	0.6
			Maximum 100 year storage rate	39.6	35.7	32.0	29.8	27.3	24.1	21.7	19.9

Storage Requirements for Ground Area (CA2)

Area = 0.0312 hectares
5-year Runoff Coefficient = 0.39 post development
100-year Runoff Coefficient = 0.48 post development

			Release Rate L/s	0.5	1	1.5	1.9	2.5	4.5	5.5	5.5
Return Period	**Time (min)**	**Intensity (mm/hr)**	**Flow CA2 Q (L/s)**	**Storage Required (m^3)**							
5 Year	5	141.18	4.78	1.3	1.1	1.0	0.9	0.7	0.1	-0.2	-0.2
	10	104.19	3.52	1.8	1.5	1.2	1.0	0.6	-0.6	-1.2	-1.2
	20	70.25	2.38	2.3	1.7	1.1	0.6	-0.1	-2.5	-3.7	-3.7
	30	53.93	1.82	2.4	1.5	0.6	-0.1	-1.2	-4.8	-6.6	-6.6
	40	44.18	1.49	2.4	1.2	0.0	-1.0	-2.4	-7.2	-9.6	-9.6
	50	37.65	1.27	2.3	0.8	-0.7	-1.9	-3.7	-9.7	-12.7	-12.7
	70	29.37	0.99	2.1	0.0	-2.1	-3.8	-6.3	-14.7	-18.9	-18.9
			Maximum 5 year storage rate	2.4	1.7	1.2	1.0	0.7	0.1	-0.2	-0.2
			Release Rate L/s	0.5	1	1.5	1.9	2.5	4.5	5.5	5.5
	5	242.70	10.10	2.9	2.7	2.6	2.5	2.3	1.7	1.4	1.4
100 Year	10	178.56	7.43	4.2	3.9	3.6	3.3	3.0	1.8	1.2	1.2
	20	119.95	4.99	5.4	4.8	4.2	3.7	3.0	0.6	-0.6	-0.6
	30	91.87	3.82	6.0	5.1	4.2	3.5	2.4	-1.2	-3.0	-3.0
	40	75.15	3.13	6.3	5.1	3.9	2.9	1.5	-3.3	-5.7	-5.7
	50	63.95	2.66	6.5	5.0	3.5	2.3	0.5	-5.5	-8.5	-8.5
	60	55.89	2.33	6.6	4.8	3.0	1.5	-0.6	-7.8	-11.4	-11.4
	70	49.79	2.07	6.6	4.5	2.4	0.7	-1.8	-10.2	-14.4	-14.4
	80	44.99	1.87	6.6	4.2	1.8	-0.1	-3.0	-12.6	-17.4	-17.4
			Maximum 100 year storage rate	6.6	5.1	4.2	3.7	3.0	1.8	1.4	1.4

APPENDIX A: STORMWATER MANAGEMENT MODEL
STORAGE VOLUME PROVIDED

Client: **Building Investments Inc.**
Job No.: **180966**
Location: **841 Grenon Ave**
Date: **January 21, 2019**

Catchment Area 1

Maximum Storage required for the 5 year Storm Event 12.7 (m^3)
Maximum Storage required for the 100 year Storm Event 29.8 (m^3)

Roof Drain Type - WATTS Small Area Roof Drain with Adjustable Flow Control. RD-200-A-ADJ - Closed Weir Opening Exposure.
Total Roof Area m^2 = 649 Area used for Storage m^2 = 389 or 60 percent

Storage Provided on Roof Catchment Area 1

		East Side of Roof			West Side of Roof						
Depth	**Layer Thickness**	**Layer Area**	**Layer Volume**	**East Side Volume**	**Layer Area**	**Layer Volume**	**West Side Volume**	**Total Cum. Volume**	**Release Rate per drain**	**Number of Drains**	**Total Release Rate**
m	m	m^2	m^3	m^3	m^2	m^3	m^3	m^3	US gpm		L/s
0.15	0.025	195	4.87	16.23	195	4.87	16.23	32.45	5	6	1.9
0.125	0.025	195	4.87	11.36	195	4.87	11.36	22.72	5	6	1.9
0.1	0.025	195	3.75	6.49	195	3.75	6.49	12.98	5	6	1.9
0.075	0.025	110	1.93	2.74	110	1.93	2.74	5.48	5	6	1.9
0.05	0.025	49	0.71	0.81	49	0.71	0.81	1.62	5	6	1.9
0.025	0.025	12	0.10	0.10	12	0.10	0.10	0.20	5	6	1.9
0	0	0	0.00	0.00	0	0.00	0.00	0.00	0	6	0.0

Catchment Area 2

Maximum Storage required for the 5 year Storm Event 1.9 (m^3)
Maximum Storage required for the 100 year Storm Event 3.7 (m^3)

Storage Provided in Storage Tanks Catchment 2

Tank Type Brentwood Storage Tanks - ST18

Tank Dimentions	Height	0.457	Total Volume	0.182
	Length	0.914	Storage Volume	0.119
	Width	0.457	Percent Voids	0.66

Proposed Tank Configuration 3 Rows Width by 37 Row Length
3 x 0.457 by 14 x 0.914
= 1.371 by 12.796

Inlet Control Device = Hydrovex 75SVHV-1
Invert of Outlet Pipe = 73.1

Elevation	**Tank Depth**	**Layer Thickness**	**Layer Area**	**Layer Volume**	**Cum. Volume**	**Head on ICD**	**Release Rate**
m	m	m	m^2	m^3	m^3	m	L/s
73.607	Top Tank	0.007	17.54	0.12	8.0	0.507	2.2
73.6	0.45	0.05	17.54	0.88	7.9	0.5	2.2
73.55	0.4	0.05	17.54	0.88	7.0	0.45	2.1
73.5	0.35	0.05	17.54	0.88	6.1	0.4	2.0
73.45	0.3	0.05	17.54	0.88	5.3	0.35	1.9
73.4	0.25	0.05	17.54	0.88	4.4	0.3	1.8
73.35	0.2	0.05	17.54	0.88	3.5	0.25	1.7
73.3	0.15	0.05	17.54	0.88	2.6	0.2	1.5
73.25	0.1	0.05	17.54	0.88	1.8	0.15	1.0
73.2	0.05	0.05	17.54	0.88	0.9	0.1	0.5
73.15	0	0	17.54	0.00	0.0	0.05	0.2

APPENDIX A: STORM SEWER DESIGN SHEET

Client: Building Investments Inc.
Job No.: 180966
Location: 841 Grenon Ave
Date: January 21, 2019

Storm Sewer Design Sheet (5-yr storm)

LOCATION												PROPOSED SEWER								
									TIME	RAINFALL	PEAK	TYPE	PIPE	PIPE			FULL FLOW	TIME OF	EXCESS	
FROM	TO	Total Area	C	C	C	Actual R	INDIV	ACCUM	OF	INTENSITY	FLOW	OF	SIZE	SLOPE	LENGTH	CAPACITY	VELOCITY	FLOW	CAPACITY	Q/Qfull
		(ha)	0.25	0.50	0.90	('C')	2.78 AR	2.78 AR	CONC.	I	Q (l/s)	PIPE	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(l/s)	
Storm Tank	STM-MH	0.031	0.0142	0.0170	0.000	0.39	0.03	0.03	10.00	104.19	3.49	PVC	200.00	1.00	45.0	32.83	1.04	0.72	29.34	0.11
ROOF	STM-MH	0.0649	0.000	0.000	0.0649	0.90	0.16	0.16	10.00	104.19	16.92	PVC	150.00	2.00	10.0	21.56	1.22	0.14	4.64	0.78

Rainfall Intensity = $998.071/(T+6.053)^{\wedge -0.814}$ T= time in minutes
(City of Ottawa, 5 year storm)

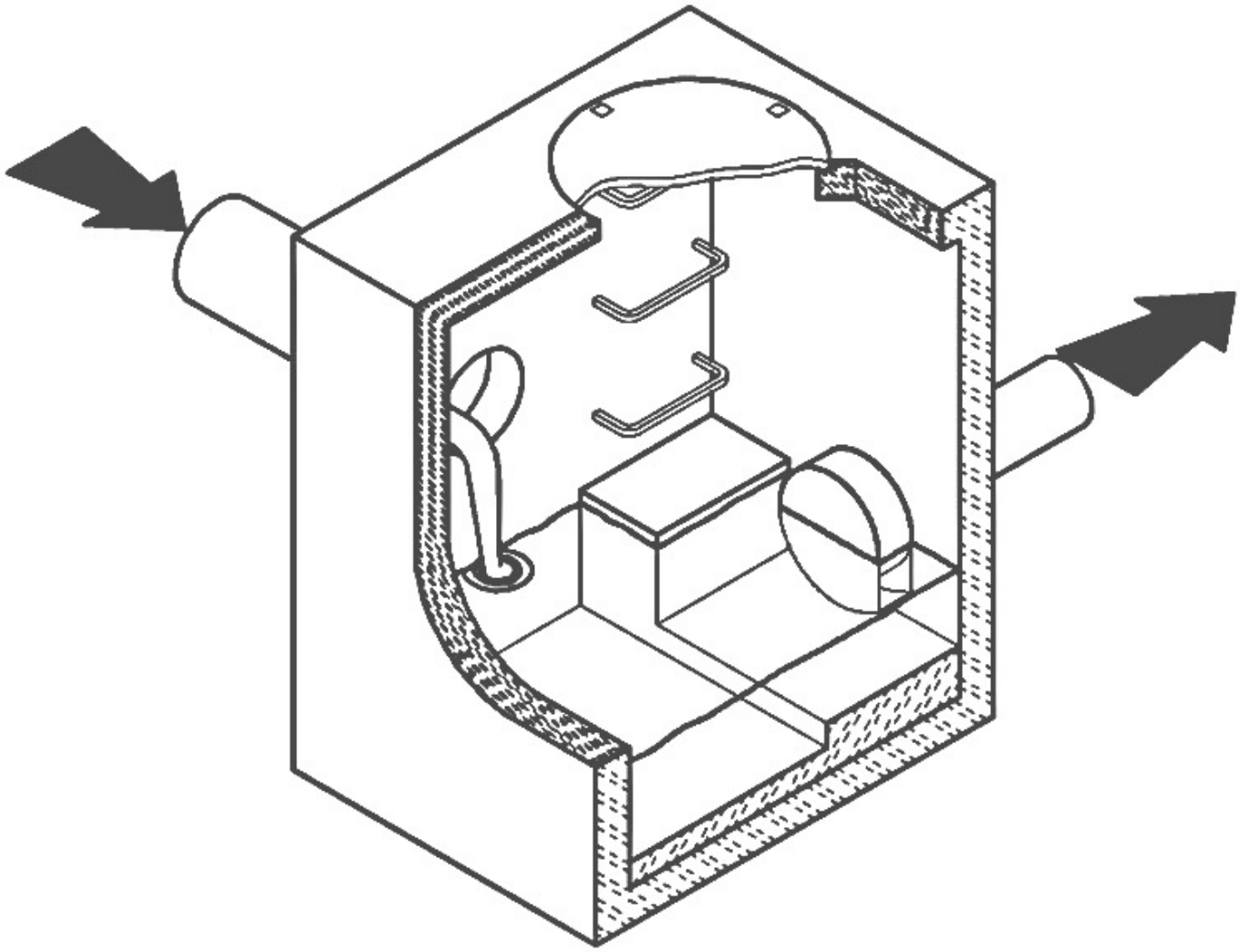
Appendix B: Product Information

- Hydrovex Selection Chart
- Roof Drain Selection
- Brentwood Storage Tanks

CSO/STORMWATER MANAGEMENT

HYDROVEX® VHV / SVHV

Vertical Vortex Flow Regulator



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APPLICATIONS

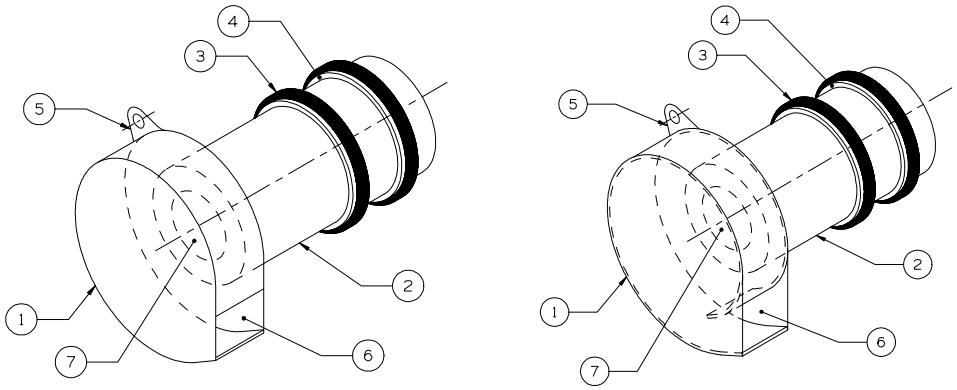
One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm, uncontrolled flows may overload the drainage system and cause flooding. Due to increased velocities, sewer pipe wear is increased dramatically and results in network deterioration. In a combined sewer system, the wastewater treatment plant may also experience significant increases in flows during storms, thereby losing its treatment efficiency.

A simple means of controlling excessive water runoff is by controlling excessive flows at their origin (manholes). **John Meunier Inc.** manufactures the **HYDROVEX® VHV / SVHV** line of vortex flow regulators to control stormwater flows in sewer networks, as well as manholes.

The vortex flow regulator design is based on the fluid mechanics principle of the forced vortex. This grants flow regulation without any moving parts, thus reducing maintenance. The operation of the regulator, depending on the upstream head and discharge, switches between orifice flow (gravity flow) and vortex flow. Although the concept is quite simple, over 12 years of research have been carried out in order to get a high performance.

The **HYDROVEX® VHV / SVHV** Vertical Vortex Flow Regulators **(refer to Figure 1)** are manufactured entirely of stainless steel, and consist of a hollow body (**1**) (in which flow control takes place) and an outlet orifice (**7**). Two rubber "O" rings (**3**) seal and retain the unit inside the outlet pipe. Two stainless steel retaining rings (**4**) are welded on the outlet sleeve to ensure that there is no shifting of the "O" rings during installation and use.

1. **BODY**
2. **SLEEVE**
3. **O-RING**
4. **RETAINING RINGS (SQUARE BAR)**
5. **ANCHOR PLATE**
6. **INLET**
7. **OUTLET ORIFICE**



VHV ***SVHV***

FIGURE 1: HYDROVEX® VHV-SVHV VERTICAL VORTREX FLOW REGULATORS

ADVANTAGES

- The **HYDROVEX® VHV / SVHV** line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.
- Having no moving parts, they require minimal maintenance.
- The geometry of the **HYDROVEX® VHV / SVHV** flow regulators allows a control equal to an orifice plate, having a cross section area 4 to 6 times smaller. This decreases the chance of blockage of the regulator, due to sediments and debris found in stormwater flows. **Figure 2** illustrates the comparison between a regulator model 100 SVHV-2 and an equivalent orifice plate. One can see that for the same height of water, the regulator controls a flow approximately four times smaller than an equivalent orifice plate.
- Installation of the **HYDROVEX® VHV / SVHV** flow regulators is quick and straightforward and is performed after all civil works are completed.
- Installation requires no special tools or equipment and may be carried out by any contractor.
- Installation may be carried out in existing structures.

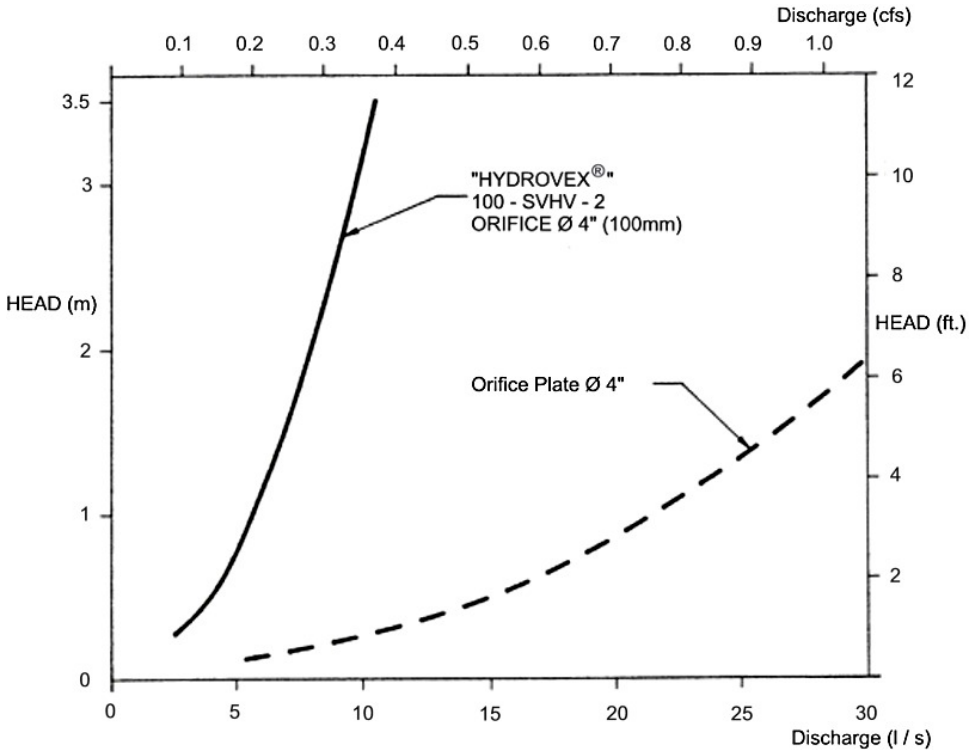


FIGURE 2: DISCHARGE CURVE SHOWING A HYDROVEX® FLOW REGULATOR VS AN ORIFICE PLATE

SELECTION

Selection of a **VHV or SVHV** regulator can be easily made using the selection charts found at the back of this brochure (see **Figure 3)**. These charts are a graphical representation of the maximum upstream water pressure (head) and the maximum discharge at the manhole outlet. The maximum design head is the difference between the maximum upstream water level and the invert of the outlet pipe. All selections should be verified by John Meunier Inc. personnel prior to fabrication.

Example:

✓ Maximum design head	2m (6.56 ft.)
✓ Maximum discharge	6 L/s (0.2 cfs)
✓ Using **Figure 3** - VHV	model required is a **75 VHV-1**

INSTALLATION REQUIREMENTS

All **HYDROVEX® VHV / SVHV** flow regulators can be installed in circular or square manholes. **Figure 4** gives the various minimum dimensions required for a given regulator. ***It is imperative to respect the minimum clearances shown to ensure easy installation and proper functioning of the regulator.***

SPECIFICATIONS

In order to specify a **HYDROVEX®** regulator, the following parameters must be defined:

- The model number (ex: 75-VHV-1)
- The diameter and type of outlet pipe (ex: 6" diam. SDR 35)
- The desired discharge (ex: 6 l/s or 0.21 CFS)
- The upstream head (ex: 2 m or 6.56 ft.) *
- The manhole diameter (ex: 36" diam.)
- The minimum clearance "H" (ex: 10 inches)
- The material type (ex: 304 s/s, 11 Ga. standard)

* ***Upstream head is defined as the difference in elevation between the maximum upstream water level and the invert of the outlet pipe where the HYDROVEX® flow regulator is to be installed.***

PLEASE NOTE THAT WHEN REQUESTING A PROPOSAL, WE SIMPLY REQUIRE THAT YOU PROVIDE US WITH THE FOLLOWING:

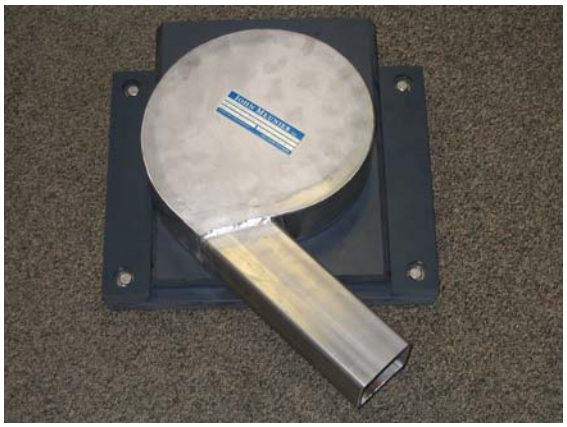
- ***project design flow rate***
- ***pressure head***
- ***chamber's outlet pipe diameter and type***

Typical VHV model in factory

OPTIONS

FV – SVHV (mounted on sliding plate)

VHV-1-O (standard model with odour control inlet)



FV – VHV-O (mounted on sliding plate with odour control inlet)

VHV with Gooseneck assembly in existing chamber without minimum release at the bottom

