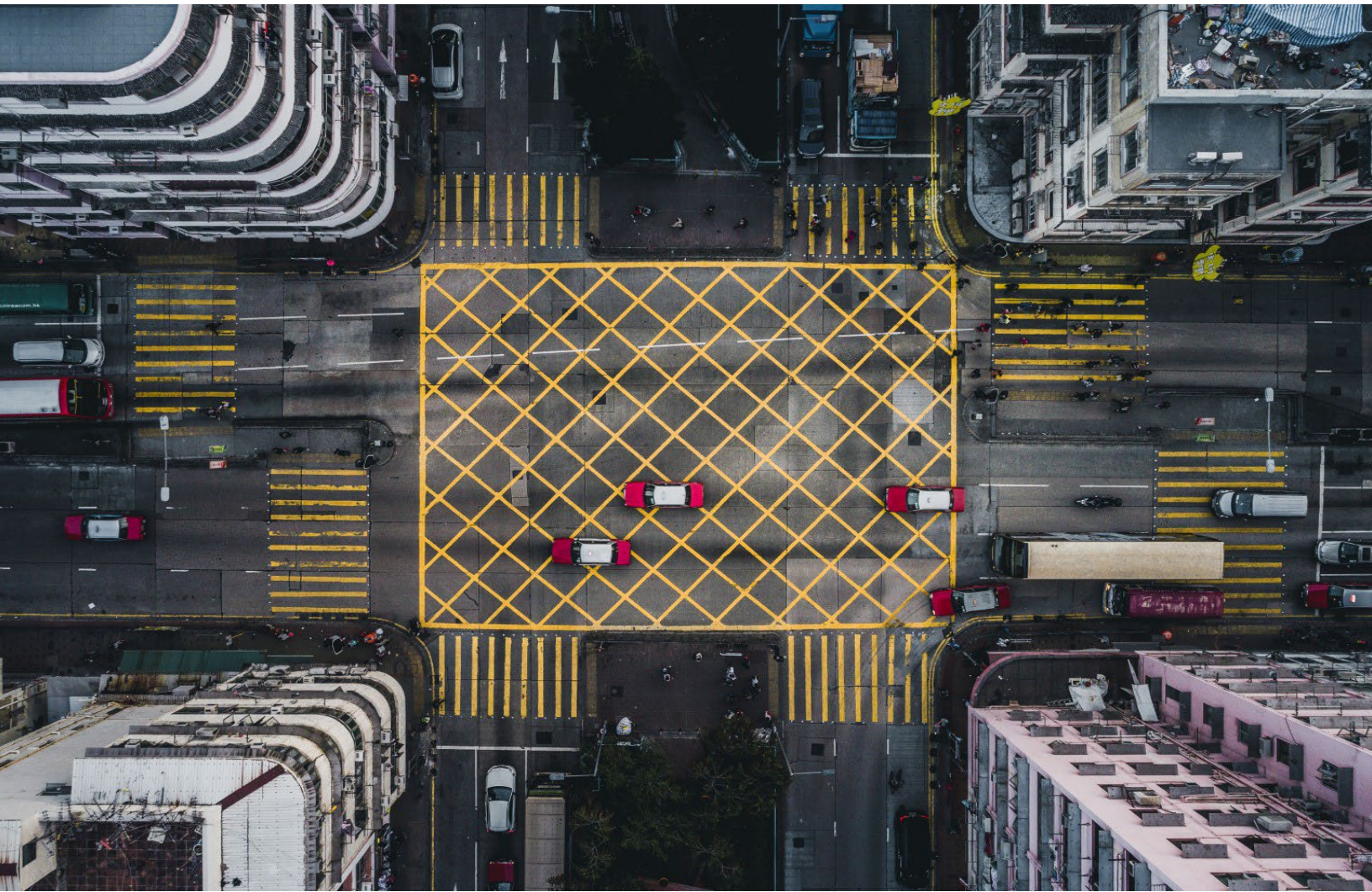
Stormwater Management Report

126 – 140 Bradford Street, Barrie, Ontario

Crown (Bradford) Developments Inc.

28 November 2023

→ The Power of Commitment



Executive Summary

This Stormwater Management (SWM) report documents the proposed, SWM strategy to support the Official Plan Amendment (OPA) and Zoning By-Law Amendment (ZBA) of the property identified as 126-140 Bradford Street (the Site) in the City of Barrie. To better understand the storm drainage conditions in the vicinity of the Site, the analysis in this report considers a larger Study Area comprised of several properties sharing drainage boundaries with the Site.

The Site is owned by Crown (Bradford) Developments Inc., and it is part of the Lake Simcoe watershed and under the jurisdiction of the Lake Simcoe Conservation Authority (LSRCA) for SWM regulatory purposes. The Site comprises approximately 0.46 ha of land located on Bradford Street between Victoria and John Street.

Development within the Site is proposed to take place in two phases. The envisioned development plan contains two 45 story residential towers, an above-ground podium parking and retail space.

The main purpose of this SWM report is to establish SWM design objectives for Site plan. The Master Servicing Report was issued under separate cover and should be read in conjunction with this report for completeness.

The SWM design criteria in this report are based on the Ministry of the Environment, Conservation and Parks (MECP) 2003 SWM Planning and Design Guidelines, the City of Barrie's Storm Drainage and Stormwater Management Policies and Design Guidelines, and the LSRCA's Technical Guidelines for Stormwater Management Submissions.

The SWM strategy contained in this report aims to meet the targets set by the City of Barrie and the LSRCA retaining to water quantity control, water balance, water quality and erosion control. Hydrologic models have been undertaken to determine the required storage volumes and to establish the allowable discharge flow rates for the estimated imperviousness based on the provided Site plan. To demonstrate the feasibility of the proposed SWM objectives, this report includes conceptual designs for the SWM facilities servicing the proposed development phases.

One stormwater management tank is proposed to receive runoff from the development's roof to provide water quantity control prior to diverting the orifice-controlled runoff to their existing storm sewer outlets. An OGS connected in series with the SWM tank will provide water quality control and an infiltration LID following the OGS will provide the required infiltration needed to meet water balance objectives.

This report recommends a SWM treatment train approach based on Best Management Practices (BMP) and Low Impact Development (LID) measures to achieve the proposed SWM objectives and discusses modelling alternatives to simulate the anticipated performance of the proposed measures from an integrated water quantity, water quality and water balance perspective. This report also recommends Erosion and Sediment Control practices to implement during construction to minimize the transport of sediment downstream. The feasibility of the proposed BMP for SWM is demonstrated by the conceptual design features illustrated in this report.

The overall strategy, objectives, design considerations and modelling recommendations provided in this report should be used to design future SWM systems within the Site.

Contents

Table index

Figure index

Appendices

Scope and Limitations

This report has been prepared by GHD for Crown (Bradford) Developments Inc. and may only be used and relied on by Crown (Bradford) Developments Inc. for the purpose agreed between GHD and Crown (Bradford) Developments Inc. as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Crown (Bradford) Developments Inc. arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD throughout this report. GHD disclaims liability arising from any of the assumptions being incorrect.

1. Introduction

1.1 Purpose of this Report

GHD has been retained by Crown (Bradford) Developments Inc. (the "Owner") to provide professional engineering services related to the preparation of a Stormwater Management Report for the property known as 126-140 Bradford Street (the "Site"), in the City of Barrie, Ontario.

This report has been prepared to support the Official Plan Amendment (OPA) and Zoning By-Law Amendment (ZBA) being submitted for the Site. It should be read in conjunction with the engineering drawings prepared for the Site development.

1.2 Site Description

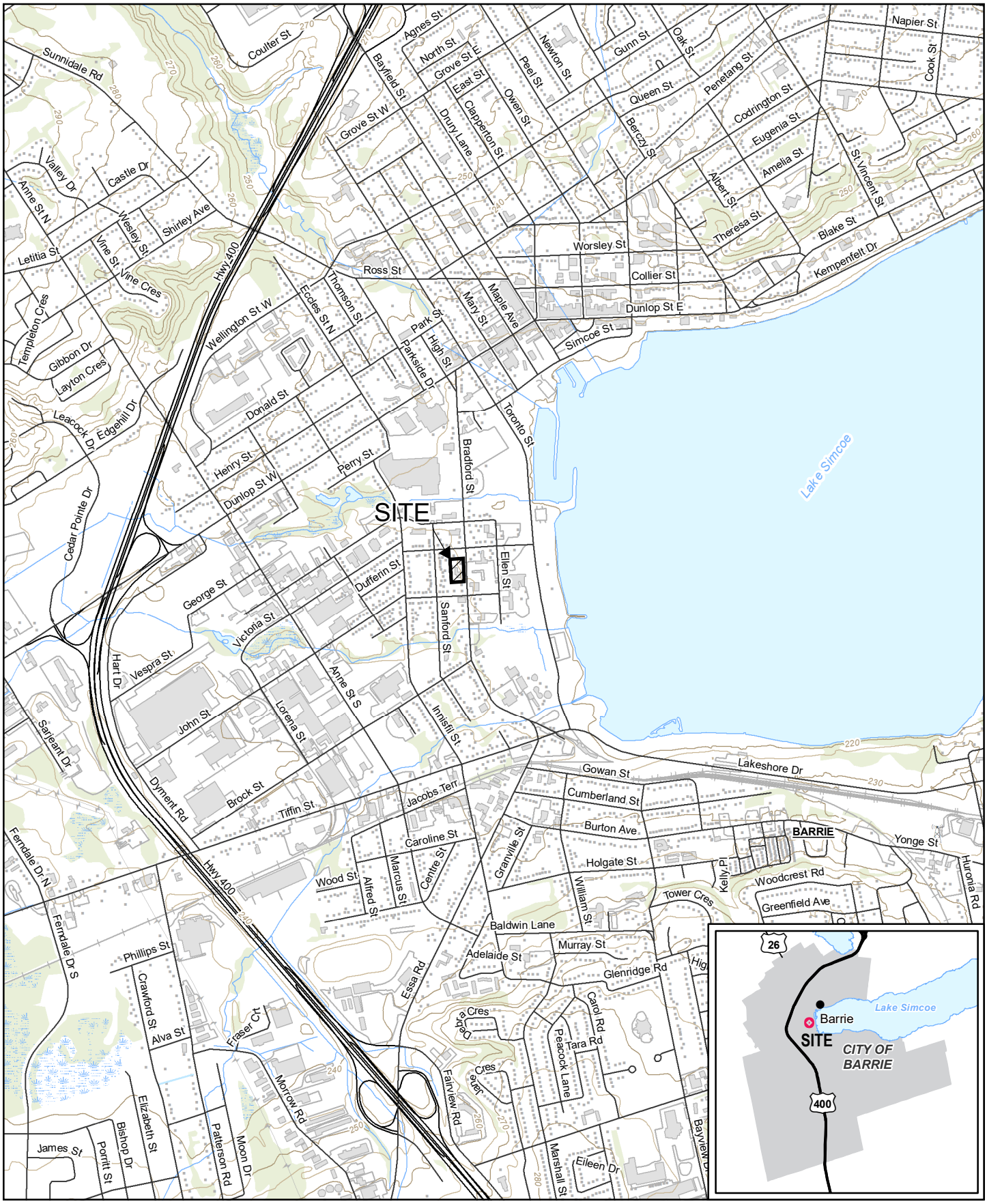
The Site is approximately 0.46 hectares and is located at 126-140 Bradford St, as shown in **Figure 1**. It has served mixed industrial, commercial, and residential purposes since the early 1900s. The Site is within the designated 'City Centre', which permits a broad range of uses, including residential, retail, and commercial. Presently, it hosts the NAPA Autocare Centre (126 Bradford Street), Barrie Foot Clinic (136 Bradford Street), and Get Moving Physio (140 Bradford Street). The NAPA Autocare Centre is an automotive repair facility, and Barrie Foot Clinic and Get Moving Physio provide professional health-related services. The commercial building is surrounded by asphalt-covered parking spaces. Under existing conditions, the Site is entirely impervious. Under existing conditions, the Site and adjacent properties have full municipal water and sewer services.

The proposed concept plan will increase the pervious area to roughly 10% of the total area, such that 90% of the Site will be impervious. GHD understands that the proposed development concept plan contains two 45 story residential towers and above-ground podium parking and retail space. The proposed building is about 3,400 m^2 with a 3-metre landscape buffer at the back and sides of the building. There is a 7m street widening space at the front of the property. It is noted that no underground structure, such as underground parking levels, is planned for the development. The proposed development is considered a "major development" per the LSRCA definition and must comply with applicable regulations. The Site will be developed in two phases, the first being the north side of the building. Phase 1 will include servicing connections and stormwater management.

The soils at the Site location consisted of very loose to very dense sand, silty sand, sandy silt, sand, and silt. The Site is primarily underlain by unsaturated fill and a loose sand deposit, which forms an unconfined aquifer underlying the Site. Based on the GHD Preliminary Hydrogeological Assessment Report dated June, 2023, the groundwater levels measured ranged from 2.2 to 3.1 mbgs. Overall, the Site topography is relatively flat at an elevation of approximately 225 meters above mean sea level (mamsl) and slopes slightly eastward towards Kempenfelt Bay, which is approximately 350 meters east of the Site.

The Site is located within the Barries Creek subwatershed. Some relevant recommendations from the subwatershed plan aside from regulation from the LSRCA document, include road salt management plan and thermal control. No water bodies are located on the Site and the closest surface water is Bunker's Creek, which is located approximately 200 m north of the Site. The Site is within the jurisdiction of the Lake Simcoe Region Conservation Area (LSRCA); however, the Site is not within any regulated areas. LSRCA-regulated areas associated with nearby creeks are located approximately 130 m to the north (Bunkers Creek) and 150 m to the south (Dyment Creek) of the Site.

The Site is located within the Lake Simcoe and Couchiching Black River Source Water Protection area and situated within the City of Barrie Wellhead Protection Area B (WHPA B). The Site is within a source water protection Significant Groundwater Recharge Area, a Highly Vulnerable Aquifer, and also falls within an issues contributing area for sodium and chloride.



Paper Size ANSI A

0 200 400 600

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

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GHD

1126-140 BRADFORD STREET, BARRIE, ONTARIO

Project No. **12623952**
Revision No. **-**
Date **Sep 29, 2023**

SITE LOCATION MAP

FIGURE 1

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Print date: 29 Sep 2023 - 10:25

1.3 Background Documents

In preparation for the stormwater management strategies, the following documents were reviewed:

- Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines (Barrie, May 2022)
- Stormwater Management Planning and Design Manual (SWMPD Manual) prepared by the Ministry of Environment, Conservation and Park, March 2003.
- Technical Guidelines for Stormwater Management Submissions (Lake Simcoe Region Conservation Authority, April 2022).
- Barrie Creeks, Lovers Creek, and Hewitt's Creek Subwatershed Plan (Lake Simcoe Region Conservation Authority, 2012).
- Final Preliminary Geotechnical Report Proposed Development, 126 and 140 Bradford Street, Barrie, Ontario (GHD, May 2023).
- Hydrogeological Assessment 126, 136 and 140 Bradford Street, Barrie, Ontario (GHD, June 2023).
- User Guide of Low Impact Development Treatment Train Tool, Lake Simcoe Region Conservation Authority (LSRCA), Credit Valley Conservation (CVC) and Toronto and Region Conservation Authority (TRCA) Software Version 5.1.

Excerpts from the above-listed documents are included in **Appendix B** for reference.

2. Objectives and Design Criteria

The SWM Report identifies the approach to meeting the requirements listed in **Table 1**. The design criteria are based on the specific conditions of the Site, Ministry of the Environment, Conservation and Parks (MECP) SWMPD Manual, the city of Barrie Storm Drainage and Stormwater Management Policies and the major development criteria from the Lake Simcoe Region Conservation Authority (LSRCA).

Table 1: Stormwater Management Design Criteria

Criteria		Objective
Minor System		Storm sewers should be designed to convey the 5-year storm (Barrie, 2022).
Major System		The major system shall be designed to safely convey flow in excess of the minor system including the larger of the 100-yr storm and Hurricane Hazel to a safe outlet without flooding private property (Barrie, 2022).
Water Quantity	**Peak Flow Control**	Match pre-development peak flows (50% imperviousness) for the critical storm of the SCS Type II (6-hr, 12-hr and 24-hr durations) and the 4-hour Chicago storm distributions for the 1:2 year through 1:100 year return period (Barrie, 2022). Existing drainage boundaries should be maintained (LSRCA, 2022).
	Volume Control	Capture, treat, and retain 25 mm storm runoff (LSRCA, 2022).
Water Quality	**TSS**	Achieve enhanced level of protection per MECP's 2003 Stormwater Management Planning and Design Manual (80% TSS removal)
	Phosphorus	Provide on-site removal of 80% of the annual Total Phosphorus (TP) load (LSRAC, 2022). Attain 100% removal of the annual TP load from all new or redevelopment (LSRCA, 2022). Demonstrate how the phosphorus load is minimized (Barrie, 2022)

Criteria	Objective
Water Balance	Demonstrate that every attempt was made to match post-development infiltration/recharge volumes to pre-development levels (50% imperviousness) on an annual basis (LSRCA, 2022).
Erosion Control	Store and release the 25 mm 4 hr Chicago storm over a minimum 24 hour period (Barrie, 2022).

3. Storm Drainage Areas

3.1 Pre-Development Conditions

The Site's drainage currently directs all the Site and external flows via uncontrolled sheet flow to the storm sewers located on Bradford Street. The catchment areas are described in **Table 2**. The imperviousness was set to 50% as the current Site exceeds the maximum imperviousness allowed for pre-development conditions defined by the LSRCA. The proposed stormwater management approach includes capturing the runoff and redirecting it via storm sewers to the outlet. More details are provided in Section 3 of this report.

Table 2: Pre-Development Drainage Areas

Catchment	Area (ha)	Imperviousness (%)
101 (site)	0.46	50
102 (external)	0.36	50

Refer to **Figure 2** for the pre-development Site drainage areas.

PRE-DEVELOPMENT

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LEGEND

- PROPERTY LINE
- x 215.00 — EXISTING GRADE
- EXISTING OVERLAND FLOW DIRECTION
- STORM DRAINAGE CATCHMENT
- ID / A % — CATCHMENT I.D. / AREA (ha) | PERCENT IMPERVIOUS (%)

SCALE: 1:200

No.	ISSUE / REVISION	YYYY/MMM/DD
A	ISSUED FOR COORDINATION	2023/OCT/25

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE RELATED TO HORIZONTAL CONTROL MONUMENT NO. 03120080022 HAVING AN ELEVATION OF 222.437 METRES. (VERTICAL DATUM: CGVD28:78

SURVEY NOTES:

SURVEY COMPLETED BY KRCMAR SURVEYOR LTD. (2023/APR/17)
JOB No.: 23-041

BEARINGS SHOWN HEROIN ARE GRID DERIVED FROM HORIZONTAL CONTROL MONOUMENTS NO. 03120080022 AND 03120080023 AND ARE REFERRED TO THE 6° UTM COORDINATE SYSTEM, ZONE 17, NAD83 (CSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9997145

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY KIRKOR ARCHTECT INC.
DRAWING No.: AD202, REV.X (2023/SEPT/21)
PROJECT No.: 23-072

DRAWING NOTES:

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.

THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT. DO NOT SCALE THIS DRAWING.

ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Stamp

PRELIMINARY

Stamp

Project

126 BRADFORD STREET
CITY OF BARRIE
COUNTY OF SIMCOE

Drawing

PRE-DEVELOPMENT DRAINAGE FIGURE

Drawn	A.S.	Design	A.S.	Project No.	12623952
Check	A.B.	Check	A.B.	Scale 1:200	Dwg. FIG 2.

3.2 Post-Development Conditions

3.2.1 Site Grading and Proposed Drainage

The proposed grading will redirect minor external flows toward the catchbasins on Bradford Street. Flows from the roof area will be directed to a SWM tank that will release controlled flows to an LID treatment train, then will discharge to the storm sewer on Bradford Street. Flows from the road widening and landscape areas will be uncontrolled and directed to the catchbasins on Bradford Street, as it is neither practical nor feasible to control these flows.

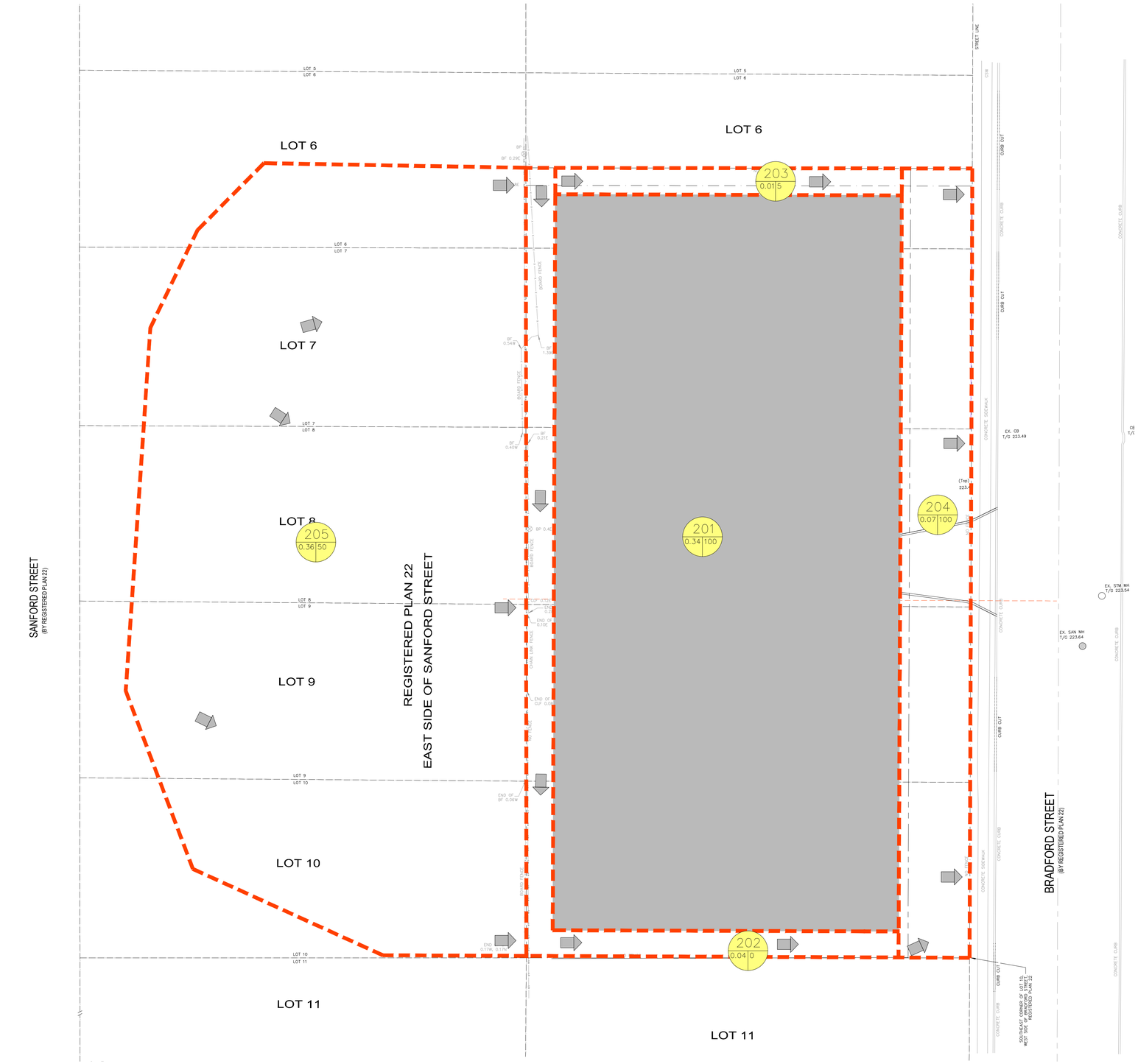
Table 3: Pre-Development Drainage Areas

Catchment	Area (ha)	Imperviousness (%)	Proposed Discharging Method
201 (roof)	0.34	100	Controlled by SWM tank and released to treatment train for water quality and infiltration. Water then discharges to storm sewers on Bradford Street.
202 (landscaped)	0.04	0	Uncontrolled discharge to Bradford Street storm sewers.
203 (landscaped)	0.01	5	Uncontrolled discharge to Bradford Street storm sewers.
204 (road widening)	0.07	100	Uncontrolled discharge to Bradford Street storm sewers.
205 (external)	0.36	50	Redirected by property line swales.

Refer to **Figure 3** for the proposed Site drainage areas.

PRE–DEVELOPMENT

POST–DEVELOPMENT



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LEGEND

- PROPERTY LINE
- x 215.00 — EXISTING GRADE
- PROPOSED OVERLAND FLOW DIRECTION
- STORM DRAINAGE CATCHMENT
- ID / A | % — CATCHMENT I.D. / AREA (ha) | PERCENT IMPERVIOUS (%)
- BUILDING FOOTPRINT

5 0m 5 10 15 20
SCALE: 1:250

No.	ISSUE / REVISION	YYYY/MMM/DD
A	ISSUED FOR COORDINATION	2023/OCT/25

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE RELATED TO HORIZONTAL CONTROL MONUMENT NO. 03120080022 HAVING AN ELEVATION OF 222.437 METRES. (VERTICAL DATUM: CGVD28:78

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NOT FOR SUBMISSION

Stamp

PRELIMINARY

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Project
126 BRADFORD STREET
CITY OF BARRIE
COUNTY OF SIMCOE

Drawing
POST-DEVELOPMENT DRAINAGE FIGURE

Drawn	A.S.	Design	A.S.	Project No.	12623952
Check	A.B.	Check	A.B.	Scale	1:250
				Dwg.	FIG 3.

4. Storm Drainage System Design

A conceptual storm sewer will be designed to convey flow from the SWM tank to the storm sewer at the detail design stage. The design will provide sufficient cover and where the cover is not enough, the storm pipes will be insulated.

There are no interim service conditions. The tank will be installed once the grading is complete. All external flows will be conveyed via a property line swale and discharged on Bradford Street.

5. Stormwater Management Facility Design

5.1 Water Quantity Control

5.1.1 Quantity Control Approach

The Site's existing development includes a roof area and a parking lot covering the majority of the Site. As such, the existing conditions are 100% impervious. Following discussions with the Lake Simcoe Region Authority (LSRCA), shown in **Appendix B,** the recommended approach for assessing quantity control analysis was to match the pre-development to the post-development peak. A CN curve number of 49 was selected for open spaces with grass cover between 50-70% for Hydrologic Soils Group A. See **Appendix B** for curve number selection explanation for usage in PC SWMM. External areas were redirected away from the Site post-development conditions; therefore, the target flows from pre-development conditions only considered the Site area. The Site characteristics are summarized in **Table 4**.

Table 4: Site Characteristics for SWM

Condition	Catchment ID	Percent Impervious, %	Drainage Area, ha
Pre-Development	101	50	0.46
Post-Development	201 (roof)	100	0.34
	202 (landscape)	0	0.04
	203 (landscape)	5	0.01
	204 (road widening)	100	0.07
	Total Post-Development	**-**	**0.46**

A PC SWMM analysis was conducted to estimate pre- and post-development peak flows. The pre-development flows from the Site area (0.46 ha) were used as targets for post-development. Only the flow from the roof (catchment 201) was controlled by the 265 m^3 watertank (165 m^3 quantity control storage and 100 m^3 dead storage) with the 150 mm orifice plate. All other flows from other catchments were added to account for the uncontrolled peak flow.

The quantity control analysis compared the peak flows from the 4-hour Chicago, the 6-hour SCS, the 12-hour SCS, and the 24-hour SCS, as recommended by the City of Barrie. The results are shown in **Table 5**. Additionally, the PC SWMM Output can be found in **Appendix C.**

Table 5: Peak Flow Quantity Control Results

Design Storm	Storm Recurrence Interval, years	Pre-Development Peak Flow (m^3/s)	Uncontrolled Post Development Peak Flow (m^3/s)	Controlled Post-Development Peak Flow (m^3/s)
4hr Chicago	2	0.05	0.09	0.04
	5	0.07	0.12	0.05
	10	0.08	0.14	0.06
	25	0.09	0.17	0.07
	50	0.10	0.19	0.07
	100	0.12	0.20	0.08
6hr SCS	2	0.04	0.07	0.04
	5	0.06	0.11	0.06
	10	0.07	0.12	0.06
	25	0.09	0.15	0.08
	50	0.11	0.18	0.08
	100	0.12	0.20	0.09
12hr SCS	2	0.04	0.07	0.04
	5	0.05	0.10	0.05
	10	0.07	0.11	0.6
	25	0.08	0.13	0.07
	50	0.10	0.15	0.08
	100	0.11	0.18	0.08
24hr SCS	2	0.04	0.07	0.04
	5	0.05	0.09	0.05
	10	0.07	0.11	0.06
	25	0.09	0.13	0.07
	50	0.10	0.16	0.08
	100	0.11	0.18	0.08

As shown in **Table 5**, the proposed peak flows for each design storm have been controlled to match or are lower than in pre-development conditions. Additionally, the SWM tank can retain the Regional Hazel Storm. The Regional hazel storm requires 81.57 m^3 of storage and the SWM Tank provides 165 m^3 of water quantity storage (not including dead storage).

5.1.2 Volume Control

The LSRCA requires volume control for major developments. The LSRCA recommends that the 25 mm storm be captured, treated, and retained on-site. The 25 mm storm results are show in **Table 6.**

Table 6: 25 mm Storm Summary

Catchment ID	Precipitation (m^3)	Evaporation (m^3)	Infiltration (m^3)	Runoff (m^3)
201	85.0	5.0	0.0	80.0
202	10.0	0.6	9.3	0.0
203	2.5	0.2	2.2	0.1
204	17.5	0.3	0.0	17.2
Total	**115.0**	**6.1**	**11.6**	**97.3**

Table 6 illustrates that catchments 203 and 202 retain most of the 25 mm storm. Catchment 204, which includes the road widening, remains uncontrolled. Its limited infiltration opportunities mean that approximately 17.2 m^3 will not be retained on-site. Catchment 204 belongs to the City of Barrie and therefore its control is not the responsibility of the development.

There will be 100 m^3 of dead storage in the SWM tank to hold the 25 mm storm for Catchment 201 and to account for catchment 204. The dead storage volume will later be used for irrigation purposes, which is an accepted method of volume control stated in the LSRCA SWM Guidelines.

Silva cells or other Low Impact Development (LID) options that are connected to the Stormwater Management (SWM) tank will enhance the infiltration capacity of Catchment 201, helping to retain the 25 mm storm. These LIDs will be designed during the Site Plan submission. These infiltration LIDs will be located along the entrance to the parking lot or on the road widening.

5.2 Water Balance

The Hydrogeological Assessment (GHD, 2023) preliminary water balance calculations were mainly based on the Barrie WPCC and the Shanty Bay weather stations. The initial water balance objectives were refined by means of a continuous model based on historical hourly precipitation data for the year 1991.

Under the premise that historical rain patterns are the best predictor of future precipitation values, continuous modelling allows for more accurate and site-specific estimations of dynamic processes like infiltration, runoff, and evaporation. It also allows for a better estimate of the anticipated performance of LIDs and other SWM BMP in a treatment train configuration.

The Barrie WPCC weather station is the closest station (0.6 km away) to the Site with Code A standard (no more than three consecutive days of missing data for precipitation and weather, no more than five total missing days for precipitation and weather, and over 30 years of data). Therefore, the continuous model results for pre-development conditions and post-development water balance using the Barrie WPCC's data are considered appropriate to establish post-development targets and to design BMPs and LIDs for the Site. All additional Information can be found in the **Appendix C**.

The 1991 data selected for the continuous model is considered the best representative of yearly precipitation patterns to test municipal infrastructure by a team of consultants retained by the City of Toronto after evaluating decades of historical data. Although the Site is relatively far from Toronto, their 1991 precipitation patterns are deemed reasonably similar for the purpose of the water balance assessment. The response of future LIDs and BMP within the Site may be evaluated using data from different years at the judgement of the designer at the detailed design stage.

The LSRCA recommends improving recharge to groundwater from pre-development conditions defined as “the predominant site condition over the past 10 years. A maximum of 50% impervious area is to be assumed for pre-development runoff calculations where there is a known flooding / erosion concern in the area, or adequate controls do not exist downstream under existing conditions” (LSRCA, 2022).

The proposed continuous modelling approach to establish post-development water balance and evaluate the performance of BMPs or LID measures for future development within the Site is as follows:

- Run pre-development simulation based on pre-development imperviousness levels from LSRCA definition.
- Run initial post-development simulation based on preliminary post-development imperviousness levels.
- Estimate total post-development recharge to groundwater deficit based on difference between pre and post development results.
- Design and incorporate proposed BMP’s or LIDs to hydrological model.
- Run final post-development simulation.

