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39 Years

Queensway-Carleton Hospital Overall Campus Part 4 Expansion

Stormwater Management Report

QUEENSWAY CARLETON HOSPITAL
PART 4 EXPANSION

STORMWATER MANAGEMENT REPORT

Prepared by:

NOVATECH
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November 28, 2025
Revised September 25, 2026

Ref: R-2025-085
Novatech File No. 123089

NOVATECH
Engineers, Planners & Landscape Architects

September 25, 2026

Parkin Architects Limited
200 Laurier Avenue West, 3rd floor
Ottawa, Ontario
K1P 6M7

Attention: **Derek Judson**

Re: **Queensway Carleton Hospital: Part 4 Expansion**
Stormwater Management Report
3045 Baseline Road, Ottawa, ON
Novatech File No.: 123089

Enclosed is a copy of the revised Stormwater Management Report prepared for the proposed Queensway Carleton Hospital: Part 4 Expansion located at 3045 Baseline Road. This report addresses the approach to on-site stormwater management and is submitted in support of the Site Plan Control (SPC) application.

Please contact the undersigned, should you have any questions or require additional information.

NOVATECH

François Thauvette, P. Eng.
Senior Project Manager

cc: Sue Sallaj Ginn (QCH)
Mohammed Fawzi (City of Ottawa)
Daniel Vancek (VR Eng.)
Linda Rutherford (VR Eng.)

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Civil Notes, Details & Tables (123089-NDT)

1.0 INTRODUCTION

The Queensway-Carleton Hospital (QCH) is undergoing another facility expansion to meet the growing demands of the Greater Ottawa community. The proposed Part 4 expansion will include new Hospital buildings, building expansions and renovations, the construction of a new multi-storey parking garage, the extension of the Ring Road along the west side of the campus, internal roadway re-alignments as well as parking lot modifications. The QCH has retained Novatech to complete the site servicing, grading, and stormwater management design for this proposed expansion phase. As part of the proposed works, the existing infrastructure systems (i.e., sewers, watermains and utilities) are being reviewed and upgraded to meet the needs of the Part 4 campus expansion, while also considering future Master Plan expansion phases. One of the central objectives is to upgrade the storm sewers and to ensure they will be relocated where they will not be impacted by future development phases. Another important goal is to ensure the overall sequencing of the work will minimize disruptions to Hospital operations during construction. This report addresses the approach to stormwater management (SWM) on the QCH campus and is being submitted in support of the Site Plan Control (SPC) application.

1.1 Statement from the Licensed Engineering Practitioners

Based on the information provided to us, the information in this report is accurate as of the date it is signed and sealed. The information included in this report considers the results of the site assessment conducted in respect of the catchment area of the storm water management works. All proposed works are designed in a manner that will mitigate any adverse impacts to both the proposed and surrounding properties.



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Project Manager | Water Resources

1.2 Statement from the Owner

All information provided to the licensed engineering practitioner, for the purpose of preparing the following report, is complete and accurate to the best of my knowledge.

Sue Sallaj Ginn, B.Sc. Geo Eng., PMP
Queensway Carleton Hospital
Chief Planning Officer & Director

2.0 GENERAL INFORMATION

The Queensway-Carleton Hospital is located at 3045 Baseline Road and situated on a 20.2-hectare property administered by the National Capital Commission (NCC). The site's north-western entrance off Richmond Road and south-eastern entrance off Baseline Road are connected by John Sutherland Drive. Residential properties and Highway 416 border the subject site to the north-east and south-west,

respectively. The legal description of the property is designated as Part of Lot 16, Concession 2 (O.F.), Geographic Township of Nepean, City of Ottawa. Refer to **Figure 1** for an aerial view of the QCH campus.

Figure 1 - Aerial View of the Subject Site



Image Source: geoOttawa (City of Ottawa)

First constructed in the mid 1970s, the Hospital campus has undergone several facility expansions, including various building additions and parking lot modifications. A brief overview of the past QCH expansion projects is as follows:

- The 1998 expansion phase included a small Hospital addition and construction of the Ring Road on the west side of the campus as well as the construction of several parking lots. Portions of the existing storm sewer and watermain were also replaced to accommodate the Hospital expansion as well as anticipated future developments. The increased flow was mitigated using controlled flow roof drains and inlet control devices (ICDs) located within the storm sewer system in the parking lots. A Stormceptor STC 4000 was installed to provide water quality control prior to discharging the stormwater runoff into the existing ditch along the west property line.
- In 2003, the expansion phase included the construction of the Emergency building on the east side of the Hospital, a new parking lot in the northwest corner of the campus, and the reconfiguration of some existing parking lots. Similarly, the increased flow was mitigated using controlled flow roof drains and ICDs located within the storm sewer system in the various parking lots. Based on this report, the existing Stormceptor STC 4000 was determined to be at capacity for the campus.
- In 2005, the Operations Room (OR) addition was constructed as well as the removal of some of the existing storm sewers within the loading dock area. The increased flow was to be mitigated using controlled flow roof drains.
- In 2008, the expansion phase included construction of a Power Plan addition, Cancer Centre, multi-level parking structure, and surface parking lots on the north side of the campus. A new on-site sanitary pump station including twin forcemains were also constructed in response to capacity concerns within the Graham Creek Sanitary Sewer, with most campus sanitary flows being re-directed to the Lynwood Sanitary Collector south of Baseline Road. Portions of the

existing storm sewer and watermain were also replaced to accommodate the Hospital expansion. Underground super-pipes were constructed within the new paved parking areas to provide storage for stormwater management purposes. Also included in the works was the installation of a new Stormceptor STC 9000 replacing the existing Stormceptor STC 4000.

- The 2012 expansion phase included construction of a Surgical Centre addition, MRI Centre, and Main Entry building, as well as modifications to the alignment of the Ring Road on the west side of the campus. Additionally, portions of the existing storm sewer and watermain were replaced to accommodate the proposed Hospital expansion.
- In 2023, the Mental Health Wing, located within the southwest portion of the campus, was expanded and includes control flow roof drains as part of the overall campus SWM strategy.

2.1 Pre-Consultation Information

A pre-consultation meeting was held with the City of Ottawa on May 23, 2024, at which time the QCH was advised of the general submission requirements. Subsequent meetings were held with the National Capital Commission (NCC) and City staff to further discuss the project and approach to site servicing, drainage, and stormwater management. Refer to **Appendix A** for a summary of the correspondence related to the proposed development.

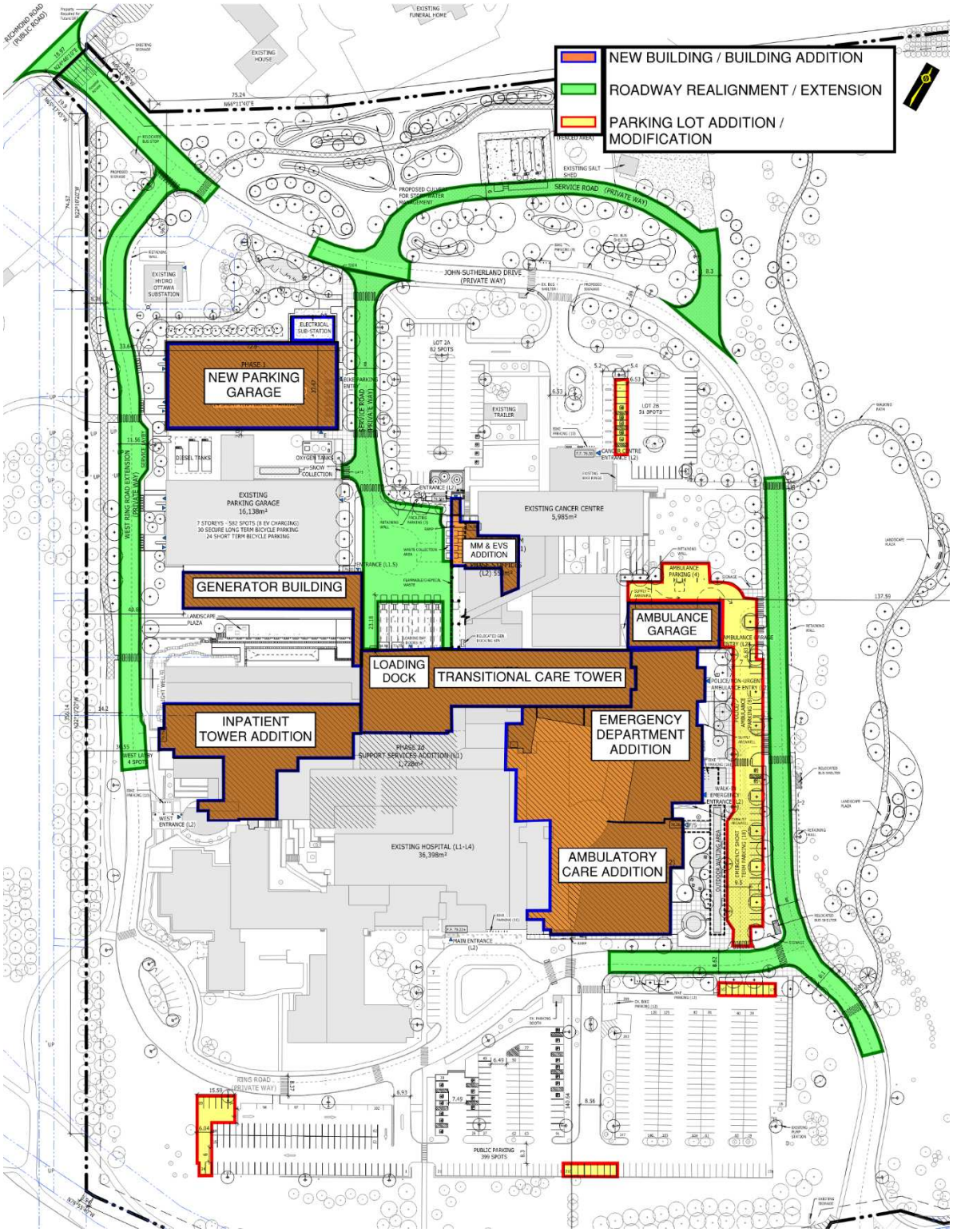
The subject site is located within the jurisdiction of the Rideau Valley Conservation Authority (RVCA). Based on feedback from the City of Ottawa, on-site stormwater management, including both quantity and quality control measures, will be required. The proposed development will be required to meet a *'Normal'* Level of treatment for stormwater quality treatment (i.e., 70% long-term TSS removal) prior to releasing flows from the developed portion of the campus. An amendment to the existing QCH stormwater management Certificate of Approval (C of A) No. 6601-8B8MMR is also anticipated to be required due to the proposed modifications to the on-site stormwater management system. Refer to **Appendix E** for a copy of the existing C of A.

2.2 Proposed Development within the Site Catchment Area

The proposed Part 4 expansion will include new medical facilities and ancillary buildings, including an Ambulance Garage, Generator building, Electrical Sub-Station, Materials Management & Environmental Services (MM & EVS) building, and Loading Docks adjacent to the Materials Management addition. The proposed works will also include building additions and renovations at the Emergency Department, Ambulatory Care, Inpatient Tower and Transitional Care Tower. The increased demand for on-site parking will be provided by the construction of a new Multi-Storey Parking Garage as well as modifications to the various surface parking lots on the QCH campus. Proposed roadwork includes the extension of the west Ring Road as well as the re-alignment of the central loading dock area and portions of John Sutherland Drive.

As part of the proposed storm drainage and stormwater management works, the existing infrastructure (i.e., storm sewers) are being reviewed, and certain portions are being upgraded. Portions of the existing private sewer system will be removed and realigned, while new segments will be extended to accommodate the new buildings, roadways and parking lot modifications. New storm sewer works will be required along the west Ring Road extension, within the loading dock area, below the new Emergency building expansion, along the realigned portion of the John Sutherland Drive as well as within the northern portion of the campus. The proposed development will be phased appropriately to ensure minimal disruptions to the Hospital's operations during construction. Refer to **Figure 2** for new building locations and proposed roadworks within the QCH campus.

Figure 2 - New Buildings and Roadway Locations



2.3 Reference Material and Site Catchment Area Assessment

The following design guidelines have been used to establish the servicing and stormwater management requirements for the proposed development:

- Ottawa Sewer Design Guidelines (2025)
- Ministry of the Environment Design Guidelines for Sewage Works (2008)
- Ministry of the Environment Design Guidelines for Drinking Water Systems (2008)

The following reports and studies were reviewed and/or prepared as part of the site assessment for the subject property:

[1] Queensway-Carleton Hospital Stormwater Management Report, prepared by Novatech Engineering Consultants Ltd., dated October 1998.

[2] Queensway-Carleton Hospital Stormwater Management Report, prepared by Ainley Group, dated May 2003.

[3] Queensway-Carleton Hospital Stormwater Management Report, prepared by IBI Group, dated May 2005.

[4] Queensway-Carleton Hospital Overall Campus – Cancer Centre Addition Stormwater Management Report, prepared by Novatech Engineering Consultants Ltd., dated March 2008.

[5] Queensway-Carleton Hospital Overall Campus – Part 3 Expansion Stormwater Management Report, prepared by Novatech Engineering Consultants Ltd., dated July 2010.

[6] Queensway-Carleton Hospital Part 4 Expansion – Site Servicing Report, prepared by Novatech, dated September 25, 2026.

[7] Geotechnical Investigation – Queensway-Carleton Hospital Expansion, prepared by WSP, dated September 03, 2026.

The details of the proposed QCH Part 4 site servicing design, which will have an impact on the overall SWM design for the campus, are addressed in a separate report entitled: Queensway-Carleton Hospital Part 4 Expansion – Site Servicing Report[6].

The proposed campus expansion will include modifications to the existing on-site stormwater management system that outlets to a municipal roadside ditch. It is the opinion of Novatech that the proposed activity falls within the activities prescribed in Section of Ontario Regulation 137/25.

The proposed activities taking place within the catchment area are institutional (hospital) uses, comprised of vehicle access roads and parking areas (paved asphalt), pedestrian access and amenity areas (concrete/pavers), and softscape landscaped areas (grassed areas, berms, and drainage swales).

2.4 Significant Drinking Water Threat Assessment

The subject site is located within the Rideau Valley Source Protection Area. Based on a review of the Conservation Authority mapping for the surrounding area, the site is not located within a wellhead protection area or a significant groundwater recharge area; however, it should be noted that the site is located adjacent to an Intake Protection Zone 2. Hospital uses are not listed as a significant water threat under O. Reg. 137/25, therefore the site does not technically constitute a significant drinking water threat. However, due to the nature of hospital activities, there is potential for the occasional rare spill on site (i.e., medical waste or fuel spill) which could constitute a significant drinking water threat. To mitigate the risk of drinking water contamination, emergency shut-off valves complete with indicator posts will be installed downstream of the new loading dock trench drains where contaminant spills could occur. Furthermore, the proposed stormwater quality treatment units near the storm outlet will be equipped with hydrocarbon spill protection measures, thus greatly reducing the risk of fuel spills contaminating drinking water. Refer to **Appendix F** for an excerpt from the MECP Source Protection Information Atlas which provides additional source protection details for the subject site.

2.5 Stormwater Runoff Assessment

With the proposed additions, the overall impervious area within the hospital campus will increase. To ensure there is no increase in peak flows from the site outlets, additional storage and control measures will be implemented.

The proposed works are designed to capture surface runoff from most of the subject site. The sewer inlets along major roadways have been designed for unrestricted inflows from all storm events due to frequent emergency vehicle use. Sewer inlets within parking areas have been generally designed to limit inflows into the storm sewer to the 2-year storm event. Larger flows will follow the defined overland flow route to the ultimate outlet for the site, Graham Creek. Quality control for the site will be provided by two new water quality units / oil-grit separators located upstream of the main outlet from the campus.

The stormwater catchment areas for the site have been determined based on the grading for the site. In addition, the runoff coefficients for the catchments have been calculated based on the proposed site plan. The hydrologic / hydraulic analysis was completed using the following synthetic design storms and historical storms. The IDF parameters used to generate the design storms were taken from the City of Ottawa Sewer Design Guidelines (December 2025).

3 Hour Chicago Storms:
25mm 3hr Chicago storm
2-year 3-hr Chicago storm
5-year 3hr Chicago storm
100-year 3hr Chicago storm
100-year+20% 3hr Chicago storm

12 Hour SCS Type II Storms:
2-year 12-hr SCS Type II storm
5-year 12-hour SCS Type II storm
100-year 12hr SCS Type II storm

Historical Storms:
July 1, 1979 storm
August 4, 1988 storm
August 8, 1996 storm

The 3-hour Chicago distribution generates the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design of the storm drainage system.

The following sections of the report will outline the details of the proposed stormwater management design.

3.0 DESIGN

On-site stormwater management, including both water quantity and quality control measures, will be required for the proposed QCH campus expansion. The general approach to stormwater management will be consistent with previously approved QCH SWM Reports[1,2,3,4,5]. The objective of the storm drainage and stormwater management design is to provide proper sewer outlets for the QCH campus while meeting the design criteria established by the City of Ottawa. Refer to the enclosed plans and subsequent sections of the report for further details.

3.1 Existing Conditions

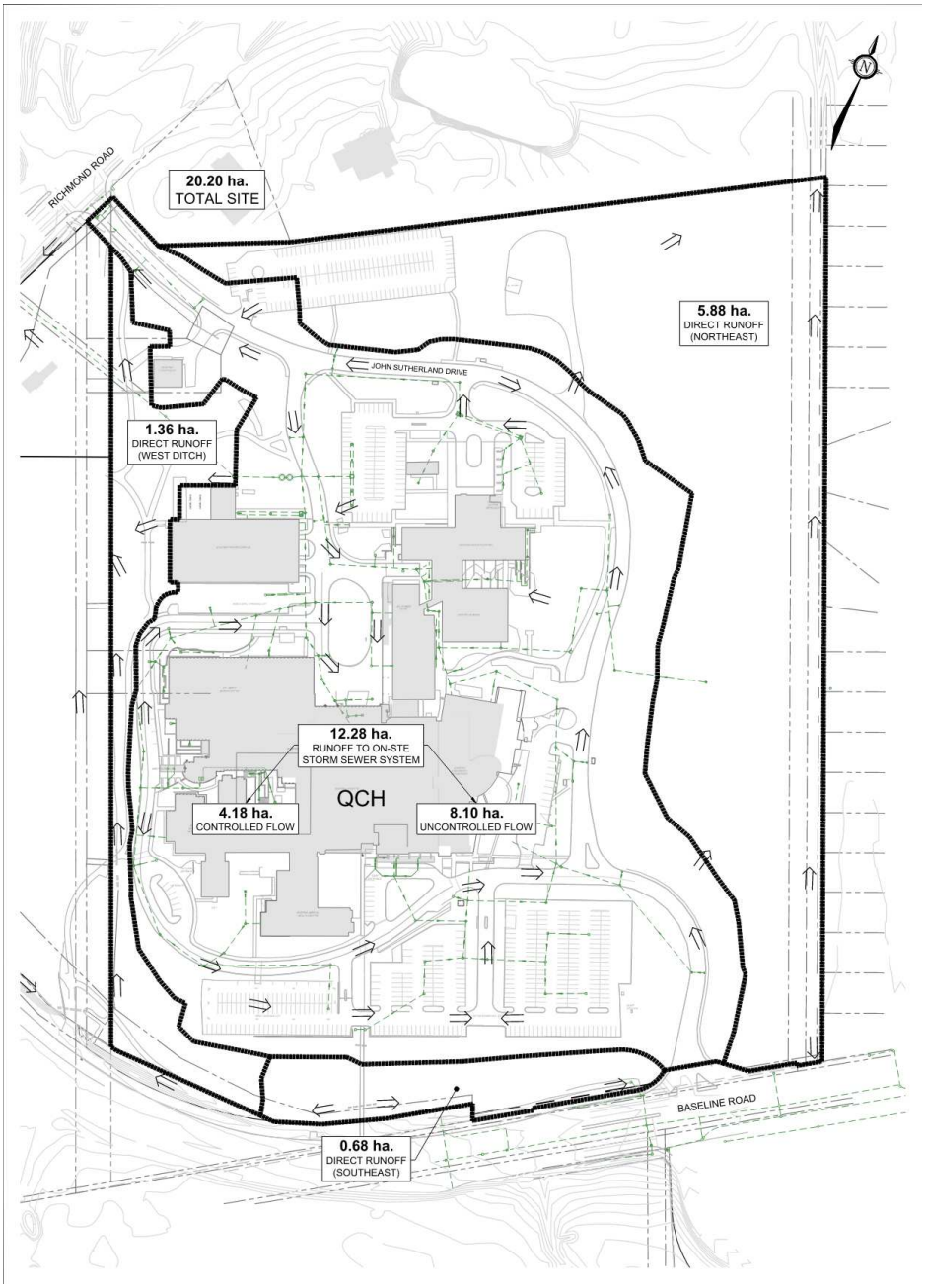
John Sutherland Drive essentially forms the boundary between the developed portion of the campus to the southwest and the largely undeveloped landscaped area to the northeast. The developed portion of the QCH campus, southwest of John Sutherland Drive, consists of existing Hospital buildings, surface parking lots, a multi-level parking structure, access roads and small landscaped areas. The remainder of the campus northeast of John Sutherland Drive, with the exception of the gravel snow dump area and ancillary surface parking lot (which is being removed as part of the proposed works), is comprised of grass fields, berms, and landscaped areas.

3.1.1 Existing Drainage Patterns

The previous SWM Report[5] divided existing drainage into two drainage areas. However, based on a detailed review of new topographical information and due to additional development on the campus after the Part 3 expansion, the existing drainage areas have been re-assessed and are outlined as follows.

Under existing conditions, the 20.20 ha QCH campus generally consists of four drainage areas; A large undeveloped grass/vegetated area (5.88 ha) which currently drains uncontrolled towards the northeast corner of the property, a small grassed area (0.68 ha) along the southern boundary of the campus which currently drains to the storm sewers within Baseline Road, a grassed area with multi-use pathways (1.34 ha) along the western boundary of the campus which drains uncontrolled to the ditch adjacent to Richmond Road, and finally the main campus area (12.28 ha) which drains to the Richmond Road ditch via the on-site storm sewer system and downstream Stormceptor STC 9000 water quality treatment unit. Refer to **Figure 3**: Existing Storm Drainage Areas for details.

Figure 3 - Existing Storm Drainage Areas



A high-level breakdown of the various QCH campus drainage areas is provided in **Table 3.1** below.

Table 3.1: Existing Drainage Conditions

<table>
<tr><th colspan="4">Total Site Area (20.20 ha)</th></tr>
<tr><td rowspan="3">Area Draining to the NE Corner of the QCH campus (5.88 ha)</td><td colspan="2">Area Draining to the Existing Ditch Along Richmond Road (13.64 ha)</td><td rowspan="3">Direct Runoff SE Outlet (0.68 ha)</td></tr>
<tr><td colspan="2">Flow to the Storm Sewer System (12.28 ha)</td><td rowspan="2">Direct Runoff to West Ditch (1.36 ha)</td></tr>
<tr><td>Controlled Flow (4.18 ha)</td><td>Uncontrolled Flow (8.10 ha)</td></tr>
</table>

As described in the previous SWM Reports[1,2,3,4,5], the existing QCH campus stormwater management design includes both controlled and uncontrolled flows. The controlled flows include runoff from the building roofs, the existing parking structure and some of the surface parking lots around the campus; while the uncontrolled flows include direct runoff from the landscaped areas as well as uncontrolled flow directed to the on-site storm sewer system. Stormwater drainage from the campus (including direct runoff to the NE corner and SE outlet) ultimately discharges into Graham Creek, via the roadside ditch along Richmond Road, and via the municipal storm sewer in Baseline Road. Refer to **Appendix G** for excerpts from the previously approved SWM reports, including an Overall Drainage Plan (9915-49-ODP) for the campus.

3.1.2 Existing Release Rate

As the existing conditions drainage areas have been revised, existing conditions peak flows have been re-calculated using the rational method to be used as a basis for the allowable release rates from the site. Peak flows for the 5-year and 100-year storm events are outlined in **Table 3.2**. Refer to **Appendix D** for detailed calculations.

Table 3.2: Existing Stormwater Flow Rate

<table>
<tr><th colspan="4">Total Site (L/s)
5-year = 1,303
100-year = 2,384</th></tr>
<tr><td rowspan="3">Direct Runoff to the NE Corner of the QCH campus (L/s)
5-yr = 160
100-yr = 328</td><td colspan="2">Drainage to the Existing Ditch Along Richmond Road (L/s)
5-year = 1,119
100-year = 2,007</td><td rowspan="3">Direct Runoff to SE Outlet (L/s)
5-yr = 24
100-yr = 49</td></tr>
<tr><td colspan="2">Flow to the Storm Sewer System (L/s)
5-year = 1,075
100-year = 1,917</td><td rowspan="2">Direct Runoff to West Ditch (L/s)
5-yr = 44
100-yr = 90</td></tr>
<tr><td>Controlled Flow (L/s)*
5-yr = 230
100-yr = 273</td><td>Uncontrolled Flow (L/s)
5-yr = 845
100-yr = 1,644</td></tr>
</table>

*Information taken directly from previous SWM report[5] and design drawings.

3.1.3 Existing Quality Control Measures

Based on a review of the previous SWM Report[5], the Stormceptor STC 9000 currently provides a *'Normal'* level of protection (i.e. minimum 70% long-term removal of TSS) for the runoff from approximately 11.46 ha (of the 12.28 ha portion of the site) that is currently tributary to the existing storm sewer system which outlets to the west ditch. There is a small area along John Sutherland Drive (0.82 ha of the 12.28 ha portion of the site) at the northwest corner of the campus which is not routed through the water quality unit and outlets directly to the Richmond Road ditch.

Approximately 1.36 ha of undeveloped vegetated area of the total 13.64 ha tributary to the west ditch along Richmond Road, does not require any stormwater quality control measures. Similarly, no stormwater quality control measures are currently being provided for the mainly grass/vegetated areas sheet draining overland towards the northeast corner of the campus (5.88 ha) and towards the southeast outlet (0.68 ha).

3.2 Post-Development Conditions

As described above, the proposed Part 4 QCH Hospital expansion will consist of additional medical facilities, renovations to existing buildings, modifications to internal roadways, the construction of a new parking garage and modifications to existing surface parking lots. Significant upgrades to the on-site storm sewer system will be necessary to accommodate the proposed works and to divert flows, including the removal and realignment of existing sewer segments as well as the construction of new infrastructure. The hospital campus will continue to be serviced by a dual drainage system, including upgrading and expanding the existing storm sewer network (minor system) and by improving the surface storage capacity and major overland flow routes (major system), where possible.

Due to the extent of hard surface areas and limited release rate from the campus, runoff exceeding the existing conditions release rate will be stored on site. Where possible, this will be achieved using controlled flow roof drains on the proposed and existing buildings, by providing surface storage within parking areas with inflows to the storm sewer controlled by ICDs, and by providing storage within over-sized storm sewers and underground tanks. Stormwater runoff from the remainder of the campus, unaffected by the expansion, will generally remain unchanged.

Storm sewer outlets will remain the same, with runoff from most of the campus being routed to the existing storm sewer at the northwest corner of the campus, ultimately discharging to Graham Creek, via the drainage ditch along Richmond Road. The remainder of the campus, northeast of John Sutherland Drive will generally remain undeveloped, except for the new propane tank access loop, which will be offset by the removal of the large existing surface parking lot in this area. Stormwater runoff from the landscaped area northeast of John Sutherland Drive and south of the main parking lot along Baseline Road will generally continue to sheet drain towards their respective outlets per existing conditions.

Refer to **Figure 4** for a plan showing the existing storm sewers servicing the QCH Campus and the proposed storm sewer modifications for the Part 4 expansion.

Figure 4 - Storm Sewer Drainage Plan



Image Source: geoOttawa (City of Ottawa)

3.2.1 Stormwater Management Criteria and Objectives

The stormwater management (SWM) criteria for the proposed QCH Part 4 expansion have been provided during pre-consultation meetings with the City of Ottawa and are intended to generally follow the approach of the previously approved QCH SWM Reports[1,2,3,4,5]. The SWM criteria and design objectives are as follows:

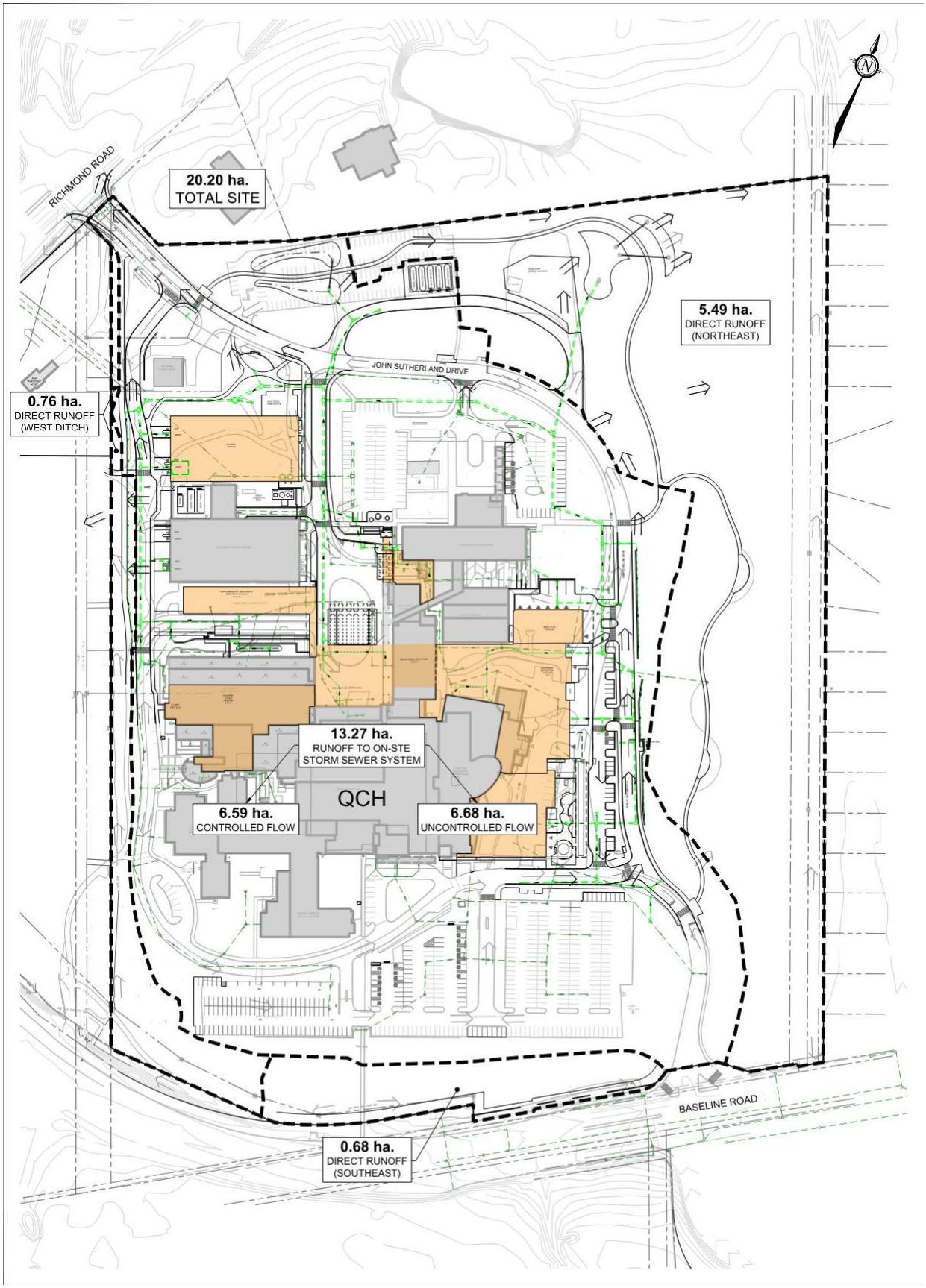
- Provide a dual drainage system (i.e., minor, and major system flows – where possible);
- Provide on-site stormwater quantity control measures, prior to releasing flows into the drainage ditch adjacent to Richmond Road, for all storms up to and including the 100-year design event;
- Ensure that no surface ponding will occur on the paved surfaces (parking lots and drive aisles) during the 2-year storm event;
    - Ensure that no surface ponding will occur on roadways to be used by emergency vehicles during any storm event.

- Provide on-site stormwater quality control equivalent to a *"Normal"* level of protection (minimum 70% long-term TSS removal) prior to releasing flows from the site;
    - Based on the previous SWM Reports, Graham Creek is a Type II Habitat requiring 70% TSS removal, as described in the MOE Stormwater Management Planning and Design Manual.
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion a Sediment Control.

3.2.2 Post-Development Flow

Under post-development conditions, the 20.20 ha QCH campus will still consist of four drainage areas. A large undeveloped grass/vegetated area, approximately 5.49 ha (reduced from 5.88 ha), will continue to drain uncontrolled towards the northeast corner of the property, a small grassed area (0.68 ha, unchanged) south of the main parking lot will continue to drain to the municipal storm sewer within Baseline Road, a grassed area of 0.76 ha (reduced from 1.34 ha) along the western boundary of the campus which drains uncontrolled to the ditch adjacent to Richmond Road, and finally the main campus area of 13.27 ha (increased from 12.28 ha), will continue to drain towards the existing ditch along Richmond Road. The latter area can be further divided into two smaller sub-catchment areas; the undeveloped vegetated area which drains uncontrolled to the ditch and the remainder of the campus, where flows are being directed to the ditch via the on-site storm sewer system and new water quality treatment units. Refer to **Figure 5**: Post-Development Storm Drainage Areas for details.

Figure 5 - Post-Development Storm Drainage Areas



A high-level breakdown of the various QCH campus post-development drainage areas is provided in **Table 3.**

Table 3.3: Proposed Drainage Conditions

<table>
<tr><th colspan="5">Total Site Area (20.20 ha)</th></tr>
<tr><td rowspan="3">Area Draining to the NE Corner (5.49 ha)</td><td colspan="3">Area Draining to the Existing Ditch Along the West Property Line (14.03 ha)</td><td rowspan="3">Direct Runoff to SE Outlet (0.68 ha)</td></tr>
<tr><td colspan="2">Flow to the Storm Sewer System (13.27 ha)</td><td rowspan="2">Direct Runoff to West Ditch (0.76 ha)</td></tr>
<tr><td>Controlled Flow (6.59 ha)</td><td>Uncontrolled Flow (6.68 ha)</td></tr>
</table>

The post-development flow from the QCH campus will include both controlled flow and uncontrolled runoff. The controlled portion will include flow from the various building roofs, the existing parking structure and various parking lots around the campus. The uncontrolled portion will include direct runoff from the landscaped areas as well as uncontrolled flow directed to the on-site storm sewer system.

4.0 STORMWATER MANAGEMENT MODELLING

The City of Ottawa Sewer Design Guidelines (December 2025) requires hydrologic / hydraulic modeling for all dual drainage systems. The performance of the proposed storm drainage system for the site was evaluated using the PCSWMM hydrologic / hydraulic model.

The PCSWMM model schematics and model output data are provided in **Appendix D**. Digital copies of the modeling files and model output for all storm events are provided as part of the digital submission.

4.1 Design Storms

The hydrologic analysis was completed using the following synthetic design storms:

- 3-hour Chicago storm distribution
- 12-hour SCS Type II storm distribution

The return periods analyzed include the 2,5 & 100-year storm events. The IDF parameters used to generate the design storms were taken from the City of Ottawa Sewer Design Guidelines (December 2025). The 25mm water quality storm event was also run.

The 3-hour Chicago distribution generated the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design of the storm drainage system.

The proposed drainage system was also ‘stress tested’ using a 100-year (+20%) 3-hour Chicago design storm. This design storm has a 20% higher intensity and total volume compared to the 100-year event.

4.2 Model Development

The PCSWMM model represents both the minor and major system flows from the campus. The model further delineates the above-noted four drainage areas for the existing campus and proposed expansion areas. Existing and proposed stormwater management infrastructure including pipes, storage tanks, roof drains, and inlet control devices have been included to determine appropriate sizing to reduce peak flows from the increased impervious area. Model parameters are outlined as follows:

Infiltration

Infiltration losses for all catchment areas were modeled using Horton’s infiltration equation, which defines the infiltration capacity of soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values as specified in the City of Ottawa Sewer Design Guidelines were used for all catchments.

Horton's Equation: $f(t) = f_c + (f_o - f_c)e^{-k(t)}$

Initial infiltration rate: f_o = 76.2 mm/hr

Final infiltration rate: f_c = 13.2 mm/hr

Decay Coefficient: k = 4.14/hr

Depression Storage

The default values for depression storage in the City of Ottawa Sewer Design Guidelines were used for all sub-catchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

The rooftops assumed to provide no depression storage (zero-impervious parameter).

Equivalent Width

'Equivalent Width' refers to the width of the sub-catchment flow path. This parameter (Table 5.1) is calculated as described in Section 5.4.5.6 of the City of Ottawa Sewer Design Guidelines.

Impervious Values

Runoff coefficients for each sub-catchment area were determined based on the proposed site plan. Refer to the Stormwater Management Plan (123089-SWM) for details. Percent impervious values were calculated using:

$$\%imp = (C - 0.20) / 0.70$$

Storm Drainage Areas

For modeling purposes, the site has been divided into sub-catchments based on the drainage areas tributary to each inlet of the proposed storm sewer system. The sub-catchment areas are shown on the Stormwater Management Plan (123089-SWM). The hydrologic modeling parameters were developed based on the imperviousness of each sub-catchment. A summary of sub-catchment parameters is provided in **Table 4.1**. An expanded table has been provided in **Appendix D**. Please note that some areas have been further sub-divided in the PCSWMM model.

Table 4.1: Sub-catchment Parameters

Area ID	Catchment Area (ha)	Runoff Coeff. (C)	Percent Imperv. (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
A101	0.157	0.60	57%	0%	20.06	78.28	0.5%
A102	0.202	0.36	23%	0%	36.40	55.49	0.5%
A103	0.190	0.53	47%	0%	20.51	92.66	0.5%
A104	0.195	0.69	70%	0%	32.95	59.19	0.5%
A105	0.082	0.67	67%	0%	24.52	33.44	0.5%
A106	0.027	0.43	33%	0%	18.17	14.86	0.5%
A107	0.079	0.64	63%	0%	15.54	50.85	0.5%
A108	0.087	0.66	66%	0%	19.39	44.86	0.5%
A113	0.792	0.90	100%	0%	106.42	74.42	0.5%
A116a	0.038	0.90	100%	0%	22.08	17.21	0.5%
A116B	0.017	0.90	100%	0%	6.04	28.13	0.5%
A117	0.023	0.90	100%	0%	13.56	16.96	0.5%
A119	0.122	0.64	63%	0%	47.79	25.53	0.5%
A120	0.227	0.55	50%	0%	41.94	54.12	0.5%

Area ID	Catchment Area (ha)	Runoff Coeff. (C)	Percent Imperv. (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
A121	0.100	0.80	86%	0%	19.31	51.78	0.5%
A122	0.283	0.38	25%	0%	28.93	97.82	0.5%
A137	0.021	0.62	60%	0%	8.26	25.42	0.5%
B101	0.549	0.48	40%	0%	29.24	187.74	0.5%
B102	0.127	0.71	73%	0%	28.00	45.35	0.5%
B103	0.019	0.55	50%	0%	9.24	20.56	0.5%
B104	0.149	0.72	74%	0%	23.48	63.45	0.5%
B105	0.077	0.66	66%	0%	14.96	51.48	0.5%
B106	0.156	0.74	77%	0%	16.43	94.94	0.5%
B107	0.081	0.53	47%	0%	18.79	43.12	0.5%
B108	0.053	0.87	96%	0%	12.81	41.38	0.5%
B109	0.052	0.64	63%	0%	14.15	36.75	0.5%
B110a	0.068	0.86	94%	0%	23.39	29.07	0.5%
B110b	0.075	0.25	7%	0%	26.71	28.08	0.5%
B111	0.061	0.84	91%	0%	14.51	42.04	0.5%
B112	0.607	0.47	38%	0%	32.21	188.43	0.5%
B113	0.092	0.20	0%	0%	18.80	48.95	0.5%
B114	0.547	0.69	70%	0%	44.22	123.71	0.5%
B115	0.285	0.85	93%	0%	35.39	80.53	0.5%
B116	0.300	0.23	4%	0%	39.04	76.84	0.5%
B117	0.217	0.49	42%	0%	36.93	58.76	0.5%
B118	0.069	0.49	41%	0%	17.52	39.39	0.5%
B119	0.079	0.63	61%	0%	18.46	42.80	0.5%
B120	0.084	0.67	67%	0%	12.13	69.27	0.5%
B122	0.220	0.79	84%	0%	47.70	46.12	0.5%
B122-1	0.002	0.79	84%	0%	8.00	2.50	0.5%
B122-2	0.002	0.79	84%	0%	8.00	2.50	0.5%
B124	0.247	0.64	63%	0%	18.59	132.87	0.5%
B127	0.229	0.54	49%	0%	21.61	105.96	0.5%
B128	0.096	0.42	32%	0%	18.48	51.96	0.5%
B129	0.016	0.20	0%	0%	9.82	16.30	0.5%
B130	0.080	0.66	65%	0%	16.95	47.19	0.5%
B131	0.098	0.58	54%	0%	24.03	40.78	0.5%
B132	0.180	0.76	80%	0%	37.40	48.13	0.5%
B133	0.145	0.46	37%	0%	46.93	30.90	0.5%
B134a_1	0.190	0.56	51%	0%	22.29	85.22	0.5%
B134a_2	0.121	0.56	51%	0%	20.96	57.75	0.5%
B134b_1	0.058	0.28	11%	0%	28.48	20.37	0.5%
B134b_2	0.047	0.28	11%	0%	25.07	18.75	0.5%
B135a_1	0.112	0.67	67%	0%	27.13	41.21	0.5%
B135a_2	0.164	0.67	67%	0%	30.78	53.35	0.5%

Area ID	Catchment Area (ha)	Runoff Coeff. (C)	Percent Imperv. (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
B135b	0.059	0.25	7%	0%	34.94	16.89	0.5%
B136	0.065	0.35	21%	0%	10.04	64.75	0.5%
B137	0.086	0.56	51%	0%	21.30	40.38	0.5%
B138	0.042	0.24	6%	0%	11.26	37.31	0.5%
B139	0.035	0.54	49%	0%	14.43	24.25	0.5%
EX.A02.01	0.028	0.71	73%	0%	16.43	17.04	0.5%
EX.A02.02	0.039	0.65	64%	0%	24.19	16.12	0.5%
EX.A03.01	0.080	0.90	100%	0%	18.92	42.28	0.5%
EX.A03.02	0.158	0.90	100%	0%	13.87	113.93	0.5%
EX.A04	0.040	0.90	100%	0%	10.31	38.81	0.5%
EX.R01	0.072	0.90	100%	0%	19.92	36.14	0.5%
EX.R02	0.295	0.90	100%	0%	55.27	53.37	0.5%
EX.R03	0.043	0.90	100%	0%	28.31	15.19	0.5%
EX_A01a_1	0.215	0.66	66%	0%	25.73	83.41	0.5%
EX_A01a_2	0.208	0.66	66%	0%	27.92	74.66	0.5%
EX_A01b_1	0.177	0.76	80%	0%	25.40	69.54	0.5%
EX_A01B_2	0.159	0.76	80%	0%	22.23	71.69	0.5%
EX_A02a	0.400	0.71	73%	0%	130.29	30.70	0.5%
EX_A02B	0.518	0.65	64%	0%	34.34	150.86	0.5%
P3-01	0.486	0.90	100%	0%	58.72	82.76	0.5%
P3-02	0.017	0.90	100%	0%	11.23	15.14	0.5%
P3-03	0.038	0.90	100%	0%	11.65	32.62	0.5%
P4-01	0.200	0.90	100%	0%	22.83	87.60	0.5%
P4-02	0.294	0.90	100%	0%	28.29	103.93	0.5%
P4-03	0.087	0.90	100%	0%	30.47	28.55	0.5%
P4-04	0.110	0.90	100%	0%	38.34	28.69	0.5%
P4-05	0.337	0.90	100%	0%	50.84	66.29	0.5%
P4-07	0.042	0.90	100%	0%	11.61	36.19	0.5%
P4-08	0.288	0.90	100%	0%	19.42	148.27	0.5%
P4-09	0.272	0.90	100%	0%	67.83	40.10	0.5%
P4-DR1a_1	0.721	0.28	11%	0%	69.47	103.79	0.5%
P4-DR1a_2	0.038	0.28	11%	0%	76.00	5.00	0.5%
P4-DR1b	0.681	0.24	6%	0%	209.28	32.54	2.0%
P4-DR2	5.496	0.24	6%	0%	510.02	107.76	1.5%
TOTAL:	**20.22**						

4.3 Model Results

The on-site storage and conveyance system requirements were refined using the PCSWMM model. The model was used to ensure that peak flows are controlled to the allowable release rates.

4.3.1 Storage Requirements

Roof Drains

The existing building roofs contain both uncontrolled and control flow roof drains. Flows from the new and renovated building roofs (excluding the new parking garage) will be attenuated using Watts adjustable 'Accutrol' control flow roof drains (model number RD-100-A-ADJ) prior to being directed to the downstream storm sewer system. Where possible, runoff from some existing roofs will be directed onto the new roofs to optimize on-site storage and reduce peak flows. Peak flows from new roofs are based on the number of control flow roof drains and their individual weir setting (i.e., fully closed, ¼ open, etc.). Storage provided on the new roofs has been estimated based on average end-area method calculations and a maximum ponding depth of 0.15m above the drains. Scuppers will be installed to provide an overflow for storms that exceed the maximum available storage (i.e. for storms greater than the 100-year design event). **Table 4.2** summarizes the roof drainage area ID, number of drains within the roof area, 100-year peak flows and maximum storage available.

Table 4.2: Roof Flows & Storage

Drainage Area ID	Number of Roof Drains	100-Year Peak Flow from Drains (L/s)	Maximum Storage Volume Available (m^3)
A113*	-	371.5	-
A116*	-	30.3	-
A117*	-	11.4	-
P3-1	28	31.6	154.2
P3-2**	2	2.3	4.5
*P3-3**	-	12.1	-
P4-1	5	2.9	75.7
P4-2	7	5.4	92.7
P4-3	2	0.6	33.1
P4-4	4	2.5	68.2
P4-5	12	5.1	146.9
P4-7	3	1.6	23.8

**Denotes uncontrolled roof drainage*
***Information taken directly from the previous SWM Report[5].*

Refer to **Appendix C** for control flow roof drain information and **Appendix D** for detailed SWM calculations.

Surface Storage

Under existing conditions, the southern parking lots (areas EX-A01a, EX-A01b, EX-A02a, EX-A02b) provide some surface storage with flows being controlled by ICDs installed in the various catchbasins. These areas will provide approximately 309 m^3 of storage, per the previous SWM Report[5].

Under post-development conditions, the new eastern short-term parking lots (areas B104 and B106) will provide approximately 54m^3 of surface storage. Additionally, the new northern landscaped swale (area B116) will provide approximately 89m^3 of surface storage and will act as an LID conveyance control by discharging storm water at a lower rate and promoting infiltration. Refer to **Appendix D** for detailed SWM calculations.

Tank Storage

Two new storage tanks will be installed near the new and existing parking garages to provide additional storage and peak flow control. The new internal storage tank within the footprint of the new parking garage will provide approximately 130m^3 of storage, whereas the new external storage tank adjacent to

the existing parking garage will provide approximately 65m^3 of storage. Refer to **Appendix C** for detailed external storage tank information.

Oversized Storm Sewers

Two existing oversized storm sewers (1500mm) provided within the parking area towards the northeast corner of the site, adjacent to the Cancer Centre provides some underground storage for runoff from the parking area. Under existing conditions, flows from these storm sewers are controlled by ICDs located within the respective downstream manhole. The proposed ICD sizes are outlined in subsequent sections of the report.

Perforated Subdrains

To promote infiltration and maintain additional runoff on-site, perforated subdrains are being proposed as an LID measure within the landscaped areas along the new west road extension and re-aligned John Suttherland Drive. The new subdrains will mitigate soil saturation and waterlogged conditions, which could be caused by the layer of clayey silt to silty clay encountered throughout the site (as described in the Geotechnical Report[7]).

It should be noted that perforated subdrains were not modelled in the PCSWMM model for the site.

4.3.2 Orifice Controls

Storm flows from some of the existing paved parking areas are attenuated using inlet control devices (ICDs) located within the outlet pipes of existing storm sewer structures. These ICDs allow for increased surface storage during large storm events (5-year and larger) and reduce the peak flow to the storm sewer system. As a part of the PCSWMM modelling exercise, existing ICDs were assessed to determine if they could be replaced to further reduce peak flows and maximize available surface storage. **Table 4.3** outlines the existing and proposed ICD specifications, peak design flow rates, and anticipated maximum ponding depths.

Table 4.3: Inlet Control Device Parameters

Drainage Area ID	Structure ID	ICD Size	ICD Type	5-Yr Peak Flow (L/s)	100-Yr Peak Flow (L/s)	Max Ponding Depth (m)
Existing						
EX. A1a	EX. CB132	84mm	Plug Type Orifice	19.77	20.61	0.35
EX. A1b	EX. CB	85mm	Plug Type Orifice	19.95	20.46	0.35
EX. A2a	EX. CB	91mm	Plug Type Orifice	22.32	22.44	0.35
EX. A2b	EX. CB129	81mm	Plug Type Orifice	19.84	20.38	0.35
Proposed						
B114	EX.CBMH 10	83mm	Slide-in plate	20.48	26.57	0.29
B115	EX.MH011	83mm	Slide-in plate	15.48	24.41	0.26
B116,117,118, 119	CBMH413	83mm	Slide-in plate	20.52	26.42	0.5
B128	CB411	94mm	Slide-in plate	10.80	25.46	N/A
B129	CB412	83mm	Slide-in plate	0.73	3.89	N/A
B104	CBMH402	83mm	Slide-in plate	21.81	22.24	0.20
B106	CB403	94mm	Slide-in plate	27.61	28.42	0.20
B134b_1*	CB414	83mm	Slide-in plate	3.47	14.03	0.25
B135b	EX-LD01	83mm	Slide-in plate	2.02	7.26	0.53
P4-08	Tank 01	225mm	Slide-in plate	60.47	84.24	N/A
P4-09	Tank 02	83mm	Slide-in plate	10.30	13.93	N/A

**Denotes a sub-area from a larger subcatchment area*

Refer to **Appendix C** for ICD information and to **Appendix D** for detailed SWM calculations and modelling results.

4.3.3 Peak Flows

The following table summarizes the post-development flows for the QCH campus and provides a comparison to existing conditions for both the 5-year and 100-year design events:

Table 4.4: Post-Development Flow Summary and Comparison to Existing Conditions (L/s)

Post-Development Stormwater Flow Rate						
Design Event	**Direct Runoff to Northeast**	**Direct Runoff to South Ditch**	**Flows from Main Campus**	**Direct Runoff to West Ditch**	**Direct Runoff to Richmond Rd.**	**Total Proposed Site Flow***
5-year	108	14	1,141	30	82	1,280
100-year	254	34	1,657	84	169	2,128
Existing Conditions Stormwater Flow Rate						
Design Event	**Direct Runoff to Northeast**	**Direct Runoff to South Ditch**	**Flows from Main Campus**	**Direct Runoff to West Ditch**	**Direct Runoff to Richmond Rd.**	**Existing Conditions Peak Flow****
5-year	160	24	1,075	44	44	1,303
100-year	328	49	2,007	90	90	2,384

**Total site flow is not a direct addition of all the peak flows from the various outlets. As the peaks for each outlet occur at different times, the instantaneous peak is taken from the PCSWMM model "Outfall Loading Summary" and accounts for hydrograph timing.*

***Refer to **Appendix D** for existing stormwater flow calculations, and to **Appendix G** for excerpts from previously approved SWM reports.*

Based on the information summarized in the table above, total post-development peak flows will be lower than the calculated existing conditions peak flows for both the 5-year and 100-year design event. Although the post-development flow rates at some outlets appear to be slightly higher than existing conditions flow rates (i.e., direct runoff to Richmond Road and flows from Main Campus), it should also be noted that there are limitations with comparing peak flows calculated using the Rational Method (previous SWM Reports) and those calculated using the PCSWMM model. The Rational Method calculation provides good approximation of peak flows, however the PCSWMM model is generally more accurate as it accounts for more variables (i.e. slopes, storage controls, hydrograph timing etc.) which can result in higher overall peak flows.

Furthermore, it is anticipated that future QCH campus expansions phases will continue to improve the stormwater management controls as uncontrolled areas will be replaced with new buildings with control-flow roof drains.

4.3.4 Stormwater Quality Control Unit Sizing

As discussed previously, the existing water quality control unit (Stormceptor STC9000) currently provides a *'Normal'* level of protection (i.e., minimum 70% long-term removal of TSS). Stormwater flows from the developed portion of the campus flowing through the STC9000 are being discharged into the existing roadside ditch along Richmond Road, which is ultimately tributary to Graham Creek.

To accommodate the proposed Part 4 Expansion, the existing STC9000 water quality treatment unit will be removed. Under post-development conditions, the *'Normal'* level of water quality control will be maintained by two (2) new treatment units, which will be installed immediately upstream of the existing 900mm dia. QCH campus storm sewer outlet pipe. Stormwater runoff collected by the on-site storm sewer system (13.27 ha) can be subdivided into three smaller sub catchment areas. Flows from a portion of the existing storm sewer system near the northwest corner of the campus (0.75 ha) will continue to outlet directly into the existing ditch without treatment, while stormwater runoff from the western portion of the campus (3.38 ha) will be treated by the new water quality treatment unit ("OGS #1") and stormwater runoff from the remainder of the campus (9.14 ha) will be treated by second new water quality treatment unit ("OGS #2").

The "PCSWMM for Stormceptor" online tool has been used to size the two new water quality treatment units capable of meeting the TSS removal requirements (*'Normal'* or 70% long-term TSS removal). The model parameters for the TSS removal were based on historical rainfall data from the Ottawa CDA RCS rainfall station. It was determined that a Stormceptor model EFO6 for the 3.38 ha drainage area (OGS #1) will meet the target removal rate, providing a net annual 70% TSS removal. However, a Stormceptor model EFO8 is recommended, as this would provide a net annual 80% TSS removal and would provide flexibility for potential increased water quality treatment requirements related to future campus expansions. Similarly, it was determined that a Stormceptor Model EFO10 for the 9.56 ha drainage area (OGS #2) will meet the target removal rate, providing a net annual 71% TSS removal. However, a Stormceptor model EFO12 is recommended, as this would provide a net annual 77% TSS removal and would also provide flexibility for potential increased water quality treatment requirements related to future campus expansions. Refer **Appendix C** for detailed sizing information.

4.4 Existing Conditions and Post-Development Storm Sewer Design Sheets

Storm Sewer Design Sheets for the 5-year design storm have been provided showing a detailed breakdown of the pipe flow under post-development conditions. As indicated on the Storm Sewer Design Sheets, the time on concentration for the main storm sewer outlet has been calculated to be approximately 20.35 minutes.

As identified in the previous SWM Report[5], the Storm Sewer Design Sheets indicate that the existing main campus storm sewer outlet is undersized and sometimes operates under surcharge conditions. Although the existing main campus outlet is not being upsized under the Part 4 Expansion due to budgetary constraints, future expansion projects will provide additional opportunities to mitigate the effects of increased flows using conventional upstream minor system improvements, such as new / re-sized inlet control devices, control flow roof drains for new building roofs, and upgrades to the storm sewer system where required.

It should be noted that the peak stormwater flows calculated in the Storm Sewer Design Sheets strictly represent the stormwater flows tributary to the QCH campus storm sewer system. Furthermore, the peak flows calculated in the Storm Sewer Design Sheets differ slightly from the peak flows described in this report. This discrepancy is caused by the calculation method, as the peak flows calculated in the Storm Sewer Design Sheets are based on the Rational Method, whereas the peak flows described in this report are based on PCSWMM modelling results. Refer to **Appendix D** for the Post-Development Storm Sewer Design Sheets.

5.0 PHASED INSTALLATION OF STORMWATER MANAGEMENT WORKS

It is understood that the proposed development will be constructed in phases due to the complex scope of work and sensitive nature of hospital operations. The intent is for the installation of the proposed stormwater management works to generally align with the proposed construction phasing. However, portions of the proposed storm sewer may need to be installed as part of "Early Servicing" sub-phases to ensure that storm drainage patterns are maintained during construction.

To accommodate the removal of existing infrastructure and construction of new infrastructure, storm flows may need to be temporarily pumped. Details of the temporary stormwater pumping systems (including temporary dewatering measures) will be developed by the contractor at the appropriate time, ensuring that flows are discharged safely to an approved outlet as directed by the engineer. Stormwater controls

(i.e., roof drains and ICDs) will be installed once the construction of the associated buildings or paved parking areas is generally complete.

Although not required for approvals, the "Suggested Construction Sequencing" document was prepared to provide general guidance on the construction sequencing to maintain service to the existing hospital buildings and minimize disruptions to hospital operations. Refer to the "Suggested Construction Sequencing" document for further details.

6.0 ASSESSMENT OF MONITORING

Stormwater runoff from building roofs and landscape areas, which comprise approximately 72% of the total site area, is typically considered clean for the purposes of water quality and aquatic habitat. Furthermore, on-site stormwater quality control will be provided to exceed a "Normal" level of protection (i.e., minimum 70% long-term removal of TSS), combining grassed swales, perforated subdrains, and mechanical separators, prior to releasing flows from the site. A monitoring plan will therefore not be required, as there are minimal concerns regarding effluent being discharged from the on-site stormwater management works.

7.0 OPERATION AND MAINTENANCE MANUAL

It is recommended that the QCH implement an inspection and maintenance program for the stormwater management works and maintain records of these works.

The storm drainage system should be inspected routinely (at least annually) and after significant storm events; including inspection of the ICDs and roof drains to ensure they are free of debris. More frequent inspections are to be undertaken if there are issues noted with the system functionality.

- Confirm ICDs are installed and functioning properly.
- Visually inspect roof drains for debris and remove debris if present.
- Visually inspect maintenance hole inlets and outlets for blockages and remove blockages if present.
- Confirm the amount of sediment accumulation within the sump of the structure. If sediment accumulation exceeds 50% of the structure's capacity, the structure must be cleaned.
- Visually inspect maintenance hole walls, ladders, and ICDs for damage and schedule repair if needed.

The water quality treatment units should be inspected at regular intervals based on manufacturer recommendations and maintained when necessary to ensure optimal performance. The manufacturer's Quality Assurance Plan will cover inspection and maintenance for a minimum of 5 years, after which the owner will need to enter a continued maintenance program. Inspection and maintenance shall be performed by a professional service provider who has experience in cleaning OGS devices and has been trained and certified in applicable health and safety practices.

- Visually inspect the insert for debris and remove debris if present.
- Visually inspect the drop pipe opening for blockage and remove blockage if present.
- Visually inspect the insert and weir for damage and schedule repair if needed.
- Check sediment depth using a sediment probe and oil depth using an oil dipstick. If sediment depth has reached the manufacturer's recommended maintenance sediment depth, extract sediment and floatables using a vacuum hose and jetting wand.
- Record inspection and maintenance in a data log.

Periodic inspections of the storm sewers (CCTV) should be conducted to confirm the structural integrity of the pipes. During the later stages of the project life cycle, the frequency of scheduled inspections should be increased to ensure system integrity (1-year intervals recommended).