VHV with air vent for minimal slopes

HYDROVEX®

VHV Vertical Vortex Flow Regulator

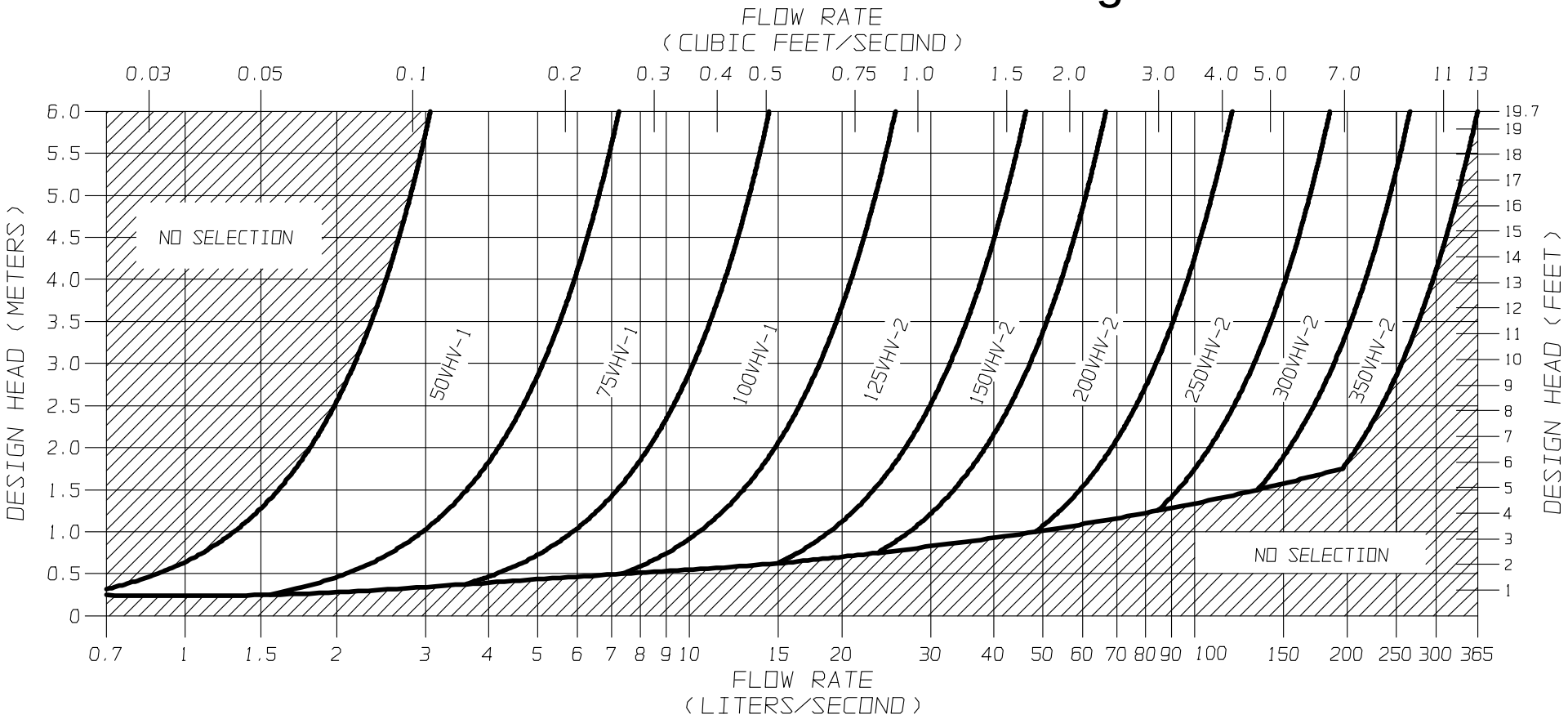


FIGURE 3 - VHV

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HYDROVEX®

SVHV Vertical Vortex Flow Regulator

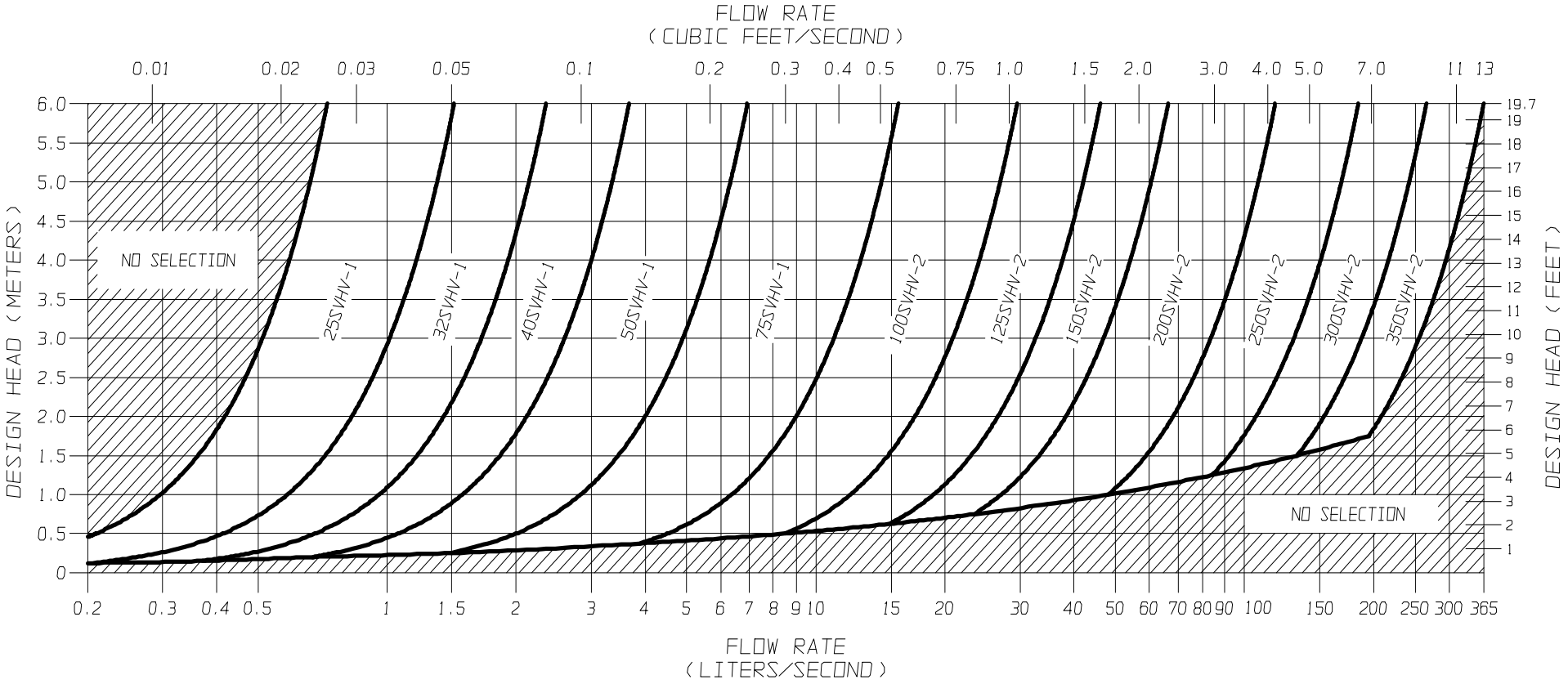

FIGURE 3 - SVHV

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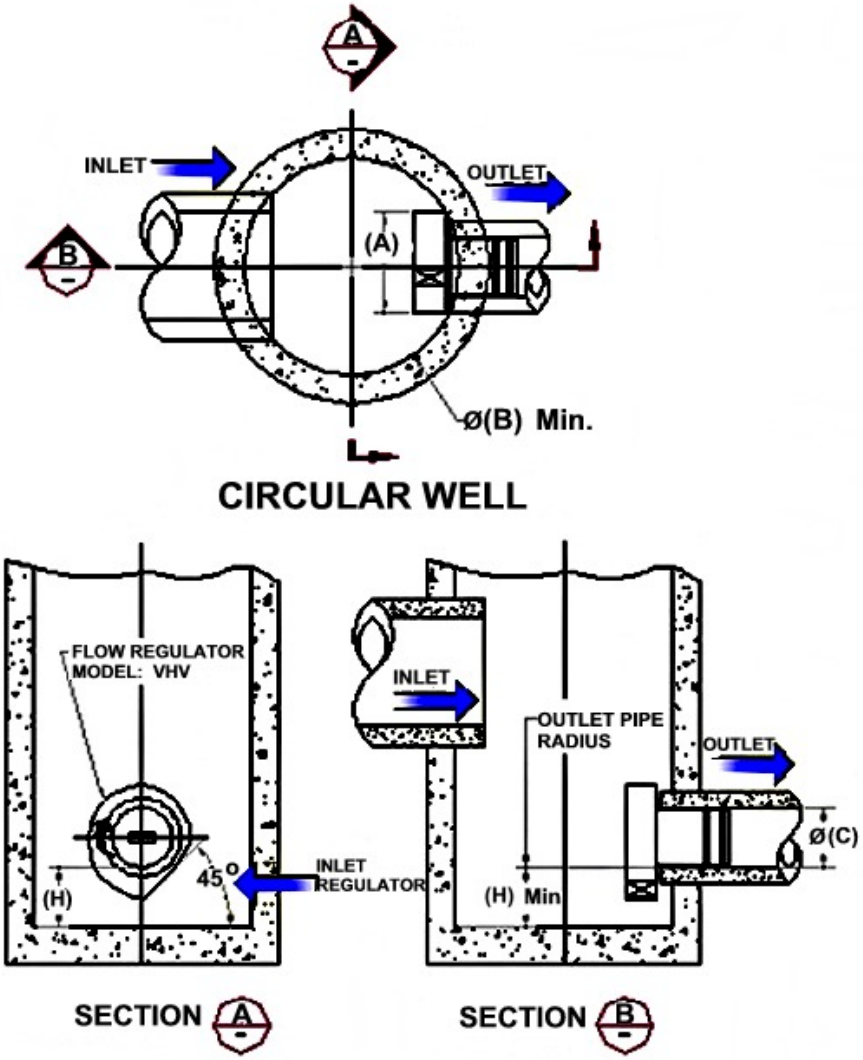
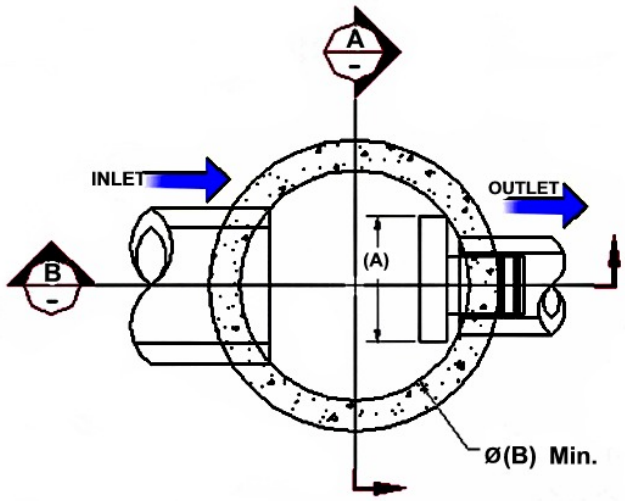
FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL VHV)

Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	900	36	150	6	200	8
125VHV-2	275	11	900	36	150	6	200	8
150VHV-2	350	14	900	36	150	6	225	9
200VHV-2	450	18	1200	48	200	8	300	12
250VHV-2	575	23	1200	48	250	10	350	14
300VHV-2	675	27	1600	64	250	10	400	16
350VHV-2	800	32	1800	72	300	12	500	20

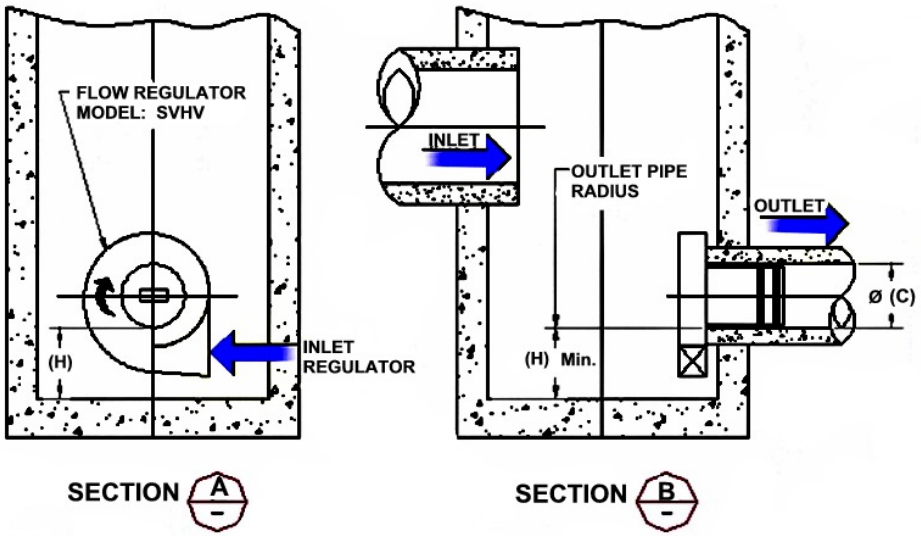


FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL SVHV)

Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	900	36	150	6	275	11
100 SVHV-2	275	11	900	36	150	6	250	10
125 SVHV-2	350	14	900	36	150	6	300	12
150 SVHV-2	425	17	1200	48	150	6	350	14
200 SVHV-2	575	23	1600	64	200	8	450	18
250 SVHV-2	700	28	1800	72	250	10	550	22
300 SVHV-2	850	34	2400	96	250	10	650	26
350 SVHV-2	1000	40	2400	96	250	10	700	28



CIRCULAR WELL

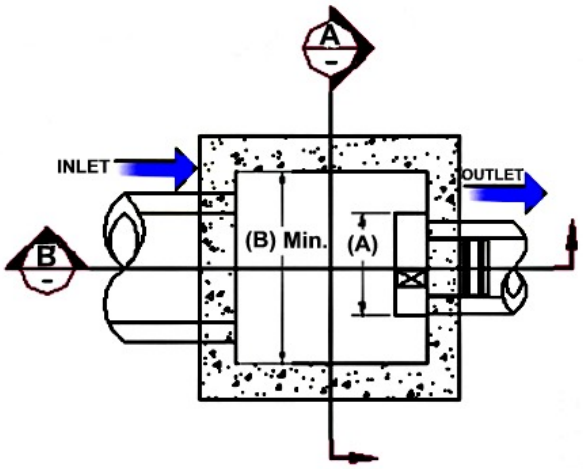


SECTION A **SECTION B**

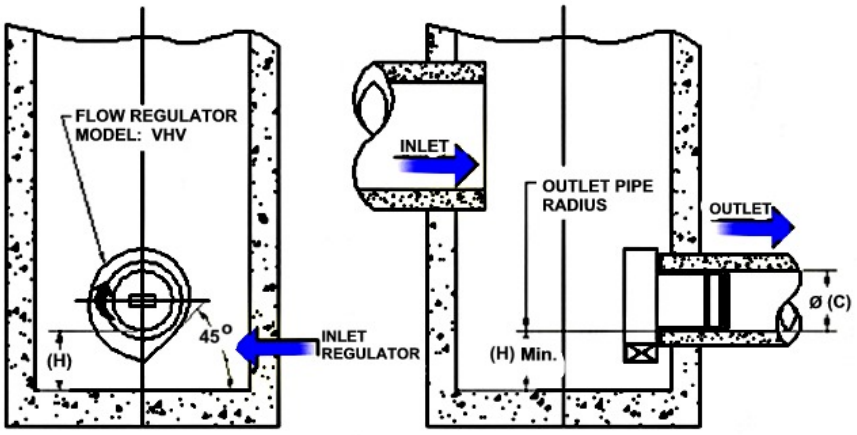
FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL VHV)

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	600	24	150	6	200	8
125VHV-2	275	11	600	24	150	6	200	8
150VHV-2	350	14	600	24	150	6	225	9
200VHV-2	450	18	900	36	200	8	300	12
250VHV-2	575	23	900	36	250	10	350	14
300VHV-2	675	27	1200	48	250	10	400	16
350VHV-2	800	32	1200	48	300	12	500	20

NOTE: ***In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.***



SQUARE / RECTANGULAR WELL

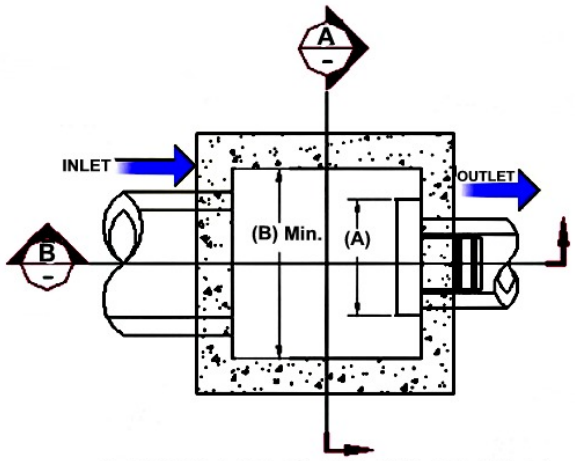


SECTION A **SECTION B**

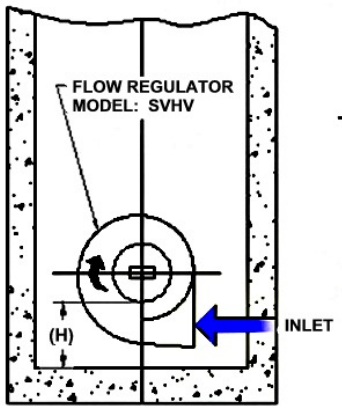
FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL SVHV)

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	600	24	150	6	275	11
100 SVHV-2	275	11	600	24	150	6	250	10
125 SVHV-2	350	14	600	24	150	6	300	12
150 SVHV-2	425	17	600	24	150	6	350	14
200 SVHV-2	575	23	900	36	200	8	450	18
250 SVHV-2	700	28	900	36	250	10	550	22
300 SVHV-2	850	34	1200	48	250	10	650	26
350 SVHV-2	1000	40	1200	48	250	10	700	28

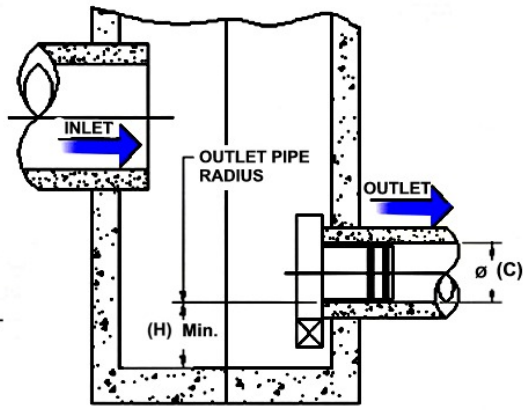
NOTE: ***In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.***



SQUARE / RECTANGULAR WELL



SECTION A



SECTION B

INSTALLATION

The installation of a **HYDROVEX®** regulator may be undertaken once the manhole and piping is in place. Installation consists of simply fitting the regulator into the outlet pipe of the manhole. **John Meunier Inc.** recommends the use of a lubricant on the outlet pipe, in order to facilitate the insertion and orientation of the flow controller.

MAINTENANCE

HYDROVEX® regulators are manufactured in such a way as to be maintenance free; however, a periodic inspection (every 3-6 months) is suggested in order to ensure that neither the inlet nor the outlet has become blocked with debris. The manhole should undergo periodically, particularly after major storms, inspection and cleaning as established by the municipality

GUARANTY

The **HYDROVEX®** line of **VHV / SVHV** regulators are guaranteed against both design and manufacturing defects for a period of 5 years. Should a unit be defective, **John Meunier Inc.** is solely responsible for either modification or replacement of the unit.

John Meunier Inc.
ISO 9001 : 2008

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Revised: 2011-05-03

WATTS®	Adjustable Accutrol Weir Tag: _____	Adjustable Flow Control for Roof Drains

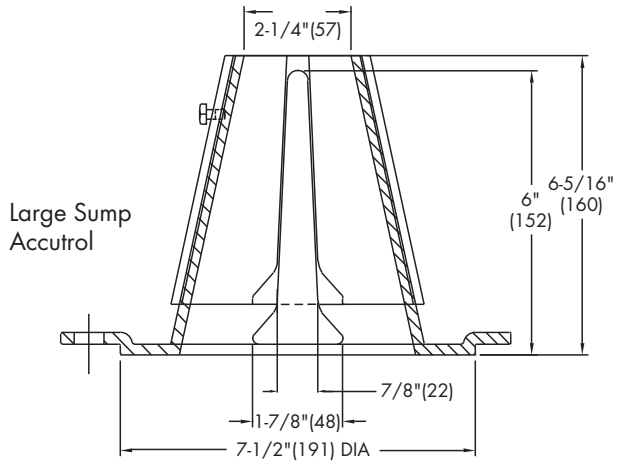
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

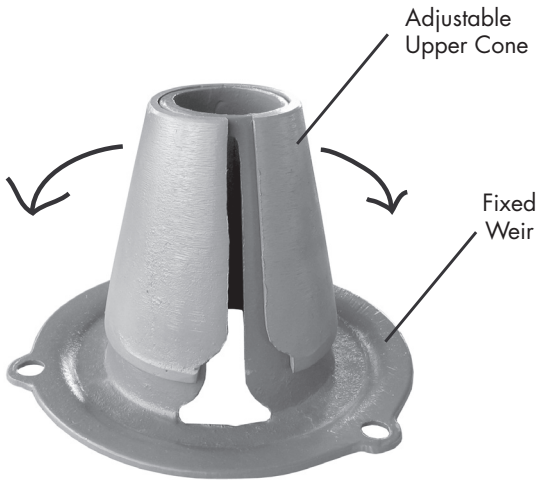
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name _____ Contractor _____

Job Location _____ Contractor's P.O. No. _____

Engineer _____ Representative _____

WATTS®
A Watts Water Technologies Company

USA: Tel: (800) 338-2581 • Fax: (828) 248-3929 • Watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • Watts.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

RD-200

Tag: _____

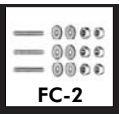
Small Sump Roof Drain

Components:

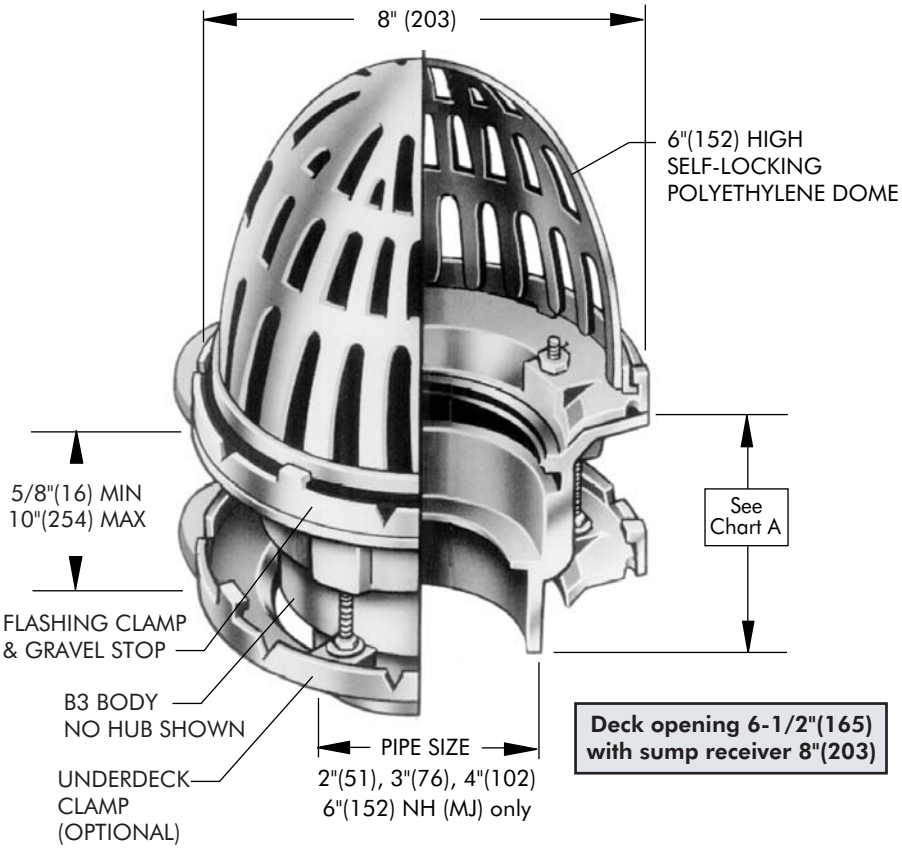

B3


B3-FLG


B3-DM


FC-2

SPECIFICATION: Watts Drainage Products RD-200 epoxy coated cast iron small sump roof drain with wide serrated flashing flange, flashing clamp device with integral gravel stop and selflocking polyethylene (standard) dome strainer.