The proposed approach also considers the use of continuous modelling to evaluate the effectiveness of the proposed SWM treatment train to meet the general water quality and phosphorus removal targets. For modelling purposes, the effectiveness of each BMP should be estimated using documented performance values.

Under pre-development conditions, the entirety of the Site is considered to have 50% impervious surface, aligning with the LSRCA definition of pre-development conditions. The continuous model used the same Site characteristics as used in the quantity control section (**Table 4**).

Using the runoff summary and the groundwater summary from the continuous model in SWMM, the total infiltration volume was calculated by multiplying the area of each catchment as shown in **Table 7.** Note that external areas were ignored for the purpose of modelling the Site’s water balance and water quality.

Table 7: PC SWMM Water Balance Results

Condition	Catchment	Precipitation (m^3/yr)	Runoff (m^3/yr)	Evaporation (m^3/yr)	Infiltration (m^3/yr)
Pre-Development (50% impervious)	**101**	**3825**	**1340**	**2003**	**482**
Uncontrolled Post Development	201 (roof)	2827	1838	989	0
	202 (landscape)	333	0	296	36
	203 (landscape)	83	3	72	9
	204 (road widening)	582	499	83	0
	Total	**3825**	**2340**	**1440**	**45**
Infiltration Deficit (m^3/yr)	-	-	-	-	**437**

Based on the results from the continuous model, the pre-development conditions had 482 m^3/yr of infiltration. The uncontrolled post-development infiltration was 45 m^3/yr, suggesting an infiltration deficit of 437 m^3/yr from pre-development to post-development. To ensure that the post-development condition meets the water balance requirements, the LIDs must infiltrate a total of 437 m^3/yr. For water balance, the design will demonstrate best efforts to maintain pre-development water balance targets, nevertheless, due to the limited landscape area, infiltration practices may not be feasible.

To achieve the water balance target of having the post-development infiltration volume to meet the pre-development infiltration volume, LID measures shall be explored and evaluated to increase the Site's infiltration capacity. The following LIDS have been considered to attempt to maintain the pre-development water balance, relating to infiltration targets and evapotranspiration targets:

– Silva cells
– Infiltration trenches

The infiltration LIDs will be placed along the driveway or on the road widening setback to meet the targets. A preliminary assessment using the continuous model using the sand deposit hydraulic conductivity of 6.2 $*10^{-3}$ cm/s and a factor of safety of 2.5 such that the exfiltration loss in the infiltration LID would be approximately 40 mm/hr, was conducted. Using the continuous model, an infiltration volume of 4.2 m^3 is required to meet the target. The 4.2 m^3 infiltration LID can achieve additional infiltration of 456 m^3/yr. Further LID analysis will be conducted at the detailed design stage.

Water Balance calculations can be found in **Appendix A.**

5.3 Water Quality

The quality control treatment train approach is designed to meet the Enhanced Control (80% long-term total suspended solid removal). The design must also implement phosphorus reduction to help reduce the increase in phosphorus entering the lakes from new development based on the regulations from the LSRCA. This section of the

report provides details on the treatment train opportunities for the development and compares the post-development pollutant loads to the existing conditions.

The LSRCA requires that there is 80% on-site removal of the annual Total Phosphorus (TP) load and that there is 100% removal of the annual TP load from all new or redevelopment.

The TSS and Total Phosphorus (TP) loads were modelled in the continuous model described in the water balance using the Land Cover Event Mean Concentrations from the Low Impact development Treatment Train (LID TTT) User Manual and a year of rainfall data. TSS and TP load targets were set based on removal targets from the MOE. The detailed design stage will show how the implemented LIDs achieve the targets.

For this design the land cover was estimated to be the following for each condition, shown in **Table 8**:

Table 8: Land Use Summary

	Existing Conditions (100% impervious)	Uncontrolled Post-development Conditions *			
Catchment ID	**101**	**201**	**202**	**203**	**204**
Area (ha)	0.46	0.34	0.04	0.01	0.07
Landscape Area (%)	0	0	100	100	0
Paved Area (%)	83	0	0	0	100
Roof Area (%)	17	100	0	0	0

*Note the post development conditions assume that there are no green roofs.

The TSS and phosphorus loads were calculated using the EMC from the LID TTT user guide and a continuous year of rainfall data from the 1991 Barrie WPCC weather station. To achieve 80% of the target TSS loading, the load was multiplied by 0.2.

The proposed stormwater management strategy includes an OGS, and infiltration LIDs connected in series to the SWM tank to provide water quality control for catchment 201. The controlled post-development conceptual plan was modelled assuming the OGS has 50% TSS removal and used an infiltration LID of 4.2 m^3, as described in the water balance section of the report. The infiltration LID is assumed to have 75% TSS removal and a 60% TP removal, as per the LID TTT User Guide recommendations. The pollutant load for each catchment under the existing condition and uncontrolled post-development condition is included in **Table 9**.

Table 9: Pollutant Load by Catchment ID

Condition	Catchment ID	TSS Load (kg/yr)	TP Load (kg/yr)
Existing	101	178.52	0.49
Uncontrolled Post-Development	201	11.57	0.15
	202	0.00	0.00
	203	0.29	0.00
	204	41.68	0.11

The existing conditions and the post development conditions were compared to assess that there was no net increase in phosphorus load from the development. Catchment 204 was ignored for water quality as it belongs to the City of Barrie. A weighted area loading was calculated for existing conditions to reflect that catchment 204 was ignored.

Catchment 101 has an area weighted TSS loading of 388.09 kg/yr/ha. The sum of the area of catchment 201, 202, and 203, is 0.39 ha. Using that area, the existing TSS load is 151.36 kg/yr, as shown in **Table 10**.

Table 10: Pollutant Load Excluding Catchment 204 Loads

Condition	Existing	Uncontrolled Post-Development	Controlled Post-Development Target	Controlled Post-Development*	Controlled/ Uncontrolled
TSS Load (kg/yr)	151.36	11.87	2.37	0.87	7%

* Using conceptual treatment train approach

The proposed treatment train achieves 93% TSS removal from post-development.

In the detailed design stage, the treatment train will be modelled in PC SWMM using the continuous model and the phosphorus and TSS removal efficiencies for major classes of BMPs as described in the LID TTT manual. Additional sand filters may be implemented if needed for additional phosphorus removal. The continuous model will test the efficiency of the LIDs.

Water quality calculations can be found in **Appendix A.** The model output files are provided in **Appendix C**.

5.3.1 Phosphorus Budget

Catchment 101 has an area weighted TP load of 1.07 kg/yr/ha. The sum of the area of catchment 201, 202, and 203, is 0.39 ha. Using that area, the existing TP load is 0.42 kg/yr.

Based on the results from the continuous model, the controlled post-development TP load is less than the existing conditions; therefore, the 100% removal of annual TP Load from all new or redevelopment is met. Additionally, there is 88% TP removal from existing conditions, as shown in **Table 11**.

Table 11: Phosphorus Budget Excluding Catchment 204 Loads

Condition	Existing	Uncontrolled Post-Development	Controlled Post-Development*	Removal from existing conditions
TP Load (kg/yr)	0.42	0.17	0.05	88%

5.4 Erosion Control

The erosion control requires that the Site can retain or release the 25 mm storm over a minimum period of 24 hours. The dead storage of 100 m^3 provided in the SWM tank as described in the volume control section describes that the SWM tank can hold the 25 mm storm. This volume will later be used for irrigation purposes, meaning that the 25 mm storm is captured and retained for over 24 hours.

Catchments 203 and 202 retain most of the 25 mm storm (**Table 6**). Catchment 204, which consists of the road widening, remains uncontrolled. Catchment 204 will belong to the City of Barrie and will not be the development's responsibility to control.

Silva cells or other Low Impact Development (LID) options that are connected to the Stormwater Management (SWM) tank will enhance the infiltration capacity of Catchment 201, helping to retain the 25 mm storm. These LIDs will be designed during the Site Plan submission.

6. Erosion and Sediment Control During Construction

An erosion and sediment control plan has been prepared to meet the requirements of the city. The design will limit sediment and debris from leaving the Site during construction and from entering the adjacent lands and the surrounding municipal right-of-way.

The following guidelines will be followed for the preparation of the plan:

- A sediment control fence will be installed along the perimeter of the site where the grade will direct flows off-site.
- Site access will be limited to two entrances. A mud mat will be installed at each access point to remove mud from vehicles leaving the Site.
- Once the Site has been pre-graded, the lot will generally be lower than the surrounding property. This will limit runoff from entering neighbouring properties until the storm sewers are installed.
- Once the storm sewer system has been constructed, catchbasin sediment control devices will be installed and maintained until most of the construction is complete.

Erosion measures will be in place prior to any grading on the Site. A program will be in place to monitor and maintain the erosion and sediment controls. The sediment controls will be inspected by the Site Engineer and contractor every two weeks and after each significant rainfall event (greater than 14 mm).

Proper construction sequencing will also help with erosion and sediment control. The following schedule is recommended:

1. Install sediment control fence and gravel mud mats.
2. Install sediment control devices on municipal catchbasins, as required.
3. Excavation and foundation construction.
4. Rough grade Site to subgrade elevations.
5. Install services and sediment control devices on Site catchbasins.
6. Re-vegetate disturbed areas including lands left vacant for future development.

Details of the proposed ESC measures can be referenced on the ESC Plan Drawing (Drawing G101). Erosion and sediment control measures during construction are to comply with the City of Barrie Site Alteration By-law 2006-101.

7. SWM Facility Inspection and Maintenance Requirements

The general procedure for the maintenance of the SWM controls is to check the sediment depth, ensure the orifice is not clogged with sediment, inspect for oil, and check for damage to any part of the structure. An inspection and maintenance log should be completed after each inspection.

Based on the Owner's Manual, the following is recommended for the OGS.

– Post-construction inspection is required prior to putting the Stormceptor into service.
– Every six months for the first year of service to determine oil and sediment loading.
– Future inspection frequency can be adjusted based upon previous inspection observations.
– Inspect the unit immediately after an oil, fuel or chemical spill.

A detailed operation and maintenance document will be provided at the detailed design stage.

8. Summary and Conclusions

This Stormwater Management Report has been prepared in support of the Official Plan and Zoning By-Law Amendments being submitted for the Site known as 126-140 Bradford St in the City of Barrie. This report demonstrates that the proposed development can be serviced through the utilization of existing infrastructures, and improves existing stormwater quantity control, water balance and water quality without any adverse impact to the surrounding areas. Refer to **Table 12** for the stormwater management summary.

Table 12: Stormwater Management Summary

Description	Value
Pre-Development 100-Year Flow	0.12
Post-Development 100-Year Flow	0.08
Tank Storage	165 m^3 for water quantity purposes 100 m^3 for dead storage Total 265 m^3
Volume Control Provided	SWM tank for volume control, 100 m^3 provided for irrigation/rainwater re-use
Low Impact Development and Water Quality Control Strategy	OGS for some water quality TSS removal Infiltration LIDs for water balance and water quality
Water Balance Infiltration Required (m^3/yr)	437
Water Balance Infiltration Provided (m^3/yr)	456
Net Zero Increase in Phosphorus	Yes
TSS Removal from Site	93%

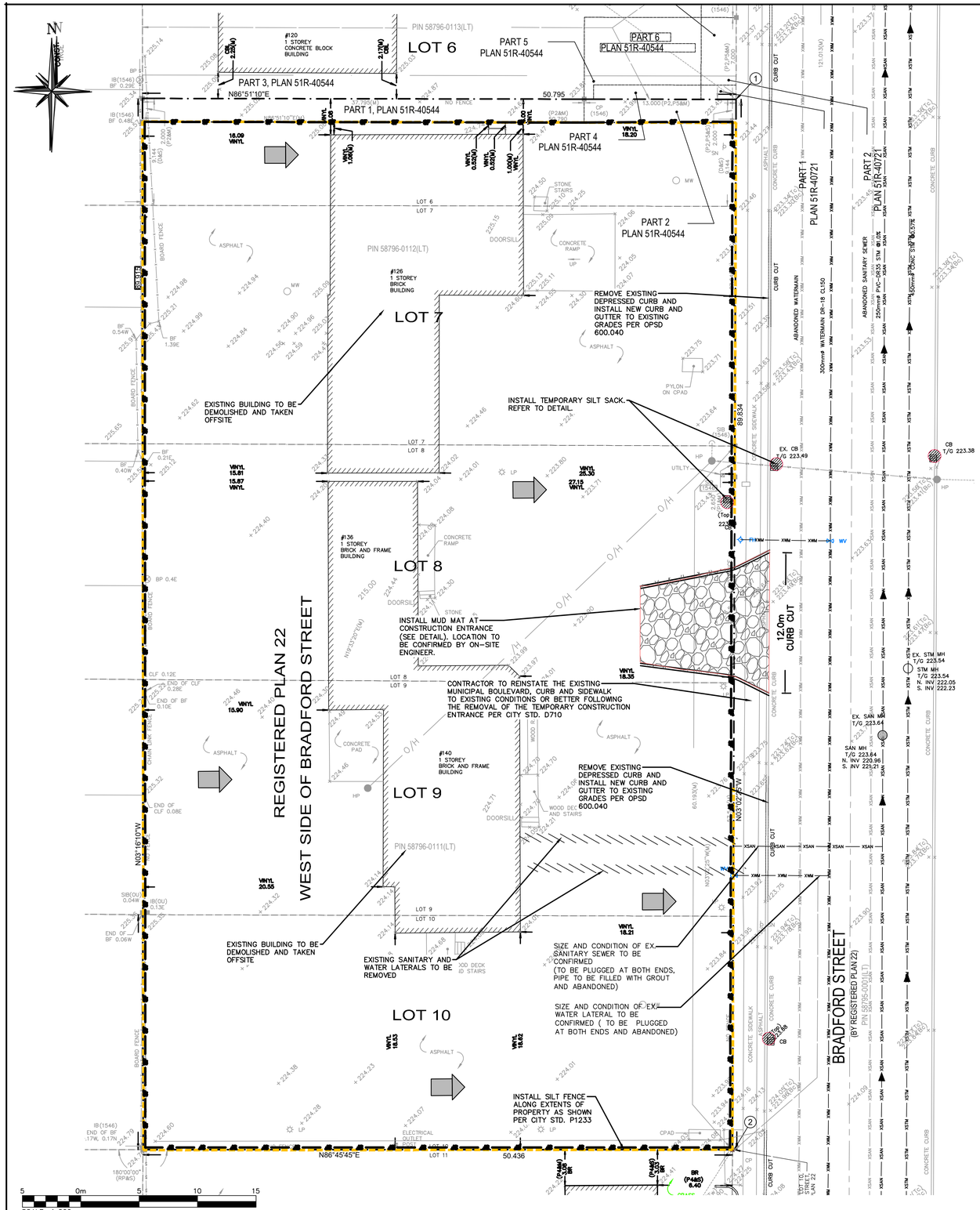
All of Which is Respectfully Submitted,

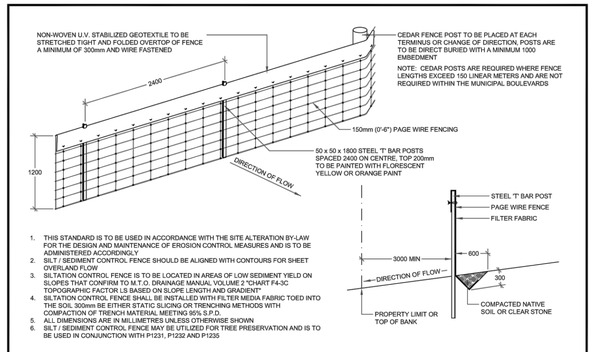
GHD

Winston Thai, P. Eng.
Project Manager

Jeff Zhang, M.A.Sc., P. Eng.
Senior Water Resources Engineer

Drawings





1. THIS STANDARD IS TO BE USED IN ACCORDANCE WITH THE SITE ALTERATION BY-LAW FOR THE DESIGN AND MAINTENANCE OF EROSION CONTROL MEASURES AND IS TO BE ADMINISTERED ACCORDINGLY
2. SILT / SEDIMENT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW
3. SILTATION CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFIRM TO M.T.O. DRAINAGE MANUAL VOLUME 2 "CHART F4-3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT"
4. SILTATION CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL 300mm BE EITHER STATIC SLICING OR TRENCHING METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% S.P.D.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN
6. SILT / SEDIMENT CONTROL FENCE MAY BE UTILIZED FOR TREE PRESERVATION AND IS TO BE USED IN CONJUNCTION WITH P1231, P1232 AND P1235

Barrie

FENCE
SILTATION CONTROL

REV No.	DATE: APR 2023
3	SCALE: N.T.S.
	P1233

CONTAMINANT MANAGEMENT PLAN – PROJECT SPECIFIC NOTES

THE CONTAMINANT MANAGEMENT PLAN DEMONSTRATES THE STEPS TO PREVENT CONTAMINATION AND EXPLAINS HOW THE ENVIRONMENTAL RISKS WILL BE MITIGATED AND MANAGED. SOME CONTAMINANTS THAT MAY BE PRESENT AT THIS SITE INCLUDE LIQUID FUEL, OIL, PAINT, AND COOLANT. EVERY PRECAUTION SHOULD BE TAKEN TO AVOID A SPILL. LEAKS SHOULD BE KEPT AWAY FROM FLOOR DRAINS AND CATCH BASINS.

IN THIS SECTION A MINOR SPILL IS DEFINED AS A SPILL SMALL ENOUGH TO BE SAFELY CLEANED UP USING AN EMERGENCY SPILL KIT(S), DOES NOT SPREAD RAPIDLY, IS CONTAINED WITHIN THE BUILDING ENVELOPE, AND DOES NOT THREATEN TO ENTER THE SEWER SYSTEM, OR POSE A THREAT FOR AN ADVERSE EFFECT TO THE ENVIRONMENT, PEOPLE, OR PLANT/ANIMAL LIFE.

IN THE CASE OF A MINOR SPILL, THE SPILL WILL BE ISOLATED FROM ANY POSSIBLE IGNITION SOURCES, SUCH AS SMOKING, HEATERS, WELDING AND GRINDING ACTIVITIES, AND ELECTRICAL EQUIPMENT. THE MINOR SPILL PROCEDURE IS AS FOLLOWS:

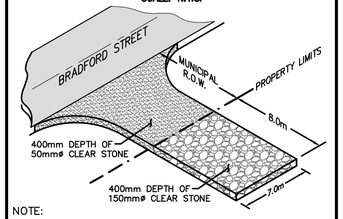
1. RESPOND IMMEDIATELY TO SPILLS THAT OCCUR AT THE SITE AS SOON AS IT IS IDENTIFIED.
2. CHECK FOR HAZARDS (FLAMMABLE MATERIAL, NOXIOUS FUMES, CAUSE OF SPILL). IF FLAMMABLE LIQUID, TURN OFF ENGINES AND NEARBY ELECTRICAL SOURCES. IF NOXIOUS FUMES ARE PRESENT, PROVIDE VENTILATION TO THE SPILL AREA. IF SERIOUS HAZARDS ARE PRESENT LEAVE THE AREA AND CALL 911. WHEN IN DOUBT, CONSULT THE SDS FOR HAZARDS.
3. PUT ON APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT (PPE)
4. STOP THE SOURCE OF THE SPILL (PLUG THE HOLE, UPRIGHT THE CONTAINER, SHUT OFF THE VALVE, ETC.).
5. NOTIFY THE SUPERVISOR AND ADVISE OF THE SITUATION AND RESPONSE TO BE TAKEN.
6. CONTAIN SPILL USING CONTENTS OF THE SPILL KIT TO PREVENT CONTAMINANTS FROM ENTERING ANY DRAIN OR THE NATURAL ENVIRONMENT.
7. DIRECT SPILL AWAY FROM FLOOR DRAINS, STORM SEWERS, CATCH BASINS, SOURCES OF IGNITION (FIRE HAZARDS), OTHER INCOMPATIBLE CHEMICALS, AND PATHWAYS TO SENSITIVE NATURAL FEATURES (E.G. WELL HEAD PROTECTION AREA – A)
8. CLEAN UP THE SPILL BY MOVING DYKE OF ABSORBENT SOCKS SLOWLY TOWARD THE MIDDLE OF THE SPILL WHILE MAINTAINING THE DYKE. IF ABSORBENT SOCKS OR PADS ARE SPENT AND THERE IS STILL A LARGE QUANTITY OF SPILLED MATERIAL TO BE ABSORBED, PLACE ADDITIONAL ABSORBENT SOCKS, IF AVAILABLE, OUTSIDE THE DYKE OF USED ABSORBENT SOCKS. REMOVE SPENT ABSORBENT SOCKS/PADS/GRANULAR AND PLACE THEM IN THE PLASTIC DISPOSAL BAG IN THE KIT, AND PLACE THE BAG IN THE KIT CONTAINER.
9. MOP THE AREA OF THE SPILL WITH A DISPOSABLE MOP OR WIPE CONTAMINATED SURFACES WITH A DAMP DISPOSABLE CLOTH. DO NOT FLUSH THE AREA WITH WATER.
10. DISPOSE OF USED SPILL RESPONSE EQUIPMENT BY PLACING CONTAMINATED EQUIPMENT AND PPE IN A PLASTIC DISPOSAL BAG INSIDE THE SPILL KIT/CONTAINER. SEAL AND LABEL ALL CONTAINERS CONTAINING CONTAMINATED MATERIALS. CONTACT HAZARDOUS WASTE DISPOSAL CONTRACTOR FOR PICK-UP AND PROPER DISPOSAL.
11. FOLLOW ALL REGULATORY PROCEDURES FOR THE REPORTING OF DISPOSAL OF HAZARDOUS WASTE THROUGH THE HAZARDOUS WASTE INFORMATION NETWORK (SEE WWW.HWIN.CA FOR MORE INFORMATION).
12. RECORD SPILL IN LOGBOOK ON SITE, AND SUBMIT TO SUPERVISOR.

FOR MAJOR SPILLS, THE PROCEDURE IS AS FOLLOWS:

1. NOTIFY MOECC SPILLS ACTION CENTRE (SAC) IMMEDIATELY (1-800-268-6060; FAX: 416-325-3011 – OPEN 24 HOURS A DAY). THE DETAILS OF THE SPILL ARE BASED ON THE INFORMATION AVAILABLE AT THE TIME OF THE CALL AND ARE REQUIRED TO BE REPORTED TO THE MOECC BY O.REG. 675/98 SS 13(3) AND (4), INCLUDING BUT NOT LIMITED TO DESCRIPTION OF THE DISCHARGE OR SPILL LOCATION (MUNICIPAL ADDRESS IF POSSIBLE).
   - THE DATE AND TIME THE DISCHARGE SPILL WAS DISCOVERED/OCCURRED.
   - THE NAME AND CONTACT INFORMATION FOR THOSE CONTACTED TO RESPOND TO THE DISCHARGE.
   - THE DURATION OF THE DISCHARGE.
   - THE POLLUTANT(S) DISCHARGED OR SPILLED AND QUANTITY OF POLLUTANT(S) DISCHARGED.
   - RELEVANT INFORMATION REGARDING THE CAUSE OF THE DISCHARGE.
2. FOLLOW PROCEDURES FOR "MINOR SPILLS" STEPS 1-7.
3. CONTACT A REMEDIATION COMPANY TO CLEAN UP THE SPILL AND PROPERLY DISPOSE OF ANY HAZARDOUS MATERIALS FROM THE SITE.
4. BARRICADE THE SPILL AREA WHILE MAINTAINING EMERGENCY ESCAPE ROUTES.
5. RECORD SPILL IN THE LOG BOOK ON-SITE AND SUBMIT IT TO THE SUPERVISOR.

MUD-MAT DETAIL

SCALE: N.T.S.



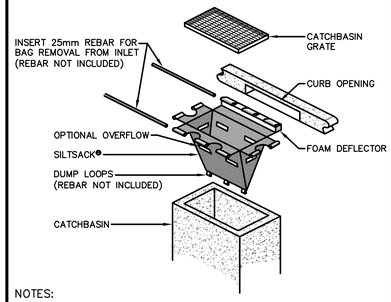
NOTE:
GEOTEXTILE (TERRAFIX 270R OR APPROVED EQUAL) TO BE PLACED AS SEPARATION BARRIER BETWEEN EXISTING GROUND AND CLEAR STONE.

EROSION AND SEDIMENT CONTROL – PROJECT SPECIFIC NOTES

1. ALL SEDIMENT CONTROL DEVICES TO BE ROUTINELY INSPECTED AND MAINTAINED IN PROPER WORKING ORDER UNTIL AREA IS STABILIZED.
2. IF NECESSARY, TRUCKS WILL BE WASHED DOWN BEFORE LEAVING THE SITE.
3. THE CONTRACTOR SHALL SUPPLY ALL NECESSARY WATER AND/OR CALCIUM CHLORIDE AS REQUIRED FOR COMPACTION AND/OR DUST CONTROL.
4. ALL CONSTRUCTION EQUIPMENT MUST BE PARKED ON-SITE.
5. IF CONSTRUCTION IS INTERRUPTED, AND/OR INACTIVITY EXCEEDS 30 DAYS, STRIPPED/ BARE AREAS WILL BE STABILIZED BY SEEDING.
6. SEDIMENT CONTROL FENCE TO BE INSTALLED PER ESC DWG. G101.
7. ALL CONSTRUCTION VEHICLES TO ENTER AND EXIT SITE FROM CONSTRUCTION ACCESS.
8. ALL TOPSOIL STOCKPILES TO BE SURROUNDED WITH SEDIMENT CONTROL FENCING.
9. SILT SACKS WILL BE PLACED ON THE CATCHBASINS ON ALL STREETS ACROSS THE PROPERTY FRONTAGE.
10. STREET SWEEPING, CATCH BASIN CLEANING AND DUST CONTROL ARE THE RESPONSIBILITY OF THE CONTRACTOR AND MUST BE KEPT UNDER CONTROL ON ALL ROADWAYS TO THE SATISFACTION OF THE CITY.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONDITION OF THE SITE AT ALL TIMES. EROSION AND SEDIMENT CONTROL MEASURES INCLUDING SEDIMENT CONTROL FENCE, CATCHBASIN SEDIMENT BARRIERS, SEDIMENT TRAPS AND OTHER EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO COMMENCING CONSTRUCTION, IN ACCORDANCE WITH CITY REQUIREMENTS.
12. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION AND SEDIMENT CONTROL DEVICES AND STRUCTURES IN GOOD WORKING ORDER AT ALL TIMES. CONTRACTOR SHALL INSPECT SUCH DEVICES AT LEAST ONCE PER WEEK AND AFTER EACH RAINFALL EVENT GREATER THAN 10MM, AND MAKE ALL NECESSARY REPAIRS AS REQUIRED.
13. ALL SEDIMENTS SHALL BE DISPOSED OFF-SITE AS PER CITY REGULATIONS.
14. CONTRACTOR IS RESPONSIBLE FOR CLEAN UP OF MUDTRACKING ON A DAILY BASIS OR ON A MORE FREQUENT BASIS IF DIRECTED BY THE TOWN OR OWNER.
15. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL OF ALL EROSION AND SEDIMENT CONTROL DEVICES AND STRUCTURES ONCE SEEDING OR SODDING IS IN PLACE AND THE SITE HAS STABILIZED.

'SILTSACK' DETAIL

SCALE: N.T.S.



NOTES:
1. INSTALL TERRAFIX 'SILTSACK' IN ALL CATCHBASINS & CATCHBASIN MANHOLES AFFECTED BY CONSTRUCTION.
2. INSTALL TERRAFIX 'SILTSACK' IN ALL NEW CATCHBASINS & CATCHBASIN MANHOLES.

NOT FOR SUBMISSION

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Whitby Ontario L1N 8Y3
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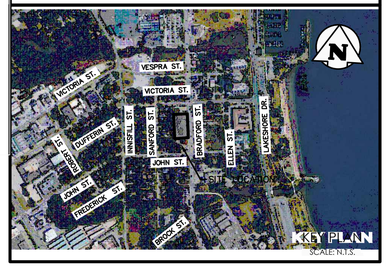
E ytomail@ghd.com **W** www.ghd.com



LEGEND

- PROPERTY LINE
- HP — EXISTING HYDRO POLE
- x — x — EXISTING FENCE
- x 215.00 — EXISTING GRADE
- EXISTING OVERLAND FLOW DIRECTION
- MUD-MAT; SEE DETAIL
- SILT FENCE; SEE DETAIL
- TEMPORARY CATCHBASIN SILTATION CONTROL DEVICE. (SILTSACK)
- LIMITS OF EX. SERVICE TO BE REMOVED

No.	ISSUE / REVISION	YYYY/MMM/DD
A	ISSUED FOR COORDINATION	2023/NOV/06

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE RELATED TO HORIZONTAL CONTROL MONUMENT NO. 03120080022 HAVING AN ELEVATION OF 222.437 METRES. (VERTICAL DATUM: CGVD28:78

SURVEY NOTES:

SURVEY COMPLETED BY KRCMAR SURVEYOR LTD. (2023/APR/17)
JOB No.: 23-041

BEARINGS SHOWN HEROIN ARE GRID DERIVED FROM HORIZONTAL CONTROL MONOUMENTS NO. 03120080022 AND 03120080023 AND ARE REFERRED TO THE 6° UTM COORDINATE SYSTEM, ZONE 17, NAD83 (GSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9997145

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY KIRKOR ARCHTECT INC.
DRAWING No.: AD202, REV.X (2023/SEPT/21)
PROJECT No.: 23-072

DRAWING NOTES:

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.

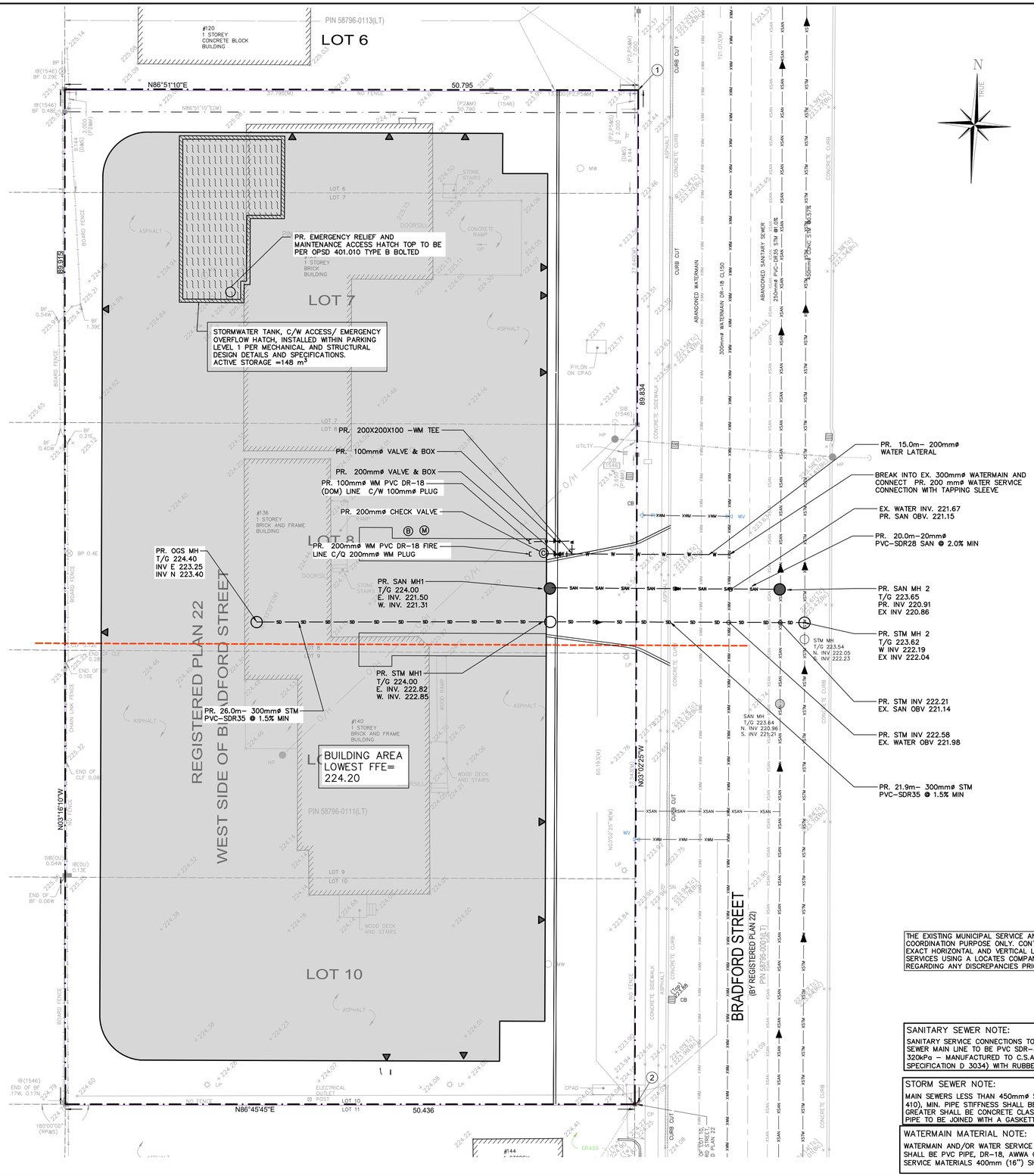
THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT. DO NOT SCALE THIS DRAWING.

ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project
126 BRADFORD STREET
CITY OF BARRIE
COUNTY OF SIMCOE

Drawing
REMOVALS PLAN
EROSION & SEDIMENT CONTROL & CONTAMINANT MANAGEMENT PLAN

Drawn	A.S.	Design	A.S.	Project No.	12623952
Check	A.B.	Check	A.B.	Scale	1:200
				Dwg.	G101



N

LOCATIONS OF EXISTING SERVICES & UTILITIES:

THE VERTICAL & HORIZONTAL LOCATIONS SHOWN FOR EX. MUNICIPAL SERVICES AND UTILITIES ARE APPROXIMATE ONLY, AND ARE BASED ON TOPOGRAPHIC SURVEY AND AS-CONSTRUCTED DRAWINGS 2003-002-008 AND 2003-002-009 (MARCH, 2003)
THE EXACT VERTICAL & HORIZONTAL LOCATIONS ARE TO BE CONFIRMED ON SITE BY A LOCATES COMPANY PRIOR TO CONSTRUCTION.

EXISTING UTILITIES AND SERVICES

CONTRACTOR SHALL NOTE THAT THE CONSTRUCTION ZONE HAS NUMEROUS EXISTING UNDERGROUND UTILITIES AND SERVICES, SOME OF WHICH ARE TO BE ABANDONED OR REMOVED, AND OTHERS WHICH ARE TO BE PROTECTED AND MAINTAINED IN SERVICE.

PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL RETAIN THE SERVICES OF A COMPANY, WHICH SPECIALIZES IN SUBSURFACE UTILITY ENGINEERING FOR THE PURPOSES OF LOCATING, MARKING AND SURVEYING ALL UNDERGROUND UTILITIES AND SERVICES. ALL CURRENT METHODS SHALL BE USED FOR THESE LOCATIONS INCLUDING ELECTRONIC METHODS, VACUUM EXCAVATIONS, SURVEYING MANHOLES AND CHAMBERS ETC.

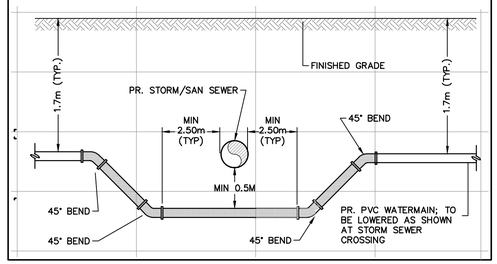
THE UTILITIES AND SERVICES SHALL BE SURVEYED AND TIED INTO THE PROJECT COORDINATE SYSTEM. A COPY OF THE SURVEY SHALL BE PROVIDED TO THE ENGINEER FOR RECORD PURPOSES.

ANY CONFLICT WITH THE PROPOSED WORKS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL LOCATIONS FOR PROTECTION AND TEMPORARY RELOCATION OF UNDERGROUND UTILITIES AND SERVICES AS REQUIRED FOR THE COMPLETE INSTALLATION OF THE PROPOSED WORKS.

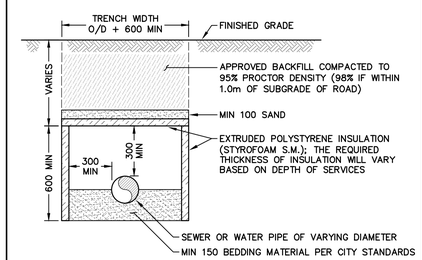
WATERMAIN LOWERING DETAIL

SCALE: N.T.S.



INSULATION FOR SHALLOW MUNICIPAL SERVICES

SCALE: N.T.S.



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. 50mm OF INSULATION IS REQUIRED FOR EVERY 600mm OF COVER DEFICIENCY.
3. MINIMUM COVER REQUIREMENTS;
   - STORM SEWER 1.2m
   - WATERMAIN 1.7m
   - SANITARY SEWER 1.4m

THE EXISTING MUNICIPAL SERVICE AND UTILITIES ARE SHOWN FOR COORDINATION PURPOSE ONLY. CONTRACTOR TO VERIFY ON SITE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF THE EXISTING MUNICIPAL SERVICES USING A LOCATES COMPANY, AND ADVISE THE ENGINEER REGARDING ANY DISCREPANCIES PRIOR TO CONSTRUCTION START.

SANITARY SEWER NOTE:

SANITARY SERVICE CONNECTIONS TO BE PVC SDR-28 AND SANITARY SEWER MAIN LINE TO BE PVC SDR-35 WITH MINIMUM PIPE STIFFNESS OF 320kPa - MANUFACTURED TO C.S.A. STANDARD B182.2 (A.S.T.M. SPECIFICATION D 3034) WITH RUBBER GASKETTED BELL AND SPIGOT JOINTS.

STORM SEWER NOTE:

MAIN SEWERS LESS THAN 450mmø SHALL BE PVC PIPE SDR 35 (OPSS 410), MIN. PIPE STIFFNESS SHALL BE 320kPa. MAIN SEWERS 450mmø OR GREATER SHALL BE CONCRETE CLASS-65D UNLESS NOTED OTHERWISE. ALL PIPE TO BE JOINED WITH A GASKETTED BELL AND SPIGOT SYSTEM.

WATERMAIN MATERIAL NOTE:

WATERMAIN AND/OR WATER SERVICE MATERIALS 100mm (4") TO 300mm (12") SHALL BE PVC PIPE, DR-18, AWWA C900. WATERMAIN AND/OR WATER SERVICE MATERIALS 400mm (16") SHALL BE PVC CSA B137.3, AWWA C905.

WATERMAIN NOTE:

WATERMAIN & WATER SERVICES SHALL HAVE A MINIMUM DEPTH OF 1.7m AND SHALL HAVE A MINIMUM OUTSIDE BARREL VERTICAL SEPARATION OF 0.5m & HORIZONTAL SEPARATION OF 2.5m BETWEEN THE WATER PIPE AND SEWERS PIPES. IN CASE OF CONFLICT BETWEEN THE PROPOSED WATERMAIN AND PROPOSED SEWERS, CONTRACTOR TO LOWER THE PROPOSED WATERMAIN TO ENSURE MIN. 0.5m CLEARANCE BETWEEN WATERMAIN PIPE AND SEWERS PIPE, PER DETAIL ON THIS DRAWING.

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E ytomail@ghd.com **W** www.ghd.com

LEGEND

- PROPERTY LINE
- EXISTING WATERMAIN & GATE VALVE
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE / DOUBLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE
- PROPOSED WATERMAIN & GATE VALVE
- PROPOSED DETECTOR CHECK VALVE IN CHAMBER PER CITY STANDARD W536
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED SIAMESE CONNECTION
- PROPOSED WATER METER
- PROPOSED BACKFLOW PREVENTOR
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED SINGLE / DOUBLE CATCHBASIN
- PROPOSED SANITARY SEWER & MANHOLE

No.	ISSUE / REVISION	YYYY/MMM/DD
A	ISSUED FOR COORDINATION	2023/NOV/06

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE RELATED TO HORIZONTAL CONTROL MONUMENT NO. 03120080022 HAVING AN ELEVATION OF 222.437 METRES. (VERTICAL DATUM: CGVD28:78

SURVEY NOTES:

SURVEY COMPLETED BY KRCMAR SURVEYOR LTD. (2023/APR/17)
JOB No.: 23-041

BEARINGS SHOWN HEROIN ARE GRID DERIVED FROM HORIZONTAL CONTROL MONOUMENTS NO. 03120080022 AND 03120080023 AND ARE REFERRED TO THE 6° UTM COORDINATE SYSTEM, ZONE 17, NAD83 (CSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9997145

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY KIRKOR ARCHTECT INC.
DRAWING No.: AD202, REV.X (2023/SEPT/21)
PROJECT No.: 23-072

DRAWING NOTES:

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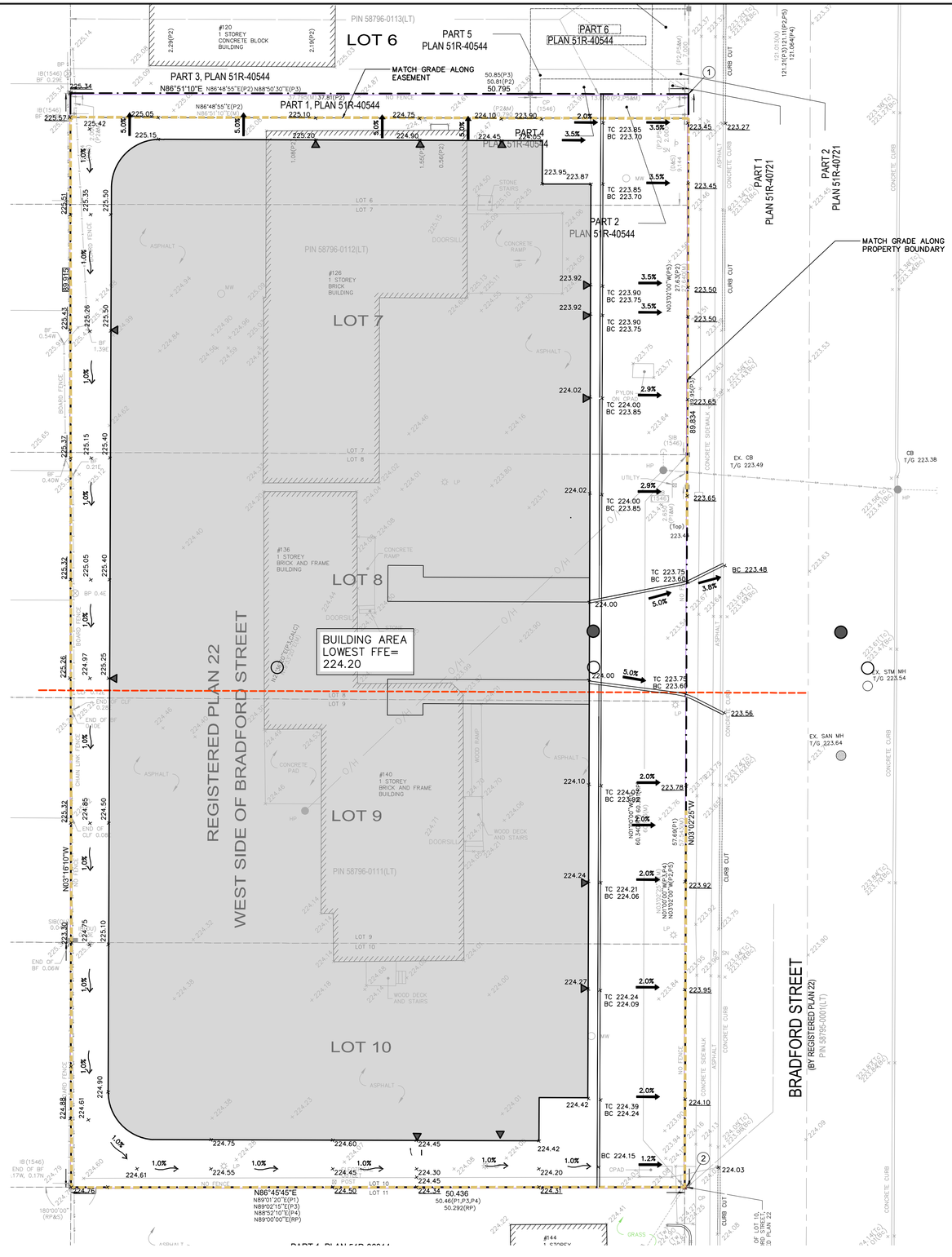
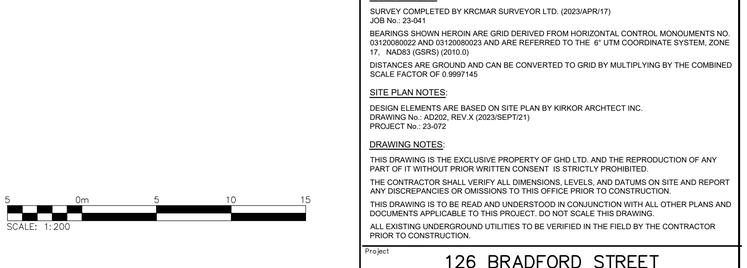
ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project
126 BRADFORD STREET
CITY OF BARRIE
COUNTY OF SIMCOE

Drawing
SITE SERVICING PLAN

Drawn	A.S.	Design	A.S.	Project No.	12623952
Check	A.B.	Check	A.B.	Scale	1:200
				Dwg.	G102





5 0m 5 10 15
SCALE: 1:200

LEGEND

- PROPERTY LINE
- EXISTING FENCE
- ×215.00 EXISTING GRADE
- ×215.00 PROPOSED GRADE
- ×215.00 PROPOSED GRADE (TO MATCH EXISTING)
- 2.0% PROPOSED MINOR FLOW DIRECTION
- 2.0% PROPOSED GRASSED SWALE
- PROPOSED RETAINING WALL
- PROPOSED SLOPE (3:1 MAX.)
- EXTENTS OF WORK
- BUILDING ENTRANCE (PERSONNEL DOOR)
- PROPOSED MAJOR OVERLAND FLOW DIRECTION
- EXISTING FIRE HYDRANT & GATE VALVE
- PROPOSED SIAMESE (FIRE DEPT.) CONNECTION

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

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No.	ISSUE / REVISION	YYYY/MMM/DD
A	ISSUED FOR COORDINATION	2023/NOV/06

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE RELATED TO HORIZONTAL CONTROL MONUMENT NO. 03120080022 HAVING AN ELEVATION OF 222.437 METRES. (VERTICAL DATUM: CGVD28:78

SURVEY NOTES:

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DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9997145

SITE PLAN NOTES:

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DRAWING No.: AD202, REV.X (2023/SEPT/21)
PROJECT No.: 23-072

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ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project
126 BRADFORD STREET CITY OF BARRIE COUNTY OF SIMCOE

Drawing
SITE GRADING PLAN

Drawn	Design	Project No.	
A.S.	A.S.		12623952
Check	Check	Scale	Dwg.
A.B.	A.B.	1:200	G103

Appendices

Appendix A

Calculations

Project Name	126 Bradford St
Project No.	12623952
Subject	Peak Flow

Area	0.46

Design Storm	Storm Recurrence Interval	Pre-Development Peak Flow (m3/s)	Uncontrolled Post Development Peak Flow	Controlled Post-Development Peak Flow (m3/s) 110 m2 tank
4hr Chicago	2	0.05	0.09	0.04
	5	0.07	0.12	0.05
	10	0.08	0.14	0.06
	25	0.09	0.17	0.07
	50	0.1	0.19	0.07
	100	0.12	0.2	0.08
6hr SCS	2	0.04	0.07	0.04
	5	0.06	0.11	0.05
	10	0.07	0.12	0.06
	25	0.09	0.15	0.08
	50	0.11	0.18	0.08
	100	0.12	0.2	0.09
12hr SCS	2	0.04	0.07	0.04
	5	0.05	0.1	0.05
	10	0.07	0.11	0.6
	25	0.08	0.13	0.07
	50	0.1	0.15	0.08
	100	0.11	0.18	0.08
24hr SCS	2	0.04	0.07	0.04
	5	0.05	0.09	0.05
	10	0.07	0.11	0.06
	25	0.09	0.13	0.07
	50	0.1	0.16	0.08
	100	0.11	0.18	0.08

Storage	
Area (m2)	110
Depth (m)	1.5
Orifice Plate (mm)	150
Orifice Plate Coefficient	0.62

Subcatchment	
Area (ha)	0.46
Pre Dev Impervious (%)	50
Post Dev Impervious (%)	90

Project Name	126-140 Bradford Street
Project No.	12623952
Subject	Water Balance Pre-Development Conditions

Condition	Catchment	Area (ha)	Runoff Volume (m3/yr)	Infiltration Volume (m3/yr)	Evaporation Volume (m3/yr) *	Sum of Volume (m3/yr)
Pre-Development(50% Impervious)	**101**	0.46	1340	482	2003	3825
	Total	0.46	1340	482	2003	3825
	Percentage	-	35	13	52	

Condition	Catchment	Area (ha)	Runoff Volume (m3/yr)	Infiltration Volume (m3/yr)	Evaporation Volume (m3/yr) *	Sum of Volume (m3/yr)
Actual (100% Impervious)	**100**	0.46	2663	0	1162	3824
	Total	0.46	2663	0	1162	3824
	Percentage	-	70	0	30	

Project Name	126-140 Bradford Street
Project No.	12623952
Subject	Water Balance Post-Development

Condition	Catchment	Area (ha)	Runoff Volume (m3/yr)	Infiltration Volume (m3/yr)	Evaporation Volume (m3/yr) *	Sum of Volume (m3/yr)
Uncontrolled Post Development	**201**	0.34	1838	0	989	2827
	202	0.04	0	36	296	333
	203	0.01	3	9	72	83
	204	0.07	499	0	83	582
	Total	0.46	2340	45	1440	3825
Controlled Post Development (5.72 m2*0.7 depth)	**201**	0.34	1382	456	989	2827
	202	0.04	0	36	296	333
	203	0.01	3	9	72	83
	204	0.07	499	0	83	582
	Total	0.46	1884	501	1440	3825

Project Name	126-140 Bradford Street
Project No.	12623952
Subject	Water Balance

	Actual Conditions (100 % impervious)	Pre-Development (50% Impervious)	Uncontrolled Post-Development	Controlled Post-Development
Evaporation (m3)	1162	2003	1440	1440
Runoff (m3)	2663	1340	2340	1884
Infiltration (m3)	0	482	45	501

Project Name	126-140 Bradford Street
Project No.	12623952
Subject	Volume and Erosion Control

Condition	Catchment	Area (ha)	Runoff Volume (m3/yr)	Infiltration Volume (m3/yr)	Evaporation Volume (m3/yr)	Sum of Volume (m3/yr)
25 mm storm	**201**	0.34	80.0	0.0	5.0	85.0
	202	0.04	0.0	9.3	0.6	10.0
	203	0.01	0.1	2.2	0.2	2.5
	204	0.1	17.2	0.0	0.3	17.5
	Total	0.5	97.3	11.6	6.1	115.0

Project No.	12623952
Subject	Pollutant Load Summary

Catchment ID	Uncontrolled TSS Load (kg/yr)	Target TSS Load (kg/yr)	Uncontrolled TP Load (kg/yr)	Target TP Load (kg/yr)
201	12.85	2.57	0.17	0.03
202	0.00	0.00	0.00	0.00
203	0.29	0.06	0.00	0.00
204	41.68	8.34	0.11	0.02
Total	54.82	10.96	0.27	0.05

TOTAL LOAD

Condition	TSS Load (kg/yr)	TP Load (kg/yr)
Pre-development	132.50	0.40
Existing Conditions	178.52	0.49
Uncontrolled Post-Development	54.82	0.27
Controlled Post-Dev	42.54	0.16
Controlled Post-Dev excluding 204	0.86	0.05
Existing Conditions Excluding 204 area	151.35	0.41
Uncontrolled Post-Development Excluding 204	13.15	0.17

Appendix B

Excerpts from Reference Reports

Corinne Ruthenberg

From: Corinne.Ruthenberg@ghd.com
Subject: FW: 126-140 Bradford St - SWM inquiry
Attachments: LSRCA preconsulation.pdf

CompleteRepository: 12623952
Description: 1126-140 Bradford St
JobNo: 12623952
OperatingCentre: 662
RepoEmail: 12623952@ghd.com
RepoType: Proposal

From: Winston Thai <Winston.Thai@ghd.com>
Sent: Friday, October 6, 2023 10:03 AM
To: Jeff Zhang <Jeff.Zhang@ghd.com>
Cc: Corinne Ruthenberg <Corinne.Ruthenberg@ghd.com>
Subject: FW: 126-140 Bradford St - SWM inquiry

Hi Jeff,

Please see below from LSRCA.

Thanks and Regards,
Winston

From: Alison Edwards <A.Edwards@lsrca.on.ca>
Sent: Friday, October 6, 2023 10:00 AM
To: Winston Thai <Winston.Thai@ghd.com>
Cc: Shawn Filson <S.Filson@lsrca.on.ca>
Subject: 126-140 Bradford St - SWM inquiry

Hi Winston.

I will most likely be the engineer responsible for the review of this application.

As per LSRCA's technical guidelines, post-to-pre control is required. The glossary (section 8.0) defines pre-development as the predominant site condition over the past 10 years. A maximum of 50% impervious area is to be assumed for pre-development runoff calculations where there is a known flooding/erosion concern in the area, or adequate controls do not exist downstream.

Supporting information will need to be submitted to demonstrate pre-development conditions. I assume there are no adequate controls downstream in which the 50% imp. rule will be applicable.

Hope this helps.
- Alison

From: Winston Thai <Winston.Thai@ghd.com>
Sent: Thursday, October 5, 2023 3:41 PM
To: Emma Dias <E.Dias@lsrca.on.ca>
Subject: 126-140 Bradford St - SWM inquiry

Hi Emma,

Hope all is well.

I am emailing regarding the new development located at 126-140 Bradford St. I have a question regarding peak flow control criteria that I hope you can answer.

Regarding to peak flows control criteria, Section 3.2.1 of the LSRCA's SWM Submission Guidelines provides the general target, i.e. post to pre control for all design storm events. It also states other criteria, such as over-control (for example, from 100-yr post to 2-yr pre) might be required. Our site is currently 100% impervious and as such post to pre control target is easy to achieve. Does the City or the LSRCA have a specific peak flow control criteria for this site?

Thanks and Regards,
Winston

Winston Thai
P.Eng.
Project Manager

GHD
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Final Preliminary Geotechnical Report

Proposed Development, 126 and 140 Bradford Street, Barrie, Ontario

Crown Communities Developments Inc. and Crown (Bradford) Developments Inc.

05 May 2023

→ The Power of Commitment

Detailed descriptions of subsurface conditions are provided in the following sections of this report. The subsurface conditions are described in accordance with the Unified Soil Classification System and the Canadian Foundation Engineering Manual, (CFEM 2006).

3.2.1 Fill

Fill material comprising of sand was encountered immediately below asphalt and granular base in all boreholes at the Site. The fill extended to a depth of 2.3 mbgs (Elevations ranging from 221.4 m to 221.3 m).

SPT 'N' values within the fill material ranged between 0 and 10 blows per 0.3 m of penetration, suggesting a very loose to compact relative density.

Grain size testing was carried out on one (1) representative sample of the fill material. The results are summarized in the table below and presented in **Appendix B** and on the borehole records in **Appendix A.**

Table 3.1 Grain size Distribution Analysis Test Results – Fill Material

Borehole Identification Number	Sample Number	Depth (mbgs)	Grain Size Distribution			
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH6-23	SS3	1.5 – 2.1	5	88	7	0

Moisture contents measured on samples of the fill material ranged between 5% and 23%.

3.2.2 Native Deposits – Sand, Silty Sand/Sandy Silt, Silt and Sand, Silt

A native sand deposit was encountered immediately below the fill material in borehole BH5-23 at depth of 2.3 mbgs (Elevation 221.4 m) and extended to the depth of 4.6 mbgs (Elevation 219.1 m). SPT 'N' values within the sand deposit ranged between 1 blow to 4 blows per 0.3 m of penetration, suggesting a very loose relative density. Moisture contents measured on samples of the fill material ranged between 26% and 29%.

Silty sand, sandy silt, sand & silt deposits were encountered below the sand layer in borehole BH5-23 to a depth of 12.2 mbgs (Elevation 211.5 m), and below the fill material in borehole BH6-23 to a depth of 22.9 mbgs (Elevation 200.8). SPT 'N' values within the silty sand, sandy silt deposit ranged between 5 blows per 0.3 m of penetration to 50 blows per 0.11 m of penetration, suggesting loose to very dense relative density. Moisture contents measured on samples of these soils ranged between 18% and 30%.

A deposit of silt was encountered below the upper sand and silt deposit in borehole BH5-23, and below a silty clay deposit in BH6-23 at depths ranging from 12.2 mbgs to 25.9 mbgs (Elevations ranging from 211.5 m to 197.7 m) and extended to the termination depth of 28.0 mbgs (Elevations 195.7 m and 195.6 m). SPT 'N' values within the silt deposit ranged between 14 blows per 0.3 m of penetration and 50 blows per 0.13 m of penetration, suggesting compact to very dense relative density. Moisture contents measured on samples of the silt ranged between 14% and 25%.

Grain size testing was carried out on seven (7) select soil samples within these deposits and the results are provided in **Appendix B** and on the borehole records in **Appendix A**. The results are also summarized in the table below.

Table 3.4 Atterberg Testing Results – Silty Clay

Borehole Identification Number	Sample Number	Depth (mbgs)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Classification
BH6-23	SS15	22.9 – 23.5	37	20	17	CI

3.3 Groundwater Conditions

Groundwater was encountered during drilling at a depth of 2.3 mbgs (Elevation 221.4 m) in BH5-23 and 1.6 mbgs (Elevation 222.0 m) in BH6-23.

The groundwater observations were obtained from the open boreholes upon completion of drilling each borehole. Groundwater at completion of drilling was at the surface, however, it is noted that mud rotary/wash boring methods were utilized and, therefore, the water level upon completion of drilling is not considered realistic. The results of the groundwater observations are summarized in the borehole logs in the **Appendix A**.

It should be noted that the groundwater level is subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year.

Based on the CPT porewater pressure dissipation tests, the inferred depth of groundwater table generally ranged between 2.0 and 2.5 mbgs, with the exception of the SCPT23-03 location that indicated a groundwater depth ranging between 2.9 and 3.5 mbgs.

Based on the GHD Preliminary Hydrogeological Assessment Report dated February 10, 2023, the groundwater levels measured (dated January 23, 2023) in the monitoring wells MW1-23 through MW4-23 ranged from 2.2 to 3.1 mbgs.

4. Engineering Discussion and Recommendations

This section of the report provides preliminary geotechnical engineering design recommendations for the proposed development.

The following recommendations are based on the interpretation of the factual data obtained from the boreholes and other testing advanced during this subsurface investigation. It should be noted that the geotechnical investigation, discussion, and recommendations are intended for use by the designers only and should not be relied upon for any other purpose or by any other parties, including the construction or design-build contractor. Contractors bidding on or undertaking any work at the proposed development should examine the factual results of the assessment, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of this factual data as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, scheduling, and the like. Where comments are made on construction, they are provided to highlight those aspects that could affect the design of the project. Comments, techniques, or recommendations pertaining to construction should not be construed as instructions to the contractor.

4.1 Seismic Site Classification

GHD conducted a Multichannel Analysis of Surface Waves (MASW) testing as part of the geotechnical investigation for the proposed development. The results of the findings are presented in **Appendix E**. Based on the findings of the investigation, a weighted average shear wave velocity of 327 m/s was calculated for a depth of 30 mbgs.

Based on the Seismic Piezocone Penetration Test findings at locations SCPT23-01 through SCPT23-04, SCPT23-04 was chosen as the reference for calculating the weighted average shear wave velocity due to the deepest depth and

The upper zone of the soil (down to a depth below the caisson cap equal to 1.5 times B (after Broms, 1964[12,13], where B is the caisson diameter) should be neglected in the calculation of lateral resistance of the caisson to account for disturbance effects during installation.

Group action for lateral loading should be considered when the caisson spacing in the direction of the loading is less than 6 to 8 caisson diameters. Group action can be evaluated by reducing the coefficient of horizontal subgrade reaction in the direction of loading by a Reduction Factor, R, as follows:

Table 4.5 Subgrade Reaction Reduction Factor R for Group Action in Lateral Loading

Spacing in Direction of Loading (B = Pile Diameter)	Subgrade Reaction Reduction, R
8B	1.00
6B	0.70
4B	0.40
3B	0.25

4.6 Slab-on-grade Support

Considering the presence of very loose to compact fill material, the use of slab-on-grades carry the risk of long-term differential settlements and cracking. As such, ground floor slab for the buildings should be designed as structural slabs supported on deep foundations such as caissons.

4.7 Preliminary Pavement Design

The subsequent sections include preliminary pavement design recommendations for the construction of the driveway and surface parking lot for the proposed development.

4.7.1 Earth Fill Condition

The existing earth fill at the Site extended to an approximate depth of 2.3 mbgs at the borehole locations. Non-cohesive fill material generally consisting of sand trace gravel trace silt was encountered below the topsoil in boreholes BH5-23, BH6-23, and MW1-23 to MW4-23. The fill material was generally underlain by native sand and silty sand to sandy silt to the borehole termination depths.

SPT ‘N’ values within the non-cohesive fill material ranged from 0 to 8 blows per 300 mm penetration, indicating a very loose to loose state of compactness.

4.7.2 Frost Susceptibility of Subgrade Soils

The frost susceptibility of the subgrade soils is assessed using the Ministry of Transportation of Ontario’s guidelines, which are based on the presence of silt sized particles in the 75µm to 5µm range. Based on the classification of the soils, it is assumed that the existing fill material underlying the topsoil and within the frost penetration depth is of Low to Susceptibility to Frost Heaving (LSFH).

[12] Broms, B.B., 1964. Lateral resistance of piles in cohesive soils. Journal of the soil mechanics and foundations division, 90(2), pp.27-63.
[13] Broms, B.B., 1964. Lateral resistance of piles in cohesionless soils. Journal of the Soil Mechanics and Foundations Division, 90(3), pp.123-156.

5.4 Groundwater Control

Groundwater was encountered during drilling at a depth of 1.6 mbgs (Elevation 222.0 m) in BH6-23, and 2.3 mbgs (Elevation 221.4 m) in BH5-23. The inferred groundwater table depth from the CPT dissipation tests was in the range of 2 to 2.5 mbgs. Therefore, excavations for the utilities and foundations may extend below the groundwater level. Groundwater levels are typically high during snow melting and heavy rains in spring and summer. Therefore, depending on the time of construction and the depth of associated excavations, the groundwater level may rise and adversely affect construction.

Surface water and runoff should be directed away from the excavation areas to prevent ponding of water that could result in disturbance and weakening of the subgrade. Investigative test pits are recommended prior to construction for the contractor's planning of groundwater control means and methods.

5.5 Temporary Excavation Support Systems/Shoring

Should the recommended excavation slopes be impractical in some areas of the Site, due to space limitations or risk of damaging existing structures or underground service utilities, engineered temporary shoring systems will be required. Temporary excavation support systems should be designed and constructed in accordance with OPSS.MUNI 539 (*Temporary Protection Systems*). The lateral movement of the protection system should meet Performance Level 2 as specified in OPSS.MUNI 539, provided that any utilities, if present can tolerate this magnitude of deformation. The selection and design of the temporary protection system will be the responsibility of the contractor.

It is anticipated that a driven interlocking sheet pile system may be constructable; Alternatively, a soldier pile and lagging system could be used at the Site.

The following information is provided to the designers to aid in assessment of the approximate construction costs. Passive toe restraint to the soldier piles may be determined using conventional passive earth pressure distribution acting over an equivalent width equal to three times the soldier pile socket diameter provided that the soldier piles are separated by more than three times the socket diameter. Design of the temporary protection system should include an evaluation of basal stability and hydraulic uplift stability as defined in the CFEM (2006).

The total passive resistance below the base of the excavation (i.e., adjacent to the temporary protection system) may be calculated based on the values of K_p indicated below in Table 5.1. The earth pressure coefficients given in Table 5.1 assume that the ground surface behind the shoring system is horizontal. If the retained ground is sloping, the lateral earth pressure coefficients must be adjusted accordingly to account for the slope.