8.0 SITE GRADING

The existing QCH campus generally slopes in a north-westerly direction, with the approximate elevation dropping from 79.40m at the site entrance off Baseline Road down to approximately 74.20m at the Richmond Road entrance. The finished floor elevations (FFE) of the proposed Part 4 expansion buildings are based on the existing hospital floor elevations, site topography, and elevations of the new internal roadways. The new buildings additions generally match into the existing Level 1 (74.98m) and Level 2 (79.25m) floor elevations, while the new parking garage has been set at an elevation of 77.40m. Where possible, overland flow is generally directed outwards towards the West Ring Road extension and John Sutherland Drive, captured by downstream catchbasins. Some existing and proposed parking lots will provide low-point surface storage above the catchbasins. The grading design will generally match into the existing elevations around the site.

Refer to the enclosed Grading and Erosion & Sediment Control Plans (123089-GR1 and 123089-GR2) for details.

8.1 Major Overland Flow Route

As discussed above, the QCH campus generally slopes in a north-westerly direction, with the main storm sewer outlet discharging to the roadside ditch along Richmond Road, located near the northwest corner of the site. In the case of a major rainfall event exceeding the design storms provided for, the stormwater located within the parking and landscaped areas will cascade into lower drainage areas along the re-aligned portion of John Sutherland Drive and ultimately spill towards the northeast corner of the campus. Meanwhile, stormwater located within the northwest portion of John Sutherland Drive and west Ring Road will overflow toward the existing naturalized drainage ditch to the west and/or directly towards the roadside ditch along Richmond Road. The major system continues north from these ditches to Graham Creek, which ultimately outlets to the Ottawa River. The major overland flow route within the QCH campus is shown on the enclosed Grading and Erosion & Sediment Control Plans.

Under post-development conditions, a few existing areas on the QCH campus will continue to be low-points that do not have a functional major system (i.e., major overland flow route) due to site layout and elevation constrains. Furthermore, due to the existing topography / grading, the major overland flow route from some of the adjacent (higher) areas will drain towards these low-lying areas. As part of the Part 4 expansion works and where it is feasible, storm flows will be diverted away from these low-lying areas towards the new / upsized storm sewers discharging directly into 900mm dia. campus storm sewer outlet pipe. Additional mitigation measures to improve drainage, where conventional major overland flow routes are not available, are discussed in the following section of the report.

9.0 CONTINGENCY PLAN FOR EXTREME WEATHER EVENTS

On July 1st, 2026, the City of Ottawa experienced an extreme weather event that resulted in numerous flooding occurrences throughout the City, including portions of the QCH campus. This is a reminder that although infrequent, extreme storm events can and do occur. At the request of the QCH, the following mitigation measures are being implemented as part of the Part 4 expansion project (i.e., items 1 & 2) or considered for future implementation (i.e., item 3) to further protect the hospital campus from extreme weather events exceeding the 100-year design storm:

1. The proposed on-site free-flowing storm sewer upgrades within the low-lying loading dock area, downstream of the Cancer Centre storm outlet, are being oversized to provide additional underground storage during extreme weather events.
2. New emergency perched overflow (secondary) pipes will provide relief to the minor system during storm events exceeding the 100-year design storm by directing stormwater to new low-lying ponding areas at the northeast corner of the campus. The invert of the perched overflow pipes will be slightly above the 100-year hydraulic grade line (HGL) to ensure that water is not discharged for events below the 100-year storm. Furthermore, the obvert of the perched overflow pipes will be below the lowest building opening to mitigate the effects of extreme storm events on the existing buildings and proposed building expansions within existing low-lying areas on campus.

3. An alternate emergency overflow system could provide additional relief to the loading dock, Cancer Centre surface parking lot, and Cancer Centre courtyard areas during storm events exceeding the 100-year design storm by directing stormwater to new low-lying ponding areas at the northeast corner of the campus via a separate storm sewer (i.e., not directly connected to the campus storm minor system). The catchbasin grates of the emergency overflow within these areas would need to be above the 100-year water elevation within the minor system to ensure that water is not discharged for events below the 100-year storm. Additional details for this alternate emergency overflow system will be provided if/once it is formally approved for implementation by the QCH.

10.0 EROSION AND SEDIMENT CONTROL

To mitigate erosion and to prevent sediment from entering the storm sewer system and downstream drainage ditch, temporary erosion and sediment control measures will be implemented during construction in accordance with current Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter bags / catch basin inserts (sediment sacks) will be placed under the grates of all nearby proposed and existing stormwater inlets and will remain in place until vegetation has been established and construction is completed.
- Silt fencing will be placed per OPSS 577 and OPSD 219.110 along the surrounding construction limits.
- Mud mats or other approved measures will be installed at the site entrances to minimize sediment track-out onto roadways.
- Street sweeping and cleaning will be performed, as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site.
- On-site dewatering is to be directed to a sediment trap and/or gravel splash pad and discharged safely to an approved outlet as directed by the engineer.
- Any stockpiled material will be properly managed to prevent those materials from entering the sewer system and/or the downstream ditch or watercourse.
- Dust control will be provided with the application of water during dry periods. Chemical dust suppressants (i.e., Calcium Chloride) will only be used where necessary on problem areas.
- Exposed soils will be protected with natural or synthetic mulches and re-vegetated as soon as possible.

The temporary erosion and sediment control measures will need to be installed to the satisfactory of the City of Ottawa, MECP and engineer, prior to construction, and will remain in place during all phases of construction. The contractor will be required to inspect all erosion and sediment control measures weekly during active construction and as soon as practicable following each significant rainfall event, significant snowmelt event, and any other extreme weather event. Maintenance is to be undertaken as required based on these inspections. The contractor will be required to keep records of inspection, including at a minimum: the qualified inspector's name, date of inspection, visual observations, and any necessary remedial measures to maintain the erosion and sediment control measures. Once construction is completed, all sewers will be cleaned and inspected, and all temporary erosion and sediment control measures will be removed.

Permanent erosion and sediment control will be provided by the two new water quality treatment units installed immediately upstream of the existing 900mm dia. QCH campus storm sewer outlet pipe. Additional sediment control will be provided by the new on-site catchbasins and storm manhole structures, which will be equipped with sumps to promote additional settling of sediment.

11.0 GEOTECHNICAL INVESTIGATIONS

The Geotechnical Investigation – Queensway Carleton Hospital Expansion (CA0033714.1722, dated September 03, 2026) has been prepared by WSP for the QCH Campus Part 4 Expansion. Refer to the Geotechnical Report[7] for subsurface conditions, construction recommendations and geotechnical inspection requirements.

12.0 CONCLUSIONS

This report has been prepared in support of the Site Plan Control (SPC) application for the proposed Queensway Carleton Hospital Part 4 Expansion, located at 3045 Baseline Road, in Ottawa.

The conclusions are as follows:

- A dual drainage system consisting of storm sewers (minor system) and an overland flow path (major system) has been provided to control and convey peak flows from the hospital campus.
- On-site stormwater quantity control measures have been provided, where possible, using control flow roof drains and ICDs. The total 5-year release rate from the campus, including both controlled flows, uncontrolled flows, and direct runoff was determined to be 1,280 L/s, while the total 100-year release rate was determined to be 2,128 L/s. Post-development peak flows are less than existing conditions.
- Campus flows will continue to be directed into the existing outlets including the drainage ditch adjacent to the Richmond Road entrance, near the northeast corner of the campus, and the southeast outlet to the municipal storm sewer in Baseline Road.
- Surface ponding will generally not occur on the paved surfaces (parking lots and drive aisles) during the 2-year storm event, with the exception of minor surface ponding within the southern parking areas, as per existing conditions. There will be no ponding remaining by the end of the storm event.
- No surface ponding will occur on the main campus roadways used by emergency vehicles during typical design storm events (i.e., less than the 100-year design storm).
- On-site stormwater quality control has been provided to exceed a *"Normal"* level of protection (minimum 70% long-term TSS removal) via two new water quality treatment units (Stormceptor EFO8 and Stormceptor EFO12) prior to releasing flows from the site.
- Guidelines have been provided to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

It is recommended that the proposed stormwater management design be approved for implementation.

NOVATECH

Prepared by:



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CAD Designer | Land Development



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Project Manager | Water Resources

Reviewed by:



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Senior Project Manager | Land Development

APPENDIX A

Project Correspondence

File No.: PC2024-0148

June 6, 2024

Derek Judson
Parkin
Via email: judson@parkin.ca

Subject: Pre-Consultation: Meeting Feedback
Proposed Site Plan Control Application – 3045 Baseline Road

Please find below information regarding next steps as well as consolidated comments from the above-noted pre-consultation meeting held on May 23, 2024.

Pre-Consultation Preliminary Assessment

1 ☐	**2** ☐	**3** ☒	**4** ☐	**5** ☐

One (1) indicates that considerable major revisions are required while five (5) suggests that the proposal appears to meet the City's key land use policies and guidelines. This assessment is purely advisory and does not consider technical aspects of the proposal or in any way guarantee application approval.

Next Steps

1. A review of the proposal and materials submitted for the above-noted pre-consultation has been undertaken. Please proceed to complete a Phase 2 Pre-consultation Application Form and submit it together with the necessary studies and/or plans to planningcirculations@ottawa.ca.

2. In your subsequent pre-consultation submission, please ensure that all comments or issues detailed herein are addressed. A detailed cover letter stating how each issue has been addressed must be included with the submission materials. Please coordinate the numbering of your responses within the cover letter with the comment number(s) herein.

3. Please note, if your development proposal changes significantly in scope, design, or density before the Phase 3 pre-consultation, you may be required to complete or repeat the Phase 2 pre-consultation process.

Supporting Information and Material Requirements

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified, during this phase of pre-consultation, as either required (R) or advised (A) as part of a future complete application submission.

a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.

Consultation with Technical Agencies

1. You are encouraged to consult with technical agencies early in the development process and throughout the development of your project concept. A list of technical agencies and their contact information is enclosed.

Planning

Comments:

1. Site is located in the Greenbelt Transect of the Official Plan
2. Current Zoning: RI[307r] H(20) (Rural Institutional Zone, Urban Exception 307r, height restriction 20) & O1[434r] (Parks and Open Space Zone, Urban Exception 434r)
    a. Additional height proposed will require a Zoning Bylaw Amendment application
3. Site Plan application required
4. Consultation is required with the Ministry of Transportation due to proximity to Highway 417.
    a. We recommend consultation with MTO prior to full application submission
5. There looks to be a residence located at the NW end of John Sutherland Drive that may be impacted by the proposed road connection
    a. Consulttaion with this homeowner will be required
    b. Is this a land lease agreement with the NCC? Not sure as propertie details are not available at this time.
6. Please reach out to the RVCA for consultation prior to application submission
7. The Active Transportation Network traverses the site. The new proposed road alignment causes a disruption to the current routes.
    a. Please consider the bike bath realigment
    b. Please consider pathway connections at the intersection of Richmond Road and John Sutherland Road

c. Please consider pathway realignment at the intersection of Baseline Road and Cedarview Road.

Process Comments

8. Site Plan Control & Zoning By-Law Amendment applications can no longer run concurrently

    a. Pre-Consultation for both applications can be done together

    b. Applications to separate at time of full submission

9. Consultation/ Application process with the NCC

    a. The NCC has a separate and distinct review process for development applications

    b. Recommendation to coordinate submission requirements with the NCC – ideally creating one set of submission requirements to be shared between the City and the NCC

        i. City Staff will wait until further consultation has been done with the NCC before providing a Studies and Plans Identification List (SPIL) so no materials will be duplicated

        ii. Updated survey plan for proper lotting may be required

10. Please reach out to Ted Horton (ted.horton@ncc-ccn.ca) to begin pre-consultation process with the NCC

Urban Design

Comments:

11. Submission requirements:

    a. A Design Brief will be required but will be minimal in terms of requirements. A terms of reference will be provided in the follow-up.

    b. Site plan

    c. Landscape plan

    d. Elevations

12. For new buildings, please avoid blank facades. Incorporating windows, doors and architectural treatments to reduce blank facades from the public realm should be sought. For parking garages, please utilize plantings to hide and screen blank walls with all-season plantings.

13. Please ensure there are clear pedestrian linkages from new structures to entrances.

14. Please provide bicycle parking in close proximity to building entrances. Bicycle parking that is covered would be optimal.

Engineering

General Comments:

15. With the development being spread throughout different parts of the site, the applicant should first ensure that they have reviewed all previous studies and plans developed for the site.

16. Existing public services (main connections) have been listed in these comments. It is the responsibility of the applicant to confirm the existing infrastructure on site and to demonstrate adequate outlets/connections to City infrastructure.

17. During the pre-consultation meeting the applicant asked if an update to the previously developed servicing report report would be acceptable or if a new report would be required for this proposal. Please contact Ryan Brault to further discuss.

Water:

Existing Public Services:

1220mm, SE of site, Baseline Road, Backbone Infrastructure

Boundary Conditions:

18. Request Boundary Conditions prior to first submission. Contact assigned City Infrastructure Project Manager with the following information:

    a. Location of service(s)

    b. Type of development

    c. Fire flow (per FUS method – include FUS calculation sheet with boundary condition request – boundary conditions will not be requested without fire flow calculations)

    d. Average Daily Demand (l/s)

    e. Maximum Hourly Demand (l/s)

    f. Maximum Daily Demand (l/s)

General Comments:

19. Per WDG 4.3.1, where basic demand is greater than 50 m3 /day, there shall be a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.

20. Per WDG 4.4.7.2, District Meter Area (DMA) Chamber is required for services greater than 150mm in diameter.

SANITARY

Existing Public Services:

525mm (conc.), E boundary of site

245mm (conc.), S of site, S of E-W rail corridor

Existing forcemain to collector sewer

General Comments:

21. Please submit anticipated sanitary demands.

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

STORMWATER

Existing Infrastructure/Systems:

Ditch, NW of site, at Richmond Road

General Comments:

23. Quantity Control:

    a. Allowable runoff coefficient(c): Lesser of pre-development or c=0.5.

    b. Time of Concentration (Tc): pre-development or maximum=10min.

    c. Site should be controlled Post=Pre up to the the 100-year storm event

24. Quality Control:

    a. Normal level of treatment is required: minimum 70% TSS removal

GEOTECHNICAL INVESTIGATION

25. A geotechnical report is required for this development proposal.

GENERAL INFORMATION/OTHER

26. Topographic information and design grades to be tied to proper geodetic benchmark along with proper description of the Geodetic Benchmark used.

27. All submitted report and plan are to be provided in *.pdf documents (documents shall be flattened and unsecured)

REFERENCES AND RESOURCES

28. 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).

29. Servicing and site works shall be in accordance with the following documents:

    a. Previous studies/master plans developed for the site

    b. General City of Ottawa guidelines (including technical bulletins)

30. geoOttawa - https://maps.ottawa.ca/geoOttawa/

Feel free to contact Ryan Brault ((613) 580-2424 ext. 32540, ryan.brault@ottawa.ca), Project Manager, for follow-up questions.

Noise

Comments:

31. Noise Impact Studies required for the following:

    a. Road, as the site is within proximity to Highway 417, Richmond Road and Baseline Road.

    b. Rail

    c. Stationary, due to the proximity to neighboring exposed mechanical equipment and/or if there will be any exposed mechanical equipment due to the proximity to neighboring noise sensitive land uses.

Feel free to contact Josiane Gervais, TPM, for follow-up questions.

Transportation

Comments:

32. Follow Transportation Impact Assessment Guidelines:

a. Note that the TIA Guidelines have been updated to align with the new pre-application consultation process. The changes are available on the City's website.

b. A Transportation Impact Assessment is required. Please submit the Scoping report to josiane.gervais@ottawa.ca at your earliest convenience or, at the latest, as part of the Phase 2 pre-con package. Should a Phase 2 pre-con be waived, the applicant is still responsible to submit the Scoping Report and must allow for a 14 day circulation period.

c. The Strategy Report must be submitted for review at the latest with the Phase 3 pre-con package. The applicant is still encouraged to submit the Strategy Repot to the TMP before submission of the Phase 3 pre-con package and allow for a 14 day circulation period.

d. Changes to the Baseline/Cedarview intersection will trigger an RMA. Since an RMA is required to support the proposed development, the functional plan and/or RMA plans must be submitted with the formal submission to deem complete. Request base mapping asap via Engineering Services

e. There are constraints with the existing structure over Hwy 417 that could impact the potential for adding an eastbound left-turn lane.

33. ROW Protection:

a. Ensure that the development proposal complies with the Right-of-Way protection requirements of the Official Plan's Schedule C16.

b. Any requests for exceptions to ROW protection requirements must be discussed with Transportation Planning and concurrence provided by Transportation Planning management.

c. If required, ROW must be unincumbered and conveyed at no cost to the City. Note that conveyance of the ROW/corner triangle will be required prior to registration of the SP agreement. Additional information on the conveyance process can be provided upon request.

34. Transportation Master Plan includes:

a. Transit Priority Corridor (Isolated Measures) (Affordable Network) along Baseline and Richmond Road

b. BRT (2031 Network Concept) along Baseline and Richmond Road

35. Nearby planned construction and infrastructure projects include:

a. road resurfacing along Baseline, planned in 3-5 years; and

b. Transit Priority work planned in 1-2 years (for more information contact PM Chris Ogilvie)

36. There are numerous transit stops along the property frontage and throughout the site. An upgrade to stop #1391 may be required as part of the proposed intersection work. OC Transpo may also wish to adjust service along the new road for more direct access to the expanded inpatient building. Therefore new bus stops may be added onto the road which should be considered.

37. As the proposed site is institutional and for general public use, AODA legislation applies.

    a. Ensure all crosswalks located internally on the site provide a TWSI at the depressed curb, per requirements of the Integrated Accessibility Standards Regulation under the AODA.

    b. 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).

    c. Please consider using the City's Accessibility Design Standards, which provide a summary of AODA requirements.

38. On site plan:

    a. Ensure site access meets the City's Private Approach Bylaw.

    b. Ensure drive aisle meets Part 4 – Parking, Queueing and Loading Privisions of the Zoning By-law.

    c. Show all details of the roads abutting the site; include such items as pavement markings, accesses and/or sidewalks.

    d. Turning movement diagrams required for all accesses showing the largest vehicle to access/egress the site.

    e. Turning movement diagrams required for internal movements (loading areas, garbage).

    f. Show all curb radii measurements; ensure that all curb radii are reduced as much as possible and fall within TAC guidelines (Figure 8.5.1).

    g. Show dimensions for site elements (i.e. lane/aisle widths, access width and throat length, parking stalls, sidewalks, pedestrian pathways, etc.)

    h. Sidewalk is to be continuous across accesses as per City Specification 7.1.

i. Show details of parking stalls within proposed lots. Parking stalls at the end of dead-end parking aisles require adequate turning around space.

j. Show slope of garage ramps on site plan. Note that underground ramps should be limited to a 12% grade and must contain a subsurface melting device when exceeding 6% if exposed to the elements. Ramp grades greater than 15% can be psychological barriers to some drivers. When parking ramp's break over slope exceeds 8%, a vertical-curve transition or a transition slope of half the ramp slope should be used. Without this transition, bottoming out of vehicles may occur.

k. Note areas that will not be impacted by this application.

Feel free to contact Josiane Gervais, Transportation Project Manager, for follow-up questions.

Environment

Comments:

39. The access road is within an area designated as a Greenbelt Natural Linkage Area, which is a designation that triggers an Environmental Impact Study (EIS) for development. The EIS will need to address all NCC requirements and the City will accept a different format if that is what is required to meet NCC needs. If the road is removed from the area designated Greenbelt Natural Linkage Area, we could support waiving the EIS since there would be no development within that feature/area.

40. The EIS will need to address both Federally and Provincially listed species.

41. Bird-Safe Design Guidelines - Please review and incorporate bird safe design elements. Some of the risk factors include glass and related design traps such as corner glass and fly-through conditions, ventilation grates and open pipes, landscaping, light pollution. More guidance and solutions are available in the guidelines which can be found here: https://documents.ottawa.ca/sites/documents/files/birdsafedesign_guidelines_en.pdf

42. Urban Heat Island - Please add features that reduce the urban heat island effect (see OP 10.3.3) produced by the parking lot and a building footprint. For example, this impact can be reduced by adding large canopy trees, green roofs or vegetation walls, or constructing the parking lot or building differently.

Feel free to contact Matthew Hayley, Environmental Planner, for follow-up questions.

Forestry

Comments:

43. Priority should be given to the retention of trees and softscape areas that could accommodate future tree plantings. Consider altering the design of the connections to John Sutherland Dr. and Baseline Rd to make use of the existing road network on site, rather than converting greenspace to paved surfaces.

44. To mitigate the increase in paved areas, the Landscape Plan should include a tree planting plan that focuses on providing shade to the proposed parking lots, along pedestrian connections, and waiting/drop-off areas.

45. The following Tree Conservation Report (TCR) guidelines have been adapted from the Schedule E of the Tree Protection By-law – for more information on these requirements please contact julian.alvarez-barkham@ottawa.ca

    a. A Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City
        i. An approved TCR is a requirement of Site Plan approval.
    b. Any removal of privately-owned trees 10cm or larger in diameter within the urban area, 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.
    c. The TCR must contain 2 separate plans:
        i. Plan/Map 1 - show existing conditions with tree cover information.
        ii. Plan/Map 2 - show proposed development with tree cover information.
    d. The TCR must list all trees on site, as well as off-site trees if the CRZ (critical root zone) extends into the developed area, by species, diameter, and health condition.
        i. For ease of review, the Planning Forester suggests that all trees be numbered and referenced in an inventory table.
    e. Please identify trees by ownership – private onsite, private on adjoining site, city owned, co-owned (trees on a property line)
    f. If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained.
        i. Compensation may be required for the removal of city owned trees.
    g. The removal of trees on a property line will require the permission of both property owners.
    h. 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 on the Tree Protection Specification or by searching Ottawa.ca.
        i. The location of tree protection fencing must be shown on the plan.

ii. Show the critical root zone of the retained trees.

i. 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.

46. The following Landscape Plan (LP) guidelines have been adapted from Schedule E of the Tree Protection By-law – for more information on these requirements please contact julian.alvarez-barkham@ottawa.ca

a. Please ensure any retained trees are shown on the LP.

b. Minimum Setbacks

i. Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.

ii. Maintain 2.5m from curb.

iii. Coniferous species require a minimum 4.5m setback from curb, sidewalk, or MUP/cycle track/pathway.

iv. 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.

v. Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when planting around overhead primary conductors.

b. Tree specifications

i. Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.

ii. Maximize the use of large deciduous species wherever possible to maximize future canopy coverage.

c. Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and if possible, include watering and warranty as described in the specification.

d. No root barriers, dead-man anchor systems, or planters are permitted.

e. No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)

f. Hard surface planting

i. If there are hard surface plantings, a planting detail must be provided.

ii. Curb style planter design is highly recommended.

iii. No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.

c. Trees are to be planted at grade.

d. Soil Volume - Please demonstrate as per the **Landscape Plan Terms of Reference** that the available soil volumes for new plantings will meet or exceed the following:

Tree Type/Size	Single Tree Soil Volume (m^3)	Multiple Tree Soil Volume (m^3/tree)
Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

i. It is strongly suggested that the proposed species list include a column listing the available soil volume.

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

f. The City requests that consideration be given to planting native species wherever there is a high probability of survival to maturity.

g. Efforts shall be made to provide as much future canopy cover as possible at a site level, through tree planting and tree retention. The Landscape Plan shall show/document that the proposed tree planting and retention will contribute to the City's overall canopy cover over time. **Please provide a projection of the future canopy cover for the site to 40 years.**

Feel free to contact Julian Alvarez-Barkham, Forester, for follow-up questions.

Parkland

Comments: Parkland comments to be provided at a later date.

Other

47. The High Performance Development Standard (HPDS) is a collection of voluntary and required standards that raise the performance of new building projects to achieve sustainable and resilient design. The HPDS was passed by Council on April 13, 2022.

    a. At this time, the HPDS is not in effect and Council has referred the 2023 HPDS Update Report back to staff with direction to bring forward an updated report to Committee with recommendations for revised phasing timelines, resource requirements and associated amendments to the Site Plan Control By-law by no later than Q1 2024.

    b. Please refer to ottawa.ca/HPDS for more information.

Submission Requirements and Fees

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified as either required (R) or advised (A) as part of a future complete application submission.
    a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.
2. All of the above comments or issues should be addressed to ensure the effectiveness of the application submission review.

Should there be any questions, please do not hesitate to contact myself or the contact identified for the above areas / disciplines.

Yours Truly,
Kieran Watson

Encl. List Applicable Information

c.c. Insert contacts to be cc'd

APPENDIX B

Development Servicing Study Checklist

Servicing study guidelines for development applications

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- ☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.
- ☒ Summary of Pre-consultation Meetings with City and other approval agencies.
- ☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.
- ☒ Statement of objectives and servicing criteria.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- ☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).
- ☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.
- ☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.
- ☒ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:
- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

☐ Confirm consistency with Master Servicing Study, if available
☐ Availability of public infrastructure to service proposed development
☐ Identification of system constraints
☐ Identify boundary conditions
☐ Confirmation of adequate domestic supply and pressure
☐ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.
☐ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.
☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design
☐ Address reliability requirements such as appropriate location of shut-off valves
☐ Check on the necessity of a pressure zone boundary modification.
☐ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

- ☐ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.
- ☐ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.
- ☐ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.
- ☐ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- ☐ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).
- ☐ Confirm consistency with Master Servicing Study and/or justifications for deviations.
- ☐ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.
- ☐ Description of existing sanitary sewer available for discharge of wastewater from proposed development.
- ☐ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)
- ☐ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix ‘C’) format.
- ☐ Description of proposed sewer network including sewers, pumping stations, and forcemains.
- ☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).
- ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.
- ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.
- ☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.
- ☐ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

- ☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)
- ☐ Analysis of available capacity in existing public infrastructure.
- ☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.
- ☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.
- ☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.
- ☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.
- ☐ Set-back from private sewage disposal systems.
- ☐ Watercourse and hazard lands setbacks.
- ☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.
- ☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.
- ☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- ☐ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- ☒ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.
- ☐ Any proposed diversion of drainage catchment areas from one outlet to another.
- ☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
- ☒ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100 year return period storm event.
- ☒ Identification of potential impacts to receiving watercourses
- ☐ Identification of municipal drains and related approval requirements.
- ☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.
- ☐ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

- ☐ Inclusion of hydraulic analysis including hydraulic grade line elevations.
- ☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- ☐ Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.
- ☐ Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

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

- ☐ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.
- ☐ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.
- ☐ Changes to Municipal Drains.
- ☐ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

- ☒ Clearly stated conclusions and recommendations
- ☐ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.
- ☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

APPENDIX C

Storm Servicing Background Information

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

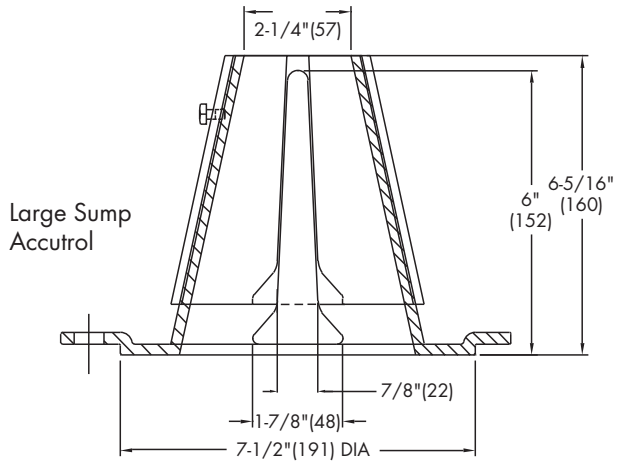
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

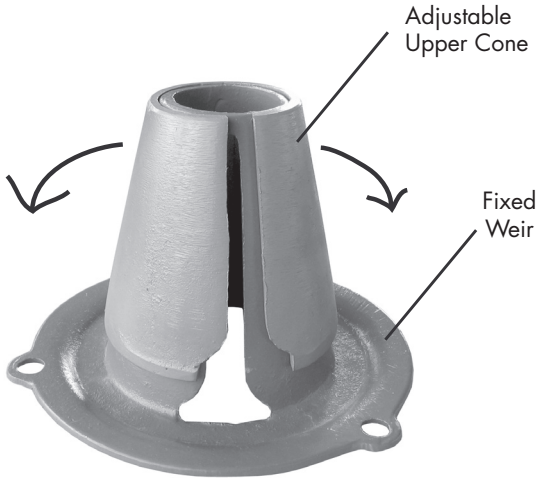
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the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

EXAMPLE:

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

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





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

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

Job Name _____ Contractor _____

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

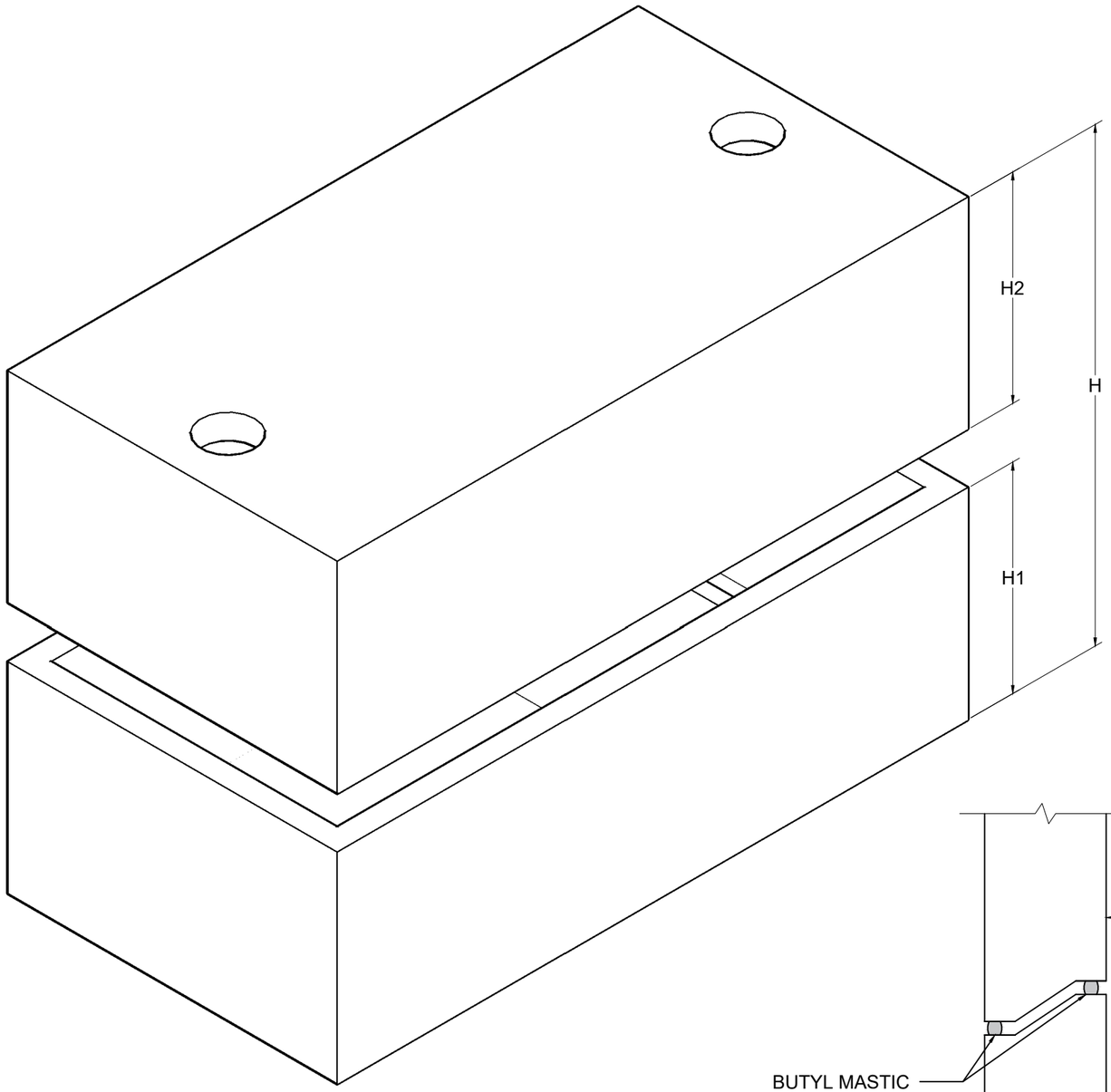
Engineer _____ Representative _____

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.

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Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

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A Watts Water Technologies Company

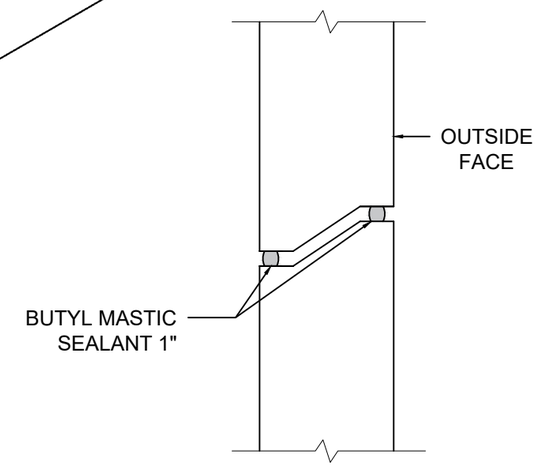
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ISOMETRIC VIEW

CAPACITY		H1		H2		H	
LITRE	GALLON	OUTSIDE	INSIDE	OUTSIDE	INSIDE	OUTSIDE	INSIDE
35000	7700	2100	1850	600	350	2700	2200
40000	8800	2100	1850	900	650	3000	2500
45000	9900	2100	1850	1150	900	3250	2750
50000	11000	2100	1850	1350	1100	3450	2950
55000	12100	2100	1850	1650	1400	3750	3250
60000	13200	2100	1850	1850	1600	3950	3450
65000	14300	2100	1850	2100	1850	4200	3700

CAPACITY		WEIGHT (tonne)		
LITRE	GALLON	BASE	TOP	ALL
35000	7700	36	18.3	54.3
40000	8800	36	21.6	57.6
45000	9900	36	24.3	60.3
50000	11000	36	26.4	62.4
55000	12100	36	29.6	65.6
60000	13200	36	31.8	67.8
65000	14300	36	34	70



JOINT DETAIL

NOTES:

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED.

NOT TO SCALE

NON TRAFFIC RATED, TRAFFIC RATED DESIGNS AVAILABLE UPON REQUEST

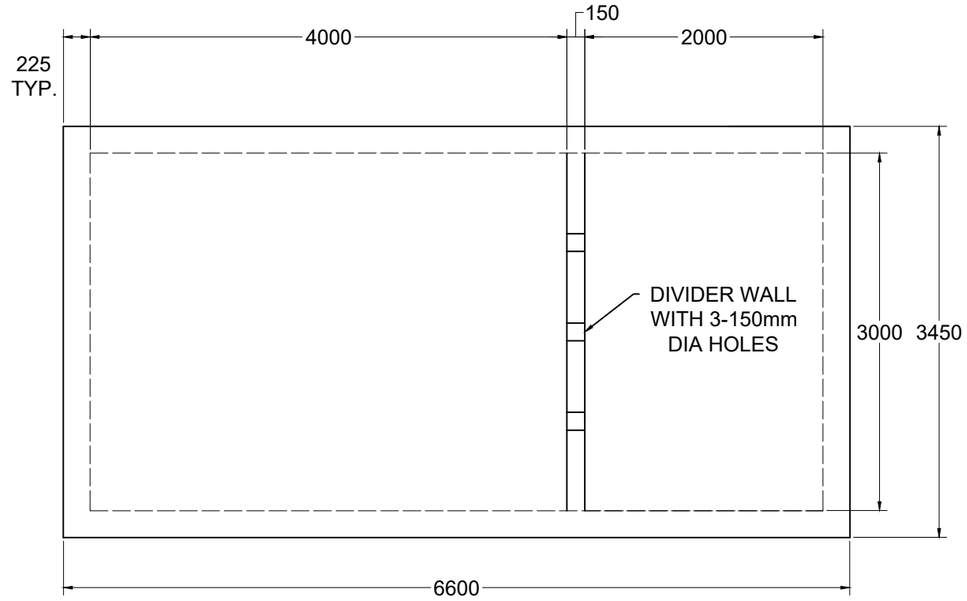
CUSTOM ACCESS OPENINGS, RISERS, AND HATCHES AVAILABLE UPON REQUEST

MAX DEPTH OF COVER = 1500mm

TYP. SLAB THICKNESS = 250mm

TANK DELIVERED IN TWO PIECES, TO BE ASSEMBLED ON SITE BY OTHERS

ALL LIFTING ANCHORS ARE TO BE DAYTON SUPERIOR OR APPROVED ALTERNATIVE. ALL RIGGING, HOISTING, AND LIFTING TO BE IN STRICT ACCORDANCE WITH DAYTON SUPERIOR MANUAL.



PLAN VIEW

SPECIFICATIONS:
PRODUCT DESIGNED IN ACCORDANCE WITH CSA A23.3

PRODUCTION:
IN ACCORDANCE WITH CSA A23.4

CONCRETE:
IN ACCORDANCE WITH CSA A23.1

REINFORCING:
IN ACCORDANCE WITH WITH CSA G30.18
GRADE 400W

SEPTIC TANK
(35,000L - 65,000L)

DRAWN BY:
JS

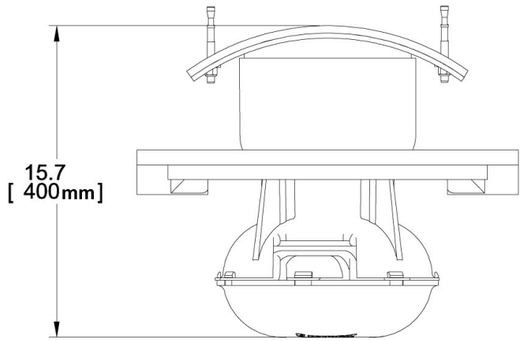
DATE:
AUG 2023

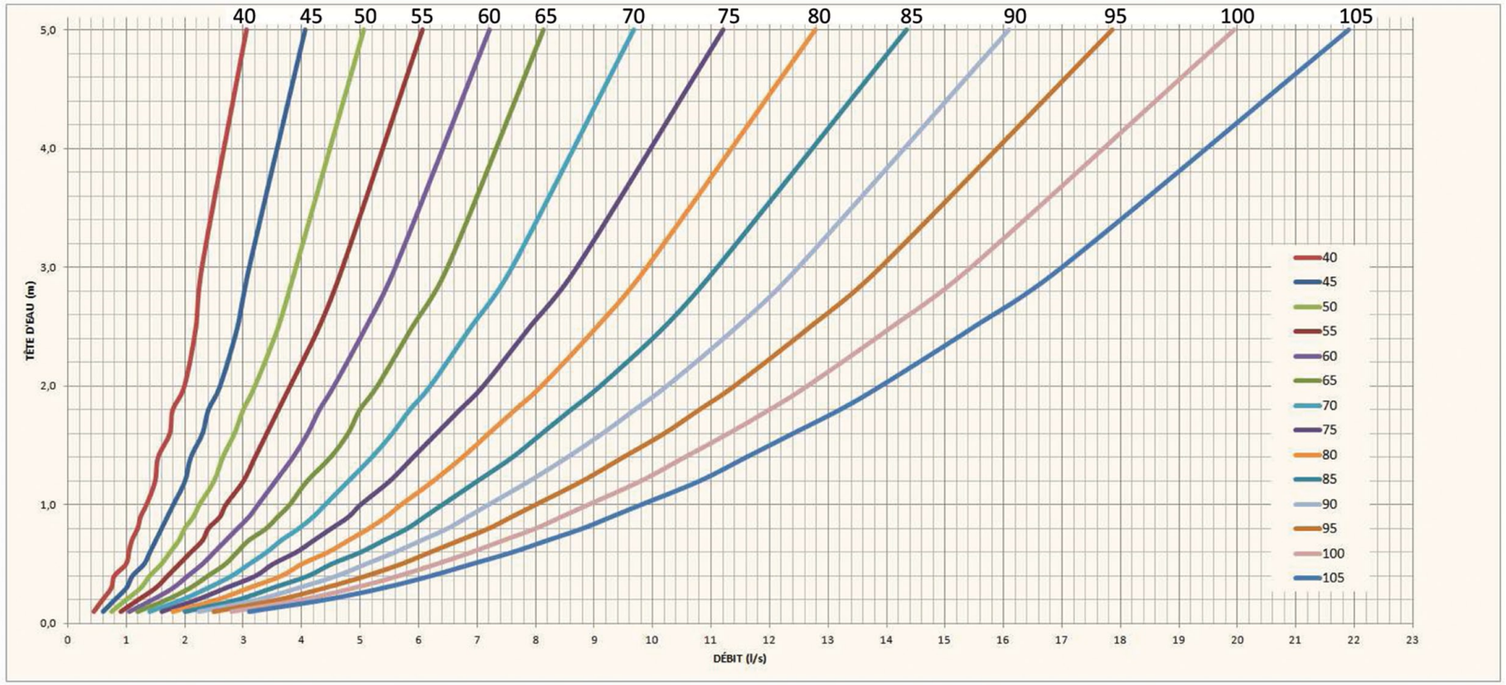
ANCHOR CONCRETE PRODUCTS

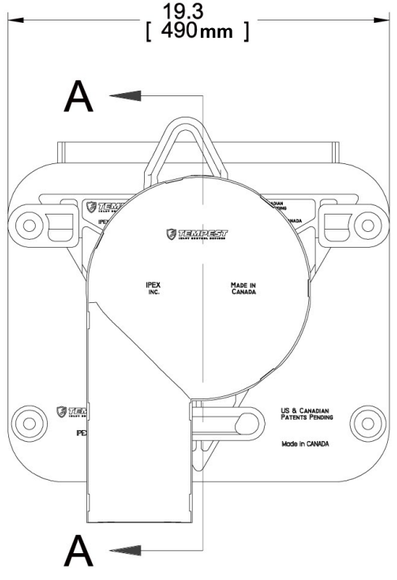
1645 SYDENHAM RD.
KINGSTON, ON

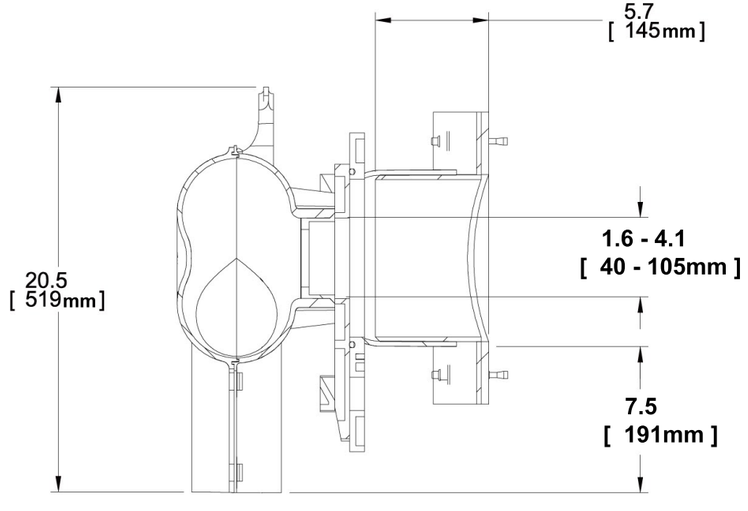
PHONE:
(800) 223-0012
1-613-546-6683

WWW.ANCHORCONCRETE.COM









SECTION A-A

IPEX

Product development engineering
3 Place du commerce, Suite 101
Île des Soeurs, Montréal, QC, H3E 1H7
Canada Tel 514 769 2200
www.ipexna.com

PROJECTION	UNITS	TITLE			
	in [mm]	Tempest LMF round CB assembly [VORTEX]	SIZE B	SCALE(S) 1/8	1-2014

IPEX Tempest™ Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition

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The information contained here within is based on current information and product design at the time of publication and is subject to change without notification. IPEX does not guarantee or warranty the accuracy, suitability for particular applications, or results to be obtained therefrom.

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.

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

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.



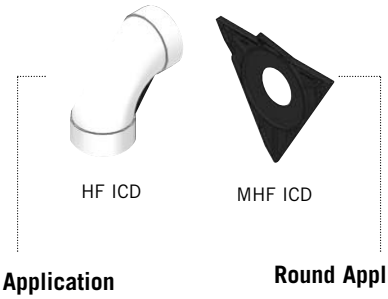
TEMPEST MHF (Medium to High Flow):
The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

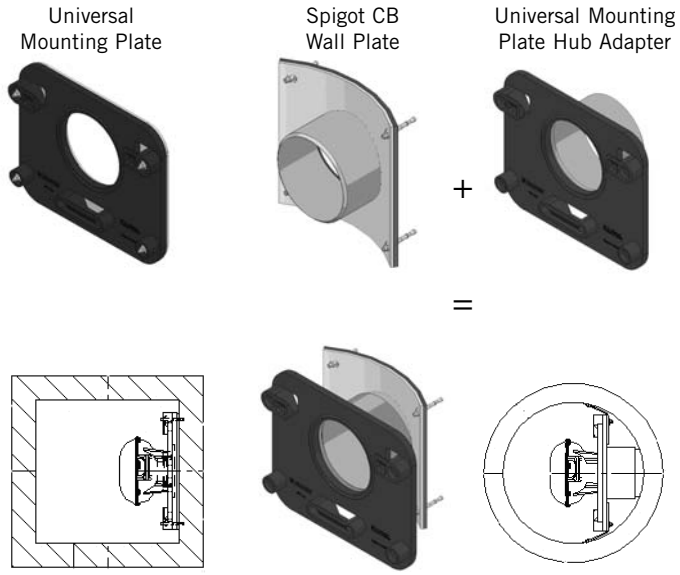
The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

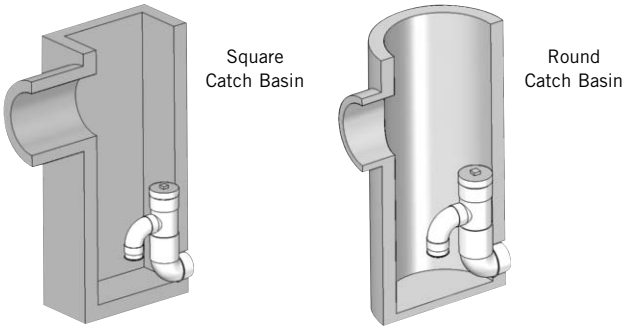
The HF and MHF ICD's are available to accommodate both square and round applications:



Square Application **Round Application**

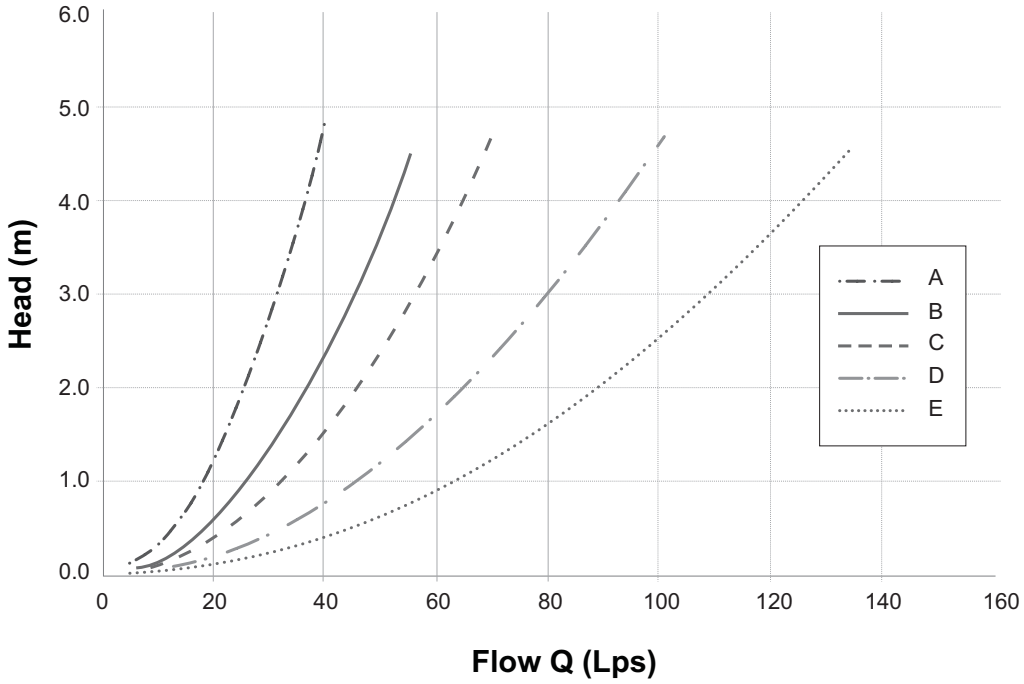


The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

Chart 3: HF & MHF Preset Flow Curves



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

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.

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

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.
- 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 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.

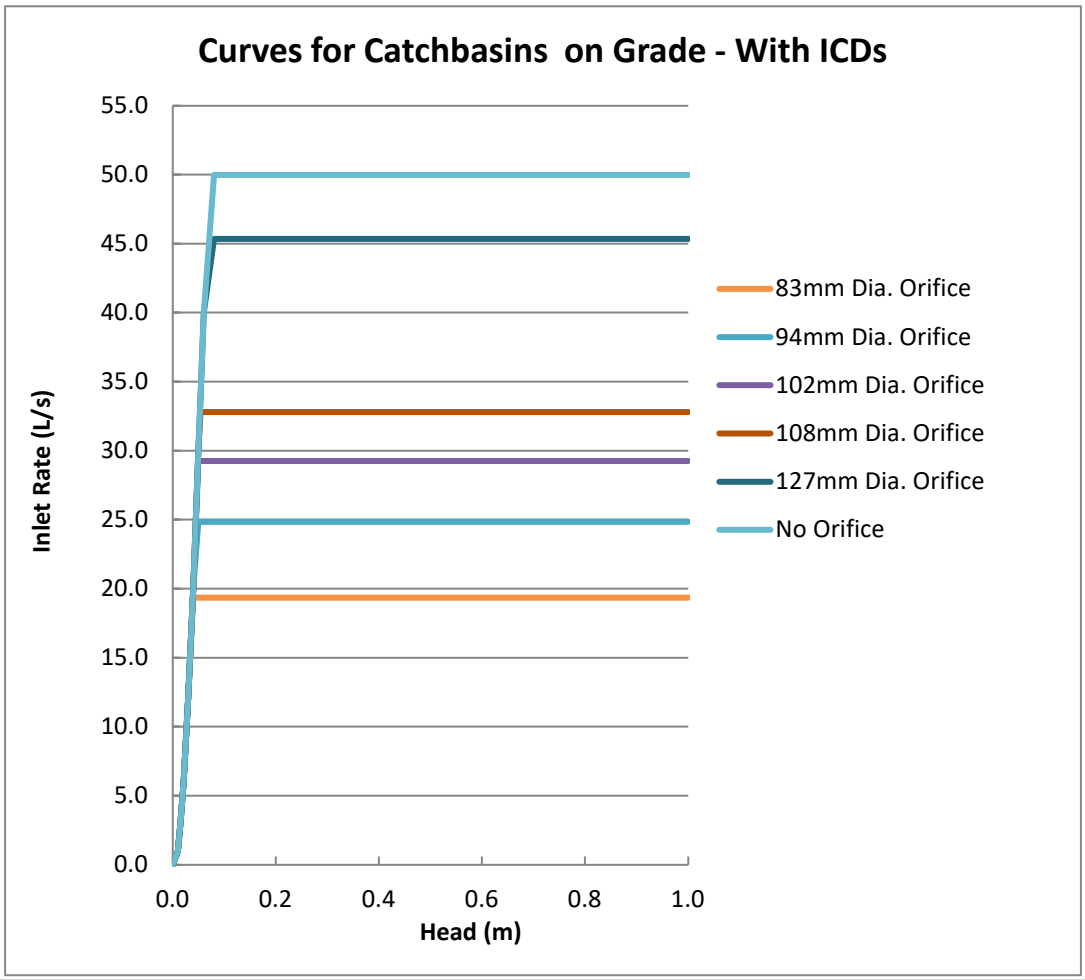
Installation

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.

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

Queensway-Carleton Hospital Part 4 Expansion
Catchbasin (On-Grade) with ICD Curves

NOVATECH
Engineers, Planners & Landscape Architects



Curb Inlet Catchbasins on Continuous Grade

Depth vs. Captured Flow Curve

A standard depth vs. captured flow curve for catch basins on a continuous grade was provided to Novatech by City staff for use in a dual-drainage model of an existing residential neighbourhood. This standard curve was derived using the inlet curves in Appendix 7A of the Ottawa Sewer Design Guidelines.

Novatech reviewed the methodology used to create this standard curve (described below) and determined that it was suitable for general use in other dual-drainage models.

- MTO Design Chart 4.04 provides the relationship between the gutter flow rate (Q_t) and flow spread (T) for Barrier Curb.
- MTO Design Chart 4.12 provides the relationship between flow spread (T) and flow depth (D).
- The relationship between the gutter flow rate (Q_t) and flow depth (D) was determined for different road slopes using the above charts and Manning's equation (refer to pages 58-60 of the MTO Drainage Management Manual – Part 2);
- The relationship between approach flow (Q_t) and captured flow (Q_c) was determined for different road slopes using the design chart for Barrier Curb with Gutter (Appendix 7-A.2).
- Using the above information, a family of curves was developed to characterize the relationship between flow depth and captured flow for curb inlet catchbasins on different road slopes. The results of this exercise can be summarized as follows:
    - For a given flow depth, the gutter flow rate (Q_t) increases as the road slope increases.
    - The capture efficiency (Q_c) of curb inlet catchbasins decrease as the road slope increases.
    - The net result is that the relationship between flow depth and capture rate is largely independent of road slope: While approach flow vs. captured flow (Q_t vs. Q_c) varies significantly with road grade, flow depth vs. captured flow (D vs. Q_c) does not.

Since there was very little difference in the flow depth vs. captured flow curves for different road slopes, this family of curves was averaged to create a single standard curve for use in dual-drainage models.

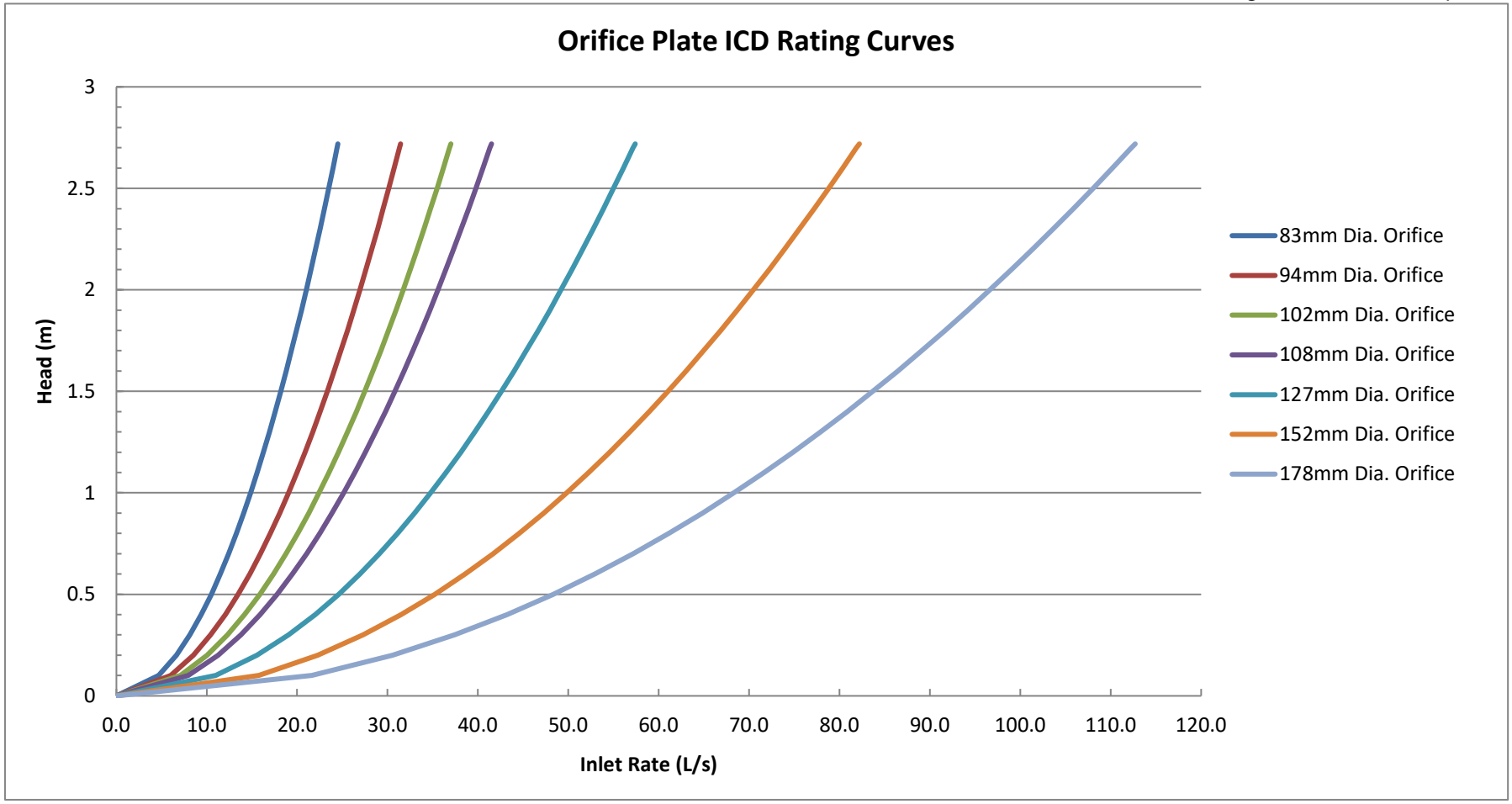
Inlet Control Devices

The standard depth vs. capture flow curve was modified to account for the installation of ICDs in curb inlet catchbasins on continuous grade. Separate inlet curves were created for each standard ICD orifice size by capping the inlet rate on the depth vs. capture flow curve at the maximum flow rate through the ICD at a head of 1.2m (depth from centerline of CB lead to top of CICB frame).