Deck opening 6-1/2"(165) with sump receiver 8"(203)

Order Code: RD-20☐☐-☐-☐

Ex. RD-202P-K

Pipe Sizing (Select One)		
Suffix	Description	
2	2"(51) Pipe Size	☐
3	3"(76) Pipe Size	☐
4	4"(102) Pipe Size	☐
6	6"(152) Pipe Size	☐

Outlet Type (Select One)		
Suffix	Description	
NH	No Hub (MJ)	☐
P	Push On	☐
T	Threaded Outlet	☐
X	Inside Caulk	☐

Options (Select One or More)		
Suffix	Description	
-A	Accutrol weir (specify #1-6 slots)	☐
-B	Sump Receiver Flange	☐
-BED	Sump Receiver, Adj. Ext., Deck Clamp*	☐
-C	Secondary Membrane Clamp	☐
-D	Underdeck Clamp*	☐
-E	Adjustable Extension	☐
-GSS	Stainless Steel Ballast Guard	☐
-K	Ductile Iron Dome	☐
-K80	Aluminum Dome	☐
-L	Vandal Resistant Dome	☐
-R	2" High External Water Dam	☐
-SO	Side Outlet**	☐
-W	Adj. Water Level Regulator	☐
-W-1	Waterproofing Flange	☐
-Z	Extended Integral Wide Flange	☐
-5	Sediment Bucket	☐
-12	Galvanized Dome	☐
-13	All Galvanized	☐
-83	Mesh Covered Dome	☐
-113M	Special Epoxy from 3M Range	☐

Optional Body Material (NH Only)		
Suffix	Description	
-60	PVC Body w/Socket Outlet	☐
-61	ABS Body w/Socket Outlet	☐

Chart A

Free Area Sq. In.
35

	Std.	P	T	X	60/61
Pipe Size	No Hub	Push On	Female Thread	Inside Caulk	PVC/ ABS
2"(51)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	3-3/4"(95)
3"(76)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	3-3/4"(95)
4"(102)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	4"(102)
6"(152)	3-1/2"(89)				

* Underdeck Clamp (-BED and -D options) only available in 2"(51), 3"(76), 4"(102) pipe sizes.

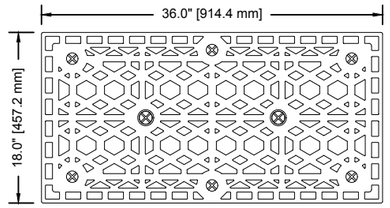
** Side Outlet (-SO) option only available in 2"(51), 3"(76), 4"(102) pipe sizes. Underdeck Clamp (-BED and -D options) are not available when -SO is selected.

Job Name _____ Contractor _____

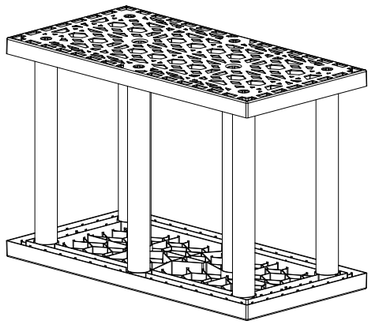
Job Location _____ Contractor's P.O. No. _____

Engineer _____ Representative _____

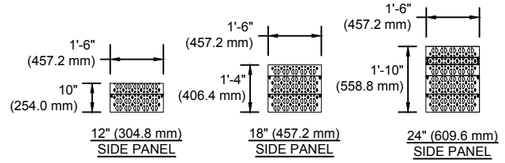
CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca

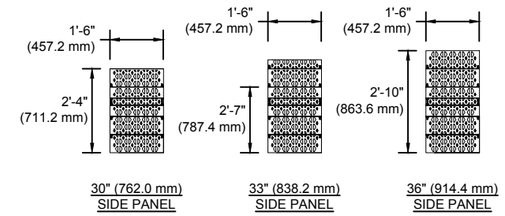


TOP



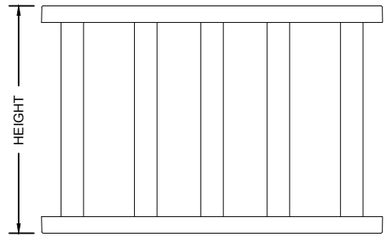
ISOMETRIC VIEW



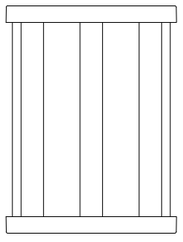


NOTES:
1. SIDE PANELS TO BE INSTALLED ALONG SYSTEM PERIMETER, UNLESS OTHERWISE SPECIFIED.
2. ALL HEIGHTS TO BE CUT FROM A 36" (914.4 mm) SIDE PANEL AT PRE-SCRIBED LOCATIONS, EXCEPT 33" (838.2 mm) & 12" (304.8 mm) SIDE PANEL.

SIDE PANEL DETAIL



FRONT



SIDE

MODULE DETAIL

STORMTANK® MODULE				
NAME	HEIGHT (mm)	CAPACITY (m^3)	VOID RATIO	NOMINAL WEIGHT (kg)
ST-12	12" (304.8)	4.22 cf (0.1194)	93.70%	17.56 lbs. (7.965)
ST-18	18" (457.2)	6.44 cf (0.1824)	95.50%	22.70 lbs. (10.29)
ST-24	24" (609.6)	8.66 cf (0.2452)	96.00%	26.30 lbs. (11.92)
ST-30	30" (762.0)	10.88 cf (0.3081)	96.50%	29.50 lbs. (13.38)
ST-33	33" (838.2)	11.99 cf (0.3395)	96.90%	29.82 lbs. (13.53)
ST-36	36" (914.4)	13.10 cf (0.3710)	97.00%	33.10 lbs. (15.01)

NOTES:
a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.
b. SIDE PANELS REQUIRED AROUND THE PERIMETER OF THE INSTALLATION ONLY, UNLESS OTHERWISE NOTED.
c. SIDE PANELS ARE TO BE CUT FROM A 36" PANEL AT THE PRE-SCRIBED LOCATIONS.

REV.	DATE	RECORD OF CHANGES	BY	APPRV.
D	2/17/17	ST-12 MODULE ADDED, METRIC DIMENSIONS UPDATED	CGB	
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

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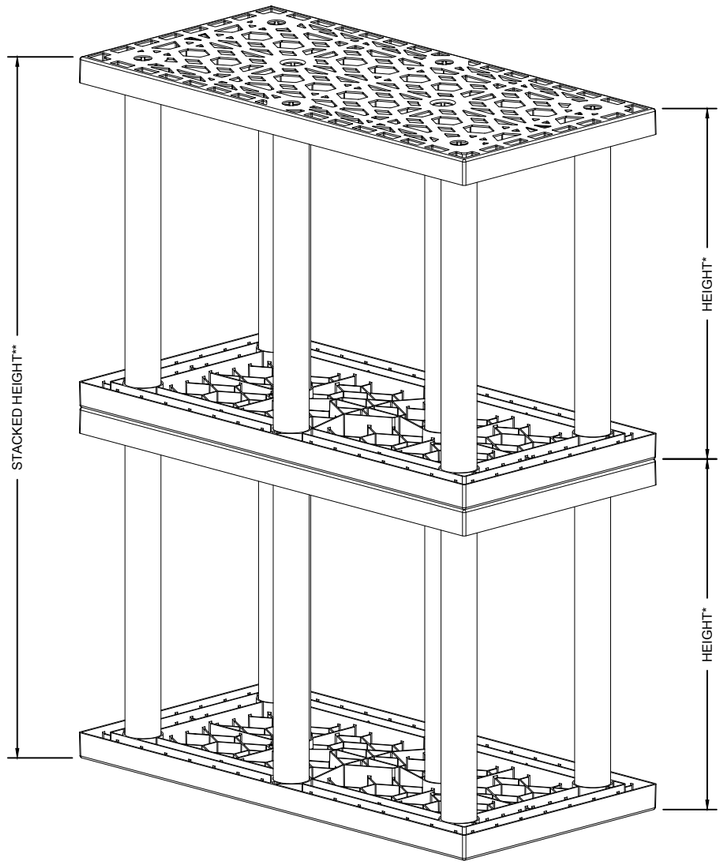
Fax: (610) 376-6022
www.brentwoodindustries.com

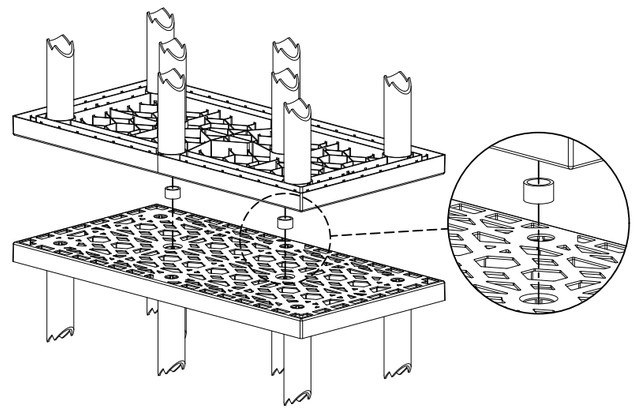
Project Name: MODULE DETAIL

Title: STORMTANK® MODULE

Drawn By: B.LINE | Date: 4/5/12
Drawing No.: STM-000-00 | Sheet: 1 of 2 | Scale: NTS



MODULE DOUBLE STACK DETAIL



STACKING PIN DETAIL

DOUBLE STACK CONFIGURATIONS:						
SYSTEM HEIGHT (mm)	ST-18	ST-24	ST-30	ST-33	ST-36	CAPACITY (m^3)
42" (1,067)	1	1	-	-	-	15.08 cf (0.4270)
48" (1,219)	1	-	1	-	-	17.30 cf (0.4899)
51" (1,295)	1	-	-	1	-	18.42 cf (0.5216)
54" (1,372)	1	-	-	-	1	19.50 cf (0.5522)
57" (1,448)	-	1	-	1	-	20.64 cf (0.5845)
60" (1,524)	-	1	-	-	1	21.75 cf (0.6159)
63" (1,600)	-	-	1	1	-	22.86 cf (0.6473)
66" (1,676)	-	-	-	2	-	23.97 cf (0.6788)
69" (1,753)	-	-	-	1	1	25.08 cf (0.7101)
72" (1,829)	-	-	-	-	2	26.20 cf (0.7419)

NOTES:
a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.
b. STACKING PINS REQUIRED BETWEEN MODULE LAYERS, FOR ALL STACKED SYSTEMS (SEE DETAIL).

REV.	DATE	RECORD OF CHANGES	BY	APPRV.
D	2/17/17	ST-12 MODULE ADDED, METRIC DIMENSIONS UPDATED	CGB	
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

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Project Name
MODULE DOUBLE STACK DETAIL

Title
STORMTANK
MODULE

Drawn By		Date
B.LINE		4/5/12
Drawing No.	Sheet	Scale
STM-000-00	2 of 2	NTS

STEP 1:

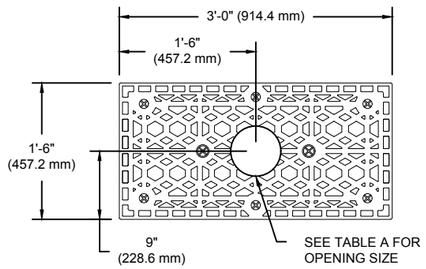
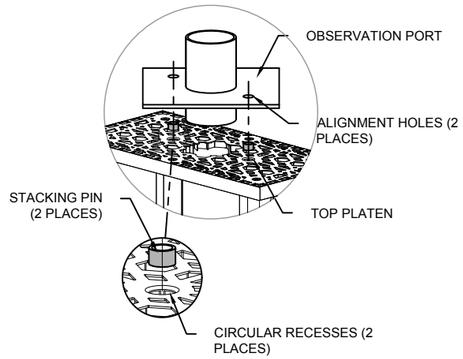


TABLE A: OBSERVATION PORT DIMENSION		
PORT SIZE	OPEN SIZE	RISER PIPE DIA.
6" (152.4 mm)	7" (177.8 mm)	6" (152.4 mm)
8" (203.2 mm)	9" (228.6 mm)	8" (203.2 mm)
10" (254.0 mm)	11" (279.4 mm)	10" (254.0 mm)

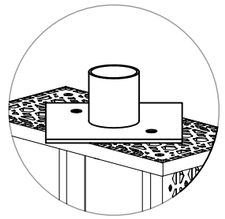
LAYOUT & CUT OPENING INTO THE CENTER OF THE TOP PLATEN FOR BRENTWOOD OBSERVATION PORT.

STEP 2:



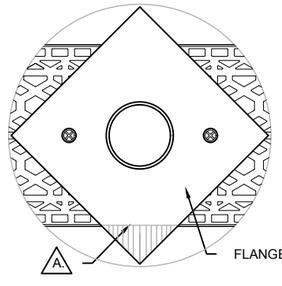
ALIGN PORT PLATE WITH TOP PANEL:
INSERT TWO STORMTANK MODULE STACKING PINS INTO THE CIRCULAR RECESSES IN THE TOP PLATEN OF THE STORMTANK MODULE. INSERT THE SHORT SIDE OF THE PORT PIPE STUB INTO THE PLATEN ALIGNING THE PORT PLATE ALIGNMENT HOLES WITH THE STACKING PINS.

STEP 3:



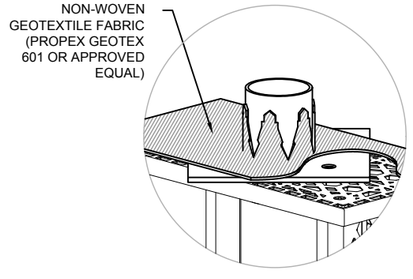
INSTALL OBSERVATION PORT

STEP 4:



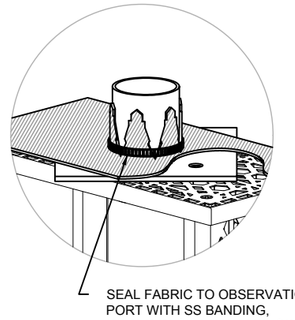
A MARK & CUT FLANGE PLATE FLUSH WITH MODULE SIDE "WHEN MODULE IS ON THE PERIMETER OF THE SYSTEM."

STEP 5:



INSTALL GEOTEXTILE:
WRAP SPECIFIED GEOTEXTILE FABRIC AROUND ENTIRE INSTALLATION OF STORMTANK MODULES. CUT "X" PATTERN INTO GEOTEXTILE FABRIC AT OBSERVATION PORT AND PEEL EDGES OUT.

STEP 6:



NOTES:
a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER INSTALLATION PRACTICES.

REV.	DATE	RECORD OF CHANGES	BY	APPRV.
F	2/17/17	METRIC DIMENSIONS UPDATED	CGB	
E	11/10/14	GEOTEXTILE PRODUCT SPECIFIED	CGB	
D	9/9/13	UPDATED DRAWING FORMAT	JKB	JKB
C	9/7/12	UPDATED DRAWING FORMAT	BLL	FK
B	3/27/12	REMOVE 6" DIA. PORT CALLOUT	BLL	FK
A	1/11/12	INITIAL RELEASE	BLL	FK

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Project Name
OBSERVATION PORT INSTALLATION DETAIL

Title
STORMTANK MODULE

Drawn By		Date
B.LINE		1/11/12
Drawing No.	Sheet	Scale
STM-002-00	1 of 1	NTS

DESIGN GUIDE

STORMTANK® Module

BRENTWOOD®

Contents

General Notes

1. Brentwood recommends that the installing contractor contact either Brentwood or the local distributor prior to installation of the system to schedule a pre-construction meeting. This meeting will ensure that the installing contractor has a firm understanding of the installation instructions.
2. All systems must be designed and installed to meet or exceed Brentwood's minimum requirements. Although Brentwood offers support during the design, review, and construction phases of the Module system, it is the ultimate responsibility of the Engineer of Record to design the system in full compliance with all applicable engineering practices, laws, and regulations.
3. Brentwood requires a minimum cover of 24" (610 mm) and/or a maximum Module invert of 11' (3.35 m). Additionally, a minimum 6" (152 mm) leveling bed, 12" (305 mm) side backfill, and 12" (305 mm) top backfill are required on every system.
4. Brentwood recommends a minimum bearing capacity and subgrade compaction for all installations. If site conditions are found not to meet any design requirements during installation, the Engineer of Record must be contacted immediately.
5. All installations require a minimum two layers of geotextile fabric. One layer is to be installed around the Modules, and another layer is to be installed between the stone/soil interfaces.
6. Stone backfilling is to follow all requirements of the most current installation instructions.
7. The installing contractor must apply all protective measures to prevent sediment from entering the system during and after installation per local, state, and federal regulations.
8. The StormTank® Module carries a Limited Warranty, which can be accessed at www.brentwoodindustries.com.

1.0 Introduction

About Brentwood

Brentwood is a global manufacturer of custom and proprietary products and systems for the construction, consumer, medical, power, transportation, and water industries. A focus on plastics innovation, coupled with diverse production capabilities and engineering expertise, has allowed Brentwood to build a strong reputation for thermoplastic molding and solutions development.

Brentwood's product and service offerings continue to grow with an ever-increasing manufacturing presence. By emphasizing customer service and working closely with clients throughout the design, engineering, and manufacturing phases of each project, Brentwood develops forward-thinking strategies to create targeted, tailored solutions.

StormTank® Module

The StormTank Module is a strong, yet lightweight, alternative to other subsurface systems and offers the largest void space (up to 97%) of any subsurface stormwater storage unit on the market. The Modules are simple to assemble on site, limiting shipping costs, installation time, and labor. Their structural PVC columns pressure fit into the polypropylene top/bottom platens, with side panels inserted around the perimeter of the system. This open design and lack of internal walls make the Module system easy to clean compared to other subsurface box structures. When properly designed, applied, installed, and maintained, the Module system has been engineered to achieve a 50-year lifespan.

Technical Support

Brentwood's knowledgeable distributor network and in-house associates emphasize customer service and support by parterning with customers to extend the process beyond physical material supply. These trained specialists are available to assist in the review of proposed systems, conversions of alternatively designed systems, or to resolve any potential concerns before, during, and after the design process. To provide the best assistance, it is recommended that associates be provided with a site plan and cross-sections that include grading, drainage structures, dimensions, etc.

2.0 Product Information

Applications

The Module system can be utilized for detention, infiltration, capture and reuse, and specialty applications across a wide range of industries, including the commercial, residential, and recreational segments. The product's modular design allows the system to be configured in almost any shape (even around utilities) and to be located under almost any pervious or impervious surface.

Module Selection

Brentwood manufactures the Module in five different heights (Table 1) that can be stacked uniformly up to two Modules high. This allows for numerous height configurations up to 6' (1.83 m) tall. The Modules can be buried up to a maximum invert of 11' (3.35 m) and require a minimum cover of 24" (610 mm) for load rating. When selecting the proper Module, it is important to consider the minimum required cover, any groundwater or limiting zone restrictions, footprint requirements, and all local, state, and federal regulations.

Table 1: Nominal StormTank® Module Specificiations

	ST-18	ST-24	ST-30	ST-33	ST-36
Height	18" (457 mm)	24" (610 mm)	30" (762 mm)	33" (838 mm)	36" (914 mm)
Void Space	95.5%	96.0%	96.5%	96.9%	97.0%
Module Storage Capacity	6.54 ft^3 (0.18 m^3)	8.64 ft^3 (0.24 m^3)	10.86 ft^3 (0.31 m^3)	11.99 ft^3 (0.34 m^3)	13.10 ft^3 (0.37 m^3)
Min. Installed Capacity*	9.15 ft^3 (0.26 m^3)	11.34 ft^3 (0.32 m^3)	13.56 ft^3 (0.38 m^3)	14.69 ft^3 (0.42 m^3)	15.80 ft^3 (0.45 m^3)
Weight	22.70 lbs (10.30 kg)	26.30 lbs (11.93 kg)	29.50 lbs (13.38 kg)	31.3 lbs (14.20 kg)	33.10 lbs (15.01 kg)

Min. Installed Capacity includes the leveling bed, Module, and top backfill storage capacity for one Module. Stone storage capacity is based on 40% void space.* ***Side backfill storage is not included.*

3.0 Manufacturing Standards

Brentwood selects material based on long-term performance needs. To ensure long-term performance and limit component deflection over time (creep), Brentwood selected polyvinyl chloride (PVC) for the Module's structural columns and a virgin polypropylene (PP) blend for the top/bottom and side panels. PVC provides the largest creep resistance of commonly available plastics, and therefore, provides the best performance under loading conditions. Materials like polyethylene (HDPE) and recycled PP have lower creep resistance and are not recommended for load-bearing products and applications.

Materials:

Brentwood's proprietary PVC and PP copolymer resins have been chosen specifically for utilization in the StormTank® Module. The PVC is blended in house by experts and is a 100% blend of post-manuacturing/pre-consumer recycled material. Both materials exhibit structural resilience and naturally resist the chemicals typically found in stormwater runoff.

Methods:

Injection Molding

The Module's top/bottom platens and side panels are injection molded, using proprietary molds and materials. This allows Brentwood to manufacture a product that meets structural requirements while maintaining dimensional control, molded-in traceability, and quality control.

Extrusion

Brentwood's expertise in PVC extrusion allows the structural columns to be manufactured in house. The column extrusion includes the internal structural ribs required for lateral support.

Quality Control

Brentwood maintains strict quality control in order to ensure that materials and the final product meet design requirments. This quality assurance program includes full material property testing in accordance with American Society for Testing and Materials (ASTM) standards, full-part testing, and process testing in order to quantify product performance during manufacturing. Additionally, Brentwood conducts secondary finshed-part testing to verify that design requirements continue to be met post-manufacturing.

All Module parts are marked with traceability information that allows for tracking of manufacturing. Brentwood maintains equipment at all manufacturing locations, as well as at its corporate testing lab, to ensure all materials and products meet all requirements.

