



CREATIVITY BEYOND ENGINEERING

Final Storm Water Management Plan

For

**Waukesha Nissan
City of Waukesha, Wisconsin**

raSmith Project No. 3220213

May 30, 2023



Final Storm Water Management Plan For

Waukesha Nissan City of Waukesha, Wisconsin

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INTRODUCTION

R.A. Smith, Inc. was retained to prepare a storm water management report for the proposed car dealership located at 1451 E. Moreland Blvd in the City of Waukesha, WI. The site is further described as being in the Northeast 1/4 of the Southeast 1/4 of Section 35, Town 7 North, Range 19 East, in the City of Waukesha, Waukesha County, Wisconsin.

The hydrologic analysis (the "Site") is approximately 1.98 acres with Moreland Blvd. to the North, Manhattan Drive to the West and South, and 'Boucher Genesis of Waukesha' to the East. The proposed project consists of razing the existing 'Boucher Nissan of Waukesha' on the West side of the Site and replacing it with a new building and asphalt pavement. Due to the current site conditions, the proposed site is considered redevelopment.

Storm water discharge control for this site is regulated by the City of Waukesha and Wisconsin Administrative Codes NR 151. The most stringent of the codes, City of Waukesha, requires post-development peak discharge rates resulting from the 1-, 2-, 10-, 100-year, 24 hour storm events maintain the same rates as the pre-developed conditions, respectively. Additionally, the City of Waukesha and DNR Code requires the reduction in total suspended solids (TSS) by 40% from parking lots and roads for re-development. Finally, the City of Waukesha requires developments with >80% of connected imperviousness to infiltrate sufficient runoff volume so that the post-development infiltration volume has at least 60% of the pre-developed infiltration volume, based on the average annual rainfall.

Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. The Natural Resources Conservation Service (NRCS) has adopted a standard for classifying soils and their general characteristics relating to infiltration and runoff by classifying common soil textures into Hydrologic Soil Groups (HSG's). The HSG's are then used to determine runoff curve numbers (RCN). According to the NRCS Web Soil Survey, the site generally consists of 'Gravel pit'. According to the Waukesha County GIS system, 'Gravel pit' belongs to NRCS Hydrologic Soil Group A (see Appendix B). These soils are soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

In order to satisfy both City of Waukesha and WDNR stormwater management requirements, the Site will use an ADS StormTech underground storage system to achieve quality standards. The StormTech system will have an impermeable pond liner on top of the subgrade to prevent possible oversaturation of the subbase causing pavement and structural failure. However, the City of Waukesha infiltration requirements will still be met considering the amount of green space in the post-developed condition will be greater than the pre-developed condition (See Appendix E for supporting calculations). The design intent of the storm water drainage for this site is to collect and direct the runoff to the proposed underground system, which will temporarily detain the runoff and release the storm water volume generated at a controlled rate. In addition to controlling runoff rates, the detention facility will reduce the TSS loads from parking lots and roads by 40% based on the average annual rainfall, as compared to no runoff management controls

METHOD OF HYDROLOGIC ANALYSIS

A hydrologic analysis is required to determine peak storm water runoff from the subject property under existing and proposed conditions. The analysis was performed using the HydroCAD Version 10.10 hydrologic simulation computer model. The discharges were generated using the SCS Dimensionless Unit Hydrograph Method for a 24-hour duration storm. Model parameters include drainage area, SCS runoff curve number, average basin slope, hydraulic length, 24-hour precipitation (see Table 1) and time of concentration.

Table 1 – Design Storm Events
Chapter 32.11, Table 3 – Rainfall Depths

Frequency (years)	Duration (hours)	Rainfall Depth (inches)
1	24	2.40
2	24	2.70
10	24	3.81
100	24	6.18

The computer model used for water quality analysis is Source Loading and Management Model (SLAMM). SLAMM was adopted and calibrated by the Wisconsin Department of Natural Resources (WDNR). This model was originally developed to better understand the relationships between sources of urban runoff pollutants and runoff quality. Special emphasis has been placed on small storm hydrology and particulate wash-off, which are the most significant contributing factors to water quality.

EXISTING HYDROLOGY CONDITIONS

The storm water generated from the existing site drains offsite in two different directions. The majority of storm water, E-1, drains on Site into the storm sewer network that drains northeast toward Manhattan Drive. The next two watersheds, EU-2 and EU-3, drain offsite to the East and North, respectively, of the Site to meet at the southwest corner of Moreland Blvd and Manhattan Drive. Finally, EU-1 drains south across the property into the existing commercial development’s storm sewer network.

The information provided in Table 2 summarizes the parameters and peak flows generated for the 1-, 2-, 10-, and 100-year, 24 hour storm event under the existing conditions. The existing peak discharge rates are used to determine the allowable site release rates generated for the proposed conditions.

Table 2 – Existing Runoff Release Rates

Watershed	Area (acres)	Composite RCN	Tc (minutes)	Peak Discharge (cfs)			
				1-yr	2-yr	10-yr	100-yr
E-1	1.36	96	6	4.56	5.19	7.51	12.42
EU-1	0.49	93	6	1.48	1.71	2.56	4.36
EU-2	0.08	54	6	0.00	0.00	0.07	0.30
EU-3	0.05	74	6	0.05	0.07	0.14	0.31
E-TOTAL	1.98	---	---	6.08	6.96	10.24	17.18

PROPOSED HYDROLOGY CONDITIONS (BEFORE DETENTION)

The proposed site has been graded and designed to maintain existing drainage patterns as much as possible. Watershed P-1 receives runoff via overland flow and storm sewer from the building roof, parking lot pavement and landscaped green space, which ultimately is conveyed to ‘UG Detention’ system. Watershed O-1 is an offsite watershed that is conveyed to ‘UG Detention’. This watershed is not included in the existing condition due to proposed grade changes. Watershed PU-1 and PU-2 are not conveyed to the underground systems and flow from the site undetained.

The information provided in Table 3 summarizes the parameters and peak flows generated for the 1-, 2-, 10-, and 100-year, 24 hour storm under the proposed conditions, before detention.

Table 3 – Proposed Hydrology Summary (before detention)

Watershed	Area (acres)	Composite RCN	Tc (minutes)	Peak Discharge (cfs)			
				1-yr	2-yr	10-yr	100-yr
P-1	1.69	96	6	5.66	6.45	9.34	15.43
PU-1	0.10	39	6	0.00	0.00	0.00	0.04
PU-2	0.19	42	6	0.00	0.00	0.00	0.15
O-1	0.01	82	6	0.02	0.03	0.04	0.08
P TOTAL (W/O DETENTION)	1.99	---	---	5.68	6.48	9.38	15.70

PROPOSED HYDROLOGY CONDITIONS (AFTER DETENTION)

Normally due to the increased impervious area for a proposed site, the resulting peak discharges for the proposed drainage conditions are greater than the existing conditions, thus requiring detention to regulate peak flows. However, in this case, this site actually has a slightly higher amount of green space, thus providing lower peak discharges rates even before any type of detention. However, considering this site also has to comply with TSS requirements, an ADS StormTech underground systems are being proposed for this project.

The information provided in Tables 4 and 5 summarizes the parameters and peak flows generated for the 1-, 2-, 10-, and 100-year, 24 hour storm event under the proposed conditions, after detention.

Table 4 – UG Detention

Storm Event	Discharge (cfs)	Maximum Elevation	Maximum Storage (af)
1-Year	2.50	95.07	0.076
2-Year	2.84	95.17	0.087
10-Year	5.39	95.51	0.120
100-Year	14.03	95.92	0.150

The information provided in Table 5 summarizes the peak flows generated for the 1-, 2-, 10-, and 100-year, 24 hour storm event for existing and proposed conditions, including the undetained areas.

Table 5 – Peak Discharge Summary

EXISTING PROPOSED	
1-yr	
E-Total (cfs)	P-Total (cfs)
6.08	2.50
2-yr	
E-Total (cfs)	P-Total (cfs)
6.96	2.84
10-yr	
E-Total (cfs)	P-Total (cfs)
10.24	5.39

100-yr	
E-Total (cfs)	P-Total (cfs)
17.18	14.22

STORM WATER QUALITY

Waukesha County and DNR Code requires water quality best management practices to reduce the post-construction total suspended solids (TSS) load by 40% for re-development based on the average annual rainfall, as compared to no runoff management controls.

Water quality TSS reduction goals are met by directing on site drainage through the proposed storm sewer systems directed to an underground ADS StormTech storage and cleaning systems. The cleaning mechanism of the underground systems occurs in an "Isolator Row" that is completely encased in a geotextile fabric and acts as a sediment trap. A strip of woven geotextile is placed under the entire length of the row between the chambers and the base stone. This provides a floor to the row that will allow water to pass, but will trap sediment and debris. The isolator row is the first row in the chamber bed at each inlet point. Only when the isolator row fills does the water build enough of to reach the manifold invert to the standard rows.

The information provided in Table 6 show the SLAMM input data tributary to the ADS StormTech and the undetained areas.

Table 6 – Proposed SLAMM Input

Source Area	P-1 (acres)	PU-1 (acres)	PU-2 (acres)	O-1 (acres)	Total Area (acres)
Grass	0.05	0.10	0.18	0.002	0.332
Pavement	1.11	0.00	0.01	0.008	1.198
Sidewalk	0.04	0.00	0.00	0.00	0.04
Roof	0.49	0.00	0.00	0.00	0.42
TOTAL	1.69	0.10	0.19	0.01	1.99

Table 7 – Proposed SLAMM Output

	Total Suspended Solids	Percent Reduction
Proposed Site w/o Controls	1,199 lbs.	
Proposed Site with Controls	668.7 lbs.	44.23%

INFILTRATION

This site is required to infiltrate sufficient runoff volume so that the post-development infiltration volume is at least 60% of the pre-development infiltration volume (or depth), based on an average annual rainfall. This Site's infiltration requirement is met considering the amount of green space in the post-developed condition is greater than the pre-developed condition. Below is a brief list of variables needed to calculate pre-developed and post-developed infiltration depths on an average annual basis. See Appendix E for supporting calculations.