Queensway-Carleton Hospital Part 4 Expansion

ICD Rating Curves

NOVATECH
Engineers, Planners & Landscape Architects



Stormceptor® EF Sizing Report

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

09/03/2026

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20

Site Name:	OGS 1

Drainage Area (ha):	3.38
% Imperviousness:	70.00

Runoff Coefficient 'c': 0.72

Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	78.55
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	415.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	2254
Estimated Average Annual Sediment Volume (L/yr):	0

Project Name:	QCH Part 4 Expansion - OGS1
Project Number:	123089
Designer Name:	Kallie Auld
Designer Company:	Novatech
Designer Email:	k.auld@novatech-eng.com
Designer Phone:	613-254-9643
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	55
EFO5	63
EFO6	70
EFO8	80
EFO10	86
EFO12	90

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 70

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

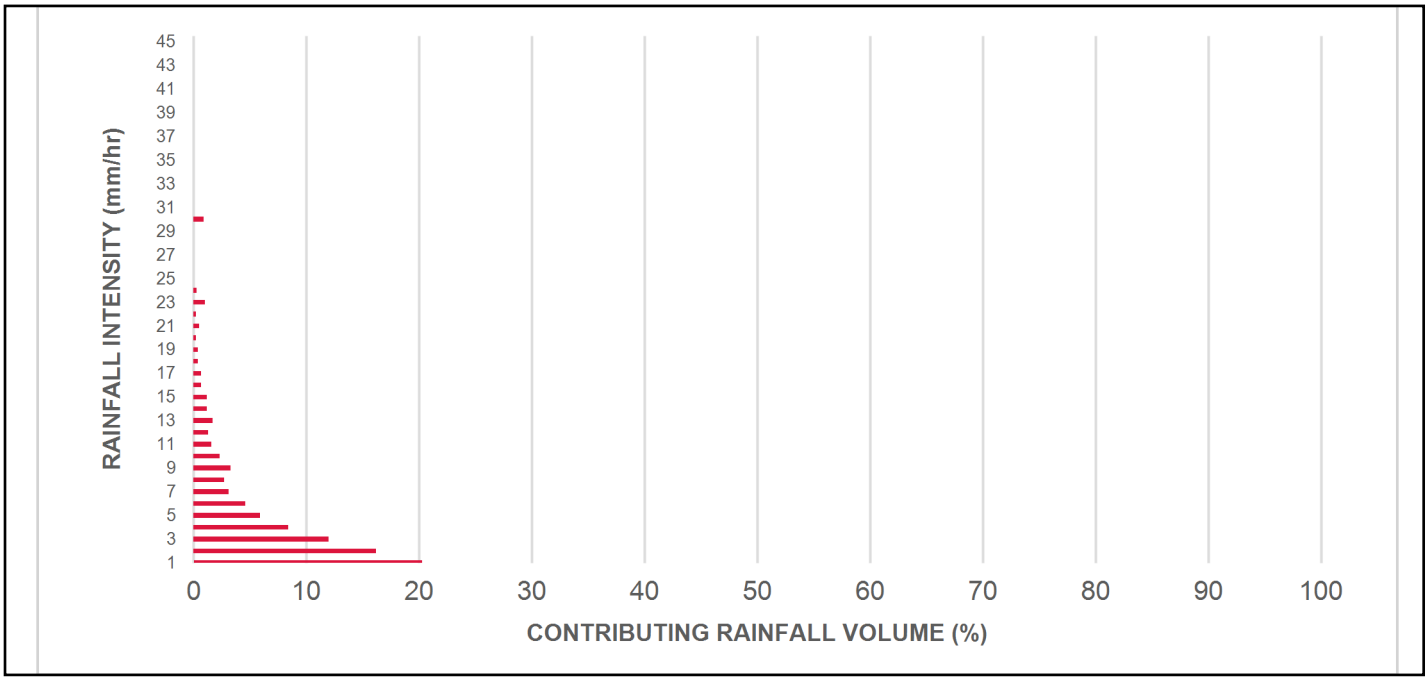
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a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

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

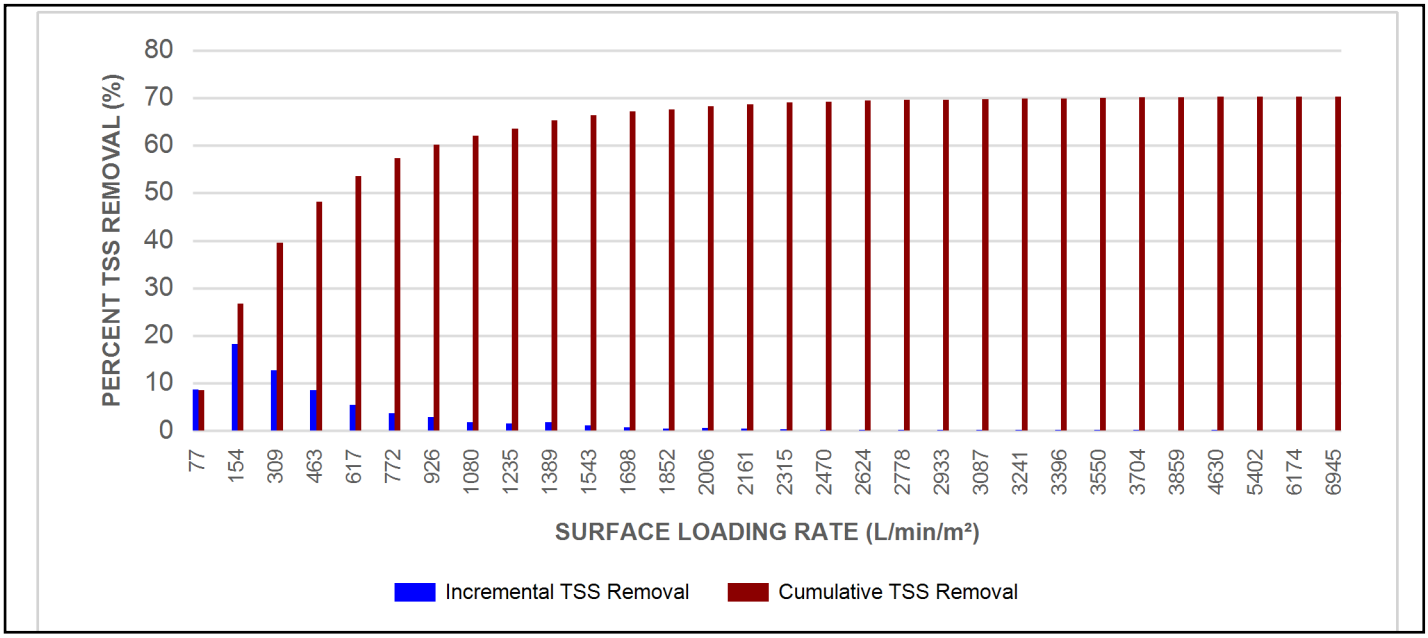
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	3.38	203.0	77.0	100	8.6	8.6
1.00	20.3	29.0	6.77	406.0	154.0	89	18.2	26.8
2.00	16.2	45.2	13.53	812.0	309.0	78	12.7	39.5
3.00	12.0	57.2	20.30	1218.0	463.0	71	8.5	48.1
4.00	8.4	65.6	27.06	1624.0	617.0	65	5.4	53.5
5.00	5.9	71.6	33.83	2030.0	772.0	63	3.8	57.3
6.00	4.6	76.2	40.59	2436.0	926.0	62	2.9	60.2
7.00	3.1	79.3	47.36	2841.0	1080.0	60	1.8	62.0
8.00	2.7	82.0	54.12	3247.0	1235.0	56	1.5	63.5
9.00	3.3	85.3	60.89	3653.0	1389.0	53	1.8	65.3
10.00	2.3	87.6	67.65	4059.0	1543.0	48	1.1	66.4
11.00	1.6	89.2	74.42	4465.0	1698.0	43	0.7	67.1
12.00	1.3	90.5	81.18	4871.0	1852.0	40	0.5	67.6
13.00	1.7	92.2	87.95	5277.0	2006.0	37	0.6	68.2
14.00	1.2	93.5	94.72	5683.0	2161.0	34	0.4	68.6
15.00	1.2	94.6	101.48	6089.0	2315.0	32	0.4	69.0
16.00	0.7	95.3	108.25	6495.0	2470.0	30	0.2	69.2
17.00	0.7	96.1	115.01	6901.0	2624.0	28	0.2	69.4
18.00	0.4	96.5	121.78	7307.0	2778.0	27	0.1	69.5
19.00	0.4	96.9	128.54	7713.0	2933.0	25	0.1	69.6
20.00	0.2	97.1	135.31	8118.0	3087.0	24	0.1	69.7
21.00	0.5	97.5	142.07	8524.0	3241.0	23	0.1	69.8
22.00	0.2	97.8	148.84	8930.0	3396.0	22	0.1	69.8
23.00	1.0	98.8	155.60	9336.0	3550.0	21	0.2	70.0
24.00	0.3	99.1	162.37	9742.0	3704.0	20	0.1	70.1
25.00	0.0	99.1	169.14	10148.0	3859.0	19	0.0	70.1
30.00	0.9	100.0	202.96	12178.0	4630.0	16	0.1	70.2
35.00	0.0	100.0	236.79	14207.0	5402.0	14	0.0	70.2
40.00	0.0	100.0	270.62	16237.0	6174.0	12	0.0	70.2
45.00	0.0	100.0	304.44	18267.0	6945.0	11	0.0	70.2
Estimated Net Annual Sediment (TSS) Load Reduction =								**70 %**

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



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

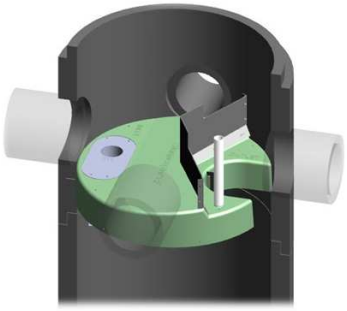
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

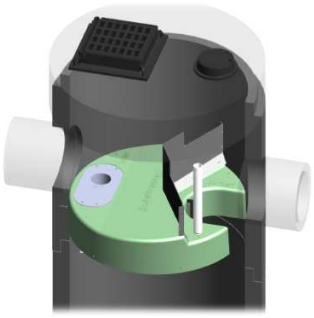
DESIGN FLEXIBILITY

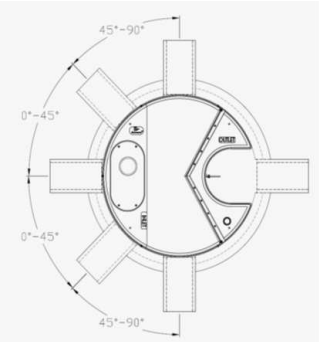
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

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

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

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

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

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

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

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

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

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

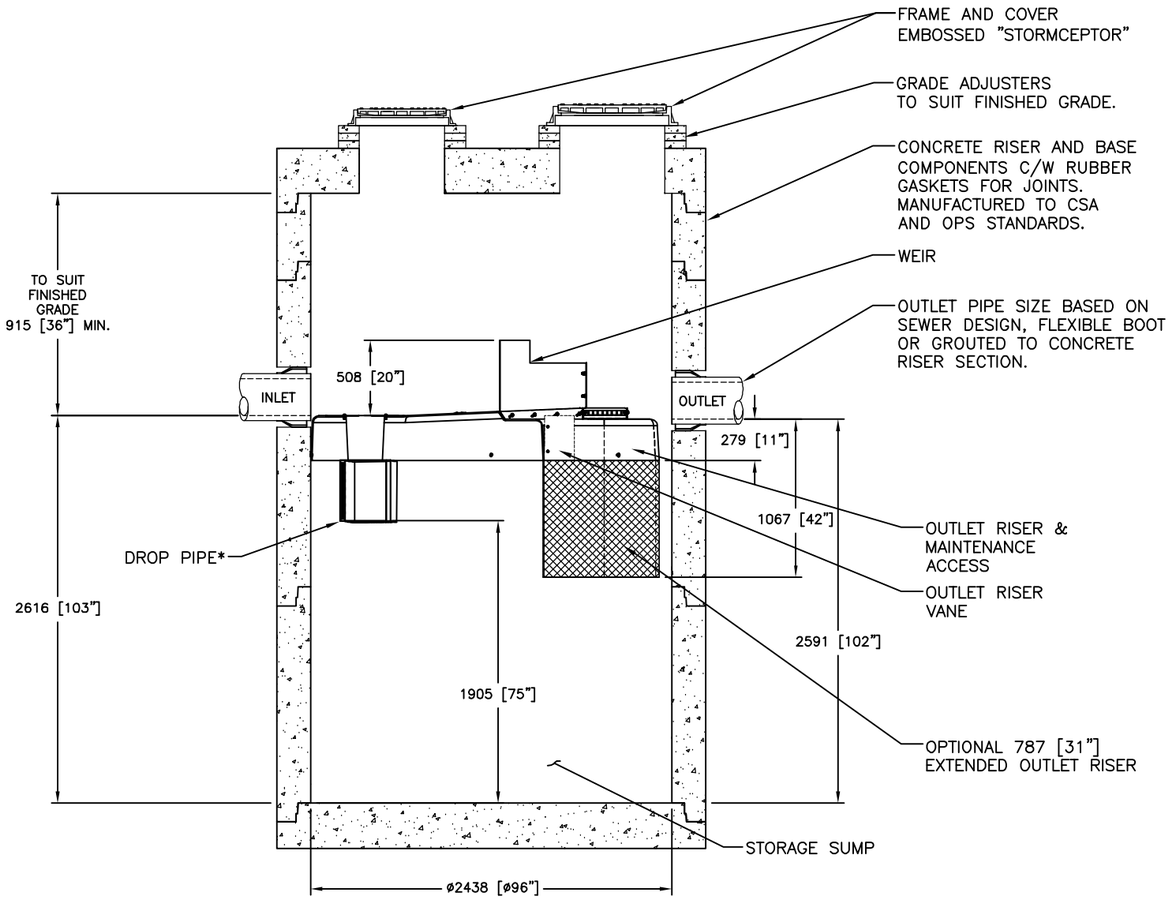
3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid

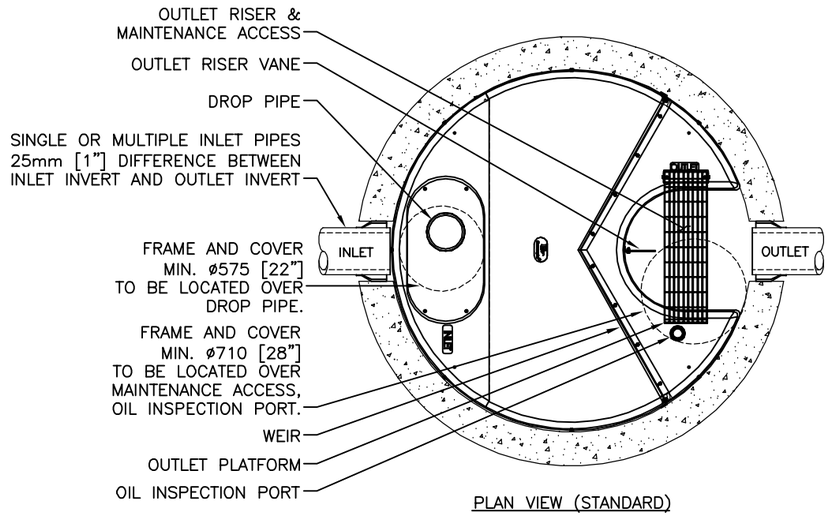
Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

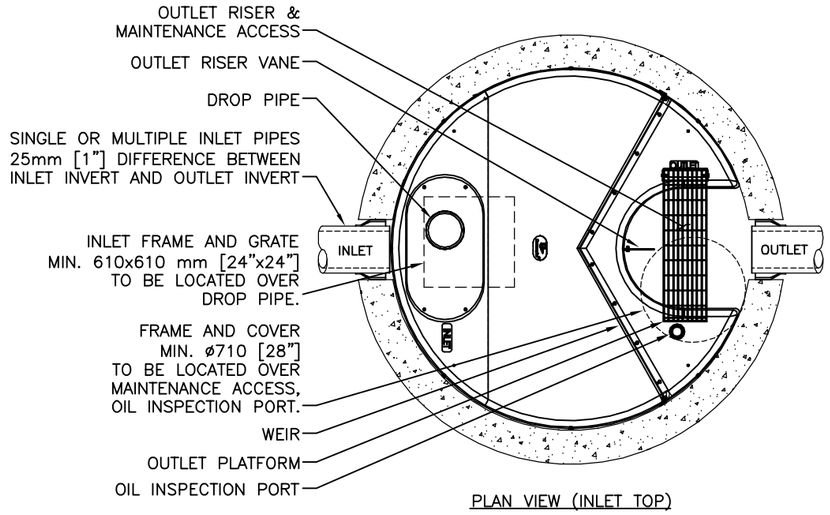
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF8 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO8 (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.

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.

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).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO8				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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If discrepancies between the supplied information upon which this drawing is based and actual conditions are encountered, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for design based on inaccurate, incomplete or inaccurate information supplied by others.

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

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 9A9
TF 800-565-6801 CA 416-665-8600 INTL +1-416-665-8600

DATE:	10/13/2017
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: *
PROJECT No.: EFO8	SEQUENCE No.: *
SHEET:	1 OF 1

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EF\40 DRAWINGS & DETAILS\STANDARD DETAILS\EFO8 STANDARD DETAILS\EFO8-DETAIL.DWG 4/12/2019 11:07 AM

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

09/03/2026

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20

Site Name:	OGS 2

Drainage Area (ha):	9.56
% Imperviousness:	70.00

Runoff Coefficient 'c': 0.72

Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	212.40
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	1200.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	6182
Estimated Average Annual Sediment Volume (L/yr):	0

Project Name:	QCH Part 4 Expansion - OGS2
Project Number:	123089
Designer Name:	Kallie Auld
Designer Company:	Novatech
Designer Email:	k.auld@novatech-eng.com
Designer Phone:	613-254-9643
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	34
EFO5	42
EFO6	50
EFO8	62
EFO10	71
EFO12	77

Recommended Stormceptor EFO Model: EFO10

Estimated Net Annual Sediment (TSS) Load Reduction (%): 71

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

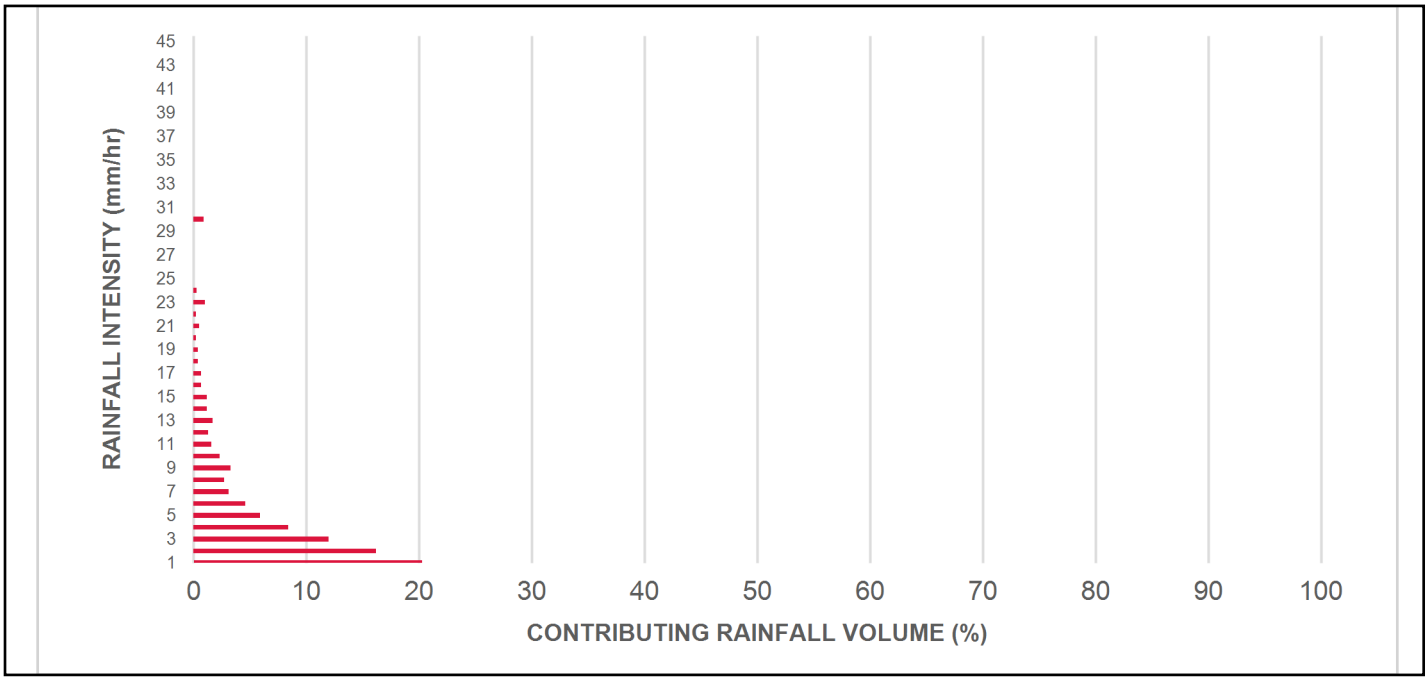
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a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

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

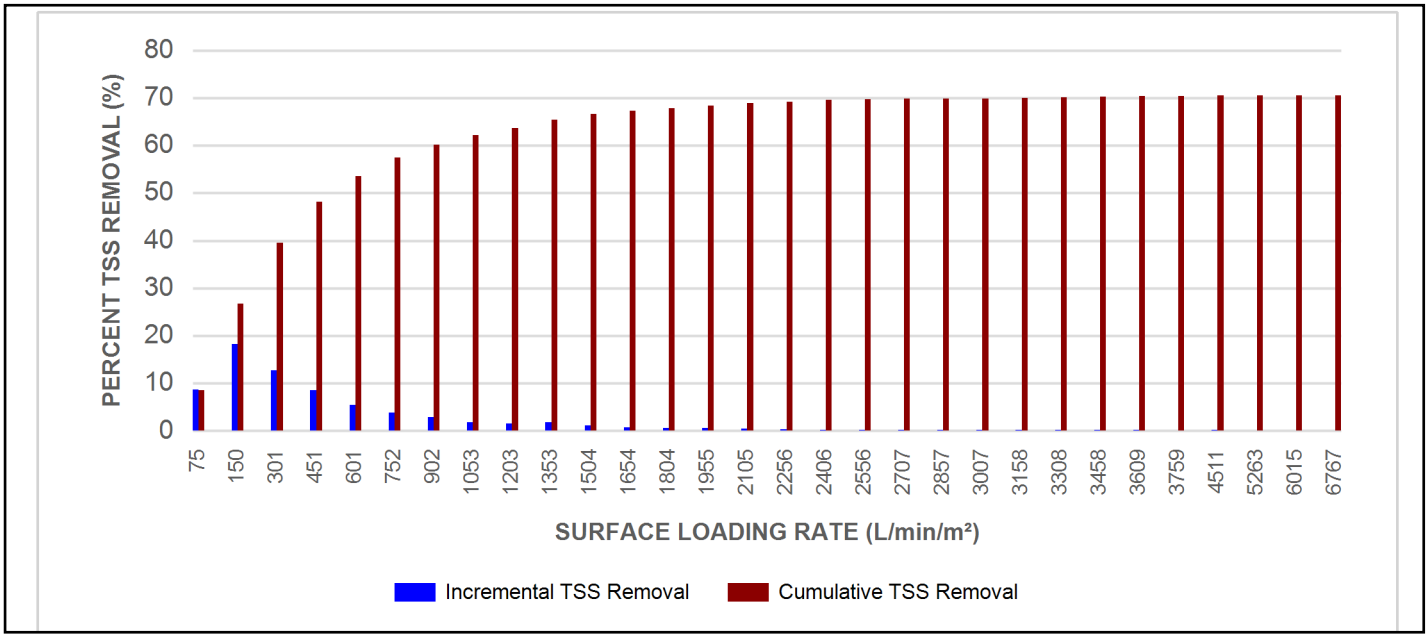
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	9.15	549.0	75.0	100	8.6	8.6
1.00	20.3	29.0	18.29	1098.0	150.0	89	18.2	26.8
2.00	16.2	45.2	36.59	2195.0	301.0	78	12.7	39.5
3.00	12.0	57.2	54.88	3293.0	451.0	72	8.6	48.1
4.00	8.4	65.6	73.18	4391.0	601.0	65	5.5	53.6
5.00	5.9	71.6	91.47	5488.0	752.0	63	3.8	57.4
6.00	4.6	76.2	109.77	6586.0	902.0	62	2.9	60.2
7.00	3.1	79.3	128.06	7684.0	1053.0	60	1.9	62.1
8.00	2.7	82.0	146.36	8781.0	1203.0	57	1.6	63.7
9.00	3.3	85.3	164.65	9879.0	1353.0	53	1.8	65.4
10.00	2.3	87.6	182.95	10977.0	1504.0	49	1.1	66.6
11.00	1.6	89.2	201.24	12074.0	1654.0	44	0.7	67.3
12.00	1.3	90.5	219.54	13172.0	1804.0	41	0.5	67.8
13.00	1.7	92.2	237.83	14270.0	1955.0	38	0.6	68.4
14.00	1.2	93.5	256.12	15367.0	2105.0	35	0.4	68.9
15.00	1.2	94.6	274.42	16465.0	2256.0	33	0.4	69.2
16.00	0.7	95.3	292.71	17563.0	2406.0	31	0.2	69.5
17.00	0.7	96.1	311.01	18661.0	2556.0	29	0.2	69.7
18.00	0.4	96.5	329.30	19758.0	2707.0	27	0.1	69.8
19.00	0.4	96.9	347.60	20856.0	2857.0	26	0.1	69.9
20.00	0.2	97.1	365.89	21954.0	3007.0	24	0.1	69.9
21.00	0.5	97.5	384.19	23051.0	3158.0	24	0.1	70.0
22.00	0.2	97.8	402.48	24149.0	3308.0	22	0.1	70.1
23.00	1.0	98.8	420.78	25247.0	3458.0	22	0.2	70.3
24.00	0.3	99.1	439.07	26344.0	3609.0	20	0.1	70.4
25.00	0.0	99.1	457.37	27442.0	3759.0	20	0.0	70.4
30.00	0.9	100.0	548.84	32930.0	4511.0	16	0.2	70.5
35.00	0.0	100.0	640.31	38419.0	5263.0	14	0.0	70.5
40.00	0.0	100.0	731.78	43907.0	6015.0	12	0.0	70.5
45.00	0.0	100.0	823.26	49395.0	6767.0	11	0.0	70.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**71 %**

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



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

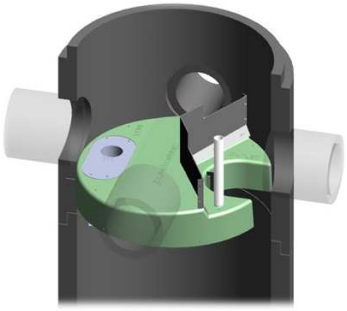
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

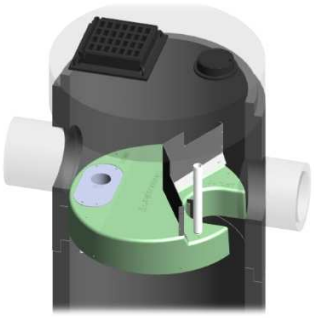
DESIGN FLEXIBILITY

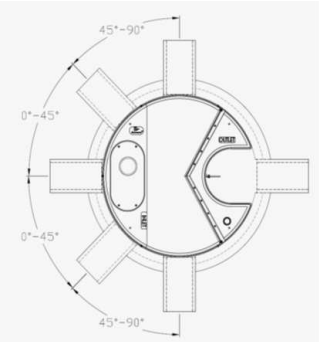
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

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

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

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

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

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

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

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

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

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

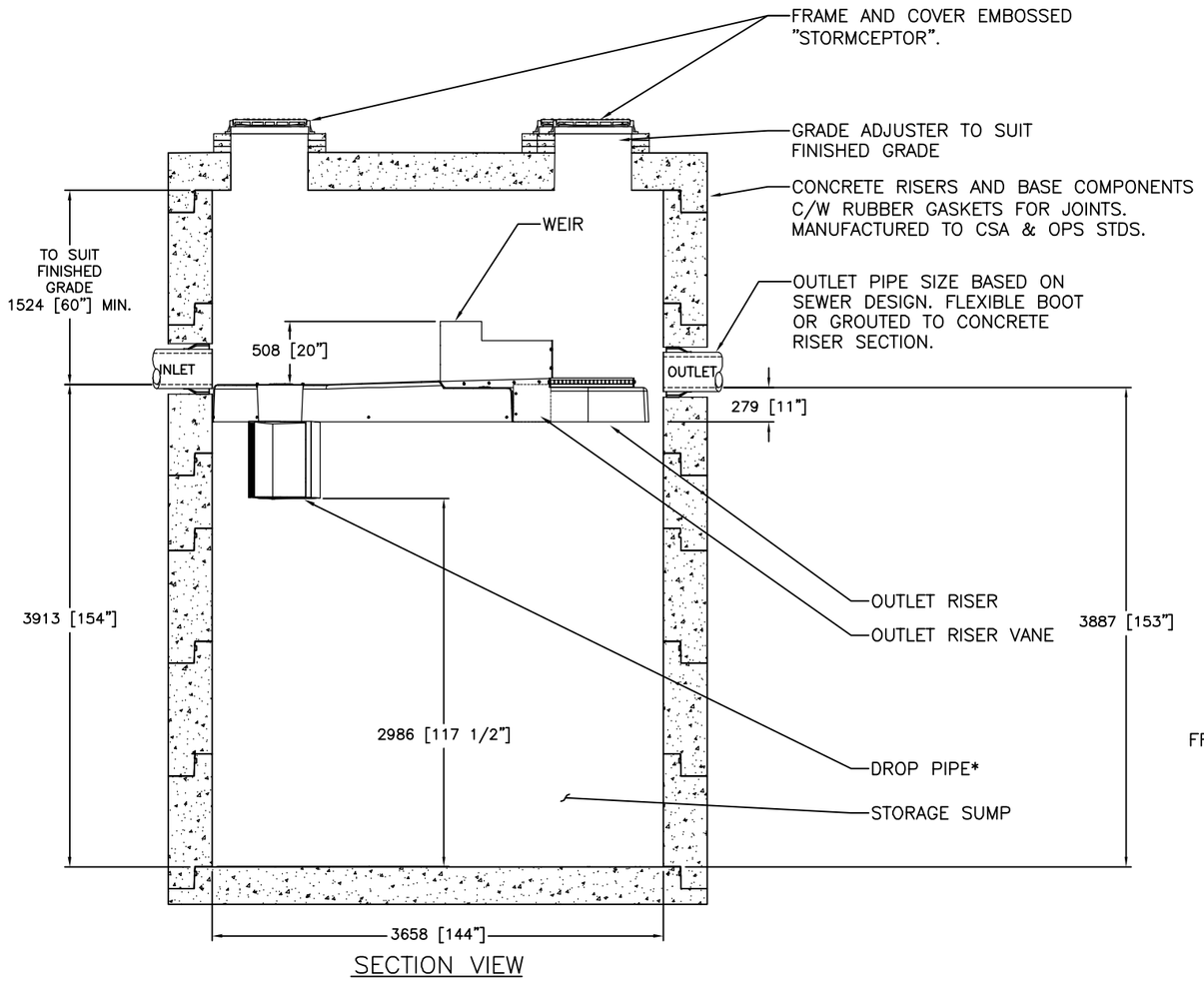
3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid

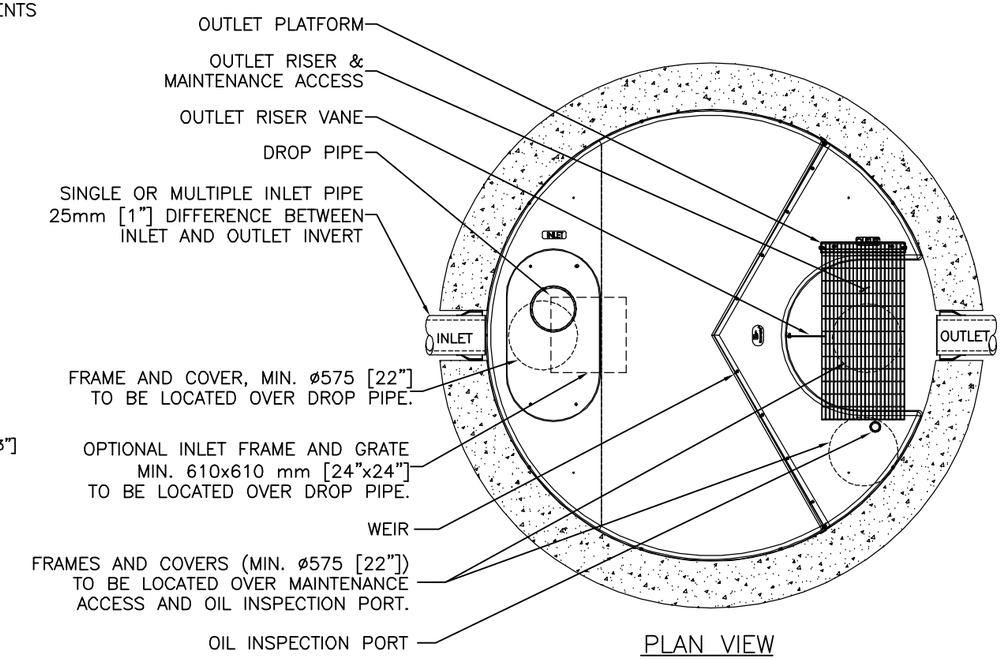
Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF12 AND 535 L/min/m^2 (13.1 gpm/ft^2) 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.

INSTALLATION NOTES

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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.

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STANDARD DETAIL
NOT FOR CONSTRUCTION

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

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

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 9A9
TF 800-565-4801 CA 416-665-8600 INTL +1-416-665-8600

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DATE: 10/24/2017

DESIGNED:	DRAWN:
JSK	JSK
CHECKED:	APPROVED:
BSF	SP
PROJECT No.:	SEQUENCE No.:
EFO12	*

SHEET: 1 OF 1

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APPENDIX D

Stormwater Management Calculations,
Correspondence to support Rooftop Stormwater Storage Strategy

Existing Stormwater Flows									
Description	***Area (ha)***	***$A_{impervious}$ (ha)***	***A_{gravel} (ha) C=0.75***	***$A_{pervious}$ (ha) C=0.2***	**Weighted C_{w5}**	**Weighted C_{w100}**	**T_c****	**5-Year Flow (L/s)**	**100-Year Flow (L/s)**
Direct Runoff (Northeast)	5.883	0.399	0.190	5.293	0.27	0.32	51.58	159.7	328.2
Direct Runoff (West Ditch)	1.364	0.159	0.000	1.205	0.28	0.34	43.96	44.1	89.9
Direct Runoff (South Ditch)	0.676	0.039	0.000	0.637	0.24	0.29	31.49	23.5	48.9
Controlled Flow to On-Site Storm Sewer System*	4.176	**N/A**						229.6	272.8
Uncontrolled Flow to On-Site Storm Sewer System	8.102	3.810	0.000	4.293	0.53	0.60	19.70	845.3	1643.8
						Total Site Flows :		**1302.2**	**2383.6**

*Information taken directly from previous SWM report and design drawings.

**T_c for landscaped areas calculated using Airport Formula. T_c for on-site sewer system taken directly from previous SWM report.

Queensway-Carleton Hospital Part 4 Expansion
Overall Model Schematic

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Legend

Junctions
- Visible
- Roof Drain Connection
- Outfalls

Storages
- Visible
- OGS Unit
- Storage Tank
- Catchbasin
- Catchbasin MH
- DICB
- Roof Storage
- Stormtech Chambers
- Manhole
- Trench Drain

Conduits
- Visible
- Superpipe Storage
- Major System
- Overland Flow
- Orifices
- Weirs
- Outlets

Subcatchments
- Visible
- Parking/ Roadways
- External/ Uncontrolled
- Roof
- Roof-NEW
- Green Roof
- Loading Dock
- Landscaped Area
- NEW-TEMP

- Background
- InternalPlumb
- Background02

N

150 m

9/4/2026
PREPARED BY: NOVATECH

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Queensway-Carleton Hospital Part 4 Expansion
Model Parameters

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Area ID	Description	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
A101	Ex. Ring Road - Uncontrolled	0.157	0.60	57%	0%	20.06	78.28	0.5%
A102	Ex. Landscaped Area - Uncontrolled	0.202	0.36	23%	0%	36.40	55.49	0.5%
A103	Ex. Ring Road - Uncontrolled	0.190	0.53	47%	0%	20.51	92.66	0.5%
A104	Ex. Ring Road - Uncontrolled	0.195	0.69	70%	0%	32.95	59.19	0.5%
A105	Ex. Landscaped Area - Uncontrolled	0.082	0.67	67%	0%	24.52	33.44	0.5%
A106	Ex. Landscaped Area - Uncontrolled	0.027	0.43	33%	0%	18.17	14.86	0.5%
A107	Ex. Ring Road - Uncontrolled	0.079	0.64	63%	0%	15.54	50.85	0.5%
A108	Modified Ring Road - Uncontrolled	0.087	0.66	66%	0%	19.39	44.86	0.5%
A113	Existing Building Roof - Uncontrolled	0.792	0.90	100%	0%	106.42	74.42	0.5%
A116a	Modified Building Roof - Uncontrolled	0.038	0.90	100%	0%	22.08	17.21	0.5%
A116B	Modified Building Roof - Uncontrolled	0.017	0.90	100%	0%	6.04	28.13	0.5%
A117	Modified Building Roof - Uncontrolled	0.023	0.90	100%	0%	13.56	16.96	0.5%
A119	Modified Paved Parking Area - Uncontrolled	0.122	0.64	63%	0%	47.79	25.53	0.5%
A120	Ex. Ring Road - Uncontrolled	0.227	0.55	50%	0%	41.94	54.12	0.5%
A121	Ex. Ring Road - Uncontrolled	0.100	0.80	86%	0%	19.31	51.78	0.5%
A122	Ex. John Sutherland Drive - Uncontrolled	0.283	0.38	25%	0%	28.93	97.82	0.5%
A137	Ex. Landscaped Area - Uncontrolled	0.021	0.62	60%	0%	8.26	25.42	0.5%
B101	Modified John Sutherland Drive - Uncontrolled	0.549	0.48	40%	0%	29.24	187.74	0.5%
B102	Modified Ring Road - Uncontrolled	0.127	0.71	73%	0%	28.00	45.35	0.5%
B103	Landscaped Area - Uncontrolled	0.019	0.55	50%	0%	9.24	20.56	0.5%
B104	Paved Parking Area - Controlled (ICD)	0.149	0.72	74%	0%	23.48	63.45	0.5%
B105	Modified John Sutherland Drive - Uncontrolled	0.077	0.66	66%	0%	14.96	51.48	0.5%
B106	Paved Parking Area - Controlled (ICD)	0.156	0.74	77%	0%	16.43	94.94	0.5%
B107	Modified John Sutherland Drive - Uncontrolled	0.081	0.53	47%	0%	18.79	43.12	0.5%
B108	Modified John Sutherland Drive - Controlled (ICD)	0.053	0.87	96%	0%	12.81	41.38	0.5%
B109	Paved Parking Area - Uncontrolled	0.052	0.64	63%	0%	14.15	36.75	0.5%
B110a	Landscaped Area - Uncontrolled	0.068	0.86	94%	0%	23.39	29.07	0.5%
B110b	Landscaped Area - Uncontrolled	0.075	0.25	7%	0%	26.71	28.08	0.5%
B111	Paved Parking Area - Uncontrolled	0.061	0.84	91%	0%	14.51	42.04	0.5%
B112	Modified John Sutherland Drive - Controlled (ICD)	0.607	0.47	38%	0%	32.21	188.43	0.5%
B113	Landscaped Area - Uncontrolled	0.092	0.20	0%	0%	18.80	48.95	0.5%
B114	Modified Paved Parking Area - Controlled (ICD)	0.547	0.69	70%	0%	44.22	123.71	0.5%
B115	Modified Paved Parking Area - Controlled (ICD)	0.285	0.85	93%	0%	35.39	80.53	0.5%
B116	Landscaped Area - Controlled	0.300	0.23	4%	0%	39.04	76.84	0.5%
B117	Paved Parking Area - Controlled	0.217	0.49	42%	0%	36.93	58.76	0.5%
B118	Paved Parking Area - Controlled	0.069	0.49	41%	0%	17.52	39.39	0.5%
B119	Modified John Sutherland Drive - Controlled (ICD)	0.079	0.63	61%	0%	18.46	42.80	0.5%
B120	Modified John Sutherland Drive - Controlled (ICD)	0.084	0.67	67%	0%	12.13	69.27	0.5%
B122	Modified Loading Dock Area - Uncontrolled	0.220	0.79	84%	0%	47.70	46.12	0.5%
B122-1	Modified Loading Dock Area - Uncontrolled	0.002	0.79	84%	0%	8.00	2.50	0.5%
B122-2	Modified Loading Dock Area - Uncontrolled	0.002	0.79	84%	0%	8.00	2.50	0.5%
B124	Modified Loading Dock Area - Uncontrolled	0.247	0.64	63%	0%	18.59	132.87	0.5%
B127	Loading Dock Access Road - Uncontrolled	0.229	0.54	49%	0%	21.61	105.96	0.5%
B128	Landscaped Area - Controlled (ICD)	0.096	0.42	32%	0%	18.48	51.96	0.5%
B129	Landscaped Area - Controlled (ICD)	0.016	0.20	0%	0%	9.82	16.30	0.5%
B130	Modified Ring Road - Controlled (ICD)	0.080	0.66	65%	0%	16.95	47.19	0.5%
B131	Modified Ring Road - Controlled (ICD)	0.098	0.58	54%	0%	24.03	40.78	0.5%

Queensway-Carleton Hospital Part 4 Expansion
Model Parameters

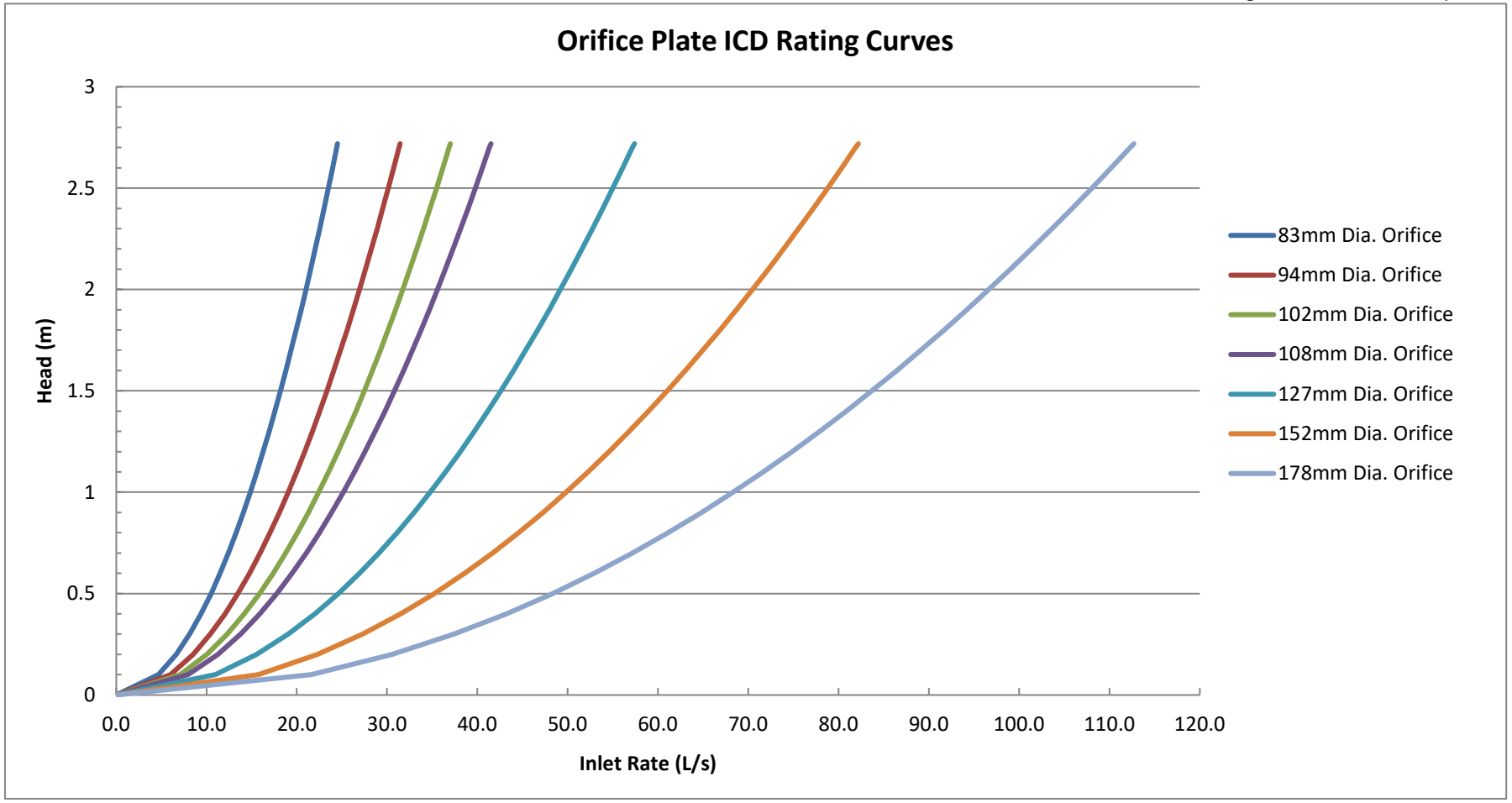
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Area ID	Description	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
B132	Modified Ring Road - Controlled (ICD)	0.180	0.76	80%	0%	37.40	48.13	0.5%
B133	Modified Ring Road - Controlled (ICD)	0.145	0.46	37%	0%	46.93	30.90	0.5%
B134a_1	Modified John Sutherland Drive - Uncontrolled	0.190	0.56	51%	0%	22.29	85.22	0.5%
B134a_2	Modified John Sutherland Drive - Uncontrolled	0.121	0.56	51%	0%	20.96	57.75	0.5%
B134b_1	Landscaped Area - Controlled (ICD)	0.058	0.28	11%	0%	28.48	20.37	0.5%
B134b_2	Landscaped Area - Controlled (ICD)	0.047	0.28	11%	0%	25.07	18.75	0.5%
B135a_1	Modified John Sutherland Drive - Uncontrolled	0.112	0.67	67%	0%	27.13	41.21	0.5%
B135a_2	Modified John Sutherland Drive - Uncontrolled	0.164	0.67	67%	0%	30.78	53.35	0.5%
B135b	Landscaped Area - Controlled (ICD)	0.059	0.25	7%	0%	34.94	16.89	0.5%
B136	Landscaped Area - Uncontrolled	0.065	0.35	21%	0%	10.04	64.75	0.5%
B137	Generator Access Road - Uncontrolled	0.086	0.56	51%	0%	21.30	40.38	0.5%
B138	Landscaped Area - Uncontrolled	0.042	0.24	6%	0%	11.26	37.31	0.5%
B139	Generator Access Road - Uncontrolled	0.035	0.54	49%	0%	14.43	24.25	0.5%
EX.A02.01	Modified Paved Parking Area - Controlled (ICD)	0.028	0.71	73%	0%	16.43	17.04	0.5%
EX.A02.02	Modified Paved Parking Area - Controlled (ICD)	0.039	0.65	64%	0%	24.19	16.12	0.5%
EX.A03.01	Modified Paved Parking Area - Controlled (ICD)	0.080	0.90	100%	0%	18.92	42.28	0.5%
EX.A03.02	Modified Paved Parking Area - Controlled (ICD)	0.158	0.90	100%	0%	13.87	113.93	0.5%
EX.A04	Modified Paved Parking Area - Controlled (ICD)	0.040	0.90	100%	0%	10.31	38.81	0.5%
EX.R01	Modified Paved Parking Area - Controlled (ICD)	0.072	0.90	100%	0%	19.92	36.14	0.5%
EX.R02	Existing Green Building Roof - Uncontrolled	0.295	0.90	100%	0%	55.27	53.37	0.5%
EX.R03	Existing Green Building Roof - Uncontrolled	0.043	0.90	100%	0%	28.31	15.19	0.5%
EX_A01a_1	Existing Bunker Roof - Controlled (Roof Drains)	0.215	0.66	66%	0%	25.73	83.41	0.5%
EX_A01a_2	Ex. Cancer Centre Roof - Controlled (Roof Drains)	0.208	0.66	66%	0%	27.92	74.66	0.5%
EX_A01b_1	Modified Building Roof - Controlled (Roof Drains)	0.177	0.76	80%	0%	25.40	69.54	0.5%
EX_A01B_2	Existing Building Roof - Controlled (Roof Drains)	0.159	0.76	80%	0%	22.23	71.69	0.5%
EX_A02a	Modified Building Roof - Controlled (Roof Drains)	0.400	0.71	73%	0%	130.29	30.70	0.5%
EX_A02B	Existing Building Roof - Controlled (Roof Drains)	0.518	0.65	64%	0%	34.34	150.86	0.5%
P3-01	Modified Building Roof - Controlled (Roof Drains)	0.486	0.90	100%	0%	58.72	82.76	0.5%
P3-02	Existing Building Roof - Controlled (Roof Drains)	0.017	0.90	100%	0%	11.23	15.14	0.5%
P3-03	Existing Building Roof - Uncontrolled	0.038	0.90	100%	0%	11.65	32.62	0.5%
P4-01	Ambulatory Care Addition - Controlled (Roof Drains)	0.200	0.90	100%	0%	22.83	87.60	0.5%
P4-02	Emerg. Dept. Addition - Controlled (Roof Drains)	0.294	0.90	100%	0%	28.29	103.93	0.5%
P4-03	Ambulance Garage - Controlled (Roof Drains)	0.087	0.90	100%	0%	30.47	28.55	0.5%
P4-04	Generator/MEP Room - Controlled (Roof Drains)	0.110	0.90	100%	0%	38.34	28.69	0.5%
P4-05	Transitional Care Tower - Controlled (Roof Drains)	0.337	0.90	100%	0%	50.84	66.29	0.5%
P4-07	M.M. & E.V.S. Building - Controlled (Roof Drains)	0.042	0.90	100%	0%	11.61	36.19	0.5%
P4-08	Ex. Parking Garage - Controlled (UG Tank)	0.288	0.90	100%	0%	19.42	148.27	0.5%
P4-09	New Parking Garage - Controlled (UG Tank)	0.272	0.90	100%	0%	67.83	40.10	0.5%
P4-DR1a_1	Direct Runoff to Richmond Rd Roadside Ditch	0.721	0.28	11%	0%	69.47	103.79	0.5%
P4-DR1a_2	Direct Runoff to Richmond Rd Roadside Ditch	0.038	0.28	11%	0%	76.00	5.00	0.5%
P4-DR1b	Direct Runoff to Baseline Road Roadside Ditch	0.681	0.24	6%	0%	209.28	32.54	2.0%
P4-DR2	Direct Runoff to Northeast Corner of Property	5.496	0.24	6%	0%	510.02	107.76	1.5%
TOTAL:		**20.22**						

Queensway-Carleton Hospital Part 4 Expansion

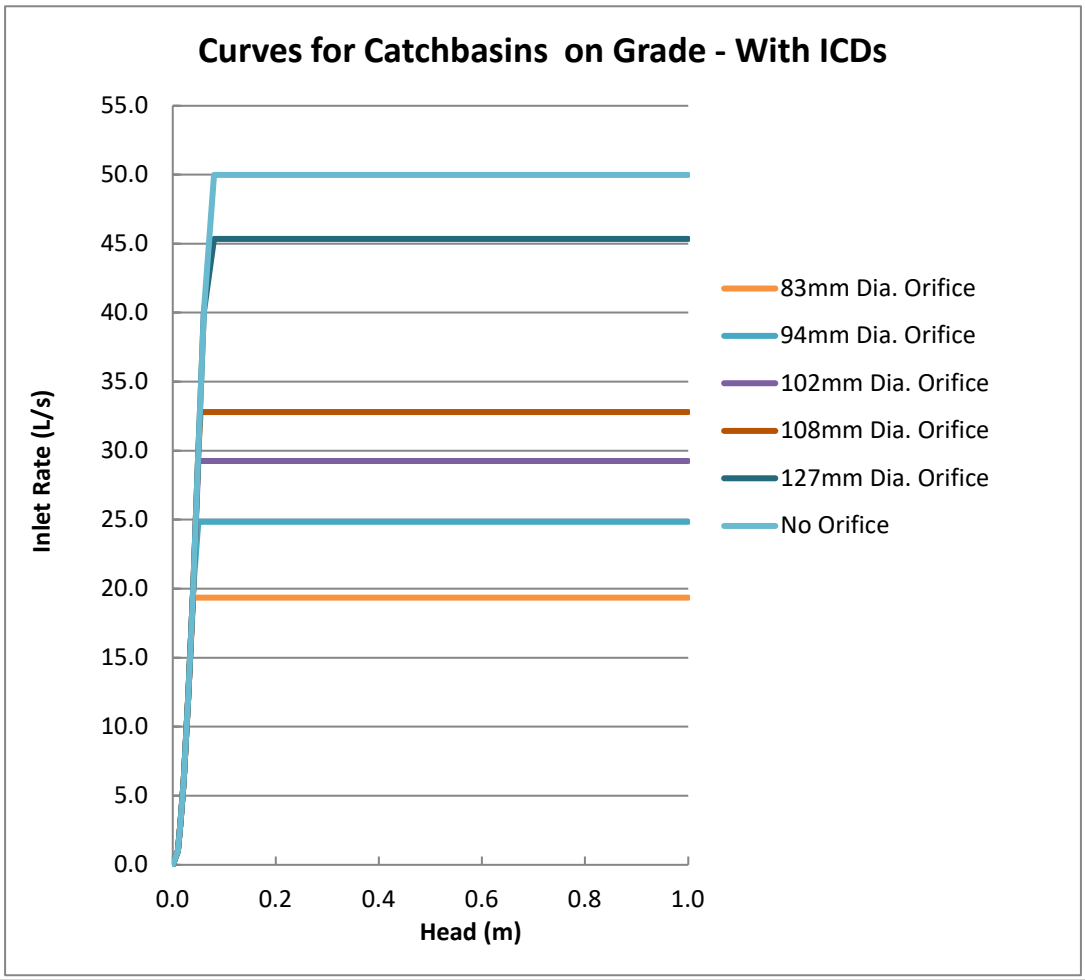
ICD Rating Curves

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Queensway-Carleton Hospital Part 4 Expansion
Catchbasin (On-Grade) with ICD Curves

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Curb Inlet Catchbasins on Continuous Grade

Depth vs. Captured Flow Curve

A standard depth vs. captured flow curve for catch basins on a continuous grade was provided to Novatech by City staff for use in a dual-drainage model of an existing residential neighbourhood. This standard curve was derived using the inlet curves in Appendix 7A of the Ottawa Sewer Design Guidelines.

Novatech reviewed the methodology used to create this standard curve (described below) and determined that it was suitable for general use in other dual-drainage models.

- MTO Design Chart 4.04 provides the relationship between the gutter flow rate (Q_t) and flow spread (T) for Barrier Curb.
- MTO Design Chart 4.12 provides the relationship between flow spread (T) and flow depth (D).
- The relationship between the gutter flow rate (Q_t) and flow depth (D) was determined for different road slopes using the above charts and Manning's equation (refer to pages 58-60 of the MTO Drainage Management Manual – Part 2);
- The relationship between approach flow (Q_t) and captured flow (Q_c) was determined for different road slopes using the design chart for Barrier Curb with Gutter (Appendix 7-A.2).
- Using the above information, a family of curves was developed to characterize the relationship between flow depth and captured flow for curb inlet catchbasins on different road slopes. The results of this exercise can be summarized as follows:
    - For a given flow depth, the gutter flow rate (Q_t) increases as the road slope increases.
    - The capture efficiency (Q_c) of curb inlet catchbasins decrease as the road slope increases.
    - The net result is that the relationship between flow depth and capture rate is largely independent of road slope: While approach flow vs. captured flow (Q_t vs. Q_c) varies significantly with road grade, flow depth vs. captured flow (D vs. Q_c) does not.

Since there was very little difference in the flow depth vs. captured flow curves for different road slopes, this family of curves was averaged to create a single standard curve for use in dual-drainage models.

Inlet Control Devices

The standard depth vs. capture flow curve was modified to account for the installation of ICDs in curb inlet catchbasins on continuous grade. Separate inlet curves were created for each standard ICD orifice size by capping the inlet rate on the depth vs. capture flow curve at the maximum flow rate through the ICD at a head of 1.2m (depth from centerline of CB lead to top of CICB frame).

