1DOOR4CARE CHEO INTEGRATED TREATMENT CENTRE

SERVICING AND STORMWATER MANAGEMENT REPORT| SEPTEMBER 18, 2023

WALTERFEDY

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1.0 INTRODUCTION

WalterFedy was retained by EllisDon to provide civil consulting engineering services in support of the construction of a new parking garage structure which will support the Children's Hospital of Eastern Ontario's (CHEO) new 1Door4Care integrated treatment centre at 401 Smyth Road, in the City of Ottawa.

The proposed development plan is to construct a new parking garage on the CHEO campus to meet the forecasted parking demand that will come with the completion of the new 1Door4Care Building. The development will consist of a seven-storey parking garage structure containing approximately 1,050 parking spaces. The proposed parking garage will have a footprint area of approximately 4,807 m2.

The new parking garage will replace an existing surface parking lot located southeast of the existing CHEO building and southwest of the Ottawa Hospital General Campus.

The purpose of this report is to identify how the Site will be serviced for water, sanitary, and storm and to demonstrate compliance with municipal and provincial standards for site servicing and stormwater management.

1.1 Site Location and Background

The overall CHEO campus occupies approximately 13.9 hectares of land on the southwest corner of the Ottawa Health Science Centre (OHSC) campus. The site for the new parking garage has an area of approximately 1.126 hectares will be located on the eastern edge of the CHEO campus – replacing an existing gravel parking lot (Lot E).

The site is bounded by a wooded area to the north, Ring Road to the south, the Ottawa Hospital General Campus to the east, and the CHEO visitor parking lot (Lot A) to the west.

In general, the site slopes from east to west, ranging in elevations from 82.166m along the eastern limits of the site to approximately 82.231m at the southwest corner of the site. The site is currently occupied by an existing gravel parking lot with an asphalt pathway running alongside the northern limits of the site.

1.2 Reference Reports and Drawings

In preparation of this report, the following background information was referenced:

1. 1Door4Care: CHEO Integrated Treatment Centre Preliminary Development Feasibility Review (Parking Garage), Fotenn Planning + Design, prepared for Infrastructure Ontario, October 2022
2. 1Door4Care: CHEO Integrated Treatment Centre Preliminary Functional Servicing Study (Parking Garage), Stantec Consulting Ltd., prepared for Infrastructure Ontario, October 2022
3. 1Door4Care: CHEO Integrated Treatment Centre – Climate Risk Assessment, Stantec Consulting Ltd., prepared for Infrastructure Ontario, December 2022
4. Phase One Environmental Site Assessment, GHD Ltd., prepared for Infrastructure Ontario, June 2020
5. Phase Two Environmental Site Assessment, GHD Ltd., prepared for Infrastructure Ontario, June 2020
6. 1Door4Care: CHEO Integrated Treatment Centre – Geotechnical Investigation Report (Parking Garage), GHD Ltd., prepared for Infrastructure Ontario, October 2022

7. 1Door 4Care: CHEO Integrated Treatment Centre – Hydrogeological Assessment (Parking Garage), GHD Ltd., prepared for Infrastructure Ontario, October 2022
8. Preliminary Geotechnical Design Recommendations, 1Door4Care, CHEO Integrated Treatment Centre, Thurber Engineering Ltd., prepared for EllisDon, December 2022
9. Children's Hospital of Eastern Ontario Parking Garage SPC Application, B+H Architects, prepared for the City of Ottawa, November 2022
10. Civil Design Narrative CHEO Parking Garage, EXP Services inc., prepared for B+H Architects, November 2022
11. Ottawa Health Sciences Centre Site Services Assessment, J.L. Richards & Associates Ltd., prepared for the Ottawa Health Sciences Centre, January 2011
12. Ottawa Health Sciences Centre Storm and Sanitary Sewer Capacity Assessment, Morrison Hershfield, prepared for the University of Ottawa, May 2017
13. Ottawa Health Sciences Centre Stormwater Master Plan, Morrison Hershfield, prepared for the Children's Hospital of Eastern Ontario (CHEO) & Ottawa Children's Treatment Centre (OCTC), July 2019
14. Various Subsurface Utilities Locates, T2 Utility Engineers., prepared for Infrastructure Ontairo, February 2020

The following guidance documents were also referenced in preparation of this report:

1. City of Ottawa: Sewer Design Guidelines, The City of Ottawa, October 2012
2. Ottawa Design Guidelines - Water Distribution, The City of Ottawa, July 2010
3. Stormwater Management Planning and Design Manual, Ministry of the Environment, Conservation and Parks (MECP), March 2003.
4. Design Guidelines for Sewage Works, Ministry of the Environment, Conservation and Parks, March 2019.
5. Design Guidelines for Drinking Water Systems, Ministry of the Environment, Conservation and Parks, May 2019.

2.0 EXISTING CONDITIONS

2.1 Topography, Land Use and Drainage

Existing topographical and legal boundary information for this site was obtained from a survey by Annis, O'Sullivan, Vollebekk Ltd., dated May 2021. The Site occupies approximately 1.1126 ha of land located on the eastern extent of the overall CHEO campus. The majority of the site is currently occupied by an existing gravel parking lot, with gravel surfaces occupying approximately 9,024 m^2 of the site. The site also contains entirely impervious surfaces such as asphalt and concrete, occupying an area of approximately 57.6 m^2.

The topography on site ranges from an elevation of 81.91m along the western edge of the stie to an elevation of 82.22m on the southwestern corner of the site. Based on the topographic survey, there are no catchbasin structures located on site.

No existing stormwater controls appear to exist on site. The drainage from the site is ultimately conveyed through a series of storm sewers towards the northwest corner of the OHSC campus where the campus' internal storm system connects to the City of Ottawa's storm sewers. The City of Ottawa's storm sewers ultimately drains to the Rideau River.

2.2 Existing Servicing

A 300mm diameter watermain exists north of the site and runs along the pedestrian access path connecting the CHEO buildings to the Ottawa General Hospital. A second 300mm diameter watermain runs along the southeastern boundary of the site, fronting the main entrance to the Ottawa General Hospital.

An existing 750mm-diameter storm sewer runs along the northern boundary of the site, underneath of the pedestrian access road connecting the CHEO campus to the Ottawa General Hospital. A separate 375mm diameter storm sewer also runs along the eastern edge of the site. Both storm sewer lines connect to a larger storm sewer line, ultimately leading to a series of 1350mm-diameter storm sewers located in the northwestern corner of the OHSC campus that connect to the City of Ottawa's storm sewer system which ultimately outlets to the Rideau River.

A 300mm-diameter sanitary sewer exists on the northern edge of the site, underneath of the pedestrian access between the CHEO Campus and Ottawa General Hospital. A separate 200mm sanitary sewer exists along the eastern limits of the site. Both sanitary sewers run northwards, and eventually discharge to the 381mm-diameter trunk sewer running west along the northern segment of Ring Road. The system eventually connects to the Rideau River Collector Sewer west of Riverside Drive.

2.3 Other Existing Utilities

Based on utilities information provided by T2 Utility Engineers, it is understood that hydro, gas, and communications servicing lines are readily available in the adjacent rights-of-ways and access roads. Streetlight services are provided in the existing parking area and will be removed or relocated as necessary to facilitate the construction of the proposed parking garage. Local utility companies will be contacted to confirm the capacity of existing utilities and confirm if any upsizing of existing services will be required to service the proposed parking garage.

2.4 Geotechnical Investigation

GHD Ltd. was retained by Infrastructure Ontario to complete a preliminary geotechnical investigation for the proposed development. Supplemental commentary was provided by Thurber Engineering as part of the project team. These reports are provided under a separate cover. The following summarizes the findings of the geotechnical investigation as they relate to proposed grading, servicing, and stormwater management:

- A preliminary investigation was completed in December 2021. During the preliminary investigation a total of 11 boreholes were advanced on site to assess the geotechnical conditions, four of which also included installation of groundwater monitoring wells.

- A supplementary geotechnical investigation was completed in June 2022. A total of 12 boreholes were advanced on site to assess the geotechnical conditions, two of which also included installation of groundwater monitoring wells.

- A layer of asphaltic concrete was found in all boreholes with the exception of boreholes B1-21 to B3-21, BH4-21, BH6-21, BH7-21, MW9-22 to BH12-22, and BH14-22 to BH18-22. The asphaltic concrete layer was noted to have a thickness ranging between 50mm and 175mm.

- All boreholes noted a layer of fill/disturbed native soil, extending a depth of 0.3 to 1.1m below grade. In general, the fill material consisted of a heterogeneous mixture of gravelly sand/silty sand/sandy silt or sand and gravel. Asphalt fragments were found within the fill layer.

- Native soil with a varying composition from silty sand/ gravelly sand/ sand and silt/ sandy gravel/ clayey silt was encountered in all boreholes (with the exception of BH1-21 to MW5-21, BH7-21 to M28-21, and BH15022) and extended to depths of 0.6 to 1.2m below grade. The native soil was found to contain some silt and trace clay.

- Bedrock was encountered in all boreholes at a depth of 0.4 to 1.2m below grade. The bedrock was noted to be shale bedrock and was visually identified as the Georgian Bay Formation. A review of bedrock geology maps of the Ottawa area was conducted for the subsequent Thurber Engineering memorandum, where it was found that the site is located at the border of Carlsbad and Billings Shale formations, not the Georgian Bay Formation referenced in the original GHD report. It was noted that this formation generally consists of dark grey weak to moderately strong shale.

- Adjeleian Allen Rubeli Ltd. created a report in 1998 detailing "swelling shale" conditions that were encountered at the Children's Treatment Centre in the OHSC campus. The report indicated that the swelling shale phenomenon has caused heaving by a factor of 2 to 3mm per year with no evidence to suggest that the swelling will cease in the future.

2.5 Hydrogeological Investigation

GHD Ltd. was retained by Infrastructure Ontario to complete a preliminary hydrogeological investigation for the proposed development. The report is provided under a separate cover. The following summarizes the findings of the hydrogeological investigation as they relate to site servicing and stormwater management:

- The site is primarily underlain by fill, a gravelly sand to sand deposit, and weathered and competent shale bedrock. During the hydrogeological investigation, the fill and gravelly sand to sand deposit were unsaturated while groundwater was found to be present within the weathered bedrock.

- The weathered shale bedrock underlying the site forms an aquitard. Based on hydraulic testing, the horizontal hydraulic conductivity of the bedrock was found to be approximately 9.44×10^{-4} cm/s.

- The shallow course textured soils found on site were determined to have a high infiltration rate of 214 mm/hr. It was noted that while the soils were very permeable, infiltration on site is constrained by shallow bedrock and saturated conditions during precipitation events. The high permeability of the soils paired with the high bedrock on site leads to 'perched groundwater' conditions.

- Groundwater levels measured from January 2021 to August 2022 ranged from 1.32m to 3.09m below grade, with the water table elevation ranging from approximately 78.68m to 80.88m above mean sea level.

2.6 Source Water Protection

According to the Province of Ontario's Source Protection Information Atlas, the Site is not part of any water quality or quantity source water protection areas. As such, the Rideau Valley Source Protection Plan is not applicable to this development. Table I provides the source protection details for the Site.

Table I: Source Protection Details

SOURCE PROTECTION AREA	RIDEAU VALLEY
Water Quality	
Wellhead Protection Area	No
Wellhead Protection Area E (GUDI):	No
Intake Protection Zone:	No
Issue Contributing Area:	No
Significant Groundwater Recharge Area:	No
Highly Vulnerable Aquifer:	No
Event Based Area:	No
Water Quantity	
Wellhead Protection Area Q1:	No
Wellhead Protection Area Q2:	No
Intake Protection Zone Q:	No

3.0 GROUND WATER CONTROL

3.1 Short Term Discharge (During Construction)

The proposed development of the new parking garage on the CHEO campus will require excavations to provide servicing to the Site. Based on the Hydrogeological Assessment of the Site conducted by GHD, an anticipated dewatering rate of 41.73 m3/day was calculated using a 3x safety factor. The predicted groundwater takings are below the Ministry of the Environment, Conservation and Parks (MECP) Environmental Activity and Sector Registry (EASR) limit of 50,000 L/day. Therefore, it is not anticipated that an EASR is required for the utility excavations on Site.

It is noted that the short-term dewatering rate is subject to change, and may potentially be lower, depending on the shoring methodology that is selected. Watertight shoring systems may limit the ingress of water, and dewatering could be completed over a longer timeframe, should the construction timelines permit it, resulting in an overall lower discharge rate. The conservative flow rate is used for the purposes of this functional assessment.

The geotechnical assessment for the dewatering impact to existing structures and sewers around the site will result in negligible increase of effective stress and is not anticipated to be of concern.

3.2 Quality and Discharge

As part of the hydrogeological investigation, samples of groundwater were collected and analyzed for compliance with City of Ottawa Sewer Use By-Law (2003-514) parameters. The analysis notes that the discharge would be a combination of groundwater, surface water runoff and precipitation into the open excavation pits and would require further assessment to confirm its quality and requirement for pre-treatment. Prior to discharge to the sewer, a City of Ottawa sewer-use discharge permit will be required.

3.3 Foundation and Under Slab Drainage

As reported within the Geotechnical Design Report created by Thurber Engineering Ltd., perimeter drains and under slab drains are not required in areas where the finished floor elevation is at least 200 mm above the exterior grades and where surface water is directed away from the proposed parking garage. In areas that include below grade structures, it was recommended that the walls and floors be designed to be water-tight in order to resist

hydrostatic pressures – otherwise perimeter and under slab drainage will be required. The finished floor elevation noted for the parking garage was set to be match or exceed the requirement of being 200 mm higher than exterior grades, therefore perimeter and under slab drains were not incorporated into the parking garage design. Additionally, the elevator pit – which is the sole structure that is proposed to be below grade – is proposed to contain a sanitary connection which will act as a drainage structure.

4.0 PROPOSED CONDITIONS

The Development is to consist of a seven-storey parking garage structure to support the construction and operation of the new 1Door4Care facility. The proposed development will contain approximately 1,050 parking spaces.

5.0 SANITARY SERVICING

5.1 Design Criteria

The City of Ottawa relies on their Ottawa Sewer Design Guidelines for design of wastewater and stormwater infrastructure. The following requirements are noted for the development:

- A Manning's Roughness Coefficient of 0.013 for all PVC pipes and all new sanitary sewer systems
- A minimum velocity of 0.6m/s and maximum velocity of 3.0m/s is permitted within the pipe
- An average wastewater flow rate for institutional areas of 28,000 L/ha/day
- An institutional peaking factor of 1.5
- An infiltration allowance of 0.33 L/s/effective gross ha

The proposed development is expected to discharge all drips collected within the parking garage (including windblown rain, snow, and precipitation carried in by vehicles) to the sanitary sewer system, with the exception of drainage collected on the uppermost open storey of the structure.

5.2 Total Sanitary Demand

The proposed development is expected to discharge domestic sanitary sewage to the private sanitary sewer system on site. Under the City of Ottawa's Ottawa Sewer Design Guidelines, institutional areas are given an average sewage flow rate of 28,000 L/ha/day and is to be peaked using a peaking factor of 1.5. The total calculated wastewater from the site was calculated as shown in Table II below.

Table II: Sanitary Flow Calculation

Average Daily Wastewater Flow (Institutional Areas)	28,000	*L/ha/day*
Site Area	1.126	Ha
Average Daily Wastewater Flow	0.365	L/s
Peaking Factor	1.5	
Peak Domestic Wastewater Flow	**0.547**	**L/s**
Site Area	1.126	ha
Infiltration Allowance (0.33 L/s/ha)	0.330	L/s
Total Sanitary Drainage	**0.919**	**L/s**

It should be noted that there are no washrooms in this parking garage, and the floor drains are being directed to the storm sewer. As such, it is anticipated that the anticipated sanitary flow will be significantly less than what is listed above.

5.3 Wastewater Collection and Discharge

Wastewater from the site will be collected in private sanitary sewers within the site. It is anticipated that a 300mm diameter sanitary sewer will be sufficient to convey the sewage to the existing sanitary sewer located north of the site.

The design of the sewers for this project was completed using the Chézy-Manning formula with a roughness coefficient of 0.013 in accordance with City of Ottawa Guidelines. Table III below illustrates the minimum design considerations for the service connection to the northern 150mm diameter sanitary sewer to ensure compliance with MECP requirements and provide self cleansing velocities within the pipe. A full sanitary sewer design sheet is provided within Appendix B.

Table III: Sanitary Service Design

Diameter of Service	250	*mm*
Minimum Slope of Service	0.50	*%*
Full Flow Capacity	42.05	*L/s*
Full Flow Velocity	0.86	*m/s*

The sanitary sewers will be constructed at a minimum depth of 1.2m below ground surface to prevent freezing. Insulation will be provided for sewers that cannot be placed at this minimum depth to prevent freezing.

A capacity assessment of the existing system was completed in 2011 by J.L. Richards. The subsequent report notes that the sanitary sewers within the north-west corner of the OHSC campus had a capacity of over 215 L/s at the outlet of the OHSC campus sewer system, and 325 L/s downstream of the National Defence Medical Centre. No capacity constraints were noted in the downstream system at the time of the report.

6.0 WATER DISTRIBUTION DESIGN

A 200mm-diameter watermain exists along Ring Road at the western limits of the Site, and a 300mm-diameter watermain exists along the access road at the eastern limits of the Site.

6.1 Design Criteria

The City of Ottawa's *Ottawa Design Guidelines – Water Distribution* defer to MECP requirements for water distribution. In accordance with MECP guidelines, the water distribution system shall be capable of delivering the water demands at a minimum residual pressure of 275 kPa (40 psi) in a non-fire scenario and at a minimum residual pressure of 140 kPa (20 psi) in the event of a fire. Under standard conditions, the MECP guidelines recommend an operating pressure in the range of 350 kPa (50 psi) to 480 kPa (70 psi), with pressure at any point in the system not exceeding 700 kPa (100 psi).

6.2 Fire Water Demand

Water demand for fire protection was calculated in accordance with the Fire Underwriter's Survey *Water Supply for Public Fire Protection* (FUS 2020).

It is understood that from a building code perspective, the proposed building will be classified as consisting of non-combustible construction.

6.2.1 FUS 2020 Methodology

The required fire flow (RFF) is calculated based on a coefficient of construction (C) and the effective floor area (A)

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

The following sections outline reasoning used to determine the values of the above coefficients, as well as the adjustments made to the required fire flow for the proposed development.

(1) Coefficient of Construction

The FUS 2020 classification uses different definitions for the type of construction, corresponding to a type of construction coefficient used in the calculations. FUS 2020 has the following definitions that are considered applicable to the development:

- Fire-Resistive Construction (Type I) (C=0.6): A building is considered to be of Fire-resistive construction (Type I) when all structural elements, walls, arches, floors, and roof are constructed with a minimum 2-hour fire resistance rating, and all materials used in the construction of the structural elements, walls, arches, floors, and roofs are constructed with non-combustible materials.

- Non-combustible Construction (Type II) (C=0.8): A building is considered to be of Non-combustible construction (Type II) when all structural elements, walls, arches, floors, and roofs are constructed with a minimum 1-hour fire resistance rating and are constructed with non-combustible materials.

Based on the Preliminary Code Review, the facility does not classify as a Fire-Resistive Construction (C=0.6), as all structural members do not have a 2-hour fire resistance rating ("Roofs that do not support an occupancy do not require fire-resistance ratings"). As such, a Coefficient of Construction, C=0.8, is proposed for the development under FUS 2020.

(2) Effective Floor Area

FUS 2020 notes that for open parking garages, the area of the largest floor should be used as the Total Effective Area. As such, the total effective floor area used within the calculation was approximately 4807 m^2.

Based on the above, an RFF of 12,000 LPM (200 L/s) is noted for this building.

(3) Occupancy Charge

The RFF calculated within the above section can be modified depending on the various occupancy classes defined within FUS 2020. Occupancy charges area assigned based on the fire hazard level associated with the contents that will be stored within the proposed development. The main categories defined under FUS 2020 area as follows:

- Non-combustible Contents (-25%): includes merchandise or materials (including stock, furniture, and equipment) which in permissible quantities does not themselves constitute an active fuel for the spread of fire.

- Limited Combustible Contents (-15%): includes merchandise or materials of a low combustibility, with limited concentration of combustible materials.

- Combustible Contents (0%): Includes merchandise or materials of moderate combustibility.

- Free Burning Contents (+15%): Includes merchandise or materials which burn freely, constituting an active fuel.

- Rapid Burning Contents (+25%): Includes merchandise or materials which either burn with great intensity, spontaneously ignite and are difficult to extinguish, or give off flammable or explosive vapours at ordinary temperature.

The proposed development falls into the major occupancy category of "storage garages, including open air parking garages" from the National Building Code of Canada (NBC). This major occupancy category has a suggested occupancy charge of combustible according to FUS 2020; therefore, no adjustments were made to the calculated RFF.

(4) Automatic Sprinkler Protection

The required RFF can be further reduced depending on the adequacy of the automatic sprinkler system provided. Table IV identifies the available credits that can be applied depending on the design of the automatic sprinkler system.

Table IV: Sprinkler Credits (FUS 2020)

Automatic Sprinkler System Design	Credit
Automatic sprinkler protection designed and installed in accordance with NFPA 13	30%
Water supply is standard for both the system and Fire Department hose lines	10%
Fully supervised system	10%

Given the design of the sprinkler system for the proposed building, all three of the above listed credits were applied to the system, resulting in an RFF reduction of 50%.

(5) Exposure Charge Adjustment

The RFF of the development can be increased depending on the distance between exposed risks (i.e. structures, stored materials, forests, etc.) and the proposed development. The exposure charges applied to the building depends on the separation distance between the building and the exposed risk. Table V summarizes the exposed risks identified, their measured separation differences, and the exposure adjustment charge applied.

Table V: Summary of Exposure Charges Applied

EXPOSED RISK IDENTIFIED	SEPARATION DISTANCE MEASURED	EXPOSURE CHARGE APPLIED
Main CHEO Building	>30m	0%
The Ottawa General Hospital Campus	>30m	0%
Total Exposure Charge Applied		**0%**

(6) Total Required Fire Flow

A summary of the calculated RFF and subsequent modifications made using the FUS 2020 methodology is provided in Table VI below.

Table VI: Summary of Required Fire Flow Calculations

Calculated Required Fire Flow	12,000 L/min
Occupancy Charge Applied	0%
Adjusted Required Fire Flow	12,000 L/min
Automated Sprinkler Protection Credit Applied	-50%
Adjusted Required Fire Flow	6,000 L/min
Exposure Charges Applied	0%
Adjusted Required Fire Flow	6,000 L/min
Total Required Fire Flow	**100 L/s**

6.3 Municipal System Capacity and Service Design

Hydrant flow testing was conducted by Clean Water Works on the Ottawa Health Science Centre Campus throughout April and May 2021. The report prepared by Clean Water Works is provided within Appendix B. One hydrant tested during this inspection were noted to be within close proximity to the Site (Hydrant PPH328-02). The results of the flow test noted that a static pressure of 50 PSI was available at the Site, and a residual pressure of 54 PSI was measured at a flow of 1190 GPM. An N185 graph of the results is included within Appendix B.

Extrapolating the results of the flow test, it is noted that the rated capacity of the system at 20 PSI is in the order of 2650 GPM or approximately 168 L/s. This value is greater than the calculated fire flow rate of 100 L/s, therefore no impacts to the municipal system are expected as a result of this development.

7.0 STORM SERVICING AND STORMWATER MANAGEMENT

7.1 Design Criteria

Morrison Hershfield completed a Stormwater Master Plan for the OHSC campus in July, 2019. The conclusions and recommendations of the Stormwater Master Plan governs all stormwater management measures on Site. The following is the design criteria based on the most stringent requirements from the MECP in addition to the conclusions and recommendations of the Stormwater Master Plan:

- **Quantity Control:** Provide attenuation such that peak flows for proposed conditions are equal to or less than the peak flow recorded for the pre-development 2-year design storm event. The attenuation is to be provided for the 2-year through 100-year design events. The 3-hour City of Ottawa design storm events will be used for this assessment for all event to the 100-year. Peak flow shall be determined using a C value of 0.5 in accordance with the City of Ottawa Sewer Design Guidelines.

- Quality Control: Quality Control is provided by the oil grit separator installed at the northwester corner of the OHSC campus. No further water quality control measures are anticipated to be needed for the proposed development.

- Water Balance: Review significance of existing groundwater systems and develop recommendations for groundwater recharge and water balance to the extent technically, physically and economically practicable.

7.2 Existing Stormwater Management Controls

The evaluation of the existing storm sewer conditions conducted as part of the Master Plan prepared by Morrison Hershfield found several problems with the existing stormwater management system in the OHSC campus. Existing conditions modelling of the system indicated that, under the 5-year and 100-year storm events, peak flow directed to the receiving Alta Vista Hospital Link (AVHL) sewer exceeded the 10-year flow of 3,920 L/s that the sewer was designed for. In addition to the peak flow exceedance noted above, it was also found that 20% of storm sewers within the campus exceeded their theoretical full flow capacity under the 2-year storm event. This number increases to 37% under the 5-year storm event and 60% under the 100-year storm event. The modelling conducted also indicated that elevated hydraulic grade line elevations exist in the minor system during intense storm events.