Pre-Developed Stay-On Depth (Ave. Annual Basis on 1.98 Ac.) = 7.65 inches

60% Target Stay-On Depth = $7.65 \times 60\% = 4.59$ inches

Post-Developed Stay-On Depth (Ave. Annual Basis on 1.98 Ac.) = **6.80 inches**

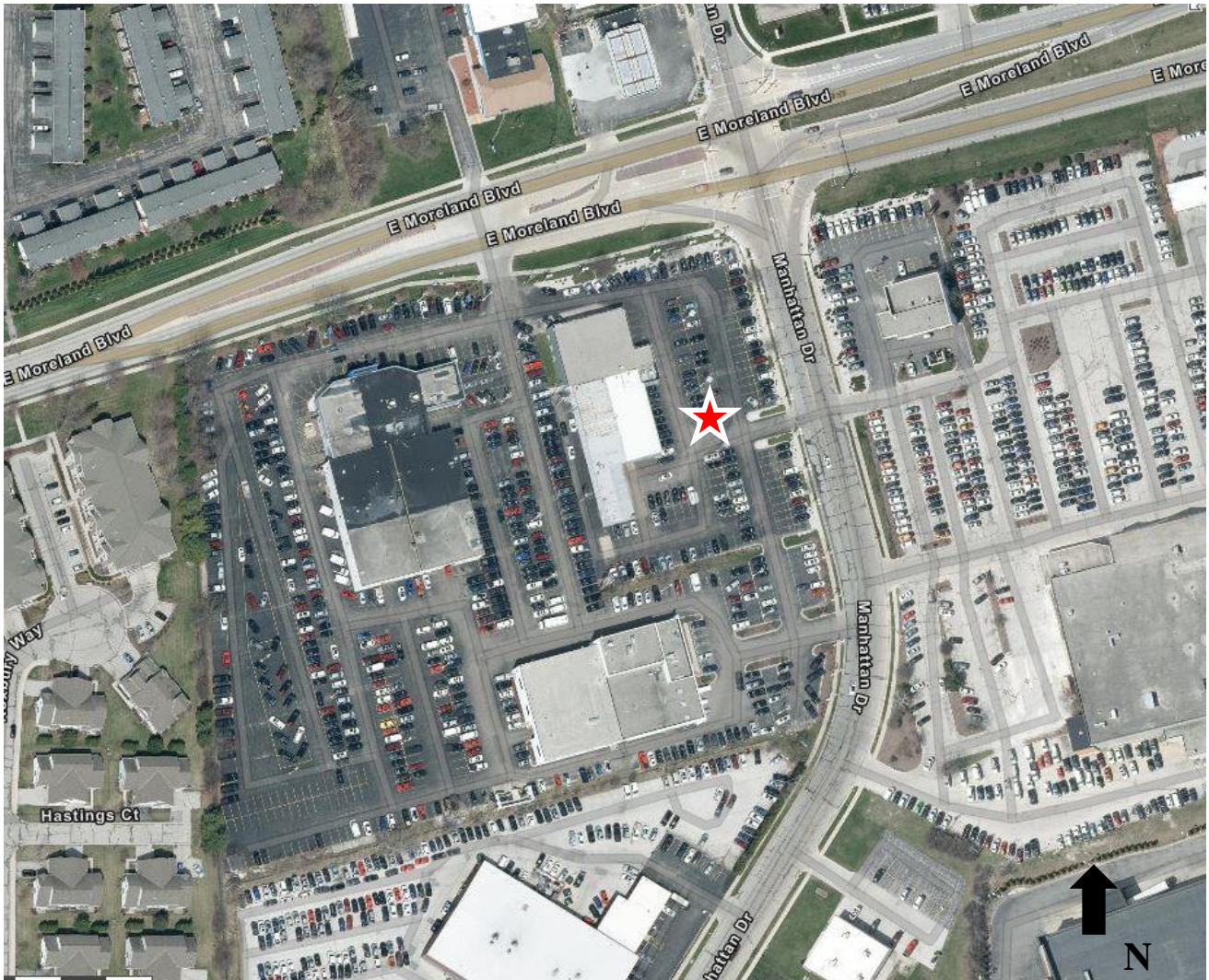
The post-developed stay-on depth of 6.80 inches exceeds the required pre-developed stay-on depth of 4.59 inches.

SUMMARY

Storm water requirements are regulated by the City of Waukesha and The Department of Natural Resources NR151. R.A. Smith, Inc. has completed a storm water management analysis for this site, which meets the applicable regulating agencies requirements.

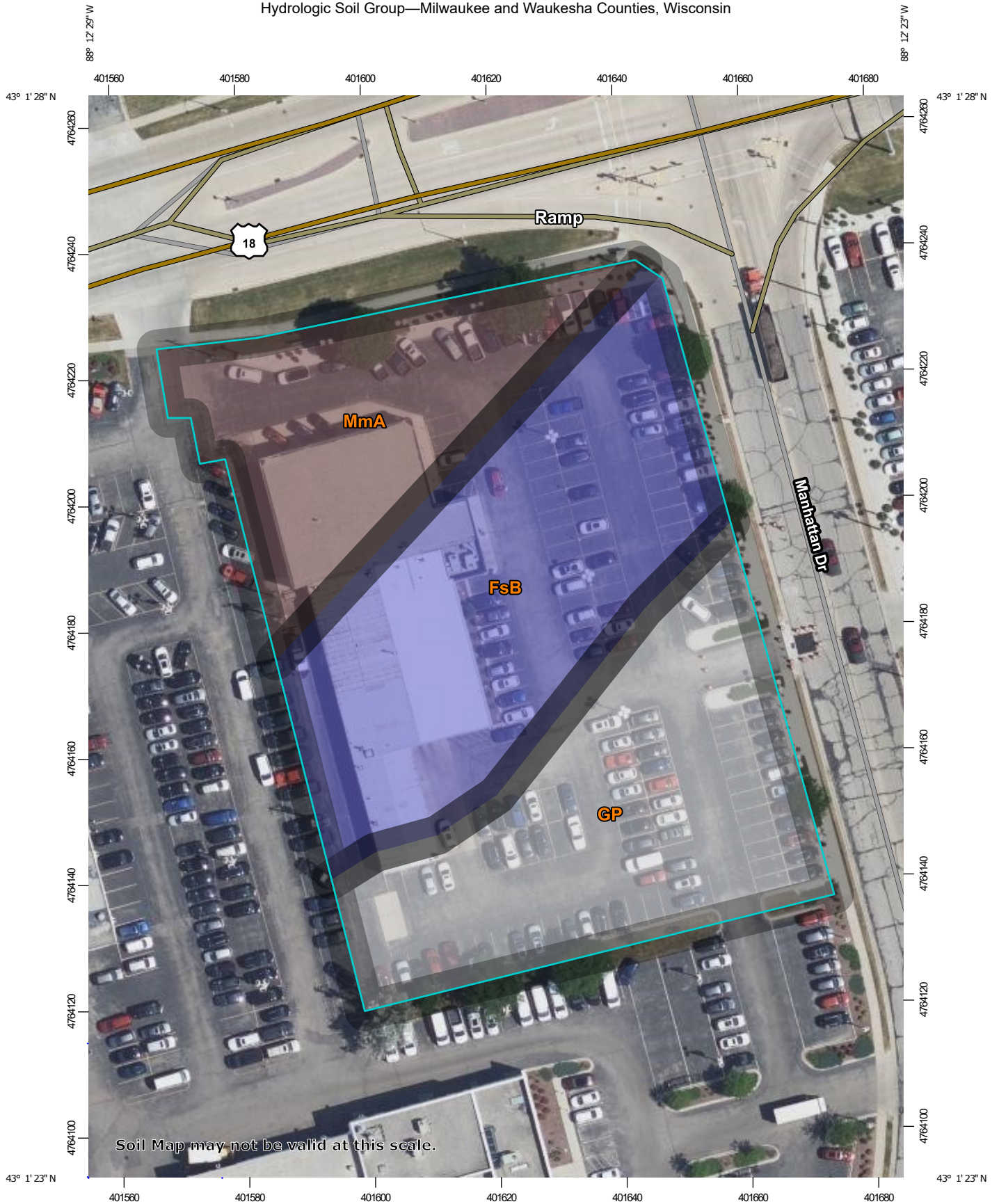
APPENDIX A
LOCATION MAP

Location Map



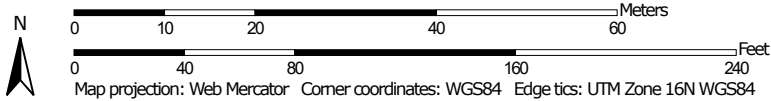
APPENDIX B
NRCS Soil Map

Hydrologic Soil Group—Milwaukee and Waukesha Counties, Wisconsin



Soil Map may not be valid at this scale.

Map Scale: 1:835 if printed on A portrait (8.5" x 11") sheet.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines


 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Milwaukee and Waukesha Counties, Wisconsin
 Survey Area Data: Version 18, Sep 7, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 20, 2020—Aug 20, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FsB	Fox silt loam, 2 to 6 percent slopes	B	0.8	40.6%
GP	Gravel pit		0.7	35.3%
MmA	Matherton silt loam, 1 to 3 percent slopes	B/D	0.5	24.2%
Totals for Area of Interest			2.0	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

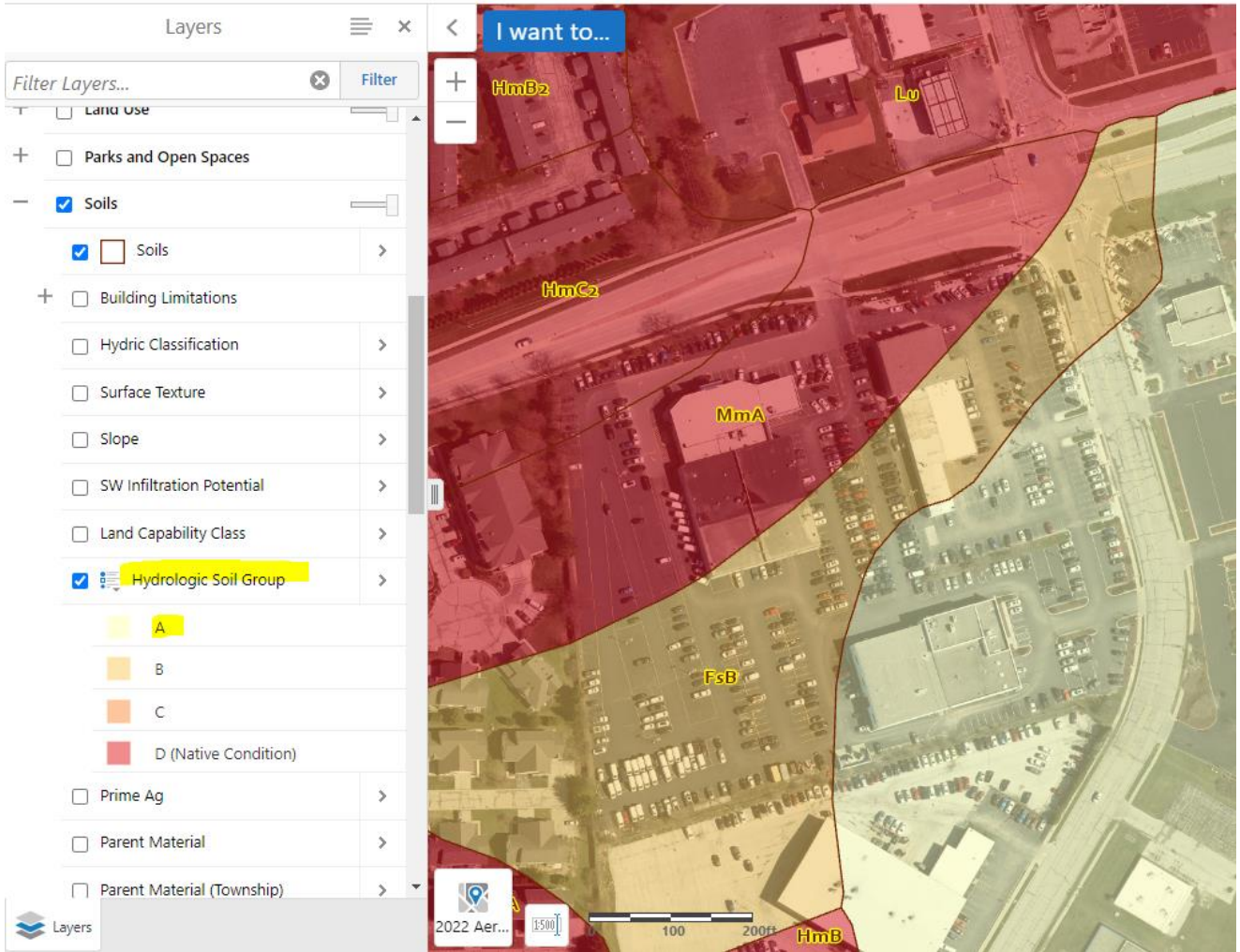
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