Table 5.1 Lateral Earth Pressure Coefficients – Static Condition

Soil Type	Bulk Density γ (kN/m^3)	Angle of Internal Friction Φ (°)	Undrained Shear Strength S_u (kPa)	Lateral Earth Pressure Coefficients		
				K_a (active)	K_0 (at-rest)	K_p (passive)
Very Loose to Compact Non-Cohesive Fill Material	18	30	-	0.33	0.50	3.00
Compact to Very Dense Native sand and silt	19	33	-	0.29	0.46	3.39
Stiff to Very Stiff Silty Clay Deposit	19	30	125	0.33	0.50	3.00
Imported Fill Material (OPSS.MUNI 1010 Granular A)	22	35	-	0.27	0.43	3.69
Imported Fill Material (OPSS.MUNI 1010 Granular B Type II)	21	35	-	0.27	0.43	3.69

Hydrogeological Assessment

126, 136 and 140 Bradford Street, Barrie, Ontario

Crown Communities Developments Inc. and

Crown (Bradford) Developments Inc.

30 June 2023

→ The Power of Commitment

City of Barrie Environmental Risk Management

The Site is situated within municipal water supply Source Water Protection areas, and the City of Barrie Environmental Risk Management stipulates that building supports are not permitted to be constructed within the municipal supply aquifer, and permanent long term groundwater seepage to a building foundation drainage system (e.g., weepers) is not allowed (City of Barrie, 2021)[5].

Based on the City of Barrie's, Environmental Risk Assessment internal regional model (City of Barrie, January 20, 2023), the following groundwater conditions are anticipated to underlie the Site:

- Depth to Water Table - 2m
- Depth to Perched Water – 2m
- Depth to Aquifer A1 - 2m
- Depth to Aquitard C1 – 4m
- Depth to Aquifer A2 - 21m
- Depth to Aquitard C2 - 31m
- Depth to Confined Municipal Aquifer – 49m
- Depth to Uppermost Significant Aquifer - 49m
- Cumulative Transmissivity to Base of A1 – Low 38 m^2/day
- Cumulative Transmissivity to Base of A2 - Low 45m^2/day
- Cumulative Transmissivity to Base of A3 – High 3,618 m^2/day

Municipal Water Supply

As outlined in the Lakes Simcoe and Couchiching-Black River Source Protection Area Approved Assessment Report, Chapter 8 City of Barrie (SGBLS, 2015):

The water supply wells are constructed in deep overburden aquifers. The municipal wells in the core area are constructed within a channelized aquifer unit described as the Barrie-Borden tunnel valley aquifer. The aquifers underlying the City of Barrie are part of a regionally extensive and complex aquifer system, within which four major sand and gravel aquifer units have been identified. Locally, these are referred to as the upper, intermediate and shallow/deep lower aquifers. The municipal aquifers are identified regionally as part of the A3 and A4 aquifer systems (Golder Associates, 2004). These aquifers are locally overlain by relatively thick protective clay and silt aquitard deposits, however localized windows exist in areas. The aquifers in the vicinity of Barrie are productive, with relatively high transmissivities, ranging from approximately 250 to over 3,000 m^2/day. Transmissivities in the core area of Barrie are high, ranging from approximately 1,000 to over 3,000 m^2/day.

The capture zones and resultant wellhead protection areas for these wellfields are fairly broad and extend outward through the coarse grained and highly conductive deep aquifer systems. Whereas the wellhead protection areas are encompassed by a high to medium vulnerability area, the protective aquitard layers overlying the deep production aquifers provide effective barriers to surficial activities in most areas. The exception to this is that a portion of local recharge is possibly captured by Well 11. This is supported by the available groundwater quality data, which suggests that the water extracted contains elevated concentrations of industrial solvents, chloride and nitrate.

Wells 11 and 14 are located in Heritage Park, along the north shore of Kempenfelt Bay, adjacent to the City docks, and accessed off Lakeshore Drive. Wells 12 and 15 are located in Centennial Park, on the west shore of Kempenfelt Bay. Well 15 is located north of Well 12 and is adjacent to the City marina.

Table 2.1 – City of Barrie Municipal Production Well Details

[5] City of Barrie Deep Drilling Terms of Reference (September 2021).

3.3 Groundwater Level Monitoring

Groundwater level monitoring was conducted from January 23 to June 7, 2023 to collect of six-months of monitoring through the spring freshet to determine seasonal fluctuations. Bi-monthly manual groundwater levels were collected using an electronic water level meter. Two (2) monitoring wells (MW01-22, and MW03-22) were equipped with electronic data loggers to continuously record water levels and provide a detailed record groundwater response to climatic conditions throughout the period.

Groundwater levels were measured with reference to the surveyed top of riser pipe. The depth to water below top of riser pipe was converted to depth in metres below ground surface (mBGS), and these levels are presented in **Table 3.3&3.4**. The manual groundwater elevation data are presented on the hydrograph in **Appendix D**.

3.4 Groundwater Quality

One groundwater sample was collected from monitoring well MW01-22 on January 23, 2023 for laboratory analysis of the parameters listed in City of Barrie Sanitary and Storm Sewer Use By-Law 2021-002 and Provincial Water Quality Objectives (PWQO) to assess water quality for discharge to the sewer.

Prior to sampling, the wells were purged using low-flow methods to ensure that the sample collected was representative of groundwater quality. Purging of the well was considered complete when three consistent field measurement readings of pH, conductivity, and temperature had been obtained after each removed.

The samples were submitted under chain of custody procedures to ALS Canada Limited (ALS), an analytical laboratory in Waterloo, Ontario for analysis. The laboratory certificates of analysis are presented in **Appendix E**. The groundwater analytical results are shown in **Table 3.5** and discussed in Section 4.0.

3.5 Water Balance

A water balance analysis was undertaken for the extent of the Site's due diligence boundary (approximately 0.45 ha) to determine the amount of water surplus generated for the existing and proposed Site conditions. A water balance analysis has been conducted on one development scenario as shown on the Conceptual Site Plan dated October 25, 2022 (Innovative Planning Solutions) presented in **Appendix G**. GHD understands that the stormwater management (SWM) plan for the site is still under development, therefore the water balance assessment provided represents uncontrolled post-development conditions which can be used during the SWM design process. The proposed Site conditions include residential and retail buildings, roadway, and landscaped areas.

The Site is located within the jurisdiction of the Lake Simcoe Region Conservation Area (LSRCA); however, the Site is not located within any regulated areas. LSRCA regulated areas associated with nearby creeks are located approximately 130 m to the north (Bunkers Creek) and 150 m to the south (Dyment Creek) of the Site.

Climate data for the water balance model, including daily air temperature and precipitation data between 1973 and 2022 was obtained from Environment Canada's Meteorological Service of Canada. The continuous weather data record provided by Environment Canada was obtained mainly from Barrie WPCC (Climate ID: 6110557) and Shanty Bay (Climate ID: 6117684) weather stations, with data from Barrie Landfill (Climate ID: 6110556), Midhurst (Climate ID: 6115099), and Barrie-Oro (Climate ID: 6117700) weather stations supplementing for missing records. The Barrie WPCC and Shanty Bay weather stations are located approximately 0.6 and 5.3 kilometers from the Site, respectively. The Barrie Landfill, Midhurst, and Barrie-Oro are located approximately 3.4, 9.6, and 16.2 kilometers from the Site, respectively.

The water balance surplus was estimated using the most recent version of the water balance model developed by Meteorological Service of Canada (MSC, see Johnstone and Louie, 1983). The new MSC's water balance method accounts for snow accumulation and melt (degree day method of USACE, 1956), potential evapotranspiration (Thornthwaite and Mather, 1955), soil storage (Phillips,1976), actual evapotranspiration, and moisture deficit and surplus. The MSC program calculates a 'water surplus' as the final product, which is the total water available in a given month to run off as surface overland flow and/or infiltrate to the ground and recharge the groundwater table. The MSC

water balance model uses continuous daily precipitation and air temperature data. The use of daily data allows for more accurate modelling of snowmelt and snow storage, which are of particular importance in a cold weather/winter climate (Johnstone and Louie, 1983).

4. Geology and Hydrogeology

The following sections provide a description of the geology and hydrogeology of the Site, based on the results of the investigations completed and on the available background information. The investigative locations are presented on **Figure 3.1.** and hydrogeologic profiles are shown on **Figures 4.1 and 4.2.**

4.1 Site Geology

The following surficial materials and geologic deposits underlie the Site (see **Figures 4.1** and **4.2**):

- **Surficial Material (0 to 1.7 mBGS)** – asphalt and sand fill
- **Glaciolacustrine Deposit (1.7 to greater than 6.1 mBGS)** - sand

The Site is underlain by a thin layer of asphalt (less than 10 cm thick) and fill comprised of sand. The sand fill is typically brown, loose, poorly graded, moist and contains occasional brick fragments. The fill extends to depths in the range of 1.5 to 1.6 mBGS.

The fill is underlain by a glaciolacustrine deposit comprised of sand that is brown, loose, poorly graded and moist. The deposit becomes grey and saturated at a depth in the range of 2.6 to 3.1 mBGS, and extends to the termination depth of the boreholes at 6.1 mBGS.

4.2 Site Hydrogeology

The Site is primarily underlain by unsaturated fill and a loose sand deposit, which forms an unconfined aquifer underlying the Site.

The hydrogeological field investigations completed for the Site included hydrogeologic testing and assessment of the groundwater conditions. The SWRTs were completed at representative groundwater monitoring wells. A summary of the hydrogeologic properties is presented in **Table 3.2**.

Fill (unsaturated) – No testing was completed on the fill, due to the thin nature of the fill and primarily unsaturated conditions at the time of drilling. Groundwater level monitoring to date indicates the fill is unsaturated.

Glaciolacustrine (Aquifer) – The sand deposit forms an aquifer, which allows for significant groundwater flow across the Site. The hydraulic conductivity (K_h) of the sand is 6.2 x 10^{-3} cm/s (geometric mean), which is representative of an aquifer.

4.3 Groundwater Levels

Manual groundwater level monitoring events were conducted from January 23, 2023 to June 7, 2023. Monitoring demonstrates fully recovered stable water level conditions in each well, as well as seasonal fluctuations. Groundwater levels were collected using a Solinst electronic water level meter. All groundwater levels collected from the on-site monitoring wells are summarized in **Table 3.3** in metres below ground surface (mBGS), and the depth to the water table is presented on **Figure 4.3**, based on May 18, 2023 monitoring event. Based on a review on ground water levels

collected to date, the water table is present within the sand deposit at depths ranging from approximately 1.98 to 3.1 mBGS.

All groundwater levels collected from the on-site monitoring wells are summarized in **Table 3.4** in metres above mean sea level (mAMSL). Based on a review on ground water levels collected to date, the water table is present within the sand deposit at depths ranging from approximately 222.28 to 221.56 mAMSL. A hydrograph of the levels is presented in **Appendix D**.

4.4 Groundwater Management - Quality

In the event groundwater takings are required during construction, the collected water is anticipated to be discharged to an onsite sanitary or storm sewer system. Groundwater samples were collected from MW1-22 for analysis of the parameters listed in the City of Barrie Sanitary and Storm Sewer Use By-Law 2021-002 and Provincial Water Quality Objectives (PWQO) to assess water quality for discharge to the sewer. Results from the laboratory analyses are presented in **Table 3.5** and the laboratory analytical report is provided in **Appendix E**. Based on review of **Table 3.5**, the following parameters had concentrations above the by-law and PWQO criteria:

Table 3.6 Groundwater Analytical Exceedances

Criteria	MW01-22
The City of Barrie – Storm Sewer	Total Suspended Solids (TSS)
PWQO	Aluminum (total) Chromium (total) Iron (total) Silver (total) Silver (dissolved) Alkalinity, total (as CaCO3) Phosphorous (total)

As the water that accumulates in the excavation will primarily be a combination of stormwater seepage and runoff and direct precipitation, the groundwater sample analytical results alone are not representative of the actual excavation discharge water quality. Pre-treatment methods such as settlement, filter bags and/or other methods may be required to lower total suspended solids (TSS) to meet the storm sewer use criteria. Additional sample collection will be required from the construction water takings prior to discharge to the City's sewer. A permit for discharge of private water must be obtained, and confirmatory sampling undertaken prior to discharge to the sewer for the construction activities.

5. Water Taking Evaluation

The proposed development will be constructed with no underground levels (i.e., slab on grade). The majority of the development would not require groundwater takings but given the water table is encountered at depths of up to 1.96 mBGS it is possible the installation of underground utilities would require some groundwater takings.

Shallow underground utilities, associated with the proposed residential and retail development, are anticipated to be installed within the proposed parking lot and building footprint. It is considered that servicing could extend up to 3 mBGS (or more) into the overburden for utility installations. These may require progressive open trench segments of up to 15 meters in length.

H = 2.18 m height of water table
hw = 0.0 m dewatering height
Ro = 57.19 m
rw = 5.73 m
a = 15.0 m
b = 3.0 m

The analytical solution provides a good estimation of potential long term (steady state) groundwater seepage. The geometric hydraulic conductivity of the sand was utilized to estimate the groundwater seepage into the utility excavation. The geometric hydraulic conductivity of the sand was calculated as 6.19 $x10^{-3}$ cm/sec.

The groundwater seepage to the excavation is estimated to be approximately 41.38 cubic metres per day (m^3/day) (**Appendix F.1**) or 41,380 litres per day (L/day), or 28.73 litres per minute (L/min). As the estimate above is for steady state conditions, it does not consider water taking rates at the commencement of dewatering. During this period, water takings can be higher to remove water storage in the immediate vicinity of the excavation. A safety factor of 3X is applied to the estimated steady state groundwater seepage rate to account for this short-term increased water taking. The maximum short term construction water takings are estimated to be up to 124.14 m^3/day (124,140 L/day) based on a 3X safety factor.

A Ministry of the Environment, Conservation and Parks (MECP) Environmental Activity and Sector Registration (EASR) is required for construction water takings between 50,000 to 400,000 litres per day (L/day), and a Permit To Take Water (PTTW) is require for construction water takings of greater than 400,000 L/day. The predicted water takings for the utility trench excavations are estimated to be up to 124,140 L/day. The predicted takings are below the MECP EASR limit of 50,000 L/day. Based on this, an EASR is anticipated to be required for the construction groundwater takings for the utility trench excavations.

6. Water Balance

Under existing conditions, the site consists of 100% impervious area and 0% pervious area. Once the site has been developed, approximately 88% of the Site will consist of impervious area (i.e., buildings, paved surfaces, etc.) and 12% pervious area (i.e., landscaped areas). Native soil deposits consisting of sand deposits were encountered in the boreholes. Based on the geotechnical information and related investigations, the general underlying soil type is described as sand and a soil holding capacity of 100 mm was selected.

GHD estimated the existing pervious and impervious areas based on available aerial imagery, as presented in **Table 6.1**. The proposed development areas were estimated based on the development concept shown on the Conceptual Site Plan and are presented in **Table 6.2**.

Table 6.1 Existing Conditions Areas

	Area (ha)	Total Percent Area (%)
Pervious (landscaped areas)	0.00	0
Impervious (building, pavement)	0.45	100
Total Site Area:	**0.45**	**100**

Table 6.2 Proposed Conditions Areas

	Area (ha)	Total Percent Area (%)
Pervious (landscaped areas)	0.05	12
Impervious (building, pavement)	0.40	88
Total Site Area:	**0.45**	**100**

Water surplus is the total water available in a given month to runoff as surface overland flow and/or infiltrate to the ground and recharge the groundwater table. Under the proposed development scenario, the amount of runoff would decrease as a result of the increase in pervious area and decrease in impervious area. The annual average water balance volume calculations for existing and proposed Site conditions are presented in **Table 6.3** below and in **Appendix G**.

Table 6.3 Annual Average Water Balance – Uncontrolled Condition

Site Condition	Site Area (ha)	Rainfall Volume (m^3)	Evapotranspiration Volume (m^3)	Water Surplus (m^3)	Infiltration Volume (m^3)	Runoff Volume (m^3)
Existing	0.45	4,330	2,158	2,172	0	2,172
Proposed	0.45	4,330	2,202	2,128	166	1,962
Difference	**-**	-	44	-44	166	-210

Based on the water balance calculations, it is estimated that the average annual water surplus for existing Site conditions is approximately 2,172 cubic metres (m^3). The water surplus of 2,172 m^3 is determined by subtracting the existing conditions evapotranspiration volume total of approximately 2,158 m^3 from the existing conditions rainfall volume total of 4,330 m^3 (4,330 m^3 – 2,158 m^3 = 2,172 m^3).

It is estimated that there will be a decrease in the amount of water surplus from existing conditions to the uncontrolled proposed conditions of approximately 44 m^3 annually. The decrease in water surplus is determined by subtracting the existing conditions water surplus of 2,172 m^3 from the proposed conditions water surplus of 2,128 m^3.

Under the proposed development, the amount of runoff would decrease as a result of the decrease in impervious area and increase in pervious surfaces. While the existing hydrogeological conditions will be improved upon, additional storm water management controls could be considered to enhance infiltration and evapotranspiration within the proposed development area to further reduce runoff and further improve upon existing hydrological conditions.

The proposed Conceptual Site Plan provided to GHD as part of the water balance assessment has not indicated the inclusion of any SWM control features. If SWM control features are eventually included in the proposed works and have been sized as part of the SWM design, it is recommended that the water balance assessment be updated to include the controlled post-development scenario.

The location, design, and construction of the stormwater management controls should be in accordance with, at a minimum, the following guidance documents:

– Stormwater Management Planning and Design Manual (MECP, 2003)
– Low Impact Development Stormwater Management Planning and Design Guide (CVC & TRCA, 2010)
– Low Impact Development Stormwater Management Guidance Manual – Draft Version (MECP, 2017)
– Technical Guidelines for Stormwater Management Submissions (LSRCA, 2022)

It should be noted that additional construction measures could be required to meet required guidelines. These guidelines include maintaining a minimum of 1.0 m buffer from the seasonally high groundwater table and 4.0 m buffer from building foundations for infiltrative LID measures. The following stormwater management controls could be further evaluated for feasibility at the site:

– Should infiltrative LID measures be deemed feasible, and area is available (i.e., 4.0 m from building foundations), permeable pavement on sidewalks or other paved areas would allow precipitation to drain from the surface to a stone reservoir where it can infiltrate into the underlying soils.
– Surface runoff from the Site could be directed to a bioswale or potential bioretention facilities or to underground infiltration galleries (if deemed feasible). Enhanced grassed swales or bioretention facilities could be located within any of the proposed landscaped areas.

Additional construction measures that could enhance infiltration and evapotranspiration include:

– Reduction of grading to 0.5 - 1.0% slope in paved and landscaped areas, and swales to allow for additional evapotranspiration and infiltration.
– Scarification, or tilling of the soil to a depth of approximately 300 mm, would enhance evapotranspiration and infiltration within the landscaped areas to overcome soil compaction that occurs during construction.

7. Summary and Conclusions

Based on the results of the hydrogeological investigation and monitoring undertaken to date, the following summary and conclusions are provided:

1) The Site is underlain by a thin layer of fill (up to 1.7 mBGS) and a sand deposit which extends to a depth of at least 6.1 mBGS. The fill was unsaturated at the time of investigation, and the water table was encountered within the sand.
2) The hydraulic conductivity of the sand deposit is 6.2×10^{-3} cm/s, which is representative of an aquifer.
3) Groundwater level monitoring conducted from January 23, 2023 to June 07, 2023, the water table within the sand deposit ranges from 222.28 to 221.56 mAMSL, and depth ranging from 1.98 to 3.1 mBGS.
4) The proposed residential and retail development concept plan contains two residential towers and above ground podium parking and retail space. The plan consists of two residential towers containing 740 residential units (370 units each), each tower with 33 storeys and eight 8 levels of above ground podium parking, and podium retail space. The proposed development will be constructed with no underground levels (i.e., slab on grade). The majority of the development would not require groundwater takings but given the water table is encountered at depths of up to 2.06 mBGS it is possible the installation of underground utilities would require some groundwater takings.
5) The construction groundwater takings for the proposed utility excavations are anticipated to be up to 142.12 m^3/day (142,120 L/day) based on a 3X safety factor. The typical groundwater taking is estimated to be approximately 41385 m^3/day (41,380 L/day) once groundwater levels are lowered and during a dry period. The predicted groundwater takings are above the MECP EASR limit of 50,000 L/day. Based on this, an EASR is anticipated to be required for the construction groundwater takings for the utility excavations.
6) In the event that water takings are required during development construction activities, the groundwater is not anticipated to meet the City of Barrie Storm Sewer Use By-Law 2021-002 or Provincial Water Quality Objectives (PWQO). The discharge would be a combination of groundwater, surface water runoff and precipitation into the excavation and would require further assessment to confirm its quality and requirement for pre-treatment. Prior to discharge to the sewer, a sewer-use discharge permit will be required, as applicable.

7) Based on the water balance calculations, it is estimated that the difference between the average annual water surplus for existing and proposed Site conditions is approximately -44 cubic metres (m^3) for the proposed uncontrolled development scenario. Under the proposed development scenario, the amount of runoff would decrease because of the decrease in impervious area and increase in pervious area. If considered, stormwater management controls should concentrate on enhancing infiltration and evapotranspiration further within the developed area to improve hydrological conditions further. GHD recommends that the water balance be updated to include the controlled post-development scenario once the post-development drainage areas and any SWM designs have been finalized.

Table G.1

Land Type Parameters
Hydrogeological Assessment
126 and 140 Bradford Street, Barrie, Ontario
Crown Communities Development Inc.

Pervious Area (Sand - 100 mm Holding Capacity)

Month	Temperature (°C)	Precipitation (mm)	Rainfall (mm)	Snowmelt (mm)	Potential Evapotranspiration (mm)	Actual Evapotranspiration (mm)	Water Surplus (mm)
January	-7.6	88	18	23	1	1	39
February	-6.9	65	13	29	1	1	41
March	-1.7	61	32	92	8	8	117
April	5.6	69	64	47	30	30	82
May	12.6	77	77	1	77	77	17
June	17.8	84	84	0	112	110	3
July	20.7	79	79	0	134	111	0
August	19.9	94	94	0	118	98	0
September	15.5	88	88	0	79	69	5
October	9	82	82	0	40	39	8
November	2.8	84	69	12	13	13	40
December	-3.4	84	29	22	3	3	42
Total		**955**	**729**	**226**	**616**	**560**	**395**

Impervious Area (Pavement, Gravel - 10 mm Holding Capacity)

Month	Temperature (°C)	Precipitation (mm)	Rainfall (mm)	Snowmelt (mm)	Potential Evapotranspiration (mm)	Actual Evapotranspiration (mm)	Water Surplus (mm)
January	-7.6	88	18	23	1	1	39
February	-6.9	65	13	29	1	1	41
March	-1.7	61	32	92	8	8	116
April	5.6	69	64	47	30	30	81
May	12.6	77	77	1	77	65	17
June	17.8	84	84	0	112	83	5
July	20.7	79	79	0	134	78	2
August	19.9	94	94	0	118	87	6
September	15.5	88	88	0	79	68	18
October	9	82	82	0	40	39	38
November	2.8	84	69	12	13	13	67
December	-3.4	84	29	22	3	3	48
Total		**955**	**729**	**226**	**616**	**476**	**479**

Table G.2

Existing Conditions Water Balance Calculations
Hydrogeological Assessment
126 and 140 Bradford Street, Barrie, Ontario
Crown Communities Development Inc.

Detail	*Units*	*Impervious Area*	*Pervious Area*	*Total*
Input Information				
Land Type	**%**	100	0	100
Area [1]	**ha**	0.45	0.00	0.45
Soil Type		Sand	Sand	
Hydrologic Soil Group		A	A	
Pervious Infiltration Factor [2]				
Topography		-	0.3	
Soil		-	0.4	
Land Type		-	0.1	
TOTAL		0	0.8	
Average Annual Depth				
Precipitation	***mm***	955	955	
Evapotranspiration	***mm***	476	560	
Output Information				
Annual Rainfall Volume	m^3	**4,330**	**0**	**4,330**
Annual Evapotranspiration Volume	m^3	**2,158**	**0**	**2,158**
Precipitation Surplus	m^3	2,172	0	2,172
Annual Groundwater Recharge Volume	m^3	**0**	**0**	**0**
Annual Runoff Volume	m^3	**2,172**	**0**	**2,172**

Notes:
1. Total developable site area.
2. Table 3.1 from the Stormwater Management Planning and Design Manual (MECP, March 2003).

Table G.3

Proposed Water Balance Calculations
Hydrogeological Assessment
126 and 140 Bradford Street, Barrie, Ontario
Crown Communities Development Inc.

Detail	*Units*	*Impervious Area*	*Pervious Area*	*Total*
Input Information				
Land Type	**%**	88	12	100
Area [1]	**ha**	0.40	0.05	0.45
Soil Type		Sand	Sand	
Hydrologic Soil Group		A	A	
Pervious Infiltration Factor [2]				
Topography		-	0.3	
Soil		-	0.4	
Land Type		-	0.1	
TOTAL		0	0.8	
Average Annual Depth				
Precipitation	***mm***	955	955	
Evapotranspiration	***mm***	476	560	486
Output Information				
Annual Rainfall Volume	m^3	**3,829**	**501**	**4,330**
Annual Evapotranspiration Volume	m^3	**1,908**	**294**	**2,202**
Precipitation Surplus	m^3	1,921	207	2,128
Annual Groundwater Recharge Volume	m^3	**0**	**166**	**166**
Annual Runoff Volume	m^3	**1,921**	**41**	**1,962**

Notes:
1. Total developable site area.
2. Table 3.1 from the Stormwater Management Planning and Design Manual (MECP, March 2003)

Table G.4

Summary of Calculations
Hydrogeological Assessment
126 and 140 Bradford Street, Barrie, Ontario
Crown Communities Development Inc.

Details	*Precipitation* (m^3)	*Evapotranspiration* (m^3)	*Precipitation Surplus* (m^3)	*Infiltration* (m^3)	*Runoff* (m^3)
Pre-Development					
Existing Conditions	**4,330**	**2,158**	**2,172**	**-**	**2,172**
Percentage of Annual Precipitation		50%		0%	50%
Post-Development					
Proposed Conditions - Uncontrolled	**4,330**	**2,202**	**2,128**	**166**	**1,962**
Percentage of Annual Precipitation		51%		4%	45%
Pre- to Post-Development Difference					
Proposed Conditions - Uncontrolled	**0**	**44**	**-44**	**166**	**-210**
Percentage Change		2%	-2%	-	-10%

SWMM Knowledge Base

Guoshun Zhang

The original question can be simplified as: Should the CN we input in SWMM be a composite CN for a subcatchment or the CN for pervious land only?

Based on my re-read of the SWMM5 manual (no luck) and the source code, the answer I have now is the CN should be for the pervious land only. Please correct me if my understanding is wrong. Below is a section of source code from "subcatch.c," and within the function of "getSubareaRunoff()."

```
// --- compute infiltration loss rate for pervious subarea
 //     (inflow consists of runon + precip - evap)
 infil = 0.0;
 if ( i == PERV )
 {
     if ( Subcatch[j].infil  == j )
     {
         infil = infil_getInfil(j, InfilModel, tStep,
                 (subarea->inflow - surfEvap), subarea->depth);
     }
     if ( infil > availMoisture - surfEvap )
     {
         infil = MAX(0.0, availMoisture - surfEvap);
     }
```

So as the code shows, the infiltration calculation is carried out to pervious area only (the CN is used later in the function of "infil_getInfil()"). Thus, the CN should be for the pervious land only instead of a composite CN for the whole subcatchment. Unfortunately this is not highlighted either in the manual or the annotation of the CN input window.

Please correct me if the above observation is wrong.

Robert Dickinson

In SWMM 5 you should input the CN for pervious land area only since the CN is ONLY used in SWMM 5 to calculate the infiltration loss. If the CN is only used for infiltration purposes it should have been obvious that entering a composite CN is not required or even a good idea. I think the problem is that users are so used to the concept of the CN being used to generate the runoff that using the SCS unit hydrograph that a model that only uses the CN for infiltration confuses the modeling issues. If you use the CN method in SWMM 5 the Runoff from the watershed is still generated exactly the same way as if you used Green Ampt or Horton infiltration.