To remedy these noted issues, three recommendations were provided. These recommendations included implementing backflow preventers be installed on all building drainage connections to the minor system, inlet control devices should be installed on highlighted catchbasin structures, and future development within the OHSC campus adhere to strict stormwater quantity control criteria. The phasing and priority of the above recommendations were suggested to be completed in the order that they were presented above.

The subject site itself does not appear to have any existing controls. As summarized above, the *Stormwater Master Plan* for the OHSC campus completed by Morrison Hershfield in 2019 provides several criteria for stormwater management design on the campus. The report states that peak flows from future developments under all storm events shall be controlled to the pre-existing 2-year storm conditions. Additionally, peak flow from pre-development conditions shall be determined using a runoff coefficient value of 0.5 in accordance with the City of Ottawa Sewer Design Guidelines.

7.3 Existing Conditions

Under existing conditions runoff from the Site is directed towards two outlets. The majority of the Site (approximately 0.99 ha) directs runoff to the wooded area along the northern boundary of the Site, while the remaining 0.20 ha directs runoff towards the Ring Road storm sewer system. An existing catchment areas plan has been provided within Appendix A of this report. A summary of the pre-development catchment parameters is provided within Table VII below.

Table VII: Summary of Pre-Development Catchment Parameters

CATCHMENT ID	DESCRIPTION	AREA (HA)
101	Main portion of the existing gravel parking lot – directs runoff to north hospital outlet.	0.913
102	Northwest portion of the existing gravel parking lot – directs runoff to Ring Road storm sewer.	0.129
103	Southwest portion of the existing gravel parking lot – directs runoff to Ring Road storm sewer.	0.084

As per the Stormwater Master Plan created by Morrison Hershfield, the allowable release rate form the Site is set as the pre-development peak flow rate under the 2-year design storm event using a runoff coefficient of 0.50. This allowable release rate was determined using the rational method. The rainfall intensity used within the rational method calculation was determined using the intensity-duration-frequency (IDF) curve parameters for the 2-year storm event alongside a time of concentration of 10 minutes. The parameters utilized within the rational method calculation as well as the allowable release rates calculated are summarized in Table VIII and Table IX.

Table VIII: Allowable Release Rate to the North Hospital Storm Sewer

Area of Catchment (A)	0.913	ha
Runoff Coefficient (C)	0.50	-
IDF Curve Parameters from City of Ottawa Sewer Design Guidelines		
a	732.951	-
b	6.199	min
c	0.810	-
Time of Concentration (t_c)	10	min
Rainfall intensity (i)	76.805	mm/hr
2-Year Pre-Development Peak Flow Rate (North Hospital)	0.097	m^3/s

Table IX: Allowable Release Rate to the Ring Road Storm Sewer

Area of Catchment (A)	0.213	ha
Runoff Coefficient (C)	0.50	-
IDF Curve Parameters from City of Ottawa Sewer Design Guidelines		
A	732.951	-
B	6.199	min
C	0.810	-
Time of Concentration (t_c)	10	min
Rainfall intensity (i)	76.805	mm/hr
2-Year Pre-Development Peak Flow Rate (Ring Road)	0.023	m^3/s

7.4 Proposed Conditions

Under proposed conditions the overall percent impervious for the Site was calculated to be 75%. A catchment area plan of proposed conditions has been included within Appendix A of this report. A summary of post-development catchment parameters has been provided in Table X below.

Table X: Proposed Catchment Parameters

CATCHMENT ID	DESCRIPTION	AREA (HA)
201A	North portion of proposed parking garage - directs flow to North Hospital	0.25
201B	South portion of proposed parking garage - minor flows directed to North Hospital, major flows directed to Ring Road	0.24
202	South portion of restored gravel area – directs flow to North Hospital	0.13
203	North portion of restored gravel area - directs flow to North Hospital	0.11
204	North entrance driveway – directs minor flow to North Hospital, major flows to Ring Road	0.10
205	North entrance driveway - directs minor flow to North Hospital, major flows to Ring Road	0.07
206	West pedestrian pathway - minor flows directed to North Hospital, major flows directed to Ring Road	0.03
207	South parking garage entrance - directs flows to Ring Road	0.12
208	East landscaped areas - directs flows to North Hospital	0.13

The proposed development will increase the peak outflow to the Site, therefore necessitating peak flow reduction measures. The following sections outlines the stormwater management practices that are proposed to be implemented in order to attenuate flows to the noted allowable release rates.

7.4.1 Surface Ponding

Surface ponding is proposed to occur on the restored gravel areas to the west of the proposed parking garage structure (Catchments 202 and 203). As per the *1Door4Care: CHEO Integrated Treatment Centre – Climate Risk Assessment Report* completed by Stantec in 2022, surface ponding was restricted to storm events larger than the 2-year storm event. This was accomplished utilizing a 150 mm diameter orifice plate installed downstream of CBMH3. This orifice plate was sized such that flows from the 2-year design storm event would be able to pass through without interference while flows generated from the 5- through 100-year design storm events were restricted such that ponding could occur.

Ponding was restricted to a maximum depth of 0.30 m with a maximum allowable ponded volume of 32.4 m^3. Peak inflow/outflow rates and maximum storage volumes recorded for the surface ponding storage node within all modelled storm events are listed within Table 5 in Appendix C.

7.4.2 Detention Gallery

In order to further attenuate flows directed towards the existing north hospital storm system, an underground detention gallery comprised of 99 ADS SC-740 StormTech chambers. This detention gallery provides 231.23 m^3 of storage and will receive flows from the storm sewers and overland flow along the northern driveway on Site. The proposed storm sewer system was designed for the 100-year design storm event, storm sewer design sheets have been provided within Appendix C. Flow from the gallery is controlled using a 200 mm diameter orifice plate located along the eastern edge of the facility. The small diameter of the proposed orifice plate acts to constrict flow leaving the gallery, thereby requiring the usage of the provided storage volume. Peak inflow/outflow rates

and maximum storage volumes recorded for the detention gallery node within all modelled storm events are listed within Table 5 in Appendix C.

From the geotechnical report created by Thurber Engineering Ltd., boreholes located in close proximity to the proposed detention gallery note a groundwater elevation ranging between 78.9-80.17. Roughly interpolating between these elevations gives a groundwater elevation of roughly 79.7m in the location of the proposed gallery. This is slightly above the base elevation of the stone layer for the detention chamber (79.643 m). In order to ensure that the high groundwater table will not impact the storage capacity of the detention system, it is proposed that it be wrapped in an impervious thermoplastic liner.

The peak flow rates recorded under post-development conditions after the implementation of the above noted stormwater management measures is summarized within Table XI and Table XII.

Table XI: Comparison of Pre- and Post-Development Peak Flow Rates to the North Hospital Storm Sewer System

DESIGN STORM EVENT	PRE-DEVELOPMENT PEAK FLOW RATE (M^3/S)	ALLOWABLE RELEASE RATE (M^3/S)	POST-DEVELOPMENT PEAK FLOW RATE (M^3/S)
2-Year	0.097	0.097	0.055
5-Year	0.132	0.097	0.064
10-Year	0.155	0.097	0.070
25-Year	0.184	0.097	0.076
50-Year	0.205	0.097	0.079
100-Year	0.227	0.097	0.081

Table XII: Comparison of Pre- and Post-Development Peak Flow Rates to Ring Road

DESIGN STORM EVENT	PRE-DEVELOPMENT PEAK FLOW RATE (M^3/S)	ALLOWABLE RELEASE RATE (M^3/S)	POST-DEVELOPMENT PEAK FLOW RATE (M^3/S)
2-Year	0.023	0.023	0.010
5-Year	0.031	0.023	0.015
10-Year	0.036	0.023	0.018
25-Year	0.043	0.023	0.022
50-Year	0.048	0.023	0.025
100-Year	0.053	0.023	0.029

As seen in Table XI, the proposed stormwater management measures are capable of successfully reducing the post-development peak flow rates to the allowable release rate. Post-development peak flow rates directed towards Ring Road can be seen to slightly surpass the allowable release rate to the outlet, but remain below the calculated pre-development peak flow rates for their respective storm events. These overages will continue to flow west as uncontrolled surface flow to the CHEO 1Door4Care facility, where flows will enter the facility's stormwater management system and be treated and attenuated. Given that the post-development peak flow rates directed towards Ring Road remain below the calculated pre-development peak flow conditions for each storm event, runoff directed towards Ring Road will not be worse than those seen within existing conditions. Therefore, no further stormwater management measures will be necessary within interim conditions.

7.5 Quality Control

It is understood that the existing private storm sewer network already has quality control measures in place at the downstream end of the system. To supplement the downstream measures, drainage from the site is directed towards a detention gallery equipped with an isolator row. The LID measure will reduce maintenance needs and provide additional TSS removal for runoff from the site to act as an upstream quality control prior to the existing downstream quality control measures.

7.6 Water Balance

The increase in imperviousness will locally alter water balance as compared to existing conditions. The exact impact will have to be evaluated based on the other stormwater design decisions.

8.0 CONSTRUCTION EROSION AND SEDIMENT CONTROL

Prior to start of any construction, all erosion and sediment control measures will be installed and inspected by the Consultant. The measures will also be periodically inspected and upgraded/altered as site conditions change. Periodic inspections will consist of visual observation of the effectiveness of the control measures and sediment migration offsite. Construction inspections will be conducted biweekly and within 24 hours of any rainfall event of 25mm or greater, until such a time that paving works are complete and vegetation has established itself to a density equivalent to 70% of the background native vegetation density. Records of all inspections will be maintained and made available to the RVCA, City of Ottawa and the MECP upon request.

Any sediment tracked onto the roadway during the course of construction will be cleaned by the Contractor. To minimize the amount of mud tracked onto the roadway, a mud-mat will be installed at all construction exits and the contractor will be required to ensure that vehicles leave through the exit. The mudmat will be periodically inspected and cleaned as required to ensure it is functioning as intended.

Each inlet structure to remain, and new inlet structures to be installed will require a heavy-duty silt sac to be installed. Filter fabric will be wrapped around the lids of all manholes to prevent intrusion of sediment into the storm sewer network. The inserts will be cleaned once they reach one-third their sediment accumulation capacity or as per the manufacturer's recommendations.

All erosion and sediment control measures will be removed at the end of construction.

9.0 CONCLUSIONS

Based on the servicing design presented in this report, the following conclusions are presented:

- The Site is not located within a Source Protection Area and the Rideau Valley Source Protection Policies will apply to the site.
- Sanitary discharge from the site will be conveyed to the municipal sanitary sewer to the northwest corner of the OHSC campus.
- No capacity concerns are noted within the downstream sanitary infrastructure.

- Water servicing will be provided from the 300mm diameter watermain running along the pedestrian access road north of the Site.

- Hydrant flow testing indicates that the existing water distribution system can accommodate the anticipated post-development water demand within the acceptable pressure range. No concerns are anticipated.

- A private fire hydrant will be provided within 45m of the fire department connection, connected to the municipal service. This hydrant is expected to provide the required fire flow at or above the minimum 140 kPa residual pressure.

- Peak stormwater flow control will be required for this Site. Peak flow rates directed towards the existing storm sewer system to the North of the Site are shown to be attenuated to the allowable peak flow rate through the implementation of orifice controls, surface ponding and underground detention gallery. Increases in major storm peak flow directed to Ring Road will continue west where it will be captured and attenuated by the stormwater management infrastructure for the CHEO 1Door4Care facility.

- Water quality controls are provided for the OHSC at the downstream outlet to the municipal system. The detention gallery is equipped with an isolator row for some LID treatment. No additional water quality controls are required on Site.

- Erosion and Sediment Control measures will ensure protection of the adjacent natural features and the municipal storm system. Measures will be put in place prior to any construction activity and maintained until construction is completed and ground surfaces have been stabilized.

All of which is respectfully submitted,

WALTERFEDY

Shelley Forwell, P.Eng.
Design Engineer, Civil Engineering
Partner

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Circe Mahoney
Water Resources EIT, Civil Engineering

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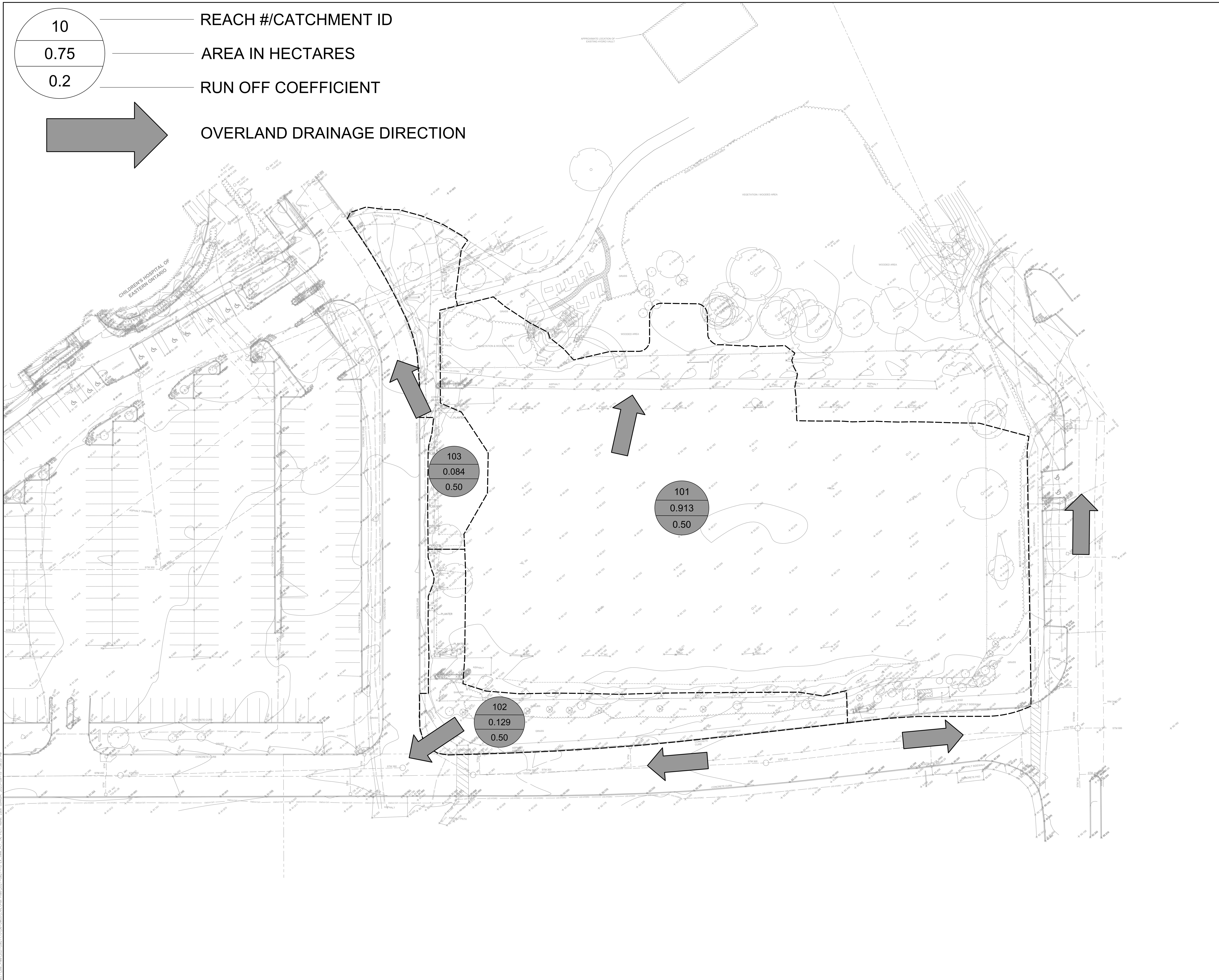
519.576.2150 Ext. 414

APPENDIX A

Figures



CHEO
1Door4Care

Infrastructure Ontario

EllisDon
INFRASTRUCTURE Healthcare

WALTERFEDY
KITCHENER OFFICE
675 Queen Street South, Suite 111, Kitchener, Ontario N2M 1A1
T: 519.576.2150 F: 519.576.5499 walterfedy.com

NORTH ARROW
KEY PLAN

GENERAL NOTES

1. THIS SET OF PLANS SHALL NOT BE USED FOR CONSTRUCTION UNTIL STAMPED BY THE DESIGN ENGINEER AND APPROVED BY THE LOCAL MUNICIPALITY.
2. NO CHANGES ARE TO BE MADE WITHOUT THE APPROVAL OF THE DESIGN ENGINEER.
3. THIS PLAN NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE PERMISSION OF WALTERFEDY.
4. THE POSITION OF 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, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM AND THOSE NOT LOCATED PRIOR TO CONSTRUCTION.
5. ANY AREA DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO ITS ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE CONSULTANT AND AUTHORITY HAVING JURISDICTION. THE CONTRACTOR IS RESPONSIBLE FOR RESTORING ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY TO MUNICIPAL STANDARDS.
6. ALL HEALTH AND SAFETY RELATED SIGNAGE MUST BE POSTED AT THE SITE AS REQUIRED BY APPLICABLE LAW AND BEST MANAGEMENT PRACTICES.
7. AT THE END OF CONSTRUCTION, THE CONTRACTOR SHALL PROVIDE THE CONSULTANT WITH A DIGITAL FILE OF AS-CONSTRUCTED DRAWINGS. THE DRAWINGS MUST REFLECT THE CONSTRUCTED STATE OF THE WORK. SUBMISSION OF UNALTERED DESIGN DRAWINGS AND CONTRACT CHANGES WILL NOT BE ACCEPTED.

#	DATE:	REVISION:
3	2023-08-31	ISSUED FOR 100% DD SUBMISSION
2	2023-08-16	ISSUED FOR SPC SUBMISSION
1	2023-07-31	ISSUED FOR 50% DD SUBMISSION
0	2023-04-20	ISSUED FOR TECHNICAL SUBMISSION

REVISIONS

CLIENT
1DOOR4CARE: CHEO INTEGRATED TREATMENT CENTRE: PARKING GARA
401 SMYTH RD. OTTAWA, ON K1H8L1

TITLE
EXISTING CATCHMENT AREAS PLAN - PARKING GARAGE

SCALE: 1:250
DRAWN BY: DR,RB
REVIEWED BY: RK
JOB NUMBER: 2021-0821-10
PLOT DATE: 2023.09.15

DRAWING NUMBER:
FIG1

PLAN #: 18912
DEVELOPMENT #: D07-12-22-0170

10
0.75
0.2

REACH #/CATCHMENT ID

AREA IN HECTARES

RUN OFF COEFFICIENT

OVERLAND DRAINAGE DIRECTION

206
0.056
0.58

204
0.062
0.65

205
0.063
0.90

203
0.111
0.70

201a
0.248
0.90

201b
0.243
0.90

202
0.135
0.74

207
0.098
0.68

208
0.111
0.41

PHASE 1A
PARKING GARAGE
FF=82.953

PHASE 1A
PARKING GARAGE
FF=82.70

PHASE 1A
PARKING GARAGE
FF=83.346

RESTORED
GRAVEL AREA

PARKING
ENTRY/EXIT

CHILDREN'S HOSPITAL OF EASTERN ONTARIO

CHEO
1Door4Care

Infrastructure Ontario

EllisDon
INFRASTRUCTURE Healthcare

WALTERFEDY
KITCHENER OFFICE
675 Queen Street South, Suite 111, Kitchener, Ontario N2M 1A1
T: 519.576.2150 F: 519.576.5499 walterfedy.com

NORTH ARROW

KEY PLAN

SITE 1A

GENERAL NOTES

1. THIS SET OF PLANS SHALL NOT BE USED FOR CONSTRUCTION UNTIL STAMPED BY THE DESIGN ENGINEER AND APPROVED BY THE LOCAL MUNICIPALITY.
2. NO CHANGES ARE TO BE MADE WITHOUT THE APPROVAL OF THE DESIGN ENGINEER.
3. THIS PLAN NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE PERMISSION OF WALTERFEDY.
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#	DATE:	REVISION:
3	2023-08-31	ISSUED FOR 100% DD SUBMISSION
2	2023-08-16	ISSUED FOR SPC SUBMISSION
1	2023-07-31	ISSUED FOR 50% DD SUBMISSION
0	2023-04-20	ISSUED FOR TECHNICAL SUBMISSION

REVISIONS

CLIENT

1DOOR4CARE: CHEO INTEGRATED TREATMENT CENTRE: PARKING GARA

401 SMYTH RD. OTTAWA, ON K1H8L1

TITLE

PROPOSED CATCHMENT AREAS PLAN - PARKING GARAGE

SCALE: 1:250
DRAWN BY: DR,RB
REVIEWED BY: RK
JOB NUMBER: 2021-0821-10
PLOT DATE: 2023.09.15
DRAWING NUMBER:

FIG2

PLAN #: 18912
DEVELOPMENT #: D07-12-22-0170

APPENDIX B

Water and Wastewater Servicing Information

WASTEWATER GENERATION

MECP Design Criteria

WALTERFEDY

Project	CHEO 1Door4Care Parking Garage
Project #	2021-0821-10
Designer	CM
Address	401 Smyth Road, Ottawa, Ontario
Description	Domestic Flows - Proposed Condtions

Building Description	Site Area[1] (ha)	Average Daily Wastewater Flow (L/gross hectare/day)[3]	Average Wastewater Generated (L/day)	Peaking Factor[3]	Infiltration Allowance[2] (L/s/ha)	Peak Domestic Wastewater Flow (L/s)
1Door4Care - Parking Garage	1.13	28000	31,528	1.50		0.55
Infiltration Allowance	1.13				0.33	0.37
Total						**0.92**

Notes:

1. Site Area based on Civil Drawings
2. Average Daily Wastewater Flow and Infiltration Allowance taken from City of Ottawa's Ottawa Sewer Design Guidelines for Institutional Developments
3. Peaking Factor taken from City of Ottawa's Sewer Design Guidelines for institutional developments

Project:	CHEO 1Door4Care Parking Garage				**Design Data**			**SANITARY SEWER DESIGN CALCULATIONS**															
Project No:	2021-0821-10				Min. Velocity	0.6	m/s																
Date:	2023-09-15				Max. Velocity	3.0	m/s		**Residential**					**Commercial/Institutional**								
Designed By:	CM	Checked By:			Manning's 'n'	0.013		Peaking Factor	Harmon					Peaking Factor	1.5							
					Infiltration	0.33	l/s/ha	Avg. Daily Flow	275	L/c/d				Avg. Daily Flow	0.324	L/s/ha						
Catchments	**Pipe Data**			**Residential**				**Cumulative**			**Commercial/Office**			**Infiltration**		**Total**	**Design Data**					
	From	To	Length	Area	Units	Density	Population	Area	Population	Peak Factor	Area	Total Area		Area	Total Area	**Flow**	Diameter	Slope	Q_{FULL}	V_{FULL}		
			(m)	*(ha)*		*(ppu)*	*(people)*	*(ha)*	*(people)*		*(ha)*	*(ha)*		*(ha)*	*(ha)*	*(L/s)*	*(mm)*	*(%)*	*(L/s)*	*(m/s)*		
Site	SAN-CON-1	MH16A	10.2	1.13	0	0	**0**	1.13	0	**4.50**	1.13	1.13		1.13	1.13	**0.92**	250	2.00	**84.10**	**1.71**		
	MH16A	MH17A	39.3	0.00	0	0	**0**	1.13	0	**4.50**	0.00	1.13		0.00	1.13	**0.92**	250	0.50	**42.05**	**0.86**		
	MH17A	MH829A	30.9	0.00	0	0	**0**	1.13	0	**4.50**	0.00	1.13		0.00	1.13	**0.92**	250	1.35	**69.10**	**1.41**		

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 2020)

WALTERFEDY

Project	CHEO 1Door4Care
Project #	2021-0821-10
Designer	CM
Address	401 Smyth Road, Ottawa, Ontario
Description	Fire Flows (Parking Garage)

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

F = Required fire flow (LPM)
C = Coefficient related to type of construction
A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Non-Combustible Construction	**C =**	0.8
Description	**Unprotected Metal Structural Components, Masonry or Metal Walls. All Structural Members are Constructed with Minimum 1 Hour Fire Rating**		

Floor Area	32292	m^2
# Storeys	7	
Fire Resistant Building?	NO	

Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating? YES

Area	4807	m^2
Description	Open Air Parking Garage - Area of largest floor to be used as the total effective area	
Required Fire Flow	12000	L/min