4.0 Structural Response

Structural Design

The Module has been designed to resist loads calculated in accordance with the American Association of State Highway and Transportation Official's (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design manual. This fully factored load includes a multiple presence factor, dynamic load allowance, and live load factor to account for real-world situations. This loading was considered when Brentwood developed both the product and installation requirements. The developed minimum cover ensures the system maintains an adequate resistance factor for the design truck (HS-20) and HS-25 loads.

Full-Scale Product Testing

Engineers at Brentwood's in-house testing facility have completed full-scale vertical and lateral tests on the Module to evaluate product response. To date, Brentwood continues in-house testing in order to evaluate long-term creep effects.

Fully Installed System Testing

Brentwood's dedication to providing a premier product extends to fully installed testing. Through a partnership with Queen's University's GeoEngineering Centre in Kingston, Ontario, Brentwood has conducted full-scale installation tests of single- and double-stacked Module systems to analyze short- and long-term performance. Testing includes short-term ultimate limit state testing under fully factored AASHTO loads and minimum installation cover, lateral load testing, long-term performance and lifecycle testing utilizing time-temperature superposition, and load resistance development. Side backfill material tests were also performed to compare the usage of sand, compacted stone, and uncompacted stone.

5.0 Foundation

The foundation (subgrade) of the subsurface storage structure may be the most important part of the Module system installation as this is the location where the system applies the load generated at the surface. If the subgrade lacks adequate support or encounters potential settlement, the entire system could be adversely affected. Therefore, when implementing an underground storage solution, it is imperative that a geotechnical investigation be performed to ensure a strong foundation.

Considerations & Requirements:

Bearing Capacity

The bearing capacity is the ability of the soil to resist settlement. In other words, it is the amount of weight the soil can support. This is important versus the native condition because the system is replacing earth, and even though the system weighs less than the earth, the additional load displacement of the earth is not offset by the difference in weight.

Using the Loading and Resistance Factor Design (LRFD) calculation for bearing capacity, Brentwood has developed a conservative minimum bearing capacity table (see Appendix). The Engineer of Record shall reference this table to assess actual cover versus the soil bearing required for each unit system.

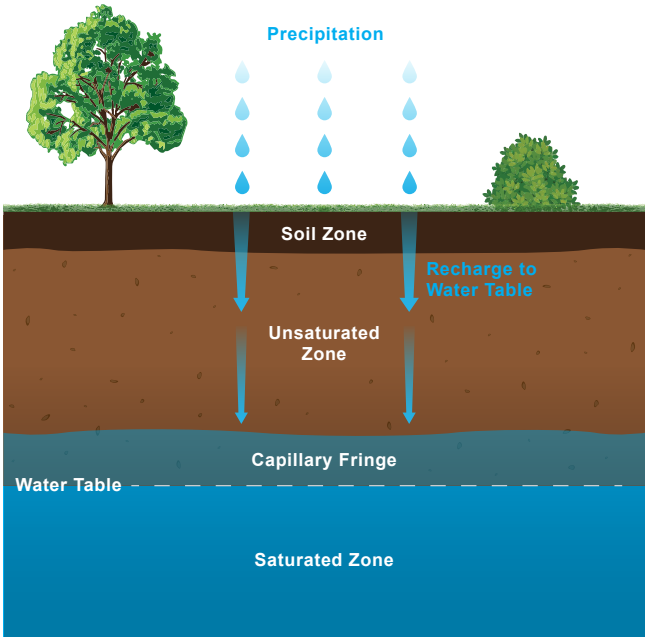
Soil Profile

Limiting Zones

Limiting zones are conditions in the underlying soils that can affect the maximum available depth for installation and can reduce the strength and stability of the underlying subgrade. The three main forms of limiting zones are water tables, bedrock, and karst topography. It is recommended that a system be offset a minimum of 12" (305 mm) from any limiting zones.

Compaction

Soil compaction occurs as the soil particles are pressed together and pore space is eliminated. By compacting the soils to 95% (as recommended by Brentwood), the subgrade strength will increase, in turn limiting both the potential for the soil to move once installed and for differential settlement to occur throughout the system. If designing the specific compaction requirement, settlement should be limited to less than 1" (25 mm) through the entire subgrade and should not exceed a 1/2" (13 mm) of differential settlement between any two adjacent units within the system over time.



Water Table Zones

Mitigation

If a minimum subgrade bearing capacity cannot be achieved because of weak soil, a suitable design will need to be completed by a Geotechnical Engineer. This design may include the over-excavation of the subgrade and an engineered fill or slurry being placed. Additional material such as geogrid or other products may also be required. Please contact a Geotechnical Engineer prior to selecting products or designing the subgrade.

6.0 System Materials

Geotextile Fabric

The 6-ounce geotextile fabric is recommended to be installed between the soil and stone interfaces around the Modules to prevent soil migration.

Leveling Bed

The leveling bed is constructed of 6”-thick (152 mm) angular stone (Table 2). The bed has not been designed as a structural element but is utilized to provide a level surface for the installation of the system and provide an even distribution of load to the subgrade.

Stone Backfill

The stone backfill is designed to limit the strain on the product through displacement of load and ensure the product’s longevity. Therefore, a minimum of 12”-wide (305 mm) angular stone must be placed around all sides of the system. In addition, a minimum layer of 12” (305 mm) angular stone is required on top of the system. All material is to be placed evenly in 12” (305 mm) lifts around and on top of the system and aligned with a vibratory plate compactor.

Table 2: Approved Backfill Material

Material Location	Description	AASHTO M43 Designation	ASTM D2321 Class	Compaction/Density
Finished Surface	Topsoil, hardscape, stone, concrete, or asphalt per Engineer of Record	N/A	N/A	Prepare per engineered plans
Suitable Compactable Fill	Well-graded granular soil/aggregate, typically road base or earthen fill (maximum 4" particle size)	56, 57, 6, 67, 68	I & II III (Earth Only)	Place in maximum 12" lifts to a minimum 90% standard proctor density
Top Backfill	Crushed angular stone placed between Modules and road base or earthen fill	56, 57, 6, 67, 68	I & II	Plate vibrate to provide evenly distributed layers
Side Backfill	Crushed angular stone placed between earthen wall and Modules	56, 57, 6, 67, 68	I & II	Place and plate vibrate in uniform 12" lifts around the system
Leveling Bed	Crushed angular stone placed to provide level surface for installation of Modules	56, 57, 6, 67, 68	I & II	Plate vibrate to achieve level surface

Impermeable Liner

In designs that prevent runoff from infiltrating into the surrounding soil (detention or reuse applications) or groundwater from entering the system, an impermeable liner is required. When incorporating a liner as part of the system, Brentwood recommends using a manufactured product such as a PVC liner. This can be installed around the Modules themselves or installed around the excavation (to gain the benefit of the void space in the stone) and should include an underdrain system to ensure the basin fully drains. This liner is installed with a layer of geotextile fabric on both sides to prevent puncture, in accordance with manufacturer recommendations.

7.0 Connections

Stormwater runoff must be able to move readily in and out of the StormTank® Module system. Brentwood has developed numerous means of connecting to the system, including inlet/outlet ports and direct abutment to a catch basin or endwall. All methods of connection should be evaluated as each one may offer a different solution. Brentwood has developed drawings to assist with specific installation methods, and these are available at www.brentwoodindustries.com.

Inlet/Outlet and Pipe Connections

To facilitate easy connection to the system, Brentwood manufactures two inlet/outlet ports. They are 12" (305 mm) and 14" (356 mm), respectfully, and utilize a flexible coupling connection to the adjoining pipe.

Another common installation method is to directly connect the pipe to the system. In order to do this, an opening is cut into the side panels, the pipe is inserted, and then the system is wrapped in geotextile fabric. When utilizing this connection method, the pipe must be located a minimum of 3" (76 mm) from the bottom of the system. This provides adequate clearance for the bottom platen and the required strength in the remaining side panel. To maintain the required clearances or reduce pipe size, it may be necessary to connect utilizing a manifold system.

Direct Abutment

The system can also be connected by directly abutting Modules to a concrete catch basin or endwall. This allows for a seamless connection of structures in close proximity to the system and eliminates the need for numerous pipe connections. When directly abutting one of these structures, remove any side panels that fully abut the structure, and make sure it is flush with the system to prevent material migration into the structure.

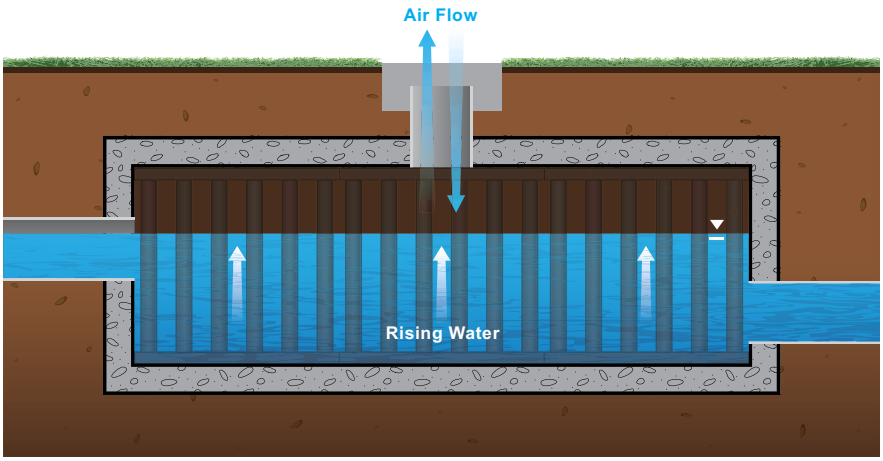
Underdrain

Underdrains are typically utilized in detention applications to ensure the system fully drains since infiltration is limited or prohibited. The incorporation of an underdrain in a detention application will require an impermeable liner between the stone-soil interface.

Cleanout Ports

Brentwood understands the necessity to inspect and clean a subsurface system and has designed the Module without any walls to allow full access. Brentwood offers three different cleanout/observation ports for utilization with the system. The ports are made from PVC, provide an easy means of connection, and are available in 6" (152 mm), 8" (203 mm) and 10" (254 mm) diameters. The 10" (254 mm) port is sized to allow access to the system by a vacuum truck suction hose for easy debris removal.

It is recommended that ports be located a maximum of 30' (9.14 m) on center to provide adequate access, ensure proper airflow, and allow the system to completely fill.



Ventilation and Air Flow

8.0 Pretreatment

Removing pollutants from stormwater runoff is an important component of any stormwater management plan. Pretreatment works to prevent water quality deterioration and also plays an integral part in allowing the system to maintain performance over time and increase longevity. Treatment products vary in complexity, design, and effectiveness, and therefore, should be selected based on specific project requirements.

Typical Stormwater System

StormTank® Shield

Brentwood's StormTank Shield provides a low-cost solution for stormwater pretreatment. Designed to improve sumped inlet treatment, the Shield reduces pollutant discharge through gross sediment removal and oil/water separation. For more information, please visit www.brentwoodindustries.com.

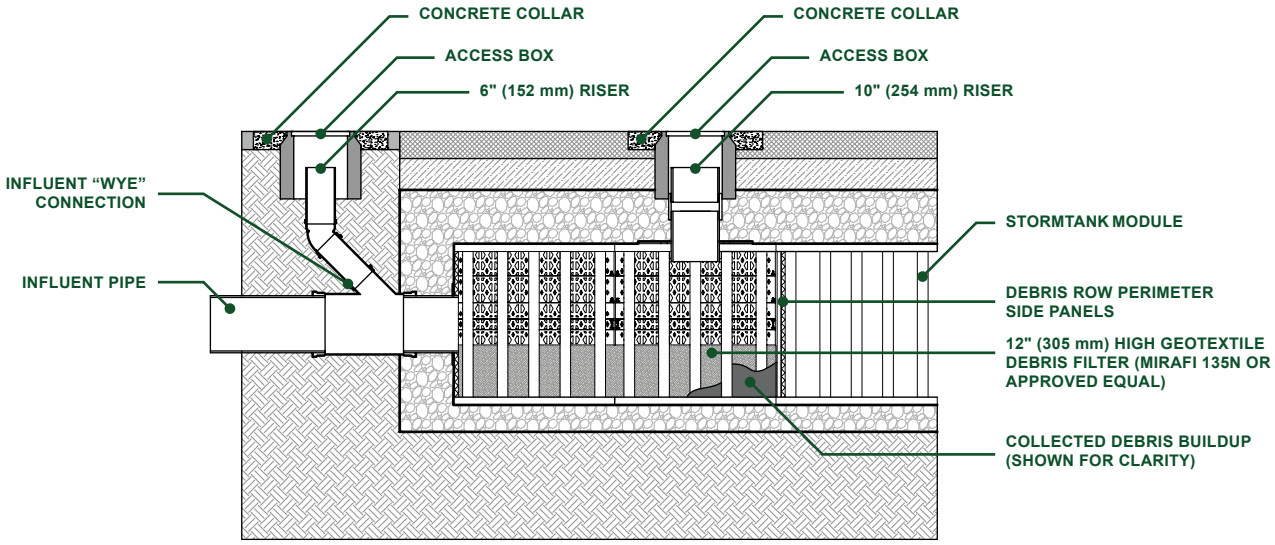
Debris Row (Easy Cleanout)

An essential step of designing, installing, and maintaining a subsurface system is preventing debris from entering the storage. This can be done by incorporating debris rows (or bays) at the inlets of the system to prevent debris from entering the rest of the system.

The debris row is built into the system utilizing side panels with a 12" (305 mm) segment of geotextile fabric. This allows for the full basin capacity to be utilized while storing any debris in an easy-to-remove location. To calculate the number of side panels required to prevent backing up, the opening area of the side panels on the area above the geotextile fabric has been calculated and compared to the inflow pipe diameter.

Debris row cleanout is made easy by including 10" (254 mm) suction ports, based on the length of the row, and a 6" (152 mm) saddle connection to the inflow pipe. If the system is directly abutting a catch basin, the saddle connection is not required, and the flush hose can be inserted through the catch basin. Debris is then flushed from the inlet toward the suction ports and removed.

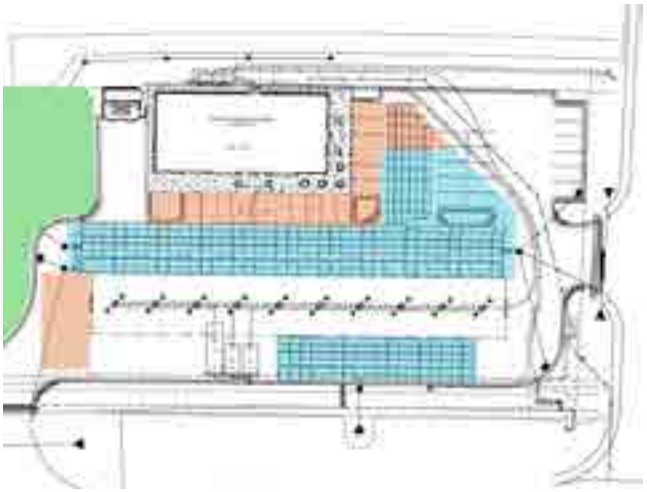
Brentwood has developed drawings and specifications that are available at www.brentwoodindustries.com to illustrate the debris row configuration and layouts.



Debris Row Section Detail

9.0 Additional Considerations

Many variable factors, such as the examples below, must be taken into consideration when designing a StormTank® Module system. As these considerations require complex calculations and proper planning, please contact Brentwood or your local distributor to discuss project-specific requirements.



Site Plan Module Layout Adaptability
(StormTank Modules shown in blue)

Adaptability

The Modules can be arranged in custom configurations to meet tight site constraints and to provide different horizontal and edge configurations. Modules can also be stacked, to a maximum 2 units tall, to meet capacity needs and can be buried to a maximum invert of 11' (3.35 m) to allow for a stacked system or deeper burial.

Adjacent Structures

The location of adjacent structures, especially the location of footings and foundations, must be taken into consideration as part of system design. The foundation of a building or retaining wall produces a load that is transmitted to a footing and then applied to the surface below. The footing is intended to distribute the line load of the wall over a larger area without increasing the larger wall's thickness. The reason this is important is because the load the footing is applying to the earth is distributed through the earth and could potentially affect a subsurface system as either a vertical load to the top of the Module or a lateral load to the side of the Module.

Based on this increased loading, it is recommended that the subsurface system either maintain a distance away from the foundation, footing equal to the height between the Module invert and structure invert of the system, or the foundation or footing extend at a minimum to the invert of the subsurface system. By locating the foundation away from the system or equal to the invert, the loading generated by the structure does not get transferred onto the system. It is recommended that all adjacent structures be completed prior to the installation of the Modules to prevent construction loads from being imparted on the system.

Adjacent Excavation

The subsurface system must be protected before, during, and after the installation. Once a system is installed, it is important to remember that excavation adjacent to the system could potentially cause the system to become unstable. The uniform backfilling will evenly distribute the lateral loads to the system and prohibit the system from becoming unstable and racking from unequal loads. However, it is recommended that any excavation adjacent to a system remain a minimum distance away from the system equal to the invert. This will provide a soil load that is equal to the load applied by the opposite side of the installation. If the excavation is to exceed the invert of the system, additional analysis may be necessary.

Sloped Finished Grade

Much like adjacent excavation, a finished grade with a differential cover could potentially cause a subsurface system to become disproportionately loaded. For example, if one side of the system has 10' (3.05 m) of cover and the adjacent side has 24" (610 mm) of cover, the taller side will generate a higher lateral load, and the opposite side may not have an equal amount of resistance to prevent a racking of the system. Additional evaluation may be required when working on sites where the final grade around a system exceeds 5%.

10.0 Inspection & Maintenance

Description

Proper inspection and maintenance of a subsurface stormwater storage system are vital to ensuring proper product functioning and system longevity. It is recommended that during construction the contractor takes the necessary steps to prevent sediment from entering the subsurface system. This may include the installation of a bypass pipe around the system until the site is stabilized. The contractor should install and maintain all site erosion and sediment per Best Management Practices (BMP) and local, state, and federal regulations.

Once the site is stabilized, the contractor should remove and properly dispose of erosion and sediment per BMP and all local, state, and federal regulations. Care should be taken during removal to prevent collected sediment or debris from entering the stormwater system. Once the controls are removed, the system should be flushed to remove any sediment or construction debris by following the maintenance procedure outlined below.

During the first service year, a visual inspection should be completed during and after each major rainfall event, in addition to semi-annual inspections, to establish a pattern of sediment and debris buildup. Each stormwater system is unique, and multiple criteria can affect maintenance frequency. For example, whether or not a system design includes inlet protection or a pretreatment device has a substantial effect on the system's need for maintenance. Other factors include where the runoff is coming from (hardscape, gravel, soil, etc.) and seasonal changes like autumn leaves and winter salt.

During and after the second year of service, an established annual inspection frequency, based on the information collected during the first year, should be followed. At a minimum, an inspection should be performed semi-annually. Additional inspections may be required at the change of seasons for regions that experience adverse conditions (leaves, cinders, salt, sand, etc).

Maintenance Procedures

Inspection:

1. Inspect all observation ports, inflow and outflow connections, and the discharge area.
2. Identify and log any sediment and debris accumulation, system backup, or discharge rate changes.
3. If there is a sufficient need for cleanout, contact a local cleaning company for assistance.

Cleaning:

1. If a pretreatment device is installed, follow manufacturer recommendations.
2. Using a vacuum pump truck, evacuate debris from the inflow and outflow points.
3. Flush the system with clean water, forcing debris from the system.
4. Repeat steps 2 and 3 until no debris is evident.

11.0 System Sizing

System Sizing Calculation

This section provides a brief description of the process required to size the StormTank® Module system. If you need additional assistance in determining the required number of Modules or assistance with the proposed configuration, it is recommended that you contact Brentwood or your local distributor. Additionally, Brentwood's volume calculator can help you to estimate the available storage volumes with and without stone storage. This tool is available at www.brentwoodindustries.com.

1. Determine the required storage volume (Vs):
It is the sole responsibility of the Engineer of Record to calculate the storage volume in accordance with all local, state, and federal regulations.

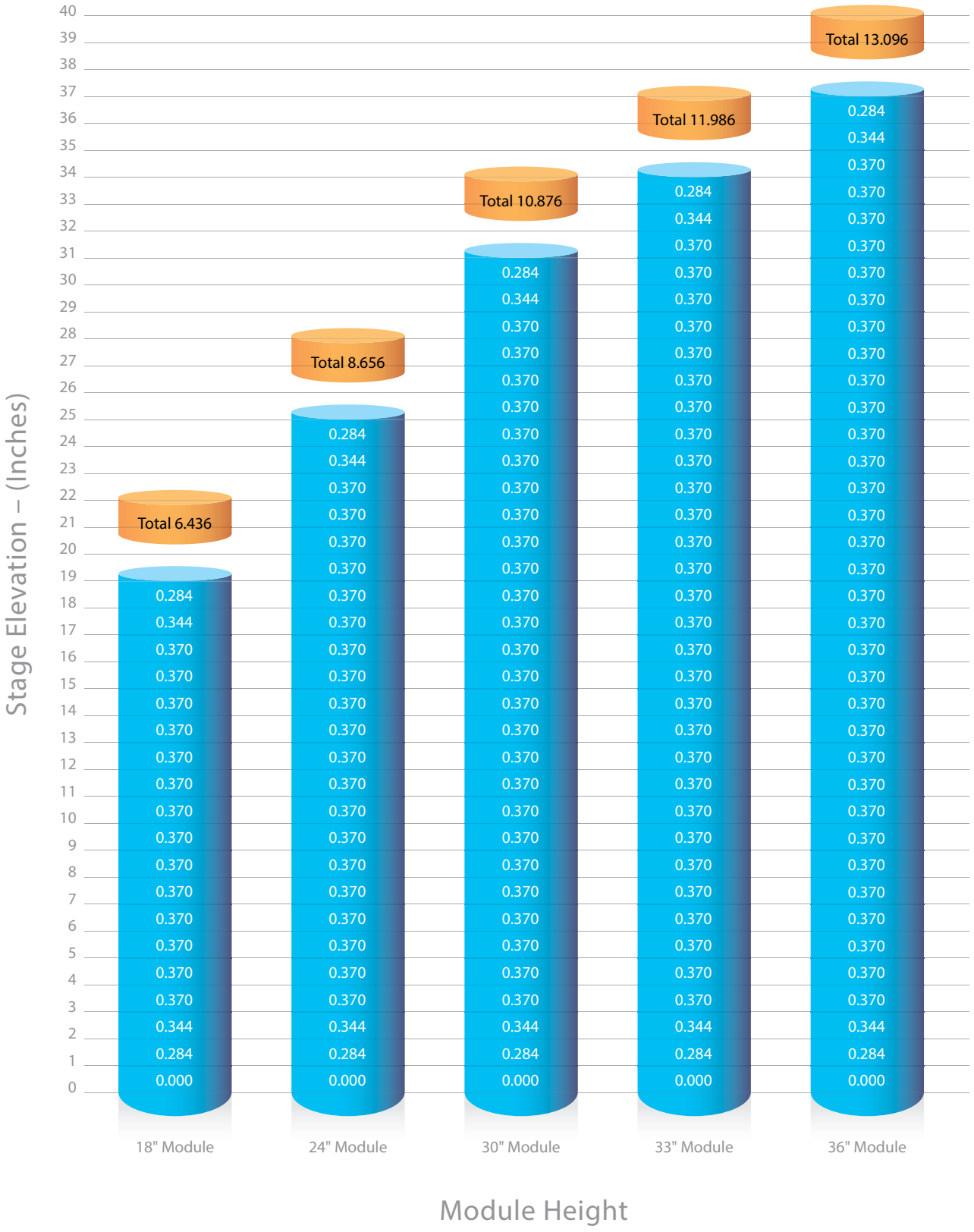
2. Determine the required number of Modules (N):
If the storage volume does not include stone storage, take the total volume divided by the selected Module storage volume. If the stone storage is to be included, additional calculations will be required to determine the available stone storage for each configuration.