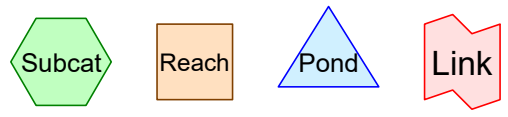
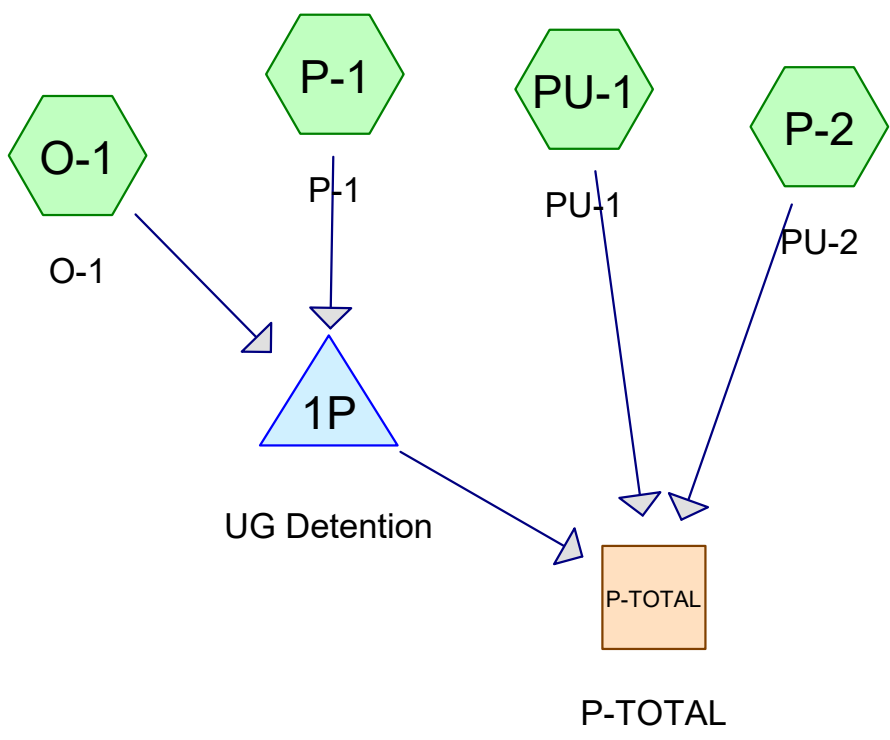
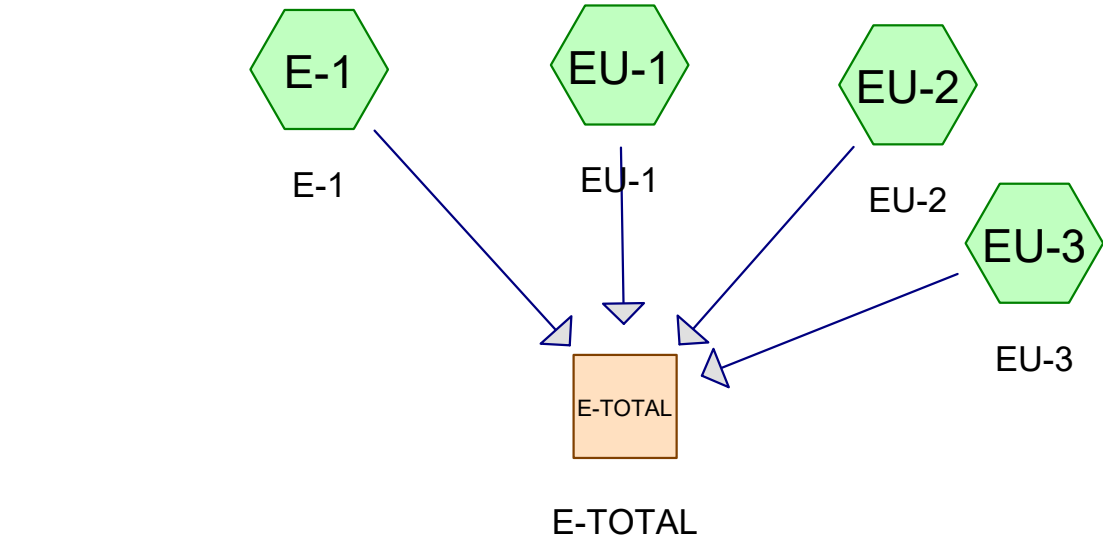
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



APPENDIX C

Hydrology Calculations (1-yr, 2-yr, 10-yr, 100-yr)



Routing Diagram for 3220213 - Waukesha Nissan_230530
 Prepared by {enter your company name here}, Printed 5/30/2023
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3220213 - Waukesha Nissan_230530

Prepared by {enter your company name here}

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	MSE 24-hr	3	Default	24.00	1	2.40	2
2	2-yr	MSE 24-hr	3	Default	24.00	1	2.70	2
3	10-yr	MSE 24-hr	3	Default	24.00	1	3.81	2
4	100-yr	MSE 24-hr	3	Default	24.00	1	6.18	2

3220213 - Waukesha Nissan_230530

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.502	39	>75% Grass cover, Good, HSG A (E-1, EU-1, EU-2, EU-3, O-1, P-1, P-2, PU-1)
2.518	98	Paved parking, HSG A (E-1, EU-1, EU-2, EU-3, O-1, P-1, P-2)
0.350	98	Roofs, HSG A (E-1, EU-1)
0.110	98	Unconnected pavement, HSG A (E-1, P-1)
0.490	98	Unconnected roofs, HSG A (P-1)
3.970	91	TOTAL AREA

3220213 - Waukesha Nissan_230530

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.970	HSG A	E-1, EU-1, EU-2, EU-3, O-1, P-1, P-2, PU-1
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
3.970		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.502	0.000	0.000	0.000	0.000	0.502	>75% Grass cover, Good	E-1, EU-1, EU-2, EU-3, O-1, P-1, P-2, PU-1
2.518	0.000	0.000	0.000	0.000	2.518	Paved parking	E-1, EU-1, EU-2, EU-3, O-1, P-1, P-2
0.350	0.000	0.000	0.000	0.000	0.350	Roofs	E-1, EU-1
0.110	0.000	0.000	0.000	0.000	0.110	Unconnected pavement	E-1, P-1
0.490	0.000	0.000	0.000	0.000	0.490	Unconnected roofs	P-1
3.970	0.000	0.000	0.000	0.000	3.970	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	1P	94.13	94.07	25.3	0.0024	0.012	0.0	12.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: E-1 Runoff Area=1.360 ac 96.32% Impervious Runoff Depth>1.96"
Tc=6.0 min CN=96 Runoff=4.56 cfs 0.222 af

Subcatchment EU-1: EU-1 Runoff Area=0.490 ac 91.84% Impervious Runoff Depth>1.68"
Tc=6.0 min CN=93 Runoff=1.48 cfs 0.069 af

Subcatchment EU-2: EU-2 Runoff Area=0.080 ac 25.00% Impervious Runoff Depth>0.05"
Tc=0.0 min CN=54 Runoff=0.00 cfs 0.000 af

Subcatchment EU-3: EU-3 Runoff Area=0.050 ac 60.00% Impervious Runoff Depth>0.55"
Tc=6.0 min CN=74 Runoff=0.05 cfs 0.002 af

Subcatchment O-1: O-1 Runoff Area=0.010 ac 80.00% Impervious Runoff Depth>1.16"
Tc=6.0 min CN=86 Runoff=0.02 cfs 0.001 af

Subcatchment P-1: P-1 Runoff Area=1.690 ac 97.04% Impervious Runoff Depth>1.96"
Tc=6.0 min CN=96 Runoff=5.66 cfs 0.276 af

Subcatchment P-2: PU-2 Runoff Area=0.190 ac 5.26% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=42 Runoff=0.00 cfs 0.000 af

Subcatchment PU-1: PU-1 Runoff Area=0.100 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Reach E-TOTAL: E-TOTAL Inflow=6.08 cfs 0.294 af
Outflow=6.08 cfs 0.294 af

Reach P-TOTAL: P-TOTAL Inflow=2.50 cfs 0.274 af
Outflow=2.50 cfs 0.274 af

Pond 1P: UG Detention Peak Elev=95.07' Storage=0.076 af Inflow=5.68 cfs 0.277 af
Outflow=2.50 cfs 0.274 af

Total Runoff Area = 3.970 ac Runoff Volume = 0.571 af Average Runoff Depth = 1.73"
12.64% Pervious = 0.502 ac 87.36% Impervious = 3.468 ac

Summary for Subcatchment E-1: E-1

Runoff = 4.56 cfs @ 12.13 hrs, Volume= 0.222 af, Depth> 1.96"

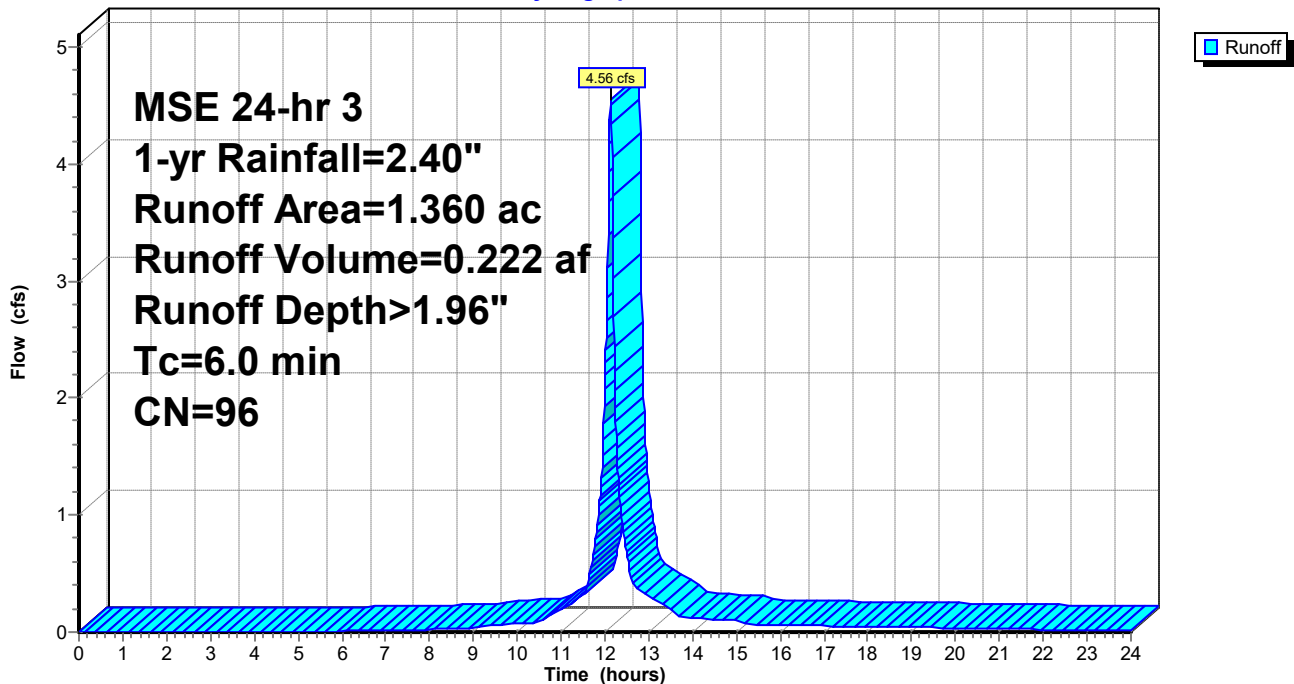
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.020	98	Roofs, HSG A
1.220	98	Paved parking, HSG A
0.070	98	Unconnected pavement, HSG A
1.360	96	Weighted Average
0.050		3.68% Pervious Area
1.310		96.32% Impervious Area
0.070		5.34% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment E-1: E-1