Queensway-Carleton Hospital Part 4 Expansion

ROW and Parking Lot Ponding Depths

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Structure	Drainage Area ID	T/G	Max. Static Ponding (Spill Depth)		2-yr Event (3hr)				5-yr Event (3hr)				100-yr Event (3hr)			
		(m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Cascading Flow?	Cascade Depth (m)	Elev. (m)	Depth (m)	Cascading Flow?	Cascade Depth (m)	Elev. (m)	Depth (m)	Cascading Flow?	Cascade Depth (m)
CB403	B106	78.60	78.80	0.20	73.95	0.00	N	0.00	74.00	0.00	N	0.00	75.04	0.00	N	0.00
CB409	B116	77.00	77.50	0.50	75.46	0.00	N	0.00	76.20	0.00	N	0.00	77.33	0.33	N	0.00
CB414	B134b_1	75.85	76.10	0.25	75.03	0.00	N	0.00	75.07	0.00	N	0.00	75.91	0.06	N	0.00
CBMH402	B104	78.55	78.75	0.20	78.55	0.00	N	0.00	78.60	0.05	N	0.00	78.68	0.13	N	0.00
CBMH411	B117	77.45	77.50	0.05	75.46	0.00	N	0.00	76.20	0.00	N	0.00	77.39	0.00	N	0.00
CBMH412	B118	77.35	77.50	0.15	75.46	0.00	N	0.00	76.20	0.00	N	0.00	77.32	0.00	N	0.00
CBMH-R2	B115	77.48	77.71	0.23	74.82	0.00	N	0.00	75.13	0.00	N	0.00	76.74	0.00	N	0.00
CBMH-R3	B115	77.47	77.71	0.24	74.82	0.00	N	0.00	75.13	0.00	N	0.00	76.74	0.00	N	0.00
EX_CB006	B114	78.40	78.52	0.12	76.55	0.00	N	0.00	77.20	0.00	N	0.00	78.49	0.09	N	0.00
EX_CBMH010	B114	78.23	78.52	0.29	76.50	0.00	N	0.00	77.19	0.00	N	0.00	78.49	0.26	N	0.00
EX_CBMH011	B114	78.37	78.52	0.15	76.50	0.00	N	0.00	77.19	0.00	N	0.00	78.49	0.12	N	0.00
EX_CBMH012	B114	78.42	78.52	0.10	76.76	0.00	N	0.00	77.19	0.00	N	0.00	78.49	0.07	N	0.00
EX_CBMH014	B114	78.39	78.52	0.13	76.57	0.00	N	0.00	77.19	0.00	N	0.00	78.49	0.10	N	0.00
EX_CBA01a	EXA01a	78.07	78.18	0.11	78.19	0.12	Y	0.01	78.27	0.20	Y	0.09	78.37	0.30	Y	0.19
EX_CBA01b-1	EXA01b	78.11	78.24	0.13	78.23	0.12	N	0.00	78.28	0.17	Y	0.04	78.37	0.26	Y	0.13
EX_CBA01b-2	EXA01b	78.08	78.24	0.16	78.17	0.09	N	0.00	78.21	0.13	N	0.00	78.30	0.22	Y	0.06
EX_CBA02a	EXA02a	78.85	79.09	0.24	79.03	0.18	N	0.00	79.11	0.26	Y	0.02	79.14	0.29	Y	0.05
EX-CB129	EXA02b	78.00	78.18	0.18	78.09	0.09	N	0.00	78.14	0.14	N	0.00	78.24	0.24	Y	0.06
EX-CB130	EXA02b	78.00	78.18	0.18	78.11	0.11	N	0.00	78.16	0.16	N	0.00	78.29	0.29	Y	0.11
EX-CB132	EXA01a	77.93	78.18	0.25	78.09	0.16	N	0.00	78.15	0.22	N	0.00	78.29	0.36	Y	0.11
EX-LD01	B135b	74.52	75.05	0.53	74.05	0.00	N	0.00	74.07	0.00	N	0.00	74.28	0.00	N	0.00

Queensway-Carleton Hospital Part 4 Expansion
Design Storm Time Series Data
3-hour Chicago Design Storms

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C25mm-3.stm		C2-3.stm		C5-3.stm	
Duration	Intensity	Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr	min	mm/hr
0:00	0	0:00	0	0:00	0
0:10	2.21	0:10	2.81	0:10	3.68
0:20	2.75	0:20	3.5	0:20	4.58
0:30	3.68	0:30	4.69	0:30	6.15
0:40	5.73	0:40	7.3	0:40	9.61
0:50	14.29	0:50	18.21	0:50	24.17
1:00	60.28	1:00	76.81	1:00	104.19
1:10	18.9	1:10	24.08	1:10	32.04
1:20	9.7	1:20	12.36	1:20	16.34
1:30	6.53	1:30	8.32	1:30	10.96
1:40	4.94	1:40	6.3	1:40	8.29
1:50	3.99	1:50	5.09	1:50	6.69
2:00	3.37	2:00	4.29	2:00	5.63
2:10	2.92	2:10	3.72	2:10	4.87
2:20	2.58	2:20	3.29	2:20	4.3
2:30	2.32	2:30	2.95	2:30	3.86
2:40	2.1	2:40	2.68	2:40	3.51
2:50	1.93	2:50	2.46	2:50	3.22
3:00	1.79	3:00	2.28	3:00	2.98

Queensway-Carleton Hospital Part 4 Expansion
Design Storm Time Series Data
3-hour Chicago Design Storms

Engineers, Planners & Landscape Architects

C10-3.stm		C25-3.stm		C50-3.stm	
Duration	Intensity	Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr	min	mm/hr
0:00	0.00	0:00	0.00	0:00	0.00
0:10	4.25	0:10	4.93	0:10	5.47
0:20	5.29	0:20	6.15	0:20	6.82
0:30	7.11	0:30	8.28	0:30	9.19
0:40	11.13	0:40	13.01	0:40	14.44
0:50	28.10	0:50	33.04	0:50	36.76
1:00	122.14	1:00	144.69	1:00	161.47
1:10	37.28	1:10	43.90	1:10	48.88
1:20	18.95	1:20	22.22	1:20	24.70
1:30	12.70	1:30	14.85	1:30	16.49
1:40	9.59	1:40	11.19	1:40	12.42
1:50	7.73	1:50	9.01	1:50	10.00
2:00	6.50	2:00	7.57	2:00	8.40
2:10	5.63	2:10	6.54	2:10	7.26
2:20	4.97	2:20	5.78	2:20	6.40
2:30	4.46	2:30	5.18	2:30	5.74
2:40	4.05	2:40	4.70	2:40	5.21
2:50	3.71	2:50	4.31	2:50	4.77
3:00	3.43	3:00	3.98	3:00	4.41

Queensway-Carleton Hospital Part 4 Expansion
Design Storm Time Series Data
3-hour Chicago Design Storms

C100-3.stm		C100-3+20%.stm	
Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr
0:00	0	0:00	0
0:10	6.05	0:10	6:14
0:20	7.54	0:20	9.05
0:30	10.16	0:30	12.19
0:40	15.97	0:40	19.16
0:50	40.65	0:50	48.78
1:00	178.56	1:00	214.27
1:10	54.05	1:10	64.86
1:20	27.32	1:20	32.78
1:30	18.24	1:30	21.89
1:40	13.74	1:40	16.49
1:50	11.06	1:50	13.27
2:00	9.29	2:00	11.15
2:10	8.02	2:10	9.62
2:20	7.08	2:20	8.5
2:30	6.35	2:30	7.62
2:40	5.76	2:40	6.91
2:50	5.28	2:50	6.34
3:00	4.88	3:00	5.86

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)
------------------------------------------------------------

Queensway-Carleton Hospital Part 4 Expansion
WARNING 03: negative offset ignored for Link 37
WARNING 04: minimum elevation drop used for Conduit 65
WARNING 04: minimum elevation drop used for Conduit 66
WARNING 04: minimum elevation drop used for Conduit 68
WARNING 04: minimum elevation drop used for Conduit 72
WARNING 04: minimum elevation drop used for Conduit 73
WARNING 04: minimum elevation drop used for Conduit 75
WARNING 04: minimum elevation drop used for Conduit 76
WARNING 04: minimum elevation drop used for Conduit 77
WARNING 03: negative offset ignored for Link CB410-MH416
WARNING 03: negative offset ignored for Link MH411-412
WARNING 03: negative offset ignored for Link MH412-413
WARNING 03: negative offset ignored for Link MH420-CB410
WARNING 03: negative offset ignored for Link R03-MH419
WARNING 02: maximum depth increased for Node EX-A04-STOR
WARNING 02: maximum depth increased for Node EX-A3-01&02-STOR
WARNING 02: maximum depth increased for Node EX-CB132
WARNING 02: maximum depth increased for Node EX-R02-STOR
WARNING 02: maximum depth increased for Node EX-R03-STOR
WARNING 02: maximum depth increased for Node EX-R1-STOR
WARNING 02: maximum depth increased for Node P3-01-STOR
WARNING 02: maximum depth increased for Node P3-02-STOR
WARNING 02: maximum depth increased for Node P3-03-STOR
WARNING 02: maximum depth increased for Node P4-01-STOR
WARNING 02: maximum depth increased for Node P4-02-STOR
WARNING 02: maximum depth increased for Node P4-03-STOR
WARNING 02: maximum depth increased for Node P4-04-STOR
WARNING 02: maximum depth increased for Node P4-05-stor

*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 89
Number of nodes ........... 177
Number of links ........... 226
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Raingage             06-C100yr-3hr               INTENSITY   10 min.


*******************
Subcatchment Summary
*******************
```

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A101	0.16	78.28	57.00	0.5000	Raingage	EX_CB_XXZ_(STM)
A102	0.20	55.49	23.00	0.5000	Raingage	EX-CB004
A103	0.19	92.66	47.00	0.5000	Raingage	EX-CB_XYY
A104	0.20	59.19	70.00	0.5000	Raingage	EX-CBMH_XYZ
A105	0.08	33.44	67.00	0.5000	Raingage	EX-CBMH303
A106	0.03	14.86	33.00	0.5000	Raingage	EX-CBMH303
A107	0.08	50.85	63.00	0.5000	Raingage	EX-CBMH302
A108	0.09	44.86	66.00	0.5000	Raingage	EX-CBMH_XXX
A113	0.79	74.42	100.00	0.5000	Raingage	ROOF-03
A116a	0.04	17.21	100.00	0.5000	Raingage	ROOF-03
A116B	0.02	28.13	100.00	0.5000	Raingage	P3-02-STOR
A117	0.02	16.96	100.00	0.5000	Raingage	ROOF-03
A119	0.12	25.53	63.00	0.5000	Raingage	EX-CBMH_XXZ
A120	0.23	54.12	50.00	0.5000	Raingage	EX-CBMH301
A121	0.10	51.78	86.00	0.5000	Raingage	EX-CB301
A122	0.28	97.82	25.00	0.5000	Raingage	EX-CB100-101_DUMMY
A137	0.02	25.42	60.00	0.5000	Raingage	MH421
B101	0.55	187.74	40.00	0.5000	Raingage	CBMH401-402
B102	0.13	45.35	73.00	0.5000	Raingage	CB401
B103	0.02	20.56	50.00	0.5000	Raingage	CBMH403
B104	0.15	63.45	74.00	0.5000	Raingage	CBMH402
B105	0.08	51.48	66.00	0.5000	Raingage	CBMH401-404
B106	0.16	94.94	77.00	0.5000	Raingage	CB403
B107	0.08	43.12	47.00	0.5000	Raingage	CBMH404-405
B108	0.05	41.38	96.00	0.5000	Raingage	CB405
B109	0.05	36.75	63.00	0.5000	Raingage	CBMH406
B110a	0.07	29.07	94.00	0.5000	Raingage	EX-CBMH008
B110b	0.07	28.08	7.00	0.5000	Raingage	CB416

B111	0.06	42.04	91.00	0.5000	Raingage
CBMH419					
B112	0.61	188.43	38.00	0.5000	Raingage
CBMH408-406					
B113	0.09	48.95	0.00	0.5000	Raingage
CBMH407					
B114	0.55	123.71	70.00	0.5000	Raingage
EX_CBMH011					
B115	0.28	80.53	93.00	0.5000	Raingage
EX.MH011					
B116	0.30	76.84	4.00	0.5000	Raingage
CB409					
B117	0.22	58.76	42.00	0.5000	Raingage
CBMH411					
B118	0.07	39.39	41.00	0.5000	Raingage
CBMH412					
B119	0.08	42.80	61.00	0.5000	Raingage
CBMH413_dummy					
B120	0.08	69.27	67.00	0.5000	Raingage
CB410					
B122	0.22	46.12	84.00	0.5000	Raingage
LD-TD01					
B122-1	0.00	2.50	84.00	0.5000	Raingage
LD-TD01					
B122-2	0.00	2.50	84.00	0.5000	Raingage
LD-TD01					
B124	0.25	132.87	63.00	0.5000	Raingage
LD-TD02					
B127	0.23	105.96	49.00	0.5000	Raingage
CBMH410					
B128	0.10	51.96	32.00	0.5000	Raingage
CB411					
B129	0.02	16.30	0.00	0.5000	Raingage
CB412					
B130	0.08	47.19	65.00	0.5000	Raingage
CB413					
B131	0.10	40.78	54.00	0.5000	Raingage
CB402					
B132	0.18	48.13	80.00	0.5000	Raingage
CICB403					
B133	0.14	30.90	37.00	0.5000	Raingage
CICB404					
B134a_1	0.19	85.22	51.00	0.5000	Raingage
EX-CB03					
B134a_2	0.12	57.75	51.00	0.5000	Raingage
EX-CBMH01					
B134b_1	0.06	20.37	11.00	0.5000	Raingage
CB414					
B134b_2	0.05	18.75	11.00	0.5000	Raingage
LP-stor					
B135a_1	0.11	41.21	67.00	0.5000	Raingage
EX-CB02					
B135a_2	0.16	53.35	67.00	0.5000	Raingage
21					
B135b	0.06	16.89	7.00	0.5000	Raingage
EX-LD01					
B136	0.07	64.75	21.00	0.5000	Raingage
CB417					
B137	0.09	40.38	51.00	0.5000	Raingage
CBMH417					
B138	0.04	37.31	6.00	0.5000	Raingage
EX.CBMH					
B139	0.04	24.25	49.00	0.5000	Raingage
CBMH418					
EX.A02.01	0.03	17.04	73.00	0.5000	Raingage
ROOF-04					
EX.A02.02	0.04	16.12	64.00	0.5000	Raingage
EX_CBMH012					
EX.A03.01	0.08	42.28	100.00	0.5000	Raingage
EX-A3-01&02-STOR					
EX.A03.02	0.16	113.93	100.00	0.5000	Raingage
EX-A3-01&02-STOR					
EX.A04	0.04	38.81	100.00	0.5000	Raingage
EX-A04-STOR					
EX.R01	0.07	36.14	100.00	0.5000	Raingage
EX-R1-STOR					
EX.R02	0.29	53.37	100.00	0.5000	Raingage
EX-R02-STOR					
EX.R03	0.04	15.19	100.00	0.5000	Raingage
EX-R03-STOR					
EX_A01a_1	0.21	83.41	66.00	0.5000	Raingage
EX_CBA01a					
EX_A01a_2	0.21	74.66	66.00	0.5000	Raingage
EX-CB132					
EX_A01b_1	0.18	69.54	80.00	0.5000	Raingage
EX_CBA01b-1					
EX_A01B_2	0.16	71.69	80.00	0.5000	Raingage
EX_CBA01b-2					
EX_A02a	0.40	30.70	73.00	0.5000	Raingage
EX_CBA02a					
EX_A02B	0.52	150.86	64.00	0.5000	Raingage
EX-CB130					
P3-01	0.49	82.76	100.00	0.5000	Raingage
P3-01-STOR					
P3-02	0.02	15.14	100.00	0.5000	Raingage
P3-02-STOR					
P3-03	0.04	32.62	100.00	0.5000	Raingage
P3-03-STOR					
P4-01	0.20	87.60	100.00	0.5000	Raingage
P4-01-STOR					
P4-02	0.29	103.93	100.00	0.5000	Raingage
P4-02-STOR					
P4-03	0.09	28.55	100.00	0.5000	Raingage
P4-03-STOR					
P4-04	0.11	28.69	100.00	0.5000	Raingage
P4-04-STOR					
P4-05	0.34	66.29	100.00	0.5000	Raingage
P4-05-stor					
P4-07	0.04	36.19	100.00	0.5000	Raingage
P4-07-STOR					
P4-08	0.29	148.27	100.00	0.5000	Raingage
TANK01					
P4-09	0.27	40.10	100.00	0.5000	Raingage
TANK02					
P4-DR1a_1	0.72	103.79	11.00	0.5000	Raingage
DR-WD					
P4-DR1a_2	0.04	5.00	11.00	0.5000	Raingage
DR-WD					
P4-DR1b	0.68	32.54	6.00	0.5000	Raingage
DR-SD					

P4-DR2 5.50 107.76 6.00 2.0000 Raingage
DR-NE

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
1	JUNCTION	79.11	0.35	0.0	
10	JUNCTION	78.97	0.35	0.0	
11	JUNCTION	78.80	0.35	0.0	
12	JUNCTION	78.70	0.35	0.0	
13	JUNCTION	78.80	0.35	0.0	
14	JUNCTION	80.05	0.35	0.0	
15	JUNCTION	78.90	0.35	0.0	
16	JUNCTION	79.10	0.35	0.0	
17	JUNCTION	79.05	0.35	0.0	
18	JUNCTION	79.05	0.35	0.0	
19	JUNCTION	77.05	0.35	0.0	
2	JUNCTION	78.48	0.35	0.0	
20	JUNCTION	77.10	0.35	0.0	
21	JUNCTION	75.69	0.35	0.0	
22	JUNCTION	77.15	0.35	0.0	
23	JUNCTION	73.69	1.50	0.0	
24	JUNCTION	73.17	3.40	0.0	
25	JUNCTION	78.31	0.35	0.0	
3	JUNCTION	78.95	0.35	0.0	
4	JUNCTION	78.75	0.35	0.0	
5	JUNCTION	78.95	0.35	0.0	
6	JUNCTION	79.05	0.35	0.0	
7	JUNCTION	78.95	0.35	0.0	
8	JUNCTION	78.95	0.35	0.0	
9	JUNCTION	78.95	0.35	0.0	
CBMH413_dummy	JUNCTION	77.95	0.35	0.0	
EX-CB100-101_DUMMY	JUNCTION	78.42	0.35	0.0	
EX-CBMH_XYY_dummy	JUNCTION	79.38	0.35	0.0	
MH426a	JUNCTION	72.22	4.76	0.0	
ROOF-01	JUNCTION	73.32	10.00	0.0	
ROOF-02	JUNCTION	73.36	10.15	0.0	
ROOF-03	JUNCTION	72.85	10.15	0.0	
ROOF-04	JUNCTION	73.11	10.15	0.0	
ROOF-06	JUNCTION	73.43	10.15	0.0	
ROOF-07	JUNCTION	73.98	11.00	0.0	
ROOF-08	JUNCTION	75.45	10.00	0.0	
ROOF-09	JUNCTION	77.37	10.20	0.0	
ROOF-10	JUNCTION	77.32	5.15	0.0	
ROOF-11	JUNCTION	75.97	10.00	0.0	
DR-NE	OUTFALL	0.00	0.00	0.0	
DR-SD	OUTFALL	79.21	0.35	0.0	
DR-WD	OUTFALL	0.00	0.00	0.0	
EMERG-OUT	OUTFALL	73.91	0.61	0.0	
OUT13772	OUTFALL	71.56	0.91	0.0	
OUT16389	OUTFALL	72.90	0.46	0.0	
RR-01	OUTFALL	73.96	0.35	0.0	
RR-02	OUTFALL	74.00	0.35	0.0	
CB401	STORAGE	76.15	2.35	0.0	
CB402	STORAGE	74.95	2.15	0.0	
CB403	STORAGE	76.50	2.45	0.0	
CB405	STORAGE	78.45	0.35	0.0	
CB409	STORAGE	74.95	2.75	0.0	
CB410	STORAGE	77.90	0.35	0.0	
CB411	STORAGE	75.50	2.35	0.0	
CB412	STORAGE	75.80	2.35	0.0	
CB413	STORAGE	77.60	0.35	0.0	
CB414	STORAGE	74.98	1.97	0.0	
CB416	STORAGE	73.98	2.72	0.0	
CB417	STORAGE	74.30	2.35	0.0	
CBMH401-402	STORAGE	75.53	2.77	0.0	
CBMH401-404	STORAGE	74.10	5.00	0.0	
CBMH402	STORAGE	76.40	2.50	0.0	
CBMH403	STORAGE	75.32	3.98	0.0	
CBMH404-405	STORAGE	73.21	5.89	0.0	
CBMH406	STORAGE	73.13	6.07	0.0	
CBMH407	STORAGE	72.95	4.60	0.0	
CBMH408-406	STORAGE	74.07	3.58	0.0	
CBMH409	STORAGE	72.87	2.53	0.0	
CBMH410	STORAGE	72.26	4.14	0.0	
CBMH411	STORAGE	74.90	2.90	0.0	
CBMH412	STORAGE	74.71	2.99	0.0	
CBMH413	STORAGE	74.41	3.89	0.0	
CBMH414	STORAGE	73.28	2.47	0.0	
CBMH415	STORAGE	73.18	2.97	0.0	
CBMH417	STORAGE	73.05	4.80	0.0	
CBMH418	STORAGE	72.94	4.91	0.0	
CBMH419	STORAGE	73.86	4.99	0.0	
CBMH-R2	STORAGE	74.10	3.73	0.0	
CBMH-R3	STORAGE	74.10	3.72	0.0	
CICB403	STORAGE	74.60	2.50	0.0	
CICB404	STORAGE	74.85	2.50	0.0	
EX.CB307	STORAGE	74.65	1.90	0.0	
EX.CBMH	STORAGE	74.14	4.04	0.0	
EX.MH011	STORAGE	74.00	4.16	0.0	
EX_CB_XXZ_(STM)	STORAGE	76.90	2.12	0.0	
EX_CB006	STORAGE	76.55	2.20	0.0	
EX_CB306	STORAGE	74.49	2.02	0.0	
EX_CBA01a	STORAGE	76.69	1.73	0.0	
EX_CBA01b-1	STORAGE	76.80	1.66	0.0	
EX_CBA01b-2	STORAGE	76.53	1.90	0.0	
EX_CBA02a	STORAGE	77.50	1.70	0.0	
EX_CBMH010	STORAGE	75.25	3.33	0.0	
EX_CBMH011	STORAGE	75.38	3.34	0.0	
EX_CBMH012	STORAGE	76.70	2.07	0.0	
EX_CBMH014	STORAGE	76.57	2.17	0.0	
EX_STMMH_1	STORAGE	72.95	1.15	0.0	
EX-A04-STOR	STORAGE	82.85	0.25	0.0	
EX-A3-01&02-STOR	STORAGE	83.11	0.35	0.0	
EX-CB_XYY	STORAGE	75.94	2.90	0.0	
EX-CB004	STORAGE	77.12	1.77	0.0	
EX-CB01	STORAGE	74.06	0.35	0.0	
EX-CB02	STORAGE	74.02	0.35	0.0	
EX-CB03	STORAGE	76.50	0.35	0.0	
EX-CB100-101	STORAGE	76.85	1.92	0.0	

EX-CB129	STORAGE	76.13	2.22	0.0
EX-CB130	STORAGE	76.69	1.66	0.0
EX-CB132	STORAGE	76.42	2.27	0.0
EX-CB150	STORAGE	75.55	2.68	0.0
EX-CB301	STORAGE	76.30	2.65	0.0
EX-CB304	STORAGE	74.25	3.00	0.0
EX-CB305	STORAGE	74.15	4.18	0.0
EX-CBMH_XXX	STORAGE	74.95	3.89	0.0
EX-CBMH_XXZ	STORAGE	76.06	2.18	0.0
EX-CBMH_XYY	STORAGE	76.59	3.14	0.0
EX-CBMH_XYZ	STORAGE	75.67	3.35	0.0
EX-CBMH_XZY	STORAGE	75.69	2.93	0.0
EX-CBMH_XZZ	STORAGE	75.51	2.77	0.0
EX-CBMH003	STORAGE	77.23	2.08	0.0
EX-CBMH008	STORAGE	73.85	1.14	0.0
EX-CBMH01	STORAGE	74.73	2.11	0.0
EX-CBMH301	STORAGE	77.00	2.10	0.0
EX-CBMH302	STORAGE	75.21	3.04	0.0
EX-CBMH303	STORAGE	76.08	2.40	0.0
EX-DICB001-002	STORAGE	76.82	2.80	0.0
EX-LD01	STORAGE	74.01	1.04	0.0
EX-MH_XXZ	STORAGE	75.89	2.39	0.0
EX-MH_XZY	STORAGE	75.29	3.26	0.0
EX-MH001	STORAGE	76.79	3.11	0.0
EX-MH301	STORAGE	77.20	1.66	0.0
EX-R02-STOR	STORAGE	83.43	0.45	0.0
EX-R03-STOR	STORAGE	82.85	0.25	0.0
EX-R1-STOR	STORAGE	85.97	0.25	0.0
EX-STMMH_XXX	STORAGE	74.27	5.32	0.0
LD-TD01	STORAGE	72.99	1.99	0.0
LD-TD02	STORAGE	73.24	1.76	0.0
LP-stor	STORAGE	75.90	1.00	0.0
MH401	STORAGE	75.27	3.33	0.0
MH402	STORAGE	73.87	4.71	0.0
MH403	STORAGE	76.25	2.10	0.0
MH404	STORAGE	74.62	3.88	0.0
MH405	STORAGE	73.30	5.59	0.0
MH406	STORAGE	73.78	4.97	0.0
MH407	STORAGE	73.05	5.78	0.0
MH408	STORAGE	74.91	3.69	0.0
MH410	STORAGE	73.69	5.27	0.0
MH411	STORAGE	72.89	4.81	0.0
MH412	STORAGE	72.87	5.70	0.0
MH413	STORAGE	72.56	6.49	0.0
MH415	STORAGE	72.43	6.42	0.0
MH416	STORAGE	72.11	5.24	0.0
MH417	STORAGE	71.80	5.80	0.0
MH418	STORAGE	72.52	2.18	0.0
MH419	STORAGE	72.58	2.32	0.0
MH420	STORAGE	72.23	3.62	0.0
MH421	STORAGE	72.98	2.17	0.0
MH422	STORAGE	72.77	4.83	0.0
MH423	STORAGE	71.98	5.72	0.0
MH424	STORAGE	71.76	5.49	0.0
MH425	STORAGE	73.36	5.09	0.0
MH426	STORAGE	72.32	4.73	0.0
MH427	STORAGE	72.17	4.78	0.0
MH428	STORAGE	72.09	4.99	0.0
MH429	STORAGE	73.98	2.82	0.0
MH430	STORAGE	72.74	4.81	0.0
OGS_#1_(3600Ø)_(STM)	STORAGE	72.02	4.95	0.0
OGS_#2_(3600Ø)_(STM)	STORAGE	71.93	5.97	0.0
P3-01-STOR	STORAGE	83.36	0.35	0.0
P3-02-STOR	STORAGE	82.85	0.25	0.0
P3-03-STOR	STORAGE	87.37	0.25	0.0
P4-01-STOR	STORAGE	85.45	0.35	0.0
P4-02-STOR	STORAGE	84.98	0.45	0.0
P4-03-STOR	STORAGE	83.57	0.35	0.0
P4-04-STOR	STORAGE	83.32	0.25	0.0
P4-05-stor	STORAGE	82.75	0.45	0.0
P4-07-STOR	STORAGE	83.11	0.15	0.0
TANK01	STORAGE	73.05	1.00	0.0
TANK02	STORAGE	73.12	1.00	0.0

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Link Summary
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Name	From Node	To Node	Type	Length	% Slope	Roughness
1	EX_STMMH_1	OUT16389	CONDUIT	15.6	0.3206	0.0130
11	EX-CB100-101_DUMMY	DR-SD	CONDUIT	57.3	1.3785	0.0160
16	EX-CB100-101_DUMMY	CBMH401-402	CONDUIT	53.2	0.8829	0.0160
17	4	CBMH401-402	CONDUIT	37.1	2.1571	0.0160
18	4	CBMH402	CONDUIT	5.0	4.0032	0.0160
19	5	CBMH402	CONDUIT	5.0	8.0257	0.0160
2	CBMH-R2	EX.MH011	CONDUIT	18.5	0.2703	0.0130
20	3	CBMH401-402	CONDUIT	65.0	1.7681	0.0160
21	5	CB403	CONDUIT	5.0	7.0172	0.0160
22	6	CB403	CONDUIT	5.0	9.0367	0.0160
23	6	CBMH406	CONDUIT	15.1	1.3253	0.0160
24	7	CBMH406	CONDUIT	7.3	1.3644	0.0160
25	7	CB405	CONDUIT	23.0	2.1331	0.0160
26	3	CBMH401-404	CONDUIT	20.8	0.9605	0.0160
27	8	CBMH401-404	CONDUIT	19.6	1.0194	0.0160
28	8	CBMH404-405	CONDUIT	20.3	0.9859	0.0160
29	9	CBMH404-405	CONDUIT	16.0	1.2538	0.0160

3		CBMH-R3	EX.MH011	CONDUIT	16.3	
0.3069	0.0130					
30		9	CB405	CONDUIT	24.0	
2.0389	0.0160					
31		CB405	CBMH408-406	CONDUIT	33.8	
3.4352	0.0160					
32		2	CBMH408-406	CONDUIT	130.1	
0.9070	0.0160					
33		LP-stor	CB414	CONDUIT	15.0	
0.6667	0.0240					
33_1		2	25	CONDUIT	24.4	
0.6978	0.0160					
33_2		25	CB410	CONDUIT	61.5	
0.6666	0.0160					
34		2	CBMH413_dummy	CONDUIT	88.6	
0.5980	0.0160					
35		CB410	EX-CBMH01	CONDUIT	86.9	
1.6221	0.0160					
36		CBMH413_dummy	EX-CB03	CONDUIT	81.0	
1.7915	0.0160					
37		EX-CB03	EX-CB02	CONDUIT	75.9	
3.2699	0.0160					
38		20	21	CONDUIT	68.2	
2.0639	0.0160					
38_1		EX-CBMH01	21	CONDUIT	25.1	
3.1737	0.0160					
38_3		21	EX-CB01	CONDUIT	51.4	
3.1766	0.0160					
39		13	CBMH401-402	CONDUIT	48.2	
1.7642	0.0160					
4		ROOF-02	CBMH414	CONDUIT	5.0	
1.0001	0.0130					
40		13	CB401	CONDUIT	28.0	
2.3237	0.0160					
41		12	CB401	CONDUIT	28.5	
1.9311	0.0160					
42		12	EX-CB301	CONDUIT	10.5	
0.9566	0.0160					
43		11	EX-CB301	CONDUIT	13.1	
1.5258	0.0160					
44		11	EX-CBMH301	CONDUIT	12.3	
0.4063	0.0160					
45		10	EX-CBMH301	CONDUIT	35.0	
0.6293	0.0160					
46		10	EX_CB_XXZ_(STM)	CONDUIT	19.8	
1.5117	0.0160					
47		14	EX_CB_XXZ_(STM)	CONDUIT	44.8	
3.0824	0.0160					
48		14	EX-CBMH_XYY_dummy	CONDUIT	29.0	
2.3101	0.0160					
49		LD-TD02	MH421	CONDUIT	3.6	
1.1112	0.0130					
49_1		EX-CBMH_XYY_dummy	1	CONDUIT	15.5	
1.7468	0.0160					
49_2		1	EX-CB_XYY	CONDUIT	15.7	
1.7186	0.0160					
50		20	CICB404	CONDUIT	11.7	
0.8581	0.0160					
51		19	CICB404	CONDUIT	17.9	
0.2801	0.0160					
52		19	CICB403	CONDUIT	32.8	
0.9139	0.0160					
53		22	CICB403	CONDUIT	25.4	
1.5769	0.0160					
54		22	CB402	CONDUIT	14.8	
0.3377	0.0160					
55		CB413	CB402	CONDUIT	33.2	
1.5074	0.0160					
56		18	CB413	CONDUIT	43.0	
3.3761	0.0160					
57		18	EX-CBMH_XXX	CONDUIT	26.4	
0.7966	0.0160					
58		17	EX-CBMH_XXX	CONDUIT	11.2	
1.8750	0.0160					
59		17	EX-CBMH302	CONDUIT	9.7	
1.5544	0.0160					
6		ROOF-01	CBMH417	CONDUIT	19.1	
0.9964	0.0130					
60		16	EX-CBMH302	CONDUIT	20.9	
0.9552	0.0160					
61		16	EX-CBMH_XYZ	CONDUIT	24.1	
1.7842	0.0160					
62		15	EX-CBMH_XYZ	CONDUIT	32.5	
0.7068	0.0160					
63		15	EX-CB_XYY	CONDUIT	10.2	
0.5911	0.0160					
64		EX_CBA02a	10	CONDUIT	5.0	
2.8011	0.0160					
65		EX_CBA01a	EX_CBA01b-1	CONDUIT	5.0	
0.0061	0.0160					
66		EX_CBA01b-1	EX_CBA01b-2	CONDUIT	25.8	
0.0012	0.0160					
67		EX_CBA01b-2	CB401	CONDUIT	5.0	
4.8055	0.0160					
68		EX-CB132	EX_CBA01a	CONDUIT	5.0	
0.0061	0.0160					
69		CB417	24	CONDUIT	6.1	
5.0719	0.0130					
7		EX-CBMH008	MH421	CONDUIT	67.9	
1.1487	0.0130					
72		EX_CB006	EX_CBMH014	CONDUIT	5.0	
0.0061	0.0160					
73		EX_CBMH014	EX_CBMH010	CONDUIT	5.0	
0.0061	0.0160					
74		EX_CBMH010	25	CONDUIT	24.8	
0.6455	0.0160					
75		EX_CBMH012	EX_CBMH011	CONDUIT	5.0	
0.0061	0.0160					
76		EX_CBMH011	EX_CBMH010	CONDUIT	5.0	
0.0061	0.0160					
77		EX-CB132	EX_CBA01b-2	CONDUIT	5.0	
0.0061	0.0160					
79		EX-CB02	RR-01	CONDUIT	8.4	
0.7154	0.0160					
80		EX-CB01	RR-02	CONDUIT	11.1	
0.5387	0.0160					
CB100-MH403		EX-CB100-101	MH403	CONDUIT	37.6	
0.7985	0.0130					
CB401-MH401		CB401	MH401	CONDUIT	18.2	
3.0167	0.0130					

CB401-Mh402	CBMH401-402	MH402	CONDUIT	30.7	0.8141	0.0130
CB403-MH408	CBMH403	MH408	CONDUIT	17.6	1.0205	0.0130
CB404-MH405	CBMH401-404	MH405	CONDUIT	13.4	1.4883	0.0130
CB405-CB406	CBMH404-405	CBMH406	CONDUIT	20.4	0.1958	0.0130
CB406-MH407	CBMH406	MH407	CONDUIT	28.3	0.2120	0.0130
CB407-CBMH14	EX_CB006	EX_CBMH014	CONDUIT	23.4	0.9844	0.0130
CB407-MH411	CBMH407	MH411	CONDUIT	11.3	0.2646	0.0130
CB409-CB412	CB409	CBMH412	CONDUIT	21.2	0.8954	0.0130
CB409-MH422	CBMH409	MH422	CONDUIT	16.8	0.4765	0.0130
CB410-MH416	CBMH410	MH416	CONDUIT	42.4	0.3300	0.0130
CB411-412	CBMH411	CBMH412	CONDUIT	16.1	0.9932	0.0130
CB414-415	CBMH414	CBMH415	CONDUIT	17.5	0.2860	0.0130
CB416-417_1	CBMH415	24	CONDUIT	4.0	0.3023	0.0130
CB416-417_2	24	CBMH417	CONDUIT	12.0	0.3159	0.0130
CB416-CBMH419	CB416	CBMH419	CONDUIT	14.3	0.4895	0.0130
CB417-418	CBMH417	CBMH418	CONDUIT	38.6	0.3111	0.0130
CB418-MH430	CBMH418	MH430	CONDUIT	17.1	0.2915	0.0130
CBMH412-413	CBMH412	CBMH413	CONDUIT	22.3	0.9870	0.0130
EX.CBMH014-010	EX_CBMH014	EX_CBMH010	CONDUIT	25.6	0.3514	0.0130
EX.CBMH-CB418	EX.CBMH	CBMH418	CONDUIT	10.1	5.9511	0.0130
EXCB06-CBMH	EX_CB306	EX.CBMH	CONDUIT	9.8	0.7158	0.0130
EXCB07-06	EX.CB307	EX_CB306	CONDUIT	18.2	0.7151	0.0130
EX-STMMH_XXX-MH425	EX-STMMH_XXX	MH425	CONDUIT	16.9	1.0072	0.0130
MH401-402	MH401	MH402	CONDUIT	25.1	0.3581	0.0130
MH402-408	MH402	MH408	CONDUIT	33.9	0.5021	0.0130
MH403-CB401	MH403	CBMH401-402	CONDUIT	19.4	2.9864	0.0130
MH404-CB404	MH404	CBMH401-404	CONDUIT	45.7	1.0934	0.0130
MH405-CB405	MH405	CBMH404-405	CONDUIT	26.4	0.1893	0.0130
MH407-CB407	MH407	CBMH407	CONDUIT	33.7	0.2377	0.0130
MH408-404	MH408	MH404	CONDUIT	22.1	1.0841	0.0130
MH410-407	MH410	MH407	CONDUIT	26.3	0.9875	0.0130
MH411-412	MH411	MH412	CONDUIT	29.6	0.0675	0.0130
MH412-413	MH412	MH413	CONDUIT	42.0	0.5476	0.0130
MH413-415	MH413	MH415	CONDUIT	48.5	0.2064	0.0130
MH413-429	MH413	MH429	CONDUIT	70.0	0.3571	0.0130
MH415-416	MH415	MH416	CONDUIT	85.7	0.1984	0.0130
MH417-423	MH417	MH423	CONDUIT	35.0	0.1429	0.0130
MH419-418	MH419	MH418	CONDUIT	21.4	0.1401	0.0130
MH420-CB410	MH420	CBMH410	CONDUIT	18.7	- 0.1603	0.0130
MH421-409	MH421	CBMH409	CONDUIT	20.4	0.3440	0.0130
MH423-OGS2	MH423	OGS_#2_(3600Ø)_(STM)	CONDUIT	17.2	0.1742	0.0130
MH425-430	MH425	MH430	CONDUIT	23.6	1.4857	0.0130
MH426-427_1	MH426	MH426a	CONDUIT	34.4	0.2821	0.0130
MH426-427_2	MH426a	MH427	CONDUIT	18.6	0.2846	0.0130
MH427-428	MH427	MH428	CONDUIT	18.8	0.3193	0.0130
MH428-OGS1	MH428	OGS_#1_(3600Ø)_(STM)	CONDUIT	14.2	0.2819	0.0130
MH429-OUT	MH429	EMERG-OUT	CONDUIT	20.0	0.3497	0.0130
MH430-426	MH430	MH426	CONDUIT	33.6	0.8031	0.0130
OCB0408-406	CBMH408-406	CBMH407	CONDUIT	8.3	5.9988	0.0130
OCB303	EX-CBMH303	EX-CBMH302	CONDUIT	24.2	1.1585	0.0130
OCB402	CB402	MH426	CONDUIT	3.0	4.9896	0.0130
OCB404	CICB404	OGS_#1_(3600Ø)_(STM)	CONDUIT	6.6	4.9836	0.0130
OCICB403	CICB403	MH426a	CONDUIT	2.9	5.1438	0.0130
OGS1-MH424	OGS_#1_(3600Ø)_(STM)	MH424	CONDUIT	7.0	0.2878	0.0130
OGS2-MH424	OGS_#2_(3600Ø)_(STM)	MH424	CONDUIT	50.1	0.1596	0.0130
Pipe_-_(1)_(1)_(STM)	EX-CB305	MH425	CONDUIT	13.6	0.7364	0.0130
Pipe_-_(10)_(1)_(1)_(STM)	EX_CB_XXZ_(STM)	EX-CBMH_XYY	CONDUIT	71.8	0.7794	0.0130
Pipe_-_(10)_(1)_(2)_(1)_(STM)	EX-CB004	EX-CBMH003	CONDUIT	18.4	0.9760	0.0130
Pipe_-_(10)_(1)_(2)_(103)_(STM)	MH422	MH420	CONDUIT	18.8	0.4790	0.0130
Pipe_-_(10)_(1)_(2)_(11)_(STM)	EX-CBMH302	EX-CBMH_XXX	CONDUIT	20.7	1.0167	0.0130

Pipe_-_(10)_(1)_(2)_(15)_(STM)	EX-CBMH_XXX	EX-STMMH_XXX	CONDUIT	34.6	1.0969	0.0130
Pipe_-_(10)_(1)_(2)_(16)_(STM)	EX-CB304	EX-CB305	CONDUIT	14.0	0.7150	0.0130
Pipe_-_(10)_(1)_(2)_(2)_(STM)	ROOF-10	EX-CBMH003	CONDUIT	8.5	0.9400	0.0130
Pipe_-_(10)_(1)_(2)_(3)_(STM)	EX-CBMH003	EX-MH001	CONDUIT	20.7	0.5805	0.0130
Pipe_-_(10)_(1)_(2)_(31)_(STM)	MH424	OUT13772	CONDUIT	99.0	0.2021	0.0130
Pipe_-_(10)_(1)_(2)_(4)_(STM)	EX-CBMH_XYY	EX-CB_XYY	CONDUIT	30.8	0.9728	0.0130
Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_1	EX-CBMH01	23	CONDUIT	49.6	2.0948	0.0130
Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_2	23	EX_STMMH_1	CONDUIT	33.1	2.0940	0.0130
Pipe_-_(10)_(1)_(2)_(45)_(STM)	EX-DICB001-002	EX-CB130	CONDUIT	38.9	1.0022	0.0130
Pipe_-_(10)_(1)_(2)_(46)_(STM)	EX-CB130	EX-CB129	CONDUIT	18.5	2.7623	0.0130
Pipe_-_(10)_(1)_(2)_(48)_(STM)	EX-CB150	EX-CBMH_XZY	CONDUIT	20.7	0.2412	0.0130
Pipe_-_(10)_(1)_(2)_(49)_(STM)	EX-CBMH_XXZ	EX-CB150	CONDUIT	13.8	0.7989	0.0130
Pipe_-_(10)_(1)_(2)_(5)_(STM)	EX-CB_XYY	EX-CBMH_XYZ	CONDUIT	41.8	1.0051	0.0130
Pipe_-_(10)_(1)_(2)_(50)_(STM)	EX-MH_XXZ	EX-CBMH_XXZ	CONDUIT	33.0	0.3631	0.0130
Pipe_-_(10)_(1)_(2)_(52)_(STM)	EX_CBA01a	EX-CB132	CONDUIT	22.9	1.0022	0.0130
Pipe_-_(10)_(1)_(2)_(54)_(STM)	EX_CBA01b-1	EX_CBA01b-2	CONDUIT	23.0	0.9573	0.0130
Pipe_-_(10)_(1)_(2)_(55)_(STM)	EX-CBMH_XZY	EX-MH_XZY	CONDUIT	11.8	0.1691	0.0130
Pipe_-_(10)_(1)_(2)_(57)_(STM)	EX-CB301	EX-MH_XZY	CONDUIT	8.6	4.7623	0.0130
Pipe_-_(10)_(1)_(2)_(58)_(STM)	EX-MH_XZY	EX-CBMH_XZZ	CONDUIT	44.5	0.1799	0.0130
Pipe_-_(10)_(1)_(2)_(59)_(STM)	EX-CBMH_XZZ	MH401	CONDUIT	15.0	0.1998	0.0130
Pipe_-_(10)_(1)_(2)_(7)_(STM)	EX-CBMH_XYZ	EX-CBMH302	CONDUIT	44.9	1.0244	0.0130
Pipe_-_(10)_(1)_(2)_(71)_(STM)	EX-MH301	EX-CBMH301	CONDUIT	28.0	0.5000	0.0130
Pipe_-_(10)_(1)_(2)_(72)_(STM)	EX-CBMH301	EX-CBMH_XZY	CONDUIT	28.8	2.9880	0.0130
Pipe_-_(10)_(1)_(2)_(8)_(STM)	ROOF-11	EX-CBMH_XYZ	CONDUIT	16.7	1.0161	0.0130
Pipe_-_(10)_(1)_(2)_(82)_(STM)	MH406	MH405	CONDUIT	17.8	1.0122	0.0130
Pipe_-_(10)_(1)_(2)_(STM)	EX-MH001	EX-CBMH_XYY	CONDUIT	13.4	2.6146	0.0130
Pipe_-_(14)_(1)_(2)_(STM)_2	MH416	MH417	CONDUIT	8.5	0.1170	0.0130
Pipe_-_(15)_(STM)	MH418	MH420	CONDUIT	52.4	0.1526	0.0130
Pipe_-_(17)_(1)_(2)_(STM)	EX_CBMH011	EX_CBMH010	CONDUIT	37.9	0.2111	0.0130
Pipe_-_(17)_(1)_(3)_(STM)	EX_CBMH012	EX_CBMH011	CONDUIT	34.3	0.3503	0.0130
R03-MH419	ROOF-03	MH419	CONDUIT	5.0	0.8000	0.0130
R04-MH421	ROOF-04	MH421	CONDUIT	5.0	1.0001	0.0130
R06-CB406	ROOF-06	CBMH406	CONDUIT	19.7	0.8634	0.0130
R07-MH406	ROOF-07	MH406	CONDUIT	17.6	1.0245	0.0130
R08-CB403	ROOF-08	CBMH403	CONDUIT	9.5	1.0557	0.0130
R09-MH301	ROOF-09	EX-MH301	CONDUIT	11.6	1.0354	0.0130
TD01-MH410	CBMH419	MH410	CONDUIT	12.2	0.9861	0.0130
TD01-MH419	LD-TD01	MH419	CONDUIT	8.4	0.3589	0.0130
O-CB10	EX_CBMH010	MH415	ORIFICE			
O-CB129	EX-CB129	EX-CB150	ORIFICE			
O-CB132	EX-CB132	EX-MH_XXZ	ORIFICE			
O-CB403	CB403	MH406	ORIFICE			
O-CB411	CB411	MH423	ORIFICE			
O-CB412	CB412	OGS_#2_(3600Ø)_(STM)	ORIFICE			
O-CB414	CB414	EX-CBMH01	ORIFICE			
O-CBMH402	CBMH402	MH408	ORIFICE			
O-CBMH413	CBMH413	MH417	ORIFICE			
O-EXCBA01b	EX_CBA01b-2	EX-MH_XXZ	ORIFICE			
O-EXCBA02a	EX_CBA02a	EX_CB_XXZ_(STM)	ORIFICE			
O-EXMH011	EX.MH011	CBMH410	ORIFICE			
O-LD01	EX-LD01	23	ORIFICE			
O-TANK01	TANK01	MH426	ORIFICE			
O-TANK02	TANK02	MH427	ORIFICE			
10	P4-01-STOR	CBMH403	WEIR			
12	P3-01-STOR	CBMH414	WEIR			
15	P4-04-STOR	CBMH417	WEIR			
8	EX-A04-STOR	CBMH409	WEIR			
9	P3-02-STOR	P4-05-stor	WEIR			
EX-A3-01&02-OVF	EX-A3-01&02-STOR	CBMH409	WEIR			
EX-R02-OVF	EX-R02-STOR	CBMH406	WEIR			
EX-R03-OVF	EX-R03-STOR	P4-05-stor	WEIR			
EX-R1-OVF	EX-R1-STOR	EX-CBMH_XYZ	WEIR			
P3-03-OVF	P3-03-STOR	EX-CBMH301	WEIR			
P4-02-OVF	P4-02-STOR	CB403	WEIR			
P4-03-OVF	P4-03-STOR	CBMH419	WEIR			
P4-05-OVF	P4-05-stor	LD-TD01	WEIR			
13	EX-CB01	EX_STMMH_1	OUTLET			
14	EX-CB02	EX_STMMH_1	OUTLET			
5	P4-04-STOR	ROOF-01	OUTLET			
71	CBMH413_dummy	CBMH413	OUTLET			
EX-A04-STOR_out	EX-A04-STOR	ROOF-03	OUTLET			
EX-A3-01&02-STOR_out	EX-A3-01&02-STOR	ROOF-04	OUTLET			
EX-CB100-101_CBOGx2	EX-CB100-101_DUMMY	EX-CB100-101	OUTLET			
EX-CBMH_XYY_CBOG	EX-CBMH_XYY_dummy	EX-CBMH_XYY	OUTLET			
EX-R02-STOR_out	EX-R02-STOR	ROOF-06	OUTLET			
EX-R03-STOR_out	EX-R03-STOR	ROOF-03	OUTLET			
EX-R1-STOR_out	EX-R1-STOR	ROOF-11	OUTLET			
OCB405	CB405	MH407	OUTLET			
OCB410	CB410	MH417	OUTLET			
OCB413	CB413	MH430	OUTLET			

P3-01-STOR_out	P3-01-STOR	ROOF-02	OUTLET
P3-02-STOR_out	P3-02-STOR	ROOF-03	OUTLET
P3-03-STOR_out	P3-03-STOR	ROOF-09	OUTLET
P4-01-STOR_out	P4-01-STOR	ROOF-08	OUTLET
P4-02-STOR_out	P4-02-STOR	ROOF-07	OUTLET
P4-03-STOR_out	P4-03-STOR	MH410	OUTLET
P4-05-STOR_out	P4-05-stor	ROOF-03	OUTLET
P4-07-STOR_out	P4-07-STOR	ROOF-04	OUTLET
Pipe_-_(10)_(1)_(2)_(39)_(STM)	EX-CB03	EX-CBMH01	OUTLET

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
1	CIRCULAR	0.46	0.16	0.11	0.46	1	168.24
11	RECT_OPEN	0.35	3.50	0.33	10.00	1	12193.56
16	RECT_OPEN	0.35	3.50	0.33	10.00	1	9758.55
17	RECT_OPEN	0.35	3.50	0.33	10.00	1	15253.45
18	RECT_OPEN	0.35	3.50	0.33	10.00	1	20779.46
19	RECT_OPEN	0.35	3.50	0.33	10.00	1	29422.02
2	CIRCULAR	1.50	1.77	0.38	1.50	1	3675.16
20	RECT_OPEN	0.35	3.50	0.33	10.00	1	13809.87
21	RECT_OPEN	0.35	3.50	0.33	10.00	1	27511.40
22	RECT_OPEN	0.35	3.50	0.33	10.00	1	31220.13
23	RECT_OPEN	0.35	3.50	0.33	10.00	1	11956.14
24	RECT_OPEN	0.35	3.50	0.33	10.00	1	12131.06
25	RECT_OPEN	0.35	3.50	0.33	10.00	1	15168.10
26	RECT_OPEN	0.35	3.50	0.33	10.00	1	10178.50
27	RECT_OPEN	0.35	3.50	0.33	10.00	1	10485.94
28	RECT_OPEN	0.35	3.50	0.33	10.00	1	10312.10
29	RECT_OPEN	0.35	3.50	0.33	10.00	1	11628.97
3	CIRCULAR	1.50	1.77	0.38	1.50	1	3916.53
30	RECT_OPEN	0.35	3.50	0.33	10.00	1	14829.43
31	RECT_OPEN	0.35	3.50	0.33	10.00	1	19248.91
32	RECT_OPEN	0.35	3.50	0.33	10.00	1	9890.81
33	CIRCULAR	0.30	0.07	0.07	0.30	1	42.77
33_1	RECT_OPEN	0.35	1.75	0.31	5.00	1	4158.40
33_2	RECT_OPEN	0.35	1.75	0.31	5.00	1	4064.15
34	RECT_OPEN	0.35	1.75	0.31	5.00	1	3849.59
35	RECT_OPEN	0.35	1.75	0.31	5.00	1	6340.03
36	RECT_OPEN	0.35	1.75	0.31	5.00	1	6662.86
37	RECT_OPEN	0.35	1.75	0.31	5.00	1	9001.60
38	RECT_OPEN	0.35	3.50	0.33	10.00	1	14920.36
38_1	RECT_OPEN	0.35	1.75	0.31	5.00	1	8868.26
38_3	RECT_OPEN	0.35	1.75	0.31	5.00	1	8872.27
39	RECT_OPEN	0.35	3.50	0.33	10.00	1	13794.30
4	CIRCULAR	0.39	0.12	0.10	0.39	1	192.03
40	RECT_OPEN	0.35	3.50	0.33	10.00	1	15831.49
41	RECT_OPEN	0.35	3.50	0.33	10.00	1	14432.33
42	RECT_OPEN	0.35	3.50	0.33	10.00	1	10157.79
43	RECT_OPEN	0.35	3.50	0.33	10.00	1	12828.80
44	RECT_OPEN	0.35	3.50	0.33	10.00	1	6620.28
45	RECT_OPEN	0.35	3.50	0.33	10.00	1	8238.97
46	RECT_OPEN	0.35	3.50	0.33	10.00	1	12769.34
47	RECT_OPEN	0.35	3.50	0.33	10.00	1	18233.82
48	RECT_OPEN	0.35	3.50	0.33	10.00	1	15784.99
49	CIRCULAR	0.25	0.05	0.06	0.25	1	62.69
49_1	RECT_OPEN	0.35	3.50	0.33	10.00	1	13726.34
49_2	RECT_OPEN	0.35	3.50	0.33	10.00	1	13614.91
50	RECT_OPEN	0.35	3.50	0.33	10.00	1	9620.57
51	RECT_OPEN	0.35	3.50	0.33	10.00	1	5496.18
52	RECT_OPEN	0.35	3.50	0.33	10.00	1	9928.52
53	RECT_OPEN	0.35	3.50	0.33	10.00	1	13041.75
54	RECT_OPEN	0.35	3.50	0.33	10.00	1	6035.08

55	RECT_OPEN	0.35	3.50	0.33	10.00	1	12750.91
56	RECT_OPEN	0.35	3.50	0.33	10.00	1	19082.50
57	RECT_OPEN	0.35	3.50	0.33	10.00	1	9269.35
58	RECT_OPEN	0.35	3.50	0.33	10.00	1	14221.01
59	RECT_OPEN	0.35	3.50	0.33	10.00	1	12948.40
6	CIRCULAR	0.30	0.07	0.08	0.30	1	100.88
60	RECT_OPEN	0.35	3.50	0.33	10.00	1	10150.02
61	RECT_OPEN	0.35	3.50	0.33	10.00	1	13872.50
62	RECT_OPEN	0.35	3.50	0.33	10.00	1	8731.14
63	RECT_OPEN	0.35	3.50	0.33	10.00	1	7984.64
64	RECT_OPEN	0.35	1.75	0.31	5.00	1	8331.38
65	RECT_OPEN	0.35	1.75	0.31	5.00	1	388.67
66	RECT_OPEN	0.35	1.75	0.31	5.00	1	171.22
67	RECT_OPEN	0.35	1.75	0.31	5.00	1	10912.50
68	RECT_OPEN	0.35	1.75	0.31	5.00	1	388.67
69	CIRCULAR	0.20	0.03	0.05	0.20	1	73.87
7	CIRCULAR	0.25	0.05	0.06	0.25	1	66.49
72	RECT_OPEN	0.35	3.50	0.33	10.00	1	810.87
73	RECT_OPEN	0.35	3.50	0.33	10.00	1	810.87
74	RECT_OPEN	0.35	1.75	0.31	5.00	1	3999.58
75	RECT_OPEN	0.35	3.50	0.33	10.00	1	810.87
76	RECT_OPEN	0.35	3.50	0.33	10.00	1	810.87
77	RECT_OPEN	0.35	1.75	0.31	5.00	1	388.67
79	RECT_OPEN	0.35	1.75	0.31	5.00	1	4210.47
80	RECT_OPEN	0.35	1.75	0.31	5.00	1	3653.50
CB100-MH403	CIRCULAR	0.30	0.07	0.08	0.30	1	90.31
CB401-MH401	CIRCULAR	0.20	0.03	0.05	0.20	1	56.97
CB401-Mh402	CIRCULAR	0.38	0.11	0.10	0.38	1	165.05
CB403-MH408	CIRCULAR	0.30	0.07	0.08	0.30	1	102.09
CB404-MH405	CIRCULAR	0.53	0.22	0.13	0.53	1	546.27
CB405-CB406	CIRCULAR	0.69	0.37	0.17	0.69	1	388.35
CB406-MH407	CIRCULAR	0.69	0.37	0.17	0.69	1	404.12
CB407-CBMH14	CIRCULAR	0.25	0.05	0.06	0.25	1	61.56
CB407-MH411	CIRCULAR	0.69	0.37	0.17	0.69	1	451.42
CB409-CB412	CIRCULAR	0.25	0.05	0.06	0.25	1	56.28
CB409-MH422	CIRCULAR	0.46	0.16	0.11	0.46	1	205.08
CB410-MH416	CIRCULAR	0.91	0.66	0.23	0.91	1	1083.64
CB411-412	CIRCULAR	0.30	0.07	0.08	0.30	1	100.72
CB414-415	CIRCULAR	0.39	0.12	0.10	0.39	1	102.70
CB416-417_1	CIRCULAR	0.39	0.12	0.10	0.39	1	105.58
CB416-417_2	CIRCULAR	0.39	0.12	0.10	0.39	1	107.92
CB416-CBMH419	CIRCULAR	0.25	0.05	0.06	0.25	1	41.61
CB417-418	CIRCULAR	0.39	0.12	0.10	0.39	1	107.11
CB418-MH430	CIRCULAR	0.39	0.12	0.10	0.39	1	103.68
CBMH412-413	CIRCULAR	0.30	0.07	0.08	0.30	1	100.41
EX.CBMH014-010	CIRCULAR	0.30	0.07	0.08	0.30	1	59.91
EX.CBMH-CB418	CIRCULAR	0.25	0.05	0.06	0.25	1	151.35
EXCB06-CBMH	CIRCULAR	0.25	0.05	0.06	0.25	1	52.49
EXCB07-06	CIRCULAR	0.25	0.05	0.06	0.25	1	52.46
EX-STMMH_XXX-MH425	CIRCULAR	0.46	0.16	0.11	0.46	1	298.17
MH401-402	CIRCULAR	0.53	0.22	0.13	0.53	1	267.98
MH402-408	CIRCULAR	0.53	0.22	0.13	0.53	1	317.29
MH403-CB401	CIRCULAR	0.30	0.07	0.08	0.30	1	174.65
MH404-CB404	CIRCULAR	0.53	0.22	0.13	0.53	1	468.24
MH405-CB405	CIRCULAR	0.69	0.37	0.17	0.69	1	381.88
MH407-CB407	CIRCULAR	0.69	0.37	0.17	0.69	1	427.88
MH408-404	CIRCULAR	0.53	0.22	0.13	0.53	1	466.23
MH410-407	CIRCULAR	0.30	0.07	0.08	0.30	1	100.43
MH411-412	CIRCULAR	0.69	0.37	0.17	0.69	1	228.10
MH412-413	CIRCULAR	0.69	0.37	0.17	0.69	1	649.49

```
  MH413-415        CIRCULAR             0.76     0.46     0.19     0.76        1
527.62
  MH413-429        CIRCULAR             0.61     0.29     0.15     0.61        1
381.83
  MH415-416        CIRCULAR             0.76     0.46     0.19     0.76        1
517.31
  MH417-423        CIRCULAR             0.91     0.66     0.23     0.91        1
713.03
  MH419-418        CIRCULAR             0.69     0.37     0.17     0.69        1
328.54
  MH420-CB410      CIRCULAR             0.91     0.66     0.23     0.91        1
755.20
  MH421-409        CIRCULAR             0.46     0.16     0.11     0.46        1
174.25
  MH423-OGS2       CIRCULAR             0.91     0.66     0.23     0.91        1
787.41
  MH425-430        CIRCULAR             0.46     0.16     0.11     0.46        1
362.14
  MH426-427_1      CIRCULAR             0.69     0.37     0.17     0.69        1
466.14
  MH426-427_2      CIRCULAR             0.69     0.37     0.17     0.69        1
468.20
  MH427-428        CIRCULAR             0.69     0.37     0.17     0.69        1
495.96
  MH428-OGS1       CIRCULAR             0.69     0.37     0.17     0.69        1
465.98
  MH429-OUT        CIRCULAR             0.61     0.29     0.15     0.61        1
377.80
  MH430-426        CIRCULAR             0.53     0.22     0.13     0.53        1
401.29
  OCB0408-406      CIRCULAR             0.25     0.05     0.06     0.25        1
151.96
  OCB303           CIRCULAR             0.30     0.07     0.07     0.30        1
104.09
  OCB402           CIRCULAR             0.20     0.03     0.05     0.20        1
73.27
  OCB404           CIRCULAR             0.20     0.03     0.05     0.20        1
73.22
  OCICB403         CIRCULAR             0.20     0.03     0.05     0.20        1
74.39
  OGS1-MH424       CIRCULAR             0.69     0.37     0.17     0.69        1
470.82
  OGS2-MH424       CIRCULAR             0.91     0.66     0.23     0.91        1
753.69
  Pipe_-_(1)_(1)_(STM) CIRCULAR             0.25     0.05     0.06     0.25
1    53.24
  Pipe_-_(10)_(1)_(1)_(STM) CIRCULAR             0.30     0.07     0.08     0.30
1    89.23
  Pipe_-_(10)_(1)_(2)_(1)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.40
  Pipe_-_(10)_(1)_(2)_(103)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   205.62
  Pipe_-_(10)_(1)_(2)_(11)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   299.58
  Pipe_-_(10)_(1)_(2)_(15)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   311.16
  Pipe_-_(10)_(1)_(2)_(16)_(STM) CIRCULAR             0.25     0.05     0.06
0.25        1    52.46
  Pipe_-_(10)_(1)_(2)_(2)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    31.80
  Pipe_-_(10)_(1)_(2)_(3)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    24.99
  Pipe_-_(10)_(1)_(2)_(31)_(STM) CIRCULAR             0.91     0.66     0.23
0.91        1   847.99
  Pipe_-_(10)_(1)_(2)_(4)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    99.68
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_1 CIRCULAR             0.38     0.11     0.10
0.38        1   264.75
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_2 CIRCULAR             0.38     0.11     0.10
0.38        1   264.70
  Pipe_-_(10)_(1)_(2)_(45)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   101.17
  Pipe_-_(10)_(1)_(2)_(46)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   167.97
  Pipe_-_(10)_(1)_(2)_(48)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   145.92
  Pipe_-_(10)_(1)_(2)_(49)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   163.49
  Pipe_-_(10)_(1)_(2)_(5)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   101.32
  Pipe_-_(10)_(1)_(2)_(50)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    60.90
  Pipe_-_(10)_(1)_(2)_(52)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.84
  Pipe_-_(10)_(1)_(2)_(54)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    32.09
  Pipe_-_(10)_(1)_(2)_(55)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   184.13
  Pipe_-_(10)_(1)_(2)_(57)_(STM) CIRCULAR             0.20     0.03     0.05
0.20        1    71.58
  Pipe_-_(10)_(1)_(2)_(58)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   189.91
  Pipe_-_(10)_(1)_(2)_(59)_(STM) CIRCULAR             0.53     0.22     0.13
0.53        1   200.17
  Pipe_-_(10)_(1)_(2)_(7)_(STM) CIRCULAR             0.46     0.16     0.11
0.46        1   300.70
  Pipe_-_(10)_(1)_(2)_(71)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1    71.47
  Pipe_-_(10)_(1)_(2)_(72)_(STM) CIRCULAR             0.30     0.07     0.08
0.30        1   174.70
  Pipe_-_(10)_(1)_(2)_(8)_(STM) CIRCULAR             0.15     0.02     0.04
0.15        1    15.35
  Pipe_-_(10)_(1)_(2)_(82)_(STM) CIRCULAR             0.38     0.11     0.10
0.38        1   184.03
  Pipe_-_(10)_(1)_(2)_(STM) CIRCULAR             0.20     0.03     0.05     0.20
1    53.04
  Pipe_-_(14)_(1)_(2)_(STM)_2 CIRCULAR             0.91     0.66     0.23     0.91
1   645.39
  Pipe_-_(15)_(STM) CIRCULAR             0.69     0.37     0.17     0.69        1
342.84
  Pipe_-_(17)_(1)_(2)_(STM) CIRCULAR             1.52     1.82     0.38     1.52
1  3388.33
  Pipe_-_(17)_(1)_(3)_(STM) CIRCULAR             0.30     0.07     0.08     0.30
1    59.82
  R03-MH419        CIRCULAR             0.30     0.07     0.08     0.30        1
90.40
  R04-MH421        CIRCULAR             0.38     0.11     0.10     0.38        1
182.93
  R06-CB406        CIRCULAR             0.38     0.11     0.10     0.38        1
169.97
```

R07-MH406	CIRCULAR	0.38	0.11	0.10	0.38	1
185.15						
R08-CB403	CIRCULAR	0.30	0.07	0.08	0.30	1
103.84						
R09-MH301	CIRCULAR	0.25	0.05	0.06	0.25	1
63.13						
TD01-MH410	CIRCULAR	0.30	0.07	0.08	0.30	1
100.36						
TD01-MH419	CIRCULAR	0.30	0.07	0.08	0.30	1
60.54						