Appendix C

Model Output

Table of Contents

1. Quantity Control
1.1 Pre-Development

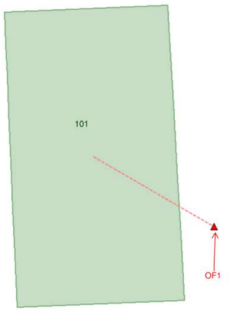

Figure 1 *Pre-Development Model Schematics Labelled*

1.1.1 4-hr Chicago Design Storm
1.1.1.1 2-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 Chicago_4hr_2yr      OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
----------------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0


****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
```

```
  Water Quality ..... NO
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date ..... 10/06/2023 00:00:00
Ending Date ..... 10/07/2023 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.017        36.955
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.008        17.867
Surface Runoff ...........         0.008        18.185
Final Storage ............         0.000         0.985
Continuity Error (%) .....        -0.223


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.008         0.083
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.008         0.083
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv      Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment               mm         mm         mm         mm        mm        mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                     36.96       0.00       0.00      17.87     18.18      0.00      18.18       0.08      0.05   0.492

Analysis begun on:  Tue Oct 31 13:45:22 2023
Analysis ended on:  Tue Oct 31 13:45:23 2023
Total elapsed time: 00:00:01
```

1.1.1.2 5-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                    Data       Recording
Name                 Data Source                    Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                   INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr              INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr               INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr               INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr                INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr               INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr                INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr                 INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                  INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                  INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                   INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                  INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                   INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr                 INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                  INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                  INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                   INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                  INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                   INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                  INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                   INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                   INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                    INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                   INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                    INTENSITY   15 min.
```

```
********************
Subcatchment Summary
********************
Name                           Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
101                            0.46     90.00     50.00    2.0000 Chicago_4hr_5yr      OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.023        50.518
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.011        23.775
Surface Runoff ...........         0.012        25.878
Final Storage ............         0.000         0.955
Continuity Error (%) .....        -0.177


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.012         0.118
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.012         0.118
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
101                        50.52       0.00       0.00      23.77      24.97       0.91      25.88       0.12      0.07   0.512


Analysis begun on:  Tue Oct 31 13:47:04 2023
Analysis ended on:  Tue Oct 31 13:47:04 2023
Total elapsed time: < 1 sec
```

1.1.1.3 10-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                           Data       Recording
```

Name	Data Source	Type	Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	90.00	50.00	2.0000	Chicago_4hr_10yr	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.027	59.693
Evaporation Loss	0.000	0.000
Infiltration Loss	0.012	27.070
Surface Runoff	0.014	31.756
Final Storage	0.000	0.960
Continuity Error (%)	-0.155	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.014	0.145
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.014	0.145
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	59.69	0.00	0.00	27.07	29.56	2.20	31.76	0.14	0.08	0.532

```
Analysis begun on:  Tue Oct 31 13:48:07 2023
Analysis ended on:  Tue Oct 31 13:48:08 2023
Total elapsed time: 00:00:01
```

1.1.1.4 25-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 Chicago_4hr_25yr     OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.032        71.237
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.014        30.897
Surface Runoff ...........         0.018        39.459
Final Storage ............         0.000         0.985
Continuity Error (%) .....        -0.147
```

```
*************************        Volume         Volume
Flow Routing Continuity       hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.018          0.180
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         0.000          0.000
External Outflow .........         0.018          0.180
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.000          0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total      Total     Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff   Runoff   Coeff
Subcatchment                mm         mm         mm         mm         mm         mm         mm   10^6 ltr      CMS
-----------------------------------------------------------------------------------------------------------------------------------
101                      71.24       0.00       0.00      30.90      35.34       4.12      39.46       0.18     0.09   0.554


Analysis begun on:  Tue Oct 31 13:49:12 2023
Analysis ended on:  Tue Oct 31 13:49:12 2023
Total elapsed time: < 1 sec
```

1.1.1.5 50-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                    Data       Recording
Name                 Data Source                    Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                   INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr              INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr               INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr               INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr                INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr               INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr                INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr                 INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                  INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                  INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                   INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                  INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                   INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr                 INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                  INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                  INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                   INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                  INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                   INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                  INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                   INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                   INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                    INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                   INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                    INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                         Area     Width   %Imperv    %Slope Rain Gage           Outlet
-----------------------------------------------------------------------------------------------
101                          0.46     90.00     50.00    2.0000 Chicago_4hr_50yr     OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
----------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
```

```
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.036        79.453
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.015        33.491
Surface Runoff ...........         0.021        45.100
Final Storage ............         0.000         0.974
Continuity Error (%) .....        -0.140


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.021         0.205
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.021         0.205
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                          Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                         Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment                 mm         mm         mm         mm         mm         mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                       79.45       0.00       0.00      33.49      39.45       5.65      45.10       0.21      0.10   0.568

Analysis begun on:  Tue Oct 31 13:50:22 2023
Analysis ended on:  Tue Oct 31 13:50:23 2023
Total elapsed time: 00:00:01
```

1.1.1.6 100-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
```

```
SCS_6hr_25yr         SCS_6hr_25yr                  INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                   INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                  INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                   INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 Chicago_4hr_100yr    OF1


************
Node Summary
************
                                     Invert      Max.    Ponded    External
Name                 Type             Elev.     Depth      Area    Inflow
------------------------------------------------------------------------------
OF1                  OUTFALL          223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.040        87.578
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.016        35.919
Surface Runoff ...........         0.023        50.824
Final Storage ............         0.000         0.957
Continuity Error (%) .....        -0.139


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.023         0.231
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.023         0.231
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                        Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff     Runoff     Runoff   Coeff
Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr        CMS
-----------------------------------------------------------------------------------------------------------------------
101                      87.58       0.00       0.00      35.92      43.51       7.32      50.82       0.23      0.12   0.580


Analysis begun on:  Tue Oct 31 13:51:29 2023
Analysis ended on:  Tue Oct 31 13:51:29 2023
Total elapsed time: < 1 sec
```

1.1.2 6-hr SCS Design Storm

1.1.2.1 2-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
```

Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	90.00	50.00	2.0000	SCS_6hr_2yr	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.019	42.303
Evaporation Loss	0.000	0.000
Infiltration Loss	0.009	20.432
Surface Runoff	0.010	20.986
Final Storage	0.000	0.975
Continuity Error (%)	-0.215	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.010	0.096
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.010	0.096
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	42.30	0.00	0.00	20.43	20.87	0.12	20.99	0.10	0.04	0.496

```
Analysis begun on:  Tue Oct 31 13:52:48 2023
Analysis ended on:  Tue Oct 31 13:52:48 2023
Total elapsed time: < 1 sec
```

1.1.2.2 5-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
```

Name	Data Source	Data Type	Recording Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

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

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	90.00	50.00	2.0000	SCS_6hr_5yr	OF1

```
************
Node Summary
************
```

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	

```
***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.027        59.500
```

```
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.012        26.797
Surface Runoff ...........         0.014        31.837
Final Storage ............         0.000         0.982
Continuity Error (%) .....        -0.193


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.014         0.145
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.014         0.145
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv      Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff    Runoff    Runoff  Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm  10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                     59.50       0.00       0.00      26.80     29.48      2.35     31.84      0.14      0.06  0.535


Analysis begun on:  Tue Oct 31 13:53:54 2023
Analysis ended on:  Tue Oct 31 13:53:54 2023
Total elapsed time: < 1 sec
```

1.1.2.3 10-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                         Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
101                          0.46     90.00     50.00    2.0000 SCS_6hr_10yr         OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
```

```
OF1                OUTFALL            223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date ..... 10/06/2023 00:00:00
Ending Date ..... 10/07/2023 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation .....          0.032        70.803
Evaporation Loss .....             0.000         0.000
Infiltration Loss .....            0.014        30.566
Surface Runoff .....               0.018        39.423
Final Storage .....                0.000         0.946
Continuity Error (%) .....       -0.187


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .....           0.000         0.000
Wet Weather Inflow .....           0.018         0.179
Groundwater Inflow .....           0.000         0.000
RDII Inflow .....                  0.000         0.000
External Inflow .....             0.000         0.000
External Outflow .....            0.018         0.179
Flooding Loss .....                0.000         0.000
Evaporation Loss .....             0.000         0.000
Exfiltration Loss .....            0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume .....          0.000         0.000
Continuity Error (%) .....        0.000


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

-------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv     Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff     Runoff    Runoff  Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm   10^6 ltr       CMS
-------------------------------------------------------------------------------------------------------------------------------
101                     70.80       0.00       0.00      30.57     35.14      4.28     39.42       0.18      0.07   0.557


Analysis begun on:  Tue Oct 31 13:55:45 2023
Analysis ended on:  Tue Oct 31 13:55:46 2023
Total elapsed time: 00:00:01
```

1.1.2.4 25-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ..... 25
Number of subcatchments ... 1
Number of nodes ..... 1
Number of links ..... 0
Number of pollutants ..... 0
Number of land uses ..... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name               Data Source                   Type       Interval
----------------------------------------------------------------------
Chicago_25mm       Chicago_25mm                  INTENSITY   10 min.
Chicago_4hr_100yr  Chicago_4hr_100Yr             INTENSITY   10 min.
Chicago_4hr_10yr   Chicago_4hr_10Yr              INTENSITY   10 min.
Chicago_4hr_25yr   Chicago_4hr_25Yr              INTENSITY   10 min.
Chicago_4hr_2yr    Chicago_4hr_2Yr               INTENSITY   10 min.
Chicago_4hr_50yr   Chicago_4hr_50Yr              INTENSITY   10 min.
Chicago_4hr_5yr    Chicago_4hr_5Yr               INTENSITY   10 min.
SCS_12hr_100yr     SCS_12hr_100yr                INTENSITY   15 min.
SCS_12hr_10yr      SCS_12hr_10yr                 INTENSITY   15 min.
SCS_12hr_25yr      SCS_12hr_25yr                 INTENSITY   15 min.
SCS_12hr_2yr       SCS_12hr_2yr                  INTENSITY   15 min.
SCS_12hr_50yr      SCS_12hr_50yr                 INTENSITY   15 min.
SCS_12hr_5yr       SCS_12hr_5yr                  INTENSITY   15 min.
```

```
SCS_24hr_100yr       SCS_24hr_100yr                INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                 INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                 INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                  INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                 INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                  INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                 INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                  INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                  INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                   INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                  INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                   INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_6hr_25yr         OF1


************
Node Summary
************
                                     Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
------------------------------------------------------------------------------
OF1                  OUTFALL          223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ..............  CMS
Process Models:
  Rainfall/Runoff ........  YES
  RDII ...................  NO
  Snowmelt ...............  NO
  Groundwater ............  NO
  Flow Routing ...........  NO
  Water Quality ..........  NO
Infiltration Method ......  HORTON
Surcharge Method .........  EXTRAN
Starting Date ............  10/06/2023 00:00:00
Ending Date ..............  10/07/2023 00:00:00
Antecedent Dry Days ......  0.0
Report Time Step .........  00:01:00
Wet Time Step ............  00:05:00
Dry Time Step ............  00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.039        85.197
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.016        34.900
Surface Runoff ...........         0.023        49.441
Final Storage ............         0.000         1.008
Continuity Error (%) .....        -0.178


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.023         0.225
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.023         0.225
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv      Perv      Total       Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff    Runoff     Runoff     Runoff    Runoff  Coeff
Subcatchment                mm         mm         mm         mm        mm        mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------
101                      85.20       0.00       0.00      34.90     42.35      7.09      49.44       0.23      0.09   0.580


Analysis begun on:  Tue Oct 31 13:56:47 2023
Analysis ended on:  Tue Oct 31 13:56:47 2023
Total elapsed time: < 1 sec
```

1.1.2.5 50-year

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

Pre-development conditions

*************
Element Count
*************
```

```
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                  INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                 INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                  INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                 Area     Width   %Imperv    %Slope Rain Gage           Outlet
-------------------------------------------------------------------------------------------------
101                  0.46     90.00     50.00    2.0000 SCS_6hr_50yr        OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL        223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.044        95.900
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.017        37.946
Surface Runoff ...........         0.026        57.126
Final Storage ............         0.000         1.001
Continuity Error (%) .....        -0.180


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      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 .........         0.026         0.260
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000
```

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

-----------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv      Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff    Runoff    Runoff   Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm  10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                     95.90       0.00       0.00      37.95     47.70      9.42     57.13      0.26      0.11   0.596


Analysis begun on:  Tue Oct 31 13:57:48 2023
Analysis ended on:  Tue Oct 31 13:57:48 2023
Total elapsed time: < 1 sec
```

1.1.2.6 100-year

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

  Pre-development conditions

  *************
  Element Count
  *************
  Number of rain gages ...... 25
  Number of subcatchments ... 1
  Number of nodes ........... 1
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ***************
  Raingage Summary
  ***************
                                                  Data       Recording
  Name                 Data Source                Type       Interval
  ----------------------------------------------------------------------
  Chicago_25mm         Chicago_25mm               INTENSITY   10 min.
  Chicago_4hr_100yr    Chicago_4hr_100Yr          INTENSITY   10 min.
  Chicago_4hr_10yr     Chicago_4hr_10Yr           INTENSITY   10 min.
  Chicago_4hr_25yr     Chicago_4hr_25Yr           INTENSITY   10 min.
  Chicago_4hr_2yr      Chicago_4hr_2Yr            INTENSITY   10 min.
  Chicago_4hr_50yr     Chicago_4hr_50Yr           INTENSITY   10 min.
  Chicago_4hr_5yr      Chicago_4hr_5Yr            INTENSITY   10 min.
  SCS_12hr_100yr       SCS_12hr_100yr             INTENSITY   15 min.
  SCS_12hr_10yr        SCS_12hr_10yr              INTENSITY   15 min.
  SCS_12hr_25yr        SCS_12hr_25yr              INTENSITY   15 min.
  SCS_12hr_2yr         SCS_12hr_2yr               INTENSITY   15 min.
  SCS_12hr_50yr        SCS_12hr_50yr              INTENSITY   15 min.
  SCS_12hr_5yr         SCS_12hr_5yr               INTENSITY   15 min.
  SCS_24hr_100yr       SCS_24hr_100yr             INTENSITY   15 min.
  SCS_24hr_10yr        SCS_24hr_10yr              INTENSITY   15 min.
  SCS_24hr_25yr        SCS_24hr_25yr              INTENSITY   15 min.
  SCS_24hr_2yr         SCS_24hr_2yr               INTENSITY   15 min.
  SCS_24hr_50yr        SCS_24hr_50yr              INTENSITY   15 min.
  SCS_24hr_5yr         SCS_24hr_5yr               INTENSITY   15 min.
  SCS_6hr_100yr        SCS_6hr_100yr              INTENSITY   15 min.
  SCS_6hr_10yr         SCS_6hr_10yr               INTENSITY   15 min.
  SCS_6hr_25yr         SCS_6hr_25yr               INTENSITY   15 min.
  SCS_6hr_2yr          SCS_6hr_2yr                INTENSITY   15 min.
  SCS_6hr_50yr         SCS_6hr_50yr               INTENSITY   15 min.
  SCS_6hr_5yr          SCS_6hr_5yr                INTENSITY   15 min.


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
  ------------------------------------------------------------------------------------------------
  101                         0.46     90.00     50.00    2.0000 SCS_6hr_100yr        OF1


  ************
  Node Summary
  ************
                                        Invert      Max.    Ponded    External
  Name                 Type              Elev.     Depth      Area    Inflow
  ----------------------------------------------------------------------------
  OF1                  OUTFALL           223.20      0.00       0.0


  ***************
  Analysis Options
  ***************
  Flow Units ............... CMS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... HORTON
  Surcharge Method ......... EXTRAN
  Starting Date ............ 10/06/2023 00:00:00
  Ending Date .............. 10/07/2023 00:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:05:00
```

```
**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.048       106.500
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.019        40.847
Surface Runoff ...........         0.030        64.907
Final Storage ............         0.000         0.934
Continuity Error (%) .....        -0.177

**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.030         0.295
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.030         0.295
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                          Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                         Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff     Runoff     Runoff   Coeff
Subcatchment                 mm         mm         mm         mm         mm         mm         mm   10^6 ltr        CMS
-----------------------------------------------------------------------------------------------------------------------------
101                      106.50       0.00       0.00      40.85      53.00      11.90      64.91       0.30       0.12   0.609


Analysis begun on:  Tue Oct 31 14:02:11 2023
Analysis ended on:  Tue Oct 31 14:02:11 2023
Total elapsed time: < 1 sec
```

1.1.3 12-hr SCS Design Storm

2-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                         Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
101                          0.46     90.00     50.00    2.0000 SCS_12hr_2yr         OF1


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

```
Node Summary
************
                                  Invert      Max.    Ponded    External
Name                Type           Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                 OUTFALL       223.20      0.00       0.0

***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00

*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.021        46.690
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.010        22.025
Surface Runoff ...........         0.011        23.746
Final Storage ............         0.000         1.000
Continuity Error (%) .....        -0.175

*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.011         0.108
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.011         0.108
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000

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

-----------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv      Perv      Total      Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff    Runoff     Runoff     Runoff    Runoff  Coeff
Subcatchment                mm         mm         mm         mm        mm        mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                      46.69       0.00       0.00      22.02     23.05      0.70      23.75       0.11      0.04   0.509

Analysis begun on:  Tue Oct 31 14:03:22 2023
Analysis ended on:  Tue Oct 31 14:03:22 2023
Total elapsed time: < 1 sec
```

5-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0

***************
Raingage Summary
***************
                                                 Data       Recording
Name                Data Source                  Type       Interval
----------------------------------------------------------------------
Chicago_25mm        Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr   Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr    Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr    Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr     Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr    Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr     Chicago_4hr_5Yr              INTENSITY   10 min.
SCS_12hr_100yr      SCS_12hr_100yr               INTENSITY   15 min.
```

```
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                  INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                 INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                  INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_12hr_5yr         OF1


************
Node Summary
************
                                     Invert      Max.    Ponded    External
Name                 Type             Elev.     Depth      Area    Inflow
------------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ..............  CMS
Process Models:
  Rainfall/Runoff ........  YES
  RDII ...................  NO
  Snowmelt ...............  NO
  Groundwater ............  NO
  Flow Routing ...........  NO
  Water Quality ..........  NO
Infiltration Method ......  HORTON
Surcharge Method .........  EXTRAN
Starting Date ............  10/06/2023 00:00:00
Ending Date ..............  10/07/2023 00:00:00
Antecedent Dry Days ......  0.0
Report Time Step .........  00:01:00
Wet Time Step ............  00:05:00
Dry Time Step ............  00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.029        64.310
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.013        28.159
Surface Runoff ...........         0.016        35.256
Final Storage ............         0.000         0.998
Continuity Error (%) .....        -0.162


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.016         0.161
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.016         0.161
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv      Perv     Total      Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff     Runoff    Runoff  Coeff
Subcatchment                mm         mm         mm         mm        mm        mm        mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                      64.31       0.00       0.00      28.16     31.88      3.38     35.26       0.16      0.05   0.548


Analysis begun on:  Tue Oct 31 14:04:43 2023
Analysis ended on:  Tue Oct 31 14:04:43 2023
Total elapsed time: < 1 sec
```

10-year

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

Pre-development conditions

```
*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_12hr_10yr        OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.035        76.000
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.015        31.885
Surface Runoff ...........         0.020        43.254
Final Storage ............         0.000         0.982
Continuity Error (%) .....        -0.158


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.020         0.197
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.020         0.197
Flooding Loss ............         0.000         0.000
```

```
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total       Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment                mm         mm         mm         mm         mm         mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                      76.00       0.00       0.00      31.88      37.73       5.53      43.25       0.20      0.07   0.569


Analysis begun on:  Tue Oct 31 14:05:45 2023
Analysis ended on:  Tue Oct 31 14:05:46 2023
Total elapsed time: 00:00:01
```

25-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_12hr_25yr        OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
```

```
Ending Date ..... 10/07/2023 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.041        90.690
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.016        36.189
Surface Runoff ...........         0.024        53.649
Final Storage ............         0.000         0.991
Continuity Error (%) .....        -0.153


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.024         0.244
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.024         0.244
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment               mm         mm         mm         mm         mm         mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
101                     90.69       0.00       0.00      36.19      45.08       8.57      53.65       0.24      0.08   0.592


Analysis begun on:  Tue Oct 31 14:06:45 2023
Analysis ended on:  Tue Oct 31 14:06:45 2023
Total elapsed time: < 1 sec
```

50-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                  INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                 INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                  INTENSITY   15 min.


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

```
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_12hr_50yr        OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.046       101.690
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.018        39.192
Surface Runoff ...........         0.028        61.659
Final Storage ............         0.000         0.991
Continuity Error (%) .....        -0.150


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.028         0.281
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.028         0.281
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-------------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total       Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff      Runoff    Runoff   Coeff
Subcatchment                mm         mm         mm         mm        mm         mm         mm    10^6 ltr       CMS
-------------------------------------------------------------------------------------------------------------------------------
101                     101.69       0.00       0.00      39.19     50.58      11.08      61.66        0.28      0.10   0.606


Analysis begun on:  Tue Oct 31 14:07:51 2023
Analysis ended on:  Tue Oct 31 14:07:51 2023
Total elapsed time: < 1 sec
```

100-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
```

```
Chicago_4hr_25yr     Chicago_4hr_25Yr              INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr               INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr              INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr               INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr                INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                 INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                 INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                  INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                 INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                  INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr                INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                 INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                 INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                  INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                 INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                  INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                 INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                  INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                  INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                   INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                  INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                   INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_12hr_100yr       OF1


************
Node Summary
************
                                     Invert      Max.    Ponded    External
Name                 Type             Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------------
OF1                  OUTFALL          223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ..... HORTON
Surcharge Method ........ EXTRAN
Starting Date ........... 10/06/2023 00:00:00
Ending Date ............. 10/07/2023 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ........ 00:01:00
Wet Time Step ........... 00:05:00
Dry Time Step ........... 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.051       112.505
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.019        41.998
Surface Runoff ...........         0.032        69.704
Final Storage ............         0.000         0.967
Continuity Error (%) .....        -0.146


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.032         0.317
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.032         0.317
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv      Perv     Total     Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff    Runoff    Runoff  Coeff
Subcatchment                mm         mm         mm         mm        mm        mm        mm  10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                     112.50       0.00       0.00      42.00     56.00     13.71     69.70      0.32      0.11   0.620


Analysis begun on:  Tue Oct 31 14:09:40 2023
Analysis ended on:  Tue Oct 31 14:09:40 2023
Total elapsed time: < 1 sec
```

1.1.4 24-hr Design Storm

2-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_24hr_2yr         OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
----------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.025        54.840
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.010        22.709
Surface Runoff ...........         0.013        28.998
Final Storage ............         0.001         3.239
Continuity Error (%) .....        -0.194


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
```

```
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.013         0.132
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.013         0.132
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-------------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total       Total      Peak  Runoff
                        Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment                mm         mm         mm         mm         mm         mm         mm   10^6 ltr       CMS
-------------------------------------------------------------------------------------------------------------------------------
101                      54.84       0.00       0.00      22.71      27.08       1.92      29.00       0.13      0.04   0.529

Analysis begun on:  Tue Oct 31 14:11:20 2023
Analysis ended on:  Tue Oct 31 14:11:21 2023
Total elapsed time: 00:00:01
```

5-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                         Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
101                          0.46     90.00     50.00    2.0000 SCS_24hr_5yr         OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
```

```
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.034        75.780
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.013        29.449
Surface Runoff ...........         0.020        43.108
Final Storage ............         0.002         3.366
Continuity Error (%) .....        -0.188


**************************        Volume         Volume
Flow Routing Continuity        hectare-m       10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.020         0.196
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.020         0.196
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                          Total      Total      Total      Total     Imperv       Perv      Total       Total      Peak  Runoff
                         Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff    Runoff  Coeff
Subcatchment                 mm         mm         mm         mm        mm         mm         mm    10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                       75.78       0.00       0.00      29.45     37.56       5.55      43.11        0.20      0.05   0.569


Analysis begun on:  Tue Oct 31 14:12:31 2023
Analysis ended on:  Tue Oct 31 14:12:31 2023
Total elapsed time: < 1 sec
```

10-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
```

```
SCS_6hr_2yr          SCS_6hr_2yr                   INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                  INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                   INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_24hr_10yr        OF1


************
Node Summary
************
                                     Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
------------------------------------------------------------------------
OF1                  OUTFALL          223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.041        89.667
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.015        33.479
Surface Runoff ...........         0.024        52.907
Final Storage ............         0.002         3.448
Continuity Error (%) .....        -0.185


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.024         0.241
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.024         0.241
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                          Total      Total      Total      Total     Imperv       Perv      Total       Total      Peak  Runoff
                         Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment                 mm         mm         mm         mm        mm         mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
101                       89.67       0.00       0.00      33.48     44.51       8.40      52.91       0.24      0.07   0.590


Analysis begun on:  Tue Oct 31 14:13:33 2023
Analysis ended on:  Tue Oct 31 14:13:34 2023
Total elapsed time: 00:00:01
```

25-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0
```

```
***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                  INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                 INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                  INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------------
101                         0.46     90.00     50.00    2.0000 SCS_24hr_25yr        OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0


***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Surcharge Method ......... EXTRAN
Starting Date ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.049       107.150
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.017        38.123
Surface Runoff ...........         0.030        65.671
Final Storage ............         0.002         3.548
Continuity Error (%) .....        -0.179


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.030         0.299
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.030         0.299
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total       Total     Peak  Runoff
                        Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff   Runoff   Coeff
```

Subcatchment	mm	mm	mm	mm	mm	mm	mm	10^6 ltr	CMS	
101	107.15	0.00	0.00	38.12	53.25	12.42	65.67	0.30	0.09	0.613

Analysis begun on: Tue Oct 31 14:16:21 2023
Analysis ended on: Tue Oct 31 14:16:22 2023
Total elapsed time: 00:00:01

50-year

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

Pre-development conditions

Element Count
Number of rain gages 25
Number of subcatchments ... 1
Number of nodes 1
Number of links 0
Number of pollutants 0
Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	90.00	50.00	2.0000	SCS_24hr_50yr	OF1

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	

Analysis Options
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.055	120.265
Evaporation Loss	0.000	0.000
Infiltration Loss	0.019	41.331
Surface Runoff	0.034	75.523

```
Final Storage ............         0.002         3.621
Continuity Error (%) .....        -0.175


**************************        Volume        Volume
Flow Routing Continuity       hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.034         0.344
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.034         0.344
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


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

-----------------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                        Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff     Runoff     Runoff   Coeff
Subcatchment                mm         mm         mm         mm         mm         mm         mm   10^6 ltr        CMS
-----------------------------------------------------------------------------------------------------------------------------
101                     120.26       0.00       0.00      41.33      59.81      15.71      75.52       0.34       0.10   0.628


Analysis begun on:  Tue Oct 31 14:17:46 2023
Analysis ended on:  Tue Oct 31 14:17:47 2023
Total elapsed time: 00:00:01
```

100-year

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 25
Number of subcatchments ... 1
Number of nodes ........... 1
Number of links ........... 0
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                  INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                 INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                  INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                         Area     Width   %Imperv    %Slope Rain Gage           Outlet
-------------------------------------------------------------------------------------------------
101                          0.46     90.00     50.00    2.0000 SCS_24hr_100yr      OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
```

```
***************
Analysis Options
***************
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date ..... 10/06/2023 00:00:00
Ending Date ..... 10/07/2023 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.061	133.197
Evaporation Loss	0.000	0.000
Infiltration Loss	0.020	44.286
Surface Runoff	0.039	85.451
Final Storage	0.002	3.689
Continuity Error (%)	-0.171	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.039	0.389
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.039	0.389
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
101	133.20	0.00	0.00	44.29	66.28	19.17	85.45	0.39	0.11	0.642

```
Analysis begun on:  Tue Oct 31 14:19:42 2023
Analysis ended on:  Tue Oct 31 14:19:43 2023
Total elapsed time: 00:00:01
```

1.2 Post Development

Note Post-development runoff summary shows uncontrolled post-development results.

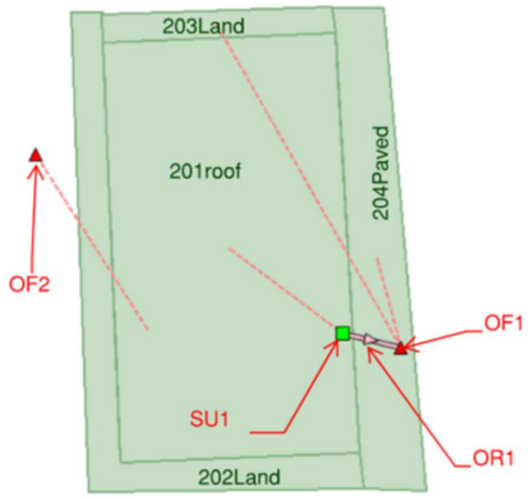

Figure 2 *Post-Development Wate Quantity Model Schematics Labelled*

1.2.1 4-hr Chicago Design Storm

1.2.1.1 2-year

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

  Controlled post-development conditions

  *************
  Element Count
  *************
  Number of rain gages ...... 26
  Number of subcatchments ... 4
  Number of nodes ........... 3
  Number of links ........... 1
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                  Data       Recording
  Name                 Data Source                Type       Interval
  ----------------------------------------------------------------------
  Chicago_25mm         Chicago_25mm               INTENSITY   10 min.
  Chicago_4hr_100yr    Chicago_4hr_100Yr          INTENSITY   10 min.
  Chicago_4hr_10yr     Chicago_4hr_10Yr           INTENSITY   10 min.
  Chicago_4hr_25yr     Chicago_4hr_25Yr           INTENSITY   10 min.
  Chicago_4hr_2yr      Chicago_4hr_2Yr            INTENSITY   10 min.
  Chicago_4hr_50yr     Chicago_4hr_50Yr           INTENSITY   10 min.
  Chicago_4hr_5yr      Chicago_4hr_5Yr            INTENSITY   10 min.
  Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)     INTENSITY   60 min.
  SCS_12hr_100yr       SCS_12hr_100yr             INTENSITY   15 min.
  SCS_12hr_10yr        SCS_12hr_10yr              INTENSITY   15 min.
  SCS_12hr_25yr        SCS_12hr_25yr              INTENSITY   15 min.
  SCS_12hr_2yr         SCS_12hr_2yr               INTENSITY   15 min.
  SCS_12hr_50yr        SCS_12hr_50yr              INTENSITY   15 min.
  SCS_12hr_5yr         SCS_12hr_5yr               INTENSITY   15 min.
  SCS_24hr_100yr       SCS_24hr_100yr             INTENSITY   15 min.
  SCS_24hr_10yr        SCS_24hr_10yr              INTENSITY   15 min.
  SCS_24hr_25yr        SCS_24hr_25yr              INTENSITY   15 min.
  SCS_24hr_2yr         SCS_24hr_2yr               INTENSITY   15 min.
  SCS_24hr_50yr        SCS_24hr_50yr              INTENSITY   15 min.
  SCS_24hr_5yr         SCS_24hr_5yr               INTENSITY   15 min.
  SCS_6hr_100yr        SCS_6hr_100yr              INTENSITY   15 min.
  SCS_6hr_10yr         SCS_6hr_10yr               INTENSITY   15 min.
  SCS_6hr_25yr         SCS_6hr_25yr               INTENSITY   15 min.
  SCS_6hr_2yr          SCS_6hr_2yr                INTENSITY   15 min.
  SCS_6hr_50yr         SCS_6hr_50yr               INTENSITY   15 min.
  SCS_6hr_5yr          SCS_6hr_5yr                INTENSITY   15 min.


  **********************
  Subcatchment Summary
  **********************
  Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
  ------------------------------------------------------------------------------------------------
  201roof                     0.34     90.00    100.00    2.0000 Chicago_4hr_2yr      SU1
  202Land                     0.04     90.00      0.00    2.0000 Chicago_4hr_2yr      OF2
  203land                     0.01      5.00      5.00    2.0000 Chicago_4hr_2yr      OF1
  204Paved                    0.06     91.00    100.00    2.0000 Chicago_4hr_2yr      OF1


  ************
  Node Summary
  ************
                                       Invert      Max.    Ponded    External
  Name                 Type               Elev.     Depth      Area    Inflow
  ----------------------------------------------------------------------------
```

```
OF1                 OUTFALL            223.20      0.00       0.0
OF2                 OUTFALL            223.20      0.00       0.0
SU1                 STORAGE            223.39      1.50       0.0


************
Link Summary
************
Name              From Node        To Node          Type            Length    %Slope Roughness
------------------------------------------------------------------------------------------------
OR1               SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.017        36.955
Evaporation Loss .........         0.001         1.255
Infiltration Loss ........         0.002         3.661
Surface Runoff ...........         0.015        32.069
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.081


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.015         0.146
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.015         0.146
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
```

```
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %

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

-----------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv     Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff     Runoff    Runoff  Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
201roof                 36.95       0.00       1.48       0.00     35.51      0.00     35.51       0.12      0.08   0.961
202Land                 36.95       0.00       0.51      32.42      0.00      4.03      4.03       0.00      0.00   0.109
203land                 36.96       0.00       1.74      33.42      1.79      0.00      1.79       0.00      0.00   0.048
204Paved                36.95       0.00       0.43       0.00     36.58      0.00     36.58       0.02      0.01   0.990

******************
Node Depth Summary
******************

-----------------------------------------------------------------------
                            Average  Maximum  Maximum  Time of Max    Reported
                              Depth    Depth      HGL   Occurrence   Max Depth
Node               Type      Meters   Meters   Meters  days hr:min      Meters
-----------------------------------------------------------------------
OF1                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
OF2                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
SU1                STORAGE     0.02     0.41   223.80     0  01:34        0.41

******************
Node Inflow Summary
******************

-----------------------------------------------------------------------------------------------------
                            Maximum  Maximum                  Lateral       Total        Flow
                            Lateral    Total  Time of Max      Inflow      Inflow     Balance
                             Inflow   Inflow   Occurrence      Volume      Volume       Error
Node               Type         CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-----------------------------------------------------------------------------------------------------
OF1                OUTFALL    0.015    0.042     0  01:30      0.0236       0.144       0.000
OF2                OUTFALL    0.000    0.000     0  01:30     0.00157     0.00157       0.000
SU1                STORAGE    0.078    0.078     0  01:30       0.121       0.121       0.000

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

No nodes were surcharged.

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

No nodes were flooded.

