

1319 Johnston Road Site Plan
Light Industrial Development
Servicing and Stormwater
Management Report

Prepared For:

2079 Artistic Place GP Inc.

Prepared By:

Robinson Land Development

Project No. 23034
July 2024

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LEGAL NOTIFICATION

This report was prepared by Robinson Land Development for the account of **2079 Artistic Place GP Inc.**

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Robinson Land Development** accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project

1.0 INTRODUCTION

Robinson Land Development has been retained by 2079 Artistic Place Inc. to prepare a servicing and stormwater management design for a proposed commercial development located at 1319 Johnston Road, located in the corner of Johnston Road and Bank Street (and Artistic Place). The subject site is proposed to be developed into eight separate light industrial buildings. The extent of the development is bounded by Sawmill Creek on the west and tributary ditches to Sawmill Creek on the north and east side of the property. Refer to architectural site plan provided in **Appendix A** for reference.

This report will detail the proposed means of servicing the site and provide details on how to meet the stormwater management requirements. Pre-consultation notes from the City of Ottawa have been provided in **Appendix A** for reference.

2.0 EXISTING CONDITIONS

The 4.89 ha subject site is zoned Light Industrial (IL) and is currently partially developed for concreting/landscaping yardworks. These existing works will be demolished for the proposed development. The only municipal ROW access the site has is a 15.25 m wide strip at the southeast corner of the site that connects to Johnston Road.

The following infrastructure exists adjacent to the site:

- 300 mm dia. cast iron watermain along Johnston Road.
- 750 mm dia. concrete sanitary sewer along Johnston Road.
 - 250 mm dia. concrete sanitary sewer along Johnston Road that crosses in front of the site entrance ties and discharges into the 750 mm dia. sanitary.
- 450 to 1050 mm dia. concrete storm sewer along Johnston Road.
 - The storm sewer along Johnston Road collects to an 1800 mm dia. sewer and travels north adjacent to the site, crosses the property from the east edge to the northwest corner in a 9 m wide easement. This storm sewer discharges to Sawmill Creek shortly downstream.

Refer to GeoOttawa screen captures of the existing watermain, sanitary, and storm infrastructure provided in **Appendix A** for more details.

3.0 DEVELOPMENT PROPOSAL

The Owner is proposing to develop the subject site into eight separate light industrial buildings and associated parking lots. Only 3.70 ha of the site are proposed for development, allowing a 30 m setback from the west property line and a 15 m setback from the north property line for the Sawmill Creek tributaries. The eight commercial buildings are sized as follows, following clockwise around the site beginning at Building G:

- Building G: 2,439 m²
- Building H: 2,439 m²
- Building F: 2,019 m²
- Building E: 1,464 m²
- Building C: 1,859 m²
- Building B: 1,098 m²
- Building D: 1,588 m²
- Building A: 2,453 m²

Refer to the Site Plan, prepared by Allan Stone Architect, in **Appendix A** for more details.

The proposed development will be provided with new water, sanitary and storm services per City requirements. The proposed civil design drawings are provided in **Appendix B** including:

- Servicing Plan
- Grading Plan
- Notes & Details Plan
- Erosion & Sediment Control Plan
- Existing Conditions & Removals Plan
- Storm Drainage Area Plan

3.1 Phasing

The architectural site plan in **Appendix A** indicates five phases of development. Phase 1 will involve most of the civil servicing infrastructure, including the storm pond, storm tank, and all hydrants. Only CB 215 (Phase 2/3), and CB 211 and CB 213 (Phase 4) and will be constructed during the respective phases. As the full storm quantity and quality control infrastructure will be constructed during phase 1 and the future phases will be left as softscaping in the interim, there are no concerns about stormwater management during the interim conditions. The main watermain loop and all hydrants will be constructed during Phase 1, therefore there are no concerns about fire servicing during the interim conditions. Likewise, the full sanitary sewer will be constructed during Phase 1.

4.0 WATER SERVICING

The subject site will receive water supply via a twinned 200 mm watermain connected to the existing 300 mm watermain on Johnston Road, looped within the site for supply redundancy. The watermain system has been designed according to the following standards and guidelines:

- Ottawa Design Guidelines – Water Distribution (2010) periodically amended as part of Technical Bulletins
- Fire Underwriters Survey (FUS) Water Supply for Public Fire Protection (2020)
- MOECC Design Guidelines for Drinking-Water Systems (2008)

Accordingly, the following watermain design criteria have been utilized for the subject site:

- Light Industrial Flow: 35,000 L/ha/d
- Max Day Demand Factor: 1.5
- Peak Hour Demand Factor: 1.8
- Minimum Pressure During Peak Hour 276 kPa (40 psi)
- Minimum Pressure During Maximum Day Plus Fire 140 kPa (20 psi)
- Maximum Pressure in Unoccupied Areas 689 kPa (100 psi)
- Maximum Pressure in Occupied Areas 552 kPa (80 psi)

4.1 Boundary Conditions

The City of Ottawa provided boundary conditions for the subject site at the proposed connections to the existing 300 mm watermain on Johnston Road. Refer to **Appendix C** for proposed domestic and fire demand calculations and received boundary conditions. The boundary conditions have been summarized in **Table 1** below:

Table 1 – Boundary Conditions

| Demand Scenario | Head (m) | Pressure (psi) |
|---------------------------|----------|----------------|
| Maximum HGL (Average Day) | 131.3 | 73.8 |
| Minimum HGL (Peak Hour) | 123.9 | 63.3 |

| | | |
|----------------|-------|------|
| Max Day + Fire | 123.7 | 63.0 |
|----------------|-------|------|

4.2 Fire Protection

The nearest existing municipal hydrant to the site is located approximately 45 m from the site entrance on Johnston Road. Fire protection for the subject site will be provided by proposed on-site private hydrants fed from the same 200 mm private watermain loop. The proposed hydrants will be located to provide coverage of all buildings based on their calculated fire demand, with a maximum spacing of 90 m. Buildings G, H, C, and A will be sprinklered, and Buildings F, E, B, and D will be unsprinklered. A hydrant is within 45 m of each building's respective fire department connection (HYD-8 for Building G and A, HYD-4 for Building H, and HYD-5 for Building C), located on the outside wall of the mechanical room.

The required fire flow for the subject site was calculated using the Fire Underwriter's Survey (FUS) long form for each building (refer to **Appendix C**). Based on the building construction, occupancy and ground floor area for each building, the maximum required fire flow is 14,000 L/min (233.3 L/s) at Building E and F.

4.3 Hydraulic Model Results

The hydraulic model results for Maximum HGL, Peak Hour and Maximum Day + FF have been calculated and summarized in **Table 2** below. The fire demand scenario was rendered for the set of three hydrants nearest an unsprinklered building and its associated fire demand, and the set of two hydrants nearest a sprinklered building and its associated fire demand.

Table 2 – Hydraulic Model Results

| Criteria | Fire Demand (L/min) | Min. Pressure (psi) | Max. Pressure (psi) | Allowable Pressure Range |
|--|---------------------|---------------------|---------------------|--------------------------|
| Avg Day | - | 67.9 | 72.8 | 40 – 80 psi |
| Peak Hour | - | 57.3 | 62.3 | 40 – 80 psi |
| Max Day + Fire (Hyd 8,1 - Bldg G or A - sprinklered) | 7,000 | 52.4 | - | >20 psi |
| Max Day + Fire (Hyd 3,4 Bldg H - sprinklered) | 8,000 | 43.9 | - | >20 psi |
| Max Day + Fire (Hyd 2,3,4 - Bldg F) | 14,000 | 26.0 | - | >20 psi |
| Max Day + Fire (Hyd 3,4,5 - Bldg E) | 14,000 | 22.2 | - | >20 psi |
| Max Day + Fire (Hyd 5,6 - Bldg C - sprinklered) | 9,000 | 37.6 | - | >20 psi |
| Max Day + Fire (Hyd 5,6,7 - Bldg D or B) | 12,000 | 28.2 | - | >20 psi |

As indicated in **Table 3** above, the subject site can be adequately serviced for both domestic and fire demands. Refer to the hydraulic model outputs provided in **Appendix C** for details.

5.0 SANITARY SERVICING

5.1 Design Criteria

Sanitary flows from the site will discharge to the 750 mm sanitary sewer on Johnston Road. The sanitary sewer system has been designed according to the following standards and guidelines:

- Ottawa Sewer Design Guidelines (2012) periodically amended as part of Technical Bulletins
- MOECC Design Guidelines for Sewage Works (2008)

Accordingly, the following design parameters have been implemented for the subject site:

- Light Industrial Flow: 35,000 L/ha/d
- Peaking Factor: 7.0
- Infiltration Allowance: 0.33 L/s/ha
- Minimum Velocity: 0.60 m/s
- Maximum Velocity: 3.0 m/s

5.2 Proposed Design

All proposed sanitary sewers have been designed to have capacities to convey the peak design flows and meet minimum full flow velocities. Refer to the sanitary sewer design sheet in **Appendix D** for more details. Confirmation from the City of Ottawa that the existing 750 mm sanitary on Johnston Rd. has sufficient capacity for the proposed development is provided in **Appendix D**.

A monitoring maintenance hole is located at the site entrance near the property line immediately prior to discharge to the existing 750 mm municipal sewer.

6.0 STORM SERVICING

6.1 Design Criteria

Stormwater runoff collected on the subject site will be discharged to the existing 1800 mm storm sewer that runs in an easement through the site and ultimately discharges to the Sawmill Creek shortly downstream. Existing stormwater runoff is directed to the boundaries of the property. Ditches/streams that are tributary to Sawmill Creek run along the property lines to collect the sites current stormwater runoff.

The storm sewer system has been designed according to the following standards and guidelines:

- Ottawa Sewer Design Guidelines (2012) periodically amended as part of Technical Bulletins
- MOECC Stormwater Management Planning and Design Manual (2003)
- Sawmill Creek Subwatershed Study Update (2003) by CH2M Hill
- Site Plan Application pre-consultation meeting minutes

Accordingly, the following design parameters have been implemented for the subject site:

- Quantity Control: 100-year post-development to 2-year pre-development
- Quality Control: Enhanced (80% TSS reduction)
- Infiltration: Provide infiltration for 40% of hard surfaces
- Ponding: No ponding during 2-year, max. 300mm ponding
- Minimum Velocity: 0.80 m/s
- Maximum Velocity: 3.0 m/s

Additionally, the storage system must remain above the 100-year hydraulic grade line of the 1800 mm storm sewer as confirmed by the City. These criteria were confirmed with the City and provided in **Appendix E** for reference.

The allowable controlled flow rate was calculated based on the 2-year pre-development flow rate, accounting for the uncontrolled area. Refer to **Appendix E** for details of the calculations. The summary of the calculations are as follows:

- 2-year Pre-Development Flow Rate: 127 L/s
- 100-year Controlled Area Allowable Discharge Rate: 100 L/s

6.2 Minor System

Because the 1800mm storm sewer and its easement crosses the site the drainage system is effectively split into two sections: the Main Site and Building A. Stormwater runoff from the Main Site will be captured and discharge to a new MH installed on the 1800 mm storm sewer. Stormwater runoff from the Building A side will be captured and discharge to the existing MH on the 1800 mm storm sewer. Based on the site plan the two drainage system sections cannot effectively be discharged to the same location on the 1800 mm storm sewer, thus two connection points are required. A portion of the entrance driveway cannot be captured by the storm system and will be captured by the existing catch basins on Johnston Rd. immediately outside the site entrance (which is also conveyed through the 1800 mm storm sewer). The buildings are assumed to have no roof storage capacity (sloped roofs) with roof drainage discharging at-grade at downspouts identified on the plan. Refer to the 2-year storm sewer design sheet in **Appendix E** for details of the calculations and the Storm Drainage Area Plan in **Appendix B** for reference. Accordingly, under the 2-year storm no ponding will occur.

6.3 Major System/Quantity Control

The major system flows of the site involve ponding in the respective drainage areas. Quantity storage is provided by surface ponding at catch basins, an underground storage tank in the centre of the site, and a dry pond at the north end of the site. No spillover will occur during the 5-year storm. During the 100-year storm some spillover will occur between the individual drainage areas (from Drainage Areas 4, 5, and 7) though no emergency spillover off-site up to and including the 100-year storm. Surface ponding depths are limited to maximum 300mm measured from the catch basin T/G, with all local overflow elevations minimum 300mm below building entrance elevations. Emergency overflow flow routes are directed towards:

- Johnston Road (Drainage Areas 10,13 and 14);
- Existing Sawmill Creek along the west property line (Drainage Areas 1-5,7-9,15,17, and 18);
- Existing tributary ditch along the east property line (Drainage Area 16)

Refer to the 5-year and 100-year storm sewer design sheets in **Appendix E** for details of the calculations and the Storm Drainage Area Plan in **Appendix B** for reference.

While individual drainage areas were generally designed to operate independently during the 2-year and 5-year storms, due to the flow restrictions the Main Site and Building A systems will each operate as a whole (though still independent of one another). Flow restrictions were calculated for the site with the use of inlet control devices at the end of the respective sewer trains, but before the oil-grit separators. The details of the calculations are provided in **Appendix E** and summarized in **Table 3** below.

Table 3 – 100-Year Post-Development Discharge Rates

| Drainage Area | Max Discharge Rate (L/s) |
|--------------------------|--------------------------|
| Main Site (1-14) | 91.1 |
| Building G (15-18) | 8.7 |
| Uncontrolled Entranceway | 26.8 |
| Total | 126.6 |

Based on these flow restrictions the total storm storage was calculated for the 100-yr design storm for the Main Site and Building A portions. Since ICD flow rate is a function of head pressure, for total storage calculations the discharge rate was assumed at 50% of the maximum rate. On the Main Site side there is sufficient storage for the 100-yr design storm up to the spillover elevation of 82.80 m. On the Building A side all storage is contained within the dry pond up to the 100-yr design storm at an elevation of 82.50 m, but there remains additional storage in the site up to the spillover elevation of 82.83 m (spilling over from Drainage Area 18 to the Main Site side at Drainage Area 6 and ultimately to the emergency spillover at the west end of the site). The details of the calculations are provided in **Appendix E** and summarized in **Table 4** below.

Table 4 – 100-Year Post-Development Storage Volumes

| Drainage Area | Required Storage (m ³) | Available Storage (m ³) | Elevation (m) |
|--------------------|------------------------------------|-------------------------------------|---------------|
| Main Site (1-14) | 1,573 | 1,577 | 82.80 |
| Building A (15-18) | 527 | 541 | 82.50 |
| Total | | 2,118 | |

The underground storage tank is proposed as a GreenStorm ST underground storage module or equivalent which provides high volume efficiency storage capacity, highway-rated vehicle loading, and infiltration capacity with exposed bottom construction. Typical details of the GreenStorm system are provided in **Appendix E** for reference. The tank ICD will be secured in a dedicated maintenance hole immediately downstream of the tank but before the oil-grit separator. The ICD for the Main Site drainage portion is proposed as a Tempest HF Model E or equivalent to provide high flow-rate control along with additional level of control against the discharge of floatable contaminants prior to the OGS. Typical details of the Tempest ICDs are provided in **Appendix E** for reference. The dry pond will be a simple grassed open area with 3:1 side walls and concrete headwalls for the inlet and outlet pipes. The pond ICD orifice plate will be secured at the outlet headwall, with the oil-grit separator immediately downstream.

6.4 Hydraulic Grade Line

As confirmed by the City of Ottawa the hydraulic grade line of the 1800mm storm sewer will be above the obvert of the pipe during the 100-year storm. Accordingly, the connecting storm storage system will be above the hydraulic grade line at the connection point to avoid backflow of the system and negating storage capacity. The hydraulic grade line provided by email is shown in **Appendix E** and summarized as follows:

- Main Site (underground tank) connection: Minimum elevation at ex. MHST33692 of 80.77 m (HGL downstream of MHST33692 at connection point will be lower)
- Building A (dry pond) connection: Minimum elevation at ex. MHST33693 of 80.56 m

The bottom of the underground storage tank is set to 80.77 m and the bottom of the dry pond is set to 80.60 m, above the 100-yr HGL of the 1800mm storm sewer.

6.5 Infiltration

In line with the Sawmill Creek Subwatershed Study, infiltration of minimum 40% of the impervious area is desired for maintaining overall creek baseflow volumes and water table recharging. This equates to 9,433 m³ per year based on Environment Canada monitoring station rainfall data at the Ottawa MacDonald-Cartier International Airport years 1993-2023 (available from the Government of Canada website for historical weather, climate and hazard data). This is the same monitoring station the City of Ottawa based their rainfall IDF curves upon from years 1967-1997. Infiltration capacity of a site is impacted by soil type, and bedrock and groundwater level, with a minimum difference between bottom of infiltration and top of either bedrock or groundwater around 1 m. Per the geotechnical investigation for 1319 Johnston Road prepared by Gemtec dated July 24, 2023, bedrock elevations (or auger refusal) ranged from 73.9-78.9 m and groundwater levels ranged from 79.6-80.5 m. The bedrock elevations are well below the underground storage tank and dry pond, however the measured groundwater level is less than the typical 1 m desired difference (though still below the minimum system elevations). This does not mean that infiltration will not occur, but that the system has a reduced infiltration capacity.

Beneath the storm storage tank is a 150 mm layer of gravel for infiltration that will be filled during a typical storm event. This equals a minimum infiltration volume of 111 m³ within the gravel bed (any volume above the gravel bed will most likely be discharged before it can be infiltrated). For the silty-clayey sand layer that the storm storage tank will be within or just above per the geotechnical investigation, a percolation rate of 35 min/cm was chosen (average of 20-50 min/cm per MMAH SB-6) with a factor of safety of 2.0 for the proximity of the groundwater table. At this infiltration rate the gravel bed is expected to infiltrate its volume within 10.5 hr, typically infiltration from a storm event is expected within 24-48 hrs. With these parameters it was calculated that the required yearly infiltration target can be achieved over the course of 84 rainfall events across the year (an average year was found to have 118 rainfall events). Or to put in another way, during the average rainfall year the storage tank will infiltrate approximately 13,200 m³. The details of the calculations are provided in **Appendix E** and summarized in **Table 5** below.

Table 5 – Infiltration at the Storm Storage Tank

| Required Infiltration per Year (m ³) | Minimum Infiltration per Event (m ³) | Number of Typical Events Required per Year | Total Infiltration per Year (m ³) |
|--|--|--|---|
| 9,433 | 111 | 85 | 13,209 |

This above calculation does not take into account the infiltration capacity of the dry pond itself which will further contribute to the site's total infiltration. Therefore, it is concluded that the infiltration requirements are met.

For additional consideration, from the geotechnical investigation, the locations of infiltration will be within or just above areas of silty-clayey sand but below a layer of stiff silty clay that was found through most of the site with thicknesses between 0.21-1.25 m. This layer of stiff silty clay would significantly impact the site's existing infiltration capacity from surface runoff.

6.6 Quality Control

Quality control will be provided by oil-grit separators prior to discharge to the 1800 mm storm sewer sized for 60% TSS reduction at ETV particle size distribution based on the restricted flow rates of the Main Site and Building G drainage portions. Refer to OGS sizing cutsheets in **Appendix E** for more details. This is the approximate maximum reduction rate a typical OGS unit can achieve using ETV particle size distribution, equivalent to approximately 90% TSS reduction using typical "Fine" particle size distribution. In order to achieve the required 80% TSS reduction, additional settlement exists in the underground tank and dry pond systems where inflow velocity is significantly reduced.

7.0 EROSION AND SEDIMENT CONTROL

Prior to construction and until vegetation has been re-established in disturbed areas, erosion and sediment control measures must be implemented to mitigate the impact on receiving watercourses and existing infrastructure. The following erosion and sediment control (ESC) measures have been proposed for the subject site:

- Limiting the extent of exposed soils at any given time.
- Erosion and sediment control measures shall be maintained until vegetation has been re-established in all disturbed areas. Re-vegetate disturbed areas in accordance with approved Landscape Plan as soon as possible.
- Stockpile soil away (15 metres or greater) from watercourses, drainage features and top of steep slopes.
- Installation of silt sacks between frame and cover on all proposed and existing catch basins and open cover storm manholes until construction is completed.
- Silt fence to be installed and maintained along the property boundaries.
- Install mud mats at all construction entrances.
- During active construction periods, visual inspections shall be undertaken on a weekly basis and after major storm events (>25mm of rain in 24 hour period) on ESC and any damage repaired immediately.
- ESC shall also be assessed (and repaired as required) following significant snowmelt events.
- Visual inspections shall also be undertaken in anticipation of large storm events (or a series of rainfall and/or snowmelt days) that could potentially yield significant runoff volumes.
- Care shall be taken to prevent damage to ESC during construction operations.
- In some cases, barriers may be removed temporarily to accommodate construction operations. The affected barriers shall be reinstated immediately after construction operations are completed.
- ESC should be adjusted during construction to adapt to site features as the site becomes developed.
- ESC shall be cleaned of accumulated sedimentation as required and replaced as necessary.

- During the course of construction, if the Engineer believes that additional prevention methods are required to control erosion and sedimentation, the Contractor shall implement additional measures, as required, to the satisfaction of the Engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) 805.

Refer to the Erosion and Sediment Control Plan provided in **Appendix B** for more details.

8.0 APPROVALS

The proposed development is subject to City of Ottawa site plan approval with criteria from the Rideau Valley Conservation Authority. Since stormwater quantity and quality control is being provided for an industrial-use site an Environmental Compliance Approval from the Ontario Ministry of Environment, Conservation and Parks will also be required.

9.0 CONCLUSIONS

This servicing and stormwater management report has been prepared to support the Site Plan Application for the development of the property located at 1319 Johnston Road. The report has detailed the proposed means of servicing the site for potable water and sanitary sewer and provided details on how to meet the stormwater management requirements in accordance with City of Ottawa standards and the Sawmill Creek Subwatershed Study. The proposed servicing and stormwater management designs will be achieved by implementing the following key features:

- Domestic water supply will be provided by a 200 mm diameter watermain connection to the existing 300 mm diameter watermain on Johnston Road.
- Fire protection will be provided by proposed on-site hydrants.
- Sanitary flows will be conveyed to the existing 750 mm diameter sanitary sewer on Johnston Road via a proposed 250 mm diameter sanitary sewer.
- Stormwater runoff (minor system) will be conveyed by the proposed storm sewer system to the existing 1800 mm storm sewer that runs through the site at two locations: a new MH on the 1800 mm and at an existing MH immediately downstream.
- Stormwater runoff for all storm events up to and including the 100-year design storm will be controlled on-site at maximum the 2-year pre-development flow rate.
- On-site storage will be provided for all storm events up to and including the 100-year design storm event through surface ponding, underground storage, and a dry pond.
- Emergency overland flows will be conveyed to Sawmill Creek and its tributary ditches along the property boundaries as well as Johnston Road.
- Infiltration equivalent to 40% of the impervious areas is provided at the underground storage tank, as well as the dry pond.
- Quality control will be provided by oil-grit separators immediately downstream of the ICD flow restrictions and immediately prior to discharge to the existing 1800 mm system.
- Erosion and sediment control measures will be implemented prior to construction and maintained until vegetation has been re-established in disturbed areas.

Report Prepared By:

Report Reviewed By:



Stephen McCaughey, P.Eng.
Project Engineer

A handwritten signature in black ink, appearing to read "CC", positioned above a horizontal line.

Chris Collins
Manager, Land Development

Appendix A

Architectural Site Plan

Pre-Consultation Notes

GeoOttawa existing watermain,
sanitary and storm

2059 Artistic Place
Meeting Summary Notes
June 17th, 2022. Online Teams Meeting

Attendees:

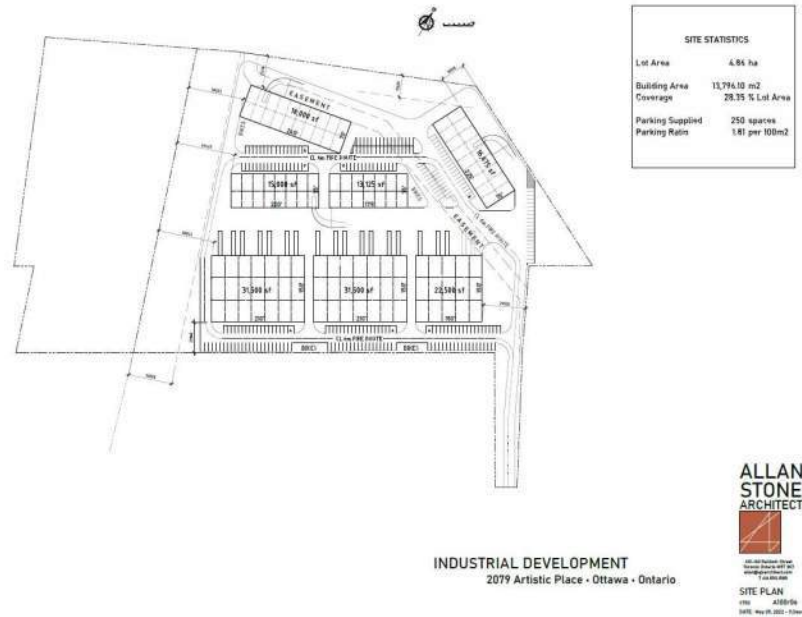
- Jocelyn Chandler (Applicant, JFSA)
- Barry Godfrey (Applicant, Quaestus)
- David Meikle (DBM Consulting)
- Tim Eisner (JFSA)
- Allan Stone (CMV Arch)
- Alex Meacoe (Gemtec)
- Andrew Harte (CGH)
- Michelle Chen (CGH)
- Chris Collins (EXP)
- Morphet, Katie (File Lead, Planner, City of Ottawa)
- Cassidy, Tyler (Project Manager, City of Ottawa)
- Charie, Kelsey (EIT, City of Ottawa)
- Richardson, Mark (Forestry, City of Ottawa)
- Elliott, Mark (Environmental Planner, City of Ottawa)
- Jamie Batchelor (RVCA)

Not in Attendance:

- Christopher Moise (Urban Design, City of Ottawa)
- Neetu Paudel (Transportation Project Manager, City of Ottawa)
- Phil Castro (Parks, City of Ottawa)

Issue of Discussion:

- Site Plan Control for 7 new 1-storey light industrial buildings.

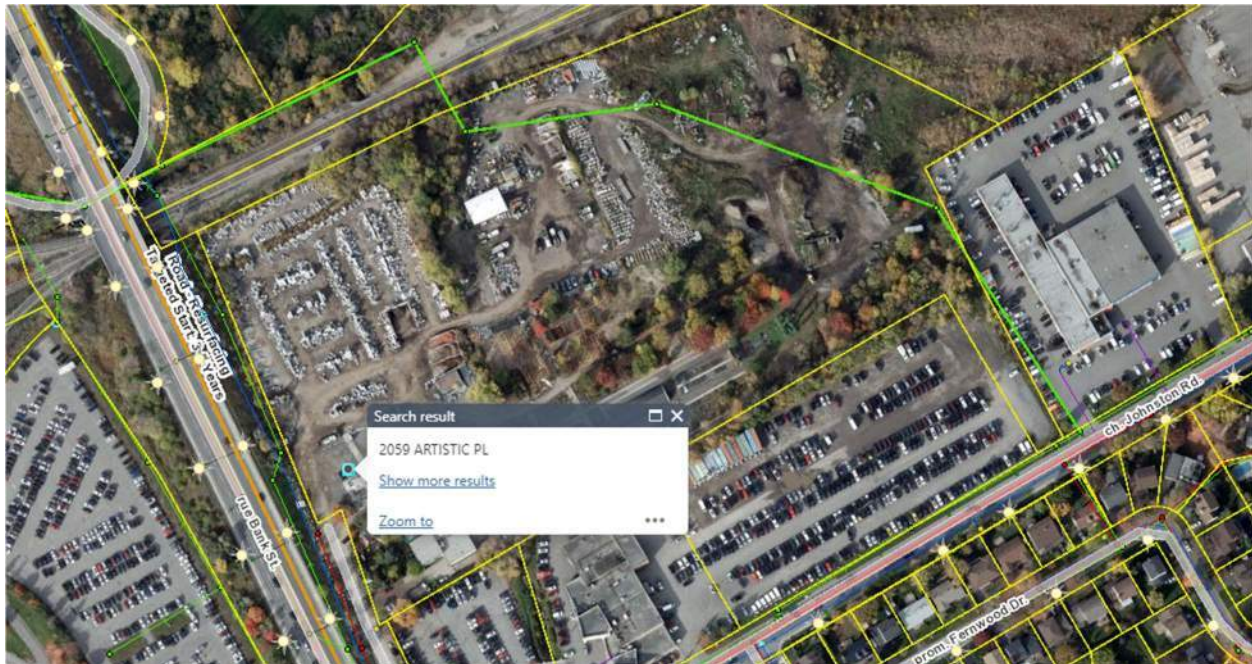


1. Infrastructure/Servicing – Tyler Cassidy

Please note the following information regarding the engineering design submissions for the above noted site:

1. The Servicing Study Guidelines for Development Applications are available at the following address:
<https://ottawa.ca/en/city-hall/planning-and-development/how-develop-property/development-application-review-process-2/guide-preparing-studies-and-plans>
2. Servicing and site works shall be in accordance with the following documents:
 - Ottawa Sewer Design Guidelines (October 2012) and all the Technical Bulletins including, Technical Bulletin PIEDTB-2016-01 and ISTB-2018-01
 - Ottawa Design Guidelines – Water Distribution (2010) and Technical Bulletins ISD-2010-2, ISDTB-2014-02 and ISTB-2018-02
 - Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
 - City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
 - City of Ottawa Environmental Noise Control Guidelines (January, 2016)
 - City of Ottawa Park and Pathway Development Manual (2012)
 - City of Ottawa Accessibility Design Standards (2012)
 - Ottawa Standard Tender Documents (latest version)
 - Ontario Provincial Standards for Roads & Public Works (2013)

3. Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x 44455
4. The Stormwater Management Criteria, for the subject site, is to be based on the following (as established in the "**Sawmill Creek Subwatershed Study – Final Report**" dated May 2003:
 - The pre-development runoff coefficient or a maximum equivalent 'C' of 0.5, whichever is less (§ 8.3.7.3).
 - Flows to the storm sewer in excess of the 2-year storm release rate, up to and including the 100-year storm event, must be detained on site.
 - Ensure no overland flow for all storms up to and including the 100-year event.
 - Use of Low Impact Development (LIDs) are considered Best Management Practices (BMP) for this site.
 - The 2-yr storm or 5-yr storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.
 - A calculated time of concentration (Cannot be less than 10 minutes).
 - Quality control requirements to be provided by Rideau Valley Conservation Authority (RVCA). ^{**}(As determined in the sawmill creek subwatershed).
 - This property is located within the **Sawmill Creek** subwatershed. Please verify any subwatershed specific SWM criteria with the RVCA.
5. Deep Services:



i. A plan view of the approximate services may be seen above. Services should ideally be grouped in a common trench to minimize the number of road cuts. The sizing of available future services is:

a. Connections (Johnson Road):

- i. Existing 450 mm dia. STM (Conc.)
- ii. Existing 305 mm dia. Watermain (CI)
- iii. Existing 250 mm dia. SAN (Conc.)

b. Connections (Sawmill Creek Storm Trunk Sewer):

- i. Existing 1800 mm dia. STM (Conc.) * Note that the connection must be to a maintenance hole, and drop pipes will most likely be required.

- ii. Direct discharge to the Sawmill Creek is not permitted as there are available storm connections fronting the property.

*Note that only one (1) san, stm, or water connection to the right of way is permitted per site.

- ii. *Provide existing servicing information and the recommended location for the proposed connections. Services should ideally be grouped in a common trench to minimize the number of road cuts.*
 - iii. *Provide information on the monitoring manhole requirements – should be located in an accessible location on private property near the property line (ie. Not in a parking area).*
 - iv. *Provide information on the type of connection permitted*
Sewer connections to be made above the springline of the sewermain as per:
 - a. Std Dwg S11.1 for flexible main sewers – *connections made using approved tee or wye fittings.*
 - b. Std Dwg S11 (For rigid main sewers) – *lateral must be less than 50% the diameter of the sewermain,*
 - c. Std Dwg S11.2 (for rigid main sewers using bell end insert method) – *for larger diameter laterals where manufactured inserts are not available; lateral must be less than 50% the diameter of the sewermain,*
 - d. Connections to manholes permitted when the connection is to rigid main sewers where the lateral exceeds 50% the diameter of the sewermain. – Connect obvert to obvert with the outlet pipe unless pipes are a similar size.
 - e. *No submerged outlet connections.*
6. Civil consultant must request boundary conditions from the City's assigned Project Manager prior to first submission. Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:
- i. Location of service(s)
 - ii. Type of development and the amount of fire flow required (as per FUS, 1999).
 - iii. Average daily demand: ____ l/s.
 - iv. Maximum daily demand: ____ l/s.
 - v. Maximum hourly daily demand: ____ l/s.
 - vi. Hydrant location and spacing to meet City's Water Design guidelines.

- vii. Water supply redundancy will be required for more than 50 m³/day water demand.
- 7. Phase 1 ESAs and Phase 2 ESAs must conform to clause 4.8.4 of the Official Plan that requires that development applications conform to Ontario Regulation 153/04.
- 8. MECP ECA Requirements (Standard) –

All development applications should be considered for an Environmental Compliance Approval (ECA) by the Ministry of the Environment, Conservation, and Parks (MECP);

- a. Consultant determines if an approval for sewage works under Section 53 of OWRA is required. Consultant then determines what type of application is required and the City's project manager confirms. (If the consultant is not clear if an ECA is required, they will work with the City to determine what is required. If the consultant it is still unclear or there is a difference of opinion only then will the City PM approach the MECP.
 - b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
 - c. Standard Works ToR Draft ECA's are sent to the local MECP office (moeccottawasewage@ontario.ca) for information only
 - d. Additional ToR draft ECAs require a project summary/design brief and require a response from the local MECP (10 business day window)
 - e. Site plan Approval, or Draft Approval, is required before an application is sent to the MECP
9. General/ additional comments:
- i. Only one watermain connection per site. However, looping would be required if proposed demand is 50m³/day or greater.
 - ii. A pre and post construction CCTV inspection is required for re-using any existing servicing connections.

2. Initial Planning Comments

- Please include a table on the Site Plan drawing which identifies all required Zoning By-law required provisions and how they are being achieved onsite.
- Please ensure that the required planning rationale includes policy analysis for the current Official Plan and the City's new Official Plan.

- If possible, we would like to see additional landscaping added onsite.
- Please delineate any intended employee pedestrian connections using alternative materials or line painting.
- I was able to confirm that a Future land Use Study will not be required for this site if no Zoning By-law Amendment is being sought.

3. Urban Design Comments – Christopher Moise

- This proposal does not run along or does not meet the threshold in one of the City's Design Priority Areas and need not attend the City's UDRP. Staff will be responsible for evaluating the proposal and providing design direction;
- We appreciate the material presented and have the following comments/questions about the proposal:
 - **Parking:** Minimize quantity of vehicular parking as much as use will allow, provide in discreet locations and screened with landscaping. We recommend using minimum parking requirements to reduce the surface area of asphalt to mitigate heat island effects;
 - **Landscaping:** Improve the landscaping treatment around the site and with enhanced plantings and trees;
 - **Pedestrian connectivity:** Consider safe and convenient access to buildings from parking locations using sidewalks, clear painted lines and interspersed with landscaping;
- A scoped Design Brief is a required submittal for all Site Plan/Re-zoning applications and can be combined with the Planning Rationale. Please see the Design Brief Terms of Reference provided.

Note. The Design Brief submittal should have a section which addresses these pre-consultation comments;

This is an exciting project in an area full of potential. We look forward to helping you achieve its goals with the highest level of design resolution. We are happy to assist and answer any questions regarding the above. Good luck.

4. Parks – Phil Castro

Comments expected July 4th. It is expected that Parks will be requiring 2% parkland dedication for this area.

5. Trees - Mark Richardson

TCR requirements:

1. a Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City
 - a. an approved TCR is a requirement of Site Plan approval.
 - b. The TCR may be combined with the EIS provided all information is supplied
2. Any removal of privately-owned trees 10cm or larger in diameter, or city-owned trees of any diameter requires a tree permit issued under the Tree Protection Bylaw (Bylaw 2020 – 340); the permit will be based on an approved TCR and made available at or near plan approval.
3. The Planning Forester from Planning and Growth Management as well as foresters from Forestry Services will review the submitted TCR
 - a. If tree removal is required, both municipal and privately-owned trees will be addressed in a single permit issued through the Planning Forester
 - b. Compensation may be required for city owned trees – if so, it will need to be paid prior to the release of the tree permit
4. the TCR must list all trees on site, as well as off-site trees if the CRZ extends into the developed area, by species, diameter and health condition
5. Please identify trees by ownership – private onsite, private on adjoining site, city owned, co-owned (trees on a property line)
6. If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained
7. All retained trees must be shown, and all retained trees within the area impacted by the development process must be protected as per City guidelines available at [Tree Protection Specification](#) or by searching Ottawa.ca
 - a. the location of tree protection fencing must be shown on the plan
8. the City encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.
9. For more information on the process or help with tree retention options, contact Mark Richardson mark.richardson@ottawa.ca or on [City of Ottawa](#)

LP tree planting requirements:

For additional information on the following please contact tracy.smith@Ottawa.ca

Minimum Setbacks

- Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.
- Maintain 2.5m from curb
- Coniferous species require a minimum 4.5m setback from curb, sidewalk or MUP/cycle track/pathway.
- Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing, except where otherwise approved in naturalization / afforestation areas. Adhere to Ottawa Hydro's planting guidelines

(species and setbacks) when planting around overhead primary conductors.

Tree specifications

- Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.
- Maximize the use of large deciduous species wherever possible to maximize future canopy coverage
- Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and include watering and warranty as described in the specification (can be provided by Forestry Services).
- Plant native trees whenever possible
- No root barriers, dead-man anchor systems, or planters are permitted.
- No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)

Hard surface planting

- Curb style planter is highly recommended
- No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.
- Trees are to be planted at grade

Soil Volume

- Please document on the LP that adequate soil volumes can be met:

| Tree Type/Size | Single Tree Soil Volume (m3) | Multiple Tree Soil Volume (m3/tree) |
|----------------|------------------------------|-------------------------------------|
| Ornamental | 15 | 9 |
| Columnar | 15 | 9 |
| Small | 20 | 12 |
| Medium | 25 | 15 |
| Large | 30 | 18 |
| Conifer | 25 | 15 |

Please note that these soil volumes are not applicable in cases with Sensitive Marine Clay.

Sensitive Marine Clay

- Please follow the City's 2017 Tree Planting in Sensitive Marine Clay guidelines

Tree Canopy Cover

- The landscape plan shall show how the proposed tree planting will replace and increase canopy cover on the site over time, to support the City's 40% urban forest canopy cover target.
- At a site level, efforts shall be made to provide as much canopy cover as possible, through tree planting and tree retention, with an aim of 40% canopy cover at 40 years, as appropriate.
- Indicate on the plan the projected future canopy cover at 40 years for the site.

6. Environment – Mark Elliot

Endangered Species: Nothing of concern. There are some birds (Peregrine Falcon, Chimney Swift, Barn Swallow, Black Crowned Night Heron) that have been spotted in the woods across Bank Street, and a Snapping Turtle upstream in Sawmill Creek. However, none of the proposed changes would negatively impact these species. Indeed, the applicant's proposal to plant more trees in the area is likely to improve habitat, rather than degrade it.

Watercourse: Any development within the 30m setback (4.9.3 in the New OP, 4.7.3 in the Old OP) will require an EIS to determine ecological function and that no negative impact will come from it. The CA covered issues with flood plains in detail so I won't comment on them except to say that I agree with what was said.

Unevaluated Wetlands: The applicant noted during the preconsultation that the unevaluated wetlands in the Northeastern corner are likely a mapping artifact and do not exist on the ground. However, this would need to be confirmed by ground truthing because it would otherwise be considered a surface water feature (per definition in New OP p.266) and be protected under 4.9.3 in the New OP.