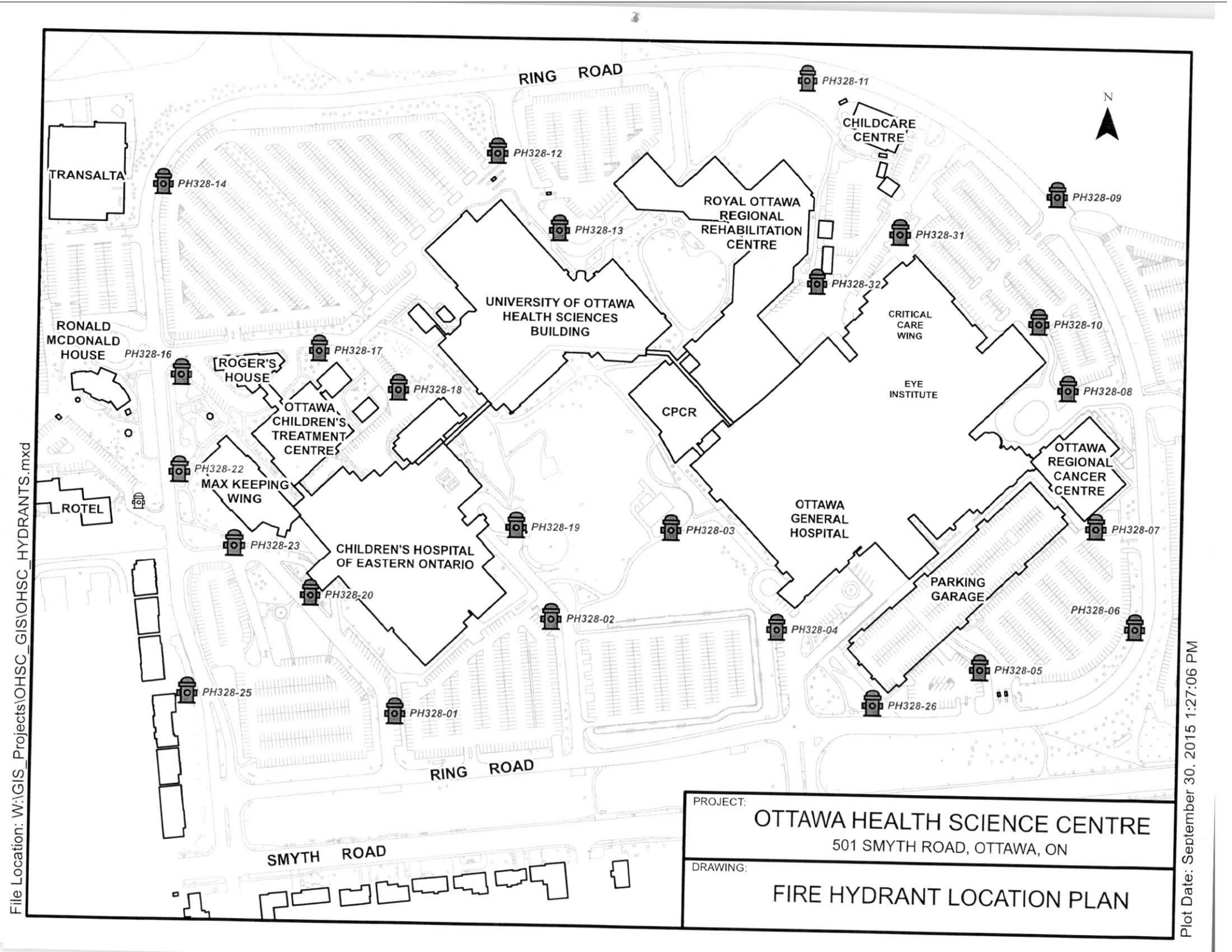
Occupancy Charge	Combustible Contents			
Fire Flow Reduction	0%	**OR**	0	L/min
Required Fire Flow	12000	L/min		

Automated Sprinker Protection	YES		
Designed to NFPA 13 Standard	YES	-30%	
Standard Water Supply to Sprinklers and Standpipes	YES	-10%	
Fully Supervised System	YES	-10%	
Fire Flow Adjustment		-6000	L/min

Exposure 1 (North)	**Distance**	>30	m	**Charge**	0%
Description	University of Ottawa Roger Guindon Hall				
Exposure 2 (East)	**Distance**	>30	m	**Charge**	0%
Description	The Ottawa Hospital General Campus				
Exposure 3 (West)	**Distance**	>30	m	**Charge**	0%
Description	Main CHEO Campus Buildings				
Exposure 4 (South)	**Distance**	>30	m	**Charge**	0%
Description	Existing Residential Buildings				

Total Exposure Charge	0%	
Fire Flow Adjustment	0	L/min

Total Required Fire Flow	6000	L/min
Total Required Fire Flow	1585	U.S. GPM
Total Required Fire Flow	100	L/s



PROJECT:

OTTAWA HEALTH SCIENCE CENTRE

501 SMYTH ROAD, OTTAWA, ON

DRAWING:

FIRE HYDRANT LOCATION PLAN

File Location: W:\GIS_Projects\OHSC_GIS\OHSC_HYDRANTS.mxd

Plot Date: September 30, 2015 1:27:06 PM

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 01

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI): 48
Pitot Reading (GPM): 1160
Static Pressure (PSI): 60
Residual Pressure (PSI): 50

Flow @ 20 PSI (GPM): 2452

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: PFH328-01

Date: 28 / 04 / 21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TOH	Contact	
Site Name	General Campus	Phone #	
Site Address	501 Smyth	P.O. #	
Inspected By	AVR	Make / Model	
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.	
Barrel Ext.		Hose Nozzles	
Flange Elev.		Hydrant Colour	Body: / Top:

Isolation Valve	Yes	No
VP068		
Visible	✓	
Operates properly	✓	
Cap in place	✓	
Valve open	✓	
Barrel	**Yes**	**No**
Self draining	✓	
Water level: Dry		
Plugged		✓
Ground Flange	**Yes**	**No**
Solid	✓	
Buried		✓
Damaged		✓
Caps and Gaskets	**Yes**	**No**
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged	✓	
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	
Hydrant	**Yes**	**No**
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required	✓	
Hydrant marker in place	✓	

Hydro Static Testing	Yes	No
Prior to opening – underground leak	✓	
Fully open – above ground leak		✓
Fully open – underground leak	✓	
Fully closed – underground leak	✓	

Flow Testing	
Pitot reading (PSI)	48
Pitot reading (GPM)	1160
Static Pressure (PSI)	60
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	50
Flow @ 20 PSI	2452

Comments: Slight damage to both hose nozzles.

Possible underground leak upstream from main valve disc.

-> Re & Re (approx 6ft to top of valve)

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 02

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI): 50
Pitot Reading (GPM): 1190
Static Pressure (PSI): 64
Residual Pressure (PSI): 54

Flow @ 20 PSI (GPM): 2649

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: PH328 - 02

Date: 27 / 04 / 21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TOH	Contact		
Site Name	General campus	Phone #		
Site Address	501 Smyth	P.O. #		
Inspected By	AvR	Make / Model		
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.		
Barrel Ext.		Hose Nozzles		
Flange Elev.		Hydrant Colour	Body:	Top:

Isolation Valve	Yes	No
VP 067 Visible	✓	
Operates properly	✓	
Cap in place	✓	
Valve open	✓	
Barrel	**Yes**	**No**
Self draining	✓	
Water level ____ Dry		
Plugged		✓
Ground Flange	**Yes**	**No**
Solid	✓	
Buried		✓
Damaged		✓
Caps and Gaskets	**Yes**	**No**
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	
Hydrant	**Yes**	**No**
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required	✓	
Hydrant marker in place	✓	

Hydro Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak	✓	
Fully open – underground leak		
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	50
Pitot reading (GPM)	1190
Static Pressure (PSI)	64
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	54
Flow @ 20 PSI	2649

Comments: Leaking from bonnet ⇒ Top Seals

Possible internal damage ⇒ Conversion

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 03

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI): 44
Pitot Reading (GPM): 1110
Static Pressure (PSI): 60
Residual Pressure (PSI): 50

Flow @ 20 PSI (GPM): 2347

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: PH 328-03

Date: 27 / 04 / 21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TOH		Contact		
Site Name	General Campus		Phone #		
Site Address	501 Smyth		P.O. #		
Inspected By	AvR		Make / Model		
Inspection #	1 2 3 4 5 6 7 SP		Year of Man.		
Barrel Ext.			Hose Nozzles		
Flange Elev.			Hydrant Colour	Body:	Top:

Isolation Valve	Yes	No
VP 065 Visible	✓	
Operates properly	✓	
Cap in place	✓	
Valve open		

Barrel	Yes	No
Self draining	✓	
Water level: Dry		
Plugged		✓

Ground Flange	Yes	No
Solid	✓	
Buried		✓
Damaged		✓

Caps and Gaskets	Yes	No
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	

Hydrant	Yes	No
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required		✓
Hydrant marker in place	✓	

Hydro Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak		✓
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	44
Pitot reading (GPM)	1110
Static Pressure (PSI)	60
Volume of water used (GPM x total flow min.)	50
Residual pressure (PSI)	
Flow @ 20 PSI	2347

Comments:

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 04

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI): 40
Pitot Reading (GPM): 1060
Static Pressure (PSI): 62
Residual Pressure (PSI): 52

Flow @ 20 PSI (GPM): 2300

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: PH328-04

Date: 27/04/21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TCH	Contact		
Site Name	General Campus	Phone #		
Site Address	501 Smyth	P.O. #		
Inspected By	AvR	Make / Model		
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.		
Barrel Ext.		Hose Nozzles		
Flange Elev.		Hydrant Colour	Body:	Top:

Isolation Valve	Yes	No
VP 063 Visible	✓	
Operates properly	✓	
Cap in place	✓	
Valve open	✓	
Barrel	**Yes**	**No**
Self drainage	✓	
Water level / Dry		
Plugged		✓
Ground Flange	**Yes**	**No**
Solid	✓	
Buried		✓
Damaged		-
Caps and Gaskets	**Yes**	**No**
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	
Hydrant	**Yes**	**No**
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required		✓
Hydrant marker in place	✓	

Hydro Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak		✓
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	40
Pitot reading (GPM)	1060
Static Pressure (PSI)	82
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	52
Flow @ 20 PSI	2300

Comments:

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 20

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI): 42
Pitot Reading (GPM): 1090
Static Pressure (PSI): 60
Residual Pressure (PSI): 50

Flow @ 20 PSI (GPM): 2304

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: PH 323-20

Date: 28/04/21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TOH	Contact		
Site Name	General Campus	Phone #		
Site Address	501 Smyth	P.O. #		
Inspected By	AvR	Make / Model		
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.		
Barrel Ext.		Hose Nozzles		
Flange Elev.		Hydrant Colour	Body:	Top:

Isolation Valve	Yes	No
Visible	✓	
Operates properly		
Cap in place	✓	
Valve open		

Barrel	Yes	No
Self draining	✓	
Water level / Dry		
Plugged		✓

Ground Flange	Yes	No
Solid	✓	
Buried		✓
Damaged		✓

Caps and Gaskets	Yes	No
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged	✓	
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	

Hydrant	Yes	No
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required	✓	
Hydrant marker in place	✓	

Hydro Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak	✓	
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	42
Pitot reading (GPM)	1090
Static Pressure (PSI)	60
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	50
Flow @ 20 PSI	2304

Comments: Damage to hose nozzle thread.
Cracked bearing housing.
Leaking from operating nut.

↳ Conversion

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 23

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI): 42
Pitot Reading (GPM): 1090
Static Pressure (PSI): 60
Residual Pressure (PSI): 50

Flow @ 20 PSI (GPM): 2304

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: PH 32823

Date: 28 / 04 / 21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TCH	Contact	
Site Name	General Campus	Phone #	
Site Address	501 Smyth	P.O. #	
Inspected By	AVR	Make / Model	
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.	
Barrel Ext.		Hose Nozzles	
Flange Elev.		Hydrant Colour	Body: Top:

Isolation Valve	Yes	No
No iso valve — Visible	N	
Operates properly		A
Cap in place		
Valve open		

Barrel	Yes	No
Self draining	✓	
Water level ____ Dry		
Plugged		

Ground Flange	Yes	No
Solid	✓	
Buried		✓
Damaged		✓

Caps and Gaskets	Yes	No
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		
Damaged		
Leaking		
Repaired		
Proper nozzle orientation		
Pumper nozzle		

Hydrant	Yes	No
Colour coded		
Painting required		
Lubricate upper stem		
Operation satisfactory		
Restoration required		
Hydrant marker in place		

Hydro Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak	✓	
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	42
Pitot reading (GPM)	1090
Static Pressure (PSI)	60
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	50
Flow @ 20 PSI	2304

Comments: Draining very slow.
Already checked parts in December
↳ Excavate
Leaking from bonnet.
Had new seals in December
↳ Internals worn out.
Getting tough to operate again.

8pt to disc
8 ½" bury?

⇒ Re & Re + iso valve

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 25

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI): 48
Pitot Reading (GPM): 1160
Static Pressure (PSI): 62
Residual Pressure (PSI): 52

Flow @ 20 PSI (GPM): 2517

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: PH328-25

Date: 28 / 04 / 21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TOH		Contact		
Site Name	General Campus		Phone #		
Site Address	501 Smyth		P.O. #		
Inspected By	AR		Make / Model		
Inspection #	1 2 3 4 (5) 6 7 SP		Year of Man.		
Barrel Ext.			Hose Nozzles		
Flange Elev.			Hydrant Colour	Body:	Top:

Isolation Valve	Yes	No
VP 093 Visible	✓	
Operates properly	✓	
Cap in place	✓	
Valve open	✓	

Barrel	Yes	No
Self draining	✓	
Water level ____ Dry		
Plugged		✓

Ground Flange	Yes	No
Solid	✓	
Buried		✓
Damaged		✓

Caps and Gaskets	Yes	No
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	

Hydrant	Yes	No
Colour coded	✓	
Painting required		✓
Lubricate upper stem		✓
Operation satisfactory	✓	
Restoration required	✓	
Hydrant marker in place	✓	

Hydro Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak	✓	
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	48
Pitot reading (GPM)	1160
Static Pressure (PSI)	62
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	52
Flow @ 20 PSI	2517

Comments: Leaking from bonnet.
Cracked bearing housing
↳ Hydralube conversion

Compliance Report

CLEAN WATER WORKS

Fire Hydrant #: PH328- 26

Date: April/May 2021
Work Order #: 101791
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #:

Hydrant Make and Model: ((See Master List))
Year Manufactured: ((See Master List))
Hydrant Location: ((See Map))
Surface Condition: ((See Master List))
Seat Valve Size: ((See Master List))
Flange Elevation: ((See Master List))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See Master List))
Surface Condition: ((See Master List))

Flow Test Results:

Pitot Reading (PSI):	40
Pitot Reading (GPM):	1060
Static Pressure (PSI):	62
Residual Pressure (PSI):	52
Flow @ 20 PSI (GPM):	2300

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☑ ☐
Water Level	Drained
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☑ **NO** ☐

CLEAN WATER WORKS

FH ID #: FH 328-26

Date: 03 / 05 / 21 dd/mm/yy

W.O. #: 101791

Fire Hydrant Inspection Report

Customer	TOH	Contact	
Site Name	General Campus	Phone #	
Site Address	301 Smyth	P.O. #	
Inspected By	AvR	Make / Model	
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.	
Barrel Ext.		Hose Nozzles	
Flange Elev.		Hydrant Colour	Body: / Top:

Isolation Valve	Yes	No
VP 053 Visible		✓
Operates properly		
Cap in place		
Valve open		

Barrel	Yes	No
Self draining	✓	
Water level / Dry		
Plugged		✓

Ground Flange	Yes	No
Solid	✓	
Buried		✓
Damaged		✓

Caps and Gaskets	Yes	No
Missing		✓
Replaced		✓
Lubricated	✓	

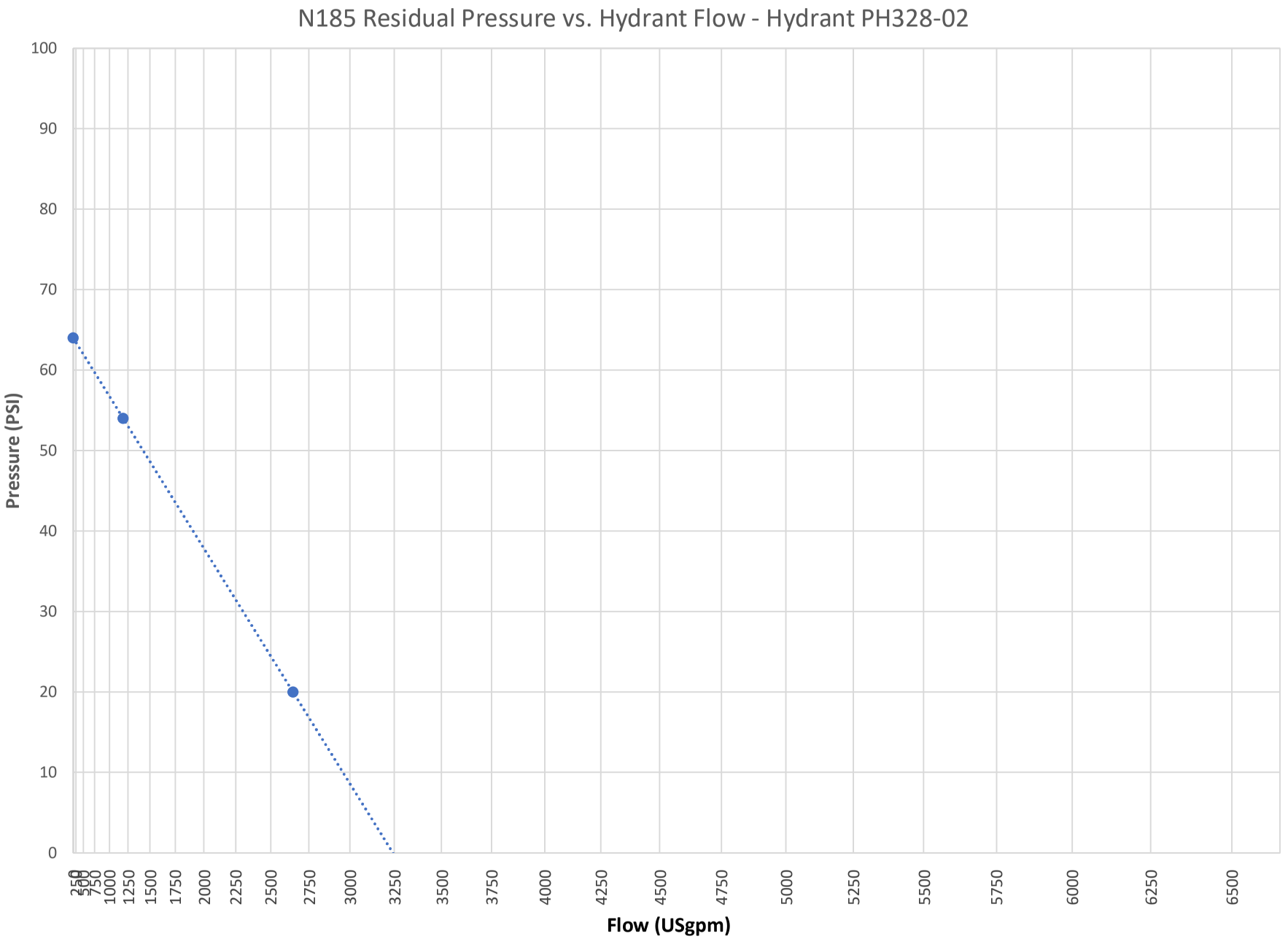
Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation		✓
Pumper nozzle	✓	

Hydrant	Yes	No
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required		✓
Hydrant marker in place	✓	

Hydro Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak		✓
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	40
Pitot reading (GPM)	1060
Static Pressure (PSI)	62
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	52
Flow @ 20 PSI	2300

Comments: Valve not visible, able to isolate with zone valves. This will turn off 3 or 4 hydrants together. No buildings affected.
Hydrant is accessible by Ontario Fire Code standards, however, we do recommend rotating the hydrant to facilitate quicker/easier hook ups during an emergency situation.


N185 Residual Pressure vs. Hydrant Flow - Hydrant PH328-02
Pressure (PSI)
100
90
80
70
60
50
40
30
20
10
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
3750
4000
4250
4500
4750
5000
5250
5500
5750
6000
6250
6500
Flow (USgpm)

APPENDIX C

Stormwater Management Information
5 Year Storm Sewer Design Sheet
100 Year Storm Sewer Design Sheet

APPENDIX D

PCSWMM Report Files

TABLE 1
DESIGN STORM PARAMETERS

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

Design Storm	IDF Storm Parameters			Time of Peak	Storm Duration	Max. Rainfall Intensity	Max. Rainfall Depth
	a	b	c	r	D (h)	(mm/hr)	(mm)
2-year	732.951	6.199	0.810	0.3	3	76.8	31.9
5-year	998.071	6.053	0.814	0.3	3	104.2	42.5
10-year	1174.184	6.014	0.816	0.3	3	122.1	49.5
25-year	1402.884	6.018	0.819	0.3	3	144.7	58.3
50-year	1569.580	6.014	0.820	0.3	3	161.5	64.8
100-year	1735.688	6.014	0.820	0.3	3	178.6	71.7

Notes:
(1) IDF curve parameters taken from City of Ottawa Sewer Design Guidelines (October 2012)

TABLE 2
PROPOSED CATCHMENT PARAMETERS

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

							Mannings Roughness		Horton Infiltration[1]			Depression Storage				
Subcatchment	Comment	Area (ha)	Percent Impervious[2] (%)	Width (m)	Flow Length (m)	Slope (%)	Impervious	Pervious	Max. Infiltration Rate (mm/hr)	Min. Infiltration Rate (mm/hr)	Decay Constant (1/hr)	Impervious (mm)	Pervious (mm)	Percent Zero Impervious (%)	Subarea Routing	Percent Routed (%)
To the Ottawa Health Science Centre Campus Storm Sewer System																
201A	North portion of proposed parking garage - directs flow to North Hospital	0.25	90	20	124	0.5	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
201B	South portion of proposed parking garage - minor flows directed to North Hospital, major flows directed to Ring Road	0.24	90	20	124	0.5	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
202	South portion of restored gravel area - minor flows directed to North Hospital, major flows directed to Ring Road	0.14	74	15	89	2.1	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
203	North portion of restored gravel area - directs flow to North Hospital	0.11	70	15	74	2.5	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
204	North entrance driveway - directs fow to North Hospital	0.06	65	16	40	1.5	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
205	North entrance driveway - directs flow to North Hospital	0.06	90	16	40	1.0	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
206	West pedestrian pathway - minor flows directed to North Hospital, major flows directed to Ring Road	0.06	58	9	60	0.5	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
207	South parking garage entrance - directs flows to Ring Road	0.10	68	7	150	0.5	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
208	East landscaped areas - directs flows to North Hospital	0.11	41	7	150	0.5	0.013	0.250	76.20	13.20	4.14	1.57	4.67	0	OUTLET	100
Total (site)		1.13	76													

Notes:
(1) Horton InfiltrationMethod Parameters taken from *Ottawa Design Guidelines - Sewer* , October 2012

TABLE 3
PEAK RUNOFF VOLUMES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

Subcatchment	Design Storms					
	2-year (m^3)	5-year (m^3)	10-year (m^3)	25-year (m^3)	50-year (m^3)	100-year (m^3)
Proposed Conditions						
201A	132	182	216	258	290	324
201B	67	91	108	129	145	161
202	31	43	52	63	72	80
203	24	34	41	50	57	64
204	12	18	22	27	30	34
205	17	24	28	34	38	42
206	10	14	17	22	25	29
207	20	28	34	42	48	54
208	14	20	25	32	38	44

TABLE 4
PEAK RUNOFF FLOW RATES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

Subcatchment	Design Storms					
	Chicago 2-Year (m^3/s)	**Chicago** 5-Year (m^3/s)	**Chicago** 10-Year (m^3/s)	**Chicago** 25-Year (m^3/s)	**Chicago** 50-Year (m^3/s)	**Chicago** 100-Year (m^3/s)
Proposed Conditions						
201A	0.060	0.090	0.110	0.140	0.160	0.180
201B	0.040	0.060	0.070	0.080	0.090	0.110
202	0.020	0.030	0.040	0.050	0.050	0.060
203	0.020	0.020	0.030	0.040	0.040	0.050
204	0.010	0.010	0.020	0.020	0.020	0.030
205	0.010	0.020	0.020	0.020	0.030	0.030
206	0.010	0.010	0.010	0.010	0.020	0.020
207	0.010	0.020	0.020	0.030	0.030	0.030
208	0.010	0.010	0.020	0.020	0.020	0.020

TABLE 5
GALLERY PERFORMANCE SUMMARY

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

PCSWMM Model Element	Design Storm	Peak Inflow (m^3/s)	Peak Outflow to Storm Sewer Network (m^3/s)	Max. Storage Volume (m^3)	Max. Ponding Elevation (m)
Detention Gallery					
	2-year	0.085	0.052	58	79.99
	5-year	0.125	0.058	89	80.09
	10-year	0.151	0.061	116	80.18
	25-year	0.184	0.064	152	80.30
	50-year	0.210	0.067	179	80.39
	100-year	0.235	0.070	208	80.48

PCSWMM Model Element	Design Storm	Peak Inflow (m^3/s)	Peak Outflow to Storm Sewer Network (m^3/s)	Max. Storage Volume (m^3)	Max. Ponding Elevation (m)
Surface Ponding					
	2-year	0.017	0.017	0.00	81.57
	5-year	0.025	0.016	6.00	81.74
	10-year	0.031	0.017	9.00	81.76
	25-year	0.038	0.018	12.00	81.77
	50-year	0.044	0.019	15.00	81.79
	100-year	0.049	0.020	18.00	81.80

TABLE 6
OUTLET COMPARISONS

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

Design Storm Event	To Ring Road Storm Sewer		
	Existing (m^3/s)	Allowable [1] (m^3/s)	Proposed (m^3/s)
2-year	0.023	0.023	0.010
5-year	0.031	0.023	0.015
10-year	0.036	0.023	0.018
25-year	0.043	0.023	0.022
50-year	0.048	0.023	0.025
100-year	0.053	0.023	0.029

Design Storm Event	To North Hospital Storm Sewer		
	Existing (m^3/s)	Allowable [1] (m^3/s)	Proposed (m^3/s)
2-year	0.097	0.097	0.055
5-year	0.132	0.097	0.064
10-year	0.155	0.097	0.070
25-year	0.184	0.097	0.076
50-year	0.205	0.097	0.079
100-year	0.227	0.097	0.081

(1) The allowable release rate has been set equal to the outflow from a pre-development, 2-year storm event with a runoff coefficient of 0.5 as per the *Stormwater Master Plan* created by Morrison Hershfield.