```
  ***************
  Analysis Options
  ***************
  Flow Units ..............  LPS
  Process Models:
    Rainfall/Runoff ........  YES
    RDII ...................  NO
    Snowmelt ...............  NO
    Groundwater ............  NO
    Flow Routing ...........  YES
    Ponding Allowed ........  NO
    Water Quality ..........  NO
  Infiltration Method ......  HORTON
  Flow Routing Method ......  DYNWAVE
  Surcharge Method .........  EXTRAN
  Starting Date ............  10/03/2025 00:00:00
  Ending Date ..............  10/05/2025 00:00:00
  Antecedent Dry Days ......  0.0
  Report Time Step .........  00:01:00
  Wet Time Step ............  00:01:00
  Dry Time Step ............  00:01:00
  Routing Time Step ........  2.00 sec
  Variable Time Step .......  YES
  Maximum Trials ...........  8
  Number of Threads ........  8
  Head Tolerance ...........  0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	1.449	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.581	28.724
Surface Runoff	0.854	42.243
Final Storage	0.015	0.736
Continuity Error (%)	-0.052	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.854	8.543
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.850	8.502
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.006	0.061
Continuity Error (%)	-0.226	

```
  ************************
  Highest Continuity Errors
  ************************
  Node ROOF-09 (7.38%)
  Node EX-CB100-101 (2.21%)
  Node EX_CBMH014 (2.20%)

  ***************************
  Time-Step Critical Elements
  ***************************
  Link OCICB403 (9.27%)
  Link CB416-417_1 (1.28%)

  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link P3-03-STOR_out (11)
  Link EX-A04-STOR_out (7)
  Link R03-MH419 (6)
  Link EX-R03-STOR_out (5)
  Link EX-A3-01&02-STOR_out (3)

  *********************************
  Most Frequent Nonconverging Nodes
  *********************************
  Node DR-NE (0.37%)
  Node DR-SD (0.37%)
  Node DR-WD (0.37%)
  Node EMERG-OUT (0.37%)
  Node OUT13772 (0.37%)

  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :     1.90 sec
  Maximum Time Step           :     2.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.08
  % of Steps Not Converging   :     0.37
  Time Step Frequencies       :
      2.000 -  1.516 sec      :    90.68 %
```

```
      1.516 -  1.149 sec      :     4.02 %
      1.149 -  0.871 sec      :     2.25 %
      0.871 -  0.660 sec      :     1.59 %
      0.660 -  0.500 sec      :     1.47 %


  **************************
  Subcatchment Runoff Summary
  **************************

  ----------------------------------------------------------------------------------
-----------------------------------------------
                             Total      Total      Total      Total     Imperv
Perv      Total       Total     Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff      Runoff   Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm
mm         mm    10^6 ltr      LPS
  ----------------------------------------------------------------------------------
-----------------------------------------------
  A101                      71.67       0.00       0.00      19.49      40.01
11.34      51.35        0.08    62.89   0.716
  A102                      71.67       0.00       0.00      37.15      16.15
18.04      34.19        0.07    42.41   0.477
  A103                      71.67       0.00       0.00      24.23      32.99
13.77      46.76        0.09    68.64   0.652
  A104                      71.67       0.00       0.00      13.67      49.11
7.84       56.96        0.11    82.60   0.795
  A105                      71.67       0.00       0.00      14.93      47.02
8.73       55.75        0.05    34.90   0.778
  A106                      71.67       0.00       0.00      30.78      23.17
17.25      40.42        0.01     8.51   0.564
  A107                      71.67       0.00       0.00      16.58      44.22
9.95       54.18        0.04    34.27   0.756
  A108                      71.67       0.00       0.00      15.29      46.32
9.09       55.41        0.05    37.66   0.773
  A113                      71.67       0.00       0.00       0.00      70.12
0.00       70.12        0.56   371.50   0.978
  A116a                     71.67       0.00       0.00       0.00      70.16
0.00       70.16        0.03    18.84   0.979
  A116B                     71.67       0.00       0.00       0.00      70.21
0.00       70.21        0.01     8.43   0.980
  A117                      71.67       0.00       0.00       0.00      70.18
0.00       70.18        0.02    11.41   0.979
  A119                      71.67       0.00       0.00      17.32      44.20
9.20       53.40        0.07    46.04   0.745
  A120                      71.67       0.00       0.00      23.65      35.08
12.19      47.28        0.11    73.98   0.660
  A121                      71.67       0.00       0.00       6.19      60.35
3.85       64.20        0.06    48.22   0.896
  A122                      71.67       0.00       0.00      35.55      17.55
18.21      35.76        0.10    67.35   0.499
  A137                      71.67       0.00       0.00      17.74      42.13
10.96      53.09        0.01     9.47   0.741
  B101                      71.67       0.00       0.00      28.08      28.07
14.93      43.01        0.24   167.39   0.600
  B102                      71.67       0.00       0.00      12.19      51.22
7.17       58.39        0.07    55.99   0.815
  B103                      71.67       0.00       0.00      22.30      35.11
13.56      48.67        0.01     8.06   0.679
  B104                      71.67       0.00       0.00      11.67      51.93
6.98       58.91        0.09    67.09   0.822
  B105                      71.67       0.00       0.00      15.19      46.33
9.19       55.52        0.04    34.17   0.775
  B106                      71.67       0.00       0.00      10.22      54.04
6.28       60.32        0.09    72.95   0.842
  B107                      71.67       0.00       0.00      24.15      32.99
13.85      46.84        0.04    29.79   0.654
  B108                      71.67       0.00       0.00       1.75      67.38
1.12       68.50        0.04    26.14   0.956
  B109                      71.67       0.00       0.00      16.54      44.22
9.99       54.22        0.03    22.77   0.757
  B110a                     71.67       0.00       0.00       2.64      65.95
1.67       67.62        0.05    33.41   0.944
  B110b                     71.67       0.00       0.00      44.49       4.91
22.18      27.09        0.02    12.16   0.378
  B111                      71.67       0.00       0.00       3.95      63.87
2.51       66.37        0.04    29.85   0.926
  B112                      71.67       0.00       0.00      29.24      26.67
15.21      41.88        0.25   175.24   0.584
  B113                      71.67       0.00       0.00      46.98       0.00
24.70      24.70        0.02    15.55   0.345
  B114                      71.67       0.00       0.00      13.84      49.11
7.67       56.78        0.31   224.77   0.792
  B115                      71.67       0.00       0.00       3.09      65.24
1.93       67.17        0.19   139.23   0.937
  B116                      71.67       0.00       0.00      47.40       2.81
21.41      24.22        0.07    34.17   0.338
  B117                      71.67       0.00       0.00      27.47      29.47
14.11      43.58        0.09    64.52   0.608
  B118                      71.67       0.00       0.00      26.92      28.78
15.38      44.16        0.03    24.16   0.616
  B119                      71.67       0.00       0.00      17.58      42.81
10.39      53.20        0.04    33.11   0.742
  B120                      71.67       0.00       0.00      14.68      47.03
8.99       56.03        0.05    38.10   0.782
  B122                      71.67       0.00       0.00       7.22      58.92
4.25       63.17        0.14   101.53   0.881
  B122-1                    71.67       0.00       0.00       7.03      58.97
4.46       63.43        0.00     0.97   0.885
  B122-2                    71.67       0.00       0.00       7.03      58.97
4.46       63.43        0.00     0.97   0.885
  B124                      71.67       0.00       0.00      16.66      44.22
9.88       54.09        0.13   105.05   0.755
  B127                      71.67       0.00       0.00      23.33      34.39
13.23      47.63        0.11    83.66   0.665
  B128                      71.67       0.00       0.00      31.29      22.47
17.47      39.93        0.04    29.70   0.557
  B129                      71.67       0.00       0.00      45.54       0.00
26.16      26.16        0.00     4.10   0.365
  B130                      71.67       0.00       0.00      15.70      45.62
9.40       55.03        0.04    34.86   0.768
  B131                      71.67       0.00       0.00      21.05      37.90
11.93      49.83        0.05    37.04   0.695
  B132                      71.67       0.00       0.00       9.03      56.12
5.32       61.44        0.11    81.90   0.857
  B133                      71.67       0.00       0.00      30.52      25.96
14.64      40.60        0.06    37.50   0.567
  B134a_1                   71.67       0.00       0.00      22.41      35.80
12.72      48.52        0.09    70.49   0.677
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B134a_2		71.67	0.00	0.00	22.35	35.80
12.78	48.57	0.06	45.43	0.678		
B134b_1		71.67	0.00	0.00	42.63	7.72
21.16	28.89	0.02	10.13	0.403		
B134b_2		71.67	0.00	0.00	42.26	7.72
21.53	29.26	0.01	8.79	0.408		
B135a_1		71.67	0.00	0.00	14.98	47.01
8.68	55.70	0.06	47.07	0.777		
B135a_2		71.67	0.00	0.00	15.05	47.01
8.61	55.62	0.09	68.17	0.776		
B135b		71.67	0.00	0.00	45.38	4.91
21.28	26.19	0.02	8.11	0.365		
B136		71.67	0.00	0.00	35.71	14.74
20.93	35.67	0.02	21.44	0.498		
B137		71.67	0.00	0.00	22.37	35.80
12.76	48.56	0.04	32.18	0.678		
B138		71.67	0.00	0.00	42.93	4.21
24.46	28.67	0.01	10.94	0.400		
B139		71.67	0.00	0.00	23.00	34.40
13.57	47.97	0.02	13.79	0.669		
EX.A02.01		71.67	0.00	0.00	12.03	51.24
7.33	58.57	0.02	12.84	0.817		
EX.A02.02		71.67	0.00	0.00	16.33	44.91
9.49	54.40	0.02	16.21	0.759		
EX.A03.01		71.67	0.00	0.00	0.00	70.17
0.00	70.17	0.06	39.67	0.979		
EX.A03.02		71.67	0.00	0.00	0.00	70.18
0.00	70.18	0.11	78.37	0.979		
EX.A04		71.67	0.00	0.00	0.00	70.19
0.00	70.19	0.03	19.84	0.979		
EX.R01		71.67	0.00	0.00	0.00	70.17
0.00	70.17	0.05	35.71	0.979		
EX.R02		71.67	0.00	0.00	0.00	70.14
0.00	70.14	0.21	144.68	0.979		
EX.R03		71.67	0.00	0.00	0.00	70.16
0.00	70.16	0.03	21.31	0.979		
EX_A01a_1		71.67	0.00	0.00	15.42	46.31
8.96	55.27	0.12	90.09	0.771		
EX_A01a_2		71.67	0.00	0.00	15.47	46.31
8.91	55.22	0.12	86.70	0.771		
EX_A01b_1		71.67	0.00	0.00	8.94	56.13
5.41	61.54	0.11	82.17	0.859		
EX_A01B_2		71.67	0.00	0.00	8.91	56.14
5.43	61.57	0.10	74.61	0.859		
EX_A02a		71.67	0.00	0.00	13.26	51.19
6.09	57.28	0.23	149.75	0.799		
EX_A02B		71.67	0.00	0.00	16.55	44.91
9.26	54.16	0.28	206.12	0.756		
P3-01		71.67	0.00	0.00	0.00	70.14
0.00	70.14	0.34	237.84	0.979		
P3-02		71.67	0.00	0.00	0.00	70.19
0.00	70.19	0.01	8.43	0.979		
P3-03		71.67	0.00	0.00	0.00	70.19
0.00	70.19	0.03	18.85	0.979		
P4-01		71.67	0.00	0.00	0.00	70.16
0.00	70.16	0.14	99.16	0.979		
P4-02		71.67	0.00	0.00	0.00	70.16
0.00	70.16	0.21	145.67	0.979		
P4-03		71.67	0.00	0.00	0.00	70.15
0.00	70.15	0.06	43.09	0.979		
P4-04		71.67	0.00	0.00	0.00	70.15
0.00	70.15	0.08	54.37	0.979		
P4-05		71.67	0.00	0.00	0.00	70.14
0.00	70.14	0.24	165.69	0.979		
P4-07		71.67	0.00	0.00	0.00	70.19
0.00	70.19	0.03	20.83	0.979		
P4-08		71.67	0.00	0.00	0.00	70.17
0.00	70.17	0.20	142.82	0.979		
P4-09		71.67	0.00	0.00	0.00	70.13
0.00	70.13	0.19	132.27	0.979		
P4-DR1a_1		71.67	0.00	0.00	46.03	7.72
17.76	25.48	0.18	79.87	0.356		
P4-DR1a_2		71.67	0.00	0.00	46.45	7.72
17.34	25.06	0.01	4.04	0.350		
P4-DR1b		71.67	0.00	0.00	55.19	4.21
12.18	16.39	0.11	33.86	0.229		
P4-DR2		71.67	0.00	0.00	56.38	4.21
10.99	15.20	0.84	254.13	0.212		

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Node Depth Summary
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Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
1	JUNCTION	0.00	0.00	79.11	0 00:00	0.00
10	JUNCTION	0.00	0.01	78.98	0 01:11	0.01
11	JUNCTION	0.00	0.00	78.80	0 00:00	0.00
12	JUNCTION	0.00	0.00	78.70	0 00:00	0.00
13	JUNCTION	0.00	0.00	78.80	0 00:00	0.00
14	JUNCTION	0.00	0.00	80.05	0 00:00	0.00
15	JUNCTION	0.00	0.00	78.90	0 00:00	0.00
16	JUNCTION	0.00	0.00	79.10	0 00:00	0.00
17	JUNCTION	0.00	0.00	79.05	0 00:00	0.00
18	JUNCTION	0.00	0.00	79.05	0 00:00	0.00
19	JUNCTION	0.00	0.00	77.05	0 00:00	0.00
2	JUNCTION	0.00	0.00	78.48	0 00:00	0.00
20	JUNCTION	0.00	0.00	77.10	0 00:00	0.00
21	JUNCTION	0.00	0.02	75.71	0 01:10	0.02
22	JUNCTION	0.00	0.00	77.15	0 00:00	0.00
23	JUNCTION	0.01	0.17	73.87	0 01:10	0.17
24	JUNCTION	0.02	0.18	73.35	0 01:10	0.18
25	JUNCTION	0.00	0.02	78.33	0 01:28	0.02
3	JUNCTION	0.00	0.00	78.95	0 00:00	0.00
4	JUNCTION	0.00	0.00	78.75	0 00:00	0.00
5	JUNCTION	0.00	0.00	78.95	0 00:00	0.00
6	JUNCTION	0.00	0.00	79.05	0 00:00	0.00
7	JUNCTION	0.00	0.00	78.95	0 00:00	0.00
8	JUNCTION	0.00	0.00	78.95	0 00:00	0.00
9	JUNCTION	0.00	0.00	78.95	0 00:00	0.00
CBMH413_dummy	JUNCTION	0.00	0.01	77.96	0 01:10	0.01
EX-CB100-101_DUMMY	JUNCTION	0.00	0.01	78.43	0 01:10	0.01
EX-CBMH_XYY_dummy	JUNCTION	0.00	0.00	79.38	0 00:00	0.00
MH426a	JUNCTION	0.06	1.11	73.33	0 01:10	1.11

ROOF-01	JUNCTION	0.01	0.03	73.35	0	04:29	0.03
ROOF-02	JUNCTION	0.02	0.14	73.50	0	01:33	0.14
ROOF-03	JUNCTION	0.05	1.99	74.84	0	01:10	1.99
ROOF-04	JUNCTION	0.02	0.95	74.06	0	01:10	0.95
ROOF-06	JUNCTION	0.20	1.65	75.08	0	01:15	1.65
ROOF-07	JUNCTION	0.03	1.28	75.26	0	01:15	1.28
ROOF-08	JUNCTION	0.02	0.58	76.03	0	01:13	0.58
ROOF-09	JUNCTION	0.01	0.08	77.45	0	01:01	0.08
ROOF-10	JUNCTION	0.01	0.51	77.83	0	01:14	0.51
ROOF-11	JUNCTION	0.01	0.05	76.02	0	00:56	0.05
DR-NE	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
DR-SD	OUTFALL	0.00	0.00	79.21	0	00:00	0.00
DR-WD	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
EMERG-OUT	OUTFALL	0.00	0.00	73.91	0	00:00	0.00
OUT13772	OUTFALL	0.09	0.91	72.47	0	01:03	0.91
OUT16389	OUTFALL	0.01	0.30	73.20	0	01:10	0.30
RR-01	OUTFALL	0.00	0.04	74.00	0	01:10	0.04
RR-02	OUTFALL	0.00	0.02	74.02	0	01:10	0.02
CB401	STORAGE	0.01	0.60	76.75	0	01:10	0.59
CB402	STORAGE	0.01	0.15	75.10	0	01:10	0.15
CB403	STORAGE	0.10	2.27	78.77	0	01:13	2.27
CB405	STORAGE	0.00	0.02	78.47	0	01:10	0.02
CB409	STORAGE	0.16	2.38	77.33	0	01:41	2.38
CB410	STORAGE	0.00	0.01	77.91	0	01:10	0.01
CB411	STORAGE	0.03	1.83	77.33	0	01:10	1.77
CB412	STORAGE	0.00	0.11	75.91	0	01:10	0.11
CB413	STORAGE	0.00	0.01	77.61	0	01:10	0.01
CB414	STORAGE	0.02	0.93	75.91	0	01:13	0.93
CB416	STORAGE	0.02	1.04	75.02	0	01:15	1.04
CB417	STORAGE	0.00	0.07	74.37	0	01:10	0.07
CBMH401-402	STORAGE	0.02	1.14	76.67	0	01:10	1.10
CBMH401-404	STORAGE	0.04	1.24	75.34	0	01:15	1.24
CBMH402	STORAGE	0.10	2.28	78.68	0	01:17	2.28
CBMH403	STORAGE	0.02	0.71	76.03	0	01:13	0.71
CBMH404-405	STORAGE	0.40	1.95	75.16	0	01:15	1.95
CBMH406	STORAGE	0.08	1.95	75.08	0	01:15	1.95
CBMH407	STORAGE	0.08	1.94	74.89	0	01:14	1.94
CBMH408-406	STORAGE	0.02	1.38	75.45	0	01:10	1.36
CBMH409	STORAGE	0.04	1.11	73.98	0	01:10	1.11
CBMH410	STORAGE	0.07	1.60	73.86	0	01:12	1.60
CBMH411	STORAGE	0.17	2.49	77.39	0	01:10	2.49
CBMH412	STORAGE	0.18	2.62	77.33	0	01:10	2.61
CBMH413	STORAGE	0.21	2.92	77.33	0	01:10	2.89
CBMH414	STORAGE	0.02	0.14	73.42	0	01:33	0.14
CBMH415	STORAGE	0.02	0.17	73.35	0	01:10	0.17
CBMH417	STORAGE	0.06	0.18	73.23	0	03:42	0.18
CBMH418	STORAGE	0.04	0.16	73.10	0	01:27	0.16
CBMH419	STORAGE	0.03	1.16	75.02	0	01:15	1.16
CBMH-R2	STORAGE	0.15	2.64	76.74	0	01:25	2.64
CBMH-R3	STORAGE	0.15	2.64	76.74	0	01:25	2.64
CICB403	STORAGE	0.01	0.23	74.83	0	01:10	0.23
CICB404	STORAGE	0.00	0.10	74.95	0	01:10	0.10
EX.CB307	STORAGE	0.00	0.00	74.65	0	00:00	0.00
EX.CBMH	STORAGE	0.00	0.01	74.15	0	01:55	0.01
EX.MH011	STORAGE	0.16	2.74	76.74	0	01:25	2.74
EX_CB_XXZ_(STM)	STORAGE	0.32	1.49	78.39	0	01:12	1.49
EX_CB006	STORAGE	0.40	1.94	78.49	0	01:23	1.94
EX_CB306	STORAGE	0.00	0.00	74.49	0	00:00	0.00
EX_CBA01a	STORAGE	0.17	1.68	78.37	0	01:10	1.68
EX_CBA01b-1	STORAGE	0.14	1.57	78.37	0	01:12	1.57
EX_CBA01b-2	STORAGE	0.17	1.77	78.30	0	01:40	1.77
EX_CBA02a	STORAGE	0.12	1.64	79.14	0	01:10	1.64
EX_CBMH010	STORAGE	0.28	3.24	78.49	0	01:25	3.24
EX_CBMH011	STORAGE	0.26	3.11	78.49	0	01:24	3.11
EX_CBMH012	STORAGE	0.12	1.79	78.49	0	01:26	1.79
EX_CBMH014	STORAGE	0.13	1.92	78.49	0	01:23	1.92
EX_STMMH_1	STORAGE	0.01	0.30	73.25	0	01:10	0.30
EX-A04-STOR	STORAGE	0.00	0.10	82.95	0	01:10	0.10
EX-A3-01&02-STOR	STORAGE	0.01	0.17	83.28	0	01:21	0.17
EX-CB_XYY	STORAGE	0.32	1.18	77.12	0	01:13	1.18
EX-CB004	STORAGE	0.31	0.85	77.97	0	01:10	0.83
EX-CB01	STORAGE	0.00	0.03	74.09	0	01:10	0.03
EX-CB02	STORAGE	0.00	0.04	74.06	0	01:10	0.04
EX-CB03	STORAGE	0.00	0.02	76.52	0	01:10	0.02
EX-CB100-101	STORAGE	0.30	0.35	77.20	0	01:11	0.35
EX-CB129	STORAGE	0.24	2.11	78.24	0	01:54	2.11
EX-CB130	STORAGE	0.17	1.60	78.29	0	01:21	1.60
EX-CB132	STORAGE	0.19	1.88	78.30	0	01:40	1.88
EX-CB150	STORAGE	0.33	1.08	76.63	0	01:12	1.08
EX-CB301	STORAGE	0.30	0.43	76.73	0	01:10	0.43
EX-CB304	STORAGE	0.00	0.00	74.25	0	00:00	0.00
EX-CB305	STORAGE	0.00	0.00	74.15	0	00:00	0.00
EX-CBMH_XXX	STORAGE	0.02	0.49	75.44	0	01:10	0.48
EX-CBMH_XXZ	STORAGE	0.02	0.61	76.67	0	01:12	0.61
EX-CBMH_XYY	STORAGE	0.03	1.02	77.61	0	01:13	1.02
EX-CBMH_XYZ	STORAGE	0.02	0.31	75.98	0	01:10	0.31
EX-CBMH_XZY	STORAGE	0.04	0.93	76.62	0	01:12	0.93
EX-CBMH_XZZ	STORAGE	0.04	0.93	76.44	0	01:12	0.93
EX-CBMH003	STORAGE	0.01	0.60	77.83	0	01:14	0.60
EX-CBMH008	STORAGE	0.01	0.33	74.18	0	01:10	0.33
EX-CBMH01	STORAGE	0.01	0.16	74.89	0	01:10	0.16
EX-CBMH301	STORAGE	0.01	0.19	77.19	0	01:10	0.19
EX-CBMH302	STORAGE	0.02	0.44	75.65	0	01:10	0.42
EX-CBMH303	STORAGE	0.01	0.13	76.21	0	01:10	0.13
EX-DICB001-002	STORAGE	0.42	1.48	78.30	0	01:21	1.48
EX-LD01	STORAGE	0.01	0.28	74.29	0	01:10	0.28
EX-MH_XXZ	STORAGE	0.32	0.83	76.72	0	01:12	0.83
EX-MH_XZY	STORAGE	0.34	1.27	76.56	0	01:12	1.27
EX-MH001	STORAGE	0.31	0.92	77.71	0	01:14	0.92
EX-MH301	STORAGE	0.01	0.09	77.29	0	01:02	0.09
EX-R02-STOR	STORAGE	0.01	0.25	83.68	0	01:23	0.25
EX-R03-STOR	STORAGE	0.00	0.17	83.02	0	01:14	0.17
EX-R1-STOR	STORAGE	0.01	0.17	86.14	0	01:30	0.17
EX-STMMH_XXX	STORAGE	0.19	0.65	74.92	0	01:10	0.64
LD-TD01	STORAGE	0.03	1.01	74.00	0	01:12	1.01
LD-TD02	STORAGE	0.02	0.90	74.14	0	01:10	0.88
LP-stor	STORAGE	0.25	0.34	76.24	0	01:10	0.34
MH401	STORAGE	0.04	1.11	76.38	0	01:12	1.10
MH402	STORAGE	1.29	2.38	76.25	0	01:12	2.38
MH403	STORAGE	0.00	0.43	76.68	0	01:10	0.40
MH404	STORAGE	0.04	1.05	75.67	0	01:14	1.05
MH405	STORAGE	0.31	1.94	75.24	0	01:15	1.94
MH406	STORAGE	0.07	1.48	75.26	0	01:15	1.48
MH407	STORAGE	0.08	1.95	75.00	0	01:15	1.95

MH408	STORAGE	0.04	1.12	76.03	0	01:13	1.12
MH410	STORAGE	0.03	1.32	75.01	0	01:15	1.32
MH411	STORAGE	0.09	1.93	74.82	0	01:14	1.93
MH412	STORAGE	0.07	1.68	74.55	0	01:14	1.68
MH413	STORAGE	0.08	1.67	74.23	0	01:13	1.67
MH415	STORAGE	0.08	1.66	74.09	0	01:13	1.66
MH416	STORAGE	0.09	1.72	73.83	0	01:12	1.72
MH417	STORAGE	0.35	2.00	73.80	0	01:12	2.00
MH418	STORAGE	0.08	1.43	73.95	0	01:11	1.43
MH419	STORAGE	0.06	1.40	73.98	0	01:11	1.40
MH420	STORAGE	0.10	1.64	73.87	0	01:12	1.64
MH421	STORAGE	0.03	1.08	74.06	0	01:10	1.08
MH422	STORAGE	0.03	1.15	73.92	0	01:11	1.15
MH423	STORAGE	0.10	1.66	73.64	0	01:12	1.66
MH424	STORAGE	0.10	1.36	73.12	0	01:11	1.36
MH425	STORAGE	0.34	0.68	74.04	0	01:10	0.68
MH426	STORAGE	0.06	1.05	73.37	0	01:10	1.05
MH427	STORAGE	0.07	1.13	73.30	0	01:11	1.13
MH428	STORAGE	0.08	1.18	73.27	0	01:11	1.18
MH429	STORAGE	0.00	0.00	73.98	0	00:00	0.00
MH430	STORAGE	0.04	0.67	73.41	0	01:10	0.67
OGS_#1_(3600Ø)_(STM)	STORAGE	0.08	1.18	73.20	0	01:11	1.18
OGS_#2_(3600Ø)_(STM)	STORAGE	0.09	1.49	73.42	0	01:12	1.49
P3-01-STOR	STORAGE	0.01	0.16	83.52	0	01:33	0.16
P3-02-STOR	STORAGE	0.01	0.24	83.09	0	01:10	0.24
P3-03-STOR	STORAGE	0.00	0.22	87.59	0	01:10	0.22
P4-01-STOR	STORAGE	0.03	0.19	85.64	0	01:42	0.19
P4-02-STOR	STORAGE	0.03	0.22	85.20	0	01:43	0.22
P4-03-STOR	STORAGE	0.04	0.19	83.76	0	01:41	0.19
P4-04-STOR	STORAGE	0.02	0.12	83.44	0	02:19	0.12
P4-05-stor	STORAGE	0.03	0.19	82.94	0	02:20	0.19
P4-07-STOR	STORAGE	0.01	0.11	83.22	0	01:50	0.11
TANK01	STORAGE	0.02	0.83	73.88	0	01:11	0.83
TANK02	STORAGE	0.09	0.92	74.04	0	01:41	0.92

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Flow Volume 10^6 ltr	Flow Balance Error Percent
1	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
10	JUNCTION	0.00	117.12	0 01:10	0	0.0702	0.000
11	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
12	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
13	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
14	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
15	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
16	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
17	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
18	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
19	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
2	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
20	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
21	JUNCTION	68.17	68.17	0 01:10	0.0913	0.0913	-0.006
22	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
23	JUNCTION	0.00	103.42	0 01:10	0	0.175	-0.006
24	JUNCTION	0.00	52.92	0 01:10	0	0.364	0.031
25	JUNCTION	0.00	25.65	0 01:26	0	0.0215	0.028
3	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
4	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
5	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
6	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
7	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
8	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
9	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
CBMH413_dummy	JUNCTION	33.11	33.11	0 01:10	0.042	0.042	-0.020
EX-CB100-101_DUMMY	JUNCTION	67.35	67.35	0 01:10	0.101	0.101	-0.008
EX-CBMH_XYY_dummy	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
MH426a	JUNCTION	0.00	406.82	0 01:04	0	1.62	-0.000
ROOF-01	JUNCTION	0.00	2.54	0 00:33	0	0.0772	0.005
ROOF-02	JUNCTION	0.00	31.60	0 00:48	0	0.34	-0.039
ROOF-03	JUNCTION	401.75	426.63	0 01:10	0.598	0.907	0.418
ROOF-04	JUNCTION	12.84	38.88	0 01:10	0.0164	0.212	-0.244

ROOF-06	JUNCTION	0.00	24.63	0	01:04	0	0.182
0.499							
ROOF-07	JUNCTION	0.00	8.11	0	01:03	0	0.168
0.010							
ROOF-08	JUNCTION	0.00	8.28	0	01:09	0	0.112
-0.005							
ROOF-09	JUNCTION	0.00	12.12	0	01:01	0	0.0363
7.969							
ROOF-10	JUNCTION	0.00	2.70	0	01:08	0	0.000258
-1.849							
ROOF-11	JUNCTION	0.00	3.90	0	00:40	0	0.0486
0.109							
DR-NE	OUTFALL	254.13	254.13	0	01:10	0.835	0.835
0.000							
DR-SD	OUTFALL	33.86	33.86	0	01:10	0.112	0.112
0.000							
DR-WD	OUTFALL	83.91	83.91	0	01:10	0.193	0.193
0.000							
EMERG-OUT	OUTFALL	0.00	0.00	0	00:00	0	0
0.000 ltr							
OUT13772	OUTFALL	0.00	1526.08	0	01:12	0	6.91
0.000							
OUT16389	OUTFALL	0.00	131.14	0	01:10	0	0.213
0.000							
RR-01	OUTFALL	0.00	115.14	0	01:10	0	0.161
0.000							
RR-02	OUTFALL	0.00	54.31	0	01:10	0	0.0776
0.000							
CB401	STORAGE	55.99	55.99	0	01:10	0.0742	0.0742
0.193							
CB402	STORAGE	37.04	69.18	0	01:10	0.0488	0.0904
0.003							
CB403	STORAGE	72.95	72.95	0	01:10	0.0941	0.133
-0.129							
CB405	STORAGE	26.14	26.14	0	01:10	0.0363	0.0363
-0.011							
CB409	STORAGE	34.17	88.60	0	01:10	0.0727	0.094
0.059							
CB410	STORAGE	38.10	38.10	0	01:10	0.0471	0.0686
-0.009							
CB411	STORAGE	29.70	29.70	0	01:10	0.0383	0.0383
0.001							
CB412	STORAGE	4.10	4.10	0	01:10	0.00419	0.00419
0.003							
CB413	STORAGE	34.86	34.86	0	01:10	0.044	0.044
-0.021							
CB414	STORAGE	10.13	17.57	0	01:10	0.0168	0.0296
0.002							
CB416	STORAGE	12.16	14.61	0	01:06	0.0203	0.0204
-0.204							
CB417	STORAGE	21.44	21.44	0	01:10	0.0232	0.0232
0.003							
CBMH401-402	STORAGE	167.39	217.69	0	01:10	0.236	0.337
0.153							
CBMH401-404	STORAGE	34.17	463.55	0	01:07	0.0427	1.7
-0.089							
CBMH402	STORAGE	67.09	67.09	0	01:10	0.0878	0.0878
-0.060							
CBMH403	STORAGE	8.06	16.21	0	01:09	0.00925	0.15
-0.014							
CBMH404-405	STORAGE	29.79	454.91	0	01:07	0.0379	2.04
0.135							
CBMH406	STORAGE	22.77	477.53	0	01:06	0.0282	2.27
-0.020							
CBMH407	STORAGE	15.55	628.56	0	01:10	0.0227	2.71
0.010							
CBMH408-406	STORAGE	175.24	197.82	0	01:10	0.254	0.277
0.046							
CBMH409	STORAGE	0.00	161.73	0	01:05	0	0.403
-0.057							
CBMH410	STORAGE	83.66	639.15	0	01:08	0.109	1.77
0.011							
CBMH411	STORAGE	64.52	64.52	0	01:10	0.0946	0.0946
0.062							
CBMH412	STORAGE	24.16	86.11	0	01:10	0.0305	0.219
-0.025							
CBMH413	STORAGE	0.00	42.42	0	01:07	0	0.201
-0.023							
CBMH414	STORAGE	0.00	31.90	0	01:33	0	0.341
-0.018							
CBMH415	STORAGE	0.00	31.90	0	01:34	0	0.341
0.001							
CBMH417	STORAGE	32.18	87.33	0	01:10	0.0418	0.483
0.007							
CBMH418	STORAGE	13.79	198.99	0	01:10	0.0168	0.613
-0.064							
CBMH419	STORAGE	29.85	38.68	0	01:09	0.0405	0.0793
0.200							
CBMH-R2	STORAGE	0.00	36.45	0	01:08	0	0.0257
0.072							
CBMH-R3	STORAGE	0.00	33.72	0	01:09	0	0.023
0.066							
CICB403	STORAGE	81.90	81.90	0	01:10	0.111	0.111
0.001							
CICB404	STORAGE	37.50	37.50	0	01:10	0.0589	0.0589
0.001							
EX.CB307	STORAGE	0.00	0.00	0	00:00	0	0
0.000 ltr							
EX.CBMH	STORAGE	10.94	10.94	0	01:10	0.012	0.012
0.003							
EX.MH011	STORAGE	139.23	139.23	0	01:10	0.191	0.24
-0.014							
EX_CB_XXZ_(STM)	STORAGE	62.89	117.62	0	01:11	0.0806	0.285
0.232							
EX_CB006	STORAGE	0.00	27.28	0	01:07	0	0.0038
1.844							
EX_CB306	STORAGE	0.00	0.00	0	00:00	0	0
0.000 ltr							
EX_CBA01a	STORAGE	90.09	90.09	0	01:10	0.119	0.124
0.304							
EX_CBA01b-1	STORAGE	82.17	108.32	0	01:10	0.109	0.112
-0.162							
EX_CBA01b-2	STORAGE	74.61	98.05	0	01:10	0.0981	0.21
0.116							
EX_CBA02a	STORAGE	149.75	149.75	0	01:10	0.229	0.229
0.013							
EX_CBMH010	STORAGE	0.00	185.46	0	01:11	0	0.348
0.009							
EX_CBMH011	STORAGE	224.77	231.18	0	01:07	0.311	0.334
-0.057							

EX_CBMH012	STORAGE	16.21	48.60	0	01:06	0.0212	0.0233	1.189
EX_CBMH014	STORAGE	0.00	53.54	0	01:06	0	0.0202	2.252
EX_STMMH_1	STORAGE	0.00	131.87	0	01:10	0	0.213	-0.000
EX-A04-STOR	STORAGE	19.84	19.84	0	01:10	0.0281	0.0281	-18.865
EX-A3-01&02-STOR	STORAGE	118.04	118.04	0	01:10	0.167	0.167	0.265
EX-CB_XYY	STORAGE	68.64	163.02	0	01:10	0.0888	0.441	0.030
EX-CB004	STORAGE	42.41	42.41	0	01:10	0.0691	0.0691	0.523
EX-CB01	STORAGE	0.00	65.32	0	01:10	0	0.0913	-0.228
EX-CB02	STORAGE	47.07	136.59	0	01:10	0.0623	0.185	-0.095
EX-CB03	STORAGE	70.49	99.34	0	01:10	0.0922	0.131	-0.036
EX-CB100-101	STORAGE	0.00	5.89	0	01:10	0	0.011	2.258
EX-CB129	STORAGE	0.00	68.86	0	01:11	0	0.28	0.003
EX-CB130	STORAGE	206.12	208.95	0	01:10	0.281	0.288	0.154
EX-CB132	STORAGE	86.70	138.07	0	01:10	0.115	0.242	-0.035
EX-CB150	STORAGE	0.00	98.11	0	01:06	0	0.785	0.018
EX-CB301	STORAGE	48.22	48.22	0	01:10	0.0642	0.0642	0.468
EX-CB304	STORAGE	0.00	0.00	0	00:00	0	0	0.000 ltr
EX-CB305	STORAGE	0.00	0.00	0	00:00	0	0	0.000 ltr
EX-CBMH_XXX	STORAGE	37.66	344.68	0	01:10	0.0482	0.75	-0.015
EX-CBMH_XXZ	STORAGE	46.04	81.39	0	01:09	0.0651	0.505	0.056
EX-CBMH_XYY	STORAGE	0.00	129.92	0	01:12	0	0.352	-0.164
EX-CBMH_XYZ	STORAGE	82.60	238.85	0	01:10	0.111	0.603	0.002
EX-CBMH_XZY	STORAGE	0.00	187.39	0	01:10	0	0.954	-0.026
EX-CBMH_XZZ	STORAGE	0.00	210.19	0	01:09	0	1.02	0.029
EX-CBMH003	STORAGE	0.00	39.24	0	01:10	0	0.0689	0.020
EX-CBMH008	STORAGE	33.41	33.41	0	01:10	0.046	0.046	0.127
EX-CBMH01	STORAGE	45.43	97.01	0	01:10	0.0588	0.159	-0.006
EX-CBMH301	STORAGE	73.98	107.60	0	01:10	0.107	0.169	0.084
EX-CBMH302	STORAGE	34.27	315.80	0	01:10	0.0428	0.702	0.023
EX-CBMH303	STORAGE	43.41	43.41	0	01:10	0.0566	0.0566	-0.002
EX-DICB001-002	STORAGE	0.00	21.10	0	01:00	0	0.00789	-3.682
EX-LD01	STORAGE	8.11	8.11	0	01:10	0.0155	0.0155	0.002
EX-MH_XXZ	STORAGE	0.00	41.07	0	01:40	0	0.44	-0.051
EX-MH_XZY	STORAGE	0.00	221.90	0	01:09	0	1.02	-0.016
EX-MH001	STORAGE	0.00	32.59	0	01:10	0	0.0686	0.036
EX-MH301	STORAGE	0.00	12.29	0	01:01	0	0.0336	0.315
EX-R02-STOR	STORAGE	144.68	144.68	0	01:10	0.207	0.207	-0.401
EX-R03-STOR	STORAGE	21.31	21.31	0	01:10	0.0302	0.0302	-8.155
EX-R1-STOR	STORAGE	35.71	35.71	0	01:10	0.0505	0.0505	-0.102
EX-STMMH_XXX	STORAGE	0.00	340.25	0	01:10	0	0.75	0.002
LD-TD01	STORAGE	103.47	103.47	0	01:10	0.142	0.161	0.137
LD-TD02	STORAGE	105.05	105.05	0	01:10	0.134	0.134	0.054
LP-stor	STORAGE	8.79	8.79	0	01:10	0.0138	0.0138	0.010
MH401	STORAGE	0.00	254.21	0	01:09	0	1.09	-0.035
MH402	STORAGE	0.00	438.46	0	01:09	0	1.43	0.004
MH403	STORAGE	0.00	10.02	0	01:08	0	0.0111	-0.018
MH404	STORAGE	0.00	451.78	0	01:08	0	1.66	0.066
MH405	STORAGE	0.00	454.42	0	01:07	0	2.01	0.060
MH406	STORAGE	0.00	40.08	0	01:31	0	0.301	0.006
MH407	STORAGE	0.00	499.70	0	01:21	0	2.41	-0.052
MH408	STORAGE	0.00	457.04	0	01:08	0	1.66	0.043
MH410	STORAGE	0.00	36.26	0	01:05	0	0.122	0.055
MH411	STORAGE	0.00	606.92	0	01:10	0	2.71	0.002
MH412	STORAGE	0.00	607.86	0	01:20	0	2.71	0.058
MH413	STORAGE	0.00	613.74	0	01:20	0	2.71	0.013
MH415	STORAGE	0.00	649.27	0	01:20	0	3.02	-0.213
MH416	STORAGE	0.00	1128.39	0	01:10	0	4.79	0.030
MH417	STORAGE	0.00	1150.02	0	01:14	0	5	0.006
MH418	STORAGE	0.00	472.41	0	01:08	0	1.06	0.333
MH419	STORAGE	0.00	483.82	0	01:07	0	1.06	-0.010

MH420	STORAGE	0.00	568.80	0	01:08	0	
1.46	-0.374						
MH421	STORAGE	9.47	165.67	0	01:05	0.0111	
0.403	0.050						
MH422	STORAGE	0.00	156.71	0	01:05	0	
0.404	0.097						
MH423	STORAGE	0.00	1171.68	0	01:14	0	
5.04	-0.022						
MH424	STORAGE	0.00	1525.06	0	01:11	0	
6.91	-0.006						
MH425	STORAGE	0.00	340.68	0	01:10	0	
0.75	0.002						
MH426	STORAGE	0.00	390.34	0	01:05	0	
1.51	-0.057						
MH427	STORAGE	0.00	400.84	0	01:05	0	
1.81	0.006						
MH428	STORAGE	0.00	390.91	0	01:05	0	
1.81	0.000						
MH429	STORAGE	0.00	0.00	0	00:00	0	
0	0.000 ltr						
MH430	STORAGE	0.00	341.91	0	01:10	0	
1.36	0.089						
OGS_#1_(3600Ø)_(STM)	STORAGE	0.00	415.58	0	01:06	0	
1.87	0.003						
OGS_#2_(3600Ø)_(STM)	STORAGE	0.00	1177.74	0	01:13	0	
5.04	0.005						
P3-01-STOR	STORAGE	237.84	237.84	0	01:10	0.341	
0.341	0.045						
P3-02-STOR	STORAGE	16.86	16.86	0	01:10	0.0239	
0.0239	-0.257						
P3-03-STOR	STORAGE	18.85	18.85	0	01:10	0.0267	
0.0267	-32.830						
P4-01-STOR	STORAGE	99.16	99.16	0	01:10	0.14	
0.14	-0.002						
P4-02-STOR	STORAGE	145.67	145.67	0	01:10	0.206	
0.206	-0.010						
P4-03-STOR	STORAGE	43.09	43.09	0	01:10	0.061	
0.061	0.003						
P4-04-STOR	STORAGE	54.37	54.37	0	01:10	0.0772	
0.0772	-0.005						
P4-05-stor	STORAGE	165.69	176.55	0	01:10	0.236	
0.244	-0.011						
P4-07-STOR	STORAGE	20.83	20.83	0	01:10	0.0295	
0.0295	-0.013						
TANK01	STORAGE	142.82	142.82	0	01:10	0.202	
0.202	0.001						
TANK02	STORAGE	132.27	132.27	0	01:10	0.191	
0.191	0.001						

****
Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
ROOF-03	JUNCTION	0.57	1.686	8.159
ROOF-04	JUNCTION	0.33	0.574	9.195
ROOF-06	JUNCTION	0.45	1.102	8.497
ROOF-07	JUNCTION	0.38	0.895	9.724
ROOF-08	JUNCTION	0.21	0.276	9.419
ROOF-10	JUNCTION	0.22	0.314	4.636
CB411	STORAGE	0.64	1.735	0.521
CBMH409	STORAGE	0.39	0.613	1.420
EX-CB004	STORAGE	0.24	0.354	0.916
EX-CBMH008	STORAGE	0.03	0.073	0.813
LD-TD01	STORAGE	0.35	0.561	0.979
LD-TD02	STORAGE	0.37	0.648	0.862
P4-07-STOR	STORAGE	48.00	0.111	0.039

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Node Flooding Summary
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No nodes were flooded.

****
Storage Volume Summary
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Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence hr:min	Maximum Outflow LPS
CB401	0.000	0.4	0.0	0.0	0.000	25.4	0 01:10	53.55
CB402	0.000	0.3	0.0	0.0	0.000	7.2	0 01:10	69.12
CB403	0.000	0.7	0.0	0.0	0.015	26.9	0 01:13	28.42
CB405	0.000	0.3	0.0	0.0	0.000	4.6	0 01:10	26.05
CB409	0.002	0.9	0.0	0.0	0.061	22.4	0 01:41	22.16
CB410	0.000	0.2	0.0	0.0	0.000	4.0	0 01:10	34.95
CB411	0.000	1.1	0.0	0.0	0.001	77.8	0 01:10	25.45
CB412	0.000	0.1	0.0	0.0	0.000	4.7	0 01:10	3.89
CB413	0.000	0.1	0.0	0.0	0.000	2.7	0 01:10	33.18
CB414	0.000	0.0	0.0	0.0	0.001	0.7	0 01:13	14.03
CB416	0.000	0.7	0.0	0.0	0.000	38.4	0 01:15	9.31

CB417	0.000	0.1	0.0	0.0	0.000	3.1	0
01:10 21.40							
CBMH401-402	0.000	0.9	0.0	0.0	0.001	41.1	0
01:10 204.04							
CBMH401-404	0.000	0.8	0.0	0.0	0.001	24.9	0
01:15 433.70							
CBMH402	0.000	0.4	0.0	0.0	0.018	15.9	0
01:17 22.24							
CBMH403	0.000	0.5	0.0	0.0	0.001	17.9	0
01:13 20.30							
CBMH404-405	0.001	6.8	0.0	0.0	0.003	33.0	0
01:15 437.51							
CBMH406	0.000	1.2	0.0	0.0	0.003	32.1	0
01:15 475.52							
CBMH407	0.000	1.8	0.0	0.0	0.003	42.1	0
01:14 606.92							
CBMH408-406	0.000	0.7	0.0	0.0	0.002	38.5	0
01:10 191.67							
CBMH409	0.000	1.7	0.0	0.0	0.001	43.9	0
01:10 156.71							
CBMH410	0.000	1.6	0.0	0.0	0.004	38.7	0
01:12 614.13							
CBMH411	0.000	1.5	0.0	0.0	0.003	22.2	0
01:10 62.15							
CBMH412	0.000	0.6	0.0	0.0	0.003	9.3	0
01:10 81.85							
CBMH413	0.000	5.3	0.0	0.0	0.003	74.9	0
01:10 26.41							
CBMH414	0.000	0.7	0.0	0.0	0.000	5.8	0
01:33 31.90							
CBMH415	0.000	0.6	0.0	0.0	0.000	5.8	0
01:10 31.98							
CBMH417	0.058	1.2	0.0	0.0	0.180	3.8	0
03:42 33.97							
CBMH418	0.037	0.7	0.0	0.0	0.163	3.3	0
01:27 40.16							
CBMH419	0.000	0.5	0.0	0.0	0.001	23.2	0
01:15 35.62							
CBMH-R2	0.000	0.4	0.0	0.0	0.003	7.4	0
01:25 3.43							
CBMH-R3	0.000	0.4	0.0	0.0	0.003	8.0	0
01:25 3.07							
CICB403	0.000	0.3	0.0	0.0	0.000	9.3	0
01:10 81.81							
CICB404	0.000	0.2	0.0	0.0	0.000	4.1	0
01:10 37.45							
EX.CB307	0.000	0.0	0.0	0.0	0.000	0.0	0
00:00 0.00							
EX.CBMH	0.003	0.1	0.0	0.0	0.011	0.3	0
01:55 0.50							
EX.MH011	0.000	3.8	0.0	0.0	0.007	65.9	0
01:25 85.93							
EX_CB_XXZ_(STM)	0.000	15.1	0.0	0.0	0.001	70.1	0
01:12 106.50							
EX_CB006	0.000	1.4	0.0	0.0	0.001	12.2	0
01:23 3.35							
EX_CB306	0.000	0.0	0.0	0.0	0.000	0.0	0
00:00 0.00							
EX_CBA01a	0.001	3.9	0.0	0.0	0.023	74.1	0
01:10 80.07							
EX_CBA01b-1	0.002	2.7	0.0	0.0	0.034	55.7	0
01:12 41.23							
EX_CBA01b-2	0.004	2.2	0.0	0.0	0.069	38.1	0
01:40 37.76							
EX_CBA02a	0.002	3.0	0.0	0.0	0.046	67.8	0
01:10 135.66							
EX_CBMH010	0.002	2.4	0.0	0.0	0.040	56.1	0
01:25 72.44							
EX_CBMH011	0.000	1.6	0.0	0.0	0.006	25.4	0
01:24 181.98							
EX_CBMH012	0.000	0.4	0.0	0.0	0.004	8.2	0
01:26 21.35							
EX_CBMH014	0.000	0.5	0.0	0.0	0.006	11.3	0
01:23 27.28							
EX_STMMH_1	0.000	1.1	0.0	0.0	0.000	26.4	0
01:10 131.14							
EX-A04-STOR	0.000	0.6	0.0	0.0	0.005	41.8	0
01:10 11.00							
EX-A3-01&02-STOR	0.003	2.0	0.0	0.0	0.064	48.3	0
01:21 26.03							
EX-CB_XYY	0.000	11.1	0.0	0.0	0.001	40.5	0
01:13 157.85							
EX-CB004	0.000	17.4	0.0	0.0	0.000	48.3	0
01:10 39.24							
EX-CB01	0.000	0.3	0.0	0.0	0.000	7.8	0
01:10 64.51							
EX-CB02	0.000	0.4	0.0	0.0	0.000	11.0	0
01:10 133.97							
EX-CB03	0.000	0.2	0.0	0.0	0.000	6.0	0
01:10 95.87							
EX-CB100-101	0.000	15.5	0.0	0.0	0.000	18.3	0
01:11 5.74							
EX-CB129	0.006	3.2	0.0	0.0	0.086	48.6	0
01:54 20.38							
EX-CB130	0.005	4.4	0.0	0.0	0.082	70.9	0
01:21 73.05							
EX-CB132	0.007	1.5	0.0	0.0	0.106	23.2	0
01:40 34.07							
EX-CB150	0.000	12.3	0.0	0.0	0.000	40.5	0
01:12 94.40							
EX-CB301	0.000	11.4	0.0	0.0	0.000	16.1	0
01:10 48.12							
EX-CB304	0.000	0.0	0.0	0.0	0.000	0.0	0
00:00 0.00							
EX-CB305	0.000	0.0	0.0	0.0	0.000	0.0	0
00:00 0.00							
EX-CBMH_XXX	0.000	0.5	0.0	0.0	0.001	12.6	0
01:10 340.25							
EX-CBMH_XXZ	0.000	1.1	0.0	0.0	0.001	28.1	0
01:12 78.85							
EX-CBMH_XYY	0.000	0.8	0.0	0.0	0.001	32.5	0
01:13 126.38							
EX-CBMH_XYZ	0.000	0.5	0.0	0.0	0.000	9.2	0
01:10 239.43							
EX-CBMH_XZY	0.000	1.4	0.0	0.0	0.001	31.7	0
01:12 175.76							
EX-CBMH_XZZ	0.000	1.4	0.0	0.0	0.001	33.6	0
01:12 200.71							
EX-CBMH003	0.000	0.6	0.0	0.0	0.001	29.0	0
01:14 32.83							

EX-CBMH008	0.000	0.6	0.0	0.0	0.000	28.7	0
01:10 33.19							
EX-CBMH01	0.000	0.3	0.0	0.0	0.000	7.5	0
01:10 96.36							
EX-CBMH301	0.000	0.4	0.0	0.0	0.000	9.2	0
01:10 104.27							
EX-CBMH302	0.000	0.6	0.0	0.0	0.000	14.3	0
01:10 307.09							
EX-CBMH303	0.000	0.2	0.0	0.0	0.000	5.6	0
01:10 43.13							
EX-DICB001-002	0.000	14.8	0.0	0.0	0.002	53.0	0
01:21 13.14							
EX-LD01	0.000	0.0	0.0	0.0	0.000	0.7	0
01:10 7.26							
EX-MH_XXZ	0.000	13.4	0.0	0.0	0.001	34.7	0
01:12 44.32							
EX-MH_XZY	0.000	10.4	0.0	0.0	0.001	39.0	0
01:12 210.19							
EX-MH001	0.000	9.9	0.0	0.0	0.001	29.7	0
01:14 29.75							
EX-MH301	0.000	0.4	0.0	0.0	0.000	5.4	0
01:02 12.32							
EX-R02-STOR	0.004	2.8	0.0	0.0	0.086	56.2	0
01:23 33.14							
EX-R03-STOR	0.000	1.9	0.0	0.0	0.008	69.6	0
01:14 7.97							
EX-R1-STOR	0.002	4.7	0.0	0.0	0.026	68.4	0
01:30 5.11							
EX-STMMH_XXX	0.000	3.5	0.0	0.0	0.001	12.2	0
01:10 340.68							
LD-TD01	0.000	0.1	0.0	0.0	0.019	5.7	0
01:12 89.91							
LD-TD02	0.000	0.3	0.0	0.0	0.004	15.6	0
01:10 96.24							
LP-stor	0.001	7.8	0.0	0.0	0.002	13.6	0
01:10 7.78							
MH401	0.000	1.3	0.0	0.0	0.001	33.2	0
01:12 247.70							
MH402	0.002	27.3	0.0	0.0	0.004	50.5	0
01:12 426.98							
MH403	0.000	0.2	0.0	0.0	0.000	20.5	0
01:10 12.39							
MH404	0.000	1.0	0.0	0.0	0.002	27.1	0
01:14 431.17							
MH405	0.001	5.6	0.0	0.0	0.003	34.8	0
01:15 429.58							
MH406	0.000	1.4	0.0	0.0	0.002	29.7	0
01:15 48.53							
MH407	0.000	1.4	0.0	0.0	0.003	33.7	0
01:15 509.53							
MH408	0.000	1.2	0.0	0.0	0.002	30.3	0
01:13 451.78							
MH410	0.000	0.7	0.0	0.0	0.001	25.1	0
01:15 32.28							
MH411	0.000	1.9	0.0	0.0	0.003	40.2	0
01:14 607.86							
MH412	0.000	1.2	0.0	0.0	0.003	29.6	0
01:14 613.74							
MH413	0.000	1.2	0.0	0.0	0.003	25.8	0
01:13 622.73							
MH415	0.000	1.2	0.0	0.0	0.003	25.8	0
01:13 662.62							
MH416	0.000	1.7	0.0	0.0	0.004	32.9	0
01:12 1122.95							
MH417	0.001	6.0	0.0	0.0	0.005	34.5	0
01:12 1152.85							
MH418	0.000	3.6	0.0	0.0	0.003	65.5	0
01:11 446.79							
MH419	0.000	2.4	0.0	0.0	0.002	60.3	0
01:11 472.41							
MH420	0.000	2.8	0.0	0.0	0.004	45.3	0
01:12 542.72							
MH421	0.000	1.5	0.0	0.0	0.001	49.9	0
01:10 161.73							
MH422	0.000	0.7	0.0	0.0	0.001	23.9	0
01:11 148.10							
MH423	0.000	1.7	0.0	0.0	0.004	29.1	0
01:12 1174.81							
MH424	0.000	1.8	0.0	0.0	0.003	24.8	0
01:11 1526.08							
MH425	0.000	6.7	0.0	0.0	0.001	13.4	0
01:10 341.00							
MH426	0.000	1.3	0.0	0.0	0.002	22.2	0
01:10 337.87							
MH427	0.000	1.4	0.0	0.0	0.002	23.7	0
01:11 390.91							
MH428	0.000	1.5	0.0	0.0	0.002	23.7	0
01:11 383.94							
MH429	0.000	0.0	0.0	0.0	0.000	0.0	0
00:00 0.00							
MH430	0.000	0.9	0.0	0.0	0.001	14.0	0
01:10 344.69							
OGS_#1_(3600Ø)_(STM)	0.001	1.6	0.0	0.0	0.012	23.9	0
01:11 399.40							
OGS_#2_(3600Ø)_(STM)	0.001	1.6	0.0	0.0	0.015	24.9	0
01:12 1184.87							
P3-01-STOR	0.010	2.8	0.0	0.0	0.163	45.2	0
01:33 31.90							
P3-02-STOR	0.000	4.1	0.0	0.0	0.008	97.0	0
01:10 13.41							
P3-03-STOR	0.000	1.1	0.0	0.0	0.000	86.4	0
01:10 18.85							
P4-01-STOR	0.014	7.7	0.0	0.0	0.095	53.8	0
01:42 8.82							
P4-02-STOR	0.016	5.7	0.0	0.0	0.134	48.3	0
01:43 12.62							
P4-03-STOR	0.009	11.4	0.0	0.0	0.043	55.0	0
01:41 4.11							
P4-04-STOR	0.007	6.1	0.0	0.0	0.054	47.4	0
02:19 2.54							
P4-05-stor	0.030	6.7	0.0	0.0	0.182	41.4	0
02:20 7.82							
P4-07-STOR	0.002	6.8	0.0	0.0	0.018	74.3	0
01:50 1.59							
TANK01	0.002	2.4	0.0	0.0	0.054	83.3	0
01:11 83.94							
TANK02	0.011	8.6	0.0	0.0	0.120	91.9	0
01:41 13.93							

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
DR-NE	12.54	79.16	254.13	0.835
DR-SD	11.23	11.87	33.86	0.112
DR-WD	10.98	23.26	83.91	0.193
EMERG-OUT	0.00	0.00	0.00	0.000
OUT13772	98.92	75.97	1526.08	6.909
OUT16389	15.06	20.11	131.14	0.213
RR-01	12.46	19.13	115.14	0.161
RR-02	12.33	9.19	54.31	0.078
System	21.69	238.69	2127.91	8.502

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
1	CONDUIT	131.14	0	01:10	1.13	0.78	0.66
11	CONDUIT	0.00	0	00:00	0.00	0.00	0.02
16	CONDUIT	51.72	0	01:10	0.36	0.01	0.04
17	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
18	CONDUIT	0.00	0	00:00	0.00	0.00	0.19
19	CONDUIT	0.00	0	00:00	0.00	0.00	0.19
2	CONDUIT	36.45	0	01:08	0.07	0.01	1.00
20	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
21	CONDUIT	0.00	0	00:00	0.00	0.00	0.24
22	CONDUIT	0.00	0	00:00	0.00	0.00	0.24
23	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
24	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
25	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
26	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
27	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
28	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
29	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
3	CONDUIT	33.72	0	01:09	0.06	0.01	1.00
30	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
31	CONDUIT	22.58	0	01:10	0.38	0.00	0.02
32	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
33	CONDUIT	7.78	0	01:10	0.52	0.18	0.26
33_1	CONDUIT	0.00	0	00:00	0.00	0.00	0.02
33_2	CONDUIT	23.16	0	01:28	0.35	0.01	0.04
34	CONDUIT	0.00	0	00:00	0.00	0.00	0.02
35	CONDUIT	32.34	0	01:10	0.46	0.01	0.04
36	CONDUIT	28.96	0	01:10	0.34	0.00	0.05
37	CONDUIT	89.86	0	01:10	0.60	0.01	0.09
38	CONDUIT	0.00	0	00:00	0.00	0.00	0.03
38_1	CONDUIT	0.00	0	00:00	0.00	0.00	0.03
38_3	CONDUIT	65.32	0	01:10	0.58	0.01	0.06
39	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
4	CONDUIT	31.90	0	00:52	1.01	0.17	0.33
40	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
41	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
42	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
43	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
44	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
45	CONDUIT	38.84	0	01:11	0.30	0.00	0.04
46	CONDUIT	65.61	0	01:11	0.45	0.01	0.04
47	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
48	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
49	CONDUIT	96.24	0	01:10	1.96	1.54	1.00
49_1	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
49_2	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
50	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
51	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
52	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
53	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
54	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
55	CONDUIT	32.24	0	01:10	0.34	0.00	0.03
56	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
57	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
58	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
59	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
6	CONDUIT	2.54	0	04:52	0.59	0.03	0.22
60	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
61	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
62	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
63	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
64	CONDUIT	117.12	0	01:10	1.20	0.01	0.06
65	CONDUIT	27.67	0	01:10	0.23	0.07	0.09
66	CONDUIT	12.01	0	01:12	0.12	0.07	0.06
67	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
68	CONDUIT	26.60	0	01:10	0.24	0.07	0.06
69	CONDUIT	21.40	0	01:10	2.04	0.29	0.37
7	CONDUIT	33.19	0	01:07	0.81	0.50	1.00
72	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
73	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
74	CONDUIT	25.65	0	01:26	0.37	0.01	0.05
75	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
76	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
77	CONDUIT	17.43	0	01:19	0.18	0.04	0.13
79	CONDUIT	115.14	0	01:10	0.60	0.03	0.11
80	CONDUIT	54.31	0	01:10	0.43	0.01	0.07
CB100-MH403	CONDUIT	5.74	0	01:11	0.69	0.06	0.17
CB401-MH401	CONDUIT	53.55	0	01:09	1.97	0.94	1.00
CB401-Mh402	CONDUIT	201.30	0	01:10	1.77	1.22	1.00
CB403-MH408	CONDUIT	20.30	0	01:26	0.87	0.20	1.00
CB404-MH405	CONDUIT	433.70	0	01:07	2.69	0.79	1.00
CB405-CB406	CONDUIT	437.51	0	01:06	1.57	1.13	1.00
CB406-MH407	CONDUIT	475.52	0	01:21	1.29	1.18	1.00
CB407-CBMH14	CONDUIT	27.28	0	01:07	0.60	0.44	1.00
CB407-MH411	CONDUIT	606.92	0	01:10	1.64	1.34	1.00

CB409-CB412	CONDUIT	55.26	0	01:10	1.13	0.98	1.00
CB409-MH422	CONDUIT	156.71	0	01:05	1.21	0.76	1.00