Hydrograph



Summary for Subcatchment EU-1: EU-1

Runoff = 1.48 cfs @ 12.13 hrs, Volume= 0.069 af, Depth> 1.68"

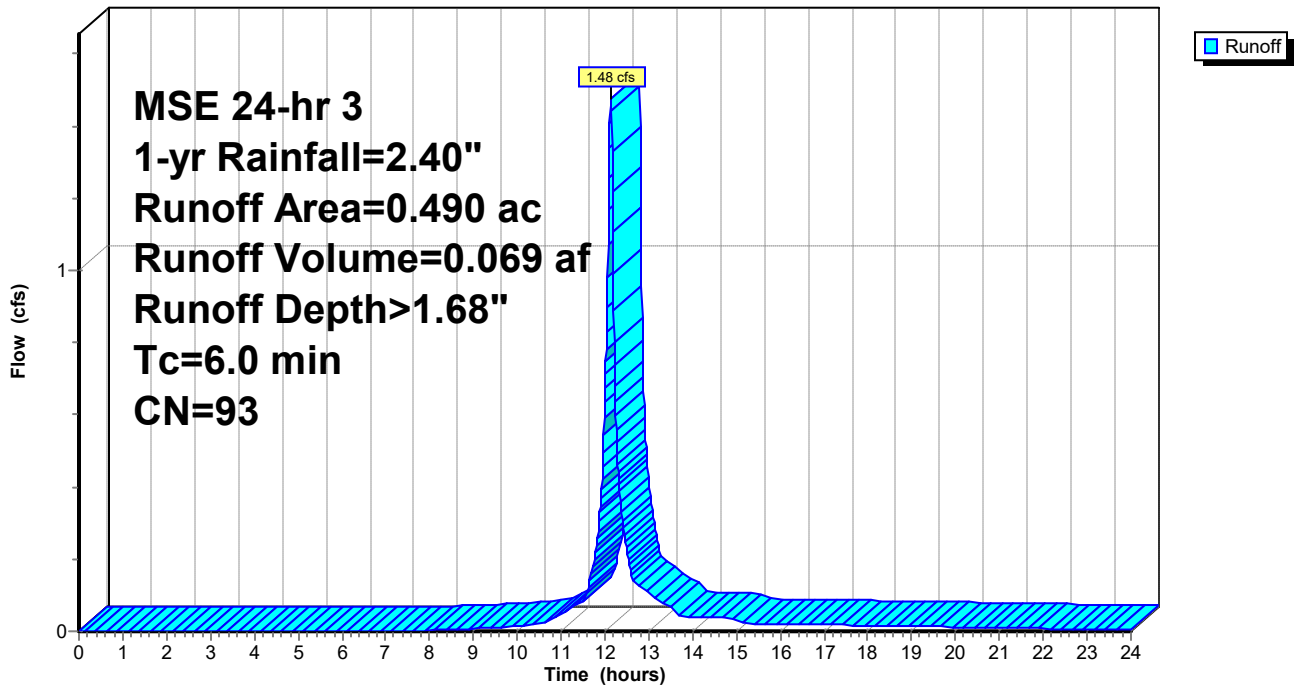
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
0.120	98	Paved parking, HSG A
0.330	98	Roofs, HSG A
0.490	93	Weighted Average
0.040		8.16% Pervious Area
0.450		91.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment EU-1: EU-1

Hydrograph



Summary for Subcatchment EU-2: EU-2

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

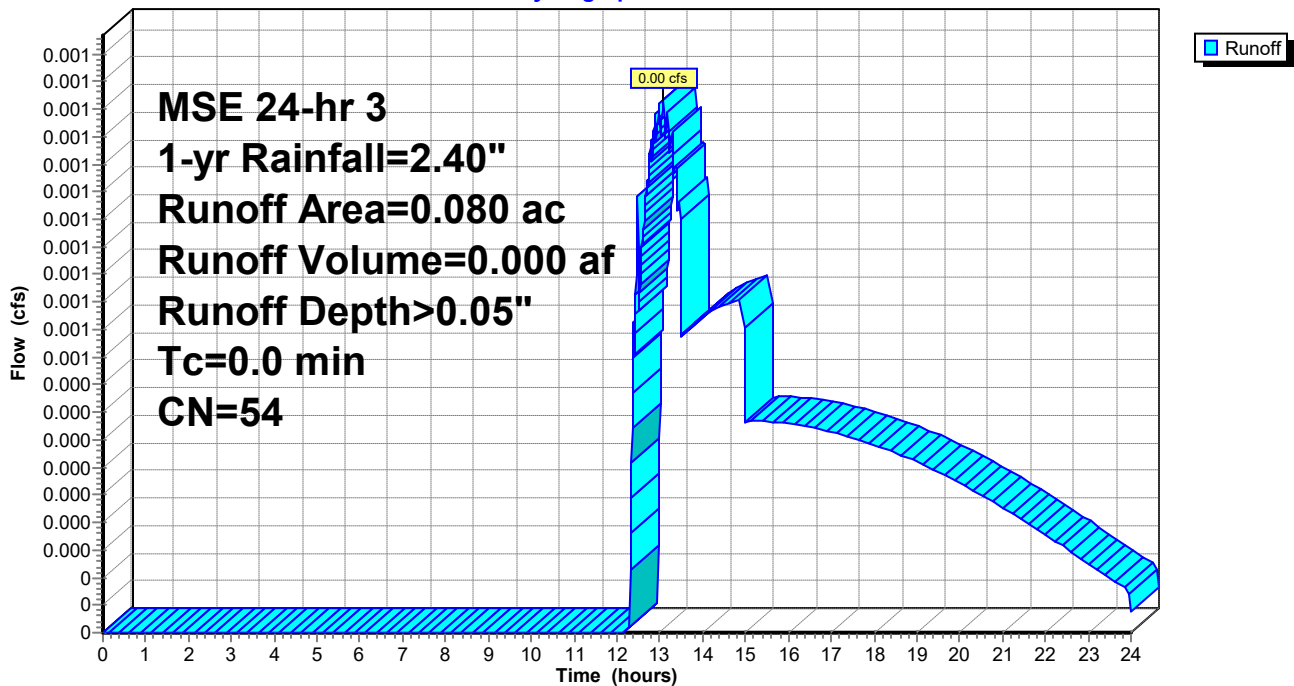
Runoff = 0.00 cfs @ 13.09 hrs, Volume= 0.000 af, Depth> 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.060	39	>75% Grass cover, Good, HSG A
0.020	98	Paved parking, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

Subcatchment EU-2: EU-2

Hydrograph



Summary for Subcatchment EU-3: EU-3

Runoff = 0.05 cfs @ 12.14 hrs, Volume= 0.002 af, Depth> 0.55"

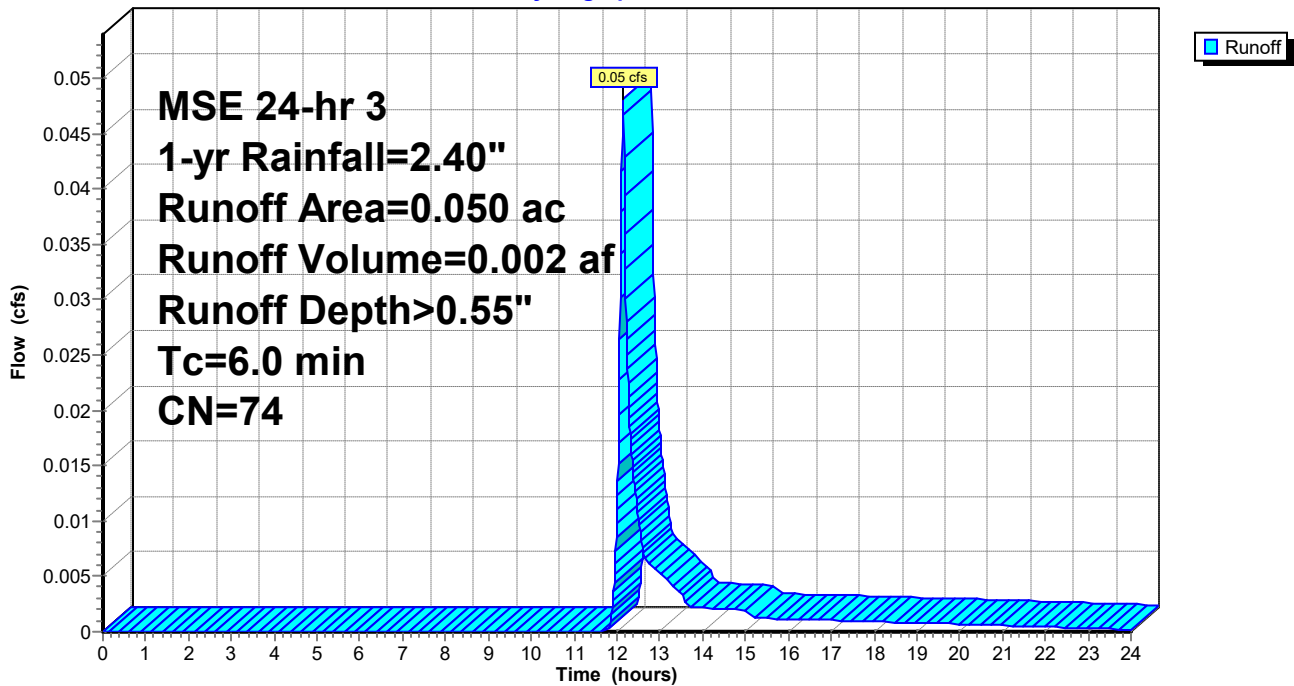
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.030	98	Paved parking, HSG A
0.050	74	Weighted Average
0.020		40.00% Pervious Area
0.030		60.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment EU-3: EU-3

Hydrograph



Summary for Subcatchment O-1: O-1

Runoff = 0.02 cfs @ 12.13 hrs, Volume= 0.001 af, Depth> 1.16"

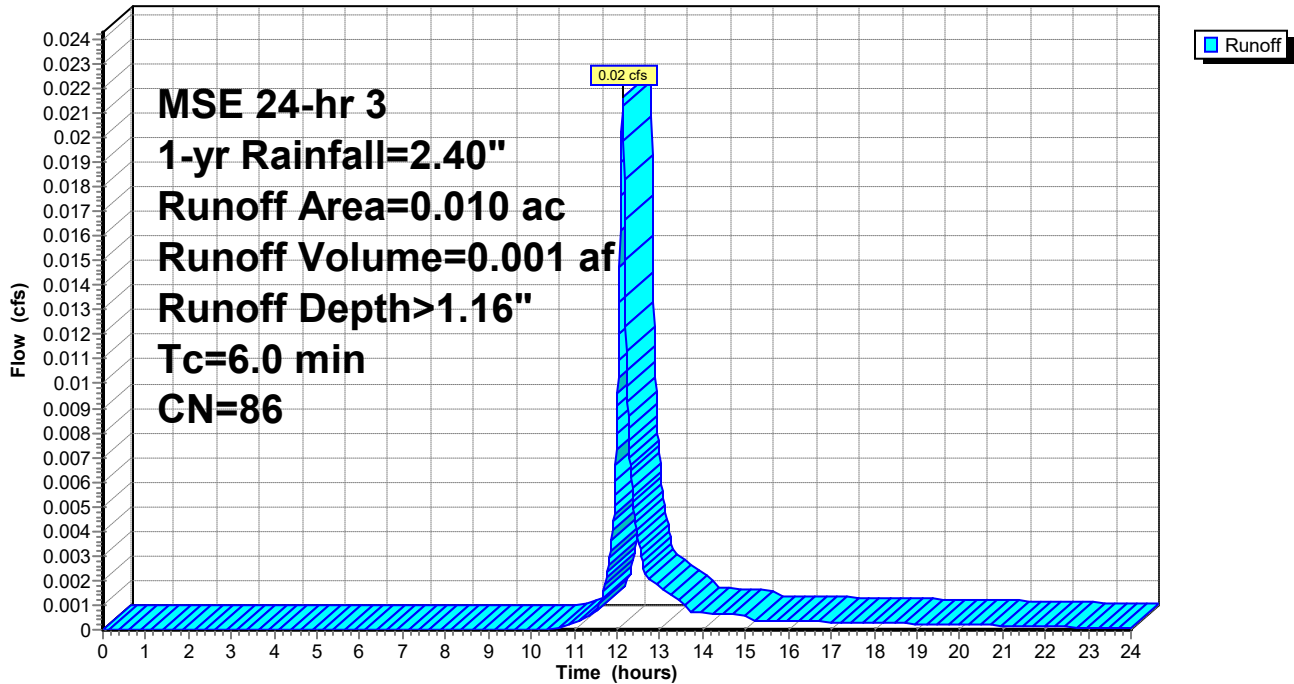
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.002	39	>75% Grass cover, Good, HSG A
0.008	98	Paved parking, HSG A
0.010	86	Weighted Average
0.002		20.00% Pervious Area
0.008		80.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment O-1: O-1

