

SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared for:
Homes First Nicholas Corp.

Medium Density Residential Development

0 Nicholas Street
Picton, ON K0K 2T0

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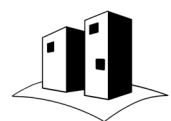
August 6, 2026
Project No.: 23-026

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Submission History

Submission	Date	Issued For	Issued To
1	Apr. 5, 2024	SPA	Picton
2	Oct. 16, 2024	SPA	Picton
3	May 13, 2026	SPA	Picton
4	August 5, 2026	SPA	Picton



1.0 INTRODUCTION

1.1 Purpose

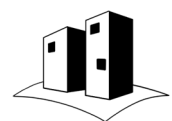
SITEPLANTECH was retained by Homes First Nicholas Corp. to prepare a Functional Servicing Report, in support of an OPA, ZBA and Site Plan application, to investigate water supply, sanitary sewerage and storm drainage for a proposed development located at 0 Nicholas Street, Picton, Ontario.

The purpose of this report is to provide site specific information for the Town of Picton, Prince Edward County and Quinte Conservation's review with respect to the adequacy of the existing infrastructure to support the proposed development. SITEPLANTECH has received and reviewed the comments from the Town and Quinte Conservation dated September 2024 and have updated the following report to address all related comments.

1.2 Background Information

The following documents were requested and made available to SITEPLANTECH for our review and forms the basis of this report:

- Stuart M. Moore, OLS., KRCMAR (2023, December 21), Plan of Survey Showing Topographical Information, Registered Plan 24, Town of Picton. (23-185). [Technical drawing].
- Stormwater Management Submission Guidelines, Quinte Conservation, dated May 2012.
- Bay of Quinte Remedial Action Plan Implementation Area Stormwater Management Design Guidelines, Revised March 2006.
- Design guidelines for Drinking-Water Systems, Ministry of the Environment (2008).
- Author Unknown, Dillon Consulting, (2012, April), Record Drawings of Wastewater Treatment Plant Replacement, Siteworks Pipe Routing Plan (Project No. 09-1910), Drawing No. R100 [Technical drawing].
- Author Unknown, Dillon Consulting, (2012, April), Record Drawings of Wastewater Treatment Plant Replacement, Siteworks Forcemain Plan and Profile (Project No. 09-1910), Drawing No. R150 [Technical drawing].
- Rhonda Horne-McQuay, Colbourne & Kembel Architects Inc., Nicholas Apartments, (100A, 102). [Technical drawings].
- Stuart Baird, M.Eng., P.Eng., Geotechnical Investigation Report Proposed Residential Development – Nicholas Street, Cambium (January 25, 2024)



1.3 Site Description

The subject site is approximately 21,932.6m² (2.19 Ha) and is currently vacant. The site is bounded by:

- Vacant lands to the north;
- Nicholas Street and Cumberland Street to the east;
- Picton Wastewater treatment plant to the south; and,
- Lalor Street and Delhi Park to the west.

1.4 Proposed Development

The proposed development is a medium density multi-building development that has been designed to integrate with the surrounding built form and the natural landscape. It consists of a townhouse block and a semi-detached building which front onto Nicholas Street, and a low-rise apartment building accessed from a new road extension. In total, the proposed development will yield 120 residential units consisting of a mix of studios, one-, two- and three-bedroom units and townhouses. Below and at-grade parking for 120 vehicles will be provided from Nicholas Street.

The site is located within the Bay of Quinte Remedial Action Plan Implementation Area as identified by Quinte Conservation. The property is partially located within a regulated area, the boundaries of which are identified on the various plans and reports.

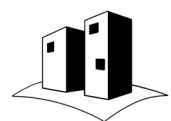
Please refer to the site plan and site statistics in **Appendix A** for additional information.

1.5 Easements and Land Conveyances

Although there are no easements registered on title, there are a few unopened road allowances traversing the property. Refer to topographic plan in **Appendix A** for additional details.

The Town or County have not requested any land conveyances and no easements will be necessary to develop the subject lands.

For the purpose of our report and calculations, the net disturbed land area of approximately 16,315m² (1.63 Ha) will form basis of all calculations.



2.0 SERVICING TERMS OF REFERENCE AND METHODOLOGY

2.1 Terms of Reference

This report was prepared in accordance with the Town, County and Conservation Authority's terms of reference outlined in **Section 1.2** above.

2.2 Methodology: Stormwater Management

In accordance with the stormwater management guidelines, the modified rational method will be used to calculate runoff rates and target release rates from the site based on Intensity-Duration-Frequency (IDF) rainfall curves obtained from the Ministry of Transportation (MTO) database found in **Appendix B**.

We will provide a detailed account of the pre- and post-development conditions and comment on opportunities to reduce peak flows. Due to the extreme grading of the site and the need to minimize land disturbance, the proposed stormwater management requirements are summarized below:

- TSS removal: Long-term average of 80% TSS removal is required.
- Water quantity: The post-development 100-year storm shall be controlled to the 2-year pre-development rates for all impervious surfaces and captured areas while pervious surfaces for areas that cannot be captured will be left draining uncontrolled, such that post-development flows for the entire development do not exceed pre-development run-off conditions.
- Erosion control: Shall be designed as per the Erosion and Sedimentation Control Guidelines for Urban Construction (2006).

Detailed servicing and grading plans will be prepared based on the recommendations of this report.

2.3 Methodology: Sanitary Drainage

The sanitary sewage discharge from the site will be determined using sanitary flow rates that consider the land use and building statistics as supplied by the design team. The calculated values provide peak sanitary flow discharge that considers infiltration.

The proposed sanitary discharge flows from the site will be calculated based on the Prince Edward County's criteria shown in **Table 1** below.

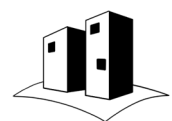


Table 1: Sanitary Flow Criteria

Use	Population	Flow
Studio / 1-BDRM	1.4	320 L/c/d
2-BDRM	2.1	320 L/c/d
3-BDRM	2.4	320 L/c/d
3-BDRM Towns	2.5	320 L/c/d
4-BDRM Semis	3.0	320 L/c/d

The proposed site generated flows will be calculated, and recommendations will be made to address capacity issues identified, if applicable.

2.4 Methodology: Water Supply

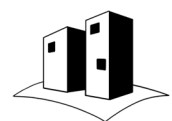
The proposed domestic water demands from the site will be determined using the same criteria as outlined in **Table 1** above. Peak flows from the development will be calculated as per the MOECP Guidelines for Drinking Water, as per **Table 2** below.

Table 2: Water Demands Criteria

Criteria	P _f
Min Daily	0.84
Max Hour	0.90
Max Day	1.10

It is our understanding that the development will not need to be sprinklered in accordance with the OBC.

Pressure and flow testing will be conducted at hydrants within the vicinity of the site when it will be permissible to do so to obtain existing flows, residual and static pressure. Fire suppression calculations, in accordance with the Fire Underwriters Survey (FUS) Guidelines, will be undertaken to determine the minimum flow required at 140 KPa for fire protection, the results of which will be compared to the results of hydrant flow tests to confirm adequate supply.



3.0 STORMWATER MANAGEMENT

All calculations and figures pertaining to the information summarized in the following sections are found in **Appendix B**.

3.1 Existing Drainage System

The following storm sewer infrastructure is located within the vicinity of the subject site:

- A 250 mm diameter storm sewer located on the east side of the road centre line of Nicholas Street which picks up drainage from the road side ditch of Cumberland Street;
- A road side ditch on the west side of Nicholas Street.

All captured flows drain north to a headwall at the intersection of Nicholas Street and Richmond Street which then drains west towards the Delhi Park Creek and subsequently to Picton Harbour.

Surface drainage from the property currently flows in a westerly direction towards Lalor Street and Delhi Park.

Based on the survey reviewed, the property receives drainage from external sources emanating from the east. Refer to **Figure 201** for existing drainage conditions.

Boreholes were advanced as part of the geotechnical review of the soil conditions from which groundwater elevations were noted as indicated in **Table 3** below:

Table 3: Groundwater Elevations

BH No.	Highwater GW Elev. (MASL)	Ex. Ground Elev. (MASL)	Depth below grade (m)
BH101-23	87.53	90.13	2.6
BH102-23	-	94.72	-
BH103-23	-	93.27	-
BH104-23	-	95.26	-
BH105-23	85.24	85.84	0.6
BH106-23	-	94.44	-
BH107-23	87.95	90.55	2.6
BH108-23	87.15	90.15	3.0
BH109-23	83.68	88.68	5.0

3.2 Existing Runoff

The pre-development runoff conditions were calculated based on the County's and Quinte Conservation's criteria, with an initial time of concentration of 10 minutes as calculated for existing rural areas, and will be used to determine net flow reduction from the site. The pre-development runoff from the site is summarized in **Table 4** below:

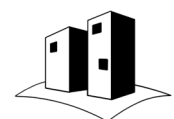


Table 4: Pre-Development Runoff

Return Period	Drainage Area (Ha)	Runoff C	Q (L/s)
2-Year	1.631	0.307	103.1
5-Year	1.631	0.307	137.2
10-Year	1.631	0.307	159.6
25-Year	1.631	0.307	187.3
50-Year	1.631	0.307	208.2
100-Year	1.631	0.307	228.7

3.3 Allowable Release Rate

To the extent practical, the proposed stormwater management release rate will match pre-development flows for all storm events based on a runoff coefficient of 0.307. The calculated allowable release rate summarized in the above **Table 4**.

3.4 Proposed Stormwater Management Strategy

The post-development storm drainage will generally follow pre-development conditions.

Except for areas which cannot be captured within reasonable means, grading has been designed to be self-contained during the 100-year storm event. An emergency overland flow outlet via the access driveway, will be provided to limit surface ponding to a maximum of 0.30m and direct emergency flows to Nicholas Street.

The grading has been designed such that all external flows coming from lands to the east will be cut-off by an interceptor swale and redirected around the property. The interceptor swale conveyance and rip rap sizing calculations are found in the appendix.

All captured flows will be directed to two separate underground stormwater management facilities. Drainage from the tank will drain by gravity to a lift station where it will be pumped to the proposed outlet elevation. The on-site storm sewers leading to the lift station were sized to convey the 2-year release rate from the SWM facility and the mechanical consultant has confirmed that the pumps were designed to discharge the maximum release rate from the tank. Drainage from the lower parking areas and building courtyard will drain by gravity and outlet to a rip-rap outlet at grade

3.5 Quantity Control

As shown in **Table 5** below, the 100-year post-development discharge rate from the subject development will be controlled such that the total release rate does not exceed the pre-development flows from the site. Refer to **Figure 202**.



Table 5: Post-Development Release Rates

Storm Event	Pre-Dev. Flow (L/s)	Controlled Flow (L/s)¹	Uncontrolled Flow (L/s)²	Total Site Flow (L/s)	Required Storage (m³)¹
2-Year	103.1	30.1	45.9	76.0	79.3
5-Year	137.2	35.8	61.1	96.6	110.9
10-Year	159.6	39.4	71.0	110.4	132.6
25-Year	187.3	45.9	91.7	137.7	178.9
50-Year	208.2	55.7	111.2	166.9	232.9
100-Year	228.6	59.9	127.2	187.1	270.0

Note: the sums outlined in the table above may not be exact due to significant digit rounding.

In total, 270.0 m³ of active storage is required to meet the allowable release rate this volume is split between drainage ID 210 and 211. Quantity controls for ID 210 will be provided by a cast-in-place stormwater management (SWM) chamber located below grade. The 2- through the 100-year storm event will be controlled by a 100mm diameter tamper-proof orifice plate located at the outlet of the SWM chamber (upstream of the control manhole). The SWM chamber was upsized to ensure that the 100-year flow to the tank is conveyed without surcharging, and also to reduce the outlet flow to minimize the lift-station infrastructure. As such approximately 294m³ is available for storage purposes.

Quantity controls for ID 211 will be provided by underground storage units consisting of 16 DC-780 chambers. The 2- through the 100-year storm event will be controlled by a 125mm diameter tamper-proof orifice plate located at the outlet of storm MH5. Approximately 44.7m³ is available for storage purposes.

Details and sections of the SWM chamber, underground storage units and orifice controls are provided on **Plan 002** and **Plan 101**, found in **Appendix E**.

To protect the building against a complete system failure, the stormwater management chamber will be equipped with a perforated manhole lid accessible at grade to provide an emergency overland release point that also provides inspection and maintenance access to the SWM chamber. The site will be graded in such a way that overland flow relief (emergency) will be directed north to Nicholas Street. Refer to **Plan 401** for grading details.

¹ Sum of ID 210 and ID 211 released rate

² Sum of ID 220 and ID 221 released rate



3.6 Quality Control

As per the MOE requirements, quality controls must achieve a minimum of 80% total suspended solids (TSS) removal. The development will consist of rooftop and parking surfaces with perimeter landscaped surfaces

Based on the Effective TSS removal calculations, the proposed development will achieve a net TSS removal of 63% and 12% for drainage areas 210 and 211 respectively. It is therefore proposed to treat run-off from each drainage areas using a treatment train approach consisting of an oil grit separator (model no. FD-4HC) and an isolator row. Runoff will be treated by the OGS prior to entering the active storage components of the SWM tank or underground storage chambers such that the volume of water release from the site will have been treated.

Using a treatment train approach considering of a combination of oil-grit separators, isolator rows and extended detention, the proposed development will achieve a combined TSS removal of 90.3% as per the calculations prepared by ADS. Refer to **Plan 101** for additional information.

3.7 Erosion Control

Please refer to **Section 7.0** below for details related to the proposed temporary erosion and sedimentation controls to be implemented during construction.

3.8 100-Year Capture

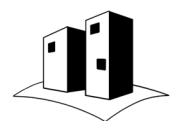
To ensure that the 100-year flows are captured from the grassed areas around the perimeter areas of the building susceptible to overland flow, all area drains were modelled as horizontal orifice plates assuming a 50% blockage.

The total maximum flow contributing to an area drain (Q_{100AD}) is equivalent to 20.6L/s, based on the maximum individual AD catchment area of 500m². A summary of the design flows and inlet capacity is summarized in **Table 6** below:

Table 6: 100-Year Capture Points

Drainage ID	Area (m ²)	100-Year Flow (L/s)	Max Head (m)	½ inlet Capacity (L/s)
AD (TYP.)	500	20.6	0.3	50.0

Considering a 50% blockage of the 100-year capture points, area drains such as Zurn Z662-HF (or approved equivalent) at all AD locations are sufficient to ensure total capture from the designed drainage areas.



3.9 External Drainage

The proposed development receives external drainage from areas beyond the eastern side of the property due to the sloped terrain. Therefore, cut-off swales were designed to convey this existing flow without having a negative impact on the proposed development. There are 2 external drainage areas identified; drainage ID EXT-1 and drainage ID EXT-2, as noted on **Figure EXT** in **Appendix B**. The flows from EXT-1 will flow into the cut-off swale along the southern property line and drain towards the west while the flows from EXT-2 will flow into the cut-off swale along the eastern property line and drain towards the north.

The time of concentration was calculated separately for each drainage area, where EXT-1 has a Tc of 18 minutes and EXT-2 has a Tc of 19.7 minutes. Refer to the Initial Tc Calculations.

The external runoff flow for **EXT-1** is calculated in **Table 7** below:

Table 7: EXT-1 Runoff

Return Period	Drainage Area (Ha)	Runoff C	Q (L/s)
2-Year	0.80	0.30	32.7
5-Year	0.80	0.30	43.6
100-Year	0.80	0.38	90.8

The external runoff flow for **EXT-2** is calculated in **Table 8** below:

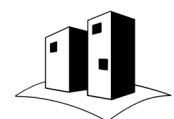
Table 8: EXT-2 Runoff

Return Period	Drainage Area (Ha)	Runoff C	Q (L/s)
2-Year	1.01	0.30	38.9
5-Year	1.01	0.30	51.7
100-Year	1.01	0.38	107.7

These flows were calculated for each cut-off swale and have been determined to have enough capacity to convey these external flows. The cut-off swale for EXT-1 has a capacity of 232.4 L/s at the most conservative segment, whereas the cut-off swale for EXT-2 has a capacity of 146.6 L/s at the most conservative segment. Refer to the Flow Depth Calculations for EXT-1 and EXT-2.

3.10 Nicholas St. Culvert Sizing

The townhouse driveways fronting Nicholas Street will require culverts in order to bridge the roadside drainage ditch. Culverts were sized based on the drainage area contributing to the



roadside ditch (refer to area "DI1" on plan 202), which includes the detached home driveways but not the front lawns as those are capture by the east side ditch and catchbasins.

Under the 100-year scenario, drainage ID1 will contribute 42.4 L/s and the development (pump and uncontrolled flows) is expected to be approximately 53.5 L/s. Therefore culverts must be sized to safely convey the sum of the two, or 95.9 L/s. As per the culvert chart, a CSP can be attributed with a Manning's roughness coefficient of 0.024. According to the chart in **Appendix B**, a 300mm corrugated steel pipe with a slope of 3.68% will convey 104.8 L/s and is therefore adequately sized.

3.11 Stormwater Management Flow Summary

The following **Table 9** provides an overall summary of the pre- and post-development flow changes as a result of the proposed development:

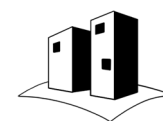
Table 9: Stormwater Management Flow Summary

Return Period	Pre-Dev Flows to Delhi Park	Pre-Dev Flows to Nicholas	Post-Dev Flows to Delhi Park (ID 211+ID220)	Post-Dev Flows to Nicholas (ID210+ID221)
2-Year	79.6	-	52.2	23.8
5-Year	111.4	-	67.0	29.9
10-Year	133.2	-	76.9	33.6
25-Year	179.8	-	96.4	41.2
50-Year	233.6	-	118.9	48.0
100-Year	271.1	-	133.6	53.5

3.12 Proposed Drainage System

Due to the challenges related to the grading of the site and the local bedrock elevation, it is proposed to outlet stormwater from the development in two manners: the first (ID 210) will outlet to the existing roadside ditch on the west side of Nicholas Street and the second outlet (ID 211) will discharge at grade through a headwall and rip-rap outlet.

As the invert of the roadside ditch outlet will be higher than the bottom of the SWM tank, it will be necessary to lift/pump the released stormwater flows. The lift station will consist of a manhole with a 1.0m deep sump equipped with duplex pumps, the details of which will be provided by Neiva Engineering.



The driveway culverts downstream of the outlet were sized to convey the storm sewers downstream of the SWM structure were sized to safely convey the Nicholas Street road drainage as well as the peak release rate from the lift station. A 300mm diameter culverts, the slope of which will match the existing roadside ditch grade, will be adequate to convey the estimated peak flow of 104.5L/s (34.3 from the right-of-way drainage and 70.2 from the SWM Tank outlet). The outlet to the existing ditch will be made through a proposed retaining/headwall which will connect to the proposed lift station.

A control manhole, providing inspection and access to the SWM infrastructure, will be installed near the property line forming part of the stormwater management tank described above.

Refer to **Drawing 101** found in **Appendix E** for the details related to the service connection.



4.0 SANITARY DRAINAGE

All calculations pertaining to the information summarized in the following sections are found in **Appendix C**.

4.1 Existing Sanitary Drainage System

The following sanitary sewer infrastructure is located within the vicinity of the subject site:

- An existing 200 mm diameter gravity sanitary sewer located west side of the Nicholas Street right of way. This sewer drains north to the local pump station.
- Two existing 350 mm diameter forcemains located immediately east of the 200mm gravity sewer. These forcemains flow from the pumping station to the wastewater treatment plant located south of the subject site.
- A 500mm diameter outfall gravity sewer located immediately east of the 200mm gravity sewer. This sewer drains north towards the local pump station and ultimately outlets to the creek at Delhi Park.
- A 150mm gravity sanitary sewer down the centre of Nicholas Street.

4.2 Existing Sanitary Flows

The existing property does not contribute sanitary flows.

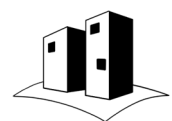
4.3 Proposed Sanitary Flows

The proposed sanitary discharge flows from the site were calculated based on the criteria outlined in **Section 2.3**, the proposed building and site information. A total peak design flow of 2.9 L/s was calculated for the subject property.

4.4 Proposed Sanitary Connection

The sanitary effluent from the proposed development will generally discharge to the municipal sanitary sewer by gravity. However, sanitary effluent from the lower-level units and from sanitary drainage fixtures located within the covered portion of the parking structure will require pumping to the sanitary building service due to elevation constraints. Only sanitary wastewater will be conveyed through this pumped system; stormwater and other non-sanitary drainage will be collected and discharged through separate storm drainage infrastructure and will not be connected to the sanitary building service.

All sanitary flow from the proposed development will discharge to the existing 150 mm diameter sanitary sewer on Nicholas Street. The townhouse block and the low-rise residential development will each be serviced independently, with a dedicated inspection manhole located at the respective property line.



For the low-rise residential development, the existing 150 mm diameter sanitary sewer located at the centreline of Nicholas Street will be extended south to provide service to the development. For the townhouse block, sanitary flows from all units will be collected within the site and conveyed through a single 150 mm diameter sanitary service connection, which will connect to the existing 150 mm diameter sanitary sewer on Nicholas Street via a riser connection.

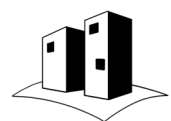
The proposed sanitary service connections have been sized to accommodate the calculated design flows while maintaining the minimum self-cleaning velocity of 0.6 m/s.

Refer to **Drawing 101** found in **Appendix E** for the details related to the service connection.

4.5 Sanitary Sewer Capacity Review

As the County requested that the connection to the municipal infrastructure be made to the 150mm sanitary sewer reference above, a design sheet was prepared to conform conveyance capacity. The design sheet found in the appendix assumes that all local sanitary effluent from Cumberland St, Richmond Street and Thomas street discharge at MH-591, which is a conservative assessment. According to our calculations, including the proposed development the municipal infrastructure would flow at a maximum of 26% capacity without surcharging thereby confirming that the local infrastructure is suitable to support the development.

The area drains to the Lalor Street pump station. There are concerns that the pump station may be near or at capacity. It is our understanding that a future development (Village A - Base 31) is proposing to drain sanitary effluent to the Lalor Street pump station until such time that a new pump station at the waste treatment plant would divert flows directly to the treatment plant. The report prepared for Base 31, an excerpt of which is included in the appendix, suggest that the current pump station has a remaining capacity of approximately 37 L/s during peak events, suggesting that the station is operating at roughly 90% capacity. It is estimated that the Base 31 development will contribute approximately 24.4L/s to the sanitary effluent. In combination with the proposed 2.9L/s from the development, a total future increase of 27.3 L/s can be anticipated. This increase in flow is within the remaining capacity of the Lalor Street pump station.



5.0 WATER SUPPLY

All calculations pertaining to the information summarized in the following sections are found in **Appendix D**.

5.1 Existing System

The following water infrastructure is located within the vicinity of the subject site:

- An existing 200 mm diameter PVC watermain located within the east boulevard of Nicholas Street, south of Cumberland Street.
- An existing 150 mm diameter ductile iron (DI) watermain located within the east boulevard of Nicholas Street, north of Cumberland Street.

Two hydrant flow tests were carried out within the vicinity of the site to determine flow and pressure conditions for the existing watermain. The first test was carried out on May 5, 2024 and the second on May 14, 2024; both by Prince Edward County.

The first hydrant flow test was performed on Nicholas Street. The test results indicate the watermain is operating at a static pressure of approximately 441 kPa (64 PSI) and that the available flow at 140 kPa (20 PSI) is approximately 5,353 L/min (1,414 USPGM).

The second hydrant flow test was performed on Centre Street. The results of this test indicate the watermain is operating at a static pressure of approximately 462 kPa (67 PSI), and that the available flow at 140 kPa (20 PSI) is approximately 9,948 L/min (2,628 USPGM)..

5.2 Existing Water Demands

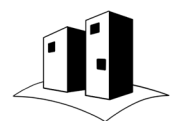
The existing property does not draw water from the local infrastructure.

5.3 Proposed Water Supply Requirements

The estimated water consumption was calculated as per the criteria outlined in **Section 2.4** above. The proposed average day domestic water consumption rate is estimated to be 0.7 L/s (maximum day demand of approximately 120,202 L/day).

Water Supply for Public Fire Protection calculations, as provided by the Fire Underwriters Survey (FUS), were undertaken to determine the minimum requirement to provide adequate fire suppression. According to our calculations, a minimum fire suppression flow of approximately 6,749 L/min (1,783 USGPM) at a pressure of 140 KPa (20 PSI) will be required for the subject development. According to the flow test referenced above, the Max Day + Fire Flow rate of approximately 6,833 L/min (1,805 USGPM) is available at a pressure which exceeds the minimum FUS requirements.

The municipal water system therefore has adequate flow and pressure to satisfy the water demands of the proposed development.



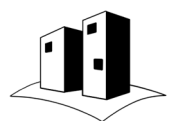
5.4 Proposed Water Connection

As the proposed buildings will not be sprinklered, each development will be serviced with a domestic water supply. A hydrant within the aboveground parking area will be connected to provide the required fire protection coverage. In accordance with municipal requirements, non-sprinklered buildings may be serviced by a single domestic supply.

The townhouse block will be serviced by a 150 mm PVC watermain connected to the existing 150 mm diameter ductile iron (DI) watermain on Nicholas Street. The low-rise residential development will be serviced by a separate 200 mm PVC watermain connected to the existing 200 mm diameter watermain on Nicholas Street. Each connection will be complete with a tapping sleeve and valve.

Each service will be equipped with a combined water meter and backflow preventer, such as an OMNI+ Fireline (F2) water meter (or approved equivalent), located within a meter chamber.

Refer to **Drawing 101** found in **Appendix E** for additional details.



6.0 SITE GRADING

6.1 Existing Grades

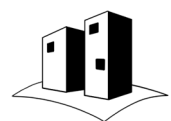
The in-situ conditions can be described as grassed surfaces. Existing drainage flows overland and is directed to the west towards Lalor Street and Dehli Park as shown on **Figure 201** found in **Appendix B**. The topography of the surrounding areas suggests that the site receives drainage from external sources located to the east. The site has an approximate 32.0m grade difference from high to low point.

6.2 Proposed Grades

Based on the development concept and the review of the perimeter site grades, the finished floor elevation of the various proposed buildings will vary. The proposed townhouse's finished floor elevation fronting Nicholas Street will vary between 89.73 and 91.92, while the main building's first floor elevation will be 92.15.

The proposed finished floor elevations and grading of the site perimeter will be compatible with the existing developments. Perimeter grades will be designed to produce grades in the range of 2.0% to 5.0% throughout the site and towards the adjacent municipal right-of-way where existing grades will be met at the bottom of curb as the boulevards will be reconstructed. In order to match existing grades along the eastern slope, a 2:1 maximum grade is proposed and is to be constructed per the geotechnical recommendation.

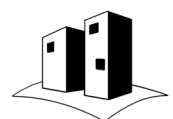
The development of this site and will not adversely impact adjacent lands. Please refer to **Drawing 401** found in **Appendix E** for additional information.



7.0 EROSION AND SEDIMENT CONTROL

To ensure stormwater runoff during the construction phase does not transport sediment to the existing municipal infrastructure, temporary catchbasin sediment control devices are proposed along the site frontages of Nicholas Street. In addition, a temporary sediment control fence will be erected around the site perimeter and a temporary construction access (mud mat) will be built at the construction entrance proposed on Nicholas Street.

These measures will be designed and constructed in accordance with the "Erosion and Sediment Control Guideline for Urban Construction" document (December 2019). These measures, as well as any additional information pertaining to ESC Controls, are detailed on **Drawing 601** found in **Appendix E**. All reasonable measures will be taken to ensure sediment loading to the adjacent properties and municipal right-of-way is minimized both during and following construction.



8.0 CONCLUSIONS AND RECOMMENDATIONS

This report is to be read in conjunction with the application submission material for the project proposal known as Homes First Nicholas Corp development. We conclude and recommend the following:

8.1 STORMWATER MANAGEMENT

Peak runoff rates for the proposed development were designed to be less than or equal to the existing condition by implementing onsite SWM controls. Stormwater storage for each drainage areas will be implemented to achieve this and will be provided by on-site storage and orifice plates. A total storage volume of 270.0m³ is required to meet quantity controls.

Quality controls will be provided by an oil-grit separator located upstream of the SWM tank's active storage area. An overall TSS removal efficiency of approximately 82% will be achieved.

8.2 SANITARY DRAINAGE

The sanitary discharge from the proposed development will be directed to the existing infrastructure on Nicholas Street. According to our calculations, the total flow within the sanitary sewer infrastructure will flow at a maximum of 10.0% full post development. Therefore, the existing infrastructure thus has adequate capacity to safely convey effluent from the proposed development to the local pump station.

8.3 WATER SUPPLY

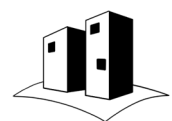
The proposed development will be serviced by the existing municipal watermain on Nicholas Street. The townhouse block will be connected to the existing 150 mm ductile iron (DI) watermain located north of Cumberland Street, while the low-rise residential development will be connected to the existing 200 mm PVC watermain located south of Cumberland Street. Based on the available hydrant flow test results, the existing municipal water infrastructure has sufficient capacity to support the maximum day demand plus the required fire flow for the proposed development.

8.4 SITE GRADING

The proposed grading is compatible with existing elevations at the property limits.

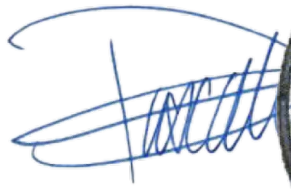
8.5 EROSION AND SEDIMENT CONTROL

ESC measures were designed as per the "Erosion and Sediment Control Guideline for Urban Construction" document (December 2019). Provided that these measures are well maintained during construction, these will be adequate to keep sediments from entering the municipal infrastructure during construction.



Respectfully submitted,

SITEPLANTECH INC.



Pascal Monat, P.Eng.
Principal

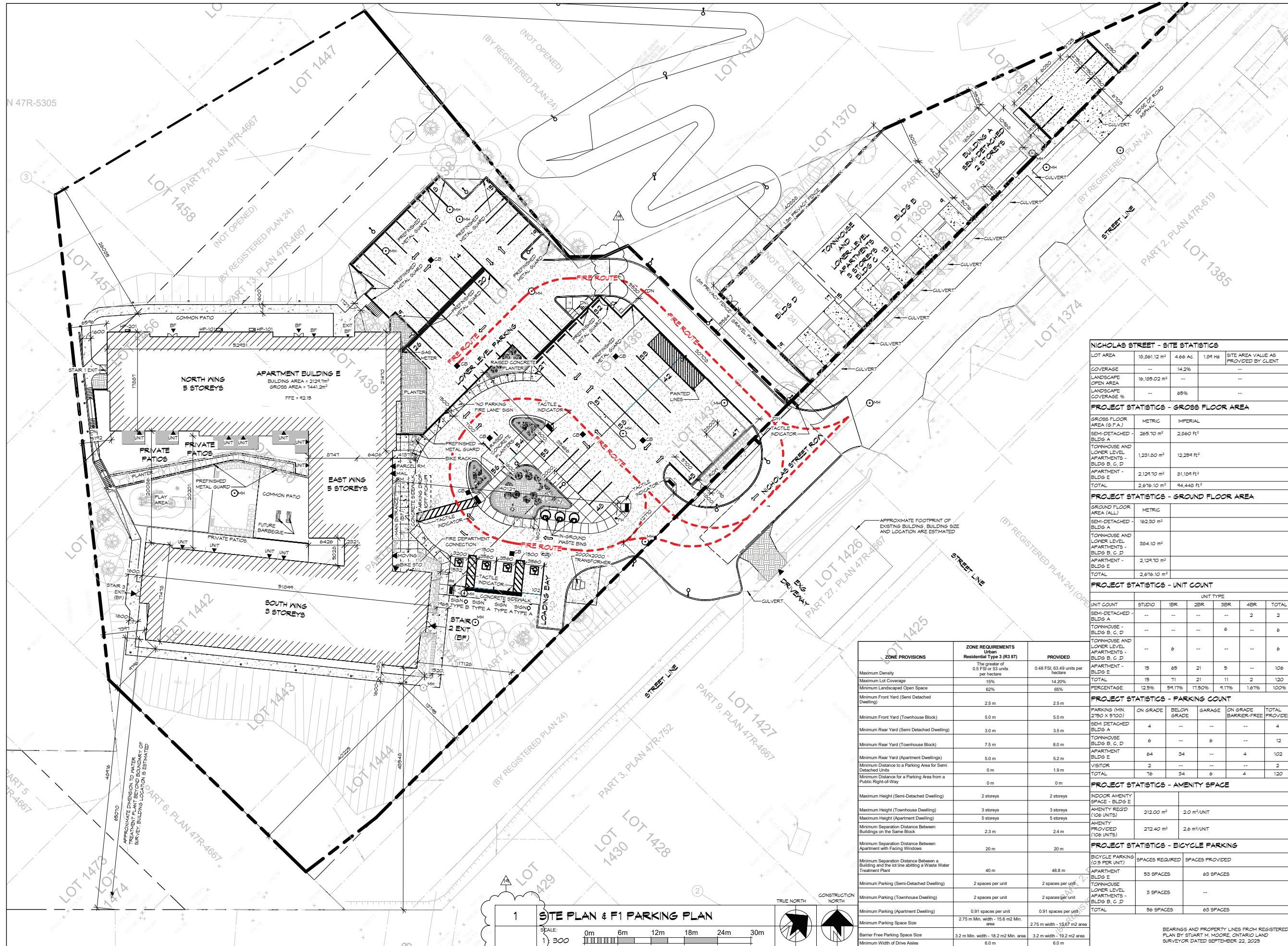


P:\23-026 - 0 Nicholas St. - Picton\Reports and Drawings\Reports\23-026 - FSR Current.docx



Appendix A

Background Information



NOTES:

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DRAWINGS MUST NOT BE SCALED. VERIFY DIMENSIONS ON SITE.

SITE LEGEND

A/B - BF PARKING SIGNAGE SEE DETAIL 5/102

FIRE HYDRANT

PLANTING: TREES, BUSHES, SHRUBS, ETC.

TACTILE WALKING SURFACE INDICATOR

FENCE

SAN - SANITARY

STM - STORMWATER

WAT - WATERLINE

PROPERTY LINE

EXTENT OF PARKING BELOW

ASPHALT PAVING

EARTH / SOIL

PAINTED CROSSWALK STRIPES

CONCRETE DRIVEWAY

NICHOLAS STREET - SITE STATISTICS

LOT AREA	10,061.12 m ²	4.86 AC	1.24 HS	SITE AREA VALUE AS PROVIDED BY CLIENT
COVERAGE	--	14.2%	--	--
LANDSCAPE OPEN AREA	16,185.02 m ²	--	--	--
LANDSCAPE COVERAGE %	--	65%	--	--

PROJECT STATISTICS - GROSS FLOOR AREA

GROSS FLOOR AREA (G.F.A.)	METRIC	IMPERIAL
SEMI-DETACHED - BLDG A	265.10 m ²	2,860 ft ²
TOWNHOUSE AND LOWER LEVEL APARTMENTS - BLDG B, C, D	1,231.60 m ²	12,294 ft ²
APARTMENT - BLDG E	2,124.10 m ²	21,194 ft ²
TOTAL	2,676.10 m ²	24,448 ft ²

PROJECT STATISTICS - GROUND FLOOR AREA

GROUND FLOOR AREA (ALL)	METRIC
SEMI-DETACHED - BLDG A	162.30 m ²
TOWNHOUSE AND LOWER LEVEL APARTMENTS - BLDG B, C, D	304.10 m ²
APARTMENT - BLDG E	2,124.10 m ²
TOTAL	2,676.10 m ²

PROJECT STATISTICS - UNIT COUNT

UNIT COUNT	STUDIO	1BR	2BR	3BR	4BR	TOTAL
SEMI-DETACHED - BLDG A	--	--	--	--	2	2
TOWNHOUSE - BLDG B, C, D	--	--	--	6	--	6
TOWNHOUSE AND LOWER LEVEL APARTMENTS - BLDG B, C, D	--	6	--	--	--	6
APARTMENT - BLDG E	15	65	21	5	--	106
TOTAL	15	71	21	11	2	120
PERCENTAGE	12.5%	59.17%	11.50%	9.17%	1.67%	100%

PROJECT STATISTICS - PARKING COUNT

PARKING (MIN 2750 N 9100)	ON GRADE	BELOW GRADE	GARAGE	ON GRADE BARRIER-FREE	TOTAL PROVIDED
SEMI-DETACHED BLDG A	4	--	--	--	4
TOWNHOUSE BLDG B, C, D	6	--	6	--	12
APARTMENT BLDG E	64	34	--	4	102
VISITOR	2	--	--	--	2
TOTAL	76	34	6	4	120

PROJECT STATISTICS - AMENITY SPACE

INDOOR AMENITY SPACE - BLDG E	AMENITY REQ'D (106 UNITS)	212.00 m ²	2.0 m ² /UNIT
AMENITY PROVIDED (106 UNITS)	212.40 m ²	2.0 m ² /UNIT	

PROJECT STATISTICS - BICYCLE PARKING

BICYCLE PARKING (0.5 PER UNIT)	SPACES REQUIRED	SPACES PROVIDED
APARTMENT BLDG E	53 SPACES	63 SPACES
TOWNHOUSE LOWER LEVEL APARTMENTS - BLDG B, C, D	3 SPACES	--
TOTAL	56 SPACES	63 SPACES

COLBOURNE & KEMBEL, ARCHITECTS INC.