User Inputs

Chamber Model:	SC-740
Outlet Control Structure:	Yes
Project Name:	CHEO Parking Garage
Engineer:	Zack Schnurr
Project Location:	Ontario
Measurement Type:	Metric
Required Storage Volume:	226.76 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	153 mm.
Stone Above Chambers:	153 mm.
Average Cover Over Chambers:	2438 mm.
Design Constraint Dimensions:	(19.01 m. x 40.00 m.)

Results

System Volume and Bed Size

Installed Storage Volume:	231.23 cubic meters.
Storage Volume Per Chamber:	1.30 cubic meters.
Number Of Chambers Required:	99
Number Of End Caps Required:	20
Chamber Rows:	10
Maximum Length:	34.72 m.
Maximum Width:	15.12 m.
Approx. Bed Size Required:	360.94 square meters.

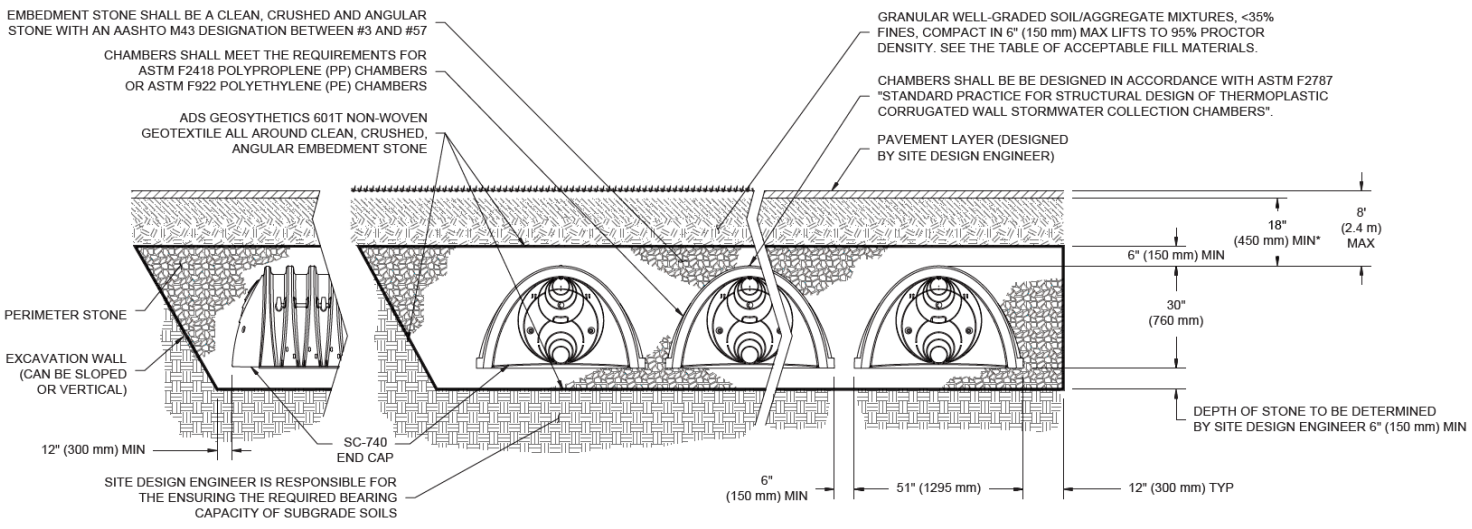
System Components

Amount Of Stone Required:	257 cubic meters
Volume Of Excavation (Not Including Fill):	386 cubic meters
Total Non-woven Geotextile Required:	1555 square meters
Woven Geotextile Required (excluding Isolator Row):	14 square meters
Woven Geotextile Required (Isolator Row):	94 square meters
Total Woven Geotextile Required:	107 square meters
Impervious Liner Required:	561 square meters

Impervious Liner notes:

Technical Note 6.50 : Thermoplastic Liners for Detention Systems

The impervious liner quantity shown is only an estimate. ADS does not provide or design impervious liners. Please contact a liner manufacturer for a final estimate.



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

ADS SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
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CHEO PARKING GARAGE

OTTAWA, ON, CANADA

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

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

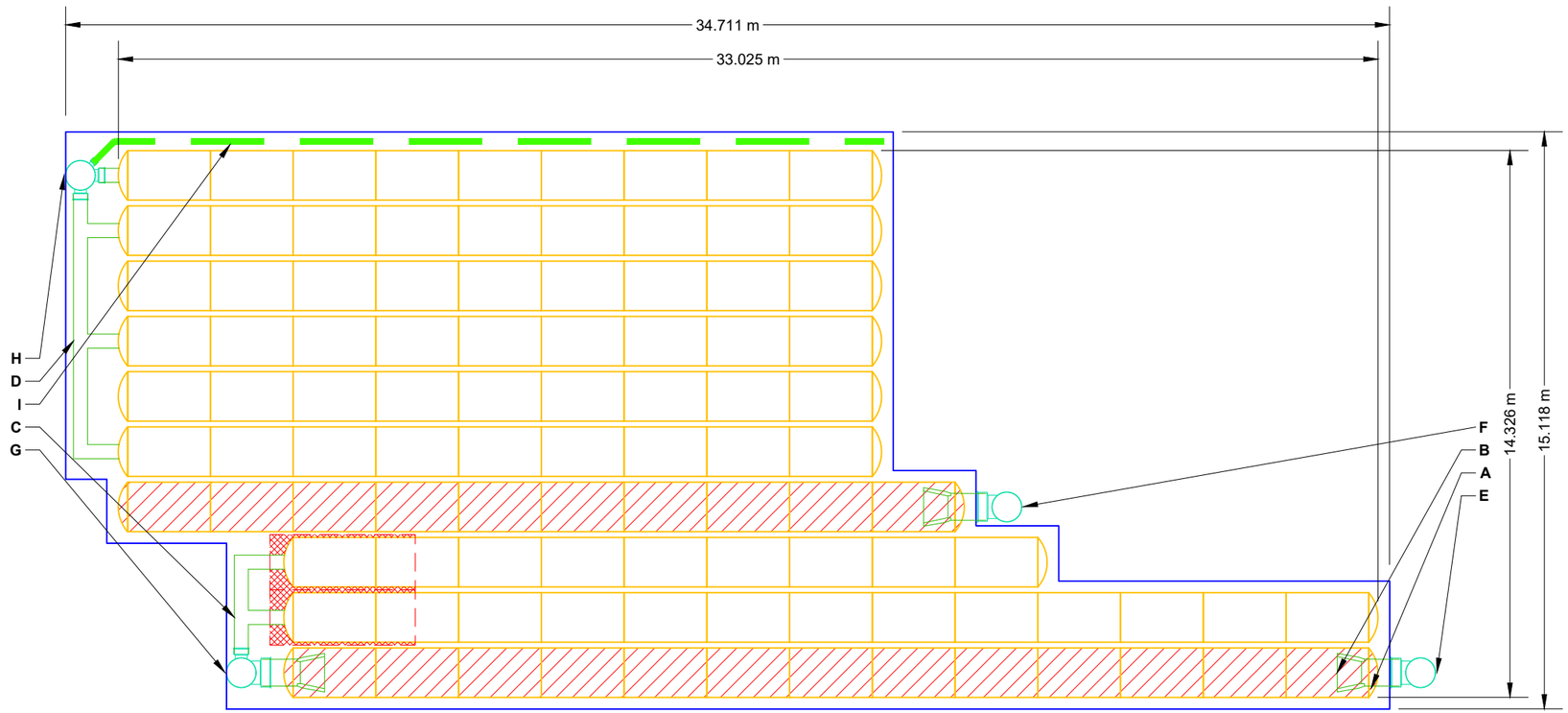
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		PROPOSED ELEVATIONS:	
99	STORMTECH SC-740 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	82.996
20	STORMTECH SC-740 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	81.167
152	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	81.015
152	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	81.015
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	81.015
231.3	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	80.710
		TOP OF SC-740 CHAMBER:	80.557
		300 mm x 300 mm TOP MANIFOLD INVERT:	80.113
		300 mm x 300 mm BOTTOM MANIFOLD INVERT:	79.826
360.9	SYSTEM AREA (m^2)	300 mm BOTTOM CONNECTION INVERT:	79.826
99.7	SYSTEM PERIMETER (m)	600 mm ISOLATOR ROW PLUS INVERT:	79.798
561	THERMOPLASTIC LINER (m^2) (20% OVERAGE)	600 mm ISOLATOR ROW PLUS INVERT:	79.798
		600 mm ISOLATOR ROW PLUS INVERT:	79.798
		BOTTOM OF SC-740 CHAMBER:	79.795
		UNDERDRAIN INVERT:	79.643
		BOTTOM OF STONE:	79.643

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED EZ END CAP	A	600 mm BOTTOM PREFABRICATED EZ END CAP, PART#: SC740ECEZ / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	3 mm	
FLAMP	B	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: SC74024RAMP (TYP 3 PLACES)		
MANIFOLD	C	300 mm x 300 mm TOP MANIFOLD, ADS N-12	318 mm	
MANIFOLD	D	300 mm x 300 mm BOTTOM MANIFOLD, ADS N-12	30 mm	
NYLOPLAST (INLET W/ ISO PLUS ROW)	E	750 mm DIAMETER (610 mm SUMP MIN)		
NYLOPLAST (INLET W/ ISO PLUS ROW)	F	750 mm DIAMETER (610 mm SUMP MIN)		
NYLOPLAST (INLET W/ ISO PLUS ROW)	G	750 mm DIAMETER (610 mm SUMP MIN)		130 L/s IN
NYLOPLAST (OUTLET)	H	750 mm DIAMETER (DESIGN BY ENGINEER)		113 L/s OUT
UNDERDRAIN	I	150 mm ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS
(SEE DETAIL/TYP 2 PLACES)

PLACE MINIMUM 3.810 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

THERMOPLASTIC LINER (SEE TECH NOTE #6.50 PROVIDED BY OTHERS / DESIGN BY OTHERS)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- ADS DOES NOT DESIGN OR PROVIDE MEMBRANE LINER SYSTEMS FOR CISTERNS (RAINWATER HARVESTING). TO MINIMIZE THE LEAKAGE POTENTIAL OF LINER SYSTEMS, THE MEMBRANE LINER SYSTEM SHOULD BE DESIGNED BY A KNOWLEDGEABLE GEOTEXTILE PROFESSIONAL AND INSTALLED BY A QUALIFIED CONTRACTOR.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

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DESCRIPTION	CHK	DRW	DATE

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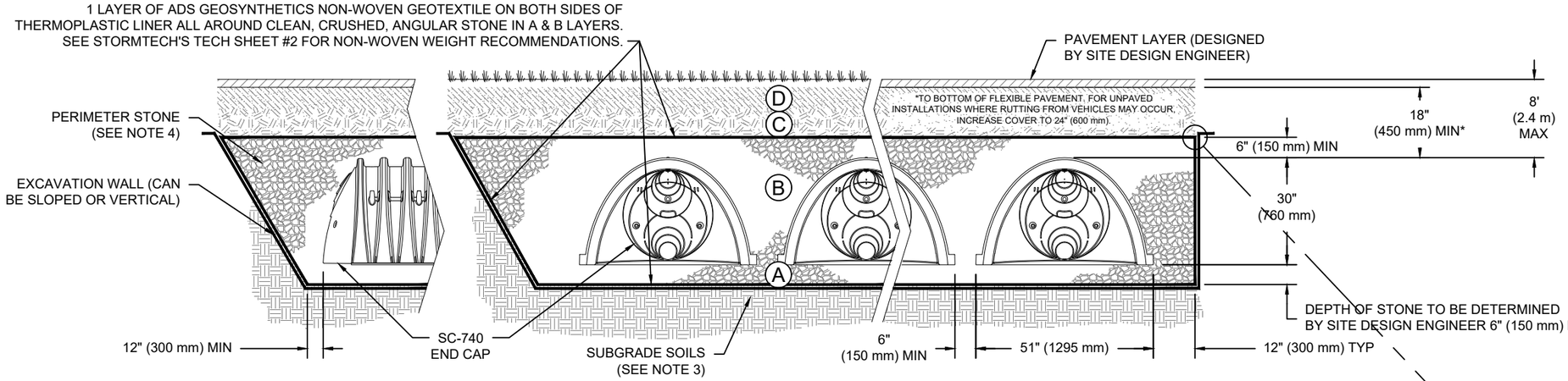
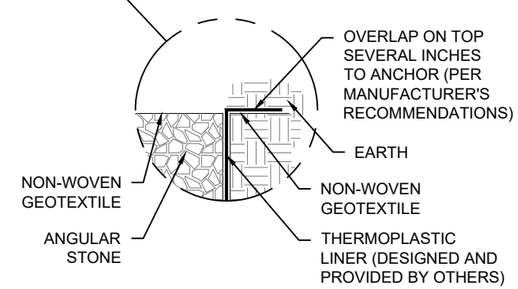
SCALE = 1 : 150

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

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

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.





THERMOPLASTIC LINER DETAIL

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 550 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

CHEO PARKING GARAGE
OTTAWA, ON, CANADA
DRAWN: ZS
CHECKED: N/A
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

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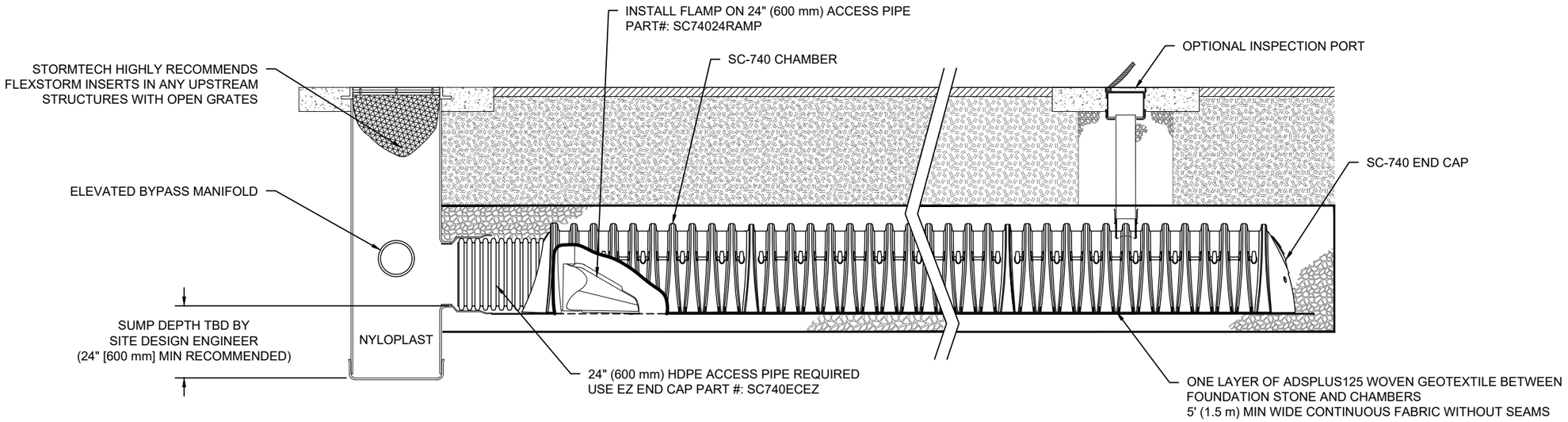

SC-740 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

CHEO PARKING GARAGE
OTTAWA, ON, CANADA
DRAWN: ZS
CHECKED: N/A
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PROJECT #:

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UNDERDRAIN DETAIL

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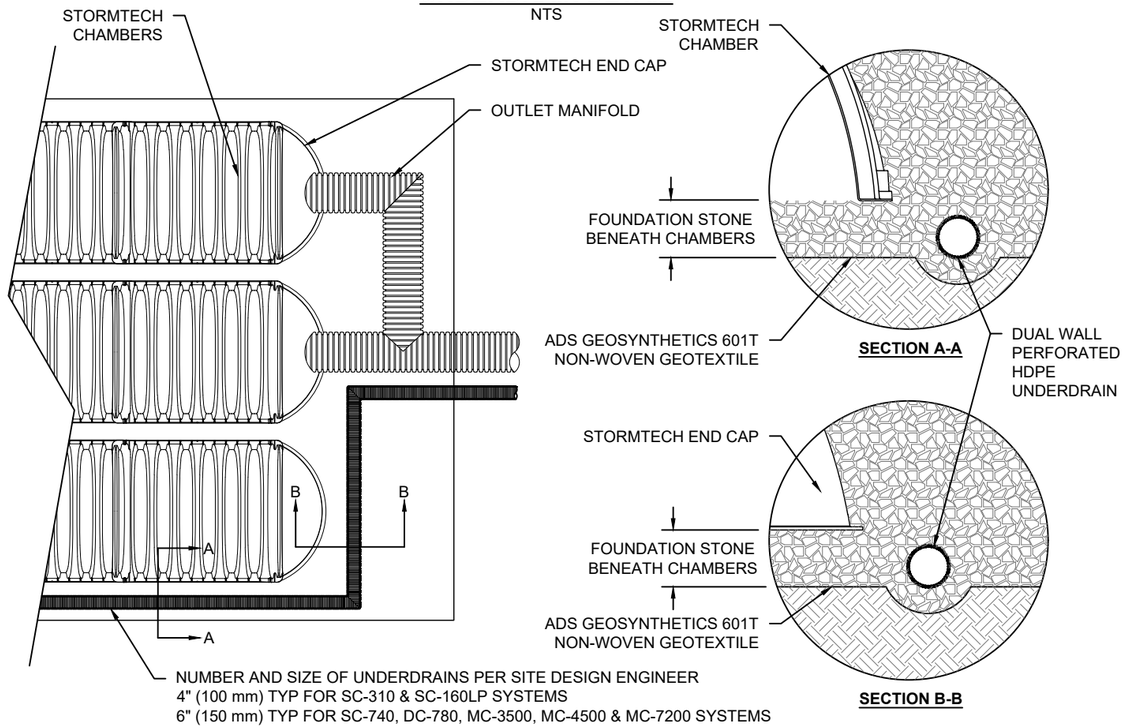
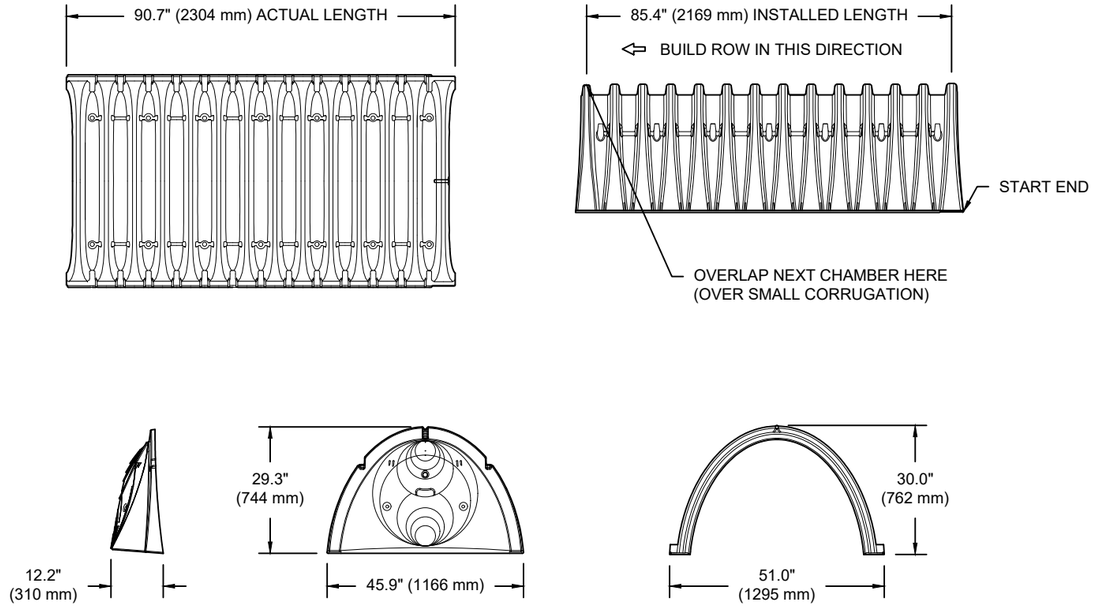


SC-740 TECHNICAL SPECIFICATION

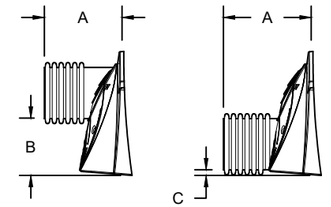
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



PRE-FAB STUB AT BOTTOM OF END CAP WITH FLAMP END WITH "BR"
PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740ECEZ*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740ECEZ ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

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

NOTE: ALL DIMENSIONS ARE NOMINAL

CHEO PARKING GARAGE
OTTAWA, ON, CANADA
DATE:
DRAWN: ZS
PROJECT #:
CHECKED: N/A

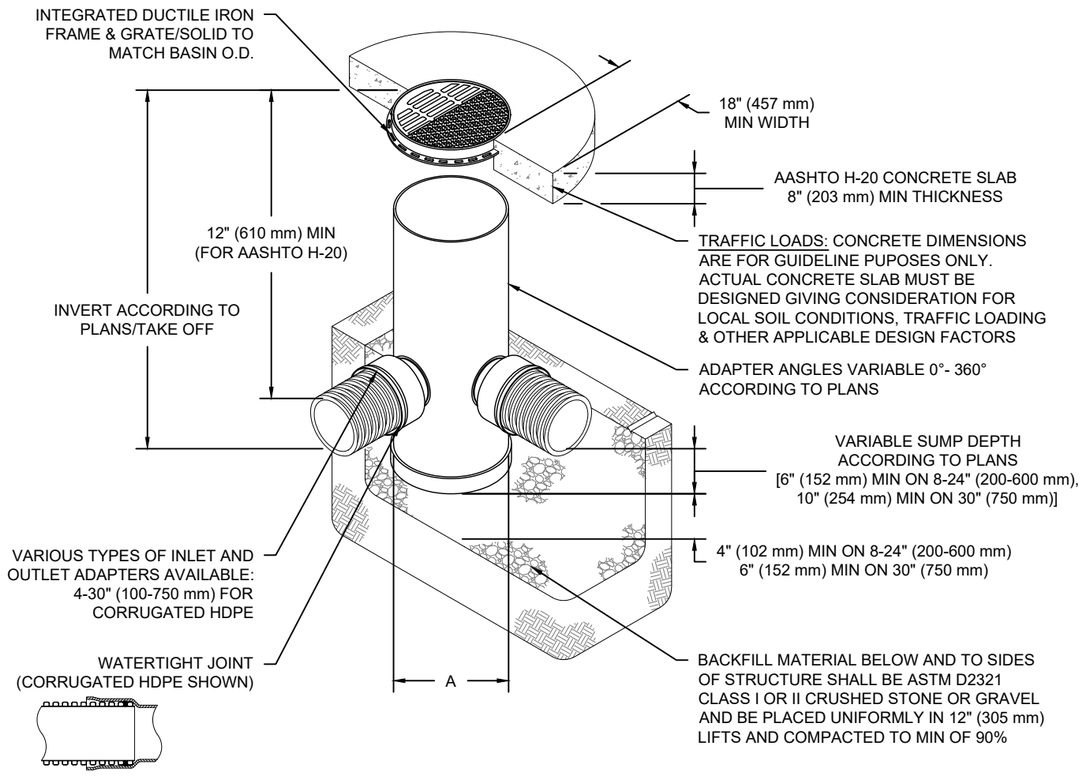
DATE	DRW	CHK	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM

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

NYLOPLAST DRAIN BASIN

NTS



NOTES

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

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

CHEO PARKING GARAGE

OTTAWA, ON, CANADA

DATE:

DRAWN: ZS

PROJECT #:

CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

Nyloplast®

770-932-2443 | WWW.NYLOPLAST-US.COM

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

INV=80.600

CAUTION CROSSINGS.
PRIMARY ELECTRICAL
DUCT BANKS TO HAVE
MINIMUM 1m COVER

MH60 (1200Ø)
T/G=82.12
E INV=79.387
W INV=79.357

MH57 (1200Ø)
T/G=82.06
E INV=79.190
NW INV=79.160

3.0m

3.0m

MH75 (1200Ø)
T/G=82.57
W INV=79.795

INV=80.800

INV=81.300

4.7m-375mmØ
STM @ 2.00%

INV=79.795

MH41 (1200Ø)
T/G=82.57
W INV=79.795
S INV=80.395

MH17A (1200Ø)
T/G=82.55
E INV=80.620
W INV=80.560

CAUTION CROSSINGS.
PRIMARY ELECTRICAL
DUCT BANKS TO HAVE
MINIMUM 1m COVER

MH16A (1200Ø)
T/G=82.66
S INV=80.840
W INV=80.780

WV

WV

HYD

PHASE 1A
PARKING GARAGE
FF=82.953

PR FIRE
DEPARTMENT
CONNECTION

INV=80.800

STORM SEWER DESIGN SHEET - 5 Year Storm

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

IDF Data - 5 Year City of Ottawa	
A	998.071
B	6.053
C	0.814

Pipe Data		
Roughness (n)	0.013	
Min. Velocity	0.6	m/s
Max. Velocity	3	m/s

Pipe	Sewer Segments			Area		AC			Tc		Design Flow		Pipe Flow					
	From	To	L (m)	Inc (ha)	Total (ha)	C	Inc. (ha)	Total (ha)	Inlet (min)	System (min)	I (mm/hr)	Q (m^3/s)	D (mm)	Slope (design)	Qfull (m^3/s)	Q/QF	Velocity (m/s)	Travel Time (min)
1	CB50	MH40	6.2	0.06	0.06	0.58	0.03	0.03	10	10.00	104.2	0.010	200	1.91%	0.045	0.222	1.44	0.072
2	CB38	CBMH39	29	0.14	0.14	0.74	0.10	0.10	10	10.00	104.2	0.016	250	0.50%	0.042	0.381	0.86	0.564
3	CBMH39	MH40	28.2	0.11	0.25	0.70	0.08	0.18	10	10.56	101.3	0.016	250	0.50%	0.042	0.381	0.86	0.549
4	MH40	MH75	31.6	0.06	0.37	0.63	0.04	0.25	10	10.56	101.3	0.071	375	0.36%	0.105	0.673	0.95	0.553
5	STM1	MH41	11.3	0.49	0.49	0.90	0.44	0.44	10	10.00	104.2	0.128	375	2.00%	0.248	0.516	2.25	0.084
6	CBMH48	GALLERY	3	0.06	0.06	0.90	0.06	0.06	10	10.00	104.2	0.016	375	3.40%	0.323	0.051	2.93	0.017
7	MH60	MH57	24						10	10.00	104.2	0.057	300	2.40%	0.150	0.380	2.12	0.189
8	MH57	EX MH780	2						10	10.19	103.2	0.057	300	2.40%	0.150	0.380	2.12	0.016

Notes:
1. The design flow entering system branch reaching between CB38 and MH40 (Pipes 2 and 3 above) was set equal to the modelled outflow from the surface ponding storage
2. The design flow entering system branch following the storage gallery (Pipes 7 and 8 above) was set equal to the modelled outflow from the gallery node within the PCSWM model

STORM SEWER DESIGN SHEET - 100 Year Storm

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

IDF Data - 100 Year City of Ottawa	
A	1735.688
B	6.014
C	0.820

Pipe Data		
Roughness (n)	0.013	
Min. Velocity	0.6	m/s
Max. Velocity	3	m/s

Pipe	Sewer Segments			Area		AC			Tc		Design Flow		Pipe Flow					
	From	To	L (m)	Inc (ha)	Total (ha)	C	Inc. (ha)	Total (ha)	Inlet (min)	System (min)	I (mm/hr)	Q (m^3/s)	D (mm)	Slope (design)	Qfull (m^3/s)	Q/QF	Velocity (m/s)	Travel Time (min)
1	CB50	MH40	6.2	0.06	0.06	0.58	0.03	0.03	10	10.00	178.6	0.016	200	1.91%	0.045	0.356	1.44	0.072
2	CB38	CBMH39	29	0.14	0.14	0.74	0.10	0.10	10	10.00	178.6	0.020	250	0.50%	0.042	0.476	0.86	0.564
3	CBMH39	MH40	28.2	0.11	0.25	0.70	0.08	0.18	10	10.56	173.6	0.020	250	0.50%	0.042	0.476	0.86	0.549
4	MH40	MH75	31.6	0.06	0.36	0.63	0.04	0.25	10	10.56	173.6	0.055	375	0.36%	0.105	0.523	0.95	0.553
5	STM1	MH41	11.3	0.49	0.49	0.90	0.44	0.44	10	10.00	178.6	0.219	375	2.00%	0.248	0.885	2.25	0.084
6	CBMH48	GALLERY	3	0.06	0.06	0.90	0.06	0.06	10	10.00	178.6	0.219	375	3.40%	0.323	0.679	2.93	0.017
7	MH60	MH57	24						10	10.00	178.6	0.070	300	2.40%	0.150	0.467	2.12	0.189
8	MH57	EX MH780	2						10	10.19	176.9	0.070	300	2.40%	0.150	0.467	2.12	0.016

Notes:
1. The design flow entering system branch reaching between CB38 and MH40 (Pipes 1 and 2 above) was set equal to the modelled outflow from the surface ponding storage
2. The design flow entering system branch following the storage gallery (Pipes 7 and 8 above) was set equal to the modelled outflow from the gallery node within the PCSWM model

STORMWATER MANAGEMENT CALCULATIONS
ORIFICE DESIGN CALCULATION

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
CHEO 1DOOR4CARE - PARKING GARAGE
OTTAWA, ONTARIO

Parameters for Orifice Plate - Surface Storage Node		
$Q = C_d\sqrt{2gh}$		
Discharge Coefficient (C_d)	0.65	-
Acceleration due to Gravity (g)	9.81	m/s
Max. Water Level Assigned to Storage Unit	81.87	m
Centreline Elevation of Orifice Plate	80.25	m
Hydraulic Head (h)	0.30	m
Calculated Max. Flow out of Orifice (Q)	**1.58**	**m^3/s**

Parameters for Orifice Plate - Detention Gallery Node		
$Q = C_d\sqrt{2gh}$		
Discharge Coefficient (C_d)	0.65	-
Acceleration due to Gravity (g)	9.81	m/s
Max. Water Level Assigned to Storage Unit	80.56	m
Centreline Elevation of Orifice Plate	79.90	m
Hydraulic Head (h)	0.66	m
Calculated Max. Flow out of Orifice (Q)	**2.34**	**m^3/s**

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.3)

****
Element Count
****
Number of rain gages 7
Number of subcatchments ... 9
Number of nodes 14
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100-Year	100-Year	INTENSITY	10 min.
10-Year	10-Year	INTENSITY	10 min.
2_yr	2_yr	INTENSITY	10 min.
25-Year	25-Year	INTENSITY	10 min.
2-Year	2-Year	INTENSITY	10 min.
50-Year	50-Year	INTENSITY	10 min.
5-Year	5-Year	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201A	0.25	20.00	90.00	0.5000	2_yr	STM1
201B	0.24	19.60	90.00	0.5000	2_yr	201A
202	0.14	33.75	74.00	2.1000	2_yr	CB38-S
203	0.11	27.75	70.00	2.5000	2_yr	GRAVEL_STORAGE
204	0.06	15.50	65.00	1.5000	2_yr	MH40-S

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205	0.06	15.75	90.00	1.0000	2_yr	CBMH48-S
206	0.06	9.33	58.00	0.5000	2_yr	MH40-S
207	0.10	6.53	68.00	0.5000	2_yr	Ring_Road
208	0.11	7.40	41.00	0.5000	2_yr	North_Hospital

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB38	JUNCTION	80.35	1.22	0.0	
CB38-S	JUNCTION	81.57	0.25	0.0	
CB50	JUNCTION	80.20	1.31	0.0	
CBMH39	JUNCTION	80.17	1.50	0.0	
CBMH48	JUNCTION	79.94	2.39	0.0	
CBMH48-S	JUNCTION	82.33	0.25	0.0	
MH40	JUNCTION	79.91	1.86	0.0	
MH40-S	JUNCTION	81.77	0.25	0.0	
MH57	JUNCTION	79.16	2.90	0.0	
STM1	JUNCTION	81.20	1.80	0.0	
North_Hospital	OUTFALL	79.11	0.30	0.0	
Ring_Road	OUTFALL	81.72	0.25	0.0	
DETENTION	STORAGE	79.80	0.76	0.0	
GRAVEL_STORAGE	STORAGE	81.57	0.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CB38-to-CBMH39	CB38	CBMH39	CONDUIT	29.0	0.4966	0.0130
CB38-to-CBMH39-S	CB38-S	GRAVEL_STORAGE	CONDUIT	29.0	-1.0345	0.0130
CB50-to-MH40	CB50	MH40	CONDUIT	6.2	1.9197	0.0130
CB50-to-MH40-S	MH40-S	Ring_Road	CONDUIT	190.0	0.0263	0.0130
CBMH39-to-MH40	CBMH39	MH40	CONDUIT	28.2		

```
0.4929    0.0130
  CBMH48-to-GALLERY CBMH48           DETENTION        CONDUIT            3.0
4.9728    0.0130
  CON1-to-MH41     STM1              DETENTION        CONDUIT           11.3
12.5309    0.0130
  GAL-to-MH57      DETENTION         MH57             CONDUIT           24.0
2.6468    0.0130
  MH40-to-MH75     MH40              DETENTION        CONDUIT           31.6
0.3639    0.0130
  MH40-to-MH75-S   CBMH48-S          MH40-S           CONDUIT           63.0
0.8889    0.0130
  MH57-to-EXMH780  MH57              North_Hospital   CONDUIT            2.0
2.4007    0.0130
  9                GRAVEL_STORAGE    CBMH39           ORIFICE


  **********************
  Cross Section Summary
  **********************
                                       Full     Full     Hyd.     Max.   No. of
 Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
 Flow

-------------------------------------------------------------------------------
----
  CB38-to-CBMH39   CIRCULAR             0.25     0.05     0.06     0.25        1
 0.04
  CB38-to-CBMH39-S Street              0.25     2.41     0.18    13.00        1
 5.94
  CB50-to-MH40     CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  CB50-to-MH40-S   Street              0.25     2.41     0.18    13.00        1
 0.95
  CBMH39-to-MH40   CIRCULAR            0.25     0.05     0.06     0.25        1
 0.04
  CBMH48-to-GALLERY CIRCULAR            0.38     0.11     0.09     0.38        1
 0.39
  CON1-to-MH41     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.62
  GAL-to-MH57      CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  MH40-to-MH75     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.11
  MH40-to-MH75-S   Street              0.25     2.41     0.18    13.00        1
 5.51
  MH57-to-EXMH780  CIRCULAR            0.30     0.07     0.07     0.30        1
 0.15
```

2021-0821-10: 2 Year Storm Event

```
**************
Street Summary
**************

Street Street
Area:
            0.0005     0.0021     0.0047     0.0083     0.0130
            0.0187     0.0255     0.0333     0.0421     0.0520
            0.0629     0.0748     0.0878     0.1019     0.1169
            0.1331     0.1502     0.1684     0.1876     0.2079
            0.2292     0.2516     0.2749     0.2994     0.3248
            0.3514     0.3784     0.4054     0.4324     0.4595
            0.4865     0.5135     0.5405     0.5676     0.5946
            0.6216     0.6486     0.6757     0.7027     0.7297
            0.7568     0.7838     0.8108     0.8378     0.8649
            0.8919     0.9189     0.9459     0.9730     1.0000
Hrad:
            0.0138     0.0275     0.0413     0.0550     0.0688
            0.0825     0.0963     0.1101     0.1238     0.1376
            0.1513     0.1651     0.1789     0.1926     0.2064
            0.2201     0.2339     0.2476     0.2614     0.2752
            0.2889     0.3027     0.3164     0.3302     0.3440
            0.3577     0.3849     0.4121     0.4393     0.4664
            0.4934     0.5205     0.5474     0.5744     0.6013
            0.6281     0.6550     0.6817     0.7085     0.7352
            0.7618     0.7885     0.8150     0.8416     0.8681
            0.8945     0.9210     0.9473     0.9737     1.0000
Width:
            0.0385     0.0769     0.1154     0.1538     0.1923
            0.2308     0.2692     0.3077     0.3462     0.3846
            0.4231     0.4615     0.5000     0.5385     0.5769
            0.6154     0.6538     0.6923     0.7308     0.7692
            0.8077     0.8462     0.8846     0.9231     0.9615
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


***************
Analysis Options
***************
Flow Units ..............  CMS
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 ............ 01/04/2023 00:00:00
Ending Date .............. 01/04/2023 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.036	31.880
Evaporation Loss	0.000	0.000
Infiltration Loss	0.009	7.818
Surface Runoff	0.026	23.058
Final Storage	0.001	1.211
Continuity Error (%)	-0.650	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.026	0.260
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.022	0.222
Flooding Loss	0.000	0.002
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.005	0.046
Continuity Error (%)	-3.881	

2021-0821-10: 2 Year Storm Event

Highest Continuity Errors

Node CB38-S (94.52%)
Node MH40-S (2.55%)

Time-Step Critical Elements

Link MH57-to-EXMH780 (98.66%)
Link CON1-to-MH41 (1.14%)

Highest Flow Instability Indexes

All links are stable.

Most Frequent Nonconverging Nodes

Convergence obtained at all time steps.

Routing Time Step Summary

```
Minimum Time Step           :     0.52 sec
Average Time Step           :     1.67 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
   30.000 - 13.228 sec      :     0.20 %
   13.228 -  5.833 sec      :     0.13 %
    5.833 -  2.572 sec      :    21.65 %
    2.572 -  1.134 sec      :    36.84 %
    1.134 -  0.500 sec      :    41.18 %
```

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201A	31.88	26.92	0.00	4.54	51.75	1.36	53.11	0.13	0.06	0.903
201B	31.88	0.00	0.00	3.19	27.48	0.00	27.48	0.07	0.04	0.862
202	31.88	0.00	0.00	8.29	22.60	0.01	22.61	0.03	0.02	0.709
203	31.88	0.00	0.00	9.56	21.37	0.01	21.38	0.02	0.02	0.671
204	31.88	0.00	0.00	11.16	19.86	0.01	19.87	0.01	0.01	0.623
205	31.88	0.00	0.00	3.19	27.54	0.01	27.55	0.02	0.01	0.864
206	31.88	0.00	0.00	13.39	17.75	0.00	17.76	0.01	0.01	0.557
207	31.88	0.00	0.00	10.20	20.77	0.00	20.77	0.02	0.01	0.651
208	31.88	0.00	0.00	18.81	12.54	0.00	12.54	0.01	0.01	0.393

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB38	JUNCTION	0.00	0.00	80.35	0 00:00	0.00
CB38-S	JUNCTION	0.24	0.25	81.82	0 02:31	0.25
CB50	JUNCTION	0.02	0.05	80.25	0 01:12	0.05
CBMH39	JUNCTION	0.02	0.10	80.27	0 01:02	0.09
CBMH48	JUNCTION	0.00	0.04	79.99	0 01:14	0.04
CBMH48-S	JUNCTION	0.00	0.02	82.35	0 01:00	0.02
MH40	JUNCTION	0.03	0.13	80.04	0 01:01	0.13
MH40-S	JUNCTION	0.02	0.04	81.81	0 01:12	0.04
MH57	JUNCTION	0.04	0.12	79.28	0 01:14	0.12
STM1	JUNCTION	0.02	0.08	81.28	0 01:00	0.08
North_Hospital	OUTFALL	0.04	0.12	79.23	0 01:14	0.12

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Ring_Road	OUTFALL	0.01	0.02	81.74	0	01:12	0.02
DETENTION	STORAGE	0.07	0.19	79.99	0	01:14	0.19
GRAVEL_STORAGE	STORAGE	0.02	0.14	81.71	0	01:01	0.14

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Flow Balance Error Percent
CB38	JUNCTION	0.000	0.000	0 00:00	0	0.000 ltr
CB38-S	JUNCTION	0.021	0.021	0 01:00	0.0305	0.0305 1726.111
CB50	JUNCTION	0.007	0.007	0 01:12	0.0395	0.0395 0.013
CBMH39	JUNCTION	0.000	0.013	0 01:01	0	0.0237 0.007
CBMH48	JUNCTION	0.000	0.000	0 01:04	0	5.21e-05 0.092
CBMH48-S	JUNCTION	0.012	0.012	0 01:00	0.0173	0.0173 -2.262
MH40	JUNCTION	0.011	0.028	0 01:01	0.0169	0.0801 -0.094
MH40-S	JUNCTION	0.006	0.017	0 01:00	0.00529	0.0231 2.614
MH57	JUNCTION	0.000	0.052	0 01:14	0	0.201 0.005
STM1	JUNCTION	0.058	0.058	0 01:00	0.132	0.132 -0.034
North_Hospital	OUTFALL	0.009	0.055	0 01:13	0.0139	0.215 0.000
Ring_Road	OUTFALL	0.008	0.010	0 01:00	-0.0192	0.0276 0.000
DETENTION	STORAGE	0.000	0.085	0 01:01	0	0.212 0.114

```
  GRAVEL_STORAGE       STORAGE      0.017    0.017     0  01:00      0.0237
0.0237      -0.018


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                          Max. Height   Min. Depth
                            Hours       Above Crown    Below Rim
  Node                Type      Surcharged         Meters       Meters
  -------------------------------------------------------------------------
  CB38-S              JUNCTION       12.48          0.000        0.000


  **********************
  Node Flooding Summary
  **********************

  Flooding refers to all water that overflows a node, whether it ponds or not.
  ---------------------------------------------------------------------------
                                                        Total   Maximum
                              Maximum   Time of Max       Flood    Ponded
                    Hours       Rate    Occurrence      Volume     Depth
  Node              Flooded      CMS   days hr:min    10^6 ltr    Meters
  ---------------------------------------------------------------------------
  CB38-S               2.22     0.001      0  02:31       0.002     0.000


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------
-------------
                         Average    Avg   Evap  Exfil     Maximum    Max    Time of
Max    Maximum
                          Volume   Pcnt   Pcnt   Pcnt      Volume   Pcnt
Occurrence    Outflow
  Storage Unit           1000 m³   Full   Loss   Loss     1000 m³   Full    days
hr:min        CMS

-------------------------------------------------------------------------------
-------------
  DETENTION                0.022    9.5    0.0    0.0       0.058   25.0       0
01:14      0.052
```



```
  GRAVEL_STORAGE           0.000    0.0    0.0    0.0       0.000    0.0       0
01:01      0.017


  **********************
  Outfall Loading Summary
  **********************

  ---------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
  Outfall Node          Pcnt       CMS       CMS    10^6 ltr
  ---------------------------------------------------------
  North_Hospital       99.80     0.010     0.055       0.215
  Ring_Road            70.28     0.002     0.010       0.028
  ---------------------------------------------------------
  System               85.04     0.012     0.060       0.242


  ******************
  Street Flow Summary
  ******************


-------------------------------------------------------------------------------
-------------------------------------------------

    Peak     Avg.   Bypass     Back     Peak     Peak
                       Peak   Maximum   Maximum
    Flow     Flow     Flow     Flow  Capture   Bypass
                        Flow    Spread     Depth  Inlet             Inlet     Inlet
 Capture  Capture     Freq     Freq  / Inlet     Flow
  Street Conduit        CMS        m         m  Design            Location
    Pcnt     Pcnt     Pcnt     Pcnt      CMS      CMS

-------------------------------------------------------------------------------
-------------------------------------------------
  CB38-to-CBMH39-S     0.000    6.251     0.125  Inlet1            ON-GRADE      1
  CB50-to-MH40-S       0.005    1.560     0.031  Inlet1            ON-SAG        1
  100.00   100.00     0.00     0.00     0.00     0.00
  MH40-to-MH75-S       0.012    1.633     0.033  Inlet1            ON-GRADE      1
   89.27    99.33    12.85     0.00     0.01     0.00


  ******************
  Link Flow Summary
  ******************

  -------------------------------------------------------------------------
```

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
CB38-to-CBMH39	CONDUIT	0.000	0	00:00	0.00	0.00	0.13
CB38-to-CBMH39-S	CONDUIT	0.000	0	00:00	0.00	0.00	0.50
CB50-to-MH40	CONDUIT	0.007	0	01:12	1.07	0.16	0.27
CB50-to-MH40-S	CONDUIT	0.005	0	01:12	0.09	0.00	0.12
CBMH39-to-MH40	CONDUIT	0.013	0	01:02	0.77	0.31	0.37
CBMH48-to-GALLERY	CONDUIT	0.000	0	01:04	0.02	0.00	0.31
CON1-to-MH41	CONDUIT	0.058	0	01:00	3.37	0.09	0.34
GAL-to-MH57	CONDUIT	0.052	0	01:14	1.94	0.98	0.80
MH40-to-MH75	CONDUIT	0.028	0	01:02	1.11	0.27	0.40
MH40-to-MH75-S	CONDUIT	0.012	0	01:00	0.30	0.00	0.13
MH57-to-EXMH780	CONDUIT	0.052	0	01:14	1.93	0.35	0.41
9	ORIFICE	0.013	0	01:01			0.95

****
Flow Classification Summary
****

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
CB38-to-CBMH39	1.00	0.93	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB38-to-CBMH39-S	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB50-to-MH40	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
CB50-to-MH40-S	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.00
CBMH39-to-MH40	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
CBMH48-to-GALLERY	1.00	0.03	0.92	0.00	0.04	0.00	0.00	0.00	0.90	0.00
CON1-to-MH41	1.00	0.03	0.00	0.00	0.92	0.05	0.00	0.00	0.94	0.00
GAL-to-MH57	1.00	0.06	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00
MH40-to-MH75	1.00	0.03	0.00	0.00	0.94	0.03	0.00	0.00	0.93	0.00
MH40-to-MH75-S	1.00	0.03	0.00	0.00	0.96	0.01	0.00	0.00	0.95	0.00
MH57-to-EXMH780	1.00	0.06	0.00	0.00	0.00	0.94	0.00	0.00	0.41	0.00

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****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Sep 15 14:13:26 2023
Analysis ended on: Fri Sep 15 14:13:27 2023
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.3)

****
Element Count
****
Number of rain gages 7
Number of subcatchments ... 9
Number of nodes 14
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100-Year	100-Year	INTENSITY	10 min.
10-Year	10-Year	INTENSITY	10 min.
25-Year	25-Year	INTENSITY	10 min.
2-Year	2-Year	INTENSITY	10 min.
5_yr	5_yr	INTENSITY	10 min.
50-Year	50-Year	INTENSITY	10 min.
5-Year	5-Year	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201A	0.25	20.00	90.00	0.5000	5_yr	STM1
201B	0.24	19.60	90.00	0.5000	5_yr	201A
202	0.14	33.75	74.00	2.1000	5_yr	CB38-S
203	0.11	27.75	70.00	2.5000	5_yr	GRAVEL_STORAGE
204	0.06	15.50	65.00	1.5000	5_yr	MH40-S

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205	0.06	15.75	90.00	1.0000	5_yr	CBMH48-S
206	0.06	9.33	58.00	0.5000	5_yr	MH40-S
207	0.10	6.53	68.00	0.5000	5_yr	Ring_Road
208	0.11	7.40	41.00	0.5000	5_yr	North_Hospital

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB38	JUNCTION	80.35	1.22	0.0	
CB38-S	JUNCTION	81.57	0.25	0.0	
CB50	JUNCTION	80.20	1.31	0.0	
CBMH39	JUNCTION	80.17	1.50	0.0	
CBMH48	JUNCTION	79.94	2.39	0.0	
CBMH48-S	JUNCTION	82.33	0.25	0.0	
MH40	JUNCTION	79.91	1.86	0.0	
MH40-S	JUNCTION	81.77	0.25	0.0	
MH57	JUNCTION	79.16	2.90	0.0	
STM1	JUNCTION	81.20	1.80	0.0	
North_Hospital	OUTFALL	79.11	0.30	0.0	
Ring_Road	OUTFALL	81.72	0.25	0.0	
DETENTION	STORAGE	79.80	0.76	0.0	
GRAVEL_STORAGE	STORAGE	81.57	0.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CB38-to-CBMH39	CB38	CBMH39	CONDUIT	29.0	0.4966	0.0130
CB38-to-CBMH39-S	CB38-S	GRAVEL_STORAGE	CONDUIT	29.0	-1.0345	0.0130
CB50-to-MH40	CB50	MH40	CONDUIT	6.2	1.9197	0.0130
CB50-to-MH40-S	MH40-S	Ring_Road	CONDUIT	190.0	0.0263	0.0130
CBMH39-to-MH40	CBMH39	MH40	CONDUIT	28.2		

```
0.4929    0.0130
  CBMH48-to-GALLERY CBMH48           DETENTION        CONDUIT            3.0
4.9728    0.0130
  CON1-to-MH41     STM1              DETENTION        CONDUIT           11.3
12.5309    0.0130
  GAL-to-MH57      DETENTION         MH57             CONDUIT           24.0
2.6468    0.0130
  MH40-to-MH75     MH40              DETENTION        CONDUIT           31.6
0.3639    0.0130
  MH40-to-MH75-S   CBMH48-S          MH40-S           CONDUIT           63.0
0.8889    0.0130
  MH57-to-EXMH780  MH57              North_Hospital   CONDUIT            2.0
2.4007    0.0130
  9                GRAVEL_STORAGE    CBMH39           ORIFICE


  **********************
  Cross Section Summary
  **********************
                                       Full     Full     Hyd.     Max.   No. of
 Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
 Flow