7. Transportation – Mike Giampa

- Follow Transportation Impact Assessment Guidelines:
 - o A TIA is required.
 - o Start this process asap. The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable) and/or monitoring report (if applicable).
- As the proposed site is for the general public use, AODA legislation applies.
 - o Clearly define accessible parking stalls and ensure they meet AODA standards (include an access aisle next to the parking stall and a pedestrian curb ramp at the end of the access aisle, as required).
 - o Please consider using the City's Accessibility Design Standards, which provide a summary of AODA requirements. <https://ottawa.ca/en/city-hall/creating-equal-inclusive-and-diverse-city/accessibility-services/accessibility-design-standards-features#accessibility-design-standards>
- On site plan:
 - o Parking stalls at the end of dead-end parking aisles require adequate turning around space
 - o
 - o Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements and at all access (entering and exiting and going in both directions).
 - o Show all curb radii measurements; ensure that all curb radii are reduced as much as possible

- Show lane/aisle widths.
 - Incorporate pedestrian circulation into the site layout by providing sidewalks/ walkways.
 - Ensure the access is 3m away from the property line.
- Noise Impact Studies required for the following:
 - Rail (if the proposed development is considered noise sensitive)

8. General Information

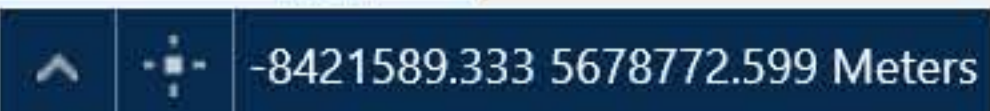
- a. Ensure that all plans and studies are prepared as per City guidelines – as available online...
<https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans>



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Appendix B

Servicing Plan
(DWG. 23034-S1)

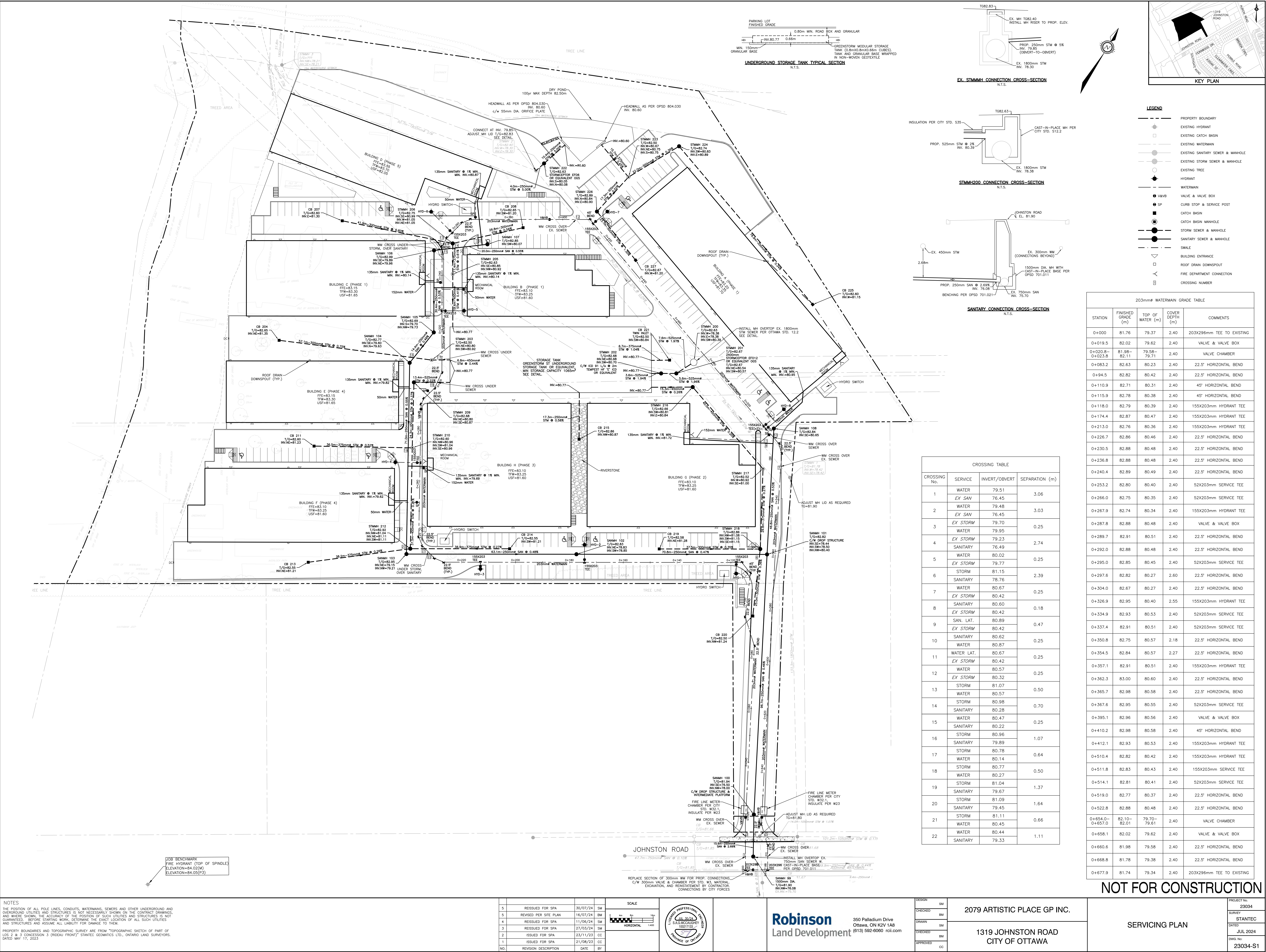
Grading Plan
(DWG. 23034-GR1)

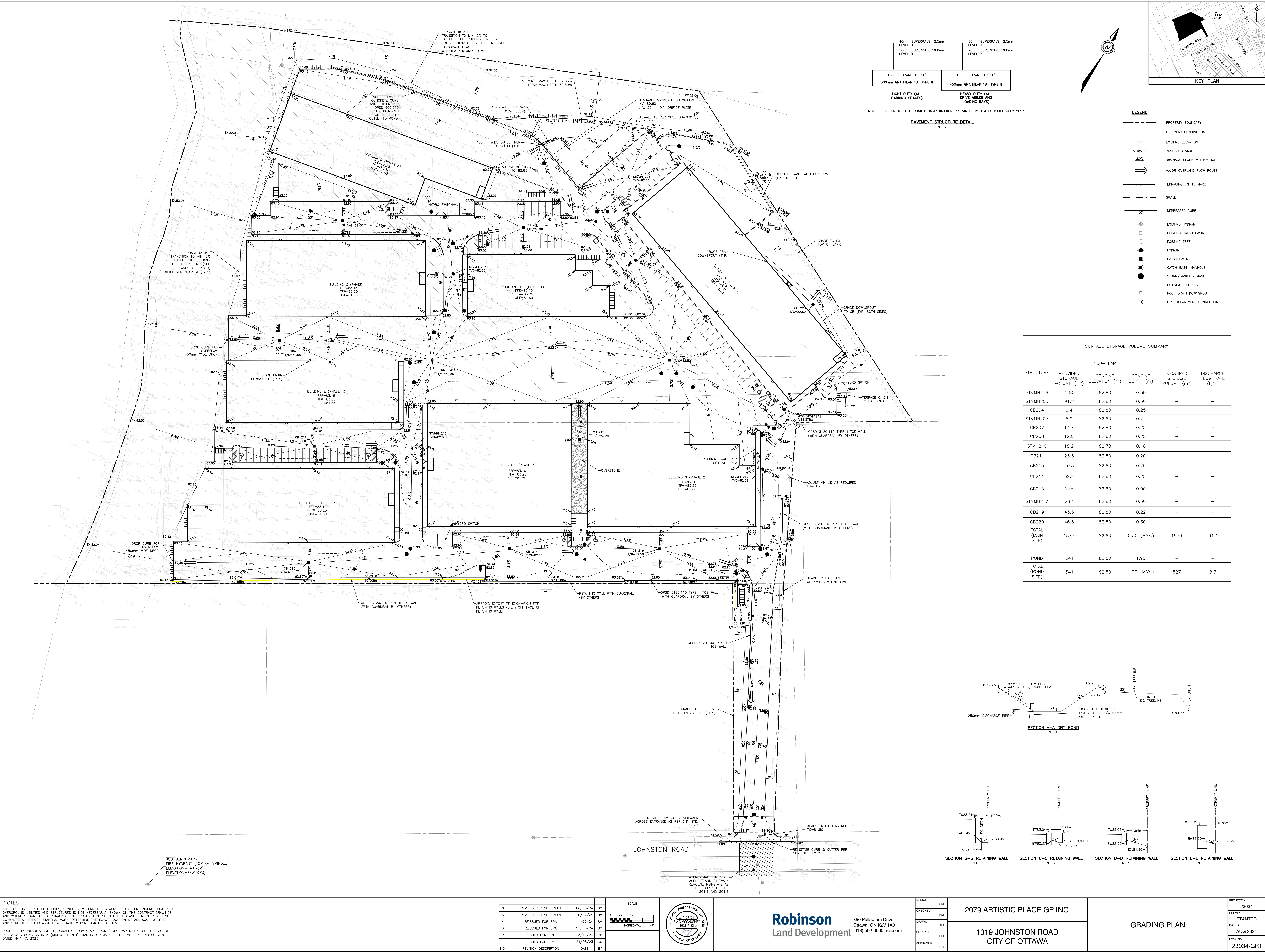
Notes & Details
(DWG. 23034-N1)

Erosion and Sediment Control Plan
(DWG. 23034-ESC1)

Existing Conditions and Removals Plan
(DWG. 23034-R1)

Storm Drainage Area Plan
(DWG. 23034-STM1)

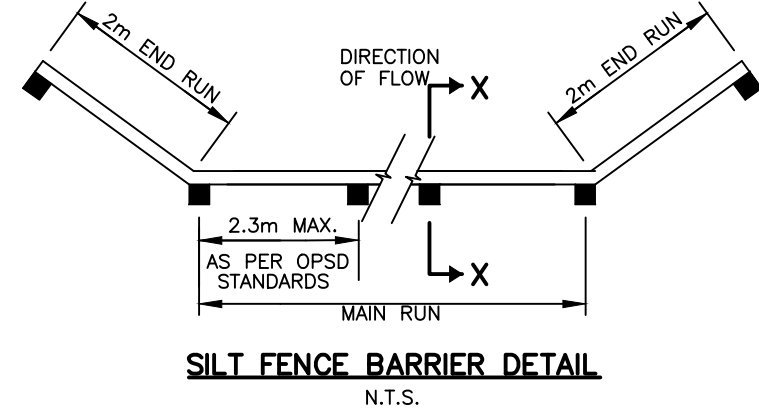




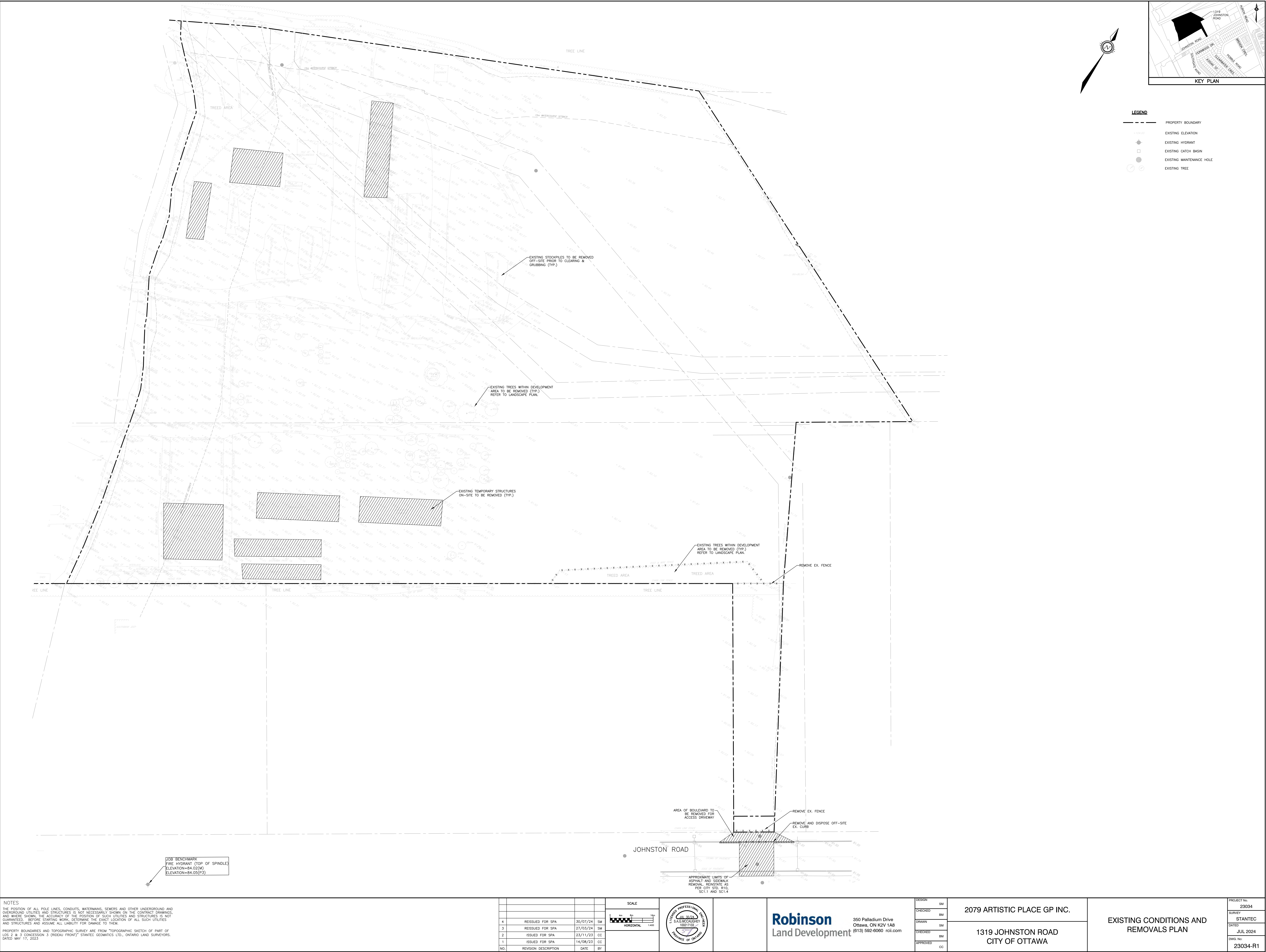
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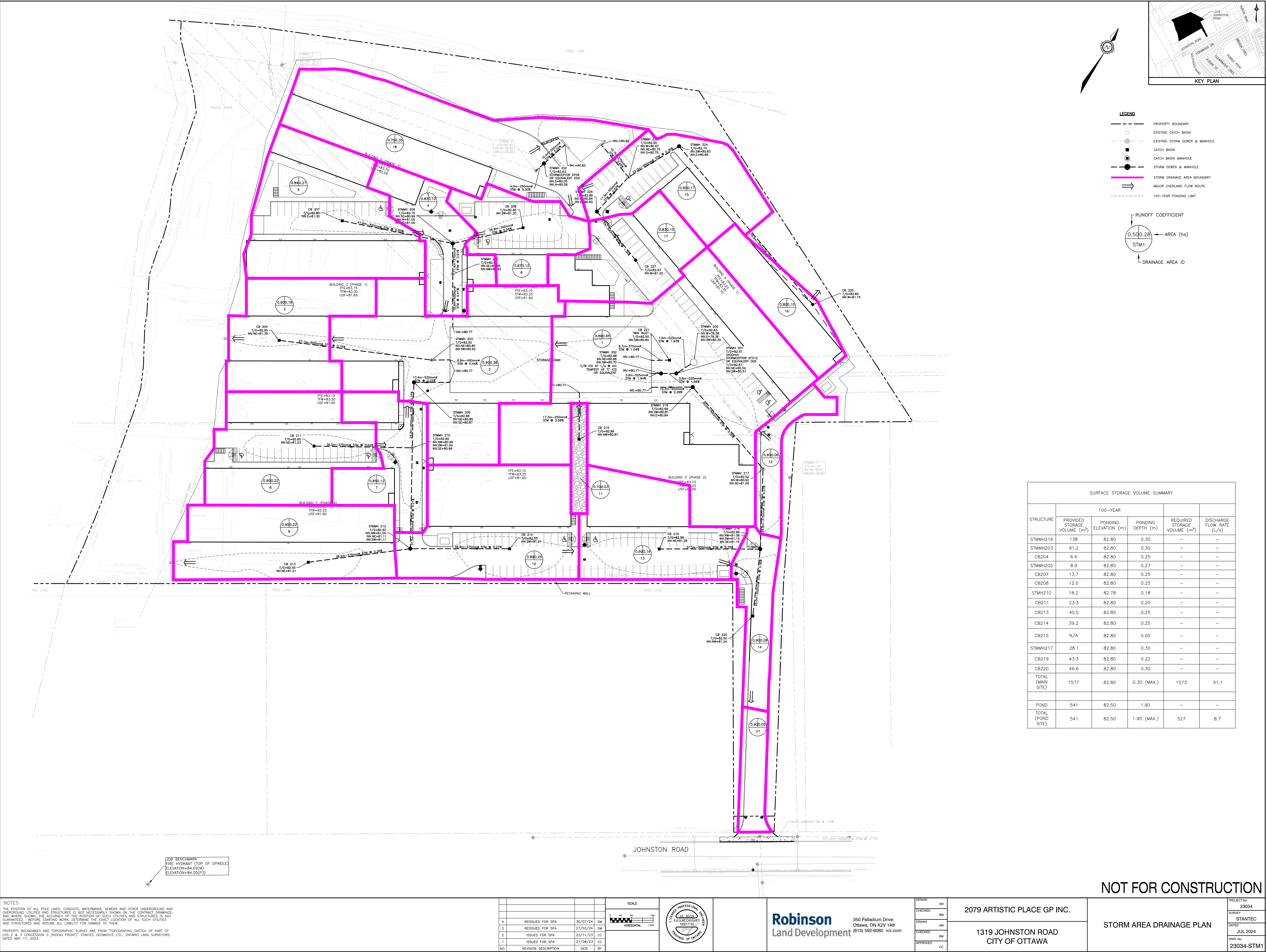
1. ALL PVC WATERLINES SHALL BE INSTALLED TO MEET TO AWWA C-900 CLASS 150, SDR 18, OR APPROVED EQUAL.
2. ALL PVC WATERLINES SHALL BE INSTALLED WITH A MINIMUM OF 18" COVER.
3. UNLESS OTHERWISE SPECIFIED, BEDDING AND COVER MATERIAL SHALL BE SPECIFIED BY PROJECT ENGINEER.
4. ALL PVC WATERMAIN SHALL BE INSTALLED WITH A 10 GAUGE STRANDWOUND COPPER TWIN OR WAGO AT THE WATERMETER.
5. ALL PVC WATERMAIN SHALL BE INSTALLED WITH A MINIMUM OF 18" COVER.
6. ALL WATERMETER SHALL BE INSTALLED WITH A MINIMUM OF 18" COVER.
7. WATERMETER TO SUPPLY HYDRANT EXISTING OR NEW SHALL BE THE LEASTLY AVAILABLE SIZE THAT MEETS THE REQUIREMENTS.
8. ALL VALVES SHALL BE INSTALLED AS PER CITY OF OTTAWA STD. 119, AND LOCATED AS PER CITY STD. W18.
9. VALVE BOXES SHALL BE INSTALLED AS PER CITY OF OTTAWA STD. W24.
10. WATERMAIN IN FILL AREAS TO BE INSTALLED WITH RESTRAINED JOINTS AS PER CITY OF OTTAWA STD. W24.
11. ALL WATERMETER SHALL BE INSTALLED WITH A MINIMUM OF 18" COVER.
12. THE CONTRACTOR SHALL PROVIDE ALL TEMPORARY CUES, FILLS, AND BACKFILLS.
13. INSULATION FOR WATERMAIN CROSSING OVER AND BELOW SEWER SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STD. W24.
14. ALL WATERMETER SHALL BE INSTALLED WITH A MINIMUM OF 18" COVER.
15. AS PER CITY GUIDELINE, THE MINIMUM VERTICAL CLEARANCE BETWEEN WATERMAIN AND SEWER / UTILITIES SHALL BE 1.5 METERS.
16. THE CONTRACTOR SHALL PROVIDE ALL TEMPORARY CUES, FILLS, AND BACKFILLS.
17. ADEQUATE STRUCTURAL SUPPORT FOR THE SEWERS IS REQUIRED TO PREVENT EXCESS DEFLECTION SO THAT THE JOINTS WILL BE EQUIJOSTANT AND AS FAR AS POSSIBLE FROM THE SEWER FOR PER CITY STD. W18.
18. ALL WATERMETER SHALL BE INSTALLED WITH A MINIMUM OF 18" COVER.
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1. CONCRETE CURB SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STD. SC-1.1 (BARRIER CURBS) UNLESS OTHERWISE SPECIFIED.
2. ALL BARRIER CURB TO BE 150mm ABOVE FINISHED ASPHALT GRADE INCLUDING CURBSIDE UNITS.
3. SUPERELEVATED CURB AND GUTTER TO BE 200mm ABOVE FINISHED ASPHALT GRADE UNLESS OTHERWISE SPECIFIED.
4. MONOTHEIC CURB AND SIDEWALK SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STD. SC2.
5. ALL CURBSIDE UTILITY COVERS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STD. R10 AND CPSC 509.010, CPSC 310.
6. GRANULAR "A" SHALL BE PLACED TO A MINIMUM THICKNESS OF 300mm AROUND ALL STRUCTURES WITHIN ASPHALT WEAR COURSE SHALL NOT BE PLACED UNTIL THE VIDEO INSPECTION OF SEAMS & NECESSARY REPAIRS HAVE BEEN CARRIED OUT WITH SATISFACTION OF THE ENGINEER.
7. CURBSIDE UTILITY COVERS SHALL BE PLACED WITHIN A MINIMUM 300mm UTILITY.
8. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW-CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW ASPHALT.
9. PAVEMENT DESIGN AS PER GEOLOGICAL RECOMMENDATIONS.



| | |
|-------------|------------|
| PROJECT No. | 23034 |
| SURVEY | STANTEC |
| DATED | JUL 2024 |
| DWG. No: | 23034-ESC1 |



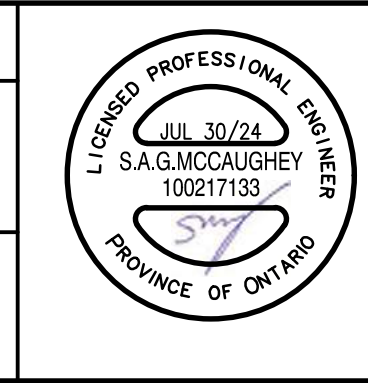


NOTES

THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

PROPERTY BOUNDARIES AND TOPOGRAPHIC SURVEY ARE FROM "TOPOGRAPHIC SKETCH OF PART OF LOTS 2 & 3 CONCESSION 3 (RIDEAU FRONT)" STANTEC GEOMATICS LTD., ONTARIO LAND SURVEYORS, DATED MAY 17, 2023

| NO. | REVISION DESCRIPTION | DATE | BY |
|-----|----------------------|----------|----|
| 4 | REISSUED FOR SPA | 30/07/24 | SM |
| 3 | REISSUED FOR SPA | 27/03/24 | SM |
| 2 | ISSUED FOR SPA | 23/11/23 | CC |
| 1 | ISSUED FOR SPA | 21/08/23 | CC |
| NO. | REVISION DESCRIPTION | DATE | BY |



Robinson
Land Development

350 Palladium Drive
Ottawa, ON K2V 1A8
(613) 592-6060 rcil.com

| | |
|----------|----|
| DESIGN | SM |
| CHECKED | BM |
| DRAWN | SM |
| CHECKED | BM |
| APPROVED | CC |

2079 ARTISTIC PLACE GP INC.

1319 JOHNSTON ROAD
CITY OF OTTAWA

STORM AREA DRAINAGE PLAN

| | |
|-------------|------------|
| PROJECT No. | 23034 |
| SURVEY | STANTEC |
| DATED | JUL 2024 |
| DWS No. | 23034-STM1 |

Appendix C

Water Demand Calculations

Fire Demand Calculations

Boundary Conditions

Water Model Outputs

WATERMAIN DESIGN SHEET

1319 Johnston Road Site Plan
Project No. 23034

Robinson
Consultants

| Junction Node Number | RESIDENTIAL POPULATION | | | | NON-RES | | | AVG. DAILY | | | | | MAX. DAILY | | | | | PEAK HOURLY | | | | |
|----------------------------|------------------------|-------------------|-----------------|---------------------|--------------|---------------|---------------|--------------|------|-------|-------|-------------|--------------|------|-------|-------|-------------|--------------|------|-------|-------|-------------|
| | ACTUAL COUNT | | | | IND. (ha) | COMM. (ha) | INST. (ha) | DEMAND (L/s) | | | | | DEMAND (L/s) | | | | | DEMAND (L/s) | | | | |
| | Low Density | Medium Density | High Density | Total Population | | | | RES. | IND. | COMM. | INST. | TOTAL | RES. | IND. | COMM. | INST. | TOTAL | RES. | IND. | COMM. | INST. | TOTAL |
| Bldg G | | | | | 0.62 | | | | 0.25 | | | 0.25 | | 0.38 | | | 0.38 | | 0.68 | | | 0.68 |
| Bldg H | | | | | 0.50 | | | | 0.20 | | | 0.20 | | 0.30 | | | 0.30 | | 0.55 | | | 0.55 |
| Bldg F | | | | | 0.40 | | | | 0.16 | | | 0.16 | | 0.24 | | | 0.24 | | 0.44 | | | 0.44 |
| Bldg E | | | | | 0.44 | | | | 0.18 | | | 0.18 | | 0.27 | | | 0.27 | | 0.48 | | | 0.48 |
| Bldg C | | | | | 0.32 | | | | 0.13 | | | 0.13 | | 0.19 | | | 0.19 | | 0.35 | | | 0.35 |
| Bldg B | | | | | 0.27 | | | | 0.11 | | | 0.11 | | 0.16 | | | 0.16 | | 0.30 | | | 0.30 |
| Bldg A | | | | | 0.65 | | | | 0.26 | | | 0.26 | | 0.39 | | | 0.39 | | 0.71 | | | 0.71 |
| Bldg D | | | | | 0.40 | | | | 0.16 | | | 0.16 | | 0.24 | | | 0.24 | | 0.44 | | | 0.44 |
| Total | | | | | 3.60 | | | | | | | 1.46 | | | | | 2.19 | | | | | 3.94 |

Residential Densities

Low Density (SFH's) = 3.4 cap/unit
Medium Density (Townhouses) = 2.7 cap/unit
High Density (Apartments) = 1.8 cap/unit

Avg. Daily Demand:

Residential = 280 L/cap/day
Industrial (Light) = 35000 L/ha/day
Commercial = 28000 L/ha/day
Institutional = 28000 L/ha/day

Max. Daily Demand:

2.5 x Avg. Day
1.5 x Avg. Day
1.5 x Avg. Day
1.5 x Avg. Day

Max. Hourly Demand:

2.2 x Max. Day
1.8 x Max. Day
1.8 x Max. Day
1.8 x Max. Day

Table 6

| Distance to the Exposure (m) | Length-Height Factor of Exposing Building Face | Construction Type of Exposed Building Face | | | | |
|------------------------------|--|--|--------------------------|--------------------------|------------------------|------------------------|
| | | Type V | Type III-IV ² | Type III-IV ³ | Type I-II ² | Type I-II ³ |
| 0 - 3 | 0-20 | 20% | 15% | 5% | 10% | 0% |
| | 21-40 | 21% | 16% | 6% | 11% | 1% |
| | 41-60 | 22% | 17% | 7% | 12% | 2% |
| | 61-80 | 23% | 18% | 8% | 13% | 3% |
| | 81-100 | 24% | 19% | 9% | 14% | 4% |
| | Over 100 | 25% | 20% | 10% | 15% | 5% |
| 3.1 to 10 | 0-20 | 15% | 10% | 3% | 6% | 0% |
| | 21-40 | 16% | 11% | 4% | 7% | 0% |
| | 41-60 | 17% | 12% | 5% | 8% | 1% |
| | 61-80 | 18% | 13% | 6% | 9% | 2% |
| | 81-100 | 19% | 14% | 7% | 10% | 3% |
| | Over 100 | 20% | 15% | 8% | 11% | 4% |
| 10.1 to 20 | 0-20 | 10% | 5% | 0% | 3% | 0% |
| | 21-40 | 11% | 6% | 1% | 4% | 0% |
| | 41-60 | 12% | 7% | 2% | 5% | 0% |
| | 61-80 | 13% | 8% | 3% | 6% | 1% |
| | 81-100 | 14% | 9% | 4% | 7% | 2% |
| | Over 100 | 15% | 10% | 5% | 8% | 3% |
| 20.1 to 30 | 0-20 | 0% | 0% | 0% | 0% | 0% |
| | 21-40 | 2% | 1% | 0% | 0% | 0% |
| | 41-60 | 4% | 2% | 0% | 1% | 0% |
| | 61-80 | 6% | 3% | 1% | 2% | 0% |
| | 81-100 | 8% | 4% | 2% | 3% | 0% |
| | Over 100 | 10% | 5% | 3% | 4% | 0% |
| Over 30 | All | 0% | 0% | 0% | 0% | 0% |

² with unprotected openings

³ without unprotected openings

1.5 for **Type V** Wood Frame Construction
0.8 for **Type IV-A** Mass Timber Construction
0.9 for **Type IV-B** Mass Timber Construction
1.0 for **Type IV-C** Mass Timber Construction
1.5 for **Type IV-D** Mass Timber Construction
1.0 for **Type III** Ordinary Construction
0.8 for **Type II** Noncombustible Construction
0.6 for **Type I** Fire Resistive Construction


| | | Type V | | | | | |
|---------------------|----------|----------------------|----------|----------|----------|----------|-----|
| Separation Distance | | Length-Height Factor | | | | | |
| | | 0 | 20.00001 | 40.00001 | 60.00001 | 80.00001 | 100 |
| | 0 | 20% | 21% | 22% | 23% | 24% | 25% |
| | 3 | 15% | 16% | 17% | 18% | 19% | 20% |
| | 10 | 10% | 11% | 12% | 13% | 14% | 15% |
| | 20 | 0% | 2% | 4% | 6% | 8% | 10% |
| | 30.00001 | 0% | 0% | 0% | 0% | 0% | 0% |

| | | Type III-IV2 | | | | | |
|---------------------|----------|----------------------|----------|----------|----------|----------|-----|
| Separation Distance | | Length-Height Factor | | | | | |
| | | 0 | 20.00001 | 40.00001 | 60.00001 | 80.00001 | 100 |
| | 0 | 15% | 16% | 17% | 18% | 19% | 20% |
| | 3 | 10% | 11% | 12% | 13% | 14% | 15% |
| | 10 | 5% | 6% | 7% | 8% | 9% | 10% |
| | 20 | 0% | 1% | 2% | 3% | 4% | 5% |
| | 30.00001 | 0% | 0% | 0% | 0% | 0% | 0% |


| | | Type III-IV3 | | | | | |
|---------------------|----------|----------------------|----------|----------|----------|----------|-----|
| Separation Distance | | Length-Height Factor | | | | | |
| | | 0 | 20.00001 | 40.00001 | 60.00001 | 80.00001 | 100 |
| | 0 | 5% | 6% | 7% | 8% | 9% | 10% |
| | 3 | 3% | 4% | 5% | 6% | 7% | 8% |
| | 10 | 0% | 1% | 2% | 3% | 4% | 5% |
| | 20 | 0% | 0% | 0% | 1% | 2% | 3% |
| | 30.00001 | 0% | 0% | 0% | 0% | 0% | 0% |

| | | Type I-II2 | | | | | |
|---------------------|----------|----------------------|----------|----------|----------|----------|-----|
| Separation Distance | | Length-Height Factor | | | | | |
| | | 0 | 20.00001 | 40.00001 | 60.00001 | 80.00001 | 100 |
| | 0 | 10% | 11% | 12% | 13% | 14% | 15% |
| | 3 | 6% | 7% | 8% | 9% | 10% | 11% |
| | 10 | 3% | 4% | 5% | 6% | 7% | 8% |
| | 20 | 0% | 0% | 1% | 2% | 3% | 4% |
| | 30.00001 | 0% | 0% | 0% | 0% | 0% | 0% |


| | | Type I-II3 | | | | | |
|---------------------|----------|----------------------|----------|----------|----------|----------|-----|
| Separation Distance | | Length-Height Factor | | | | | |
| | | 0 | 20.00001 | 40.00001 | 60.00001 | 80.00001 | 100 |
| | 0 | 0% | 1% | 2% | 3% | 4% | 5% |
| | 3 | 0% | 0% | 1% | 2% | 3% | 4% |
| | 10 | 0% | 0% | 0% | 1% | 2% | 3% |
| | 20 | 0% | 0% | 0% | 0% | 0% | 0% |
| | 30.00001 | 0% | 0% | 0% | 0% | 0% | 0% |

| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg G | |  | | | |
|---|--|---|--|--|----------------|
| Calculations for Total Required Fire Flow | | | | | |
| Step | Parameter | | | Value | |
| A | Type of Construction | Options | C | Non-Combustible Construction (Type II) | 0.8 |
| | | Wood Frame (Type V) | 1.5 | | |
| | | Ordinary Construction (Type III) | 1.0 | | |
| | | Non-Combustible Construction (Type II) | 0.8 | | |
| | | Fire Resistive Construction (Type I) | 0.6 | | |
| B | Ground Floor Area | | | 4948.9 | m ² |
| | Total Effective Floor Area | | | 4,948.9 | m ² |
| C | Fire Flow | | | 12,000 | L/min |
| D | Occupancy Class | Options | Charge | Free burning | 0.15 |
| | | Non-combustible | -0.25 | | |
| | | Limited Combustible | -0.15 | | |
| | | Combustible | 0.00 | | |
| | | Free burning | 0.15 | | |
| | | Rapid Burning | 0.25 | | |
| | Occupancy Adjustment | | | 1800 | L/min |
| Fire Flow | | | 13,800 | L/min | |
| E | Sprinkler Protection | Options | Charge | Automatic Sprinkler Protection | -0.30 |
| | | Automatic Sprinkler Protection | -0.30 | | |
| | | None | 0.00 | | |
| | | Water Supply is Standard for System and Hose Lines | -0.10 | | |
| | | Full Supervision of the Sprinkler System | -0.10 | | |
| | Sprinkler Reduction | | | -6,900 | L/min |
| | Exposures | | | | |
| | West Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | Yes | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | Yes | |
| | Exposed Wall Length | | | 46 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 92 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| | Separation Distance | | | 6.0 | m |
| | West Side Exposure Charge | | | 0.00 | |
| | North Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 4.7 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 9.4 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |


| | | | | | |
|---|--|---|--|--|-----------|
| F | Separation Distance | | **>30m; No Exposure** | 32.3 | m |
| | North Side Exposure Charge | | | 0.00 | |
| | East Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 10 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 20 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| | Separation Distance | | | 25 | m |
| | East Side Exposure Charge | | | 0.00 | |
| | South Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 62.5 | m |
| Exposed Wall No. of Storeys | | | 2 | | |
| Length-Height Factor of Exposed Wall | | | 125 | m.storeys | |
| Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Wood Frame | | | | |
| | Ordinary with Unprotected Openings | | | | |
| | Ordinary without Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | | |
| Separation Distance | | **>30m; No Exposure** | 145 | m | |
| South Side Exposure Charge | | | 0.00 | | |
| Total Exposure Charge | | | 0 | < 0.75 | |
| Increase for Exposures | | | 0 | L/min | |
| G | Total Required Fire Flow | | | 7,000 | L/min |
| Notes: 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | | |

| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg H | |  | | | |
|---|-----------------------------------|---|--------|--|----------------|
| Calculations for Total Required Fire Flow | | | | | |
| Step | Parameter | | | Value | |
| A | Type of Construction | Options | C | Non-Combustible Construction (Type II) | 0.8 |
| | | Wood Frame (Type V) | 1.5 | | |
| | | Ordinary Construction (Type III) | 1.0 | | |
| | | Non-Combustible Construction (Type II) | 0.8 | | |
| | | Fire Resistive Construction (Type I) | 0.6 | | |
| B | Ground Floor Area | | | 4879.2 | m ² |
| | Total Effective Floor Area | | | 4,879.2 | m ² |
| C | Fire Flow | | | 12,000 | L/min |
| D | Occupancy Class | Options | Charge | Free burning | 0.15 |
| | | Non-combustible | -0.25 | | |
| | | Limited Combustible | -0.15 | | |
| | | Combustible | 0.00 | | |
| | | Free burning | 0.15 | | |
| | Rapid Burning | 0.25 | | | |
| Occupancy Adjustment | | | | 1800 | L/min |
| Fire Flow | | | | 13,800 | L/min |
| E | Sprinkler Protection | Options | Charge | Automatic Sprinkler Protection | -0.30 |
| | | Automatic Sprinkler Protection | -0.30 | | |
| | | None | 0.00 | | |
| | | Water Supply is Standard for System and Hose Lines | -0.10 | | |
| | | Full Supervision of the Sprinkler System | -0.10 | | |
| Sprinkler Reduction | | | | -6,900 | L/min |
| Exposures | | | | | |
| West Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 28.7 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 57.4 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Separation Distance | | | | 12.0 | m |
| West Side Exposure Charge | | | | 0.05 | |
| North Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 47 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 94 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Noncombustible or Fire Resistive without Unprotected Openings | | | | | |


| | | | | | |
|---|--|---|--|--|-----------|
| F | Separation Distance | | **>30m; No Exposure** | 32.3 | m |
| | North Side Exposure Charge | | | 0.00 | |
| | East Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | Yes | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | Yes | |
| | Exposed Wall Length | | | 46 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 92 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| | Separation Distance | | | 6 | m |
| | East Side Exposure Charge | | | 0.00 | |
| | South Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 53.3 | m |
| Exposed Wall No. of Storeys | | | 2 | | |
| Length-Height Factor of Exposed Wall | | | 106.6 | m.storeys | |
| Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Wood Frame | | | | |
| | Ordinary with Unprotected Openings | | | | |
| | Ordinary without Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | | |
| Separation Distance | | **>30m; No Exposure** | 145 | m | |
| South Side Exposure Charge | | | 0.00 | | |
| Total Exposure Charge | | | 0.05 | < 0.75 | |
| Increase for Exposures | | | 690 | L/min | |
| G | Total Required Fire Flow | | | 8,000 | L/min |
| Notes: 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | | |

| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg F | |  | | | |
|---|--|---|--|--|----------------|
| Calculations for Total Required Fire Flow | | | | | |
| Step | Parameter | | | Value | |
| A | Type of Construction | Options | C | Non-Combustible Construction (Type II) | 0.8 |
| | | Wood Frame (Type V) | 1.5 | | |
| | | Ordinary Construction (Type III) | 1.0 | | |
| | | Non-Combustible Construction (Type II) | 0.8 | | |
| | | Fire Resistive Construction (Type I) | 0.6 | | |
| B | Ground Floor Area | | | 4046.3 | m ² |
| | Total Effective Floor Area | | | 4,046.3 | m ² |
| C | Fire Flow | | | 11,000 | L/min |
| D | Occupancy Class | Options | Charge | Free burning | 0.15 |
| | | Non-combustible | -0.25 | | |
| | | Limited Combustible | -0.15 | | |
| | | Combustible | 0.00 | | |
| | | Free burning | 0.15 | | |
| | Rapid Burning | 0.25 | | | |
| Occupancy Adjustment | | | | 1650 | L/min |
| Fire Flow | | | | 12,650 | L/min |
| E | Sprinkler Protection | Options | Charge | None | 0.00 |
| | | Automatic Sprinkler Protection | -0.30 | | |
| | | None | 0.00 | | |
| | | Water Supply is Standard for System and Hose Lines | -0.10 | | |
| | Full Supervision of the Sprinkler System | -0.10 | No | 0.00 | |
| Sprinkler Reduction | | | | 0 | L/min |
| Exposures | | | | | |
| West Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 27.4 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 54.8 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Noncombustible or Fire Resistive without Unprotected Openings | | | | | |
| Separation Distance | | | | **>30m; No Exposure** | 70.0 m |
| West Side Exposure Charge | | | | 0.00 | |
| North Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 64 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 128 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Noncombustible or Fire Resistive without Unprotected Openings | | | | | |


| | | | | |
|---|--|---|--|--------------|
| F | Separation Distance | | 17.0 | m |
| | North Side Exposure Charge | | 0.08 | |
| | East Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | Yes | |
| | Exposed Wall Length | | 28 | m |
| | Exposed Wall No. of Storeys | | 2 | |
| | Length-Height Factor of Exposed Wall | | 56 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | |
| | | Ordinary with Unprotected Openings | | |
| | | Ordinary without Unprotected Openings | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | |
| | Separation Distance | | 12 | m |
| | East Side Exposure Charge | | 0.03 | |
| | South Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Wall Length | | 76.8 | m |
| Exposed Wall No. of Storeys | | 2 | | |
| Length-Height Factor of Exposed Wall | | 153.6 | m.storeys | |
| Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Wood Frame | | | |
| | Ordinary with Unprotected Openings | | | |
| | Ordinary without Unprotected Openings | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| Separation Distance | | **>30m; No Exposure** | 145 | m |
| South Side Exposure Charge | | 0.00 | | |
| Total Exposure Charge | | 0.105 | | |
| Increase for Exposures | | 1328.25 | | |
| G | Total Required Fire Flow | | 14,000 | L/min |
| Notes: 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | |

| | | | |
|---|---|---|------------------------|
| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg E | |  | |
| Calculations for Total Required Fire Flow | | | |
| Step | Parameter | | Value |
| A | Type of Construction | Options | C |
| | | Wood Frame (Type V) | 1.5 |
| | | Ordinary Construction (Type III) | 1.0 |
| | | Non-Combustible Construction (Type II) | 0.8 |
| | | Fire Resistive Construction (Type I) | 0.6 |
| B | Ground Floor Area | | 2927.3 m ² |
| | Total Effective Floor Area | | 2,927.3 m ² |
| C | Fire Flow | | 10,000 L/min |
| D | Occupancy Class | Options | Charge |
| | | Non-combustible | -0.25 |
| | | Limited Combustible | -0.15 |
| | | Combustible | 0.00 |
| | | Free burning | 0.15 |
| | | Rapid Burning | 0.25 |
| | Occupancy Adjustment | | 1500 L/min |
| Fire Flow | | 11,500 L/min | |
| E | Sprinkler Protection | Options | Charge |
| | | Automatic Sprinkler Protection | -0.30 |
| | | None | 0.00 |
| | | Water Supply is Standard for System and Hose Lines | -0.10 |
| | | Full Supervision of the Sprinkler System | -0.10 |
| Sprinkler Reduction | | 0 L/min | |
| Exposures | | | |
| West Side | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| Exposed Wall Length | | 23 | m |
| Exposed Wall No. of Storeys | | 2 | |
| Length-Height Factor of Exposed Wall | | 46 | m.storeys |
| Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | |
| | Wood Frame | | |
| | Ordinary with Unprotected Openings | | |
| | Ordinary without Unprotected Openings | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | |
| Separation Distance | | **>30m; No Exposure** | 100.0 m |
| West Side Exposure Charge | | 0.00 | |
| North Side | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| Exposed Wall Length | | 57.6 | m |
| Exposed Wall No. of Storeys | | 2 | |
| Length-Height Factor of Exposed Wall | | 115.2 | m.storeys |
| Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | |
| | Wood Frame | | |
| | Ordinary with Unprotected Openings | | |
| | Ordinary without Unprotected Openings | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | |


| | | | | |
|---|--|---|--|-----------|
| F | Separation Distance | | 16.7 | m |
| | North Side Exposure Charge | | 0.08 | |
| | East Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | Yes | |
| | Exposed Wall Length | | 7.2 | m |
| | Exposed Wall No. of Storeys | | 2 | |
| | Length-Height Factor of Exposed Wall | | 14.4 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | |
| | | Ordinary with Unprotected Openings | | |
| | | Ordinary without Unprotected Openings | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | |
| | Separation Distance | | 10.7 | m |
| | East Side Exposure Charge | | 0.02 | |
| | South Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Wall Length | | 64 | m |
| Exposed Wall No. of Storeys | | 2 | | |
| Length-Height Factor of Exposed Wall | | 128 | m.storeys | |
| Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Wood Frame | | | |
| | Ordinary with Unprotected Openings | | | |
| | Ordinary without Unprotected Openings | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| Separation Distance | | 17 | m | |
| South Side Exposure Charge | | 0.08 | | |
| Total Exposure Charge | | 0.175 | < 0.75 | |
| Increase for Exposures | | 2012.5 | L/min | |
| G | Total Required Fire Flow | | 14,000 | L/min |
| Notes: 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | |

| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg C | |  | | | |
|---|-----------------------------------|---|--------|--|----------------|
| Calculations for Total Required Fire Flow | | | | | |
| Step | Parameter | | | Value | |
| A | Type of Construction | Options | C | Non-Combustible Construction (Type II) | 0.8 |
| | | Wood Frame (Type V) | 1.5 | | |
| | | Ordinary Construction (Type III) | 1.0 | | |
| | | Non-Combustible Construction (Type II) | 0.8 | | |
| | | Fire Resistive Construction (Type I) | 0.6 | | |
| B | Ground Floor Area | | | 3717.5 | m ² |
| | Total Effective Floor Area | | | 3,717.5 | m ² |
| C | Fire Flow | | | 11,000 | L/min |
| D | Occupancy Class | Options | Charge | Free burning | 0.15 |
| | | Non-combustible | -0.25 | | |
| | | Limited Combustible | -0.15 | | |
| | | Combustible | 0.00 | | |
| | | Free burning | 0.15 | | |
| | Rapid Burning | 0.25 | | | |
| Occupancy Adjustment | | | | 1650 | L/min |
| Fire Flow | | | | 12,650 | L/min |
| E | Sprinkler Protection | Options | Charge | Automatic Sprinkler Protection | -0.30 |
| | | Automatic Sprinkler Protection | -0.30 | | |
| | | None | 0.00 | | |
| | | Water Supply is Standard for System and Hose Lines | -0.10 | | |
| | | Full Supervision of the Sprinkler System | -0.10 | | |
| Sprinkler Reduction | | | | -6,325 | L/min |
| Exposures | | | | | |
| West Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 22.9 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 45.8 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Separation Distance | | | | **>30m; No Exposure** | 100.0 m |
| West Side Exposure Charge | | | | 0.00 | |
| North Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 32 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 64 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Noncombustible or Fire Resistive without Unprotected Openings | | | | | |


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|--|--|---|--|-----------|
| F | Separation Distance | | 16.2 | m |
| | North Side Exposure Charge | | 0.06 | |
| | East Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Wall Length | | 22.9 | m |
| | Exposed Wall No. of Storeys | | 2 | |
| | Length-Height Factor of Exposed Wall | | 45.8 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | |
| | | Ordinary with Unprotected Openings | | |
| | | Ordinary without Unprotected Openings | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | |
| | Separation Distance | | 15.6 | m |
| | East Side Exposure Charge | | 0.05 | |
| | South Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Wall Length | | 57.6 | m |
| | Exposed Wall No. of Storeys | | 2 | |
| | Length-Height Factor of Exposed Wall | | 115.2 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | |
| Wood Frame | | | | |
| Ordinary with Unprotected Openings | | | | |
| Ordinary without Unprotected Openings | | | | |
| Noncombustible or Fire Resistive with Unprotected Openings | | | | |
| Noncombustible or Fire Resistive without Unprotected Openings | | | | |
| Separation Distance | | 16.7 | m | |
| South Side Exposure Charge | | 0.08 | | |
| Total Exposure Charge | | 0.19 | < 0.75 | |
| Increase for Exposures | | 2403.5 | L/min | |
| G | Total Required Fire Flow | | 9,000 | L/min |
| Notes: | | | | |
| 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) | | | | |
| 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height | | | | |
| 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | |

| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg B | |  | | | |
|---|--|---|--|--|----------------|
| Calculations for Total Required Fire Flow | | | | | |
| Step | Parameter | | | Value | |
| A | Type of Construction | Options | C | Non-Combustible Construction (Type II) | 0.8 |
| | | Wood Frame (Type V) | 1.5 | | |
| | | Ordinary Construction (Type III) | 1.0 | | |
| | | Non-Combustible Construction (Type II) | 0.8 | | |
| | | Fire Resistive Construction (Type I) | 0.6 | | |
| B | Ground Floor Area | | | 2196.8 | m ² |
| | Total Effective Floor Area | | | 2,196.8 | m ² |
| C | Fire Flow | | | 8,000 | L/min |
| D | Occupancy Class | Options | Charge | Free burning | 0.15 |
| | | Non-combustible | -0.25 | | |
| | | Limited Combustible | -0.15 | | |
| | | Combustible | 0.00 | | |
| | | Free burning | 0.15 | | |
| | | Rapid Burning | 0.25 | | |
| | Occupancy Adjustment | | | 1200 | L/min |
| Fire Flow | | | 9,200 | L/min | |
| E | Sprinkler Protection | Options | Charge | None | 0.00 |
| | | Automatic Sprinkler Protection | -0.30 | | |
| | | None | 0.00 | | |
| | | Water Supply is Standard for System and Hose Lines | -0.10 | | |
| | | Full Supervision of the Sprinkler System | -0.10 | | |
| | Sprinkler Reduction | | | 0 | L/min |
| | Exposures | | | | |
| | West Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 22.9 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 45.8 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| | Separation Distance | | | 15.6 | m |
| | West Side Exposure Charge | | | 0.05 | |
| | North Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 18.2 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 36.4 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |

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|---|--|---|--|-----------|
| F | Separation Distance | | 23.7 | m |
| | North Side Exposure Charge | | 0.00 | |
| | East Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Wall Length | | 17.4 | m |
| | Exposed Wall No. of Storeys | | 2 | |
| | Length-Height Factor of Exposed Wall | | 34.8 | m.storeys |
| | Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | |
| | | Ordinary with Unprotected Openings | | |
| | | Ordinary without Unprotected Openings | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | |
| | Separation Distance | | 29.4 | m |
| | East Side Exposure Charge | | 0.00 | |
| | South Side | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | No | |
| | Exposed Wall Length | | 51.7 | m |
| Exposed Wall No. of Storeys | | 2 | | |
| Length-Height Factor of Exposed Wall | | 103.4 | m.storeys | |
| Construction Type of Exposed Wall | Options | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Wood Frame | | | |
| | Ordinary with Unprotected Openings | | | |
| | Ordinary without Unprotected Openings | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| Separation Distance | | **>30m; No Exposure** | 32.3 | m |
| South Side Exposure Charge | | 0.00 | | |
| Total Exposure Charge | | 0.05 | < 0.75 | |
| Increase for Exposures | | 460 | L/min | |
| G | Total Required Fire Flow | | 10,000 | L/min |
| Notes: 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | |

| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg D | |  | | | | | |
|---|---|---|--|--|----------------|----|------|
| Calculations for Total Required Fire Flow | | | | | | | |
| Step | Parameter | | | Value | | | |
| A | Type of Construction | Options | C | Non-Combustible Construction (Type II) | 0.8 | | |
| | | Wood Frame (Type V) | 1.5 | | | | |
| | | Ordinary Construction (Type III) | 1.0 | | | | |
| | | Non-Combustible Construction (Type II) | 0.8 | | | | |
| | | Fire Resistive Construction (Type I) | 0.6 | | | | |
| B | Ground Floor Area | | | 3177.1 | m ² | | |
| | Total Effective Floor Area | | | 3,177.1 | m ² | | |
| C | Fire Flow | | | 10,000 | L/min | | |
| D | Occupancy Class | Options | Charge | Free burning | 0.15 | | |
| | | Non-combustible | -0.25 | | | | |
| | | Limited Combustible | -0.15 | | | | |
| | | Combustible | 0.00 | | | | |
| | | Free burning | 0.15 | | | | |
| | | Rapid Burning | 0.25 | | | | |
| | Occupancy Adjustment | | | 1500 | L/min | | |
| Fire Flow | | | 11,500 | L/min | | | |
| E | Sprinkler Protection | Options | Charge | None | 0.00 | | |
| | | Automatic Sprinkler Protection | -0.30 | | | | |
| | | None | 0.00 | | | | |
| | | Water Supply is Standard for System and Hose Lines | -0.10 | | | No | 0.00 |
| | | Full Supervision of the Sprinkler System | -0.10 | | | No | 0.00 |
| Sprinkler Reduction | | | 0 | L/min | | | |
| Exposures | | | | | | | |
| West Side | | | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | | | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | | | |
| Exposed Wall Length | | | | 23 | m | | |
| Exposed Wall No. of Storeys | | | | 2 | | | |
| Length-Height Factor of Exposed Wall | | | | 46 | m.storeys | | |
| Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | | | | |
| | Wood Frame | | | | | | |
| | Ordinary with Unprotected Openings | | | | | | |
| | Ordinary without Unprotected Openings | | | | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | | | | |
| Separation Distance | | | | **>30m; No Exposure** | 100.0 m | | |
| West Side Exposure Charge | | | | 0.00 | | | |
| North Side | | | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | | | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | | | |
| Exposed Wall Length | | | | 80 | m | | |
| Exposed Wall No. of Storeys | | | | 2 | | | |
| Length-Height Factor of Exposed Wall | | | | 160 | m.storeys | | |
| Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | | | | |
| | Wood Frame | | | | | | |
| | Ordinary with Unprotected Openings | | | | | | |
| | Ordinary without Unprotected Openings | | | | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | | | | |

| | | | | | |
|---|--|---|--|--|-----------|
| F | Separation Distance | | **>30m; No Exposure** | 100.0 | m |
| | North Side Exposure Charge | | | 0.00 | |
| | East Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 12 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 24 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| | Separation Distance | | **>30m; No Exposure** | 55 | m |
| | East Side Exposure Charge | | | 0.00 | |
| | South Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 50.2 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| Length-Height Factor of Exposed Wall | | | 100.4 | m.storeys | |
| Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Wood Frame | | | | |
| | Ordinary with Unprotected Openings | | | | |
| | Ordinary without Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | | |
| Separation Distance | | | 16.2 | m | |
| South Side Exposure Charge | | | 0.08 | | |
| Total Exposure Charge | | | 0.08 | < 0.75 | |
| Increase for Exposures | | | 920 | L/min | |
| G | Total Required Fire Flow | | | 12,000 | L/min |
| Notes: 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | | |

| Project Name: 1319 Johnston Rd Project Location: Ottawa ON Project No: 23034 Date: 26-Mar-24 Building Type: Light Industrial Building Being Considered: Bldg A | |  | | | |
|---|-----------------------------------|---|--------|--|----------------|
| Calculations for Total Required Fire Flow | | | | | |
| Step | Parameter | | | Value | |
| A | Type of Construction | Options | C | Non-Combustible Construction (Type II) | 0.8 |
| | | Wood Frame (Type V) | 1.5 | | |
| | | Ordinary Construction (Type III) | 1.0 | | |
| | | Non-Combustible Construction (Type II) | 0.8 | | |
| | | Fire Resistive Construction (Type I) | 0.6 | | |
| B | Ground Floor Area | | | 4907.1 | m ² |
| | Total Effective Floor Area | | | 4,907.1 | m ² |
| C | Fire Flow | | | 12,000 | L/min |
| D | Occupancy Class | Options | Charge | Free burning | 0.15 |
| | | Non-combustible | -0.25 | | |
| | | Limited Combustible | -0.15 | | |
| | | Combustible | 0.00 | | |
| | | Free burning | 0.15 | | |
| | Rapid Burning | 0.25 | | | |
| Occupancy Adjustment | | | | 1800 | L/min |
| Fire Flow | | | | 13,800 | L/min |
| E | Sprinkler Protection | Options | Charge | Automatic Sprinkler Protection | -0.30 |
| | | Automatic Sprinkler Protection | -0.30 | | |
| | | None | 0.00 | | |
| | | Water Supply is Standard for System and Hose Lines | -0.10 | | |
| | | Full Supervision of the Sprinkler System | -0.10 | | |
| Sprinkler Reduction | | | | -6,900 | L/min |
| Exposures | | | | | |
| West Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 15.9 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 31.8 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Separation Distance | | | | 29.4 | m |
| West Side Exposure Charge | | | | 0.00 | |
| North Side | | | | | |
| Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Building Fully Protected with Automatic Sprinkler Systems | | | | No | |
| Exposed Wall Length | | | | 118 | m |
| Exposed Wall No. of Storeys | | | | 2 | |
| Length-Height Factor of Exposed Wall | | | | 236 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| Noncombustible or Fire Resistive without Unprotected Openings | | | | | |

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|---|--|---|--|--|-----------|
| F | Separation Distance | | **>30m; No Exposure** | 100.0 | m |
| | North Side Exposure Charge | | | 0.00 | |
| | East Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 26.8 | m |
| | Exposed Wall No. of Storeys | | | 2 | |
| | Length-Height Factor of Exposed Wall | | | 53.6 | m.storeys |
| | Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | |
| | | Wood Frame | | | |
| | | Ordinary with Unprotected Openings | | | |
| | | Ordinary without Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive with Unprotected Openings | | | |
| | | Noncombustible or Fire Resistive without Unprotected Openings | | | |
| | Separation Distance | | **>30m; No Exposure** | 39 | m |
| | East Side Exposure Charge | | | 0.00 | |
| | South Side | | | | |
| | Subject Building and Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Building Fully Protected with Automatic Sprinkler Systems | | | No | |
| | Exposed Wall Length | | | 19.9 | m |
| Exposed Wall No. of Storeys | | | 2 | | |
| Length-Height Factor of Exposed Wall | | | 39.8 | m.storeys | |
| Construction Type of Exposed Wall | Options | | Noncombustible or Fire Resistive with Unprotected Openings | | |
| | Wood Frame | | | | |
| | Ordinary with Unprotected Openings | | | | |
| | Ordinary without Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive with Unprotected Openings | | | | |
| | Noncombustible or Fire Resistive without Unprotected Openings | | | | |
| Separation Distance | | | 25 | m | |
| South Side Exposure Charge | | | 0.00 | | |
| Total Exposure Charge | | | 0 | < 0.75 | |
| Increase for Exposures | | | 0 | L/min | |
| G | Total Required Fire Flow | | | 7,000 | L/min |
| Notes: 1. Fire flow calculations have been prepared in accordance with Fire Underwriters Survey (v. 2020) 2. Floor areas used in Step B equivalent to 2-storey given ~8m building height 3. Where buildings are at a diagonal to each other, the shortest separation distance is increased by 3 metres and used as the exposure distance (Ref. FUS v.2020 pg.30). | | | | | |

Stephen McCaughey

From: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Sent: July 31, 2023 8:25 PM
To: Stephen McCaughey
Subject: RE: 1319 Johnston Rd - SPA criteria
Attachments: 1319 Johnston Road July 2023.pdf

"CAUTION: External Sender"

Hi Stephen,

Please find below the boundary conditions for the proposed development at 1319 Johnston Road:

The following are boundary conditions, HGL, for hydraulic analysis at 1319 Johnston Road (zone 2W2C) assumed to be connected to the 305 mm on Johnston Road (see attached PDF for location).

Minimum HGL = 123.9 m

Maximum HGL = 131.3 m

Max Day + FireFlow (133.3 L/s): 126.2 m

Max Day + FireFlow (233.3 L/s): 123.7 m

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

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

The results were based on the following demand scenarios:

Water avg day: 1.46 L/s

Water peak hour: 8.02 L/s

Water max day + fire 1: 3.65 L/s + 8,000 L/min (Bldg F) = 136.98 L/s

Water max day + fire 2: 3.65 + 14,000 L/min = 237 L/s

Feel free to reach out at any time.

Thank you,

From: Stephen McCaughey <smccaughey@rcii.com>
Sent: July 28, 2023 7:42 AM
To: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Subject: RE: 1319 Johnston Rd - SPA criteria

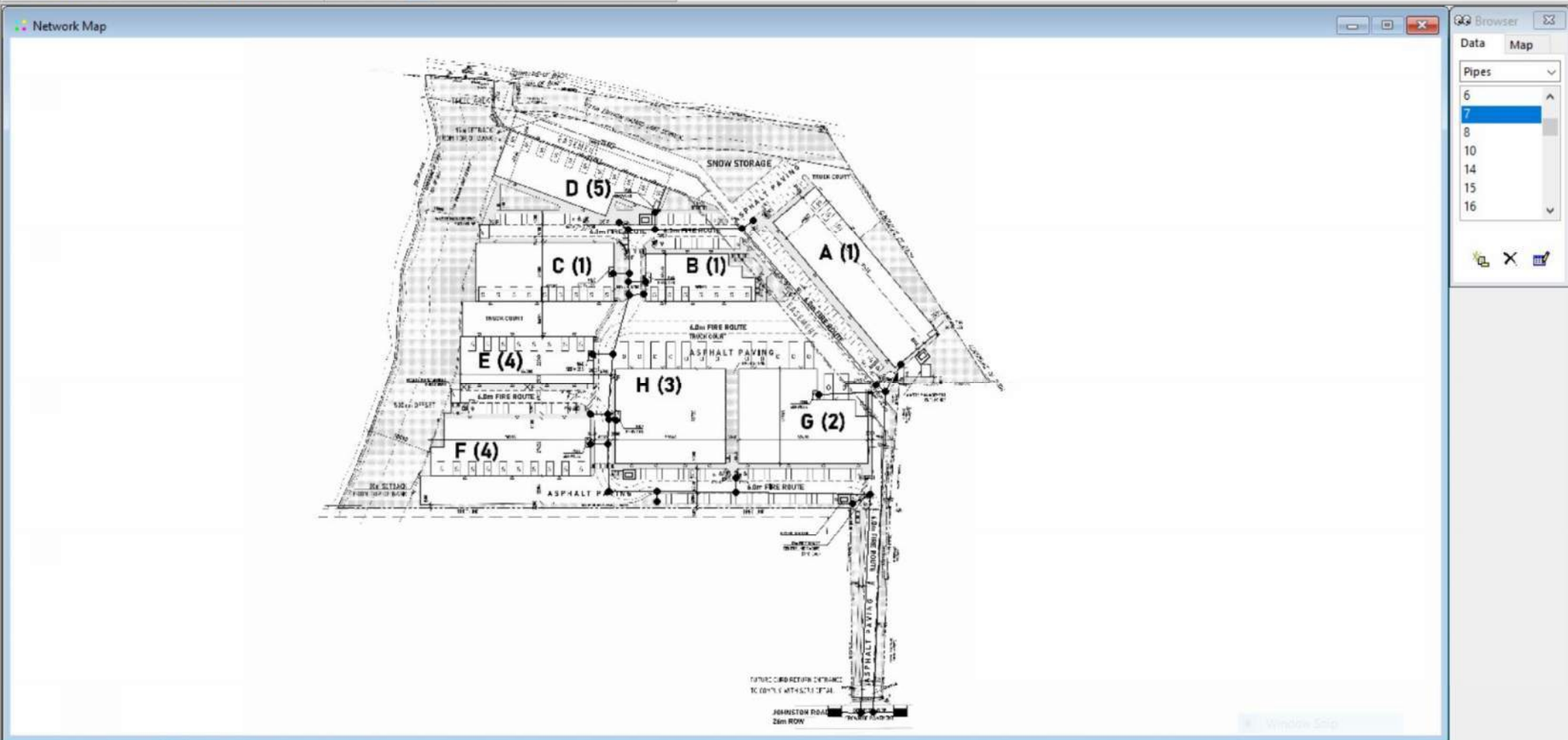
Boundary Conditions for 1319 Johnston Road



Legend

- Public
- Private





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*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

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Input File: 1319 Johnston.net
Average Day Demand

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |

| | | | | |
|----|--------------|--------------|----|-----|
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 131.30 | 51.95 | 0.00 |
| EastConnect | 0.00 | 131.30 | 51.95 | 0.00 |
| HYD-1 | 0.00 | 131.30 | 48.80 | 0.00 |
| HYD-2 | 0.00 | 131.30 | 48.30 | 0.00 |
| HYD-3 | 0.00 | 131.30 | 48.30 | 0.00 |
| HYD-4 | 0.00 | 131.30 | 48.40 | 0.00 |
| HYD-5 | 0.00 | 131.30 | 48.20 | 0.00 |
| HYD-6 | 0.00 | 131.30 | 48.00 | 0.00 |
| HYD-8 | 0.00 | 131.30 | 48.30 | 0.00 |
| BldgG | 0.25 | 131.30 | 48.20 | 0.00 |
| BldgA | 0.26 | 131.30 | 48.10 | 0.00 |
| BldgAGConnect | 0.00 | 131.30 | 51.20 | 0.00 |
| HYD8Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| HYD1Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| HYD2Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| HYD3Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| 20 | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgFConnect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgF | 0.16 | 131.29 | 48.19 | 0.00 |
| HYD4Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgEConnect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgE | 0.18 | 131.29 | 48.19 | 0.00 |
| HYD5Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgCConnect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgC | 0.13 | 131.30 | 48.00 | 0.00 |
| HYD6Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgDConnect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgD | 0.16 | 131.30 | 47.75 | 0.00 |
| HYD7Connect | 0.00 | 131.30 | 51.20 | 0.00 |
| HYD-7 | 0.00 | 131.30 | 48.30 | 0.00 |
| BldgHConnect | 0.00 | 131.30 | 51.20 | 0.00 |
| BldgH | 0.20 | 131.30 | 48.20 | 0.00 |
| BldgB | 0.11 | 131.30 | 48.20 | 0.00 |
| BldgBConnect | 0.00 | 131.30 | 51.20 | 0.00 |
| West | -0.72 | 131.30 | 0.00 | 0.00 Reservoir |
| East | -0.73 | 131.30 | 0.00 | 0.00 Reservoir |



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Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|------------|-------------|-----------------|-----------------------|--------|
| 1 | 0.72 | 0.01 | 0.00 | Open |
| 2 | 0.07 | 0.00 | 0.00 | Open |
| 3 | -0.73 | 0.01 | 0.00 | Open |
| 4 | -0.80 | 0.03 | 0.01 | Open |
| 5 | -0.29 | 0.01 | 0.00 | Open |
| 6 | 0.00 | 0.00 | 0.00 | Open |
| 7 | -0.26 | 0.01 | 0.01 | Open |
| 8 | 0.25 | 0.01 | 0.00 | Open |
| 10 | -0.29 | 0.01 | 0.00 | Open |
| 14 | 0.16 | 0.08 | 0.43 | Open |
| 15 | 0.13 | 0.00 | 0.00 | Open |
| 16 | 0.00 | 0.00 | 0.00 | Open |
| 17 | 0.13 | 0.00 | 0.00 | Open |
| 18 | 0.13 | 0.01 | 0.00 | Open |
| 20 | 0.00 | 0.00 | 0.00 | Open |
| 21 | -0.11 | 0.00 | 0.00 | Open |
| 22 | 0.18 | 0.09 | 0.53 | Open |
| 23 | -0.29 | 0.01 | 0.00 | Open |
| 24 | 0.00 | 0.00 | 0.00 | Open |
| 26 | 0.16 | 0.08 | 0.43 | Open |
| 27 | -0.65 | 0.02 | 0.01 | Open |
| 28 | -0.65 | 0.02 | 0.01 | Open |
| 29 | 0.00 | 0.00 | 0.00 | Open |
| 32 | 0.00 | 0.00 | 0.00 | Open |
| 34 | -0.65 | 0.02 | 0.01 | Open |
| 35 | 0.00 | 0.00 | 0.00 | Open |
| 36 | -0.65 | 0.02 | 0.01 | Open |
| 37 | 0.00 | 0.00 | 0.00 | Open |
| 9 | -0.65 | 0.02 | 0.01 | Open |
| 25 | 0.49 | 0.02 | 0.00 | Open |
| 30 | 0.29 | 0.01 | 0.00 | Open |
| 31 | 0.20 | 0.10 | 0.64 | Open |
| 33 | 0.11 | 0.00 | 0.00 | Open |
| 38 | 0.00 | 0.00 | 0.00 | Open |
| 39 | 0.11 | 0.01 | 0.00 | Open |
| 40 | -0.29 | 0.01 | 0.00 | Open |

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

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Input File: 1319 Johnston.net
Peak Hour Demand

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |

| | | | | |
|----|--------------|--------------|----|-----|
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 123.90 | 44.55 | 0.00 |
| EastConnect | 0.00 | 123.90 | 44.55 | 0.00 |
| HYD-1 | 0.00 | 123.90 | 41.40 | 0.00 |
| HYD-2 | 0.00 | 123.89 | 40.89 | 0.00 |
| HYD-3 | 0.00 | 123.89 | 40.89 | 0.00 |
| HYD-4 | 0.00 | 123.89 | 40.99 | 0.00 |
| HYD-5 | 0.00 | 123.89 | 40.79 | 0.00 |
| HYD-6 | 0.00 | 123.89 | 40.59 | 0.00 |
| HYD-8 | 0.00 | 123.89 | 40.89 | 0.00 |
| BldgG | 0.68 | 123.89 | 40.79 | 0.00 |
| BldgA | 0.71 | 123.89 | 40.69 | 0.00 |
| BldgAGConnect | 0.00 | 123.89 | 43.79 | 0.00 |
| HYD8Connect | 0.00 | 123.89 | 43.79 | 0.00 |
| HYD1Connect | 0.00 | 123.90 | 43.80 | 0.00 |
| HYD2Connect | 0.00 | 123.89 | 43.79 | 0.00 |
| HYD3Connect | 0.00 | 123.89 | 43.79 | 0.00 |
| 20 | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgFConnect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgF | 0.44 | 123.87 | 40.77 | 0.00 |
| HYD4Connect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgEConnect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgE | 0.48 | 123.85 | 40.75 | 0.00 |
| HYD5Connect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgCConnect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgC | 0.35 | 123.89 | 40.59 | 0.00 |
| HYD6Connect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgDConnect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgD | 0.44 | 123.87 | 40.32 | 0.00 |
| HYD7Connect | 0.00 | 123.89 | 43.79 | 0.00 |
| HYD-7 | 0.00 | 123.89 | 40.89 | 0.00 |
| BldgHConnect | 0.00 | 123.89 | 43.79 | 0.00 |
| BldgH | 0.55 | 123.88 | 40.78 | 0.00 |
| BldgB | 0.30 | 123.89 | 40.79 | 0.00 |
| BldgBConnect | 0.00 | 123.89 | 43.79 | 0.00 |
| West | -1.97 | 123.90 | 0.00 | 0.00 Reservoir |
| East | -1.98 | 123.90 | 0.00 | 0.00 Reservoir |



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Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|---------|----------|--------------|--------------------|--------|
| 1 | 1.97 | 0.03 | 0.01 | Open |
| 2 | 0.19 | 0.00 | 0.00 | Open |
| 3 | -1.98 | 0.03 | 0.01 | Open |
| 4 | -2.18 | 0.07 | 0.05 | Open |
| 5 | -0.79 | 0.03 | 0.01 | Open |
| 6 | 0.00 | 0.00 | 0.00 | Open |
| 7 | -0.71 | 0.04 | 0.03 | Open |
| 8 | 0.68 | 0.04 | 0.03 | Open |
| 10 | -0.79 | 0.03 | 0.01 | Open |
| 14 | 0.44 | 0.22 | 2.79 | Open |
| 15 | 0.35 | 0.01 | 0.00 | Open |
| 16 | 0.00 | 0.00 | 0.00 | Open |
| 17 | 0.35 | 0.01 | 0.00 | Open |
| 18 | 0.35 | 0.02 | 0.01 | Open |
| 20 | 0.00 | 0.00 | 0.00 | Open |
| 21 | -0.30 | 0.01 | 0.00 | Open |
| 22 | 0.48 | 0.24 | 3.27 | Open |
| 23 | -0.78 | 0.02 | 0.01 | Open |
| 24 | 0.00 | 0.00 | 0.00 | Open |
| 26 | 0.44 | 0.22 | 2.79 | Open |
| 27 | -1.77 | 0.06 | 0.04 | Open |
| 28 | -1.77 | 0.06 | 0.04 | Open |
| 29 | 0.00 | 0.00 | 0.00 | Open |
| 32 | 0.00 | 0.00 | 0.00 | Open |
| 34 | -1.77 | 0.06 | 0.04 | Open |
| 35 | 0.00 | 0.00 | 0.00 | Open |
| 36 | -1.77 | 0.06 | 0.04 | Open |
| 37 | 0.00 | 0.00 | 0.00 | Open |
| 9 | -1.77 | 0.06 | 0.04 | Open |
| 25 | 1.33 | 0.04 | 0.02 | Open |
| 30 | 0.78 | 0.02 | 0.01 | Open |
| 31 | 0.55 | 0.28 | 4.21 | Open |
| 33 | 0.30 | 0.01 | 0.00 | Open |
| 38 | 0.00 | 0.00 | 0.00 | Open |
| 39 | 0.30 | 0.02 | 0.01 | Open |
| 40 | -0.79 | 0.03 | 0.01 | Open |

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

```

Input File: 1319 Johnston.net
 Max Day + Building F (14,000 L/min)

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |

| | | | | |
|----|--------------|--------------|----|-----|
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 123.65 | 44.30 | 0.00 |
| EastConnect | 0.00 | 123.65 | 44.30 | 0.00 |
| HYD-1 | 0.00 | 110.36 | 27.86 | 0.00 |
| HYD-2 | 77.80 | 101.25 | 18.25 | 0.00 |
| HYD-3 | 77.80 | 101.47 | 18.47 | 0.00 |
| HYD-4 | 77.80 | 100.21 | 17.31 | 0.00 |
| HYD-5 | 0.00 | 104.78 | 21.68 | 0.00 |
| HYD-6 | 0.00 | 106.58 | 23.28 | 0.00 |
| HYD-8 | 0.00 | 114.49 | 31.49 | 0.00 |
| BldgG | 0.38 | 114.86 | 31.76 | 0.00 |
| BldgA | 0.39 | 114.86 | 31.66 | 0.00 |
| BldgAGConnect | 0.00 | 114.86 | 34.76 | 0.00 |
| HYD8Connect | 0.00 | 114.49 | 34.39 | 0.00 |
| HYD1Connect | 0.00 | 110.36 | 30.26 | 0.00 |
| HYD2Connect | 0.00 | 102.98 | 22.88 | 0.00 |
| HYD3Connect | 0.00 | 101.85 | 21.75 | 0.00 |
| 20 | 0.00 | 101.88 | 21.78 | 0.00 |
| BldgFConnect | 0.00 | 101.91 | 21.81 | 0.00 |
| BldgF | 0.24 | 101.91 | 18.81 | 0.00 |
| HYD4Connect | 0.00 | 101.94 | 21.84 | 0.00 |
| BldgEConnect | 0.00 | 103.25 | 23.15 | 0.00 |
| BldgE | 0.27 | 103.24 | 20.14 | 0.00 |
| HYD5Connect | 0.00 | 104.78 | 24.68 | 0.00 |
| BldgCConnect | 0.00 | 105.41 | 25.31 | 0.00 |
| BldgC | 0.19 | 105.41 | 22.11 | 0.00 |
| HYD6Connect | 0.00 | 106.58 | 26.48 | 0.00 |
| BldgDConnect | 0.00 | 107.17 | 27.07 | 0.00 |
| BldgD | 0.24 | 107.16 | 23.61 | 0.00 |
| HYD7Connect | 0.00 | 109.57 | 29.47 | 0.00 |
| HYD-7 | 0.00 | 109.57 | 26.57 | 0.00 |
| BldgHConnect | 0.00 | 101.93 | 21.83 | 0.00 |
| BldgH | 0.30 | 101.93 | 18.83 | 0.00 |
| BldgB | 0.16 | 105.25 | 22.15 | 0.00 |
| BldgBConnect | 0.00 | 105.25 | 25.15 | 0.00 |
| West | -119.74 | 123.70 | 0.00 | 0.00 Reservoir |
| East | -115.83 | 123.70 | 0.00 | 0.00 Reservoir |



Page 3

Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|------------|-------------|-----------------|-----------------------|--------|
| 1 | 119.74 | 1.69 | 10.40 | Open |
| 2 | -23.66 | 0.33 | 0.52 | Open |
| 3 | -115.83 | 1.64 | 9.79 | Open |
| 4 | -92.17 | 2.93 | 54.26 | Open |
| 5 | -91.40 | 2.91 | 53.42 | Open |
| 6 | 0.00 | 0.00 | 0.00 | Open |
| 7 | -0.39 | 0.02 | 0.01 | Open |
| 8 | 0.38 | 0.02 | 0.01 | Open |
| 10 | -91.40 | 2.91 | 53.42 | Open |
| 14 | 0.24 | 0.12 | 0.91 | Open |
| 15 | 91.16 | 2.90 | 53.16 | Open |
| 16 | 0.00 | 0.00 | 0.00 | Open |
| 17 | 91.16 | 2.90 | 53.16 | Open |
| 18 | 0.19 | 0.01 | 0.00 | Open |
| 20 | 0.00 | 0.00 | 0.00 | Open |
| 21 | 90.81 | 2.89 | 52.79 | Open |
| 22 | 0.27 | 0.14 | 1.13 | Open |
| 23 | 90.54 | 2.88 | 52.50 | Open |
| 24 | 77.80 | 4.40 | 192.04 | Open |
| 26 | 0.24 | 0.12 | 0.91 | Open |
| 27 | 12.20 | 0.39 | 1.28 | Open |
| 28 | 12.20 | 0.39 | 1.28 | Open |
| 29 | 77.80 | 4.40 | 192.03 | Open |
| 32 | -77.80 | 4.40 | 192.04 | Open |
| 34 | -143.40 | 4.56 | 123.02 | Open |
| 35 | 0.00 | 0.00 | 0.00 | Open |
| 36 | -143.40 | 4.56 | 123.02 | Open |
| 37 | 0.00 | 0.00 | 0.00 | Open |
| 9 | -65.60 | 2.09 | 28.90 | Open |
| 25 | -12.44 | 0.40 | 1.33 | Open |
| 30 | -12.74 | 0.41 | 1.40 | Open |
| 31 | 0.30 | 0.15 | 1.37 | Open |
| 33 | -90.81 | 2.89 | 52.79 | Open |
| 38 | -90.97 | 2.90 | 52.96 | Open |
| 39 | 0.16 | 0.01 | 0.00 | Open |
| 40 | -91.40 | 2.91 | 53.42 | Open |

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

```

Input File: 1319 Johnston.net
 Max Day + Building H (8,000 L/min)

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |

| | | | | |
|----|--------------|--------------|----|-----|
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 123.68 | 44.33 | 0.00 |
| EastConnect | 0.00 | 123.68 | 44.33 | 0.00 |
| HYD-1 | 0.00 | 119.24 | 36.74 | 0.00 |
| HYD-2 | 0.00 | 116.77 | 33.77 | 0.00 |
| HYD-3 | 66.70 | 114.87 | 31.87 | 0.00 |
| HYD-4 | 66.70 | 113.77 | 30.87 | 0.00 |
| HYD-5 | 0.00 | 116.19 | 33.09 | 0.00 |
| HYD-6 | 0.00 | 116.90 | 33.60 | 0.00 |
| HYD-8 | 0.00 | 120.02 | 37.02 | 0.00 |
| BldgG | 0.38 | 120.17 | 37.07 | 0.00 |
| BldgA | 0.39 | 120.17 | 36.97 | 0.00 |
| BldgAGConnect | 0.00 | 120.17 | 40.07 | 0.00 |
| HYD8Connect | 0.00 | 120.02 | 39.92 | 0.00 |
| HYD1Connect | 0.00 | 119.24 | 39.14 | 0.00 |
| HYD2Connect | 0.00 | 116.77 | 36.67 | 0.00 |
| HYD3Connect | 0.00 | 115.16 | 35.06 | 0.00 |
| 20 | 0.00 | 115.13 | 35.03 | 0.00 |
| BldgFConnect | 0.00 | 115.09 | 34.99 | 0.00 |
| BldgF | 0.24 | 115.09 | 31.99 | 0.00 |
| HYD4Connect | 0.00 | 115.07 | 34.97 | 0.00 |
| BldgEConnect | 0.00 | 115.59 | 35.49 | 0.00 |
| BldgE | 0.27 | 115.57 | 32.47 | 0.00 |
| HYD5Connect | 0.00 | 116.19 | 36.09 | 0.00 |
| BldgCConnect | 0.00 | 116.43 | 36.33 | 0.00 |
| BldgC | 0.19 | 116.43 | 33.13 | 0.00 |
| HYD6Connect | 0.00 | 116.90 | 36.80 | 0.00 |
| BldgDConnect | 0.00 | 117.13 | 37.03 | 0.00 |
| BldgD | 0.24 | 117.12 | 33.57 | 0.00 |
| HYD7Connect | 0.00 | 118.08 | 37.98 | 0.00 |
| HYD-7 | 0.00 | 118.08 | 35.08 | 0.00 |
| BldgHConnect | 0.00 | 115.07 | 34.97 | 0.00 |
| BldgH | 0.30 | 115.07 | 31.97 | 0.00 |
| BldgB | 0.16 | 116.37 | 33.27 | 0.00 |
| BldgBConnect | 0.00 | 116.37 | 36.27 | 0.00 |
| West | -68.53 | 123.70 | 0.00 | 0.00 Reservoir |
| East | -67.04 | 123.70 | 0.00 | 0.00 Reservoir |



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Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|------------|-------------|-----------------|-----------------------|--------|
| 1 | 68.53 | 0.97 | 3.70 | Open |
| 2 | -10.88 | 0.15 | 0.12 | Open |
| 3 | -67.04 | 0.95 | 3.56 | Open |
| 4 | -56.17 | 1.79 | 21.68 | Open |
| 5 | -55.40 | 1.76 | 21.13 | Open |
| 6 | 0.00 | 0.00 | 0.00 | Open |
| 7 | -0.39 | 0.02 | 0.01 | Open |
| 8 | 0.38 | 0.02 | 0.01 | Open |
| 10 | -55.40 | 1.76 | 21.13 | Open |
| 14 | 0.24 | 0.12 | 0.91 | Open |
| 15 | 55.16 | 1.76 | 20.96 | Open |
| 16 | 0.00 | 0.00 | 0.00 | Open |
| 17 | 55.16 | 1.76 | 20.96 | Open |
| 18 | 0.19 | 0.01 | 0.00 | Open |
| 20 | 0.00 | 0.00 | 0.00 | Open |
| 21 | 54.81 | 1.74 | 20.72 | Open |
| 22 | 0.27 | 0.14 | 1.13 | Open |
| 23 | 54.54 | 1.74 | 20.53 | Open |
| 24 | 66.70 | 3.77 | 144.40 | Open |
| 26 | 0.24 | 0.12 | 0.91 | Open |
| 27 | -12.70 | 0.40 | 1.38 | Open |
| 28 | -12.70 | 0.40 | 1.38 | Open |
| 29 | 66.70 | 3.77 | 144.40 | Open |
| 32 | 0.00 | 0.00 | 0.00 | Open |
| 34 | -79.40 | 2.53 | 41.17 | Open |
| 35 | 0.00 | 0.00 | 0.00 | Open |
| 36 | -79.40 | 2.53 | 41.17 | Open |
| 37 | 0.00 | 0.00 | 0.00 | Open |
| 9 | -79.40 | 2.53 | 41.17 | Open |
| 25 | 12.46 | 0.40 | 1.33 | Open |
| 30 | 12.16 | 0.39 | 1.27 | Open |
| 31 | 0.30 | 0.15 | 1.37 | Open |
| 33 | -54.81 | 1.74 | 20.72 | Open |
| 38 | -54.97 | 1.75 | 20.83 | Open |
| 39 | 0.16 | 0.01 | 0.00 | Open |
| 40 | -55.40 | 1.76 | 21.13 | Open |


```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

```

Input File: 1319 Johnston.net
 Max Day + Building E (14,000 L/min)

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |

| | | | | |
|----|--------------|-------------|----|-----|
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2
Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 123.65 | 44.30 | 0.00 |
| EastConnect | 0.00 | 123.65 | 44.30 | 0.00 |
| HYD-1 | 0.00 | 112.14 | 29.64 | 0.00 |
| HYD-2 | 0.00 | 105.75 | 22.75 | 0.00 |
| HYD-3 | 77.80 | 101.21 | 18.21 | 0.00 |
| HYD-4 | 77.80 | 98.54 | 15.64 | 0.00 |
| HYD-5 | 77.80 | 98.96 | 15.86 | 0.00 |
| HYD-6 | 0.00 | 102.71 | 19.41 | 0.00 |
| HYD-8 | 0.00 | 112.42 | 29.42 | 0.00 |
| BldgG | 0.38 | 112.88 | 29.78 | 0.00 |
| BldgA | 0.39 | 112.88 | 29.68 | 0.00 |
| BldgAGConnect | 0.00 | 112.88 | 32.78 | 0.00 |
| HYD8Connect | 0.00 | 112.42 | 32.32 | 0.00 |
| HYD1Connect | 0.00 | 112.14 | 32.04 | 0.00 |
| HYD2Connect | 0.00 | 105.75 | 25.65 | 0.00 |
| HYD3Connect | 0.00 | 101.59 | 21.49 | 0.00 |
| 20 | 0.00 | 101.11 | 21.01 | 0.00 |
| BldgFConnect | 0.00 | 100.59 | 20.49 | 0.00 |
| BldgF | 0.24 | 100.59 | 17.49 | 0.00 |
| HYD4Connect | 0.00 | 100.26 | 20.16 | 0.00 |
| BldgEConnect | 0.00 | 100.37 | 20.27 | 0.00 |
| BldgE | 0.27 | 100.36 | 17.26 | 0.00 |
| HYD5Connect | 0.00 | 100.50 | 20.40 | 0.00 |
| BldgCConnect | 0.00 | 101.28 | 21.18 | 0.00 |
| BldgC | 0.19 | 101.28 | 17.98 | 0.00 |
| HYD6Connect | 0.00 | 102.71 | 22.61 | 0.00 |
| BldgDConnect | 0.00 | 103.43 | 23.33 | 0.00 |
| BldgD | 0.24 | 103.43 | 19.88 | 0.00 |
| HYD7Connect | 0.00 | 106.38 | 26.28 | 0.00 |
| HYD-7 | 0.00 | 106.38 | 23.38 | 0.00 |
| BldgHConnect | 0.00 | 100.28 | 20.18 | 0.00 |
| BldgH | 0.30 | 100.28 | 17.18 | 0.00 |
| BldgB | 0.16 | 101.08 | 17.98 | 0.00 |
| BldgBConnect | 0.00 | 101.08 | 20.98 | 0.00 |
| West | -118.54 | 123.70 | 0.00 | 0.00 Reservoir |
| East | -117.03 | 123.70 | 0.00 | 0.00 Reservoir |



Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|---------|----------|--------------|--------------------|--------|
| 1 | 118.54 | 1.68 | 10.21 | Open |
| 2 | -14.16 | 0.20 | 0.20 | Open |
| 3 | -117.03 | 1.66 | 9.97 | Open |
| 4 | -102.87 | 3.27 | 66.50 | Open |
| 5 | -102.10 | 3.25 | 65.58 | Open |
| 6 | 0.00 | 0.00 | 0.00 | Open |
| 7 | -0.39 | 0.02 | 0.01 | Open |
| 8 | 0.38 | 0.02 | 0.01 | Open |
| 10 | -102.10 | 3.25 | 65.58 | Open |
| 14 | 0.24 | 0.12 | 0.91 | Open |
| 15 | 101.86 | 3.24 | 65.30 | Open |
| 16 | 0.00 | 0.00 | 0.00 | Open |
| 17 | 101.86 | 3.24 | 65.30 | Open |
| 18 | 0.19 | 0.01 | 0.00 | Open |
| 20 | 77.80 | 4.40 | 192.04 | Open |
| 21 | 23.71 | 0.75 | 4.39 | Open |
| 22 | 0.27 | 0.14 | 1.13 | Open |
| 23 | 23.44 | 0.75 | 4.30 | Open |
| 24 | 77.80 | 4.40 | 192.04 | Open |
| 26 | 0.24 | 0.12 | 0.91 | Open |
| 27 | -54.90 | 1.75 | 20.78 | Open |
| 28 | -54.90 | 1.75 | 20.78 | Open |
| 29 | 77.80 | 4.40 | 192.03 | Open |
| 32 | 0.00 | 0.00 | 0.00 | Open |
| 34 | -132.70 | 4.22 | 106.56 | Open |
| 35 | 0.00 | 0.00 | 0.00 | Open |
| 36 | -132.70 | 4.22 | 106.56 | Open |
| 37 | 0.00 | 0.00 | 0.00 | Open |
| 9 | -132.70 | 4.22 | 106.56 | Open |
| 25 | 54.66 | 1.74 | 20.61 | Open |
| 30 | 54.36 | 1.73 | 20.40 | Open |
| 31 | 0.30 | 0.15 | 1.37 | Open |
| 33 | -101.51 | 3.23 | 64.88 | Open |
| 38 | -101.67 | 3.24 | 65.07 | Open |
| 39 | 0.16 | 0.01 | 0.00 | Open |
| 40 | -102.10 | 3.25 | 65.58 | Open |

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*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

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Input File: 1319 Johnston.net
 Max Day + Building C (9,000 L/min)

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |

| | | | | |
|----|--------------|--------------|----|-----|
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 123.68 | 44.33 | 0.00 |
| EastConnect | 0.00 | 123.68 | 44.33 | 0.00 |
| HYD-1 | 0.00 | 119.63 | 37.13 | 0.00 |
| HYD-2 | 0.00 | 117.39 | 34.39 | 0.00 |
| HYD-3 | 0.00 | 115.93 | 32.93 | 0.00 |
| HYD-4 | 0.00 | 113.53 | 30.63 | 0.00 |
| HYD-5 | 75.00 | 110.11 | 27.01 | 0.00 |
| HYD-6 | 75.00 | 109.75 | 26.45 | 0.00 |
| HYD-8 | 0.00 | 117.15 | 34.15 | 0.00 |
| BldgG | 0.38 | 117.42 | 34.32 | 0.00 |
| BldgA | 0.39 | 117.42 | 34.22 | 0.00 |
| BldgAGConnect | 0.00 | 117.42 | 37.32 | 0.00 |
| HYD8Connect | 0.00 | 117.15 | 37.05 | 0.00 |
| HYD1Connect | 0.00 | 119.63 | 39.53 | 0.00 |
| HYD2Connect | 0.00 | 117.39 | 37.29 | 0.00 |
| HYD3Connect | 0.00 | 115.93 | 35.83 | 0.00 |
| 20 | 0.00 | 115.06 | 34.96 | 0.00 |
| BldgFConnect | 0.00 | 114.13 | 34.03 | 0.00 |
| BldgF | 0.24 | 114.12 | 31.02 | 0.00 |
| HYD4Connect | 0.00 | 113.53 | 33.43 | 0.00 |
| BldgEConnect | 0.00 | 112.61 | 32.51 | 0.00 |
| BldgE | 0.27 | 112.60 | 29.50 | 0.00 |
| HYD5Connect | 0.00 | 111.54 | 31.44 | 0.00 |
| BldgCConnect | 0.00 | 111.54 | 31.44 | 0.00 |
| BldgC | 0.19 | 111.54 | 28.24 | 0.00 |
| HYD6Connect | 0.00 | 111.54 | 31.44 | 0.00 |
| BldgDConnect | 0.00 | 111.96 | 31.86 | 0.00 |
| BldgD | 0.24 | 111.95 | 28.40 | 0.00 |
| HYD7Connect | 0.00 | 113.67 | 33.57 | 0.00 |
| HYD-7 | 0.00 | 113.67 | 30.67 | 0.00 |
| BldgHConnect | 0.00 | 113.57 | 33.47 | 0.00 |
| BldgH | 0.30 | 113.57 | 30.47 | 0.00 |
| BldgB | 0.16 | 111.54 | 28.44 | 0.00 |
| BldgBConnect | 0.00 | 111.54 | 31.44 | 0.00 |
| West | -76.08 | 123.70 | 0.00 | 0.00 Reservoir |
| East | -76.09 | 123.70 | 0.00 | 0.00 Reservoir |



Page 3

Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|---------|----------|--------------|--------------------|--------|
| 1 | 76.08 | 1.08 | 4.49 | Open |
| 2 | 0.64 | 0.01 | 0.00 | Open |
| 3 | -76.09 | 1.08 | 4.49 | Open |
| 4 | -76.72 | 2.44 | 38.63 | Open |
| 5 | -75.95 | 2.42 | 37.92 | Open |
| 6 | 0.00 | 0.00 | 0.00 | Open |
| 7 | -0.39 | 0.02 | 0.01 | Open |
| 8 | 0.38 | 0.02 | 0.01 | Open |
| 10 | -75.95 | 2.42 | 37.92 | Open |
| 14 | 0.24 | 0.12 | 0.91 | Open |
| 15 | 75.71 | 2.41 | 37.70 | Open |
| 16 | 75.00 | 4.24 | 179.43 | Open |
| 17 | 0.71 | 0.02 | 0.01 | Open |
| 18 | 0.19 | 0.01 | 0.00 | Open |
| 20 | 75.00 | 4.24 | 179.43 | Open |
| 21 | -74.64 | 2.38 | 36.71 | Open |
| 22 | 0.27 | 0.14 | 1.13 | Open |
| 23 | -74.91 | 2.38 | 36.95 | Open |
| 24 | 0.00 | 0.00 | 0.00 | Open |
| 26 | 0.24 | 0.12 | 0.91 | Open |
| 27 | -75.45 | 2.40 | 37.45 | Open |
| 28 | -75.45 | 2.40 | 37.45 | Open |
| 29 | 0.00 | 0.00 | 0.00 | Open |
| 32 | 0.00 | 0.00 | 0.00 | Open |
| 34 | -75.45 | 2.40 | 37.45 | Open |
| 35 | 0.00 | 0.00 | 0.00 | Open |
| 36 | -75.45 | 2.40 | 37.45 | Open |
| 37 | 0.00 | 0.00 | 0.00 | Open |
| 9 | -75.45 | 2.40 | 37.45 | Open |
| 25 | 75.21 | 2.39 | 37.23 | Open |
| 30 | 74.91 | 2.38 | 36.95 | Open |
| 31 | 0.30 | 0.15 | 1.37 | Open |
| 33 | -0.36 | 0.01 | 0.00 | Open |
| 38 | -0.52 | 0.02 | 0.01 | Open |
| 39 | 0.16 | 0.01 | 0.00 | Open |
| 40 | -75.95 | 2.42 | 37.92 | Open |