1390 MILLIKEN PARK PLACE
KINGSTON, ONTARIO K7M 8H8
TEL: 613-364-2240
INFO@CKA.CA WWW.CKA.CA

PROJECT: NICHOLAS APARTMENTS

31 NICHOLAS STREET, PICTON ON, K0K 2T0

DRAWING: OVERALL SITE PLAN & STATISTICS

SCALE: As Indicated

PROFESSIONAL SEAL: ONTARIO ASSOCIATION OF ARCHITECTS Rhonda Horne-McQuay RNDON LORRAINE HORNE-MCQUAY LICENCE 6078

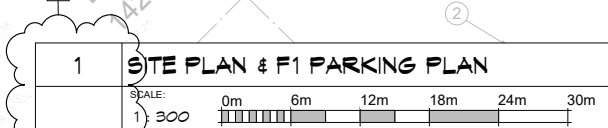
DRAWN: CBB/ZB DATE: OCT. 2024

CHECKED: TB PRINTED: 2026-07-22

REVIEWED: RHM DRAWING NO: 24012

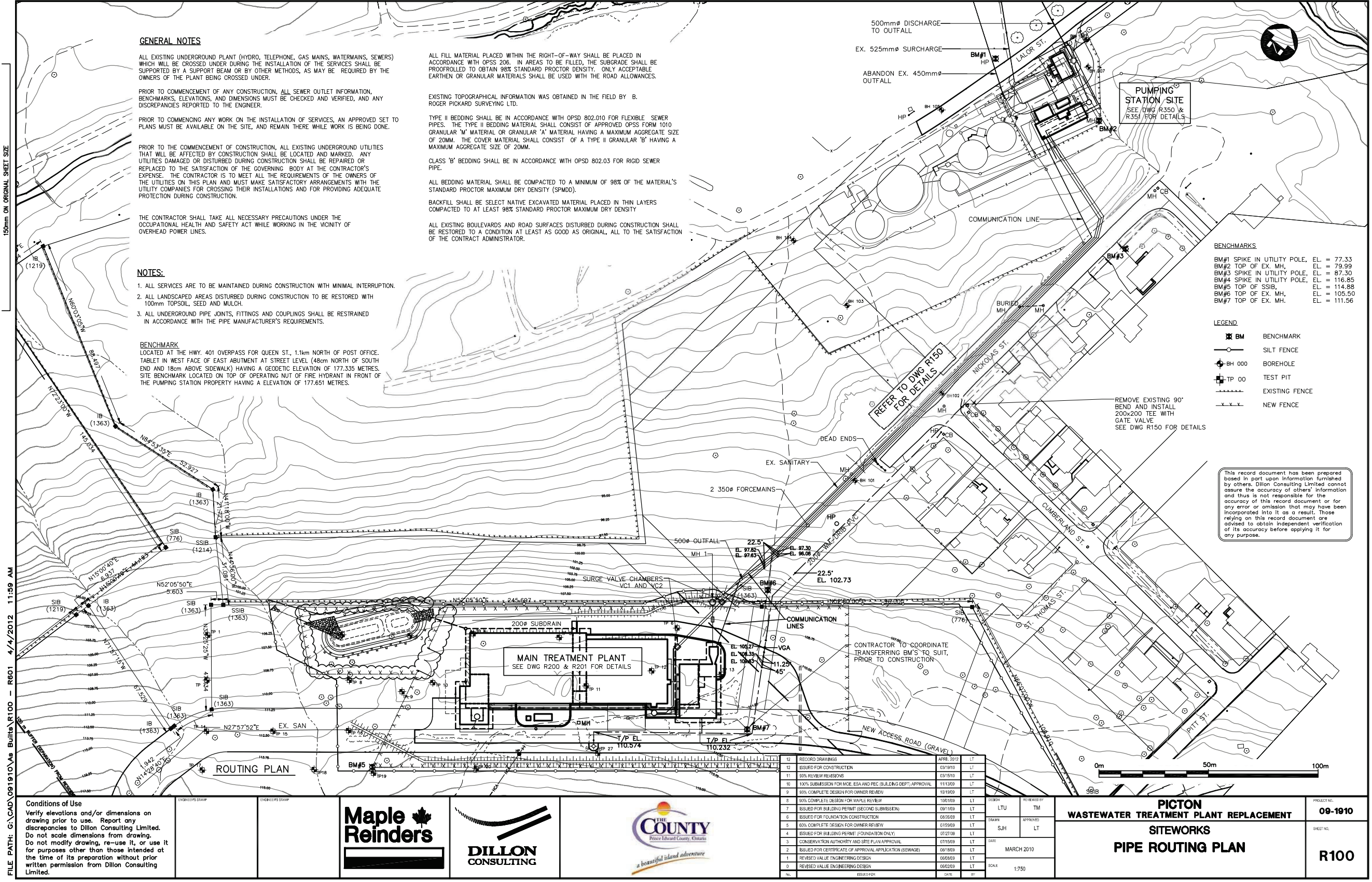
PROJECT NO: 100A

NOT FOR PERMIT OR CONSTRUCTION WITHOUT SEAL AND ISSUED NOTE



ZONE PROVISIONS	ZONE REQUIREMENTS Urban Residential Type 3 (R3.87)	PROVIDED
Maximum Density	The greater of 0.5 FSI or 53 units per hectare	0.48 FSI, 63.49 units per hectare
Maximum Lot Coverage	15%	14.20%
Minimum Landscaped Open Space	62%	65%
Minimum Front Yard (Semi Detached Dwelling)	2.5 m	2.5 m
Minimum Front Yard (Townhouse Block)	5.0 m	5.0 m
Minimum Rear Yard (Semi Detached Dwelling)	3.0 m	3.5 m
Minimum Rear Yard (Townhouse Block)	7.5 m	8.0 m
Minimum Rear Yard (Apartment Dwellings)	5.0 m	5.2 m
Minimum Distance to a Parking Area for Semi Detached Units	0 m	1.9 m
Minimum Distance for a Parking Area from a Public Right-of-Way	0 m	0 m
Maximum Height (Semi-Detached Dwelling)	2 storeys	2 storeys
Maximum Height (Townhouse Dwelling)	3 storeys	3 storeys
Maximum Height (Apartment Dwelling)	5 storeys	5 storeys
Minimum Separation Distance Between Buildings on the Same Block	2.3 m	2.4 m
Minimum Separation Distance Between Apartment with Facing Windows	20 m	20 m
Minimum Separation Distance Between a Building and the lot line abutting a Waste Water Treatment Plant	40 m	48.8 m
Minimum Parking (Semi-Detached Dwelling)	2 spaces per unit	2 spaces per unit
Minimum Parking (Townhouse Dwelling)	2 spaces per unit	2 spaces per unit
Minimum Parking (Apartment Dwelling)	0.91 spaces per unit	0.91 spaces per unit
Minimum Parking Space Size	2.75 m Min. width - 15.6 m ² Min. area	2.75 m width - 15.67 m ² area
Barrier Free Parking Space Size	3.2 m Min. width - 18.2 m ² Min. area	3.2 m width - 19.2 m ² area
Minimum Width of Drive Aisles	6.0 m	6.0 m

BEARINGS AND PROPERTY LINES FROM REGISTERED PLAN BY STUART M. MOORE, ONTARIO LAND SURVEYOR, DATED SEPTEMBER 22, 2025



GENERAL NOTES

ALL EXISTING UNDERGROUND PLANT (HYDRO, TELEPHONE, GAS MAINS, WATERMAINS, SEWERS) WHICH WILL BE CROSSED UNDER DURING THE INSTALLATION OF THE SERVICES SHALL BE SUPPORTED BY A SUPPORT BEAM OR BY OTHER METHODS, AS MAY BE REQUIRED BY THE OWNERS OF THE PLANT BEING CROSSED UNDER.

PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION, ALL SEWER OUTLET INFORMATION, BENCHMARKS, ELEVATIONS, AND DIMENSIONS MUST BE CHECKED AND VERIFIED, AND ANY DISCREPANCIES REPORTED TO THE ENGINEER.

PRIOR TO COMMENCING ANY WORK ON THE INSTALLATION OF SERVICES, AN APPROVED SET TO PLANS MUST BE AVAILABLE ON THE SITE, AND REMAIN THERE WHILE WORK IS BEING DONE.

PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL EXISTING UNDERGROUND UTILITIES THAT WILL BE AFFECTED BY CONSTRUCTION SHALL BE LOCATED AND MARKED. ANY UTILITIES DAMAGED OR DISTURBED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE GOVERNING BODY AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR IS TO MEET ALL THE REQUIREMENTS OF THE OWNERS OF THE UTILITIES ON THIS PLAN AND MUST MAKE SATISFACTORY ARRANGEMENTS WITH THE UTILITY COMPANIES FOR CROSSING THEIR INSTALLATIONS AND FOR PROVIDING ADEQUATE PROTECTION DURING CONSTRUCTION.

THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS UNDER THE OCCUPATIONAL HEALTH AND SAFETY ACT WHILE WORKING IN THE VICINITY OF OVERHEAD POWER LINES.

NOTES:

1. ALL SERVICES ARE TO BE MAINTAINED DURING CONSTRUCTION WITH MINIMAL INTERRUPTION.
2. ALL LANDSCAPED AREAS DISTURBED DURING CONSTRUCTION TO BE RESTORED WITH 100mm TOPSOIL, SEED AND MULCH.
3. ALL UNDERGROUND PIPE JOINTS, FITTINGS AND COUPLINGS SHALL BE RESTRAINED IN ACCORDANCE WITH THE PIPE MANUFACTURER'S REQUIREMENTS.

BENCHMARK

LOCATED AT THE HWY. 401 OVERPASS FOR QUEEN ST., 1.1km NORTH OF POST OFFICE, TABLET IN WEST FACE OF EAST ABUTMENT AT STREET LEVEL (48cm NORTH OF SOUTH END AND 18cm ABOVE SIDEWALK) HAVING A GEODETIC ELEVATION OF 177.335 METRES. SITE BENCHMARK LOCATED ON TOP OF OPERATING NUT OF FIRE HYDRANT IN FRONT OF THE PUMPING STATION PROPERTY HAVING A ELEVATION OF 177.651 METRES.

ALL FILL MATERIAL PLACED WITHIN THE RIGHT-OF-WAY SHALL BE PLACED IN ACCORDANCE WITH OPSS 206. IN AREAS TO BE FILLED, THE SUBGRADE SHALL BE PROCTORROLLED TO OBTAIN 98% STANDARD PROCTOR DENSITY. ONLY ACCEPTABLE EARTHEN OR GRANULAR MATERIALS SHALL BE USED WITH THE ROAD ALLOWANCES.

EXISTING TOPOGRAPHICAL INFORMATION WAS OBTAINED IN THE FIELD BY B. ROGER PICKARD SURVEYING LTD.

TYPE II BEDDING SHALL BE IN ACCORDANCE WITH OPSD 802.010 FOR FLEXIBLE SEWER PIPES. THE TYPE II BEDDING MATERIAL SHALL CONSIST OF APPROVED OPSS FORM 1010 GRANULAR 'M' MATERIAL OR GRANULAR 'A' MATERIAL HAVING A MAXIMUM AGGREGATE SIZE OF 20MM. THE COVER MATERIAL SHALL CONSIST OF A TYPE II GRANULAR 'B' HAVING A MAXIMUM AGGREGATE SIZE OF 20MM.

CLASS 'B' BEDDING SHALL BE IN ACCORDANCE WITH OPSD 802.03 FOR RIGID SEWER PIPE.

ALL BEDDING MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 98% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).

BACKFILL SHALL BE SELECT NATIVE EXCAVATED MATERIAL PLACED IN THIN LAYERS COMPACTED TO AT LEAST 98% STANDARD PROCTOR MAXIMUM DRY DENSITY

ALL EXISTING BOULEVARDS AND ROAD SURFACES DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO A CONDITION AT LEAST AS GOOD AS ORIGINAL, ALL TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.

BENCHMARKS

BM#1 SPIKE IN UTILITY POLE, EL. = 77.33
BM#2 TOP OF EX. MH, EL. = 79.99
BM#3 SPIKE IN UTILITY POLE, EL. = 87.30
BM#4 SPIKE IN UTILITY POLE, EL. = 116.85
BM#5 TOP OF SSIB, EL. = 114.88
BM#6 TOP OF EX. MH, EL. = 105.50
BM#7 TOP OF EX. MH, EL. = 111.56

LEGEND

- BM BENCHMARK
- SILT FENCE
- BH 000 BOREHOLE
- TP 00 TEST PIT
- EXISTING FENCE
- NEW FENCE

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FILE PATH: G:\CAD\091910\As Builts\R100 - R601 4/4/2012 11:59 AM

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ENGINEER'S STAMP

Maple Reinders

ENGINEER'S STAMP

DILLON CONSULTING

THE COUNTY of Peterborough

a beautiful island adventure

12	RECORD DRAWINGS	APRIL 2012	LT
12	ISSUED FOR CONSTRUCTION	03/18/10	LT
11	90% REVIEW REVISIONS	03/19/10	LT
10	100% SUBMISSION FOR MCE, ESA AND PEC (BUILDING DEPT) APPROVAL	11/13/09	LT
9	90% COMPLETE DESIGN FOR OWNER REVIEW	10/19/09	LT
8	90% COMPLETE DESIGN FOR MAPLE REVIEW	10/05/09	LT
7	ISSUED FOR BUILDING PERMIT (SECOND SUBMISSION)	09/11/09	LT
6	ISSUED FOR FOUNDATION CONSTRUCTION	08/26/09	LT
5	60% COMPLETE DESIGN FOR OWNER REVIEW	07/29/09	LT
4	ISSUED FOR BUILDING PERMIT (FOUNDATION ONLY)	07/27/09	LT
3	CONSERVATION AUTHORITY AND SITE PLAN APPROVAL	07/15/09	LT
2	ISSUED FOR CERTIFICATE OF APPROVAL APPLICATION (SEWAGE)	06/18/09	LT
1	REVISED VALUE ENGINEERING DESIGN	06/09/09	LT
0	REVISED VALUE ENGINEERING DESIGN	06/02/09	LT

DESIGN	REVIEWED BY
LTU	TM
DRAWN	APPROVED
SJH	LT
DATE	MARCH 2010
SCALE	1:750

PICTON

WASTEWATER TREATMENT PLANT REPLACEMENT

SITEWORKS

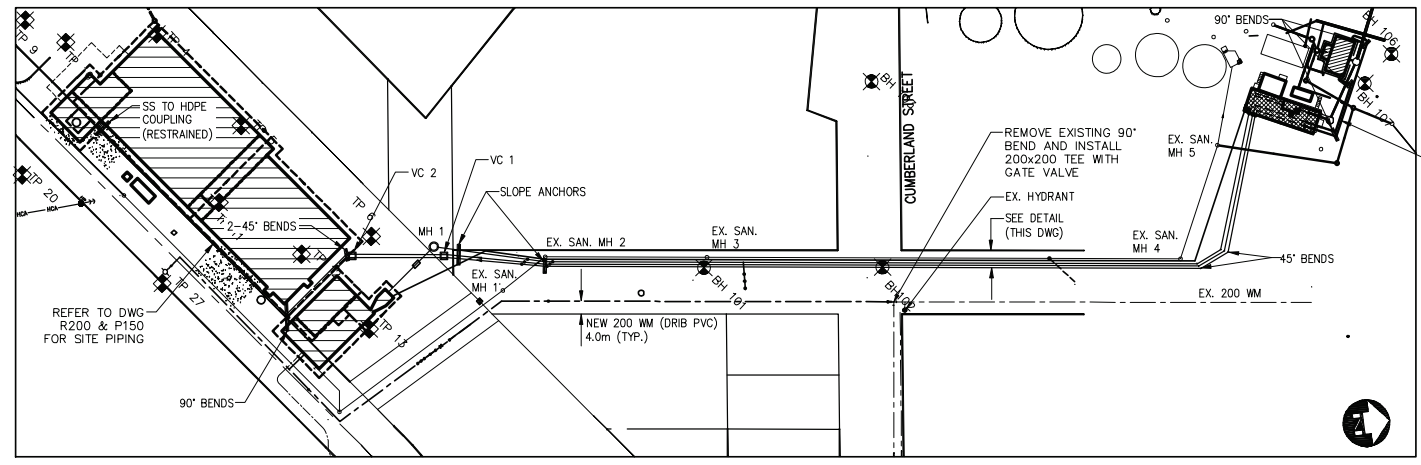
PIPE ROUTING PLAN

PROJECT NO. **09-1910**

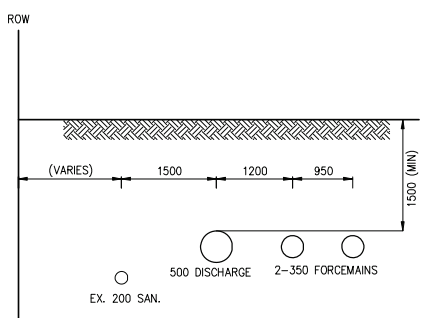
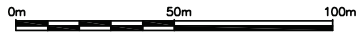
SHEET NO. **R100**

150mm ON ORIGINAL SHEET SIZE

FILE PATH: G:\CAD\091910\As Builts\R100 - R601 4/4/2012 11:59 AM

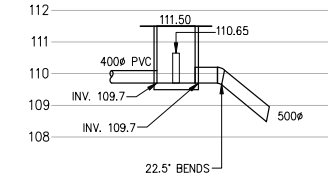


PLAN
SCALE: 1:1000

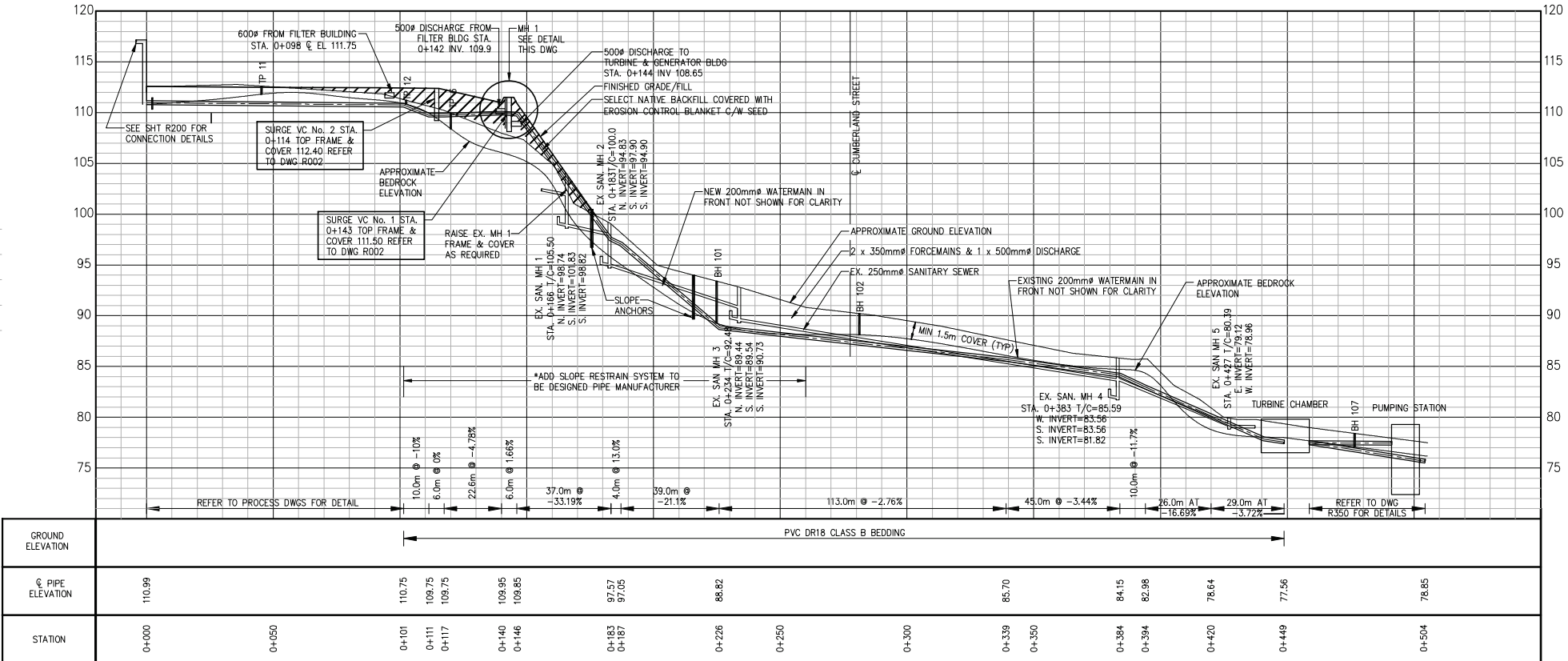


DETAIL
SCALE: NTS

NOTE: REFER TO DWG. R100 FOR ADDITIONAL NOTES



MH 1 DETAIL
SCALE: H=1:50 V=1:100



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ENGINEER'S STAMP

ENGINEER'S STAMP



7	RECORD DRAWINGS	APRIL 2012	LT	DESIGN	TM	REVIEWED BY	TM
6	ISSUED FOR CONSTRUCTION	03/10/10	LT	DESIGN	TM	APPROVED	
5	50% REVIEW REVISIONS	03/10/10	LT	DESIGN	SJH	APPROVED	
4	100% SUBMISSION FOR MCE, LSA AND PEC (BUILDING DEPT) APPROVAL	11/13/09	LT	DATE			
3	90% COMPLETE DESIGN FOR OWNER REVIEW	10/19/09	LT	DATE			
2	90% COMPLETE DESIGN FOR MAPLE REVIEW	10/19/09	LT	DATE			
1	ISSUED FOR FOUNDATION CONSTRUCTION	08/26/09	LT	SCALE			
0	90% COMPLETE DESIGN FOR OWNER REVIEW	07/29/09	LT	SCALE			
NO.	REVISION FOR	DATE	BY				

PROJECT NO.		09-1910
SHEET NO.		R150
WASTEWATER TREATMENT PLANT REPLACEMENT		
SITWORKS		
FORCEMAIN PLAN AND PROFILE		

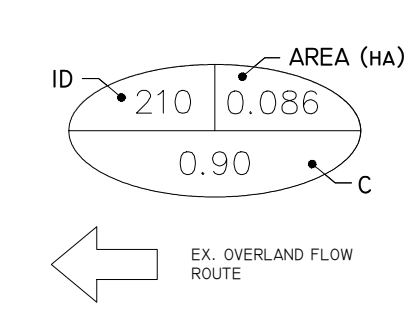
Appendix B

Storm Data



LOCATION PLAN
N.T.S.

LEGEND

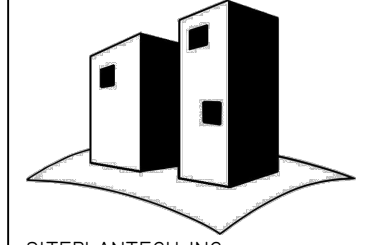


TOWN OF PICTON
PRINCE EDWARD COUNTY

CITY FILE NO.:	REGION FILE NO.:
--	--

SURVEY INFO.	BENCHMARK
KRCHMAR SURVEYORS LTD. 137 CENTRE STREET THORNHILL, ON PHONE: (905) 738-0055 FAX: (905) 738-9221	ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE RELATED TO THE TOWN OF PICTON BENCH MARK 67JUS9, HAVING A PUBLISHED ELEVATION OF 76.435 METRES.

SITE PLAN INFO.
HSPH HOLDINGS INC. 50 ST. CLEMENTS AVE. TORONTO, ON M4B 1G9 PHONE: (416) 270-7515
NO. ISSUE
7 RE-ISSUED FOR SPA 08/10/26 LPH
6 RE-ISSUED FOR SPA 05/13/26 LPH
5 REVISED BLDG B-D FFE AND SAN INVERT 02/11/26 LPH
4 ISSUED FOR SPA 12/11/25 LPH
3 REVISED SAN & WH SERVICES 24/01/25 LPH
2 ISSUED FOR RZA & SPA 10/08/24 LPH
1 ISSUED FOR RZA & SPA 04/17/24 LPH
NO. ISSUE MH/05/11 BY

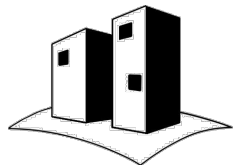
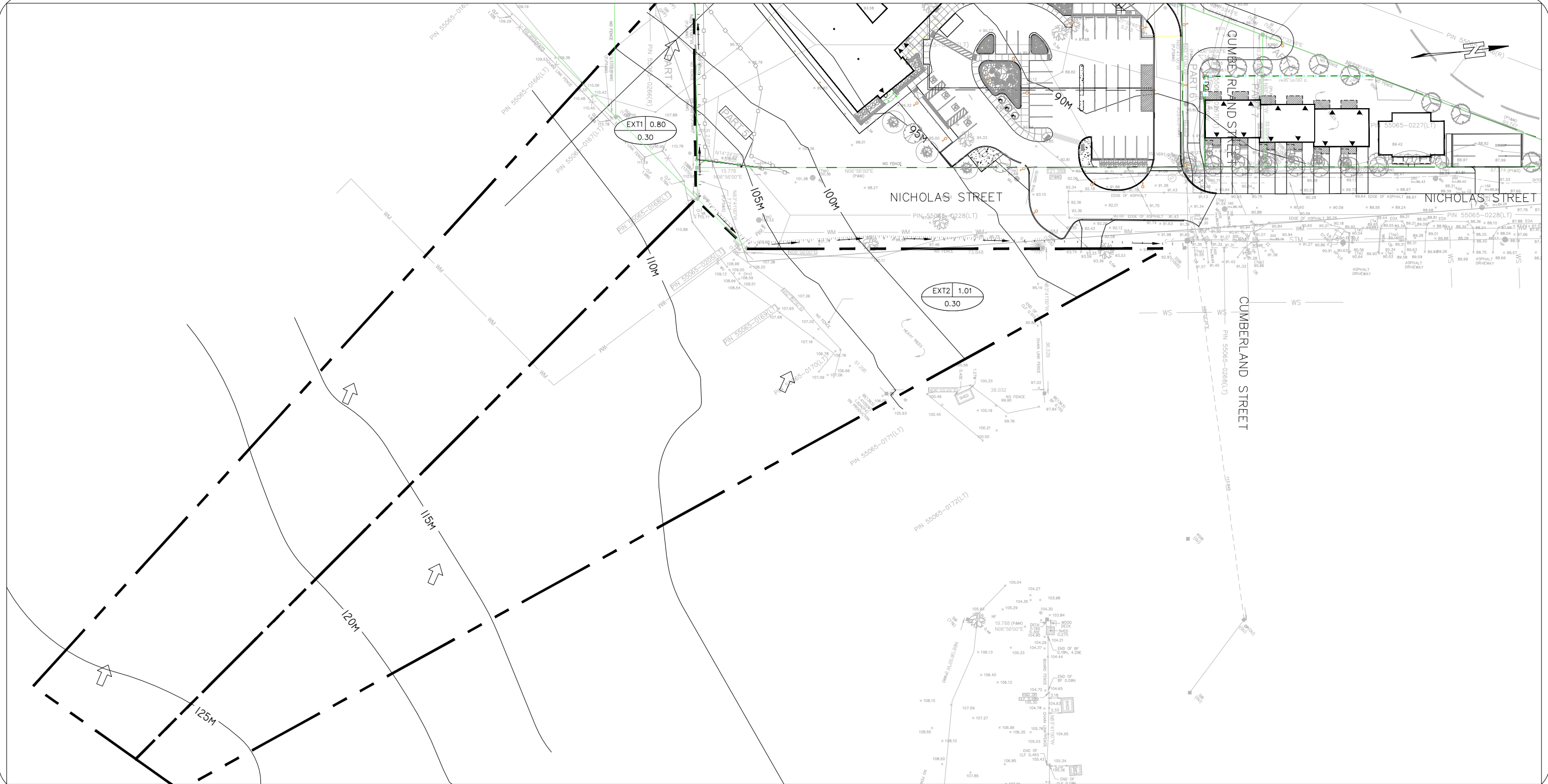


SITEPLANTECH INC.
50 ST. CLEMENTS AVE.
TORONTO, ON M4B 1G9
PHONE: (416) 270-7515

HOMES FIRST NICHOLAS CORP
NICHOLAS APARTMENT BUILDING
NICHOLAS STREET

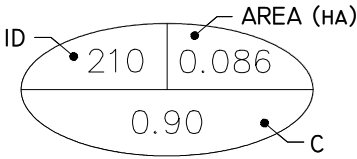
PRE-DEVELOPMENT DRAINAGE AREA PLAN

PROJECT NO.	23-026
DRAWING:	201



SITEPLANTECH INC.
50 ST. CLEMENTS AVE.
TORONTO, ON
M4R 1G9

HOMES FIRST NICHOLAS CORP
NICHOLAS APARTMENT BUILDING
NICHOLAS STREET



OVERLAND FLOW
ROUTE

DRAINAGE
BOUNDARY

EXTERNAL DRAINAGE AREA PLAN

FIGURE: EXT	PROJECT No.: 23-026
SCALE = 1:1000	OCTOBER 2024

FLOW DEPTH CALCULATION

-

EXT-1 DRAINAGE SWALE

CHANNEL CAPACITY CALCULATIONS

Flow Depth	0.17 m	Top width	1.3 m
Side Slope Ratio	3.0 /1		
Bottom width	0.30 m		
Area (A)	0.14 m ²	Hydraulic Radius (R)	0.100 m
Wetted Perimeter (Wp)	1.38 m	Friction Slope (S _f)	0.098 m/m
Slope (S)	9.80 %		
Manning (n)*	0.04		
Channel capacity (Q)	0.232 m ³ /s 232.4 L/s	Velocity (V)	1.7 m/s

Where: $Q = \frac{A * R^{2/3} * S^{1/2}}{n}$



FLOW DEPTH CALCULATION

-

EXT-2 DRAINAGE SWALE

CHANNEL CAPACITY CALCULATIONS

Flow Depth	0.17 m	Top width	0.8 m
Side Slope Ratio	3.0 /1		
Bottom width	0.30 m		
Area (A)	0.14 m ²	Hydraulic Radius (R)	0.100 m
Wetted Perimeter (Wp)	1.38 m	Friction Slope (S _f)	0.039 m/m
Slope (S)	3.90 %		
Manning (n)*	0.04		
Channel capacity (Q)	0.147 m ³ /s 146.6 L/s	Velocity (V)	1.1 m/s

Where: $Q = \frac{A * R^{2/3} * S^{1/2}}{n}$



EXTERNAL RUN-OFF CALCULATIONS

-

EXT-1

IDF set: Picton

Return Period	<i>a</i>	<i>T_c</i> *	<i>b</i>	<i>c</i>
2-Year	21.2	18.0	0.00	0.699
5-Year	28.2	18.0	0.00	0.699
100-Year	47.0	18.0	0.00	0.699

Where:
$$I = \frac{a}{(t_c + b)^c}$$

* Refer to Ext. *I_c* calculations

External Runoff Volume

Return Period	Area (Ha)	Composite C	<i>I</i> (mm/hr)*	<i>Q</i> (L/s)
2-Year	0.80	0.30	49.18	32.7
5-Year	0.80	0.30	65.42	43.6
100-Year	0.80	0.38	109.04	90.8

Where:
$$Q = \frac{CIA}{360}$$



**EXTERNAL RUN-OFF
CALCULATIONS**

-

EXT-2

IDF set: Picton

Return Period	<i>a</i>	<i>T_c</i> *	<i>b</i>	<i>c</i>
2-Year	21.2	19.7	0.00	0.699
5-Year	28.2	19.7	0.00	0.699
100-Year	47.0	19.7	0.00	0.699

Where:
$$I = \frac{a}{(t_c + b)^c}$$

* Refer to Ext. *I_c* calculations

External Runoff Volume

Return Period	Area (Ha)	Composite C	<i>I</i> (mm/hr)*	<i>Q</i> (L/s)
2-Year	1.01	0.30	46.18	38.9
5-Year	1.01	0.30	61.42	51.7
100-Year	1.01	0.38	102.37	107.7

Where:
$$Q = \frac{CIA}{360}$$



**INITIAL T_c CALCULATIONS
(AIRPORT METHOD)**

Drainage ID	EXT-1
k	3.26
Length (L)	244
Runnoff coefficient (C)	0.3
Upstream elevation (m)	125.0
downstream elevation (m)	96.0
Elevation change (m)	29.0
Slope (S)	11.9%
T _c (min.)	18.0

Drainage ID	EXT-2
k	3.26
Length (L)	280
Runnoff coefficient (C)	0.3
Upstream elevation (m)	125.0
downstream elevation (m)	94.0
Elevation change (m)	31.0
Slope (S)	11.1%
T _c (min.)	19.7

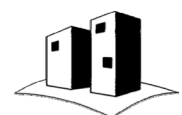
Where: $t_c = \frac{k(1.1 - C)L^{0.5}}{S^{0.33}}$



ROAD SIDE DITCH CAPACITY AND FLOW DEPTH CALCULATION

ROAD-SIDE DITCH CAPACITY CALCULATIONS			
Flow Depth	0.27 m	Top width	1.9 m
Side Slope Ratio	3.0 /1		
Bottom width	0.30 m		
Area (A)	0.30 m ²	Hydraulic Radius (R)	0.149 m
Wetted Perimeter (Wp)	2.01 m	Friction Slope (S _f)	0.037 m/m
Slope (S)	3.68 %		
Manning (n)*	0.025		
Channel capacity (Q)	0.647 m ³ /s	Velocity (V)	2.2 m/s

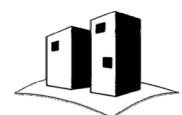
Where: $Q = \frac{A * R^{2/3} * S^{1/2}}{n}$



**INITIAL T_c CALCULATIONS
(AIRPORT METHOD)**

Drainage ID	101
k	3.26
Length (L)	109
Runnoff coefficient (C)	0.3
Upstream elevation (m)	108.2
downstream elevation (m)	85.3
Elevation change (m)	22.9
Slope (S)	21.0%
Tc (min.)	10.0

Where:
$$t_c = \frac{k(1.1 - C)L^{0.5}}{S^{0.33}}$$



Calculating Capacity and Velocity

					n=0.024 g=9.81 % Increment 0.02					
	6 in 152.4 150mm		8 in 203.2 200mm		10 in 254 250mm		12 in 304.8 300mm		15 in 381 375mm	
Slope (%)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)
3.18	0.0153	0.8413	0.0331	1.0192	0.0599	1.1826	0.0974	1.3355	0.1767	1.5497
3.20	0.0154	0.8439	0.0332	1.0224	0.0601	1.1864	0.0978	1.3397	0.1772	1.5546
3.22	0.0154	0.8466	0.0333	1.0256	0.0603	1.1901	0.0981	1.3439	0.1778	1.5594
3.24	0.0155	0.8492	0.0334	1.0287	0.0605	1.1937	0.0984	1.3480	0.1783	1.5642
3.26	0.0155	0.8518	0.0335	1.0319	0.0607	1.1974	0.0987	1.3522	0.1789	1.5691
3.28	0.0156	0.8544	0.0336	1.0351	0.0609	1.2011	0.0990	1.3563	0.1794	1.5739
3.30	0.0156	0.8570	0.0337	1.0382	0.0610	1.2047	0.0993	1.3604	0.1800	1.5787
3.32	0.0157	0.8596	0.0338	1.0414	0.0612	1.2084	0.0996	1.3646	0.1805	1.5834
3.34	0.0157	0.8622	0.0339	1.0445	0.0614	1.2120	0.0999	1.3687	0.1811	1.5882
3.36	0.0158	0.8648	0.0340	1.0476	0.0616	1.2156	0.1002	1.3728	0.1816	1.5929
3.38	0.0158	0.8674	0.0341	1.0507	0.0618	1.2193	0.1005	1.3768	0.1822	1.5977
3.40	0.0159	0.8699	0.0342	1.0538	0.0620	1.2229	0.1008	1.3809	0.1827	1.6024
3.42	0.0159	0.8725	0.0343	1.0569	0.0621	1.2265	0.1011	1.3850	0.1832	1.6071
3.44	0.0160	0.8750	0.0344	1.0600	0.0623	1.2300	0.1014	1.3890	0.1838	1.6118
3.46	0.0160	0.8776	0.0345	1.0631	0.0625	1.2336	0.1016	1.3930	0.1843	1.6165
3.48	0.0161	0.8801	0.0346	1.0662	0.0627	1.2372	0.1019	1.3971	0.1848	1.6211
3.50	0.0161	0.8826	0.0347	1.0692	0.0629	1.2407	0.1022	1.4011	0.1854	1.6258
3.52	0.0161	0.8851	0.0348	1.0723	0.0630	1.2443	0.1025	1.4051	0.1859	1.6304
3.54	0.0162	0.8876	0.0349	1.0753	0.0632	1.2478	0.1028	1.4091	0.1864	1.6351
3.56	0.0162	0.8902	0.0350	1.0783	0.0634	1.2513	0.1031	1.4130	0.1869	1.6397
3.58	0.0163	0.8926	0.0351	1.0814	0.0636	1.2548	0.1034	1.4170	0.1875	1.6443
3.60	0.0163	0.8951	0.0352	1.0844	0.0638	1.2583	0.1037	1.4209	0.1880	1.6489
3.62	0.0164	0.8976	0.0353	1.0874	0.0639	1.2618	0.1040	1.4249	0.1885	1.6534
3.64	0.0164	0.9001	0.0354	1.0904	0.0641	1.2653	0.1043	1.4288	0.1890	1.6580
3.66	0.0165	0.9026	0.0355	1.0934	0.0643	1.2688	0.1045	1.4327	0.1895	1.6625
3.68	0.0165	0.9050	0.0356	1.0964	0.0645	1.2722	0.1048	1.4366	0.1901	1.6671
3.70	0.0166	0.9075	0.0357	1.0993	0.0646	1.2757	0.1051	1.4405	0.1906	1.6716
3.72	0.0166	0.9099	0.0357	1.1023	0.0648	1.2791	0.1054	1.4444	0.1911	1.6761
3.74	0.0166	0.9124	0.0358	1.1053	0.0650	1.2825	0.1057	1.4483	0.1916	1.6806
3.76	0.0167	0.9148	0.0359	1.1082	0.0652	1.2860	0.1060	1.4522	0.1921	1.6851
3.78	0.0167	0.9172	0.0360	1.1112	0.0653	1.2894	0.1062	1.4560	0.1926	1.6896

Corrugated Steel Pipe—Manning's "n" Value

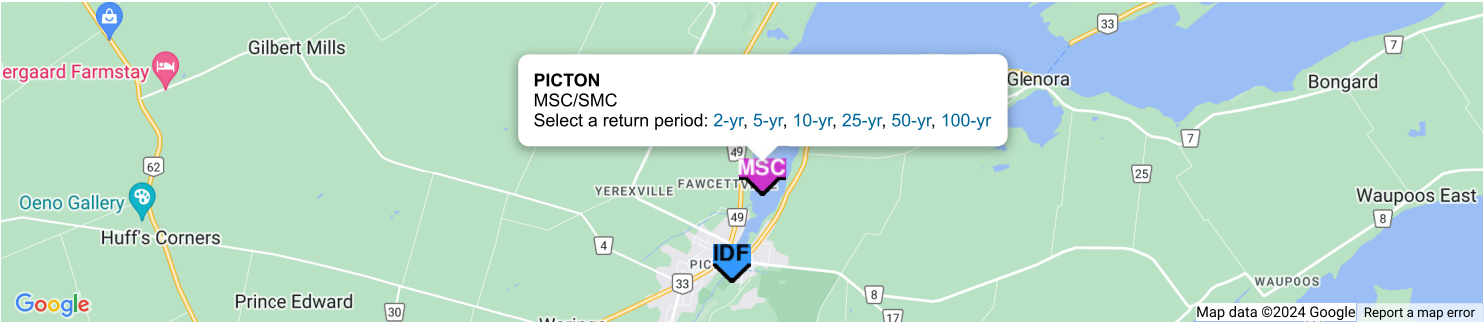
All Diameters				Helical * Corrugation							
		1-1/2" x 1/4"		Helical—2-2/3" x 1/2" 60 in.							
2-2/3" x 1/2"	Annular	8 in.	10 in.	12 in.	15 in.	18 in.	24 in.	36 in.	48 in.	and Larger	
Unpaved	0.024	0.012	0.014	0.011	0.012	0.013	0.015	0.018	0.020	0.021	
PAVED-INVERT	0.021						0.014	0.017	0.020	0.019	
SMOOTH-FLO	0.012						0.012	0.012	0.012	0.012	
HEL-COR CL	0.012						0.012	0.012	0.012	0.012	
SmoothCor	N/A						0.012	0.012	0.012	0.012	
				Helical *—3" x 1"							
3" x 1"	Annular			36 in.	42 in.	48 in.	54 in.	60 in.	66 in.	72 in.	78 in. and Larger
Unpaved	0.027			0.022	0.022	0.023	0.023	0.024	0.025	0.026	0.027
PAVED-INVERT	0.023			0.019	0.019	0.020	0.020	0.021	0.022	0.022	0.023
SMOOTH-FLO	0.012					0.012	0.012	0.012	0.012	0.012	0.012
HEL-COR CL	0.012					0.012	0.012	0.012	0.012	0.012	0.012
SmoothCor	N/A					0.012	0.012	0.012	0.012	0.012	0.012
				Helical *—5" x 1"							
5" x 1"						48 in.	54 in.	60 in.	66 in.	72 in.	78 in. and Larger
Unpaved	0.025					0.022	0.022	0.023	0.024	0.024	0.025
PAVED-INVERT	0.022					0.019	0.019	0.020	0.021	0.021	0.022
SMOOTH-FLO	0.012							0.012	0.012	0.012	0.012
HEL-COR CL	0.012							0.012	0.012	0.012	0.012
ULTRA-FLO		3/4" x 3/4" x 7-1/2" All diameters n = 0.012									

*Tests on helically corrugated pipe demonstrate a lower coefficient of roughness than for annually corrugated steel pipe. Pipe-arches approximately have the same roughness characteristics as their equivalent round pipes.