-------------------------------------------------------------------------------
----
  CB38-to-CBMH39   CIRCULAR             0.25     0.05     0.06     0.25        1
 0.04
  CB38-to-CBMH39-S Street              0.25     2.41     0.18    13.00        1
 5.94
  CB50-to-MH40     CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  CB50-to-MH40-S   Street              0.25     2.41     0.18    13.00        1
 0.95
  CBMH39-to-MH40   CIRCULAR            0.25     0.05     0.06     0.25        1
 0.04
  CBMH48-to-GALLERY CIRCULAR            0.38     0.11     0.09     0.38        1
 0.39
  CON1-to-MH41     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.62
  GAL-to-MH57      CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  MH40-to-MH75     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.11
  MH40-to-MH75-S   Street              0.25     2.41     0.18    13.00        1
 5.51
  MH57-to-EXMH780  CIRCULAR            0.30     0.07     0.07     0.30        1
 0.15
```

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**************
Street Summary
**************

Street Street
Area:
            0.0005     0.0021     0.0047     0.0083     0.0130
            0.0187     0.0255     0.0333     0.0421     0.0520
            0.0629     0.0748     0.0878     0.1019     0.1169
            0.1331     0.1502     0.1684     0.1876     0.2079
            0.2292     0.2516     0.2749     0.2994     0.3248
            0.3514     0.3784     0.4054     0.4324     0.4595
            0.4865     0.5135     0.5405     0.5676     0.5946
            0.6216     0.6486     0.6757     0.7027     0.7297
            0.7568     0.7838     0.8108     0.8378     0.8649
            0.8919     0.9189     0.9459     0.9730     1.0000
Hrad:
            0.0138     0.0275     0.0413     0.0550     0.0688
            0.0825     0.0963     0.1101     0.1238     0.1376
            0.1513     0.1651     0.1789     0.1926     0.2064
            0.2201     0.2339     0.2476     0.2614     0.2752
            0.2889     0.3027     0.3164     0.3302     0.3440
            0.3577     0.3849     0.4121     0.4393     0.4664
            0.4934     0.5205     0.5474     0.5744     0.6013
            0.6281     0.6550     0.6817     0.7085     0.7352
            0.7618     0.7885     0.8150     0.8416     0.8681
            0.8945     0.9210     0.9473     0.9737     1.0000
Width:
            0.0385     0.0769     0.1154     0.1538     0.1923
            0.2308     0.2692     0.3077     0.3462     0.3846
            0.4231     0.4615     0.5000     0.5385     0.5769
            0.6154     0.6538     0.6923     0.7308     0.7692
            0.8077     0.8462     0.8846     0.9231     0.9615
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


***************
Analysis Options
***************
Flow Units ..... CMS
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 ............ 01/04/2023 00:00:00
Ending Date .............. 01/04/2023 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.048	42.540
Evaporation Loss	0.000	0.000
Infiltration Loss	0.011	9.456
Surface Runoff	0.036	32.182
Final Storage	0.001	1.211
Continuity Error (%)	-0.724	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.036	0.362
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.031	0.312
Flooding Loss	0.001	0.014
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.005	0.046
Continuity Error (%)	-2.714	

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```
Highest Continuity Errors
*************************
Node CB38-S (66.89%)
Node MH40-S (2.12%)


**************************
Time-Step Critical Elements
**************************
Link MH57-to-EXMH780 (98.65%)
Link CON1-to-MH41 (1.19%)


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*******************************
Most Frequent Nonconverging Nodes
*******************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.51 sec
Average Time Step           :     1.58 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
   30.000 - 13.228 sec      :     0.15 %
   13.228 -  5.833 sec      :     0.15 %
    5.833 -  2.572 sec      :    20.31 %
    2.572 -  1.134 sec      :    34.72 %
    1.134 -  0.500 sec      :    44.67 %


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


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-----------------------------------------
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201A	42.54	36.82	0.00	4.87	70.36	3.11	73.47	0.18	0.09	0.926
201B	42.54	0.00	0.00	3.85	37.16	0.42	37.58	0.09	0.06	0.883
202	42.54	0.00	0.00	9.73	30.52	1.42	31.94	0.04	0.03	0.751
203	42.54	0.00	0.00	11.24	28.85	1.61	30.46	0.03	0.02	0.716
204	42.54	0.00	0.00	13.28	26.81	1.68	28.50	0.02	0.01	0.670
205	42.54	0.00	0.00	3.69	37.20	0.61	37.82	0.02	0.02	0.889
206	42.54	0.00	0.00	16.61	23.99	1.29	25.28	0.01	0.01	0.594
207	42.54	0.00	0.00	12.95	28.09	0.68	28.77	0.03	0.02	0.676
208	42.54	0.00	0.00	24.30	16.96	0.82	17.77	0.02	0.01	0.418

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB38	JUNCTION	0.00	0.00	80.35	0 00:00	0.00
CB38-S	JUNCTION	0.24	0.25	81.82	0 01:11	0.25
CB50	JUNCTION	0.02	0.07	80.27	0 01:11	0.07
CBMH39	JUNCTION	0.02	0.11	80.28	0 01:03	0.10
CBMH48	JUNCTION	0.02	0.15	80.09	0 01:19	0.14
CBMH48-S	JUNCTION	0.01	0.03	82.36	0 01:00	0.03
MH40	JUNCTION	0.05	0.18	80.09	0 01:19	0.18
MH40-S	JUNCTION	0.02	0.05	81.82	0 01:11	0.05
MH57	JUNCTION	0.04	0.13	79.29	0 01:41	0.13
STM1	JUNCTION	0.02	0.10	81.30	0 01:00	0.10
North_Hospital	OUTFALL	0.04	0.13	79.24	0 01:41	0.13

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Ring_Road	OUTFALL	0.01	0.02	81.74	0	01:11	0.02
DETENTION	STORAGE	0.09	0.29	80.09	0	01:19	0.29
GRAVEL_STORAGE	STORAGE	0.02	0.17	81.74	0	01:02	0.16

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CB38	JUNCTION	0.000	0.000	0 00:00	0	0	0.000 ltr
CB38-S	JUNCTION	0.031	0.031	0 01:00	0.0431	0.0431	201.978
CB50	JUNCTION	0.012	0.012	0 01:11	0.0547	0.0547	0.010
CBMH39	JUNCTION	0.000	0.016	0 01:02	0	0.0338	0.005
CBMH48	JUNCTION	0.000	0.001	0 01:00	0	0.000171	0.062
CBMH48-S	JUNCTION	0.017	0.017	0 01:00	0.0238	0.0238	-2.136
MH40	JUNCTION	0.014	0.038	0 01:01	0.0227	0.111	-0.071
MH40-S	JUNCTION	0.009	0.025	0 01:00	0.00907	0.0335	2.163
MH57	JUNCTION	0.000	0.057	0 01:41	0	0.282	0.004
STM1	JUNCTION	0.088	0.088	0 01:00	0.182	0.182	-0.025
North_Hospital	OUTFALL	0.013	0.064	0 01:04	0.0197	0.302	0.000
Ring_Road	OUTFALL	0.010	0.015	0 01:00	-0.0265	0.0396	0.000
DETENTION	STORAGE	0.000	0.125	0 01:00	0	0.294	0.086

```
  GRAVEL_STORAGE       STORAGE      0.025    0.025     0  01:00      0.0338
0.0338      -0.010


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                          Max. Height   Min. Depth
                              Hours       Above Crown    Below Rim
  Node                 Type  Surcharged       Meters       Meters
  -------------------------------------------------------------------------
  CB38-S               JUNCTION      13.81          0.000        0.000


  **********************
  Node Flooding Summary
  **********************

  Flooding refers to all water that overflows a node, whether it ponds or not.
  ---------------------------------------------------------------------------
                                                          Total   Maximum
                               Maximum   Time of Max       Flood    Ponded
                    Hours       Rate    Occurrence      Volume     Depth
  Node             Flooded       CMS   days hr:min    10^6 ltr    Meters
  ---------------------------------------------------------------------------
  CB38-S              3.57     0.009      0  01:11       0.014     0.000


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------
-------------
                         Average    Avg   Evap  Exfil     Maximum    Max    Time of
Max    Maximum
                          Volume   Pcnt   Pcnt   Pcnt      Volume   Pcnt
Occurrence    Outflow
  Storage Unit           1000 m³   Full   Loss   Loss     1000 m³   Full    days
hr:min        CMS

-------------------------------------------------------------------------------
-------------
  DETENTION                0.028   12.2    0.0    0.0       0.089   38.7       0
01:19      0.058
```



```
  GRAVEL_STORAGE           0.000    0.7    0.0    0.0       0.006   12.5       0
01:02      0.016


  **********************
  Outfall Loading Summary
  **********************

  ---------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
  Outfall Node          Pcnt       CMS       CMS    10^6 ltr
  ---------------------------------------------------------
  North_Hospital       99.84     0.015     0.064       0.302
  Ring_Road            72.43     0.002     0.015       0.040
  ---------------------------------------------------------
  System               86.13     0.017     0.072       0.342


  ******************
  Street Flow Summary
  ******************


-------------------------------------------------------------------------------
-------------------------------------------------

    Peak     Avg.   Bypass     Back     Peak     Peak
                       Peak   Maximum   Maximum
    Flow     Flow     Flow     Flow  Capture   Bypass
                        Flow    Spread     Depth  Inlet             Inlet     Inlet
 Capture  Capture     Freq     Freq  / Inlet     Flow
  Street Conduit        CMS        m         m  Design            Location
    Pcnt     Pcnt     Pcnt     Pcnt      CMS      CMS

-------------------------------------------------------------------------------
-------------------------------------------------
  CB38-to-CBMH39-S     0.000    6.251     0.125  Inlet1            ON-GRADE      1
  CB50-to-MH40-S       0.008    1.874     0.037  Inlet1            ON-SAG        1
  100.00   100.00     0.00     0.00     0.00     0.00
  MH40-to-MH75-S       0.017    1.925     0.039  Inlet1            ON-GRADE      1
   84.53    98.78    16.12     0.00     0.01     0.00


  ******************
  Link Flow Summary
  ******************

  -------------------------------------------------------------------------
```

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
CB38-to-CBMH39	CONDUIT	0.000	0	00:00	0.00	0.00	0.15
CB38-to-CBMH39-S	CONDUIT	0.000	0	00:00	0.00	0.00	0.50
CB50-to-MH40	CONDUIT	0.012	0	01:11	1.21	0.25	0.34
CB50-to-MH40-S	CONDUIT	0.008	0	01:11	0.11	0.01	0.15
CBMH39-to-MH40	CONDUIT	0.016	0	01:03	0.82	0.37	0.41
CBMH48-to-GALLERY	CONDUIT	0.001	0	01:00	0.04	0.00	0.59
CON1-to-MH41	CONDUIT	0.088	0	01:00	3.35	0.14	0.48
GAL-to-MH57	CONDUIT	0.057	0	01:41	1.95	1.08	0.97
MH40-to-MH75	CONDUIT	0.038	0	01:01	1.04	0.36	0.64
MH40-to-MH75-S	CONDUIT	0.017	0	01:00	0.30	0.00	0.15
MH57-to-EXMH780	CONDUIT	0.057	0	01:41	1.98	0.38	0.43
9	ORIFICE	0.016	0	01:02			1.00

****
Flow Classification Summary
****

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
CB38-to-CBMH39	1.00	0.90	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB38-to-CBMH39-S	1.00	0.02	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB50-to-MH40	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
CB50-to-MH40-S	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
CBMH39-to-MH40	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
CBMH48-to-GALLERY	1.00	0.03	0.90	0.00	0.07	0.00	0.00	0.00	0.87	0.00
CON1-to-MH41	1.00	0.02	0.00	0.00	0.92	0.05	0.00	0.00	0.94	0.00
GAL-to-MH57	1.00	0.06	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00
MH40-to-MH75	1.00	0.03	0.00	0.00	0.94	0.03	0.00	0.00	0.89	0.00
MH40-to-MH75-S	1.00	0.02	0.00	0.00	0.96	0.01	0.00	0.00	0.96	0.00
MH57-to-EXMH780	1.00	0.06	0.00	0.00	0.00	0.94	0.00	0.00	0.41	0.00

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****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
GAL-to-MH57	0.01	0.55	0.01	0.71	0.01

Analysis begun on: Fri Sep 15 14:13:27 2023
Analysis ended on: Fri Sep 15 14:13:28 2023
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.3)

****
Element Count
****
Number of rain gages 7
Number of subcatchments ... 9
Number of nodes 14
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
10_yr	10_yr	INTENSITY	10 min.
100-Year	100-Year	INTENSITY	10 min.
10-Year	10-Year	INTENSITY	10 min.
25-Year	25-Year	INTENSITY	10 min.
2-Year	2-Year	INTENSITY	10 min.
50-Year	50-Year	INTENSITY	10 min.
5-Year	5-Year	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201A	0.25	20.00	90.00	0.5000	10_yr	STM1
201B	0.24	19.60	90.00	0.5000	10_yr	201A
202	0.14	33.75	74.00	2.1000	10_yr	CB38-S
203	0.11	27.75	70.00	2.5000	10_yr	GRAVEL_STORAGE
204	0.06	15.50	65.00	1.5000	10_yr	MH40-S

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205	0.06	15.75	90.00	1.0000	10_yr	CBMH48-S
206	0.06	9.33	58.00	0.5000	10_yr	MH40-S
207	0.10	6.53	68.00	0.5000	10_yr	Ring_Road
208	0.11	7.40	41.00	0.5000	10_yr	North_Hospital

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB38	JUNCTION	80.35	1.22	0.0	
CB38-S	JUNCTION	81.57	0.25	0.0	
CB50	JUNCTION	80.20	1.31	0.0	
CBMH39	JUNCTION	80.17	1.50	0.0	
CBMH48	JUNCTION	79.94	2.39	0.0	
CBMH48-S	JUNCTION	82.33	0.25	0.0	
MH40	JUNCTION	79.91	1.86	0.0	
MH40-S	JUNCTION	81.77	0.25	0.0	
MH57	JUNCTION	79.16	2.90	0.0	
STM1	JUNCTION	81.20	1.80	0.0	
North_Hospital	OUTFALL	79.11	0.30	0.0	
Ring_Road	OUTFALL	81.72	0.25	0.0	
DETENTION	STORAGE	79.80	0.76	0.0	
GRAVEL_STORAGE	STORAGE	81.57	0.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CB38-to-CBMH39	CB38	CBMH39	CONDUIT	29.0	0.4966	0.0130
CB38-to-CBMH39-S	CB38-S	GRAVEL_STORAGE	CONDUIT	29.0	-1.0345	0.0130
CB50-to-MH40	CB50	MH40	CONDUIT	6.2	1.9197	0.0130
CB50-to-MH40-S	MH40-S	Ring_Road	CONDUIT	190.0	0.0263	0.0130
CBMH39-to-MH40	CBMH39	MH40	CONDUIT	28.2		

```
0.4929    0.0130
  CBMH48-to-GALLERY CBMH48           DETENTION        CONDUIT            3.0
4.9728    0.0130
  CON1-to-MH41     STM1              DETENTION        CONDUIT           11.3
12.5309    0.0130
  GAL-to-MH57      DETENTION         MH57             CONDUIT           24.0
2.6468    0.0130
  MH40-to-MH75     MH40              DETENTION        CONDUIT           31.6
0.3639    0.0130
  MH40-to-MH75-S   CBMH48-S          MH40-S           CONDUIT           63.0
0.8889    0.0130
  MH57-to-EXMH780  MH57              North_Hospital   CONDUIT            2.0
2.4007    0.0130
  9                GRAVEL_STORAGE    CBMH39           ORIFICE


  **********************
  Cross Section Summary
  **********************
                                       Full     Full     Hyd.     Max.   No. of
 Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
 Flow

--------------------------------------------------------------------------------
----
  CB38-to-CBMH39   CIRCULAR             0.25     0.05     0.06     0.25        1
 0.04
  CB38-to-CBMH39-S Street              0.25     2.41     0.18    13.00        1
 5.94
  CB50-to-MH40     CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  CB50-to-MH40-S   Street              0.25     2.41     0.18    13.00        1
 0.95
  CBMH39-to-MH40   CIRCULAR            0.25     0.05     0.06     0.25        1
 0.04
  CBMH48-to-GALLERY CIRCULAR            0.38     0.11     0.09     0.38        1
 0.39
  CON1-to-MH41     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.62
  GAL-to-MH57      CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  MH40-to-MH75     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.11
  MH40-to-MH75-S   Street              0.25     2.41     0.18    13.00        1
 5.51
  MH57-to-EXMH780  CIRCULAR            0.30     0.07     0.07     0.30        1
 0.15
```

2021-0821-10: 10 Year Storm Event

```
**************
Street Summary
**************

Street Street
Area:
            0.0005     0.0021     0.0047     0.0083     0.0130
            0.0187     0.0255     0.0333     0.0421     0.0520
            0.0629     0.0748     0.0878     0.1019     0.1169
            0.1331     0.1502     0.1684     0.1876     0.2079
            0.2292     0.2516     0.2749     0.2994     0.3248
            0.3514     0.3784     0.4054     0.4324     0.4595
            0.4865     0.5135     0.5405     0.5676     0.5946
            0.6216     0.6486     0.6757     0.7027     0.7297
            0.7568     0.7838     0.8108     0.8378     0.8649
            0.8919     0.9189     0.9459     0.9730     1.0000
Hrad:
            0.0138     0.0275     0.0413     0.0550     0.0688
            0.0825     0.0963     0.1101     0.1238     0.1376
            0.1513     0.1651     0.1789     0.1926     0.2064
            0.2201     0.2339     0.2476     0.2614     0.2752
            0.2889     0.3027     0.3164     0.3302     0.3440
            0.3577     0.3849     0.4121     0.4393     0.4664
            0.4934     0.5205     0.5474     0.5744     0.6013
            0.6281     0.6550     0.6817     0.7085     0.7352
            0.7618     0.7885     0.8150     0.8416     0.8681
            0.8945     0.9210     0.9473     0.9737     1.0000
Width:
            0.0385     0.0769     0.1154     0.1538     0.1923
            0.2308     0.2692     0.3077     0.3462     0.3846
            0.4231     0.4615     0.5000     0.5385     0.5769
            0.6154     0.6538     0.6923     0.7308     0.7692
            0.8077     0.8462     0.8846     0.9231     0.9615
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


***************
Analysis Options
***************
Flow Units ..............  CMS
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 ............ 01/04/2023 00:00:00
Ending Date .............. 01/04/2023 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.056	49.534
Evaporation Loss	0.000	0.000
Infiltration Loss	0.011	10.125
Surface Runoff	0.043	38.578
Final Storage	0.001	1.211
Continuity Error (%)	-0.768	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.043	0.434
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.037	0.375
Flooding Loss	0.002	0.023
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.005	0.046
Continuity Error (%)	-2.102	

2021-0821-10: 10 Year Storm Event

```
Highest Continuity Errors
*************************
Node CB38-S (55.53%)
Node MH40-S (1.88%)


**************************
Time-Step Critical Elements
**************************
Link MH57-to-EXMH780 (98.74%)
Link CON1-to-MH41 (1.13%)


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*******************************
Most Frequent Nonconverging Nodes
*******************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.53 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
   30.000 - 13.228 sec      :     0.13 %
   13.228 -  5.833 sec      :     0.15 %
    5.833 -  2.572 sec      :    19.54 %
    2.572 -  1.134 sec      :    33.59 %
    1.134 -  0.500 sec      :    46.59 %


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


--------------------------------------------------------------------------------
----------------------------------------
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201A	49.53	43.52	0.00	5.04	82.75	4.32	87.08	0.22	0.11	0.936
201B	49.53	0.00	0.00	4.08	43.52	0.90	44.42	0.11	0.07	0.897
202	49.53	0.00	0.00	10.27	35.72	2.74	38.46	0.05	0.04	0.776
203	49.53	0.00	0.00	11.87	33.77	3.13	36.90	0.04	0.03	0.745
204	49.53	0.00	0.00	14.03	31.38	3.42	34.81	0.02	0.02	0.703
205	49.53	0.00	0.00	3.90	43.55	1.13	44.67	0.03	0.02	0.902
206	49.53	0.00	0.00	17.77	28.09	3.09	31.18	0.02	0.01	0.629
207	49.53	0.00	0.00	14.05	32.89	1.82	34.72	0.03	0.02	0.701
208	49.53	0.00	0.00	26.82	19.86	2.43	22.29	0.02	0.02	0.450

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB38	JUNCTION	0.00	0.00	80.35	0 00:00	0.00
CB38-S	JUNCTION	0.25	0.25	81.82	0 01:04	0.25
CB50	JUNCTION	0.03	0.08	80.28	0 01:10	0.08
CBMH39	JUNCTION	0.02	0.11	80.29	0 01:04	0.11
CBMH48	JUNCTION	0.03	0.23	80.18	0 01:22	0.22
CBMH48-S	JUNCTION	0.01	0.03	82.36	0 01:00	0.03
MH40	JUNCTION	0.06	0.27	80.18	0 01:22	0.26
MH40-S	JUNCTION	0.02	0.06	81.83	0 01:10	0.06
MH57	JUNCTION	0.05	0.13	79.29	0 01:22	0.13
STM1	JUNCTION	0.02	0.11	81.31	0 01:00	0.11
North_Hospital	OUTFALL	0.05	0.13	79.24	0 01:22	0.13

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
Ring_Road	OUTFALL	0.01	0.02	81.74	0 01:10	0.02
DETENTION	STORAGE	0.11	0.38	80.18	0 01:22	0.37
GRAVEL_STORAGE	STORAGE	0.03	0.19	81.76	0 01:03	0.18

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Flow Balance Error Percent
CB38	JUNCTION	0.000	0.000	0 00:00	0	0
CB38-S	JUNCTION	0.039	0.039	0 01:00	0.0519	0.0519
CB50	JUNCTION	0.015	0.015	0 01:10	0.0656	0.0656
CBMH39	JUNCTION	0.000	0.017	0 01:03	0	0.0409
CBMH48	JUNCTION	0.000	0.001	0 00:58	0	0.000273
CBMH48-S	JUNCTION	0.020	0.020	0 01:00	0.0281	0.0281
MH40	JUNCTION	0.016	0.044	0 01:01	0.0264	0.133
MH40-S	JUNCTION	0.011	0.031	0 01:00	0.0126	0.0414
MH57	JUNCTION	0.000	0.061	0 01:22	0	0.338
STM1	JUNCTION	0.109	0.109	0 01:00	0.216	0.216
North_Hospital	OUTFALL	0.016	0.070	0 01:02	0.0247	0.363
Ring_Road	OUTFALL	0.012	0.018	0 01:00	-0.0316	0.0486
DETENTION	STORAGE	0.000	0.151	0 01:00	0	0.349

```
  GRAVEL_STORAGE       STORAGE      0.031    0.031     0  01:00      0.0409
0.0409      -0.009


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                          Max. Height   Min. Depth
                                Hours      Above Crown    Below Rim
  Node                 Type    Surcharged      Meters       Meters
  -------------------------------------------------------------------------
  CB38-S               JUNCTION     13.93        0.000        0.000


  **********************
  Node Flooding Summary
  **********************

  Flooding refers to all water that overflows a node, whether it ponds or not.
  ---------------------------------------------------------------------------
                                                          Total   Maximum
                                Maximum   Time of Max      Flood    Ponded
                         Hours     Rate    Occurrence     Volume     Depth
  Node                 Flooded      CMS   days hr:min   10^6 ltr    Meters
  ---------------------------------------------------------------------------
  CB38-S                  3.71    0.019      0  01:04      0.023     0.000


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------
-------------
                         Average    Avg   Evap  Exfil     Maximum    Max    Time of
Max    Maximum
                          Volume   Pcnt   Pcnt   Pcnt      Volume   Pcnt
Occurrence    Outflow
  Storage Unit           1000 m³   Full   Loss   Loss     1000 m³   Full    days
hr:min        CMS

-------------------------------------------------------------------------------
-------------
  DETENTION                0.035   15.0    0.0    0.0       0.116   50.2       0
01:22      0.061
```



```
  GRAVEL_STORAGE           0.001    1.1    0.0    0.0       0.009   17.5       0
01:03      0.017


  **********************
  Outfall Loading Summary
  **********************

  ---------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
  Outfall Node          Pcnt       CMS       CMS    10^6 ltr
  ---------------------------------------------------------
  North_Hospital       99.87     0.018     0.070       0.363
  Ring_Road            73.61     0.003     0.018       0.049
  ---------------------------------------------------------
  System               86.74     0.021     0.084       0.411


  ******************
  Street Flow Summary
  ******************


-------------------------------------------------------------------------------
-------------------------------------------------

    Peak     Avg.   Bypass     Back     Peak     Peak
                       Peak   Maximum   Maximum
    Flow     Flow     Flow     Flow  Capture   Bypass
                        Flow    Spread     Depth  Inlet             Inlet     Inlet
 Capture  Capture     Freq     Freq  / Inlet     Flow
  Street Conduit        CMS        m         m  Design            Location
    Pcnt     Pcnt     Pcnt     Pcnt      CMS      CMS

-------------------------------------------------------------------------------
-------------------------------------------------
  CB38-to-CBMH39-S     0.000    6.251     0.125  Inlet1            ON-GRADE      1
  CB50-to-MH40-S       0.010    2.074     0.041  Inlet1            ON-SAG        1
  100.00   100.00     0.00     0.00     0.01     0.00
  MH40-to-MH75-S       0.020    2.102     0.042  Inlet1            ON-GRADE      1
   81.89    98.46    18.65     0.00     0.01     0.00