3. Determine the required volume of stone (Vstone):
The system requires a minimum 6" (152 mm) leveling bed, 12" (305 mm) backfill around the system, and 12" (305 mm) top backfill utilizing 3/4" (19 mm) angular clean stone. Therefore, take the area of the system times the leveling bed and the top backfill. Once that value is determined, add the volume based on the side backfill width times the height from the invert of the Modules to the top of the Modules.

4. Determine the required excavation volume (Vexcv):
Utilizing the area of the system, including the side backfill, multiply by the depth of the system including the leveling bed. It is noted that this calculation should also include any necessary side pitch or benching that is required for local, state, or federal safety standards.

5. Determine the required amount of geotextile (G):
The system utilizes a multiple layer system of geotextile fabric. Therefore, two calculations are required to determine the necessary amount of geotextile. The first layer surrounds the entire system (including all backfill), and the second layer surrounds the Module system only. It is recommended that an additional 20% be included for waste and overlap.

11.1 Storage Volume



11.2 Material Quantity Worksheet

Project Name: | By:

Location: | Date:

System Requirements

Required Storage		ft^3 (m^3)
Number of Modules		Each
Module Storage		ft^3 (m^3)
Stone Storage		ft^3 (m^3)
Module Footprint		ft^2 (m^2) Number of Modules x 4.5 ft^2 (0.42 m^2)
System Footprint w/ Stone		ft^2 (m^2) Module Footprint + 1 ft (0.3048 m) to each edge
Stone		Tons (kg) Leveling Bed + Side Backfill + Top Backfill
Volume of Excavation		yd^3 (m^3) System Footprint w/ Stone x Total Height
Area of Geotextile		yd^2 (m^2) Wrap around Modules + Wrap around Stone/Soil Interface

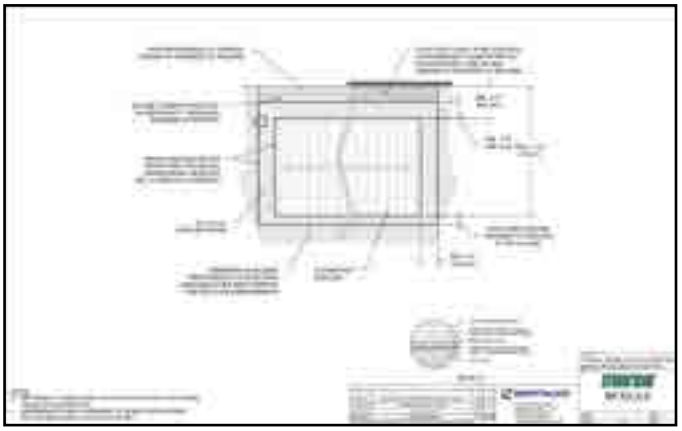
System Cost

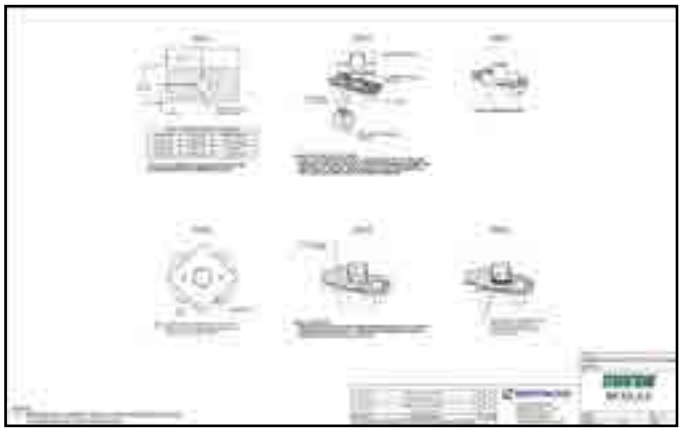
	Quantity			Unit Price			Total
Modules		ft^3 (m^3)	X	$	ft^3 (m^3)	=	$
Stone		Tons (kg)	X	$	Tons (kg)	=	$
Excavation		yd^3 (m^3)	X	$	yd^3 (m^3)	=	$
Geotextile		yd^2 (m^2)	X	$	yd^2 (m^2)	=	$
					Subtotal =		$
					Tons =		$

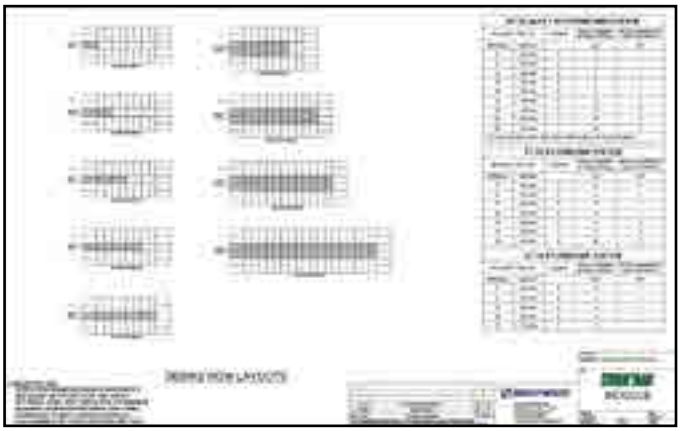
Material costs may not include freight.
Please contact Brentwood or your local distributor for this information.

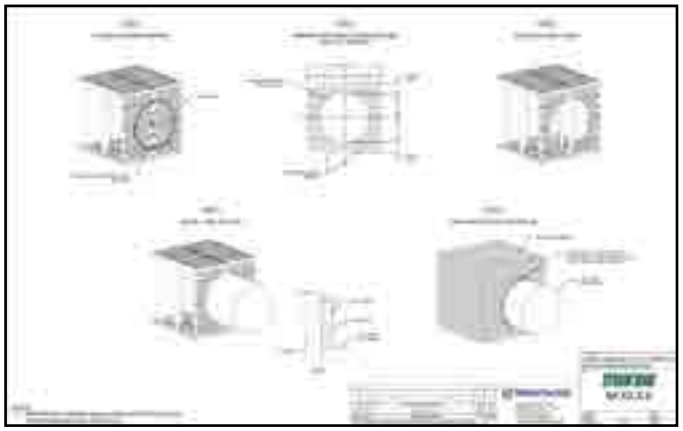
12.0 Detail Drawings

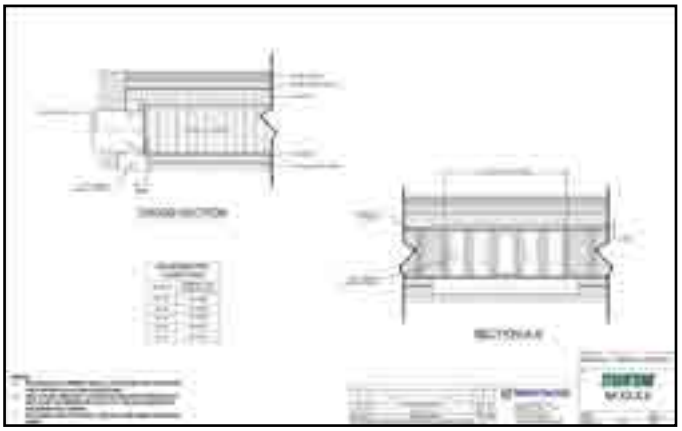
Brentwood has developed numerous drawings for utilization when specifying a StormTank® Module system. Below are some examples of drawings available at [www.brentwoodindustries.com.](http://www.brentwoodindustries.com)











13.0 Specifications

1) General

a) This specification shall govern the implementation, performance, material, and fabrication pertaining to the subsurface stormwater storage system. The subsurface stormwater storage system shall be manufactured by Brentwood Industries, Inc., 500 Spring Ridge Drive, Reading, PA 19610 (610.374.5109), and shall adhere to the following specification at the required storage capacities.

b) All work is to be completed per the design requirements of the Engineer of Record and to meet or exceed the manufacturer's design and installation requirements.

2) Subsurface Stormwater Storage System Modules

a) The subsurface stormwater storage system shall be constructed from virgin polypropylene and 100% recycled PVC to meet the following requirements:

i) High-Impact Polypropylene Copolymer Material

(1) Injection molded, polypropylene, top/bottom platens and side panels formed to a dimension of 36" (914 mm) long by 18" (457 mm) wide [nominal].

ii) 100% Recycled PVC Material

(1) PVC conforming to ASTM D-1784 Cell Classification 12344 b-12454 B.

(2) Extruded, rigid, and 100% recycled PVC columns sized for applicable loads as defined by Section 3 of the AASHTO LRFD Bridge Design Specifications and manufactured to the required length per engineer-approved drawings.

iii) Platens and columns are assembled on site to create Modules, which can be uniformly stacked up to two Modules high, in vertical structures of variable height (custom for each project).

iv) Modular stormwater storage units must have a minimum 95% void space and be continuously open in both length and width, with no internal walls or partitions.

3) Submittals

a) Only systems that are approved by the engineer will be allowed.

b) At least 10 days prior to bid, submit the following to the engineer to be considered for pre-qualification to bid:

i) A list of materials to be provided for work under this article, including the name and address of the materials producer and the location from which the materials are to be obtained.

ii) Three hard copies of the following:

(1) Shop drawings.

(2) Specification sheets.

(3) Installation instructions.

(4) Maintenance guidelines.

c) Subsurface Stormwater Storage System Component Samples for review:

i) Subsurface stormwater storage system Modules provide a single 36" (914 mm) long by 18" (457 mm) wide, height as specified, unit of the product for review.

ii) Sample to be retained by owner.

d) Manufacturers named as acceptable herein are not required to submit samples.

4) Structural Design

a) The structural design, backfill, and installation requirements shall ensure the loads and load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 3 are met.

b) Product shall be tested under minimum installation criteria for short-duration live loads that are calculated to include a 20% increase over the AASHTO Design Truck standard with consideration for impact, multiple vehicle presences, and live load factor.

c) Product shall be tested under maximum burial criteria for long-term dead loads.

d) The engineer may require submission of third-party test data and results in accordance with items 4b and 4c to ensure adequate structural design and performance.

14.0 Appendix - Bearing Capacity Tables

Cover		HS-25 (Unfactored)		HS-25 (Factored)	
English (in)	Metric (mm)	English (ksf)	Metric (kPa)	English (ksf)	Metric (kPa)
24	610	1.89	90.45	4.75	227.43
25	635	1.82	86.96	4.53	216.90
26	660	1.75	83.78	4.34	207.80
27	686	1.69	80.88	4.16	199.18
28	711	1.63	78.24	3.99	191.04
29	737	1.58	75.82	3.84	183.86
30	762	1.54	73.62	3.70	177.16
31	787	1.50	71.60	3.57	170.93
32	813	1.46	69.75	3.45	165.19
33	838	1.42	68.06	3.34	159.92
34	864	1.39	66.51	3.24	155.13
35	889	1.36	65.10	3.14	150.34
36	914	1.33	63.80	3.05	146.03
37	940	1.31	62.62	2.97	142.20
38	965	1.29	61.54	2.90	138.85
39	991	1.26	60.55	2.83	135.50
40	1,016	1.25	59.65	2.76	132.15
41	1,041	1.23	58.54	2.70	129.28
42	1,067	1.21	58.09	2.67	127.84
43	1,092	1.20	57.42	2.60	124.49
44	1,118	1.19	56.81	2.55	122.09
45	1,143	1.18	56.26	2.50	119.70
46	1,168	1.16	55.77	2.46	117.79
47	1,194	1.16	55.33	2.42	115.87
48	1,219	1.15	54.94	2.39	114.43
49	1,245	1.14	54.59	2.36	113.00
50	1,270	1.13	54.29	2.33	111.56
51	1,295	1.13	54.03	2.30	110.12
52	1,321	1.12	53.80	2.27	108.69
53	1,346	1.12	53.62	2.25	107.73
54	1,372	1.12	53.46	2.23	106.77
55	1,397	1.11	53.34	2.21	105.82
56	1,422	1.11	53.24	2.19	104.86
57	1,448	1.11	53.18	2.17	103.90
58	1,473	1.11	53.14	2.16	103.42
59	1,499	1.11	53.12	2.14	102.46
60	1,524	1.11	53.13	2.13	101.98
61	1,549	1.11	53.16	2.12	101.51
62	1,575	1.11	53.21	2.11	101.03
63	1,600	1.11	53.28	2.10	100.55
64	1,626	1.11	53.37	2.09	100.07
65	1,651	1.12	53.48	2.08	99.59
66	1,676	1.12	53.61	2.08	99.59
67	1,702	1.12	53.75	2.07	99.11
68	1,727	1.13	53.91	2.07	99.11
69	1,753	1.13	54.08	2.06	98.63

Cover		HS-25 (Unfactored)		HS-25 (Factored)	
English (in)	Metric (mm)	English (ksf)	Metric (kPa)	English (ksf)	Metric (kPa)
70	1,778	1.13	54.26	2.06	98.63
71	1,803	1.14	54.46	2.06	98.63
72	1,829	1.14	54.67	2.06	98.63
73	1,854	1.15	54.90	2.06	98.63
74	1,880	1.15	55.13	2.06	98.63
75	1,905	1.16	55.38	2.06	98.63
76	1,930	1.16	55.64	2.06	98.63
77	1,956	1.17	55.90	2.06	98.63
78	1,981	1.17	56.18	2.06	98.63
79	2,007	1.18	56.46	2.07	99.11
80	2,032	1.19	56.76	2.07	99.11
81	2,057	1.19	57.06	2.07	99.11
82	2,083	1.20	57.37	2.08	99.59
83	2,108	1.20	57.69	2.08	99.59
84	2,134	1.21	58.02	2.09	100.07
85	2,159	1.22	58.35	2.09	100.07
86	2,184	1.23	58.69	2.10	100.55
87	2,210	1.23	59.04	2.11	101.03
88	2,235	1.24	59.39	2.11	101.03
89	2,261	1.25	59.75	2.12	101.51
90	2,286	1.26	60.11	2.13	101.98
91	2,311	1.26	60.48	2.13	101.98
92	2,337	1.27	60.86	2.14	102.46
93	2,362	1.28	61.24	2.15	102.94
94	2,388	1.29	61.62	2.16	103.42
95	2,413	1.30	62.01	2.17	103.90
96	2,438	1.30	62.41	2.18	104.38
97	2,464	1.31	62.81	2.19	104.86
98	2,489	1.32	63.21	2.20	105.34
99	2,515	1.33	63.62	2.21	105.82
100	2,540	1.34	64.03	2.22	106.29
101	2,565	1.35	64.45	2.23	106.77
102	2,591	1.35	64.87	2.24	107.25
103	2,616	1.36	65.29	2.25	107.73
104	2,642	1.37	65.72	2.27	108.69
105	2,667	1.38	66.15	2.28	109.17
106	2,692	1.39	66.58	2.29	109.65
107	2,718	1.40	67.02	2.30	110.12
108	2,743	1.41	67.45	2.31	110.60
109	2,769	1.42	67.90	2.33	111.56
110	2,794	1.43	68.34	2.34	112.04
111	2,819	1.44	68.79	2.35	112.52
112	2,845	1.45	69.24	2.36	113.00
113	2,870	1.46	69.69	2.38	113.96
114	2,896	1.47	70.15	2.39	114.43

BRENTWOOD®

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brentwoodindustries.com
stormtank@brentw.com
+1.610.374.5109

Appendix C: Sanitary Sewer Calculation Sheet

Sanitary Sewer Design Calculations

841 Grenon Avenue, City Of Ottawa, Ontario

Location			Residential Flow								Commercial/Institutional			Infiltration		Flow	Sanitary Sewer Design					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	24
STREET	From	To	No. of Single Dwellings	No. of Row/Semi Dwellings	Pop.	Area, A	Tributary		Peaking Factor	Res. Flow, $Q_{(p)}$	Area	Tributary Area, A	Com. Flow, $Q_{(p)}$	Total Tributary Area	Infiltration Flow	Peak Design Flow	Length, L	Diameter, d_{nom}*	Slope, s	Pipe Capacity, Q_f	Full Flow Velocity, v_f	Design peak Velocity Vp
							Pop.	Area														
	MH	MH			[no.]	[ha]	[no.]	[ha]		[L/s]	[ha]	[Sq.m]	[L/s]	[ha]	[L/s]	[L/s]	[m]	[mm]	[%]	[L/s]	[m/s]	[m/s]
Prior to Development																						
Grenon	1	2	1	45	125	1.19	125	1.19	4.22	1.71	0.00	0.00	0.000	1.19	0.39	2.10	31	225	2.61%	72.54	1.82	0.82
Grenon	2	3	4	0	14	0.26	139	1.45	4.20	1.89	0.00	0.00	0.000	1.45	0.48	2.37	111	225	2.72%	74.05	1.86	0.88
Grenon	3	4	3	20	64	0.43	203	1.88	4.15	2.72	0.00	0.00	0.000	1.88	0.62	3.35	101	225	2.82%	75.40	1.90	0.99
Grenon	4	5	0	0	0	0.06	203	1.95	4.15	2.72	0.17	0.17	0.081	2.11	0.70	3.50	330	225	2.80%	75.13	1.89	0.98
After Development																						
Grenon	1	2	1	45	125	1.19	125	1.19	4.00	1.62	0.00	0.00	0.000	1.19	0.39	2.01	31	225	2.61%	72.54	1.82	0.82
Grenon	2	3	4	0	14	0.26	139	1.45	4.00	1.80	0.00	0.00	0.000	1.45	0.48	2.27	111	225	2.72%	74.05	1.86	0.86
Grenon	2	3	0	0	62	0.00	201	1.45	4.00	2.60	0.00	0.00	0.000	1.45	0.48	3.08	111	225	2.72%	74.05	1.86	0.95
Grenon	3	4	3	20	64	0.43	265	1.88	4.10	3.52	0.00	0.00	0.000	1.88	0.62	4.14	101	225	2.82%	75.40	1.90	1.04
Grenon	4	5	0	0	0	0.06	265	1.95	4.10	3.52	0.17	0.17	0.081	2.11	0.70	4.30	330	225	2.80%	75.13	1.89	1.06

Notes:

Q = Average daily flow per capita — 280 L/day per capita

$Q_{ext.}$ = Unit peak extraneous flow — 0.33 L/s per gross ha.

Pop. Single Family — 3.4 Persons

Pop. Semi-Detached & Row House — 2.7 Persons

Commercial/institutional consumption rate — 28000 L/gross ha/day

0.324 L/ha/s

Commercial peak factor — 1.5

Commercial peak flow — 0.486 L/ha/s

Project: Building Investments and Dev.

Location 841 Grenon Avenue
City Of Ottawa, Ontario

Design by: SD **Date:** January 11, 2019

Checked by: SD **Rev.** 0

Min Velocity of flow > 0.6m/s

Max Velocity of flow > 3m/s

Kollaard Associates File #: 180966

Appendix D: Fire Flow Calculations and Boundary Conditions

- Fire Flow Requirements – FUS (Technical Bulletin ISTB-2018-02)

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Materials Testing •

(613) 860-0923

FAX: (613) 258-0475

December 18, 2018

Mark Fraser – Project Manager
Planning Infrastructure & Economic Development Department
Planning Services.

Re: Boundary Conditions - 841 Grenon Avenue

Kollaard Associates Inc has been retained by Nick Legault of Building Investments Inc. to complete the Site Servicing Plan and Site Servicing Report for the proposed residential development at 841 Grenon Avenue, Ottawa.

Could you provide us with the boundary conditions for the property based on the following information.