Active coordinate

44° 0' 15" N, 77° 8' 15" W (44.004167,-77.137500)

Retrieved: Wed, 20 Mar 2024 15:54:12 GMT



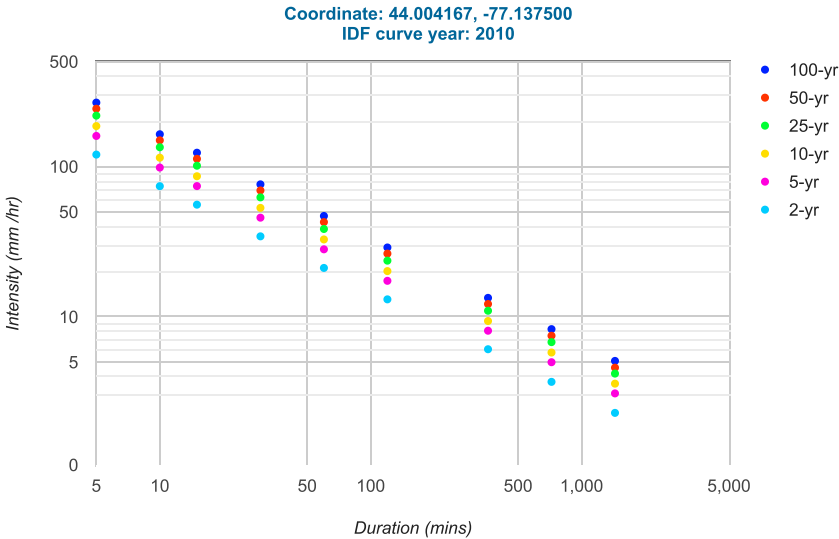
Location summary

These are the locations in the selection.

IDF Curve: 44° 0' 15" N, 77° 8' 15" W (44.004167,-77.137500)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 44° 0' 15" N, 77° 8' 15" W (44.004167,-77.137500)

Retrieved: Wed, 20 Mar 2024 15:54:12 GMT

Data year: 2010

IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	21.2	28.2	32.8	38.5	42.8	47.0
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr⁻¹)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	120.4	74.2	55.9	34.4	21.2	13.1	6.1	3.7	2.3
5-yr	160.2	98.7	74.3	45.8	28.2	17.4	8.1	5.0	3.1
10-yr	186.3	114.8	86.4	53.2	32.8	20.2	9.4	5.8	3.6
25-yr	218.7	134.7	101.5	62.5	38.5	23.7	11.0	6.8	4.2
50-yr	243.1	149.8	112.8	69.5	42.8	26.4	12.2	7.5	4.6
100-yr	267.0	164.4	123.9	76.3	47.0	29.0	13.4	8.3	5.1

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.0	12.4	14.0	17.2	21.2	26.1	36.4	44.8	55.2
5-yr	13.3	16.4	18.6	22.9	28.2	34.7	48.4	59.6	73.4
10-yr	15.5	19.1	21.6	26.6	32.8	40.4	56.2	69.3	85.4
25-yr	18.2	22.5	25.4	31.3	38.5	47.4	66.0	81.3	100.2
50-yr	20.3	25.0	28.2	34.7	42.8	52.7	73.4	90.4	111.4
100-yr	22.2	27.4	31.0	38.1	47.0	57.9	80.6	99.3	122.3

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Coordinate Selection

Current selection:

1

Submit

[Show Instructions](#) | [Show/hide gauging stations](#) | [Re-center selection](#) | [Upload a basin outline](#)

Latitude:

44.00390334464

 Longitude:

-77.13789781825

 Return period:

all

▼

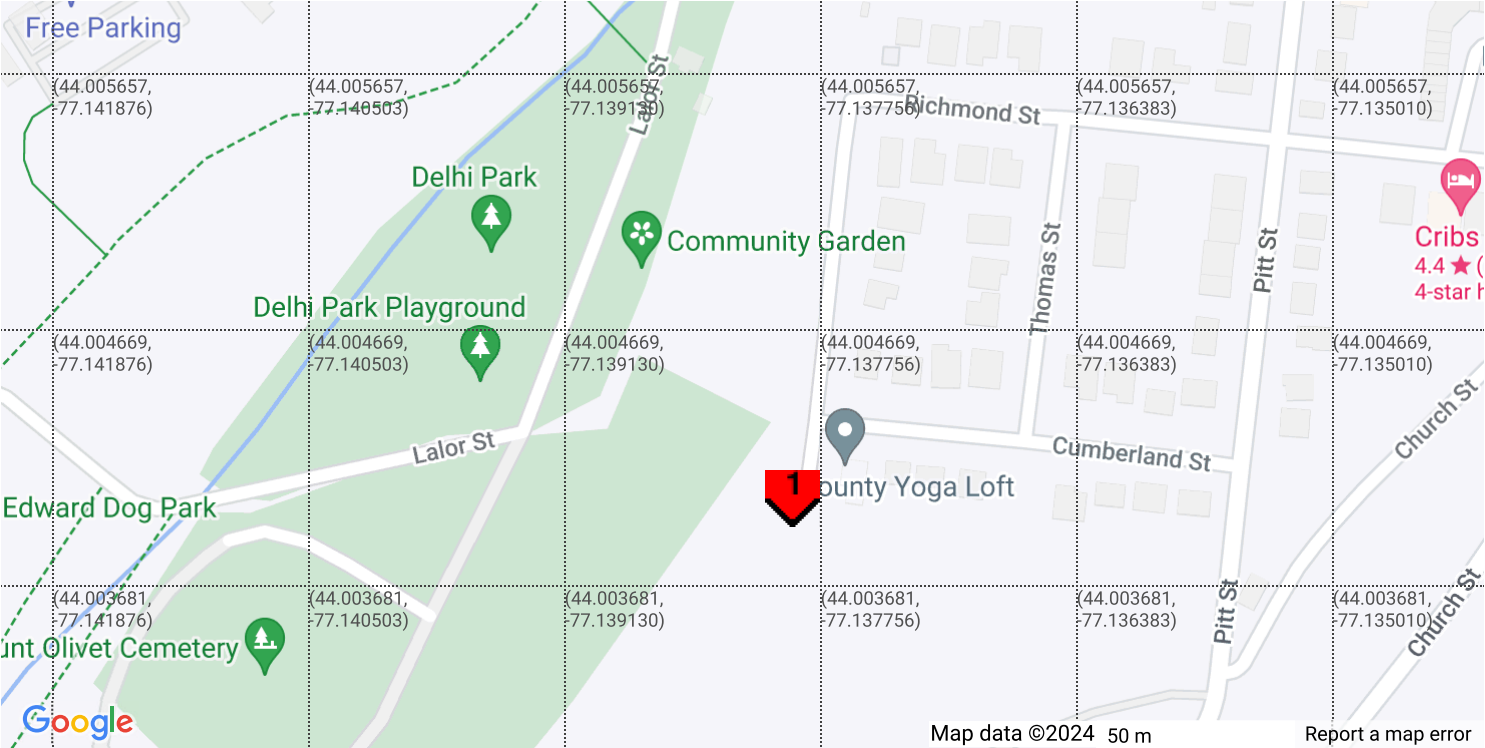
 -yr

IDF curve year:

2010

 (2010 is the reference year for present day IDF curves)

[Hide Options](#)



**PRE-DEVELOPMENT
RUNOFF COEFFICIENT**

Drainage Area 101 (To Delhi Park)

Surface Type	C	A (Ha)	A*C
Grass	0.30	1.612	0.483
Composite C		1.612	0.300

Drainage Area 102 (To Nicholas)

Surface Type	C	A (Ha)	A*C
Asphalt	0.90	0.019	0.017
Composite C		0.019	0.900

Summary

Drainage Area	C	A (Ha)	A*C
101 (To Delhi Park)	0.30	1.612	0.483
102 (To Nicholas)	0.90	0.019	0.017
TOTAL		1.631	0.307



ALLOWABLE RELEASE RATE CALCULATION

IDF set: Picton

Return Period	<i>a</i>	<i>T_c</i>	<i>b</i>	<i>c</i>
2-year	21.200	10	0.000	0.699
5-year	28.200	10	0.000	0.699
10-year	32.800	10	0.000	0.699
25-year	38.500	10	0.000	0.699
50-year	42.800	10	0.000	0.699
100-year	47.000	10	0.000	0.699

Where:
$$I = \frac{a}{(t_c + b)^c}$$

Pre-Development ID 101 Runoff Volume

Return Period	Area (Ha)	Composite C	I (mm/hr)*	Q (L/s)
2-year	1.612	0.300	74.18	99.6
5-year	1.612	0.300	98.67	132.5
10-year	1.612	0.300	114.76	154.1
25-year	1.612	0.300	134.71	180.9
50-year	1.612	0.300	149.75	201.1
100-year	1.612	0.300	164.45	220.8

Pre-Development ID 102 Runoff Volume

Return Period	Area (Ha)	Composite C	I (mm/hr)*	Q (L/s)
2-year	0.019	0.900	74.18	3.5
5-year	0.019	0.900	98.67	4.7
10-year	0.019	0.900	114.76	5.5
25-year	0.019	0.900	134.71	6.4
50-year	0.019	0.900	149.75	7.1
100-year	0.019	0.900	164.45	7.8

Allowable Release Rate Calculation

Drainage Area	Area (Ha)	Composite C	I (mm/hr)*	Q (L/s)
2-year	1.631	0.307	74.18	103.1
5-year	1.631	0.307	98.67	137.2
10-year	1.631	0.307	114.76	467.8
25-year	1.631	0.307	134.71	187.3
50-year	1.631	0.307	149.75	208.2
100-year	1.631	0.307	164.45	228.7

Where:
$$Q = \frac{CIA}{360}$$



**POST-DEVELOPMENT
RUNOFF COEFFICIENT**

Drainage Area 210

Surface Type	C	A (Ha)	A*C
Roof	0.900	0.210	0.189
Asphalt/Hardscape	0.900	0.283	0.255
Grass	0.300	0.336	0.101
Composite C		0.829	0.657

Drainage Area 211

Surface Type	C	A (Ha)	A*C
Asphalt	0.900	0.152	0.137
Permeable Pavement	0.55	0.000	0.000
Grass	0.30	0.086	0.026
Composite C		0.238	0.683

Drainage Area 220

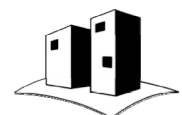
Surface Type	C	A (Ha)	A*C
Roof	0.900	0.051	0.046
Grass	0.300	0.432	0.130
Composite C		0.483	0.363

Drainage Area 221

Surface Type	C	A (Ha)	A*C
Asphalt	0.900	0.038	0.03
Grass	0.300	0.044	0.013
Composite C		0.082	0.577

Summary

Drainage Area	C	A (Ha)	A*C
210	0.657	0.829	0.544
211	0.683	0.238	0.163
220	0.363	0.483	0.175
221	0.577	0.082	0.047
TOTAL		1.632	0.570



**STORMWATER MANAGEMENT
QUANTITY CONTROL SUMMARY**

2-year Summary Matrix

Drainage Area	210	211	220	221	Total
Bldg ID					
C₂	0.657	0.683	0.363	0.577	-
A (Ha)	0.829	0.238	0.483	0.082	1.63
Q_{Release} (L/s)	14.0	16.1	36.1	9.8	76.0
Storage (m³)	68.8	10.5	0.0	0.0	79.3
Vol. Avail. (m³)	294.0	32.1	-	-	326.1
Orifice	100	125	Uncontrolled	Uncontrolled	-
Q_{Orifice} (L/s)	14.0	16.1	-	-	-
Unctrl'd Q (L/s)	-	-	36.1	9.8	-
Orifice type	PLATE	PLATE	-	-	-

5-year Summary Matrix

Drainage Area	210	211	220	221	Total
Bldg ID					
C₅	0.657	0.683	0.363	0.577	-
A (Ha)	0.829	0.238	0.483	0.082	1.63
Q_{Release} (L/s)	16.8	19.0	48.1	13.0	96.9
Storage (m³)	95.5	15.4	0.0	0.0	110.9
Vol. Avail. (m³)	294.0	32.1	-	-	326.1
Orifice	100	125	Uncontrolled	Uncontrolled	-
Q_{Orifice} (L/s)	16.8	19.0	-	-	-
Unctrl'd Q (L/s)	-	-	48.1	13.0	-
Orifice type	PLATE	PLATE	-	-	-

10-Year Summary Matrix

Drainage Area	210	211	220	221	Total
Bldg ID					
C₁₀	0.657	0.683	0.363	0.577	-
A (Ha)	0.829	0.238	0.483	0.082	1.63
Q_{Release} (L/s)	18.4	21.0	55.9	15.2	110.4
Storage (m³)	114.0	18.5	0.0	0.0	132.6
Vol. Avail. (m³)	294.0	32.1	-	-	326.1
Orifice	100	125	Uncontrolled	Uncontrolled	-
Q_{Orifice} (L/s)	18.4	21.0	-	-	-
Unctrl'd Q (L/s)	-	-	55.9	15.2	-
Orifice type	PLATE	PLATE	-	-	-



**STORMWATER MANAGEMENT
QUANTITY CONTROL SUMMARY**

25-Year Summary Matrix

Drainage Area	210	211	220	221	Total
Bldg ID					
C₂₅	0.722	0.752	0.399	0.635	-
A (Ha)	0.829	0.238	0.483	0.082	1.63
Q_{Release} (L/s)	21.7	24.2	72.2	19.6	137.7
Storage (m³)	153.3	25.6	0.0	0.0	178.9
Vol. Avail. (m³)	294.0	32.1	-	-	326.1
Orifice	100	125	Uncontrolled	Uncontrolled	-
Q_{Orifice} (L/s)	21.7	24.2	-	-	-
Unctrl'd Q (L/s)	-	-	72.2	19.6	-
Orifice type	PLATE	PLATE	-	-	-

50-Year Summary

Drainage Area	210	211	220	221	Total
Bldg ID					
C₅₀	0.788	1.000	0.436	0.692	-
A (Ha)	0.829	0.238	0.483	0.082	1.63
Q_{Release} (L/s)	24.3	31.4	87.5	23.7	166.9
Storage (m³)	192.3	40.6	0.0	0.0	232.9
Vol. Avail. (m³)	294.0	32.1	-	-	326.1
Orifice	100	125	Uncontrolled	Uncontrolled	-
Q_{Orifice} (L/s)	24.3	31.4	-	-	-
Unctrl'd Q (L/s)	-	-	87.5	23.7	-
Orifice type	PLATE	PLATE	-	-	-

100-Year Summary

Drainage Area	210	211	220	221	Total
Bldg ID					
C₁₀₀	0.821	1.000	0.454	0.721	-
A (Ha)	0.829	0.238	0.483	0.082	1.63
Q_{Release} (L/s)	26.4	33.5	100.1	27.1	187.1
Storage (m³)	224.8	45.2	0.0	0.0	270.0
Vol. Avail. (m³)	294.0	32.1	-	-	326.1
Orifice	100	125	Uncontrolled	Uncontrolled	-
Q_{Orifice} (L/s)	26.4	33.5	-	-	-
Unctrl'd Q (L/s)	-	-	100.1	27.1	-
Orifice type	PLATE	PLATE	-	-	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 210	
Area (Ha)	0.83
C ₂	0.66
AC	0.54
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	14.0
Req. vol. (m ³)	68.8

Picton	2-year
a=	21.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	74.2	112.2	67.3	0.0	8.4	58.9
15	55.9	84.5	76.1	0.0	12.6	63.5
20	45.7	69.1	82.9	0.0	16.8	66.2
25	39.1	59.1	88.7	0.0	21.0	67.7
30	34.4	52.1	93.7	0.0	25.2	68.5
35	30.9	46.7	98.2	0.0	29.4	68.8
40	28.1	42.6	102.2	0.0	33.5	68.6
45	25.9	39.2	105.9	0.0	37.7	68.1
50	24.1	36.4	109.3	0.0	41.9	67.3
55	22.5	34.1	112.5	0.0	46.1	66.3
60	21.2	32.1	115.4	0.0	50.3	65.1
65	20.0	30.3	118.3	0.0	54.5	63.7
70	19.0	28.8	120.9	0.0	58.7	62.2
75	18.1	27.4	123.5	0.0	62.9	60.6
80	17.3	26.2	125.9	0.0	67.1	58.8
85	16.6	25.1	128.2	0.0	71.3	56.9
90	16.0	24.2	130.4	0.0	75.5	55.0
95	15.4	23.3	132.6	0.0	79.7	52.9
100	14.8	22.4	134.6	0.0	83.9	50.8
105	14.3	21.7	136.6	0.0	88.1	48.6
110	13.9	21.0	138.6	0.0	92.3	46.3
115	13.5	20.4	140.4	0.0	96.5	44.0
120	13.1	19.8	142.2	0.0	100.6	41.6
125	12.7	19.2	144.0	0.0	104.8	39.2
130	12.3	18.7	145.7	0.0	109.0	36.7
135	12.0	18.2	147.4	0.0	113.2	34.1
140	11.7	17.7	149.0	0.0	117.4	31.6
145	11.4	17.3	150.6	0.0	121.6	29.0
150	11.2	16.9	152.1	0.0	125.8	26.3
155	10.9	16.5	153.6	0.0	130.0	23.6
160	10.7	16.2	155.1	0.0	134.2	20.9
165	10.5	15.8	156.5	0.0	138.4	18.2



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 210	
Area (Ha)	0.83
C ₅	0.66
AC	0.54
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	16.8
Req. vol. (m ³)	95.5

Picton	5-year
a=	28.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	98.7	149.3	89.6	0.0	10.1	79.4
15	74.3	112.4	101.2	0.0	15.2	86.0
20	60.8	91.9	110.3	0.0	20.2	90.1
25	52.0	78.7	118.0	0.0	25.3	92.7
30	45.8	69.3	124.7	0.0	30.3	94.3
35	41.1	62.2	130.6	0.0	35.4	95.2
40	37.4	56.6	135.9	0.0	40.4	95.5
45	34.5	52.2	140.8	0.0	45.5	95.3
50	32.0	48.5	145.4	0.0	50.5	94.8
55	30.0	45.3	149.6	0.0	55.6	94.0
60	28.2	42.7	153.6	0.0	60.6	92.9
65	26.7	40.3	157.3	0.0	65.7	91.6
70	25.3	38.3	160.9	0.0	70.8	90.1
75	24.1	36.5	164.2	0.0	75.8	88.4
80	23.1	34.9	167.5	0.0	80.9	86.6
85	22.1	33.4	170.5	0.0	85.9	84.6
90	21.2	32.1	173.5	0.0	91.0	82.5
95	20.5	30.9	176.4	0.0	96.0	80.3
100	19.7	29.8	179.1	0.0	101.1	78.0
105	19.1	28.8	181.7	0.0	106.1	75.6
110	18.5	27.9	184.3	0.0	111.2	73.1
115	17.9	27.1	186.8	0.0	116.2	70.6
120	17.4	26.3	189.2	0.0	121.3	67.9
125	16.9	25.5	191.5	0.0	126.3	65.2
130	16.4	24.8	193.8	0.0	131.4	62.4
135	16.0	24.2	196.0	0.0	136.5	59.6
140	15.6	23.6	198.2	0.0	141.5	56.7
145	15.2	23.0	200.3	0.0	146.6	53.7
150	14.9	22.5	202.3	0.0	151.6	50.7
155	14.5	22.0	204.3	0.0	156.7	47.7
160	14.2	21.5	206.3	0.0	161.7	44.6
165	13.9	21.0	208.2	0.0	166.8	41.5



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

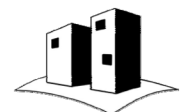
Drainage Area 210	
Area (Ha)	0.83
C ₁₀	0.66
AC	0.54
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	18.4
Req. vol. (m ³)	114.0

Picton	10-year
a=	32.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	114.8	173.6	104.2	0.0	11.1	93.1
15	86.4	130.8	117.7	0.0	16.6	101.1
20	70.7	106.9	128.3	0.0	22.1	106.2
25	60.5	91.5	137.2	0.0	27.6	109.6
30	53.2	80.5	145.0	0.0	33.2	111.8
35	47.8	72.3	151.9	0.0	38.7	113.2
40	43.5	65.9	158.1	0.0	44.2	113.9
45	40.1	60.7	163.8	0.0	49.8	114.0
50	37.3	56.4	169.1	0.0	55.3	113.8
55	34.9	52.7	174.0	0.0	60.8	113.2
60	32.8	49.6	178.6	0.0	66.3	112.3
65	31.0	46.9	183.0	0.0	71.9	111.1
70	29.4	44.5	187.1	0.0	77.4	109.7
75	28.1	42.5	191.0	0.0	82.9	108.1
80	26.8	40.6	194.8	0.0	88.5	106.3
85	25.7	38.9	198.4	0.0	94.0	104.4
90	24.7	37.4	201.8	0.0	99.5	102.3
95	23.8	36.0	205.1	0.0	105.0	100.1
100	23.0	34.7	208.3	0.0	110.6	97.7
105	22.2	33.6	211.4	0.0	116.1	95.3
110	21.5	32.5	214.4	0.0	121.6	92.7
115	20.8	31.5	217.3	0.0	127.2	90.1
120	20.2	30.6	220.1	0.0	132.7	87.4
125	19.6	29.7	222.8	0.0	138.2	84.6
130	19.1	28.9	225.4	0.0	143.7	81.7
135	18.6	28.1	228.0	0.0	149.3	78.7
140	18.1	27.4	230.5	0.0	154.8	75.7
145	17.7	26.8	233.0	0.0	160.3	72.6
150	17.3	26.1	235.3	0.0	165.9	69.5
155	16.9	25.6	237.7	0.0	171.4	66.3
160	16.5	25.0	240.0	0.0	176.9	63.1
165	16.2	24.5	242.2	0.0	182.4	59.8



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 210	
Area (Ha)	0.83
C ₂₅	0.72
AC	0.60
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	21.7
Req. vol. (m ³)	153.3

Picton	25-year
a=	38.5
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	134.7	224.1	134.5	0.0	13.0	121.5
15	101.5	168.8	151.9	0.0	19.5	132.4
20	83.0	138.1	165.7	0.0	26.0	139.7
25	71.0	118.1	177.2	0.0	32.5	144.7
30	62.5	104.0	187.2	0.0	39.0	148.2
35	56.1	93.4	196.1	0.0	45.5	150.6
40	51.1	85.1	204.1	0.0	52.0	152.1
45	47.1	78.3	211.5	0.0	58.5	153.0
50	43.7	72.8	218.3	0.0	65.0	153.3
55	40.9	68.1	224.7	0.0	71.5	153.1
60	38.5	64.1	230.6	0.0	78.0	152.6
65	36.4	60.6	236.3	0.0	84.5	151.7
70	34.6	57.5	241.6	0.0	91.0	150.5
75	32.9	54.8	246.7	0.0	97.5	149.1
80	31.5	52.4	251.5	0.0	104.0	147.4
85	30.2	50.2	256.1	0.0	110.6	145.6
90	29.0	48.3	260.6	0.0	117.1	143.5
95	27.9	46.5	264.8	0.0	123.6	141.3
100	26.9	44.8	269.0	0.0	130.1	138.9
105	26.0	43.3	272.9	0.0	136.6	136.4
110	25.2	41.9	276.8	0.0	143.1	133.7
115	24.4	40.7	280.5	0.0	149.6	130.9
120	23.7	39.5	284.1	0.0	156.1	128.1
125	23.0	38.4	287.6	0.0	162.6	125.1
130	22.4	37.3	291.1	0.0	169.1	122.0
135	21.8	36.3	294.4	0.0	175.6	118.8
140	21.3	35.4	297.6	0.0	182.1	115.5
145	20.8	34.6	300.8	0.0	188.6	112.2
150	20.3	33.8	303.9	0.0	195.1	108.8
155	19.8	33.0	306.9	0.0	201.6	105.3
160	19.4	32.3	309.8	0.0	208.1	101.7
165	19.0	31.6	312.7	0.0	214.6	98.1



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 210	
Area (Ha)	0.83
C ₅₀	0.79
AC	0.65
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	24.3
Req. vol. (m ³)	192.3

Picton	50-year
a=	42.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	149.8	271.8	163.1	0.0	14.6	148.5
15	112.8	204.7	184.3	0.0	21.9	162.4
20	92.2	167.5	200.9	0.0	29.2	171.8
25	78.9	143.3	214.9	0.0	36.5	178.4
30	69.5	126.1	227.0	0.0	43.8	183.3
35	62.4	113.2	237.8	0.0	51.0	186.8
40	56.8	103.1	247.6	0.0	58.3	189.2
45	52.3	95.0	256.5	0.0	65.6	190.9
50	48.6	88.3	264.8	0.0	72.9	191.8
55	45.5	82.6	272.5	0.0	80.2	192.3
60	42.8	77.7	279.7	0.0	87.5	192.2
65	40.5	73.5	286.5	0.0	94.8	191.7
70	38.4	69.8	293.0	0.0	102.1	190.9
75	36.6	66.5	299.1	0.0	109.4	189.7
80	35.0	63.5	305.0	0.0	116.7	188.3
85	33.6	60.9	310.6	0.0	124.0	186.6
90	32.2	58.5	316.0	0.0	131.3	184.7
95	31.0	56.3	321.2	0.0	138.6	182.6
100	29.9	54.4	326.2	0.0	145.8	180.3
105	28.9	52.5	331.0	0.0	153.1	177.9
110	28.0	50.9	335.7	0.0	160.4	175.2
115	27.2	49.3	340.2	0.0	167.7	172.5
120	26.4	47.9	344.6	0.0	175.0	169.6
125	25.6	46.5	348.8	0.0	182.3	166.5
130	24.9	45.3	353.0	0.0	189.6	163.4
135	24.3	44.1	357.0	0.0	196.9	160.1
140	23.7	43.0	360.9	0.0	204.2	156.8
145	23.1	41.9	364.8	0.0	211.5	153.3
150	22.6	40.9	368.5	0.0	218.8	149.8
155	22.0	40.0	372.2	0.0	226.1	146.1
160	21.6	39.1	375.8	0.0	233.3	142.4
165	21.1	38.3	379.2	0.0	240.6	138.6



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 210	
Area (Ha)	0.83
C ₁₀₀	0.82
AC	0.68
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	26.4
Req. vol. (m ³)	224.8

Picton	100-year
a=	47
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	164.4	311.0	186.6	0.0	15.8	170.7
15	123.9	234.2	210.8	0.0	23.8	187.0
20	101.3	191.5	229.9	0.0	31.7	198.2
25	86.7	163.9	245.8	0.0	39.6	206.2
30	76.3	144.3	259.7	0.0	47.5	212.1
35	68.5	129.5	272.0	0.0	55.5	216.5
40	62.4	118.0	283.2	0.0	63.4	219.8
45	57.5	108.7	293.4	0.0	71.3	222.1
50	53.4	101.0	302.9	0.0	79.2	223.6
55	49.9	94.4	311.7	0.0	87.2	224.5
60	47.0	88.9	319.9	0.0	95.1	224.8
65	44.4	84.0	327.7	0.0	103.0	224.7
70	42.2	79.8	335.1	0.0	110.9	224.2
75	40.2	76.0	342.2	0.0	118.9	223.3
80	38.4	72.7	348.9	0.0	126.8	222.1
85	36.8	69.7	355.3	0.0	134.7	220.6
90	35.4	66.9	361.5	0.0	142.6	218.8
95	34.1	64.5	367.4	0.0	150.6	216.8
100	32.9	62.2	373.1	0.0	158.5	214.6
105	31.8	60.1	378.6	0.0	166.4	212.2
110	30.8	58.2	384.0	0.0	174.3	209.6
115	29.8	56.4	389.1	0.0	182.3	206.9
120	29.0	54.7	394.2	0.0	190.2	204.0
125	28.1	53.2	399.0	0.0	198.1	200.9
130	27.4	51.8	403.8	0.0	206.0	197.7
135	26.7	50.4	408.4	0.0	214.0	194.4
140	26.0	49.2	412.9	0.0	221.9	191.0
145	25.4	48.0	417.3	0.0	229.8	187.4
150	24.8	46.8	421.5	0.0	237.7	183.8
155	24.2	45.8	425.7	0.0	245.7	180.1
160	23.7	44.8	429.8	0.0	253.6	176.2
165	23.2	43.8	433.8	0.0	261.5	172.3



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 211	
Area (Ha)	0.24
C ₂	0.68
AC	0.16
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	16.1
Req. vol. (m ³)	10.5

Picton	2-year
a=	21.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	74.2	33.5	20.1	0.0	9.6	10.5
15	55.9	25.3	22.7	0.0	14.5	8.3
20	45.7	20.7	24.8	0.0	19.3	5.5
25	39.1	17.7	26.5	0.0	24.1	2.4
30	34.4	15.6	28.0	0.0	28.9	-
35	30.9	14.0	29.3	0.0	33.8	-
40	28.1	12.7	30.5	0.0	38.6	-
45	25.9	11.7	31.6	0.0	43.4	-
50	24.1	10.9	32.7	0.0	48.2	-
55	22.5	10.2	33.6	0.0	53.0	-
60	21.2	9.6	34.5	0.0	57.9	-
65	20.0	9.1	35.3	0.0	62.7	-
70	19.0	8.6	36.1	0.0	67.5	-
75	18.1	8.2	36.9	0.0	72.3	-
80	17.3	7.8	37.6	0.0	77.2	-
85	16.6	7.5	38.3	0.0	82.0	-
90	16.0	7.2	39.0	0.0	86.8	-
95	15.4	7.0	39.6	0.0	91.6	-
100	14.8	6.7	40.2	0.0	96.4	-
105	14.3	6.5	40.8	0.0	101.3	-
110	13.9	6.3	41.4	0.0	106.1	-
115	13.5	6.1	42.0	0.0	110.9	-
120	13.1	5.9	42.5	0.0	115.7	-
125	12.7	5.7	43.0	0.0	120.6	-
130	12.3	5.6	43.5	0.0	125.4	-
135	12.0	5.4	44.0	0.0	130.2	-
140	11.7	5.3	44.5	0.0	135.0	-
145	11.4	5.2	45.0	0.0	139.8	-
150	11.2	5.1	45.5	0.0	144.7	-
155	10.9	4.9	45.9	0.0	149.5	-
160	10.7	4.8	46.3	0.0	154.3	-
165	10.5	4.7	46.8	0.0	159.1	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 211	
Area (Ha)	0.24
C ₅	0.68
AC	0.16
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	19.0
Req. vol. (m ³)	15.4

Picton	5-year
a=	28.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	98.7	44.6	26.8	0.0	11.4	15.4
15	74.3	33.6	30.2	0.0	17.1	13.1
20	60.8	27.5	33.0	0.0	22.8	10.2
25	52.0	23.5	35.3	0.0	28.5	6.8
30	45.8	20.7	37.2	0.0	34.2	3.1
35	41.1	18.6	39.0	0.0	39.9	-
40	37.4	16.9	40.6	0.0	45.6	-
45	34.5	15.6	42.1	0.0	51.3	-
50	32.0	14.5	43.4	0.0	57.0	-
55	30.0	13.5	44.7	0.0	62.7	-
60	28.2	12.7	45.9	0.0	68.4	-
65	26.7	12.1	47.0	0.0	74.1	-
70	25.3	11.4	48.1	0.0	79.8	-
75	24.1	10.9	49.1	0.0	85.5	-
80	23.1	10.4	50.0	0.0	91.2	-
85	22.1	10.0	51.0	0.0	96.8	-
90	21.2	9.6	51.8	0.0	102.5	-
95	20.5	9.2	52.7	0.0	108.2	-
100	19.7	8.9	53.5	0.0	113.9	-
105	19.1	8.6	54.3	0.0	119.6	-
110	18.5	8.3	55.1	0.0	125.3	-
115	17.9	8.1	55.8	0.0	131.0	-
120	17.4	7.9	56.5	0.0	136.7	-
125	16.9	7.6	57.2	0.0	142.4	-
130	16.4	7.4	57.9	0.0	148.1	-
135	16.0	7.2	58.6	0.0	153.8	-
140	15.6	7.1	59.2	0.0	159.5	-
145	15.2	6.9	59.9	0.0	165.2	-
150	14.9	6.7	60.5	0.0	170.9	-
155	14.5	6.6	61.1	0.0	176.6	-
160	14.2	6.4	61.7	0.0	182.3	-
165	13.9	6.3	62.2	0.0	188.0	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 211	
Area (Ha)	0.24
C ₁₀	0.68
AC	0.16
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	21.0
Req. vol. (m ³)	18.5

Picton	10-year
a=	32.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	114.8	51.9	31.1	0.0	12.6	18.5
15	86.4	39.1	35.2	0.0	18.9	16.3
20	70.7	32.0	38.3	0.0	25.2	13.2
25	60.5	27.3	41.0	0.0	31.5	9.5
30	53.2	24.1	43.3	0.0	37.8	5.6
35	47.8	21.6	45.4	0.0	44.1	1.3
40	43.5	19.7	47.2	0.0	50.3	-
45	40.1	18.1	48.9	0.0	56.6	-
50	37.3	16.8	50.5	0.0	62.9	-
55	34.9	15.8	52.0	0.0	69.2	-
60	32.8	14.8	53.4	0.0	75.5	-
65	31.0	14.0	54.7	0.0	81.8	-
70	29.4	13.3	55.9	0.0	88.1	-
75	28.1	12.7	57.1	0.0	94.4	-
80	26.8	12.1	58.2	0.0	100.7	-
85	25.7	11.6	59.3	0.0	107.0	-
90	24.7	11.2	60.3	0.0	113.3	-
95	23.8	10.8	61.3	0.0	119.6	-
100	23.0	10.4	62.2	0.0	125.9	-
105	22.2	10.0	63.2	0.0	132.2	-
110	21.5	9.7	64.1	0.0	138.5	-
115	20.8	9.4	64.9	0.0	144.8	-
120	20.2	9.1	65.8	0.0	151.0	-
125	19.6	8.9	66.6	0.0	157.3	-
130	19.1	8.6	67.4	0.0	163.6	-
135	18.6	8.4	68.1	0.0	169.9	-
140	18.1	8.2	68.9	0.0	176.2	-
145	17.7	8.0	69.6	0.0	182.5	-
150	17.3	7.8	70.3	0.0	188.8	-
155	16.9	7.6	71.0	0.0	195.1	-
160	16.5	7.5	71.7	0.0	201.4	-
165	16.2	7.3	72.4	0.0	207.7	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 211	
Area (Ha)	0.24
C ₂₅	0.75
AC	0.18
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	24.2
Req. vol. (m ³)	25.6