**********************
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
-----------------------------------------------------------------------------------------------
SU1                     0.002    1.4    0.0    0.0       0.046   27.6       0  01:34      0.028

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

-----------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
Outfall Node            Pcnt       CMS       CMS   10^6 ltr
-----------------------------------------------------
OF1                    34.31     0.005     0.042       0.144
OF2                    12.57     0.000     0.000       0.002
-----------------------------------------------------
System                 23.44     0.005     0.042       0.146

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

-----------------------------------------------------------------------
                            Maximum  Time of Max   Maximum    Max/    Max/
                              |Flow|   Occurrence   |Veloc|    Full    Full
Link               Type         CMS  days hr:min     m/sec    Flow   Depth
-----------------------------------------------------------------------
OR1                ORIFICE    0.028     0  01:34                      1.00

**************************
Flow Classification Summary
**************************
```

```
-------------------------------------------------------------------------------
                  Adjusted    ---------- Fraction of Time in Flow Class ----------
                   /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit             Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:24:52 2023
Analysis ended on:  Tue Oct 31 14:24:53 2023
Total elapsed time: 00:00:01
```

1.2.1.2 5-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 Chicago_4hr_5yr      SU1
202Land                     0.04     90.00      0.00    2.0000 Chicago_4hr_5yr      OF2
203land                     0.01      5.00      5.00    2.0000 Chicago_4hr_5yr      OF1
204Paved                    0.06     91.00    100.00    2.0000 Chicago_4hr_5yr      OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
OF1                  OUTFALL          223.20      0.00       0.0
OF2                  OUTFALL          223.20      0.00       0.0
SU1                  STORAGE          223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


********************
Cross Section Summary
********************
                                  Full     Full     Hyd.     Max.   No. of     Full
```

Conduit	Shape	Depth	Area	Rad.	Width	Barrels	Flow

****
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 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 5.00 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	0.023	50.518
Evaporation Loss	0.001	1.263
Infiltration Loss	0.002	4.816
Surface Runoff	0.020	44.481
Final Storage	0.000	0.000
Continuity Error (%)	-0.081	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.020	0.202
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.020	0.202
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
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	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.00
% of Steps Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %
1.991 - 1.256 sec	:	0.00 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	50.52	0.00	1.48	0.00	49.08	0.00	49.08	0.17	0.10	0.971
202Land	50.52	0.00	0.54	42.41	0.00	7.56	7.56	0.00	0.00	0.150

203land	50.52	0.00	1.80	44.75	2.47	1.50	3.97	0.00	0.00	0.079
204Paved	50.52	0.00	0.43	0.00	50.16	0.00	50.16	0.03	0.02	0.993

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.03	0.57	223.96	0 01:35	0.57

****
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
OF1	OUTFALL	0.020	0.052	0 01:30	0.0326	0.199	0.000
OF2	OUTFALL	0.001	0.001	0 01:30	0.00295	0.00295	0.000
SU1	STORAGE	0.103	0.103	0 01:30	0.167	0.167	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.003	2.0	0.0	0.0	0.062	37.8	0 01:35	0.034

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	34.88	0.007	0.052	0.199
OF2	13.71	0.000	0.001	0.003
System	24.30	0.007	0.053	0.202

****
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
OR1	ORIFICE	0.034	0 01:35			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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Oct 31 14:26:34 2023
Analysis ended on: Tue Oct 31 14:26:35 2023

```
Total elapsed time: 00:00:01
```

1.2.1.3 10-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 Chicago_4hr_10yr     SU1
202Land                     0.04     90.00      0.00    2.0000 Chicago_4hr_10yr     OF2
203land                     0.01      5.00      5.00    2.0000 Chicago_4hr_10yr     OF1
204Paved                    0.06     91.00    100.00    2.0000 Chicago_4hr_10yr     OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
OF2                  OUTFALL         223.20      0.00       0.0
SU1                  STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 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	0.027	59.693
Evaporation Loss	0.001	1.265
Infiltration Loss	0.003	5.520
Surface Runoff	0.024	52.957
Final Storage	0.000	0.000
Continuity Error (%)	-0.082	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.024	0.241
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.024	0.241
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

```
**************************
Time-Step Critical Elements
**************************
None
```

```
*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	59.69	0.00	1.48	0.00	58.26	0.00	58.26	0.20	0.12	0.976
202Land	59.69	0.00	0.56	48.70	0.00	10.44	10.44	0.00	0.00	0.175
203land	59.69	0.00	1.79	51.03	2.93	3.94	6.87	0.00	0.00	0.115
204Paved	59.69	0.00	0.43	0.00	59.34	0.00	59.34	0.04	0.02	0.994

```
******************
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.04	0.68	224.07	0 01:37	0.68

```
*******************
Node Inflow Summary
*******************

------------------------------------------------------------------------------------------------
                                 Maximum  Maximum                  Lateral       Total        Flow
                                 Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                  Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                 Type           CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
------------------------------------------------------------------------------------------------
OF1                  OUTFALL      0.023    0.058     0  01:30      0.0388       0.237       0.000
OF2                  OUTFALL      0.002    0.002     0  01:30     0.00407     0.00407       0.000
SU1                  STORAGE      0.119    0.119     0  01:30       0.198       0.198       0.000


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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-------------------------------------------------------------------------------------------------
SU1                     0.004    2.4    0.0    0.0       0.074   45.1       0  01:37      0.038


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

-----------------------------------------------------------
                       Flow       Avg       Max       Total
                       Freq      Flow      Flow      Volume
Outfall Node           Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                   35.14     0.008     0.058       0.237
OF2                   14.35     0.000     0.002       0.004
-----------------------------------------------------------
System                24.74     0.008     0.060       0.241


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

-----------------------------------------------------------------------------
                             Maximum  Time of Max   Maximum    Max/    Max/
                              |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type        CMS  days hr:min     m/sec    Flow   Depth
-----------------------------------------------------------------------------
OR1                  ORIFICE   0.038     0  01:37                     1.00


**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:28:10 2023
Analysis ended on:  Tue Oct 31 14:28:10 2023
Total elapsed time: < 1 sec
```

1.2.1.4 25-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
```

```
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 Chicago_4hr_25yr     SU1
202Land                     0.04     90.00      0.00    2.0000 Chicago_4hr_25yr     OF2
203land                     0.01      5.00      5.00    2.0000 Chicago_4hr_25yr     OF1
204Paved                    0.06     91.00    100.00    2.0000 Chicago_4hr_25yr     OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL       223.20      0.00       0.0
OF2                  OUTFALL       223.20      0.00       0.0
SU1                  STORAGE       223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
```

```
*************************     ---------       -------
Total Precipitation ......         0.032        71.237
Evaporation Loss .........         0.001         1.267
Infiltration Loss ........         0.003         6.349
Surface Runoff ...........         0.029        63.679
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.082

*************************        Volume        Volume
Flow Routing Continuity       hectare-m      10^6 ltr
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.029         0.290
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.029         0.290
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
Time-Step Critical Elements
***************************
None


*********************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff     Runoff     Runoff     Runoff    Runoff  Coeff
Subcatchment               mm         mm         mm         mm        mm         mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------
201roof                 71.24       0.00       1.49       0.00     69.81       0.00      69.81       0.24      0.14   0.980
202Land                 71.24       0.00       0.58      56.12      0.00      14.55      14.55       0.01      0.00   0.204
203land                 71.24       0.00       1.80      58.34      3.51       7.59      11.10       0.00      0.00   0.156
204Paved                71.24       0.00       0.43       0.00     70.90       0.00      70.90       0.05      0.03   0.995


******************
Node Depth Summary
******************

-------------------------------------------------------------------------------
                            Average  Maximum  Maximum  Time of Max    Reported
                              Depth    Depth      HGL   Occurrence   Max Depth
Node               Type       Meters   Meters   Meters  days hr:min      Meters
-------------------------------------------------------------------------------
OF1                OUTFALL      0.00     0.00   223.20     0  00:00        0.00
OF2                OUTFALL      0.00     0.00   223.20     0  00:00        0.00
SU1                STORAGE      0.04     0.82   224.21     0  01:40        0.82


*******************
Node Inflow Summary
*******************

-------------------------------------------------------------------------------------------------
                            Maximum  Maximum                  Lateral       Total        Flow
                            Lateral    Total  Time of Max      Inflow      Inflow     Balance
                             Inflow   Inflow   Occurrence      Volume      Volume       Error
Node               Type         CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                OUTFALL    0.027    0.066     0  01:30      0.0467       0.284       0.000
OF2                OUTFALL    0.002    0.002     0  01:30     0.00567     0.00567       0.000
SU1                STORAGE    0.140    0.140     0  01:30       0.237       0.237       0.000


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

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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-------------------------------------------------------------------------------------------------
SU1                      0.005    3.0    0.0    0.0       0.090   54.8       0  01:40      0.042


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

-----------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
Outfall Node            Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                    35.39     0.009     0.066       0.284
OF2                    14.91     0.000     0.002       0.006
-----------------------------------------------------------
System                 25.15     0.010     0.068       0.290


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

-------------------------------------------------------------------------------
                              Maximum  Time of Max   Maximum    Max/    Max/
                              |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type         CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE    0.042     0  01:40                     1.00


***************************
Flow Classification Summary
***************************

-----------------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit              Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-----------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:31:30 2023
Analysis ended on:  Tue Oct 31 14:31:31 2023
Total elapsed time: 00:00:01
```

1.2.1.5 50-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
-----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
```

```
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)         INTENSITY   60 min.
SCS_12hr_100yr         SCS_12hr_100yr                 INTENSITY   15 min.
SCS_12hr_10yr          SCS_12hr_10yr                  INTENSITY   15 min.
SCS_12hr_25yr          SCS_12hr_25yr                  INTENSITY   15 min.
SCS_12hr_2yr           SCS_12hr_2yr                   INTENSITY   15 min.
SCS_12hr_50yr          SCS_12hr_50yr                  INTENSITY   15 min.
SCS_12hr_5yr           SCS_12hr_5yr                   INTENSITY   15 min.
SCS_24hr_100yr         SCS_24hr_100yr                 INTENSITY   15 min.
SCS_24hr_10yr          SCS_24hr_10yr                  INTENSITY   15 min.
SCS_24hr_25yr          SCS_24hr_25yr                  INTENSITY   15 min.
SCS_24hr_2yr           SCS_24hr_2yr                   INTENSITY   15 min.
SCS_24hr_50yr          SCS_24hr_50yr                  INTENSITY   15 min.
SCS_24hr_5yr           SCS_24hr_5yr                   INTENSITY   15 min.
SCS_6hr_100yr          SCS_6hr_100yr                  INTENSITY   15 min.
SCS_6hr_10yr           SCS_6hr_10yr                   INTENSITY   15 min.
SCS_6hr_25yr           SCS_6hr_25yr                   INTENSITY   15 min.
SCS_6hr_2yr            SCS_6hr_2yr                    INTENSITY   15 min.
SCS_6hr_50yr           SCS_6hr_50yr                   INTENSITY   15 min.
SCS_6hr_5yr            SCS_6hr_5yr                    INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 Chicago_4hr_50yr     SU1
202Land                     0.04     90.00      0.00    2.0000 Chicago_4hr_50yr     OF2
203land                     0.01      5.00      5.00    2.0000 Chicago_4hr_50yr     OF1
204Paved                    0.06     91.00    100.00    2.0000 Chicago_4hr_50yr     OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                Type               Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------------
OF1                 OUTFALL            223.20      0.00       0.0
OF2                 OUTFALL            223.20      0.00       0.0
SU1                 STORAGE            223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.036        79.453
Evaporation Loss .........         0.001         1.268
Infiltration Loss ........         0.003         6.906
Surface Runoff ...........         0.032        71.346
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.083


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.032         0.325
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
```

```
External Outflow .........         0.032         0.325
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000
```

****
Time-Step Critical Elements
****
None

****
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	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.00
% of Steps Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %
1.991 - 1.256 sec	:	0.00 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	79.45	0.00	1.49	0.00	78.04	0.00	78.04	0.27	0.16	0.982
202Land	79.45	0.00	0.58	61.09	0.00	17.78	17.78	0.01	0.00	0.224
203land	79.45	0.00	1.76	63.29	3.92	10.50	14.41	0.00	0.00	0.181
204Paved	79.45	0.00	0.43	0.00	79.12	0.00	79.12	0.05	0.03	0.996

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.05	0.93	224.32	0 01:40	0.93

****
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
OF1	OUTFALL	0.029	0.071	0 01:30	0.0524	0.318	0.000
OF2	OUTFALL	0.003	0.003	0 01:30	0.00693	0.00693	0.000
SU1	STORAGE	0.155	0.155	0 01:30	0.265	0.265	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.006	3.4	0.0	0.0	0.102	61.8	0 01:40	0.045

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	35.55	0.010	0.071	0.318
OF2	15.27	0.001	0.003	0.007
System	25.41	0.011	0.074	0.325

****
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
OR1	ORIFICE	0.045	0 01:40			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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Oct 31 14:33:16 2023
Analysis ended on: Tue Oct 31 14:33:17 2023
Total elapsed time: 00:00:01

1.2.1.6 100-year

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

Controlled post-development conditions

****
Element Count
****
Number of rain gages 26
Number of subcatchments ... 4
Number of nodes 3
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
Hurricane_Hazel_(0-25)	Hurricane_Hazel_(0-25)	INTENSITY	60 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.

```
SCS_6hr_50yr         SCS_6hr_50yr                  INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                   INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 Chicago_4hr_100yr    SU1
202Land                     0.04     90.00      0.00    2.0000 Chicago_4hr_100yr    OF2
203land                     0.01      5.00      5.00    2.0000 Chicago_4hr_100yr    OF1
204Paved                    0.06     91.00    100.00    2.0000 Chicago_4hr_100yr    OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0
OF2                  OUTFALL           223.20      0.00       0.0
SU1                  STORAGE           223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.040        87.578
Evaporation Loss .........         0.001         1.269
Infiltration Loss ........         0.003         7.428
Surface Runoff ...........         0.036        78.954
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.083


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.036         0.359
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.036         0.359
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv     Total     Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff    Runoff    Runoff  Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm  10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------------
201roof                 87.58       0.00       1.49       0.00     86.17      0.00     86.17      0.29      0.17   0.984
202Land                 87.58       0.00       0.59      65.79      0.00     21.21     21.21      0.01      0.00   0.242
203land                 87.58       0.00       1.78      67.84      4.32     13.64     17.96      0.00      0.00   0.205
204Paved                87.58       0.00       0.43       0.00     87.25      0.00     87.25      0.06      0.03   0.996


******************
Node Depth Summary
******************

-----------------------------------------------------------------------------
                          Average  Maximum  Maximum  Time of Max    Reported
                            Depth    Depth      HGL   Occurrence   Max Depth
Node               Type    Meters   Meters   Meters  days hr:min      Meters
-----------------------------------------------------------------------------
OF1                OUTFALL   0.00     0.00   223.20     0  00:00        0.00
OF2                OUTFALL   0.00     0.00   223.20     0  00:00        0.00
SU1                STORAGE   0.06     1.04   224.43     0  01:40        1.04


*******************
Node Inflow Summary
*******************

-------------------------------------------------------------------------------------------------
                          Maximum  Maximum                  Lateral       Total        Flow
                          Lateral    Total  Time of Max      Inflow      Inflow     Balance
                           Inflow   Inflow   Occurrence      Volume      Volume       Error
Node               Type       CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                OUTFALL  0.032    0.077     0  01:30       0.058       0.351       0.000
OF2                OUTFALL  0.004    0.004     0  01:30     0.00827     0.00827       0.000
SU1                STORAGE  0.170    0.170     0  01:30       0.293       0.293       0.000


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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-----------------------------------------------------------------------------------------------
SU1                  0.006    3.9    0.0    0.0       0.115   69.6       0  01:40      0.048


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

-------------------------------------------------------
                    Flow       Avg       Max       Total
                    Freq      Flow      Flow      Volume
Outfall Node        Pcnt       CMS       CMS    10^6 ltr
-------------------------------------------------------
```

```
OF1                    35.64     0.011     0.077       0.351
OF2                    15.61     0.001     0.004       0.008
-----------------------------------------------------------
System                 25.62     0.012     0.081       0.359


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

-------------------------------------------------------------------------
                            Maximum  Time of Max   Maximum    Max/    Max/
                             |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type       CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------
OR1                  ORIFICE     0.048     0  01:40                    1.00


***************************
Flow Classification Summary
***************************

-------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit              Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:34:24 2023
Analysis ended on:  Tue Oct 31 14:34:24 2023
Total elapsed time: < 1 sec
```

1.2.2 6-hr SCS Design Storm

1.2.2.1 2-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_6hr_2yr          SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_6hr_2yr          OF2
203land                     0.01      5.00      5.00    2.0000 SCS_6hr_2yr          OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_6hr_2yr          OF1


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

Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	
OF2	OUTFALL	223.20	0.00	0.0	
SU1	STORAGE	223.39	1.50	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	OF1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
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 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 5.00 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	0.019	42.303
Evaporation Loss	0.001	1.449
Infiltration Loss	0.002	4.133
Surface Runoff	0.017	36.743
Final Storage	0.000	0.000
Continuity Error (%)	-0.056	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.017	0.167
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.017	0.167
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
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 : 4.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec

```
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	42.30	0.00	1.68	0.00	40.65	0.00	40.65	0.14	0.06	0.961
202Land	42.30	0.00	0.64	36.47	0.00	5.19	5.19	0.00	0.00	0.123
203land	42.30	0.00	2.01	38.20	2.05	0.04	2.09	0.00	0.00	0.049
204Paved	42.30	0.00	0.63	0.00	41.72	0.00	41.72	0.03	0.01	0.986

```
******************
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.02	0.46	223.85	0 03:16	0.46

```
*******************
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
OF1	OUTFALL	0.012	0.042	0 03:15	0.027	0.165	0.000
OF2	OUTFALL	0.001	0.001	0 03:15	0.00203	0.00203	0.000
SU1	STORAGE	0.062	0.062	0 03:15	0.138	0.138	0.000

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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
SU1	0.003	1.7	0.0	0.0	0.051	30.9	0 03:16	0.030

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

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	42.06	0.005	0.042	0.165
OF2	14.65	0.000	0.001	0.002
System	28.35	0.005	0.042	0.167

```
*******************
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
OR1	ORIFICE	0.030	0 03:16			1.00

```
**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                    Adjusted    ---------- Fraction of Time in Flow Class ----------
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:35:40 2023
Analysis ended on:  Tue Oct 31 14:35:41 2023
Total elapsed time: 00:00:01
```

1.2.2.2 5-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_6hr_5yr          SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_6hr_5yr          OF2
203land                     0.01      5.00      5.00    2.0000 SCS_6hr_5yr          OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_6hr_5yr          OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
OF2                  OUTFALL         223.20      0.00       0.0
SU1                  STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name              From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------
OR1               SU1              OF1              ORIFICE
```

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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.027        59.500
Evaporation Loss .........         0.001         1.458
Infiltration Loss ........         0.003         5.495
Surface Runoff ...........         0.024        52.584
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.061


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.024         0.239
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.024         0.239
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


********************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------
                         Total      Total      Total      Total     Imperv       Perv      Total       Total     Peak  Runoff
```

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Runoff CMS	Coeff
201roof	59.50	0.00	1.68	0.00	57.86	0.00	57.86	0.20	0.09	0.972
202Land	59.50	0.00	0.70	48.57	0.00	10.23	10.23	0.00	0.00	0.172
203land	59.50	0.00	2.03	50.48	2.91	4.08	6.98	0.00	0.00	0.117
204Paved	59.50	0.00	0.63	0.00	58.94	0.00	58.94	0.04	0.02	0.991

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.04	0.68	224.07	0 03:16	0.68

****
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
OF1	OUTFALL	0.017	0.054	0 03:15	0.0386	0.235	0.000
OF2	OUTFALL	0.002	0.002	0 03:15	0.00399	0.00399	0.000
SU1	STORAGE	0.088	0.088	0 03:15	0.197	0.197	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.004	2.4	0.0	0.0	0.075	45.4	0 03:16	0.038

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	42.67	0.006	0.054	0.235
OF2	16.03	0.000	0.002	0.004
System	29.35	0.007	0.056	0.239

****
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
OR1	ORIFICE	0.038	0 03:16			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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Oct 31 14:36:45 2023
Analysis ended on: Tue Oct 31 14:36:45 2023
Total elapsed time: < 1 sec

1.2.2.3 10-year

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

Controlled post-development conditions

****
Element Count
****
Number of rain gages 26
Number of subcatchments ... 4
Number of nodes 3
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
Hurricane_Hazel_(0-25)	Hurricane_Hazel_(0-25)	INTENSITY	60 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201roof	0.34	90.00	100.00	2.0000	SCS_6hr_10yr	SU1
202Land	0.04	90.00	0.00	2.0000	SCS_6hr_10yr	OF2
203land	0.01	5.00	5.00	2.0000	SCS_6hr_10yr	OF1
204Paved	0.06	91.00	100.00	2.0000	SCS_6hr_10yr	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	
OF2	OUTFALL	223.20	0.00	0.0	
SU1	STORAGE	223.39	1.50	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	OF1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 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	0.032	70.802
Evaporation Loss	0.001	1.461
Infiltration Loss	0.003	6.306
Surface Runoff	0.029	63.081
Final Storage	0.000	0.000
Continuity Error (%)	-0.064	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.029	0.287
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.029	0.287
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

```
**************************
Time-Step Critical Elements
**************************
None
```

```
*********************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	70.80	0.00	1.68	0.00	69.17	0.00	69.17	0.24	0.10	0.977
202Land	70.80	0.00	0.73	55.85	0.00	14.23	14.23	0.01	0.00	0.201
203land	70.80	0.00	2.03	57.60	3.47	7.71	11.18	0.00	0.00	0.158
204Paved	70.80	0.00	0.63	0.00	70.25	0.00	70.25	0.04	0.02	0.992

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

```
OF1                 OUTFALL      0.00     0.00   223.20     0  00:00        0.00
OF2                 OUTFALL      0.00     0.00   223.20     0  00:00        0.00
SU1                 STORAGE      0.04     0.83   224.22     0  03:16        0.83


******************
Node Inflow Summary
******************

-------------------------------------------------------------------------------------------------
                                  Maximum  Maximum                  Lateral       Total        Flow
                                  Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                   Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                Type              CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                 OUTFALL         0.020    0.061     0  03:15      0.0463       0.281       0.000
OF2                 OUTFALL         0.003    0.003     0  03:15     0.00555     0.00555       0.000
SU1                 STORAGE         0.104    0.104     0  03:15       0.235       0.235       0.000


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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-------------------------------------------------------------------------------------------------
SU1                     0.005    2.9    0.0    0.0       0.092   55.5       0  03:16      0.042


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

-----------------------------------------------------------
                       Flow       Avg       Max       Total
                       Freq      Flow      Flow      Volume
Outfall Node           Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                   42.95     0.008     0.061       0.281
OF2                   17.42     0.000     0.003       0.006
-----------------------------------------------------------
System                30.19     0.008     0.064       0.287


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

-------------------------------------------------------------------------
                             Maximum  Time of Max   Maximum    Max/    Max/
                             |Flow|   Occurrence   |Veloc|    Full    Full
Link                Type        CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------
OR1                 ORIFICE   0.042     0  03:16                    1.00


**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:39:01 2023
Analysis ended on:  Tue Oct 31 14:39:03 2023
Total elapsed time: 00:00:02
```

1.2.2.4 25-year

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

Controlled post-development conditions

*************
Element Count
*************
```

```
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_6hr_25yr         SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_6hr_25yr         OF2
203land                     0.01      5.00      5.00    2.0000 SCS_6hr_25yr         OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_6hr_25yr         OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
OF2                  OUTFALL         223.20      0.00       0.0
SU1                  STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 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	0.039	85.198
Evaporation Loss	0.001	1.464
Infiltration Loss	0.003	7.263
Surface Runoff	0.035	76.528
Final Storage	0.000	0.000
Continuity Error (%)	-0.067	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.035	0.348
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.035	0.348
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Time-Step Critical Elements

None

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	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.00
% of Steps Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %
1.991 - 1.256 sec	:	0.00 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	85.20	0.00	1.68	0.00	83.57	0.00	83.57	0.28	0.13	0.981
202Land	85.20	0.00	0.75	64.43	0.00	20.02	20.02	0.01	0.00	0.235
203land	85.20	0.00	2.02	65.97	4.19	13.02	17.22	0.00	0.00	0.202
204Paved	85.20	0.00	0.63	0.00	84.66	0.00	84.66	0.05	0.02	0.994

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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.06	1.03	224.42	0 03:16	1.03

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
OF1	OUTFALL	0.024	0.071	0 03:15	0.0563	0.34	0.000
OF2	OUTFALL	0.004	0.004	0 03:15	0.00781	0.00781	0.000

```
SU1                   STORAGE      0.125    0.125     0  03:15       0.284       0.284       0.000

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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-------------------------------------------------------------------------------------------------
SU1                      0.006    3.7    0.0    0.0       0.113   68.6       0  03:16       0.047


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

-----------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
Outfall Node            Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                    43.23     0.009     0.071       0.340
OF2                    18.84     0.000     0.004       0.008
-----------------------------------------------------------
System                 31.03     0.010     0.075       0.348


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

-------------------------------------------------------------------------------
                              Maximum  Time of Max   Maximum    Max/    Max/
                               |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type         CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE     0.047     0  03:16                     1.00


***************************
Flow Classification Summary
***************************

-----------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit              Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-----------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:40:12 2023
Analysis ended on:  Tue Oct 31 14:40:12 2023
Total elapsed time: < 1 sec
```

1.2.2.5 50-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
```

Name	Data Source	Data Type	Recording Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
Hurricane_Hazel_(0-25)	Hurricane_Hazel_(0-25)	INTENSITY	60 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201roof	0.34	90.00	100.00	2.0000	SCS_6hr_50yr	SU1
202Land	0.04	90.00	0.00	2.0000	SCS_6hr_50yr	OF2
203land	0.01	5.00	5.00	2.0000	SCS_6hr_50yr	OF1
204Paved	0.06	91.00	100.00	2.0000	SCS_6hr_50yr	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	
OF2	OUTFALL	223.20	0.00	0.0	
SU1	STORAGE	223.39	1.50	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	OF1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
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 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 5.00 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	0.044	95.900
Evaporation Loss	0.001	1.466
Infiltration Loss	0.004	7.924
Surface Runoff	0.039	86.577
Final Storage	0.000	0.000
Continuity Error (%)	-0.069	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.039	0.394
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.039	0.394
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
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 : 4.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 2.00
% of Steps Not Converging : 0.00
Time Step Frequencies :
5.000 - 3.155 sec : 100.00 %
3.155 - 1.991 sec : 0.00 %
1.991 - 1.256 sec : 0.00 %
1.256 - 0.792 sec : 0.00 %
0.792 - 0.500 sec : 0.00 %

****
Subcatchment Runoff Summary

****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	95.90	0.00	1.68	0.00	94.28	0.00	94.28	0.32	0.14	0.983
202Land	95.90	0.00	0.76	70.37	0.00	24.78	24.78	0.01	0.01	0.258
203land	95.90	0.00	2.03	71.73	4.73	17.42	22.14	0.00	0.00	0.231
204Paved	95.90	0.00	0.63	0.00	95.38	0.00	95.38	0.06	0.03	0.995

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.06	1.18	224.57	0 03:16	1.18

****
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 Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.027	0.077	0 03:15	0.0637	0.384	0.000
OF2	OUTFALL	0.005	0.005	0 03:15	0.00966	0.00966	0.000
SU1	STORAGE	0.141	0.141	0 03:15	0.321	0.321	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.007	4.3	0.0	0.0	0.130	78.6	0 03:16	0.051

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	43.41	0.010	0.077	0.384
OF2	19.74	0.001	0.005	0.010
System	31.57	0.011	0.083	0.394

****
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
OR1	ORIFICE	0.051	0	03:16		1.00	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Oct 31 14:42:45 2023
Analysis ended on: Tue Oct 31 14:42:45 2023
Total elapsed time: < 1 sec

1.2.2.6 100-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_6hr_100yr        SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_6hr_100yr        OF2
203land                     0.01      5.00      5.00    2.0000 SCS_6hr_100yr        OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_6hr_100yr        OF1
```

```
************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                Type             Elev.     Depth      Area    Inflow
----------------------------------------------------------------------------
OF1                 OUTFALL         223.20      0.00       0.0
OF2                 OUTFALL         223.20      0.00       0.0
SU1                 STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.048       106.500
Evaporation Loss .........         0.001         1.467
Infiltration Loss ........         0.004         8.541
Surface Runoff ...........         0.044        96.568
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.071


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.044         0.439
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.044         0.439
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
Time-Step Critical Elements
***************************
None


*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	106.50	0.00	1.69	0.00	104.89	0.00	104.89	0.36	0.16	0.985
202Land	106.50	0.00	0.77	75.92	0.00	29.82	29.82	0.01	0.01	0.280
203land	106.50	0.00	2.02	77.13	5.26	22.10	27.36	0.00	0.00	0.257
204Paved	106.50	0.00	0.63	0.00	105.99	0.00	105.99	0.07	0.03	0.995

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.07	1.33	224.72	0 03:16	1.33

****
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
OF1	OUTFALL	0.031	0.084	0 03:15	0.0711	0.428	0.000
OF2	OUTFALL	0.006	0.006	0 03:15	0.0116	0.0116	0.000
SU1	STORAGE	0.157	0.157	0 03:15	0.357	0.357	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.008	4.9	0.0	0.0	0.146	88.6	0 03:16	0.054

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	43.54	0.011	0.084	0.428
OF2	20.44	0.001	0.006	0.012
System	31.99	0.012	0.090	0.439

****
Link Flow Summary
****

	Maximum |Flow|	Time of Max Occurrence	Maximum |Veloc|	Max/ Full	Max/ Full

```
Link                 Type          CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE     0.054     0  03:16                     1.00


**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                    Adjusted    ---------- Fraction of Time in Flow Class ----------
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:44:31 2023
Analysis ended on:  Tue Oct 31 14:44:32 2023
Total elapsed time: 00:00:01
```

1.2.3 12-hr SCS Design Storm

1.2.3.1 2-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_12hr_2yr         SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_12hr_2yr         OF2
203land                     0.01      5.00      5.00    2.0000 SCS_12hr_2yr         OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_12hr_2yr         OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL        223.20      0.00       0.0
OF2                  OUTFALL        223.20      0.00       0.0
SU1                  STORAGE        223.39      1.50       0.0


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

```
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.021        46.690
Evaporation Loss .........         0.001         2.012
Infiltration Loss ........         0.002         4.487
Surface Runoff ...........         0.018        40.196
Final Storage ............         0.000         0.016
Continuity Error (%) .....        -0.045


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.018         0.183
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.018         0.183
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	46.69	0.00	2.27	0.00	44.44	0.00	44.44	0.15	0.06	0.952
202Land	46.69	0.00	1.03	39.68	0.00	5.97	5.97	0.00	0.00	0.128
203land	46.69	0.00	2.08	41.17	2.24	0.61	2.84	0.00	0.00	0.061
204Paved	46.69	0.00	1.22	0.00	45.51	0.00	45.51	0.03	0.01	0.975

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.03	0.43	223.82	0 06:16	0.43

****
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
OF1	OUTFALL	0.011	0.039	0 06:15	0.0295	0.181	0.000
OF2	OUTFALL	0.001	0.001	0 06:15	0.00233	0.00233	0.000
SU1	STORAGE	0.058	0.058	0 06:15	0.151	0.151	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.003	2.0	0.0	0.0	0.047	28.4	0 06:16	0.029

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	65.55	0.003	0.039	0.181
OF2	19.70	0.000	0.001	0.002
System	42.63	0.003	0.040	0.183

****
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
OR1	ORIFICE	0.029	0 06:16			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

```
************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:49:53 2023
Analysis ended on:  Tue Oct 31 14:49:53 2023
Total elapsed time: < 1 sec
```

1.2.3.2 5-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_12hr_5yr         SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_12hr_5yr         OF2
203land                     0.01      5.00      5.00    2.0000 SCS_12hr_5yr         OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_12hr_5yr         OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
OF2                  OUTFALL         223.20      0.00       0.0
SU1                  STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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

```
***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 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	0.029	64.310
Evaporation Loss	0.001	2.027
Infiltration Loss	0.003	5.829
Surface Runoff	0.026	56.471
Final Storage	0.000	0.014
Continuity Error (%)	-0.050	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.026	0.257
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.026	0.257
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

```
**************************
Time-Step Critical Elements
**************************
None
```

```
*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	64.31	0.00	2.27	0.00	62.07	0.00	62.07	0.21	0.08	0.965
202Land	64.31	0.00	1.15	51.73	0.00	11.44	11.44	0.00	0.00	0.178
203land	64.31	0.00	2.16	52.92	3.12	5.57	8.69	0.00	0.00	0.135
204Paved	64.31	0.00	1.23	0.00	63.14	0.00	63.14	0.04	0.02	0.982

```
******************
Node Depth Summary
******************

-------------------------------------------------------------------------------
                                 Average  Maximum  Maximum  Time of Max    Reported
                                   Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type         Meters   Meters   Meters  days hr:min      Meters
-------------------------------------------------------------------------------
OF1                  OUTFALL        0.00     0.00   223.20     0  00:00        0.00
OF2                  OUTFALL        0.00     0.00   223.20     0  00:00        0.00
SU1                  STORAGE        0.04     0.61   224.00     0  06:16        0.61


*******************
Node Inflow Summary
*******************

-------------------------------------------------------------------------------------------------
                                 Maximum  Maximum                  Lateral       Total        Flow
                                 Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                  Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                 Type           CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                  OUTFALL      0.015    0.050     0  06:15      0.0415       0.252       0.000
OF2                  OUTFALL      0.002    0.002     0  06:15     0.00446     0.00446       0.000
SU1                  STORAGE      0.080    0.080     0  06:15       0.211       0.211       0.000


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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-------------------------------------------------------------------------------------------------
SU1                      0.004    2.7    0.0    0.0       0.067   40.8       0  06:16      0.036


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

-----------------------------------------------------------
                        Flow       Avg       Max     Total
                        Freq      Flow      Flow    Volume
Outfall Node            Pcnt       CMS       CMS  10^6 ltr
-----------------------------------------------------------
OF1                    66.37     0.004     0.050     0.252
OF2                    29.06     0.000     0.002     0.004
-----------------------------------------------------------
System                 47.71     0.005     0.052     0.257


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

-------------------------------------------------------------------------------
                                 Maximum  Time of Max   Maximum    Max/    Max/
                                |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type           CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE      0.036     0  06:16                      1.00


**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup    Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:47:15 2023
Analysis ended on:  Tue Oct 31 14:47:15 2023
Total elapsed time: < 1 sec
```

1.2.3.3 10-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                 Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof              0.34     90.00    100.00    2.0000 SCS_12hr_10yr        SU1
202Land              0.04     90.00      0.00    2.0000 SCS_12hr_10yr        OF2
203land              0.01      5.00      5.00    2.0000 SCS_12hr_10yr        OF1
204Paved             0.06     91.00    100.00    2.0000 SCS_12hr_10yr        OF1


************
Node Summary
************
                                   Invert      Max.    Ponded    External
Name                 Type           Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL       223.20      0.00       0.0
OF2                  OUTFALL       223.20      0.00       0.0
SU1                  STORAGE       223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 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	0.035	76.000
Evaporation Loss	0.001	2.034
Infiltration Loss	0.003	6.642
Surface Runoff	0.031	67.350
Final Storage	0.000	0.014
Continuity Error (%)	-0.052	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.031	0.306
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.031	0.306
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

```
**************************
Time-Step Critical Elements
**************************
None
```

```
*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	76.00	0.00	2.28	0.00	73.76	0.00	73.76	0.25	0.09	0.971
202Land	76.00	0.00	1.20	59.03	0.00	15.78	15.78	0.01	0.00	0.208
203land	76.00	0.00	2.20	60.00	3.70	9.59	13.29	0.00	0.00	0.175
204Paved	76.00	0.00	1.23	0.00	74.84	0.00	74.84	0.05	0.02	0.985

```
******************
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.05	0.74	224.13	0 06:16	0.74

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

```
Node Inflow Summary
*******************

------------------------------------------------------------------------------------------------
                                 Maximum  Maximum                  Lateral       Total        Flow
                                 Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                  Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                 Type           CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
------------------------------------------------------------------------------------------------
OF1                  OUTFALL      0.018    0.057     0  06:15      0.0495         0.3       0.000
OF2                  OUTFALL      0.003    0.003     0  06:15     0.00615     0.00615       0.000
SU1                  STORAGE      0.095    0.095     0  06:15       0.251       0.251       0.000


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

No nodes were surcharged.