Type of Development: 4 storey, 33 Unit Residential Building – Sprinklered with minimum 1 hr fire rating on floor and wall assemblies. Using Technical Bulletin ISTB-2018-02 and ISO construction classes for building as provided in the technical bulletin, the exterior of the building will be constructed of non-combustible assemblies with a fire-resistance rating of 1 hour or longer and as such can be considered to be ordinary construction type (C = 1.0)
Location of Services: 841 Grenon Avenue
Amount of Fire Flow: 116.7 L/s (See attached fire flow requirements)
Average daily water demand: 0.25 L/s
Maximum daily water demand: 0.62 L/s
Maximum Hourly water demand: 1.37 L/s

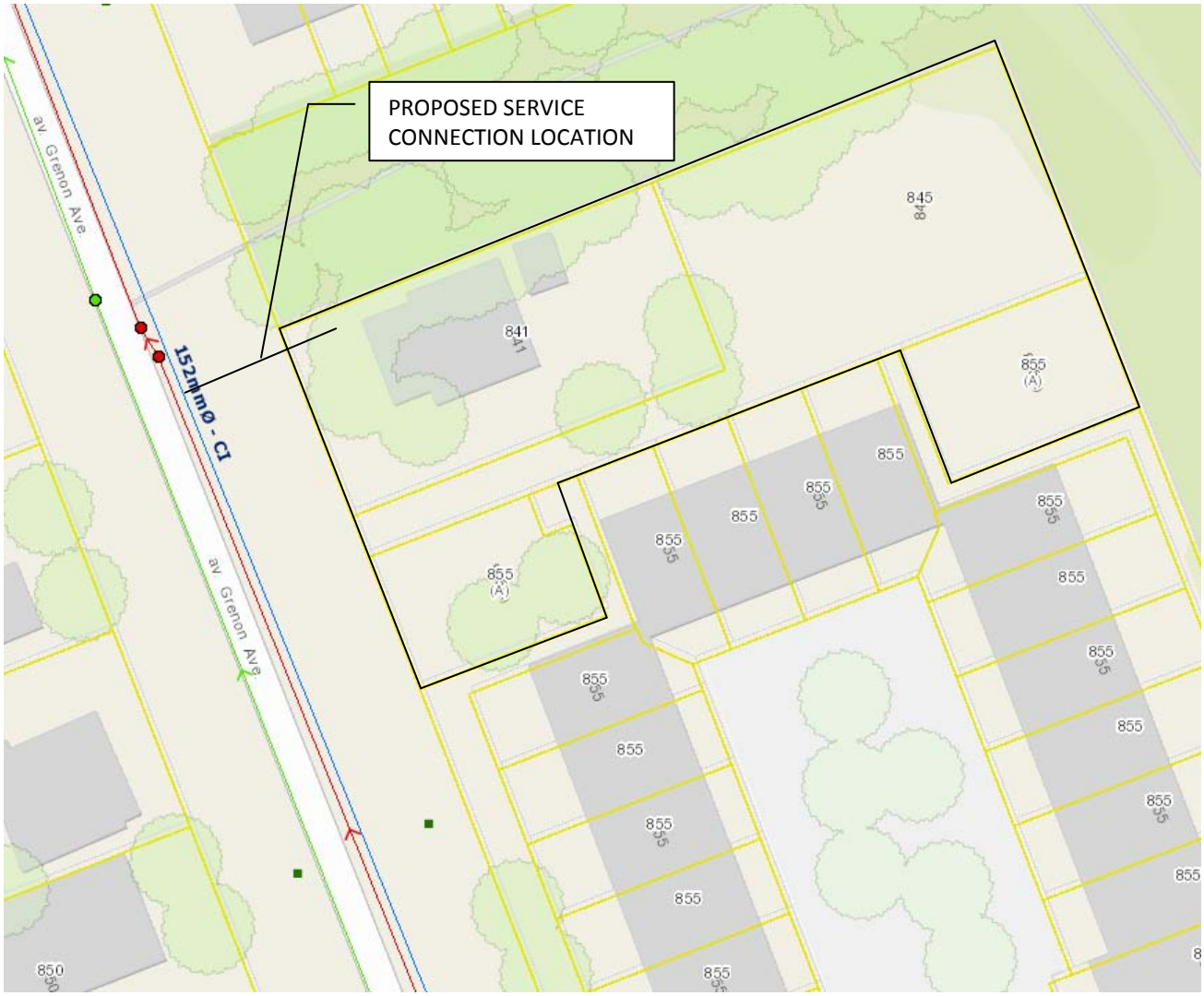
Please note:

- Fire flow is based on FUS calculations and takes into account the methodology provided in Technical Bulletin ISTB-2018-02
- Design calculation spread sheets for FUS, and Water are attached
- A sketch is attached showing proposed connection location

If there are any questions related to the above please contact the undersigned.

Sincerely,
KOLLAARD ASSOCIATES INC.

Steven deWit, P.Eng.


PROPOSED SERVICE CONNECTION LOCATION
av Grenon Ave
152mmø - CI
av Grenon Ave
845
841
855 (A)
855
850

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

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Structural • Environmental •
Hydrogeology
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FAX: (613) 258-0475

APPENDIX C: CALCULATION OF FIRE FLOW REQURIEMENTS - 854 Grenon Avenue

Calculation Based on Fire Underwriters Survey, 1999 and Ottawa Technical Bulletin ISTB-2018-02

Proposed Building:

4 storey wood frame 33 unit residential building with basement more than 50 Percent below grade.
Minimum 1 hr fire resistive rating between each unit. Minimum 2 hrs fire resistive rating on ceillings

1) An estimate of the Fire Flow required for a given fire area may be estimated by:

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

where F = required fire flow in litres per minute

A = Fire-Resistive Building with min 1hr fire rating. Consider only area of the largest floor plus 25 percent of each of the two immedately adjoining floors. Floors 2, 3 and 4 are the same size and are larger than 1. Therefore consider 3rd floor area with 25% of 2nd and 25% of 4thfloor areas.

C = coefficient related to the type of construction:

1.5	for wood construction (structure essentially combustible)
1.0	for ordinary construction (brick or other masonry walls, combustible floor and interior)
0.8	for noncombustible construction (unprotected metal structural components, masonary or metal walls)
0.6	for fire-resistive construction (fully protected frame, floors, roof)

Area of floor 3 = 567 m^2 25% of 2ndFloor = 141.8 m^2

25% of 4th Floor = 141.8 m^2

A = 850.5 m^2 (Fire Resistive Construction)

C = 1.0

F = 6,416 L/min ----------> Rounded to nearest 1000 = **6,000**

2) The value obtained in 1. may be reduced by as much as 25% for occupancies having a low

Non-combustible =	-25%
Limited Combustible =	-15%
Combustible =	0%
Free Burning =	15%
Rapid Burning =	25%

Reduction due to low occupancy hazard = -15% x 6,000 = **= 5,100** L/min

3) The value above my be reduced by up to 50% for automatic sprinlker system

Reduction due to automatic sprinker system = -30% x 5,100 = **-1,530**

4) The value obtained in 2. may be increased for structures exposed within 45 metres by the fire

Separation (metres)	Condtion	Max Charge*
0m to 3.0m	1	25%
3.1m to 10.0m	2	20%
10.1m to 20.0m	3	15%
20.1m to 30.0m	4	10%
30.1m to 45.0m	5	5%
45.1m to	6	0%

Charge for separation has been modified by Technical Bulletin ISTB-2018-02 based on construction and Lenght-Height Ratio

Exposures	Distance(m)	Condtion		Charge
Side 1 (north)	3.1	2	-------->	17%
Side 2 (south)	7.0	2	-------->	17%
Front (west)	14.0	3	-------->	12%
Back (east)	7.5	2	-------->	17%
				63%

Increase due to separation = 63% x 5,100 = **3,213** L/min

The fire flow requirement is = **5,100**

Reduction due to Sprinkler = **-1,530**

Increase due to Separation = 3,213

6,783

10,000 L/min Cap as per Technical Bulletin ISTB-2018-02

The Total fire flow requirement is = 7,000 L/min

or **116.7 L/sec**

Subject: RE: 841 Grenon Avenue - Boundary Conditions Request
From: "Fraser, Mark" <Mark.Fraser@ottawa.ca>
Date: 20/12/2018, 4:06 p.m.
To: Steve deWit <steve@kollaard.ca>

Hi Steve,

The following are boundary conditions, HGL, for hydraulic analysis at 841 Grenon (zone 1W) assumed to be connected to the 152mm on Grenon (see attached PDF for location).

Minimum HGL = 107.2m
Maximum HGL = 115.7m
MaxDay + FireFlow (117 L/s) = 96.5m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

If you have any questions please let me know.

Regards,

Mark Fraser
Project Manager, Planning Services
Development Review West Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West. 4th Floor, Ottawa ON, K1P 1J1
Tel:613.580.2424 ext. 27791
Fax: 613-580-2576
Mail: Code 01-14
Email: Mark.Fraser@ottawa.ca

From: Steve deWit <steve@kollaard.ca>
Sent: December 18, 2018 2:24 PM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Subject: 841 Grenon Avenue - Boundary Conditions Request

Good Afternoon Mark

Please see attached PDF letter requesting boundary conditions for 841 Grenon Ave.

Thank you

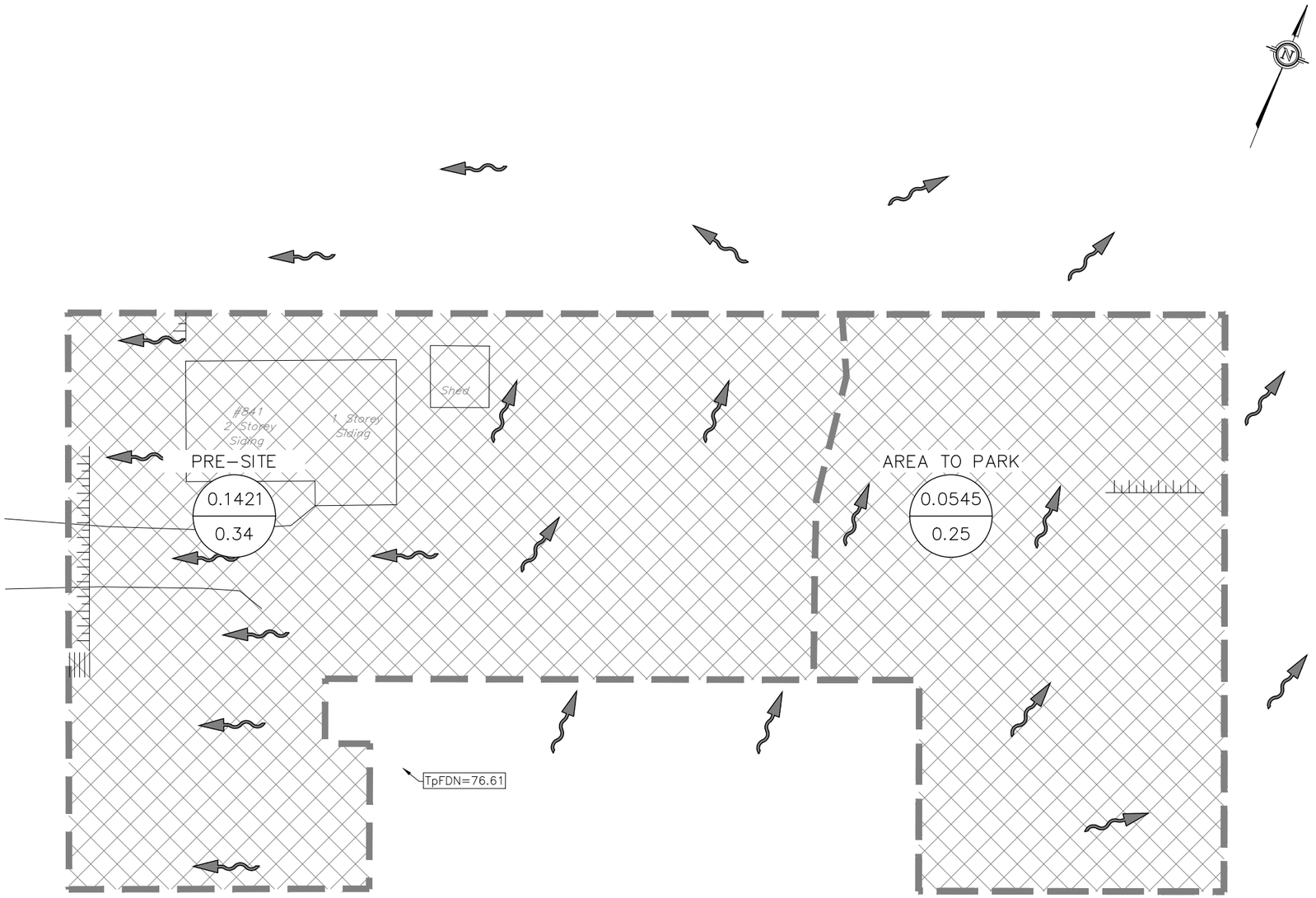
--

Steven deWit, P.Eng.
Kollaard Associates Inc
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario
K0G 1J0 CANADA
t: 613.860.0923 f: 613.258.0475
c: 613.223.4049
www.kollaard.ca


Boundary Condition for 841 Grenon
N
152mm
102mm
152mm
203mm
102mm
av. Grenon Ave
GRENON AVE
MICHELE DR
prom. Michèle Dr
841
845
837
820
830
832
838
842
846
850
856
2955
2926
2881
825
855
Legend
Pipe Ownership
Ownership
Private
Public
City of Ottawa

Appendix E: Drawings

- 180966– PRE – PRE-DEVELOPMENT DRAINAGE
- 180966– POST – POST-DEVELOPMENT DRAINAGE
- 180966– SER – Site Servicing Plan
- 180966– GRD – Site Grading Plan
- 180966– ER – Sediment and Erosion Control



PRE-DEVELOPMENT CATCHMENT AREAS

SCALE = 1:250

DRAWING NUMBER:
180966-PRE

PRE-DEVELOPMENT DRAINAGE

LEGEND
(STORM WATER MANAGEMENT)

- CONTROLLED — CATCHMENT LABEL
- 0.0649 — CATCHMENT AREA (HECTARES)
- 0.34 — RUNOFF COEFFICIENT
- CATCHMENT AREA BOUNDARY
- DIRECTION OF FLOW
- PROPERTY LINE
- TOP OF SLOPE
- CONTROLLED AREA
- UNCONTROLLED AREA
- DRAINAGE PATTERN

0	REVISION NOTE	YYYY/MM/DD	BY

Kollaard Associates
Engineers

P.O. BOX 189, 210 PRESCOTT ST
KEMPTVILLE, ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

(613) 860-0923
info@kollaard.ca

CLIENT:

BUILDING INVESTMENTS AND DEVELOPMENTS
Nick Legault, CEO
205-1320 Carling Ave
Ottawa, ON, K1Z7K8
Tel 613-853-4833
email nlegault@BuildingInvestments.ca

PROJECT:

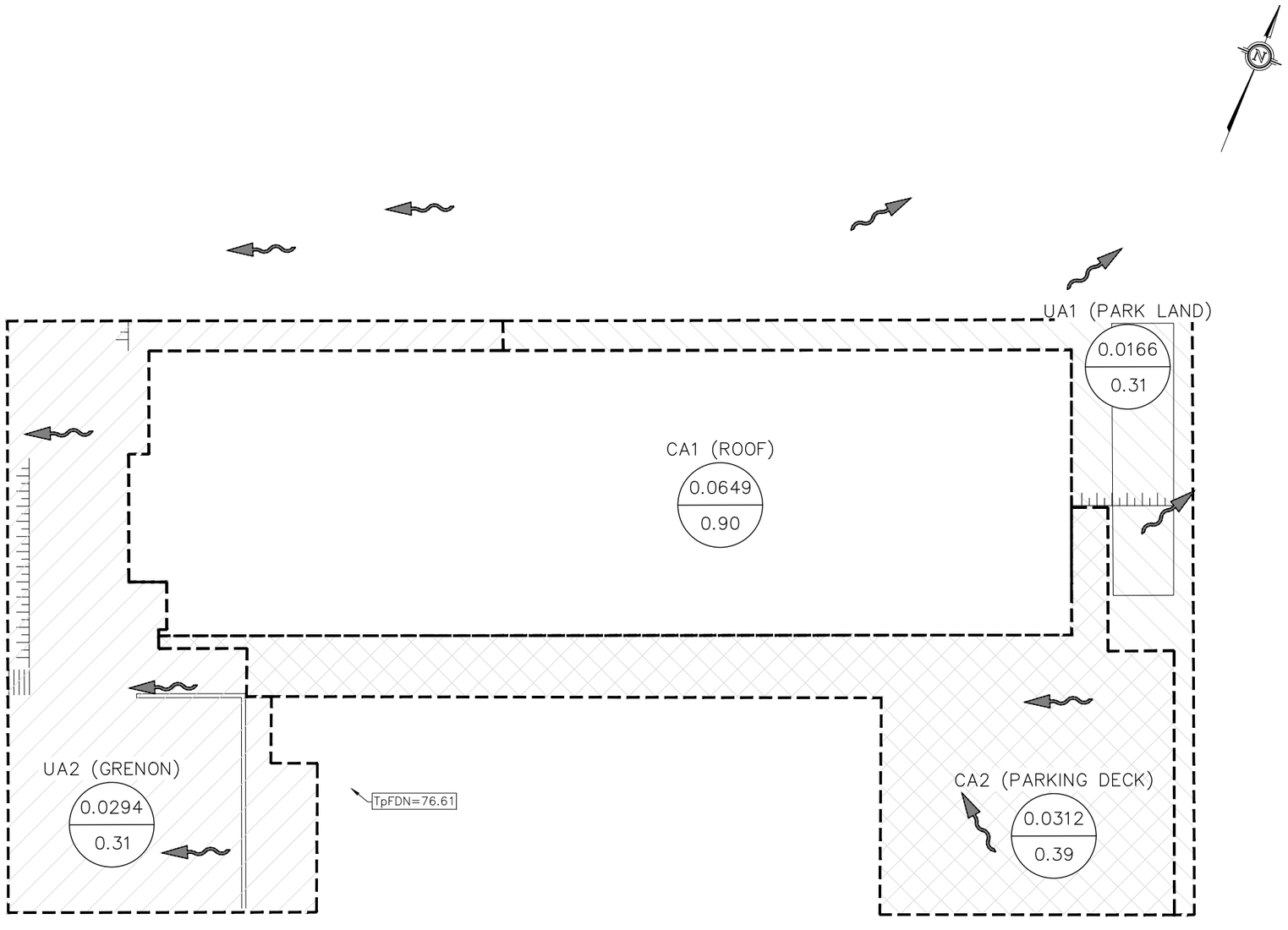
MULTI-UNIT RESIDENTIAL BUILDING

LOCATION:

841 GRENON AVENUE,
CITY OF OTTAWA, ON.

DESIGNED BY:	*DATE:*
SD	18.JAN.2019
DRAWN BY:	*SCALE:*
SD	1:250

KOLLAARD FILE NUMBER:
180966



POST–DEVELOPMENT CATCHMENT AREAS

SCALE = 1:250

DRAWING NUMBER:
180966–POST

POST–DEVELOPMENT DRAINAGE

LEGEND
(STORM WATER MANAGEMENT)

- CONTROLLED — CATCHMENT LABEL
- 0.0649 / 0.34 — CATCHMENT AREA (HECTARES) / RUNOFF COEFFICIENT
- CATCHMENT AREA BOUNDARY
- DIRECTION OF FLOW
- PROPERTY LINE
- TOP OF SLOPE
- CONTROLLED AREA
- UNCONTROLLED AREA
- DRAINAGE PATTERN

0	REVISION NOTE	YYYY/MM/DD	BY

Kollaard Associates
Engineers

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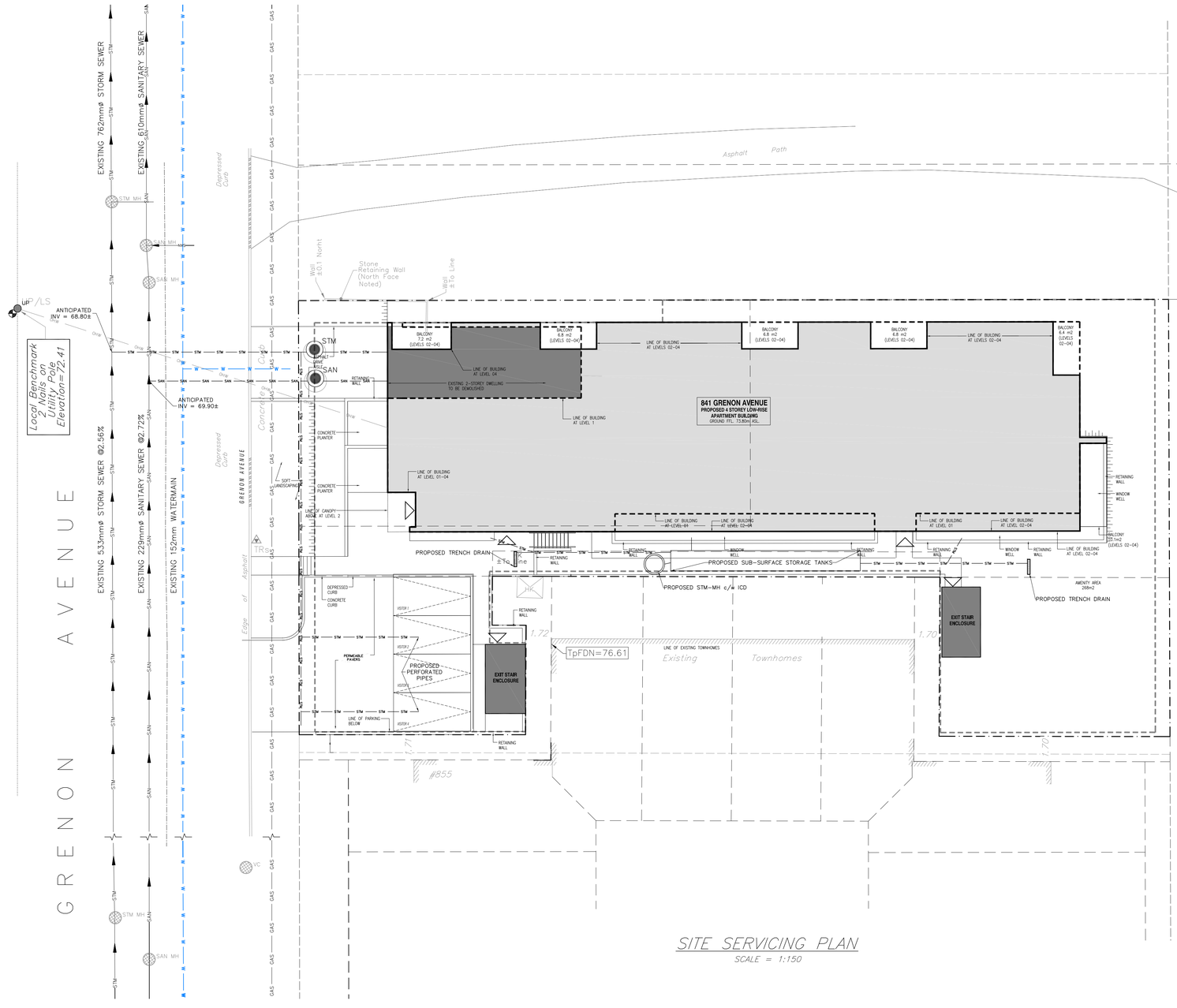
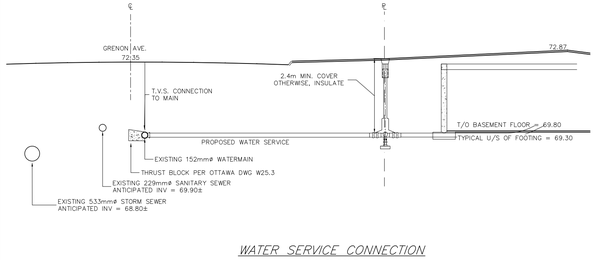
SD	1:250

KOLLAARD FILE NUMBER:
180966



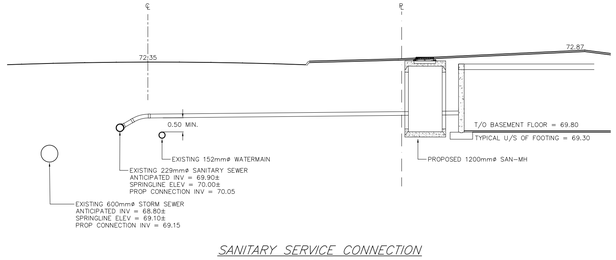
SITE SERVICING PLAN

SCALE = 1:150



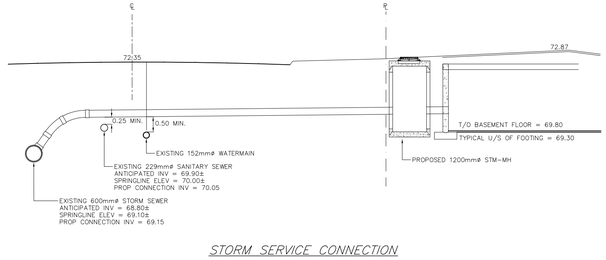
WATER SERVICE CONNECTION

NOT TO SCALE



SANITARY SERVICE CONNECTION

NOT TO SCALE



STORM SERVICE CONNECTION

NOT TO SCALE

LEGEND

- EXISTING ELEVATION
- PROPOSED/EXISTING ELEVATIONS
- PROPOSED ELEVATION
- DRAINAGE SLOPE
- EXISTING DRAINAGE
- WATERMAIN
- STORM SEWER
- SANITARY SEWER
- TOP OF SLOPE
- PROPERTY LINE
- OVERHEAD WIRE
- SILT FENCE
- OVERLAND FLOW ROUTE
- EXISTING UTILITY POLE
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- WATER METER
- REMOTE WATER METER
- PROPOSED WATER VALVE
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING VALVE CHAMBER
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN/MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCH BASIN
- TEMPORARY BENCHMARK

SEWER NOTES:

1. SUPPLY AND CONSTRUCT ALL SEWERS AND APPURTENANCES IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS AND ONTARIO PROVINCIAL STANDARDS FOR ROADS AND PUBLIC WORKS.
2. SPECIFICATIONS:

ITEM	SPEC. No.	CITY STD DWG No.
CATCH BASIN (600mm x 600mm)	OPSD 705.010	S2
STORM/SANITARY MANHOLE (1200ø)	OPSD 701.010	
STORM/SANITARY MANHOLE (1500ø)	OPSD 701.011	
STORM/SANITARY MANHOLE (1800ø)	OPSD 701.012	
SEWER SERVICE CONNECTION		S11 & S11.1
SANITARY BENCHING	OPSD 701.021	
CATCH BASIN & MANHOLE ADJUSTMENTS	OPSD 704.010	
STORM MANHOLE FRAME & COVER	OPSD 401.010	S24.1 & S25
CATCH BASIN FRAME & COVER	OPSD 400.020	S19, S22 & S23
SEWER TRENCH		S6 & S7
SANITARY MANHOLE FRAME & COVER	OPSD 401.030	S24 & S25

SEWER TRENCH:
SITE SERVICES EXCAVATION, BEDDING & BACKFILL AS PER THE RECOMMENDATIONS OF THE GEOTECHNICAL INVESTIGATION PREPARE BY KOLLAARD ASSOCIATES INC.