Picton	25-year
a=	38.5
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	134.7	67.0	40.2	0.0	14.5	25.6
15	101.5	50.4	45.4	0.0	21.8	23.6
20	83.0	41.3	49.5	0.0	29.1	20.4
25	71.0	35.3	53.0	0.0	36.4	16.6
30	62.5	31.1	55.9	0.0	43.6	12.3
35	56.1	27.9	58.6	0.0	50.9	7.7
40	51.1	25.4	61.0	0.0	58.2	2.8
45	47.1	23.4	63.2	0.0	65.5	-
50	43.7	21.7	65.2	0.0	72.7	-
55	40.9	20.3	67.1	0.0	80.0	-
60	38.5	19.1	68.9	0.0	87.3	-
65	36.4	18.1	70.6	0.0	94.6	-
70	34.6	17.2	72.2	0.0	101.8	-
75	32.9	16.4	73.7	0.0	109.1	-
80	31.5	15.7	75.1	0.0	116.4	-
85	30.2	15.0	76.5	0.0	123.6	-
90	29.0	14.4	77.9	0.0	130.9	-
95	27.9	13.9	79.1	0.0	138.2	-
100	26.9	13.4	80.4	0.0	145.5	-
105	26.0	12.9	81.6	0.0	152.7	-
110	25.2	12.5	82.7	0.0	160.0	-
115	24.4	12.1	83.8	0.0	167.3	-
120	23.7	11.8	84.9	0.0	174.6	-
125	23.0	11.5	86.0	0.0	181.8	-
130	22.4	11.2	87.0	0.0	189.1	-
135	21.8	10.9	88.0	0.0	196.4	-
140	21.3	10.6	88.9	0.0	203.7	-
145	20.8	10.3	89.9	0.0	210.9	-
150	20.3	10.1	90.8	0.0	218.2	-
155	19.8	9.9	91.7	0.0	225.5	-
160	19.4	9.6	92.6	0.0	232.7	-
165	19.0	9.4	93.4	0.0	240.0	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 211	
Area (Ha)	0.24
C ₅₀	1.00
AC	0.24
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	31.4
Req. vol. (m ³)	40.6

Picton	50-year
a=	42.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	149.8	99.1	59.4	0.0	18.8	40.6
15	112.8	74.6	67.2	0.0	28.3	38.9
20	92.2	61.0	73.2	0.0	37.7	35.6
25	78.9	52.2	78.3	0.0	47.1	31.2
30	69.5	46.0	82.7	0.0	56.5	26.2
35	62.4	41.3	86.7	0.0	65.9	20.8
40	56.8	37.6	90.2	0.0	75.3	14.9
45	52.3	34.6	93.5	0.0	84.8	8.7
50	48.6	32.2	96.5	0.0	94.2	2.3
55	45.5	30.1	99.3	0.0	103.6	-
60	42.8	28.3	101.9	0.0	113.0	-
65	40.5	26.8	104.4	0.0	122.4	-
70	38.4	25.4	106.8	0.0	131.8	-
75	36.6	24.2	109.0	0.0	141.3	-
80	35.0	23.2	111.2	0.0	150.7	-
85	33.6	22.2	113.2	0.0	160.1	-
90	32.2	21.3	115.2	0.0	169.5	-
95	31.0	20.5	117.1	0.0	178.9	-
100	29.9	19.8	118.9	0.0	188.3	-
105	28.9	19.2	120.6	0.0	197.8	-
110	28.0	18.5	122.3	0.0	207.2	-
115	27.2	18.0	124.0	0.0	216.6	-
120	26.4	17.4	125.6	0.0	226.0	-
125	25.6	17.0	127.1	0.0	235.4	-
130	24.9	16.5	128.7	0.0	244.8	-
135	24.3	16.1	130.1	0.0	254.3	-
140	23.7	15.7	131.6	0.0	263.7	-
145	23.1	15.3	133.0	0.0	273.1	-
150	22.6	14.9	134.3	0.0	282.5	-
155	22.0	14.6	135.7	0.0	291.9	-
160	21.6	14.3	137.0	0.0	301.3	-
165	21.1	14.0	138.2	0.0	310.8	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 211	
Area (Ha)	0.24
C ₁₀₀	1.00
AC	0.24
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	33.5
Req. vol. (m ³)	45.2

Picton	100-year
a=	47
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	164.4	108.8	65.3	0.0	20.1	45.2
15	123.9	82.0	73.8	0.0	30.1	43.6
20	101.3	67.0	80.4	0.0	40.2	40.2
25	86.7	57.3	86.0	0.0	50.2	35.8
30	76.3	50.5	90.9	0.0	60.3	30.6
35	68.5	45.3	95.2	0.0	70.3	24.9
40	62.4	41.3	99.1	0.0	80.4	18.7
45	57.5	38.0	102.7	0.0	90.4	12.2
50	53.4	35.3	106.0	0.0	100.5	5.5
55	49.9	33.0	109.1	0.0	110.5	-
60	47.0	31.1	111.9	0.0	120.6	-
65	44.4	29.4	114.7	0.0	130.6	-
70	42.2	27.9	117.3	0.0	140.7	-
75	40.2	26.6	119.7	0.0	150.7	-
80	38.4	25.4	122.1	0.0	160.8	-
85	36.8	24.4	124.3	0.0	170.8	-
90	35.4	23.4	126.5	0.0	180.8	-
95	34.1	22.6	128.6	0.0	190.9	-
100	32.9	21.8	130.6	0.0	200.9	-
105	31.8	21.0	132.5	0.0	211.0	-
110	30.8	20.4	134.4	0.0	221.0	-
115	29.8	19.7	136.2	0.0	231.1	-
120	29.0	19.2	137.9	0.0	241.1	-
125	28.1	18.6	139.6	0.0	251.2	-
130	27.4	18.1	141.3	0.0	261.2	-
135	26.7	17.6	142.9	0.0	271.3	-
140	26.0	17.2	144.5	0.0	281.3	-
145	25.4	16.8	146.0	0.0	291.4	-
150	24.8	16.4	147.5	0.0	301.4	-
155	24.2	16.0	149.0	0.0	311.5	-
160	23.7	15.7	150.4	0.0	321.5	-
165	23.2	15.3	151.8	0.0	331.6	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 220	
Area (Ha)	0.483
C ₂	0.363
AC	0.18
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	36.1
Req. vol. (m ³)	0.0

Picton	2-year
a=	21.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	74.2	36.1	21.7	0.0	21.7	0.0
15	55.9	27.2	24.5	0.0	32.5	-
20	45.7	22.3	26.7	0.0	43.3	-
25	39.1	19.0	28.6	0.0	54.2	-
30	34.4	16.8	30.2	0.0	65.0	-
35	30.9	15.1	31.6	0.0	75.9	-
40	28.1	13.7	32.9	0.0	86.7	-
45	25.9	12.6	34.1	0.0	97.5	-
50	24.1	11.7	35.2	0.0	108.4	-
55	22.5	11.0	36.2	0.0	119.2	-
60	21.2	10.3	37.2	0.0	130.0	-
65	20.0	9.8	38.1	0.0	140.9	-
70	19.0	9.3	38.9	0.0	151.7	-
75	18.1	8.8	39.8	0.0	162.5	-
80	17.3	8.4	40.5	0.0	173.4	-
85	16.6	8.1	41.3	0.0	184.2	-
90	16.0	7.8	42.0	0.0	195.0	-
95	15.4	7.5	42.7	0.0	205.9	-
100	14.8	7.2	43.4	0.0	216.7	-
105	14.3	7.0	44.0	0.0	227.6	-
110	13.9	6.8	44.6	0.0	238.4	-
115	13.5	6.6	45.2	0.0	249.2	-
120	13.1	6.4	45.8	0.0	260.1	-
125	12.7	6.2	46.4	0.0	270.9	-
130	12.3	6.0	46.9	0.0	281.7	-
135	12.0	5.9	47.4	0.0	292.6	-
140	11.7	5.7	48.0	0.0	303.4	-
145	11.4	5.6	48.5	0.0	314.2	-
150	11.2	5.4	49.0	0.0	325.1	-
155	10.9	5.3	49.5	0.0	335.9	-
160	10.7	5.2	49.9	0.0	346.8	-
165	10.5	5.1	50.4	0.0	357.6	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 220	
Area (Ha)	0.483
C ₅	0.363
AC	0.18
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	48.1
Req. vol. (m ³)	0.0

Picton	5-year
a=	28.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	98.7	48.1	28.8	0.0	28.8	0.0
15	74.3	36.2	32.6	0.0	43.2	-
20	60.8	29.6	35.5	0.0	57.7	-
25	52.0	25.3	38.0	0.0	72.1	-
30	45.8	22.3	40.1	0.0	86.5	-
35	41.1	20.0	42.0	0.0	100.9	-
40	37.4	18.2	43.8	0.0	115.3	-
45	34.5	16.8	45.3	0.0	129.7	-
50	32.0	15.6	46.8	0.0	144.2	-
55	30.0	14.6	48.2	0.0	158.6	-
60	28.2	13.7	49.4	0.0	173.0	-
65	26.7	13.0	50.7	0.0	187.4	-
70	25.3	12.3	51.8	0.0	201.8	-
75	24.1	11.8	52.9	0.0	216.2	-
80	23.1	11.2	53.9	0.0	230.6	-
85	22.1	10.8	54.9	0.0	245.1	-
90	21.2	10.3	55.9	0.0	259.5	-
95	20.5	10.0	56.8	0.0	273.9	-
100	19.7	9.6	57.7	0.0	288.3	-
105	19.1	9.3	58.5	0.0	302.7	-
110	18.5	9.0	59.3	0.0	317.1	-
115	17.9	8.7	60.1	0.0	331.5	-
120	17.4	8.5	60.9	0.0	346.0	-
125	16.9	8.2	61.7	0.0	360.4	-
130	16.4	8.0	62.4	0.0	374.8	-
135	16.0	7.8	63.1	0.0	389.2	-
140	15.6	7.6	63.8	0.0	403.6	-
145	15.2	7.4	64.5	0.0	418.0	-
150	14.9	7.2	65.1	0.0	432.5	-
155	14.5	7.1	65.8	0.0	446.9	-
160	14.2	6.9	66.4	0.0	461.3	-
165	13.9	6.8	67.0	0.0	475.7	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 220	
Area (Ha)	0.483
C ₁₀	0.363
AC	0.18
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	55.9
Req. vol. (m ³)	0.0

Picton	10-year
a=	32.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	114.8	55.9	33.5	0.0	33.5	0.0
15	86.4	42.1	37.9	0.0	50.3	-
20	70.7	34.4	41.3	0.0	67.1	-
25	60.5	29.5	44.2	0.0	83.8	-
30	53.2	25.9	46.7	0.0	100.6	-
35	47.8	23.3	48.9	0.0	117.4	-
40	43.5	21.2	50.9	0.0	134.1	-
45	40.1	19.5	52.7	0.0	150.9	-
50	37.3	18.1	54.4	0.0	167.7	-
55	34.9	17.0	56.0	0.0	184.4	-
60	32.8	16.0	57.5	0.0	201.2	-
65	31.0	15.1	58.9	0.0	218.0	-
70	29.4	14.3	60.2	0.0	234.7	-
75	28.1	13.7	61.5	0.0	251.5	-
80	26.8	13.1	62.7	0.0	268.3	-
85	25.7	12.5	63.9	0.0	285.0	-
90	24.7	12.0	65.0	0.0	301.8	-
95	23.8	11.6	66.0	0.0	318.6	-
100	23.0	11.2	67.1	0.0	335.3	-
105	22.2	10.8	68.1	0.0	352.1	-
110	21.5	10.5	69.0	0.0	368.9	-
115	20.8	10.1	70.0	0.0	385.6	-
120	20.2	9.8	70.9	0.0	402.4	-
125	19.6	9.6	71.7	0.0	419.2	-
130	19.1	9.3	72.6	0.0	435.9	-
135	18.6	9.1	73.4	0.0	452.7	-
140	18.1	8.8	74.2	0.0	469.5	-
145	17.7	8.6	75.0	0.0	486.2	-
150	17.3	8.4	75.8	0.0	503.0	-
155	16.9	8.2	76.5	0.0	519.8	-
160	16.5	8.0	77.3	0.0	536.5	-
165	16.2	7.9	78.0	0.0	553.3	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 220	
Area (Ha)	0.483
C ₂₅	0.399
AC	0.19
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	72.2
Req. vol. (m ³)	0.0

Picton	25-year
a=	38.5
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	134.7	72.2	43.3	0.0	43.3	0.0
15	101.5	54.4	48.9	0.0	65.0	-
20	83.0	44.5	53.3	0.0	86.6	-
25	71.0	38.0	57.1	0.0	108.3	-
30	62.5	33.5	60.3	0.0	129.9	-
35	56.1	30.1	63.1	0.0	151.6	-
40	51.1	27.4	65.7	0.0	173.2	-
45	47.1	25.2	68.1	0.0	194.9	-
50	43.7	23.4	70.3	0.0	216.5	-
55	40.9	21.9	72.3	0.0	238.2	-
60	38.5	20.6	74.3	0.0	259.8	-
65	36.4	19.5	76.1	0.0	281.5	-
70	34.6	18.5	77.8	0.0	303.1	-
75	32.9	17.6	79.4	0.0	324.8	-
80	31.5	16.9	81.0	0.0	346.4	-
85	30.2	16.2	82.5	0.0	368.1	-
90	29.0	15.5	83.9	0.0	389.7	-
95	27.9	15.0	85.3	0.0	411.4	-
100	26.9	14.4	86.6	0.0	433.0	-
105	26.0	13.9	87.9	0.0	454.7	-
110	25.2	13.5	89.1	0.0	476.3	-
115	24.4	13.1	90.3	0.0	498.0	-
120	23.7	12.7	91.5	0.0	519.6	-
125	23.0	12.3	92.6	0.0	541.3	-
130	22.4	12.0	93.7	0.0	562.9	-
135	21.8	11.7	94.8	0.0	584.6	-
140	21.3	11.4	95.8	0.0	606.2	-
145	20.8	11.1	96.8	0.0	627.9	-
150	20.3	10.9	97.8	0.0	649.5	-
155	19.8	10.6	98.8	0.0	671.2	-
160	19.4	10.4	99.8	0.0	692.8	-
165	19.0	10.2	100.7	0.0	714.5	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 220	
Area (Ha)	0.483
C ₅₀	0.436
AC	0.21
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	87.5
Req. vol. (m ³)	0.0

Picton	50-year
a=	42.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	149.8	87.5	52.5	0.0	52.5	0.0
15	112.8	65.9	59.3	0.0	78.8	-
20	92.2	53.9	64.7	0.0	105.0	-
25	78.9	46.1	69.2	0.0	131.3	-
30	69.5	40.6	73.1	0.0	157.5	-
35	62.4	36.5	76.6	0.0	183.8	-
40	56.8	33.2	79.7	0.0	210.0	-
45	52.3	30.6	82.6	0.0	236.3	-
50	48.6	28.4	85.2	0.0	262.6	-
55	45.5	26.6	87.7	0.0	288.8	-
60	42.8	25.0	90.1	0.0	315.1	-
65	40.5	23.7	92.3	0.0	341.3	-
70	38.4	22.5	94.3	0.0	367.6	-
75	36.6	21.4	96.3	0.0	393.8	-
80	35.0	20.5	98.2	0.0	420.1	-
85	33.6	19.6	100.0	0.0	446.4	-
90	32.2	18.8	101.7	0.0	472.6	-
95	31.0	18.1	103.4	0.0	498.9	-
100	29.9	17.5	105.0	0.0	525.1	-
105	28.9	16.9	106.6	0.0	551.4	-
110	28.0	16.4	108.1	0.0	577.6	-
115	27.2	15.9	109.5	0.0	603.9	-
120	26.4	15.4	110.9	0.0	630.1	-
125	25.6	15.0	112.3	0.0	656.4	-
130	24.9	14.6	113.7	0.0	682.7	-
135	24.3	14.2	115.0	0.0	708.9	-
140	23.7	13.8	116.2	0.0	735.2	-
145	23.1	13.5	117.5	0.0	761.4	-
150	22.6	13.2	118.7	0.0	787.7	-
155	22.0	12.9	119.8	0.0	813.9	-
160	21.6	12.6	121.0	0.0	840.2	-
165	21.1	12.3	122.1	0.0	866.4	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 220	
Area (Ha)	0.483
C ₁₀₀	0.454
AC	0.22
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	100.1
Req. vol. (m ³)	0.0

Picton	100-year
a=	47
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	164.4	100.1	60.1	0.0	60.1	0.0
15	123.9	75.4	67.9	0.0	90.1	-
20	101.3	61.7	74.0	0.0	120.1	-
25	86.7	52.8	79.1	0.0	150.2	-
30	76.3	46.5	83.6	0.0	180.2	-
35	68.5	41.7	87.6	0.0	210.2	-
40	62.4	38.0	91.2	0.0	240.3	-
45	57.5	35.0	94.5	0.0	270.3	-
50	53.4	32.5	97.5	0.0	300.3	-
55	49.9	30.4	100.3	0.0	330.4	-
60	47.0	28.6	103.0	0.0	360.4	-
65	44.4	27.1	105.5	0.0	390.4	-
70	42.2	25.7	107.9	0.0	420.5	-
75	40.2	24.5	110.2	0.0	450.5	-
80	38.4	23.4	112.3	0.0	480.5	-
85	36.8	22.4	114.4	0.0	510.6	-
90	35.4	21.6	116.4	0.0	540.6	-
95	34.1	20.8	118.3	0.0	570.6	-
100	32.9	20.0	120.1	0.0	600.7	-
105	31.8	19.4	121.9	0.0	630.7	-
110	30.8	18.7	123.6	0.0	660.7	-
115	29.8	18.2	125.3	0.0	690.8	-
120	29.0	17.6	126.9	0.0	720.8	-
125	28.1	17.1	128.5	0.0	750.8	-
130	27.4	16.7	130.0	0.0	780.9	-
135	26.7	16.2	131.5	0.0	810.9	-
140	26.0	15.8	132.9	0.0	840.9	-
145	25.4	15.4	134.3	0.0	871.0	-
150	24.8	15.1	135.7	0.0	901.0	-
155	24.2	14.7	137.1	0.0	931.0	-
160	23.7	14.4	138.4	0.0	961.1	-
165	23.2	14.1	139.7	0.0	991.1	-



**MODIFIED RATIONAL METHOD
STORAGE CALCULATIONS**

Drainage Area 221	
Area (Ha)	0.082
C ₂	0.577
AC	0.05
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	9.8
Req. vol. (m ³)	0.0

Picton	2-year
a=	21.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	74.2	9.8	5.9	0.0	5.9	0.0
15	55.9	7.4	6.6	0.0	8.8	-
20	45.7	6.0	7.2	0.0	11.7	-
25	39.1	5.2	7.7	0.0	14.7	-
30	34.4	4.5	8.2	0.0	17.6	-
35	30.9	4.1	8.6	0.0	20.6	-
40	28.1	3.7	8.9	0.0	23.5	-
45	25.9	3.4	9.2	0.0	26.4	-
50	24.1	3.2	9.5	0.0	29.4	-
55	22.5	3.0	9.8	0.0	32.3	-
60	21.2	2.8	10.1	0.0	35.2	-
65	20.0	2.6	10.3	0.0	38.2	-
70	19.0	2.5	10.6	0.0	41.1	-
75	18.1	2.4	10.8	0.0	44.1	-
80	17.3	2.3	11.0	0.0	47.0	-
85	16.6	2.2	11.2	0.0	49.9	-
90	16.0	2.1	11.4	0.0	52.9	-
95	15.4	2.0	11.6	0.0	55.8	-
100	14.8	2.0	11.8	0.0	58.7	-
105	14.3	1.9	11.9	0.0	61.7	-
110	13.9	1.8	12.1	0.0	64.6	-
115	13.5	1.8	12.3	0.0	67.6	-
120	13.1	1.7	12.4	0.0	70.5	-
125	12.7	1.7	12.6	0.0	73.4	-
130	12.3	1.6	12.7	0.0	76.4	-
135	12.0	1.6	12.9	0.0	79.3	-
140	11.7	1.5	13.0	0.0	82.2	-
145	11.4	1.5	13.1	0.0	85.2	-
150	11.2	1.5	13.3	0.0	88.1	-
155	10.9	1.4	13.4	0.0	91.0	-
160	10.7	1.4	13.5	0.0	94.0	-
165	10.5	1.4	13.7	0.0	96.9	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 221	
Area (Ha)	0.082
C ₅	0.577
AC	0.05
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	13.0
Req. vol. (m ³)	0.0

Picton	5-year
a=	28.2
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	98.7	13.0	7.8	0.0	7.8	0.0
15	74.3	9.8	8.8	0.0	11.7	-
20	60.8	8.0	9.6	0.0	15.6	-
25	52.0	6.9	10.3	0.0	19.5	-
30	45.8	6.0	10.9	0.0	23.4	-
35	41.1	5.4	11.4	0.0	27.4	-
40	37.4	4.9	11.9	0.0	31.3	-
45	34.5	4.6	12.3	0.0	35.2	-
50	32.0	4.2	12.7	0.0	39.1	-
55	30.0	4.0	13.1	0.0	43.0	-
60	28.2	3.7	13.4	0.0	46.9	-
65	26.7	3.5	13.7	0.0	50.8	-
70	25.3	3.3	14.0	0.0	54.7	-
75	24.1	3.2	14.3	0.0	58.6	-
80	23.1	3.0	14.6	0.0	62.5	-
85	22.1	2.9	14.9	0.0	66.4	-
90	21.2	2.8	15.1	0.0	70.3	-
95	20.5	2.7	15.4	0.0	74.2	-
100	19.7	2.6	15.6	0.0	78.2	-
105	19.1	2.5	15.9	0.0	82.1	-
110	18.5	2.4	16.1	0.0	86.0	-
115	17.9	2.4	16.3	0.0	89.9	-
120	17.4	2.3	16.5	0.0	93.8	-
125	16.9	2.2	16.7	0.0	97.7	-
130	16.4	2.2	16.9	0.0	101.6	-
135	16.0	2.1	17.1	0.0	105.5	-
140	15.6	2.1	17.3	0.0	109.4	-
145	15.2	2.0	17.5	0.0	113.3	-
150	14.9	2.0	17.7	0.0	117.2	-
155	14.5	1.9	17.8	0.0	121.1	-
160	14.2	1.9	18.0	0.0	125.0	-
165	13.9	1.8	18.2	0.0	129.0	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 221	
Area (Ha)	0.082
C ₁₀	0.577
AC	0.05
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	15.2
Req. vol. (m ³)	0.0

Picton	10-year
a=	32.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	114.8	15.2	9.1	0.0	9.1	0.0
15	86.4	11.4	10.3	0.0	13.6	-
20	70.7	9.3	11.2	0.0	18.2	-
25	60.5	8.0	12.0	0.0	22.7	-
30	53.2	7.0	12.7	0.0	27.3	-
35	47.8	6.3	13.3	0.0	31.8	-
40	43.5	5.7	13.8	0.0	36.4	-
45	40.1	5.3	14.3	0.0	40.9	-
50	37.3	4.9	14.8	0.0	45.5	-
55	34.9	4.6	15.2	0.0	50.0	-
60	32.8	4.3	15.6	0.0	54.5	-
65	31.0	4.1	16.0	0.0	59.1	-
70	29.4	3.9	16.3	0.0	63.6	-
75	28.1	3.7	16.7	0.0	68.2	-
80	26.8	3.5	17.0	0.0	72.7	-
85	25.7	3.4	17.3	0.0	77.3	-
90	24.7	3.3	17.6	0.0	81.8	-
95	23.8	3.1	17.9	0.0	86.4	-
100	23.0	3.0	18.2	0.0	90.9	-
105	22.2	2.9	18.4	0.0	95.4	-
110	21.5	2.8	18.7	0.0	100.0	-
115	20.8	2.7	19.0	0.0	104.5	-
120	20.2	2.7	19.2	0.0	109.1	-
125	19.6	2.6	19.4	0.0	113.6	-
130	19.1	2.5	19.7	0.0	118.2	-
135	18.6	2.5	19.9	0.0	122.7	-
140	18.1	2.4	20.1	0.0	127.3	-
145	17.7	2.3	20.3	0.0	131.8	-
150	17.3	2.3	20.5	0.0	136.4	-
155	16.9	2.2	20.7	0.0	140.9	-
160	16.5	2.2	20.9	0.0	145.4	-
165	16.2	2.1	21.1	0.0	150.0	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 221	
Area (Ha)	0.082
C ₂₅	0.635
AC	0.05
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	19.6
Req. vol. (m ³)	0.0

Picton	25-year
a=	38.5
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	134.7	19.6	11.7	0.0	11.7	0.0
15	101.5	14.7	13.3	0.0	17.6	-
20	83.0	12.1	14.5	0.0	23.5	-
25	71.0	10.3	15.5	0.0	29.3	-
30	62.5	9.1	16.3	0.0	35.2	-
35	56.1	8.1	17.1	0.0	41.1	-
40	51.1	7.4	17.8	0.0	46.9	-
45	47.1	6.8	18.5	0.0	52.8	-
50	43.7	6.4	19.1	0.0	58.7	-
55	40.9	5.9	19.6	0.0	64.5	-
60	38.5	5.6	20.1	0.0	70.4	-
65	36.4	5.3	20.6	0.0	76.3	-
70	34.6	5.0	21.1	0.0	82.2	-
75	32.9	4.8	21.5	0.0	88.0	-
80	31.5	4.6	21.9	0.0	93.9	-
85	30.2	4.4	22.4	0.0	99.8	-
90	29.0	4.2	22.7	0.0	105.6	-
95	27.9	4.1	23.1	0.0	111.5	-
100	26.9	3.9	23.5	0.0	117.4	-
105	26.0	3.8	23.8	0.0	123.2	-
110	25.2	3.7	24.2	0.0	129.1	-
115	24.4	3.5	24.5	0.0	135.0	-
120	23.7	3.4	24.8	0.0	140.8	-
125	23.0	3.3	25.1	0.0	146.7	-
130	22.4	3.3	25.4	0.0	152.6	-
135	21.8	3.2	25.7	0.0	158.4	-
140	21.3	3.1	26.0	0.0	164.3	-
145	20.8	3.0	26.3	0.0	170.2	-
150	20.3	2.9	26.5	0.0	176.0	-
155	19.8	2.9	26.8	0.0	181.9	-
160	19.4	2.8	27.0	0.0	187.8	-
165	19.0	2.8	27.3	0.0	193.6	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 221	
Area (Ha)	0.082
C ₅₀	0.692
AC	0.06
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	23.7
Req. vol. (m ³)	0.0

Picton	50-year
a=	42.8
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	149.8	23.7	14.2	0.0	14.2	0.0
15	112.8	17.9	16.1	0.0	21.3	-
20	92.2	14.6	17.5	0.0	28.5	-
25	78.9	12.5	18.8	0.0	35.6	-
30	69.5	11.0	19.8	0.0	42.7	-
35	62.4	9.9	20.8	0.0	49.8	-
40	56.8	9.0	21.6	0.0	56.9	-
45	52.3	8.3	22.4	0.0	64.0	-
50	48.6	7.7	23.1	0.0	71.2	-
55	45.5	7.2	23.8	0.0	78.3	-
60	42.8	6.8	24.4	0.0	85.4	-
65	40.5	6.4	25.0	0.0	92.5	-
70	38.4	6.1	25.6	0.0	99.6	-
75	36.6	5.8	26.1	0.0	106.7	-
80	35.0	5.5	26.6	0.0	113.9	-
85	33.6	5.3	27.1	0.0	121.0	-
90	32.2	5.1	27.6	0.0	128.1	-
95	31.0	4.9	28.0	0.0	135.2	-
100	29.9	4.7	28.5	0.0	142.3	-
105	28.9	4.6	28.9	0.0	149.4	-
110	28.0	4.4	29.3	0.0	156.6	-
115	27.2	4.3	29.7	0.0	163.7	-
120	26.4	4.2	30.1	0.0	170.8	-
125	25.6	4.1	30.4	0.0	177.9	-
130	24.9	3.9	30.8	0.0	185.0	-
135	24.3	3.8	31.2	0.0	192.1	-
140	23.7	3.8	31.5	0.0	199.2	-
145	23.1	3.7	31.8	0.0	206.4	-
150	22.6	3.6	32.2	0.0	213.5	-
155	22.0	3.5	32.5	0.0	220.6	-
160	21.6	3.4	32.8	0.0	227.7	-
165	21.1	3.3	33.1	0.0	234.8	-



MODIFIED RATIONAL METHOD STORAGE CALCULATIONS

Drainage Area 221	
Area (Ha)	0.082
C ₁₀₀	0.721
AC	0.06
T _c (min)	10.0
T incr. (min)	5
Q ₁ (l/s)	27.1
Req. vol. (m ³)	0.0

Picton	100-year
a=	47
b=	0
c=	0.699

Notes:

Required Storage Summary

T (min)	I (mm/hr)	Q (l/s)	Total Vol.	Ext. Vol. (m³)	Rel. Vol. (m³)	Storage (m³)
10	164.4	27.1	16.3	0.0	16.3	0.0
15	123.9	20.4	18.4	0.0	24.4	-
20	101.3	16.7	20.1	0.0	32.6	-
25	86.7	14.3	21.5	0.0	40.7	-
30	76.3	12.6	22.7	0.0	48.8	-
35	68.5	11.3	23.7	0.0	57.0	-
40	62.4	10.3	24.7	0.0	65.1	-
45	57.5	9.5	25.6	0.0	73.3	-
50	53.4	8.8	26.4	0.0	81.4	-
55	49.9	8.2	27.2	0.0	89.5	-
60	47.0	7.8	27.9	0.0	97.7	-
65	44.4	7.3	28.6	0.0	105.8	-
70	42.2	7.0	29.2	0.0	113.9	-
75	40.2	6.6	29.9	0.0	122.1	-
80	38.4	6.3	30.4	0.0	130.2	-
85	36.8	6.1	31.0	0.0	138.4	-
90	35.4	5.8	31.5	0.0	146.5	-
95	34.1	5.6	32.1	0.0	154.6	-
100	32.9	5.4	32.6	0.0	162.8	-
105	31.8	5.2	33.0	0.0	170.9	-
110	30.8	5.1	33.5	0.0	179.1	-
115	29.8	4.9	34.0	0.0	187.2	-
120	29.0	4.8	34.4	0.0	195.3	-
125	28.1	4.6	34.8	0.0	203.5	-
130	27.4	4.5	35.2	0.0	211.6	-
135	26.7	4.4	35.6	0.0	219.8	-
140	26.0	4.3	36.0	0.0	227.9	-
145	25.4	4.2	36.4	0.0	236.0	-
150	24.8	4.1	36.8	0.0	244.2	-
155	24.2	4.0	37.2	0.0	252.3	-
160	23.7	3.9	37.5	0.0	260.4	-
165	23.2	3.8	37.9	0.0	268.6	-



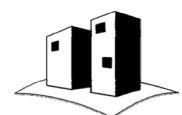
ORIFICE AND AVAILABLE STORAGE CALCULATIONS

$$Q_{orifice} = C_d A (2gh)^{1/2}$$

Type PLATE
Location MH1
Size 100 mm¹
Area 0.008 m²
C_d 0.62

Drainage Area 210 Orifice Calcs

	Elev. (m)	h (m)	Q (m ³ /s)
Inv.	88.60	0.00	-
MH TOP	92.05	3.45	-
2-yr W.L.	89.07	0.42	0.014
5-yr W.L.	89.26	0.61	0.017
10-yr W.L.	89.38	0.73	0.018
25-yr W.L.	89.66	1.01	0.022
50-yr W.L.	89.92	1.27	0.024
100-yr W.L.	90.15	1.50	0.026



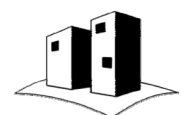
ORIFICE AND AVAILABLE STORAGE CALCULATIONS

$$Q_{orifice} = C_d A (2gh)^{1/2}$$

Type PLATE
Location MH1
Size 125 mm¹
Area 0.012 m²
C_d 0.62

Drainage Area 211 Orifice Calcs

	Elev. (m)	h (m)	Q (m ³ /s)
Inv.	83.50	0.00	-
Max Elev	87.60	4.10	-
2-yr W.L.	83.79	0.23	0.016
5-yr W.L.	83.88	0.32	0.019
10-yr W.L.	83.95	0.39	0.021
25-yr W.L.	84.08	0.52	0.024
50-yr W.L.	84.43	0.87	0.031
100-yr W.L.	84.55	0.99	0.033



EFFECTIVE TSS REMOVAL CALCULATIONS

ID 210 - TSS (Untreated) Removal Summary

Drainage Area	Surface Type	A (Ha)*	Removal Rate	Net for Treatment	Treatment Type	Rate	Effective Removal
210	Asphalt	0.289	0%	100%			0%
	Rooftops	0.210	90%	10%			90%
	Grass	0.336	100%	0%			100%
Total		0.835					63%

ID 210 - TSS (Treated) Removal Summary

Drainage Area	Surface Type	A (Ha)	Removal Rate	Net for Treatment	Treatment Type	Rate	Effective Removal
210	Asphalt	0.289	0%	100%	OGS	50%	50%
	Rooftops	0.210	90%	10%	OGS	50%	95%
	Grass	0.336	100%	0%	-	0%	100%
Total		0.835					81%

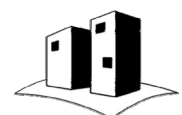
ID 211 - TSS (Untreated) Removal Summary

Drainage Area	Surface Type	A (Ha)*	Removal Rate	Net for Treatment	Treatment Type	Rate	Effective Removal
210	Asphalt	0.146	0%	100%			0%
	Rooftops	0.000	90%				
	Grass	0.083	100%	0%			100%
Total		0.712					12%

ID 211 - TSS (Treated) Removal Summary

Drainage Area	Surface Type	A (Ha)	Removal Rate	Net for Treatment	Treatment Type	Rate	Effective Removal
210	Asphalt	0.146	0%	100%	OGS	50%	50%
	Grass	0.083	100%	0%	-	50%	100%
Total		0.229					68%

* Captured area only



STAGE STORAGE CALCULATIONS

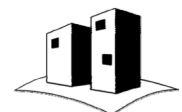
SWM Tank Specs	
WB Area	0.00
WB Invert	88.60
WB Weir Elev.	0.00
Area Above WB	147.00
Weir Area	0.00
Area Below Weir	147.00
Elev. Incr. (m)	0.01

SWM Tank Specs	
Tank Invert	88.60
MH Top	91.60
U/S Slab	1.00
Max W.L.	90.60
WB Vol. (m ³)	0.0

Notes:

Total Volume Calculation

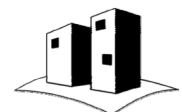
Water Elev. (m)	WB Vol. (m ³)	Active Vol. (m ³)	Inc. Vol. (m ³)	Tot. Vol. (m ³)
88.60	0.00	0.00	-	0.00
88.61	0.00	1.47	1.47	1.47
88.62	0.00	2.94	1.47	2.94
88.63	0.00	4.41	1.47	4.41
88.64	0.00	5.88	1.47	5.88
88.65	0.00	7.35	1.47	7.35
88.66	0.00	8.82	1.47	8.82
88.67	0.00	10.29	1.47	10.29
88.68	0.00	11.76	1.47	11.76
88.69	0.00	13.23	1.47	13.23
88.70	0.00	14.70	1.47	14.70
88.71	0.00	16.17	1.47	16.17
88.72	0.00	17.64	1.47	17.64
88.73	0.00	19.11	1.47	19.11
88.74	0.00	20.58	1.47	20.58
88.75	0.00	22.05	1.47	22.05
88.76	0.00	23.52	1.47	23.52
88.77	0.00	24.99	1.47	24.99
88.78	0.00	26.46	1.47	26.46
88.79	0.00	27.93	1.47	27.93
88.80	0.00	29.40	1.47	29.40
88.81	0.00	30.87	1.47	30.87
88.82	0.00	32.34	1.47	32.34
88.83	0.00	33.81	1.47	33.81
88.84	0.00	35.28	1.47	35.28
88.85	0.00	36.75	1.47	36.75
88.86	0.00	38.22	1.47	38.22
88.87	0.00	39.69	1.47	39.69
88.88	0.00	41.16	1.47	41.16
88.89	0.00	42.63	1.47	42.63
88.90	0.00	44.10	1.47	44.10
88.91	0.00	45.57	1.47	45.57



STAGE STORAGE CALCULATIONS

Total Volume Calculation

Water Elev. (m)	WB Vol. (m ³)	Active Vol. (m ³)	Inc. Vol. (m ³)	Tot. Vol. (m ³)
88.92	0.00	47.04	1.47	47.04
88.93	0.00	48.51	1.47	48.51
88.94	0.00	49.98	1.47	49.98
88.95	0.00	51.45	1.47	51.45
88.96	0.00	52.92	1.47	52.92
88.97	0.00	54.39	1.47	54.39
88.98	0.00	55.86	1.47	55.86
88.99	0.00	57.33	1.47	57.33
89.00	0.00	58.80	1.47	58.80
89.01	0.00	60.27	1.47	60.27
89.02	0.00	61.74	1.47	61.74
89.03	0.00	63.21	1.47	63.21
89.04	0.00	64.68	1.47	64.68
89.05	0.00	66.15	1.47	66.15
89.06	0.00	67.62	1.47	67.62
89.07	0.00	69.09	1.47	69.09
89.08	0.00	70.56	1.47	70.56
89.09	0.00	72.03	1.47	72.03
89.10	0.00	73.50	1.47	73.50
89.11	0.00	74.97	1.47	74.97
89.12	0.00	76.44	1.47	76.44
89.13	0.00	77.91	1.47	77.91
89.14	0.00	79.38	1.47	79.38
89.15	0.00	80.85	1.47	80.85
89.16	0.00	82.32	1.47	82.32
89.17	0.00	83.79	1.47	83.79
89.18	0.00	85.26	1.47	85.26
89.19	0.00	86.73	1.47	86.73
89.20	0.00	88.20	1.47	88.20
89.21	0.00	89.67	1.47	89.67
89.22	0.00	91.14	1.47	91.14
89.23	0.00	92.61	1.47	92.61
89.24	0.00	94.08	1.47	94.08
89.25	0.00	95.55	1.47	95.55
89.26	0.00	97.02	1.47	97.02
89.27	0.00	98.49	1.47	98.49
89.28	0.00	99.96	1.47	99.96
89.29	0.00	101.43	1.47	101.43
89.30	0.00	102.90	1.47	102.90
89.31	0.00	104.37	1.47	104.37
89.32	0.00	105.84	1.47	105.84
89.33	0.00	107.31	1.47	107.31
89.34	0.00	108.78	1.47	108.78