  ******************
  Link Flow Summary
  ******************

  -------------------------------------------------------------------------
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Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
CB38-to-CBMH39	CONDUIT	0.000	0	00:00	0.00	0.00	0.16
CB38-to-CBMH39-S	CONDUIT	0.000	0	00:00	0.00	0.00	0.50
CB50-to-MH40	CONDUIT	0.015	0	01:10	1.29	0.32	0.44
CB50-to-MH40-S	CONDUIT	0.010	0	01:10	0.12	0.01	0.17
CBMH39-to-MH40	CONDUIT	0.017	0	01:04	0.84	0.41	0.47
CBMH48-to-GALLERY	CONDUIT	0.001	0	00:58	0.04	0.00	0.81
CON1-to-MH41	CONDUIT	0.109	0	01:00	3.33	0.18	0.59
GAL-to-MH57	CONDUIT	0.061	0	01:22	1.95	1.14	0.98
MH40-to-MH75	CONDUIT	0.044	0	01:02	1.02	0.41	0.86
MH40-to-MH75-S	CONDUIT	0.020	0	01:00	0.31	0.00	0.17
MH57-to-EXMH780	CONDUIT	0.061	0	01:22	2.01	0.41	0.44
9	ORIFICE	0.017	0	01:03			1.00

****
Flow Classification Summary
****

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
CB38-to-CBMH39	1.00	0.89	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB38-to-CBMH39-S	1.00	0.02	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB50-to-MH40	1.00	0.03	0.00	0.00	0.00	0.02	0.00	0.95	0.01	0.00
CB50-to-MH40-S	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
CBMH39-to-MH40	1.00	0.02	0.00	0.00	0.04	0.00	0.00	0.93	0.04	0.00
CBMH48-to-GALLERY	1.00	0.02	0.88	0.00	0.09	0.00	0.00	0.00	0.86	0.00
CON1-to-MH41	1.00	0.02	0.00	0.00	0.92	0.05	0.00	0.00	0.94	0.00
GAL-to-MH57	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00

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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
MH40-to-MH75	1.00	0.02	0.00	0.00	0.94	0.04	0.00	0.00	0.87	0.00
MH40-to-MH75-S	1.00	0.02	0.00	0.00	0.96	0.01	0.00	0.00	0.96	0.00
MH57-to-EXMH780	1.00	0.05	0.00	0.00	0.00	0.95	0.00	0.00	0.41	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
CBMH48-to-GALLERY	0.01	0.01	0.17	0.01	0.01
CON1-to-MH41	0.01	0.01	0.17	0.01	0.01
GAL-to-MH57	0.01	0.89	0.01	1.02	0.01
MH40-to-MH75	0.01	0.01	0.17	0.01	0.01

Analysis begun on: Fri Sep 15 14:13:26 2023
Analysis ended on: Fri Sep 15 14:13:26 2023
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.3)

****
Element Count
****
Number of rain gages 7
Number of subcatchments ... 9
Number of nodes 14
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100-Year	100-Year	INTENSITY	10 min.
10-Year	10-Year	INTENSITY	10 min.
25_yr	25_yr	INTENSITY	10 min.
25-Year	25-Year	INTENSITY	10 min.
2-Year	2-Year	INTENSITY	10 min.
50-Year	50-Year	INTENSITY	10 min.
5-Year	5-Year	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201A	0.25	20.00	90.00	0.5000	25_yr	STM1
201B	0.24	19.60	90.00	0.5000	25_yr	201A
202	0.14	33.75	74.00	2.1000	25_yr	CB38-S
203	0.11	27.75	70.00	2.5000	25_yr	GRAVEL_STORAGE
204	0.06	15.50	65.00	1.5000	25_yr	MH40-S

2021-0821-10: 25 Year Storm Event

205	0.06	15.75	90.00	1.0000	25_yr	CBMH48-S
206	0.06	9.33	58.00	0.5000	25_yr	MH40-S
207	0.10	6.53	68.00	0.5000	25_yr	Ring_Road
208	0.11	7.40	41.00	0.5000	25_yr	North_Hospital

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB38	JUNCTION	80.35	1.22	0.0	
CB38-S	JUNCTION	81.57	0.25	0.0	
CB50	JUNCTION	80.20	1.31	0.0	
CBMH39	JUNCTION	80.17	1.50	0.0	
CBMH48	JUNCTION	79.94	2.39	0.0	
CBMH48-S	JUNCTION	82.33	0.25	0.0	
MH40	JUNCTION	79.91	1.86	0.0	
MH40-S	JUNCTION	81.77	0.25	0.0	
MH57	JUNCTION	79.16	2.90	0.0	
STM1	JUNCTION	81.20	1.80	0.0	
North_Hospital	OUTFALL	79.11	0.30	0.0	
Ring_Road	OUTFALL	81.72	0.25	0.0	
DETENTION	STORAGE	79.80	0.76	0.0	
GRAVEL_STORAGE	STORAGE	81.57	0.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CB38-to-CBMH39	CB38	CBMH39	CONDUIT	29.0	0.4966	0.0130
CB38-to-CBMH39-S	CB38-S	GRAVEL_STORAGE	CONDUIT	29.0	-1.0345	0.0130
CB50-to-MH40	CB50	MH40	CONDUIT	6.2	1.9197	0.0130
CB50-to-MH40-S	MH40-S	Ring_Road	CONDUIT	190.0	0.0263	0.0130
CBMH39-to-MH40	CBMH39	MH40	CONDUIT	28.2		

```
0.4929    0.0130
  CBMH48-to-GALLERY CBMH48           DETENTION        CONDUIT            3.0
4.9728    0.0130
  CON1-to-MH41     STM1              DETENTION        CONDUIT           11.3
12.5309    0.0130
  GAL-to-MH57      DETENTION         MH57             CONDUIT           24.0
2.6468    0.0130
  MH40-to-MH75     MH40              DETENTION        CONDUIT           31.6
0.3639    0.0130
  MH40-to-MH75-S   CBMH48-S          MH40-S           CONDUIT           63.0
0.8889    0.0130
  MH57-to-EXMH780  MH57              North_Hospital   CONDUIT            2.0
2.4007    0.0130
  9                GRAVEL_STORAGE    CBMH39           ORIFICE


  **********************
  Cross Section Summary
  **********************
                                       Full     Full     Hyd.     Max.   No. of
 Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
 Flow

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----
  CB38-to-CBMH39   CIRCULAR             0.25     0.05     0.06     0.25        1
 0.04
  CB38-to-CBMH39-S Street              0.25     2.41     0.18    13.00        1
 5.94
  CB50-to-MH40     CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  CB50-to-MH40-S   Street              0.25     2.41     0.18    13.00        1
 0.95
  CBMH39-to-MH40   CIRCULAR            0.25     0.05     0.06     0.25        1
 0.04
  CBMH48-to-GALLERY CIRCULAR            0.38     0.11     0.09     0.38        1
 0.39
  CON1-to-MH41     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.62
  GAL-to-MH57      CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  MH40-to-MH75     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.11
  MH40-to-MH75-S   Street              0.25     2.41     0.18    13.00        1
 5.51
  MH57-to-EXMH780  CIRCULAR            0.30     0.07     0.07     0.30        1
 0.15
```

2021-0821-10: 25 Year Storm Event

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**************
Street Summary
**************

Street Street
Area:
            0.0005     0.0021     0.0047     0.0083     0.0130
            0.0187     0.0255     0.0333     0.0421     0.0520
            0.0629     0.0748     0.0878     0.1019     0.1169
            0.1331     0.1502     0.1684     0.1876     0.2079
            0.2292     0.2516     0.2749     0.2994     0.3248
            0.3514     0.3784     0.4054     0.4324     0.4595
            0.4865     0.5135     0.5405     0.5676     0.5946
            0.6216     0.6486     0.6757     0.7027     0.7297
            0.7568     0.7838     0.8108     0.8378     0.8649
            0.8919     0.9189     0.9459     0.9730     1.0000
Hrad:
            0.0138     0.0275     0.0413     0.0550     0.0688
            0.0825     0.0963     0.1101     0.1238     0.1376
            0.1513     0.1651     0.1789     0.1926     0.2064
            0.2201     0.2339     0.2476     0.2614     0.2752
            0.2889     0.3027     0.3164     0.3302     0.3440
            0.3577     0.3849     0.4121     0.4393     0.4664
            0.4934     0.5205     0.5474     0.5744     0.6013
            0.6281     0.6550     0.6817     0.7085     0.7352
            0.7618     0.7885     0.8150     0.8416     0.8681
            0.8945     0.9210     0.9473     0.9737     1.0000
Width:
            0.0385     0.0769     0.1154     0.1538     0.1923
            0.2308     0.2692     0.3077     0.3462     0.3846
            0.4231     0.4615     0.5000     0.5385     0.5769
            0.6154     0.6538     0.6923     0.7308     0.7692
            0.8077     0.8462     0.8846     0.9231     0.9615
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


***************
Analysis Options
***************
Flow Units ..... CMS
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 ............ 01/04/2023 00:00:00
Ending Date .............. 01/04/2023 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.066	58.261
Evaporation Loss	0.000	0.000
Infiltration Loss	0.012	10.753
Surface Runoff	0.053	46.772
Final Storage	0.001	1.211
Continuity Error (%)	-0.815	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.053	0.527
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.045	0.454
Flooding Loss	0.003	0.034
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.005	0.046
Continuity Error (%)	-1.373	

2021-0821-10: 25 Year Storm Event

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Highest Continuity Errors
*************************
Node CB38-S (45.68%)
Node MH40-S (1.71%)


**************************
Time-Step Critical Elements
**************************
Link MH57-to-EXMH780 (98.81%)
Link CON1-to-MH41 (1.06%)


*******************************
Highest Flow Instability Indexes
*******************************
Link GAL-to-MH57 (2)


*******************************
Most Frequent Nonconverging Nodes
*******************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.48 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
   30.000 - 13.228 sec      :     0.12 %
   13.228 -  5.833 sec      :     0.10 %
    5.833 -  2.572 sec      :    18.66 %
    2.572 -  1.134 sec      :    32.50 %
    1.134 -  0.500 sec      :    48.62 %


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


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Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201A	58.26	51.96	0.00	5.23	98.29	5.88	104.17	0.26	0.14	0.945
201B	58.26	0.00	0.00	4.30	51.46	1.57	53.03	0.13	0.08	0.910
202	58.26	0.00	0.00	10.83	42.18	4.54	46.73	0.06	0.05	0.802
203	58.26	0.00	0.00	12.51	39.87	5.22	45.09	0.05	0.04	0.774
204	58.26	0.00	0.00	14.78	37.06	5.82	42.88	0.03	0.02	0.736
205	58.26	0.00	0.00	4.12	51.44	1.84	53.28	0.03	0.02	0.914
206	58.26	0.00	0.00	18.79	33.18	5.78	38.96	0.02	0.01	0.669
207	58.26	0.00	0.00	15.01	38.89	3.68	42.57	0.04	0.03	0.731
208	58.26	0.00	0.00	29.08	23.47	5.34	28.81	0.03	0.02	0.494

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB38	JUNCTION	0.00	0.00	80.35	0 00:00	0.00
CB38-S	JUNCTION	0.25	0.25	81.82	0 01:00	0.25
CB50	JUNCTION	0.03	0.10	80.30	0 01:25	0.09
CBMH39	JUNCTION	0.03	0.14	80.31	0 01:23	0.13
CBMH48	JUNCTION	0.06	0.35	80.30	0 01:26	0.35
CBMH48-S	JUNCTION	0.01	0.03	82.36	0 01:00	0.03
MH40	JUNCTION	0.09	0.40	80.31	0 01:24	0.39
MH40-S	JUNCTION	0.03	0.06	81.83	0 01:10	0.06
MH57	JUNCTION	0.06	0.14	79.30	0 01:26	0.14
STM1	JUNCTION	0.02	0.12	81.32	0 01:00	0.12
North_Hospital	OUTFALL	0.06	0.14	79.25	0 01:26	0.14

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Flow Balance Error Percent
Ring_Road	OUTFALL	0.01	0.03	81.75	0 01:10	0.03
DETENTION	STORAGE	0.15	0.50	80.30	0 01:26	0.50
GRAVEL_STORAGE	STORAGE	0.03	0.20	81.77	0 01:04	0.19

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Flow Balance Error Percent
CB38	JUNCTION	0.000	0.000	0 00:00	0	0.000 ltr
CB38-S	JUNCTION	0.048	0.048	0 01:00	0.063	0.063	84.079
CB50	JUNCTION	0.018	0.018	0 01:10	0.0788	0.0788	0.008
CBMH39	JUNCTION	0.000	0.018	0 01:04	0	0.05	0.500
CBMH48	JUNCTION	0.000	0.001	0 00:57	0	0.000412	0.043
CBMH48-S	JUNCTION	0.024	0.024	0 01:00	0.0335	0.0335	-2.038
MH40	JUNCTION	0.019	0.051	0 01:01	0.031	0.16	-0.211
MH40-S	JUNCTION	0.015	0.039	0 01:00	0.0174	0.0517	1.737
MH57	JUNCTION	0.000	0.064	0 01:26	0	0.407	0.002
STM1	JUNCTION	0.136	0.136	0 01:00	0.258	0.258	-0.021
North_Hospital	OUTFALL	0.019	0.076	0 01:00	0.032	0.439	0.000
Ring_Road	OUTFALL	0.014	0.022	0 01:00	-0.0371	0.0604	0.000
DETENTION	STORAGE	0.000	0.184	0 01:00	0	0.419	0.057

```
  GRAVEL_STORAGE       STORAGE      0.038    0.038     0  01:00        0.05
0.05      -0.008
```

****
Node Surcharge Summary
****

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
CB38-S	JUNCTION	13.99	0.000	0.000
MH40	JUNCTION	0.29	0.020	1.465

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Depth Meters
CB38-S	3.77	0.043	0 01:00	0.034	0.000

****
Storage Volume Summary
****

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 days hr:min	Maximum Outflow CMS
DETENTION	0.045	19.4	0.0	0.0	0.152	65.8	0	


```
01:26      0.064
  GRAVEL_STORAGE           0.001    1.8    0.0    0.0       0.012   24.8       0
01:04      0.018
```

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
North_Hospital	99.88	0.022	0.076	0.439
Ring_Road	74.81	0.004	0.022	0.060
System	87.34	0.026	0.098	0.499

****
Street Flow Summary
****

Street Conduit	Peak Flow CMS	Avg. Flow CMS	Bypass Flow Pcnt	Back Peak Flow Freq Pcnt	Peak Maximum Spread m	Maximum / Inlet Depth m	Bypass Capture Pcnt	Inlet Design CMS	Inlet Location	Inlet
CB38-to-CBMH39-S	0.000	6.251	0.125	Inlet1					ON-GRADE	1
CB50-to-MH40-S	0.014	2.296	0.046	Inlet1					ON-SAG	1
100.00	100.00	0.00	0.00	0.01	0.00					
MH40-to-MH75-S	0.024	2.303	0.046	Inlet1					ON-GRADE	1
79.03	98.11	20.86	0.00	0.01	0.01					

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
CB38-to-CBMH39	CONDUIT	0.000	0 00:00	0.00	0.00	0.22
CB38-to-CBMH39-S	CONDUIT	0.000	0 00:00	0.00	0.00	0.50
CB50-to-MH40	CONDUIT	0.018	0 01:10	1.36	0.40	0.75
CB50-to-MH40-S	CONDUIT	0.014	0 01:10	0.13	0.01	0.18
CBMH39-to-MH40	CONDUIT	0.018	0 01:04	0.86	0.44	0.78
CBMH48-to-GALLERY	CONDUIT	0.001	0 00:57	0.04	0.00	0.97
CON1-to-MH41	CONDUIT	0.136	0 01:00	3.28	0.22	0.64
GAL-to-MH57	CONDUIT	0.064	0 01:26	2.03	1.19	1.00
MH40-to-MH75	CONDUIT	0.051	0 01:01	0.99	0.48	1.00
MH40-to-MH75-S	CONDUIT	0.024	0 01:00	0.31	0.00	0.18
MH57-to-EXMH780	CONDUIT	0.064	0 01:26	2.03	0.43	0.46
9	ORIFICE	0.018	0 01:04			1.00

****
Flow Classification Summary
****

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
CB38-to-CBMH39	1.00	0.87	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB38-to-CBMH39-S	1.00	0.02	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB50-to-MH40	1.00	0.03	0.00	0.00	0.05	0.01	0.00	0.91	0.04	0.00
CB50-to-MH40-S	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
CBMH39-to-MH40	1.00	0.02	0.00	0.00	0.07	0.00	0.00	0.91	0.03	0.00
CBMH48-to-GALLERY	1.00	0.02	0.86	0.00	0.11	0.00	0.00	0.00	0.84	0.00
CON1-to-MH41	1.00	0.02	0.00	0.00	0.93	0.05	0.00	0.00	0.95	0.00

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GAL-to-MH57	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00
MH40-to-MH75	1.00	0.02	0.00	0.00	0.94	0.04	0.00	0.00	0.84
MH40-to-MH75-S	1.00	0.02	0.00	0.00	0.97	0.01	0.00	0.00	0.96
MH57-to-EXMH780	1.00	0.05	0.00	0.00	0.00	0.95	0.00	0.00	0.41

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
CB50-to-MH40	0.01	0.01	0.32	0.01	0.01
CBMH39-to-MH40	0.01	0.01	0.28	0.01	0.01
CBMH48-to-GALLERY	0.01	0.01	0.79	0.01	0.01
CON1-to-MH41	0.01	0.01	0.79	0.01	0.01
GAL-to-MH57	0.64	1.25	0.64	1.36	0.64
MH40-to-MH75	0.28	0.28	0.79	0.01	0.01

Analysis begun on: Fri Sep 15 14:13:26 2023
Analysis ended on: Fri Sep 15 14:13:27 2023
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.3)

****
Element Count
****
Number of rain gages 7
Number of subcatchments ... 9
Number of nodes 14
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100-Year	100-Year	INTENSITY	10 min.
10-Year	10-Year	INTENSITY	10 min.
25-Year	25-Year	INTENSITY	10 min.
2-Year	2-Year	INTENSITY	10 min.
50_yr	50_yr	INTENSITY	10 min.
50-Year	50-Year	INTENSITY	10 min.
5-Year	5-Year	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201A	0.25	20.00	90.00	0.5000	50_yr	STM1
201B	0.24	19.60	90.00	0.5000	50_yr	201A
202	0.14	33.75	74.00	2.1000	50_yr	CB38-S
203	0.11	27.75	70.00	2.5000	50_yr	GRAVEL_STORAGE
204	0.06	15.50	65.00	1.5000	50_yr	MH40-S

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205	0.06	15.75	90.00	1.0000	50_yr	CBMH48-S
206	0.06	9.33	58.00	0.5000	50_yr	MH40-S
207	0.10	6.53	68.00	0.5000	50_yr	Ring_Road
208	0.11	7.40	41.00	0.5000	50_yr	North_Hospital

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB38	JUNCTION	80.35	1.22	0.0	
CB38-S	JUNCTION	81.57	0.25	0.0	
CB50	JUNCTION	80.20	1.31	0.0	
CBMH39	JUNCTION	80.17	1.50	0.0	
CBMH48	JUNCTION	79.94	2.39	0.0	
CBMH48-S	JUNCTION	82.33	0.25	0.0	
MH40	JUNCTION	79.91	1.86	0.0	
MH40-S	JUNCTION	81.77	0.25	0.0	
MH57	JUNCTION	79.16	2.90	0.0	
STM1	JUNCTION	81.20	1.80	0.0	
North_Hospital	OUTFALL	79.11	0.30	0.0	
Ring_Road	OUTFALL	81.72	0.25	0.0	
DETENTION	STORAGE	79.80	0.76	0.0	
GRAVEL_STORAGE	STORAGE	81.57	0.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CB38-to-CBMH39	CB38	CBMH39	CONDUIT	29.0	0.4966	0.0130
CB38-to-CBMH39-S	CB38-S	GRAVEL_STORAGE	CONDUIT	29.0	-1.0345	0.0130
CB50-to-MH40	CB50	MH40	CONDUIT	6.2	1.9197	0.0130
CB50-to-MH40-S	MH40-S	Ring_Road	CONDUIT	190.0	0.0263	0.0130
CBMH39-to-MH40	CBMH39	MH40	CONDUIT	28.2		

```
0.4929    0.0130
  CBMH48-to-GALLERY CBMH48           DETENTION        CONDUIT            3.0
4.9728    0.0130
  CON1-to-MH41     STM1              DETENTION        CONDUIT           11.3
12.5309    0.0130
  GAL-to-MH57      DETENTION         MH57             CONDUIT           24.0
2.6468    0.0130
  MH40-to-MH75     MH40              DETENTION        CONDUIT           31.6
0.3639    0.0130
  MH40-to-MH75-S   CBMH48-S          MH40-S           CONDUIT           63.0
0.8889    0.0130
  MH57-to-EXMH780  MH57              North_Hospital   CONDUIT            2.0
2.4007    0.0130
  9                GRAVEL_STORAGE    CBMH39           ORIFICE


  **********************
  Cross Section Summary
  **********************
                                        Full     Full     Hyd.     Max.   No. of
 Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
 Flow

-------------------------------------------------------------------------------
----
  CB38-to-CBMH39   CIRCULAR             0.25     0.05     0.06     0.25        1
 0.04
  CB38-to-CBMH39-S Street              0.25     2.41     0.18    13.00        1
 5.94
  CB50-to-MH40     CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  CB50-to-MH40-S   Street              0.25     2.41     0.18    13.00        1
 0.95
  CBMH39-to-MH40   CIRCULAR            0.25     0.05     0.06     0.25        1
 0.04
  CBMH48-to-GALLERY CIRCULAR            0.38     0.11     0.09     0.38        1
 0.39
  CON1-to-MH41     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.62
  GAL-to-MH57      CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  MH40-to-MH75     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.11
  MH40-to-MH75-S   Street              0.25     2.41     0.18    13.00        1
 5.51
  MH57-to-EXMH780  CIRCULAR            0.30     0.07     0.07     0.30        1
 0.15
```

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**************
Street Summary
**************

Street Street
Area:
            0.0005     0.0021     0.0047     0.0083     0.0130
            0.0187     0.0255     0.0333     0.0421     0.0520
            0.0629     0.0748     0.0878     0.1019     0.1169
            0.1331     0.1502     0.1684     0.1876     0.2079
            0.2292     0.2516     0.2749     0.2994     0.3248
            0.3514     0.3784     0.4054     0.4324     0.4595
            0.4865     0.5135     0.5405     0.5676     0.5946
            0.6216     0.6486     0.6757     0.7027     0.7297
            0.7568     0.7838     0.8108     0.8378     0.8649
            0.8919     0.9189     0.9459     0.9730     1.0000
Hrad:
            0.0138     0.0275     0.0413     0.0550     0.0688
            0.0825     0.0963     0.1101     0.1238     0.1376
            0.1513     0.1651     0.1789     0.1926     0.2064
            0.2201     0.2339     0.2476     0.2614     0.2752
            0.2889     0.3027     0.3164     0.3302     0.3440
            0.3577     0.3849     0.4121     0.4393     0.4664
            0.4934     0.5205     0.5474     0.5744     0.6013
            0.6281     0.6550     0.6817     0.7085     0.7352
            0.7618     0.7885     0.8150     0.8416     0.8681
            0.8945     0.9210     0.9473     0.9737     1.0000
Width:
            0.0385     0.0769     0.1154     0.1538     0.1923
            0.2308     0.2692     0.3077     0.3462     0.3846
            0.4231     0.4615     0.5000     0.5385     0.5769
            0.6154     0.6538     0.6923     0.7308     0.7692
            0.8077     0.8462     0.8846     0.9231     0.9615
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


***************
Analysis Options
***************
Flow Units ..............  CMS
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 ............ 01/04/2023 00:00:00
Ending Date .............. 01/04/2023 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.073	64.845
Evaporation Loss	0.000	0.000
Infiltration Loss	0.013	11.143
Surface Runoff	0.060	53.047
Final Storage	0.001	1.211
Continuity Error (%)	-0.856	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.060	0.598
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.051	0.514
Flooding Loss	0.004	0.043
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.005	0.046
Continuity Error (%)	-0.867	

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```
Highest Continuity Errors
*************************
Node CB38-S (40.23%)
Node MH40-S (1.59%)


**************************
Time-Step Critical Elements
**************************
Link MH57-to-EXMH780 (98.75%)
Link CON1-to-MH41 (1.07%)


*******************************
Highest Flow Instability Indexes
*******************************
Link GAL-to-MH57 (2)


*******************************
Most Frequent Nonconverging Nodes
*******************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.45 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
   30.000 - 13.228 sec      :     0.10 %
   13.228 -  5.833 sec      :     0.12 %
    5.833 -  2.572 sec      :    18.09 %
    2.572 -  1.134 sec      :    31.73 %
    1.134 -  0.500 sec      :    49.97 %


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


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Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201A	64.85	58.35	0.00	5.35	110.03	7.08	117.11	0.29	0.16	0.951
201B	64.85	0.00	0.00	4.44	57.44	2.10	59.55	0.14	0.09	0.918
202	64.85	0.00	0.00	11.21	47.07	5.96	53.03	0.07	0.05	0.818
203	64.85	0.00	0.00	12.95	44.50	6.84	51.34	0.06	0.04	0.792
204	64.85	0.00	0.00	15.28	41.35	7.70	49.06	0.03	0.02	0.756
205	64.85	0.00	0.00	4.27	57.40	2.39	59.79	0.04	0.03	0.922
206	64.85	0.00	0.00	19.42	37.03	7.95	44.98	0.03	0.02	0.694
207	64.85	0.00	0.00	15.57	43.41	5.24	48.65	0.05	0.03	0.750
208	64.85	0.00	0.00	30.38	26.20	7.94	34.13	0.04	0.02	0.526