CB410-MH416	CONDUIT	614.13	0	01:09	0.98	0.57	1.00
CB411-412	CONDUIT	62.15	0	01:10	0.86	0.62	1.00
CB414-415	CONDUIT	31.90	0	01:34	0.92	0.31	0.35
CB416-417_1	CONDUIT	31.98	0	01:10	0.83	0.30	0.45
CB416-417_2	CONDUIT	52.81	0	01:10	1.05	0.49	0.44
CB416-CBMH419	CONDUIT	9.31	0	01:10	0.59	0.22	1.00
CB417-418	CONDUIT	33.97	0	03:42	0.88	0.32	0.36
CB418-MH430	CONDUIT	186.02	0	01:11	2.67	1.79	0.61
CBMH412-413	CONDUIT	40.73	0	01:07	0.70	0.41	1.00
EX.CBMH014-010	CONDUIT	53.54	0	01:06	0.75	0.89	1.00
EX.CBMH-CB418	CONDUIT	0.50	0	01:55	0.68	0.00	0.04
EXCB06-CBMH	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
EXCB07-06	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
EX-STMMH_XXX-MH425	CONDUIT	340.68	0	01:10	2.13	1.14	0.94
MH401-402	CONDUIT	247.70	0	01:09	1.11	0.92	1.00
MH402-408	CONDUIT	426.98	0	01:08	1.91	1.35	1.00
MH403-CB401	CONDUIT	12.39	0	01:11	0.76	0.07	1.00
MH404-CB404	CONDUIT	431.17	0	01:07	2.35	0.92	1.00
MH405-CB405	CONDUIT	429.58	0	01:06	1.16	1.12	1.00
MH407-CB407	CONDUIT	509.53	0	01:22	1.38	1.19	1.00
MH408-404	CONDUIT	451.78	0	01:08	2.11	0.97	1.00
MH410-407	CONDUIT	32.28	0	01:04	1.06	0.32	1.00
MH411-412	CONDUIT	607.86	0	01:20	1.64	2.66	1.00
MH412-413	CONDUIT	613.74	0	01:20	1.66	0.94	1.00
MH413-415	CONDUIT	622.73	0	01:20	1.37	1.18	1.00
MH413-429	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH415-416	CONDUIT	662.62	0	01:22	1.45	1.28	1.00
MH417-423	CONDUIT	1152.85	0	01:14	1.76	1.62	1.00
MH419-418	CONDUIT	472.41	0	01:08	1.32	1.44	1.00
MH420-CB410	CONDUIT	542.72	0	01:08	0.99	0.72	1.00
MH421-409	CONDUIT	161.73	0	01:05	1.12	0.93	1.00
MH423-OGS2	CONDUIT	1174.81	0	01:13	1.79	1.49	1.00
MH425-430	CONDUIT	341.00	0	01:10	2.53	0.94	0.77
MH426-427_1	CONDUIT	337.87	0	01:04	1.17	0.72	1.00
MH426-427_2	CONDUIT	392.67	0	01:05	1.24	0.84	1.00
MH427-428	CONDUIT	390.91	0	01:05	1.10	0.79	1.00
MH428-OGS1	CONDUIT	383.94	0	01:06	1.04	0.82	1.00
MH429-OUT	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH430-426	CONDUIT	269.28	0	01:05	1.82	0.67	1.00
OCB0408-406	CONDUIT	191.67	0	01:10	3.78	1.26	1.00
OCB303	CONDUIT	43.13	0	01:10	1.41	0.41	0.45
OCB402	CONDUIT	69.12	0	01:10	2.66	0.94	0.77
OCB404	CONDUIT	37.45	0	01:10	2.35	0.51	0.51
OCICB403	CONDUIT	81.81	0	01:10	2.75	1.10	1.00
OGS1-MH424	CONDUIT	399.40	0	01:06	1.08	0.85	1.00
OGS2-MH424	CONDUIT	1184.87	0	01:13	1.81	1.57	1.00
Pipe_-_(1)_(1)_(STM)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
Pipe_-_(10)_(1)_(1)_(STM)	CONDUIT	106.50	0	01:12	1.46	1.19	1.00
Pipe_-_(10)_(1)_(2)_(1)_(STM)	CONDUIT	39.24	0	01:10	1.25	1.21	1.00
Pipe_-_(10)_(1)_(2)_(103)_(STM)	CONDUIT	148.10	0	01:04	1.29	0.72	1.00
Pipe_-_(10)_(1)_(2)_(11)_(STM)	CONDUIT	307.09	0	01:09	2.05	1.03	0.96
Pipe_-_(10)_(1)_(2)_(15)_(STM)	CONDUIT	340.25	0	01:10	2.18	1.09	0.94
Pipe_-_(10)_(1)_(2)_(16)_(STM)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
Pipe_-_(10)_(1)_(2)_(2)_(STM)	CONDUIT	2.70	0	01:08	0.15	0.09	1.00
Pipe_-_(10)_(1)_(2)_(3)_(STM)	CONDUIT	32.59	0	01:10	1.05	1.30	1.00
Pipe_-_(10)_(1)_(2)_(31)_(STM)	CONDUIT	1526.08	0	01:12	2.33	1.80	1.00
Pipe_-_(10)_(1)_(2)_(4)_(STM)	CONDUIT	126.38	0	01:14	1.73	1.27	1.00
Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_1	CONDUIT	96.36	0	01:10	2.01	0.36	0.44
Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_2	CONDUIT	102.88	0	01:10	1.56	0.39	0.56
Pipe_-_(10)_(1)_(2)_(45)_(STM)	CONDUIT	21.10	0	01:00	0.29	0.21	1.00
Pipe_-_(10)_(1)_(2)_(46)_(STM)	CONDUIT	68.86	0	01:11	0.94	0.41	1.00
Pipe_-_(10)_(1)_(2)_(48)_(STM)	CONDUIT	94.40	0	01:05	1.04	0.65	1.00
Pipe_-_(10)_(1)_(2)_(49)_(STM)	CONDUIT	78.85	0	01:06	1.15	0.48	1.00
Pipe_-_(10)_(1)_(2)_(5)_(STM)	CONDUIT	157.85	0	01:14	2.18	1.56	0.97
Pipe_-_(10)_(1)_(2)_(50)_(STM)	CONDUIT	44.32	0	01:19	0.99	0.73	1.00
Pipe_-_(10)_(1)_(2)_(52)_(STM)	CONDUIT	27.06	0	01:08	0.86	0.82	1.00
Pipe_-_(10)_(1)_(2)_(54)_(STM)	CONDUIT	20.67	0	01:11	0.66	0.64	1.00
Pipe_-_(10)_(1)_(2)_(55)_(STM)	CONDUIT	175.76	0	01:10	0.84	0.95	1.00
Pipe_-_(10)_(1)_(2)_(57)_(STM)	CONDUIT	48.12	0	01:09	2.40	0.67	0.81
Pipe_-_(10)_(1)_(2)_(58)_(STM)	CONDUIT	210.19	0	01:09	0.98	1.11	1.00
Pipe_-_(10)_(1)_(2)_(59)_(STM)	CONDUIT	200.71	0	01:09	1.19	1.00	1.00
Pipe_-_(10)_(1)_(2)_(7)_(STM)	CONDUIT	239.43	0	01:10	1.79	0.80	0.81
Pipe_-_(10)_(1)_(2)_(71)_(STM)	CONDUIT	12.32	0	01:03	0.69	0.17	0.36
Pipe_-_(10)_(1)_(2)_(72)_(STM)	CONDUIT	104.27	0	01:10	2.14	0.60	0.82
Pipe_-_(10)_(1)_(2)_(8)_(STM)	CONDUIT	4.10	0	01:01	0.71	0.27	0.67
Pipe_-_(10)_(1)_(2)_(82)_(STM)	CONDUIT	48.53	0	01:32	0.79	0.26	1.00
Pipe_-_(10)_(1)_(2)_(STM)	CONDUIT	29.75	0	01:23	1.51	0.56	1.00
Pipe_-_(14)_(1)_(2)_(STM)_2	CONDUIT	1122.95	0	01:14	1.71	1.74	1.00
Pipe_-_(15)_(STM)	CONDUIT	446.79	0	01:08	1.40	1.30	1.00
Pipe_-_(17)_(1)_(2)_(STM)	CONDUIT	179.96	0	01:10	0.44	0.05	1.00
Pipe_-_(17)_(1)_(3)_(STM)	CONDUIT	34.06	0	01:06	0.70	0.57	1.00
R03-MH419	CONDUIT	426.56	0	01:10	5.84	4.72	1.00

R04-MH421	CONDUIT	38.79	0	01:10	1.31	0.21	1.00
R06-CB406	CONDUIT	28.84	0	01:34	0.98	0.17	1.00
R07-MH406	CONDUIT	11.94	0	01:31	0.63	0.06	1.00
R08-CB403	CONDUIT	5.68	0	01:08	0.63	0.05	1.00
R09-MH301	CONDUIT	12.29	0	01:01	0.96	0.19	0.30
TD01-MH410	CONDUIT	35.62	0	01:05	1.07	0.35	1.00
TD01-MH419	CONDUIT	89.91	0	01:05	1.38	1.49	1.00
O-CB10	ORIFICE	26.57	0	01:25			1.00
O-CB129	ORIFICE	20.38	0	01:54			1.00
O-CB132	ORIFICE	20.61	0	01:40			1.00
O-CB403	ORIFICE	28.42	0	01:13			1.00
O-CB411	ORIFICE	25.45	0	01:10			1.00
O-CB412	ORIFICE	3.89	0	01:10			1.00
O-CB414	ORIFICE	14.03	0	01:13			1.00
O-CBMH402	ORIFICE	22.24	0	01:17			1.00
O-CBMH413	ORIFICE	26.41	0	01:10			1.00
O-EXCBA01b	ORIFICE	20.46	0	01:40			1.00
O-EXCBA02a	ORIFICE	22.44	0	01:22			1.00
O-EXMH011	ORIFICE	24.41	0	01:25			1.00
O-LD01	ORIFICE	7.26	0	01:10			1.00
O-TANK01	ORIFICE	83.94	0	01:13			1.00
O-TANK02	ORIFICE	13.93	0	01:41			1.00
10	WEIR	5.96	0	01:42			0.19
12	WEIR	0.30	0	01:33			0.04
15	WEIR	0.00	0	00:00			0.00
8	WEIR	0.00	0	00:00			0.00
9	WEIR	11.13	0	01:10			0.92
EX-A3-01&02-OVF	WEIR	1.03	0	01:21			0.09
EX-R02-OVF	WEIR	13.04	0	01:23			0.34
EX-R03-OVF	WEIR	1.47	0	01:14			0.24
EX-R1-OVF	WEIR	1.21	0	01:30			0.21
P3-03-OVF	WEIR	6.73	0	01:10			0.66
P4-02-OVF	WEIR	6.91	0	01:43			0.22
P4-03-OVF	WEIR	3.47	0	01:41			0.21
P4-05-OVF	WEIR	2.72	0	02:20			0.12
13	DUMMY	10.20	0	01:10			
14	DUMMY	18.84	0	01:10			
5	DUMMY	2.54	0	00:33			
71	DUMMY	2.09	0	01:10			
EX-A04-STOR_out	DUMMY	11.00	0	01:00			
EX-A3-01&02-STOR_out	DUMMY	25.00	0	01:11			
EX-CB100-101_CBOGx2	DUMMY	5.89	0	01:10			
EX-CBMH_XYY_CBOG	DUMMY	0.00	0	00:00			
EX-R02-STOR_out	DUMMY	20.10	0	00:47			
EX-R03-STOR_out	DUMMY	6.50	0	00:53			
EX-R1-STOR_out	DUMMY	3.90	0	00:40			
OCB405	DUMMY	3.47	0	01:10			
OCB410	DUMMY	2.61	0	01:10			
OCB413	DUMMY	0.94	0	01:10			
P3-01-STOR_out	DUMMY	31.60	0	00:48			
P3-02-STOR_out	DUMMY	2.28	0	01:04			
P3-03-STOR_out	DUMMY	12.12	0	01:01			
P4-01-STOR_out	DUMMY	2.86	0	00:29			
P4-02-STOR_out	DUMMY	5.71	0	00:31			
P4-03-STOR_out	DUMMY	0.64	0	00:28			
P4-05-STOR_out	DUMMY	5.10	0	00:31			
P4-07-STOR_out	DUMMY	1.59	0	00:32			
Pipe_-_(10)_(1)_(2)_(39)_(STM)	DUMMY	6.00	0	01:10			

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.94	0.00
11	1.00	0.88	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	1.00	0.88	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00
17	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.00	0.01	0.00	0.00	0.08	0.00	0.00	0.91	0.00	0.00
20	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.00	0.01	0.00	0.00	0.08	0.00	0.00	0.91	0.00	0.00
30	1.00	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	1.00	0.96	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
32	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

33	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00
0.01									
33_1	1.00	0.90	0.10	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
33_2	1.00	0.87	0.03	0.00	0.10	0.00	0.00	0.00	0.97
0.00									
34	1.00	0.89	0.11	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
35	1.00	0.87	0.00	0.00	0.00	0.00	0.00	0.13	0.00
0.00									
36	1.00	0.83	0.06	0.00	0.11	0.00	0.00	0.00	0.12
0.00									
37	1.00	0.60	0.23	0.00	0.16	0.01	0.00	0.00	0.12
0.00									
38	1.00	0.83	0.17	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
38_1	1.00	0.83	0.17	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
38_3	1.00	0.56	0.26	0.00	0.16	0.02	0.00	0.00	0.12
0.00									
39	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
4	1.00	0.01	0.00	0.00	0.06	0.00	0.00	0.93	0.00
0.00									
40	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
41	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
42	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
43	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
44	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
45	1.00	0.93	0.00	0.00	0.00	0.00	0.00	0.07	0.00
0.00									
46	1.00	0.93	0.00	0.00	0.00	0.00	0.00	0.07	0.00
0.00									
47	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
48	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
49	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00
0.00									
49_1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
49_2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
50	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
51	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
52	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
53	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
54	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
55	1.00	0.89	0.00	0.00	0.00	0.00	0.00	0.11	0.00
0.00									

56	1.00	0.89	0.11	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
57	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
58	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
59	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
6	1.00	0.01	0.00	0.00	0.07	0.01	0.00	0.92	0.07
0.00									
60	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
61	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
62	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
63	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
64	1.00	0.93	0.05	0.00	0.00	0.01	0.00	0.00	0.97
0.00									
65	1.00	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00
0.00									
66	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00
0.00									
67	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
68	1.00	0.99	0.00	0.00	0.00	0.00	0.01	0.00	0.00
0.00									
69	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00
0.00									
7	1.00	0.01	0.00	0.00	0.04	0.00	0.00	0.95	0.03
0.00									
72	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
73	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
74	1.00	0.90	0.09	0.00	0.01	0.00	0.00	0.00	0.97
0.00									
75	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
76	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00									
77	1.00	0.97	0.00	0.00	0.03	0.00	0.00	0.00	0.00
0.00									
79	1.00	0.65	0.00	0.00	0.35	0.00	0.00	0.00	0.00
0.00									
80	1.00	0.59	0.00	0.00	0.41	0.00	0.00	0.00	0.00
0.00									
CB100-MH403	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00
0.00									
CB401-MH401	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00
0.00									
CB401-Mh402	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00
0.00									
CB403-MH408	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00
0.00									
CB404-MH405	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00
0.00									
CB405-CB406	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00
0.00									

CB406-MH407	1.00	0.01	0.00	0.00	0.25	0.00	0.00	0.74	0.08	0.00
CB407-CBMH14	1.00	0.02	0.00	0.00	0.05	0.00	0.00	0.92	0.00	0.00
CB407-MH411	1.00	0.01	0.00	0.00	0.23	0.00	0.00	0.76	0.00	0.00
CB409-CB412	1.00	0.01	0.00	0.00	0.05	0.00	0.00	0.94	0.00	0.00
CB409-MH422	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
CB410-MH416	1.00	0.01	0.00	0.00	0.41	0.00	0.00	0.58	0.36	0.00
CB411-412	1.00	0.01	0.00	0.00	0.05	0.00	0.00	0.94	0.00	0.00
CB414-415	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
CB416-417_1	1.00	0.01	0.01	0.00	0.98	0.00	0.00	0.00	0.87	0.00
CB416-417_2	1.00	0.01	0.00	0.00	0.08	0.00	0.00	0.91	0.05	0.00
CB416-CBMH419	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
CB417-418	1.00	0.02	0.00	0.00	0.17	0.00	0.00	0.81	0.06	0.00
CB418-MH430	1.00	0.01	0.00	0.00	0.01	0.01	0.00	0.98	0.00	0.00
CBMH412-413	1.00	0.01	0.00	0.00	0.05	0.00	0.00	0.94	0.01	0.00
EX.CBMH014-010	1.00	0.02	0.00	0.00	0.06	0.00	0.00	0.92	0.00	0.00
EX.CBMH-CB418	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
EXCB06-CBMH	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EXCB07-06	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EX-STMMH_XXX-MH425	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH401-402	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
MH402-408	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
MH403-CB401	1.00	0.02	0.00	0.00	0.01	0.00	0.00	0.97	0.01	0.00
MH404-CB404	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
MH405-CB405	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
MH407-CB407	1.00	0.01	0.00	0.00	0.09	0.00	0.00	0.90	0.00	0.00
MH408-404	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
MH410-407	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
MH411-412	1.00	0.01	0.01	0.00	0.98	0.00	0.00	0.00	0.38	0.00
MH412-413	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.00	0.00
MH413-415	1.00	0.01	0.00	0.00	0.10	0.00	0.00	0.89	0.01	0.00
MH413-429	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH415-416	1.00	0.01	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
MH417-423	1.00	0.01	0.00	0.00	0.27	0.00	0.00	0.72	0.00	0.00
MH419-418	1.00	0.01	0.00	0.00	0.27	0.00	0.00	0.72	0.01	0.00
MH420-CB410	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
MH421-409	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
MH423-OGS2	1.00	0.01	0.00	0.00	0.40	0.00	0.00	0.59	0.00	0.00
MH425-430	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH426-427_1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.09	0.00
MH426-427_2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.90	0.00
MH427-428	1.00	0.01	0.00	0.00	0.11	0.00	0.00	0.88	0.00	0.00
MH428-OGS1	1.00	0.01	0.00	0.00	0.10	0.00	0.00	0.89	0.00	0.00
MH429-OUT	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH430-426	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
OCB0408-406	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
OCB303	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
OCB402	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
OCB404	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
OCICB403	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
OGS1-MH424	1.00	0.01	0.00	0.00	0.03	0.00	0.00	0.96	0.00	0.00
OGS2-MH424	1.00	0.01	0.00	0.00	0.05	0.00	0.00	0.94	0.00	0.00
Pipe_-_(1)_(1)_(STM)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(10)_(1)_(1)_(STM)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(10)_(1)_(2)_(1)_(STM)	1.00	0.01	0.00	0.00	0.01	0.01	0.00	0.97	0.00	0.00
Pipe_-_(10)_(1)_(2)_(103)_(STM)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(10)_(1)_(2)_(11)_(STM)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
Pipe_-_(10)_(1)_(2)_(15)_(STM)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
Pipe_-_(10)_(1)_(2)_(16)_(STM)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(10)_(1)_(2)_(2)_(STM)	1.00	0.94	0.02	0.00	0.04	0.00	0.00	0.00	0.97	0.00
Pipe_-_(10)_(1)_(2)_(3)_(STM)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00

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  Pipe_-_(10)_(1)_(2)_(31)_(STM)    1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00
0.79  0.00
  Pipe_-_(10)_(1)_(2)_(4)_(STM)    1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_1    1.00   0.01  0.00  0.00  0.91  0.09  0.00
0.00  0.97  0.00
  Pipe_-_(10)_(1)_(2)_(40)_(2)_(STM)_2    1.00   0.01  0.00  0.00  0.00  0.01  0.00
0.98  0.00  0.00
  Pipe_-_(10)_(1)_(2)_(45)_(STM)    1.00   0.01  0.01  0.00  0.08  0.00  0.00  0.90
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(46)_(STM)    1.00   0.01  0.00  0.00  0.09  0.00  0.00  0.90
0.01  0.00
  Pipe_-_(10)_(1)_(2)_(48)_(STM)    1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(49)_(STM)    1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98
0.01  0.00
  Pipe_-_(10)_(1)_(2)_(5)_(STM)    1.00   0.01  0.00  0.00  0.00  0.00  0.00  0.99
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(50)_(STM)    1.00   0.01  0.00  0.00  0.02  0.00  0.00  0.97
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(52)_(STM)    1.00   0.01  0.00  0.00  0.07  0.00  0.00  0.92
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(54)_(STM)    1.00   0.01  0.00  0.00  0.06  0.00  0.00  0.93
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(55)_(STM)    1.00   0.01  0.00  0.00  0.02  0.00  0.00  0.97
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(57)_(STM)    1.00   0.01  0.00  0.00  0.00  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(58)_(STM)    1.00   0.01  0.08  0.00  0.91  0.00  0.00  0.00
0.90  0.00
  Pipe_-_(10)_(1)_(2)_(59)_(STM)    1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(7)_(STM)    1.00   0.01  0.01  0.00  0.91  0.07  0.00  0.00
0.98  0.00
  Pipe_-_(10)_(1)_(2)_(71)_(STM)    1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(72)_(STM)    1.00   0.01  0.00  0.00  0.00  0.00  0.00  0.99
0.00  0.00
  Pipe_-_(10)_(1)_(2)_(8)_(STM)    1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98
0.01  0.00
  Pipe_-_(10)_(1)_(2)_(82)_(STM)    1.00   0.01  0.00  0.00  0.07  0.01  0.00  0.91
0.06  0.00
  Pipe_-_(10)_(1)_(2)_(STM)    1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98
0.00  0.00
  Pipe_-_(14)_(1)_(2)_(STM)_2    1.00   0.01  0.00  0.00  0.07  0.00  0.00  0.92
0.00  0.00
  Pipe_-_(15)_(STM)       1.00   0.01  0.00  0.00  0.02  0.00  0.00  0.97  0.00
0.00
  Pipe_-_(17)_(1)_(2)_(STM)    1.00   0.01  0.00  0.00  0.10  0.00  0.00  0.89
0.00  0.00
  Pipe_-_(17)_(1)_(3)_(STM)    1.00   0.01  0.00  0.00  0.05  0.00  0.00  0.94
0.00  0.00
  R03-MH419               1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98  0.00
0.00
  R04-MH421               1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98  0.00
0.00
  R06-CB406               1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98  0.00
0.00
  R07-MH406               1.00   0.01  0.79  0.00  0.10  0.10  0.00  0.00  0.98
0.00
  R08-CB403               1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98  0.00
0.00
  R09-MH301               1.00   0.01  0.00  0.00  0.00  0.00  0.00  0.99  0.00
0.00
  TD01-MH410              1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98  0.00
0.00
  TD01-MH419              1.00   0.01  0.00  0.00  0.01  0.00  0.00  0.98  0.00
0.00


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  Conduit Surcharge Summary
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  ---------------------------------------------------------------------------
                                                              Hours         Hours
                          --------- Hours Full --------    Above Full   Capacity
  Conduit                 Both Ends  Upstream  Dnstream    Normal Flow    Limited
  ---------------------------------------------------------------------------
  2                            1.06      1.06      1.09        0.01         0.01
  3                            1.06      1.06      1.09        0.01         0.01
  49                           0.34      0.37      0.35        0.16         0.09
  7                            0.03      0.03      0.47        0.01         0.01
  CB401-MH401                  0.16      0.16      0.33        0.01         0.01
  CB401-Mh402                  0.31      0.31      0.34        0.08         0.13
  CB403-MH408                  0.27      0.27      0.36        0.01         0.01
  CB404-MH405                  0.34      0.34      0.37        0.01         0.01
  CB405-CB406                  0.39      0.39      0.39        0.39         0.38
  CB406-MH407                  0.50      0.50      0.50        0.40         0.39
  CB407-CBMH14                 2.22      2.22      2.37        0.01         0.01
  CB407-MH411                  0.52      0.52      0.52        0.48         0.51
  CB409-CB412                  2.04      2.04      2.13        0.01         0.01
  CB409-MH422                  0.40      0.40      0.43        0.01         0.01
  CB410-MH416                  0.46      0.46      0.52        0.01         0.01
  CB411-412                    2.04      2.04      2.11        0.01         0.01
  CB416-CBMH419                0.38      0.38      0.39        0.01         0.01
  CB418-MH430                  0.01      0.01      0.09        0.21         0.01
  CBMH412-413                  2.13      2.13      2.33        0.01         0.01
  EX.CBMH014-010               2.37      2.37      2.44        0.01         0.01
  EX-STMMH_XXX-MH425           0.01      0.04      0.01        0.10         0.01
  MH401-402                    0.32      0.33      0.32        0.01         0.30
  MH402-408                    0.33      0.34      0.34        0.28         0.25
  MH403-CB401                  0.04      0.04      0.29        0.01         0.01
  MH404-CB404                  0.29      0.29      0.33        0.01         0.01
  MH405-CB405                  0.52      0.52      0.53        0.39         0.42
  MH407-CB407                  0.50      0.50      0.51        0.35         0.36
  MH408-404                    0.28      0.36      0.28        0.01         0.28
  MH410-407                    0.44      0.44      0.51        0.01         0.01
  MH411-412                    0.47      0.53      0.47        0.85         0.47
  MH412-413                    0.47      0.47      0.49        0.01         0.41
  MH413-415                    0.49      0.49      0.50        0.34         0.39
  MH415-416                    0.51      0.51      0.53        0.39         0.41
  MH417-423                    0.54      0.55      0.54        0.56         0.54
  MH419-418                    0.43      0.43      0.44        0.17         0.11
  MH420-CB410                  0.46      0.46      0.47        0.01         0.01
  MH421-409                    0.36      0.36      0.39        0.01         0.08
  MH423-OGS2                   0.52      0.55      0.52        0.49         0.52
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MH426-427_1	0.41	0.41	0.46	0.01	0.01
MH426-427_2	0.46	0.46	0.48	0.01	0.01
MH427-428	0.48	0.48	0.52	0.01	0.01
MH428-OGS1	0.53	0.54	0.55	0.01	0.35
MH430-426	0.10	0.10	0.41	0.01	0.01
OCB0408-406	0.38	0.38	0.46	0.09	0.08
OCICB403	0.05	0.05	0.08	0.07	0.05
OGS1-MH424	0.57	0.58	0.57	0.01	0.57
OGS2-MH424	0.50	0.53	0.50	0.52	0.50
Pipe_-_(10)_(1)_(1)_(STM)	0.24	0.24	0.33	0.11	0.11
Pipe_-_(10)_(1)_(2)_(1)_(STM)	0.24	0.24	0.27	0.06	0.06
Pipe_-_(10)_(1)_(2)_(103)_(STM)	0.45	0.45	0.47	0.01	0.01
Pipe_-_(10)_(1)_(2)_(11)_(STM)	0.01	0.01	0.01	0.04	0.01
Pipe_-_(10)_(1)_(2)_(15)_(STM)	0.01	0.02	0.01	0.08	0.01
Pipe_-_(10)_(1)_(2)_(2)_(STM)	0.22	0.22	0.27	0.01	0.01
Pipe_-_(10)_(1)_(2)_(3)_(STM)	0.25	0.28	0.25	0.27	0.22
Pipe_-_(10)_(1)_(2)_(31)_(STM)	0.59	0.60	0.63	0.63	0.59
Pipe_-_(10)_(1)_(2)_(4)_(STM)	0.34	0.34	0.39	0.24	0.24
Pipe_-_(10)_(1)_(2)_(45)_(STM)	3.59	3.59	3.73	0.01	0.01
Pipe_-_(10)_(1)_(2)_(46)_(STM)	3.75	3.75	4.02	0.01	0.01
Pipe_-_(10)_(1)_(2)_(48)_(STM)	0.22	0.22	0.24	0.01	0.01
Pipe_-_(10)_(1)_(2)_(49)_(STM)	0.16	0.16	0.20	0.01	0.01
Pipe_-_(10)_(1)_(2)_(5)_(STM)	0.01	0.40	0.01	0.42	0.01
Pipe_-_(10)_(1)_(2)_(50)_(STM)	0.16	0.16	0.20	0.01	0.01
Pipe_-_(10)_(1)_(2)_(52)_(STM)	3.26	3.26	3.41	0.01	0.01
Pipe_-_(10)_(1)_(2)_(54)_(STM)	2.73	2.73	2.87	0.01	0.01
Pipe_-_(10)_(1)_(2)_(55)_(STM)	0.24	0.25	0.24	0.01	0.24
Pipe_-_(10)_(1)_(2)_(57)_(STM)	0.01	0.01	0.13	0.01	0.01
Pipe_-_(10)_(1)_(2)_(58)_(STM)	0.26	0.28	0.26	0.16	0.26
Pipe_-_(10)_(1)_(2)_(59)_(STM)	0.25	0.26	0.25	0.01	0.25
Pipe_-_(10)_(1)_(2)_(72)_(STM)	0.01	0.01	0.12	0.01	0.01
Pipe_-_(10)_(1)_(2)_(8)_(STM)	0.01	0.01	0.11	0.01	0.01
Pipe_-_(10)_(1)_(2)_(82)_(STM)	0.43	0.43	0.51	0.01	0.01
Pipe_-_(10)_(1)_(2)_(STM)	0.25	0.25	0.33	0.01	0.01
Pipe_-_(14)_(1)_(2)_(STM)_2	0.52	0.52	0.52	0.59	0.52
Pipe_-_(15)_(STM)	0.44	0.44	0.47	0.15	0.10
Pipe_-_(17)_(1)_(2)_(STM)	2.36	2.36	2.41	0.01	0.01
Pipe_-_(17)_(1)_(3)_(STM)	2.28	2.28	2.37	0.01	0.01
R03-MH419	0.55	0.57	0.56	0.55	0.52
R04-MH421	0.33	0.33	0.35	0.01	0.01
R06-CB406	0.45	0.45	0.50	0.01	0.01
R07-MH406	0.38	0.38	0.44	0.01	0.01
R08-CB403	0.21	0.21	0.25	0.01	0.01
TD01-MH410	0.39	0.39	0.42	0.01	0.01
TD01-MH419	0.42	0.42	0.43	0.19	0.14

Analysis begun on: Fri Sep 4 10:14:44 2026
Analysis ended on: Fri Sep 4 10:14:52 2026
Total elapsed time: 00:00:08

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Novatech Project #: 123089
Project Name: Queensway Carleton Hospital Part 4 Expansion

Date: 9/8/2026
Input By: KD
Reviewed By: FST
Drawing Reference: 123089-SWM

Storm Design Event = 5 Year

3045 Baseline Road - Queensway Carleton Hospital
Part 4 Expansion
1:5 Year Storm Sewer Design Sheet

Legend:
- Design Input by User
- As-Built Input by User
- Cumulative Cell
- Calculated Design Cell Output
- Calculated Uncontrolled Peak Flow Cell Output
- Design Input Restricted Peak Flow Cell

Reference: City of Ottawa - Sewer Design Guidelines (2012 and TBs)
MOE - Design Guidelines for Sewage Works (2008)

Location				Flow								Design Capacity / Proposed Sewer Pipe Sizing / Design								
Location	Area ID	From MH	To MH	Area A (ha.)	Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity I (mm/hr)	Total Uncontrolled Peak Flow Q (L/s)	Total Restricted Peak Flow (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
Ex. South Parking Lot	EX. A2B*	EX. CB 129	EX. CB 150	0.52	0.65	0.94	0.94	10.97	99.33	Flows controlled by ICD	**7.9**	21.7	300 PVC	0.3048	0.013	0.60	78.1	1.07	0.34	10.1%
Ex. South Parking Lot	EX. A1a, EX. A1b	EX. STMMH	EX. CBMH	0.76	0.71	1.50	1.50	10.50	101.62	Flows controlled by ICDs	**40.8**	33.1	300 PVC	0.3048	0.013	0.50	71.3	0.98	0.56	57.2%
Ex. South Parking Lot	A119	EX. CBMH	EX. CB 150	0.12	0.64	0.22	0.22	11.06	98.89	21.5		13.8	300 PVC	0.3048	0.013	0.50	71.3	0.98	0.24	30.1%
Ex. South Parking Lot	-	EX. CB 150	EX. CBMH	0.00	-	0.00	0.22	11.31	97.76	21.2	**48.7**	27.0	525 PVC	0.5334	0.013	0.50	317.2	1.42	0.32	22.0%
Ex. Main Entrance	P3-3	Part 3 Building	EX. STMMH 301	0.04	0.90	0.10	0.10	10.00	104.19	7.1		11.6	200 PVC	0.2032	0.013	1.00	34.2	1.06	0.18	20.8%
Ex. Main Entrance	-	EX. STMMH 301	EX. CBMH 301	0.00	-	0.00	0.10	10.18	103.23	7.1		28.0	250 PVC	0.2540	0.013	0.50	43.9	0.87	0.54	16.2%
Ex. Main Entrance	A120	EX. CBMH 301	EX. CBMH	0.23	0.54	0.34	0.44	10.72	100.53	43.8		28.8	300 PVC	0.3048	0.013	3.20	180.5	2.47	0.19	24.3%
Ex. South Parking Lot	-	EX CBMH	EX STMMH	0.00	-	0.00	0.44	11.62	96.33	42.0	**48.7**	14.3	525 PVC	0.5334	0.013	0.50	317.2	1.42	0.17	28.6%
Ring Road	A121	EX. CB 301	EX STMMH	0.10	0.80	0.22	0.22	10.00	104.19	23.2		22.9	200 PVC	0.2032	0.013	5.00	76.5	2.36	0.16	30.3%
Ring Road	-	EX STMMH	EX CBMH	0.00	-	0.00	0.66	11.79	95.59	63.0	**48.7**	44.5	525 PVC	0.5334	0.013	0.20	200.6	0.90	0.83	55.6%
Ring Road	-	EX CBMH	STMMH 401	0.00	-	0.00	0.66	12.62	92.13	60.7	**48.7**	12.5	525 PVC	0.5334	0.013	0.22	210.4	0.94	0.22	52.0%
Ring Road	B102	CB 401	STMMH 401	0.13	0.71	0.25	0.25	10.00	104.19	26.2		18.2	200 PVC	0.2032	0.013	3.00	59.3	1.83	0.17	44.1%
Ring Road	-	STMMH 401	STMMH 402	0.00	-	0.00	0.91	12.84	91.26	83.0	**48.7**	25.1	525 CONC	0.5334	0.013	0.35	265.4	1.19	0.35	49.6%
John Sutherland Drive	EX. A122	EX. CB 101	STMMH 403	0.28	0.38	0.30	0.30	10.00	104.19	31.1		37.6	300 PVC	0.3048	0.013	0.80	90.2	1.24	0.51	34.5%
John Sutherland Drive	-	STMMH 403	CBMH 401	0.00	-	0.00	0.30	10.51	101.59	30.4		19.4	300 PVC	0.3048	0.013	3.00	174.7	2.39	0.14	17.4%
John Sutherland Drive	B101	CBMH 401	STMMH 402	0.55	0.48	0.73	1.03	10.64	100.92	104.1		30.7	375 PVC	0.3810	0.013	0.80	163.6	1.43	0.36	63.6%
Ring Road	-	STMH 402	STMMH 408	0.00	-	0.00	1.94	13.19	89.89	174.5	**48.7**	33.9	525 CONC	0.5334	0.013	0.50	317.2	1.42	0.40	70.3%
Outpatient Care Centre	P4-1	Part 4 Building	CBMH 403	0.20	0.90	0.50	0.50	10.00	104.19	Controlled by 5 RDs	**2.5**	10.0	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.12	2.5%
East Parking Lot	B103	CBMH 403	STMMH 408	0.02	0.55	0.03	0.03	10.12	103.56	3.0		17.6	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.21	3.0%
East Parking Lot	B104	CBMH 402	STMMH 408	0.15	0.72	0.30	0.30	10.00	104.19	Flows controlled by ICD	**21.8**	5.5	200 PVC	0.2032	0.013	2.00	48.4	1.49	0.06	45.1%
John Sutherland Drive	-	STMMH 408	STMMH 404	0.00	-	0.00	1.94	13.59	88.41	171.6	**73.0**	22.1	525 CONC	0.5334	0.013	1.10	470.6	2.11	0.17	52.0%
John Sutherland Drive	-	STMMH 404	CBMH 404	0.00	-	0.00	1.94	13.76	87.77	170.4	**73.0**	45.7	525 CONC	0.5334	0.013	1.10	470.6	2.11	0.36	51.7%
John Sutherland Drive	B105	CBMH 404	STMMH 405	0.08	0.66	0.14	2.08	14.13	86.49	180.1	**73.0**	13.4	525 CONC	0.5334	0.013	1.50	549.5	2.46	0.09	46.1%
Emergency Dept. Addition	P4-2	Part 4 Building	STMMH 406	0.29	0.90	0.74	0.74	10.00	104.19	Controlled by 7 RDs	**4.6**	17.6	375 PVC	0.3810	0.013	1.00	182.9	1.60	0.18	2.5%
East Parking Lot	B106	CBMH 414	STMMH 406	0.16	0.74	0.32	0.32	10.00	104.19	Flows controlled by ICD	**27.6**	7.3	200 PVC	0.2032	0.013	2.00	48.4	1.49	0.08	57.1%
East Parking Lot	-	STMMH 406	STMMH 405	0.00	-	0.00	0.00	10.18	103.24		**32.2**	17.8	375 PVC	0.3810	0.013	1.00	182.9	1.60	0.18	17.6%
John Sutherland Drive	-	STMMH 405	CBMH 405	0.00	-	0.00	2.08	14.22	86.17	179.4	**105.2**	26.4	675 CONC	0.6858	0.013	0.20	392.2	1.06	0.41	72.6%
John Sutherland Drive	B107	CBMH 405	CBMH 406	0.08	0.53	0.12	2.20	14.63	84.77	186.6	**105.2**	20.4	675 CONC	0.6858	0.013	0.20	392.2	1.06	0.32	74.4%
Ex. Emerg. Dept. & Bunker	EX. R2*, EX. A3.1*	Part 4 Building	CBMH 406	0.38	0.90	0.94	0.94	10.00	104.19	Controlled by Ex. RDs	**25.8**	19.7	375 PVC	0.3810	0.013	0.85	168.6	1.48	0.22	18.9%
Ex. Green Roof	EX. A2.1			0.03	0.20	0.02	0.02			1.6										
Ex. Open-Air Area	A137			0.02	0.75	0.04	0.04			4.5										

STORM SEWER DESIGN SHEET

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Location				Flow								Design Capacity / Proposed Sewer Pipe Sizing / Design							
Location	Area ID	From MH	To MH	Area A (ha.)	Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity I (mm/hr)	Total Uncontrolled Peak Flow Q (L/s)	Total Restricted Peak Flow (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
East Parking Lot	B109	CBMH 406	STMMH 407	0.05	0.64	0.09	2.35	14.95	83.71	196.9	**131.0**	28.3	675 CONC	0.6858	0.013	0.20	392.2	1.06	0.44	83.6%
Ambulance Garage	P4-3	Part 4 Building	STMMH 410	0.09	0.90	0.22	0.22	10.00	104.19	Controlled by 2 RDs	**0.6**	2.7	250 PVC	0.2540	0.013	1.00	62.0	1.22	0.04	1.0%
Landscaped Area	B110b	CB 416	CBMH 419	0.08	0.22	0.05	0.05	10.00	104.19	4.8		14.3	250 PVC	0.2540	0.013	0.50	43.9	0.87	0.28	10.9%
East Parking Lot	B111	CBMH 419	STMMH 410	0.06	0.84	0.14	0.19	10.28	102.76	19.4		12.3	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.15	19.2%
East Parking Lot	-	STMMH 410	STMMH 407	0.00	-	0.00	0.19	10.42	102.01	19.2	**0.6**	26.3	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.32	19.7%
John Sutherland Drive	B108	CB 405	STMMH 407	0.05	0.87	0.13	0.13	10.00	104.19	13.4		9.0	200 PVC	0.2032	0.013	1.00	34.2	1.06	0.14	39.0%
John Sutherland Drive	-	STMMH 407	CBMH 407	0.00	-	0.00	2.67	15.40	82.30	219.7	**131.7**	33.7	675 CONC	0.6858	0.013	0.25	438.5	1.19	0.47	80.1%
John Sutherland Drive	B112	CBMH 408	CBMH 407	0.61	0.46	0.78	0.78	10.00	104.19	80.9		8.3	250 PVC	0.2540	0.013	6.00	152.0	3.00	0.05	53.2%
John Sutherland Drive	B113	CBMH 407	STMMH 411	0.09	0.20	0.05	3.50	15.87	80.85	282.7	**131.7**	11.3	675 CONC	0.6858	0.013	0.30	480.3	1.30	0.14	86.3%
John Sutherland Drive	-	STMMH 411	STMMH 412	0.00	-	0.00	3.50	16.01	80.42	281.2	**131.7**	30.3	675 CONC	0.6858	0.013	0.30	480.3	1.30	0.39	85.9%
Ex. Cancer Centre Parking	-	STMMH 412	STMMH 413	0.00	-	0.00	3.50	16.40	79.28	277.2	**131.7**	42.0	675 CONC	0.6858	0.013	0.30	480.3	1.30	0.54	85.1%
Ex. Cancer Centre Parking	-	STMMH 413	STMMH 415	0.00	-	0.00	3.50	16.94	77.77	271.9	**131.7**	48.5	750 CONC	0.7620	0.013	0.20	519.4	1.14	0.71	77.7%
Ex. Cancer Centre Parking	B114	EX. CBMH 10	TEE	0.55	0.69	1.05	1.05	10.00	104.19	Flows controlled by ICD	**20.5**	6.6	375 PVC	0.3810	0.013	3.50	342.2	3.00	0.04	6.0%
Ex. Cancer Centre Parking	-	STMMH 415	STMMH 416	0.00	-	0.00	3.50	17.65	75.87	265.3	**152.1**	85.6	750 CONC	0.7620	0.013	0.20	519.4	1.14	1.25	80.4%
Trans. Care, Loading Dock	P4-5	Part 4 Building	STMMH 419	0.34	0.90	0.84	0.84	10.00	104.19	Controlled by 12 RDs	**4.8**	2.0	450 PVC	0.4572	0.013	1.00	297.4	1.81	0.02	81.2%
Ex. Power Plant	EX. A4, A113, A116			0.88	0.90	2.19	2.19			228.6										
Ex. Power Plant	EX. R3*, P3-2*			0.06	0.90	0.15	0.15			Controlled by Ex. RDs	**8.0**									
Loading Dock	B122	Trench Drain	STMMH 419	0.23	0.78	0.49	0.49	10.00	104.19	51.1		8.4	300 PVC	0.3048	0.013	0.35	59.7	0.82	0.17	85.6%
Loading Dock	-	STMMH 419	STMMH 418	0.00	-	0.00	2.68	10.17	103.30	277.3	**12.8**	21.4	675 CONC	0.6858	0.013	0.15	339.6	0.92	0.39	85.4%
Loading Dock	EX. A117	Ex. Power Plant	EX. CBMH 13	0.02	0.90	0.06	0.06	10.00	104.19	6.0		10.8	200 PVC	0.2032	0.013	2.00	48.4	1.49	0.12	12.4%
Loading Dock	-	EX. CBMH 13	EX. STMMH 12	0.00	-	0.00	0.06	10.12	103.56	6.0		6.0	300 PVC	0.3048	0.013	1.10	105.8	1.45	0.07	5.6%
Loading Dock	-	EX. STMMH 12	STMMH 418	0.00	-	0.00	0.06	10.19	103.20	5.9		28.0	300 PVC	0.3048	0.013	1.10	105.8	1.45	0.32	5.6%
Loading Dock	-	STMMH 418	STMMH 420	0.00	-	0.00	2.74	10.56	101.33	277.8	**12.8**	51.8	675 CONC	0.6858	0.013	0.15	339.6	0.92	0.94	85.6%
MM & EVS Building	P4-7	Part 4 Building	STMMH 421	0.04	0.90	0.11	0.11	10.00	104.19	Controlled by 3 RDs	**1.4**	1.2	375 PVC	0.3810	0.013	1.00	182.9	1.60	0.01	18.5%
Ex. Cancer Centre	EX. A3.2*			0.16	0.90	0.40	0.40			Controlled by Ex. RDs	**13.3**									
Ex. Green Roof	EX. A2.2			0.04	0.20	0.02	0.02			2.3										
Ex. Cancer Centre Courtyard	B110a			0.07	0.86	0.16	0.16			16.9										
Loading Dock	B124	Trench Drain	TEE	0.25	0.64	0.44	0.44	10.00	104.19	45.8		3.6	250 PVC	0.2540	0.013	1.00	62.0	1.22	0.05	73.8%
Loading Dock	-	STMMH 421	CBMH 409	0.00	-	0.00	0.62	10.05	103.93	64.8	**14.7**	20.3	450 PVC	0.4572	0.013	0.35	176.0	1.07	0.32	45.2%
Loading Dock	-	CBMH 409	STMMH 422	0.00	-	0.00	0.62	10.36	102.31	63.8	**14.7**	16.8	450 PVC	0.4572	0.013	0.50	210.3	1.28	0.22	37.3%
Loading Dock	-	STMMH 422	STMMH 420	0.00	-	0.00	0.62	10.58	101.21	63.1	**14.7**	18.5	450 PVC	0.4572	0.013	0.50	210.3	1.28	0.24	37.0%
Loading Dock Access Rd.	-	STMMH 420	CBMH 410	0.00	-	0.00	3.37	11.50	96.89	326.1	**27.5**	19.4	750 CONC	0.7620	0.013	0.15	449.8	0.99	0.33	78.6%
Ex. Cancer Centre Parking	B115	EX. STMMH 11	CBMH 410	0.29	0.85	0.67	0.67	10.00	104.19	Flows controlled by ICD	**15.5**	16.5	300 PVC	0.3048	0.013	0.54	74.1	1.02	0.27	20.9%
Loading Dock Access Rd.	B127	CBMH 410	STMMH 416	0.23	0.54	0.34	3.71	11.83	95.45	354.0	**43.0**	43.4	825 CONC	0.8382	0.013	0.15	580.0	1.05	0.69	68.5%
Loading Dock Access Rd.	-	STMMH 416	STMMH 417	0.00	-	0.00	7.21	18.90	72.75	524.3	**195.1**	8.0	900 CONC	0.9144	0.013	0.15	731.4	1.11	0.12	98.3%
Loading Dock Access Rd.	B116	CB 409	CBMH 412	0.30	0.23	0.19	0.19	10.00	104.19	20.0		21.2	250 PVC	0.2540	0.013	0.90	58.9	1.16	0.30	34.0%
Loading Dock Access Rd.	B117	CBMH 411	CBMH 412	0.22	0.50	0.30	0.30	10.00	104.19	31.4		18.1	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.22	31.2%
Loading Dock Access Rd.	B118	CBMH 412	CBMH 413	0.07	0.45	0.09	0.58	10.30	102.61	59.4		18.1	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.22	58.9%

STORM SEWER DESIGN SHEET

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Location				Flow								Design Capacity: Proposed Sewer Pipe Sizing / Design								
Location	Area ID	From MH	To MH	Area A (ha.)	Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity I (mm/hr)	Total Uncontrolled Peak Flow Q (L/s)	Total Restricted Peak Flow (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
Loading Dock Access Rd.	B120	CB 410	TEE	0.08	0.67	0.16	0.16	10.00	104.19	16.3		2.1	200 PVC	0.2032	0.013	6.00	83.8	2.58	0.01	19.5%
Loading Dock Access Rd.	B119	CBMH 413	STMMH 417	0.08	0.63	0.14	0.87	10.52	101.51	Flows controlled by ICD	**20.5**	18.8	375 PVC	0.3810	0.013	1.00	182.9	1.60	0.20	11.2%
Landscaped Area	-	STMMH 417	STMMH 423	0.00	-	0.00	7.21	19.02	72.47	522.2	**215.6**	35.0	900 CONC	0.9144	0.013	0.15	731.4	1.11	0.52	100.9%
Landscaped Area	B128	STMMH 423	EFO6	0.10	0.42	0.11	7.32	19.55	71.26	521.5	**215.6**	17.2	900 CONC	0.9144	0.013	0.15	731.4	1.11	0.26	100.8%
Landscaped Area	B129	EFO6	STMMH 424	0.02	0.20	0.01	7.33	19.80	70.68	517.9	**215.6**	50.1	900 CONC	0.9144	0.013	0.15	731.4	1.11	0.75	100.3%
Ex. South Parking Lot	EX. A2A	EX. CB	EX. CB	0.40	0.71	0.79	0.79	10.00	104.19	Flows controlled by ICD	**22.3**	24.9	200 PVC	0.2032	0.013	1.00	34.2	1.06	0.39	65.2%
Ring Road	A101	EX. CB	EX. CBMH	0.16	0.56	0.24	0.24	10.39	102.16	25.0	**22.3**	71.8	300 PVC	0.3048	0.013	0.80	90.2	1.24	0.97	52.4%
Ring Road	A102	EX. STMMH 1	EX. CBMH	0.20	0.32	0.18	0.18	10.00	104.19	18.7		13.4	200 PVC	0.2032	0.013	2.60	55.2	1.70	0.13	33.9%
Ring Road	A103	EX. CBMH	EX. CBMH	0.00	-	0.00	0.42	11.36	97.51	41.4	**22.3**	30.8	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.37	63.1%
Ring Road		EX. CBMH	EX. CBMH	0.19	0.53	0.28	0.70	11.73	95.85	67.4	**22.3**	41.8	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.50	89.0%
Ex. Maternity Department	EX. R1*	EX. CBMH	EX. CBMH 302	0.07	0.90	0.18	0.18	12.24	93.70	Controlled by Ex. RDs	**3.9**	44.5	450 PVC	0.4572	0.013	1.00	297.4	1.81	0.41	42.9%
Ring Road	A104			0.20	0.70	0.38	1.08			101.5	**22.3**									
Ex. Landscaped Courtyard	A105	EX. CBMH	BLDG. / EX. CBMH 303	0.08	0.58	0.13	0.13	10.00	104.19	13.8		18.9	300 PVC	0.3048	0.013	0.80	90.2	1.24	0.25	15.3%
Ex. Landscaped Courtyard	A106	EX. CBMH 303	EX. CBMH 302	0.03	0.34	0.03	0.16	10.25	102.87	16.2		28.3	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.34	16.1%
Ring Road	A107	EX. CBMH 302	EX. CBMH	0.08	0.64	0.14	1.38	12.65	92.03	127.1	**26.2**	20.8	450 PVC	0.4572	0.013	1.00	297.4	1.81	0.19	51.5%
Ring Road	A108	EX. CBMH	EX. STMMH	0.09	0.66	0.16	1.54	12.84	91.27	140.6	**26.2**	34.6	450 PVC	0.4572	0.013	1.10	312.0	1.90	0.30	53.5%
Ring Road	-	EX. STMMH	STMMH 425	0.00	-	0.00	1.54	13.14	90.09	138.8	**26.2**	16.9	450 PVC	0.4572	0.013	1.10	312.0	1.90	0.15	52.9%
Ring Road	B130	STMMH 425	STMMH 430	0.08	0.66	0.15	1.69	13.29	89.53	151.1	**26.2**	23.7	450 PVC	0.4572	0.013	1.50	364.3	2.22	0.18	48.7%
Ex. James Beach Centre	P3-1	Part 3 Building	CBMH 414	0.49	0.90	1.22	1.22	10.00	104.19	Controlled by 28 RDs	**31.6**	5.0	375 PVC	0.3810	0.013	1.00	182.9	1.60	0.05	17.3%
Landscaped Courtyard	B136	CBMH 414	CBMH 415	0.02	0.35	0.02	0.02	10.05	103.92	2.2	**31.6**	17.5	375 PVC	0.3810	0.013	0.30	100.2	0.88	0.33	33.7%
		CBMH 415	CBMH 416	0.02	0.35	0.02	0.04	10.38	102.21	4.3	**31.6**	7.5	375 PVC	0.3810	0.013	0.30	100.2	0.88	0.14	35.8%
		CBMH 416	CBMH 417	0.02	0.35	0.02	0.06	10.53	101.49	6.4	**31.6**	11.9	375 PVC	0.3810	0.013	0.30	100.2	0.88	0.23	37.9%
Landscaped Courtyard	P4-4	Part 4 Building	CBMH 417	0.12	0.90	0.31	0.31	10.00	104.19	Controlled by 4 RDs	**2.2**	19.1	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.23	2.2%
Landscaped Courtyard	B137	CBMH 417	CBMH 418	0.09	0.54	0.13	0.19	10.75	100.38	19.3	**33.8**	30.0	375 PVC	0.3810	0.013	0.30	100.2	0.88	0.57	53.0%
Landscaped Courtyard	B138	EX. CB 307	EX. CB 306	0.02	0.24	0.01	0.01	10.00	104.19	1.5		18.0	250 PVC	0.2540	0.013	0.70	51.9	1.02	0.29	2.8%
Landscaped Courtyard		EX. CB 306	EX. CBMH	0.02	0.24	0.01	0.03	10.29	102.67	2.9		9.6	250 PVC	0.2540	0.013	0.70	51.9	1.02	0.16	5.5%
Landscaped Courtyard		EX. CBMH	CBMH 418	0.00	-	0.00	0.03	10.45	101.88	2.9		10.2	250 PVC	0.2540	0.013	5.00	138.7	2.74	0.06	2.1%
Landscaped Courtyard	B139	CBMH 418	STMMH 430	0.03	0.58	0.05	0.27	11.32	97.70	26.7	**33.8**	17.2	375 PVC	0.3810	0.013	0.30	100.2	0.88	0.33	60.4%
Ring Road	B131	STMMH 430	STMMH 426	0.08	0.65	0.15	2.11	13.47	88.86	187.6	**60.0**	33.6	525 CONC	0.5334	0.013	0.80	401.3	1.80	0.31	61.7%
Ex. Parking Garage	P4-8	U/G SWM Tank	STMMH 426	0.29	0.90	0.72	0.72	10.00	104.19	Flows controlled by ICD	**60.5**	12.9	300 PVC	0.3048	0.013	1.00	100.9	1.38	0.16	59.9%
Ring Road	B132	STMMH 426	STMMH 427	0.18	0.76	0.38	2.49	13.78	87.72	218.6	**120.5**	53.0	675 CONC	0.6858	0.013	0.25	438.5	1.19	0.74	77.3%
New Parking Garage	P4-9	Internal SWM Tank	STMMH 427	0.27	0.90	0.68	0.68	10.00	104.19	Flows controlled by ICD	**10.3**	16.0	300 PVC	0.3048	0.013	3.00	174.7	2.39	0.11	5.9%
Ring Road	-	STMMH 427	STMMH 428	0.00	-	0.00	2.49	14.52	85.13	212.1	**130.8**	18.8	675 CONC	0.6858	0.013	0.30	480.3	1.30	0.24	71.4%
Ring Road	-	STMMH 428	EFO10	0.00	-	0.00	2.49	14.76	84.33	210.1	**130.8**	14.2	675 CONC	0.6858	0.013	0.30	480.3	1.30	0.18	71.0%
Ring Road	B133	EFO10	STMMH 424	0.15	0.46	0.19	2.68	14.95	83.73	224.2	**130.8**	7.0	675 CONC	0.6858	0.013	0.35	518.8	1.40	0.08	68.4%
Ring Road	-	STMMH 424	Ex. Roadside Ditch	0.00	-	0.00	10.00	20.55	69.06	690.9	**346.4**	99.0	900 CONC	0.9144	0.013	0.20	844.6	1.29	1.28	122.8%
John Sutherland Drive	B134b	CB 414	EX. CBMH 1	0.10	0.28	0.08	0.08	10.00	104.19	Flows controlled by ICD	**3.5**	7.3	200 PVC	0.2032	0.013	1.00	34.2	1.06	0.12	10.1%
John Sutherland Drive	B135b	EX LD1	TEE	0.06	0.20	0.03	0.03	10.00	104.19	Flows controlled by ICD	**2.0**	8.7	250 PVC	0.2540	0.013	1.00	62.0	1.22	0.12	3.3%

STORM SEWER DESIGN SHEET

Location				Flow								Design Capacity / Proposed Sewer Pipe Sizing / Design								
Location	Area ID	From MH	To MH	Area A (ha.)	Runoff Coefficient C	Indivi. 2.78 AC	Accum. 2.78 AC	Time of Conc. Tc (min.)	Rain Intensity I (mm/hr)	Total Uncontrolled Peak Flow Q (L/s)	Total Restricted Peak Flow (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q / Qfull
John Sutherland Drive	B135a	EX CB 1 & 2	TEE	0.28	0.67	0.51	0.51	10.00	104.19	53.6		7.0	250 PVC	0.2540	0.013	1.00	62.0	1.22	0.10	86.3%
John Sutherland Drive	B134a	EX CBMH 1	EX. STMMH 1	0.31	0.56	0.48	1.00	10.12	103.57	103.4	**5.5**	81.7	375 PVC	0.3810	0.013	2.40	283.4	2.49	0.55	38.4%
Totals				**13.27**								**2338.1**								

Demand Equation / Parameters

1. Q = 2.78 ACI

Definitions

Q = Peak flow in litres per second (L/s)
A = Area in hectares (ha)
C = Weighted runoff coefficient (increased by 25% for 100-year)
I = Rainfall intensity in millimeters per hour (mm/hr)

Rainfall intensity is based on City of Ottawa IDF data presented in the City of Ottawa - Sewer Design Guidelines

Capacity Equation

Q full = $1000*(1/n)*A_p*R^{2/3}*So^{0.5}$

Definitions

Q full = Capacity (L/s)
n = Manning coefficient of roughness (0.013)
A_p = Pipe flow area (m^2)
R = Hydraulic Radius of wetted area (dia./4 for full pipes)
So = Pipe slope/gradient

Notes

1) Refer to the Novatech Report "Queensway Carleton Hospital Part 4 Expansion - Stormwater Management Report" (R-2025-085) for on-site storm drainage and stormwater details.
2) Refer to Novatech Drawings **123089-GP1** and **123089-GP2** for the storm structure designations and storm pipe details.
3) Refer to Novatech Drawing **123089-SWM** for storm drainage areas identifiers.
4) Refer to Novatech Drawing **123089-NDT** for control structure tables.
5) Stormwater flows from drainage areas P4-DR1a, P4-DR1b, and P4-DR2 do not enter the on-site storm sewer system and have therefore been excluded from this design sheet.

*Controlled flow rate / time of concentration for existing area taken directly from Novatech Report "Queensway-Carleton Hospital Part 3 Expansion - Stormwater Management Report" (R-2009-088), Appendix C.

Kynan Dsa

From: Daniel Vancek <danielv@vreng.ca>
Sent: Thursday, September 17, 2026 9:00 PM
To: Kynan Dsa
Cc: Derek Judson; Francois Thauvette; Michael D'Costa; Nemanja Vujic; Sharon Barr; Linda Rutherford