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

No nodes were flooded.


*********************
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
-------------------------------------------------------------------------------------------------
SU1                      0.005    3.2    0.0    0.0       0.081   49.3       0  06:16      0.040


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

------------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
Outfall Node            Pcnt       CMS       CMS    10^6 ltr
------------------------------------------------------------
OF1                    66.73     0.005     0.057       0.300
OF2                    30.74     0.000     0.003       0.006
------------------------------------------------------------
System                 48.74     0.005     0.060       0.306


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

-------------------------------------------------------------------------------
                              Maximum  Time of Max   Maximum    Max/    Max/
                              |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type        CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE   0.040     0  06:16                      1.00


**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:51:43 2023
Analysis ended on:  Tue Oct 31 14:51:44 2023
Total elapsed time: 00:00:01
```

1.2.3.4 25-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0
```

```
***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)       INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                  INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                 INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                  INTENSITY   15 min.


*******************
Subcatchment Summary
*******************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_12hr_25yr        SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_12hr_25yr        OF2
203land                     0.01      5.00      5.00    2.0000 SCS_12hr_25yr        OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_12hr_25yr        OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL        223.20      0.00       0.0
OF2                  OUTFALL        223.20      0.00       0.0
SU1                  STORAGE        223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.041        90.690
```

```
Evaporation Loss .........         0.001         2.041
Infiltration Loss ........         0.003         7.587
Surface Runoff ...........         0.037        81.099
Final Storage ............         0.000         0.013
Continuity Error (%) .....        -0.055
```

```
**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.037         0.369
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.037         0.369
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000
```

```
***************************
Time-Step Critical Elements
***************************
None
```

```
*********************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	90.69	0.00	2.28	0.00	88.46	0.00	88.46	0.30	0.11	0.975
202Land	90.69	0.00	1.25	67.53	0.00	21.92	21.92	0.01	0.00	0.242
203land	90.69	0.00	2.23	68.23	4.44	15.31	19.74	0.00	0.00	0.218
204Paved	90.69	0.00	1.23	0.00	89.55	0.00	89.55	0.06	0.02	0.987

```
******************
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.06	0.91	224.30	0 06:16	0.91

```
******************
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
OF1	OUTFALL	0.022	0.065	0 06:15	0.0597	0.36	0.000
OF2	OUTFALL	0.004	0.004	0 06:15	0.00855	0.00855	0.000
SU1	STORAGE	0.113	0.113	0 06:15	0.301	0.301	0.000

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

```
No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-------------------------------------------------------------------------------------------------
SU1                      0.006    3.9    0.0    0.0       0.100   60.4       0  06:16      0.044


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

-----------------------------------------------------------
                       Flow       Avg       Max       Total
                       Freq      Flow      Flow      Volume
Outfall Node           Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                   67.09     0.006     0.065       0.360
OF2                   32.59     0.000     0.004       0.009
-----------------------------------------------------------
System                49.84     0.007     0.069       0.369


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

-------------------------------------------------------------------------------
                              Maximum  Time of Max   Maximum    Max/    Max/
                              |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type        CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE   0.044     0  06:16                     1.00


***************************
Flow Classification Summary
***************************

-------------------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:52:50 2023
Analysis ended on:  Tue Oct 31 14:52:51 2023
Total elapsed time: 00:00:01
```

1.2.3.5 50-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)       INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
```

SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201roof	0.34	90.00	100.00	2.0000	SCS_12hr_50yr	SU1
202Land	0.04	90.00	0.00	2.0000	SCS_12hr_50yr	OF2
203land	0.01	5.00	5.00	2.0000	SCS_12hr_50yr	OF1
204Paved	0.06	91.00	100.00	2.0000	SCS_12hr_50yr	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	223.20	0.00	0.0	
OF2	OUTFALL	223.20	0.00	0.0	
SU1	STORAGE	223.39	1.50	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	OF1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
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 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 5.00 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	0.046	101.690
Evaporation Loss	0.001	2.044
Infiltration Loss	0.004	8.245
Surface Runoff	0.042	91.445
Final Storage	0.000	0.013
Continuity Error (%)	-0.056	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.042	0.416
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.042	0.416
Flooding Loss	0.000	0.000

```
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv     Total     Total      Peak    Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff    Runoff    Runoff     Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm  10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
201roof                101.69       0.00       2.28       0.00     99.47      0.00     99.47      0.34      0.13     0.978
202Land                101.69       0.00       1.27      73.44      0.00     26.98     26.98      0.01      0.00     0.265
203land                101.69       0.00       2.25      73.94      4.99     20.03     25.02      0.00      0.00     0.246
204Paved               101.69       0.00       1.23       0.00    100.56      0.00    100.56      0.06      0.02     0.989


******************
Node Depth Summary
******************

-----------------------------------------------------------------------
                            Average  Maximum  Maximum  Time of Max    Reported
                              Depth    Depth      HGL   Occurrence   Max Depth
Node               Type      Meters   Meters   Meters  days hr:min      Meters
-----------------------------------------------------------------------
OF1                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
OF2                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
SU1                STORAGE     0.07     1.03   224.42     0  06:16        1.03


*******************
Node Inflow Summary
*******************

-------------------------------------------------------------------------------------------------
                            Maximum  Maximum                  Lateral       Total        Flow
                            Lateral    Total  Time of Max      Inflow      Inflow     Balance
                             Inflow   Inflow   Occurrence      Volume      Volume       Error
Node               Type         CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                OUTFALL    0.025    0.071     0  06:15      0.0674       0.406       0.000
OF2                OUTFALL    0.005    0.005     0  06:15      0.0105      0.0105       0.000
SU1                STORAGE    0.127    0.127     0  06:15       0.338       0.338       0.000


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

No nodes were surcharged.


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

No nodes were flooded.


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

-----------------------------------------------------------------------------------------
                     Average    Avg   Evap  Exfil     Maximum    Max    Time of Max    Maximum
```

Storage Unit	Volume 1000 m³	Pcnt Full	Pcnt Loss	Pcnt Loss	Volume 1000 m³	Pcnt Full	Occurrence days hr:min	Outflow CMS
SU1	0.007	4.5	0.0	0.0	0.114	68.9	0 06:16	0.048

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	67.31	0.007	0.071	0.406
OF2	33.94	0.000	0.005	0.011
System	50.62	0.007	0.076	0.416

****
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
OR1	ORIFICE	0.048	0 06:16			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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Oct 31 14:54:03 2023
Analysis ended on: Tue Oct 31 14:54:04 2023
Total elapsed time: 00:00:01

1.2.3.6 100-year

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

Controlled post-development conditions

****
Element Count
****
Number of rain gages 26
Number of subcatchments ... 4
Number of nodes 3
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_25mm	Chicago_25mm	INTENSITY	10 min.
Chicago_4hr_100yr	Chicago_4hr_100Yr	INTENSITY	10 min.
Chicago_4hr_10yr	Chicago_4hr_10Yr	INTENSITY	10 min.
Chicago_4hr_25yr	Chicago_4hr_25Yr	INTENSITY	10 min.
Chicago_4hr_2yr	Chicago_4hr_2Yr	INTENSITY	10 min.
Chicago_4hr_50yr	Chicago_4hr_50Yr	INTENSITY	10 min.
Chicago_4hr_5yr	Chicago_4hr_5Yr	INTENSITY	10 min.
Hurricane_Hazel_(0-25)	Hurricane_Hazel_(0-25)	INTENSITY	60 min.
SCS_12hr_100yr	SCS_12hr_100yr	INTENSITY	15 min.
SCS_12hr_10yr	SCS_12hr_10yr	INTENSITY	15 min.
SCS_12hr_25yr	SCS_12hr_25yr	INTENSITY	15 min.
SCS_12hr_2yr	SCS_12hr_2yr	INTENSITY	15 min.
SCS_12hr_50yr	SCS_12hr_50yr	INTENSITY	15 min.
SCS_12hr_5yr	SCS_12hr_5yr	INTENSITY	15 min.
SCS_24hr_100yr	SCS_24hr_100yr	INTENSITY	15 min.
SCS_24hr_10yr	SCS_24hr_10yr	INTENSITY	15 min.
SCS_24hr_25yr	SCS_24hr_25yr	INTENSITY	15 min.
SCS_24hr_2yr	SCS_24hr_2yr	INTENSITY	15 min.
SCS_24hr_50yr	SCS_24hr_50yr	INTENSITY	15 min.
SCS_24hr_5yr	SCS_24hr_5yr	INTENSITY	15 min.
SCS_6hr_100yr	SCS_6hr_100yr	INTENSITY	15 min.
SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.

```
********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_12hr_100yr       SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_12hr_100yr       OF2
203land                     0.01      5.00      5.00    2.0000 SCS_12hr_100yr       OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_12hr_100yr       OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------------
OF1                  OUTFALL          223.20      0.00       0.0
OF2                  OUTFALL          223.20      0.00       0.0
SU1                  STORAGE          223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.051       112.505
Evaporation Loss .........         0.001         2.048
Infiltration Loss ........         0.004         8.855
Surface Runoff ...........         0.046       101.656
Final Storage ............         0.000         0.012
Continuity Error (%) .....        -0.058


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.046         0.463
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.046         0.462
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


******************************
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	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.00
% of Steps Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %
1.991 - 1.256 sec	:	0.00 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	112.51	0.00	2.28	0.00	110.29	0.00	110.29	0.37	0.14	0.980
202Land	112.51	0.00	1.30	78.92	0.00	32.29	32.29	0.01	0.01	0.287
203land	112.50	0.00	2.27	79.25	5.53	25.00	30.53	0.00	0.00	0.271
204Paved	112.51	0.00	1.23	0.00	111.38	0.00	111.38	0.07	0.03	0.990

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.08	1.16	224.55	0 06:16	1.16

****
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
OF1	OUTFALL	0.027	0.077	0 06:15	0.0749	0.45	0.000
OF2	OUTFALL	0.006	0.006	0 06:15	0.0126	0.0126	0.000
SU1	STORAGE	0.140	0.140	0 06:15	0.375	0.375	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.008	5.0	0.0	0.0	0.128	77.4	0 06:16	0.051

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	67.50	0.008	0.077	0.450
OF2	34.95	0.000	0.006	0.013

```
-------------------------------------------------------------
System               51.23     0.008     0.083       0.462


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

-------------------------------------------------------------------------------
                                Maximum  Time of Max   Maximum    Max/    Max/
                                |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type          CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE     0.051     0  06:16                     1.00


**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit              Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:57:29 2023
Analysis ended on:  Tue Oct 31 14:57:30 2023
Total elapsed time: 00:00:01
```

1.2.4 24-hr Design Storm

1.2.4.1 2-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                 Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------
201roof              0.34     90.00    100.00    2.0000 SCS_24hr_2yr         SU1
202Land              0.04     90.00      0.00    2.0000 SCS_24hr_2yr         OF2
203land              0.01      5.00      5.00    2.0000 SCS_24hr_2yr         OF1
204Paved             0.06     91.00    100.00    2.0000 SCS_24hr_2yr         OF1


************
Node Summary
```

```
************
                                        Invert      Max.    Ponded    External
Name                 Type                Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0
OF2                  OUTFALL           223.20      0.00       0.0
SU1                  STORAGE           223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE

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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.025        54.840
Evaporation Loss .........         0.001         2.300
Infiltration Loss ........         0.002         5.031
Surface Runoff ...........         0.021        46.521
Final Storage ............         0.000         1.013
Continuity Error (%) .....        -0.047


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.021         0.212
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.021         0.210
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.002
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
```

```
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	54.84	0.00	2.37	0.00	51.34	0.00	51.34	0.17	0.06	0.936
202Land	54.84	0.00	1.71	45.42	0.00	7.57	7.57	0.00	0.00	0.138
203land	54.84	0.00	1.75	43.15	2.59	2.20	4.79	0.00	0.00	0.087
204Paved	54.84	0.00	2.37	0.00	52.46	0.00	52.46	0.03	0.01	0.957

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.04	0.42	223.81	0 12:16	0.42

****
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
OF1	OUTFALL	0.011	0.039	0 12:15	0.0341	0.207	0.000
OF2	OUTFALL	0.001	0.001	0 12:15	0.00295	0.00295	0.000
SU1	STORAGE	0.057	0.057	0 12:15	0.175	0.175	-0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.004	2.5	0.0	0.0	0.046	28.1	0 12:16	0.029

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	98.69	0.002	0.039	0.207
OF2	20.84	0.000	0.001	0.003
System	59.77	0.003	0.040	0.210

****
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
OR1	ORIFICE	0.029	0 12:16			1.00

```
**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                  Adjusted    ---------- Fraction of Time in Flow Class ----------
                   /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit             Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 14:58:38 2023
Analysis ended on:  Tue Oct 31 14:58:39 2023
Total elapsed time: 00:00:01
```

1.2.4.2 5-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_24hr_5yr         SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_24hr_5yr         OF2
203land                     0.01      5.00      5.00    2.0000 SCS_24hr_5yr         OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_24hr_5yr         OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
OF2                  OUTFALL         223.20      0.00       0.0
SU1                  STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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

Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
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 10/06/2023 00:00:00
Ending Date 10/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:01:00
Dry Time Step 00:05:00
Routing Time Step ..... 5.00 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	0.034	75.780
Evaporation Loss	0.001	2.318
Infiltration Loss	0.003	6.524
Surface Runoff	0.030	65.919
Final Storage	0.000	1.057
Continuity Error (%)	-0.051	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.030	0.300
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.030	0.297
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.002
Continuity Error (%)	0.000	

****
Time-Step Critical Elements
****
None

****
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 : 4.50 sec
Average Time Step : 5.00 sec
Maximum Time Step : 5.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 2.00
% of Steps Not Converging : 0.00
Time Step Frequencies :
5.000 - 3.155 sec : 100.00 %
3.155 - 1.991 sec : 0.00 %
1.991 - 1.256 sec : 0.00 %
1.256 - 0.792 sec : 0.00 %
0.792 - 0.500 sec : 0.00 %

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff

201roof	75.78	0.00	2.37	0.00	72.26	0.00	72.26	0.25	0.08	0.954
202Land	75.78	0.00	1.88	58.90	0.00	14.78	14.78	0.01	0.00	0.195
203land	75.78	0.00	1.90	55.95	3.63	8.90	12.53	0.00	0.00	0.165
204Paved	75.78	0.00	2.37	0.00	73.41	0.00	73.41	0.05	0.01	0.969

****
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
OF2	OUTFALL	0.00	0.00	223.20	0 00:00	0.00
SU1	STORAGE	0.05	0.61	224.00	0 12:16	0.61

****
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
OF1	OUTFALL	0.015	0.050	0 12:15	0.0485	0.292	0.000
OF2	OUTFALL	0.002	0.002	0 12:15	0.00576	0.00576	0.000
SU1	STORAGE	0.079	0.079	0 12:15	0.246	0.246	-0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
SU1	0.006	3.3	0.0	0.0	0.067	40.4	0 12:16	0.035

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	98.78	0.003	0.050	0.292
OF2	44.76	0.000	0.002	0.006
System	71.77	0.004	0.052	0.297

****
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
OR1	ORIFICE	0.035	0 12:16			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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

```
Analysis begun on:  Tue Oct 31 14:59:55 2023
Analysis ended on:  Tue Oct 31 14:59:56 2023
Total elapsed time: 00:00:01
```

1.2.4.3 10-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr           INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr            INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr            INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr             INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr            INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr             INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)      INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr              INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr               INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr               INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr               INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr              INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr               INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr               INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr               INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr               INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                 INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                 INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_24hr_10yr        SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_24hr_10yr        OF2
203land                     0.01      5.00      5.00    2.0000 SCS_24hr_10yr        OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_24hr_10yr        OF1


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------------
OF1                  OUTFALL           223.20      0.00       0.0
OF2                  OUTFALL           223.20      0.00       0.0
SU1                  STORAGE           223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 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	0.041	89.668
Evaporation Loss	0.001	2.328
Infiltration Loss	0.003	7.417
Surface Runoff	0.036	78.887
Final Storage	0.000	1.084
Continuity Error (%)	-0.054	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.036	0.359
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.036	0.356
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.003
Continuity Error (%)	0.000	

```
**************************
Time-Step Critical Elements
**************************
None
```

```
*******************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201roof	89.67	0.00	2.37	0.00	86.14	0.00	86.14	0.29	0.09	0.961
202Land	89.67	0.00	1.96	66.96	0.00	20.46	20.46	0.01	0.00	0.228
203land	89.67	0.00	1.98	63.61	4.33	14.21	18.53	0.00	0.00	0.207
204Paved	89.67	0.00	2.37	0.00	87.30	0.00	87.30	0.06	0.02	0.974

```
******************
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
OF1	OUTFALL	0.00	0.00	223.20	0 00:00	0.00

```
OF2                 OUTFALL      0.00     0.00   223.20     0  00:00        0.00
SU1                 STORAGE      0.06     0.73   224.12     0  12:16        0.73


*******************
Node Inflow Summary
*******************

-------------------------------------------------------------------------------------------------
                                 Maximum  Maximum                  Lateral       Total        Flow
                                 Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                  Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                Type            CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                 OUTFALL       0.018    0.057     0  12:15      0.0581       0.348       0.000
OF2                 OUTFALL       0.003    0.003     0  12:15     0.00798     0.00798       0.000
SU1                 STORAGE       0.094    0.094     0  12:15       0.293       0.293      -0.000


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

No nodes were surcharged.


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

No nodes were flooded.


*********************
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
-------------------------------------------------------------------------------------------------
SU1                    0.007    4.0    0.0    0.0       0.081   49.0       0  12:16       0.039


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

-----------------------------------------------------------
                       Flow       Avg       Max       Total
                       Freq      Flow      Flow      Volume
Outfall Node           Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                   98.82     0.004     0.057       0.348
OF2                   56.18     0.000     0.003       0.008
-----------------------------------------------------------
System                77.50     0.004     0.060       0.356


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

-------------------------------------------------------------------------------
                            Maximum  Time of Max   Maximum    Max/    Max/
                            |Flow|   Occurrence   |Veloc|    Full    Full
Link                Type       CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                 ORIFICE  0.039     0  12:16                      1.00


****************************
Flow Classification Summary
****************************

-------------------------------------------------------------------------------------
                  Adjusted    ---------- Fraction of Time in Flow Class ----------
                   /Actual          Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit             Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 15:01:07 2023
Analysis ended on:  Tue Oct 31 15:01:08 2023
Total elapsed time: 00:00:01
```

1.2.4.4 25-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
```

```
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)       INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                 INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                 INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                  INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                 INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                  INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                 Area     Width   %Imperv    %Slope Rain Gage            Outlet
-------------------------------------------------------------------------------------------------
201roof              0.34     90.00    100.00    2.0000 SCS_24hr_25yr        SU1
202Land              0.04     90.00      0.00    2.0000 SCS_24hr_25yr        OF2
203land              0.01      5.00      5.00    2.0000 SCS_24hr_25yr        OF1
204Paved             0.06     91.00    100.00    2.0000 SCS_24hr_25yr        OF1


************
Node Summary
************
                                    Invert      Max.    Ponded    External
Name                 Type            Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------
OF1                  OUTFALL        223.20      0.00       0.0
OF2                  OUTFALL        223.20      0.00       0.0
SU1                  STORAGE        223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

```
**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.049       107.150
Evaporation Loss .........         0.001         2.337
Infiltration Loss ........         0.004         8.446
Surface Runoff ...........         0.043        95.313
Final Storage ............         0.001         1.115
Continuity Error (%) .....        -0.056

**************************        Volume        Volume
Flow Routing Continuity        hectare-m      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 .........         0.043         0.430
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.003
Continuity Error (%) .....         0.000


***************************
Time-Step Critical Elements
***************************
None


*********************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------------------
                          Total      Total      Total      Total     Imperv       Perv      Total      Total      Peak  Runoff
                         Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff     Runoff    Runoff  Coeff
Subcatchment                 mm         mm         mm         mm         mm         mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
201roof                  107.15       0.00       2.37       0.00     103.60       0.00     103.60       0.35      0.11   0.967
202Land                  107.15       0.00       2.04      76.25       0.00      28.51      28.51       0.01      0.00   0.266
203land                  107.15       0.00       2.06      72.43       5.20      21.74      26.95       0.00      0.00   0.251
204Paved                 107.15       0.00       2.37       0.00     104.79       0.00     104.79       0.07      0.02   0.978


******************
Node Depth Summary
******************

-----------------------------------------------------------------------------
                            Average  Maximum  Maximum  Time of Max    Reported
                              Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type    Meters   Meters   Meters  days hr:min      Meters
-----------------------------------------------------------------------------
OF1                  OUTFALL   0.00     0.00   223.20     0  00:00        0.00
OF2                  OUTFALL   0.00     0.00   223.20     0  00:00        0.00
SU1                  STORAGE   0.07     0.90   224.29     0  12:16        0.90


******************
Node Inflow Summary
******************

-------------------------------------------------------------------------------------------------
                            Maximum  Maximum                  Lateral       Total        Flow
                            Lateral    Total  Time of Max      Inflow      Inflow     Balance
                             Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                 Type       CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                  OUTFALL  0.022    0.065     0  12:15      0.0703       0.419       0.000
OF2                  OUTFALL  0.004    0.004     0  12:15      0.0111      0.0111       0.000
SU1                  STORAGE  0.112    0.112     0  12:15       0.352       0.352      -0.000
```

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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-------------------------------------------------------------------------------------------------
SU1                     0.008    4.8    0.0    0.0       0.099   60.2       0  12:16      0.044


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

-----------------------------------------------------------
                       Flow       Avg       Max       Total
                       Freq      Flow      Flow      Volume
Outfall Node           Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                   98.84     0.005     0.065       0.419
OF2                   58.94     0.000     0.004       0.011
-----------------------------------------------------------
System                78.89     0.005     0.069       0.430


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

-------------------------------------------------------------------------------
                              Maximum  Time of Max   Maximum    Max/    Max/
                              |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type          CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE     0.044     0  12:16                     1.00


***************************
Flow Classification Summary
***************************

-------------------------------------------------------------------------------------------
                    Adjusted    ---------- Fraction of Time in Flow Class ----------
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------------


************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 15:02:17 2023
Analysis ended on:  Tue Oct 31 15:02:18 2023
Total elapsed time: 00:00:01
```

1.2.4.5 50-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
```

```
Chicago_4hr_2yr      Chicago_4hr_2Yr               INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr              INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr               INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)        INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr                INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                 INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                 INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                  INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                 INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                  INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr                INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                 INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                 INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                  INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                 INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                  INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                 INTENSITY   15 min.
SCS_6hr_10yr         SCS_6hr_10yr                  INTENSITY   15 min.
SCS_6hr_25yr         SCS_6hr_25yr                  INTENSITY   15 min.
SCS_6hr_2yr          SCS_6hr_2yr                   INTENSITY   15 min.
SCS_6hr_50yr         SCS_6hr_50yr                  INTENSITY   15 min.
SCS_6hr_5yr          SCS_6hr_5yr                   INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_24hr_50yr        SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_24hr_50yr        OF2
203land                     0.01      5.00      5.00    2.0000 SCS_24hr_50yr        OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_24hr_50yr        OF1


************
Node Summary
************
                                     Invert      Max.    Ponded    External
Name                 Type             Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
OF2                  OUTFALL         223.20      0.00       0.0
SU1                  STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............  10/06/2023 00:00:00
Ending Date ..............  10/07/2023 00:00:00
Antecedent Dry Days ......  0.0
Report Time Step .........  00:01:00
Wet Time Step ............  00:01:00
Dry Time Step ............  00:05:00
Routing Time Step ........  5.00 sec
Variable Time Step .......  YES
Maximum Trials ...........  8
Number of Threads ........  1
Head Tolerance ...........  0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.055       120.265
Evaporation Loss .........         0.001         2.342
Infiltration Loss ........         0.004         9.156
Surface Runoff ...........         0.049       107.699
Final Storage ............         0.001         1.137
Continuity Error (%) .....        -0.058


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.049         0.490
```

```
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         0.000          0.000
External Outflow .........         0.049          0.487
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.000          0.003
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


********************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv     Total      Total      Peak    Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff     Runoff    Runoff     Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
201roof                120.27       0.00       2.37       0.00    116.71      0.00    116.71       0.40      0.13     0.970
202Land                120.26       0.00       2.09      82.66      0.00     35.12     35.12       0.01      0.01     0.292
203land                120.27       0.00       2.11      78.53      5.86     27.94     33.80       0.00      0.00     0.281
204Paved               120.27       0.00       2.37       0.00    117.91      0.00    117.91       0.08      0.02     0.980


******************
Node Depth Summary
******************

-----------------------------------------------------------------------------
                            Average  Maximum  Maximum  Time of Max    Reported
                              Depth    Depth      HGL   Occurrence   Max Depth
Node               Type      Meters   Meters   Meters  days hr:min      Meters
-----------------------------------------------------------------------------
OF1                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
OF2                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
SU1                STORAGE     0.08     1.03   224.42     0  12:16        1.03


******************
Node Inflow Summary
******************

-------------------------------------------------------------------------------------------------
                            Maximum  Maximum                  Lateral       Total        Flow
                            Lateral    Total  Time of Max      Inflow      Inflow     Balance
                             Inflow   Inflow   Occurrence      Volume      Volume       Error
Node               Type         CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
OF1                OUTFALL    0.025    0.071     0  12:15      0.0795       0.473       0.000
OF2                OUTFALL    0.005    0.005     0  12:15      0.0137      0.0137       0.000
SU1                STORAGE    0.126    0.126     0  12:15       0.397       0.397      -0.000


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

No nodes were surcharged.


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

No nodes were flooded.


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

```
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
-------------------------------------------------------------------------------------------------
SU1                      0.009    5.4    0.0    0.0       0.113   68.7       0  12:16      0.047


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

-----------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
Outfall Node            Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                    98.86     0.006     0.071       0.473
OF2                    61.04     0.000     0.005       0.014
-----------------------------------------------------------
System                 79.95     0.006     0.077       0.487


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

-----------------------------------------------------------------------------
                              Maximum  Time of Max   Maximum    Max/    Max/
                               |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type         CMS  days hr:min     m/sec    Flow   Depth
-----------------------------------------------------------------------------
OR1                  ORIFICE     0.047     0  12:16                    1.00


**************************
Flow Classification Summary
**************************

-------------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit              Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 15:03:22 2023
Analysis ended on:  Tue Oct 31 15:03:23 2023
Total elapsed time: 00:00:01
```

1.2.4.6 100-year

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

Controlled post-development conditions

*************
Element Count
*************
Number of rain gages ...... 26
Number of subcatchments ... 4
Number of nodes ........... 3
Number of links ........... 1
Number of pollutants ...... 0
Number of land uses ....... 0


***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
Hurricane_Hazel_(0-25) Hurricane_Hazel_(0-25)       INTENSITY   60 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
```

```
SCS_6hr_10yr          SCS_6hr_10yr                  INTENSITY   15 min.
SCS_6hr_25yr          SCS_6hr_25yr                  INTENSITY   15 min.
SCS_6hr_2yr           SCS_6hr_2yr                   INTENSITY   15 min.
SCS_6hr_50yr          SCS_6hr_50yr                  INTENSITY   15 min.
SCS_6hr_5yr           SCS_6hr_5yr                   INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
201roof                     0.34     90.00    100.00    2.0000 SCS_24hr_100yr       SU1
202Land                     0.04     90.00      0.00    2.0000 SCS_24hr_100yr       OF2
203land                     0.01      5.00      5.00    2.0000 SCS_24hr_100yr       OF1
204Paved                    0.06     91.00    100.00    2.0000 SCS_24hr_100yr       OF1


************
Node Summary
************
                                     Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-----------------------------------------------------------------------------
OF1                  OUTFALL         223.20      0.00       0.0
OF2                  OUTFALL         223.20      0.00       0.0
SU1                  STORAGE         223.39      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-----------------------------------------------------------------------------------------------
OR1              SU1              OF1              ORIFICE


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


***************
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 ............ 10/06/2023 00:00:00
Ending Date .............. 10/07/2023 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.061       133.197
Evaporation Loss .........         0.001         2.346
Infiltration Loss ........         0.004         9.811
Surface Runoff ...........         0.055       119.962
Final Storage ............         0.001         1.157
Continuity Error (%) .....        -0.059


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.055         0.546
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.054         0.542
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.004
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None
```

```
********************************
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           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv     Total     Total     Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff    Runoff    Runoff   Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm  10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
201roof                133.20       0.00       2.37       0.00    129.64      0.00    129.64      0.44      0.14   0.973
202Land                133.20       0.00       2.13      88.57      0.00     42.06     42.06      0.02      0.01   0.316
203land                133.20       0.00       2.14      84.14      6.50     34.46     40.97      0.00      0.00   0.308
204Paved               133.20       0.00       2.37       0.00    130.85      0.00    130.85      0.08      0.03   0.982


******************
Node Depth Summary
******************

-----------------------------------------------------------------------------
                            Average  Maximum  Maximum  Time of Max    Reported
                              Depth    Depth      HGL   Occurrence   Max Depth
Node               Type      Meters   Meters   Meters  days hr:min      Meters
-----------------------------------------------------------------------------
OF1                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
OF2                OUTFALL     0.00     0.00   223.20     0  00:00        0.00
SU1                STORAGE     0.09     1.16   224.55     0  12:16        1.16


*******************
Node Inflow Summary
*******************

-----------------------------------------------------------------------------------------------------
                            Maximum  Maximum                  Lateral       Total        Flow
                            Lateral    Total  Time of Max      Inflow      Inflow     Balance
                             Inflow   Inflow   Occurrence      Volume      Volume       Error
Node               Type         CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-----------------------------------------------------------------------------------------------------
OF1                OUTFALL    0.028    0.077     0  12:15      0.0886       0.526       0.000
OF2                OUTFALL    0.006    0.006     0  12:15      0.0164      0.0164       0.000
SU1                STORAGE    0.139    0.139     0  12:15       0.441       0.441      -0.000


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

No nodes were surcharged.


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

No nodes were flooded.