Hydrograph



Summary for Subcatchment P-1: P-1

Runoff = 5.66 cfs @ 12.13 hrs, Volume= 0.276 af, Depth> 1.96"

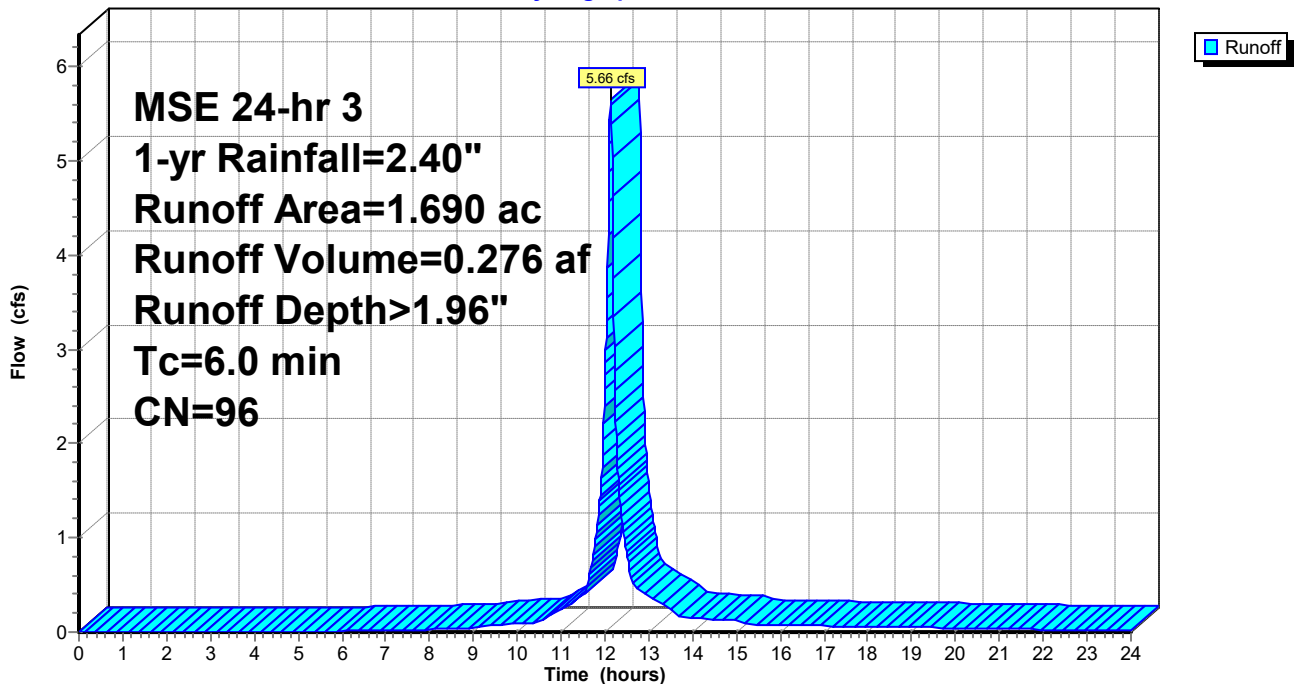
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
1.110	98	Paved parking, HSG A
0.040	98	Unconnected pavement, HSG A
0.490	98	Unconnected roofs, HSG A
1.690	96	Weighted Average
0.050		2.96% Pervious Area
1.640		97.04% Impervious Area
0.530		32.32% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-1: P-1

Hydrograph



Summary for Subcatchment P-2: PU-2

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

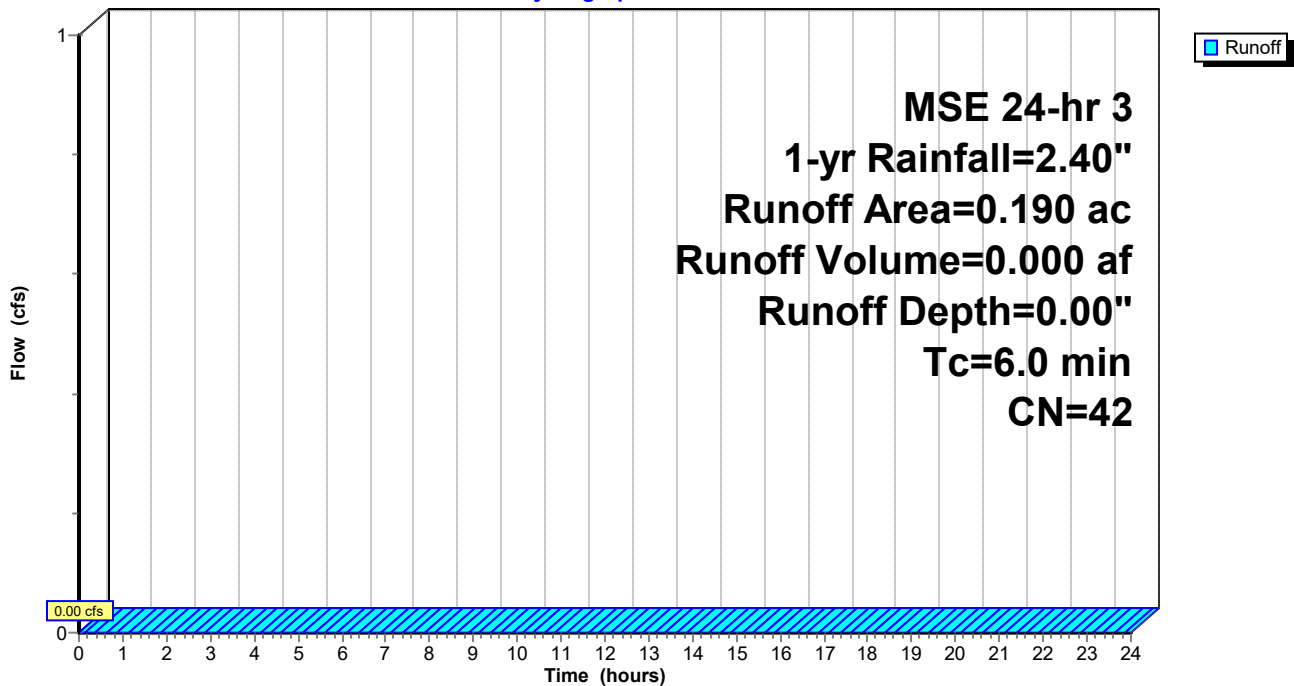
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.180	39	>75% Grass cover, Good, HSG A
0.010	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
0.190	42	Weighted Average
0.180		94.74% Pervious Area
0.010		5.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-2: PU-2

Hydrograph



Summary for Subcatchment PU-1: PU-1

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

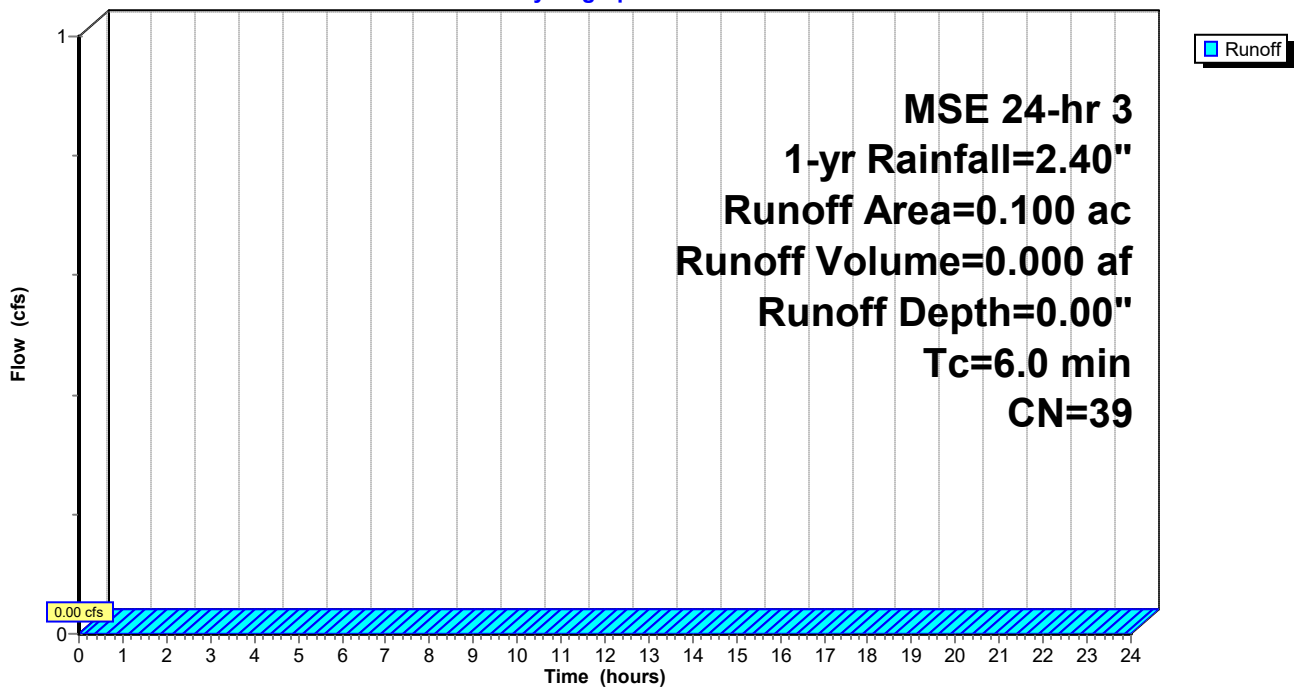
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 1-yr Rainfall=2.40"

Area (ac)	CN	Description
0.100	39	>75% Grass cover, Good, HSG A
0.000	98	Paved parking, HSG A
0.000	98	Unconnected roofs, HSG A
0.100	39	Weighted Average
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment PU-1: PU-1