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

```

Input File: 1319 Johnston.net
 Max Day + Building D (12,000 L/min)

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |

| | | | | |
|----|--------------|--------------|----|-----|
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 123.66 | 44.31 | 0.00 |
| EastConnect | 0.00 | 123.66 | 44.31 | 0.00 |
| HYD-1 | 0.00 | 117.38 | 34.88 | 0.00 |
| HYD-2 | 0.00 | 113.89 | 30.89 | 0.00 |
| HYD-3 | 0.00 | 111.62 | 28.62 | 0.00 |
| HYD-4 | 0.00 | 107.90 | 25.00 | 0.00 |
| HYD-5 | 66.70 | 103.65 | 20.55 | 0.00 |
| HYD-6 | 66.70 | 103.16 | 19.86 | 0.00 |
| HYD-8 | 0.00 | 111.67 | 28.67 | 0.00 |
| BldgG | 0.38 | 112.16 | 29.06 | 0.00 |
| BldgA | 0.39 | 112.16 | 28.96 | 0.00 |
| BldgAGConnect | 0.00 | 112.16 | 32.06 | 0.00 |
| HYD8Connect | 0.00 | 111.67 | 31.57 | 0.00 |
| HYD1Connect | 0.00 | 117.38 | 37.28 | 0.00 |
| HYD2Connect | 0.00 | 113.89 | 33.79 | 0.00 |
| HYD3Connect | 0.00 | 111.62 | 31.52 | 0.00 |
| 20 | 0.00 | 110.28 | 30.18 | 0.00 |
| BldgFConnect | 0.00 | 108.83 | 28.73 | 0.00 |
| BldgF | 0.24 | 108.82 | 25.72 | 0.00 |
| HYD4Connect | 0.00 | 107.90 | 27.80 | 0.00 |
| BldgEConnect | 0.00 | 106.47 | 26.37 | 0.00 |
| BldgE | 0.27 | 106.45 | 23.35 | 0.00 |
| HYD5Connect | 0.00 | 104.81 | 24.71 | 0.00 |
| BldgCConnect | 0.00 | 104.73 | 24.63 | 0.00 |
| BldgC | 0.19 | 104.73 | 21.43 | 0.00 |
| HYD6Connect | 0.00 | 104.60 | 24.50 | 0.00 |
| BldgDConnect | 0.00 | 104.72 | 24.62 | 0.00 |
| BldgD | 0.24 | 104.72 | 21.17 | 0.00 |
| HYD7Connect | 0.00 | 105.22 | 25.12 | 0.00 |
| HYD-7 | 66.70 | 104.36 | 21.36 | 0.00 |
| BldgHConnect | 0.00 | 107.96 | 27.86 | 0.00 |
| BldgH | 0.30 | 107.96 | 24.86 | 0.00 |
| BldgB | 0.16 | 104.75 | 21.65 | 0.00 |
| BldgBConnect | 0.00 | 104.75 | 24.65 | 0.00 |
| West | -101.00 | 123.70 | 0.00 | 0.00 Reservoir |
| East | -101.27 | 123.70 | 0.00 | 0.00 Reservoir |



Page 3

Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|---------|----------|--------------|--------------------|--------|
| 1 | 101.00 | 1.43 | 7.59 | Open |
| 2 | 5.30 | 0.08 | 0.03 | Open |
| 3 | -101.27 | 1.43 | 7.63 | Open |
| 4 | -106.58 | 3.39 | 71.01 | Open |
| 5 | -105.81 | 3.37 | 70.06 | Open |
| 6 | 0.00 | 0.00 | 0.00 | Open |
| 7 | -0.39 | 0.02 | 0.01 | Open |
| 8 | 0.38 | 0.02 | 0.01 | Open |
| 10 | -105.81 | 3.37 | 70.06 | Open |
| 14 | 0.24 | 0.12 | 0.91 | Open |
| 15 | 38.87 | 1.24 | 10.96 | Open |
| 16 | 66.70 | 3.77 | 144.40 | Open |
| 17 | -27.83 | 0.89 | 5.91 | Open |
| 18 | 0.19 | 0.01 | 0.00 | Open |
| 20 | 66.70 | 3.77 | 144.40 | Open |
| 21 | -94.88 | 3.02 | 57.25 | Open |
| 22 | 0.27 | 0.14 | 1.13 | Open |
| 23 | -95.15 | 3.03 | 57.56 | Open |
| 24 | 0.00 | 0.00 | 0.00 | Open |
| 26 | 0.24 | 0.12 | 0.91 | Open |
| 27 | -95.69 | 3.05 | 58.16 | Open |
| 28 | -95.69 | 3.05 | 58.16 | Open |
| 29 | 0.00 | 0.00 | 0.00 | Open |
| 32 | 0.00 | 0.00 | 0.00 | Open |
| 34 | -95.69 | 3.05 | 58.16 | Open |
| 35 | 0.00 | 0.00 | 0.00 | Open |
| 36 | -95.69 | 3.05 | 58.16 | Open |
| 37 | 66.70 | 3.77 | 144.40 | Open |
| 9 | -95.69 | 3.05 | 58.16 | Open |
| 25 | 95.45 | 3.04 | 57.89 | Open |
| 30 | 95.15 | 3.03 | 57.55 | Open |
| 31 | 0.30 | 0.15 | 1.37 | Open |
| 33 | 28.18 | 0.90 | 6.05 | Open |
| 38 | 28.02 | 0.89 | 5.98 | Open |
| 39 | 0.16 | 0.01 | 0.00 | Open |
| 40 | -39.11 | 1.24 | 11.09 | Open |

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.2                                *
*****

```

Input File: 1319 Johnston.net
 Max Day + Building G or A (7,000 L/min)

Link - Node Table:

| Link ID | Start Node | End Node | Length m | Diameter mm |
|---------|---------------|---------------|----------|-------------|
| 1 | West | WestConnect | 5 | 300 |
| 2 | WestConnect | EastConnect | 6 | 300 |
| 3 | EastConnect | East | 5 | 300 |
| 4 | BldgAGConnect | EastConnect | 162 | 200 |
| 5 | HYD8Connect | BldgAGConnect | 7 | 200 |
| 6 | HYD8Connect | HYD-8 | 5 | 150 |
| 7 | BldgA | BldgAGConnect | 18 | 150 |
| 8 | BldgAGConnect | BldgG | 29 | 150 |
| 10 | HYD7Connect | HYD8Connect | 92 | 200 |
| 14 | BldgDConnect | BldgD | 8 | 50 |
| 15 | BldgDConnect | HYD6Connect | 11 | 200 |
| 16 | HYD6Connect | HYD-6 | 10 | 150 |
| 17 | HYD6Connect | BldgCConnect | 22 | 200 |
| 18 | BldgCConnect | BldgC | 6 | 150 |
| 20 | HYD5Connect | HYD-5 | 8 | 150 |
| 21 | HYD5Connect | BldgEConnect | 29 | 200 |
| 22 | BldgEConnect | BldgE | 12 | 50 |
| 23 | BldgEConnect | HYD4Connect | 25 | 200 |
| 24 | HYD4Connect | HYD-4 | 9 | 150 |
| 26 | BldgFConnect | BldgF | 9 | 50 |
| 27 | BldgFConnect | 20 | 25 | 200 |
| 28 | 20 | HYD3Connect | 23 | 200 |
| 29 | HYD3Connect | HYD-3 | 2 | 150 |
| 32 | HYD-2 | HYD2Connect | 9 | 150 |
| 34 | HYD2Connect | HYD1Connect | 60 | 200 |
| 35 | HYD1Connect | HYD-1 | 4 | 150 |
| 36 | HYD1Connect | WestConnect | 108 | 200 |
| 37 | HYD7Connect | HYD-7 | 6 | 150 |
| 9 | HYD3Connect | HYD2Connect | 39 | 200 |
| 25 | BldgFConnect | BldgHConnect | 15 | 200 |
| 30 | BldgHConnect | HYD4Connect | 1 | 200 |
| 31 | BldgHConnect | BldgH | 3 | 50 |
| 33 | HYD5Connect | BldgBConnect | 9 | 200 |

| | | | | |
|----|--------------|--------------|----|-----|
| 38 | BldgBConnect | BldgCConnect | 3 | 200 |
| 39 | BldgBConnect | BldgB | 9 | 150 |
| 40 | BldgDConnect | HYD7Connect | 45 | 200 |



Page 2

Node Results:

| Node ID | Demand LPS | Head m | Pressure m | Quality |
|---------------|---------------|-----------|---------------|----------------|
| WestConnect | 0.00 | 123.69 | 44.34 | 0.00 |
| EastConnect | 0.00 | 123.69 | 44.34 | 0.00 |
| HYD-1 | 58.30 | 120.11 | 37.61 | 0.00 |
| HYD-2 | 0.00 | 120.53 | 37.53 | 0.00 |
| HYD-3 | 0.00 | 120.51 | 37.51 | 0.00 |
| HYD-4 | 0.00 | 120.48 | 37.58 | 0.00 |
| HYD-5 | 0.00 | 120.45 | 37.35 | 0.00 |
| HYD-6 | 0.00 | 120.44 | 37.14 | 0.00 |
| HYD-8 | 58.30 | 119.83 | 36.83 | 0.00 |
| BldgG | 0.38 | 120.52 | 37.42 | 0.00 |
| BldgA | 0.39 | 120.52 | 37.32 | 0.00 |
| BldgAGConnect | 0.00 | 120.52 | 40.42 | 0.00 |
| HYD8Connect | 0.00 | 120.39 | 40.29 | 0.00 |
| HYD1Connect | 0.00 | 120.56 | 40.46 | 0.00 |
| HYD2Connect | 0.00 | 120.53 | 40.43 | 0.00 |
| HYD3Connect | 0.00 | 120.51 | 40.41 | 0.00 |
| 20 | 0.00 | 120.50 | 40.40 | 0.00 |
| BldgFConnect | 0.00 | 120.48 | 40.38 | 0.00 |
| BldgF | 0.24 | 120.47 | 37.37 | 0.00 |
| HYD4Connect | 0.00 | 120.48 | 40.38 | 0.00 |
| BldgEConnect | 0.00 | 120.46 | 40.36 | 0.00 |
| BldgE | 0.27 | 120.45 | 37.35 | 0.00 |
| HYD5Connect | 0.00 | 120.45 | 40.35 | 0.00 |
| BldgCConnect | 0.00 | 120.45 | 40.35 | 0.00 |
| BldgC | 0.19 | 120.45 | 37.15 | 0.00 |
| HYD6Connect | 0.00 | 120.44 | 40.34 | 0.00 |
| BldgDConnect | 0.00 | 120.44 | 40.34 | 0.00 |
| BldgD | 0.24 | 120.43 | 36.88 | 0.00 |
| HYD7Connect | 0.00 | 120.42 | 40.32 | 0.00 |
| HYD-7 | 0.00 | 120.42 | 37.42 | 0.00 |
| BldgHConnect | 0.00 | 120.48 | 40.38 | 0.00 |
| BldgH | 0.30 | 120.47 | 37.37 | 0.00 |
| BldgB | 0.16 | 120.45 | 37.35 | 0.00 |
| BldgBConnect | 0.00 | 120.45 | 40.35 | 0.00 |
| West | -59.66 | 123.70 | 0.00 | 0.00 Reservoir |
| East | -59.11 | 123.70 | 0.00 | 0.00 Reservoir |



Page 3

Link Results:

| Link ID | Flow LPS | Velocity m/s | Unit Headloss m/km | Status |
|------------|-------------|-----------------|-----------------------|--------|
| 1 | 59.66 | 0.84 | 2.86 | Open |
| 2 | -6.02 | 0.09 | 0.04 | Open |
| 3 | -59.11 | 0.84 | 2.81 | Open |
| 4 | -53.09 | 1.69 | 19.53 | Open |
| 5 | -52.32 | 1.67 | 19.01 | Open |
| 6 | 58.30 | 3.30 | 112.54 | Open |
| 7 | -0.39 | 0.02 | 0.01 | Open |
| 8 | 0.38 | 0.02 | 0.01 | Open |
| 10 | 5.98 | 0.19 | 0.34 | Open |
| 14 | 0.24 | 0.12 | 0.91 | Open |
| 15 | -6.22 | 0.20 | 0.37 | Open |
| 16 | 0.00 | 0.00 | 0.00 | Open |
| 17 | -6.22 | 0.20 | 0.37 | Open |
| 18 | 0.19 | 0.01 | 0.00 | Open |
| 20 | 0.00 | 0.00 | 0.00 | Open |
| 21 | -6.57 | 0.21 | 0.41 | Open |
| 22 | 0.27 | 0.14 | 1.13 | Open |
| 23 | -6.84 | 0.22 | 0.44 | Open |
| 24 | 0.00 | 0.00 | 0.00 | Open |
| 26 | 0.24 | 0.12 | 0.91 | Open |
| 27 | -7.38 | 0.23 | 0.51 | Open |
| 28 | -7.38 | 0.23 | 0.51 | Open |
| 29 | 0.00 | 0.00 | 0.00 | Open |
| 32 | 0.00 | 0.00 | 0.00 | Open |
| 34 | -7.38 | 0.23 | 0.51 | Open |
| 35 | 58.30 | 3.30 | 112.54 | Open |
| 36 | -65.68 | 2.09 | 28.97 | Open |
| 37 | 0.00 | 0.00 | 0.00 | Open |
| 9 | -7.38 | 0.23 | 0.51 | Open |
| 25 | 7.14 | 0.23 | 0.48 | Open |
| 30 | 6.84 | 0.22 | 0.44 | Open |
| 31 | 0.30 | 0.15 | 1.37 | Open |
| 33 | 6.57 | 0.21 | 0.41 | Open |
| 38 | 6.41 | 0.20 | 0.39 | Open |
| 39 | 0.16 | 0.01 | 0.00 | Open |
| 40 | 5.98 | 0.19 | 0.34 | Open |

Appendix D

Sanitary Sewer Design Sheet

Confirmation of Ex. Sewer Capacity

| LOCATION | | | | RESIDENTIAL FLOW | | | COMM./INST. FLOW | | INDUSTRIAL FLOW | | | | | | CUM. PEAK DESIGN FLOW (L/s) | PIPE | | | | | | | | |
|---|----------|----------|------------------|------------------|-------------------------|-----------------------|------------------|--------------------|-----------------------|-------------------------------|-------------------|--------------------|-----------------------|---------------------------|-----------------------------------|------------|------------------|-------------------------|-------------------------|-----------|-------------------|--------------------------------|-----------------------------|-----------------|
| STREET | FROM MH | TO MH | DRAINAGE AREA | PEAK FACTOR | PEAK POP. FLOW (L/s) | EXTRAN. FLOW (L/s) | PEAK FACTOR | PEAK FLOW (L/s) | DRAINAGE AREA (ha) | CUM. DRAINAGE AREA (ha) | AVG FLOW (L/s) | PEAK FLOW (L/s) | EXTRAN. FLOW (L/s) | INDIV. PEAK FLOW (L/s) | | LENGTH (m) | DIAMETER (mm) | UPSTREAM MH INV. (m) | DNSTREAM MH INV. (m) | SLOPE (%) | CAPACITY (L/s) | FULL FLOW VELOCITY (m/s) | EXCESS CAPACITY (L/s) | PERCENT FULL |
| | SANMH107 | SANMH106 | BLDG D | | | | | | 0.50 | 0.50 | 0.20 | 1.42 | 0.17 | 1.58 | 1.58 | 20.0 | 250.00 | 80.07 | 79.96 | 0.55% | 44.15 | 0.90 | 42.56 | 4% |
| | SANMH106 | SANMH105 | BLDG B+C | | | | | | 0.65 | 1.15 | 0.26 | 1.84 | 0.21 | 2.06 | 3.64 | 30.4 | 250.00 | 79.89 | 79.73 | 0.53% | 43.19 | 0.88 | 39.55 | 8% |
| | SANMH105 | SANMH104 | | | | | | | 0.00 | 1.15 | 0.00 | 0.00 | 0.00 | 0.00 | 3.64 | 14.4 | 250.00 | 79.70 | 79.63 | 0.49% | 41.50 | 0.85 | 37.86 | 9% |
| | SANMH104 | SANMH103 | BLDG E,F+H | | | | | | 1.24 | 2.39 | 0.50 | 3.52 | 0.41 | 3.93 | 7.57 | 71.0 | 250.00 | 79.60 | 79.21 | 0.55% | 44.12 | 0.90 | 36.55 | 17% |
| | SANMH103 | SANMH102 | | | | | | | 0.00 | 2.39 | 0.00 | 0.00 | 0.00 | 0.00 | 7.57 | 63.1 | 250.00 | 79.15 | 78.85 | 0.48% | 41.05 | 0.84 | 33.48 | 18% |
| | SANMH102 | SANMH101 | | | | | | | 0.00 | 2.39 | 0.00 | 0.00 | 0.00 | 0.00 | 7.57 | 70.8 | 250.00 | 78.83 | 78.50 | 0.47% | 40.64 | 0.83 | 33.07 | 19% |
| | SANMH108 | SANMH101 | BLDG G+A | | | | | | 1.12 | 1.12 | 0.45 | 3.18 | 0.37 | 3.55 | 3.55 | 49.6 | 250.00 | 80.65 | 80.40 | 0.50% | 42.26 | 0.86 | 38.72 | 8% |
| | SANMH101 | SANMH100 | | | | | | | 0.00 | 3.51 | 0.00 | 0.00 | 0.00 | 0.00 | 11.11 | 96.7 | 250.00 | 78.44 | 78.00 | 0.46% | 40.15 | 0.82 | 29.04 | 28% |
| Johnston Road | SANMH100 | SANMH99 | | | | | | | 0.00 | 3.51 | 0.00 | 0.00 | 0.00 | 0.00 | 11.11 | 15.6 | 250.00 | 76.50 | 76.08 | 2.69% | 97.67 | 1.99 | 86.56 | 11% |
| | | | | | | | | | 3.51 | 3.51 | 1.22 | 8.54 | 0.99 | 9.53 | 11.11 | | | | | | | | | |
| DESIGN PARAMETERS | | | | | | | | | | | | | | | | | | | | | | | | |
| Average Daily Flow = 280 L/cap/day Comm./Inst. Flow = 28000 L/ha/day Industrial Flow = 35000 L/ha/day Maximum Residential Peak Factor = 4.0 Harmon - Correction Factor (K) = 0.8 Institutional/Commercial Peak Factor = 1.5 Industrial Peak Factor = 7 per OSDG App. 4-B Extraneous Flow = 0.33 L/s/ha Minimum Velocity = 0.6 m/s Maximum Velocity = 3.0 m/s | | | | | | | | | | | | | | | | | | | | | | | | |

Stephen McCaughey

From: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Sent: July 13, 2023 3:18 PM
To: Stephen McCaughey
Subject: RE: 1319 Johnston Rd - SPA criteria

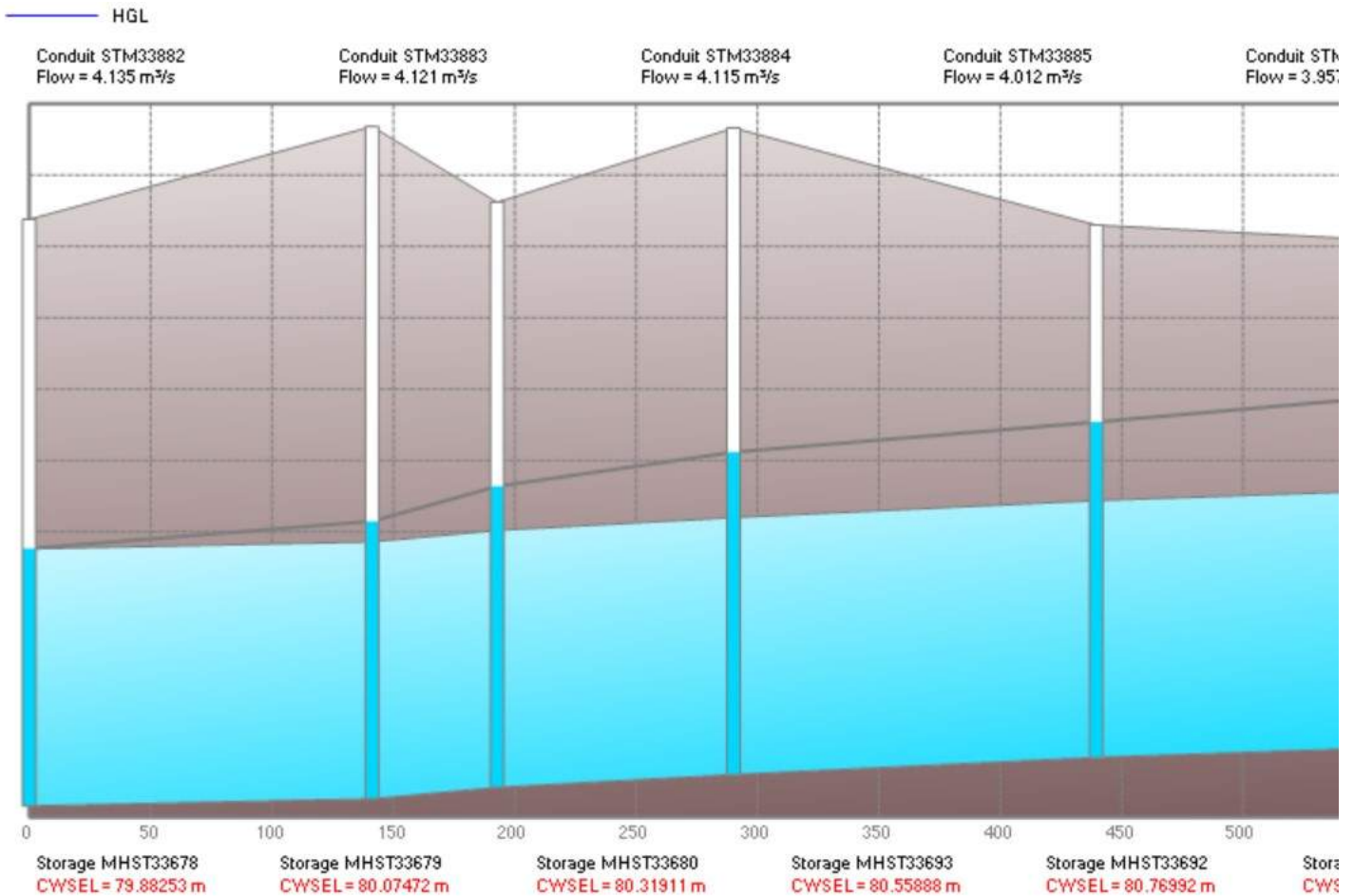
Follow Up Flag: Follow up
Flag Status: Flagged

"CAUTION: External Sender"

Hi Stephen,

I have received responses from various internal groups at the City regarding the two (2) questions you had:

- 1) **Sanitary Sewer Capacity: There are no capacity concerns based on your proposed sanitary contributions.**
- 2) Please see the inline image below of the City's hydraulic model of the Hydraulic Grade Line (HGL) during the 1:100 year event for the storm trunk sewer running through 2059 Artistic Place



Note that the following storm structure IDs are running through the site:

- MHST33680 to MHST33693 (1800 mm dia. Conc)
- MHST33693 to MHST33692 (1800 mm dia. Conc)

Appendix E

Confirmation of SWM Criteria

1800mm Storm HGL

Pre-Development Calculations

Storm Sewer Design Sheet

Storage Volume Calculations

ICD Calculations

Infiltration Calculations

Underground Storage Tank
Information

ICD Information

OGS Cutsheets

Stephen McCaughey

From: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Sent: July 5, 2023 12:22 PM
To: Stephen McCaughey
Subject: RE: 1319 Johnston Rd - SPA criteria

"CAUTION: External Sender"

Hi Stephen,

I've provided my responses in **red** to your questions in the body of the email below. Feel free to reach out if you need further clarification.

Thank you,

Tyler Cassidy, P.Eng

Infrastructure Project Manager,
Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca

From: Stephen McCaughey <smccaughey@rcii.com>
Sent: July 04, 2023 11:44 AM
To: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Subject: 1319 Johnston Rd - SPA criteria

CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.

ATTENTION : Ce courriel provient d'un expéditeur externe. Ne cliquez sur aucun lien et n'ouvrez pas de pièce jointe, excepté si vous connaissez l'expéditeur.

Hi Tyler,

I understand you're the engineering reviewer for the proposed 1319 Johnston Rd. I will be following up with sanitary and water demand estimates but I wanted to confirm about SWM criteria, particularly in reference to the 2003 Sawmill Creek Subwatershed Study:

- Is the pre-development runoff coefficient to be estimated from current land-use or as defined by the Study?
Please base the pre-development runoff coefficient on the existing land-use, up to a maximum of C=0.5.
- If I am understanding correctly, the peak flow rate is to be limited to pre-development rate for each storm condition from 2-yr to 100-yr (2-yr post- to pre-development, 50-yr post- to pre-development, 100-yr post- to pre-development) as opposed to bringing the 100-yr post-development down to the 2-yr pre-development. Is this correct?
The 2-year, 5-year & 100-year post-development peak flows are to be controlled to the 2-year pre-development peak flow. Any flows exceeding the 2-year pre-development peak flow (for all storms up to and including the 100-year storm) are to be stored on site.
- Are there any infiltration targets or requirements? We are awaiting geotechnical information currently but there is some potential about elevated groundwater levels making infiltration challenging.

There are infiltration targets based on the Sawmill Creek Subwatershed Study (see section 9.3: Creek Baseflow Protection). In general, we would like to see the capturing and infiltration of runoff from ~40% of hard surfaces. If groundwater conditions make certain infiltration measures unfeasible (exfiltration pipe systems), then total impervious area on site may need to be limited.

- Quality control is to be “enhanced” level (80% TSS removal)
That is correct.

Thank you,



Stephen McCaughey, P.Eng. | Project Engineer – Land Development
210-350 Palladium Drive, Ottawa ON, K2V 1A8
O: 613-592-6060 x160 | smccaughey@rcii.com | www.rcii.com

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,

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Stephen McCaughey

From: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Sent: July 13, 2023 3:18 PM
To: Stephen McCaughey
Subject: RE: 1319 Johnston Rd - SPA criteria

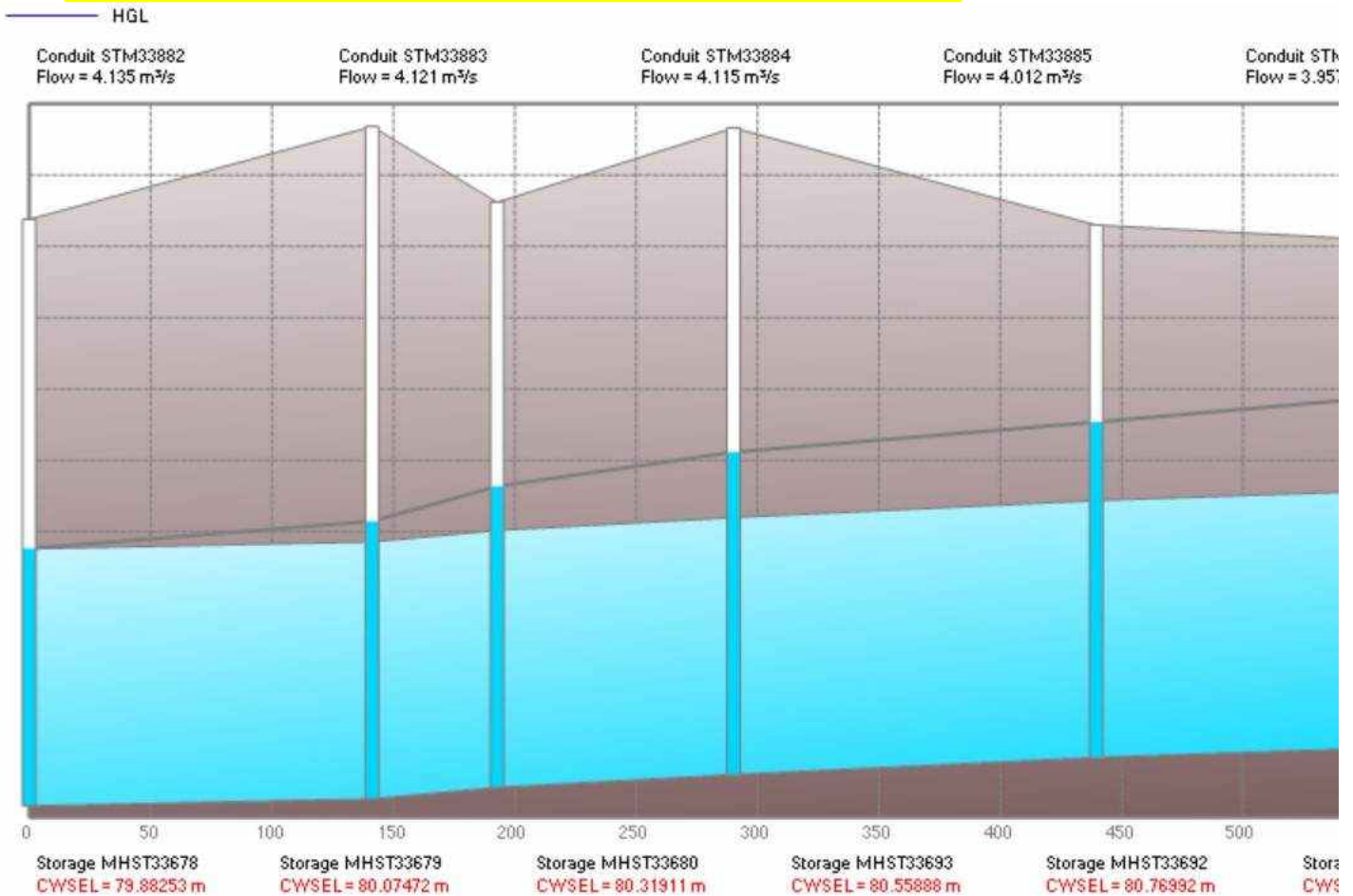
Follow Up Flag: Follow up
Flag Status: Flagged

"CAUTION: External Sender"

Hi Stephen,

I have received responses from various internal groups at the City regarding the two (2) questions you had:

- 1) Sanitary Sewer Capacity: There are no capacity concerns based on your proposed sanitary contributions.
- 2) Please see the inline image below of the City's hydraulic model of the Hydraulic Grade Line (HGL) during the 1:100 year event for the storm trunk sewer running through 2059 Artistic Place



Note that the following storm structure IDs are running through the site:

- MHST33680 to MHST33693 (1800 mm dia. Conc)
- MHST33693 to MHST33692 (1800 mm dia. Conc)

| | Impervious | Pervious | Gravel |
|---|------------|----------|--------|
| C | 0.9 | 0.2 | 0.7 |

Overall Runoff Coefficient Calculations

| Development Condition | Impervious Area (ha) | Pervious Area (ha) | Gravel Area (ha) | Total Area (ha) | C | C (100 YR) |
|-----------------------|----------------------|--------------------|------------------|-----------------|------|------------|
| PRE | | 3.70 | | 3.70 | 0.20 | 0.25 |
| POST | 3.52 | 0.15 | 0.03 | 3.70 | 0.87 | 1.00 |

Sub-Drainage Area Runoff Coefficient Calculations

| Drainage Area ID | Impervious Area (ha) | Pervious Area (ha) | Gravel Area (ha) | Total Area (ha) | C | C (100 YR) |
|------------------|----------------------|--------------------|------------------|-----------------|------|------------|
| 1 | 0.65 | 0.005 | | 0.65 | 0.89 | 1.00 |
| 2 | 0.38 | 0.000 | | 0.38 | 0.90 | 1.00 |
| 3 | 0.18 | 0.000 | | 0.18 | 0.90 | 1.00 |
| 4 | 0.11 | 0.005 | | 0.12 | 0.87 | 1.00 |
| 5 | 0.24 | 0.024 | | 0.27 | 0.84 | 1.00 |
| 6 | 0.11 | 0.005 | | 0.12 | 0.87 | 1.00 |
| 7 | 0.12 | 0.008 | | 0.12 | 0.85 | 1.00 |
| 8 | 0.22 | 0.000 | | 0.22 | 0.90 | 1.00 |
| 9 | 0.22 | 0.000 | | 0.22 | 0.90 | 1.00 |
| 10 | 0.25 | 0.003 | | 0.25 | 0.89 | 1.00 |
| 11 | 0.000 | 0.000 | 0.03 | 0.03 | 0.70 | 0.88 |
| 12 | 0.06 | 0.000 | | 0.06 | 0.90 | 1.00 |
| 13 | 0.19 | 0.000 | | 0.19 | 0.90 | 1.00 |
| 14 | 0.08 | 0.000 | | 0.08 | 0.90 | 1.00 |
| 15 | 0.17 | 0.000 | | 0.17 | 0.90 | 1.00 |
| 16 | 0.09 | 0.014 | | 0.10 | 0.80 | 1.00 |
| 17 | 0.13 | 0.015 | | 0.15 | 0.83 | 1.00 |
| 18 | 0.28 | 0.075 | | 0.35 | 0.75 | 0.94 |

Uncontrolled Flow Area Runoff Coefficient Calculations

| Drainage Area ID | Impervious Area (ha) | Pervious Area (ha) | Gravel Area (ha) | Total Area (ha) | C | C (100 YR) |
|------------------|----------------------|--------------------|------------------|-----------------|------|------------|
| U1 | 0.05 | 0.00 | 0.00 | 0.05 | 0.90 | 1.00 |

Notes:

- Runoff Coefficients: C_{imp}=0.90, C_{per}=0.20, C_{gravel}=0.80
- C (100 YR) = C + 25% (to a maximum of 1.0)

Pre-Development Flow Calculations

Given:

Area (ha) = 3.70

C = 0.20

C (100 YR) = 0.25

| Return Period | Time of Concentration (min) | Rainfall Intensity, i (mm/hr) | Flow, Q (L/s) |
|---------------|-----------------------------|-------------------------------|---------------|
| 2 Year | 15.0 | 61.8 | 127.0 |
| 5 Year | 15.0 | 83.6 | 171.8 |
| 100 Year | 15.0 | 142.9 | 367.3 |

Notes:

1. Rainfall intensity calculated using City of Ottawa IDF curve equations.
2. Flow calculated using the Rational Method ($Q = 2.78CiA$).
3. C (100 YR) = C + 25% (to a maximum of 1.0)
4. Time of concentration assumed as 15 minutes for greenfield

Uncontrolled Flow Calculations

U1 (Entranceway)

Given:

Area (ha) = 0.05
C = 0.90
C (100 YR) = 1.00

| Return Period | Time of Concentration (min) | Intensity ^{*1} , i (mm/hr) | Flow ^{*2} , Q (L/s) |
|---------------|-----------------------------|-------------------------------------|------------------------------|
| 2 Year | 10 | 76.8 | 10.4 |
| 5 Year | 10 | 104.2 | 14.1 |
| 100 Year | 10 | 178.6 | 26.8 |

Notes:

1. Rainfall intensity calculated using City of Ottawa IDF curve equations.
2. Flow calculated using the Rational Method ($Q = 2.78CiA$).

Allowable Flow Calculations

Given:

Area (ha) = 3.70
C = 0.87
C (100 YR)^{*3} = 1.00

| Return Period | Time of Concentration (min) | Intensity ^{*1} , i (mm/hr) | Flow ^{*2} , Q (L/s) | Allowable Release Rate ^{*4} (L/s) |
|-----------------|-----------------------------|-------------------------------------|------------------------------|--|
| 2 Year | 10 | 76.8 | 686.6 | 116.6 |
| 5 Year | 10 | 104.2 | 931.4 | 112.9 |
| 100 Year | 10 | 178.6 | 1835.9 | 100.2 |

Notes:

1. Rainfall intensity calculated using City of Ottawa IDF curve equations.
2. Flow calculated using the Rational Method ($Q = 2.78CiA$).
3. C (100 YR) = C + 25% (Max. 1.0)
4. Allowable Release Rate = 2-Year Pre-Development Flow less Uncontrolled Flow

| | Impervious | Pervious | Gravel |
|---|------------|----------|--------|
| C | 0.9 | 0.2 | 0.7 |

Runoff Coefficient Calculations

| Drainage Area ID | Impervious Area (ha) | Pervious Area (ha) | Gravel Area (ha) | Total Area (ha) | C | C (100 YR) | Percent Impervious (%) |
|--------------------------|----------------------|--------------------|------------------|-----------------|-------------|-------------|------------------------|
| 1 | 0.65 | 0.005 | | 0.65 | 0.89 | 1.00 | 99.2 |
| 2 | 0.38 | | | 0.38 | 0.90 | 1.00 | 100.0 |
| 3 | 0.18 | | | 0.18 | 0.90 | 1.00 | 100.0 |
| 4 | 0.11 | 0.005 | | 0.12 | 0.87 | 1.00 | 95.8 |
| 5 | 0.24 | 0.024 | | 0.27 | 0.84 | 1.00 | 91.0 |
| 6 | 0.11 | 0.005 | | 0.12 | 0.87 | 1.00 | 95.8 |
| 7 | 0.12 | 0.008 | | 0.12 | 0.85 | 1.00 | 93.5 |
| 8 | 0.22 | | | 0.22 | 0.90 | 1.00 | 100.0 |
| 9 | 0.22 | | | 0.22 | 0.90 | 1.00 | 100.0 |
| 10 | 0.25 | 0.003 | | 0.25 | 0.89 | 1.00 | 98.8 |
| 11 | 0.00 | | 0.03 | 0.03 | 0.70 | 0.88 | 100.0 |
| 12 | 0.06 | | | 0.06 | 0.90 | 1.00 | 100.0 |
| 13 | 0.19 | | | 0.19 | 0.90 | 1.00 | 100.0 |
| 14 | 0.08 | | | 0.08 | 0.90 | 1.00 | 100.0 |
| 15 | 0.17 | | | 0.17 | 0.90 | 1.00 | 100.0 |
| 16 | 0.09 | 0.014 | | 0.10 | 0.80 | 1.00 | 86.0 |
| 17 | 0.13 | 0.015 | | 0.15 | 0.83 | 1.00 | 89.8 |
| 18 | 0.28 | 0.075 | | 0.35 | 0.75 | 0.94 | 78.7 |
| TOTAL DEVELOPMENT | 3.46 | 0.15 | 0.03 | 3.64 | 0.87 | 1.00 | 95.8 |

STORM SEWER DESIGN SHEET
for
1319 JOHNSTON ROAD, OTTAWA



| LOCATION | | | 2 YEAR | | | | FLOW | | | | PROPOSED SEWER | | | | | | | | |
|--------------------|---------|-----------|-----------|------|---------------|---------------|---------------------|-----------------------------------|------------------------|------------------------|----------------|---------------|---------------|-----------|------------|----------------|--------------------------|--------------------|--------------|
| DRAINAGE AREA | FROM MH | TO MH | AREA (ha) | C | INDIV. 2.78AC | ACCUM. 2.78AC | TIME OF CONC. (min) | 2 YEAR RAINFALL INTENSITY (mm/hr) | 2 YEAR PEAK FLOW (L/s) | DESIGN PEAK FLOW (L/s) | PIPE DIA. (mm) | UPSTREAM INV. | DNSTREAM INV. | GRADE (%) | LENGTH (m) | CAPACITY (L/s) | FULL FLOW VELOCITY (m/s) | TIME OF FLOW (min) | PERCENT FULL |
| | | | | | | | | | | | | | | | | | | | |
| BUILDING A | | | | | | | | | | | | | | | | | | | |
| 17 | 227 | 226 | 0.15 | 0.83 | 0.34 | 0.34 | 10.00 | 76.81 | 26.01 | 26.01 | 300 | 81.20 | 80.90 | 1.30 | 23.1 | 110.31 | 1.56 | 0.25 | 24% |
| | 226 | 223 | 0.00 | 0.00 | 0.00 | 0.34 | 10.25 | 75.87 | 25.69 | 25.69 | 300 | 80.84 | 80.75 | 0.52 | 17.3 | 69.82 | 0.99 | 0.29 | 37% |
| | | | | | | | | | | | | | | | | | | | |
| 16 | 225 | 224 | 0.10 | 0.80 | 0.22 | 0.22 | 10.00 | 76.81 | 17.12 | 17.12 | 300 | 81.15 | 80.89 | 0.34 | 76.9 | 56.28 | 0.80 | 1.61 | 30% |
| | 224 | 223 | 0.00 | 0.00 | 0.00 | 0.22 | 11.61 | 71.13 | 15.86 | 15.86 | 300 | 80.83 | 80.75 | 0.36 | 22.0 | 58.38 | 0.83 | 0.44 | 27% |
| 15 | 223 | POND | 0.17 | 0.90 | 0.43 | 0.99 | 12.05 | 69.73 | 69.16 | 69.16 | 375 | 80.67 | 80.60 | 0.45 | 15.7 | 117.19 | 1.06 | 0.25 | 59% |
| 18 | POND | 222 | 0.35 | 0.75 | 0.73 | 1.73 | 12.30 | 68.97 | 119.09 | 119.09 | 250 | 80.60 | 80.08 | 5.00 | 10.4 | 133.11 | 2.71 | 0.06 | 89% |
| | 222 | EX. STMMH | 0.00 | 0.00 | 0.00 | 1.73 | 12.36 | 68.78 | 118.76 | 118.76 | 250 | 80.05 | 79.85 | 5.00 | 4.0 | 133.11 | 2.71 | 0.02 | 89% |
| | | | | | | | | | | | | | | | | | | | |
| MAIN DRAINAGE AREA | | | | | | | | | | | | | | | | | | | |
| 1 | 221 | TANK | 0.65 | 0.89 | 1.62 | 1.62 | 10.00 | 76.81 | 124.16 | 124.16 | 375 | 80.84 | 80.77 | 1.04 | 6.7 | 179.39 | 1.62 | 0.07 | 69% |
| | | | | | | | | | | | | | | | | | | | |
| 14 | 220 | 218 | 0.08 | 0.90 | 0.19 | 0.19 | 10.00 | 76.81 | 14.80 | 14.80 | 300 | 81.24 | 81.15 | 0.36 | 25.0 | 58.08 | 0.82 | 0.51 | 25% |
| 13 | 219 | 218 | 0.19 | 0.90 | 0.47 | 0.47 | 10.00 | 76.81 | 36.32 | 36.32 | 300 | 81.28 | 81.15 | 0.35 | 37.5 | 56.99 | 0.81 | 0.78 | 64% |
| | 218 | 217 | 0.00 | 0.00 | 0.00 | 0.67 | 10.78 | 73.95 | 49.22 | 49.22 | 375 | 81.08 | 81.00 | 0.27 | 29.8 | 90.94 | 0.82 | 0.60 | 54% |
| 12 | 217 | 216 | 0.06 | 0.90 | 0.15 | 0.81 | 11.38 | 71.89 | 58.28 | 58.28 | 450 | 80.92 | 80.84 | 0.20 | 40.0 | 127.63 | 0.80 | 0.83 | 46% |
| | 216 | TANK | 0.00 | 0.00 | 0.00 | 0.81 | 12.21 | 69.25 | 56.14 | 56.14 | 450 | 80.81 | 80.77 | 0.26 | 15.3 | 145.92 | 0.92 | 0.28 | 38% |
| | | | | | | | | | | | | | | | | | | | |
| 11 | 215 | TANK | 0.03 | 0.70 | 0.05 | 0.05 | 10.00 | 76.81 | 4.04 | 4.04 | 250 | 80.87 | 80.77 | 0.58 | 17.3 | 45.26 | 0.92 | 0.31 | 9% |
| | | | | | | | | | | | | | | | | | | | |
| 10 | 214 | 212 | 0.25 | 0.89 | 0.63 | 0.63 | 10.00 | 76.81 | 48.27 | 48.27 | 375 | 81.21 | 81.11 | 0.27 | 36.9 | 91.37 | 0.83 | 0.74 | 53% |
| 9 | 213 | 212 | 0.22 | 0.90 | 0.55 | 0.55 | 10.00 | 76.81 | 41.89 | 41.89 | 375 | 81.21 | 81.11 | 0.26 | 38.2 | 89.80 | 0.81 | 0.78 | 47% |
| | 212 | 210 | 0.00 | 0.00 | 0.00 | 1.17 | 10.78 | 73.92 | 86.78 | 86.78 | 450 | 81.04 | 80.96 | 0.21 | 37.5 | 131.82 | 0.83 | 0.75 | 66% |
| 8 | 211 | 210 | 0.22 | 0.90 | 0.55 | 0.55 | 10.00 | 76.81 | 41.89 | 41.89 | 375 | 81.23 | 81.04 | 0.52 | 36.5 | 126.63 | 1.15 | 0.53 | 33% |
| 7 | 210 | 209 | 0.12 | 0.85 | 0.29 | 2.01 | 11.54 | 71.37 | 143.73 | 143.73 | 450 | 80.96 | 80.87 | 0.37 | 24.3 | 173.69 | 1.09 | 0.37 | 83% |
| | 209 | TANK | 0.00 | 0.00 | 0.00 | 2.01 | 11.91 | 70.18 | 141.34 | 141.34 | 525 | 80.80 | 80.77 | 0.22 | 13.4 | 203.69 | 0.94 | 0.24 | 69% |
| | | | | | | | | | | | | | | | | | | | |
| 6 | 208 | 206 | 0.12 | 0.87 | 0.29 | 0.29 | 10.00 | 76.81 | 21.93 | 21.93 | 300 | 81.20 | 81.05 | 0.56 | 26.8 | 72.42 | 1.02 | 0.44 | 30% |
| 5 | 207 | 206 | 0.27 | 0.84 | 0.62 | 0.62 | 10.00 | 76.81 | 47.72 | 47.72 | 300 | 81.30 | 81.05 | 0.60 | 41.9 | 74.77 | 1.06 | 0.66 | 64% |
| | 206 | 205 | 0.00 | 0.00 | 0.00 | 0.91 | 10.66 | 74.36 | 67.43 | 67.43 | 375 | 80.99 | 80.92 | 0.61 | 11.4 | 137.53 | 1.25 | 0.15 | 49% |
| 4 | 205 | TANK | 0.12 | 0.87 | 0.29 | 1.19 | 10.81 | 73.82 | 88.02 | 88.02 | 450 | 80.85 | 80.77 | 0.41 | 19.6 | 182.33 | 1.15 | 0.28 | 48% |
| | | | | | | | | | | | | | | | | | | | |
| 3 | 204 | 203 | 0.18 | 0.90 | 0.45 | 0.45 | 10.00 | 76.81 | 34.40 | 34.40 | 300 | 81.35 | 80.92 | 0.75 | 57.1 | 84.00 | 1.19 | 0.80 | 41% |
| 2 | 203 | TANK | 0.38 | 0.90 | 0.94 | 1.39 | 10.80 | 73.86 | 102.75 | 102.75 | 450 | 80.80 | 80.77 | 0.44 | 6.8 | 189.56 | 1.19 | 0.10 | 54% |
| | | | | | | | | | | | | | | | | | | | |
| | TANK | 202 | 0.00 | 0.00 | 0.00 | 7.08 | 12.49 | 68.41 | 484.18 | 484.18 | 525 | 80.77 | 80.70 | 1.94 | 3.6 | 600.30 | 2.77 | 0.02 | 81% |
| | 202 | 201 | 0.00 | 0.00 | 0.00 | 7.08 | 12.51 | 68.35 | 483.73 | 483.73 | 525 | 80.68 | 80.57 | 1.96 | 5.6 | 603.35 | 2.79 | 0.03 | 80% |
| | 201 | 200 | 0.00 | 0.00 | 0.00 | 7.08 | 12.54 | 68.25 | 483.03 | 483.03 | 525 | 80.54 | 80.39 | 1.97 | 7.6 | 604.80 | 2.79 | 0.05 | 80% |
| | | | 3.64 | | | | | | | | | | | | | | | | |

Design Parameters

- Notes:
1. Rainfall intensity calculated using City of Ottawa IDF curve equations.
 2. Peak flows calculated using the Rational Method.
 3. Manning's roughness coefficient = 0.013
 4. Full flow velocity: MIN 0.8 m/s; MAX 3.0 m/s (City of Ottawa Sewer Design Guidelines, v.2012)