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB38	JUNCTION	0.00	0.06	80.41	0 01:25	0.06
CB38-S	JUNCTION	0.25	0.25	81.82	0 00:59	0.25
CB50	JUNCTION	0.04	0.21	80.41	0 01:26	0.21
CBMH39	JUNCTION	0.04	0.24	80.41	0 01:25	0.23
CBMH48	JUNCTION	0.09	0.44	80.39	0 01:28	0.44
CBMH48-S	JUNCTION	0.01	0.03	82.36	0 01:00	0.03
MH40	JUNCTION	0.12	0.49	80.40	0 01:27	0.48
MH40-S	JUNCTION	0.03	0.07	81.84	0 01:09	0.07
MH57	JUNCTION	0.06	0.14	79.30	0 01:28	0.14
STM1	JUNCTION	0.02	0.13	81.33	0 01:00	0.13
North_Hospital	OUTFALL	0.06	0.14	79.25	0 01:28	0.14

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Ring_Road	OUTFALL	0.01	0.03	81.75	0	01:09	0.03
DETENTION	STORAGE	0.18	0.59	80.39	0	01:28	0.59
GRAVEL_STORAGE	STORAGE	0.04	0.22	81.79	0	01:04	0.20

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CB38	JUNCTION	0.000	0.001	0 01:14	0	0.000183	0.893
CB38-S	JUNCTION	0.054	0.054	0 01:00	0.0715	0.0715	67.311
CB50	JUNCTION	0.021	0.021	0 01:09	0.0884	0.0884	0.008
CBMH39	JUNCTION	0.000	0.019	0 01:04	0	0.0571	0.454
CBMH48	JUNCTION	0.000	0.001	0 00:56	0	0.000465	0.064
CBMH48-S	JUNCTION	0.027	0.027	0 01:00	0.0376	0.0376	-1.997
MH40	JUNCTION	0.021	0.056	0 01:01	0.0344	0.179	-0.197
MH40-S	JUNCTION	0.019	0.046	0 01:00	0.0212	0.0598	1.613
MH57	JUNCTION	0.000	0.067	0 01:28	0	0.459	0.002
STM1	JUNCTION	0.156	0.156	0 01:00	0.29	0.29	-0.017
North_Hospital	OUTFALL	0.022	0.079	0 00:59	0.0379	0.497	0.000
Ring_Road	OUTFALL	0.016	0.025	0 01:00	-0.0408	0.0695	0.000
DETENTION	STORAGE	0.000	0.210	0 01:00	0	0.471	0.048

```
  GRAVEL_STORAGE       STORAGE      0.044    0.044     0  01:00      0.0569
0.0569      -0.006


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                          Max. Height   Min. Depth
                                Hours      Above Crown    Below Rim
  Node                 Type    Surcharged      Meters       Meters
  -------------------------------------------------------------------------
  CB38-S               JUNCTION     14.01       0.000        0.000
  CB50                 JUNCTION      0.23       0.012        1.099
  CBMH48               JUNCTION      0.55       0.067        1.944
  MH40                 JUNCTION      0.72       0.112        1.373


  **********************
  Node Flooding Summary
  **********************

  Flooding refers to all water that overflows a node, whether it ponds or not.
  ----------------------------------------------------------------------------
                                                          Total   Maximum
                           Maximum   Time of Max          Flood    Ponded
                    Hours     Rate   Occurrence         Volume     Depth
  Node             Flooded      CMS   days hr:min      10^6 ltr    Meters
  ----------------------------------------------------------------------------
  CB38-S              3.80    0.054      0  01:00         0.043     0.000


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------
-------------
                         Average    Avg   Evap  Exfil     Maximum    Max    Time of
Max    Maximum
                          Volume   Pcnt   Pcnt   Pcnt      Volume   Pcnt
Occurrence    Outflow
  Storage Unit           1000 m³   Full   Loss   Loss     1000 m³   Full    days
hr:min        CMS

-------------------------------------------------------------------------------
```



```
-------------
  DETENTION              0.053   23.1    0.0    0.0       0.179   77.5       0
01:28      0.067
  GRAVEL_STORAGE         0.001    2.5    0.0    0.0       0.015   30.6       0
01:04      0.019


  **********************
  Outfall Loading Summary
  **********************

  ------------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
  Outfall Node          Pcnt       CMS       CMS    10^6 ltr
  ------------------------------------------------------------
  North_Hospital       99.90     0.024     0.079       0.497
  Ring_Road            75.57     0.004     0.025       0.069
  ------------------------------------------------------------
  System               87.73     0.029     0.103       0.567


  ******************
  Street Flow Summary
  ******************


-------------------------------------------------------------------------------
-------------------------------------------------

    Peak     Avg.   Bypass     Back     Peak     Peak
                       Peak   Maximum   Maximum
    Flow     Flow     Flow     Flow  Capture   Bypass
                        Flow    Spread     Depth  Inlet            Inlet     Inlet
 Capture  Capture     Freq     Freq  / Inlet     Flow
  Street Conduit       CMS         m         m  Design           Location
    Pcnt     Pcnt     Pcnt     Pcnt      CMS      CMS

-------------------------------------------------------------------------------
-------------------------------------------------
  CB38-to-CBMH39-S     0.000     6.251     0.125  Inlet1           ON-GRADE      1
  CB50-to-MH40-S       0.016     2.450     0.049  Inlet1           ON-SAG        1
  100.00   100.00     0.00     0.00     0.01     0.00
  MH40-to-MH75-S       0.027     2.443     0.049  Inlet1           ON-GRADE      1
   77.17    97.87    21.88     0.00     0.01     0.01


  ******************
  Link Flow Summary
```

****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
CB38-to-CBMH39	CONDUIT	0.001	0	01:14	0.04	0.01	0.54
CB38-to-CBMH39-S	CONDUIT	0.000	0	00:00	0.00	0.00	0.50
CB50-to-MH40	CONDUIT	0.021	0	01:08	1.41	0.46	1.00
CB50-to-MH40-S	CONDUIT	0.016	0	01:09	0.14	0.02	0.20
CBMH39-to-MH40	CONDUIT	0.019	0	01:04	0.87	0.46	0.97
CBMH48-to-GALLERY	CONDUIT	0.001	0	00:56	0.04	0.00	1.00
CON1-to-MH41	CONDUIT	0.156	0	01:00	3.26	0.25	0.66
GAL-to-MH57	CONDUIT	0.067	0	01:28	2.13	1.25	1.00
MH40-to-MH75	CONDUIT	0.055	0	01:01	0.97	0.52	1.00
MH40-to-MH75-S	CONDUIT	0.027	0	01:00	0.32	0.00	0.20
MH57-to-EXMH780	CONDUIT	0.067	0	01:28	2.06	0.45	0.47
9	ORIFICE	0.019	0	01:04			1.00

****
Flow Classification Summary
****

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
CB38-to-CBMH39	1.00	0.03	0.05	0.00	0.09	0.00	0.00	0.83	0.89	0.00
CB38-to-CBMH39-S	1.00	0.02	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB50-to-MH40	1.00	0.02	0.00	0.00	0.07	0.01	0.00	0.90	0.02	0.00
CB50-to-MH40-S	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
CBMH39-to-MH40	1.00	0.02	0.00	0.00	0.09	0.00	0.00	0.89	0.03	0.00
CBMH48-to-GALLERY	1.00	0.02	0.85	0.00	0.13	0.00	0.00	0.00	0.82	0.00
CON1-to-MH41	1.00	0.02	0.00	0.00	0.93	0.06	0.00	0.00	0.95	0.00
GAL-to-MH57	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
MH40-to-MH75	1.00	0.02	0.00	0.00	0.94	0.04	0.00	0.00	0.83	0.00
MH40-to-MH75-S	1.00	0.02	0.00	0.00	0.97	0.01	0.00	0.00	0.96	0.00
MH57-to-EXMH780	1.00	0.05	0.00	0.00	0.00	0.95	0.00	0.00	0.42	0.00

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****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
CB50-to-MH40	0.23	0.23	0.74	0.01	0.01
CBMH39-to-MH40	0.01	0.01	0.72	0.01	0.01
CBMH48-to-GALLERY	0.55	0.55	1.07	0.01	0.01
CON1-to-MH41	0.01	0.01	1.07	0.01	0.01
GAL-to-MH57	0.95	1.49	0.95	1.59	0.95
MH40-to-MH75	0.72	0.72	1.07	0.01	0.01

Analysis begun on: Fri Sep 15 14:13:27 2023
Analysis ended on: Fri Sep 15 14:13:28 2023
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.3)

****
Element Count
****
Number of rain gages 7
Number of subcatchments ... 9
Number of nodes 14
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100_yr	100_yr	INTENSITY	10 min.
100-Year	100-Year	INTENSITY	10 min.
10-Year	10-Year	INTENSITY	10 min.
25-Year	25-Year	INTENSITY	10 min.
2-Year	2-Year	INTENSITY	10 min.
50-Year	50-Year	INTENSITY	10 min.
5-Year	5-Year	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201A	0.25	20.00	90.00	0.5000	100_yr	STM1
201B	0.24	19.60	90.00	0.5000	100_yr	201A
202	0.14	33.75	74.00	2.1000	100_yr	CB38-S
203	0.11	27.75	70.00	2.5000	100_yr	GRAVEL_STORAGE
204	0.06	15.50	65.00	1.5000	100_yr	MH40-S

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205	0.06	15.75	90.00	1.0000	100_yr	CBMH48-S
206	0.06	9.33	58.00	0.5000	100_yr	MH40-S
207	0.10	6.53	68.00	0.5000	100_yr	Ring_Road
208	0.11	7.40	41.00	0.5000	100_yr	North_Hospital

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB38	JUNCTION	80.35	1.22	0.0	
CB38-S	JUNCTION	81.57	0.25	0.0	
CB50	JUNCTION	80.20	1.31	0.0	
CBMH39	JUNCTION	80.17	1.50	0.0	
CBMH48	JUNCTION	79.94	2.39	0.0	
CBMH48-S	JUNCTION	82.33	0.25	0.0	
MH40	JUNCTION	79.91	1.86	0.0	
MH40-S	JUNCTION	81.77	0.25	0.0	
MH57	JUNCTION	79.16	2.90	0.0	
STM1	JUNCTION	81.20	1.80	0.0	
North_Hospital	OUTFALL	79.11	0.30	0.0	
Ring_Road	OUTFALL	81.72	0.25	0.0	
DETENTION	STORAGE	79.80	0.76	0.0	
GRAVEL_STORAGE	STORAGE	81.57	0.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CB38-to-CBMH39	CB38	CBMH39	CONDUIT	29.0	0.4966	0.0130
CB38-to-CBMH39-S	CB38-S	GRAVEL_STORAGE	CONDUIT	29.0	-1.0345	0.0130
CB50-to-MH40	CB50	MH40	CONDUIT	6.2	1.9197	0.0130
CB50-to-MH40-S	MH40-S	Ring_Road	CONDUIT	190.0	0.0263	0.0130
CBMH39-to-MH40	CBMH39	MH40	CONDUIT	28.2		

```
0.4929    0.0130
  CBMH48-to-GALLERY CBMH48           DETENTION        CONDUIT            3.0
4.9728    0.0130
  CON1-to-MH41     STM1              DETENTION        CONDUIT           11.3
12.5309    0.0130
  GAL-to-MH57      DETENTION         MH57             CONDUIT           24.0
2.6468    0.0130
  MH40-to-MH75     MH40              DETENTION        CONDUIT           31.6
0.3639    0.0130
  MH40-to-MH75-S   CBMH48-S          MH40-S           CONDUIT           63.0
0.8889    0.0130
  MH57-to-EXMH780  MH57              North_Hospital   CONDUIT            2.0
2.4007    0.0130
  9                GRAVEL_STORAGE    CBMH39           ORIFICE


  **********************
  Cross Section Summary
  **********************
                                       Full     Full     Hyd.     Max.   No. of
 Full
  Conduit          Shape               Depth     Area     Rad.    Width  Barrels
 Flow

-------------------------------------------------------------------------------
----
  CB38-to-CBMH39   CIRCULAR             0.25     0.05     0.06     0.25        1
 0.04
  CB38-to-CBMH39-S Street              0.25     2.41     0.18    13.00        1
 5.94
  CB50-to-MH40     CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  CB50-to-MH40-S   Street              0.25     2.41     0.18    13.00        1
 0.95
  CBMH39-to-MH40   CIRCULAR            0.25     0.05     0.06     0.25        1
 0.04
  CBMH48-to-GALLERY CIRCULAR            0.38     0.11     0.09     0.38        1
 0.39
  CON1-to-MH41     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.62
  GAL-to-MH57      CIRCULAR            0.20     0.03     0.05     0.20        1
 0.05
  MH40-to-MH75     CIRCULAR            0.38     0.11     0.09     0.38        1
 0.11
  MH40-to-MH75-S   Street              0.25     2.41     0.18    13.00        1
 5.51
  MH57-to-EXMH780  CIRCULAR            0.30     0.07     0.07     0.30        1
 0.15
```

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```
**************
Street Summary
**************

Street Street
Area:
            0.0005     0.0021     0.0047     0.0083     0.0130
            0.0187     0.0255     0.0333     0.0421     0.0520
            0.0629     0.0748     0.0878     0.1019     0.1169
            0.1331     0.1502     0.1684     0.1876     0.2079
            0.2292     0.2516     0.2749     0.2994     0.3248
            0.3514     0.3784     0.4054     0.4324     0.4595
            0.4865     0.5135     0.5405     0.5676     0.5946
            0.6216     0.6486     0.6757     0.7027     0.7297
            0.7568     0.7838     0.8108     0.8378     0.8649
            0.8919     0.9189     0.9459     0.9730     1.0000
Hrad:
            0.0138     0.0275     0.0413     0.0550     0.0688
            0.0825     0.0963     0.1101     0.1238     0.1376
            0.1513     0.1651     0.1789     0.1926     0.2064
            0.2201     0.2339     0.2476     0.2614     0.2752
            0.2889     0.3027     0.3164     0.3302     0.3440
            0.3577     0.3849     0.4121     0.4393     0.4664
            0.4934     0.5205     0.5474     0.5744     0.6013
            0.6281     0.6550     0.6817     0.7085     0.7352
            0.7618     0.7885     0.8150     0.8416     0.8681
            0.8945     0.9210     0.9473     0.9737     1.0000
Width:
            0.0385     0.0769     0.1154     0.1538     0.1923
            0.2308     0.2692     0.3077     0.3462     0.3846
            0.4231     0.4615     0.5000     0.5385     0.5769
            0.6154     0.6538     0.6923     0.7308     0.7692
            0.8077     0.8462     0.8846     0.9231     0.9615
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000
            1.0000     1.0000     1.0000     1.0000     1.0000


***************
Analysis Options
***************
Flow Units ..... CMS
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 ............ 01/04/2023 00:00:00
Ending Date .............. 01/04/2023 15:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.081	71.708
Evaporation Loss	0.000	0.000
Infiltration Loss	0.013	11.503
Surface Runoff	0.067	59.627
Final Storage	0.001	1.211
Continuity Error (%)	-0.883	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.067	0.672
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.058	0.577
Flooding Loss	0.005	0.052
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.005	0.046
Continuity Error (%)	-0.402	

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```
Highest Continuity Errors
*************************
Node CB38-S (35.80%)
Node MH40-S (1.48%)


**************************
Time-Step Critical Elements
**************************
Link MH57-to-EXMH780 (98.84%)
Link CON1-to-MH41 (1.04%)


*******************************
Highest Flow Instability Indexes
*******************************
Link GAL-to-MH57 (1)


*******************************
Most Frequent Nonconverging Nodes
*******************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.41 sec
Maximum Time Step           :    30.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
   30.000 - 13.228 sec      :     0.09 %
   13.228 -  5.833 sec      :     0.10 %
    5.833 -  2.572 sec      :    17.56 %
    2.572 -  1.134 sec      :    30.90 %
    1.134 -  0.500 sec      :    51.34 %


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


-------------------------------------------------------------------------------
-----------------------------------------
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201A	71.71	65.01	0.00	5.46	122.27	8.35	130.62	0.32	0.18	0.955
201B	71.71	0.00	0.00	4.58	63.68	2.67	66.35	0.16	0.11	0.925
202	71.71	0.00	0.00	11.58	52.16	7.45	59.60	0.08	0.06	0.831
203	71.71	0.00	0.00	13.38	49.31	8.56	57.87	0.06	0.05	0.807
204	71.71	0.00	0.00	15.77	45.82	9.69	55.51	0.03	0.03	0.774
205	71.71	0.00	0.00	4.41	63.61	2.98	66.58	0.04	0.03	0.929
206	71.71	0.00	0.00	20.01	41.04	10.28	51.32	0.03	0.02	0.716
207	71.71	0.00	0.00	16.07	48.13	6.95	55.08	0.05	0.03	0.768
208	71.71	0.00	0.00	31.52	29.04	10.86	39.90	0.04	0.02	0.556

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB38	JUNCTION	0.02	0.16	80.51	0 01:27	0.16
CB38-S	JUNCTION	0.25	0.25	81.82	0 00:58	0.25
CB50	JUNCTION	0.06	0.31	80.51	0 01:27	0.31
CBMH39	JUNCTION	0.06	0.34	80.51	0 01:27	0.34
CBMH48	JUNCTION	0.12	0.54	80.48	0 01:30	0.54
CBMH48-S	JUNCTION	0.01	0.04	82.37	0 01:00	0.04
MH40	JUNCTION	0.15	0.58	80.49	0 01:29	0.58
MH40-S	JUNCTION	0.03	0.07	81.84	0 01:08	0.07
MH57	JUNCTION	0.06	0.14	79.30	0 01:30	0.14
STM1	JUNCTION	0.03	0.14	81.34	0 01:00	0.14
North_Hospital	OUTFALL	0.06	0.14	79.26	0 01:30	0.14

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Ring_Road	OUTFALL	0.01	0.03	81.75	0	01:08	0.03
DETENTION	STORAGE	0.21	0.69	80.48	0	01:30	0.68
GRAVEL_STORAGE	STORAGE	0.04	0.23	81.80	0	01:04	0.22

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CB38	JUNCTION	0.000	0.001	0 01:11	0	0.000525	0.446
CB38-S	JUNCTION	0.061	0.061	0 01:00	0.0804	0.0804	55.767
CB50	JUNCTION	0.024	0.024	0 01:08	0.0983	0.0983	0.007
CBMH39	JUNCTION	0.000	0.020	0 01:04	0	0.0647	0.407
CBMH48	JUNCTION	0.000	0.001	0 00:55	0	0.000474	0.067
CBMH48-S	JUNCTION	0.031	0.031	0 01:00	0.0419	0.0419	-1.956
MH40	JUNCTION	0.023	0.061	0 01:02	0.0378	0.2	-0.181
MH40-S	JUNCTION	0.022	0.052	0 01:00	0.0253	0.0682	1.497
MH57	JUNCTION	0.000	0.070	0 01:30	0	0.513	0.002
STM1	JUNCTION	0.177	0.177	0 01:00	0.324	0.324	-0.014
North_Hospital	OUTFALL	0.025	0.081	0 01:00	0.0443	0.558	0.000
Ring_Road	OUTFALL	0.018	0.029	0 01:00	-0.0443	0.0791	0.000
DETENTION	STORAGE	0.000	0.235	0 01:00	0	0.525	0.041

```
  GRAVEL_STORAGE       STORAGE      0.049    0.049     0  01:00      0.0642
0.0642      -0.005


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                        Max. Height   Min. Depth
                                Hours   Above Crown    Below Rim
  Node                 Type   Surcharged     Meters       Meters
  -------------------------------------------------------------------------
  CB38-S               JUNCTION    14.03      0.000        0.000
  CB50                 JUNCTION     0.70      0.111        1.000
  CBMH39               JUNCTION     0.47      0.059        1.157
  CBMH48               JUNCTION     0.90      0.161        1.850
  MH40                 JUNCTION     1.02      0.208        1.277


  **********************
  Node Flooding Summary
  **********************

  Flooding refers to all water that overflows a node, whether it ponds or not.
  ----------------------------------------------------------------------------
                                                          Total   Maximum
                                Maximum   Time of Max      Flood    Ponded
                          Hours    Rate    Occurrence     Volume     Depth
  Node                 Flooded     CMS   days hr:min   10^6 ltr    Meters
  ----------------------------------------------------------------------------
  CB38-S                  3.83   0.061      0  01:00      0.052     0.000


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------
-------------
                         Average    Avg   Evap  Exfil     Maximum    Max    Time of
Max    Maximum
                          Volume   Pcnt   Pcnt   Pcnt      Volume   Pcnt
Occurrence    Outflow
  Storage Unit           1000 m³   Full   Loss   Loss     1000 m³   Full    days
hr:min        CMS
```



```
-------------------------------------------------------------------------------
-------------
  DETENTION                0.063   27.2    0.0    0.0       0.208   89.9       0
01:30      0.070
  GRAVEL_STORAGE           0.002    3.3    0.0    0.0       0.018   36.9       0
01:04      0.020


  **********************
  Outfall Loading Summary
  **********************

  ---------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
  Outfall Node          Pcnt       CMS       CMS    10^6 ltr
  ---------------------------------------------------------
  North_Hospital       99.91     0.027     0.081       0.558
  Ring_Road            76.29     0.005     0.029       0.079
  ---------------------------------------------------------
  System               88.10     0.032     0.110       0.637


  ******************
  Street Flow Summary
  ******************


-------------------------------------------------------------------------------
-------------------------------------------------------

    Peak     Avg.   Bypass     Back     Peak     Peak
                      Peak   Maximum   Maximum
    Flow     Flow     Flow     Flow  Capture   Bypass
                      Flow    Spread     Depth  Inlet             Inlet     Inlet
 Capture  Capture     Freq     Freq  / Inlet     Flow
  Street Conduit       CMS          m         m  Design            Location
    Pcnt     Pcnt     Pcnt     Pcnt      CMS      CMS

-------------------------------------------------------------------------------
-------------------------------------------------------
  CB38-to-CBMH39-S     0.000     6.251     0.125  Inlet1            ON-GRADE      1
  CB50-to-MH40-S       0.019     2.603     0.052  Inlet1            ON-SAG        1
  100.00   100.00     0.00     0.00     0.01     0.00
  MH40-to-MH75-S       0.030     2.579     0.052  Inlet1            ON-GRADE      1
   75.44    97.65    23.25     0.00     0.01     0.01


  ******************
```

Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
CB38-to-CBMH39	CONDUIT	0.001	0	01:11	0.07	0.03	0.83
CB38-to-CBMH39-S	CONDUIT	0.000	0	00:00	0.00	0.00	0.50
CB50-to-MH40	CONDUIT	0.024	0	01:05	1.44	0.53	1.00
CB50-to-MH40-S	CONDUIT	0.019	0	01:08	0.14	0.02	0.21
CBMH39-to-MH40	CONDUIT	0.020	0	01:05	0.87	0.48	1.00
CBMH48-to-GALLERY	CONDUIT	0.001	0	00:55	0.04	0.00	1.00
CON1-to-MH41	CONDUIT	0.177	0	01:00	3.24	0.29	0.67
GAL-to-MH57	CONDUIT	0.070	0	01:30	2.23	1.31	1.00
MH40-to-MH75	CONDUIT	0.059	0	01:00	0.95	0.56	1.00
MH40-to-MH75-S	CONDUIT	0.030	0	01:00	0.32	0.01	0.21
MH57-to-EXMH780	CONDUIT	0.070	0	01:30	2.08	0.47	0.48
9	ORIFICE	0.020	0	01:04			1.00

****
Flow Classification Summary
****

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
CB38-to-CBMH39	1.00	0.03	0.05	0.00	0.11	0.00	0.00	0.81	0.87	0.00
CB38-to-CBMH39-S	1.00	0.02	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CB50-to-MH40	1.00	0.02	0.00	0.00	0.09	0.01	0.00	0.88	0.02	0.00
CB50-to-MH40-S	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
CBMH39-to-MH40	1.00	0.02	0.00	0.00	0.11	0.00	0.00	0.88	0.03	0.00
CBMH48-to-GALLERY	1.00	0.02	0.84	0.00	0.14	0.00	0.00	0.00	0.81	0.00
CON1-to-MH41	1.00	0.02	0.00	0.00	0.92	0.06	0.00	0.00	0.95	0.00
GAL-to-MH57	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
MH40-to-MH75	1.00	0.02	0.00	0.00	0.95	0.03	0.00	0.00	0.81	0.00
MH40-to-MH75-S	1.00	0.02	0.00	0.00	0.97	0.01	0.00	0.00	0.97	0.00
MH57-to-EXMH780	1.00	0.05	0.00	0.00	0.00	0.95	0.00	0.00	0.42	0.00

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****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
CB38-to-CBMH39	0.01	0.01	0.47	0.01	0.01
CB50-to-MH40	0.70	0.70	1.04	0.01	0.01
CBMH39-to-MH40	0.59	0.59	1.02	0.01	0.01
CBMH48-to-GALLERY	0.90	0.90	1.33	0.01	0.01
CON1-to-MH41	0.01	0.01	1.33	0.01	0.01
GAL-to-MH57	1.22	1.71	1.22	1.81	1.22
MH40-to-MH75	1.02	1.02	1.33	0.01	0.01

Analysis begun on: Fri Sep 15 14:13:26 2023
Analysis ended on: Fri Sep 15 14:13:26 2023
Total elapsed time: < 1 sec