STAGE STORAGE CALCULATIONS

Total Volume Calculation

Water Elev. (m)	WB Vol. (m ³)	Active Vol. (m ³)	Inc. Vol. (m ³)	Tot. Vol. (m ³)
89.35	0.00	110.25	1.47	110.25
89.36	0.00	111.72	1.47	111.72
89.37	0.00	113.19	1.47	113.19
89.38	0.00	114.66	1.47	114.66
89.39	0.00	116.13	1.47	116.13
89.40	0.00	117.60	1.47	117.60
89.41	0.00	119.07	1.47	119.07
89.42	0.00	120.54	1.47	120.54
89.43	0.00	122.01	1.47	122.01
89.44	0.00	123.48	1.47	123.48
89.45	0.00	124.95	1.47	124.95
89.46	0.00	126.42	1.47	126.42
89.47	0.00	127.89	1.47	127.89
89.48	0.00	129.36	1.47	129.36
89.49	0.00	130.83	1.47	130.83
89.50	0.00	132.30	1.47	132.30
89.51	0.00	133.77	1.47	133.77
89.52	0.00	135.24	1.47	135.24
89.53	0.00	136.71	1.47	136.71
89.54	0.00	138.18	1.47	138.18
89.55	0.00	139.65	1.47	139.65
89.56	0.00	141.12	1.47	141.12
89.57	0.00	142.59	1.47	142.59
89.58	0.00	144.06	1.47	144.06
89.59	0.00	145.53	1.47	145.53
89.60	0.00	147.00	1.47	147.00
89.61	0.00	148.47	1.47	148.47
89.62	0.00	149.94	1.47	149.94
89.63	0.00	151.41	1.47	151.41
89.64	0.00	152.88	1.47	152.88
89.65	0.00	154.35	1.47	154.35
89.66	0.00	155.82	1.47	155.82
89.67	0.00	157.29	1.47	157.29
89.68	0.00	158.76	1.47	158.76
89.69	0.00	160.23	1.47	160.23
89.70	0.00	161.70	1.47	161.70
89.71	0.00	163.17	1.47	163.17
89.72	0.00	164.64	1.47	164.64
89.73	0.00	166.11	1.47	166.11
89.74	0.00	167.58	1.47	167.58
89.75	0.00	169.05	1.47	169.05
89.76	0.00	170.52	1.47	170.52
89.77	0.00	171.99	1.47	171.99



STAGE STORAGE CALCULATIONS

Total Volume Calculation

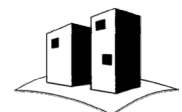
Water Elev. (m)	WB Vol. (m ³)	Active Vol. (m ³)	Inc. Vol. (m ³)	Tot. Vol. (m ³)
89.78	0.00	173.46	1.47	173.46
89.79	0.00	174.93	1.47	174.93
89.80	0.00	176.40	1.47	176.40
89.81	0.00	177.87	1.47	177.87
89.82	0.00	179.34	1.47	179.34
89.83	0.00	180.81	1.47	180.81
89.84	0.00	182.28	1.47	182.28
89.85	0.00	183.75	1.47	183.75
89.86	0.00	185.22	1.47	185.22
89.87	0.00	186.69	1.47	186.69
89.88	0.00	188.16	1.47	188.16
89.89	0.00	189.63	1.47	189.63
89.90	0.00	191.10	1.47	191.10
89.91	0.00	192.57	1.47	192.57
89.92	0.00	194.04	1.47	194.04
89.93	0.00	195.51	1.47	195.51
89.94	0.00	196.98	1.47	196.98
89.95	0.00	198.45	1.47	198.45
89.96	0.00	199.92	1.47	199.92
89.97	0.00	201.39	1.47	201.39
89.98	0.00	202.86	1.47	202.86
89.99	0.00	204.33	1.47	204.33
90.00	0.00	205.80	1.47	205.80
90.01	0.00	207.27	1.47	207.27
90.02	0.00	208.74	1.47	208.74
90.03	0.00	210.21	1.47	210.21
90.04	0.00	211.68	1.47	211.68
90.05	0.00	213.15	1.47	213.15
90.06	0.00	214.62	1.47	214.62
90.07	0.00	216.09	1.47	216.09
90.08	0.00	217.56	1.47	217.56
90.09	0.00	219.03	1.47	219.03
90.10	0.00	220.50	1.47	220.50
90.11	0.00	221.97	1.47	221.97
90.12	0.00	223.44	1.47	223.44
90.13	0.00	224.91	1.47	224.91
90.14	0.00	226.38	1.47	226.38
90.15	0.00	227.85	1.47	227.85
90.16	0.00	229.32	1.47	229.32
90.17	0.00	230.79	1.47	230.79
90.18	0.00	232.26	1.47	232.26
90.19	0.00	233.73	1.47	233.73
90.20	0.00	235.20	1.47	235.20



STAGE STORAGE CALCULATIONS

Total Volume Calculation

Water Elev. (m)	WB Vol. (m ³)	Active Vol. (m ³)	Inc. Vol. (m ³)	Tot. Vol. (m ³)
90.21	0.00	236.67	1.47	236.67
90.22	0.00	238.14	1.47	238.14
90.23	0.00	239.61	1.47	239.61
90.24	0.00	241.08	1.47	241.08
90.25	0.00	242.55	1.47	242.55
90.26	0.00	244.02	1.47	244.02
90.27	0.00	245.49	1.47	245.49
90.28	0.00	246.96	1.47	246.96
90.29	0.00	248.43	1.47	248.43
90.30	0.00	249.90	1.47	249.90
90.31	0.00	251.37	1.47	251.37
90.32	0.00	252.84	1.47	252.84
90.33	0.00	254.31	1.47	254.31
90.34	0.00	255.78	1.47	255.78
90.35	0.00	257.25	1.47	257.25
90.36	0.00	258.72	1.47	258.72
90.37	0.00	260.19	1.47	260.19
90.38	0.00	261.66	1.47	261.66
90.39	0.00	263.13	1.47	263.13
90.40	0.00	264.60	1.47	264.60
90.41	0.00	266.07	1.47	266.07
90.42	0.00	267.54	1.47	267.54
90.43	0.00	269.01	1.47	269.01
90.44	0.00	270.48	1.47	270.48
90.45	0.00	271.95	1.47	271.95
90.46	0.00	273.42	1.47	273.42
90.47	0.00	274.89	1.47	274.89
90.48	0.00	276.36	1.47	276.36
90.49	0.00	277.83	1.47	277.83
90.50	0.00	279.30	1.47	279.30
90.51	0.00	280.77	1.47	280.77
90.52	0.00	282.24	1.47	282.24
90.53	0.00	283.71	1.47	283.71
90.54	0.00	285.18	1.47	285.18
90.55	0.00	286.65	1.47	286.65
90.56	0.00	288.12	1.47	288.12
90.57	0.00	289.59	1.47	289.59
90.58	0.00	291.06	1.47	291.06
90.59	0.00	292.53	1.47	292.53
90.60	0.00	294.00	1.47	294.00



100-YEAR CAPTURE CALCULATIONS

IDF set: Bradford

Return Period	<i>a</i>	<i>T_c</i>	<i>b</i>	<i>c</i>
100-Year	47.000	10	0.000	0.699

Where:
$$I = \frac{a}{(t_c + b)^c}$$

Area 210 100-year flow

Drainage ID	Area (m ²)	Composite C	I (mm/hr)*	Q (L/s)
AD1 (TYP)	500	0.90	164.45	20.6

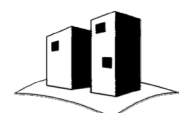
Where:
$$Q = \frac{CIA}{360}$$

$$Q_{orifice} = C_d A (2gh)^{1/2}$$

Type PLATE
Model Zurn Z662-HF
Grate Open Area (cm²) 665
1/2 Area* (m²) 0.033
C_d 0.62

Drainage ID	AD Elev. (m)	Max W.L.	h (m)	Q _{in} (L/s)
AD1 (Zurn Z662-HF)	91.60	91.90	0.30	50.0

* Assumes 50% blockage



FLOW DEPTH CALCULATION

-

EXT-1 DRAINAGE SWALE

CHANNEL CAPACITY CALCULATIONS

Flow Depth	0.17 m	Top width	1.3 m
Side Slope Ratio	3.0 /1		
Bottom width	0.30 m		
Area (A)	0.14 m ²	Hydraulic Radius (R)	0.100 m
Wetted Perimeter (Wp)	1.38 m	Friction Slope (S _f)	0.098 m/m
Slope (S)	9.80 %		
Manning (n)*	0.04		
Channel capacity (Q)	0.232 m ³ /s 232.4 L/s	Velocity (V)	1.7 m/s

Where: $Q = \frac{A * R^{2/3} * S^{1/2}}{n}$



FLOW DEPTH CALCULATION

-

EXT-2 DRAINAGE SWALE

CHANNEL CAPACITY CALCULATIONS

Flow Depth	0.17 m	Top width	0.8 m
Side Slope Ratio	3.0 /1		
Bottom width	0.30 m		
Area (A)	0.14 m ²	Hydraulic Radius (R)	0.100 m
Wetted Perimeter (Wp)	1.38 m	Friction Slope (S _f)	0.039 m/m
Slope (S)	3.90 %		
Manning (n)*	0.04		
Channel capacity (Q)	0.147 m ³ /s 146.6 L/s	Velocity (V)	1.1 m/s

Where: $Q = \frac{A * R^{2/3} * S^{1/2}}{n}$



EXTERNAL RUN-OFF CALCULATIONS

-

EXT-1

IDF set: Picton

Return Period	<i>a</i>	<i>T_c</i> *	<i>b</i>	<i>c</i>
2-Year	21.2	18.0	0.00	0.699
5-Year	28.2	18.0	0.00	0.699
100-Year	47.0	18.0	0.00	0.699

Where:
$$I = \frac{a}{(t_c + b)^c}$$

* Refer to Ext. *I_c* calculations

External Runoff Volume

Return Period	Area (Ha)	Composite C	<i>I</i> (mm/hr)*	<i>Q</i> (L/s)
2-Year	0.80	0.30	49.18	32.7
5-Year	0.80	0.30	65.42	43.6
100-Year	0.80	0.38	109.04	90.8

Where:
$$Q = \frac{CIA}{360}$$



**EXTERNAL RUN-OFF
CALCULATIONS**

-

EXT-2

IDF set: Picton

Return Period	<i>a</i>	<i>T_c</i> *	<i>b</i>	<i>c</i>
2-Year	21.2	19.7	0.00	0.699
5-Year	28.2	19.7	0.00	0.699
100-Year	47.0	19.7	0.00	0.699

Where:
$$I = \frac{a}{(t_c + b)^c}$$

* Refer to Ext. *I_c* calculations

External Runoff Volume

Return Period	Area (Ha)	Composite C	<i>I</i> (mm/hr)*	<i>Q</i> (L/s)
2-Year	1.01	0.30	46.18	38.9
5-Year	1.01	0.30	61.42	51.7
100-Year	1.01	0.38	102.37	107.7

Where:
$$Q = \frac{CIA}{360}$$



**INITIAL T_c CALCULATIONS
(AIRPORT METHOD)**

Drainage ID	EXT-1
k	3.26
Length (L)	244
Runoff coefficient (C)	0.3
Upstream elevation (m)	125.0
downstream elevation (m)	96.0
Elevation change (m)	29.0
Slope (S)	11.9%
T _c (min.)	18.0

Drainage ID	EXT-2
k	3.26
Length (L)	280
Runoff coefficient (C)	0.3
Upstream elevation (m)	125.0
downstream elevation (m)	94.0
Elevation change (m)	31.0
Slope (S)	11.1%
T _c (min.)	19.7

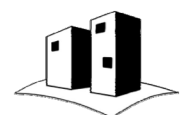
Where: $t_c = \frac{k(1.1 - C)L^{0.5}}{S^{0.33}}$



ROAD SIDE DITCH CAPACITY AND FLOW DEPTH CALCULATION

ROAD-SIDE DITCH CAPACITY CALCULATIONS			
Flow Depth	0.27 m	Top width	1.9 m
Side Slope Ratio	3.0 /1		
Bottom width	0.30 m		
Area (A)	0.30 m ²	Hydraulic Radius (R)	0.149 m
Wetted Perimeter (Wp)	2.01 m	Friction Slope (S _f)	0.037 m/m
Slope (S)	3.68 %		
Manning (n)*	0.025		
Channel capacity (Q)	0.647 m ³ /s	Velocity (V)	2.2 m/s

Where: $Q = \frac{A * R^{2/3} * S^{1/2}}{n}$



Calculating Capacity and Velocity

					n=0.024 g=9.81 % Increment 0.02					
	6 in 152.4 150mm		8 in 203.2 200mm		10 in 254 250mm		12 in 304.8 300mm		15 in 381 375mm	
Slope (%)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)	Q (m ³ /s)	V (m/s)
3.18	0.0153	0.8413	0.0331	1.0192	0.0599	1.1826	0.0974	1.3355	0.1767	1.5497
3.20	0.0154	0.8439	0.0332	1.0224	0.0601	1.1864	0.0978	1.3397	0.1772	1.5546
3.22	0.0154	0.8466	0.0333	1.0256	0.0603	1.1901	0.0981	1.3439	0.1778	1.5594
3.24	0.0155	0.8492	0.0334	1.0287	0.0605	1.1937	0.0984	1.3480	0.1783	1.5642
3.26	0.0155	0.8518	0.0335	1.0319	0.0607	1.1974	0.0987	1.3522	0.1789	1.5691
3.28	0.0156	0.8544	0.0336	1.0351	0.0609	1.2011	0.0990	1.3563	0.1794	1.5739
3.30	0.0156	0.8570	0.0337	1.0382	0.0610	1.2047	0.0993	1.3604	0.1800	1.5787
3.32	0.0157	0.8596	0.0338	1.0414	0.0612	1.2084	0.0996	1.3646	0.1805	1.5834
3.34	0.0157	0.8622	0.0339	1.0445	0.0614	1.2120	0.0999	1.3687	0.1811	1.5882
3.36	0.0158	0.8648	0.0340	1.0476	0.0616	1.2156	0.1002	1.3728	0.1816	1.5929
3.38	0.0158	0.8674	0.0341	1.0507	0.0618	1.2193	0.1005	1.3768	0.1822	1.5977
3.40	0.0159	0.8699	0.0342	1.0538	0.0620	1.2229	0.1008	1.3809	0.1827	1.6024
3.42	0.0159	0.8725	0.0343	1.0569	0.0621	1.2265	0.1011	1.3850	0.1832	1.6071
3.44	0.0160	0.8750	0.0344	1.0600	0.0623	1.2300	0.1014	1.3890	0.1838	1.6118
3.46	0.0160	0.8776	0.0345	1.0631	0.0625	1.2336	0.1016	1.3930	0.1843	1.6165
3.48	0.0161	0.8801	0.0346	1.0662	0.0627	1.2372	0.1019	1.3971	0.1848	1.6211
3.50	0.0161	0.8826	0.0347	1.0692	0.0629	1.2407	0.1022	1.4011	0.1854	1.6258
3.52	0.0161	0.8851	0.0348	1.0723	0.0630	1.2443	0.1025	1.4051	0.1859	1.6304
3.54	0.0162	0.8876	0.0349	1.0753	0.0632	1.2478	0.1028	1.4091	0.1864	1.6351
3.56	0.0162	0.8902	0.0350	1.0783	0.0634	1.2513	0.1031	1.4130	0.1869	1.6397
3.58	0.0163	0.8926	0.0351	1.0814	0.0636	1.2548	0.1034	1.4170	0.1875	1.6443
3.60	0.0163	0.8951	0.0352	1.0844	0.0638	1.2583	0.1037	1.4209	0.1880	1.6489
3.62	0.0164	0.8976	0.0353	1.0874	0.0639	1.2618	0.1040	1.4249	0.1885	1.6534
3.64	0.0164	0.9001	0.0354	1.0904	0.0641	1.2653	0.1043	1.4288	0.1890	1.6580
3.66	0.0165	0.9026	0.0355	1.0934	0.0643	1.2688	0.1045	1.4327	0.1895	1.6625
3.68	0.0165	0.9050	0.0356	1.0964	0.0645	1.2722	0.1048	1.4366	0.1901	1.6671
3.70	0.0166	0.9075	0.0357	1.0993	0.0646	1.2757	0.1051	1.4405	0.1906	1.6716
3.72	0.0166	0.9099	0.0357	1.1023	0.0648	1.2791	0.1054	1.4444	0.1911	1.6761
3.74	0.0166	0.9124	0.0358	1.1053	0.0650	1.2825	0.1057	1.4483	0.1916	1.6806
3.76	0.0167	0.9148	0.0359	1.1082	0.0652	1.2860	0.1060	1.4522	0.1921	1.6851
3.78	0.0167	0.9172	0.0360	1.1112	0.0653	1.2894	0.1062	1.4560	0.1926	1.6896

Corrugated Steel Pipe—Manning's "n" Value

All Diameters		Helical* Corrugation								
		1-1/2" x 1/4"		Helical—2-2/3" x 1/2" 60 in.						
2-2/3" x 1/2"	Annular	8 in.	10 in.	12 in.	15 in.	18 in.	24 in.	36 in.	48 in.	and Larger
Unpaved	0.024	0.012	0.014	0.011	0.012	0.013	0.015	0.018	0.020	0.021
PAVED-INVERT	0.021						0.014	0.017	0.020	0.019
SMOOTH-FLO	0.012						0.012	0.012	0.012	0.012
HEL-COR CL	0.012						0.012	0.012	0.012	0.012
SmoothCor	N/A					0.012	0.012	0.012	0.012	0.012
3" x 1"		Helical*—3" x 1"								
				36 in.	42 in.	48 in.	54 in.	60 in.	66 in.	72 in. and Larger
Unpaved	0.027			0.022	0.022	0.023	0.023	0.024	0.025	0.027
PAVED-INVERT	0.023			0.019	0.019	0.020	0.020	0.021	0.022	0.023
SMOOTH-FLO	0.012					0.012	0.012	0.012	0.012	0.012
HEL-COR CL	0.012					0.012	0.012	0.012	0.012	0.012
SmoothCor	N/A					0.012	0.012	0.012	0.012	0.012
5" x 1"		Helical*—5" x 1"								
						48 in.	54 in.	60 in.	66 in.	72 in. and Larger
Unpaved	0.025					0.022	0.022	0.023	0.024	0.025
PAVED-INVERT	0.022					0.019	0.019	0.020	0.021	0.022
SMOOTH-FLO	0.012							0.012	0.012	0.012
HEL-COR CL	0.012							0.012	0.012	0.012
ULTRA-FLO		3/4" x 3/4" x 7-1/2" All diameters n = 0.012								

*Tests on helically corrugated pipe demonstrate a lower coefficient of roughness than for annually corrugated steel pipe. Pipe-arches approximately have the same roughness characteristics as their equivalent round pipes.

ADS OGS Sizing Summary

Project Name:	Nicholas Apartments (Nicholas St Outlet)		
Consulting Engineer:	Siteplantech		
Location:	Picton, ON		
Sizing Completed By:	Steve Buckley	Email:	steve.buckley@adspipe.com

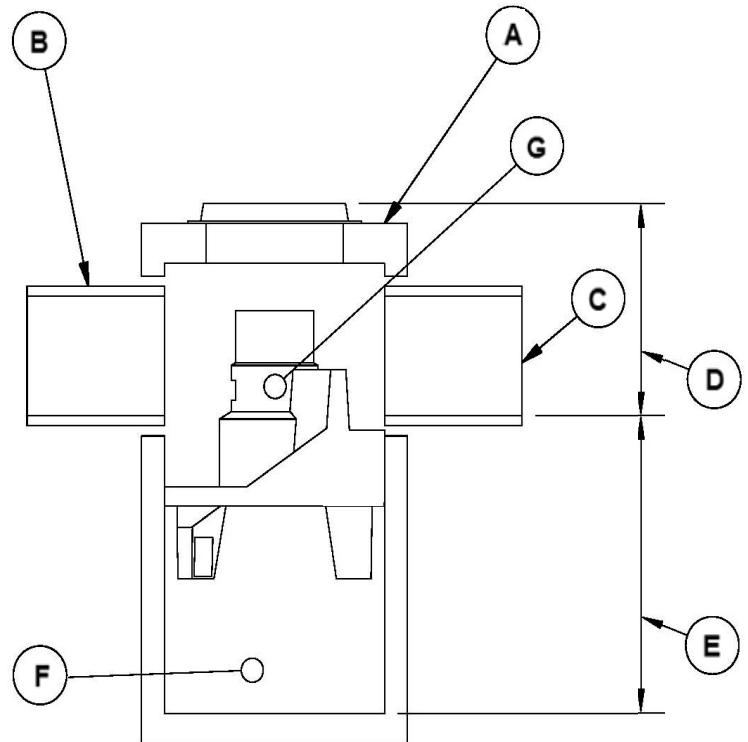
Treatment Requirements		
Treatment Goal:	Enhanced (MOE)	
Selected Parameters:	80% TSS	90% Volume
Selected Unit:	FD-4HC	

Site Details	
Site Area:	0.819 ha
% Impervious:	---
Rational C:	0.65
Rainfall Station:	Belleville, ONT
Particle Size Distribution:	Fine
Peak Flowrate:	---

Summary of Results		
Model	TSS Removal	Volume Treated
FD-4HC	89.0%	>90%
FD-5HC	92.0%	>90%
FD-6HC	94.0%	>90%
FD-8HC	97.0%	>90%
FD-10HC	98.0%	>90%

FD-4HC Specification	
Unit Diameter (A):	1,200 mm
Inlet Pipe Diameter (B):	450 mm
Outlet Pipe Diameter (C):	450 mm
Height, T/G to Outlet Invert (D):	1910 mm
Height, Outlet Invert to Sump (E):	1515 mm
Sediment Storage Capacity (F):	0.5 m ³
Oil Storage Capacity (G):	723 L
Max. Pipe Diameter:	600 mm
Peak Flow Capacity:	510 L/s

Site Elevations:	
Rim Elevation:	91.73
Inlet Pipe Elevation:	89.82
Outlet Pipe Elevation:	89.82



Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.



Project Name: Nicholas Apartments (Nicholas St Outlet)
 Consulting Engineer: Siteplantech
 Location: Picton, ON

Net Annual Removal Efficiency Summary: FD-4HC

Rainfall Intensity ⁽¹⁾	Fraction of Rainfall ⁽¹⁾	FD-4HC Removal Efficiency ⁽²⁾	Weighted Net-Annual Removal Efficiency
mm/hr	%	%	%
0.50	0.4%	100.0%	0.4%
1.00	13.2%	100.0%	13.2%
1.50	14.0%	96.5%	13.5%
2.00	14.0%	94.0%	13.1%
2.50	3.6%	92.1%	3.3%
3.00	2.5%	90.5%	2.3%
3.50	8.4%	89.2%	7.5%
4.00	5.1%	88.1%	4.5%
4.50	1.6%	87.2%	1.4%
5.00	5.1%	86.3%	4.4%
6.00	4.8%	84.9%	4.1%
7.00	4.5%	83.7%	3.8%
8.00	3.5%	82.6%	2.9%
9.00	2.4%	81.7%	2.0%
10.00	2.5%	80.9%	2.0%
20.00	9.7%	75.9%	7.3%
30.00	2.8%	73.1%	2.0%
40.00	0.9%	71.1%	0.7%
50.00	0.4%	69.7%	0.3%
100.00	0.6%	65.3%	0.4%
150.00	0.1%	62.9%	0.0%
200.00	0.0%	61.3%	0.0%
Total Net Annual Removal Efficiency:			89.0%
Total Runoff Volume Treated:			99.9%

Notes:

- (1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.
- (2) Based on third party verified data and approximating the removal of a PSD similar to the STC Fine distribution
- (3) Rainfall adjusted to 5 min peak intensity based on hourly average.

ADS OGS Sizing Summary

Project Name:	Nicholas Apartments (West Outlet)
Consulting Engineer:	Siteplantech
Location:	Picton, ON
Sizing Completed By:	Steve Buckley
Email:	steve.buckley@adspipe.com

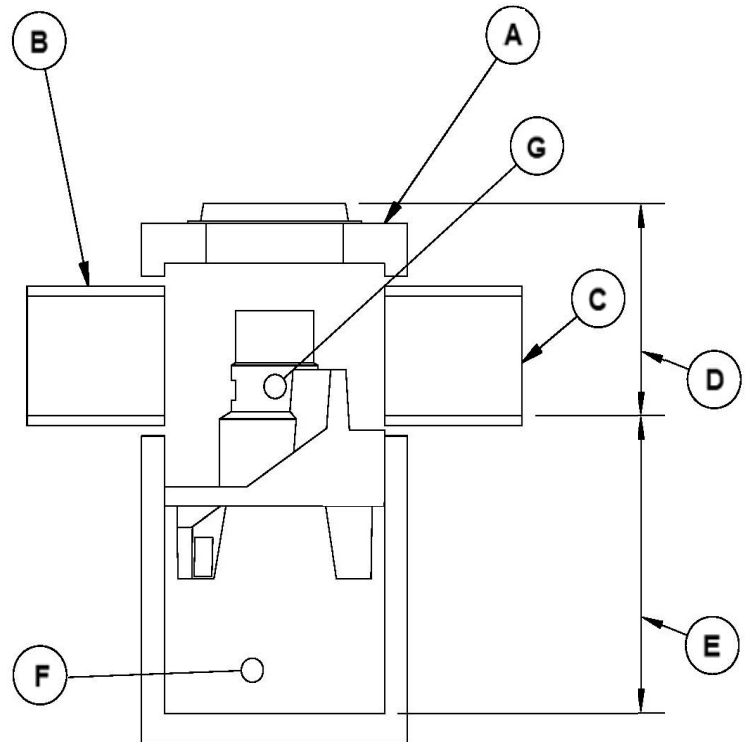
Treatment Requirements		
Treatment Goal:	Enhanced (MOE)	
Selected Parameters:	80% TSS	90% Volume
Selected Unit:	FD-4HC	

Site Details	
Site Area:	0.242 ha
% Impervious:	---
Rational C:	0.90
Rainfall Station:	Belleville, ONT
Particle Size Distribution:	Fine
Peak Flowrate:	---

Summary of Results		
Model	TSS Removal	Volume Treated
FD-4HC	95.0%	>90%
FD-5HC	97.0%	>90%
FD-6HC	98.0%	>90%
FD-8HC	99.0%	>90%
FD-10HC	99.0%	>90%

FD-4HC Specification	
Unit Diameter (A):	1,200 mm
Inlet Pipe Diameter (B):	300 mm
Outlet Pipe Diameter (C):	300 mm
Height, T/G to Outlet Invert (D):	1950 mm
Height, Outlet Invert to Sump (E):	1515 mm
Sediment Storage Capacity (F):	0.5 m ³
Oil Storage Capacity (G):	723 L
Max. Pipe Diameter:	600 mm
Peak Flow Capacity:	510 L/s

Site Elevations:	
Rim Elevation:	87.25
Inlet Pipe Elevation:	85.30
Outlet Pipe Elevation:	85.30



Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.



Project Name: Nicholas Apartments (West Outlet)
 Consulting Engineer: Siteplantech
 Location: Picton, ON

Net Annual Removal Efficiency Summary: FD-4HC

Rainfall Intensity ⁽¹⁾	Fraction of Rainfall ⁽¹⁾	FD-4HC Removal Efficiency ⁽²⁾	Weighted Net-Annual Removal Efficiency
mm/hr	%	%	%
0.50	0.4%	100.0%	0.4%
1.00	13.2%	100.0%	13.2%
1.50	14.0%	100.0%	14.0%
2.00	14.0%	100.0%	14.0%
2.50	3.6%	100.0%	3.6%
3.00	2.5%	98.4%	2.5%
3.50	8.4%	97.0%	8.2%
4.00	5.1%	95.8%	4.9%
4.50	1.6%	94.7%	1.5%
5.00	5.1%	93.8%	4.7%
6.00	4.8%	92.2%	4.4%
7.00	4.5%	90.9%	4.1%
8.00	3.5%	89.8%	3.2%
9.00	2.4%	88.8%	2.2%
10.00	2.5%	88.0%	2.2%
20.00	9.7%	82.5%	8.0%
30.00	2.8%	79.4%	2.2%
40.00	0.9%	77.3%	0.7%
50.00	0.4%	75.7%	0.3%
100.00	0.6%	71.0%	0.4%
150.00	0.1%	68.4%	0.1%
200.00	0.0%	66.6%	0.0%
Total Net Annual Removal Efficiency:			95.0%
Total Runoff Volume Treated:			99.9%

Notes:

- (1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.
- (2) Based on third party verified data and approximating the removal of a PSD similar to the STC Fine distribution
- (3) Rainfall adjusted to 5 min peak intensity based on hourly average.



ADS Isolator Row PLUS Sizing

Project Name:	Nicholas Street Apartments (West Outlet)
Consulting Engineer:	Siteplantech
Location:	Pictou, ON
Sizing Completed By:	Steve Buckley
Email:	steve.buckley@adspipe.com

Stormtech Details	
Chamber Model	DC-780
No. Chamber in Isolator Row PLUS:	6
Isolator Row PLUS TSS Removal:	81.0%
Volume Treated by Isolator Row Plus:	100.0%

Site Details	
Site Area (ha):	0.242
Rational C:	0.90
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Notes: Refer to Stormtech drawings for full IR+ configuration.

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency IR PLUS	IR+ % Volume Treated
mm/hr	%	%	%
0.50	0.4%	81.2%	0.4%
1.00	13.2%	81.2%	13.2%
1.50	14.0%	81.2%	14.0%
2.00	14.0%	81.2%	14.0%
2.50	3.6%	81.2%	3.6%
3.00	2.5%	81.2%	2.5%
3.50	8.4%	81.2%	8.4%
4.00	5.1%	81.2%	5.1%
4.50	1.6%	81.2%	1.6%
5.00	5.1%	81.2%	5.1%
6.00	4.8%	81.2%	4.8%
7.00	4.5%	81.2%	4.5%
8.00	3.5%	81.2%	3.5%
9.00	2.4%	81.2%	2.4%
10.00	2.5%	81.2%	2.5%
20.00	9.7%	81.2%	9.7%
30.00	2.8%	81.2%	2.8%
40.00	0.9%	81.2%	0.9%
50.00	0.4%	81.2%	0.4%
100.00	0.6%	58.4%	0.4%
150.00	0.1%	38.9%	0.0%
200.00	0.0%	0.0%	0.0%
		Total Net Annual Removal Efficiency	81.0%
		Total Runoff Volume Treated	100.0%

Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

(1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certified

(3) Rainfall adjusted to 5 min peak intensity based on hourly average.



ADS Treatment Train Sizing

Project Name:	Nicholas Apartments (West Outlet)		
Consulting Engineer:	Siteplantech		
Location:	Picton, ON		
Sizing Completed By:	Steve Buckley	Email:	steve.buckley@adspipe.com

Summary of Results	
Isolator Row PLUS TSS Removal:	81.0%
FD-4HC TSS Removal:	50.0%
Combined TSS Removal:	90.3%
Total Volume Treated:	99.9%

Individual OGS Results		
Model	TSS Removal	Volume Treated
FD-4HC	50.0%	>90%
FD-5HC	60.0%	>90%
FD-6HC	63.0%	>90%
FD-8HC	67.0%	>90%
FD-10HC	70.0%	>90%

Overall System Capacities	
Total Sediment Storage Capacity (m3):	0.78
Oil Storage Capacity:	723 L
Max. OGS Pipe Diameter:	600 mm
Peak OGS Flow Capacity:	596 L/s
Peak Stormtech Inlet Flow Capacity:	---
Peak IR PLUS Water Quality Flow:	43.1 L/s

OGS Specifications	
Inlet Pipe Diameter (A):	300 mm
Unit Diameter (B):	1,200 mm
Outlet Pipe Diameter (C):	300 mm
Rim Elevation (D):	87.25 m
Bottom of Sump Elevation (E):	83.80 m
Inlet Pipe Elevation (F):	85.30 m
Outlet Pipe Elevation (G):	85.30 m

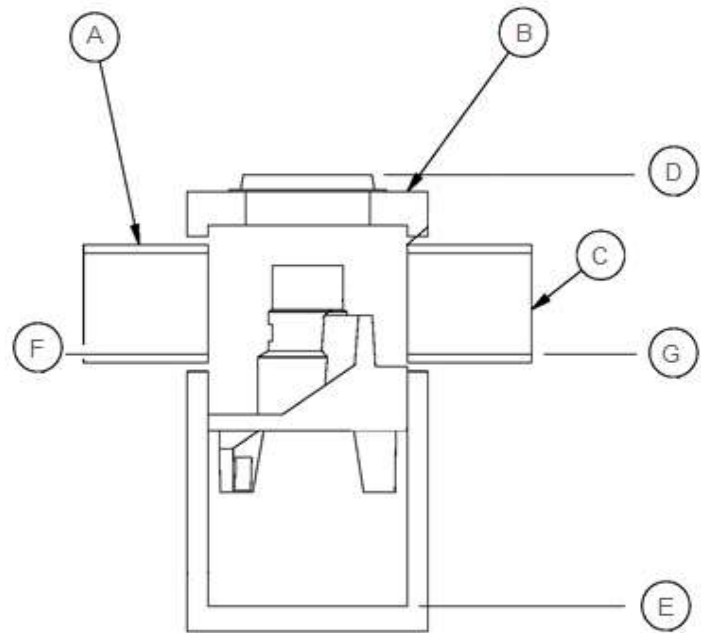
Site Details	
Site Area (ha):	0.242
Rational C:	0.9
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Notes: OGS results based on ETV PSD and results from ETV testing protocols.

Stormtech Details	
Chamber Model:	DC-780
No. Chambers in Isolator Row PLUS:	6
Volume Treated by Isolator Row PLUS:	99.8%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Isolator Row PLUS must include Flared End Ramp (FLAMP) for proper performance.



Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.