Hydrograph



Summary for Reach E-TOTAL: E-TOTAL

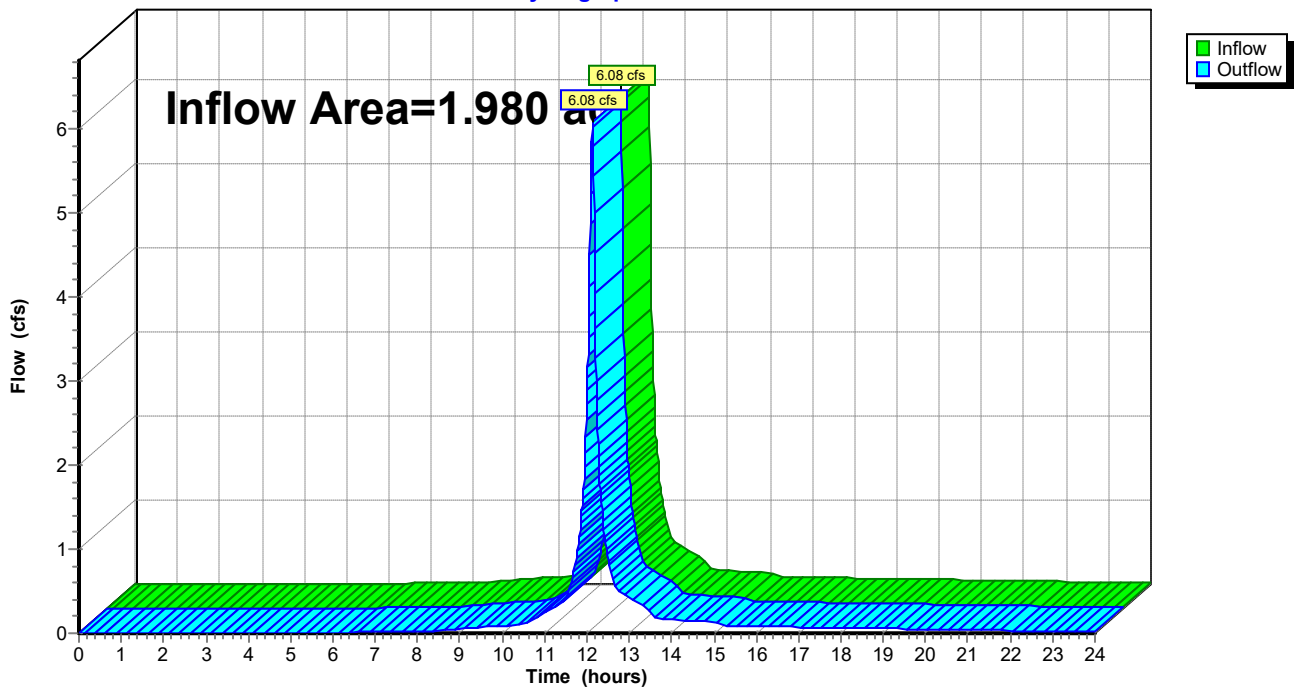
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.980 ac, 91.41% Impervious, Inflow Depth > 1.78" for 1-yr event
Inflow = 6.08 cfs @ 12.13 hrs, Volume= 0.294 af
Outflow = 6.08 cfs @ 12.13 hrs, Volume= 0.294 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach E-TOTAL: E-TOTAL

Hydrograph



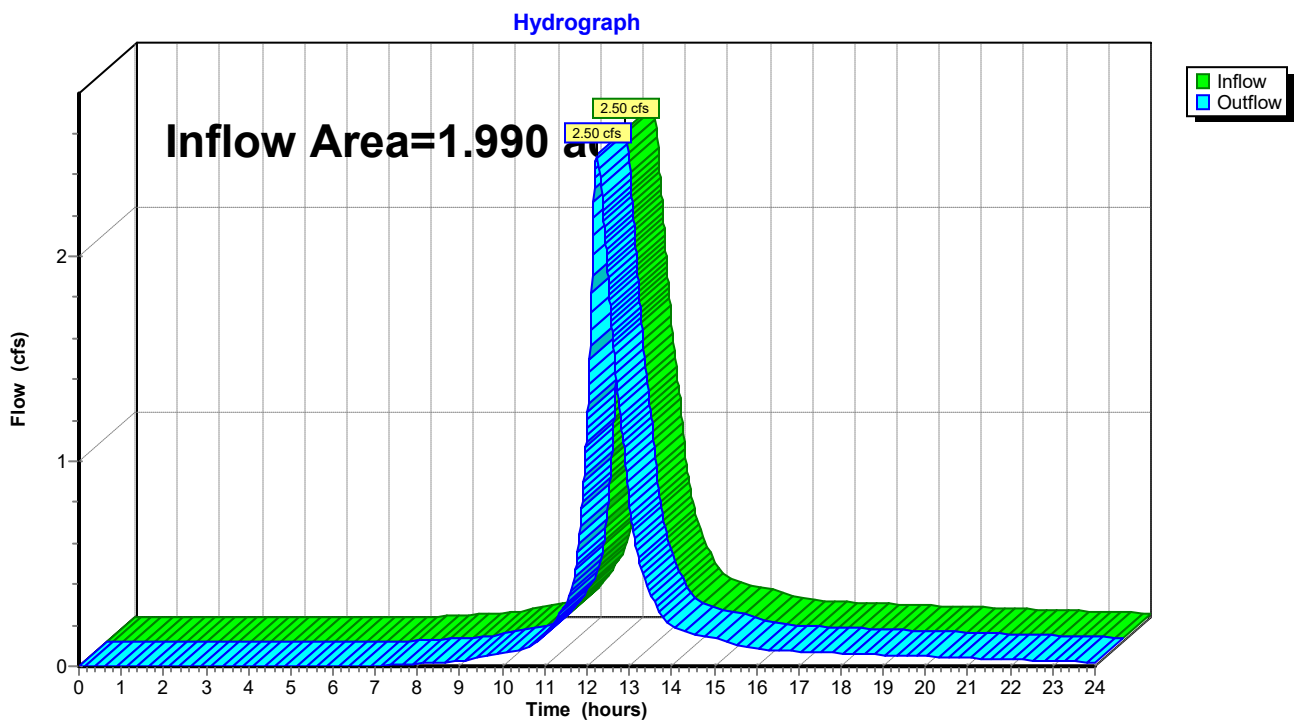
Summary for Reach P-TOTAL: P-TOTAL

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 83.32% Impervious, Inflow Depth > 1.65" for 1-yr event
Inflow = 2.50 cfs @ 12.23 hrs, Volume= 0.274 af
Outflow = 2.50 cfs @ 12.23 hrs, Volume= 0.274 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach P-TOTAL: P-TOTAL



Summary for Pond 1P: UG Detention

Inflow Area = 1.700 ac, 96.94% Impervious, Inflow Depth > 1.96" for 1-yr event
 Inflow = 5.68 cfs @ 12.13 hrs, Volume= 0.277 af
 Outflow = 2.50 cfs @ 12.23 hrs, Volume= 0.274 af, Atten= 56%, Lag= 6.3 min
 Primary = 2.50 cfs @ 12.23 hrs, Volume= 0.274 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.07' @ 12.23 hrs Surf.Area= 0.141 ac Storage= 0.076 af

Plug-Flow detention time= 34.3 min calculated for 0.274 af (99% of inflow)
 Center-of-Mass det. time= 27.1 min (798.7 - 771.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.13'	0.079 af	44.83'W x 110.00'L x 2.33'H Stone Bed 0.264 af Overall - 0.066 af Embedded = 0.198 af x 40.0% Voids
#2A	94.63'	0.066 af	ADS_StormTech SC-310 +Cap x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 13 Rows
#3B	94.13'	0.020 af	18.17'W x 67.28'L x 2.33'H Field B 0.065 af Overall - 0.015 af Embedded = 0.050 af x 40.0% Voids
#4B	94.63'	0.015 af	ADS_StormTech SC-310 +Cap x 45 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 5 Rows
		0.181 af	Total Available Storage

Storage Group A created with Chamber Wizard
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.13'	12.0" Round Culvert L= 25.3' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 94.13' / 94.07' S= 0.0024 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Primary	94.13'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	95.30'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.50 cfs @ 12.23 hrs HW=95.07' (Free Discharge)

- 1=Culvert (Barrel Controls 1.71 cfs @ 2.91 fps)
- 2=Orifice/Grate (Orifice Controls 0.78 cfs @ 3.99 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1P: UG Detention - Chamber Wizard Stone Bed

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

15 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 108.00' Row Length +12.0" End Stone x 2 = 110.00' Base Length

13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

195 Chambers x 14.7 cf = 2,874.7 cf Chamber Storage

11,507.2 cf Field - 2,874.7 cf Chambers = 8,632.5 cf Stone x 40.0% Voids = 3,453.0 cf Stone Storage

Chamber Storage + Stone Storage = 6,327.7 cf = 0.145 af

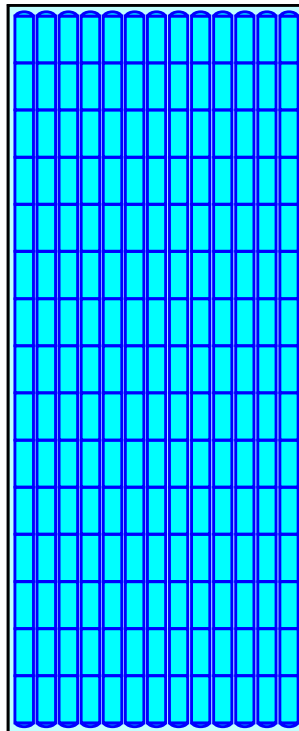
Overall Storage Efficiency = 55.0%

Overall System Size = 110.00' x 44.83' x 2.33'

195 Chambers

426.2 cy Field

319.7 cy Stone



Pond 1P: UG Detention - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.9 cf Field - 663.4 cf Chambers = 2,188.5 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af

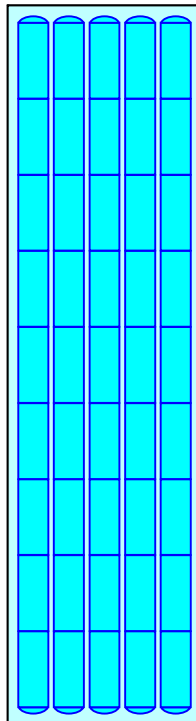
Overall Storage Efficiency = 54.0%

Overall System Size = 67.28' x 18.17' x 2.33'