Subject: RE: QCH Part 4 Expansion - Roof SWM Storage Confirmation (123089)

Hi Kynan,
We confirm that the mechanical design for the proposed Queensway Carleton Hospital expansion will support the rooftop stormwater storage strategy identified in the civil stormwater management (SWM) design, in full coordination with the architectural, civil, and structural disciplines and in compliance with applicable Ontario Building Code (OBC) requirements.

The mechanical scope will be based on the following coordinated criteria:

- Ponding Depth: Maximum controlled ponding depth will be limited to 150 mm above the roof drain elevation, matching the civil SWM calculations and storage volume assumptions.
- Overflow Provisions: Overflow scuppers will be positioned no higher than 150 mm above the roof low points at the drains, with final elevations adjusted to suit the architectural roof slopes and configuration.
- Structural Loading: The structural team will account for the dead/live loads associated with the maximum 150 mm stored stormwater volume.
- Drainage Systems: Mechanical design will incorporate flow-control roof drainage systems and coordinated overflow provisions aligned with the overall SWM plan.
- Drain Down Time: Flow-control roof drainage systems will be configured to ensure the maximum drain down time does not exceed 24 hours.

We trust this provides all the information requested by the RVCA. Please let us know if anything further is required.

Best regards,

Daniel Vancek, Associate Director
Senior Mechanical Designer | I.T. Administrator
Cell: 226-377-5742 | **Office:** 519-652-5047
Vanderwesten & Rutherford Associates Inc.
7242 Colonel Talbot Rd. | London, ON N6L 1H8

From: Kynan Dsa <k.dsa@novatech-eng.com>
Sent: Thursday, September 10, 2026 3:34 PM
To: Daniel Vancek <danielv@vreng.ca>
Cc: Derek Judson <judson@parkin.ca>; f.thauvette <f.thauvette@novatech-eng.com>
Subject: QCH Part 4 Expansion - Roof SWM Storage Confirmation (123089)

Hi Daniel,

The Rideau Valley Conservation Authority (RVCA) has requested correspondence from the mechanical engineer to acknowledge that roof storage will be provided per the civil SWM design (see RVCA SPC comment #8 below):

8.	WRE SWM	It is understood that roof storage is proposed to control runoff from the site. Please pr provided as per the SWM design presented.

We acknowledge that the mechanical design for all new building roofs may not be complete at this time. Can you provide us with e-mail confirmation that the mechanical design for all new buildings/expansions will be designed in coordination with the architect to provide roof storage as per the civil SWM design?

Thanks,

Kynan D'sa, B.A.Sc. (Engineering) (He/Him)
NOVATECH
Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6
Tel: 613.254.9643 Ext. 276 | Cell: 705.821.2278
The information contained in this email message is confidential and is for exclusive use of the addressee.

APPENDIX E

MOE Amended Certificate of Approval For Existing Storm Sewers & SWM Facilities

RECEIVED DEC 0 6 2010

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDED CERTIFICATE OF APPROVAL
INDUSTRIAL SEWAGE WORKS
NUMBER 6601-8B8MMR
Issue Date: November 30, 2010

Queensway-Carleton Hospital
3045 Baseline Road
Ottawa, Ontario
K2H 8P4

Site Location: 3045 Baseline Road
City of Ottawa,
K2H 8P4

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

Construction of stormwater management Works for the collection, treatment and disposal of stormwater run-off from a proposed Part 3 expansion at the Queensway Carleton Hospital (comprising of the construction of additional medical facilities, renovations to the existing hospital, modifications to the existing parking lots, and re-alignment of the Ring Road along the west side of the hospital campus) to provide a Normal Level of water quality protection and to attenuate post-development peak flows to pre-development levels for all storm events up to and including the 100 year event, discharging to the existing drainage tributary to Graham Creek, consisting of the following:

Area A1 (Existing Surface Vehicle Parking Lot, located south east of main hospital building)

Replacing an existing 103 mm diameter plug type inlet control device (ICD) with a smaller 84 mm diameter plug type orifice in the outlet pipe of the existing south west catchbasin (CB 132) to reduce the controlled flow from the approximately southern half of the existing parking lot identified as A1a, controlling the discharge rate to 20.4 L/s, and providing approximately 100 cu.m. of storage during the 100 year storm event;

Replacing an existing 103 mm diameter plug type ICD with a smaller 85 mm diameter plug type orifice in the outlet pipe of the existing north west catchbasin to reduce the controlled flow from the approximately northern half of the existing parking lot identified as A1b, controlling the discharge rate to 20.4 L/s, and providing approximately 112 cu.m. of storage during the 100 year storm event;

Area A2-A (Existing Surface Vehicle Parking Lot, located south of main hospital building)

Modifying the drainage area by expanding the existing parking lot and regrading the adjacent berm, maintaining the discharge rate at 21 L/s, and maintaining approximately 54 cu.m. of storage during the 100 year storm event with the existing 91 mm diameter plug type ICD in the outlet pipe of the existing catchbasin;

Area A2-B (Existing Surface Vehicle Parking Lot, located south of main hospital building)

Replacing an existing 119 mm diameter plug type ICD with a smaller 81 mm diameter plug type orifice in the outlet pipe of the existing north west catchbasin (CB 129) to reduce the controlled flow from the existing parking lot and the overflow from parking lot A2-A, controlling the discharge rate to 20.5 L/s, and providing approximately 255 cu.m. of storage during the 100 year storm event;

Area P3-1 (New Medical Facility, attached to the north west of the main hospital building)

Providing roof top storage by installing twenty-three (23) roof drains which control the discharge, and another eight (8) uncontrolled roof drains and two (2) uncontrolled catchbasins (CB 302 and CB 303), resulting in a total discharge rate of 49.4 L/s, providing approximately 195 cu.m of storage during the 100 year storm event;

Area P3-2 (MRI Expansion, attached to the north of the main hospital building)

Providing roof top storage by installing two (2) roof drains which control the discharge rate to 1.14 L/s per drain, for a total discharge rate of approximately 2.3 L/s, providing approximately 4.7 cu.m of storage during the 100 year storm event;

resulting in the following pre-development and post-development flows for the 15.51 hectare portion of the Queensway Carleton Hospital campus draining to the existing ditch along the west property line for the 1:5 year and 1:100 year design events:

Design Event	Pre-Development Total Site Flow (L/s)	Post-Development Controlled Site Flow (L/s)	Post-Development Total Site Flow (L/s)
1:5 year	1191.8	220.8	1184.0
1:100 year	1961.0	261.6	1846.8

together with any storm and sanitary sewer installation and removals as noted in the submitted documents, including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the following submitted supporting documents:

1. Application for Approval of Sewage Works dated September 2, 2010 submitted by Peter Thompson, B.ARCH., MBA, Director, Planning & Facility Redevelopment, Queensway Carleton Hospital and forwarded by Richard Buchanan, C.E.T., City of Ottawa via letter dated September 8, 2010 to the Ministry.

2. Report entitled 'Queensway-Carleton Hospital, Overall Campus - Part 3 Expansion, Stormwater Management Report' dated June 26, 2009, amended July 27, 2010, prepared for the Queensway Carleton Hospital by Novatech Engineering Consultants Ltd.

Existing Works approved under Certificate of Approval No. 7898-7DGJUK dated April 18, 2008

Construction of stormwater management Works for the collection, treatment and disposal of stormwater run-off from a proposed expansion at the Queensway Carleton Hospital (comprising of the expansion to the Cancer Centre, a Power Plant addition, additional surface vehicle parking lots, a multilevel parking structure with adjoining Hydro sub-station and generators, access road re-alignment) to provide a Normal Level of water quality protection and to attenuate post-development peak flows to pre-development levels for all storm events up to and including the 100 year event, discharging to the existing drainage ditch tributary to Graham Creek, consisting of the following:

Areas A-3.1 and A-3.2 (Proposed Cancer Centre and adjoining Roof Area)

Roof top storage provided by ten (10) roof drains which control the discharge rate to 1.9 L/s per drain, for a total controlled release rate of 19 L/s, and providing approximately 57.2 cu.m. of storage during the 100 year storm event.

Area A-4 (Proposed Overhead Covered Link)

Roof top storage provided by eleven (11) roof drains which control the discharge rate to 1.0 L/s per drain, for a total controlled release rate of 11 L/s, and providing approximately 6.8 cu.m. of storage during the 100 year storm event.

Area A-5 (Proposed Multilevel Parking Structure)

Construction of an oversized pipe located below grade to provide an approximate storage of 100 cu.m and the installation of a flow restricting orifice located in the outlet pipe from catchbasin (CBMH 1) located immediately downstream of the oversized pipe, controlling the release rate to 24.8 L/s during the 100 year storm event.

Area A-6 (Proposed Surface Vehicle Parking Lot, area north-east of Cancer Centre)

Construction of an oversized pipe located below grade together with surface ponding to provide an approximate storage of 118.1 cu.m and the installation of a flow restricting orifice located in the outlet pipe from catchbasin (CBMH 10) located immediately downstream of the oversized pipe, controlling the release rate to 28.3 L/s during the 100 year storm event.

Area A-7 (Proposed Surface Vehicle Parking Lot, area north-west of Cancer Centre)

Construction of an oversized pipe located below grade together with surface ponding to provide an approximate storage of 98.0 cu.m and the installation of a flow restricting orifice located in the outlet pipe from catchbasin (MH 11) located immediately downstream of the oversized pipe, controlling the release rate to 8.0 L/s during the 100 year storm event.

Oil/Grit Interceptor

An oil/grit interceptor (Stormceptor STC 9000, located north of the multilevel parking structure) sized to provide a normal level of water quality protection, having a sediment capacity of 32.98 cu.m., an oil capacity of 10.56 cu.m., a total holding capacity of 44.36 cu.m., discharging to the existing 900 mm diameter storm sewer and

drainage ditch, eventually discharging to Graham Creek,

together with any storm and sanitary sewer removals as noted in the submitted documents, including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the following submitted supporting documents:

1. Application for Approval of Municipal and Private Sewage Works dated March 8, 2009 submitted by Peter Thompson, B.ARCH., MBA, Director, Planning & Facility Redevelopment, Queensway Carleton Hospital and forwarded by Guy Bourgon, P. Eng., City of Ottawa via letter dated March 27, 2008 to the Ministry.

2. Report entitled 'Queensway Carleton Hospital, Overall Campus - Cancer Centre Expansion, Stormwater Management Report' dated March 10, 2008 prepared for the Queensway Carleton Hospital by Novatech Engineering Consultants Ltd.

Existing Works approved in December 2007

A **stormwater management** system on Queensway-Carleton Hospital property, to control the 100 year storm event to the lesser of the existing or 5 year post development storm event levels as per the Rational Method (the maximum allowable release flowrate is 6.5 L/s), with rooftop storage for expansion of the Operation Room building having an area of about 0.4 ha, and the installation of a post indicator valve for the related Operation Room building loading dock area's storm sewer system, comprising of the following:

Storage Component (for the 100 year storm event)

- **roof top storage** of approximately 7.12 cubic metres for the expanded Operation Room roof top;

Flow Control

- eight (8) **roof drains,** releasing a total maximum flowrate of about 6.5 L/s; for an average depth of about 18 mm for the expanded Operation Room roof top; and

- **post indicator valve** installed about 30 metres north-westerly of the loading dock catchbasin, in the existing outlet storm sewer (300 mm diameter), as part of the Queensway-Carleton Hospital's spill contingency plan, titled 'Chemical Spill and Containment' for the Operation Room Building's loading dock area;

as part of the Queensway-Carleton Hospital Building's expansion project, in the City of Ottawa;

all in accordance with the application dated November 28, 2006 and received on December 5, 2006, signed by R.P. Thompson, Director of Planning and Redevelopment, Queensway-Carleton Hospital, and all supporting documentation and information, including final plans and specifications prepared by The Walter Fedy Partnership.

Existing Works Previously Constructed

1. Storage provided within parking lots and the installation of flow restricting orifice(s) located in the outlet pipe from catchbasin to control the release rate during the 100 year storm event as event as follows:

Drainage Area	Area (ha)	Post-Development Flow 100 year event	Storage Volume Provided
Area A1	0.75	54 L/s	150 cu.m.
Area A2-A	0.29	21 L/s	54 cu.m.
Area A2-B	0.49	36 L/s	94 cu.m.
Area PL2a	0.16	11 L/s	20 cu.m.
Area PL3	0.23	24 L/s	24 cu.m.

2. Roof top storage provided by roof drains which control the discharge rate during the 100 year storm event as follows:

Drainage Area	Area (ha)	Post-Development Flow 100 year event	Storage Volume Provided
Area R1	0.07	3.9 L/s	10 cu.m.
Area R2	0.36	21.1 L/s	51 cu.m.
Area R3	0.40	6.5 L/s	7.1 cu.m.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

"Certificate" means this entire certificate of approval document, issued in accordance with Section 53 of the Ontario Water Resources Act, and includes any schedules;

"Director" means any *Ministry* employee appointed by the Minister pursuant to section 5 of the Ontario Water Resources Act;

"District Manager" means the District Manager of the Ottawa District Office of the Ministry;

"Ministry" means the Ontario Ministry of the Environment;

"Owner" means Queensway-Carleton Hospital and includes its successors and assignees;

"Works" means the sewage works described in the Owner's application, this Certificate and in the supporting documentation referred to herein, to the extent approved by this Certificate.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL CONDITIONS

1.1 The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Certificate and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

1.2 Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Certificate, the application for approval of the Works and the submitted supporting documents and plans and specifications as listed in this Certificate.

1.3 Where there is a conflict between a provision of any submitted document referred to in this Certificate and the Conditions of this Certificate, the Conditions in this Certificate shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

1.4 Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

1.5 The requirements of this Certificate are severable. If any requirement of this Certificate, or the application of any requirement of this Certificate to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this Certificate shall not be affected thereby.

2. EXPIRY OF APPROVAL

The approval issued by this Certificate will cease to apply to those parts of the Works which have not been constructed within **five (5) years** of the date of this Certificate.

3. CHANGE OF OWNER

The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within **thirty (30) days** of the change occurring:

(a) change of Owner;

(b) change of address of the Owner;

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; and

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

4. OPERATION AND MAINTENANCE

4.1 The Owner shall ensure that the design storage volumes are maintained at all times.

4.2 The Owner shall inspect the Works regularly and, if necessary, clean and maintain the Works to prevent the excessive build-up of sediments and/or vegetation.

4.3 The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook at the site for inspection by the Ministry. The logbook shall include the following:

(a) the name of the Works; and
(b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed.

4.4 The Owner shall design, construct and operate the oil/grit interceptor with the objective that no visible oil sheens occur in the effluent discharged from the oil/grit interceptor.

4.5 The Owner shall carry out and maintain an annual inspection and maintenance program on the operation of the oil/grit interceptor in accordance with the manufacturer's recommendation.

5. RECORD KEEPING

The Owner shall retain for a minimum of **five (5) years** from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Certificate.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition No.1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Certificate and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this Certificate the existence of this Certificate.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved Works and to ensure that subsequent owners of the Works are made aware of the Certificate and continue to operate the Works in compliance with it.

4. Condition 4 is included to require that the Works be properly operated and maintained such that the

environment is protected and to ensure that the oil/grit interceptor is operated and maintained without any adverse impact on the environment.

5. Condition 5 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

This Certificate of Approval revokes and replaces Certificate(s) of Approval No. 7898-7DGJUK issued on April 18, 2008

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act , R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto, Ontario
M5G 1E5

AND

The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 30th day of November, 2010

THIS CERTIFICATE WAS MAILED
ON Dec 2, 2010
(Signed)

Ian Parrott, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

DC/
c: District Manager, MOE Ottawa
François Thauvette, P.Eng., Novatech Engineering Consultants Ltd. √

APPENDIX F

Excerpt from MECP Source Protection Information Atlas

Search By

Location, Policy, PTTW Results

Searched By:
Address
Value:
3045 Baseline Road, CITY OF OTTAWA, ONTARIO

Toggle highlighted geometry on map

Water Quality | Policy Search by SPA | PTTW

Location Information

Zoom in to confirm your location and results

Latitude: **45.33568** Longitude: **-75.80720**
UTM Zone: **18**
Easting: **436752.54** Northing: **5020557.88**
Upper Tier Municipality: **N/A**
Lower Tier Municipality: **CITY OF OTTAWA**
Township Concession and Lot: **NEPEAN LOT 16 CON 2 ON OTTAWA RIVER**
Assessment Parcel Address: **3045 Baseline Road**
Assessment Roll #: **0614120235175000000**
MECP District: **Ottawa**
MECP Region: **Eastern Region**

Source Protection Details for Location

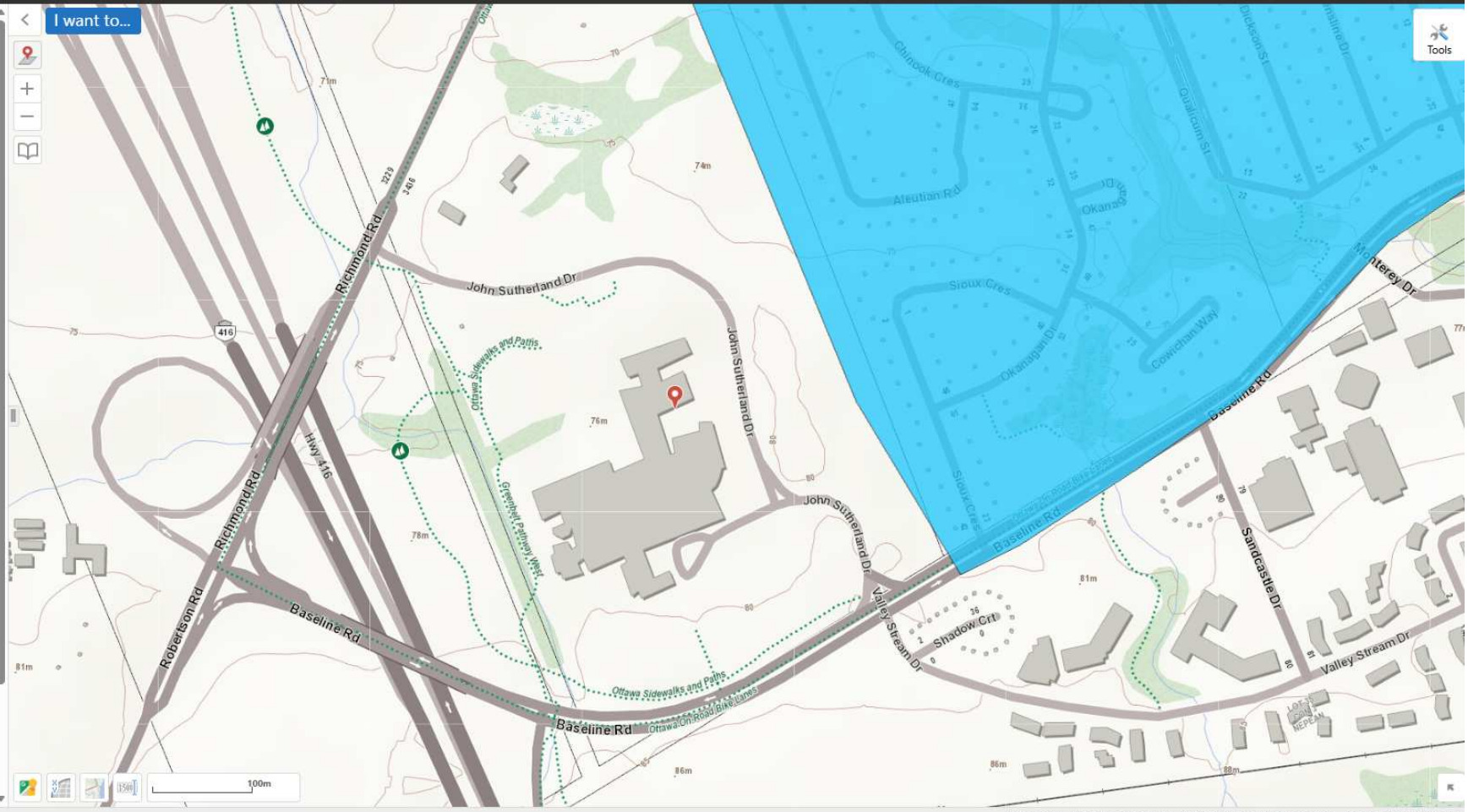
Source Protection Area: **Rideau Valley**
View Source Protection Plan
Wellhead Protection Area: **No**
Wellhead Protection Area (WHPA-E): **No**
Issue Contributing Area: **No**
Significant Groundwater Recharge Area: **No**
Highly Vulnerable Aquifer: **N/A**
Event Based Area: **No**
Wellhead Protection Area Q1: **No**
Wellhead Protection Area Q2: **No**
Intake Protection Zone Q: **No**
Information is current as of: **January 30, 2026**

Map Legend

Climate Data

I want to...

Tools



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APPENDIX G

Excerpts from Previous SWM Reports

QUEENSWAY-CARLETON HOSPITAL
OVERALL CAMPUS – PART 3 EXPANSION
STORMWATER MANAGEMENT REPORT
3045 BASELINE ROAD

Prepared for:

QUEENSWAY-CARLETON HOSPITAL

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.
Suite 200, 240 Michael Cowpland Drive
Kanata, Ontario
K2M 1P6

June 26, 2009
Revised July 16, 2010

Ref: R-2009-088
Novatech File No. 108075-1

2.0 STUDY OBJECTIVES

At the request of the Ministry of the Environment (MOE), this report will include a detailed description of the proposed Part 3 expansion works as well as a description of the storm sewer system and stormwater management plan servicing the overall Hospital campus.

The QCH currently has an MOE Certificate of Approval (No. 7898-7DGJUK, issued April 18th, 2008) for stormwater management related to the recently constructed Caner Centre. The current C of A covers the overall campus. Due to the proposed Part 3 expansion, the QCH will require an amendment to the current MOE Certificate of Approval.

2.1 DESIGN CRITERIA

2.1.1 WATER QUANTITY CONTROL

The approach for the stormwater management design for the proposed expansion is not to exceed the previously established allowable release rate. Post-development flows are to be controlled to pre-development levels for both the 1:5 year and 1:100 year design events. Post-development runoff in excess of the pre-development runoff will be stored and controlled on site prior to being released into the existing drainage ditch tributary to Graham Creek.

The approach for the stormwater management design for the existing portion of the QCH campus, not affected by the current expansion, is to remain as specified in the previous SWM Reports[1,2,3,4].

2.1.2 WATER QUALITY CONTROL

Based on the previous SWM Report[1], Graham Creek is a Type II Habitat and requires Level 2 Protection [i.e. 70% removal of Total Suspended Solids (TSS)], as described in the MOE Stormwater Management Planning and Design Manual.

3.0 PRE-DEVELOPMENT CONDITIONS

The developed portion of the QCH campus consists of existing Hospital buildings, surface parking lots, a multi-level parking structure and access roads. John Sutherland Drive essentially forms the perimeter of the developed portion of the campus. The remainder of the campus is comprised of grass fields, berms and landscaped areas. Refer to **Figure 2**: Existing Conditions for details.

4.1 POST-DEVELOPMENT FLOW

The post-development flow from the QCH campus will include both controlled flow and uncontrolled runoff. The controlled portion will include flow from the various building roofs, the existing parking structure and various parking lots around the campus. The uncontrolled portion will include direct runoff from the landscaped areas as well as uncontrolled flow directed to the on-site storm sewer system. Refer to **Figure 3**: Storm Drainage Areas for details.

A breakdown of the various QCH campus drainage areas is provided below.

<table>
<tr><th colspan="4">Total Site Area (20.20 ha)</th></tr>
<tr><td rowspan="3">Area Draining to the NE Corner (4.69 ha)</td><td colspan="3">Area Draining to the Existing Ditch Along the West Property Line (15.51 ha)</td></tr>
<tr><td colspan="2">Flow to the Storm Sewer System (12.60 ha)</td><td rowspan="2">Direct Runoff to West Ditch (2.91 ha)</td></tr>
<tr><td>Controlled Flow (4.05 ha)</td><td>Uncontrolled Flow (8.55 ha)</td></tr>
</table>

4.1.1 CONTROLLED FLOW

The controlled flow and storage requirements for the proposed expansion have been calculated using the new City of Ottawa IDF curves taken from the Ottawa Sewer Design Guidelines. Refer to the attached Stormwater Management Plan (QCH-PART3-SWM) for drainage areas and details.

The controlled flow and storage requirements from the portion of the QCH campus, unaffected by the expansion have been taken directly from the previous SWM Reports[1,2,3,4].

4.1.1.1 EXISTING AREA A1

The flow from EX. A1 is currently being attenuated by the use of two ICDs located within the outlet pipes of the existing storm sewer structures. Twin 103mm dia. plug type orifices control the flow from this area to 52.0 L/s (26.0 L/s + 26.0 L/s) for the 1:5 year event and control the flow to 54.0 L/s (27.0 L/s + 27.0 L/s) for the 1:100 year design event. The above information was taken directly from the previous SWM Report[1].

Minor modifications have been made to this drainage area. Due to the addition of parking stalls and the construction of the sanitary pump station maintenance area, the weighted runoff coefficient (C_w) has increased slightly. Consequently, the existing ICDs will not operate as previously designed. In order to asses the impact these minor modifications will have on the flow from this drainage area, EX. A1 has been split into

two smaller sub-catchment areas (EX. A1a and EX. A1b). Based on the grading of the existing paved parking lot, these sub-catchment areas will operate independently.

EXISTING AREA A1a

In order to optimize the use of the available surface storage within the paved parking lot, the existing 103mm dia. plug type ICD will be replaced with a smaller 84mm dia. plug type orifice. The new ICD will reduce the controlled flow from this sub-catchment area, while slightly increasing the storage requirements. EX. A1a has an approximate drainage area of 0.42ha and a weighted runoff coefficient C_w=0.67. The available storage was determined to be approximately 100m^3.

The Modified Rational Method was used to determine the post-development storage volume required for this area. Based on a controlled release rate of 20.1 L/s the required storage volume for the 1:5 year design event is approximately 42.3m^3. The required storage for the 1:100 year design event is approximately 93.8m^3, based on a controlled flow of 20.4 L/s. Refer to **Appendix A** for orifice calculations.

EXISTING AREA A1b

Similarly, in order to optimize the use of the available surface storage within the paved parking lot, the existing 103mm dia. plug type ICD will be replaced with a smaller 85mm dia. plug type orifice. The new ICD will reduce the controlled flow from this sub-catchment area, while slightly increasing the storage requirements. EX. A1b has an approximate drainage area of 0.33ha and a weighted runoff coefficient C_w=0.76. The available storage was determined to be approximately 112m^3.

The Modified Rational Method was used to determine the post-development storage volume required for this area. Based on a controlled release rate of 20.1 L/s the required storage volume for the 1:5 year design event is approximately 34.1m^3. The required storage for the 1:100 year design event is approximately 77.5m^3, based on a controlled flow of 20.4 L/s. Refer to **Appendix A** for orifice calculations.

A summary of the revised drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
EX. A1a (0.42)	20.1	20.4	42.3	93.8	100
EX. A1b (0.33)	20.1	20.4	34.1	77.5	112
EX. A1 Total (0.75)	40.2	40.8	76.4	171.3	212

4.1.1.2 EXISTING AREA A2-A

The flow from EX. A2-A is currently being attenuated by the use of an ICD located within the outlet pipe of the existing structure. Based on the previous SWM Report[1] a 91mm dia. plug type orifice controls the flow from this area to 20.0 L/s for the 1:5 year design event and controls the flow to 21.0 L/s for the 1:100 year design event. The above information was taken directly from the previous SWM Report[1].

Modifications have been made to this drainage area. Due to the expansion of the paved parking lot and re-grading of the adjacent berm, the drainage area has increased by approximately 0.07ha (from 0.29ha to 0.36ha). Based on the existing grading, no additional storage is available within this drainage area. Since EX. A2-B is lower than EX. A2-A, the additional runoff from EX. A2-A will spill into the downstream catchment area. The increased runoff from the parking lot expansion will be accounted for in the adjacent catchment area EX. A2-B (refer to Section 4.1.1.3 below for details). For the purpose of this report, EX. A2-A will remain as described in the previous SWM Report[1].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.29	20.0	21.0	19	43	54

4.1.1.3 EXISTING AREA A2-B

The flow from EX. A2-B is currently being attenuated by the use of an ICD located within the outlet pipe of the existing structure. A 119mm dia. plug type orifice controls the flow from this area to 35.0 L/s for the 1:5 year design event and controls the flow to 36.0 L/s for the 1:100 year design event. The above information was taken directly from the previous SWM Report[1].

In order to optimize the use of the available storage within the paved parking lot, the T/G elevations of the existing structures will be raised and a portion of the paved parking lot will be re-graded and flattened. The existing ICD will also be replaced with a new 81mm dia. plug type orifice. The new ICD will reduce the controlled flow from this sub-catchment area, while increasing the storage requirements. As stated above, the additional runoff from EX. A2-A will spill into catchment area EX. A2-B. The resulting catchment area EX. A2-B will therefore be 0.59ha (0.52ha + 0.07ha) with a weighted runoff coefficient C_w=0.69. The available storage was determined to be approximately 255 m^3.

The Modified Rational Method was used to determine the post-development storage volume required for this area. Based on a controlled release rate of 20.2 L/s the

required storage volume for the 1:5 year design event is approximately 73.5 m^3. The required storage for the 1:100 year design event is approximately 155.6 m^3, based on a controlled flow of 20.5 L/s. Refer to **Appendix A** for orifice calculations.

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.59 (0.52+0.07)	20.2	20.5	73.5	155.6	255

4.1.1.4 EXISTING AREA R1

The flow from EX. R1 is currently being attenuated by the use of controlled flow roof drains. The roof drains control the flow from this area to 3.9 L/s (or 55.8 L/s/ha x 0.07ha) for both the 1:5 year and 1:100 year design events. The total storage volume is in the order of 10m^3. The above information was taken directly from the previous SWM Reports[1,2].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.07	3.9	3.9	<10	10	10

4.1.1.5 EXISTING AREA R2

The flow from EX. R2 is currently being attenuated by the use of controlled flow roof drains. The roof drains control the flow from this area to 20.1 L/s (or 55.8 L/s/ha x 0.36ha) for both the 1:5 year and 1:100 year design events. The total storage volume is in the order of 51m^3. The above information was taken directly from the previous SWM Report[2].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.36	20.1	20.1	<51	51	51

4.1.1.6 EXISTING AREA R3

The flow from EX. R3 is currently being attenuated by the use of controlled flow roof drains. The roof drains control the flow from this area to 6.5 L/s for both the 1:5 year and 1:100 year design events. The total storage volume is in the order of 7.1m^3. The above information was taken directly from the previous SWM Report[3].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.04	6.5	6.5	<7.1	7.1	7.1

4.1.1.7 EXISTING AREAS A-3.1 AND A-3.2

The flow from EX. A-3.1 and the majority of the flow from EX. A-3.2 is currently being attenuated by the use of controlled flow roof drains. A total of 10 drains control the flow on the main roof to 1.9 L/s per drain. However, two additional drains will convey uncontrolled flow from a very small portion of Area A-3.2 (0.02ha of 0.24ha) to the internal building plumbing system. The uncontrolled flow from this small portion of the roof was calculated to be 3.5 L/s for the 1:5 year design event and 6.0 L/s for the 1:100 year design event. The total flow from the existing building roof is therefore 22.5 L/s (19.0 L/s + 3.5 L/s) for the 1:5 year event and 25.0 L/s (19.0 L/s + 6.0 L/s) for the 1:100 year design event. The above information was taken directly from the previous SWM Report[4].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.24	22.5	25.0	24.3	57.2	57.2

4.1.1.8 EXISTING AREA A-4

The flow from EX. A-4 is currently being attenuated by the use of controlled flow roof drains. A total of 11 drains control the flow to 1.0 L/s per drain. The total flow from the covered link roof is 11.0 L/s for both the 1:5 year and 1:100 year design events. The total storage volume is in the order of 6.8m^3. The above information was taken directly from the previous SWM Report[4].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.05	11.0	11.0	2.0	6.8	6.8

4.1.1.9 EXISTING AREA A-5

The flow from EX. A-5 is currently being attenuated by a 94mm diameter plug type orifice installed in the outlet pipe of existing CBMH 1 located at the downstream end of the super-pipe. The 1:5 year design event is controlled to 18.1 L/s. The same orifice releases the 1:100 year design event at the rate of 24.8 L/s. The total storage volume is in the order of $100m^3$. The above information was taken directly from the previous SWM Report[4].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.35	18.1	24.8	49.3	93.7	100

4.1.1.10 EXISTING AREA A-6

The flow from EX. A-6 is currently being attenuated by an 85mm diameter plug type orifice installed in the outlet pipe of existing CBMH 10 located at the downstream end of the super-pipe. The 1:5 year design event is controlled to 18.0 L/s. The same orifice releases the 1:100 year design event at the rate of 28.3 L/s. The total storage volume is in the order of $118m^3$. The above information was taken directly from the previous SWM Report[4].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.56	18.0	28.3	64.3	113.8	118

4.1.1.11 EXISTING AREA A-7

The flow from EX. A-7 is currently being attenuated by a Hydrovex Model 75 VHV-1 type ICD installed in the outlet pipe of existing STM MH 11 located at the downstream end of the super-pipe. The 1:5 year design event is controlled to 4.4 L/s. The same Hydrovex releases the 1:100 year design event at the rate of 8.0 L/s. The total storage volume is in the order of 98m^3. The above information was taken directly from the previous SWM Report[4].

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Drainage Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Year	1:100 Year	1:5 Year	1:100 Year	
0.24	4.4	8.0	55.5	92.1	98

4.1.1.12 AREA P3-1

The flow from P3-1 will be attenuated by the combination of controlled and uncontrolled drains. The main building roof will have a total of 31 drains, 23 of which will be controlled. The remaining 8 roof drains and the light well areas around CB 302 and CB 303 will convey uncontrolled flow to the internal building plumbing system. The release rate for the various controlled flow roof drains is based on the size and storage available within each individual sub-catchment area. The total flow from Area P3-1 will be 34.4 L/s for the 1:5 year and 49.4 L/s for the 1:100 year design events.

A summary of the drainage area, release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Roof Drain ID & Area (ha)	Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Yr	1:100 Yr	1:5 Yr	1:100 Yr	
RD1 (0.010)	1.14	1.50	0.9	1.9	4.8
RD2 (0.010)	1.14	1.50	0.9	1.9	4.8
RD3 (0.010)	1.14	1.50	0.9	1.9	4.8
RD4 (0.010)	1.14	1.50	0.9	1.9	4.8
RD5 (0.010)	1.14	1.50	0.9	1.9	4.8
RD6 (0.015)	1.27	1.77	1.7	3.3	6.6
RD7 (0.014)	1.27	1.64	1.5	3.1	6.6
RD8 (0.014)	1.27	1.64	1.5	3.1	6.6
RD9 (0.014)	1.27	1.64	1.5	3.1	6.6
RD10 (0.015)	1.27	1.77	1.7	3.3	6.8
RD11	Roof Drain ID Not Used				
RD12 (0.040)	1.27	1.89	7.6	13.6	16.3

RD13 (0.038)	1.27	1.77	7.0	12.9	17.7
RD14 (0.038)	1.27	1.77	7.0	12.9	17.7
RD15 (0.042)	1.27	1.89	8.2	14.7	17.7
RD16 (0.032)	1.27	1.64	5.5	10.6	17.7
RD17	Roof Drain ID Not Used				
RD18 (0.003)*	0.53	0.91	-	-	-
RD19 (0.009)	0.94	1.14	0.8	1.9	2.8
RD20 (0.009)	0.94	1.14	0.8	1.9	2.8
RD21 (0.029)	1.01	1.40	5.3	9.7	13.5
RD22	Roof Drain ID Not Used				
RD23 (0.006)*	1.06	1.82	-	-	-
RD24 (0.006)*	1.06	1.82	-	-	-
RD25 (0.002)*	0.35	0.61	-	-	-
RD26 (0.014)	1.27	1.64	1.5	3.1	6.2
RD27 (0.008)	0.76	1.14	0.8	1.5	2.3
RD28 (0.029)	1.01	1.40	5.3	9.7	13.5
RD29 (0.014)	1.27	1.64	1.5	3.1	6.2
RD30 (0.009)	0.76	1.14	1.2	2.2	3.3
RD31 (0.003)*	0.53	0.91	-	-	-
RD32 (0.004)*	0.71	1.22	-	-	-
RD35 (0.004) *	0.71	1.22	-	-	-
RD36 (0.005) *	0.89	1.52	-	-	-
CB 302 (0.014) *	1.66	2.84	-	-	-
CB 303 (0.005) *	0.59	1.01	-	-	-
Sub-total Uncontrolled (0.052)*	8.09	13.88	-	-	-
Sub-total Controlled (0.434)	26.36	35.56	64.9	123.2	194.9
Total (0.486)	34.45	49.44	64.9	123.2	194.9

* Indicates uncontrolled flow.

4.1.1.13 AREA P3-2

The flow from Area P3-2 will be attenuated by the use of controlled flow roof drains. A total of 2 drains will control the flow to 0.76 L/s per drain during the 1:5 year event and 1.14 L/s per drain during the 1:100 year event. The total flow from the building roof will therefore be 1.5 L/s for the 1:5 year and 2.3 L/s for the 1:100 year design events.

A summary of the drainage area, controlled release rates and storage volumes for both the 1:5 year and 1:100 year design events are shown in the following table.

Roof Drain ID & Area (ha)	Controlled Release Rate (L/s)		Storage Volume Required (m^3)		Storage Volume Provided (m^3)
	1:5 Yr	1:100 Yr	1:5 Yr	1:100 Yr	
RD 33 & 34 (0.02)	1.52	2.28	2.4	4.5	4.7

4.1.1.14 CONTROLLED FLOW SUMMARY

The following table summarizes the controlled flow from the developed portion of the QCH campus for both the 1:5 year and 1:100 year design events.

Drainage Area	Area (ha)	Post Development - Controlled Flow	
		1:5 Year	1:100 Year
EX. A1a & EX. A1b	0.75 (0.42 + 0.33)	40.2 L/s (20.1 L/s+ 20.1 L/s)	40.8 L/s (20.4 L/s + 20.4 L/s)
EX. A2-A [1]	0.29	20.0 L/s	21.0 L/s
EX.A2-B	0.59 (0.52 + 0.07)	20.2 L/s	20.5 L/s
EX. R1 [1,2]	0.07	3.9 L/s	3.9 L/s
EX. R2 [2]	0.36	20.1 L/s	20.1 L/s
EX. R3 [3]	0.04	6.5 L/s	6.5 L/s
EX. A-3.1 [4] & EX. A-3.2 [4]	0.24	22.5 L/s* (19.0 L/s + 3.5 L/s)	25.0 L/s* (19.0 L/s + 6.0 L/s)
EX. A-4 [4]	0.05	11.0 L/s	11.0 L/s
EX. A-5 [4]	0.35	18.1 L/s	24.8 L/s
EX. A-6 [4]	0.56	18.0 L/s	28.3 L/s
EX. A-7 [4]	0.24	4.4 L/s	8.0 L/s
P3-1	0.49	34.4 L/s*	49.4 L/s*
P3-2	0.02	1.5 L/s	2.3 L/s
Total	**4.05**	**220.8 L/s**	**261.6 L/s**

[1] "Queensway Carleton Hospital Stormwater Management Report" (Novatech Engineering Consultants Ltd., October 1998)

[2] "Queensway Carleton Hospital Stormwater Management Report" (Ainley Group, May 2003)

[3] "Queensway Carleton Hospital Stormwater Management Report" (IBI Group, May 2005)

[4] "Queensway Carleton Hospital Overall Campus – Cancer Centre Addition Stormwater Management Report" (Novatech Engineering Consultants Ltd., March 2008)

* Includes a portion of uncontrolled flow from the light wells and/or building roofs.

Additional flows were controlled as part of the James Beach Parking Lot project. Refer to excerpts from the James Beach Parking Lot SWM report (contained within subsequent sections of this Appendix) for further details.

4.1.2 UNCONTROLLED FLOW

The uncontrolled flow for the proposed building roofs have been calculated using the new City of Ottawa IDF curves, while the uncontrolled flow from the remainder of the QCH campus, which has essentially remained unchanged, has been calculated using the old City of Ottawa IDF Curves. The rainfall intensities from the old City of Ottawa IDF Curves correspond with values used in the previous SWM Reports and are

therefore consistent with the way the storm sewer system was originally designed in the mid 1970s.

4.1.2.1 AREA P3-3

The post-development flow from Area P3-3 will be uncontrolled and will drain to the proposed storm sewer near the main entrance of the existing hospital. The uncontrolled flow from this portion of the roof was calculated to be 7.1 L/s for the 1:5 year design event and 12.1 L/s for the 1:100 year design event. Refer to **Appendix A** for detailed calculations.

4.1.2.2 EXISTING SITE

The post-development flow from the uncontrolled portion of the QCH campus being directed to the on-site storm sewer system was calculated using the Rational Method to be 788.4 L/s for the 1:5 year design event and 1297.2 L/s for the 1:100 year design event. Refer to **Appendix A** for detailed calculations.

4.1.2.3 DIRECT RUNOFF TO WEST DITCH

The post-development flow from the portion of the QCH campus being conveyed directly to the existing ditch along the west property line was calculated using the Rational Method to be 167.7 L/s for the 1:5 year design event and 275.9 L/s for the 1:100 year design event. Refer to **Appendix A** for detailed calculations.

4.1.3 POST-DEVELOPMENT FLOW SUMMARY

The following table summarizes the pre-development release rate and the post-development flow for the portion of the QCH campus draining to the existing ditch along the west property line for both the 1:5 year and 1:100 year design events.

Design Event	Pre-Development	Post-Development			
	Release Rate (L/s)*	Controlled Site Flow (L/s)	Uncontrolled Site Runoff (L/s)**	Direct Runoff to West Ditch (L/s)	Total Site Flow (L/s)
1:5 yr	1191.8	220.8	788.4+7.1	167.7	1184.0
1:100 yr	1961.0	261.6	1297.2+12.1	275.9	1846.8

* The pre-development release rate for the 15.51 ha area draining to the existing ditch along the west property line was taken from the previous SWM Report[4].

** This includes uncontrolled flow from the site and the building roofs.

As indicated in the table above, the total post-development site flow for both the 1:5 year and the 1:100 year design events are less than the pre-development release rates.

The remainder of the QCH campus (4.69 ha), unaffected by the expansion, will continue to sheet drain uncontrolled towards the north east corner of the site. The existing grass swales and ditches will continue to convey the stormwater runoff off site to Graham Creek.

4.2 POST-DEVELOPMENT STORM SEWER DESIGN SHEETS

Storm Sewer Design Sheets for the 1:5 year design event have been provided showing a detailed breakdown of the pipe flow under post-development conditions. Refer to **Appendix C** for detailed calculations.

As indicated on the Storm Sewer Design Sheets, the time of concentration has been calculated to be approximately 19.7 minutes. The Storm Sewer Design Sheets also indicate that a few sections of the existing storm sewer system currently operate under surcharge conditions. The Hospital is aware of the situation, and is not concerned as there is no reported history of flooding on the site. Due to budget constraints, an upgrade of these existing storm sewer sections is not part of the proposed works. Furthermore, future expansion projects will provide opportunities to mitigate increased flows by the use of controlled flow roof drains, surface detention and underground storage. The proposed Part 3 expansion will not increase flows to the undersized storm sewer sections within the loading dock area.

It should be noted that the peak flows calculated in the Storm Sewer Design Sheets strictly represents the flow from the QCH campus (12.60 ha) being directed to the Stormceptor STC 9000. The peak flows calculated in the Storm Sewer Design Sheets also differs slightly from the total flow calculated in this report. This discrepancy is due to the level of precision of the Rational Method calculations when small drainage areas are measured in hectares. The discrepancy falls within a reasonable margin of error for these calculations.

5.0 WATER QUALITY CONTROL