Project Name: Nicholas Apartments (West Outlet)
 Consulting Engineer: Siteplantech
 Location: Picton, ON

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency		Combined Removal Efficiency	Combined Weighted Removal Efficiency
		FD-4HC	IR PLUS ⁽²⁾		
mm/hr	%	%	%	%	%
0.50	0.4%	50.0%	81.2%	90.6%	0.4%
1.00	13.2%	50.0%	81.2%	90.6%	12.0%
1.50	14.0%	50.0%	81.2%	90.6%	12.6%
2.00	14.0%	50.0%	81.2%	90.6%	12.6%
2.50	3.6%	50.0%	81.2%	90.6%	3.2%
3.00	2.5%	50.0%	81.2%	90.6%	2.3%
3.50	8.4%	50.0%	81.2%	90.6%	7.6%
4.00	5.1%	50.0%	81.2%	90.6%	4.6%
4.50	1.6%	50.0%	81.2%	90.6%	1.4%
5.00	5.1%	50.0%	81.2%	90.6%	4.6%
6.00	4.8%	50.0%	81.2%	90.6%	4.3%
7.00	4.5%	50.0%	81.2%	90.6%	4.1%
8.00	3.5%	50.0%	81.2%	90.6%	3.2%
9.00	2.4%	50.0%	81.2%	90.6%	2.2%
10.00	2.5%	49.9%	81.2%	90.6%	2.3%
20.00	9.7%	44.9%	81.2%	89.6%	8.7%
30.00	2.8%	42.0%	81.2%	89.1%	2.5%
40.00	0.9%	39.9%	81.2%	88.7%	0.8%
50.00	0.4%	38.3%	81.2%	88.4%	0.4%
100.00	0.6%	33.3%	57.8%	71.9%	0.4%
150.00	0.1%	30.4%	38.5%	57.2%	0.0%
200.00	0.0%	28.3%	28.9%	49.0%	0.0%
Total Net Annual Removal Efficiency					90.3%
Total Runoff Volume Treated					99.9%

Notes:

- (1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.
- (2) IR PLUS removal based on ETV PSD and ETV protocols.
- (3)
- (4) Combined removal efficiencies calculated based on NCDENR Stormwater BMP Manual, Section 3.9.4, where Total Removal Efficiency = 1st BMP Efficiency + 2nd BMP Efficiency - (1st BMP Efficiency x 2nd BMP Efficiency)

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	



0 NICHOLAS

PICTON, ON, CANADA

DC-780 STORMTECH CHAMBER SPECIFICATIONS

- CHAMBERS SHALL BE STORMTECH DC-780.
- CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
- CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
- THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
- CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
- REQUIREMENTS FOR HANDLING AND INSTALLATION:
 - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
 - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
 - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
- ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
 - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
 - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
 - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
- CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE. DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- ADS DOES NOT DESIGN OR PROVIDE MEMBRANE LINER SYSTEMS. TO MINIMIZE THE LEAKAGE POTENTIAL OF LINER SYSTEMS, THE MEMBRANE LINER SYSTEM SHOULD BE DESIGNED BY A KNOWLEDGEABLE GEOTEXTILE PROFESSIONAL AND INSTALLED BY A QUALIFIED CONTRACTOR.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE DC-780 CHAMBER SYSTEM

- STORMTECH DC-780 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
- STORMTECH DC-780 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
- CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
 - STONESHOOTER LOCATED OFF THE CHAMBER BED.
 - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
 - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
- THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
- JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
- MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
- EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE; AASHTO M43 #3, 357, 4, 467, 5, 56, OR 57.
- THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
- ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

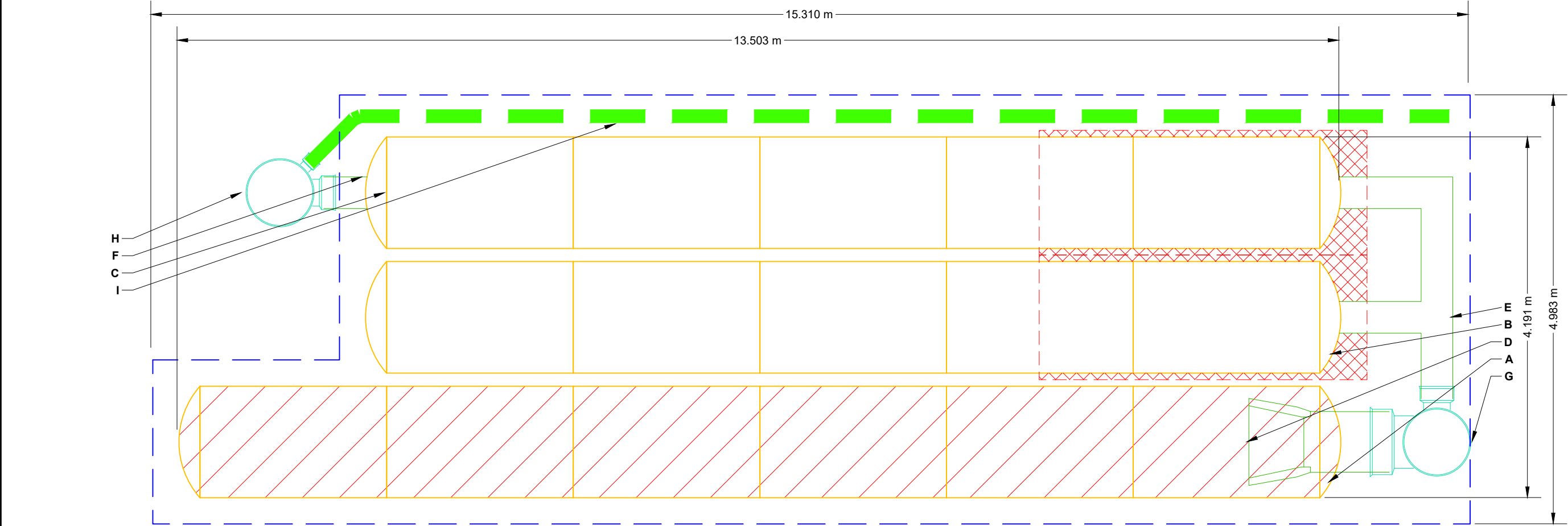
NOTES FOR CONSTRUCTION EQUIPMENT

- STORMTECH DC-780 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
- THE USE OF CONSTRUCTION EQUIPMENT OVER DC-780 CHAMBERS IS LIMITED:
 - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
 - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
 - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
- FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

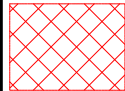
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-800-821-6710 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		PROPOSED ELEVATIONS		*INVERT ABOVE BASE OF CHAMBER				
				PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
16	STORMTECH DC-780 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	88.148					
6	STORMTECH DC-780 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	85.100	PREFABRICATED EZ END CAP	A	600 mm BOTTOM PREFABRICATED EZ END CAP, PART#: SC740ECEZ / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	3 mm	
152	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	84.948	PRE-CORED END CAP	B	300 mm TOP PRE-CORED END CAP, PART#: SC740EPE12TPC / TYP OF ALL 300 mm TOP CONNECTIONS	317 mm	
229	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	84.948	PRE-CORED END CAP	C	300 mm BOTTOM PRE-CORED END CAP, PART#: SC740EPE12BPC / TYP OF ALL 300 mm BOTTOM CONNECTIONS	30 mm	
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	84.948	FLAMP	D	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: SC80024RAMP		
44.7	INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	84.643	MANIFOLD	E	300 mm x 300 mm TOP MANIFOLD, ADS N-12	318 mm	
		TOP OF DC-780 CHAMBER:	84.491	PIPE CONNECTION	F	300 mm BOTTOM CONNECTION	30 mm	
		300 mm x 300 mm TOP MANIFOLD INVERT:	84.046					
69.6	SYSTEM AREA (m²)	300 mm BOTTOM CONNECTION INVERT:	83.759	NYLOPLAST (INLET W/ ISO PLUS ROW)	G	750 mm DIAMETER (610 mm SUMP MIN)		98 L/s IN
40.6	SYSTEM PERIMETER (m)	600 mm ISOLATOR ROW PLUS INVERT:	83.731	NYLOPLAST (OUTLET)	H	750 mm DIAMETER (DESIGN BY ENGINEER)		57 L/s OUT
		BOTTOM OF DC-780 CHAMBER:	83.729	UNDERDRAIN	I	150 mm ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		
		UNDERDRAIN INVERT:	83.500					
		BOTTOM OF STONE:	83.500					



- 

ISOLATOR ROW PLUS
(SEE DETAIL)
- 

PLACE MINIMUM 3.810 m OF ADSPLUS625 WOVEN GEOTEXTILE OVER
BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR
PROTECTION AT ALL CHAMBER INLET ROWS

 BED LIMITS

- NOTES
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
 - NOT FOR CONSTRUCTION: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

0 NICHOLAS

PICTON, ON, CANADA

DATE: 10/20/2025

PROJECT #:

DRAWN: PM

CHECKED: N/A

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Chamber System

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ADS

SCALE = 1 : 50

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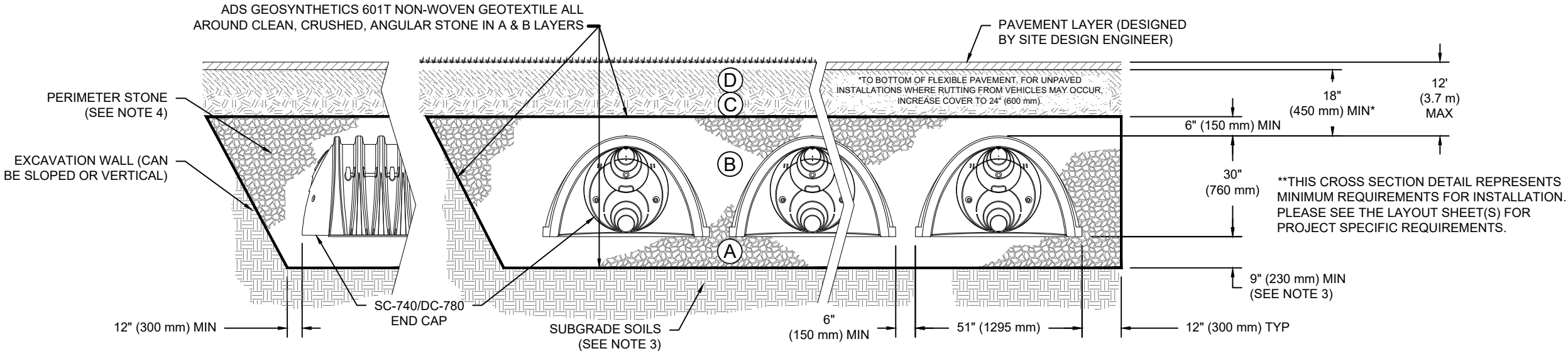
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ACCEPTABLE FILL MATERIALS: STORMTECH DC-780 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	FINAL FILL: FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	INITIAL FILL: FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145 ¹ A-1, A-2-4, A-3 OR AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	EMBEDMENT STONE: FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	FOUNDATION STONE: FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. ^{2,3}

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. DC-780 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
 - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
 - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
 - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

O NICHOLAS

PICTON, ON, CANADA

DATE: 10/20/2025

PROJECT #:

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3 OF 6

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1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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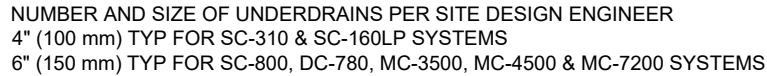
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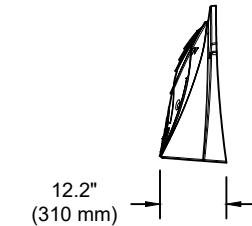
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SIZE (W X H X INSTALLED LENGTH)
CHAMBER STORAGE
MINIMUM INSTALLED STORAGE*
WEIGHT

51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
46.2 CUBIC FEET	(1.30 m ³)
78.4 CUBIC FEET	(2.20 m ³)
75.0 lbs.	(33.6 kg)

SIZE (W X H X INSTALLED LENGTH)	END CAP STORAGE	MINIMUM INSTALLED STORAGE**	WEIGHT
12" X 12" X 12"	1	1	1
12" X 12" X 24"	2	2	2
12" X 12" X 36"	3	3	3
12" X 12" X 48"	4	4	4
12" X 12" X 60"	5	5	5
12" X 12" X 72"	6	6	6
12" X 12" X 84"	7	7	7
12" X 12" X 96"	8	8	8
12" X 12" X 108"	9	9	9
12" X 12" X 120"	10	10	10
12" X 12" X 132"	11	11	11
12" X 12" X 144"	12	12	12
12" X 12" X 156"	13	13	13
12" X 12" X 168"	14	14	14
12" X 12" X 180"	15	15	15
12" X 12" X 192"	16	16	16
12" X 12" X 204"	17	17	17
12" X 12" X 216"	18	18	18
12" X 12" X 228"	19	19	19
12" X 12" X 240"	20	20	20
12" X 12" X 252"	21	21	21
12" X 12" X 264"	22	22	22
12" X 12" X 276"	23	23	23
12" X 12" X 288"	24	24	24
12" X 12" X 300"	25	25	25
12" X 12" X 312"	26	26	26
12" X 12" X 324"	27	27	27
12" X 12" X 336"	28	28	28
12" X 12" X 348"	29	29	29
12" X 12" X 360"	30	30	30
12" X 12" X 372"	31	31	31
12" X 12" X 384"	32	32	32
12" X 12" X 396"	33	33	33
12" X 12" X 408"	34	34	34
12" X 12" X 420"	35	35	35
12" X 12" X 432"	36	36	36
12" X 12" X 444"	37	37	37
12" X 12" X 456"	38	38	38
12" X 12" X 468"	39	39	39
12" X 12" X 480"	40	40	40
12" X 12" X 492"	41	41	41
12" X 12" X 504"	42	42	42
12" X 12" X 516"	43	43	43
12" X 12" X 528"	44	44	44
12" X 12" X 540"	45	45	45
12" X 12" X 552"	46	46	46
12" X 12" X 564"	47	47	47
12" X 12" X 576"	48	48	48
12" X 12" X 588"	49	49	49
12" X 12" X 600"	50	50	50
12" X 12" X 612"	51	51	51
12" X 12" X 624"	52	52	52
12" X 12" X 636"	53	53	53
12" X 12" X 648"	54	54	54
12" X 12" X 660"	55	55	55
12" X 12" X 672"	56	56	56
12" X 12" X 684"	57	57	57
12" X 12" X 696"	58	58	58
12" X 12" X 708"	59	59	59
12" X 12" X 720"	60	60	60
12" X 12" X 732"	61	61	61
12" X 12" X 744"	62	62	62
12" X 12" X 756"	63	63	63
12" X 12" X 768"	64	64	64
12" X 12" X 780"	65	65	65
12" X 12" X 792"	66	66	66
12" X 12" X 804"	67	67	67
12" X 12" X 816"	68	68	68
12" X 12" X 828"	69	69	69
12" X 12" X 840"	70	70	70
12" X 12" X 852"	71	71	71
12" X 12" X 864"	72	72	72
12" X 12" X 876"	73	73	73
12" X 12" X 888"	74	74	74
12" X 12" X 900"	75	75	75
12" X 12" X 912"	76	76	76
12" X 12" X 924"	77	77	77
12" X 12" X 936"	78	78	78
12" X 12" X 948"	79	79	79
12" X 12" X 960"	80	80	80
12" X 12" X 972"	81	81	81
12" X 12" X			

45.9" X 29.3" X 9.6"	(1166 mm X 744 mm X 244 mm)
2.6 CUBIC FEET	(0.07 m³)
14.4 CUBIC FEET	(0.40 m³)
11.7 lbs.	(5.3 kg)

**ASSUMES 6" (152 mm) STONE ABOVE, 9" (229 mm) BELOW END CAPS, 6" (152 mm) BETWEEN ROWS, 12" (305 mm) BEYOND END CAPS

Figure 1 consists of two schematic diagrams, A and B, illustrating the experimental setup. Diagram A shows a top-down view of a subject sitting at a table, looking at a screen. A target (B) is located on the screen, and a starting point (C) is marked on the table surface. Diagram B shows a side view of the target (B) and the starting point (C) relative to the table surface, indicating the vertical displacement of the target.

* FOR THE SC740ECEZ THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

0 NICHOLAS

20/2025	PICTION, ON, CANADA	DRAWN: DM
---------	---------------------	-----------

DATE: 10/20/2023	DRAWN: PM
PROJECT //	QUEVEDO //

PROJECT #:	CHECKED: N/A
------------	--------------

WITHOUT THE EOR'S PRIOR APPROVAL, EOR SHALL REVIEW THIS DRAWING PRIOR TO BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE EOR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

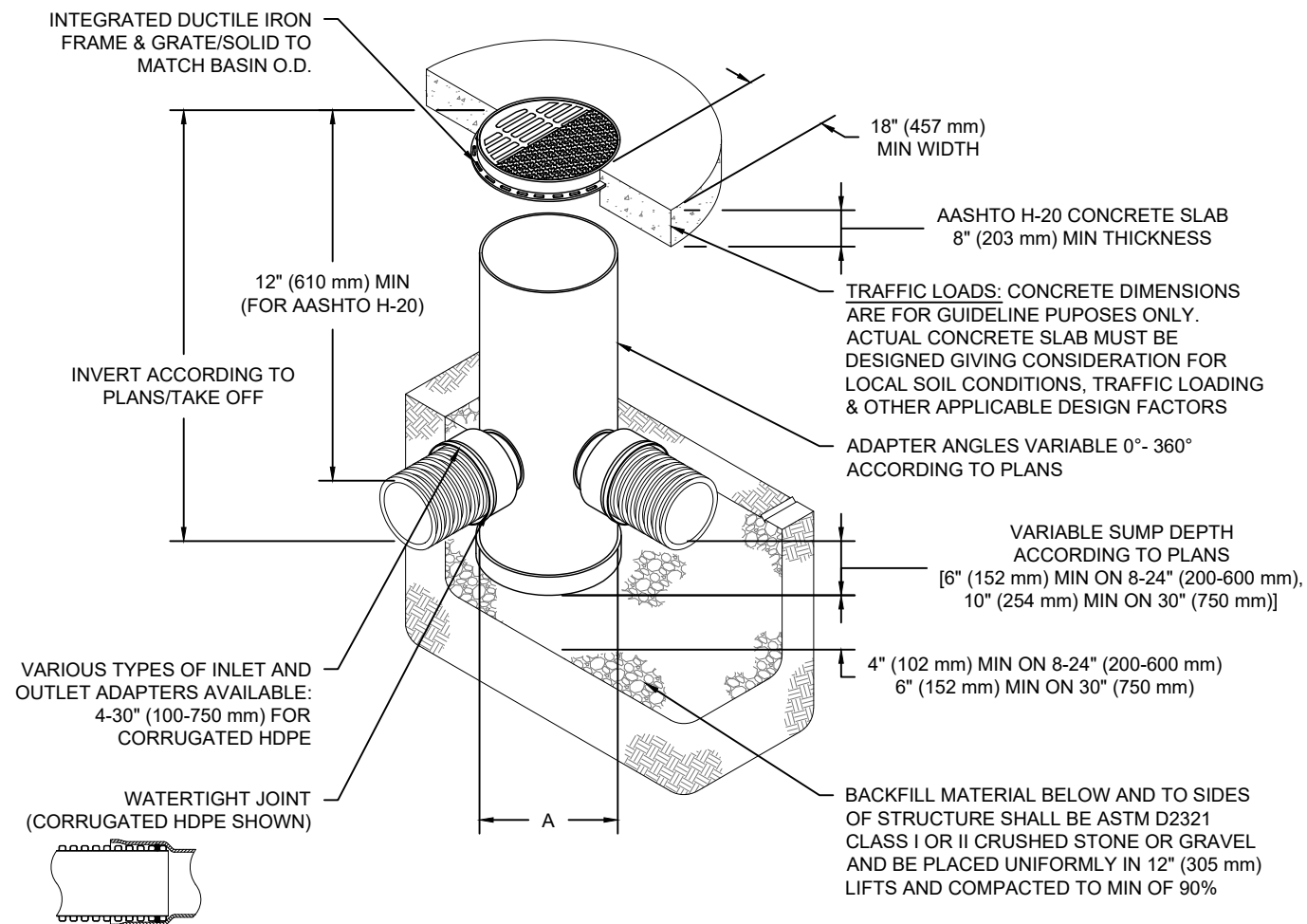
HILLIARD, OH 43026
1-800-733-7473

SHEET

5 OF 6

NYLOPLAST DRAIN BASIN

NTS



NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

O NICHOLAS

PICTON, ON, CANADA

DATE: 10/20/2025 DRAWN: PM

PROJECT #: _____ CHECKED: N/A

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ASSIST ORMECH UNDER THE DIRECTION OF THE PROJECT ENGINEER OF RECORD FOR THE PROJECT REPRESENTATIVE. WITHOUT THE OWNER'S PRIOR APPROVAL, REVIEW THIS DRAWING PRIOR TO BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE OWNER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOC. DETAILS MEET ALL APPLICABLE CODES AND ALL APPLICABLE

Nyloplast®

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

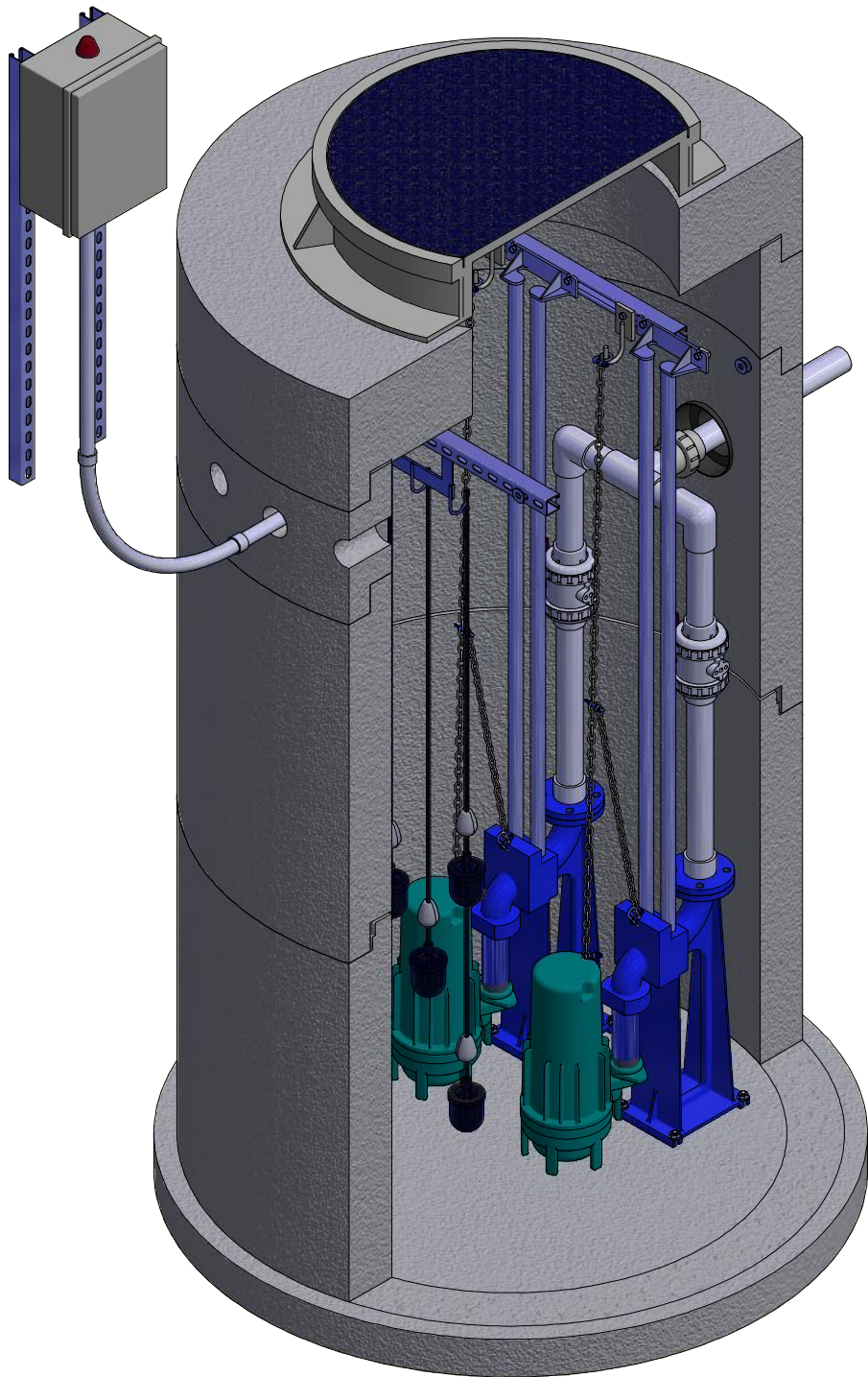


SHEET

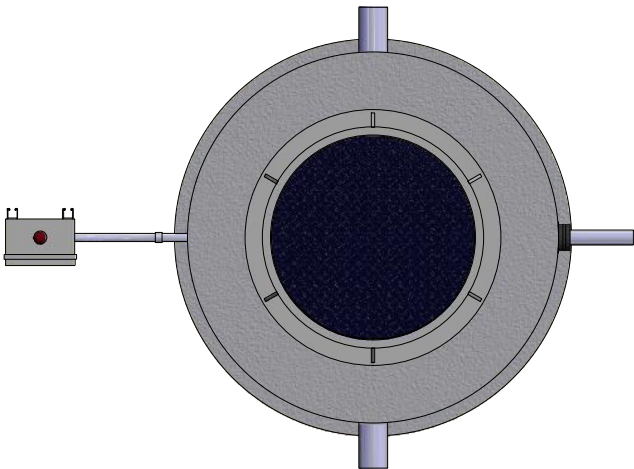
6 OF

MINI-MUNI 2IN DUPLEX STORMWATER PUMP STATION

MM-248-DN-1



TOP LEFT ISOMETRIC VIEW w/ SECTION
NOT TO SCALE



PLAN VIEW
NOT TO SCALE



PROFILE VIEW
NOT TO SCALE

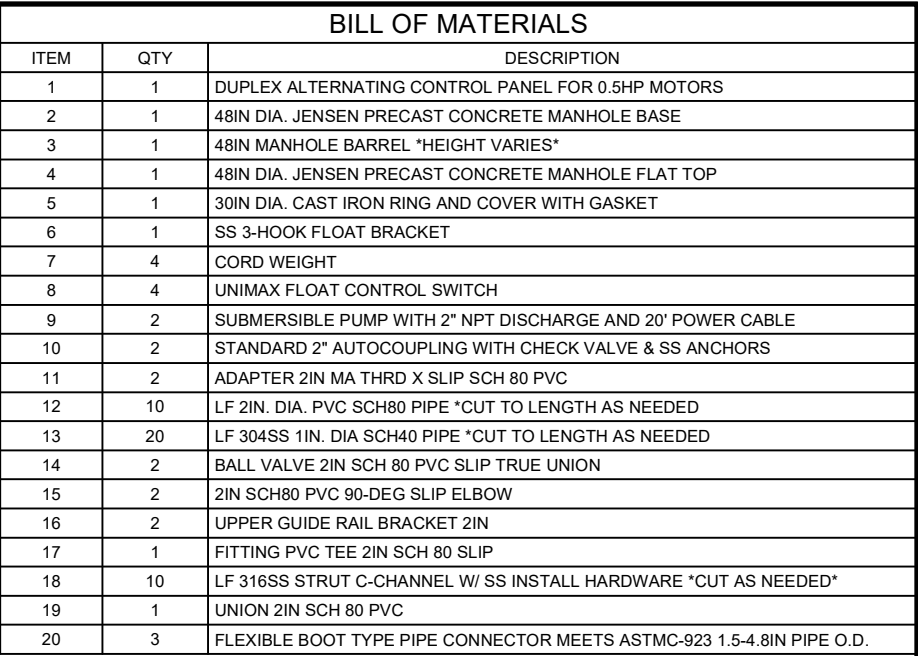
DISCLAIMERS, INCLUDING BUT NOT LIMITED TO:
1.) All elevations have been provided by others, and have not been verified by Jensen Precast. Contractor to verify all dimensions and elevations in field prior to installation.
2.) These layout drawings are intended to show overall system design only. All concrete component thicknesses, dimensions, and joint orientations may vary across Jensen Precast's manufacturing facilities. Contractor to confirm all thicknesses, dimensions, and joint orientations prior to installation.
3.) System design criteria has been provided to Jensen Precast. Others are responsible for verification that system meets intended application.
4.) Foundation, subgrade, and backfill to be designed by others.

JENSEN  PUMP STATIONS
521 DUNN CIRCLE, SPARKS, NV 89431
www.jensenwaterresources.com
(855) 468-5600


MINIMUNI
MUNICIPAL GRADE RESIDENTIAL & COMMERCIAL LIFT STATIONS

DESCRIPTION:		MINI-MUNI 2IN DUPLEX STORMWATER PUMP STATION	
TITLE PAGE			
PART NUMBER:	MM-248-DN-1	DRAWN BY:	J. Salo
CREATED:	2/18/2020	MODIFIED:	5/12/2020

REV: 1
SHEET: 1 OF 2



PUMP CHARACTERISTICS	
DESCRIPTION	VALUE
DUTY POINT RANGE	UP TO 80 GPM OR 30.0' TDH
MANUFACTURER	BARNES
MODEL NUMBER	SERIES 2SEV-L
PUMP TYPE	SUBMERSIBLE 2" SOLIDS HANDLING
MOTOR SIZE	0.5 HP
POWER SUPPLY	115V+ SINGLE PHASE



Concrete

- Precast concrete manufacturer must be NPCA-certified. Design shall be according to ACI 318/318R. Mix design shall be: 4,000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Wet well designed per ASTM C 478, precast, reinforced concrete.

Pumps

- Furnish and install 2 (qty) Barnes single phase submersible (2" spherical) solids handling type centrifugal pump with a self-engaging lift out assembly, designed to handle pumping of unscreened drainage water.
- The volute, seal plates and motor housing shall be constructed of high quality ASTM A-48 class 30 cast iron. The pump impeller shall be of the non-clog/vortex design with pump out vanes on the back side. The unit shall utilize a single mechanical shaft seal arrangement and shall operate in an oil atmosphere. Single phase motors shall be of the capacitor start, capacitor run design.
- The motor shaft shall be of 416 stainless steel. Protection against excessive temperature shall be provided by heat sensor thermostat attached to the stator windings and connected in series with the contactor coil in the control panel. The single phase models shall provide protection against excessive temperature through the use of an in-line heat/current sensor. The lower bearing shall be of the single ball type to accept radial and thrust loads, and the upper bearing of the single ball design, for radial loads. Bearings shall operate in an oil bath atmosphere.
- The pump shall utilize the Barnes break-away fitting which includes an integral check valve. The pump shall be equipped with 20 ft. of type SOW power cord and connected to the motor via quick disconnect pin terminals.

Control Panel

- Provide Alderon single phase *Check It* series pump control panel. *Check It* panel is float switch operated and includes: NEMA 4X enclosure, lockable hasp, beacon and alarm buzzer, test & silence switches, HOA switches, pump run indicators and float switch indicators.
- Control Sequence of Operation: Cycle each pump on and off automatically to maintain well wastewater level. Automatic control operates both pumps in parallel if well level rises above starting point of low-level pump, until shutoff level is reached. Automatic alternator, with manual disconnect switch, changes sequence of lead-lag sewage pumps at completion of each pumping cycle.
- Minimum 4 qty mechanical float control switches shall be provided with control panel.

Piping & Hardware

- All piping, fittings, and valves shall be Schedule 80 and conforming to ASTM Standard D 1784.
- All hardware provided and used within wet well shall be 316SS quality.

Commissioning

- The pumps and station integration shall be tested and confirmed at start-up by a qualified Jensen Pump Stations representative. On-site and remote commissioning options are available.

Disclaimer

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JENSEN®  **PUMP STATIONS**

DESCRIPTION:

MINI-MUNI 2IN DUPLEX STORMWATER PUMP STATION

MECHANICAL DETAIL

PART NUMBER:	MM-248-DN-1
--------------	-------------

DRAWN BY: J. Salo

CREATED: 2/18/2020

MODIFIED:	5/12/2020
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REV:

SHEET:

2 OF 2

Appendix C

Sanitary Data

SANITARY FLOW CALCULATIONS

Proposed Development

Residential Flow Determination

	<u>Unit type</u>	<u>No. Unit</u>	<u>Pop. / Unit</u>	<u>Population</u>
	Studio	15	1.4	21
	1-Bdrm	71	1.4	99
	2-Bdrm	21	2.1	44
	3-Bdrm	5	2.4	12
	3-Bdrm Towns	6	2.5	15
	4-Bdrm Semis	2	3.0	6
	Total	120		177 persons
Harmon Peaking Factor				3.8
Average flow				320 L/c/d
Proposed Residential Peak Flow				2.5 L/s

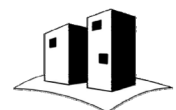
I/I Flow Determination

Site Area	1.63 ha
Infiltration (24,192 L/day/ha or 0.28 L/s/ha)	0.46 L/s
Long-term dewatering contribution	0.00 L/s

Total Proposed Peak Flow	2.9 L/s
---------------------------------	----------------

Pipe Data

LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	FULL FLOW CAP. (L/s)	FULL FLOW VEL. (m/s)	ACTUAL VEL. (m/s)	% Full
-	200	1.0%	34.2	1.1	0.6	9%



SITEPLANTECH INC.

Sanitary Design Sheet
Proposed Sanitary Conditions
0 Nicholas Street
Picton, Ontario

Project No. 23-026
Date: 31-Jul-26
Designed By: KH
Reviewed By: LPM

Min. Sewer Diameter (mm) = 200 Avg. Domestic Flow (l/cap/day) = 320
Mannings n = 0.013 Infiltration Rate (l/s/ha) = 0.28
Minimum Velocity (m/s) = 0.60 Max. Harmon Peaking Factor = 3.8
Maximum Velocity (m/s) = 5 Min. Harmon Peaking Factor = 1.5
Minimum Pipe Size (%) = 0.50 NOMINAL PIPE SIZE USED

LOCATION			RESIDENTIAL							INDUSTRIAL/COMMERCIAL/INSTITUTIONAL					FLOW CALCULATIONS								PIPE DATA					
STREET	MANHOLE		AREA	ACCUM. AREA	UNITS	DENSITY		RES. POP.	ACCUM. RES. POP.	AREA	ACCUM. AREA	FSI	FLOW RATE	GFA	INFIL.	TOTAL ACCUM. POP.	AVG. DOM. FLOW	ACCUM. AVG. DOM. FLOW	PEAKING FACTOR	PEAKED RES. FLOW	ACCUM. ICI FLOW	TOTAL FLOW	LENGTH	PIPE DIA.	SLOPE	FULL FLOW CAP.	FULL FLOW VEL	% FULL
	FROM	TO				PER UNIT	PER HA																					
						(p/unit)	(p/ha)																					
From MH1	MH3A	MH5A	1.63	1.63	112	2.5		280	280	0.00	0.00	0	0.00	0.00	0.5	280	1.0	1.0	3.80	3.9	0.0	4.4	10.6	150	2.0	21.5	1.22	20.4%
NICHOLAS ST	MH5A	MH-591	0.33	1.96	1	4.0		4	284	0.00	0.00	0	0.00	0.00	0.5	284	0.0	1.1	3.80	4.0	0.0	4.5	48.9	150	2.0	21.5	1.22	21.1%
NICHOLAS ST	MH-591	EX	0.20	2.16	49	4.0		196	480	0.00	0.00	0	0.00	0.00	0.6	480	0.7	1.8	3.80	6.8	0.0	7.4	63.0	150	3.4	28.1	1.59	26.2%



**Village A - Base 31
Picton, Ontario**

**Functional Servicing and Stormwater
Management Report**

October 2024

Revised August 2025

Submitted by:

**SCS Consulting Group Ltd
30 Centurian Drive, Suite 100
Markham, ON L3R 8B8
Phone 905 475 1900
Fax 905 475 8335**

Project Number: 2365A

7.0 Sanitary Servicing

7.1 Existing Sanitary Sewer System

All existing sanitary flows from the residential area north of the Base31 lands are conveyed by a 200 mm diameter sanitary sewer across County Road #22 to the Lalor Sanitary Pumping Station (SPS). This area is referred to throughout this report as the “Heights”, and includes the existing Macaulay Village and a future residential site, noted as Vineridge. The Lalor SPS is located just west of Nicholas Street, north-west of the Base31 subject site.

From the Lalor SPS, the sanitary flow from all of Picton is pumped to the Picton Water Pollution Control Plant (WWTP), located south of the Lalor SPS. The existing sanitary network is shown on **Figure 7.1** below:

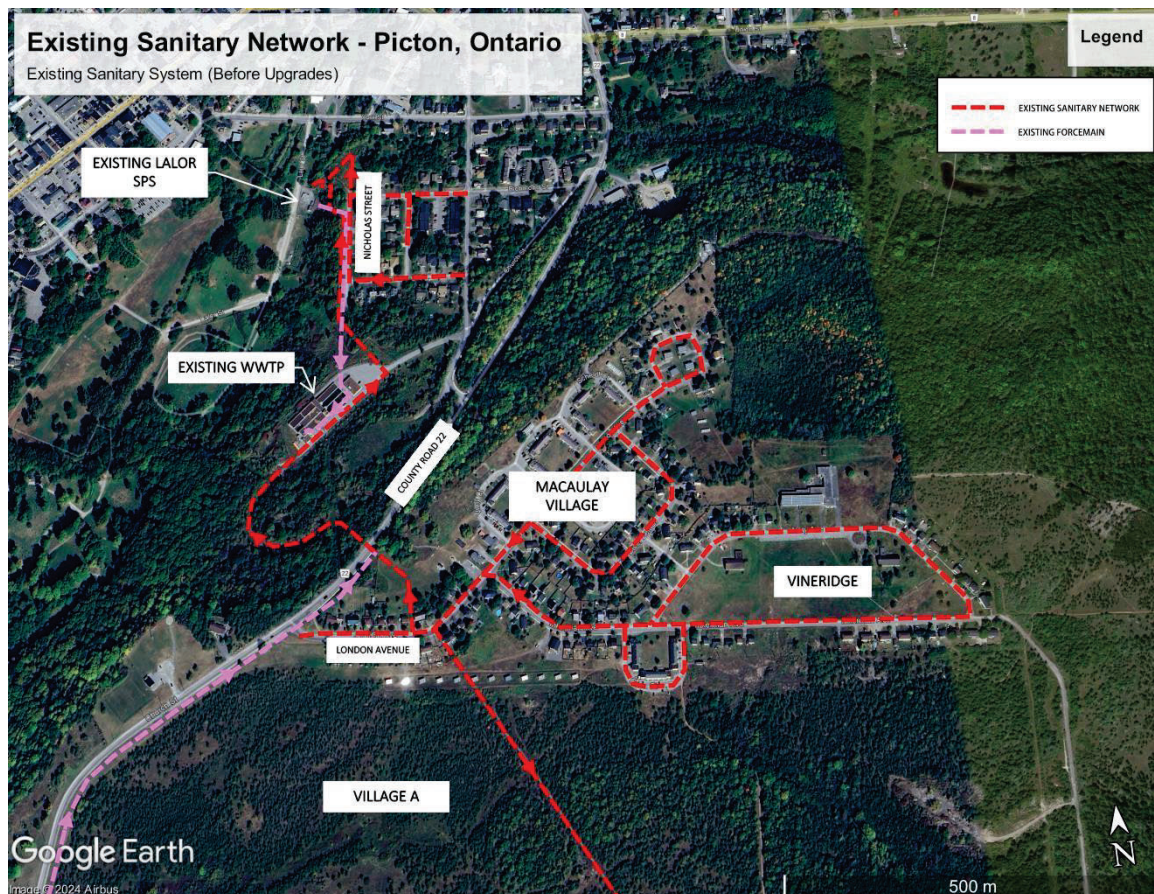


Figure 7.1: Existing Sanitary System

Based on input from County staff and a review of the background information, all three components of this existing system – the 200 mm diameter gravity sewer, the Lalor SPS and the WWTP are anticipated to be upgraded in the coming years and are approaching their rated capacity.



The following summarizes the existing systems:

Sanitary Gravity Sewer:

- The existing 200 mm diameter sanitary gravity sewer does not have the hydraulic capacity to service significant additional flow. Several pipes are currently running in excess of their hydraulic capacity and hydraulic grade line issues occur when adding additional flow. Refer to **Section 7.3** for details.

The Lalor Sanitary Pumping Station (SPS):

- The Lalor SPS has a rated design capacity of 44,000 m³/day however, with only 2 pumps functioning at 175 L/s each, the firm capacity is 30,240 m³/day.
- Operators report that the headworks at the WWTP are overwhelmed when the larger flow pumps are operating.
- It was confirmed by CIMA+ in their comment letter dated March 18, 2025 that the existing pumps within the SPS are not variable frequency drive (VFD) driven – as such, when the SPS experiences a peaked event, the high-flow pumps automatically start – causing an instantaneous, and overwhelming discharge to the headworks. Additional investigations are required to confirm.

In regard to the capacity of the Lalor SPS, we have considered information provided by the County (see **Appendix F.1**) which notes the following:

- Flow to the Lalor SPS is 364 L/s according to RVA's Report
- WWW Operations has noted that the SPS does not surcharge and stays within the wet well
- The Lalor SPS sustained a flow rate of 313 L/s in 2017 which was considered a wet year

In regards to RVA's assertion that the flow to the Lalor Street SPS is 364 L/s, we suspect that this may be overly conservative. It is higher than the measured flow which may be the result of a factor of safety being applied to the multiple catchments which drain to the Lalor SPS and as such, the overall cumulative flow is exceeding what is being observed in reality. As noted by WWW Operations, if the SPS does not surcharge and stays within the wet well, this would suggest an incoming flow of 350 L/s or less. Based on this, we have revised the PCSWMM model to exclude a surcharge at the Lalor SPS which was part of the original model.

As noted by the County, if during a wet year such as 2017, the Lalor SPS sustained a flow rate of 313 L/s over a sustained hour, this would be considered a worst-case scenario and a conservative approach to assessing the available capacity of the SPS. If the

inclusion of the third pump increases flows to the extent that upgrades are required at the WWTP headworks, the capacity of the third pump would be ignored and the use of only the two pumps which have a capacity of 175 L/s each for a total flow of 350 L/s would be considered.

If the Lalor SPS capacity can be considered as 350 L/s, and the worst-case flow event reaches 313 L/s based on historical data, it could be comfortably concluded that the station has a remaining capacity of 37 L/s.

The Picton Water Pollution Control Plant (WWTP)

- The WWTP has been designed with an average day flow (ADF) capacity of 6,000 m³/day.
- Based on Annual Operating Results, the WWTP is currently running at an average rate of 2,924 m³/day (2019-2023).
- Allocation of the remaining capacity within the WWTP is reserved to the discretion of the County.
- It is noted that a future expansion of the WWTP is anticipated based on the original design, and details regarding timing and approach will be provided within the County MSP and subsequent reports.

Upgrades to the three components of this system will be primarily dictated by the on-going Picton Master Servicing Plan (MSP) based on overall growth in Picton. While the details of these upgrades are dictated based on the on-going MSP, as well as on-going discussions with County Staff, it is to be determined by Staff if there is the potential for partial development of Village A prior to all upgrades.