45 Chambers

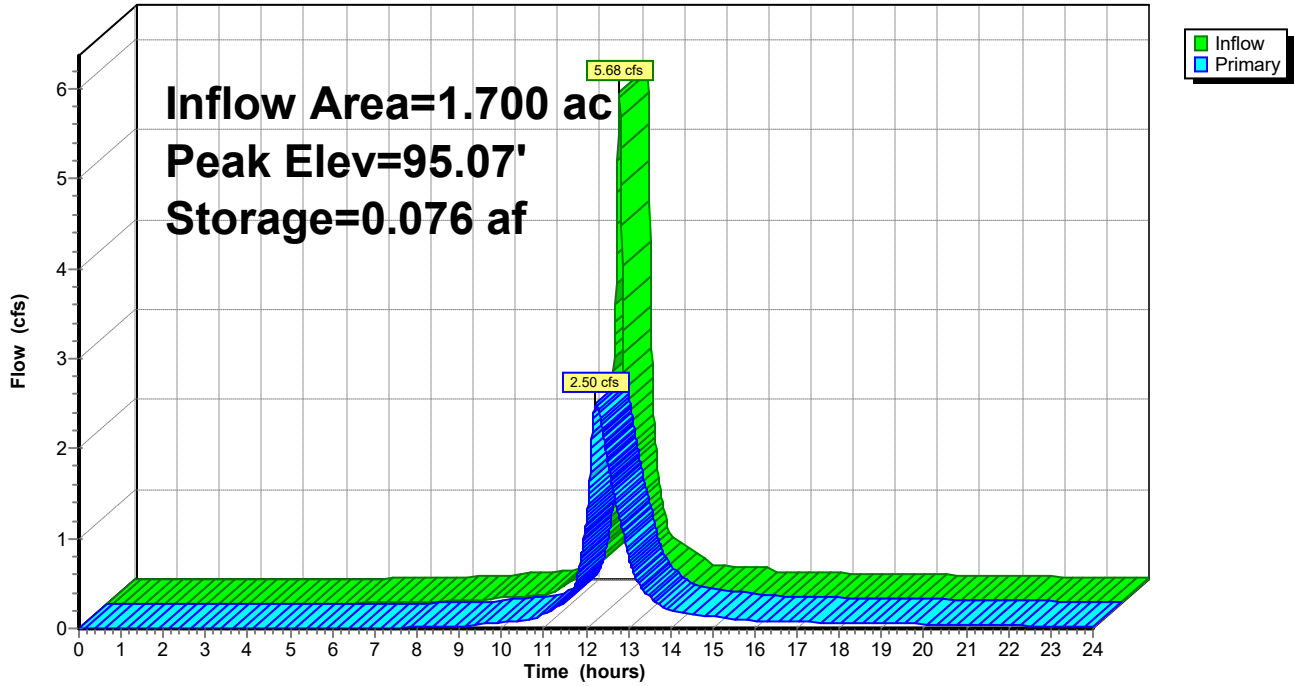
105.6 cy Field

81.1 cy Stone



Pond 1P: UG Detention

Hydrograph



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: E-1 Runoff Area=1.360 ac 96.32% Impervious Runoff Depth>2.26"
Tc=6.0 min CN=96 Runoff=5.19 cfs 0.256 af

Subcatchment EU-1: EU-1 Runoff Area=0.490 ac 91.84% Impervious Runoff Depth>1.97"
Tc=6.0 min CN=93 Runoff=1.71 cfs 0.080 af

Subcatchment EU-2: EU-2 Runoff Area=0.080 ac 25.00% Impervious Runoff Depth>0.10"
Tc=0.0 min CN=54 Runoff=0.00 cfs 0.001 af

Subcatchment EU-3: EU-3 Runoff Area=0.050 ac 60.00% Impervious Runoff Depth>0.72"
Tc=6.0 min CN=74 Runoff=0.07 cfs 0.003 af

Subcatchment O-1: O-1 Runoff Area=0.010 ac 80.00% Impervious Runoff Depth>1.41"
Tc=6.0 min CN=86 Runoff=0.03 cfs 0.001 af

Subcatchment P-1: P-1 Runoff Area=1.690 ac 97.04% Impervious Runoff Depth>2.26"
Tc=6.0 min CN=96 Runoff=6.45 cfs 0.318 af

Subcatchment P-2: PU-2 Runoff Area=0.190 ac 5.26% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=42 Runoff=0.00 cfs 0.000 af

Subcatchment PU-1: PU-1 Runoff Area=0.100 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Reach E-TOTAL: E-TOTAL Inflow=6.96 cfs 0.340 af
Outflow=6.96 cfs 0.340 af

Reach P-TOTAL: P-TOTAL Inflow=2.84 cfs 0.315 af
Outflow=2.84 cfs 0.315 af

Pond 1P: UG Detention Peak Elev=95.17' Storage=0.087 af Inflow=6.48 cfs 0.319 af
Outflow=2.84 cfs 0.315 af

Total Runoff Area = 3.970 ac Runoff Volume = 0.659 af Average Runoff Depth = 1.99"
12.64% Pervious = 0.502 ac 87.36% Impervious = 3.468 ac

Summary for Subcatchment E-1: E-1

Runoff = 5.19 cfs @ 12.13 hrs, Volume= 0.256 af, Depth> 2.26"

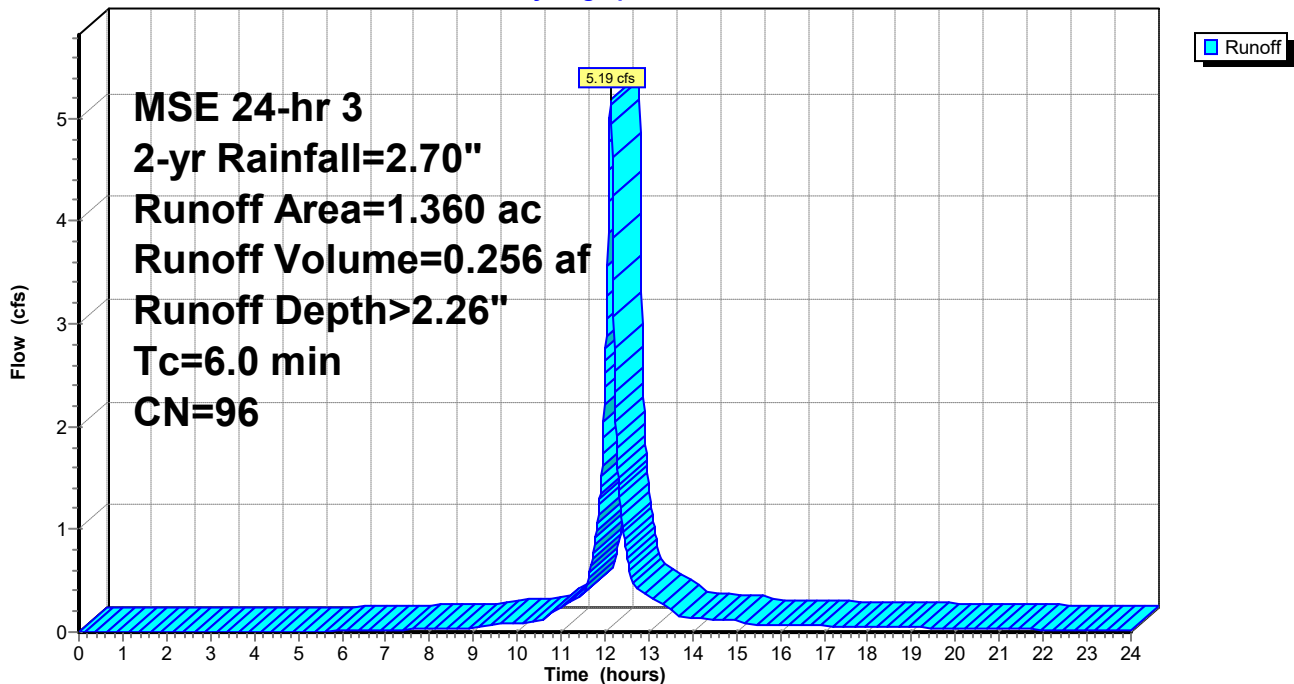
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.020	98	Roofs, HSG A
1.220	98	Paved parking, HSG A
0.070	98	Unconnected pavement, HSG A
1.360	96	Weighted Average
0.050		3.68% Pervious Area
1.310		96.32% Impervious Area
0.070		5.34% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment E-1: E-1

Hydrograph



Summary for Subcatchment EU-1: EU-1

Runoff = 1.71 cfs @ 12.13 hrs, Volume= 0.080 af, Depth> 1.97"

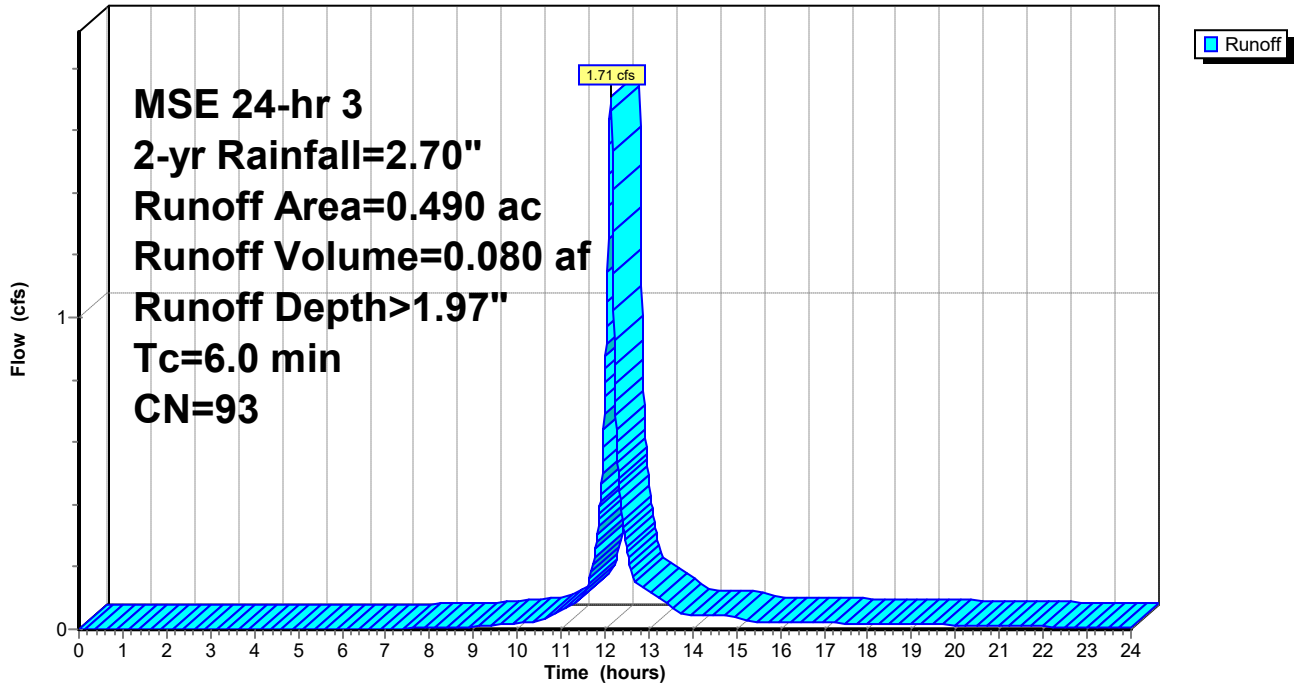
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
0.120	98	Paved parking, HSG A
0.330	98	Roofs, HSG A
0.490	93	Weighted Average
0.040		8.16% Pervious Area
0.450		91.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment EU-1: EU-1