3. INSULATE ALL STORM PIPES THAT HAVE LESS THAN 1.5m COVER AND ALL SANITARY PIPES THAT HAVE LESS THAN 2.1m COVER WITH THERMAL INSULATION. PROVIDE 150mm CLEARANCE BETWEEN PIPE AND INSULATION.
4. PIPE BEDDING, COVER AND BACKFILL ARE TO BE COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY.
5. FLEXIBLE CONNECTIONS ARE REQUIRED FOR CONNECTION PIPES TO MANHOLES (FOR EXAMPLE KOR-N-SEAL, PSX: POSITIVE SEAL AND DURASEAL). SANITARY RUBBER GASKET TYPE JOINTS SHALL CONFORM TO CSA (B-182.2,3,4).
6. THE OWNER SHALL REQUIRE THAT THE SITE SERVICING CONTRACTOR PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16, 410.07.16.04 AND 407.07.24. DYE TESTING IS TO BE COMPLETED ON ALL SANITARY SERVICES TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN. THE FIELD TESTS SHALL BE PERFORMED IN THE PRESENCE OF A CERTIFIED PROFESSIONAL ENGINEER WHO SHALL SUBMIT A CERTIFIED COPY OF THE TEST RESULTS.
7. STORM MANHOLES AND CBMHS ARE TO HAVE 300mm SUMPS (AS PER SUMP DETAIL ON OPSD 701.010), UNLESS OTHERWISE INDICATED.
8. BUILDING CONTRACTOR TO PROVIDE TEMPORARY ADDITIONAL GRANULAR BACKFILL ABOVE SHALLOW CULVERTS AND STORM SEWERS TO SUPPORT HEAVY CONSTRUCTION EQUIPMENT.
9. CONTRACTOR TO TELEVISE (CCTV) ALL PROPOSED SEWERS, 200mmø OR GREATER PRIOR TO BASE COURSE ASPHALT. UPON COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES TO MUNICIPAL SATISFACTION.
10. WHERE THE SANITARY SEWER CROSSES ABOVE THE WATERMAIN, THE CONTRACTOR IS TO PROVIDE A MINIMUM OF 0.50m VERTICAL SEPARATION, ADEQUATE STRUCTURAL SUPPORT OF THE SEWER TO PREVENT SETTLING AND EXCESSIVE JOINT DEFLECTION AND ENSURE THAT THE LENGTH OF THE WATER PIPE BE CENTERED AT THE POINT OF CROSSING SO THAT THE JOINTS ARE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE SEWER.

WATERMAIN NOTES:

1. CITY TO SUPPLY, INSTALL & DISINFECT THE WATER SERVICE; CONTRACTOR TO EXCAVATE, BACKFILL AND REINSTATE THE ROADWAY AS PER STD DWG R10.
2. SPECIFICATIONS:

ITEM REFERENCE	SPEC. No.	CITY STD DWG No.
WATERMAIN BEDDING AND BACKFILL OPSD	802.010/802.031	W17 (TRENCH DETAIL)
CATHODIC PROTECTION OPSD	1109.010	W40
PRESSURE TESTING AWWA	C-605-5	
CHLORINATION AWWA	C-651-05	
WATERMAIN MATERIAL	PVC DR18 (CLASS 150)	

3. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED. WHERE LESS THAN 2.4m COVER, THERMAL INSULATION IS TO BE PROVIDED AS PER CITY STD DWG W22 (in shallow trenches), W23 (At open structures).
4. A MINIMUM OF 0.5m VERTICAL CLEARANCE IS REQUIRED BETWEEN THE WATERMAINS AND ALL UTILITIES AND SEWERS. IN LOCATIONS WHERE THIS IS NOT ACHIEVABLE, MUST FOLLOW PROCEDURE F-6-1 SEC. 5.2 OF THE ONTARIO DRINKING WATER RESOURCES ACT.
5. METALLIC WARNING TAPE SHALL BE USED OVER ALL WATERMAINS.
6. INSTALL AND TEST TRACER WIRE FOR ALL PROPOSED WATERMAIN IN ACCORDANCE WITH THE CITY OF OTTAWA DESIGN STANDARDS AS SPECIFIED IN SECTION 8.2.8.
7. EXISTING WATERMAIN INFORMATION SHOWN IS BASED ON BEST CURRENT INFORMATION. CONTRACTOR TO VERIFY EXACT LOCATION OF WATERMAIN AND REPORT ANY DISCREPANCIES TO KOLLAARD ASSOCIATES INC.
8. WATER SHUTOFF VALVE AND VALVE BOX TO BE WITHIN THE ROAD ALLOWANCE AND LOCATED A MINIMUM OF 1.0 METRES FROM THE BUILDING FOUNDATION. TYPICAL PRIVATE SERVICE AS PER STD. DWG. W50 (WITH THE EXCEPTION THAT THE V&VB ARE TO BE LOCATED 1.0 M MINIMUM FROM THE FOUNDATION WALL); VALVE BOX ASSEMBLY AS PER STD. DWG. W24.
9. CONNECTIONS AT ELBOWS AND TEEs IN WATER MAINS SHOULD BE MADE WITH THE USE OF JOINT RESTRAINERS DESIGNED FOR WATERMAIN APPLICATION. JOINT AND PIPE RESTRAINERS SHOULD MEET THE REQUIREMENTS OF AWWA C600, C905 AND C907 AND ASTM F1674-11. JOINT RETRAINERS SHOULD BE INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
10. ALL CONNECTORS, RODS AND VALVE BOLTS SHALL BE STAINLESS STEEL.
11. VALVES ARE TO BE OPERATED BY CITY OF OTTAWA STAFF ONLY.
12. NO CONNECTION TO EXISTING WATER NETWORK SHALL BE COMPLETED UNTIL A WATER PERMIT IS OBTAINED FROM THE CITY OF OTTAWA AND CITY OF OTTAWA FORCES ARE ON HAND TO MAKE THE CONNECTION.

DRAWING No: 180966-SER

KEY PLAN: N.T.S.

SCALE:
0 1 2 3 4 5 10 15
1:150 METRES

GENERAL NOTES:

1. All dimensions are in metres; all elevations are in metres and are geodetic. TBM = 2 nails on utility pole. Elevation= 72.41.
2. This is not a legal survey. Boundary and topographic information were derived from *FAIRLEY, SMITH & DENIS SURVEYING LTD.* File No. 652-18.
3. Contractor is responsible for location and protection of utilities.
7. Existing services information shown is based on best current information. Contractor to verify exact locations of services and report any discrepancies to Kollaard Associates Inc.
8. All dimensions to be verified on site by contractor prior to construction.
9. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.
10. Client/contractor is responsible for acquiring all necessary permits. This drawing is not for construction until a building permit has been granted.
11. The proposed grades have been set and verified for site grading control only. The grade raise at the building location should be verified with regard to subsurface conditions by qualified geotechnical personnel after completion of the excavation.
12. A geotechnical engineer should be retained to provide recommendations with respect to the sub-grade conditions prior to footing installation.
13. The owner agrees to prepare and implement an erosion and sediment control plan to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control such as, and not limited to installing filter cloths across manhole/catchbasin lids to prevent sediments from entering structures and install and maintain a light duty silt fence barrier as required.
14. All materials and construction to be in accordance with City of Ottawa standards and Ontario Provincial Standards and Specifications; sewer and watermain material types; disinfection, provide minimum 2.4 metres of cover for water services, cathodic protection, City of Ottawa insulation specifications for watermain, pipe bedding, reinstatement of disturbed areas and leakage testing.
15. Reference to Kollaard file 180966 for Storm Water Management Design and Geotechnical Report file 180966.

No.	REVISION	DATE	BY
2	ISSUED SPA SUBMISSION	2019/01/25	ML
1	ISSUED FOR CLIENT REVIEW	2019/01/24	ML
0	PRELIMINARY	2018/12/13	ML
#	REVISION ITEM / DESCRIPTION	REV. DATE	INT.

Kollaard Associates
Engineers
(613) 860-0923
info@kollaard.ca
P.O. BOX 189, 210 PRESCOTT ST.
KEMPTVILLE, ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

CLIENT:

BUILDING INVESTMENTS INC.
Nick Legault, CEO
205-1320 Carling Ave
Ottawa, ON, K1Z7K8
Tel 613-853-4833
email nlegault@BuildingInvestments.ca

PROJECT:

MULTI-UNIT RESIDENTIAL BUILDING

LOCATION:

841 GRENON AVENUE,
CITY OF OTTAWA, ON.

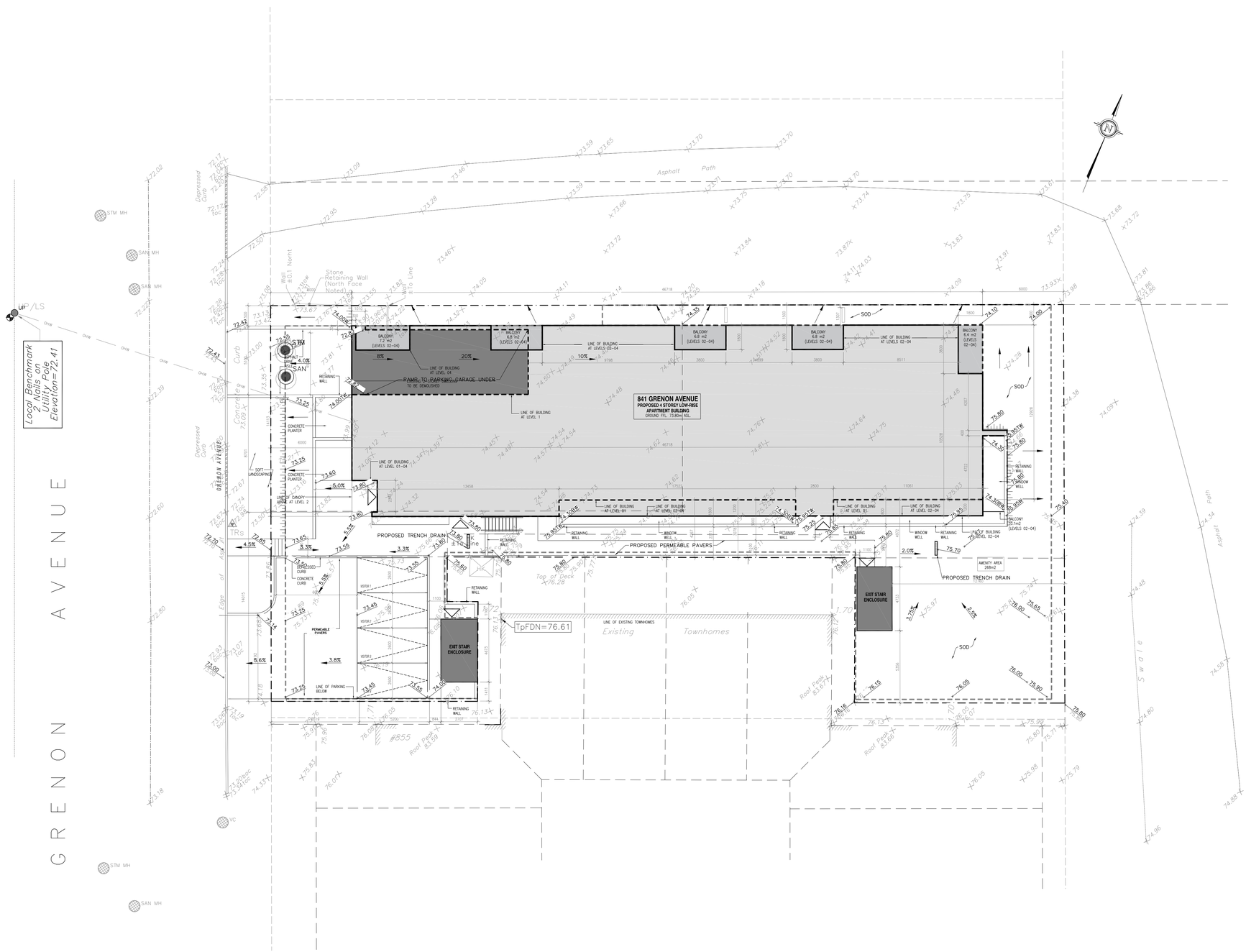
LICENSED PROFESSIONAL ENGINEER
January 25, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY:	CHECKED BY:
--	SD
DRAWN BY:	APPROVED BY:
ML	SD
DATE: DEC. 12, 2018	
SHEET SET:	

DRAWING No: 180966-SER

DRAWING NAME: SITE SERVICING PLAN

ARCH D



LEGEND

- EXISTING ELEVATION
- PROPOSED/EXISTING ELEVATIONS
- PROPOSED ELEVATION
- DRAINAGE SLOPE
- EXISTING DRAINAGE
- WATERMAIN
- STORM SEWER
- SANITARY SEWER
- TOP OF SLOPE
- PROPERTY LINE
- OVERHEAD WIRE
- SILT FENCE
- OVERLAND FLOW ROUTE
- EXISTING UTILITY POLE
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- WATER METER
- REMOTE WATER METER
- PROPOSED WATER VALVE
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING VALVE CHAMBER
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN/MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCH BASIN
- TEMPORARY BENCHMARK

DRAWING No: 180966-GRD

KEY PLAN: N.T.S.

SCALE: 0 1 2 3 4 5 10 15
1:150 METRES

GENERAL NOTES:

1. All dimensions are in metres; all elevations are in metres and are geodetic. TBM = 2 nails on utility pole. Elevation= 72.41.
2. This is not a legal survey. Boundary and topographic information were derived from *FARLEY, SMITH & DENIS SURVEYING LTD.* File No. 652-18.
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9. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.
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11. The proposed grades have been set and verified for site grading control only. The grade raise at the building location should be verified with regard to subsurface conditions by qualified geotechnical personnel after completion of the excavation.
12. A geotechnical engineer should be retained to provide recommendations with respect to the sub-grade conditions prior to footing installation.
13. The owner agrees to prepare and implement an erosion and sediment control plan to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control such as, and not limited to installing filter cloths across manhole/catchbasin lids to prevent sediments from entering structures and install and maintain a light duty silt fence barrier as required.
14. All materials and construction to be in accordance with City of Ottawa standards and Ontario Provincial Standards and Specifications; sewer and watermain material types; disinfection, provide minimum 2.4 metres of cover for water services, cathodic protection, City of Ottawa insulation specifications for watermain, pipe bedding, reinstatement of disturbed areas and leakage testing.
15. Reference to Kollaard file 180966 for Storm Water Management Design and Geotechnical Report file 180966.

No.	REVISION	DATE	BY
2	ISSUED SPA SUBMISSION	2019/01/25	ML
1	ISSUED FOR CLIENT REVIEW	2019/01/24	ML
0	PRELIMINARY	2018/12/13	ML
#	REVISION ITEM / DESCRIPTION	REV. DATE	INT.

Kollaard Associates
Engineers
(613) 860-0923
info@kollaard.ca
P.O. BOX 189, 210 PRESCOTT ST.
KEMPTVILLE, ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

CLIENT:

BUILDING INVESTMENTS INC.
Nick Legault, CEO
205-1320 Carling Ave
Ottawa, ON, K1Z7K8
Tel 613-853-4833
email nlegault@BuildingInvestments.ca

PROJECT:

MULTI-UNIT RESIDENTIAL BUILDING

LOCATION:

841 GRENON AVENUE,
CITY OF OTTAWA, ON.

LICENSED PROFESSIONAL ENGINEER
January 25, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY:	CHECKED BY:
SD	
DRAWN BY:	APPROVED BY:
ML	SD

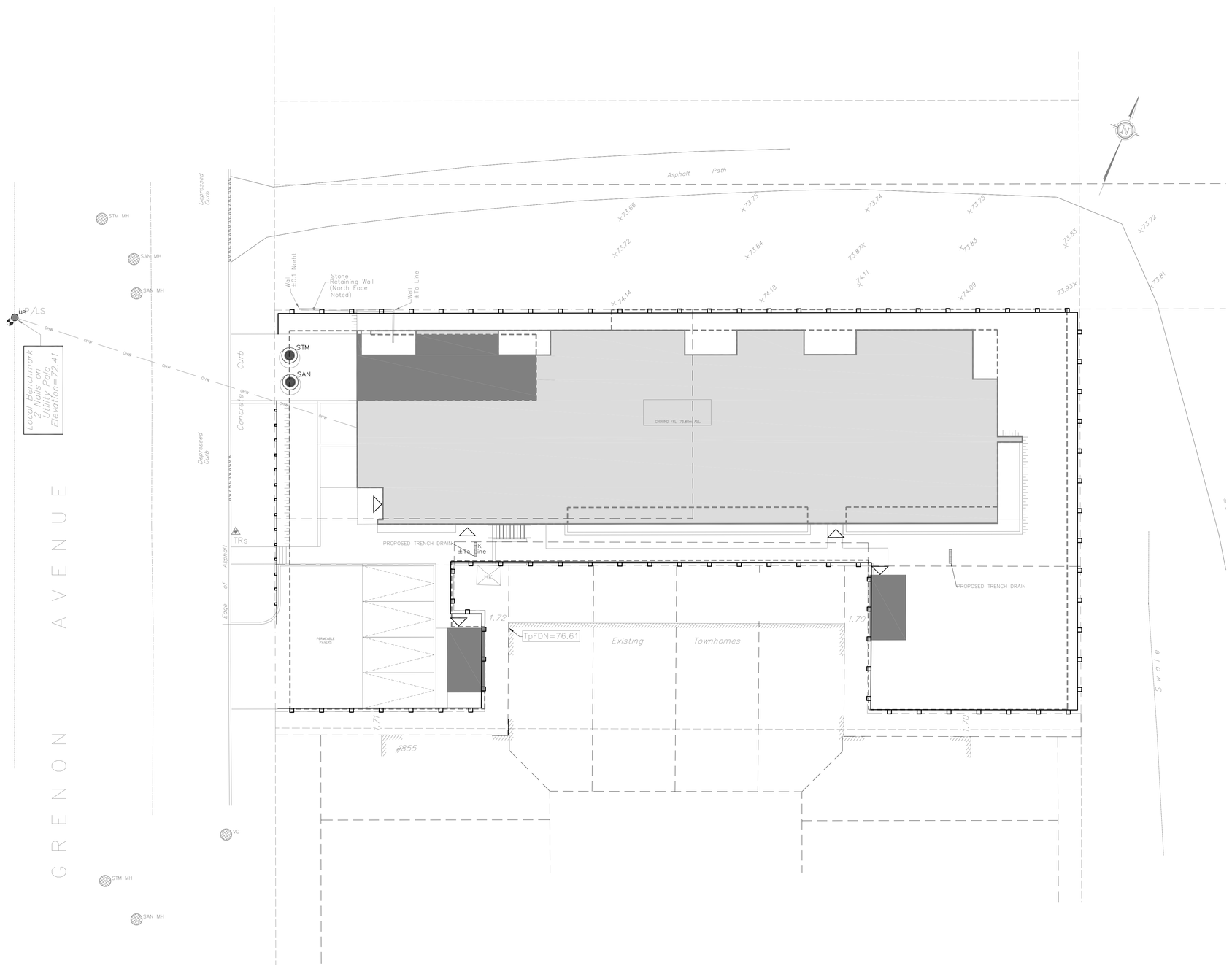
DATE: DEC. 12, 2018

SHEET SET:

DRAWING No: 180966-GRD

DRAWING NAME: SITE GRADING PLAN

ARCH D



EROSION AND SEDIMENT CONTROL PLAN

SCALE = 1:150

LEGEND

- EXISTING ELEVATION
- PROPOSED/EXISTING ELEVATIONS
- PROPOSED ELEVATION
- DRAINAGE SLOPE
- EXISTING DRAINAGE
- WATERMAIN
- STORM SEWER
- SANITARY SEWER
- TOP OF SLOPE
- PROPERTY LINE
- OVERHEAD WIRE
- SILT FENCE
- OVERLAND FLOW ROUTE
- EXISTING UTILITY POLE
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- WATER METER
- REMOTE WATER METER
- PROPOSED WATER VALVE
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING VALVE CHAMBER
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN/MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCH BASIN
- TEMPORARY BENCHMARK

EROSION AND SEDIMENT CONTROL NOTES:

1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
2. THE OWNER (AND/OR CONTRACTOR) AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN AT LEAST EQUAL TO THE STATED MINIMUM REQUIREMENTS AND TO THE SATISFACTION OF THE CITY OF OTTAWA, APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL.
3. THE CONTRACTOR IS TO ENSURE THAT THE SITE ACCESS POINTS AND ADJACENT STREETS TO THE ACCESS POINTS ARE MAINTAINED AND KEPT CLEAN OF CONSTRUCTION MATERIALS SUCH AS, BUT NOT LIMITED TO MUD, DIRT, CLAY AND GRANULARS ON A DAILY BASIS OR AS NECESSARY, TO THE SATISFACTION OF THE CITY OF OTTAWA.
4. EVERY EFFORT WILL BE MADE TO ENSURE THAT ALL DISTURBED AREAS ARE TOPSOILED AND SEEDED AS SOON AS REASONABLY POSSIBLE.
5. THE SEDIMENT AND EROSION CONTROL PLAN IS A LIVING DOCUMENT WHICH MAY BE AMENDED BY ONSITE REQUIREMENTS AT THE APPROVAL OF THE MUNICIPALITY AND THE CONSERVATION AUTHORITY.