STORM SEWER DESIGN SHEET
for
1319 JOHNSTON ROAD, OTTAWA



| LOCATION | | | 5 YEAR | | | | FLOW | | | | PROPOSED SEWER | | | | | | | | |
|--------------------|---------|-----------|-----------|------|---------------|---------------|---------------------|-----------------------------------|------------------------|------------------------|----------------|---------------|---------------|-----------|------------|----------------|--------------------------|--------------------|--------------|
| DRAINAGE AREA | FROM MH | TO MH | AREA (ha) | C | INDIV. 2.78AC | ACCUM. 2.78AC | TIME OF CONC. (min) | 5 YEAR RAINFALL INTENSITY (mm/hr) | 5 YEAR PEAK FLOW (L/s) | DESIGN PEAK FLOW (L/s) | PIPE DIA. (mm) | UPSTREAM INV. | DNSTREAM INV. | GRADE (%) | LENGTH (m) | CAPACITY (L/s) | FULL FLOW VELOCITY (m/s) | TIME OF FLOW (min) | PERCENT FULL |
| | | | | | | | | | | | | | | | | | | | |
| BUILDING A | | | | | | | | | | | | | | | | | | | |
| 17 | 227 | 226 | 0.15 | 0.83 | 0.34 | 0.34 | 10.00 | 104.19 | 35.28 | 35.28 | 300 | 81.20 | 80.90 | 1.30 | 23.1 | 110.31 | 1.56 | 0.25 | 32% |
| | 226 | 223 | 0.00 | 0.00 | 0.00 | 0.34 | 10.25 | 102.91 | 34.84 | 34.84 | 300 | 80.84 | 80.75 | 0.52 | 17.3 | 69.82 | 0.99 | 0.29 | 50% |
| | | | | | | | | | | | | | | | | | | | |
| 16 | 225 | 224 | 0.10 | 0.80 | 0.22 | 0.22 | 10.00 | 104.19 | 23.23 | 23.23 | 300 | 81.15 | 80.89 | 0.34 | 76.9 | 56.28 | 0.80 | 1.61 | 41% |
| | 224 | 223 | 0.00 | 0.00 | 0.00 | 0.22 | 11.61 | 96.40 | 21.49 | 21.49 | 300 | 80.83 | 80.75 | 0.36 | 22.0 | 58.38 | 0.83 | 0.44 | 37% |
| 15 | 223 | POND | 0.17 | 0.90 | 0.43 | 0.99 | 12.05 | 94.47 | 93.70 | 93.70 | 375 | 80.67 | 80.60 | 0.45 | 15.7 | 117.19 | 1.06 | 0.25 | 80% |
| 18 | POND | 222 | 0.35 | 0.75 | 0.73 | 1.73 | 12.30 | 93.43 | 161.33 | 8.70 | 250 | 80.60 | 80.08 | 5.00 | 10.4 | 133.11 | 2.71 | 0.06 | 7% |
| | 222 | EX. STMMH | 0.00 | 0.00 | 0.00 | 1.73 | 12.36 | 93.17 | 160.87 | 8.70 | 250 | 80.05 | 79.85 | 5.00 | 4.0 | 133.11 | 2.71 | 0.02 | 7% |
| | | | | | | | | | | | | | | | | | | | |
| MAIN DRAINAGE AREA | | | | | | | | | | | | | | | | | | | |
| 1 | 221 | TANK | 0.65 | 0.89 | 1.62 | 1.62 | 10.00 | 104.19 | 168.44 | 168.44 | 375 | 80.84 | 80.77 | 1.04 | 6.7 | 179.39 | 1.62 | 0.07 | 94% |
| | | | | | | | | | | | | | | | | | | | |
| 14 | 220 | 218 | 0.08 | 0.90 | 0.19 | 0.19 | 10.00 | 104.19 | 20.07 | 20.07 | 300 | 81.24 | 81.15 | 0.36 | 25.0 | 58.08 | 0.82 | 0.51 | 35% |
| 13 | 219 | 218 | 0.19 | 0.90 | 0.47 | 0.47 | 10.00 | 104.19 | 49.27 | 49.27 | 300 | 81.28 | 81.15 | 0.35 | 37.5 | 56.99 | 0.81 | 0.78 | 86% |
| | 218 | 217 | 0.00 | 0.00 | 0.00 | 0.67 | 10.78 | 100.27 | 66.73 | 66.73 | 375 | 81.08 | 81.00 | 0.27 | 29.8 | 90.94 | 0.82 | 0.60 | 73% |
| 12 | 217 | 216 | 0.06 | 0.90 | 0.15 | 0.81 | 11.38 | 97.44 | 78.99 | 78.99 | 450 | 80.92 | 80.84 | 0.20 | 40.0 | 127.63 | 0.80 | 0.83 | 62% |
| | 216 | TANK | 0.00 | 0.00 | 0.00 | 0.81 | 12.21 | 93.81 | 76.05 | 76.05 | 450 | 80.81 | 80.77 | 0.26 | 15.3 | 145.92 | 0.92 | 0.28 | 52% |
| | | | | | | | | | | | | | | | | | | | |
| 11 | 215 | TANK | 0.03 | 0.70 | 0.05 | 0.05 | 10.00 | 104.19 | 5.47 | 5.47 | 250 | 80.87 | 80.77 | 0.58 | 17.3 | 45.26 | 0.92 | 0.31 | 12% |
| | | | | | | | | | | | | | | | | | | | |
| 10 | 214 | 212 | 0.25 | 0.89 | 0.63 | 0.63 | 10.00 | 104.19 | 65.48 | 65.48 | 375 | 81.21 | 81.11 | 0.27 | 36.9 | 91.37 | 0.83 | 0.74 | 72% |
| 9 | 213 | 212 | 0.22 | 0.90 | 0.55 | 0.55 | 10.00 | 104.19 | 56.83 | 56.83 | 375 | 81.21 | 81.11 | 0.26 | 38.2 | 89.80 | 0.81 | 0.78 | 63% |
| | 212 | 210 | 0.00 | 0.00 | 0.00 | 1.17 | 10.78 | 100.23 | 117.66 | 117.66 | 450 | 81.04 | 80.96 | 0.21 | 37.5 | 131.82 | 0.83 | 0.75 | 89% |
| 8 | 211 | 210 | 0.22 | 0.90 | 0.55 | 0.55 | 10.00 | 104.19 | 56.83 | 56.83 | 375 | 81.23 | 81.04 | 0.52 | 36.5 | 126.63 | 1.15 | 0.53 | 45% |
| 7 | 210 | 209 | 0.12 | 0.85 | 0.29 | 2.01 | 11.54 | 96.72 | 194.79 | 194.79 | 450 | 80.96 | 80.87 | 0.37 | 24.3 | 173.69 | 1.09 | 0.37 | 112% |
| | 209 | TANK | 0.00 | 0.00 | 0.00 | 2.01 | 11.91 | 95.09 | 191.51 | 191.51 | 525 | 80.80 | 80.77 | 0.22 | 13.4 | 203.69 | 0.94 | 0.24 | 94% |
| | | | | | | | | | | | | | | | | | | | |
| 6 | 208 | 206 | 0.12 | 0.87 | 0.29 | 0.29 | 10.00 | 104.19 | 29.75 | 29.75 | 300 | 81.20 | 81.05 | 0.56 | 26.8 | 72.42 | 1.02 | 0.44 | 41% |
| 5 | 207 | 206 | 0.27 | 0.84 | 0.62 | 0.62 | 10.00 | 104.19 | 64.74 | 64.74 | 300 | 81.30 | 81.05 | 0.60 | 41.9 | 74.77 | 1.06 | 0.66 | 87% |
| | 206 | 205 | 0.00 | 0.00 | 0.00 | 0.91 | 10.66 | 100.83 | 91.44 | 91.44 | 375 | 80.99 | 80.92 | 0.61 | 11.4 | 137.53 | 1.25 | 0.15 | 66% |
| 4 | 205 | TANK | 0.12 | 0.87 | 0.29 | 1.19 | 10.81 | 100.09 | 119.34 | 119.34 | 450 | 80.85 | 80.77 | 0.41 | 19.6 | 182.33 | 1.15 | 0.28 | 65% |
| | | | | | | | | | | | | | | | | | | | |
| 3 | 204 | 203 | 0.18 | 0.90 | 0.45 | 0.45 | 10.00 | 104.19 | 46.66 | 46.66 | 300 | 81.35 | 80.92 | 0.75 | 57.1 | 84.00 | 1.19 | 0.80 | 56% |
| 2 | 203 | TANK | 0.38 | 0.90 | 0.94 | 1.39 | 10.80 | 100.14 | 139.31 | 139.31 | 450 | 80.80 | 80.77 | 0.44 | 6.8 | 189.56 | 1.19 | 0.10 | 73% |
| | | | | | | | | | | | | | | | | | | | |
| | TANK | 202 | 0.00 | 0.00 | 0.00 | 7.08 | 12.49 | 92.67 | 655.81 | 91.08 | 525 | 80.77 | 80.70 | 1.94 | 3.6 | 600.30 | 2.77 | 0.02 | 15% |
| | 202 | 201 | 0.00 | 0.00 | 0.00 | 7.08 | 12.51 | 92.58 | 655.19 | 91.08 | 525 | 80.68 | 80.57 | 1.96 | 5.6 | 603.35 | 2.79 | 0.03 | 15% |
| | 201 | 200 | 0.00 | 0.00 | 0.00 | 7.08 | 12.54 | 92.44 | 654.23 | 91.08 | 525 | 80.54 | 80.39 | 1.97 | 7.6 | 604.80 | 2.79 | 0.05 | 15% |
| | | | 3.64 | | | | | | | | | | | | | | | | |

Design Parameters

- Notes:
- Rainfall intensity calculated using City of Ottawa IDF curve equations.
 - Peak flows calculated using the Rational Method.
 - Manning's roughness coefficient = 0.013
 - Full flow velocity: MIN 0.8 m/s; MAX 3.0 m/s (City of Ottawa Sewer Design Guidelines, v.2012)
 - Design Peak Flow modified by ICD:

POND OUT8.7 L/s

STMMH20291.1 L/s

STORM SEWER DESIGN SHEET
for
1319 JOHNSTON ROAD, OTTAWA



| LOCATION | | | 100 YEAR | | | | FLOW | | | | PROPOSED SEWER | | | | | | | | |
|--------------------|---------|-----------|-----------|------|---------------|---------------|---------------------|-------------------------------------|--------------------------|------------------------|----------------|----------------|---------------|-----------|------------|----------------|--------------------------|--------------------|--------------|
| DRAINAGE AREA | FROM MH | TO MH | AREA (ha) | C | INDIV. 2.78AC | ACCUM. 2.78AC | TIME OF CONC. (min) | 100 YEAR RAINFALL INTENSITY (mm/hr) | 100 YEAR PEAK FLOW (L/s) | DESIGN PEAK FLOW (L/s) | PIPE DIA. (mm) | UPSTREA M INV. | DNSTREAM INV. | GRADE (%) | LENGTH (m) | CAPACITY (L/s) | FULL FLOW VELOCITY (m/s) | TIME OF FLOW (min) | PERCENT FULL |
| | | | | | | | | | | | | | | | | | | | |
| BUILDING A | | | | | | | | | | | | | | | | | | | |
| 17 | 227 | 226 | 0.15 | 1.00 | 0.41 | 0.41 | 10.00 | 178.56 | 72.97 | 72.97 | 300 | 81.20 | 80.90 | 1.30 | 23.1 | 110.31 | 1.56 | 0.25 | 66% |
| | 226 | 223 | 0.00 | 0.00 | 0.00 | 0.41 | 10.25 | 176.33 | 72.06 | 72.06 | 300 | 80.84 | 80.75 | 0.52 | 17.3 | 69.82 | 0.99 | 0.29 | 103% |
| | | | | | | | | | | | | | | | | | | | |
| 16 | 225 | 224 | 0.10 | 1.00 | 0.28 | 0.28 | 10.00 | 178.56 | 49.64 | 49.64 | 300 | 81.15 | 80.89 | 0.34 | 76.9 | 56.28 | 0.80 | 1.61 | 88% |
| | 224 | 223 | 0.00 | 0.00 | 0.00 | 0.28 | 11.61 | 165.07 | 45.89 | 45.89 | 300 | 80.83 | 80.75 | 0.36 | 22.0 | 58.38 | 0.83 | 0.44 | 79% |
| 15 | 223 | POND | 0.17 | 1.00 | 0.48 | 1.16 | 12.05 | 161.74 | 188.40 | 188.40 | 375 | 80.67 | 80.60 | 0.45 | 15.7 | 117.19 | 1.06 | 0.25 | 161% |
| 18 | POND | 222 | 0.35 | 0.94 | 0.92 | 2.08 | 12.30 | 159.95 | 333.22 | 8.7 | 250 | 80.60 | 80.08 | 5.00 | 10.4 | 133.11 | 2.71 | 0.06 | 7% |
| | 222 | EX. STMMH | 0.00 | 0.00 | 0.00 | 2.08 | 12.36 | 159.50 | 332.27 | 8.7 | 250 | 80.05 | 79.85 | 5.00 | 4.0 | 133.11 | 2.71 | 0.02 | 7% |
| | | | | | | | | | | | | | | | | | | | |
| MAIN DRAINAGE AREA | | | | | | | | | | | | | | | | | | | |
| 1 | 221 | TANK | 0.65 | 1.00 | 1.81 | 1.81 | 10.00 | 178.56 | 322.66 | 322.66 | 375 | 80.84 | 80.77 | 1.04 | 6.7 | 179.39 | 1.62 | 0.07 | 180% |
| | | | | | | | | | | | | | | | | | | | |
| 14 | 220 | 218 | 0.08 | 1.00 | 0.21 | 0.21 | 10.00 | 178.56 | 38.22 | 38.22 | 300 | 81.24 | 81.15 | 0.36 | 25.0 | 58.08 | 0.82 | 0.51 | 66% |
| 13 | 219 | 218 | 0.19 | 1.00 | 0.53 | 0.53 | 10.00 | 178.56 | 93.82 | 93.82 | 300 | 81.28 | 81.15 | 0.35 | 37.5 | 56.99 | 0.81 | 0.78 | 165% |
| | 218 | 217 | 0.00 | 0.00 | 0.00 | 0.74 | 10.78 | 171.77 | 127.02 | 127.02 | 375 | 81.08 | 81.00 | 0.27 | 29.8 | 90.94 | 0.82 | 0.60 | 140% |
| 12 | 217 | 216 | 0.06 | 1.00 | 0.16 | 0.90 | 11.38 | 166.87 | 150.30 | 150.30 | 450 | 80.92 | 80.84 | 0.20 | 40.0 | 127.63 | 0.80 | 0.83 | 118% |
| | 216 | TANK | 0.00 | 0.00 | 0.00 | 0.90 | 12.21 | 160.61 | 144.66 | 144.66 | 450 | 80.81 | 80.77 | 0.26 | 15.3 | 145.92 | 0.92 | 0.28 | 99% |
| | | | | | | | | | | | | | | | | | | | |
| 11 | 215 | TANK | 0.03 | 0.88 | 0.07 | 0.07 | 10.00 | 178.56 | 11.73 | 11.73 | 250 | 80.87 | 80.77 | 0.58 | 17.3 | 45.26 | 0.92 | 0.31 | 26% |
| | | | | | | | | | | | | | | | | | | | |
| 10 | 214 | 212 | 0.25 | 1.00 | 0.70 | 0.70 | 10.00 | 178.56 | 125.84 | 125.84 | 375 | 81.21 | 81.11 | 0.27 | 36.9 | 91.37 | 0.83 | 0.74 | 138% |
| 9 | 213 | 212 | 0.22 | 1.00 | 0.61 | 0.61 | 10.00 | 178.56 | 108.21 | 108.21 | 375 | 81.21 | 81.11 | 0.26 | 38.2 | 89.80 | 0.81 | 0.78 | 121% |
| | 212 | 210 | 0.00 | 0.00 | 0.00 | 1.31 | 10.78 | 171.70 | 225.06 | 225.06 | 450 | 81.04 | 80.96 | 0.21 | 37.5 | 131.82 | 0.83 | 0.75 | 171% |
| 8 | 211 | 210 | 0.22 | 1.00 | 0.61 | 0.61 | 10.00 | 178.56 | 108.21 | 108.21 | 375 | 81.23 | 81.04 | 0.52 | 36.5 | 126.63 | 1.15 | 0.53 | 85% |
| 7 | 210 | 209 | 0.12 | 1.00 | 0.34 | 2.26 | 11.54 | 165.63 | 374.58 | 374.58 | 450 | 80.96 | 80.87 | 0.37 | 24.3 | 173.69 | 1.09 | 0.37 | 216% |
| | 209 | TANK | 0.00 | 0.00 | 0.00 | 2.26 | 11.91 | 162.82 | 368.21 | 368.21 | 525 | 80.80 | 80.77 | 0.22 | 13.4 | 203.69 | 0.94 | 0.24 | 181% |
| | | | | | | | | | | | | | | | | | | | |
| 6 | 208 | 206 | 0.12 | 1.00 | 0.33 | 0.33 | 10.00 | 178.56 | 58.57 | 58.57 | 300 | 81.20 | 81.05 | 0.56 | 26.8 | 72.42 | 1.02 | 0.44 | 81% |
| 5 | 207 | 206 | 0.27 | 1.00 | 0.74 | 0.74 | 10.00 | 178.56 | 132.54 | 132.54 | 300 | 81.30 | 81.05 | 0.60 | 41.9 | 74.77 | 1.06 | 0.66 | 177% |
| | 206 | 205 | 0.00 | 0.00 | 0.00 | 1.07 | 10.66 | 172.74 | 184.88 | 184.88 | 375 | 80.99 | 80.92 | 0.61 | 11.4 | 137.53 | 1.25 | 0.15 | 134% |
| 4 | 205 | TANK | 0.12 | 1.00 | 0.33 | 1.40 | 10.81 | 171.46 | 239.75 | 239.75 | 450 | 80.85 | 80.77 | 0.41 | 19.6 | 182.33 | 1.15 | 0.28 | 131% |
| | | | | | | | | | | | | | | | | | | | |
| 3 | 204 | 203 | 0.18 | 1.00 | 0.50 | 0.50 | 10.00 | 178.56 | 88.85 | 88.85 | 300 | 81.35 | 80.92 | 0.75 | 57.1 | 84.00 | 1.19 | 0.80 | 106% |
| 2 | 203 | TANK | 0.38 | 1.00 | 1.05 | 1.55 | 10.80 | 171.56 | 265.17 | 265.17 | 450 | 80.80 | 80.77 | 0.44 | 6.8 | 189.56 | 1.19 | 0.10 | 140% |
| | | | | | | | | | | | | | | | | | | | |
| | TANK | 202 | 0.00 | 0.00 | 0.00 | 7.98 | 12.49 | 158.62 | 1265.66 | 91.1 | 525 | 80.77 | 80.70 | 1.94 | 3.6 | 600.30 | 2.77 | 0.02 | 15% |
| | 202 | 201 | 0.00 | 0.00 | 0.00 | 7.98 | 12.51 | 158.47 | 1264.45 | 91.1 | 525 | 80.68 | 80.57 | 1.96 | 5.6 | 603.35 | 2.79 | 0.03 | 15% |
| | 201 | 200 | 0.00 | 0.00 | 0.00 | 7.98 | 12.54 | 158.24 | 1262.57 | 91.1 | 525 | 80.54 | 80.39 | 1.97 | 7.6 | 604.80 | 2.79 | 0.05 | 15% |
| | | | 3.64 | | | | | | | | | | | | | | | | |

Design Parameters

- Notes:
- Rainfall intensity calculated using City of Ottawa IDF curve equations.
 - Peak flows calculated using the Rational Method.
 - Manning's roughness coefficient = 0.013
 - Full flow velocity: MIN 0.8 m/s; MAX 3.0 m/s (City of Ottawa Sewer Design Guidelines, v.2012)
 - Design Peak Flow modified by ICD:

POND OUT 8.7 L/s
STMMH202 91.1 L/s

Surface Storage Volume Calculations

Drainage Area = 1 Overflow El. = 82.80
2.78° AC = 1.81 T/G = 82.50
Ponding Area
(m2) = 1378

Available
Storage (m3) = 137.8

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 10.0 | 179.6 | 322.7 | 179.4 | 143.3 | 86.0 |
| | 11.0 | 169.9 | 307.0 | 179.4 | 127.6 | 84.2 |
| | 12.0 | 162.1 | 293.0 | 179.4 | 113.6 | 81.8 |
| | 13.0 | 155.1 | 280.3 | 179.4 | 100.9 | 78.7 |
| | 14.0 | 148.7 | 268.7 | 179.4 | 89.3 | 75.1 |
| | 15.0 | 142.9 | 258.2 | 179.4 | 78.8 | 70.9 |

Drainage Area = 4 Overflow El. = 82.80
2.78° AC = 1.40 T/G = 82.63
Ponding Area
(m2) = 157

Available
Storage (m3) = 8.9

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 10.8 | 171.5 | 239.8 | 182.3 | 57.4 | 37.3 |
| | 11.8 | 163.5 | 228.7 | 182.3 | 46.3 | 32.8 |
| | 12.8 | 156.4 | 218.7 | 182.3 | 36.3 | 27.9 |
| | 13.8 | 149.9 | 209.6 | 182.3 | 27.2 | 22.6 |
| | 14.8 | 143.9 | 201.3 | 182.3 | 19.0 | 16.8 |
| | 15.8 | 138.5 | 193.7 | 182.3 | 11.4 | 10.8 |

*Required storage for Drainage Areas 4,5&6

Drainage Area = 7 Overflow El. = 82.78
2.78° AC = 2.01 T/G = 82.60
Ponding Area
(m2) = 304

Available
Storage (m3) = 18.2

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 5 Year | 11.5 | 96.72 | 194.8 | 173.7 | 21.1 | 14.6 |
| | 12.5 | 92.5 | 186.2 | 173.7 | 12.5 | 9.4 |
| | 13.5 | 88.6 | 178.4 | 173.7 | 4.8 | 3.9 |
| | 14.5 | 85.1 | 171.4 | 173.7 | -2.3 | -2.0 |
| | 15.5 | 81.9 | 164.9 | 173.7 | -8.8 | -8.2 |
| | 16.5 | 78.9 | 158.9 | 173.7 | -14.8 | -14.7 |

*Required storage for Drainage Areas 7,8,9&10

Drainage Area = 2 Overflow El. = 82.80
2.78° AC = 1.55 T/G = 82.50
Ponding Area
(m2) = 912

Available
Storage (m3) = 91.2

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 10.8 | 171.6 | 265.2 | 189.6 | 75.6 | 49.0 |
| | 11.8 | 163.6 | 252.9 | 189.6 | 63.3 | 44.8 |
| | 12.8 | 156.5 | 241.8 | 189.6 | 52.3 | 40.1 |
| | 13.8 | 149.9 | 231.8 | 189.6 | 42.2 | 35.0 |
| | 14.8 | 144.0 | 222.6 | 189.6 | 33.0 | 29.3 |
| | 15.8 | 138.6 | 214.2 | 189.6 | 24.6 | 23.4 |

*Required storage for Drainage Areas 2&3

Drainage Area = 5 Overflow El. = 82.85
2.78° AC = 0.74 T/G = 82.60
Ponding Area
(m2) = 313

Available
Storage (m3) = 26.1

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 10 | 178.6 | 132.5 | 74.8 | 57.8 | 34.7 |
| | 15 | 142.9 | 106.1 | 74.8 | 31.3 | 28.2 |
| | 20 | 120.0 | 89.0 | 74.8 | 14.3 | 17.1 |
| | 25 | 103.8 | 77.1 | 74.8 | 2.3 | 3.5 |
| | 30 | 91.9 | 68.2 | 74.8 | -6.6 | -11.8 |
| | 35 | 82.6 | 61.3 | 74.8 | -13.5 | -28.3 |

Drainage Area = 7 Overflow El. = 82.78
2.78° AC = 2.26 T/G = 82.60
Ponding Area
(m2) = 304

Available
Storage (m3) = 18.2

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 11.5 | 165.6 | 374.6 | 173.7 | 200.9 | 139.1 |
| | 12.5 | 158.3 | 357.9 | 173.7 | 184.3 | 138.6 |
| | 13.5 | 151.6 | 342.9 | 173.7 | 169.2 | 137.4 |
| | 14.5 | 145.5 | 329.1 | 173.7 | 155.4 | 135.6 |
| | 15.5 | 140.0 | 316.5 | 173.7 | 142.9 | 133.2 |
| | 16.5 | 134.9 | 305.0 | 173.7 | 131.3 | 130.3 |

*Required storage for Drainage Areas 7,8,9&10

Drainage Area = 3 Overflow El. = 82.80
2.78° AC = 0.50 T/G = 82.65
Ponding Area
(m2) = 128

Available
Storage (m3) = 6.4

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 10 | 179.6 | 89.9 | 84.0 | 4.9 | 2.9 |
| | 11 | 169.9 | 84.5 | 84.0 | 0.5 | 0.4 |
| | 12 | 162.1 | 80.7 | 84.0 | -3.3 | -2.4 |
| | 13 | 155.1 | 77.2 | 84.0 | -6.8 | -5.3 |
| | 14 | 148.7 | 74.0 | 84.0 | -10.0 | -8.4 |
| | 15 | 142.9 | 71.1 | 84.0 | -12.9 | -11.6 |

Drainage Area = 6 Overflow El. = 82.80
2.78° AC = 0.33 T/G = 82.65
Ponding Area
(m2) = 240

Available
Storage (m3) = 12.0

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 10 | 178.6 | 58.6 | 72.4 | -13.8 | -8.3 |
| | 15 | 142.9 | 46.9 | 72.4 | -25.5 | -23.0 |
| | 20 | 120.0 | 39.3 | 72.4 | -33.1 | -39.7 |
| | 25 | 103.8 | 34.1 | 72.4 | -38.4 | -57.5 |
| | 30 | 91.9 | 30.1 | 72.4 | -42.3 | -76.1 |
| | 35 | 82.6 | 27.1 | 72.4 | -45.3 | -95.2 |

Drainage Area = 8 Overflow El. = 82.80
2.78° AC = 0.61 T/G = 82.60
Ponding Area
(m2) = 350

Available
Storage (m3) = 23.3

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 10 | 178.6 | 108.2 | 126.6 | -18.4 | -11.0 |
| | 15 | 142.9 | 86.6 | 126.6 | -40.0 | -36.0 |
| | 20 | 120.0 | 72.7 | 126.6 | -53.9 | -64.7 |
| | 25 | 103.8 | 62.9 | 126.6 | -63.7 | -95.5 |
| | 30 | 91.9 | 55.7 | 126.6 | -71.0 | -127.7 |
| | 35 | 82.6 | 50.0 | 126.6 | -76.6 | -160.8 |

Drainage Area = 9
2.78" AC = 0.61

Overflow El. = 82.80
T/G = 82.55
Ponding Area (m2) = 486

Available Storage (m3) = 40.5

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³) |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|-----------------------|
| 100 Year | 10 | 178.6 | 108.2 | 89.8 | 18.4 | 11.1 |
| | 11 | 169.9 | 103.0 | 89.8 | 13.2 | 8.7 |
| | 12 | 162.1 | 98.3 | 89.8 | 8.5 | 6.1 |
| | 13 | 155.1 | 94.0 | 89.8 | 4.2 | 3.3 |
| | 14 | 148.7 | 90.1 | 89.8 | 0.3 | 0.3 |
| | 15 | 142.9 | 86.6 | 89.8 | -3.2 | -2.9 |

Drainage Area = 12
2.78" AC = 0.90

Overflow El. = 82.80
T/G = 82.50
Ponding Area (m2) = 281

Available Storage (m3) = 28.1

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 11.4 | 166.9 | 150.3 | 127.6 | 22.7 | 15.5 |
| | 12.4 | 159.4 | 143.6 | 127.6 | 15.9 | 11.8 |
| | 13.4 | 152.8 | 137.5 | 127.6 | 9.8 | 7.9 |
| | 14.4 | 146.5 | 131.9 | 127.6 | 4.3 | 3.7 |
| | 15.4 | 140.8 | 126.8 | 127.6 | -0.8 | -0.7 |
| | 16.4 | 135.6 | 122.2 | 127.6 | -5.5 | -5.4 |

*Required storage for Drainage Areas 12,13&14

Drainage Area = 15
2.78" AC = 1.16

Overflow El. = 82.80
T/G = 82.50
Ponding Area (m2) = 559

Available Storage (m3) = 55.9

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)* |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|------------------------|
| 100 Year | 12.1 | 161.7 | 188.4 | 117.2 | 71.2 | 51.5 |
| | 13.1 | 154.8 | 180.3 | 117.2 | 63.1 | 49.4 |
| | 14.1 | 148.4 | 172.9 | 117.2 | 55.7 | 46.9 |
| | 15.1 | 142.6 | 166.1 | 117.2 | 48.9 | 44.2 |
| | 16.1 | 137.3 | 159.9 | 117.2 | 42.7 | 41.1 |
| | 17.1 | 132.4 | 154.2 | 117.2 | 37.0 | 37.9 |

*Required storage for Drainage Areas 15&16

Drainage Area = 10
2.78" AC = 0.70

Overflow El. = 82.80
T/G = 82.55
Ponding Area (m2) = 470

Available Storage (m3) = 39.2

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³) |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|-----------------------|
| 100 Year | 10 | 178.6 | 125.8 | 91.4 | 34.5 | 20.7 |
| | 15 | 142.9 | 100.7 | 91.4 | 9.3 | 8.4 |
| | 20 | 120.0 | 84.5 | 91.4 | -6.8 | -8.2 |
| | 25 | 103.8 | 73.2 | 91.4 | -18.2 | -27.3 |
| | 30 | 91.9 | 64.7 | 91.4 | -26.6 | -47.9 |
| | 35 | 82.6 | 58.2 | 91.4 | -33.2 | -69.7 |

Drainage Area = 13
2.78" AC = 0.53

Overflow El. = 82.80
T/G = 82.58
Ponding Area (m2) = 590

Available Storage (m3) = 43.3

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³) |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|-----------------------|
| 100 Year | 10 | 178.6 | 93.8 | 57.0 | 36.8 | 22.1 |
| | 15 | 142.9 | 75.1 | 57.0 | 18.1 | 16.3 |
| | 20 | 120.0 | 63.0 | 57.0 | 6.0 | 7.2 |
| | 25 | 103.8 | 54.6 | 57.0 | -2.4 | -3.6 |
| | 30 | 91.9 | 48.3 | 57.0 | -8.7 | -15.7 |
| | 35 | 82.6 | 43.4 | 57.0 | -13.6 | -28.6 |

Drainage Area = 16
2.78" AC = 0.28

Overflow El. = 82.90
T/G = 82.60
Ponding Area (m2) = 65

Available Storage (m3) = 6.5

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³) |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|-----------------------|
| 100 Year | 10 | 178.6 | 49.6 | 56.3 | -6.6 | -4.0 |
| | 15 | 142.9 | 39.7 | 56.3 | -16.6 | -14.9 |
| | 20 | 120.0 | 33.3 | 56.3 | -22.9 | -27.5 |
| | 25 | 103.8 | 28.9 | 56.3 | -27.4 | -41.1 |
| | 30 | 91.9 | 25.5 | 56.3 | -30.7 | -55.3 |
| | 35 | 82.6 | 23.0 | 56.3 | -33.3 | -70.0 |

Drainage Area = 11
2.78" AC = 0.07

Overflow El. = 82.95
T/G = 82.86
Ponding Area (m2) = 52

Available Storage (m3) = 1.6

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³) |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|-----------------------|
| 100 Year | 10 | 178.6 | 11.7 | 45.3 | -33.5 | -20.1 |
| | 15 | 142.9 | 9.4 | 45.3 | -35.9 | -32.3 |
| | 20 | 120.0 | 7.9 | 45.3 | -37.4 | -44.9 |
| | 25 | 103.8 | 6.8 | 45.3 | -38.4 | -57.7 |
| | 30 | 91.9 | 6.0 | 45.3 | -39.2 | -70.6 |
| | 35 | 82.6 | 5.4 | 45.3 | -39.8 | -83.7 |

Drainage Area = 14
2.78" AC = 0.21

Overflow El. = 82.80
T/G = 82.50
Ponding Area (m2) = 466

Available Storage (m3) = 46.6

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³) |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|-----------------------|
| 100 Year | 10 | 178.6 | 38.2 | 58.1 | -19.9 | -11.9 |
| | 15 | 142.9 | 30.6 | 58.1 | -27.5 | -24.7 |
| | 20 | 120.0 | 25.7 | 58.1 | -32.4 | -38.9 |
| | 25 | 103.8 | 22.2 | 58.1 | -35.8 | -53.8 |
| | 30 | 91.9 | 19.7 | 58.1 | -38.4 | -69.1 |
| | 35 | 82.6 | 17.7 | 58.1 | -40.4 | -84.8 |

Drainage Area = 17
2.78" AC = 0.41

Overflow El. = 82.86
T/G = 82.67
Ponding Area (m2) = 300

Available Storage (m3) = 19.0

| Return Period | Time of Concentration (min) | Intensity, i (mm/hr) | Flow In, Q (L/s) | Pipe Capacity (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³) |
|---------------|-----------------------------|----------------------|------------------|---------------------|-------------------------------|-----------------------|
| 100 Year | 10 | 178.6 | 73.0 | 110.3 | -37.3 | -22.4 |
| | 15 | 142.9 | 58.4 | 110.3 | -51.9 | -46.7 |
| | 20 | 120.0 | 49.0 | 110.3 | -61.3 | -73.6 |
| | 25 | 103.8 | 42.4 | 110.3 | -67.9 | -101.8 |
| | 30 | 91.9 | 37.5 | 110.3 | -72.8 | -131.0 |
| | 35 | 82.6 | 33.7 | 110.3 | -76.6 | -160.8 |

Drainage Area = **18 (Pond)** Max El. = 82.50 Max Area (m2) = 489.0
2.78* AC = 2.08 Bot. El. = 80.60 Base Area (m2) = 80.4

Available
Storage (m3) = **540.9**

Drainage Area = **Tank** Top El. 81.37
2.78* AC = 7.98 Bot. El. = 80.77

Storage Area (m2) 1850

Available
Storage (m3) = **1067.9**

| Return Period | Time of Concentration (min) | Intensity, I (mm/hr) | Flow In, Q (L/s) | Pipe Capacity* (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)** |
|---------------|-----------------------------|----------------------|------------------|----------------------|-------------------------------|-------------------------|
| 100 Year | 450 | 11.5 | 23.9 | 4.4 | 19.5 | 527.0 |
| | 460 | 11.3 | 23.4 | 4.4 | 19.1 | 527.1 |
| | 470 | 11.1 | 23.0 | 4.4 | 18.7 | 527.1 |
| | 480 | 10.9 | 22.7 | 4.4 | 18.3 | 527.1 |
| | 490 | 10.7 | 22.3 | 4.4 | 17.9 | 527.1 |
| | 500 | 10.5 | 21.9 | 4.4 | 17.6 | 527.0 |

*For storage calculations with ICD, 50% of max flow rate assumed account for ICD flow curve varying with head
**Required storage for Drainage Areas 15-18

| Return Period | Time of Concentration (min) | Intensity, I (mm/hr) | Flow In, Q (L/s) | Pipe Capacity* (L/s) | Net Runoff to be Stored (L/s) | Storage Required (m³)** |
|---------------|-----------------------------|----------------------|------------------|----------------------|-------------------------------|-------------------------|
| 100 Year | 130 | 30.9 | 246.5 | 45.5 | 201.0 | 1567.8 |
| | 140 | 29.2 | 232.6 | 45.5 | 187.1 | 1571.3 |
| | 150 | 27.6 | 220.3 | 45.5 | 174.8 | 1572.9 |
| | 160 | 26.2 | 209.4 | 45.5 | 163.8 | 1572.7 |
| | 170 | 25.0 | 199.6 | 45.5 | 154.0 | 1571.0 |
| | 180 | 23.9 | 190.7 | 45.5 | 145.2 | 1567.9 |

*For storage calculations with ICD, 50% of max flow rate assumed account for ICD flow curve varying with head
**Required storage for Drainage Areas 1-14

| Total Storage Available | |
|-------------------------|--|
| Drainage Area ID | Available Storage (m3) (up to spillover el. 82.80) |
| 1 | 137.80 |
| 2 | 91.20 |
| 3 | 6.40 |
| 4 | 8.90 |
| 5 | 13.70 |
| 6 | 12.00 |
| 7 | 18.24 |
| 8 | 23.33 |
| 9 | 40.50 |
| 10 | 39.17 |
| 11 | 0.00 |
| 12 | 28.10 |
| 13 | 43.27 |
| 14 | 46.60 |
| Tank | 1067.91 |
| Main Site | 1577.12 |
| | |
| Drainage Area ID | Available Storage (m3) (up to spillover el. 82.50) |
| 15 | 0.00 |
| 16 | 0.00 |
| 17 | 0.00 |
| 18 | 540.93 |
| Building A | 540.93 |

100-Year Storage Available 2118.05 m3

100-Year Post-Development Storage Required 2100.02 m3

Sawmill Creek Subwatershed Storage Required 1850 m3

ICD Sizing

Pond Outlet

| | | |
|--------------|-------|-----|
| Bot El. | 80.60 | m |
| Max El. | 82.50 | m |
| Head | 1.9 | m |
| | | |
| Orifice Size | 55 | mm |
| | | |
| Max Flow | 8.7 | L/s |

55mm Orifice Plate

Tank Outlet

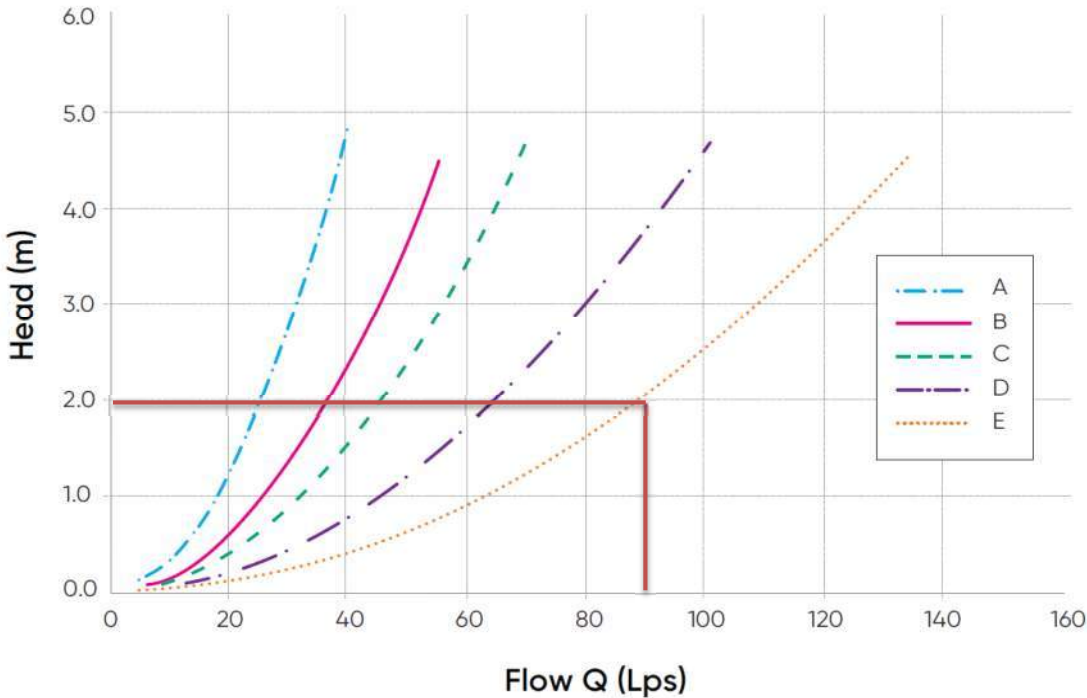
| | | |
|--------------|-------|-----|
| Bot El. | 80.77 | m |
| Max El. | 82.80 | m |
| Head | 2.03 | m |
| | | |
| Orifice Size | 175 | mm |
| | | |
| Max Flow | 91.1 | L/s |

Tempest HF Model 'E'

**Total Controlled
Discharge Rate** **99.8 L/s**

**Total Controlled
Discharge Allowed** **100.2 L/s**

Chart 3: HF & MHF Preset Flow Curves



Infiltration

| | | | |
|----------------------------|------|----|---|
| Total Impervious Area | 3.46 | ha | |
| Required Infiltration | 40% | | |
| Total Runoff to Infiltrate | 9433 | m3 | (per year, per below average total yearly rainfall) |

| | | | |
|------------------|----|--------|---|
| Percolation Rate | 35 | min/cm | (average for silty-clayey sands) |
| Percolation Rate | 70 | min/cm | (2.0 Factor of Safety for high groundwater) |

| | | | |
|--|--------|----|---|
| Average total yearly rainfall | 756.52 | mm | (per Environment Canada monitoring station at Ottawa MacDonald-Cartier International Airport; years 1993-2023)* |
| Average number of rain events per year | 119 | | (per Environment Canada monitoring station at Ottawa MacDonald-Cartier International Airport; years 1993-2023)* |
| Average rainfall per event | 6.4 | mm | |

Storm Storage Tank

| | | | |
|---------------------|------|----|------------------------------------|
| Infiltration Area | 1850 | m2 | |
| Infiltration Depth | 0.15 | m | (granular base under storage tank) |
| Void Ratio | 40% | | |
| Infiltration Volume | 111 | m3 | |
| Percolation Time | 17.5 | hr | |

| | | | |
|--------------------------------|------|----|--|
| Total Drainage Area | 2.87 | ha | |
| Runoff Coefficient | 0.89 | | |
| Runoff to Infiltrate per Event | 162 | m3 | (per above average rainfall per event) |

Check

| | | | |
|-----------------------------|-------|----|--|
| Number of Events Required | 85 | | |
| Total Infiltration per Year | 13209 | m3 | (per average number of rain events per year) |

*Environment Canada Data Source: https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

2012

MMAH Supplementary Standard SB-6



Table 3
Approximate Relationship of Coarse Grained Soil Types to Permeability and Percolation Time

| Soil Type (Unified Soil Classification) | Coefficient of Permeability, K - cm/sec | Percolation Time, T - mins/cm | Comment |
|---|---|----------------------------------|------------------------------------|
| Fine Grained More than 50% Passing #200 | | | |
| M.L. - Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, clayey silts with slight plasticity | 10^{-5} - 10^{-6} | 20 - 50 | medium to low permeability |
| C.L. - Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays | 10^{-6} and less | over 50 | unacceptable |
| O.L. - Organic silts, organic silty clays of low plasticity; liquid limit less than 50 | 10^{-5} and less | 20 - over 50 | acceptable depends on clay content |
| M.H. - Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts | 10^{-6} and less | over 50 | unacceptable |
| C.H. - Inorganic clays of medium to high plasticity, organic silts | 10^{-7} and less | over 50 | unacceptable |
| O.H. - Organic clays of medium to high plasticity organic silt; liquid limit over 50 | 10^{-6} and less | over 50 | unacceptable |
| Column 1 | 2 | 3 | 4 |