Based on the previous SWM Report[4], the Stormceptor STC 9000 will provide the required Level of Protection (i.e. minimal 70% removal of TSS) for the flow being discharged into the existing drainage ditch, which ultimately outlets to Graham Creek.

As previously stated, the 15.51 ha area draining to the existing ditch can be divided into two smaller sub-catchment areas. A portion of the undeveloped grass/vegetated area (2.91 ha) sheet drains uncontrolled to the ditch, while stormwater from the remainder of the drainage area (12.60 ha) is being directed to the on-site storm sewer system. Flow from the on-site storm sewer system is being directed to the existing ditch via the Stormceptor STC 9000. Approximately 6.84 ha (or 54%) of the 12.60 ha area being directed through this Stormceptor is impervious. Consequently, the Stormceptor STC 9000 will remove 72% of total TSS (based on rainfall data for the Ottawa area from

1967 to 2003). The STC 9000 has a sediment capacity of 32.98 m^3 and an oil capacity of 10,555 L (refer to **Appendix D** for details). Regular inspection and maintenance of the Stormceptor is recommended to ensure that the treatment unit is clean and operational.

6.0 MAJOR OVERLAND FLOW ROUTE

In the case of a major rainfall event exceeding the design events provided for, the stormwater located within the paved parking and landscaped areas will cascade into lower drainage areas along John Sutherland Drive and ultimately spill towards the NE corner of the campus. The stormwater located within the northwest portion of John Sutherland Drive will flow directly towards Richmond Road. From the roadside ditches along Richmond Road, the major system makes its way north to Graham Creek. The major system overland flow route is shown on the Overall Drainage Plan (QCH-PART3-ODP).

The existing loading dock adjacent to the recent OR expansion is a low point on the QCH campus. Consequently, there is no major overland flow route for stormwater draining towards this area. All runoff from the loading dock will be directed towards and drained through the on-site storm sewer system. Similarly, there is no overland flow route for the stormwater within the existing landscaped courtyard on the east side of the Cancer Centre and the proposed landscaped courtyard on the south side of the Part 3 expansion. Should these sections of sewer become plugged, stormwater would have to be temporarily pumped to avoid possible flooding in these areas. It is recommended that the owner conduct routine inspections of the storm sewers in these areas (at least annually) to ensure that the storm drainage system is clean and operational.

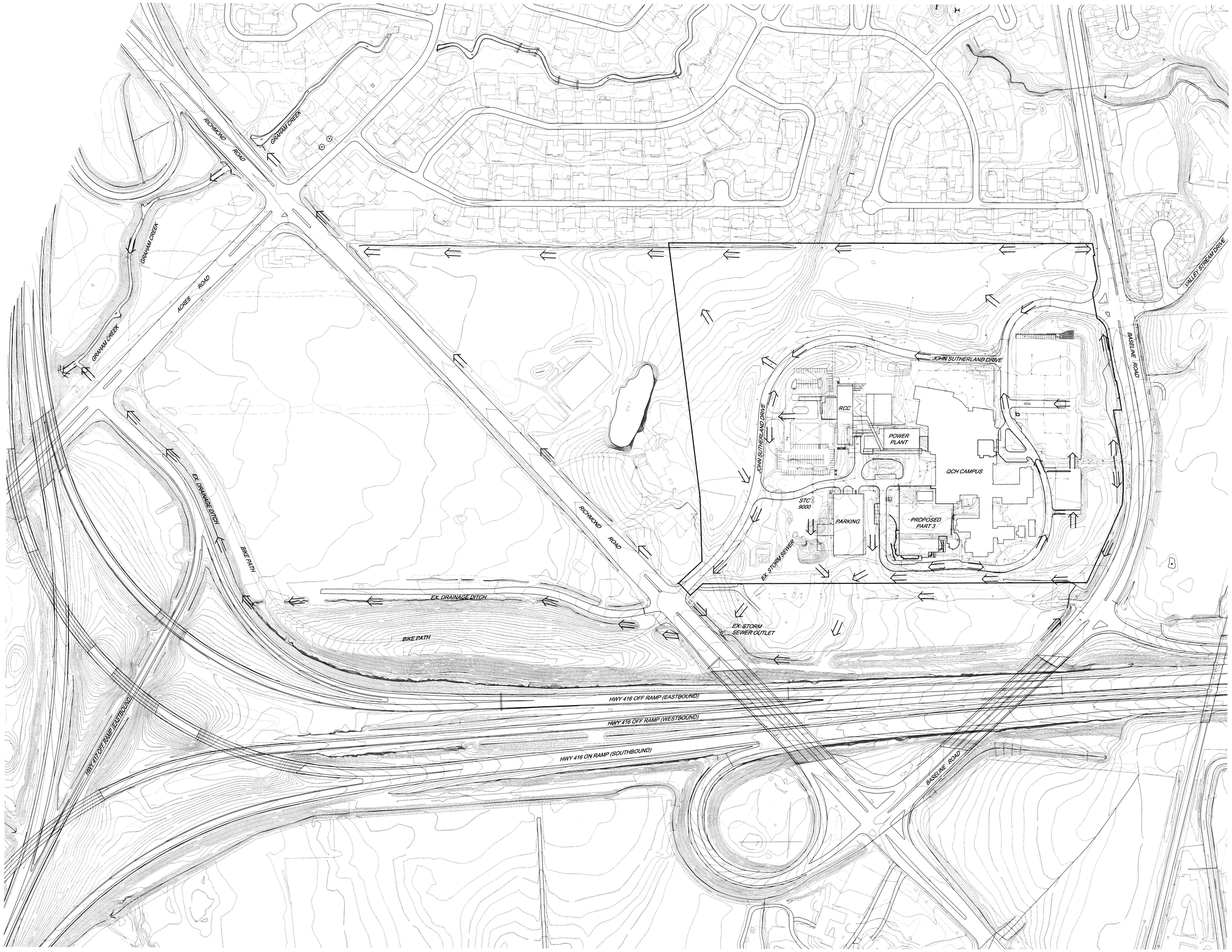
7.0 EROSION AND SEDIMENT CONTROL MEASURES

To prevent sediment from entering the storm sewer system temporary erosion and sediment control measures will be implemented on site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. These measures include:

- Placement of filter fabric under all catchbasins and maintenance hatches.
- Silt fences around the area under construction placed as per OPSS 577 and OPSD 219.110.

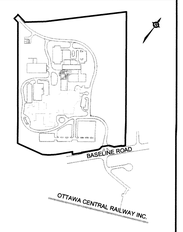
The proposed erosion and sediment control measures will be implemented prior to construction and will remain in place during all phases of construction. Regular inspection and maintenance of the erosion control measures will be under taken.

GP4 - PART 3
OVERALL DRAINAGE PLAN (ODP)
REVISED DRAINAGE PLAN
JULY 16/2010

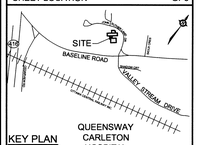


Queensway Carleton Hospital

PROJECT NORTH | TRUE NORTH



SHEET LOCATION GP3



KEY PLAN N.T.S. QUEENSWAY CARLETON HOSPITAL

No.	Description	Date
1	ISSUED WITH SWM REPORT	JUL. 16, 2010

Revisions:

All measurements are to be checked and verified on site by the contractor before proceeding with the work.

Do not scale the drawings.

PARKIN ARCHITECTS LIMITED
20 James St., Suite 200, Ottawa, Canada K2P 0T6 613.739.7700

FOR REVIEW ONLY

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NOVATECH ENGINEERING CONSULTANTS LTD.
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K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novatech@novatech-eng.com

Owner:
Project:
Address: QUEENSWAY-CARLETON HOSPITAL

PART 3
REDEVELOPMENT

3045 BASELINE ROAD
OTTAWA, ONTARIO

Drawn By:	Date:
SM	03/10/10
Checked By: FST	Scale: 1:1500

Sheet Title:
OVERALL DRAINAGE PLAN
QCH-PART3-ODP

Sheet Number:
9915-49-ODP

Drawing Path: I:\2009\09075\CAD\figure\09075-ODP.dwg Layout: ODP Updated JUL 15, 2010 at 9:05am by smatthews

PLOTTED: Jul 16, 2010 - 2:28pm
M:\2009\09075\CAD\figure\09075-ODP.dwg

3045 BASELINE ROAD
QUEENSWAY CARLETON HOSPITAL
PARKING LOT

STORMWATER MANAGEMENT REPORT

Prepared by:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Kanata, Ontario
K2M 1P6

February 10, 2017
Revised May 8, 2017

Ref: R-2017-004
Novatech File No. 116166

Table 3.4.2: Area A-3 Design Flow and ICD Information

Design Event	Drainage Area A-3				
	Post-Development Flow				
	IPEX LMF Type ICD	Design Flow (L/s)	Water Design Head (m) *	Volume Required (m^3)	Volume Provided (m^3)
1:5 Year	'Tempest' Vortex	4.4 L/s	1.03 m	8.4 m^3	18.6 m^3
1:100 Year	'Tempest' Vortex	6.7 L/s	2.35 m	18.1 m^3	18.6 m^3

*Water Design Head is calculated from the water elevation to center of the orifice.

Refer to **Appendix D** for Rational Method calculations, Modified Rational Method calculations and stage storage curves.

Summary of Post-Development Flows

Table 3.4.3: Post-Development Stormwater Flow Table

Post - Development Flows						
Area	Description	Post-Development Flow (L/s)		Storage Required (m^3)		Provided (m^3)
		5 year	100 year	5 year	100 year	
A-1	Direct Runoff	4.2	7.9	-	-	-
A-2	Paved Parking Lot	4.4	4.5	8.3	21.5	21.5
A-3	Paved Parking Lot	4.4	6.7	8.4	18.1	18.6
	Total Flow =	**13.0**	**19.1**			

Additional controlled flows as part of the James Beach Parking Lot project.

As indicated in **Table 3.4.3** the total post-development flow from the sub-catchment areas will be released from the proposed development at a combined maximum rate of 13.0 L/s during the 1:5 year design event and 19.1 L/s during the 1:100 year design event; both of which are less than or equal to the pre-development flows conveyed to the on-site storm sewer system.

3.5 Stormwater Quality Control

Based on the previous *Queensway Carleton Hospital Overall Campus Part 3 Expansion Stormwater Management Report*, the stormwater quality control for the campus is provided by the STC 9000 Stormceptor unit. The 12.6 ha drainage area having imperviousness of 54% is being directed trough the Stormceptor Unit. The STC 9000 unit provides 72% TSS removal which exceeds the required minimum of 70%. An excerpt of the previous SWM report is provided in **Appendix C**.

With the proposed parking lot, the 0.12ha pervious (grass) area will be converted into the impervious (asphalt) area. This result in approximately 1% increase in the overall site imperviousness. This change in the overall site imperviousness is considered negligible and will have little or no impact on the performance of the existing Stormceptor unit.

APPENDIX H

Engineering Plans

NORTH

KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- EASEMENT BOUNDARY
- PROPOSED SANITARY MANHOLE & SEWER WITH DIRECTION OF FLOW
- PROPOSED STORM MANHOLE & SEWER WITH DIRECTION OF FLOW
- PROPOSED PERFORATED SUBDRAIN
- PROPOSED CATCHBASIN AND LEAD
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED STORM OGS UNIT
- ICD — PROPOSED INLET CONTROL DEVICE
- PROPOSED WATERMAIN / WATER SERVICE
- PROPOSED VALVE & VALVE BOX
- PROPOSED HYDRANT C/W VALVE & LEAD
- PROPOSED WATERMAIN BEND & THRUST BLOCK
- RED — PROPOSED WATERMAIN REDUCER
- FDC — PROPOSED FIRE DEPARTMENT CONNECTION
- PROPOSED WATER METER AND REMOTE METER
- X — REMOVALS
- PROPOSED CAP
- (D.P.) — PROPOSED DROP PIPE INVERT
- 20 — SEWER / HYDRANT LEAD CROSSING IDENTIFIER
- THERMAL INSULATION FOR SHALLOW SEWERS
- PROPOSED PROPANE ALIGNMENT (REFER TO MECH. PLANS FOR DETAILS)
- GAS — PROPOSED NATURAL GAS ALIGNMENT (EXACT ALIGNMENT AND DETAILS TBD BY ENBRIDGE)
- PROPOSED ELECTRICAL ALIGNMENT (REFER TO ELEC. PLANS FOR DETAILS)
- PROPOSED ELECTRICAL GROUND CONDUCTOR (REFER TO ELEC. PLANS FOR DETAILS)
- PROPOSED OXYGEN ALIGNMENT (REFER TO MECH. PLANS FOR DETAILS)
- PROPOSED DIESEL ALIGNMENT (REFER TO MECH. PLANS FOR DETAILS)

- EXISTING SANITARY MANHOLE & SEWER WITH DIRECTION OF FLOW
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- EXISTING HYDRANT C/W VALVE & LEAD
- EXISTING VEGETATION (TREES)
- EXISTING LIGHT STANDARD
- GAS — EXISTING GAS LINE
- H.UG — EXISTING HYDRO UNDERGROUND WIRES
- OH — EXISTING OVERHEAD WIRES

PROPOSED PART 4 EXPANSION BUILDING

EXISTING BUILDING

BENCHMARK NOTES:

1. ELEVATIONS SHOWN ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978).
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT IT'S RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON THIS DRAWING.
3. BENCHMARK WAS PROVIDED ON THE PLAN OF SURVEY OF PART OF LOT 16, CONCESSION 2 (O.F.), GEOGRAPHIC TOWNSHIP OF NEPEAN, CITY OF OTTAWA, SURVEYED BY STANTEC GEOMATICS LTD., DATED NOVEMBER 5, 2024.

REFER TO PLAN 123089-GP2 FOR CONTINUATION

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES

NOTE:
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.

No.	REVISION	DATE	BY
2.	REISSUED FOR SITE PLAN CONTROL APPROVAL	SEP 25/26	FST
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE 1:400 (1:400 at 0 4 8 12 16)

DESIGN KD
CHECKED FST
DRAWN KD
CHECKED FST
APPROVED FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER — F.S. THAUVETTE — 100041399 — September 25, 2026 — PROVINCE OF ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
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Facsimile (613) 254-5867
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LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
GENERAL PLAN OF SERVICES
PART 4 EXPANSION

PROJECT No. 123089
REV REV #2
DRAWING No. 123089-GP1

ZBA# D02-02-25-0093 & SPC# D07-12-25-0163

PLOTTED: 2026-01-29 BY: FSTAUVETTE

REFER TO PLAN 123089-GP1 FOR CONTINUATION

NORTH

KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- EASEMENT BOUNDARY
- PROPOSED SANITARY MANHOLE & SEWER WITH DIRECTION OF FLOW
- PROPOSED STORM MANHOLE & SEWER WITH DIRECTION OF FLOW
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- EXISTING VEGETATION (TREES)
- EXISTING STORM STANDARD
- GAS — EXISTING GAS LINE
- H.UG — EXISTING HYDRO UNDERGROUND WIRES
- O/H — EXISTING OVERHEAD WIRES

PROPOSED PART 4 EXPANSION BUILDING

EXISTING BUILDING

BENCHMARK NOTES:

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REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES

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Queensway Carleton Hospital

No.	REVISION	DATE	BY
2.	REISSUED FOR SITE PLAN CONTROL APPROVAL	SEP 25/26	FST.
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST.

SCALE 1:400
1:400
0 4 8 12 16

DESIGN KD
CHECKED FST
DRAWN KD
CHECKED FST
APPROVED FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER — F.S. THAUVETTE — 100041399 — September 25, 2026 — PROVINCE OF ONTARIO

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LOCATION
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QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
GENERAL PLAN OF SERVICES
PART 4 EXPANSION

PROJECT No. 123089
REV. REV #2
DRAWING No. 123089-GP2

ZBA# D02-02-25-0093 & SPC# D07-12-25-0163

M:\2023\123089\CAD\ACAD\123089-GP.dwg, GEP-GP1, Sep 24, 2026 - 11:45pm, Kitra

NORTH

KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- 78.90 PROPOSED ELEVATION
- 78.90TC PROPOSED TOP OF CURB ELEVATION
- 78.90SW PROPOSED SWALE ELEVATION
- 78.90DC PROPOSED DEPRESSED CURB ELEVATION
- 79.25 PROPOSED ENTRANCE/EXIT ELEVATION
- MAXIMUM 3:1 SIDESLOPE
- 3.5% GRADE AND DIRECTION
- EMERGENCY OVERLAND FLOW ROUTE
- PROPOSED CHAIN LINK FENCE
- PROPOSED CONCRETE CURB
- PROPOSED DEPRESSED CURB
- PROPOSED ARMOUR STONE RETAINING WALL
- PROPOSED TWSI
- 1:5 YR / 1:100 YR — APPROXIMATE PONDING LIMITS
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED STORM OGS UNIT
- PROPOSED VALVE & VALVE BOX
- PROPOSED HYDRANT
- X REMOVALS
- PROPOSED PART 4 EXPANSION BUILDING

- * 78.65 × 81.38 — EXISTING ELEVATION
- EXISTING OVERHEAD WIRES
- EXISTING CONCRETE CURB
- EXISTING CATCHBASIN
- EXISTING CATCHBASIN MANHOLE
- EXISTING STORM OGS UNIT
- EXISTING STORM DRAIN
- EXISTING VALVE & VALVE BOX
- EXISTING HYDRANT
- EXISTING SANITARY MANHOLE
- EXISTING VEGETATION (TREES)
- EXISTING LIGHT STANDARD
- EXISTING SIGN
- EXISTING UTILITY POLE
- EXISTING BUILDING

BENCHMARK NOTES:

1. ELEVATIONS SHOWN ARE GEODETIC REFERENCING THE CGVD28 VERTICAL DATUM AND WERE DERIVED THROUGH CANNET REAL-TIME NETWORK OBSERVATIONS.
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Erosion and Sediment Control Responsibilities:

					During Construction			After Construction Prior to Final Acceptance		After Final Acceptance
	ESC Measure	Symbol	Specification	Installation Responsibility	Inspection/Maintenance Responsibility	Inspection Frequency	Approval to Remove	Removal Responsibility	Inspection/Maintenance Responsibility
Temporary Measures	Silt Fence Guard (Silt Curb)	— — —	OPSD 219.110	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Filter Bags		Location as indicated (if ESC Measure)	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Mud Mat	M M	Drawing Details	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A
	Dust Control		Location as Required by Contractor	Erosion and Sediment Control Notes	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A
	Stabilized Material Stockpiling		Location as Required by Contractor	Erosion and Sediment Control Notes	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Sediment Basin (to trap/clarify pumped out of excavations)		Location as Required by Contractor	. . . .	Developer's Contractor	After each Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A

REFER TO PLAN 123089-GR2 FOR CONTINUATION

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES, DETAILS AND TABLES

NOTE:
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.

Queensway Carleton Hospital

No.	REVISION	DATE	BY
2.	REISSUED FOR SITE PLAN CONTROL APPROVAL	SEP 25/26	FST
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE 1:400 (1:400 — 0 4 8 12 16)

DESIGN KD | CHECKED FST | DRAWN KD | CHECKED FST | APPROVED FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER — Daniel Jean Frederick Thaudette — F.S. THAUDETTE — 100041209 — September 25, 2026 — PROVINCE OF ONTARIO

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LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
GRADING AND EROSION & SEDIMENT CONTROL PLAN
PART 4 EXPANSION

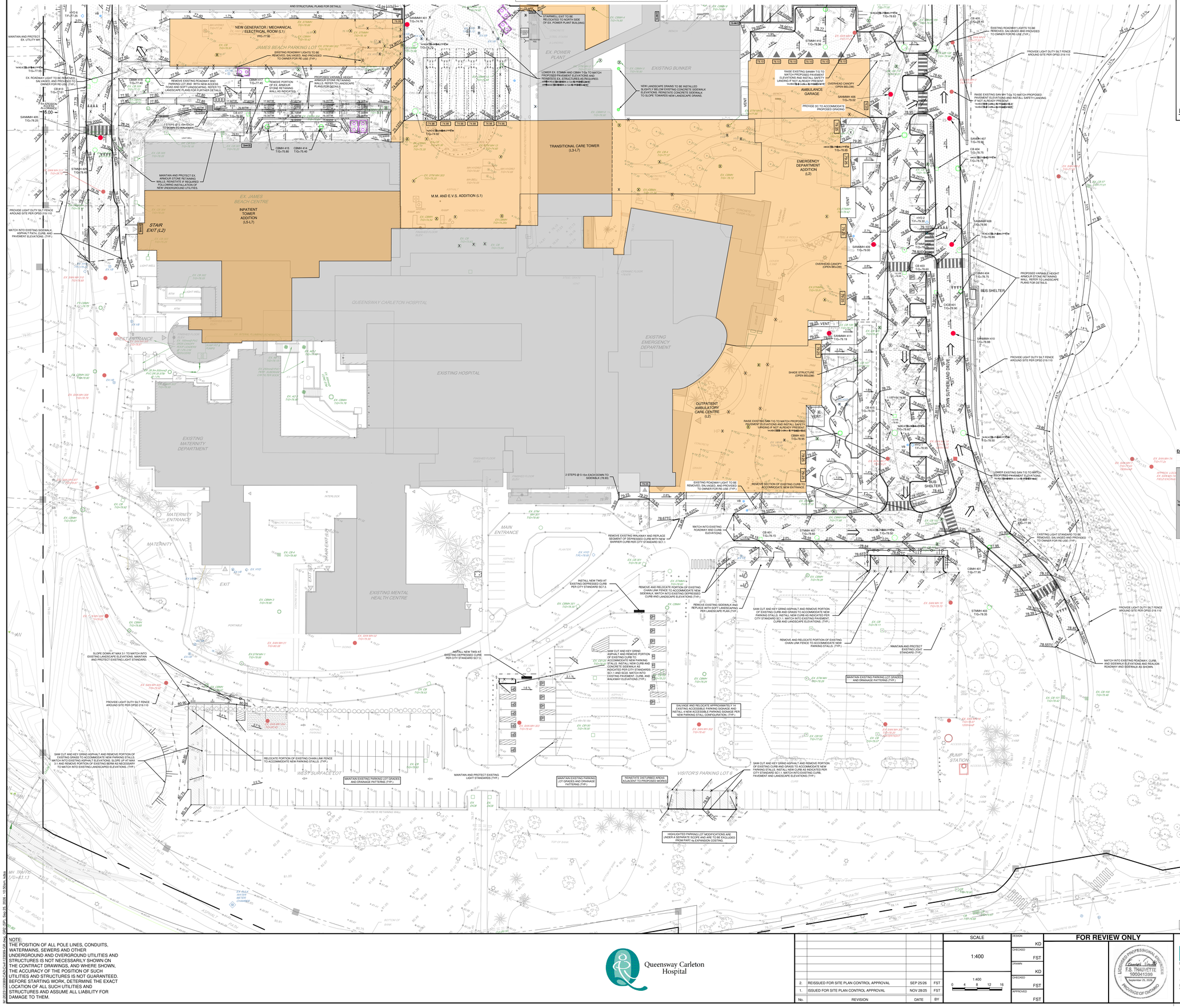
PROJECT No. 123089 | REV. REV #2 | DRAWING No. 123089-GR1

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ZBA# D02-02-25-0093 & SPC# D07-12-25-0163

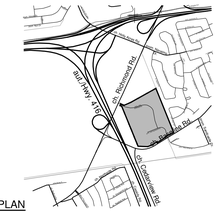
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REFER TO PLAN 123089-GR1 FOR CONTINUATION



NORTH

KEY PLAN
N.T.S.



LEGEND

- PROPERTY LINE
- PROPOSED ELEVATION
- PROPOSED TOP OF CURB ELEVATION
- PROPOSED SWALE ELEVATION
- PROPOSED DEPRESSED CURB ELEVATION
- PROPOSED ENTRANCE/EXIT ELEVATION
- MAXIMUM 3:1 SIDESLOPE
- GRADE AND DIRECTION
- EMERGENCY OVERLAND FLOW ROUTE
- PROPOSED CHAIN LINK FENCE
- PROPOSED CONCRETE CURB
- PROPOSED DEPRESSED CURB
- PROPOSED ARMOUR STONE RETAINING WALL
- PROPOSED TWSI
- 1:5 YR / 1:100 YR — APPROXIMATE PONDING LIMITS
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED STORM OGS UNIT
- PROPOSED VALVE & VALVE BOX
- PROPOSED HYDRANT
- REMOVALS

- EXISTING ELEVATION
- EXISTING OVERHEAD WIRES
- EXISTING CONCRETE CURB
- EXISTING CATCHBASIN
- EXISTING CATCHBASIN MANHOLE
- EXISTING STORM OGS UNIT
- EXISTING STORM DRAIN
- EXISTING VALVE & VALVE BOX
- EXISTING HYDRANT
- EXISTING SANITARY MANHOLE
- EXISTING VEGETATION (TREES)
- EXISTING LIGHT STANDARD
- EXISTING SIGN
- EXISTING UTILITY POLE

PROPOSED PART 4 EXPANSION BUILDING

EXISTING BUILDING

BENCHMARK NOTES:

1. ELEVATIONS SHOWN ARE GEODETIC REFERENCING THE CGVD28 VERTICAL DATUM AND WERE DERIVED THROUGH CANNET REAL-TIME NETWORK OBSERVATIONS.
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE SITE BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT ITS RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON THIS DRAWING.
3. BENCHMARK WAS PROVIDED ON PLAN OF SURVEY OF PART OF LOT 16, CONCESSION 2, GEOGRAPHIC TOWNSHIP OF NEPEAN, SURVEYED BY STANTEC GEOMATICS LTD., DATED NOVEMBER 5, 2024.

Erosion and Sediment Control Responsibilities:

	ESC Measure	Symbol	Specification	During Construction: Installation Responsibility	During Construction: Inspection/Maintenance Responsibility	During Construction: Inspection Frequency	After Construction Prior to Final Acceptance: Approval to Remove	After Construction Prior to Final Acceptance: Removal Responsibility	After Final Acceptance: Inspection/Maintenance Responsibility
Temporary Measures	Silt Fence (Light Duty)	— — —	OPSD 219.110	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Filter Bags		Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Mud Mat	M M	Drawing Details	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A
	Dust Control		Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A
	Stockpile Material Stockpiling		Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Sediment Basin De-Sediment-ation Pumped Intake		...	Developer's Contractor	Developer's Contractor	After every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES, DETAILS AND TABLES

NOTE:
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Queensway Carleton Hospital

No.	REVISION	DATE	BY
2.	REISSUED FOR SITE PLAN CONTROL APPROVAL	SEP 25/26	FST
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE 1:400 (1:400, 0 4 8 12 16)

DESIGN: KD
CHECKED: FST
DRAWN: KD
CHECKED: FST
APPROVED: FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER — F.S. THAUVETTE — 100041399 — September 25, 2026 — PROVINCE OF ONTARIO

NOVATECH
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Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
GRADING AND EROSION & SEDIMENT CONTROL PLAN PART 4 EXPANSION

PROJECT No. 123089
REV #2
DRAWING No. 123089-GR2

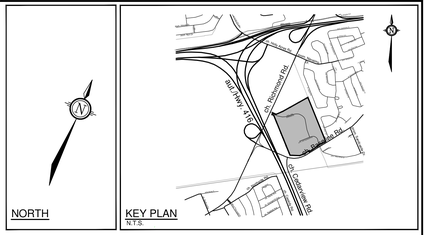
ZBA# D02-02-25-0093 & SPC# D07-12-25-0163

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NORTH

KEY PLAN
N.T.S.



LEGEND

- DRAINAGE AREA LIMITS
- B101 / 0.550 / 0.48 — POST-DEVELOPMENT AREA ID; POST-DEVELOPMENT DRAINAGE AREA (ha); 1:5 YEAR WEIGHTED RUNOFF COEFICIENT
- PROPOSED STORM MANHOLE & SEWER WITH DIRECTION OF FLOW
- PROPOSED PERFORATED SUBDRAIN
- PROPOSED CATCHBASIN AND LEAD
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED STORM OGS UNIT
- RD1 — PROPOSED CONTROL FLOW ROOF DRAIN
- LIMITS OF 100-YEAR ROOF PONDING
- PROPOSED MAJOR OVERLAND FLOW ROUTE
- X — REMOVALS
- *EXISTING STORM MANHOLE & SEWER WITH DIRECTION OF FLOW*
- *EXISTING CATCHBASIN AND LEAD*
- *EXISTING CATCHBASIN MANHOLE*
- *EXISTING STORM OGS UNIT*
- *EXISTING LANDSCAPE DRAIN*
- *EXISTING MAJOR OVERLAND FLOW ROUTE*

PROPOSED PART 4 EXPANSION BUILDING

EXISTING BUILDING

REFER TO PLAN 123089-NDT FOR ADDITIONAL NOTES, DETAILS AND TABLES

NOTE:
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Queensway Carleton Hospital

No.	REVISION	DATE	BY
2.	REISSUED FOR SITE PLAN CONTROL APPROVAL	SEP 25/26	FST
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE 1:750 (1:750, 0 10 20 30)

DESIGN FST/KD
CHECKED FST
DRAWN KD
CHECKED FST
APPROVED FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER — K. J. AULD — 100187063 — Sept 25, 2026 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — F.S. THAUVETTE — 100041399 — September 25, 2026 — PROVINCE OF ONTARIO

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Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
STORMWATER MANAGEMENT PLAN

PROJECT No. 123089
REV. REV #2
DRAWING No. 123089-SWM

ZBA# D02-02-25-0093 & SPC# D07-12-25-0163

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PLANNED_123089-SWM.dwg

GENERAL NOTES:

1. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.
4. BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $5,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5. COMPLETE ALL WORKS IN ACCORDANCE WITH THE MOST CURRENT CITY OF OTTAWA STANDARDS AND SPECIFICATIONS USING THE CURRENT GUIDELINES, BYLAWS AND STANDARDS INCLUDING MATERIALS OF CONSTRUCTION, DISINFECTION AND ALL RELEVANT REFERENCES TO OPSS, OPSD & AWWA GUIDELINES - ALL CURRENT VERSIONS AND 'AS AMENDED'.
6. RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA, OWNER, AND ENGINEER.
7. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
8. ALL ELEVATIONS ARE GEODETIC.
9. REFER TO THE GEOTECHNICAL REPORT (CA0033714.1722, DATED SEPTEMBER 03, 2026), PREPARED BY WSP CANADA INC., FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS, AND GEOTECHNICAL INSPECTION REQUIREMENTS. THE GEOTECHNICAL CONSULTANT SHALL REVIEW ON-SITE CONDITIONS AFTER EXCAVATION PRIOR TO PLACEMENT OF THE GRANULAR MATERIAL.
10. REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARD SURFACED AREAS AND DIMENSIONS.
11. REFER TO THE 'QCH PART 4 SITE SERVICING REPORT' (R-2025-078) AND TO THE 'QCH PART 4 STORMWATER MANAGEMENT REPORT' (R-2025-085), PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.
12. SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
13. PROVIDE LINE/PARKING PAINTING.
14. CONTRACTOR TO PROVIDE THE CONSULTANT WITH SERVICING PLANS OF 123089-GP1 & 123089-GP2 INDICATING ALL SERVICING AS-BUILT INFORMATION SHOWN ON THE SERVICING PLAN. AS-BUILT INFORMATION MUST INCLUDE: PIPE MATERIAL, SIZES, LENGTHS, SLOPES, INVERT AND T/G ELEVATIONS, STRUCTURE LOCATIONS, VALVE AND HYDRANT LOCATIONS, T/WM ELEVATIONS AND ANY ALIGNMENT CHANGES, ETC.

SEWER NOTES:

1. SUPPLY AND CONSTRUCT ALL SEWERS AND APPURTENANCES IN ACCORDANCE WITH THE MOST CURRENT CITY OF OTTAWA STANDARDS AND SPECIFICATIONS - ALL CURRENT VERSIONS AND 'AS AMENDED'.
2. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
CATCHBASIN (600x600mm)	705.010	OPSD
[illegible]	701.010	OPSD
[illegible]	701.011	OPSD
[illegible]	701.012	OPSD
CB, FRAME & COVER	S19.1	CITY OF OTTAWA
SANITARY MH FRAME & COVER	S24	CITY OF OTTAWA
STORM MH / CBMH FRAME & COVER	S24.1	CITY OF OTTAWA
WATERTIGHT MH FRAME AND COVER	401.030	OPSD
SEWER TRENCH	S6	CITY OF OTTAWA
SEWER CONNECTION - RIGID MAIN	S11	CITY OF OTTAWA
SEWER CONNECTION - FLEXIBLE MAIN	S11.1	CITY OF OTTAWA
INSULATION FOR SHALLOW SEWERS	S35	CITY OF OTTAWA
MH DROP STRUCTURES	1003.010	OPSD
SANITARY SEWER	PVC DR 35	
CATCHBASIN LEAD	PVC DR 35	
STORM SEWER (450mm DIAMETER AND UNDER)	PVC DR 35	
STORM SEWER (525mm DIAMETER AND OVER)	CONCRETE 65-D, 100-D, 140-D	

3. ALL STORM AND SANITARY SERVICE LATERALS SHALL BE EQUIPPED WITH A BACKFLOW PREVENTION DEVICE AS PER THE CITY OF OTTAWA STANDARD DETAILS S14 AND S14.1 / S14.2.
4. INSULATE ALL PIPES (SAN/STM) THAT HAVE LESS THAN 1.8m COVER WITH HI-40 INSULATION PER CITY OF OTTAWA STANDARD DETAIL S35. PROVIDE 150mm CLEARANCE BETWEEN PIPE AND INSULATION.
5. SERVICES ARE TO BE CONSTRUCTED TO 1.0m FROM FACE OF BUILDING AT A MINIMUM SLOPE OF 1.0%.
6. PIPE BEDDING, COVER AND BACKFILL ARE TO BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. THE USE OF CLEAR CRUSHED STONE AS A BEDDING LAYER SHALL NOT BE PERMITTED.
7. FLEXIBLE CONNECTIONS ARE REQUIRED FOR CONNECTING PIPES TO MANHOLES (FOR EXAMPLE KOR-N-SEAL, PSX: POSITIVE SEAL AND DURASEAL). THE CONCRETE CRADLE FOR THE PIPE CAN BE ELIMINATED.
8. THE OWNER SHALL REQUIRE THAT THE SITE SERVICING CONTRACTOR PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16, 410.07.16.04 AND 407.07.24. DYE TESTING IS TO BE COMPLETED ON ALL SANITARY SERVICES TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN. THE FIELD TESTS SHALL BE PERFORMED IN THE PRESENCE OF A CERTIFIED PROFESSIONAL ENGINEER WHO SHALL SUBMIT A CERTIFIED COPY OF THE TEST RESULTS.
9. ALL STORM MANHOLES AND CATCHBASIN MANHOLES WITH PIPES LESS THAN 900mm DIAMETER AND UNDER ARE TO HAVE 300mm SUMPS UNLESS OTHERWISE INDICATED. ALL CATCHBASINS ARE TO HAVE 600mm SUMPS UNLESS OTHERWISE INDICATED. MANHOLES WITH PIPES LARGER THAN 900mm DIAMETER TO BE BENCHED WITHOUT A SUMP.
10. ALL CATCHBASINS, MANHOLES AND/OR CATCHBASIN MANHOLES THAT ARE TO HAVE ICD'S INSTALLED WITHIN THEM ARE TO HAVE 600mm SUMPS.
11. ALL WEEPING TILE CONNECTIONS TO BE MADE TO THE PROPOSED STORM SEWER SYSTEM DOWNSTREAM OF ANY INLET CONTROL DEVICES.
12. [illegible] COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES. PROVIDE A COPY OF ALL CCTV INSPECTION REPORTS TO THE ENGINEER FOR REVIEW.

WATERMAIN NOTES:

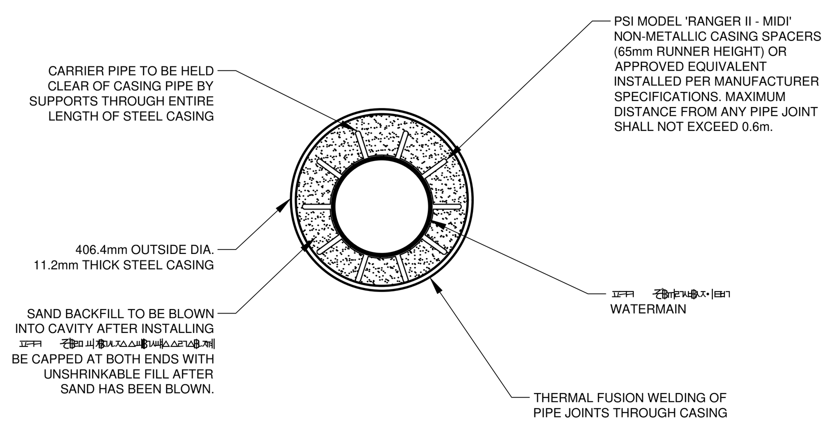
1. SUPPLY AND CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS - ALL CURRENT VERSIONS AND 'AS AMENDED'. EXCAVATION, INSTALLATION, BACKFILL AND RESTORATION OF ALL WATERMAINS BY THE CONTRACTOR. CONNECTIONS AND SHUT-OFFS AT THE MAIN BY CITY OF OTTAWA FORCES. CHLORINATION OF THE WATER SYSTEM SHALL BE PERFORMED BY THE CONTRACTOR IN THE PRESENCE CITY OF OTTAWA FORCES.
2. SPECIFICATIONS:

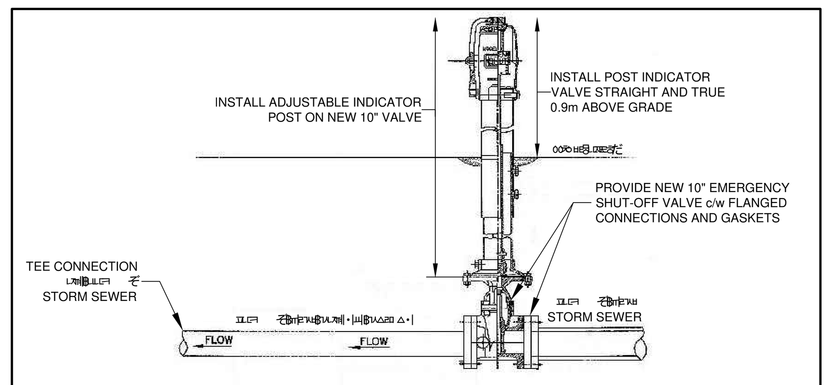
ITEM	SPEC. No.	REFERENCE
WATERMAIN TRENCHING	W17	CITY OF OTTAWA
HYDRANT INSTALLATION	W19	CITY OF OTTAWA
THERMAL INSULATION IN SHALLOW TRENCHES	W22	CITY OF OTTAWA
THERMAL INSULATION AT OPEN STRUCTURES	W23	CITY OF OTTAWA
VALVE BOX ASSEMBLY	W24	CITY OF OTTAWA
WATERMAIN CROSSING BELOW SEWER	W25	CITY OF OTTAWA
WATERMAIN CROSSING OVER SEWER	W25.2	CITY OF OTTAWA
CONCRETE THRUST BLOCKS	W25.3	CITY OF OTTAWA
THRUST BLOCK DIMENSION TABLES	W25.4	CITY OF OTTAWA
WATERMAIN MATERIAL	PVC DR 18	

3. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED.
4. PROVIDE MINIMUM 0.5m CLEARANCE BETWEEN OUTSIDE OF PIPES AT ALL CROSSINGS, WHERE POSSIBLE UNLESS OTHERWISE INDICATED.
5. WATER SERVICE IS TO BE CONSTRUCTED TO WITHIN 1.0m OF FOUNDATION WALL AND CAPPED, UNLESS OTHERWISE INDICATED.
6. HYDRANTS SHALL BE ROTATED AT THE FLANGE TO FACE THE ROAD AND ALLOW FIRE SERVICES TO OPERATE THE NUTS.
7. ALL NEW HYDRANTS ON PRIVATE PROPERTY SHALL BE PAINTED RED WITH A WHITE BONNET PER CITY MATERIAL SPECIFICATION MW-19.4.

STEEL CASING DETAIL - WATERMAIN CROSSING BELOW PARKING GARAGE

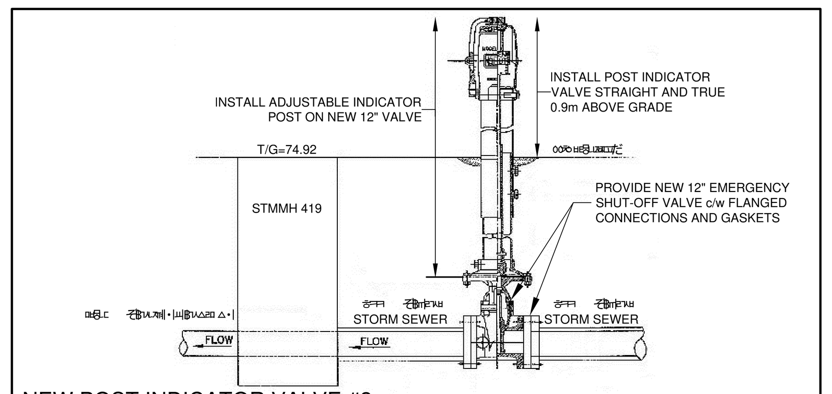
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NEW POST INDICATOR VALVE #1

N.T.S.



NEW POST INDICATOR VALVE #2

N.T.S.

NOTE:
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GRADING NOTES:

1. ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS AS DIRECTED BY THE SITE ENGINEER OR GEOTECHNICAL ENGINEER.
2. EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER AND INSPECTED BY THE GEOTECHNICAL ENGINEER PRIOR TO THE PLACEMENT OF GRANULARS.
3. ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUB-EXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.
4. THE GRANULAR BASE SHOULD BE COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5. MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.
6. MAXIMUM TERRACING GRADE TO BE 3:1 UNLESS OTHERWISE NOTED.
7. ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.
8. ALL CURBS SHALL BE BARRIER CURB (150mm) UNLESS OTHERWISE NOTED AND CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.1).
9. ALL CONCRETE SIDEWALKS SHALL BE CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.4) UNLESS OTHERWISE INDICATED.
10. ALL RETAINING WALLS OF AT LEAST 0.6m IN HEIGHT SHALL HAVE FENCING/RAILING ALONG TOP SURFACE OF WALL PER OBC ARTICLE 9.8.8.1.
11. SEPARATE RETAINING WALL DRAWINGS AND REPORT SHALL BE REQUIRED FOR ALL STRUCTURAL RETAINING WALLS WITH A HEIGHT GREATER THAN 1.0m. THE RETAINING WALL DOCUMENTS SHALL BE STAMPED BY A GEOTECHNICAL OR STRUCTURAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO PER CITY OF OTTAWA GUIDELINES.
12. REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.
13. CONTRACTOR TO PROVIDE THE CONSULTANT WITH GRADING PLANS INDICATING AS-BUILT ELEVATIONS OF ALL DESIGN GRADES SHOWN ON PLANS 123089-GR1 AND 123089-GR2.

EROSION AND SEDIMENT CONTROL NOTES :

1. ALL EROSION AND SEDIMENT CONTROLS ARE TO BE INSTALLED TO THE SATISFACTION OF THE OWNER, ENGINEER, AND THE CITY OF OTTAWA. THEY ARE TO BE APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION. THESE PRACTICES ARE TO BE IMPLEMENTED IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL AND SHOULD INCLUDE AS A MINIMUM THOSE MEASURES INDICATED ON THE PLAN.
2. EROSION AND SEDIMENT CONTROL MEASURES WILL BE IMPLEMENTED DURING CONSTRUCTION IN ACCORDANCE WITH THE "GUIDELINES ON EROSION AND SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES" (GOVERNMENT OF ONTARIO, MAY 1987). THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR MEETING ALL REGULATORY AGENCY REQUIREMENTS.
3. TO PREVENT SURFACE EROSION FROM ENTERING ANY STORM SEWER SYSTEM DURING CONSTRUCTION, FILTER BAGS WILL BE PLACED UNDER GRATES OF NEARBY CATCHBASINS AND STRUCTURES. A LIGHT DUTY SILT FENCE BARRIER WILL ALSO BE INSTALLED AROUND THE CONSTRUCTION AREA (WHERE APPLICABLE). THESE CONTROL MEASURES WILL REMAIN IN PLACE UNTIL CONSTRUCTION IS COMPLETE.
4. TO LIMIT EROSION: MINIMIZE THE AMOUNT OF EXPOSED SOILS AT ANY GIVEN TIME, RE-VEGETATE EXPOSED AREAS AND SLOPES AS SOON AS POSSIBLE AND PROTECT EXPOSED SLOPES WITH NATURAL OR SYNTHETIC MULCHES.
5. FOR MATERIAL STOCKPILING: MINIMIZE THE AMOUNT OF EXPOSED MATERIALS AT ANY GIVEN TIME; APPLY TEMPORARY SEEDING, TARPS, COMPACTION AND/OR SURFACE ROUGHENING AS REQUIRED TO STABILIZE STOCKPILED MATERIALS THAT WILL NOT BE USED WITHIN 14 DAYS.
6. ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE MAINTAINED IN GOOD WORKING ORDER. IF MAINTENANCE OR REPAIRS ARE IDENTIFIED, THEY MUST BE COMPLETED WITHIN 24 HOURS. THE SEDIMENT CONTROL MEASURES SHALL ONLY BE REMOVED WHEN, IN THE OPINION OF THE ENGINEER, THE MEASURES ARE NO LONGER REQUIRED. NO CONTROL MEASURES MAY BE PERMANENTLY REMOVED WITHOUT PRIOR AUTHORIZATION FROM THE ENGINEER.
7. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO ANY STORM SEWER SYSTEM. APPROPRIATE RESPONSE MEASURES, INCLUDING ANY REPAIRS TO EXISTING CONTROL MEASURES OR THE IMPLEMENTATION OF ADDITIONAL CONTROL MEASURES, SHALL BE CARRIED OUT BY THE CONTRACTOR WITHOUT DELAY.
8. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
9. ROADWAYS ARE TO BE SWEPT AS REQUIRED OR AS DIRECTED BY THE OWNER AND/OR ENGINEER.
10. THE CONTRACTOR SHALL ENSURE PROPER DUST CONTROL IS PROVIDED WITH THE APPLICATION OF WATER (AND IF REQUIRED, CALCIUM CHLORIDE) DURING DRY PERIODS. MONITOR DUST LEVELS DURING SITE PREPARATION/EXCAVATION, AND CONSTRUCTION ACTIVITIES, AND WHEN DUST LEVELS BECOME VISUALLY APPARENT SPRAY WATER TO MINIMIZE THE RELEASE OF DUST FROM GRAVEL, PAVED AREAS AND EXPOSED SOILS. USE CHEMICAL DUST SUPPRESSANTS ONLY WHERE NECESSARY ON PROBLEM AREAS.

PAVEMENT STRUCTURES:

LIGHT DUTY (PARKING GARAGE / STALLS - CARS ONLY)
50mm SUPERPAVE 12.5
150mm GRANULAR "A"
300mm GRANULAR "B"
ASPHALT GRADE PG 58-34
*INSTALLED PER GEOTECHNICAL REPORT

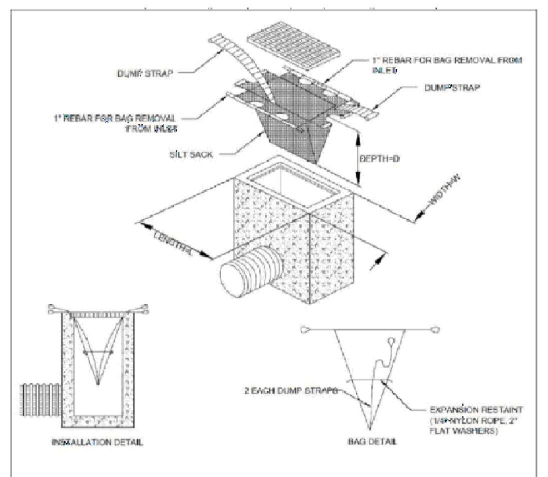
HEAVY DUTY (AMBULANCE PARKING / PARKING GARAGE - TRUCK TRAFFIC)
50mm SUPERPAVE 12.5
60mm SUPERPAVE 19.0
200mm GRANULAR "A"
400mm GRANULAR "B"
ASPHALT GRADE PG 58-34
*INSTALLED PER GEOTECHNICAL REPORT

HEAVY DUTY (NEW ROADWAYS / LOADING DOCK AREA)
60mm SUPERPAVE 12.5
60mm SUPERPAVE 19.0
300mm GRANULAR "A"
400mm GRANULAR "B"
ASPHALT GRADE PG 58-34
*INSTALLED PER GEOTECHNICAL REPORT

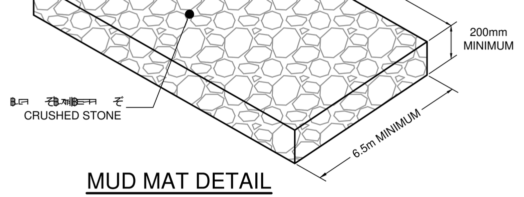
RIGID PAVEMENT STRUCTURE (LOADING DOCKS)
150mm PORTLAND LIMESTONE CEMENT CONCRETE OR EQUIVALENT
50mm (MIN.) HIGH-DENISTY RIGID STYROFOAM INSULATION
300mm GRANULAR "A"
900mm GRANULAR "B"
*INSTALLED PER GEOTECHNICAL REPORT

Erosion and Sediment Control Responsibilities:

	ESC Measure	Symbol	Specification	During Construction: Installation Responsibility	During Construction: Inspection/Maintenance Responsibility	During Construction: Inspection Frequency	After Construction Prior to Final Acceptance: Approval to Remove	After Construction Prior to Final Acceptance: Removal Responsibility	After Final Acceptance: Inspection/Maintenance Responsibility
Temporary Measures	Silt Fence (Light Duty)	—	OPSD 219.110	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Filter Bags	Location as indicated in ESC Note #3	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Mud Mat	MM	Drawing Details	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A
	Dust Control	Location as Required Around Site	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A
	Stabilized Material Stockpiling	Location as Required by Contractor	Erosion and Sediment Control Notes	Developer's Contractor	Developer's Contractor	Weekly (as a minimum) and after every Significant Storm Event	Consultant	Developer's Contractor	N/A
	Sediment Basin (for flows being pumped out of excavations)	Location as Required by Contractor	. . .	Developer's Contractor	Developer's Contractor	After every Significant Storm Event	Developer's Contractor	Developer's Contractor	N/A



INLET SEDIMENT CONTROL DEVICE
N.T.S.



MUD MAT DETAIL
N.T.S.

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
2+000.00	78.55	[illegible] *	[illegible]
2+008.80	78.33	75.93 ***	[illegible]
2+014.20	78.26	75.86 ***	[illegible]
2+024.00	77.94	75.54	[illegible]
2+024.50	77.91	75.04	[illegible]
2+025.00	77.89	75.04 ***	[illegible]
2+025.50	77.86	75.04	[illegible]
2+026.40	77.81	75.40	[illegible]
2+027.80	77.76	75.36	[illegible]
2+031.00	77.65	75.25	[illegible]
2+033.20	77.58	75.18 ***	[illegible]
2+034.30	77.57	75.17 ***	[illegible]
2+054.00	77.15	74.75	[illegible]
2+067.90	77.12	** 74.72 ***	[illegible]
2+075.00	77.22	74.82	- - -
2+093.50	76.90	74.50 ***	[illegible]
2+100.00	76.72	74.32	- - -
2+108.60	76.81	74.41	[illegible]
2+114.80	76.92	74.52	[illegible]
2+120.90	77.01	** 74.61 ***	[illegible]
2+126.70	77.05	74.65	[illegible]
2+129.10	77.10	74.70	[illegible]
2+132.50	77.17	74.77 ***	[illegible]
2+136.70	77.28	74.88 ***	[illegible]
2+150.00	77.40	75.00	SLEEVED WM BELOW PARKING GARAGE (SEE STEEL CASING DETAIL)
2+175.00	77.40	75.00	SLEEVED WM BELOW PARKING GARAGE (SEE STEEL CASING DETAIL)
2+200.00	77.40	74.85	SLEEVED WM BELOW PARKING GARAGE (SEE STEEL CASING DETAIL)
2+216.10	76.73	74.33 ***	[illegible]
2+219.70	76.68	74.28 ***	[illegible]
2+223.40	76.50	** 74.21	[illegible]
2+225.40	76.46	** 74.17 ***	[illegible]
2+228.10	76.43	** 74.11 ***	[illegible]
2+229.50	76.55	74.00	[illegible]
2+231.90	76.57	73.95	[illegible]
2+242.80	76.35	** 73.43 ***	[illegible]
2+246.40	76.28	73.58	[illegible]
2+263.00	75.80	** 73.85 ***	[illegible]
2+264.00	75.79	** 73.83	[illegible]
2+264.50	75.78	73.33	[illegible]
2+269.90	75.69	73.29 ***	[illegible]
2+273.60	75.58	73.18 ***	[illegible]
2+281.60	75.30	72.90	200 X 200 X 200 WATER SERVICE ROLLED TEE (4+000.00)
2+292.10	75.10	72.70	[illegible]
2+294.40	75.05	72.65	200 X 200 X 200 HYDRANT LEAD TEE (5+000.00)
2+300.00	74.91	72.51	- - -
2+322.80	74.60	72.20 ***	[illegible]
2+327.30	74.60	72.20 ***	[illegible]
2+331.10	74.67	** 72.39	[illegible]
2+331.60	74.68	** 72.44 ***	[illegible]
2+335.50	74.74	** [illegible] *	[illegible]
2+337.30	74.78	** [illegible] *	[illegible]
2+339.10	74.83	** [illegible] *	[illegible]

* [illegible]
** PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.
*** PIPE CROSSINGS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE. REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
3+000.00	78.53	[illegible] *	[illegible]
3+001.00	78.54	75.98	[illegible]
3+025.00	78.98	76.58	- - -
3+048.80	78.71	76.31 ***	[illegible]
3+049.80	78.69	76.29	[illegible]
3+052.70	78.66	76.26	[illegible]
3+068.80	78.71	76.26 ***	[illegible]
3+073.20	78.66	76.26	[illegible]
3+075.40	78.63	** 76.23 ***	[illegible]
3+086.40	78.70	76.30	[illegible]
3+100.00	79.03	76.49	- - -
3+105.00	78.95	76.55	[illegible]
3+112.30	78.88	** 76.48 ***	[illegible]
3+125.70	78.75	** 76.03 ***	[illegible]
3+139.30	78.89	76.49 ***	[illegible]
3+141.10	78.90	** 76.49 ***	[illegible]
3+142.50	78.91	76.49	[illegible]
3+144.50	78.93	76.49	[illegible]
3+148.10	78.89	76.49	[illegible]
3+171.80	79.19	76.79	[illegible]
3+172.80	79.21	76.80	CAP 1.0m FROM FOUNDATION WALL

* [illegible]
** PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.
*** PIPE CROSSINGS WITH WATERMAINS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE.

PROPOSED WATER SERVICE TABLE - EXISTING PARKING GARAGE

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
4+000.00	75.30	72.90	200 X 200 X 200 WATER SERVICE ROLLED TEE (2+281.60)
4+001.00	75.33	71.90	[illegible]
4+002.00	75.35	71.87	[illegible]
4+003.50	75.40	71.87 ***	[illegible]
4+007.30	75.55	71.87 ***	[illegible]
4+008.30	75.59	71.87	[illegible]
4+009.70	75.78	73.27	[illegible]
4+010.90	75.82	73.31	[illegible]
4+012.60	75.86	[illegible] *	REMOVAL OF EX. BEND AND CONNECTION TO EX. WM C/W REDUCER

* [illegible]
** PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.
*** PIPE CROSSINGS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE. REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

PROPOSED HYDRANT 3 LEAD TABLE

STATION	SURFACE ELEVATION	T/WM ELEVATION	COMMENTS
5+000.00	75.05	72.65	200 X 200 X 200 HYDRANT LEAD TEE (2+294.20)
5+001.00	75.01	72.52	200 X 150 REDUCER
5+002.30	75.00	72.49	[illegible]
5+003.00	75.01	72.49	[illegible]
5+003.60	75.01	71.89	[illegible]
5+004.60	75.02	71.89 ***	[illegible]
5+004.90	75.02	71.89	[illegible]
5+005.40	75.03	72.39	[illegible]
5+006.40	75.04	72.42	[illegible]
5+007.30	75.04	72.45 ***	[illegible]
5+008.80	75.30	72.50	CONNECTION TO NEW HYDRANT 3

** PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 IN SHALLOW TRENCHES WHERE COVER IS LESS THAN 2.4m AND/OR W23 ADJACENT TO OPEN STRUCTURES.
*** PIPE CROSSINGS ARE TO BE IN ACCORDANCE WITH CITY STANDARDS W25 AND W25.2 TO AVOID CONFLICTS, WHERE POSSIBLE. REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

ROOF DRAIN TABLE

AREA ID *	BUILDING	NUMBER OF DRAINS	ROOF DRAIN OPENING SETTING	5-YEAR RELEASE RATE	100-YEAR RELEASE RATE	MAXIMUM STORAGE VOLUME AVAILABLE (m^3)
P4-1	AMBULATORY CARE CENTRE	3	CLOSED	2.54 L/s	2.86 L/s	75.7
		2	1/4 OPEN			
P4-2	EMERGENCY DEPT. ADDITION	2	CLOSED	4.59 L/s	5.39 L/s	92.7
		5	1/4 OPEN			
P4-3	AMB. GARAGE	2	CLOSED	0.64 L/s	0.64 L/s	33.1
P4-4	GENERATOR BLDG.	2	CLOSED	2.22 L/s	2.54 L/s	68.2
		2	1/4 OPEN			
P4-5	TRANSITIONAL CARE TOWER	10	CLOSED	4.78 L/s	5.10 L/s	146.9
		2	1/4 OPEN			
P4-7	MM & EVS BLDG.	2	CLOSED	1.43 L/s	1.59 L/s	23.8
		1	1/4 OPEN			

* REFER TO THE 'QCH PART 4 STORMWATER MANAGEMENT REPORT' (R-2025-085) PREPARED BY NOVATECH FOR DRAINAGE AREA IDENTIFIERS AND STORMWATER MANAGEMENT DETAILS.
**ALL CONTROLLED FLOW ROOF DRAINS FOR THE PROPOSED BUILDINGS TO BE WATTS 'ADJUSTABLE ACCUTROL' ROOF DRAINS.

INLET CONTROL DEVICE DATA TABLE: AREA B104

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	CBMH 402	[illegible]	21.81	0.20
1:100 YR				22.24	

INLET CONTROL DEVICE DATA TABLE: AREA B106

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 94mm	CBMH 419	[illegible]	27.61	0.20
1:100 YR				28.42	

INLET CONTROL DEVICE DATA TABLE: AREA B114

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	EX. CBMH 10	[illegible]	20.48	0.29
1:100 YR				26.57	

INLET CONTROL DEVICE DATA TABLE: AREA B115

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	EX. STMMH 11	[illegible]	15.48	0.26
1:100 YR				24.41	

INLET CONTROL DEVICE DATA TABLE: AREAS B116, B117, B118, B119

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	CBMH 413	[illegible]	20.52	0.50
1:100 YR				26.41	

INLET CONTROL DEVICE DATA TABLE: AREA B128

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 94mm	CB 411	[illegible]	10.80	N/A
1:100 YR				25.45	

INLET CONTROL DEVICE DATA TABLE: AREA B129

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	CB 412	[illegible]	0.73	N/A
1:100 YR				3.89	

INLET CONTROL DEVICE DATA TABLE: AREA B134b

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	CB 414	[illegible]	3.47	0.25
1:100 YR				14.03	

INLET CONTROL DEVICE DATA TABLE: AREA B135b

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	EX. LD 1	[illegible]	2.02	0.53
1:100 YR				7.26	

INLET CONTROL DEVICE DATA TABLE: AREA P4-8

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 225mm	TANK 01	[illegible]	60.47	N/A
1:100 YR				85.06	

INLET CONTROL DEVICE DATA TABLE: AREA P4-9

DESIGN EVENT	ICD TYPE AND SIZE	OUTLET STRUCTURE	DIAMETER OF OUTLET PIPE (mm)	PEAK DESIGN FLOW (L/s)	MAX PONDING DEPTH (m)
1:5 YR	SLIDE-IN PLATE 83mm	TANK 02	[illegible]	10.30	N/A
1:100 YR				13.92	

CRITICAL SEWER PIPE CROSSING TABLE

CROSSING	LOWER PIPE	HIGHER PIPE	CLEARANCE	SURFACE ELEVATION
3 *	[illegible]	U/S DUCT BANK C-C=74.05	[illegible]	75.93 m
4	[illegible]	[illegible]	[illegible]	75.95 m
5 *	[illegible]	U/S DUCT BANK E-E=75.07	[illegible]	76.80 m
6	[illegible]	[illegible]	[illegible]	77.64 m
8	[illegible]	[illegible]	[illegible]	78.33 m
9	[illegible]	[illegible]	[illegible]	78.94 m
10	[illegible]	[illegible]	[illegible]	78.77 m
11	[illegible]	[illegible]	[illegible]	78.89 m
12	[illegible]	[illegible]	[illegible]	78.75 m
13	[illegible]	[illegible]	[illegible]	78.52 m
14	400mmØ SAN T/P=71.35±	[illegible]	[illegible]	78.30 m
15	300mmØ SAN T/P=71.55±	[illegible]	[illegible]	78.72 m
18	200mmØ SAN T/P=72.40±	[illegible]	[illegible]	78.77 m
19	200mmØ SAN T/P=72.04±	[illegible]	[illegible]	78.77 m
20 *	[illegible]	U/S DUCT BANK C-C=73.87	[illegible]	75.75 m
21	300mmØ SAN T/P=73.20±	[illegible]	[illegible]	77.90 m
23 *	[illegible]	U/S DUCT BANK F-F=75.66	[illegible]	77.39 m
24 *	[illegible]	U/S DUCT BANK G-G=75.37	[illegible]	76.92 m
25 *	[illegible]	U/S DUCT BANK X-X=75.78	[illegible]	77.33 m
26 *	[illegible]	U/S DUCT BANK G-G=75.47	[illegible]	77.02 m
27 *	[illegible]	U/S DUCT BANK X-X=75.82	[illegible]	77.37 m
29 *	[illegible]	U/S DUCT BANK F-F=75.82	[illegible]	77.55 m
30	300mmØ SAN T/P=72.50±	[illegible]	[illegible]	78.15 m

* REFER TO ELECTRICAL DRAWINGS PREPARED BY VR ENGINEERING FOR DUCT BANK CROSS-SECTIONS.

CRITICAL HYDRANT LEAD CROSSING TABLE

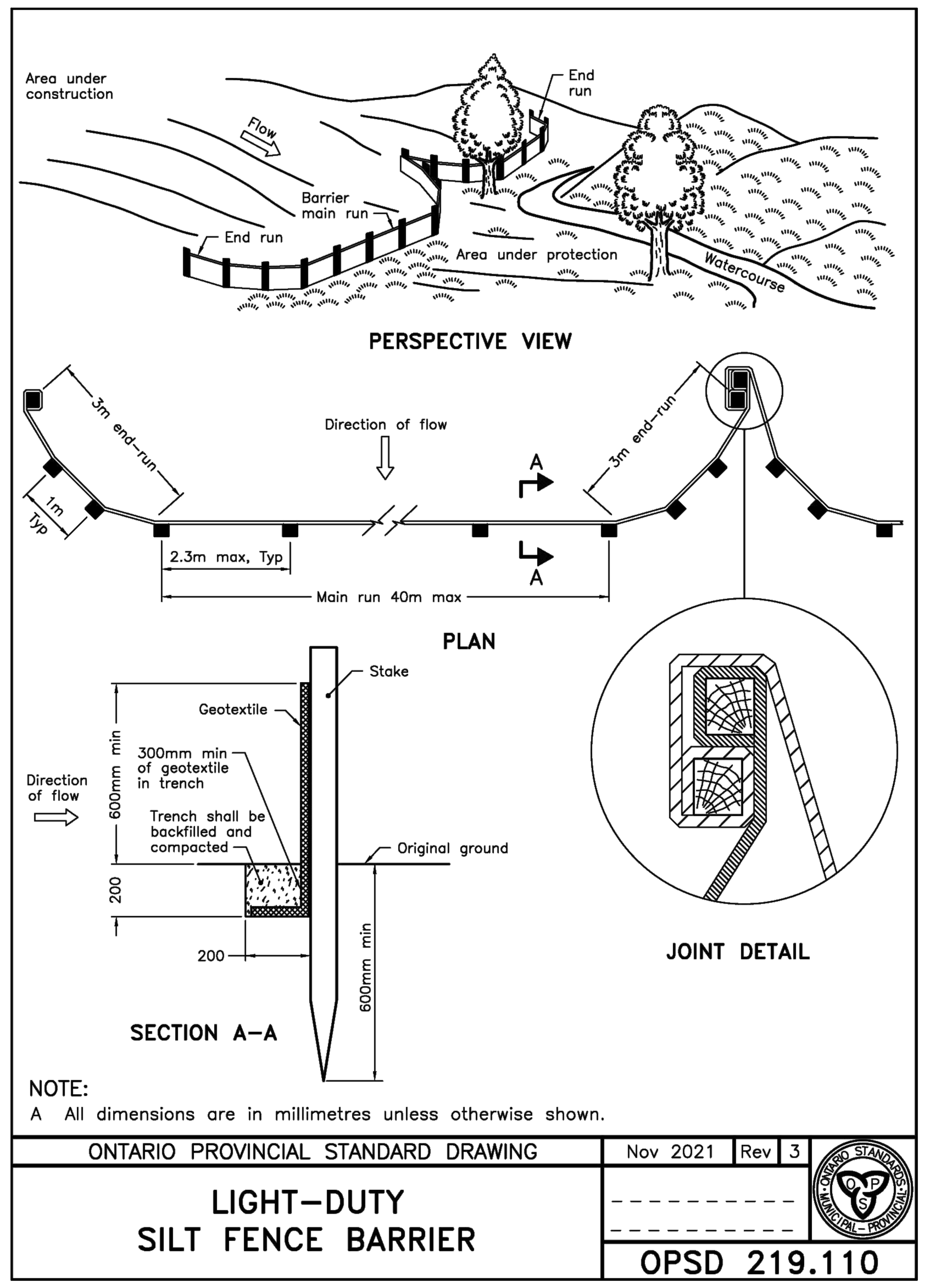
CROSSING	LOWER PIPE	HIGHER PIPE	CLEARANCE	SURFACE ELEVATION
5A	[illegible]	[illegible]	[illegible]	76.83 m
6A	[illegible]	[illegible]	[illegible]	77.11 m

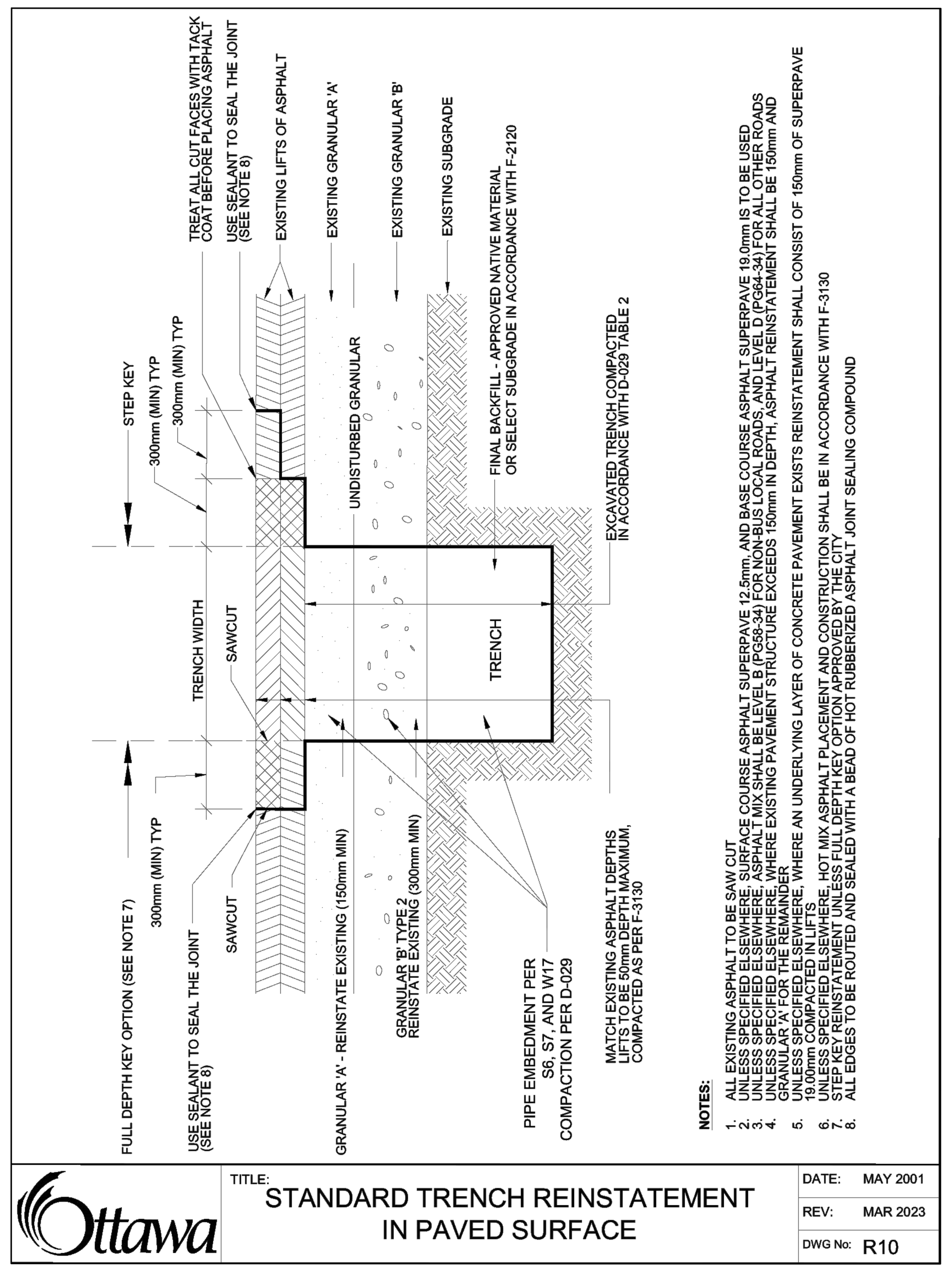
BENCHMARK NOTES:

1. ELEVATIONS SHOWN ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978).
2. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARK HAS NOT BEEN ALTERED OR DISTURBED AND THAT IT'S RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON THIS DRAWING.
3. BENCHMARK WAS PROVIDED ON THE PLAN OF SURVEY OF PART OF LOT 16, CONCESSION 2 (O.F.), GEOGRAPHIC TOWNSHIP OF NEPEAN, CITY OF OTTAWA, SURVEYED BY STANTEC GEOMATICS LTD., DATED NOVEMBER 5, 2024.



KEY PLAN
N.T.S.





ALL PROJECT NOTES, DETAILS AND SPECIFICATIONS ARE TO MEET THE MOST CURRENT AND AMENDED VERSIONS OF THE CITY OF OTTAWA AND PROVINCIAL STANDARDS

THIS PLAN IS TO BE READ IN CONJUNCTION WITH CIVIL PLANS 123089-GP1, 123089-GP2, 123089-GR1, AND 123089-GR2, AS WELL AS 123089-DET1 AND 123089-DET2

Queensway Carleton Hospital

No.	REVISION	DATE	BY
2.	REISSUED FOR SITE PLAN CONTROL APPROVAL	SEP 25/26	FST
1.	ISSUED FOR SITE PLAN CONTROL APPROVAL	NOV 28/25	FST

SCALE: NOT TO SCALE

DESIGN: KD | CHECKED: FST | DRAWN: KD | CHECKED: FST | APPROVED: FST

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER F.S. THAUVETTE 100041399 September 25, 2026 PROVINCE OF ONTARIO

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LOCATION
CITY OF OTTAWA
QUEENSWAY CARLETON HOSPITAL

DRAWING NAME
CIVIL NOTES, DETAILS & TABLES
PART 4 EXPANSION

PROJECT No. 123089
REV: REV #2
DRAWING No. 123089-NDT

ZBA# D02-02-25-0093 & SPC# D07-12-25-0163

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