MINIMUM EROSION AND SEDIMENT CONTROL PLAN REQUIREMENTS:

- TIME THE DEMOLITION AND EXCAVATION ACTIVITIES SO THAT THEY OCCUR NO SOONER THAN IS NECESSARY FOR SUBSEQUENT CONSTRUCTION ACTIVITIES.
- LANDSCAPE THE SITE AS SOON AS PRACTICALLY POSSIBLE.
- USE SILT FENCES AROUND ANY STOCKPILES OF SOIL.
- PRIOR TO CONSTRUCTION, SILT FENCE BARRIERS (OPSD 219.110) WILL BE PLACED ALONG THE PROPERTY LINES AS ON THE DRAWING.
- THE SILT FENCE SHOULD BE REMOVED ONLY WHEN THE SITE IS STABILIZED.
- INSTALL FILTER SOCKS ACROSS ALL EXISTING AND PROPOSED CATCH BASINS AND CATCH BASIN MANHOLES PRIOR TO CONSTRUCTION.

DRAWING No: 180966-ECP

KEY PLAN: N.T.S.

SCALE: 0 1 2 3 4 5 10 15
1:150 METRES

GENERAL NOTES:

1. All dimensions are in metres; all elevations are in metres and are geodetic. TBM = 2 nails on utility pole. Elevation= 72.41.
2. This is not a legal survey. Boundary and topographic information were derived from *FARLEY, SMITH & DENIS SURVEYING LTD.* File No. 652-18.
3. Contractor is responsible for location and protection of utilities.
7. Existing services information shown is based on best current information. Contractor to verify exact locations of services and report any discrepancies to Kollaard Associates Inc.
8. All dimensions to be verified on site by contractor prior to construction.
9. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.
10. Client/contractor is responsible for acquiring all necessary permits. This drawing is not for construction until a building permit has been granted.
11. The proposed grades have been set and verified for site grading control only. The grade raise at the building location should be verified with regard to subsurface conditions by qualified geotechnical personnel after completion of the excavation.
12. A geotechnical engineer should be retained to provide recommendations with respect to the sub-grade conditions prior to footing installation.
13. The owner agrees to prepare and implement an erosion and sediment control plan to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current Best Management Practices for Erosion and Sediment Control such as, and not limited to installing filter cloths across manhole/catchbasin lids to prevent sediments from entering structures and install and maintain a light duty silt fence barrier as required.
14. All materials and construction to be in accordance with City of Ottawa standards and Ontario Provincial Standards and Specifications; sewer and watermain material types; disinfection, provide minimum 2.4 metres of cover for water services, cathodic protection, City of Ottawa insulation specifications for watermain, pipe bedding, reinstatement of disturbed areas and leakage testing.
15. Reference to Kollaard file 180966 for Storm Water Management Design and Geotechnical Report file 180966.

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CLIENT:
BUILDING INVESTMENTS INC.
Nick Legault, CEO
205-1320 Carling Ave
Ottawa, ON, K1Z7K8
Tel 613-853-4833
email nlegault@BuildingInvestments.ca

PROJECT:
MULTI-UNIT RESIDENTIAL BUILDING

LOCATION:
841 GRENON AVENUE,
CITY OF OTTAWA, ON.

LICENSED PROFESSIONAL ENGINEER
January 25, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY:	CHECKED BY:
SD	
DRAWN BY:	APPROVED BY:
ML	SD
DATE: DEC. 12, 2018	
SHEET SET:	

DRAWING No: 180966-ECP

DRAWING NAME: EROSION AND SEDIMENT CONTROL PLAN

ARCH D

Appendix F: Correspondence

Hi Laurel,

This is a follow-up to the pre-application consultation meeting regarding a proposed development at **841 Grenon Avenue**. Please forward the below information to the applicant:

General:

- Please be advised that as the subject site is comprised of 4 separate parcels of land the approval exemption under O.Reg. 525/98 would not apply and an Environmental Compliance Approval (ECA) would be required.

  Ontario Regulation 525/98:

  3. Subsection 53(1) and (3) of the Act do not apply to the use, operation, establishment, alteration, extension or replacement of or a change in a storm water management facility that,
  (a) is designed to service one lot or parcel of land;
  (b) discharges into a storm sewer that is not a combined sewer;
  (c) does not service industrial land or a structure located on industrial land; and
  (d) is not located on industrial land.

  If the parcels are consolidated into one parcel the noted approval exemption would apply subject to confirmation that there is no external drainage from the adjacent lands.

- Any easements on the subject site shall be identified and respected by any development proposal and shall adhere to the conditions identified in the easement agreement. All easements shall be shown on the engineering plans.

- Please provide an **Existing Conditions/Removals Plan** as part of the engineering drawing set.

- As per the *City of Ottawa Slope Stability Guidelines for Development Applications (Section 5.8)* an engineering report prepared by a qualified geotechnical engineer licensed in the province of Ontario is required to be provided for any retaining walls proposed greater than 1m in height that establishes that the retaining wall will have a FS of 1.5 or greater against global instability and considered stable from a global stability perspective. Retaining wall design drawings are required to be provided in addition to the report

- Please note that servicing and site works shall be in accordance with the following documents:

  - Ottawa Sewer Design Guidelines (October 2012)
  - Technical Bulletin PIEDTB-2016-01
  - Technical Bulletins ISTB-2018-01, ISTB-2018-02 and ISTB-2018-03.
  - Ottawa Design Guidelines – Water Distribution (2010)
  - Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
  - City of Ottawa Accessibility Design Standards (2012)
  - Ottawa Standard Tender Documents (latest version)
  - Ontario Provincial Standards for Roads & Public Works (2013)

Disclaimer:

The City of Ottawa does not guarantee the accuracy or completeness of the data and information contained on the above image(s) and does not assume any responsibility or liability with respect to any damage or loss arising from the use or interpretation of the image(s) provided. This image is for schematic purposes only.

Stormwater Management Criteria:

- In the absence of area specific SWM criteria please control post-development runoff from the subject site, up to and including the 100-year storm event, to a pre-development **2-year allowable release rate** calculated using an allowable runoff coefficient (C) determined using the smaller of a runoff coefficient of 0.5 or the **actual pre-development existing site runoff coefficient** (Cl.8.3.7.3), and a computed time of concentration (T_c) using an appropriate method to justify the parameter selection (*T_c of 20 minutes should be used for all pre-development calculations without engineering justification; T_c of 10 minutes shall be used for all post-development calculations*).

- Please be aware that the receiving storm system is uncontrolled and therefore subject to surcharge conditions. This condition may impact any proposed underground storage system. It shall be demonstrated at that time that the downstream storm system does not backup into the site and fill the underground storage before it can be utilized as available internal site drainage.

- As stormwater treatment is not addressed offsite (ultimate outlet is the Ottawa River), onsite measures may be requested/required. Please consult with the local conservation authority (RVCA) regarding water quality criteria prior to submission of a Site Plan Control Proposal application to establish the water quality control criteria for the site.

- As per *Technical Bulletin PIEDTB-2016-01 section 8.3.11.1 (p.12 of 14)* **there shall be no surface ponding on private parking areas during the 2-year storm rainfall event**. Depending on the SWM strategy proposed underground or additional underground storage may be required to satisfy this requirement.

- When using the modified rational method to calculate the storage requirements for the site any underground storage (pipe storage etc.) should not be included in the overall available storage. The modified rational method assumes that the restricted flow rate is constant throughout the storm which underestimates the storage requirement prior to the 1:100 year head elevation being reached. Please note that if you wish to utilize any underground storage as available storage, the $Q_{(release)}$ must be modified to compensate for the lack of head on the orifice. An assumed average release rate equal to 50% of the peak allowable rate shall be applied. Otherwise, disregard the underground storage as available storage or provide modeling to support SWM strategy.

- Please note that the minimum orifice dia. for a plug style ICD is 83mm and the minimum flow rate from a vortex ICD is 6 L/s in order to reduce the likelihood of plugging.

- Emergency overland flow shall be directed to Grenon Ave.

- Please ensure that the proposed elevation at the front property line through the proposed private approach is a minimum 30cm higher (vertical clearance above the spill elevation) than the established spill elevation on Grenon Ave. to ensure that during extreme events and if a catchbasin becomes blocked, the major system on Grenon Ave. will spill to the next downstream roadway segment and not back onto the subject site property down into the underground parking garage.

- Post-development site grading shall match existing property line grades in order to minimize disruption to the adjacent residential properties.

- Please provide a **Pre-Development Drainage Area Plan** to define the pre-development drainage areas/patterns. How much of the subject site drains to Grenon Ave. and how much of the site drains overland to the rear of the property under pre-development conditions?

Storm Sewer:

- A 525mm dia. concrete storm sewer is located within Grenon Ave.

- A storm sewer monitoring maintenance hole is required to be installed at the property line (inside the property, not in a parking area) as per City of Ottawa Sewer-Use By-Law 2003-514 (14) *Monitoring Devices*.

Sanitary:

- A 225mm dia. sanitary sewer is located with Grenon Ave.

- **Analysis and demonstration that there is sufficient/adequate residual capacity to accommodate any increase in wastewater flows in the receiving and downstream wastewater system is required to be provided**.

- Please review the wastewater design flow parameters *in Technical Bulletin PIEDTB-2018-01.*

- A sanitary sewer monitoring maintenance hole is required to be installed just outside of the sewer easement to satisfy *Sewer-Use By-Law 2003-514 (14) Monitoring Devices*.

Water:

- A 152mm dia. watermain is located in Grenon Ave.

- Please review Technical Bulletin ISTB-2018-0, maximum fire flow hydrant capacity is provided in Section 3 Table 1 of Appendix I. The City will not accept the installation of a new public hydrant to support this development.

- As per City of Ottawa By-Law 2013-360 Section 75 *Every person applying for a Water Connection Permit shall be required to pay a Frontage Charge if applicable.* A **Watermain Frontage Fee** appears to be applicable to the subject site. A fee of approx. **$5,568.90** (29.31m x $190/m) would be required to be provided prior to registration of the Site Plan Agreement. (The exact fee amount will be confirmed by ROW Approval Unit once an application has been submitted).

- Rresidential buildings with a basic day demand greater than 50m3/day are required to be connection to a minimum of two water services separated by an isolation valve to avoid a vulnerable service area as per the *Ottawa Design Guidelines - Water Distribution, WDG001, July 2010 Clause 4.3.1 Configuration.* The basic day demand is anticipated to exceed 50m3/day therefore 2 water service are required.

- The subject site is located within the 1W Pressure Zone.

- Please provide the following information to the City of Ottawa via email to request water distribution network boundary conditions for the subject site. Please note that once this information has been provided to the City of Ottawa it takes approximately 5-10 business days to receive boundary conditions.

    - Type of Development
    - Site Address
    - A plan showing the proposed water service connection location.
    - **Average Daily Demand** (L/s)
    - **Maximum Daily Demand** (L/s)
    - **Peak Hour Demand** (L/s)
    - **Fire Flow** (L/min)

    [*Fire flow demand requirements shall be based on Fire Underwriters Survey (FUS) Water Supply for Public Fire Protection 1999*]

Exterior Site Lighting:

- Please note that any proposed light fixtures (both pole-mounted and wall mounted) must be part of the approved Site Plan. All external light fixtures must meet the criteria for Full Cut-off Classification as recognized by the

Illuminating Engineering Society of North America (IESNA or IES), and must result in minimal light spillage onto adjacent properties (as a guideline, 0.5 fc is normally the maximum allowable spillage). In order to satisfy these criteria, the please provide the City with a **Site Lighting Plan, Photometric Plan and Certification (Statement) Letter** from an acceptable professional engineer stating that the design is compliant.

Snow Storage:

- Any portion of the subject property which is intended to be used of permanent or temporary snow storage shall be as shown on the approved site plan and grading plan. Snow storage shall not interfere with approved grading and drainage patters or servicing. Snow storage areas shall be setback from the property lines, foundations, fencing or landscaping a minimum of 1.5m. Snow storage areas shall not occupy driveways, aisles, required parking spaces or any portion of a road allowance. If snow is to be removed from the site please indicate this on the plan(s).

Permits and Approvals:

- The consultant shall determine if this project will be subject to an Environmental Compliance Approval (ECA) for Private Sewage Works. It shall be determined if the exemptions set out under Ontario Regulation 525/98: *Approval Exemptions* are satisfied.

Capital Works:

- No **Capital Construction** works are currently planned for Grenon Ave.

Phase One Environmental Site Assessment:

- A Phase 1 ESA is required to be completed in accordance with Ontario Regulation 153/04 in support this development proposal to determine the potential for site contamination.

Geotechnical Investigation:

- A Geotechnical Study shall be prepared in support of this development proposal.
- The geotechnical engineer of record shall review the proximity of the existing townhome foundations to the proposed underground parking garage and provide recommendations to ensure the existing units not compromised during construction. There is concern that the foundations of these existing units could be undermined and compromised during construction due to the proximity of the proposed underground parking garage.

Please note that these comments are considered preliminary based on the information available to date and therefore maybe amended as additional details become available and presented to the City.

If you have any questions or require any clarification please let me know.

Regards,

Mark Fraser

Project Manager, Planning Services

Development Review West Branch

City of Ottawa | Ville d'Ottawa

Planning, Infrastructure and Economic Development Department

110 Laurier Avenue West. 4th Floor, Ottawa ON, K1P 1J1

Tel:613.580.2424 ext. 27791

Fax: 613-580-2576

Mail: Code 01-14

Email: Mark.Fraser@ottawa.ca

*Please consider your environmental responsibility before printing this e-mail

Appendix G: Servicing Guidelines Checklist

4.1 General Content

☒ Executive Summary (for larger reports only).

Comments: *N/A*

☒ Date and revision number of the report.

Comments: *Refer to cover page of the Servicing & Stormwater Management Report- Dated January 21, 2019 Rev 0*

☒ Location map and plan showing municipal address, boundary, and layout of proposed development.

Comments: *Refer to drawings180966-SER and 180966-GRd in appendix E of the SSMR*

☒ Plan showing the site and location of all existing services.

Comments: *Refer to drawing 180966-SER in appendix E of the SSMR .*

☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.

Comments: *Refer to Architectural Site plan by Project1 Studio Incorporated*

☒ Summary of Pre-consultation Meetings with City and other approval agencies.

Comments: *Pre-Consultation Meeting with City had taken place August 23, 2018 Included in Appendix F of the SSMR*

☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.

Comments: *Conformance to City of Ottawa Guidelines, No higher level studies applicable*

☒ Statement of objectives and servicing criteria.

Comments: *Refer to section 2.0 of the SSMR for Storm, Section 3 for Sanitary and Section 4 for Water.*

☒ Identification of existing and proposed infrastructure available in the immediate area.

Comments: *Refer to drawing 180966-SER for location, size and depth. Drawing located in appendix E of of the SSMR.*

☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

Comments: *N/A Discharge to City of Ottawa Storm Sewer System*

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

Comments: *There is no Master Grading Plan - Refer to grading plan180966-GRD located in appendix E of the SSMR.*

☒ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

Comments: *N/A*

☒ Proposed phasing of the development, if applicable.

Comments: *N/A*

☒ Reference to geotechnical studies and recommendations concerning servicing.

Comments: *Reference Geotechnical Report Kollaard Project # 180966 dated January 15, 2019*

☒ All preliminary and formal site plan submissions should have the following information:

- ☒ Metric scale
- ☒ North arrow (including construction North)
- ☒ Key plan
- ☒ Name and contact information of applicant and property owner
- ☒ Property limits including bearings and dimensions
- ☒ Existing and proposed structures and parking areas
- ☒ Easements, road widening and rights-of-way
- ☒ Adjacent street names

Comments: *Refer to drawings in appendix E of the SSMR*

4.2 Development Servicing Report: Water

☒ Confirm consistency with Master Servicing Study, if available

Comments: *N/A*

☒ Availability of public infrastructure to service proposed development

Comments: *Refer to Section 3 and 4 of the SSMR .*

☒ Identification of system constraints

Comments: *Yes - boundary conditions were received. Boundary Conditions can be found in appendix D of of the SSMR - Also response from City including System Constraints*

☒ Identify boundary conditions

Comments: *Boundary Conditions can be found in appendix D of the SSMR*

☒ Confirmation of adequate domestic supply and pressure

Comments: *Refer to Section 4.0 - Watermain Design of the SSMR.*

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

Comments: *Refer to Appendix D of the SSMR and Section 4.0*

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

Comments: *Pressure Reducing Valves not Required. Booster pump required to service top floor. See section 4.0 of the SSMR*

☒ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

Comments: *No phasing involved with this project*

☒ Address reliability requirements such as appropriate location of shut-off valves

Comments: *N/A*

☒ Check on the necessity of a pressure zone boundary modification.

Comments: *The water pressure available at the site is above the minimum residual pressure at the ground floor level - Section 4.0 of the SSMR*

☒ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

Comments: *Refer to Section 4.0 - Watermain Design in the SSMR*

☒ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.

Comments: *4 storey residential building serviced by mm waterservice, refer to Drawing 180966-SER in appendix E of the SSMR*

☒ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.

Comments: *N/A*

☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

Comments: *Refer to Section 4.0 - Watermain Design in the SSMR*

☒ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

Comments: *Refer to appendix D of the SSMR*

4.3 Development Servicing Report: Wastewater

☒ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).

Comments: *Refer to Section 3.0 of the SSMR .*

☒ Confirm consistency with Master Servicing Study and/or justifications for deviations.

Comments: *No Master Servicing Study, Design Conformance with Ottawa Sewer Design Guidelines.*

☒ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.

Comments: *There are no local conditions of this nature. Refer to Section 3.0 of the SSWR.*

☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

Comments: *Refer to drawing 180966-SER is appendix E of the SSMR.*

☒ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)

Comments: *Refer to Section 3.0 of the SSMR*

☒ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

Comments: *N/A*

☒ Special considerations such as contamination, corrosive environment etc.

Comments: *N/A*

4.4 Development Servicing Report: Stormwater

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

Comments: *Refer to Section 2.0 of the SSMR.*

☒ Analysis of available capacity in existing public infrastructure.

Comments: *Refer to Section 2.0 of the SSMR - Stormwater runoff to be controlled to less than existing predevelopment conditions in accordance with conditions provided by City.*

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

Comments: *Refer to drawings 180966 PRE - Pre-Development and 180966-POST - Post Development Drainage in Appendix E of the SSMR.*

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

Comments: *Refer to Section 2.0 of the SSMR.*

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

Comments: *Refer to Section 2.0 of the SSMR.*

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

Comments: *Refer to Section 2.0 and Appendix A and B of the SSMR*

☒ Set-back from private sewage disposal systems.

Comments: *N/A*

☒ Watercourse and hazard lands setbacks.

Comments: *N/A*

☒ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

Comments: *An MECP ECA is not required provided the site becomes one property*

☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

Comments: *N/A - no master servicing study avaiable*

☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).

Comments: *Refer to Appendix A of the SSMR and Section 2 of SSMR*

☒ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.

Comments: *N/A*

☒ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.

Comments: *Refer to Appendix A of the SSMR and Section 2 of SSMR*

☒ Any proposed diversion of drainage catchment areas from one outlet to another.

Comments: *N/A*

☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.

Comments: *N/A - Refer to Drawing 180966 - SER - Appendix E of the SSMR*

☒ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.

Comments: *Quantity control is provided. Refer to section 2 of the SSMR*

☒ Identification of potential impacts to receiving watercourses

Comments: *No Potential Impacts*

☒ Identification of municipal drains and related approval requirements.

Comments: *No municipal drains*

☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.

Comments: *Refer to section 2 of the SSMR*

☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

Comments: *100 year flood levels and major flow routing is shown on drawing180966-GRD in appendix E of the SSMR .*

☒ Inclusion of hydraulic analysis including hydraulic grade line elevations.

Comments: *N/A*

☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.

Comments: *Refer to Section 5.0 of the SSMR*

☒ Identification of floodplains - proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.

Comments: *N/A*

☒ Identification of fill constraints related to floodplain and geotechnical investigation.

Comments: *N/A*

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

☒ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.

Comments: *Consultation with RVCA is ongoing*

☒ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

Comments: *Not required provided the site is combined into one property.*

☒ Changes to Municipal Drains.

Comments: *N/A*

☒ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

Comments: *N/A*

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

Comments: *Refer to Section 6.0 of the SSMR*

☒ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

Comments: *-comments are to be received from review agencies and will be addressed item by item in response letters.*

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

Comments: *Signed and Stamped.*