Pond Retention Time During 100yr Storm

| Time Step (min) | Start Elevation (m) | Start Volume (m3) | Outlet Rate (L/s) | Percolation (L/s) | End Volume (m3) |
|-----------------|---------------------|-------------------|-------------------|-------------------|-----------------|
| 0 | 82.50 | 540.9 | 8.7 | 0.00056 | 540.93 |
| 10 | 82.50 | 540.9 | 8.7 | 0.00056 | 535.7 |
| 20 | 82.49 | 535.7 | 8.7 | 0.00056 | 530.5 |
| 30 | 82.48 | 530.5 | 8.7 | 0.00056 | 525.3 |
| 40 | 82.47 | 525.3 | 8.6 | 0.00056 | 520.1 |
| 50 | 82.46 | 520.1 | 8.6 | 0.00056 | 515.0 |
| 60 | 82.40 | 515.0 | 8.5 | 0.00056 | 509.9 |
| 70 | 82.39 | 509.9 | 8.4 | 0.00056 | 504.8 |
| 80 | 82.38 | 504.8 | 8.4 | 0.00056 | 499.8 |
| 90 | 82.36 | 499.8 | 8.4 | 0.00056 | 494.7 |
| 100 | 82.35 | 494.7 | 8.4 | 0.00056 | 489.7 |
| 110 | 82.29 | 489.7 | 8.2 | 0.00056 | 484.8 |
| 120 | 82.28 | 484.8 | 8.2 | 0.00056 | 479.9 |
| 130 | 82.27 | 479.9 | 8.2 | 0.00056 | 475.0 |
| 140 | 82.26 | 475.0 | 8.1 | 0.00056 | 470.1 |
| 150 | 82.25 | 470.1 | 8.1 | 0.00056 | 465.2 |
| 160 | 82.19 | 465.2 | 8.0 | 0.00056 | 460.4 |
| 170 | 82.18 | 460.4 | 7.9 | 0.00056 | 455.7 |
| 180 | 82.17 | 455.7 | 7.9 | 0.00056 | 450.9 |
| 190 | 82.16 | 450.9 | 7.9 | 0.00056 | 446.2 |
| 200 | 82.10 | 446.2 | 7.7 | 0.00056 | 441.5 |
| 210 | 82.09 | 441.5 | 7.7 | 0.00056 | 436.9 |
| 220 | 82.08 | 436.9 | 7.7 | 0.00056 | 432.3 |
| 230 | 82.08 | 432.3 | 7.7 | 0.00056 | 427.7 |
| 240 | 82.07 | 427.7 | 7.6 | 0.00056 | 423.1 |
| 250 | 82.01 | 423.1 | 7.5 | 0.00056 | 418.6 |
| 260 | 82.00 | 418.6 | 7.5 | 0.00056 | 414.1 |
| 270 | 81.99 | 414.1 | 7.4 | 0.00056 | 409.7 |
| 280 | 81.98 | 409.7 | 7.4 | 0.00056 | 405.2 |
| 290 | 81.97 | 405.2 | 7.4 | 0.00056 | 400.8 |
| 300 | 81.91 | 400.8 | 7.2 | 0.00056 | 396.4 |
| 310 | 81.90 | 396.4 | 7.2 | 0.00056 | 392.1 |
| 320 | 81.89 | 392.1 | 7.2 | 0.00056 | 387.8 |
| 330 | 81.88 | 387.8 | 7.2 | 0.00056 | 383.5 |
| 340 | 81.87 | 383.5 | 7.1 | 0.00056 | 379.2 |
| 350 | 81.82 | 379.2 | 7.0 | 0.00056 | 375.1 |
| 360 | 81.81 | 375.1 | 6.9 | 0.00056 | 370.9 |
| 370 | 81.80 | 370.9 | 6.9 | 0.00056 | 366.8 |
| 380 | 81.79 | 366.8 | 6.9 | 0.00056 | 362.6 |
| 390 | 81.78 | 362.6 | 6.9 | 0.00056 | 358.5 |
| 400 | 81.72 | 358.5 | 6.7 | 0.00056 | 354.5 |
| 410 | 81.71 | 354.5 | 6.7 | 0.00056 | 350.5 |
| 420 | 81.71 | 350.5 | 6.6 | 0.00056 | 346.5 |
| 430 | 81.70 | 346.5 | 6.6 | 0.00056 | 342.5 |
| 440 | 81.64 | 342.5 | 6.4 | 0.00056 | 338.7 |
| 450 | 81.63 | 338.7 | 6.4 | 0.00056 | 334.8 |
| 460 | 81.62 | 334.8 | 6.4 | 0.00056 | 331.0 |
| 470 | 81.62 | 331.0 | 6.4 | 0.00056 | 327.2 |
| 480 | 81.61 | 327.2 | 6.3 | 0.00056 | 323.4 |
| 490 | 81.60 | 323.4 | 6.3 | 0.00056 | 319.6 |
| 500 | 81.54 | 319.6 | 6.1 | 0.00056 | 315.9 |
| 510 | 81.53 | 315.9 | 6.1 | 0.00056 | 312.2 |

| | | | | | |
|------|-------|-------|-----|---------|-------|
| 520 | 81.53 | 312.2 | 6.1 | 0.00056 | 308.6 |
| 530 | 81.52 | 308.6 | 6.1 | 0.00056 | 305.0 |
| 540 | 81.51 | 305.0 | 6.0 | 0.00056 | 301.3 |
| 550 | 81.45 | 301.3 | 5.8 | 0.00056 | 297.8 |
| 560 | 81.45 | 297.8 | 5.8 | 0.00056 | 294.3 |
| 570 | 81.44 | 294.3 | 5.8 | 0.00056 | 290.9 |
| 580 | 81.43 | 290.9 | 5.8 | 0.00056 | 287.4 |
| 590 | 81.43 | 287.4 | 5.7 | 0.00056 | 284.0 |
| 600 | 81.37 | 284.0 | 5.5 | 0.00056 | 280.6 |
| 610 | 81.36 | 280.6 | 5.5 | 0.00056 | 277.3 |
| 620 | 81.35 | 277.3 | 5.5 | 0.00056 | 274.0 |
| 630 | 81.35 | 274.0 | 5.5 | 0.00056 | 270.8 |
| 640 | 81.34 | 270.8 | 5.4 | 0.00056 | 267.5 |
| 650 | 81.28 | 267.5 | 5.2 | 0.00056 | 264.4 |
| 660 | 81.28 | 264.4 | 5.2 | 0.00056 | 261.3 |
| 670 | 81.27 | 261.3 | 5.2 | 0.00056 | 258.1 |
| 680 | 81.27 | 258.1 | 5.2 | 0.00056 | 255.1 |
| 690 | 81.26 | 255.1 | 5.1 | 0.00056 | 252.0 |
| 700 | 81.25 | 252.0 | 5.1 | 0.00056 | 248.9 |
| 710 | 81.20 | 248.9 | 4.9 | 0.00056 | 246.0 |
| 720 | 81.19 | 246.0 | 4.9 | 0.00056 | 243.1 |
| 730 | 81.18 | 243.1 | 4.8 | 0.00056 | 240.2 |
| 740 | 81.18 | 240.2 | 4.8 | 0.00056 | 237.3 |
| 750 | 81.17 | 237.3 | 4.8 | 0.00056 | 234.4 |
| 760 | 81.12 | 234.4 | 4.5 | 0.00056 | 231.7 |
| 770 | 81.11 | 231.7 | 4.5 | 0.00056 | 229.0 |
| 780 | 81.11 | 229.0 | 4.5 | 0.00056 | 226.3 |
| 790 | 81.10 | 226.3 | 4.5 | 0.00056 | 223.6 |
| 800 | 81.09 | 223.6 | 4.4 | 0.00056 | 221.0 |
| 810 | 81.09 | 221.0 | 4.4 | 0.00056 | 218.3 |
| 820 | 81.03 | 218.3 | 4.2 | 0.00056 | 215.8 |
| 830 | 81.03 | 215.8 | 4.1 | 0.00056 | 213.4 |
| 840 | 81.02 | 213.4 | 4.1 | 0.00056 | 210.9 |
| 850 | 81.02 | 210.9 | 4.1 | 0.00056 | 208.4 |
| 860 | 81.01 | 208.4 | 4.1 | 0.00056 | 206.0 |
| 870 | 81.01 | 206.0 | 4.0 | 0.00056 | 203.6 |
| 880 | 81.00 | 203.6 | 4.0 | 0.00056 | 201.2 |
| 890 | 80.95 | 201.2 | 3.7 | 0.00056 | 199.0 |
| 900 | 80.94 | 199.0 | 3.7 | 0.00056 | 196.7 |
| 910 | 80.94 | 196.7 | 3.7 | 0.00056 | 194.5 |
| 920 | 80.93 | 194.5 | 3.6 | 0.00056 | 192.3 |
| 930 | 80.93 | 192.3 | 3.6 | 0.00056 | 190.2 |
| 940 | 80.92 | 190.2 | 3.6 | 0.00056 | 188.0 |
| 950 | 80.92 | 188.0 | 3.6 | 0.00056 | 185.9 |
| 960 | 80.87 | 185.9 | 3.3 | 0.00056 | 183.9 |
| 970 | 80.86 | 183.9 | 3.2 | 0.00056 | 182.0 |
| 980 | 80.86 | 182.0 | 3.2 | 0.00056 | 180.1 |
| 990 | 80.85 | 180.1 | 3.2 | 0.00056 | 178.1 |
| 1000 | 80.85 | 178.1 | 3.2 | 0.00056 | 176.2 |
| 1010 | 80.85 | 176.2 | 3.1 | 0.00056 | 174.4 |
| 1020 | 80.84 | 174.4 | 3.1 | 0.00056 | 172.5 |
| 1030 | 80.79 | 172.5 | 2.7 | 0.00056 | 170.9 |
| 1040 | 80.78 | 170.9 | 2.7 | 0.00056 | 169.2 |
| 1050 | 80.78 | 169.2 | 2.7 | 0.00056 | 167.6 |
| 1060 | 80.78 | 167.6 | 2.7 | 0.00056 | 166.0 |

| | | | | | |
|------|-------|-------|-----|---------|-------|
| 1070 | 80.77 | 166.0 | 2.6 | 0.00056 | 164.4 |
| 1080 | 80.77 | 164.4 | 2.6 | 0.00056 | 162.9 |
| 1090 | 80.77 | 162.9 | 2.6 | 0.00056 | 161.3 |
| 1100 | 80.77 | 161.3 | 2.6 | 0.00056 | 159.8 |
| 1110 | 80.76 | 159.8 | 2.5 | 0.00056 | 158.2 |
| 1120 | 80.71 | 158.2 | 2.1 | 0.00056 | 157.0 |
| 1130 | 80.71 | 157.0 | 2.1 | 0.00056 | 155.8 |
| 1140 | 80.70 | 155.8 | 2.0 | 0.00056 | 154.5 |
| 1150 | 80.70 | 154.5 | 2.0 | 0.00056 | 153.3 |
| 1160 | 80.70 | 153.3 | 2.0 | 0.00056 | 152.1 |
| 1170 | 80.70 | 152.1 | 2.0 | 0.00056 | 151.0 |
| 1180 | 80.69 | 151.0 | 1.9 | 0.00056 | 149.8 |
| 1190 | 80.69 | 149.8 | 1.9 | 0.00056 | 148.7 |
| 1200 | 80.69 | 148.7 | 1.9 | 0.00056 | 147.5 |
| 1210 | 80.69 | 147.5 | 1.9 | 0.00056 | 146.4 |
| 1220 | 80.68 | 146.4 | 1.8 | 0.00056 | 145.3 |
| 1230 | 80.63 | 145.3 | 1.1 | 0.00056 | 144.6 |
| 1240 | 80.63 | 144.6 | 1.1 | 0.00056 | 144.0 |
| 1250 | 80.63 | 144.0 | 1.1 | 0.00056 | 143.3 |
| 1260 | 80.63 | 143.3 | 1.1 | 0.00056 | 142.7 |
| 1270 | 80.63 | 142.7 | 1.0 | 0.00056 | 142.1 |
| 1280 | 80.63 | 142.1 | 1.0 | 0.00056 | 141.5 |
| 1290 | 80.62 | 141.5 | 1.0 | 0.00056 | 140.9 |
| 1300 | 80.62 | 140.9 | 1.0 | 0.00056 | 140.3 |
| 1310 | 80.62 | 140.3 | 0.9 | 0.00056 | 139.8 |
| 1320 | 80.62 | 139.8 | 0.9 | 0.00056 | 139.2 |
| 1330 | 80.62 | 139.2 | 0.9 | 0.00056 | 138.7 |
| 1340 | 80.62 | 138.7 | 0.9 | 0.00056 | 138.2 |
| 1350 | 80.62 | 138.2 | 0.8 | 0.00056 | 137.7 |
| 1360 | 80.62 | 137.7 | 0.8 | 0.00056 | 137.2 |
| 1370 | 80.62 | 137.2 | 0.8 | 0.00056 | 136.7 |
| 1380 | 80.61 | 136.7 | 0.8 | 0.00056 | 136.3 |
| 1390 | 80.61 | 136.3 | 0.7 | 0.00056 | 135.8 |
| 1400 | 80.61 | 135.8 | 0.7 | 0.00056 | 135.4 |
| 1410 | 80.61 | 135.4 | 0.7 | 0.00056 | 135.0 |

540.9

m³ total

0.04724

m³ infiltrated

0.009%

Pond Volume

| End Elevation (m) |
|-------------------|
| 82.50 |
| 82.49 |
| 82.48 |
| 82.47 |
| 82.46 |
| 82.40 |
| 82.39 |
| 82.38 |
| 82.36 |
| 82.35 |
| 82.29 |
| 82.28 |
| 82.27 |
| 82.26 |
| 82.25 |
| 82.19 |
| 82.18 |
| 82.17 |
| 82.16 |
| 82.10 |
| 82.09 |
| 82.08 |
| 82.08 |
| 82.07 |
| 82.01 |
| 82.00 |
| 81.99 |
| 81.98 |
| 81.97 |
| 81.91 |
| 81.90 |
| 81.89 |
| 81.88 |
| 81.87 |
| 81.82 |
| 81.81 |
| 81.80 |
| 81.79 |
| 81.78 |
| 81.72 |
| 81.71 |
| 81.71 |
| 81.70 |
| 81.64 |
| 81.63 |
| 81.62 |
| 81.62 |
| 81.61 |
| 81.60 |
| 81.54 |
| 81.53 |
| 81.53 |

| Elevation | Volume (m3) |
|-----------|-------------|
| 80.60 | 0.0 |
| 80.65 | 4.3 |
| 80.70 | 9.1 |
| 80.75 | 14.5 |
| 80.80 | 20.4 |
| 80.85 | 26.8 |
| 80.90 | 33.8 |
| 80.95 | 41.3 |
| 81.00 | 49.4 |
| 81.05 | 58.0 |
| 81.10 | 67.1 |
| 81.15 | 76.7 |
| 81.20 | 86.9 |
| 81.25 | 97.7 |
| 81.30 | 109.0 |
| 81.35 | 120.8 |
| 81.40 | 133.1 |
| 81.45 | 146.0 |
| 81.50 | 159.5 |
| 81.55 | 173.4 |
| 81.60 | 187.9 |
| 81.65 | 203.0 |
| 81.70 | 218.5 |
| 81.75 | 234.7 |
| 81.80 | 251.3 |
| 81.85 | 268.5 |
| 81.90 | 286.2 |
| 81.95 | 304.5 |
| 82.00 | 323.3 |
| 82.05 | 342.7 |
| 82.10 | 362.5 |
| 82.15 | 383.0 |
| 82.20 | 403.9 |
| 82.25 | 425.4 |
| 82.30 | 447.4 |
| 82.35 | 470.0 |
| 82.40 | 493.1 |
| 82.45 | 516.7 |
| 82.50 | 540.9 |

100yr El. = 82.5
 Bot. El. = 80.6

| |
|-------|
| 81.52 |
| 81.51 |
| 81.45 |
| 81.45 |
| 81.44 |
| 81.43 |
| 81.43 |
| 81.37 |
| 81.36 |
| 81.35 |
| 81.35 |
| 81.34 |
| 81.28 |
| 81.28 |
| 81.27 |
| 81.27 |
| 81.26 |
| 81.25 |
| 81.20 |
| 81.19 |
| 81.18 |
| 81.18 |
| 81.17 |
| 81.12 |
| 81.11 |
| 81.11 |
| 81.10 |
| 81.09 |
| 81.09 |
| 81.03 |
| 81.03 |
| 81.02 |
| 81.02 |
| 81.01 |
| 81.01 |
| 81.00 |
| 80.95 |
| 80.94 |
| 80.94 |
| 80.93 |
| 80.93 |
| 80.92 |
| 80.92 |
| 80.87 |
| 80.86 |
| 80.86 |
| 80.85 |
| 80.85 |
| 80.85 |
| 80.84 |
| 80.79 |
| 80.78 |
| 80.78 |
| 80.78 |
| 80.77 |

| |
|-------|
| 80.77 |
| 80.77 |
| 80.77 |
| 80.76 |
| 80.71 |
| 80.71 |
| 80.70 |
| 80.70 |
| 80.70 |
| 80.70 |
| 80.69 |
| 80.69 |
| 80.69 |
| 80.69 |
| 80.68 |
| 80.63 |
| 80.63 |
| 80.63 |
| 80.63 |
| 80.63 |
| 80.63 |
| 80.63 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.62 |
| 80.61 |
| 80.61 |
| 80.61 |
| 80.61 |
| 80.61 |

100yr area (m2) = 489.0

Base Area (m2) = 80.4

Pond Area Rate= 215.1 m2/m

Percolation Rate = 25 mm/hr*

*based on MMAH SB-6 Table 2 w. 2.0 Factor of Safety for high groundwater level

Tank Retention Time During 100yr Storm

| Time Step (min) | Start Elevation (m) | Start Volume (m3) | Outlet Rate (L/s) | Percolation (L/s) | End Volume (m3) |
|-----------------|---------------------|-------------------|-------------------|-------------------|-----------------|
| 0 | 82.80 | 1565.2 | 91.1 | 0.013 | 1565.2 |
| 10 | 82.80 | 1565.2 | 91.1 | 0.013 | 1510.5 |
| 20 | 82.64 | 1510.5 | 87.5 | 0.013 | 1458.0 |
| 30 | 82.49 | 1458.0 | 83.9 | 0.013 | 1407.7 |
| 40 | 82.35 | 1407.7 | 80.3 | 0.013 | 1359.5 |
| 50 | 82.21 | 1359.5 | 76.7 | 0.013 | 1313.5 |
| 60 | 82.08 | 1313.5 | 73.1 | 0.013 | 1269.7 |
| 70 | 81.95 | 1269.7 | 69.4 | 0.013 | 1228.0 |
| 80 | 81.83 | 1228.0 | 65.8 | 0.013 | 1188.5 |
| 90 | 81.72 | 1188.5 | 62.2 | 0.013 | 1151.2 |
| 100 | 81.61 | 1151.2 | 58.6 | 0.013 | 1116.0 |
| 110 | 81.51 | 1116.0 | 54.9 | 0.013 | 1083.1 |
| 120 | 81.41 | 1083.1 | 51.3 | 0.013 | 1052.3 |
| 130 | 81.36 | 1052.3 | 49.2 | 0.013 | 1022.8 |
| 140 | 81.34 | 1022.8 | 48.5 | 0.013 | 993.7 |
| 150 | 81.33 | 993.7 | 47.8 | 0.013 | 965.0 |
| 160 | 81.31 | 965.0 | 47.1 | 0.013 | 936.8 |
| 170 | 81.30 | 936.8 | 46.4 | 0.013 | 909.0 |
| 180 | 81.28 | 909.0 | 45.7 | 0.013 | 881.5 |
| 190 | 81.27 | 881.5 | 45.0 | 0.013 | 854.5 |
| 200 | 81.25 | 854.5 | 44.3 | 0.013 | 827.9 |
| 210 | 81.24 | 827.9 | 43.6 | 0.013 | 801.8 |
| 220 | 81.22 | 801.8 | 42.9 | 0.013 | 776.0 |
| 230 | 81.21 | 776.0 | 42.2 | 0.013 | 750.7 |
| 240 | 81.19 | 750.7 | 41.5 | 0.013 | 725.8 |
| 250 | 81.18 | 725.8 | 40.8 | 0.013 | 701.3 |
| 260 | 81.16 | 701.3 | 40.1 | 0.013 | 677.2 |
| 270 | 81.15 | 677.2 | 39.4 | 0.013 | 653.5 |
| 280 | 81.14 | 653.5 | 38.7 | 0.013 | 630.3 |
| 290 | 81.12 | 630.3 | 38.0 | 0.013 | 607.5 |
| 300 | 81.11 | 607.5 | 37.3 | 0.013 | 585.0 |
| 310 | 81.10 | 585.0 | 36.6 | 0.013 | 563.0 |
| 320 | 81.09 | 563.0 | 36.0 | 0.013 | 541.5 |
| 330 | 81.07 | 541.5 | 35.3 | 0.013 | 520.3 |
| 340 | 81.06 | 520.3 | 34.6 | 0.013 | 499.6 |
| 350 | 81.05 | 499.6 | 33.9 | 0.013 | 479.2 |
| 360 | 81.04 | 479.2 | 33.2 | 0.013 | 459.3 |
| 370 | 81.03 | 459.3 | 32.5 | 0.013 | 439.8 |
| 380 | 81.02 | 439.8 | 31.8 | 0.013 | 420.7 |
| 390 | 81.01 | 420.7 | 31.1 | 0.013 | 402.1 |
| 400 | 81.00 | 402.1 | 30.4 | 0.013 | 383.9 |
| 410 | 80.99 | 383.9 | 29.7 | 0.013 | 366.0 |
| 420 | 80.98 | 366.0 | 29.0 | 0.013 | 348.6 |
| 430 | 80.97 | 348.6 | 28.3 | 0.013 | 331.6 |
| 440 | 80.96 | 331.6 | 27.6 | 0.013 | 315.1 |
| 450 | 80.95 | 315.1 | 26.9 | 0.013 | 298.9 |
| 460 | 80.94 | 298.9 | 26.2 | 0.013 | 283.2 |
| 470 | 80.93 | 283.2 | 25.5 | 0.013 | 267.9 |
| 480 | 80.92 | 267.9 | 24.8 | 0.013 | 253.0 |
| 490 | 80.91 | 253.0 | 24.1 | 0.013 | 238.5 |
| 500 | 80.90 | 238.5 | 23.4 | 0.013 | 224.5 |
| 510 | 80.90 | 224.5 | 22.7 | 0.013 | 210.9 |

| | | | | | |
|-----|-------|-------|------|-------|-------|
| 520 | 80.89 | 210.9 | 22.0 | 0.013 | 197.7 |
| 530 | 80.88 | 197.7 | 21.3 | 0.013 | 184.9 |
| 540 | 80.87 | 184.9 | 20.6 | 0.013 | 172.5 |
| 550 | 80.87 | 172.5 | 19.9 | 0.013 | 160.6 |
| 560 | 80.86 | 160.6 | 19.2 | 0.013 | 149.0 |
| 570 | 80.85 | 149.0 | 18.5 | 0.013 | 137.9 |
| 580 | 80.85 | 137.9 | 17.8 | 0.013 | 127.2 |
| 590 | 80.84 | 127.2 | 17.1 | 0.013 | 117.0 |
| 600 | 80.84 | 117.0 | 16.4 | 0.013 | 107.1 |
| 610 | 80.83 | 107.1 | 15.7 | 0.013 | 97.7 |
| 620 | 80.82 | 97.7 | 15.0 | 0.013 | 88.7 |
| 630 | 80.82 | 88.7 | 14.3 | 0.013 | 80.1 |
| 640 | 80.82 | 80.1 | 13.6 | 0.013 | 72.0 |
| 650 | 80.81 | 72.0 | 12.9 | 0.013 | 64.3 |
| 660 | 80.81 | 64.3 | 12.1 | 0.013 | 57.0 |
| 670 | 80.80 | 57.0 | 11.4 | 0.013 | 50.1 |
| 680 | 80.80 | 50.1 | 10.7 | 0.013 | 43.7 |
| 690 | 80.79 | 43.7 | 10.0 | 0.013 | 37.7 |
| 700 | 80.79 | 37.7 | 9.3 | 0.013 | 32.1 |
| 710 | 80.79 | 32.1 | 8.6 | 0.013 | 26.9 |
| 720 | 80.79 | 26.9 | 7.9 | 0.013 | 22.2 |
| 730 | 80.78 | 22.2 | 7.1 | 0.013 | 17.9 |
| 740 | 80.78 | 17.9 | 6.4 | 0.013 | 14.0 |
| 750 | 80.78 | 14.0 | 5.7 | 0.013 | 10.6 |
| 760 | 80.78 | 10.6 | 4.9 | 0.013 | 7.7 |
| 770 | 80.77 | 7.7 | 4.2 | 0.013 | 5.1 |
| 780 | 80.77 | 5.1 | 3.4 | 0.013 | 3.1 |
| 790 | 80.77 | 3.1 | 2.7 | 0.013 | 1.5 |
| 800 | 80.77 | 1.5 | 1.8 | 0.013 | 0.4 |

1565.2

m³ total

0.61667

m³

0.039%

Pond Volume

| Elevation | Volume (m3) |
|-----------|-------------|
| 82.80 | 1565.2 |
| 81.37 | 1067.9 |
| 80.77 | 0.0 |

Percolation Rate = 25

Tank Area = 1850

*based on MMAH SB-6 Table 2 w. 2

| End Elevation (m) |
|-------------------|
| 82.80 |
| 82.64 |
| 82.49 |
| 82.35 |
| 82.21 |
| 82.08 |
| 81.95 |
| 81.83 |
| 81.72 |
| 81.61 |
| 81.51 |
| 81.41 |
| 81.36 |
| 81.34 |
| 81.33 |
| 81.31 |
| 81.30 |
| 81.28 |
| 81.27 |
| 81.25 |
| 81.24 |
| 81.22 |
| 81.21 |
| 81.19 |
| 81.18 |
| 81.16 |
| 81.15 |
| 81.14 |
| 81.12 |
| 81.11 |
| 81.10 |
| 81.09 |
| 81.07 |
| 81.06 |
| 81.05 |
| 81.04 |
| 81.03 |
| 81.02 |
| 81.01 |
| 81.00 |
| 80.99 |
| 80.98 |
| 80.97 |
| 80.96 |
| 80.95 |
| 80.94 |
| 80.93 |
| 80.92 |
| 80.91 |
| 80.90 |
| 80.90 |
| 80.89 |

| |
|-------|
| 80.88 |
| 80.87 |
| 80.87 |
| 80.86 |
| 80.85 |
| 80.85 |
| 80.84 |
| 80.84 |
| 80.83 |
| 80.82 |
| 80.82 |
| 80.82 |
| 80.81 |
| 80.81 |
| 80.80 |
| 80.80 |
| 80.79 |
| 80.79 |
| 80.79 |
| 80.79 |
| 80.78 |
| 80.78 |
| 80.78 |
| 80.78 |
| 80.77 |
| 80.77 |
| 80.77 |
| 80.77 |
| 80.77 |

mm/hr*
m²

.0 Factor of Safety for high groundwater level



GreenStorm ST

Rigofill ST product by **FRÄNKISCHE**

**Underground storage
infiltration modules**

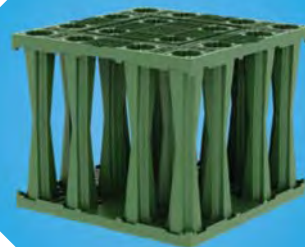


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Storing stormwater with storage/infiltration systems

Basic element for underground water storage facilities

GreenStorm ST* are plastic tanks to be installed underground (storage/infiltration modules) in which water is collected and stored. Storage/infiltration systems temporarily collect stormwater and discharge it later. In addition to infiltration using underdrained swale systems, pipe swales, and gravel swales common in the past, increasingly more storage/infiltration systems are being built today.

The storage space of the storage/infiltration system consists of numerous GreenStorm ST* modules which can be combined three-dimensionally to form large systems.

The advantage of this method is that the void ratio is up to three times larger in these infiltration systems than in gravel swales which saves space and excavation work.

GreenStorm ST* is a modular system which is characterised by high flexibility, rapid installation and a high level of user-friendliness.



Application – infiltration

Stormwater infiltration – giving back to nature

Large amounts of stormwater can reduce the performance of wastewater treatment systems. Infiltrating unpolluted stormwater nearby has therefore several advantages.

A constant growth in built-up areas and increase in impervious surfaces prevent natural infiltration of stormwater into the soil. Special infiltration systems are used in order to discharge it to the water cycle. In addition to infiltration using pipe swales, increasingly more storage/infiltration systems are being built.

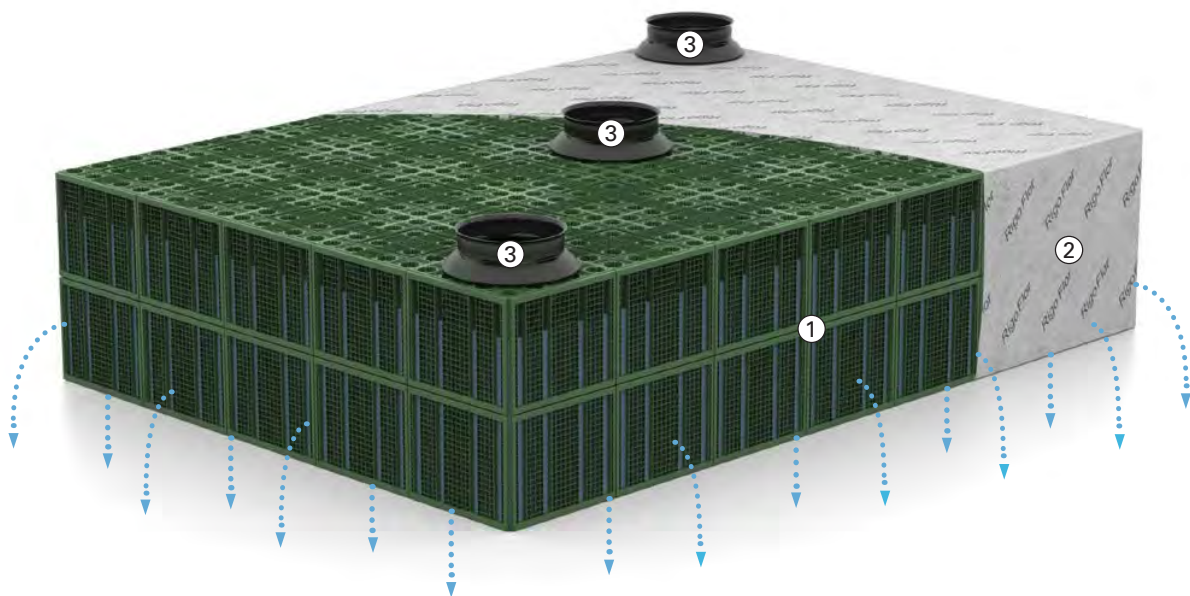
The advantage of this method is that the storage volume of the infiltration system is increased, and space and excavation are saved as compared to gravel swales. Stormwater is thus returned to the natural water cycle and can contribute to producing new groundwater. Infiltration systems are subject to very high requirements. Consequently, they have become an important component of urban drainage.

Storage/infiltration systems considerably increase the underground storage volume. High-performance storage/infiltration systems can be installed even in confined space.

In particular in urban construction no additional space is required and precious building ground is saved.

Légende

- ① GreenStorm ST* storage /infiltration module
- ② Geotextile
- ③ QuadroControl ST system shaft



Application – retention

Retaining stormwater – instead of flooding

If subsoil conditions are unfavourable to infiltration, the goal is to retain the stormwater and ensure a retarded, timelagged discharge. Exposure to impulsive stress can be eliminated or reduced in sewer networks, wastewater treatment systems and waterbodies.

Stormwater retention systems retard the infiltration of stormwater. They are comprised of a watertight retaining element, an inlet and a vortex outlet.

The stormwater distributes evenly in the system where it can be stored and is then discharged in a controlled manner through throttle shafts. If infiltration must be avoided or to prevent unintended

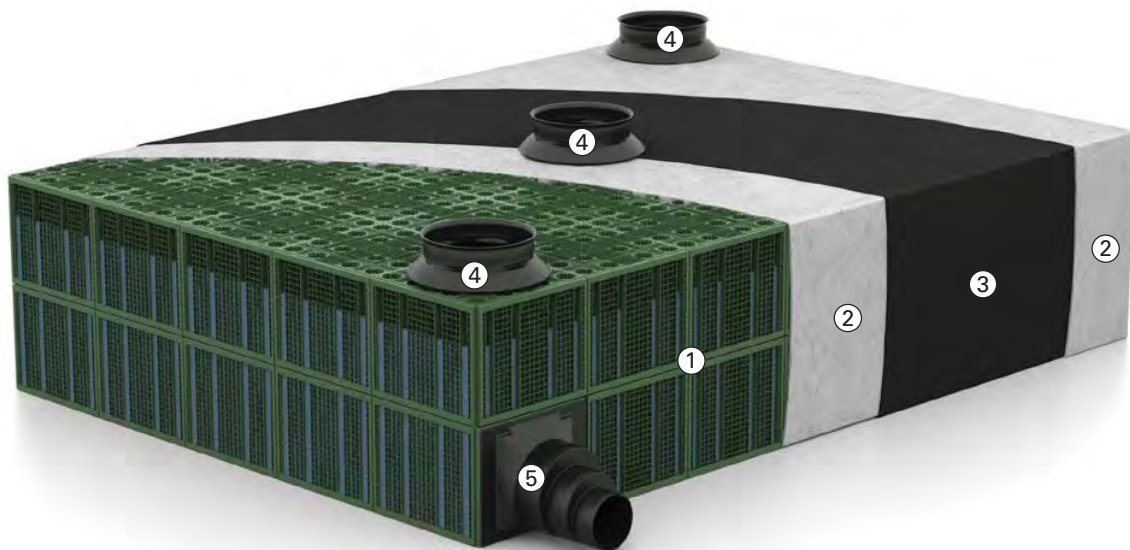
discharge of groundwater or strata water (e.g., in case of contaminated soil), it is necessary to waterproof the retention system.

Stormwater runoff from impervious surfaces that cannot infiltrate naturally leads to peak loads in sewer systems.

Stormwater retention facilities collect stormwater in an underground storage tank and discharge it in a retarded manner but continuously. Their very short construction times make storage/infiltration systems an inexpensive alternative to conventional retention facilities such as retention channels or underground concrete tanks.

Légende

- ① GreenStorm ST* storage /infiltration module
- ② Geotextile
- ③ Impermeable membrane
- ④ QuadroControl ST system shaft
- ⑤ Adapter



Application – harvesting / fire water storage

Harvesting stormwater – saving drinking water

Water – particularly drinking water – is a priceless resource which should be treated responsibly and used sparingly. It is therefore wise to collect, store and use stormwater if the water must not necessarily be suitable for drinking purposes, instead of allowing the water to infiltrate into the soil unused or diverting it into the sewer system.

There are many examples: irrigation for greens, car wash, use in toilets, etc.

Water is diverted into a waterproof storage/infiltration system and can be supplied for use via a pumping system.

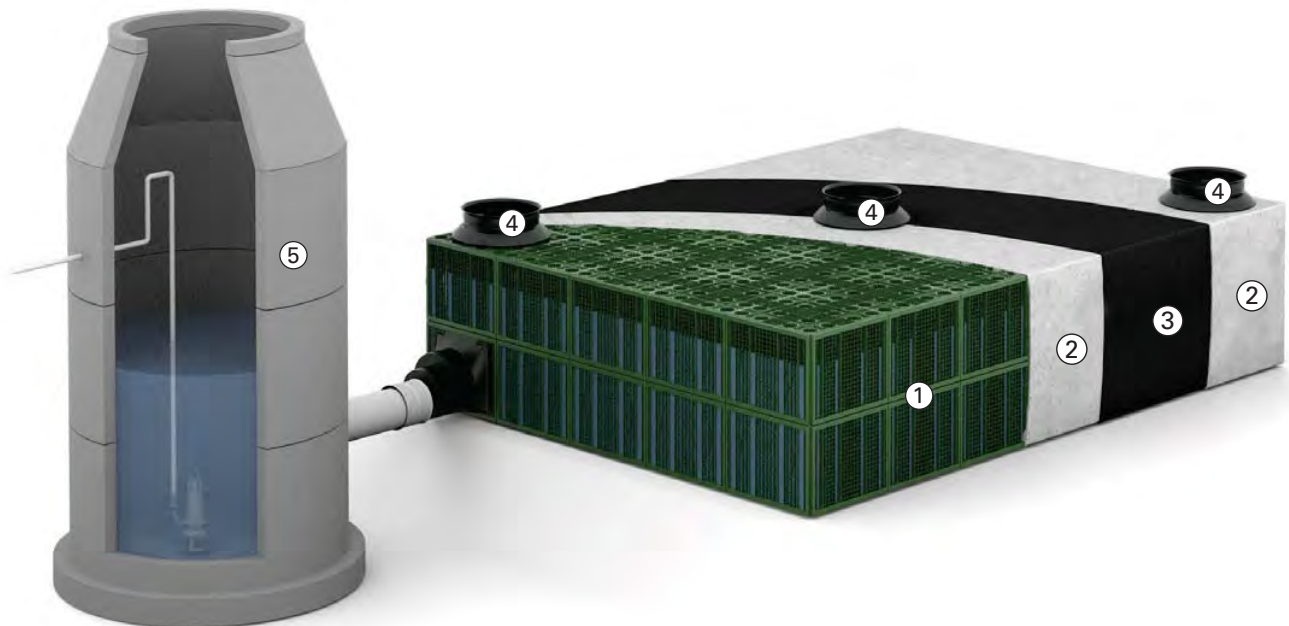
The use of the GreenStorm inspect system allows for finding solutions that fit project-specific requirements – even under the most difficult conditions such as very tight space, narrow conditions, low cover, high groundwater level, etc.

Stormwater harvesting systems provide water for different domestic and industrial water uses. They comprise a watertight retaining element, an inlet with upstream stormwater treatment system, a pump shaft and a system control.

Using GreenStorm ST* for fire water storage also saves water, since system checks can be made in a filled state and water does not have to be pumped out as is the case with conventional concrete tanks.

Légende

- ① GreenStorm ST* storage/infiltration module
- ② Geotextile
- ③ Impermeable membrane
- ④ QuadroControl ST system shaft
- ⑤ Tapping shaft (on-site)



Modular design

Individual system geometries due to modular design

Sizes (length and width) of GreenStorm ST*orage/infiltration systems can be freely designed with hardly any limitations. The 800 mm cellular block type structure can easily be adapted to fit nearly any layout.

With heights of 660 mm (full block) and 350 mm (half block), systems can be built in various sizes to accommodate any

single- or multi-layer combination.

Therefore, the system can very easily be adapted to on-site requirements. Under high groundwater conditions or low permeability of backfill soil, for example, rather shallow depth systems are to be preferred.

For soils with good permeability, however, high and compact systems are favourable and may be built accordingly. The maximum space available is used.



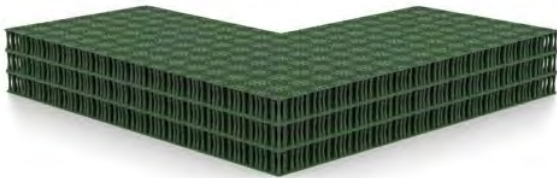
Possible system geometries



GreenStorm ST*
2-layer



GreenStorm ST*
1-layer



GreenStorm ST*
3-layer



GreenStorm ST*
3 1/2-layer

Storage volume

Extremely high volume

The GreenStorm ST* full block provides a storage volume of 406 litres with a gross volume of 422 litres. With a storage volume of more than 96 %, it stores three times as much water as gravel swales.

The half block has a height of 350 mm and is used if shallow systems are required, e.g., in case of high groundwater levels. With a gross volume of 224 litres, it offers a storage volume of 212 litres.

Column void

The column void of the storage/infiltration module is 100 % available as storage space. Large openings at the column base and at the column connection allow unrestricted filling and emptying of the columns.



Storage/infiltration systems as compared to gravel swales

Pipe and gravel swales only use approx. 30 % of their volume to store water. Therefore, three times the required water storage volume must be provided by excavation. This requires lots of space which is frequently not available in urban areas.

GreenStorm ST* storage/infiltration systems save an enormous amount of space and excavation work. Thus, subsoil storage spaces for stormwater can be built in a very efficient and cost-saving way.

Storage/infiltration systems considerably increase the storage space. High-performance storage/infiltration systems can be installed even in confined space.



Installation

Easy construction site handling



Requires little space for storage

The storage/infiltration modules are delivered in compact, stacked units with 17 modules per pallet.

The easy stackability of the GreenStorm ST* and ST-B modules allows them to be stored even in confined construction space, even outside the excavation pit. This facilitates installation, since no additional storage space must be provided in the excavation pit. Installation is neither impeded nor constrained.

Pre-assembly

Depending on the requirements, GreenStorm

ST and GreenStorm ST*-B modules can be pre-assembled in no time at all, both outside and inside the excavation pit with just one easy move. Easy high tensile strength snap connections allow for combining two half elements to create a reliable unit in only a short period of time. This can easily be done by one person alone without requiring any additional tools. The moveable parts of the snap connection are recessed and thus protected from damage.

Easy assembly

There is no need to adhere to any complex installation pattern – the pre-assembled modules or half blocks can just as well be connected to create a single unit.

The low weight allows this to be done by one person only. Connectors establish firm connections between the individual modules. The surface can be accessed immediately without any risk of accidents, since the hole size of the columns is dimensioned respectively (< 100 mm). Thus, no additional covers of column holes are required.



Montage dans la fouille

Up to

88 %

storage space saved as compared to unstackable storage/infiltration modules

Inspection

CCTV inspection even when filled

Storage/infiltration systems are durable structures for urban drainage; they must work reliably for decades. Durability and reliability are essential requirements. The best way to inspect the state of a system using state-of-the-art technology

is CCTV inspection. Thus, a storage/infiltration system can be inspected excellently – for final acceptance or later. This provides safety for authorities, engineers, construction companies, customers, and operators.

Cross-shaped inspection tunnel

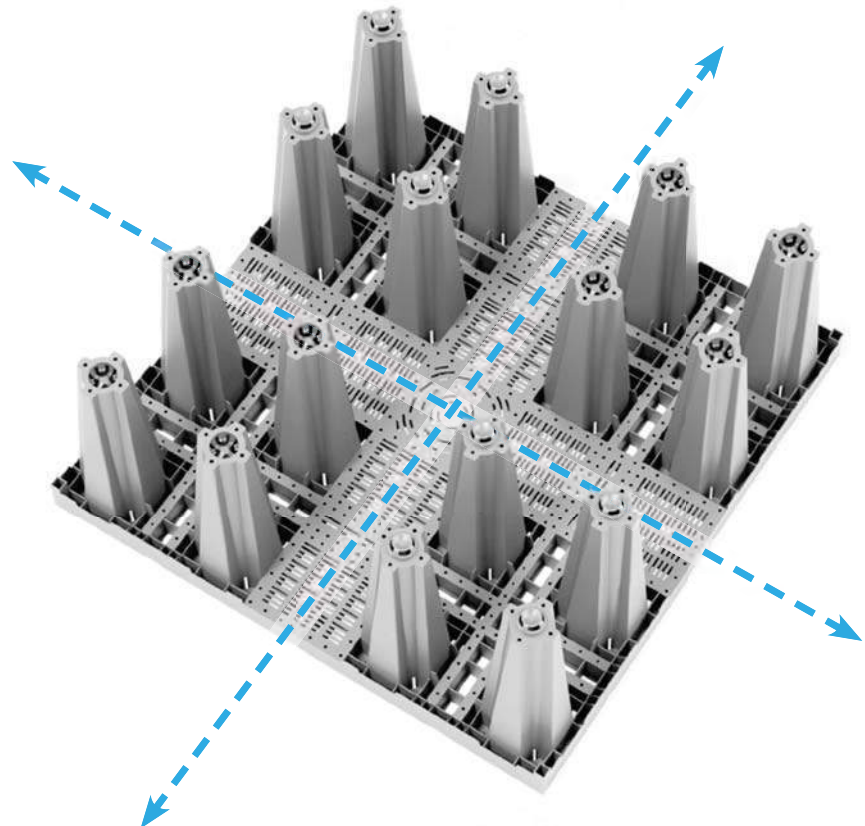
GreenStorm ST* modules have a cross-shaped tunnel which makes the storage/infiltration system camera-accessible and flushable in two axes and thus in four dimensions.

The special and open design of the inspection tunnel allows for an unobstructed view of the entire interior and not only the inspection tunnel.

For example, the statically relevant load-bearing elements, the condition of the geotextile and the entire soil area can be viewed. GreenStorm ST* and GreenStorm ST*-B thus provide excellent options to control the "inner life" of a storage/infiltration system at any time.

The ideal, level and vibration-free running surface and the slim column structure allow for an unobstructed view of the entire module volume. The Quadro Control ST shaft for GreenStorm ST*, which can be integrated, allows for easy access of the automotive dolly for both professional final acceptance inspection and flushing technology.

100 %
inspectable



Inspection

Recommended camera equipment

A standard sewer camera is sufficient for camera inspection.

A rotatable and height-adjustable camera head allows for an optimal view of the lateral soil area, a controllable carriage ensures a centred positioning, and high-performance optics together with lighting allow for a perfect picture.



Certified CCTV accessibility

GreenStorm ST* has been designed for the use of modern CCTV inspection technology.

The inspectability of the GreenStorm ST* and QuadroControl ST system unit has been tested and confirmed by leading manufacturers of pipe CCTV inspection technology!



Recommended: tender invitation for final acceptance inspection

Final acceptance of sewers using camera inspection has long since become a matter of course in sewer construction.

Also in the construction of storage/infiltration systems, the final acceptance inspection is important! Planning engineers should absolutely include this in their tender documents. For instructions on the professional system configuration of the CCTV inspection technology, please refer to **www.fraenkische.com**



Loading

GreenStorm ST* Heavy traffic

Storage/infiltration systems are subsoil structures and must have sufficient load-carrying capacity against impacting soil and traffic loads.

GreenStorm ST* storage/ infiltration systems are extremely strong and have been designed with various applications in mind:

While GreenStorm ST* has been designed in particular for traffic loads of up to 13 tons axle load.



Certification CSTB



High resistance

When installed under traffic areas, relevant national guidelines must be observed.

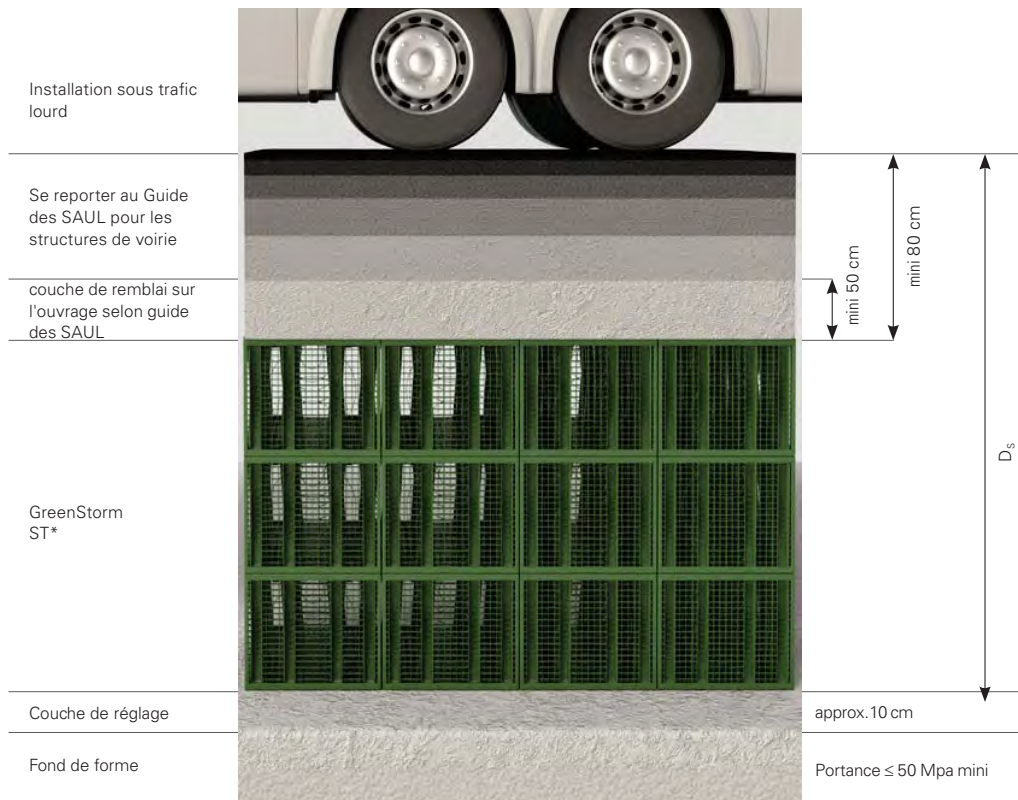
To build the planum for the road construction, an upper levelling layer must be provided. It should preferably be built as a gravel sub-base with a thickness of at least 350 mm, other materials usually result in larger covers.