**********************
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
-----------------------------------------------------------------------------------------------------
SU1                    0.010    6.0    0.0    0.0       0.127   77.2       0  12:16       0.051


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

-----------------------------------------------------------
                      Flow       Avg       Max       Total
```

```
                          Freq      Flow      Flow      Volume
Outfall Node              Pcnt       CMS       CMS    10^6 ltr
-----------------------------------------------------------
OF1                      98.87     0.006     0.077       0.526
OF2                      63.34     0.000     0.006       0.016
-----------------------------------------------------------
System                   81.10     0.006     0.084       0.542


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

-------------------------------------------------------------------------------
                                Maximum  Time of Max   Maximum    Max/    Max/
                                |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type          CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
OR1                  ORIFICE     0.051     0  12:16                     1.00


****************************
Flow Classification Summary
****************************

-------------------------------------------------------------------------------
                   Adjusted    ---------- Fraction of Time in Flow Class ----------
                    /Actual          Up    Down  Sub   Sup    Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Oct 31 15:05:12 2023
Analysis ended on:  Tue Oct 31 15:05:12 2023
Total elapsed time: < 1 sec
```

2. Water Balance and Quality Control

2.1 Existing Conditions

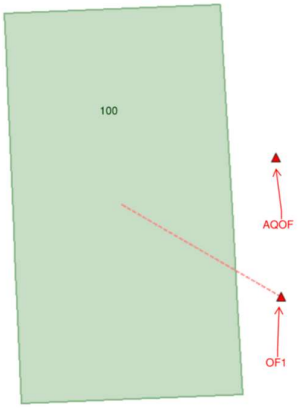

Figure 3 *Existing Condition Water Balance and Water Quality Model Schematics Labelled*

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 27
Number of subcatchments ... 1
Number of nodes ........... 2
Number of links ........... 0
Number of pollutants ...... 2
Number of land uses ....... 4


*****************
Pollutant Summary
*****************
                           Ppt.      GW         Kdecay
Name                 Units   Concen.   Concen.    1/days    CoPollutant
-------------------------------------------------------------------------
TP                    MG/L      0.00      0.00      0.00
TSS                   MG/L      0.00      0.00      0.00


***************
Landuse Summary
***************
                     Sweeping   Maximum      Last
Name                 Interval   Removal     Swept
-------------------------------------------------
```

GreenRoof	0.00	0.00	0.00
Landscape	0.00	0.00	0.00
Paved	0.00	0.00	0.00
ROOF	0.00	0.00	0.00

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
BarrieWPCC1991	BarrieWPCC1991	VOLUME	60 min.
ShantyBay1991	ShantyBay1991	VOLUME	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100	0.46	90.00	90.00	2.0000	BarrieWPCC1991	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
AQOF	OUTFALL	0.00	0.00	0.0	
OF1	OUTFALL	223.20	0.00	0.0	

****
Analysis Options
****

Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... YES
  Flow Routing ..... NO
  Water Quality ..... YES
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date 01/01/1991 00:00:00
Ending Date 12/31/1991 23:59:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:00:30
Dry Time Step 00:01:00

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.379	831.400
Evaporation Loss	0.105	230.493
Infiltration Loss	0.036	79.327
Surface Runoff	0.237	521.592
Final Storage	0.000	0.000
Continuity Error (%)	-0.001	

Runoff Quality Continuity	TP kg	TSS kg
Initial Buildup	0.000	0.000
Surface Buildup	0.485	178.517
Wet Deposition	0.000	0.000
Sweeping Removal	0.000	0.000
Infiltration Loss	0.000	0.000
BMP Removal	0.000	0.000
Surface Runoff	0.485	178.517
Remaining Buildup	0.000	0.000
Continuity Error (%)	0.000	0.000

Groundwater Continuity	Volume hectare-m	Depth mm
Initial Storage	0.616	1354.000
Infiltration	0.036	79.327
Upper Zone ET	0.009	20.455
Lower Zone ET	0.015	33.406
Deep Percolation	0.000	0.000
Groundwater Flow	0.000	0.000
Final Storage	0.628	1379.466
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.237	2.375
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.237	2.375
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000

```
Final Stored Volume ......          0.000          0.000
Continuity Error (%) .....          0.000


**************************            TP             TSS
Quality Routing Continuity            kg              kg
**************************    ----------     ----------
Dry Weather Inflow .......          0.000          0.000
Wet Weather Inflow .......          0.485        178.517
Groundwater Inflow .......          0.000          0.000
RDII Inflow ..............          0.000          0.000
External Inflow ..........          0.000          0.000
External Outflow .........          0.485        178.517
Flooding Loss ............          0.000          0.000
Exfiltration Loss ........          0.000          0.000
Mass Reacted .............          0.000          0.000
Initial Stored Mass ......          0.000          0.000
Final Stored Mass ........          0.000          0.000
Continuity Error (%) .....          0.000          0.000


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

-----------------------------------------------------------------------------------------------------------------------
                          Total       Total       Total       Total      Imperv       Perv      Total       Total      Peak  Runoff
                         Precip       Runon        Evap       Infil     Runoff     Runoff     Runoff      Runoff    Runoff   Coeff
Subcatchment                 mm          mm          mm          mm         mm         mm         mm    10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------
100                      831.40        0.00      230.49       79.33     521.59       0.00     521.59        2.37      0.01   0.627


******************
Groundwater Summary
******************

-------------------------------------------------------------------------------------------------------
                                    Total     Total  Maximum  Average  Average     Final     Final
                          Total     Lower   Lateral  Lateral    Upper    Water     Upper     Water
                          Infil    Seepage  Outflow  Outflow    Moist.   Table     Moist.    Table
Subcatchment                 mm        mm        mm       CMS                 m                 m
-------------------------------------------------------------------------------------------------------
100                       79.33     53.86      0.00     0.00     0.00     0.12    222.89      0.12    222.94


****************************
Subcatchment Washoff Summary
****************************

-------------------------------------------------
                             TP             TSS
Subcatchment                 kg              kg
-------------------------------------------------
100                       0.485        178.517
-------------------------------------------------
System                    0.485        178.517


Analysis begun on:  Tue Oct 31 15:38:53 2023
Analysis ended on:  Tue Oct 31 15:39:50 2023
Total elapsed time: 00:00:57
```

2.2 Pre-Development

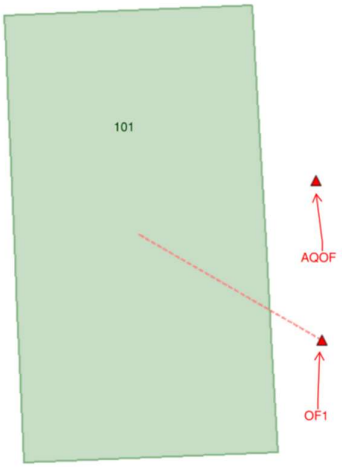

Figure 4 Pre-Development Water Balance and Quality Control Model Schematics Labelled

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

Pre-development conditions

*************
Element Count
*************
Number of rain gages ...... 27
Number of subcatchments ... 1
Number of nodes ........... 2
Number of links ........... 0
```

Number of pollutants 2
Number of land uses 3

****
Pollutant Summary
****

Name	Units	Ppt. Concen.	GW Concen.	Kdecay 1/days	CoPollutant
TP	MG/L	0.00	0.00	0.00	
TSS	MG/L	0.00	0.00	0.00	

****
Landuse Summary
****

Name	Sweeping Interval	Maximum Removal	Last Swept
Landscape	0.00	0.00	0.00
Paved	0.00	0.00	0.00
Roof	0.00	0.00	0.00

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
BarrieWPCC1991	BarrieWPCC1991	VOLUME	60 min.
ShantyBay1991	ShantyBay1991	VOLUME	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.46	90.00	50.00	2.0000	BarrieWPCC1991	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
AQOF	OUTFALL	0.00	0.00	0.0	
OF1	OUTFALL	223.20	0.00	0.0	

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... YES
  Flow Routing ..... NO
  Water Quality ..... YES
Infiltration Method ..... HORTON
Surcharge Method ..... EXTRAN
Starting Date 01/01/1991 00:00:00
Ending Date 12/31/1991 23:59:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:00:30
Dry Time Step 00:01:00

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.379	831.400
Evaporation Loss	0.065	143.556
Infiltration Loss	0.181	396.636
Surface Runoff	0.133	291.218
Final Storage	0.000	0.000
Continuity Error (%)	-0.001	

Runoff Quality Continuity	TP kg	TSS kg
Initial Buildup	0.000	0.000
Surface Buildup	0.344	115.045
Wet Deposition	0.000	0.000
Sweeping Removal	0.000	0.000
Infiltration Loss	0.000	0.000
BMP Removal	0.000	0.000
Surface Runoff	0.344	115.045
Remaining Buildup	0.000	0.000
Continuity Error (%)	0.000	0.000

Groundwater Continuity	Volume hectare-m	Depth mm
Initial Storage	0.616	1354.000
Infiltration	0.181	396.636

```
Upper Zone ET ............          0.056       122.203
Lower Zone ET ............          0.077       169.751
Deep Percolation .........          0.000         0.000
Groundwater Flow .........          0.000         0.000
Final Storage ............          0.664      1458.682
Continuity Error (%) .....          0.000


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------     ---------
Dry Weather Inflow .......          0.000         0.000
Wet Weather Inflow .......          0.133         1.326
Groundwater Inflow .......          0.000         0.000
RDII Inflow ..............          0.000         0.000
External Inflow ..........          0.000         0.000
External Outflow .........          0.133         1.326
Flooding Loss ............          0.000         0.000
Evaporation Loss .........          0.000         0.000
Exfiltration Loss ........          0.000         0.000
Initial Stored Volume ....          0.000         0.000
Final Stored Volume ......          0.000         0.000
Continuity Error (%) .....          0.000


*************************            TP            TSS
Quality Routing Continuity           kg            kg
*************************     ----------    ----------
Dry Weather Inflow .......          0.000         0.000
Wet Weather Inflow .......          0.344       115.045
Groundwater Inflow .......          0.000         0.000
RDII Inflow ..............          0.000         0.000
External Inflow ..........          0.000         0.000
External Outflow .........          0.344       115.045
Flooding Loss ............          0.000         0.000
Exfiltration Loss ........          0.000         0.000
Mass Reacted .............          0.000         0.000
Initial Stored Mass ......          0.000         0.000
Final Stored Mass ........          0.000         0.000
Continuity Error (%) .....          0.000         0.000


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

-----------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv     Total      Total      Peak    Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff    Runoff     Runoff    Runoff     Coeff
Subcatchment               mm         mm         mm         mm        mm        mm        mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------
101                    831.40       0.00     143.56     396.64    291.22      0.00    291.22       1.33      0.01     0.350


******************
Groundwater Summary
******************

-----------------------------------------------------------------------------------------------
                                  Total    Total  Maximum  Average  Average    Final    Final
                        Total     Lower  Lateral  Lateral    Upper    Water    Upper    Water
                        Infil     Seepage  Outflow  Outflow   Moist.    Table   Moist.    Table
Subcatchment               mm        mm       mm       CMS                m                m
-----------------------------------------------------------------------------------------------
101                    396.64    291.95     0.00     0.00     0.00     0.12   223.01     0.12   223.19


**************************
Subcatchment Washoff Summary
**************************

-------------------------------------------------
                             TP            TSS
Subcatchment                 kg             kg
-------------------------------------------------
101                       0.344       115.045
-------------------------------------------------
System                    0.344       115.045


Analysis begun on:  Thu Nov  2 10:07:26 2023
Analysis ended on:  Thu Nov  2 10:08:58 2023
Total elapsed time: 00:01:32
```

2.3 Post Development

Note: Post-development runoff summary and catchment loading shows uncontrolled post-development results.

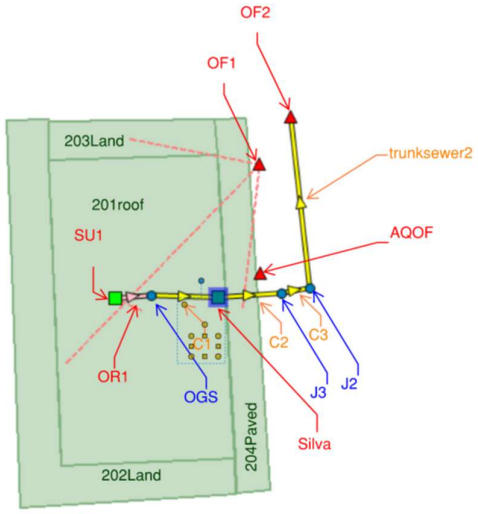

Figure 5 Post-Development Continuous Model Schematics Labelled

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

  Post-Development Treatment train

  *************
  Element Count
  *************
  Number of rain gages ...... 27
  Number of subcatchments ... 4
  Number of nodes ........... 8
  Number of links ........... 5
  Number of pollutants ...... 2
  Number of land uses ....... 4


  *****************
  Pollutant Summary
  *****************
                             Ppt.      GW         Kdecay
  Name                Units  Concen.   Concen.    1/days    CoPollutant
  ---------------------------------------------------------------------
  TP                   MG/L      0.00      0.00      0.00
  TSS                  MG/L      0.00      0.00      0.00


  ***************
  Landuse Summary
  ***************
                          Sweeping   Maximum      Last
  Name                    Interval   Removal     Swept
  ---------------------------------------------------
  GreenRoof                   0.00      0.00      0.00
  Landscape                   0.00      0.00      0.00
  Paved                       0.00      0.00      0.00
  ROOF                        0.00      0.00      0.00


  ****************
  Raingage Summary
  ****************
                                                    Data       Recording
  Name                Data Source                   Type       Interval
  ---------------------------------------------------------------------
  BarrieWPCC1991      BarrieWPCC1991                VOLUME      60 min.
    ShantyBay1991       ShantyBay1991                 VOLUME      60 min.


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
  ------------------------------------------------------------------------------------------
  201                         0.34     90.00    100.00    2.0000 BarrieWPCC1991       SWMTANK
  202Land                     0.04     90.00      0.00    2.0000 BarrieWPCC1991       OF1
  203land                     0.01      5.00      5.00    2.0000 BarrieWPCC1991       OF1
  204Paved                    0.07     91.00    100.00    2.0000 BarrieWPCC1991       OF1


  ************
  Node Summary
  ************
                                        Invert      Max.    Ponded    External
  Name                Type               Elev.     Depth      Area    Inflow
  ---------------------------------------------------------------------------
  J2                  JUNCTION          222.04      1.50       0.0
  J3                  JUNCTION          222.89      1.50       0.0
  OGS                 JUNCTION          223.47      1.50       0.0
  AQOF                OUTFALL             0.00      0.00       0.0
  OF1                 OUTFALL             0.00      0.00       0.0
  OF2                 OUTFALL           221.78      0.45       0.0
  Silva               STORAGE           222.73      0.70       0.0
  SWMTANK             STORAGE           223.62      1.50       0.0
```

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

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	OGS	Silva	CONDUIT	16.4	1.5011	0.0130
C2	Silva	J3	CONDUIT	9.2	1.5045	0.0130
C3	J3	J2	CONDUIT	6.7	10.4446	0.0130
trunksewer2	J2	OF2	CONDUIT	47.1	0.5565	0.0130
OR1	SWMTANK	OGS	ORIFICE			

```
********************
Cross Section Summary
********************
```

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.20	0.03	0.05	0.20	1	0.04
C2	CIRCULAR	0.20	0.03	0.05	0.20	1	0.04
C3	CIRCULAR	0.20	0.03	0.05	0.20	1	0.11
trunksewer2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21

```
***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ YES
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... YES
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 01/01/1991 00:00:00
Ending Date .............. 12/31/1991 23:59:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:00:30
Dry Time Step ............ 00:01:00
Routing Time Step ........ 5.00 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	0.379	831.400
Evaporation Loss	0.109	238.258
Infiltration Loss	0.040	87.677
Surface Runoff	0.230	505.481
Final Storage	0.000	0.000
Continuity Error (%)	-0.002	

Runoff Quality Continuity	TP kg	TSS kg
Initial Buildup	0.000	0.000
Surface Buildup	0.273	54.822
Wet Deposition	0.000	0.000
Sweeping Removal	0.000	0.000
Infiltration Loss	0.000	0.000
BMP Removal	0.000	0.000
Surface Runoff	0.273	54.822
Remaining Buildup	0.000	0.000
Continuity Error (%)	0.000	0.000

Groundwater Continuity	Volume hectare-m	Depth mm
Initial Storage	0.617	1354.000
Infiltration	0.040	87.677
Upper Zone ET	0.013	29.288
Lower Zone ET	0.022	48.357
Deep Percolation	0.000	0.000
Groundwater Flow	0.000	0.000
Final Storage	0.622	1364.032
Continuity Error (%)	0.000	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.230	2.305
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.185	1.849
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.046	0.456
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.004	

Quality Routing Continuity	TP kg	TSS kg
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.273	54.816
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.157	42.535
Flooding Loss	0.000	0.000
Exfiltration Loss	0.016	0.096
Mass Reacted	0.098	12.170
Initial Stored Mass	0.000	0.000
Final Stored Mass	0.004	0.035
Continuity Error (%)	-0.754	-0.036

Time-Step Critical Elements

Link C3 (4.82%)

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	:	0.00 sec
Average Time Step	:	4.94 sec
Maximum Time Step	:	5.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	2.00
% of Steps Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	99.05 %
3.155 - 1.991 sec	:	0.95 %
1.991 - 1.256 sec	:	0.00 %
1.256 - 0.792 sec	:	0.00 %
0.792 - 0.500 sec	:	0.00 %

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
201	831.40	0.00	290.80	0.00	540.61	0.00	540.61	1.84	0.01	0.650
202Land	831.40	0.00	38.13	793.27	0.00	0.00	0.00	0.00	0.00	0.000
203land	831.40	0.00	48.38	753.61	29.41	0.00	29.41	0.00	0.00	0.035
204Paved	831.40	0.00	118.54	0.00	712.90	0.00	712.90	0.46	0.00	0.857

Groundwater Summary

Subcatchment	Total Infil mm	Total Evap mm	Total Lower Seepage mm	Total Lateral Outflow mm	Maximum Lateral Outflow CMS	Average Upper Moist.	Average Water Table m	Final Upper Moist.	Final Water Table m
201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202Land	793.27	702.58	0.00	0.00	0.00	0.12	222.99	0.12	223.15
203land	753.61	667.13	0.00	0.00	0.00	0.12	222.99	0.12	223.14
204Paved	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Subcatchment Washoff Summary

Subcatchment	TP kg	TSS kg
201	0.165	12.854
202Land	0.000	0.000
203land	0.001	0.291
204Paved	0.107	41.677
System	0.273	54.822

Node Depth Summary

	Average	Maximum	Maximum	Time of Max	Reported

Node	Type	Depth Meters	Depth Meters	HGL Meters	Occurrence days hr:min	Max Depth Meters
J2	JUNCTION	0.00	0.06	222.10	184 11:01	0.06
J3	JUNCTION	0.00	0.04	222.93	184 11:00	0.04
OGS	JUNCTION	0.00	0.06	223.53	184 11:00	0.06
AQOF	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.06	221.84	184 11:01	0.06
Silva	STORAGE	0.05	0.36	223.09	184 11:00	0.36
SWMTANK	STORAGE	0.00	0.10	223.72	184 11:00	0.10

****
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
J2	JUNCTION	0.000	0.008	184 11:00	0	1.38	-0.000
J3	JUNCTION	0.000	0.008	184 11:00	0	1.38	-0.000
OGS	JUNCTION	0.000	0.008	184 11:00	0	1.84	-0.003
AQOF	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
OF1	OUTFALL	0.002	0.002	184 10:44	0.467	0.467	0.000
OF2	OUTFALL	0.000	0.008	184 11:01	0	1.38	0.000
Silva	STORAGE	0.000	0.008	184 11:00	0	1.84	-0.001
SWMTANK	STORAGE	0.008	0.008	184 11:00	1.84	1.84	-0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
Silva	0.000	7.2	0.0	24.8	0.002	51.6	184 11:00	0.008
SWMTANK	0.000	0.2	0.0	0.0	0.011	6.9	184 11:00	0.008

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Total TP kg	Total TSS kg
AQOF	0.00	0.000	0.000	0.000	0.000	0.000
OF1	9.02	0.000	0.002	0.467	0.107	41.966
OF2	8.21	0.001	0.008	1.382	0.049	0.571
System	5.74	0.001	0.009	1.849	0.157	42.538

****
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
C1	CONDUIT	0.008	184 11:00	0.99	0.19	0.30
C2	CONDUIT	0.008	184 11:00	1.28	0.19	0.24
C3	CONDUIT	0.008	184 11:00	1.96	0.07	0.18
trunksewer2	CONDUIT	0.008	184 11:01	0.63	0.04	0.13
OR1	ORIFICE	0.008	184 11:00			0.69

****
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
C1	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
C2	1.00	0.01	0.91	0.00	0.00	0.08	0.00	0.00	0.91	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
trunksewer2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.97	0.00

```
************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


**************************
Link Pollutant Load Summary
**************************

-------------------------------------------------
                               TP           TSS
Link                           kg            kg
-------------------------------------------------
C1                          0.164         2.922
C2                          0.050         0.572
C3                          0.049         0.570
trunksewer2                 0.049         0.571
OR1                         0.164         5.850


Analysis begun on:  Thu Nov  2 11:51:08 2023
Analysis ended on:  Thu Nov  2 11:54:33 2023
Total elapsed time: 00:03:25
```

3. Erosion and Volume Control

3.1 Post-Development 25 mm Storm

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

Post-Development Treatment train

*************
Element Count
*************
Number of rain gages ...... 27
Number of subcatchments ... 4
Number of nodes ........... 8
Number of links ........... 5
Number of pollutants ...... 2
Number of land uses ....... 4


*****************
Pollutant Summary
*****************
                           Ppt.      GW         Kdecay
Name                 Units Concen.   Concen.    1/days    CoPollutant
-----------------------------------------------------------------------
TP                    MG/L      0.00      0.00      0.00
TSS                   MG/L      0.00      0.00      0.00


***************
Landuse Summary
***************
                      Sweeping   Maximum      Last
Name                  Interval   Removal     Swept
-------------------------------------------------
GreenRoof                 0.00      0.00      0.00
Landscape                 0.00      0.00      0.00
Paved                     0.00      0.00      0.00
ROOF                      0.00      0.00      0.00


***************
Raingage Summary
***************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
-----------------------------------------------------------------------
BarrieWPCC1991       BarrieWPCC1991               VOLUME      60 min.
Chicago_25mm         Chicago_25mm                 INTENSITY   10 min.
Chicago_4hr_100yr    Chicago_4hr_100Yr            INTENSITY   10 min.
Chicago_4hr_10yr     Chicago_4hr_10Yr             INTENSITY   10 min.
Chicago_4hr_25yr     Chicago_4hr_25Yr             INTENSITY   10 min.
Chicago_4hr_2yr      Chicago_4hr_2Yr              INTENSITY   10 min.
Chicago_4hr_50yr     Chicago_4hr_50Yr             INTENSITY   10 min.
Chicago_4hr_5yr      Chicago_4hr_5Yr              INTENSITY   10 min.
SCS_12hr_100yr       SCS_12hr_100yr               INTENSITY   15 min.
SCS_12hr_10yr        SCS_12hr_10yr                INTENSITY   15 min.
SCS_12hr_25yr        SCS_12hr_25yr                INTENSITY   15 min.
SCS_12hr_2yr         SCS_12hr_2yr                 INTENSITY   15 min.
SCS_12hr_50yr        SCS_12hr_50yr                INTENSITY   15 min.
SCS_12hr_5yr         SCS_12hr_5yr                 INTENSITY   15 min.
SCS_24hr_100yr       SCS_24hr_100yr               INTENSITY   15 min.
SCS_24hr_10yr        SCS_24hr_10yr                INTENSITY   15 min.
SCS_24hr_25yr        SCS_24hr_25yr                INTENSITY   15 min.
SCS_24hr_2yr         SCS_24hr_2yr                 INTENSITY   15 min.
SCS_24hr_50yr        SCS_24hr_50yr                INTENSITY   15 min.
SCS_24hr_5yr         SCS_24hr_5yr                 INTENSITY   15 min.
SCS_6hr_100yr        SCS_6hr_100yr                INTENSITY   15 min.
```

SCS_6hr_10yr	SCS_6hr_10yr	INTENSITY	15 min.
SCS_6hr_25yr	SCS_6hr_25yr	INTENSITY	15 min.
SCS_6hr_2yr	SCS_6hr_2yr	INTENSITY	15 min.
SCS_6hr_50yr	SCS_6hr_50yr	INTENSITY	15 min.
SCS_6hr_5yr	SCS_6hr_5yr	INTENSITY	15 min.
ShantyBay1991	ShantyBay1991	VOLUME	60 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	0.34	90.00	100.00	2.0000	Chicago_25mm	SWMTANK
202Land	0.04	90.00	0.00	2.0000	Chicago_25mm	OF1
203land	0.01	5.00	5.00	2.0000	Chicago_25mm	OF1
204Paved	0.07	91.00	100.00	2.0000	Chicago_25mm	OF1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J2	JUNCTION	222.04	1.50	0.0	
J3	JUNCTION	222.89	1.50	0.0	
OGS	JUNCTION	223.47	1.50	0.0	
AQOF	OUTFALL	0.00	0.00	0.0	
OF1	OUTFALL	0.00	0.00	0.0	
OF2	OUTFALL	221.78	0.45	0.0	
Silva	STORAGE	222.53	0.70	0.0	
SWMTANK	STORAGE	223.62	1.50	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	OGS	Silva	CONDUIT	16.4	1.5011	0.0130
C2	Silva	J3	CONDUIT	9.2	1.5045	0.0130
C3	J3	J2	CONDUIT	6.7	10.4446	0.0130
trunksewer2	J2	OF2	CONDUIT	47.1	0.5565	0.0130
OR1	SWMTANK	OGS	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.20	0.03	0.05	0.20	1	0.04
C2	CIRCULAR	0.20	0.03	0.05	0.20	1	0.04
C3	CIRCULAR	0.20	0.03	0.05	0.20	1	0.11
trunksewer2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... YES
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... YES
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date 01/01/1991 00:00:00
Ending Date 01/05/1991 23:59:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:00:30
Dry Time Step 00:01:00
Routing Time Step ..... 5.00 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	0.011	24.996
Evaporation Loss	0.001	1.346
Infiltration Loss	0.001	2.583
Surface Runoff	0.010	21.071
Final Storage	0.000	0.000
Continuity Error (%)	0.000	

Runoff Quality Continuity	TP kg	TSS kg
Initial Buildup	0.000	0.000
Surface Buildup	0.011	2.012
Wet Deposition	0.000	0.000
Sweeping Removal	0.000	0.000
Infiltration Loss	0.000	0.000

```
BMP Removal ..............         0.000         0.000
Surface Runoff ...........         0.011         2.012
Remaining Buildup ........         0.000         0.000
Continuity Error (%) .....         0.000         0.000


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.010         0.096
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.009         0.091
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.001         0.005
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


*************************            TP           TSS
Quality Routing Continuity             kg            kg
*************************     ----------    ----------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.011         2.011
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.006         1.516
Flooding Loss ............         0.000         0.000
Exfiltration Loss ........         0.000         0.004
Mass Reacted .............         0.004         0.489
Initial Stored Mass ......         0.000         0.000
Final Stored Mass ........         0.000         0.002
Continuity Error (%) .....        -0.138        -0.047


****************************
Time-Step Critical Elements
****************************
Link C3 (6.15%)


********************************
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           :     1.56 sec
Average Time Step           :     4.85 sec
Maximum Time Step           :     5.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.00
% of Steps Not Converging   :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :    94.74 %
    3.155 -  1.991 sec      :     3.37 %
    1.991 -  1.256 sec      :     1.89 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %


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

-----------------------------------------------------------------------------------------------------------------------------------------
                        Total      Total      Total      Total     Imperv      Perv      Total      Total      Peak  Runoff
                       Precip      Runon       Evap      Infil    Runoff    Runoff     Runoff     Runoff    Runoff   Coeff
Subcatchment               mm         mm         mm         mm        mm        mm         mm   10^6 ltr       CMS
-----------------------------------------------------------------------------------------------------------------------------------------
201                     25.00       0.00       1.48       0.00     23.52      0.00      23.52       0.08      0.05   0.941
202Land                 25.00       0.00       1.62      23.37      0.00      0.00       0.00       0.00      0.00   0.000
203land                 25.00       0.00       1.60      22.20      1.19      0.00       1.19       0.00      0.00   0.048
204Paved                25.00       0.00       0.43       0.00     24.58      0.00      24.58       0.02      0.01   0.983


****************************
Subcatchment Washoff Summary
****************************

-------------------------------------------------
                            TP           TSS
Subcatchment                kg            kg
-------------------------------------------------
201                      0.007         0.560
202Land                  0.000         0.000
203land                  0.000         0.014
204Paved                 0.004         1.438
-------------------------------------------------
System                   0.011         2.012
```

****
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
J2	JUNCTION	0.00	0.09	222.14	0 01:33	0.09
J3	JUNCTION	0.00	0.06	222.95	0 01:33	0.06
OGS	JUNCTION	0.00	0.10	223.57	0 01:33	0.10
AQOF	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
OF2	OUTFALL	0.00	0.09	221.87	0 01:33	0.09
Silva	STORAGE	0.06	0.60	223.13	0 01:33	0.60
SWMTANK	STORAGE	0.01	0.24	223.86	0 01:32	0.24

****
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	
J2	JUNCTION	0.000	0.020	0 01:33	0	0.0748	0.001	
J3	JUNCTION	0.000	0.020	0 01:33	0	0.0748	0.001	
OGS	JUNCTION	0.000	0.020	0 01:33	0	0.0799	0.000	
AQOF	OUTFALL	0.000	0.000	0 00:00	0	0	0.000	ltr
OF1	OUTFALL	0.009	0.009	0 01:30	0.0161	0.0161	0.000	
OF2	OUTFALL	0.000	0.020	0 01:33	0	0.0748	0.000	
Silva	STORAGE	0.000	0.020	0 01:33	0	0.0799	-0.001	
SWMTANK	STORAGE	0.047	0.047	0 01:30	0.0799	0.0799	-0.001	

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
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
Silva	0.000	8.6	0.0	6.5	0.003	85.8	0 01:33	0.020
SWMTANK	0.001	0.4	0.0	0.0	0.027	16.2	0 01:32	0.020

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Total TP kg	Total TSS kg
AQOF	0.00	0.000	0.000	0.000	0.000	0.000
OF1	6.18	0.001	0.009	0.016	0.004	1.452
OF2	7.14	0.006	0.020	0.075	0.003	0.065
System	4.44	0.007	0.027	0.091	0.006	1.517

****
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
C1	CONDUIT	0.020	0 01:33	1.28	0.50	0.50
C2	CONDUIT	0.020	0 01:33	1.70	0.49	0.40
C3	CONDUIT	0.020	0 01:33	2.58	0.19	0.29
trunksewer2	CONDUIT	0.020	0 01:33	0.84	0.09	0.21
OR1	ORIFICE	0.020	0 01:33			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

C1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C2	1.00	0.01	0.94	0.00	0.00	0.04	0.00	0.00	0.94	0.00
C3	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
trunksewer2	1.00	0.01	0.00	0.00	0.98	0.01	0.00	0.00	0.97	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

****
Link Pollutant Load Summary
****

Link	TP kg	TSS kg
C1	0.007	0.279
C2	0.003	0.065
C3	0.003	0.065
trunksewer2	0.003	0.065
OR1	0.007	0.559

Analysis begun on: Wed Nov 1 15:00:09 2023
Analysis ended on: Wed Nov 1 15:00:10 2023
Total elapsed time: 00:00:01

General Water Balance Model Inputs

Continuous modelling allows for a more accurate estimation of dynamic processes like infiltration, runoff, and evaporation. It can model time-dependent processes that conventional methods cannot. Continuous modelling is better suited for real-world representation as it can model transient response and dynamic systems using historical data, under the premise that historical rain patters are the best predictor of future precipitation values.

For this project, the continuous modelling features of PC SWMM were used to simulate the water balance and water quality targets of 126-140 Bradford St. to a year of historical precipitation data.

1. Evaporation rate

The model uses an evaporation rate of 2.4 mm/d which was derived by taking the yearly potential evaporation of 873mm/yr (Statistic Canada **https://www150.statcan.gc.ca/n1/pub/38-20-0001/2021001/l05-eng.htm**) and dividing it by 365 days. Note that this is potential evaporation and not actual evaporation. This value models the evaporation rate from runoff events. To obtain accurate water balance evaporation rates it is also necessary to model the evaporation from soil storage. There is an aquifer simulated in the model to achieve evaporation rates that match the hydrogeological and the geotechnical report.

2. Aquifer Information

The soil type, the water level and ground level described in the Hydrogeological and Geotechnical Reports (GHD, 2023) were used to provide the aquifer information to model the soil evapotranspiration. The aquifer properties were based on the EPA SWMM hydrology guide. Most values were based on soil type.

Ultimately, the aquifer is only used to model order of magnitude evaporation results to get more accurate infiltration and runoff quantities. The curve number has a larger impact on runoff and infiltration than the aquifer editor.

3. Precipitation data

The Wet Weather Flow Management guidelines recommend data from 1991 as a representative of the typical yearly rain patterns. The water balance analysis used daily precipitation from the 1991 Barrie WPCC weather station, which was disaggregated using computer software (NetStorm) to match typical rainstorm patterns. The total rain in the data file is 831.40 mm.

The weather file can be Found in the Appendix.

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