The existing lands occupied by Village A currently do not contribute to this sanitary network. An existing abandoned sanitary sewer and watermain bisects the subject site, which previously serviced 204 Kingsley Road. However, this sewer and watermain are to be removed as part of this application. A subsurface utility investigation (SUE) was completed for the entire Village A area, including County Road #22 and the outfall to the WWTP. The SUE is found in **Appendix B.2**.

Two private sanitary forcemain service connections (75 mm and 200 mm diameter) have been constructed within the applicant's overall land holdings as part of an approved Interim Servicing Agreement between the applicant and the municipality. While it is intended that these sewers remain operational throughout construction, the intention is that they can be eliminated north of Kingsley Road, and transferred to discharge to the sanitary extensions proposed under this application as described below.

Existing Sewers East of County Road #22 to Lalor SPS (Surcharging Runs under Existing Conditions)



Appendix D

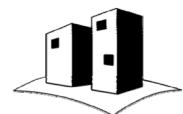
Water Data

**PROPOSED DOMESTIC FLOW
CALCULATION WORKSHEET**

Residential Use				
Unit Type	No. of Units	PPU	L/c/d	Avg. Day (L/d)
Studios	15	1.4	320	6,720
1B/1B+D	71	1.4	320	31,808
2B/2B+D	21	2.1	320	14,112
3B/3B+D	5	2.4	320	3,840
4-Bdrm Semis	2	3.4	320	2,176
3-Bdrm Towns	6	2.4	320	4,608
Residential Use Avg. Day (L/d)				63,264

Peak Flows*		
Criteria	Peaking Factor	Flow
Avg. day (L/s)	1.00	0.7
Min (L/s)	0.84	0.6
Max Hr (L/hr)	2.85	7,513
Max Day (L/d)	1.90	120,202

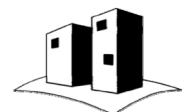
* Peaking factors per Table 3.1 of the MOE Guidelines for Drinking-Water based on the population of Prince Edward County of 25,000



FIRE FLOW CALCULATION WORKSHEET

PROJECT INFORMATION		
Address	0 Nicholas Street Picton, ON 	Notes: Based on ICF walls and precast concrete foors (4hr rating) A=Floor2 + (1/4 Floor1 + 1/4 Floor3)
NBC Occupancy		
Building Footprint		
No. of Storeys	5-storey building	

BASE FLOW CALCULATION				CREDITS	CHARGES	Q (L/min)
A=	Effective area		3,300 m ²			
C=	Non-combustible		0.8			
F=	Required fire flow	$F=220C\sqrt{A}$	10,110 L/min.			
"F" Rounded to nearest 1,000			10,000 L/min.			10,000
FLOW 'F' ADJUSTMENTS				CREDITS	CHARGES	Q (L/min)
Occupancy Adjustments (F')	%					
Non-combustible	-25%		-2,500	-2,500		7,500
Exposure Adjustments (E)						
Exposure	Sep. (m)	Charge				
N	>50	0%				
E	>50	0%				
S	>50	0%				
W	>50	0%				
E = Total Exposure Charge		0%	0			7,500
Sprinkler Adjusments (S)						
Sprinklered as per NFPA 13	No		0			7,500
Standard Water Supply	Yes		-750	-750		6,750
Fully supervised watersupply	No		0			6,750
REQUIRED FLOW (F"=F'+E+S)			(L/min)			6,750
			(USGPM)			1,783



**MUNICIPAL SUPPLY
CALCULATION WORKSHEET**

Hydrant Flow Test Input

Location	Test No.	P _s (PSI)	P _r (PSI)	Q _r (USGPM)
Nicholas St. & Cumberland St.	1	71.1	61.98	832
	2	71.1	48.82	1328.2

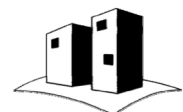
Theoretical Flow Calculation

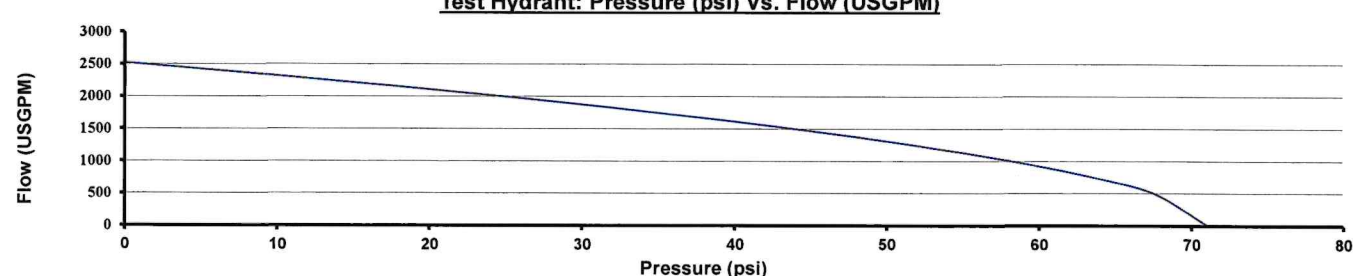
Location	Test No.	P _f (PSI)	Q _f (USGPM)
Nicholas St. & Cumberland St.	1	20	2,110
	2	20	2,079

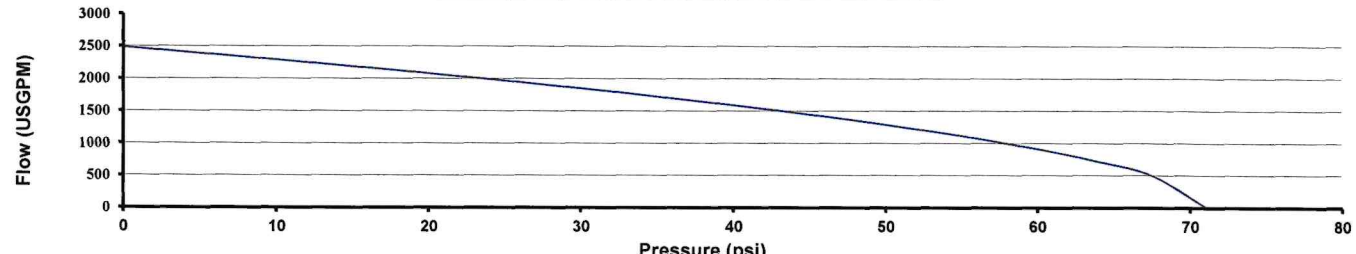
Where $Q_f = Q_r \left[\frac{P_s - P_f}{P_s - P_r} \right]^{0.54}$

Max Day + Fire Check

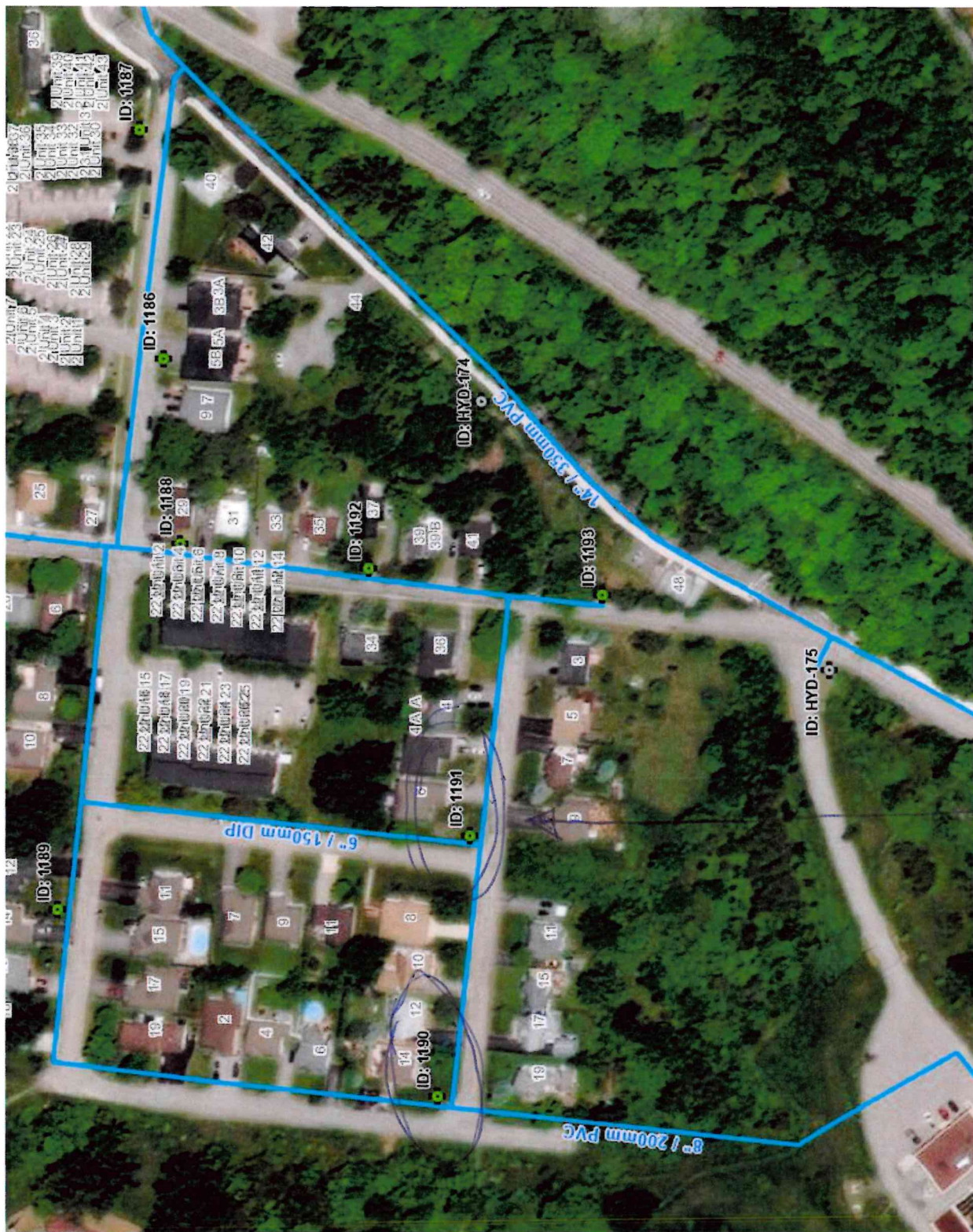
Max Day (USGPM)	F'' (USGPM)	Max Day + F'' (USGPM)	Q ₂₀ (USGPM)	Check
22	1,783	1,805	2,079	OK



DS4: Fire Flow Testing						
Document Type:		Datasheet				
Category:		Drinking Water				
Date of Fire Flow Testing		May 05 2024				
Field Operator(s)		Jeff Brooks				
Facility Operator(s)		Jeff Brooks				
Notification to Facility Operator:		Y - X	Y	Initial:		Signature: 
DWS Information						
High Lift Pump (HLP) On or Off?:		On X	Off ☐	Verified By (Initial):		JB
High Level Reservoir (HLR) Level (m):		3.08		Verified By (Initial):		JB
Bloomfield Tower Level (m):		4.43		Verified By (Initial):		JB
Test Hydrant Information						
Hydrant Number:		1190				
Location:		Nicholas and Cumberland				
Test Number:		1				
N.F.P.A. Colour Code:		Blue				
Static Pressure:		71.1				
Residual Pressure:		61.98				
Validation: Pressure Drop Greater Than 25%?		Y/N:	12.8	Actual Value:		62.0
Logger S/N:		206632				
Flow Hydrant Information						
Hydrant No.	Ports Flowed No.	Logger No.	Outlet Dia. (in.)	Coefficient (~0.9)	Pitot Gauge Reading (psi)	Flow (USGPM)
1191	1	43180737	2.5	0.9	35.07	832
Total Flow (USGPM)						832
Test Hydrant Available Flow						
Test Hydrant at 20 psi			2110	USGPM	1743	IGPM
Test Hydrant at 10 psi			2324	USGPM	1920	IGPM
Test Hydrant: Pressure (psi) Vs. Flow (USGPM)						
						
Comments/Discrepancies/Diagram						
Existing Colour Coding:		GREEN				
Recommended Colour Coding		BLUE				
Acknowledgement						
Operator Overseeing Fire Flow Testing (Print):			Jeff Brooks 			
Signature:						
Date:			MAY 14 2024			

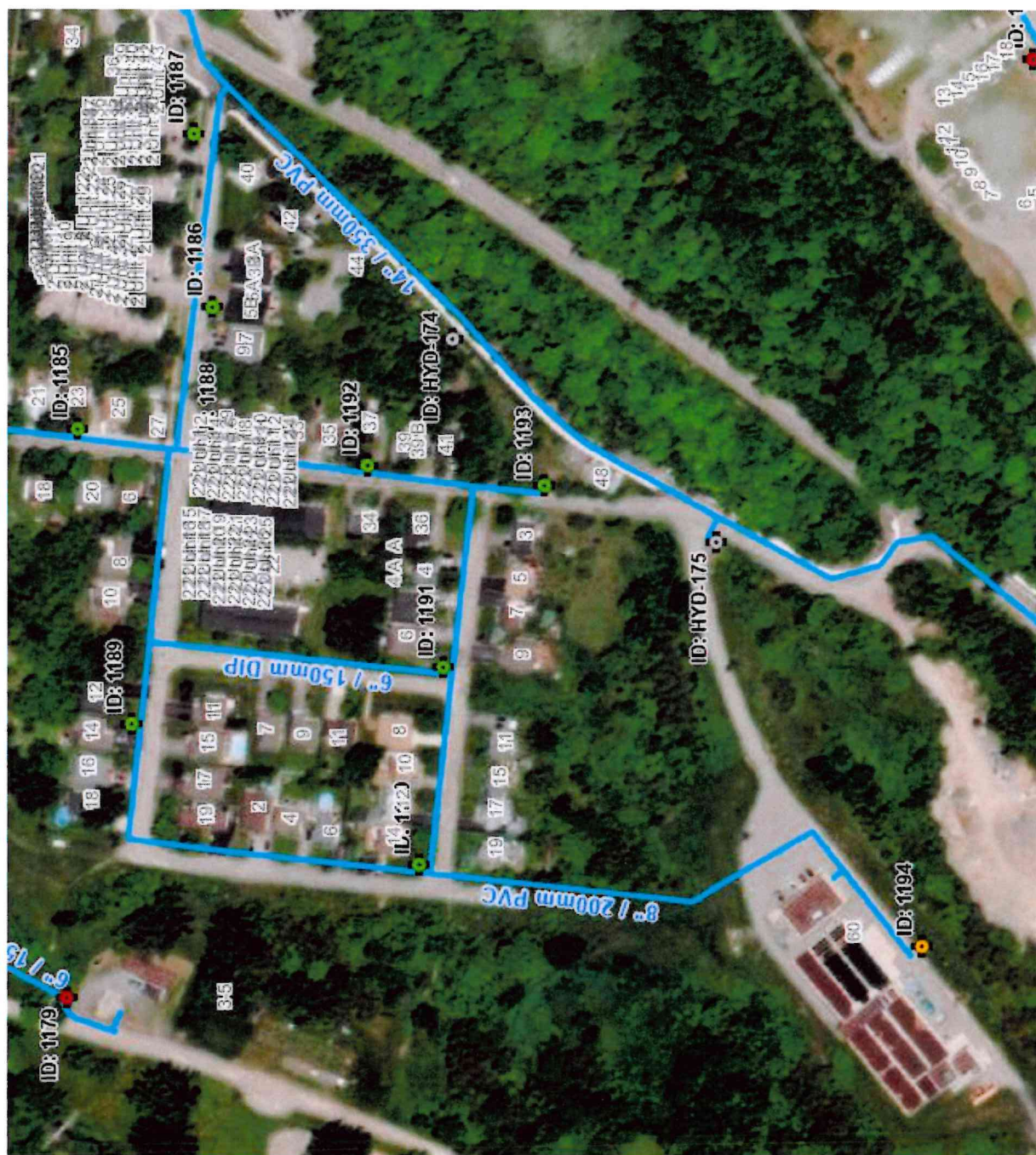
DS4: Fire Flow Testing						
Document Type:		Datasheet				
Category:		Drinking Water				
Date of Fire Flow Testing		May 14 2024				
Field Operator(s)		Jeff Brooks				
Facility Operator(s)		Jeff Brooks				
Notification to Facility Operator:		Y - X	N ☐	Initial:		Signature: 
DWS Information						
High Lift Pump (HLP) On or Off?:		On X	Off ☐	Verified By (Initial):	JB	
High Level Reservoir (HLR) Level (m):		3.08		Verified By (Initial):	JB	
Bloomfield Tower Level (m):		4.43		Verified By (Initial):	JB	
Test Hydrant Information						
Hydrant Number:		1190				
Location:		Nicholas and Cumberland				
Test Number:		2				
N.F.P.A. Colour Code:		Blue				
Static Pressure:		71.1				
Residual Pressure:		48.82				
Validation: Pressure Drop Greater Than 25%?		Y/N:	Y	Actual Value:	31.3	
Logger S/N:		206632				
Flow Hydrant Information						
Hydrant No.	Ports Flowed No.	Logger No.	Outlet Dia. (in.)	Coefficient (~0.9)	Pitot Gauge Reading (psi)	Flow (USGPM)
1191	2	43180737	2.5	0.9	22.35	1328
Total Flow (USGPM)						1328
Test Hydrant Available Flow						
Test Hydrant at 20 psi			2079	USGPM	1719	IGPM
Test Hydrant at 10 psi			2290	USGPM	1893	IGPM
Test Hydrant: Pressure (psi) Vs. Flow (USGPM)						
						
Comments/Discrepancies/Diagram						
Existing Colour Coding:		GREEN				
Recommended Colour Coding		BLUE				
Acknowledgement						
Operator Overseeing Fire Flow Testing (Print):			Jeff Brooks			
Signature:						
Date:			May 14 2024			

TEST INFORMATION					TEST HYDRANT INFORMATION						FLOW HYDRANT(S) INFORMATION								TOTAL				
Date	Time	Test #	Map #	WO#	TEST	Static	Residual	% Drop	@ 20 PSI	Colour	Hyd	Ports	Pitot	(USGPM)	Hyd	Ports	Pitot	(USGPM)	Total(GPM)	Comments			
14-May-24	14:04	1	WPX	1	1190	71.1	61.98	12.8	2109.6	BLUE	1191	1	35.07	831.9				0.0	831.9				
14-May-24	14:05	2	WPX	1	1190	71.1	48.82	31.3	2079.3	BLUE	1191	2	22.35	1328.2				0.0	1328.2				



Reserve →

Flowing



Appendix E

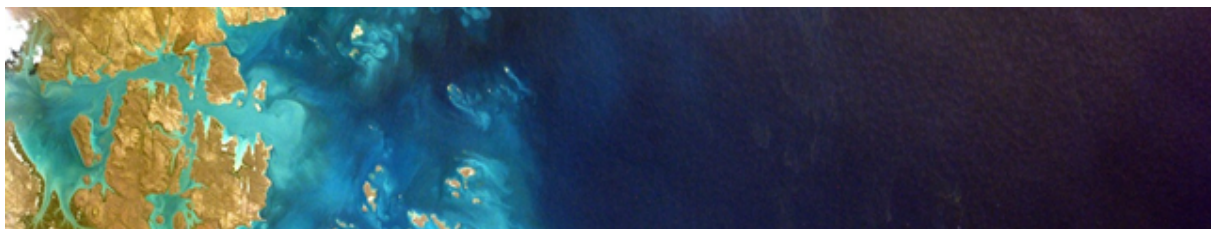
Engineering Drawings

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PLEASE REFER TO ENGINEERING DRAWINGS SUBMITTED UNDER SEPARATE COVER.

Appendix F

Operation and Maintenance Manuals

Verification Statement



Hydro International First Defense® HC Oil Grit Separator Registration number: (V-2018-10-01) Date of issue: 2018-October-15 (rev 2019-02-01)

Technology type	Oil Grit Separator		
Application	Technology to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals		
Company	Hydro International		
Address	94 Hutchins Drive, Portland, Maine USA 04102	Phone	+1-207-756 6200
Website	https://www.hydro-int.com		
E-mail	dscott@hydro-int.com		

Verified Performance Claims

The Hydro International First Defense® High Capacity (HC) Oil Grit Separator (OGS) was tested by Good Harbour Laboratories Inc. (GHL), Mississauga, Ontario, Canada in 2018. The performance test results were verified by Toronto and Region Conservation Authority (TRCA), Vaughan, Ontario, Canada following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The following performance claims were verified:

Capture test¹:

With a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and an influent test sediment concentration of 200 mg/L, the First Defense® HC OGS device removes 67, 60, 55, 50, 45, 45, and 41 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m², respectively.

Scour test¹:

With 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, the First Defense® HC OGS device generates adjusted effluent² concentrations of 0, 0, 11, 2, and 0 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m², respectively.

¹ The claims can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

² The effluent suspended sediment concentration is adjusted based on the background concentration and the smallest 5% of particles captured during the 40 L/min/m² sediment capture test (see Table 2)

Technology Application

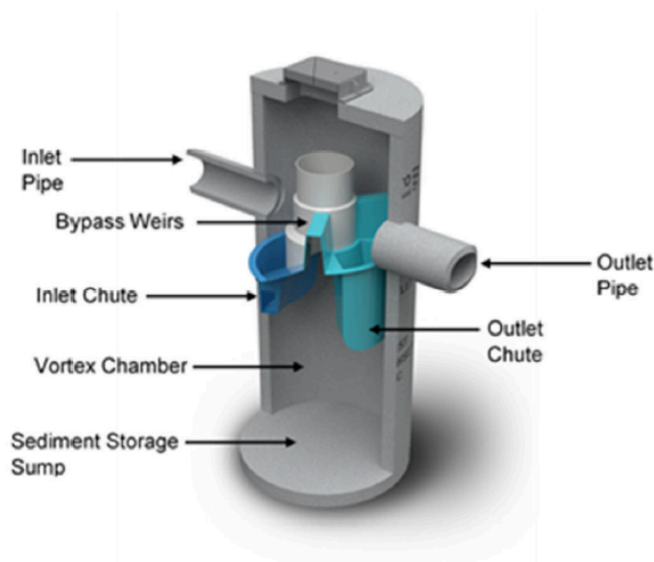
The First Defense® HC (FDHC) Oil Grit Separator can be used as a stand-alone stormwater treatment technology, depending on water quality objectives, or as a pretreatment component in a treatment train when higher TSS removals are required and polishing or volume reduction best management practices (BMPs), such as infiltration or bio-infiltration, are installed downstream. FDHC applications include: stormwater treatment at the point of entry into the drainage line; sites constrained by space, topography or drainage profiles with limited slope and depth of cover; retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line; pretreatment for filters, infiltration, other sedimentation BMPs and storage.

Technology Description

The Hydro International First Defense® HC (FDHC) is an Oil Grit Separator designed to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals. The patented flow modifying internal components are designed to be inserted into standard precast concrete manholes where they collect and treat runoff as part of the drainage system (Figure 1).

Flow entering the manhole via an inlet pipe or inlet grate is diverted into a vortex chamber beneath a separation module that includes both inlet/outlet chutes and bypass weirs. The internal bypass weirs divert flows greater than the maximum design treatment flow rate over the separation module and away from the vortex chamber where oil, sediment, debris and attached pollutants are accumulating. This function prevents high velocities from re-suspending previously captured pollutants during large storm events. The FDHC can be designed and sized to function effectively in either online or offline configurations.

Figure 1: Hydro International First Defense® HC Oil Grit Separator



The test unit was 1.2 m (4 foot) in diameter with a 1.51 m (59 5/8 inches) sump depth measured from the outlet invert to the floor of the unit. The effective treatment area (also known as the effective sedimentation area) is 1.2 m² (12.6 ft²). The maximum sediment storage depth is 0.457 m (18 inches).

Description of Test Procedure

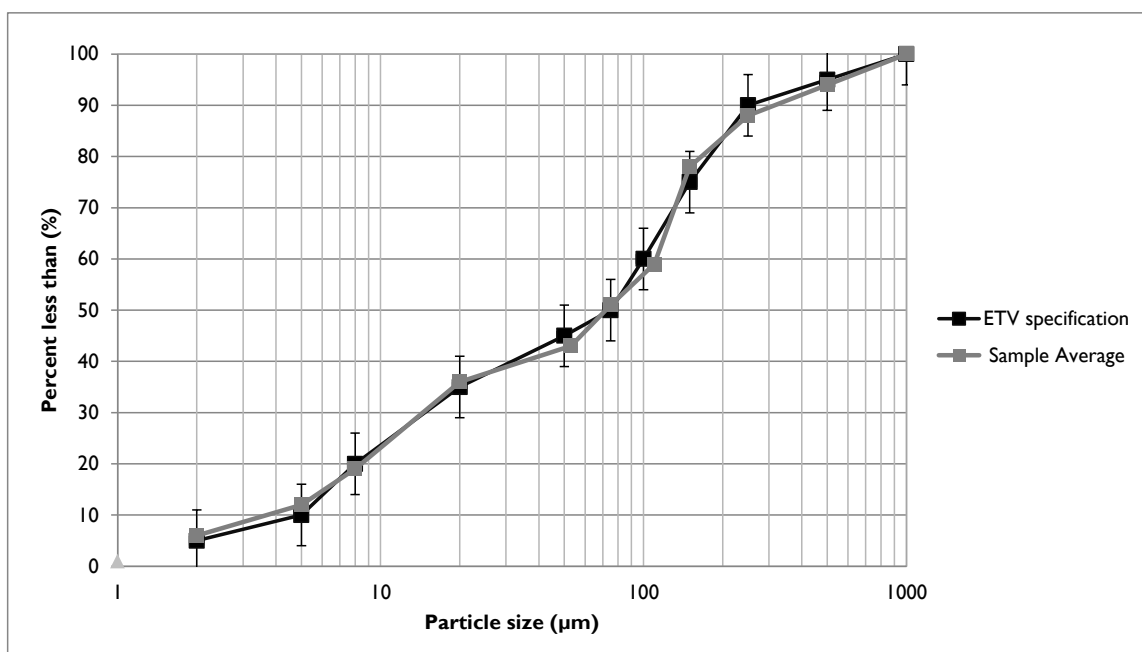
The test data and results for this verification were obtained from independent testing conducted on a 1.2 m (48 inch) diameter Hydro International First Defense® HC OGS device, in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014)*. The laboratory test procedure was originally prepared by the Toronto and Region Conservation Authority (TRCA) in association with a 31 member advisory committee from various stakeholder groups.

Verification Results

Toronto and Region Conservation Authority verified the performance test data and other information pertaining to the First Defense® HC Oil Grit Separator. A Verification Plan was prepared to guide the verification process based on the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol.

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%, and a median particle size no greater than 75 µm. Comparison of the individual sample and average test sediment PSD to the specified PSD shown in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition. The median particle size was 73 µm. Samples from test sediment batches used for each run met the specified PSD within the required tolerance thresholds.

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



The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and are attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for “all particle sizes by mass balance” (see Table 1) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1 - Removal efficiencies (%) of the First Defence HC at specified surface loading rates

Particle size fraction (µm)	Surface loading rate (L/min/m ²)						
	40	80	200	400	600	1000	1400
>500	100*	100*	100*	81	72	86	80
250 - 500	100*	97	99	100*	100*	59	88
150 - 250	100*	91	95	93	47	100*	84
105 - 150	96	89	94	89	90	70	75
75 - 105	100*	90	95	77	-20**	100	51
53 - 75	74	100*	97	62	100*	46	37
20 - 53	60	33	10	5	4	0	0
8 - 20	29	16	8	3	3	1	1
5 - 8	8	5	8	4	4	4	3
<5	5	3	0	0	0	3	3
All particle sizes By mass balance	66.5	59.9	55.4	50.2	44.9	45.2	40.5

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 184% (average 115%). See text and Bulletin # CETV 2016-11-0001 for more information.

** An outlier in the retained sediment sample sieve data resulted in negative removal for this size fraction. The outlier at the 75 µm particle size is shown in Figure 3.

Figure 3 - Particle size distribution of sediment retained in the First Defence HC in relation to the injected test sediment average

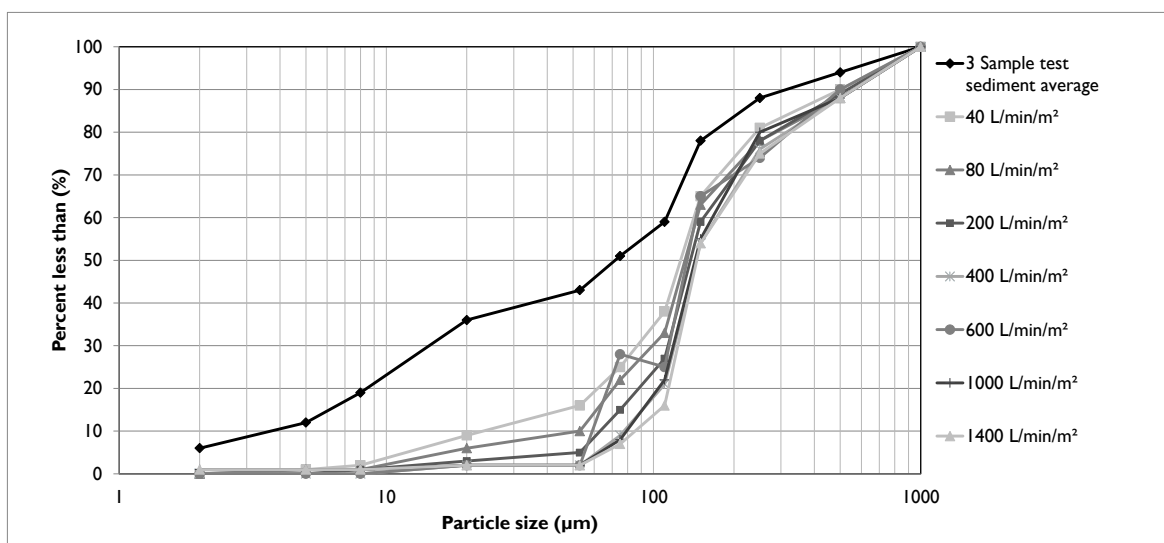


Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the FDHC device at each of the tested surface loading rates. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased, particularly in the 40 to 400 L/min/m² range.

Table 2 shows the results of the sediment scour and re-suspension test for the First Defense® HC unit. The scour test involved preloading 10.2 cm (4 inches) of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. The smallest 5% of particles captured during the 40 L/min/m² sediment capture test (13.5 µm in this case) was used to further adjust the effluent sediment concentrations, as per the method described in Bulletin # CETV 2016-09-0001. Results showed average adjusted effluent sediment concentrations below 11 mg/L at all surface loading rates. Effluent concentrations would be expected to decrease at higher flow rates since bypass over the insert bypass weirs was observed to begin at 1,032 L/min/m².

Table 2 - Scour test adjusted effluent sediment concentration at each surface loading rate

Run	Surface loading rate (L/min/m ²)	Run time (min)	Background sample concentration (mg/L)	Average adjusted effluent suspended sediment concentration (mg/L)*
1	200	1:00 – 6:00	0.8	0
2	800	7:00 – 12:00	1.0	0
3	1400	13:00 – 18:00	1.1	10.6
4	2000	19:00 – 24:00	2.8	2.4
5	2600	25:00 – 30:00	6.6	0

*The effluent suspended sediment concentration is adjusted based on the background concentration and the smallest 5% of particles captured during the 40 L/min/m² sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001.

Variances from the Procedure

Minor variances from the *Procedure for Laboratory Testing of Oil-Grit Separators* used as the basis of testing for this verification were as follows:

1. The *Procedure* states that the tested device “must be a full scale commercially available device with the same configuration and components as would be typical for an actual installation.” The unit tested for this verification had the same internal components as would be typical for a commercial installation, but the internal components were placed inside a structure constructed of composite materials, rather than a manhole made of concrete, the latter of which is typical for most installations. The dimensions of the structure were the same as would have been the case had the manhole been concrete. The use of alternate materials for the structure was not believed to significantly affect system performance.
2. As part of the capture test, evaluation of the 40 and 80 L/min/m² surface loading rate was split into 3 and 2 parts, respectively. The test was conducted in parts because of the long duration (i.e. over 10 hours) needed to feed the required minimum 11.3 kg of test sediment into the unit. At the end of the first and second parts of the test, the flow rates were gradually decreased to prevent capture of particles that would have been washed out under normal circumstances. The requirement to split the test into parts was not anticipated in the *Procedure for Laboratory Testing of Oil-Grit Separators*, but has been a common feature of testing at the 40 L/min/m² surface loading rate. Conducting the test in two parts for the 80 L/min/m² surface loading rate is less common. The testing did not assess the significance of the breaks, however, the test laboratory and verifier do not believe that the breaks significantly affected the test results.

Hydro International First Defense® HC Oil Grit Separator Verification Statement

3. During the sediment scour test, the flow rate coefficient of variation (COV) at the 200 L/min/m² surface loading rate of 0.045 slightly exceeded the target COV of 0.04. The average flow rate during the test remained within $\pm 10\%$ of the target flow rate.

Quality assurance

Performance testing and verification of the First Defense® HC Oil Grit Separator were performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The verifier, Toronto and Region Conservation Authority, has confirmed that quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This includes reviewing all data sheets and data downloads, as well as overall management of the test system, quality control and data integrity.

Verification Summary

In summary, the First Defense® HC Oil Grit Separator is designed to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals. Verification of performance claims for the Hydro International First Defense® HC Oil Grit Separator was conducted by Toronto and Region Conservation Authority based on independent third-party performance test results provided by Good Harbour Laboratories, as well as additional information provided by Hydro International. Table 3 summarizes the verification results in relation to the technology performance parameters that were identified to determine the efficacy of the First Defense® HC Oil Grit Separator.

Table 3 - Summary of Verification Results Against Performance Parameters

Performance Parameter	Verified Performance
Sediment Removal Rate	The sediment removal rate of the FDHC is dependent upon flow rate, particle density and particle size. Removal efficiency decreased with increasing surface loading rate from 67% at 40 L/min/m ² to 41% at 1400 L/min/m ² . The weighted average removal efficiency achieved by the unit will vary depending on the rainfall distribution of the jurisdiction in which it is installed, and site characteristics.
Sediment Scour	When pre-loaded with sediment with a particle size distribution matching that of the feed sediment used in the sediment capture test, the FDHC generated effluent suspended solids concentrations of less than 11 mg/L at surface loading rates ranging from 200 to 2600 L/min/m ² .
Bypass flow rate	The flow rate at which bypass occurs will vary based on model size. For the 1.2 m (4 foot) diameter test unit, the flow rate at which bypass occurred over the insert bypass weirs was 1238 L/min (327 gpm).
Head loss	The loss of hydraulic head across the FDHC was determined by measuring the water elevation difference between the inlet and outlet sides of the insert. Head loss may vary based on model size. For the tested unit the head loss ranged from 2 mm (0.08 inches) at 93.5 L/min (12.3 gpm) to 100 mm (3.94 inches) at 1238 L/min (327 gpm) when bypass was observed to occur. At 327 gpm, when bypass occurred, the depth of the water was 177 mm upstream and 77 mm downstream for a difference of 100 mm (3.94 inches). The highest water elevation difference was 111mm (4.37 inches) at a flow rate of 1635 L/min (431.8 gpm), after which head loss declined up to the maximum measured flow rate of 3036 L/min (801.9 gpm).

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

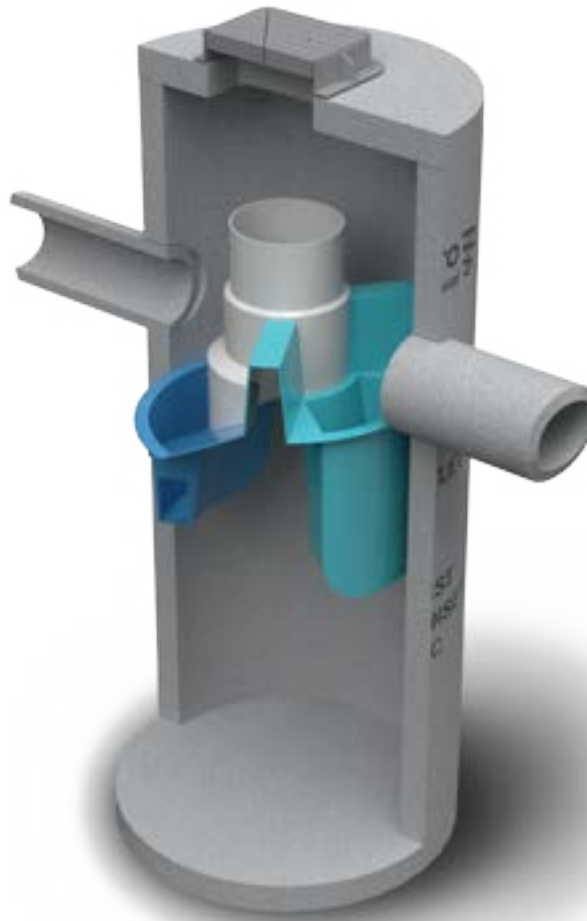
Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the First Defense® HC Oil Grit Separator, contact:	For more information on VerifiGlobal, contact:
Hydro International 94 Hutchins Drive, Portland, Maine USA 04102 t +1-207-756 6200 e: dscott@hydro-int.com w: www.hydro-int.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven t +45 7224 5900 e: info@verifiglobal.com w: www.verifiglobal.com
Signed for Hydro International: <i>Original signed by:</i> David Scott David Scott Technical Product Manager, Americas Stormwater	Signed for VerifiGlobal: <i>Original signed by:</i> Thomas Bruun Thomas Bruun, Managing Director <i>Original signed by:</i> John Neate John Neate, Managing Director

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined operational conditions and parameters and the appropriate quality assurance procedures. VerifiGlobal and the Verification Expert, Toronto and Region Conservation Authority, make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable regulatory requirements. Mention of commercial product names does not imply endorsement.

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Operation and Maintenance Manual

First Defense® and First Defense® High Capacity

Vortex Separator for Stormwater Treatment

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3	FIRST DEFENSE® BY HYDRO INTERNATIONAL - INTRODUCTION - OPERATION - POLLUTANT CAPTURE AND RETENTION
4	MODEL SIZES & CONFIGURATIONS - FIRST DEFENSE® COMPONENTS
5	MAINTENANCE - OVERVIEW - MAINTENANCE EQUIPMENT CONSIDERATIONS - DETERMINING YOUR MAINTENANCE SCHEDULE
6	MAINTENANCE PROCEDURES - INSPECTION - FLOATABLES AND SEDIMENT CLEAN OUT
8	FIRST DEFENSE® INSTALLATION LOG
9	FIRST DEFENSE® INSPECTION AND MAINTENANCE LOG

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Hydro International has been engineering stormwater treatment systems for over 30 years. We understand the mechanics of removing pollutants from stormwater and how to keep systems running at an optimal level.