Generally, a uniform modulus of deformation $EV2 \geq 45 \text{ MN/m}^2$ must be proven on the planum.

Installation under traffic area

The subsoil structures must have sufficient load-carrying capacity against impacting soil and traffic loads to ensure reliable stability.

This is why GreenStorm ST* is suitable for traffic loads of up to 15 tons axle load (20 tons possible, please refer to our technical department).



With conventional installation parameters*, depths of cover of DC 4 m and soil depths DSof 6 m are possible for infiltration systems. A project-specific stability analysis can be prepared by STORMCON.

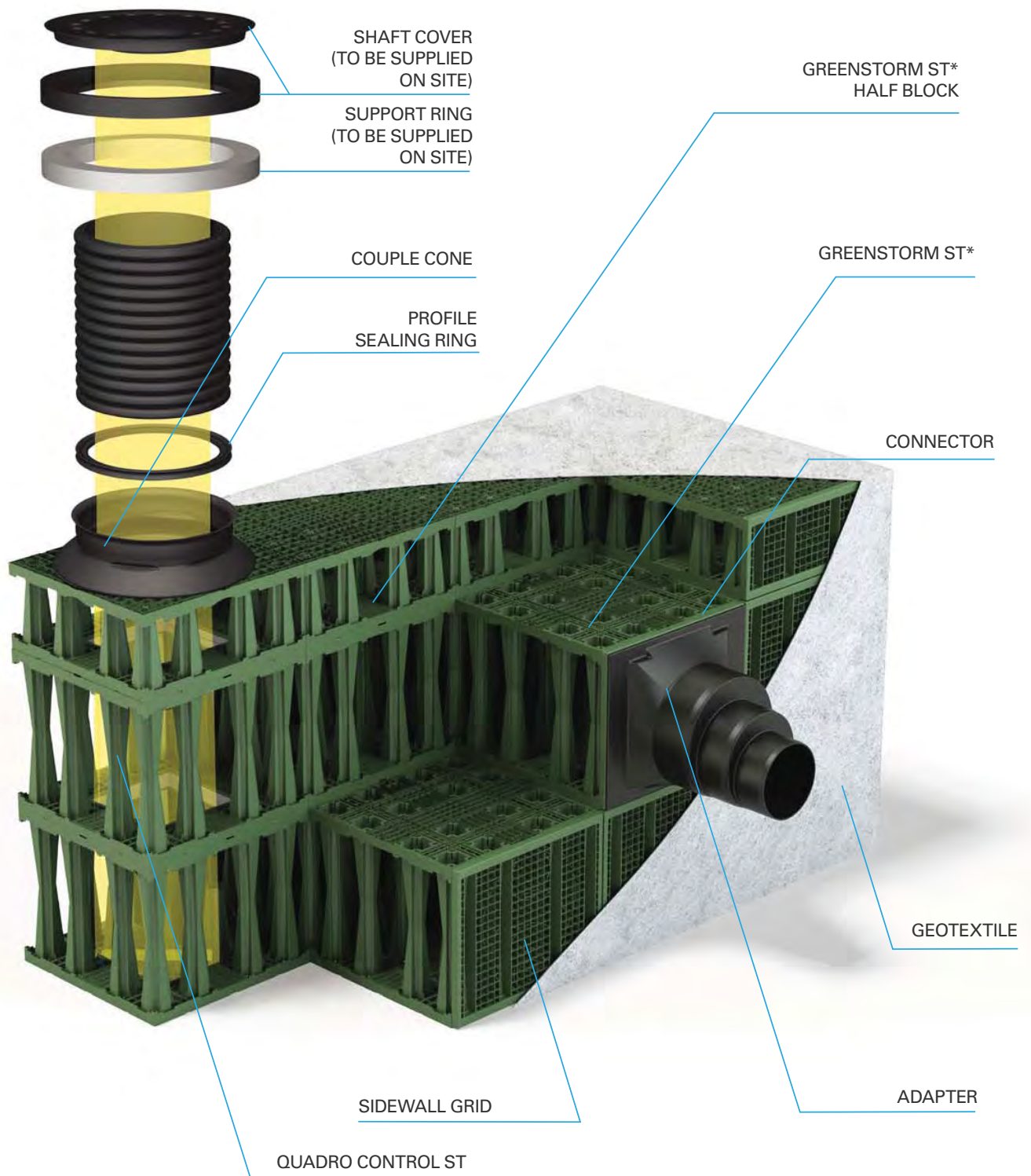
*specific weight of soil 18 kN/m^3
Mean soil temperature max. 23°C ,
6 m soil depth, = 0.3, 4-layer

Example

GreenStorm ST* Heavy traffic



Quadro® Control ST – system shaft



Quadro® Control ST – system shaft

Integrated inspection shafts

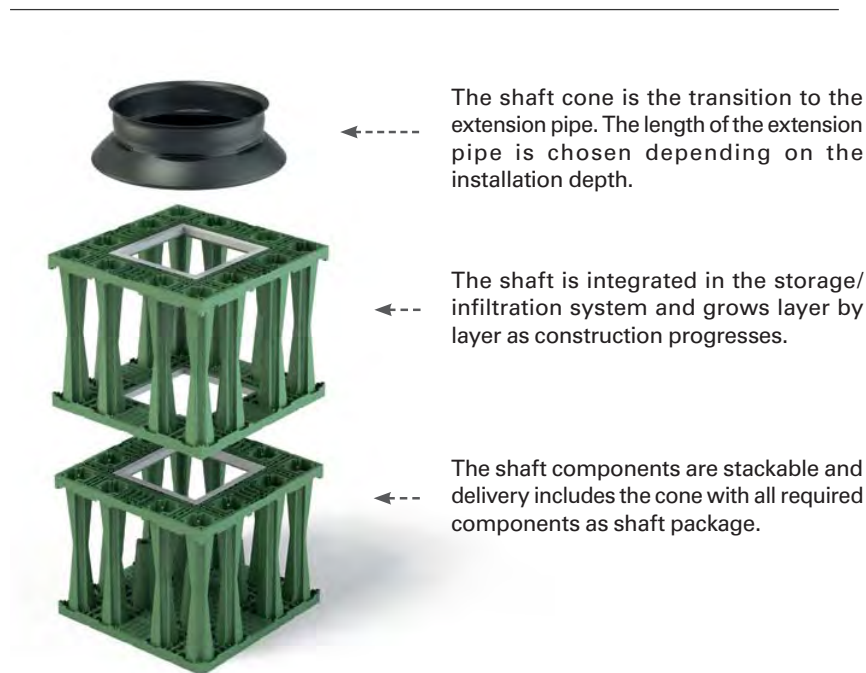
Quadro® Control ST is a polypropylene inspection shaft which can be integrated in the storage/infiltration system.

It is square with a base of 800 x 800 mm and can be used in any position of the layout.

Its height results from the number of layers of the connected storage/infiltration system. The shaft allows for comfortable access to the inspection tunnel from aboveground. High-performance inspection and flushing equipment can easily be inserted into the inspection

tunnel. The shaft is integrated in the storage/infiltration system and grows layer by layer as construction progresses. QuadroControl ST is delivered with all required components and will be assembled on site.

Structure



Arrangement of inspection shafts

Number of and position in the system are above all determined by the size of the system, access, pipe connections and design of the outdoor facilities.

In order to ensure that flushing of the complete system is possible, each module should comprise at least one inspection shaft. In addition, the shafts should be positioned such that the shaft covers do

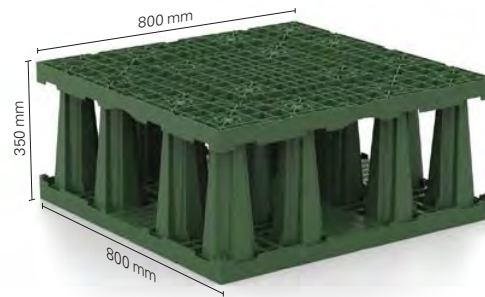
not interfere with the design of the outdoor facilities, but can easily be accessed by vehicles for maintenance purposes.

Adjacent shafts should be staggered in the layout.



GreenStorm ST* – Design-relevant dimensions

Dimensions



Sidewall grid connection options

Full block connection options

Dia 100 mm, 135 mm, 150 mm, 200 mm, 250 mm, 300 mm, 375 mm et 450 mm



This allows all available nominal diameters to be realised both at the top and the bottom of the module.



GreenStorm ST* – Design-relevant dimensions

Sidewall grid connection options

Half block connection options

Dia 100 mm, 135 mm, 150 mm, 200 mm
et 250 mm



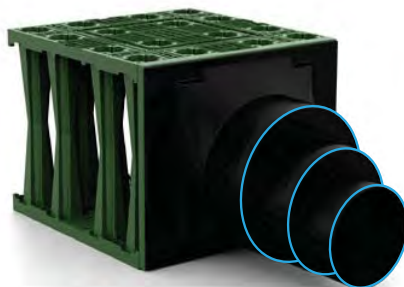
The side plates can be drilled to the height and desired position within the frame.



Adapter connection options

Connections:

Dia 300 mm, 450 mm
et 525 mm



Outside diameter 315 mm
for a pipe diameter
300 mm PVC



Outside diameter 400 mm for
a pipe diameter 450 mm PVC.
A flexible sleeve off center
is required.



Outside diameter 500 mm for
a pipe of diameter 525 mm.
A flexible sleeve off center
is required



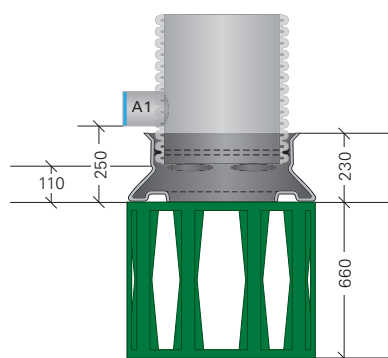
Quadro® Control ST – Design-relevant dimensions

Dimensions of Quadro® Control ST

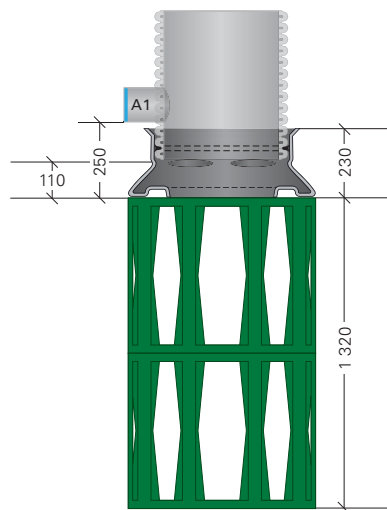
Connection options

A1

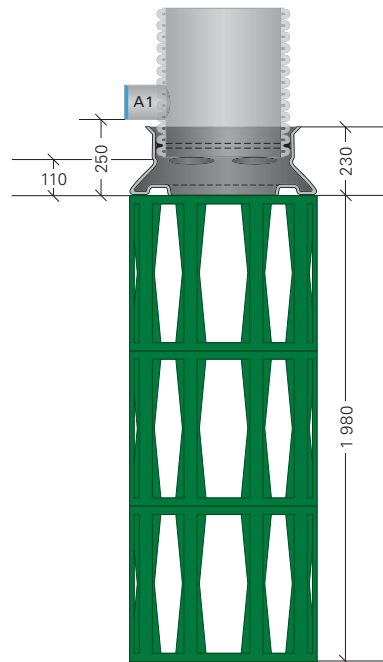
DN/OD 200 or DN/OD 315
connection possible



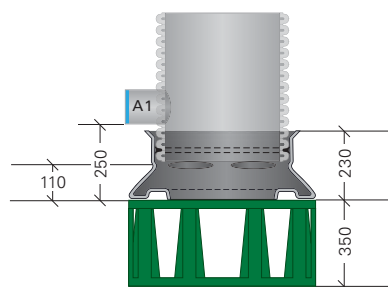
1-layer



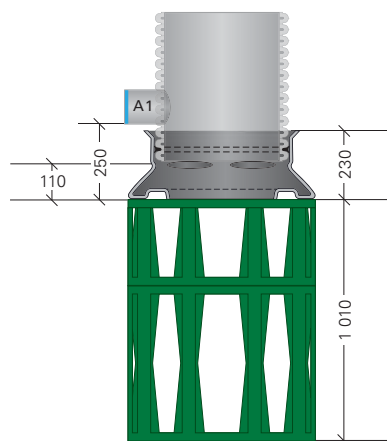
2-layer



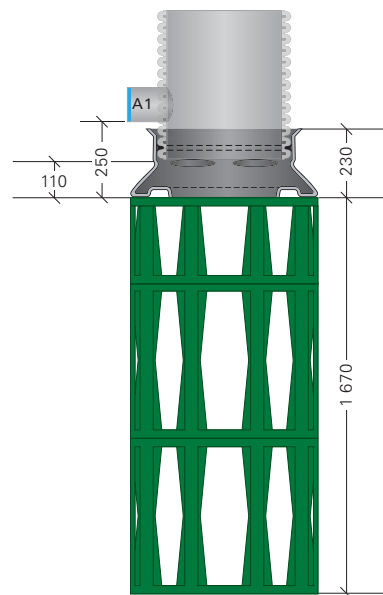
3-layer



1/2-layer



1 1/2-layer



2 1/2-layer

Quadro® Control ST – Design-relevant dimensions

Shaft design of Quadro® Control ST

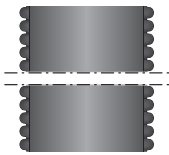
Structure of inspection shaft



Class B or D
shaft cover acc. to DIN EN 124,
CW 610



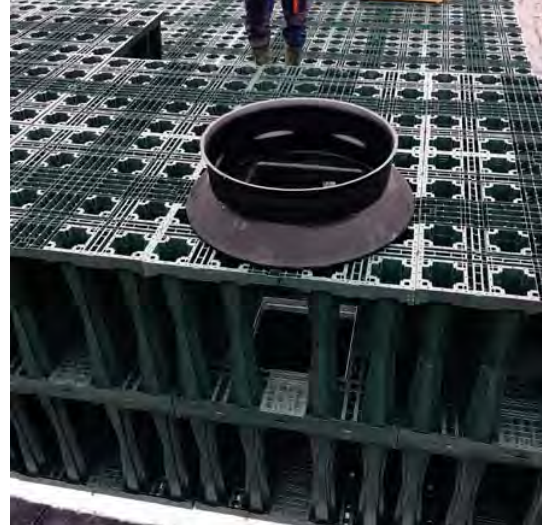
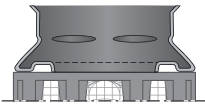
Support ring acc. to DIN 4034,
 $D_1 = 625 \text{ mm}$



Extension pipe
 $D_o 600$



Sealing ring



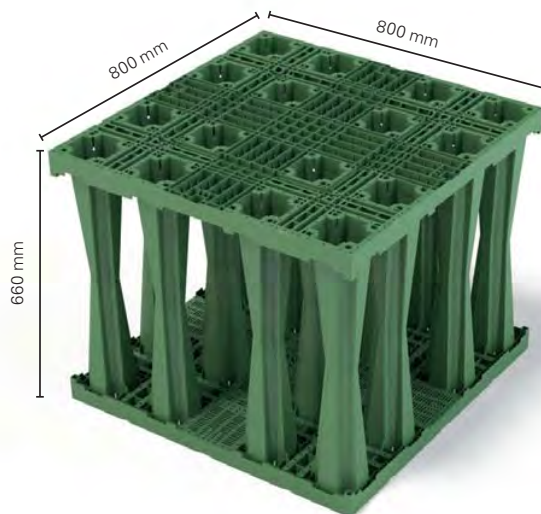
GreenStorm ST*

GreenStorm ST*

GreenStorm ST* IS highly durable and hard-wearing storage/infiltration module with a base of 800 x 800 mm and a height of 660 mm full blocks.

The polypropylene full block consists of two half elements to be installed on site and has a void ratio of more than 96 %. Water can flow through the module three-dimensionally almost without any obstacles. GreenStorm ST* allows for virtually any size and geometry of the systems.

The cross-shaped inspection tunnel in the storage/infiltration modules has been designed for the use of automotive dollies. This allows the effective drainage surface and the entire system volume with all statically relevant bearing-type fixtures to be inspected.



GreenStorm ST* – half block

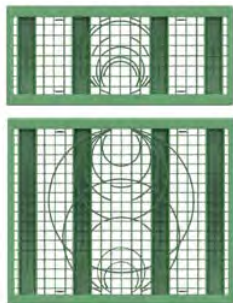
The GreenStorm ST* half block has a base of 800 x 800 mm and a height of 350 mm.

It consists of only one half element which must be assembled with a roof slab on site. This roof slab is only required for the half block. The GreenStorm ST* half block is used in particular for systems with shallow installation depths, e.g., in case of high groundwater levels.

Systems in various heights can be realised in 35 cm steps and adjusted to almost any layout in combination with the full block.



GreenStorm ST* – Accessories



Différentes hauteurs de connexion (indépendamment du diamètre nominal) sont requises au-dessus du fond selon le nombre d'étages :

| Nombre d'étages | Hauteur de raccord |
|-----------------|--------------------|
| 0.5-layer | 40 mm |
| 1-layer | 40 mm |
| 1.5-layer | 700 mm |
| 2-layer | 700 mm |
| 2.5-layer | 1 360 mm |
| 3-layer | 1 360 mm |

Sidewall grid

The sidewall grids serve as external boundary.

They can be assembled easily using snap connections. The predefined position of the connections at the sidewall grids guarantees that the connections of inlet pipe and outlet pipe and the tunnel are same level. The sidewall grids can be assembled easily also outside the excavation pit.

The sidewall grid for the full block and Quadro® Control ST has a size of W x D x H = 800 x 30 x 660 mm and is suited for connecting lateral solid wall pipes DN 110, 125, 160, 200, 225, 250, 315, 400 and 500.

The sidewall grid for the half block or the half-layer shaft has a size of W x D x H = 800 x 30 x 350 mm and is suited for connecting lateral solid wall pipes DN 110, 125, 160, 200, 225 and 250. In storage/infiltration designs with inside corners, shortened sidewall grids are used at one side.



Adapter

The adapter for GreenStorm ST* has a length of 800 mm and a height of 660 mm and serves as an inlet and outlet connection.

It provides an inlet connection with an optimised flow design with diffusor effect for solid wall pipes DN 315, 400 and 500. It can be connected to GreenStorm ST* easily and quickly thanks to the snap connection.

The predefined position of the snap connection at the module guarantees that inlet pipe and outlet pipe and tunnel connect same level.

The adapter ensures a connection with the same crown, as it is installed turned by 180°.



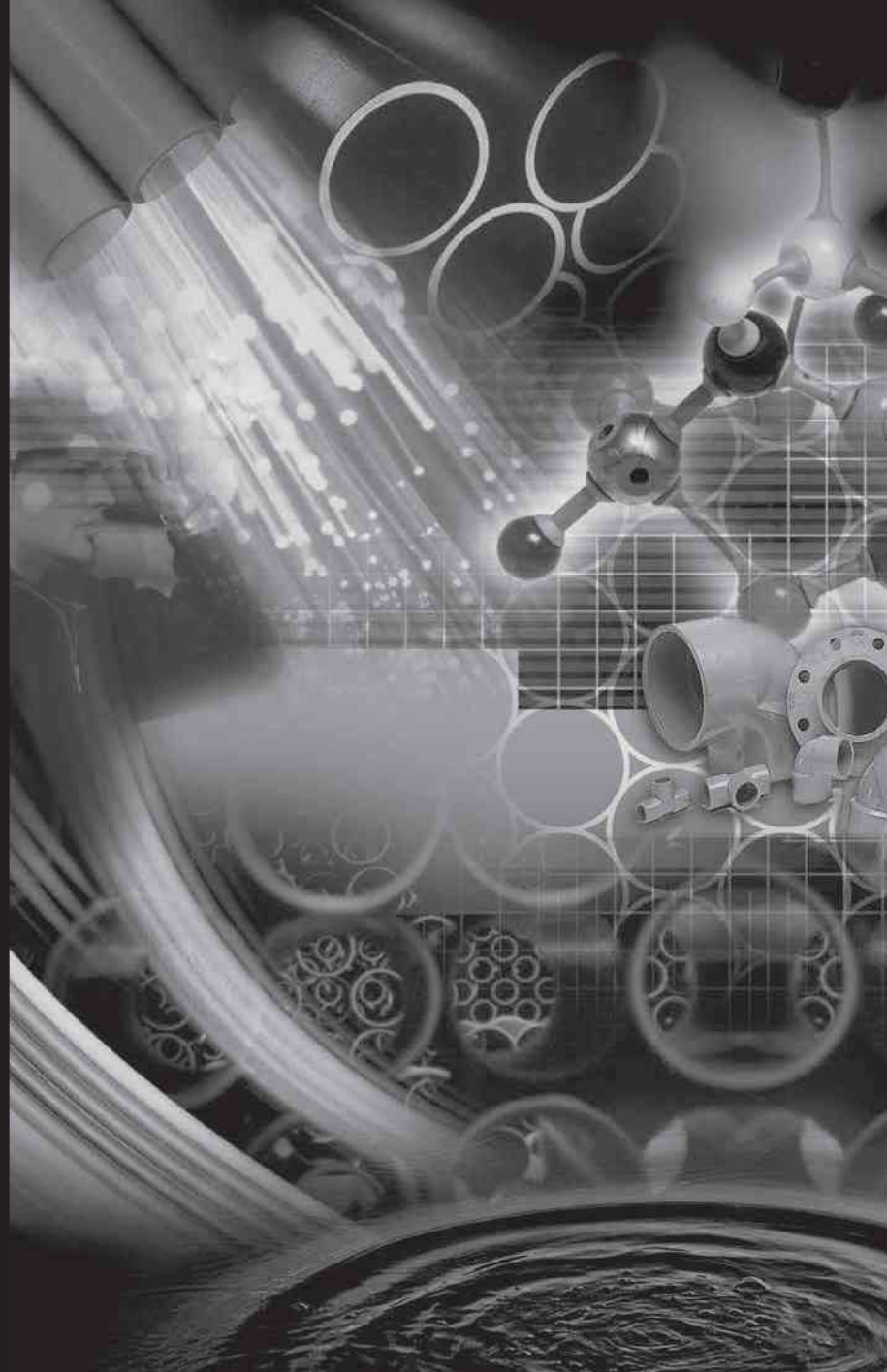


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Volume III: TEMPEST INLET CONTROL DEVICES

Municipal Technical
Manual Series



SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

MHF (Medium to High Flow) ICD



IPEX

by aliaxis

IPEX Tempest™ Inlet Control Devices

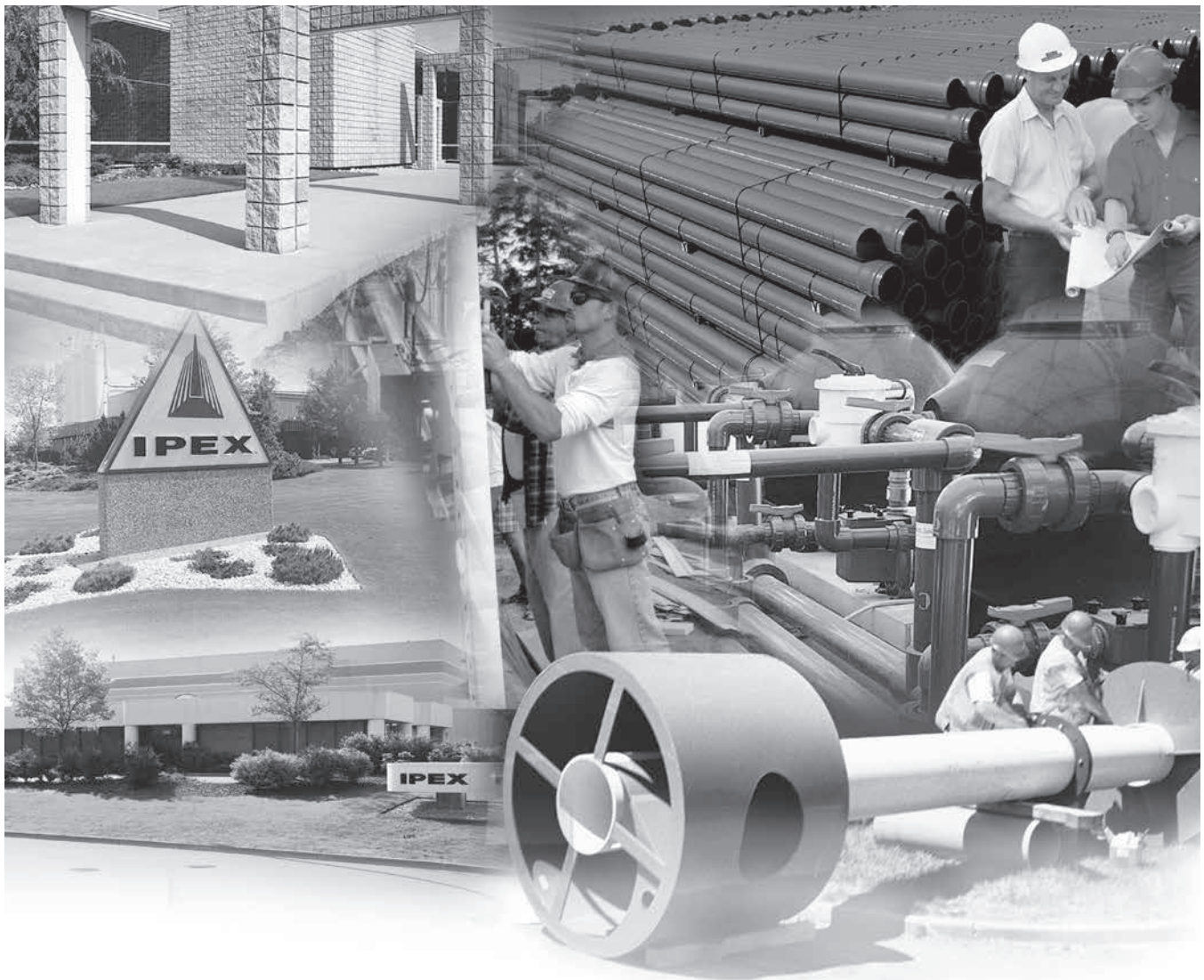
Municipal Technical Manual Series

Vol. I, 2nd Edition

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For information contact: IPEX, Marketing,
1425 North Service Road East, Oakville, Ontario, Canada, L6H 1A7

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ABOUT IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations throughout North America. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

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TEMPEST INLET CONTROL DEVICES Technical Manual

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PRODUCT INFORMATION: TEMPEST LOW, MEDIUM FLOW (LMF) ICD

Purpose

To control the amount of storm water runoff entering a sewer system by allowing a specified flow volume out of a catch basin or manhole at a specified head. This approach conserves pipe capacity so that catch basins downstream do not become uncontrollably surcharged, which can lead to basement floods, flash floods and combined sewer overflows.

Product Description

Our LMF ICD is designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter and larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 14 preset flow curves, the LMF ICD has the ability to provide flow rates: 2lps – 17lps (31gpm – 270gpm)

Product Function

The LMF ICD vortex flow action allows the LMF ICD to provide a narrower flow curve using a larger orifice than a conventional orifice plate ICD, making it less likely to clog. When comparing flows at the same head level, the LMF ICD has the ability to restrict more flow than a conventional ICD during a rain event, preserving greater sewer capacity.

Product Construction

Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

Product Applications

Will accommodate both square and round applications:

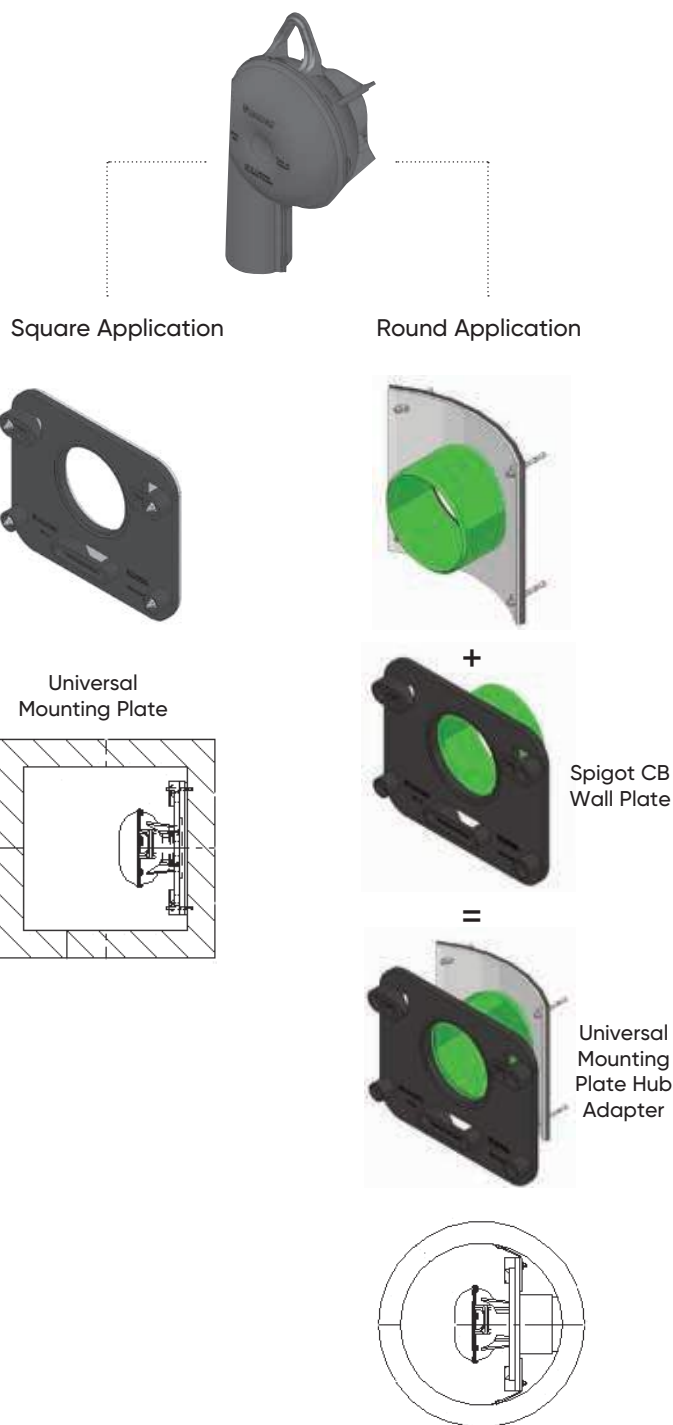


Chart 1: LMF 14 Preset Flow Curves

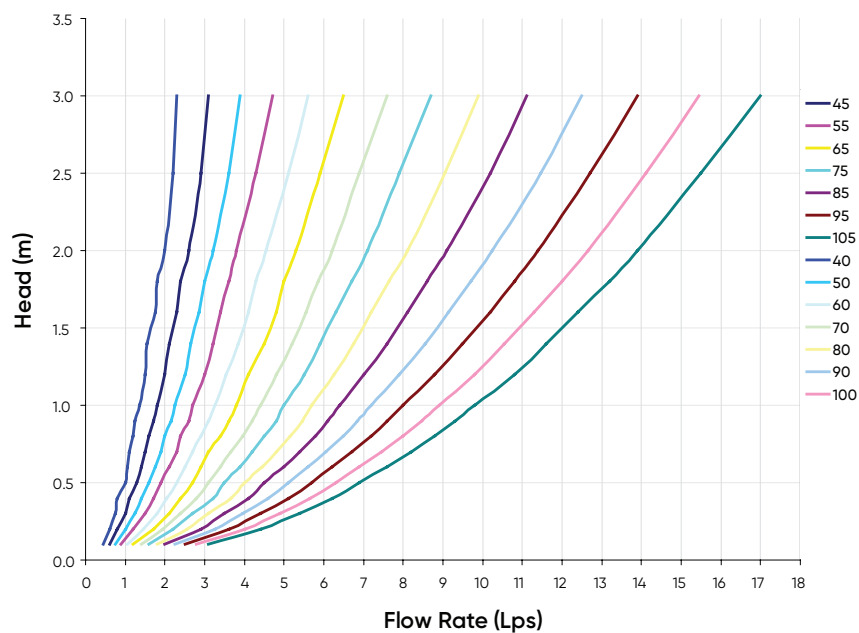
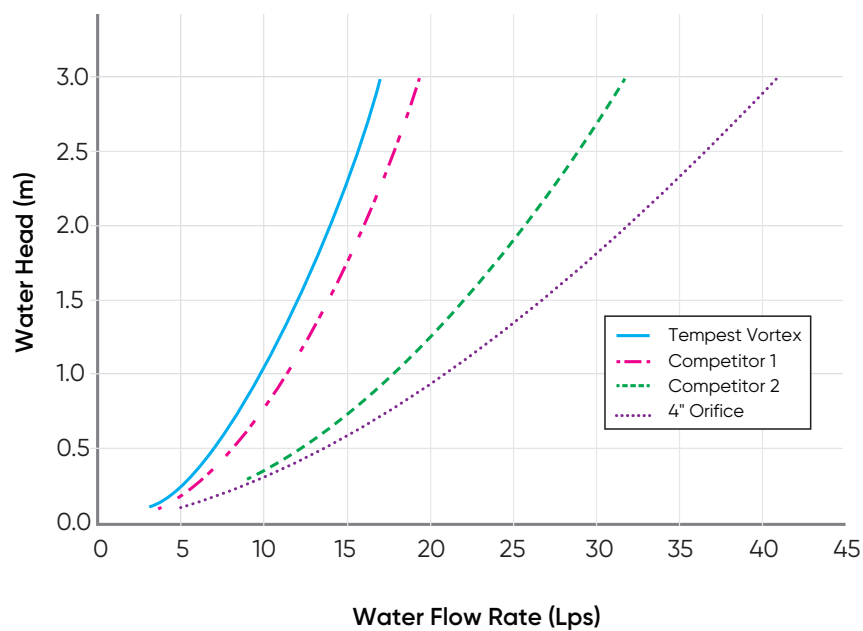


Chart 2: LMF Flow vs. ICD Alternatives



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST LMF ICD into a Square Catch Basin:

STEPS:

1. Materials and tooling verification:
 - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
 - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device.
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal mounting plate and has created a seal.



WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST LMF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
 - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
 - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the spigot catch basin wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the CB spigot wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the universal mounting plate hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the mounting plate and has created a seal.



WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut back the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at ipexna.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook will be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above must not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices will consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

Product Description

Our HF, HF Sump and MHF ICD's are designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter or larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 5 preset flow curves, these ICDs have the ability to provide constant flow rates: 9lps (143 gpm) and greater

Product Function

TEMPEST HF (High Flow): designed to manage moderate to higher flows 15 L/s (240 gpm) or greater and prevent the propagation of odour and floatables. With this device, the cross-sectional area of the device is larger than the orifice diameter and has been designed to limit head losses. The HF ICD can also be ordered without flow control when only odour and floatable control is required.

TEMPEST HF (High Flow) Sump: The height of a sewer outlet pipe in a catch basin is not always conveniently located. At times it may be located very close to the catch basin floor, not providing enough sump for one of the other TEMPEST ICDs with universal back plate to be installed. In these applications, the HF Sump is offered. The HF Sump offers the same features and benefits as the HF ICD; however, is designed to raise the outlet in a square or round catch basin structure. When installed, the HF sump is fixed in place and not easily removed. Any required service to the device is performed through a clean-out located in the top of the device which can be often accessed from ground level.

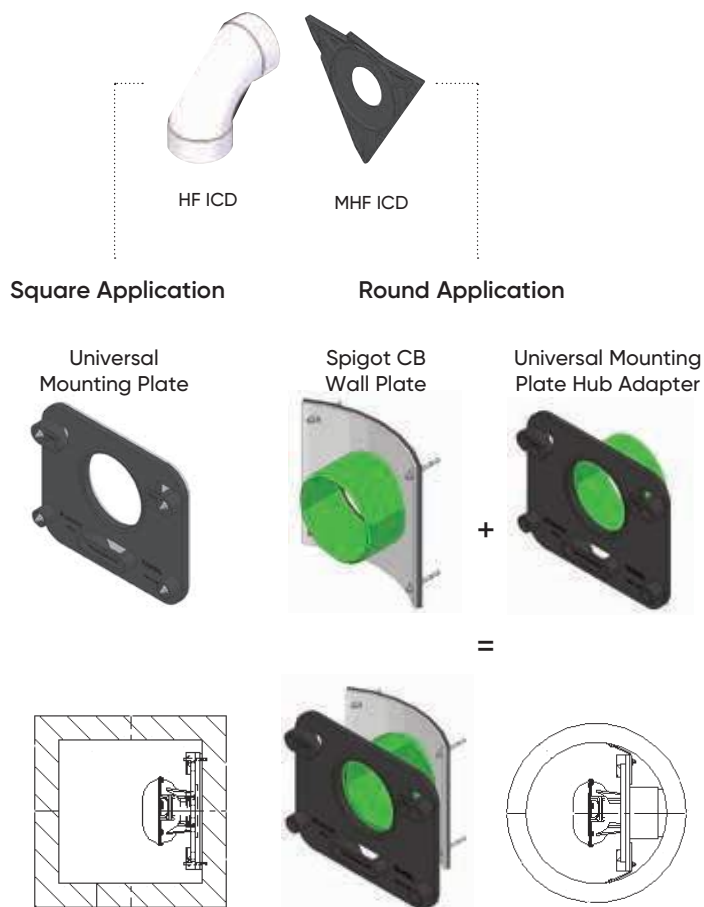
TEMPEST MHF (Medium to High Flow): The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

The HF and MHF ICD's are available to accommodate both square and round applications:



The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:

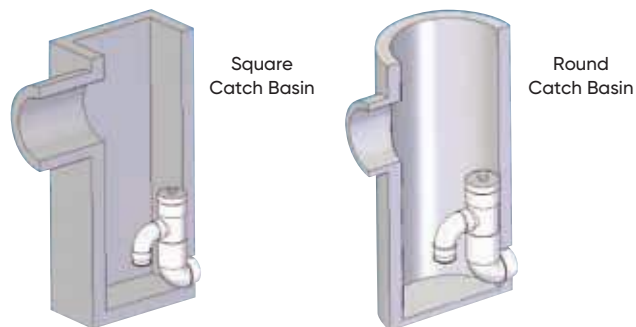
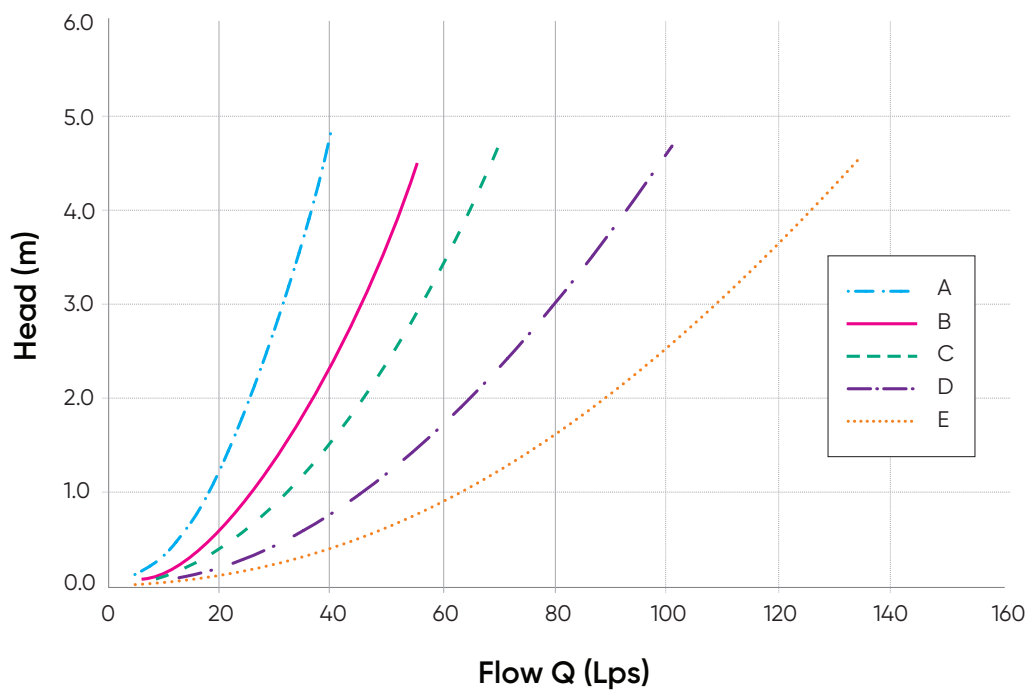


Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST HF or MHF ICD into a Square Catch Basin:

1. Materials and tooling verification:
 - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
 - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal wall mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal wall mounting plate and has created a seal.



WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF or MHF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
 - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
 - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the round catch basin spigot adaptor to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the spigot CB wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot CB wall plate and the catch basin wall.
6. Put solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the wall mounting plate and has created a seal.



WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF Sump into a Square or Round Catch Basin:

STEPS:

1. Materials and tooling verification:
 - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, mastic tape and metal strapping
 - Material: (2) concrete anchor 3/8 x 3-1/2, (2) washers, (2) nuts, HF Sump pieces (2).
2. Apply solvent cement to the spigot end of the top half of the sump. Apply solvent cement to the hub of the bottom half of the sump. Insert the spigot of the top half of the sump into the hub of the bottom half of the sump.
3. Install the 8" spigot of the device into the outlet pipe. Use the mastic tape to seal the device spigot into the outlet pipe. You should use a level to be sure that the fitting is standing at the vertical.
4. Use an impact drill with a 3/8" concrete bit to make a series of 2 holes along each side of the body throat. The depth of the hole should be between 1-1/2" to 2-1/2". Clean the concrete dust from the 2 holes.
5. Install the anchors (2) in the holes by using a hammer. Put the nuts on the top of the anchors to protect the threads when you hit the anchors. Remove the nuts from the ends of the anchors.
6. Cut the metal strapping to length and connect each end of the strapping to the anchors. Screw the nuts in place with a maximum torque of 40 N.m (30 lbf-ft). The device should be completely flush with the catch basin wall.



WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
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General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control where specified. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook shall be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above shall not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices shall consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

NOTES

SALES AND CUSTOMER SERVICE

IPEX USA LLC

Toll Free: (800) 463-9572

ipexna.com

About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
- Telecommunications and utility piping systems
- PVC, CPVC, PP, ABS, PEX, FR-PVDF and PE pipe and fittings (1/4" to 48")
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

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Tempest™ is a trademark of IPEX Branding Inc.

This literature is published in good faith and is believed to be reliable. However it does not represent and/or warrant in any manner the information and suggestions contained in this brochure. Data presented is the result of laboratory tests and field experience.

A policy of ongoing product improvement is maintained. This may result in modifications of features and/or specifications without notice.



Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/13/2024

| | | | |
|---------------------------|----------------|-------------------|----------------------|
| Province: | Ontario | Project Name: | 1319 Johnston Road |
| City: | Ottawa | Project Number: | 23034 |
| Nearest Rainfall Station: | OTTAWA CDA RCS | Designer Name: | Stephen McCaughey |
| Climate Station Id: | 6105978 | Designer Company: | Robinson Consultants |
| Years of Rainfall Data: | 20 | Designer Email: | smccaughey@rcii.com |
| | | Designer Phone: | 613-592-6060 |
| Site Name: | | EOR Name: | |
| | | EOR Company: | |
| Drainage Area (ha): | 2.86 | EOR Email: | |
| Runoff Coefficient 'c': | 0.89 | EOR Phone: | |

| | |
|-----------------------------|--------|
| Particle Size Distribution: | CA ETV |
| Target TSS Removal (%): | 60.0 |

| | |
|--|-------|
| Required Water Quality Runoff Volume Capture (%): | |
| Estimated Water Quality Flow Rate (L/s): | 82.15 |
| Oil / Fuel Spill Risk Site? | Yes |
| Upstream Flow Control? | Yes |
| Upstream Orifice Control Flow Rate to Stormceptor (L/s): | 91.10 |
| Peak Conveyance (maximum) Flow Rate (L/s): | 91.10 |
| Influent TSS Concentration (mg/L): | 150 |
| Estimated Average Annual Sediment Load (kg/yr): | 1780 |
| Estimated Average Annual Sediment Volume (L/yr): | 1447 |

Net Annual Sediment (TSS) Load Reduction Sizing Summary

| Stormceptor Model | TSS Removal Provided (%) |
|-------------------|--------------------------|
| EFO4 | 35 |
| EFO6 | 46 |
| EFO8 | 53 |
| EFO10 | 57 |
| EFO12 | 62 |

Recommended Stormceptor EFO Model: **EFO12**

Estimated Net Annual Sediment (TSS) Load Reduction (%): **62**

Water Quality Runoff Volume Capture (%): **> 90**

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

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

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

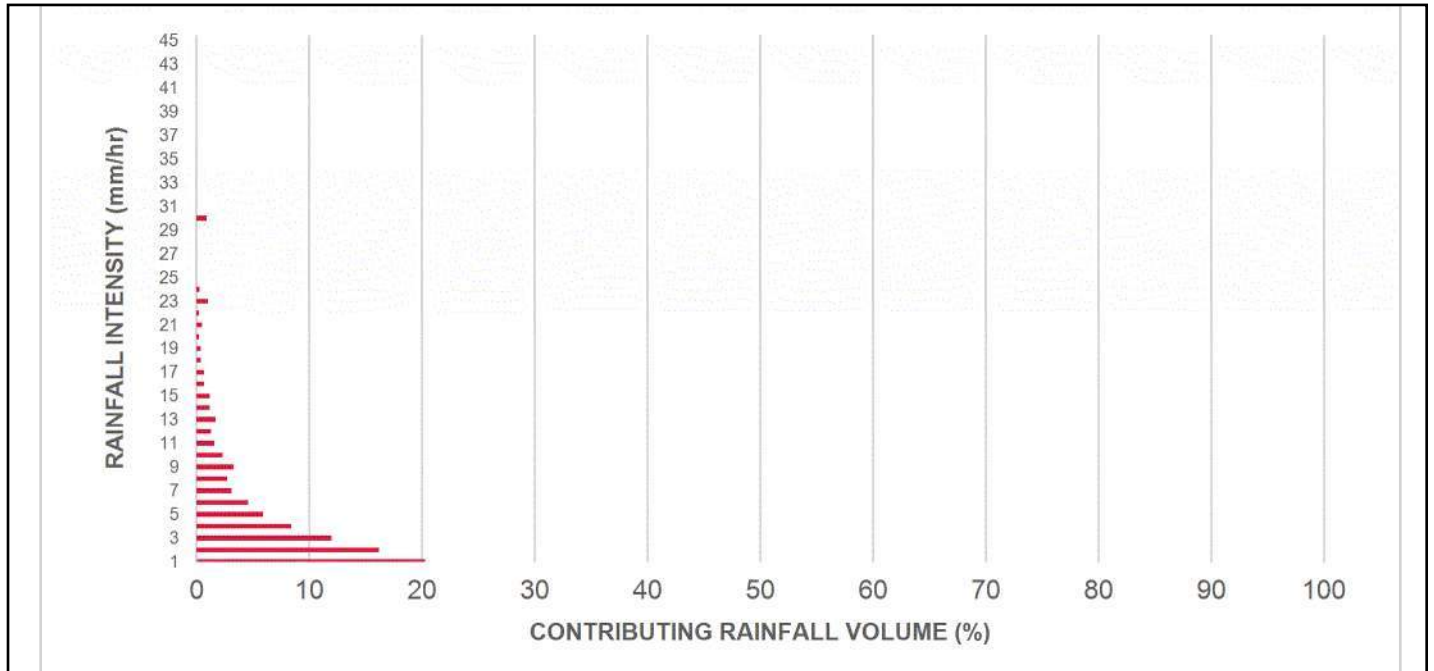
Stormceptor®EF Sizing Report

Upstream Flow Controlled Results

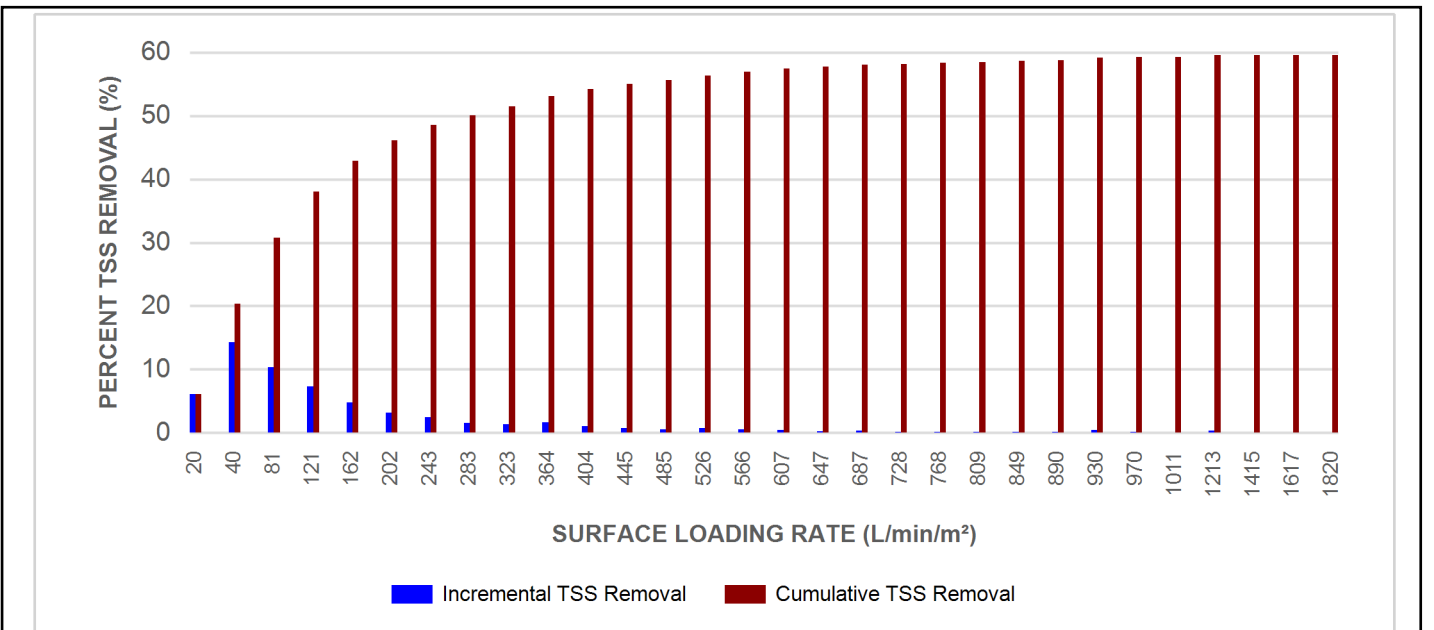
| Rainfall Intensity (mm / hr) | Percent Rainfall Volume (%) | Cumulative Rainfall Volume (%) | Flow Rate (L/s) | Flow Rate (L/min) | Surface Loading Rate (L/min/m²) | Removal Efficiency (%) | Incremental Removal (%) | Cumulative Removal (%) |
|--|-----------------------------|--------------------------------|-----------------|-------------------|---------------------------------|------------------------|-------------------------|------------------------|
| 0.50 | 8.6 | 8.6 | 3.54 | 212.0 | 17.0 | 70 | 6.1 | 6.1 |
| 1.00 | 20.3 | 29.0 | 7.08 | 425.0 | 34.0 | 70 | 14.3 | 20.4 |
| 2.00 | 16.2 | 45.2 | 14.15 | 849.0 | 68.0 | 67 | 10.9 | 31.3 |
| 3.00 | 12.0 | 57.2 | 21.23 | 1274.0 | 102.0 | 62 | 7.5 | 38.8 |
| 4.00 | 8.4 | 65.6 | 28.30 | 1698.0 | 136.0 | 60 | 5.1 | 43.8 |
| 5.00 | 5.9 | 71.6 | 35.38 | 2123.0 | 170.0 | 57 | 3.4 | 47.2 |
| 6.00 | 4.6 | 76.2 | 42.46 | 2547.0 | 204.0 | 54 | 2.5 | 49.7 |
| 7.00 | 3.1 | 79.3 | 49.53 | 2972.0 | 238.0 | 53 | 1.6 | 51.3 |
| 8.00 | 2.7 | 82.0 | 56.61 | 3397.0 | 272.0 | 52 | 1.4 | 52.7 |
| 9.00 | 3.3 | 85.3 | 63.69 | 3821.0 | 306.0 | 51 | 1.7 | 54.4 |
| 10.00 | 2.3 | 87.6 | 70.76 | 4246.0 | 340.0 | 50 | 1.1 | 55.6 |
| 11.00 | 1.6 | 89.2 | 77.84 | 4670.0 | 374.0 | 49 | 0.8 | 56.3 |
| 12.00 | 10.8 | 100.0 | 84.91 | 5095.0 | 408.0 | 48 | 5.2 | 61.5 |
| 13.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 14.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 15.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 16.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 17.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 18.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 19.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 20.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 21.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 22.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 23.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 24.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 25.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 30.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 35.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 40.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| 45.00 | 0.0 | 100.0 | 91.00 | 5460.0 | 437.0 | 47 | 0.0 | 61.5 |
| Estimated Net Annual Sediment (TSS) Load Reduction = | | | | | | | | 62 % |

Climate Station ID: 6105978 Years of Rainfall Data: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Stormceptor® EF Sizing Report

Maximum Pipe Diameter / Peak Conveyance

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

SCOUR PREVENTION AND ONLINE CONFIGURATION

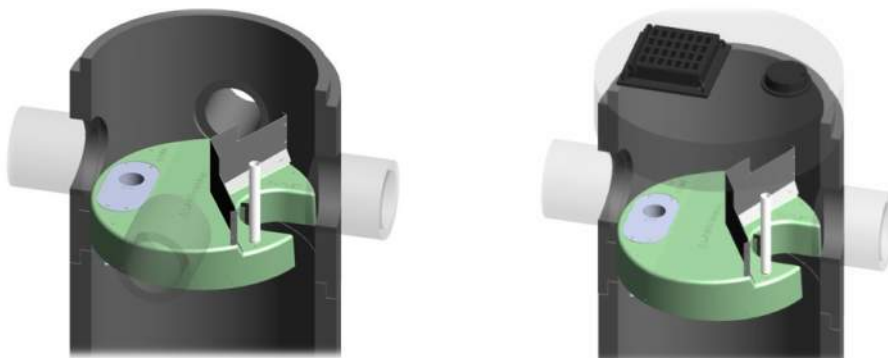
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

DESIGN FLEXIBILITY

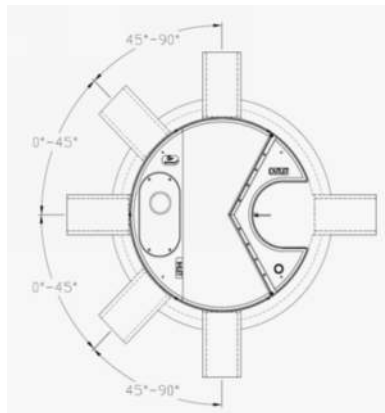
► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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



Stormceptor® EF Sizing Report



INLET-TO-OUTLET DROP

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

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

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

HEAD LOSS

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

For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

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

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

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

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

Stormceptor® EF Sizing Report

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

| SLR (L/min/m ²) | TSS % REMOVAL | SLR (L/min/m ²) | TSS % REMOVAL | SLR (L/min/m ²) | TSS % REMOVAL | SLR (L/min/m ²) | TSS % REMOVAL |
|--------------------------------|------------------|--------------------------------|------------------|--------------------------------|------------------|--------------------------------|------------------|
| 1 | 70 | 660 | 42 | 1320 | 35 | 1980 | 24 |
| 30 | 70 | 690 | 42 | 1350 | 35 | 2010 | 24 |
| 60 | 67 | 720 | 41 | 1380 | 34 | 2040 | 23 |
| 90 | 63 | 750 | 41 | 1410 | 34 | 2070 | 23 |
| 120 | 61 | 780 | 41 | 1440 | 33 | 2100 | 23 |
| 150 | 58 | 810 | 41 | 1470 | 32 | 2130 | 22 |
| 180 | 56 | 840 | 41 | 1500 | 32 | 2160 | 22 |
| 210 | 54 | 870 | 41 | 1530 | 31 | 2190 | 22 |
| 240 | 53 | 900 | 41 | 1560 | 31 | 2220 | 21 |
| 270 | 52 | 930 | 40 | 1590 | 30 | 2250 | 21 |
| 300 | 51 | 960 | 40 | 1620 | 29 | 2280 | 21 |
| 330 | 50 | 990 | 40 | 1650 | 29 | 2310 | 21 |
| 360 | 49 | 1020 | 40 | 1680 | 28 | 2340 | 20 |
| 390 | 48 | 1050 | 39 | 1710 | 28 | 2370 | 20 |
| 420 | 47 | 1080 | 39 | 1740 | 27 | 2400 | 20 |
| 450 | 47 | 1110 | 38 | 1770 | 27 | 2430 | 20 |
| 480 | 46 | 1140 | 38 | 1800 | 26 | 2460 | 19 |
| 510 | 45 | 1170 | 37 | 1830 | 26 | 2490 | 19 |
| 540 | 44 | 1200 | 37 | 1860 | 26 | 2520 | 19 |
| 570 | 43 | 1230 | 37 | 1890 | 25 | 2550 | 19 |
| 600 | 42 | 1260 | 36 | 1920 | 25 | 2580 | 18 |
| 630 | 42 | 1290 | 36 | 1950 | 24 | 2600 | 26 |

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

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

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

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

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

Stormceptor® EF Sizing Report

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

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m² to 1400 L/min/m², and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m² and 1400 L/min/m² shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m².

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m².

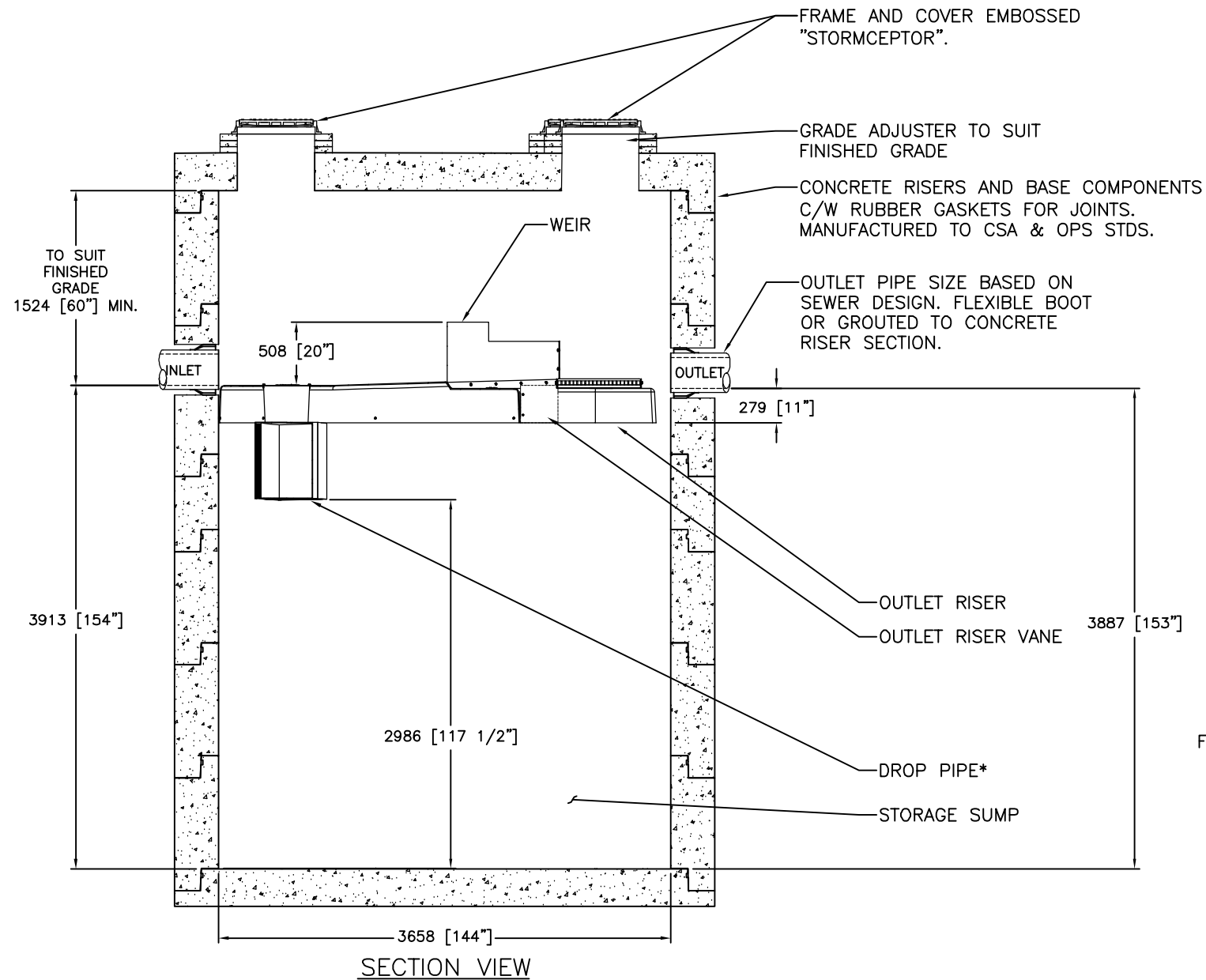
3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

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

Stormceptor® EF Sizing Report

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m² to 2600 L/min/m²) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.



GENERAL NOTES:

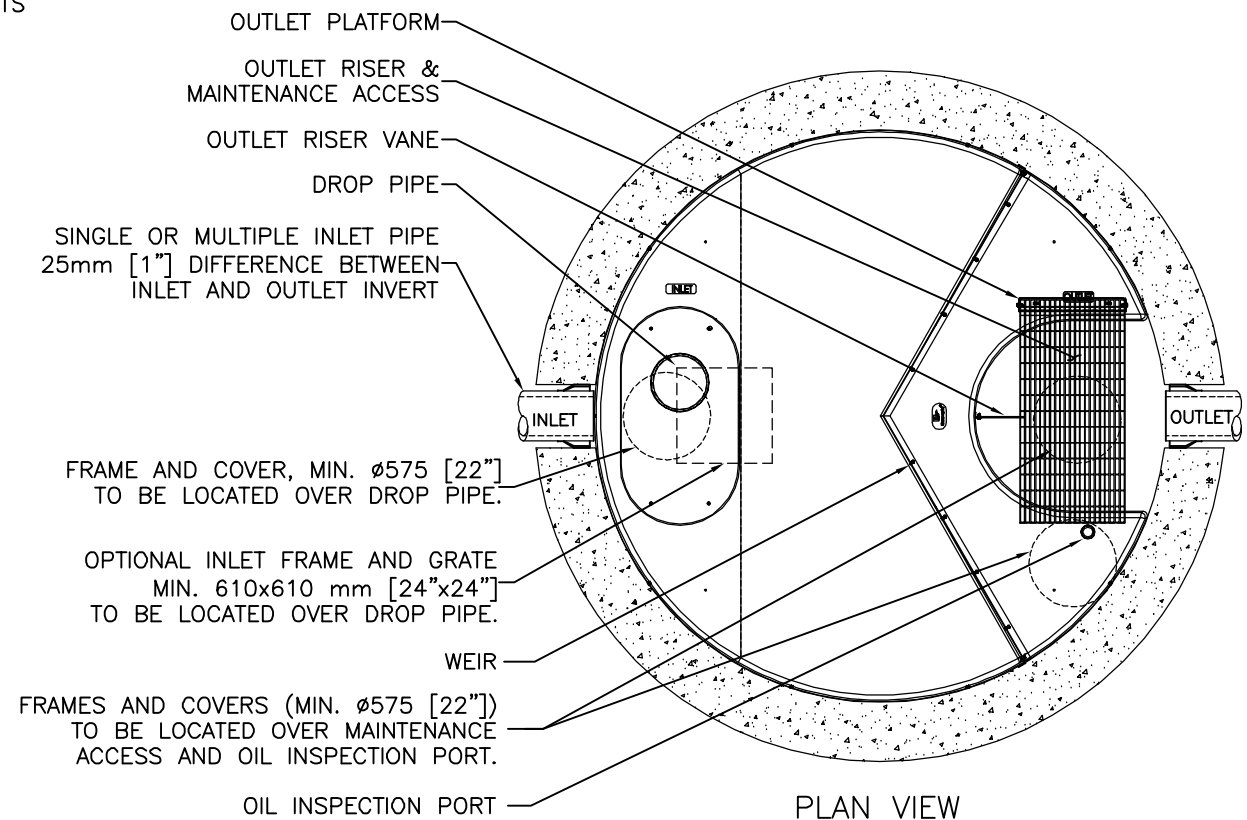
* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m² (27.9 gpm/ft²) FOR STORMCEPTOR EF12 AND 535 L/min/m² (13.1 gpm/ft²) FOR STORMCEPTOR EFO12 (OIL CAPTURE CONFIGURATION).

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

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

INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
- C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
- D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.



SITE SPECIFIC DATA REQUIREMENTS

| | | | | | |
|----------------------------------|------|-------|-------|---------|-----|
| STORMCEPTOR MODEL | | | EFO12 | | |
| STRUCTURE ID | | | | * | |
| HYDROCARBON STORAGE REQ'D (L) | | | | * | |
| WATER QUALITY FLOW RATE (L/s) | | | | * | |
| PEAK FLOW RATE (L/s) | | | | * | |
| RETURN PERIOD OF PEAK FLOW (yrs) | | | | * | |
| DRAINAGE AREA (HA) | | | | * | |
| DRAINAGE AREA IMPERVIOUSNESS (%) | | | | * | |
| PIPE DATA: | I.E. | MAT'L | DIA | SLOPE % | HGL |
| INLET #1 | * | * | * | * | * |
| INLET #2 | * | * | * | * | * |
| OUTLET | * | * | * | * | * |

* PER ENGINEER OF RECORD

The design and information shown on the drawing is provided as a service to the project owner, engineer and contractor by Inhibium Systems ("Inhibium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the written consent of Inhibium. Inhibium is not liable for any claims, damages, losses or costs, including attorney's fees, that are done at the user's own risk and Inhibium expressly disclaims any liability or responsibility for such use.

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| MARK | DATE | REVISION DESCRIPTION | BY |
|------|---------|----------------------|------|
| 0 | 5/26/17 | INITIAL RELEASE | JSK |
| 1 | 6/8/18 | OUTLET PLATFORM | JSK |
| #### | #### | #### | #### |
| #### | #### | #### | #### |
| #### | #### | #### | #### |

Stormceptor® EF

0216



| | |
|-----------------------|--------------------|
| DATE: 10/24/2017 | |
| DESIGNED: JSK | DRAWN: JSK |
| CHECKED: BSF | APPROVED: SP |
| PROJECT No.: EFO12 | SEQUENCE No.: * |
| SHEET: 1 OF 1 | |

STANDARD DETAIL
NOT FOR CONSTRUCTION

Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

03/13/2024

| | | | |
|---------------------------|----------------|-------------------|----------------------|
| Province: | Ontario | Project Name: | 1319 Johnston Road |
| City: | Ottawa | Project Number: | 23034 |
| Nearest Rainfall Station: | OTTAWA CDA RCS | Designer Name: | Stephen McCaughey |
| Climate Station Id: | 6105978 | Designer Company: | Robinson Consultants |
| Years of Rainfall Data: | 20 | Designer Email: | smccaughey@rcii.com |
| | | Designer Phone: | 613-592-6060 |
| Site Name: | | EOR Name: | |
| | | EOR Company: | |
| Drainage Area (ha): | 0.78 | EOR Email: | |
| Runoff Coefficient 'c': | 0.83 | EOR Phone: | |

| | |
|-----------------------------|--------|
| Particle Size Distribution: | CA ETV |
| Target TSS Removal (%): | 60.0 |

| | |
|--|-------|
| Required Water Quality Runoff Volume Capture (%): | |
| Estimated Water Quality Flow Rate (L/s): | 20.90 |
| Oil / Fuel Spill Risk Site? | Yes |
| Upstream Flow Control? | Yes |
| Upstream Orifice Control Flow Rate to Stormceptor (L/s): | 8.70 |
| Peak Conveyance (maximum) Flow Rate (L/s): | 8.70 |
| Influent TSS Concentration (mg/L): | 200 |
| Estimated Average Annual Sediment Load (kg/yr): | 581 |
| Estimated Average Annual Sediment Volume (L/yr): | 473 |

Net Annual Sediment (TSS) Load Reduction Sizing Summary

| Stormceptor Model | TSS Removal Provided (%) |
|-------------------|--------------------------|
| EFO4 | 54 |
| EFO6 | 62 |
| EFO8 | 66 |
| EFO10 | 69 |
| EFO12 | 70 |

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 62

Water Quality Runoff Volume Capture (%): > 90

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

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

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

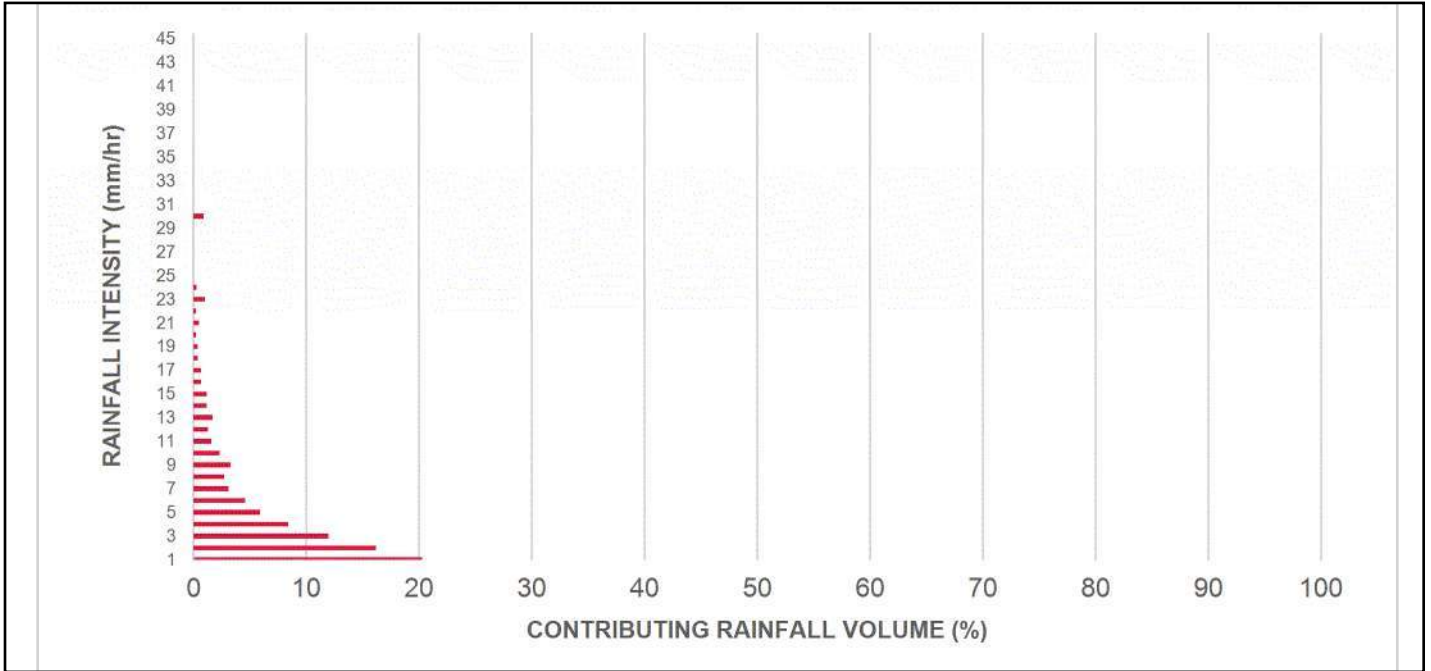
Stormceptor®EF Sizing Report

Upstream Flow Controlled Results

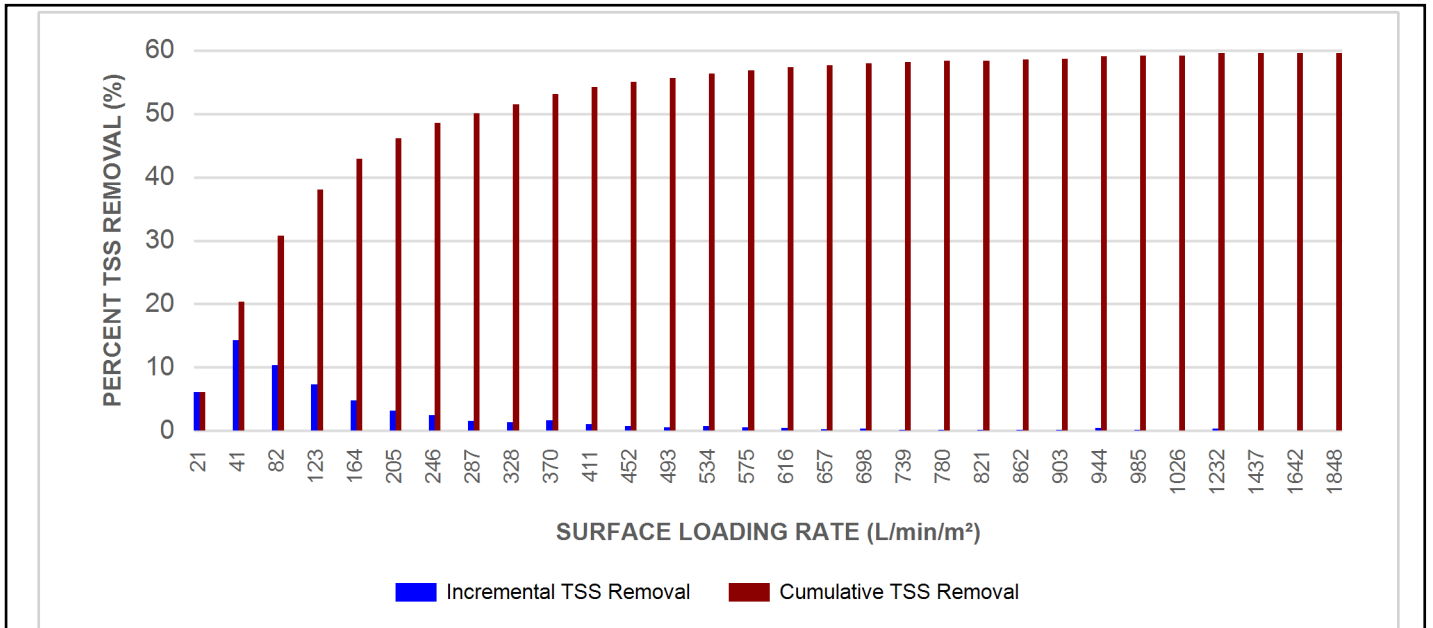
| Rainfall Intensity (mm / hr) | Percent Rainfall Volume (%) | Cumulative Rainfall Volume (%) | Flow Rate (L/s) | Flow Rate (L/min) | Surface Loading Rate (L/min/m²) | Removal Efficiency (%) | Incremental Removal (%) | Cumulative Removal (%) |
|--|-----------------------------|--------------------------------|-----------------|-------------------|---------------------------------|------------------------|-------------------------|------------------------|
| 0.50 | 8.6 | 8.6 | 0.90 | 54.0 | 21.0 | 70 | 6.1 | 6.1 |
| 1.00 | 20.3 | 29.0 | 1.80 | 108.0 | 41.0 | 70 | 14.3 | 20.4 |
| 2.00 | 16.2 | 45.2 | 3.60 | 216.0 | 82.0 | 64 | 10.4 | 30.8 |
| 3.00 | 12.0 | 57.2 | 5.40 | 324.0 | 123.0 | 61 | 7.3 | 38.0 |
| 4.00 | 8.4 | 65.6 | 7.20 | 432.0 | 164.0 | 57 | 4.8 | 42.9 |
| 5.00 | 34.4 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 18.6 | 61.5 |
| 6.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 7.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 8.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 9.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 10.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 11.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 12.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 13.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 14.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 15.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 16.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 17.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 18.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 19.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 20.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 21.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 22.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 23.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 24.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 25.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 30.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 35.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 40.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| 45.00 | 0.0 | 100.0 | 9.00 | 540.0 | 205.0 | 54 | 0.0 | 61.5 |
| Estimated Net Annual Sediment (TSS) Load Reduction = | | | | | | | | 61 % |

Climate Station ID: 6105978 Years of Rainfall Data: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Stormceptor® EF Sizing Report

Maximum Pipe Diameter / Peak Conveyance

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

SCOUR PREVENTION AND ONLINE CONFIGURATION

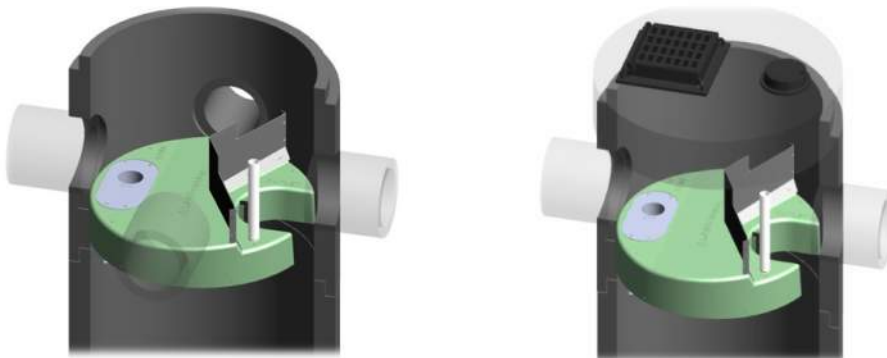
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

DESIGN FLEXIBILITY

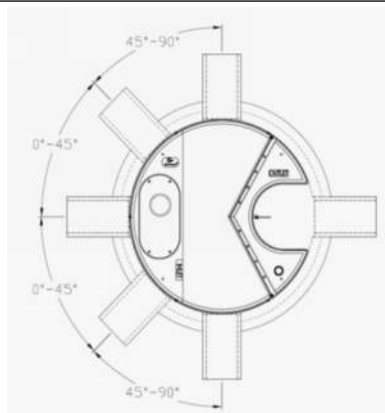
► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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



Stormceptor® EF Sizing Report



INLET-TO-OUTLET DROP

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

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

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

HEAD LOSS

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

For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

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

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

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

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

Stormceptor® EF Sizing Report

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

| SLR (L/min/m ²) | TSS % REMOVAL | SLR (L/min/m ²) | TSS % REMOVAL | SLR (L/min/m ²) | TSS % REMOVAL | SLR (L/min/m ²) | TSS % REMOVAL |
|--------------------------------|------------------|--------------------------------|------------------|--------------------------------|------------------|--------------------------------|------------------|
| 1 | 70 | 660 | 42 | 1320 | 35 | 1980 | 24 |
| 30 | 70 | 690 | 42 | 1350 | 35 | 2010 | 24 |
| 60 | 67 | 720 | 41 | 1380 | 34 | 2040 | 23 |
| 90 | 63 | 750 | 41 | 1410 | 34 | 2070 | 23 |
| 120 | 61 | 780 | 41 | 1440 | 33 | 2100 | 23 |
| 150 | 58 | 810 | 41 | 1470 | 32 | 2130 | 22 |
| 180 | 56 | 840 | 41 | 1500 | 32 | 2160 | 22 |
| 210 | 54 | 870 | 41 | 1530 | 31 | 2190 | 22 |
| 240 | 53 | 900 | 41 | 1560 | 31 | 2220 | 21 |
| 270 | 52 | 930 | 40 | 1590 | 30 | 2250 | 21 |
| 300 | 51 | 960 | 40 | 1620 | 29 | 2280 | 21 |
| 330 | 50 | 990 | 40 | 1650 | 29 | 2310 | 21 |
| 360 | 49 | 1020 | 40 | 1680 | 28 | 2340 | 20 |
| 390 | 48 | 1050 | 39 | 1710 | 28 | 2370 | 20 |
| 420 | 47 | 1080 | 39 | 1740 | 27 | 2400 | 20 |
| 450 | 47 | 1110 | 38 | 1770 | 27 | 2430 | 20 |
| 480 | 46 | 1140 | 38 | 1800 | 26 | 2460 | 19 |
| 510 | 45 | 1170 | 37 | 1830 | 26 | 2490 | 19 |
| 540 | 44 | 1200 | 37 | 1860 | 26 | 2520 | 19 |
| 570 | 43 | 1230 | 37 | 1890 | 25 | 2550 | 19 |
| 600 | 42 | 1260 | 36 | 1920 | 25 | 2580 | 18 |
| 630 | 42 | 1290 | 36 | 1950 | 24 | 2600 | 26 |

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

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

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

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

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

Stormceptor® EF Sizing Report

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

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m² to 1400 L/min/m², and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m² and 1400 L/min/m² shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m².

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m².

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

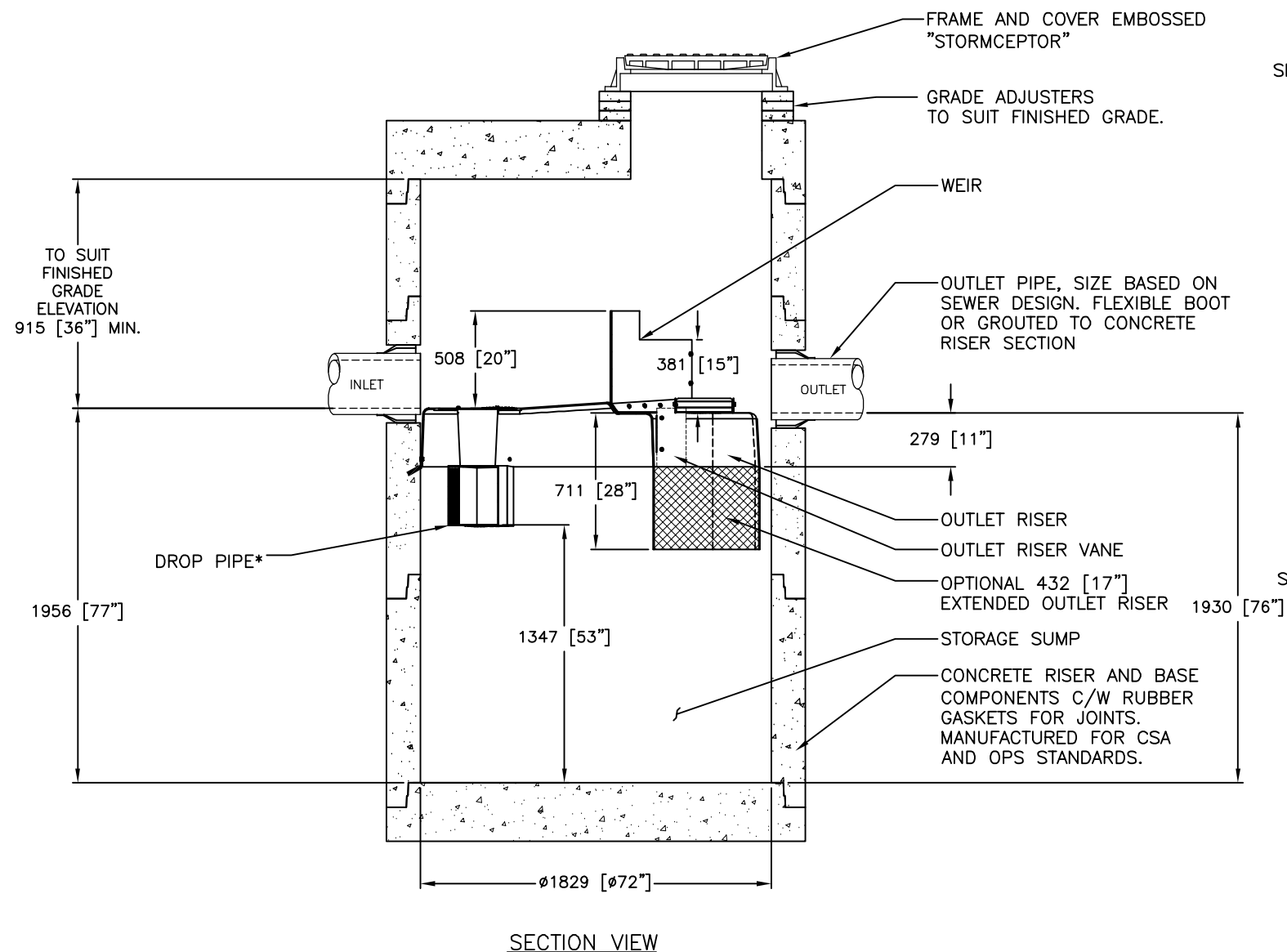
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators**, with results reported within the Canadian ETV or ISO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

Stormceptor® EF Sizing Report

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m² to 2600 L/min/m²) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

\\NIMBRIUM\PRODUCTS\STORMCEPTOR EF40 DRAWINGS & DETAILS\STANDARD DETAILS\EFO8-DETAIL.DWG 4/12/2019 11:05 AM



GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m² (27.9 gpm/ft²) FOR STORMCEPTOR EF6 AND 535 L/min/m² (13.1 gpm/ft²) FOR STORMCEPTOR EFO6 (OIL CAPTURE CONFIGURATION).

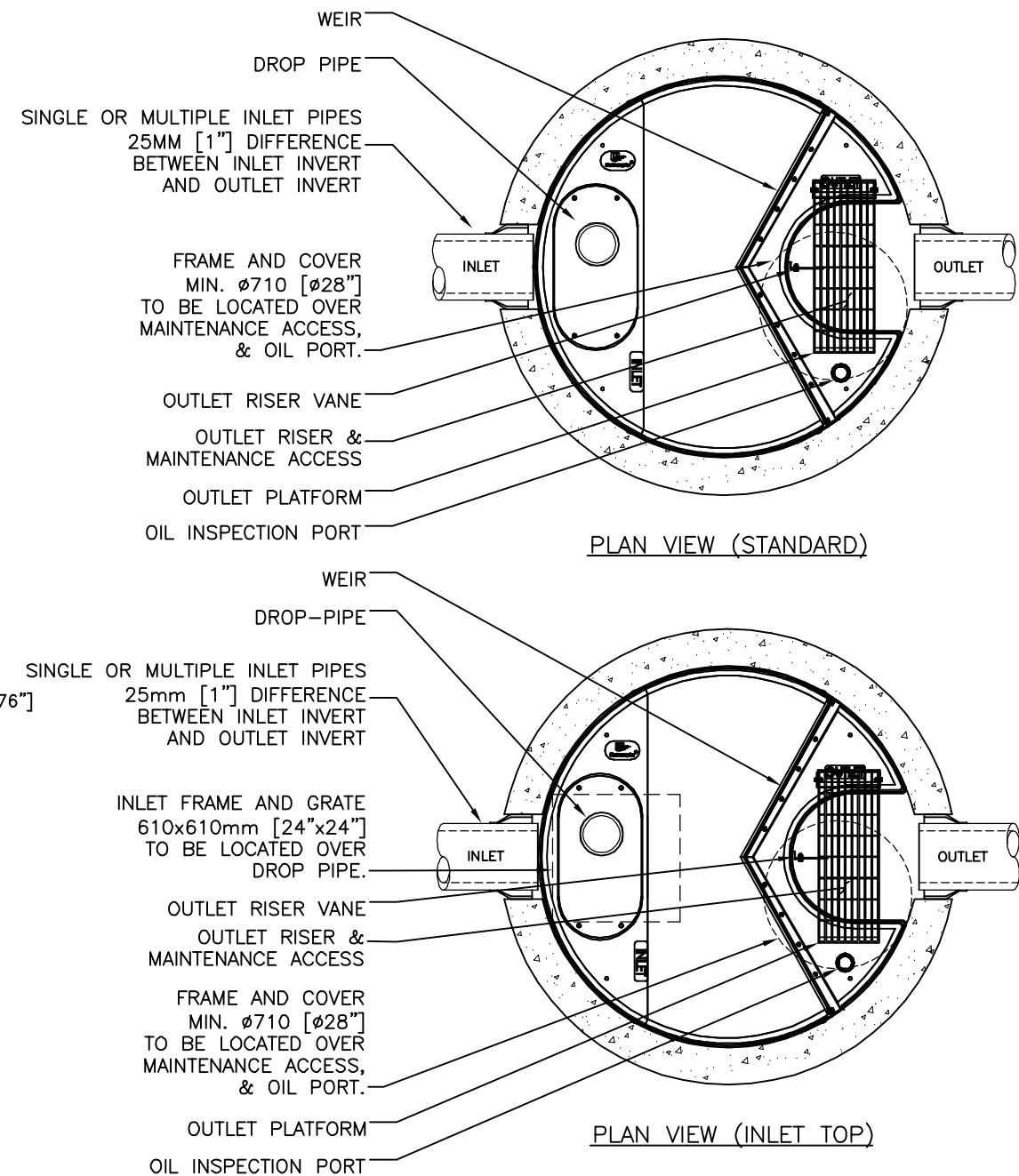
1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES,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

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

INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
- C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
- D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

STANDARD DETAIL
NOT FOR CONSTRUCTION



SITE SPECIFIC DATA REQUIREMENTS

| | | | | | |
|----------------------------------|------|-------|-----|---------|-----|
| STORMCEPTOR MODEL | | EFO6 | | | |
| STRUCTURE ID | | | | | * |
| HYDROCARBON STORAGE REQ'D (L) | | | | | * |
| WATER QUALITY FLOW RATE (L/s) | | | | | * |
| PEAK FLOW RATE (L/s) | | | | | * |
| RETURN PERIOD OF PEAK FLOW (yrs) | | | | | * |
| DRAINAGE AREA (HA) | | | | | * |
| DRAINAGE AREA IMPERVIOUSNESS (%) | | | | | * |
| PIPE DATA: | I.E. | MAT'L | DIA | SLOPE % | HGL |
| INLET #1 | * | * | * | * | * |
| INLET #2 | * | * | * | * | * |
| OUTLET | * | * | * | * | * |

* PER ENGINEER OF RECORD

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Inbrium Systems ("Inbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the express written consent of Inbrium. Inbrium hereby disclaims any liability or responsibility for such use, and any discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered in the course of the project. These conditions are the sole responsibility of the contractor. Inbrium is not responsible for re-evaluation of the design. Inbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

| | | | | |
|------|----------|----------------------|------|------|
| #### | #### | #### | #### | #### |
| #### | #### | #### | #### | #### |
| #### | #### | #### | #### | #### |
| 1 | 6/8/18 | OUTLET PLATFORM | JSK | JSK |
| 0 | 05/26/17 | INITIAL RELEASE | JSK | JSK |
| MARK | DATE | REVISION DESCRIPTION | BY | |

0216

Stormceptor® EF

[illegible]

| | |
|----------------------|--------------------|
| DATE: 10/13/2017 | |
| DESIGNED: JSK | DRAWN: JSK |
| CHECKED: BSF | APPROVED: SP |
| PROJECT No.: EFO6 | SEQUENCE No.: * |
| SHEET: 1 OF 1 | |