NOBODY KNOWS OUR SYSTEMS BETTER THAN WE DO



AVOID SERVICE NEGLIGENCE

Sanitation services providers not intimately familiar with stormwater treatment systems are at risk of the following:

- Inadvertently breaking parts or failing to clean/replace system components appropriately.
- Charging you for more frequent maintenance because they lacked the tools to service your system properly in the first place.
- Billing you for replacement parts that might have been covered under your Hydro warranty plan
- Charging for maintenance that may not yet have been required.

LEAVE THE DIRTY WORK TO US

Trash, sediment and polluted water is stored inside treatment systems until they are removed by our team with a vactor truck. Sometimes teams must physically enter the system chambers in order to prepare the system for maintenance and install any replacement parts. Services include but are not limited to:

- Solids removal
- Removal of liquid pollutants
- Replacement media installation (when applicable)



BETTER TOOLS, BETTER RESULTS

Not all vacuum trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don't specialize in stormwater treatment won't have the tools to properly clean systems or install new parts.

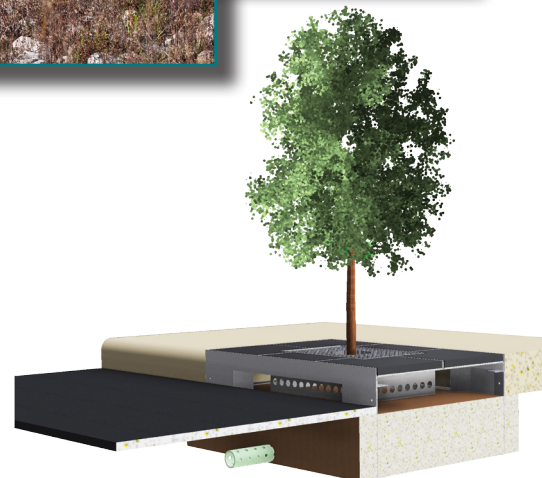


SERVICE WARRANTY

Make sure you're not paying for service that is covered under your warranty plan. Only Hydro International's service teams can identify tune-ups that should be on us, not you.

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- Biofilters/biorention systems
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- Catch basins
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I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations (refer to *Section II. Model Sizes & Configurations*, page 4) to accommodate a wide range of pipe sizes, peak flows and depth constraints.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

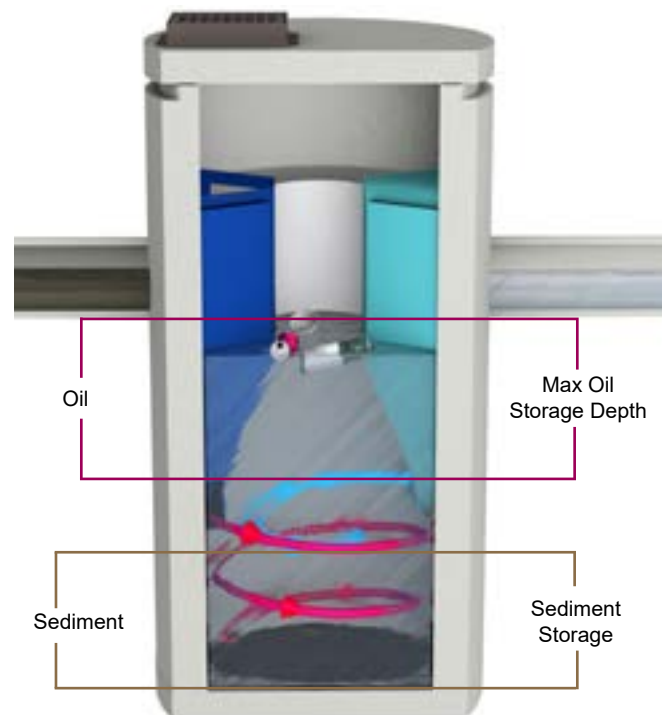


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components of the First Defense®-4HC and First Defense®-6HC have modified geometries as to allow greater design flexibility needed to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2a - 2b). First Defense® model parameters and design criteria are shown in Table 1.

First Defense® Components

- | | | |
|--------------------|-----------------------------|-------------------------|
| 1. Built-In Bypass | 4. Floatables Draw-off Port | 7. Sediment Storage |
| 2. Inlet Pipe | 5. Outlet Pipe | 8. Inlet Grate or Cover |
| 3. Inlet Chute | 6. Floatables Storage | |

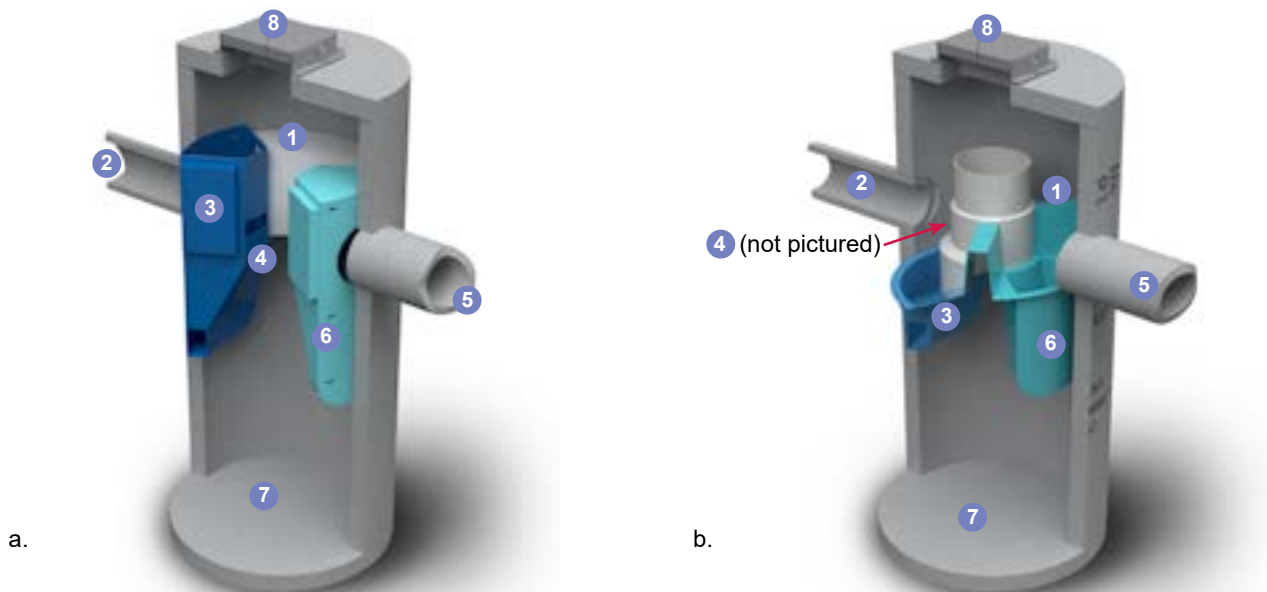


Fig.2a) First Defense®-4 and First Defense®-6; b) First Defense®-4HC and First Defense®-6HC, with higher capacity dual internal bypass and larger maximum pipe diameter.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates		Peak Online Flow Rate	Maximum Pipe Diameter ¹	Oil Storage Capacity	Typical Sediment Storage Capacity ²	Minimum Distance from Outlet Invert to Top of Rim ³	Standard Distance from Outlet Invert to Sump Floor
		NJDEP Certified	106µm						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd³ / m³)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.84 / 23.7	1.60 / 45.3	15 / 424	18 / 457	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.71 / 1.13
FD-4HC	4 / 1.2	1.50 / 42.4	1.88 / 50.9	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	4.97 / 1.5
FD-5HC	5 / 1.5	2.34 / 66.2	2.94 / 82.1	20 / 566	24 / 609	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.19 / 1.5
FD-6HC	6 / 1.8	3.38 / 95.7	4.73 / 133.9	32 / 906	30 / 750	496 / 1,878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	5.97 / 1.8
FD-8HC	8 / 2.4	6.00 / 169.9	7.52 / 212.9	50 / 1,415	48 / 1219	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 - 1.8	7.40 / 2.2

¹Contact Hydro International when larger pipe sizes are required.

²Contact Hydro International when custom sediment storage capacity is required.

³Minimum distance for models depends on pipe diameter.

III. Maintenance

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense®-HC have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

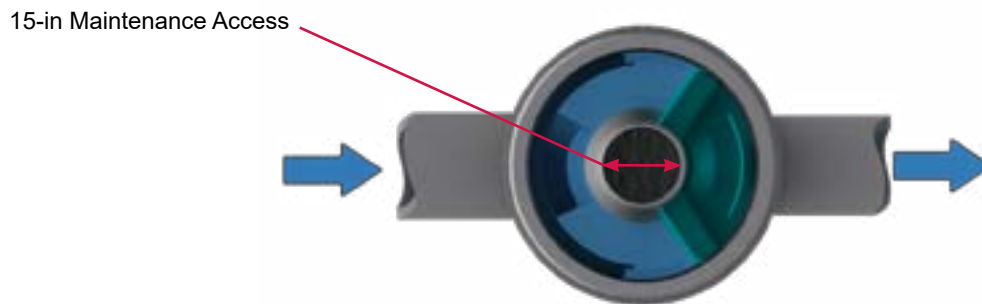


Fig.3 The central opening to the sump of the First Defense®-HC is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / floatables removal, for a 6-ft First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.5).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.
- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.



Fig.4 Floatables are removed with a vactor hose (First Defense model FD-4, shown).

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Remove oil and floatables stored on the surface of the water with the vactor hose (Fig.5) or with the skimmer or net (not pictured).
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor (Fig.5).
7. Retract the vactor hose from the vessel.
8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.
9. Securely replace the grate or lid.



Fig.5 Sediment is removed with a vactor hose (First Defense model FD-4, shown).

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area

NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): FD-4 FD-4HC FD-6 FD-6HC

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

First Defense® Inspection and Maintenance Log

[illegible]

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Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

Verification Statement



StormTech Isolator® Row PLUS Registration number: (V-2020-10-01) Date of issue: (2020-October-27)

Technology type	Stormwater Filtration Device		
Application	Stormwater filtration technology to remove sediments, nutrients, heavy metals, and organic contaminants from stormwater runoff		
Company	StormTech, LLC.		
Address	520 Cromwell Avenue, Rocky Hill, CT 06067 USA	Phone	+1-888-892-2694
Website	www.stormtech.com		
E-mail	info@stormtech.com		

Verified Performance Claims

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Based on the laboratory testing conducted, the verified performance claims are as follows:

Total Suspended Solids (TSS) Removal Efficiency - The StormTech Isolator® Row PLUS achieved $82\% \pm 1\%$ removal efficiency of suspended sediment concentration (SCC) at a 95% confidence level.

Average Loading Rate - Based on the reported flow rate data and the effective sedimentation and filtration treatment area of the test unit, the average loading rate of the test unit was 4.15 ± 0.03 GPM/ft² at a 95% confidence level.

Maximum Treatment Flow Rate (MTFR) - Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 gpm/ ft² of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft².

Detention Time and Volume - The StormTech Isolator Row PLUS detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft³ and a detention time of 2.2 minutes.

Maximum Sediment Storage Depth and Volume - The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft³ at a sediment depth of 0.5 inches.

Effective Sedimentation/Filtration Treatment Areas - The Effective Sedimentation Area (ESA) and the Effective Filtration Treatment Area (EFTA) increase as the size of the system increases. For the two overlapping StormTech SC-740 chambers tested, the ESA and the ratio of ESA/EFTA were 54.5 ft² and 1.0, respectively.

Sediment Mass Load Capacity - The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs ± 0.8 lbs (2.91 ± 0.01 lbs/ ft²) following a total sediment loading of 195.2 lbs.

Technology Application

The StormTech “Isolator® Row PLUS” is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers covered in a non-woven geotextile fabric with a single layer of proprietary woven fabric at the bottom that serves as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal. The following features make the Isolator® Row PLUS effective as a water quality solution:

- Enhanced infiltration Surface Area
- Runoff Volume Reduction
- Peak Flow Reduction
- Sediment/Pollutant Removal
- Internal Water Storage (IWS)
- Water Temperature Cooling (Thermal Buffer).

Technology Description

The Isolator® Row PLUS (shown in Figures 1 and 2) is the first row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator® Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out of the chambers, while sediment is captured in the Isolator® Row PLUS.

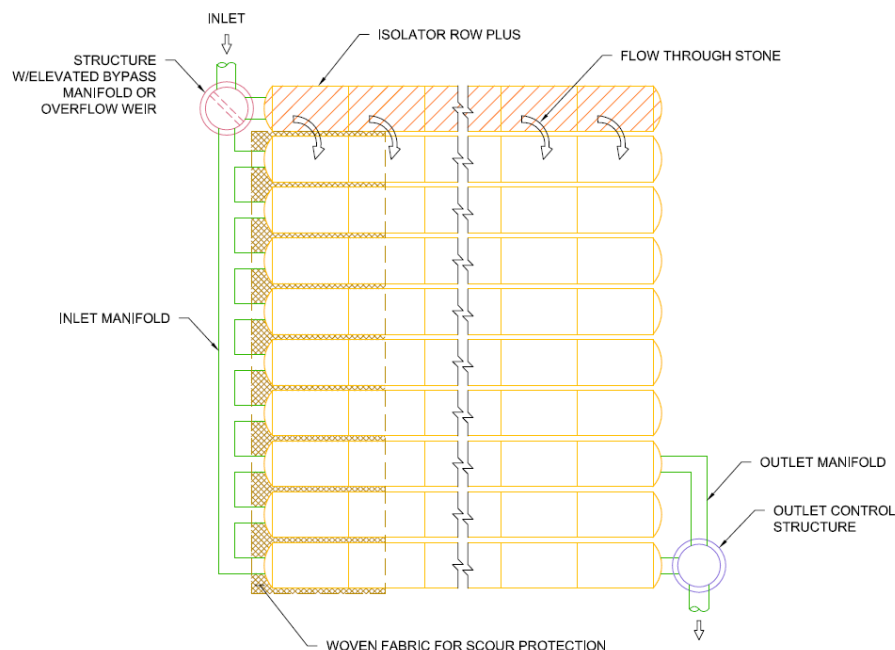


Figure 1: Schematic of the StormTech Isolator® Row PLUS System

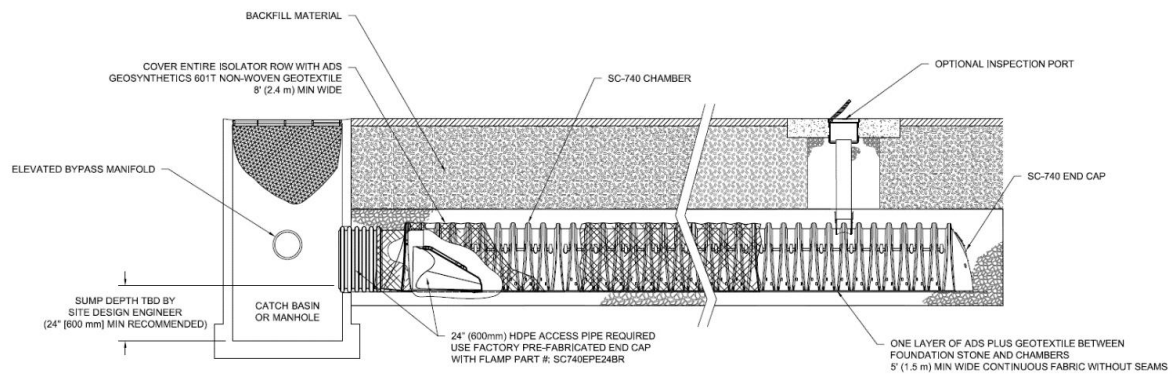


Figure 2: Isolator® Row PLUS Detail

A single layer of proprietary Advanced Drainage Systems (ADS) PLUS fabric is placed between the angular base stone and the Isolator Row PLUS chamber. The geotextile provides the means for stormwater filtration and provides a durable surface for maintenance operations. A 6 oz. non-woven fabric is placed over the chambers.

The Isolator® Row PLUS is designed to capture the “first flush” and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator® Row PLUS but includes a high low/concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator® Row PLUS bypass through a manifold to the other chambers. This is achieved with either a high-flow weir or an elevated manifold. This creates a differential between the Isolator® Row PLUS and the manifold, thus allowing for settlement time in the Isolator® Row PLUS. After Stormwater flows through the Isolator® Row PLUS and into the rest of the StormTech chamber system it is either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech developed and owns the Isolator® Row PLUS technology and has filed a number of patent applications relating to the Isolator® Row PLUS system.¹

Description of Test Procedure for the StormTech Isolator® Row PLUS

In January 2020, two overlapping StormTech SC-740 Isolator® Row PLUS commercial size chambers were installed at the Mid-Atlantic Storm Water Research Center (MASWRC, a subsidiary of BaySaver), in Mount Airy, Maryland, to evaluate the performance of the Isolator® Row PLUS system for Total Suspended Solid (TSS) removal (Figure 3) All testing and data collection procedures were supervised by Boggs Environmental Consultants, Inc. (BEC), who was hired by ADS for third party oversight, and were in accordance with the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January 2013)*.

Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 09, 2020, was submitted and approved by the New Jersey Corporation for Advanced Technology (NJCAT), c/o Center for Environmental Systems, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ 07030.

¹ (U.S. Provisional Application No. 62/753,050, filed October 30, 2018; U.S. Non-Provisional Application No. 16/670,628, filed October 31, 2019; International Application No. PCT/US2019/059283, filed October 31, 2019; U.S. Application No. 16/938,482, filed July 24, 2020; U.S. Application No. 16/938,657, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043557, filed July 24, 2020.



Figure 3: StormTech “Isolator® Row PLUS” Test Set-up at MASWRC

Verification Results

The verification process for the StormTech Isolator® Row PLUS technology was conducted by GHIL in accordance with the VerifiGlobal Verification Plan for the StormTech “Isolator® Row PLUS” Technology – 2020-09-09. The technology performance claims verified by GHIL are summarized at the front of this Verification Statement and in Table 6 on Page 8 under the heading “Verification Summary”.

Particle size distribution analysis was performed by ECS Mid-Atlantic, LLC of Frederick, MD in accordance with ASTM D422-63(2007). ECS is accredited by the American Association of State Highways and Transportation Officials (AASHTO).

ASTM D422-63(2007) is a sieve and hydrometer method where the larger particles, > 75 microns, are measured using a standard sieve stack while the smaller particles are measured based on their settling time using a hydrometer.

The PSD meets the requirements of NJDEP, which is generally accepted as representative of the type of particle sizes an OGS would be designed to treat. Actual PSD is site and rainfall event specific, so it was necessary to choose a standard PSD to make testing and comparison manageable.

Table 1 shows the NJDEP PSD specification. Table 2 and Figure 4 show the incoming material PSD as determined by ECS Mid-Atlantic and confirmed by the verifier.

Table 1: NJDEP PSD Specification

Particle Size (µm)	NJDEP Minimum Specification
1000	98
500	93
250	88
150	73
100	58
75	48
50	43
20	33
8	18
5	8
2	3
d ₅₀	< 75 µm

Table 2 – Particle Size Distribution (PSD) of Test Sediment

Mesh (mm)	US Sieve Size	Sample ID		
		PSD A	PSD B	PSD C
		Percent Finer		
9.525	0.375	100.0	100.0	100.0
4.750	#4	100.0	100.0	100.0
4.000	#5	100.0	100.0	100.0
2.360	#8	100.0	100.0	100.0
2.000	#10	100.0	100.0	100.0
1.180	#16	100.0	100.0	100.0
1.000	#18	100.0	100.0	100.0
0.500	#35	100.0	100.0	100.0
0.425	#40	93.3	93.0	93.6
0.250	#60	90.3	89.8	90.2
0.150	#100	79.3	78.1	78.1
0.125	#120	73.6	71.7	71.7
0.106	#140	68.4	65.2	64.8
0.090	#170	60.2	58.3	57.5
0.075	#200	52.0	50.9	50.3
0.053	#270	48.0	48.3	47.8
0.045	Hydrometer	46.6	46.7	46.7
0.032		42.8	42.9	41.0
0.021		37.1	37.2	35.3
0.0125		25.7	25.7	25.8
0.0090		20.1	20.1	19.2
0.0064		16.3	16.4	14.5
0.0032		8.8	8.7	7.8
0.0014		3.8	3.7	3.8

The suspended sediment concentration analysis was completed by Fredericktowne Labs Inc., Meyersville, MD. Fredericktown Labs is accredited by the Maryland Department of Environment as Maryland Certified Water Quality Laboratory. The analysis procedure was ASTM D3977-97, Suspended Sediment Concentration. The sampling procedure and submission of samples to the test lab were overseen by the independent observer, Boggs Environmental Consultants, Inc.

All test data and calculations were detailed in the report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020, which was submitted to and verified by the New Jersey Corporation for Advanced Technology (NJCAT).

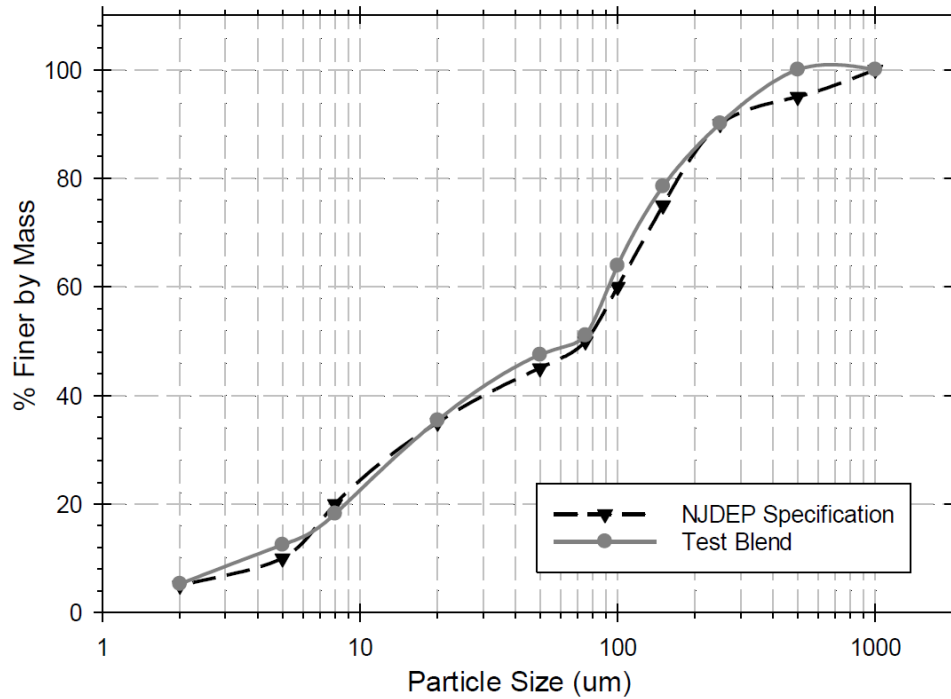


Figure 4– Particle Size Distribution (PSD)

The data in Table 3 (Flow Rate and Temperature) and Table 4 (Removal Efficiency) form the basis for the verified technology performance claim, specifically, flow rate, sediment captured and removal efficiency.

Table 3: Flow Rate and Temperature Summary

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Compliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Temperature Compliance (< 80 F)
1	232.8	223.9	226.3	0.0078	Y	48.2	Y
2	228.9	218.6	220.8	0.0104	Y	51.5	Y
3	229.4	220.0	227.2	0.0094	Y	44.7	Y
4	230.2	218.7	223.2	0.0138	Y	40.5	Y
5	228.7	216.9	222.2	0.0103	Y	44.7	Y
6	227.6	217.0	224.2	0.0115	Y	46.7	Y
7	229.7	221.9	226.4	0.0092	Y	44.6	Y
8	230.3	222.2	226.8	0.0089	Y	43.5	Y
9	233.2	218.4	225.6	0.0136	Y	45.5	Y
10	232.2	219.7	228.4	0.0126	Y	44.7	Y
11	226.9	219.2	224.1	0.0088	Y	52.4	Y
12	232.2	222.1	226.9	0.0107	Y	48.5	Y
13	234.7	221.2	226.1	0.0109	Y	48.5	Y
14	231.9	223.4	228.7	0.0103	Y	45.6	Y
15	236.8	224.1	231.4	0.0131	Y	52.2	Y
16	232.5	221.3	229.0	0.0137	Y	47.8	Y

Table 4: Removal Efficiency Results

Run	Average Influent TSS (mg/L)	Influent Water Volume (gal)	Adjusted Average Effluent TSS (mg/L)	Effluent Water Volume (gal)	Adjusted Average Drain Down TSS (mg/L)	Drain Down Water Volume (gal)	Single Run Removal Efficiency (%)	Mass of Captured Sediment (g)	Cumulative Removal Efficiency (%)
1	203	7166	46	6881	34	285	77.8	4282	77.8
2	199	6993	32	6639	27	354	84.0	4415	80.8
3	207	7197	37	6793	27	403	82.6	4654	81.4
4	217	7068	33	6635	29	433	84.9	4923	82.3
5	215	7037	39	6593	29	444	82.2	4705	82.3
6	207	7097	40	6643	31	454	81.2	4504	82.1
7	198	7169	37	6693	30	476	81.6	4386	82.0
8	201	7184	37	6716	32	468	81.6	4473	82.0
9	205	7147	38	6675	30	472	81.8	4539	82.0
10	203	7235	38	6759	31	476	81.4	4523	81.9
11	208	7096	38	6624	30	472	81.8	4567	81.9
12	209	7185	41	6709	30	476	80.7	4584	81.8
13	198	7162	41	6680	32	482	79.7	4277	81.6
14	200	7242	43	6757	34	485	78.8	4318	81.4
15	196	7329	41	6842	32	487	79.5	4320	81.3
16	202	7254	44	6769	31	485	78.9	4384	81.2
Avg.	204.2	7160	39	6713	31	447	81.2	4491	N/A
Cumulative Mass Removed (g)							71854		
Cumulative Mass Removed (lb)							158.4		
Total Mass Loaded (lb)							195.2		
Cumulative Removal Efficiency (%)							81.2		

Quality Assurance

Performance verification of the StormTech Isolator® Row PLUS technology was performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. This included reviewing all data sheets and calculated values, as well as overall management of the test system, quality control and data integrity.

Additional information on quality control measures taken can be found in section 5 of the QAPP for StormTech Isolator Row New Jersey Department of Environmental Protection Testing, Rev. 1/9/2020.

Specific QA/QC measures reviewed by the verifier are summarized in Table 5 below.

Table 5. Validation of QA/QC Procedures

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consultants, Inc. to NJCAT
Consistency of procedure	Daily logs confirm proper procedure
Existence of QAPP	Confirmed. "QAPP For StormTech Isolator Row New Jersey Department of Environmental Protection Testing", Rev. 1/9/2020)
Use of appropriate sample analysis method – ASTM D3799	Confirmed by method reference on lab reports from Fredericktowne Labs Inc.
Test method appropriate for the technology	Used industry stakeholder approved protocol: <i>New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids</i>

	<i>Removal by a Filtration Manufactured Treatment Device (January 2013)</i>
Test parameters stayed within required limits	Confirmed in report "NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC", July 2020
Third party verified data	All testing was observed and reviewed by Boggs Environmental Consultants, Inc.

Variance

Performance claims regarding structural load limitations were not verified as they are outside the scope of the performance testing that was conducted in accordance with the 'Quality Assurance Project Plan (QAPP) for StormTech Isolator Row, New Jersey Department of Environmental Protection Testing', revision dated January 09, 2020.

Verification Summary

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers wrapped in woven geotextile fabric with two layers at the bottom that serve as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal.

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Table 6 summarizes the verification results in relation to the technology performance parameters that were identified in the Verification Plan to determine the efficacy of the StormTech Isolator® Row PLUS technology.

Table 6 - Summary of Verification Results Against Performance Parameters

Parameters	Verified Claims	Accuracy
Total Suspended Solids (TSS) Removal Efficiency	Based on the laboratory testing conducted, the StormTech Isolator® Row PLUS achieved an average 82% removal efficiency of SSC	± 1% (95% confidence level)
Average Loading Rate	Based on the laboratory testing parameters, the StormTech Isolator® Row PLUS maintained a loading rate of 4.15 GPM/sf	±0.03 GPM/sf (95% confidence level)
Maximum Treatment Flow Rate (MTFR)	Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 GPM/ft ² of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft ² .	± 1.4 GPM (95% confidence level)
Detention Time and Volume	Detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft ³ (based on	N/A

	physical measurement) and a detention time of 2.2 minutes.	
Maximum Sediment Storage Depth and Volume	The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft ³ at a sediment depth of 0.5 inches.	N/A
Effective Sedimentation/ Filtration Treatment Area	The effective sedimentation and filtration treatment area increases as the size of the chamber increases. Under the tested conditions using 2 overlapping chambers, the treatment area was 54.5 ft ²	The sedimentation /filtration area was determined from the actual physical dimensions of the test unit*
Sediment Mass Load Capacity	The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs (2.91 lbs/ ft ²) following a total sediment loading of 195.2 lbs	± 0.8 lbs (±0.01 lbs/ft ²) (95% confidence level)

*Note: These numbers are determined based on physical measurement or a dimensional drawing, which is standard practice. Highly accurate measurements are not practical.

In conclusion, the StormTech Isolator® Row PLUS is a viable technology that can be used to remove contaminants from stormwater runoff via filtration. This technology has proven effective at removing suspended sediment from stormwater through in-lab testing using an industry recognized laboratory protocol.

By extension of sediment removal, this technology should also remove particle bound nutrients, heavy metals, and a wide variety of organic contaminants. Performance is a function of pollutant properties, hydraulic retention time, filter media, pre-treatment, and flow rate, such that proper design of the system is critical to achieving the desired results.

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the StormTech "Isolator® Row PLUS" technology, contact:	For more information on VerifiGlobal, contact:
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Signed for StormTech: <i>Original signed by:</i>  Greg Spires, P.E. General Manager	Signed for VerifiGlobal: <i>Original signed by:</i>  Thomas Bruun, Managing Director <i>Original signed by:</i>  John Neate, Managing Director

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Isolator[®] Row Plus

O&M Manual



The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS), Total Phosphorus (TP), Total Petroleum Hydrocarbons (TPH) and Total Nitrogen (TN) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, SC-800, MC-3500, MC-4500 or MC-7200 models, are lined with filter fabric and connected to a closely located manhole for easy access. The fabric lined chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers allow stormwater to flow vertically out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS Isolator Row and Plus fabric are placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting.

The Isolator Row Plus is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

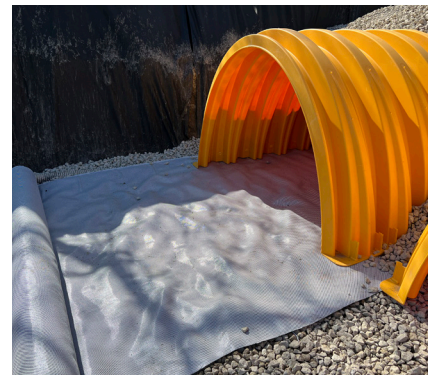
The Isolator Row Plus Flamp™ is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end, or more difficult to remove and require confined space entry into the chamber area. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

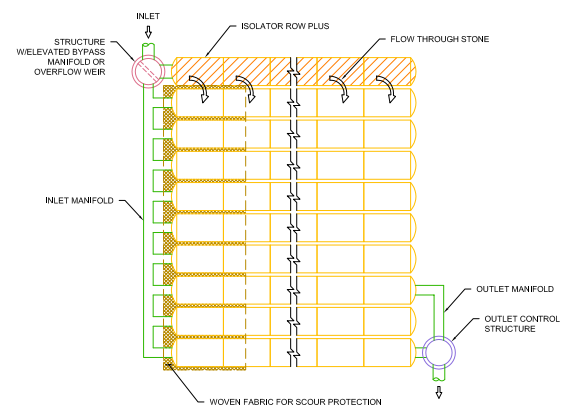
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.



Looking down the Isolator Row Plus from the manhole opening, ADS Plus Fabric is shown between the chamber and stone base.



StormTech Isolator Row Plus with Overflow Structure (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

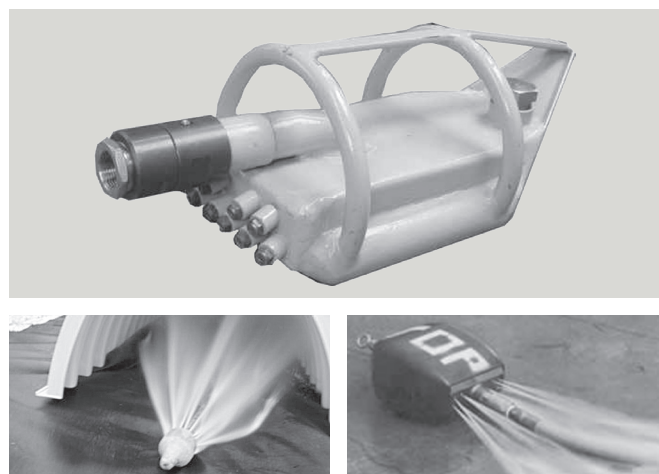
If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3" (75 mm) throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

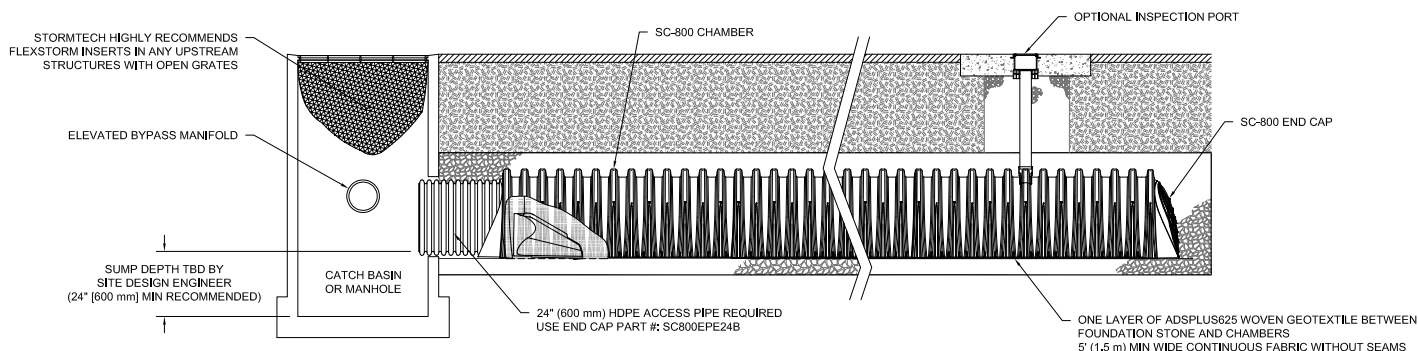
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided

via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entry.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row Plus (not to scale)



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
 - B) All Isolator Row Plus
 - i. Remove cover from manhole at upstream end of Isolator Row Plus
 - ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
- If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

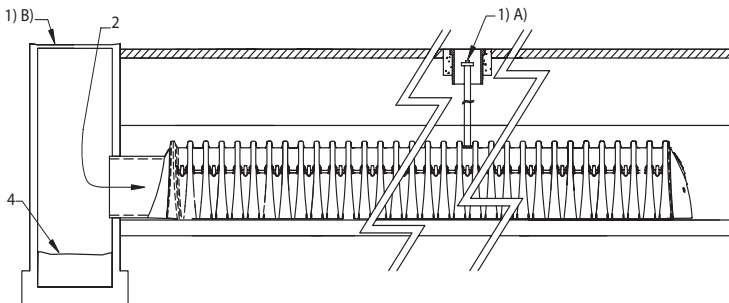
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sedi- ment Depth (1)-(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row Plus, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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STORMWATER MANAGEMENT FACILITY OPERATION & MAINTENANCE PLAN

STORMWATER MANAGEMENT FACILITY INFORMATION

The proposed development was designed with a Stormwater Management (SWM) Facility incorporated into the building structure to temporarily store stormwater runoff and control the release rate discharged to the municipal infrastructure. **Regular maintenance of this private infrastructure is required to ensure its correct function.** The designed system consists of:

- A waterproofed cast-in-place chamber designed to temporarily store a stormwater volume of 228.4m³ (228,400L) including a drop structure;
- Various pumps to control the flow from the tank to the road side ditch outlet;
- A steel orifice plate, and;
- One frame and grates (maintenance hole lids).

ADDRESS: 0 Nicholas St., Picton, Ontario

LOCATION: The SWM facility is located in the north east corner of the parking area and can be accessed from the maintenance hole located adjacent to the ramp wall.

**The SWM facility is considered a confined space as per O.Reg.632/05
and can only be entered by qualified personnel.**

RECOMMENDED MAINTENANCE AND SCHEDULE

The maintenance plan for the SWM facility at the location listed above is provided to the Owners as a guideline to ensure that the installed system operates as intended to comply with the municipal/regional stormwater management requirements. The following recommended maintenance procedures and preventative measures should be incorporated into the condominium corporation's operating and maintenance budget:

Inspection and Maintenance Checklist	Frequency	Comments
Structure		
Inspect for build-up of sediments and debris, remove debris as necessary and clean-out sediments should depth exceed 10mm	Every 2 years	Frequency may need to be adjusted based on quantity of debris and sediments
Inspect interior of chamber for de-bonded waterproofing repair as necessary	Every 5 years	After initial 20-year service life
Inspect interior of chamber for delaminated concrete, repair as necessary	Every 5 years	After initial 20-year service life
Inspect safety platform and anchors, repair as necessary	Every 5 years	-
Components		
Remove access lids clean rims and reset.	Bi-annually	Spring and fall
Service and inspect pumps	As per manufacturer's recommendations	Refer to pump ownership manuals
Inspect orifice plate, anchor and benching.	Every 5 years	-

STORMWATER MANAGEMENT FACILITY OPERATION & MAINTENANCE PLAN

Other		
Remove/sweep surface debris from access lids to prevent debris from entering chamber	As necessary	-
Remove trash and debris from grounds	As necessary	-
Inspect all roof drains, area drains and empty sediment baskets as necessary	Bi-annually	Spring and fall
Inspect catch basins and clean out sumps as necessary	Annually	Spring
Remove trash and debris from grounds	Bi-weekly	-