Hydrograph



Summary for Subcatchment EU-2: EU-2

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

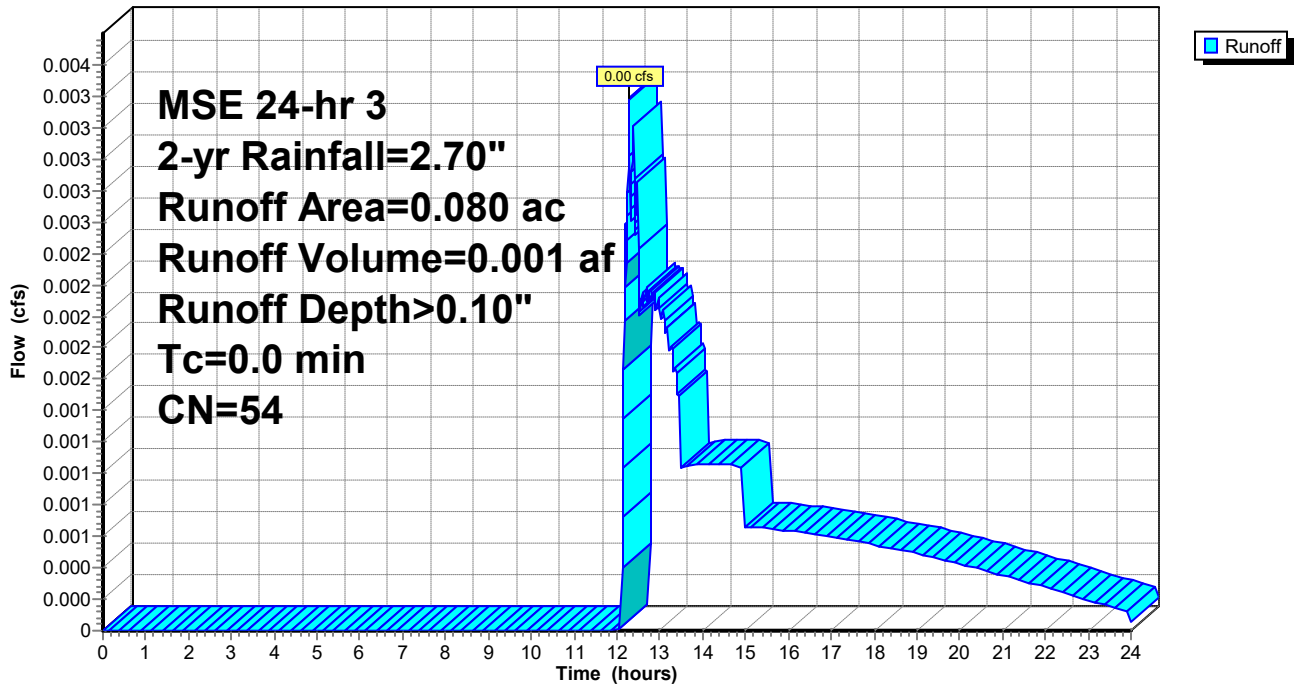
Runoff = 0.00 cfs @ 12.29 hrs, Volume= 0.001 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.060	39	>75% Grass cover, Good, HSG A
0.020	98	Paved parking, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

Subcatchment EU-2: EU-2

Hydrograph



Summary for Subcatchment EU-3: EU-3

Runoff = 0.07 cfs @ 12.14 hrs, Volume= 0.003 af, Depth> 0.72"

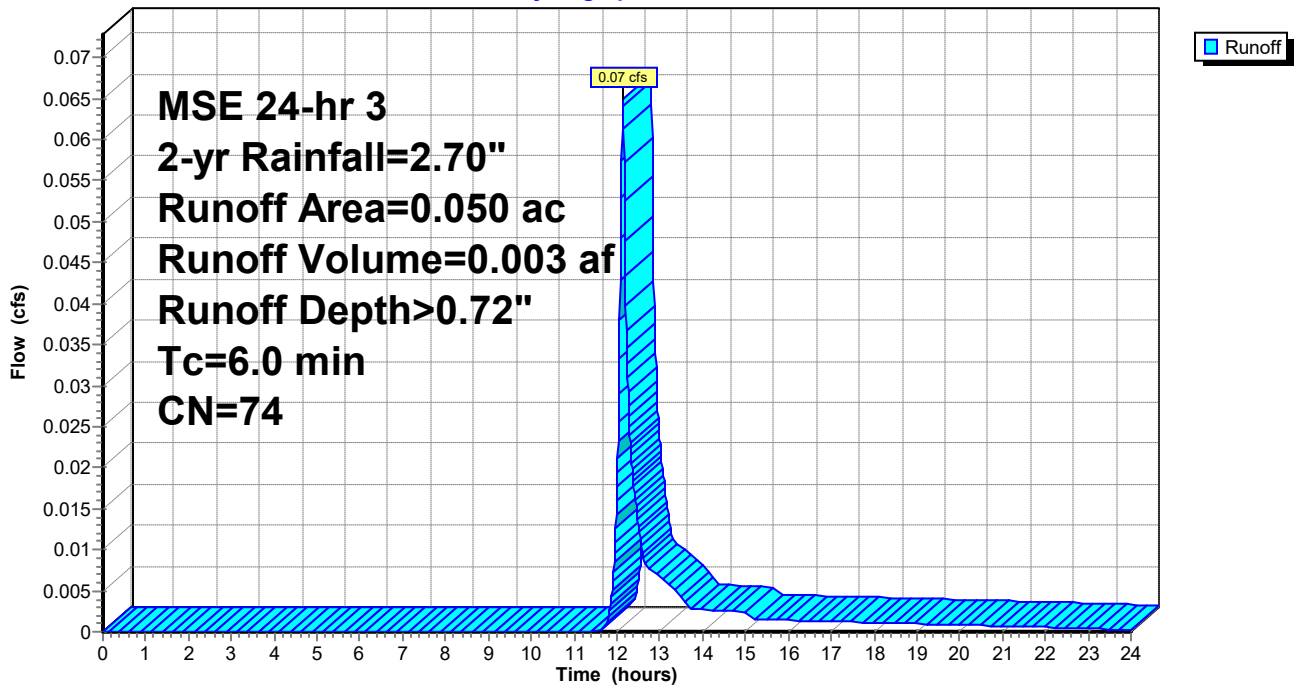
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.030	98	Paved parking, HSG A
0.050	74	Weighted Average
0.020		40.00% Pervious Area
0.030		60.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment EU-3: EU-3

Hydrograph



Summary for Subcatchment O-1: O-1

Runoff = 0.03 cfs @ 12.13 hrs, Volume= 0.001 af, Depth> 1.41"

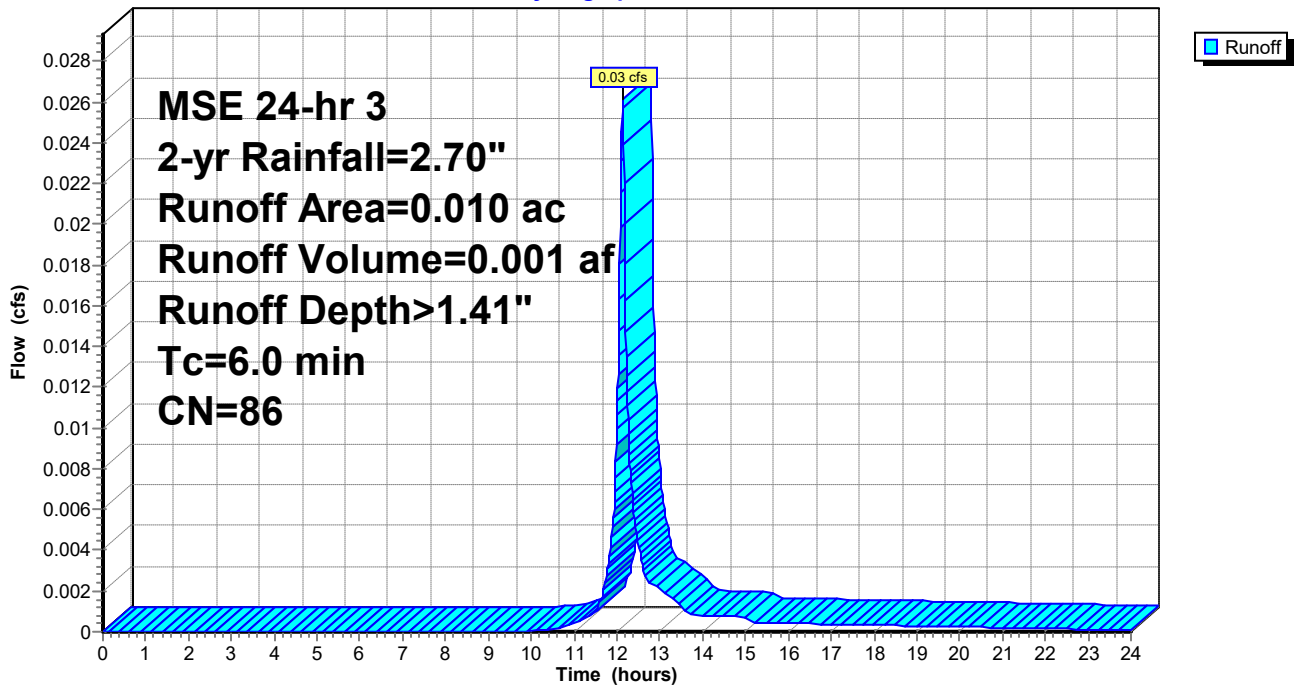
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.002	39	>75% Grass cover, Good, HSG A
0.008	98	Paved parking, HSG A
0.010	86	Weighted Average
0.002		20.00% Pervious Area
0.008		80.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment O-1: O-1

Hydrograph



Summary for Subcatchment P-1: P-1

Runoff = 6.45 cfs @ 12.13 hrs, Volume= 0.318 af, Depth> 2.26"

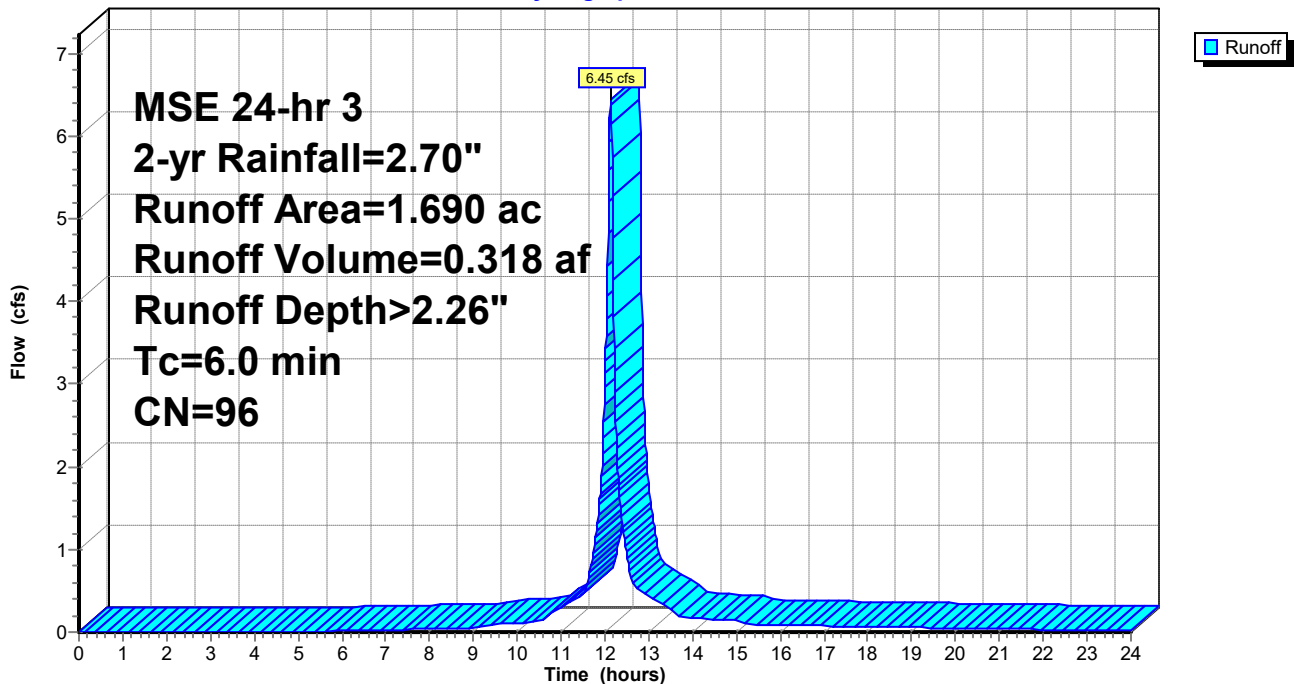
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
1.110	98	Paved parking, HSG A
0.040	98	Unconnected pavement, HSG A
0.490	98	Unconnected roofs, HSG A
1.690	96	Weighted Average
0.050		2.96% Pervious Area
1.640		97.04% Impervious Area
0.530		32.32% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-1: P-1

Hydrograph



Summary for Subcatchment P-2: PU-2

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

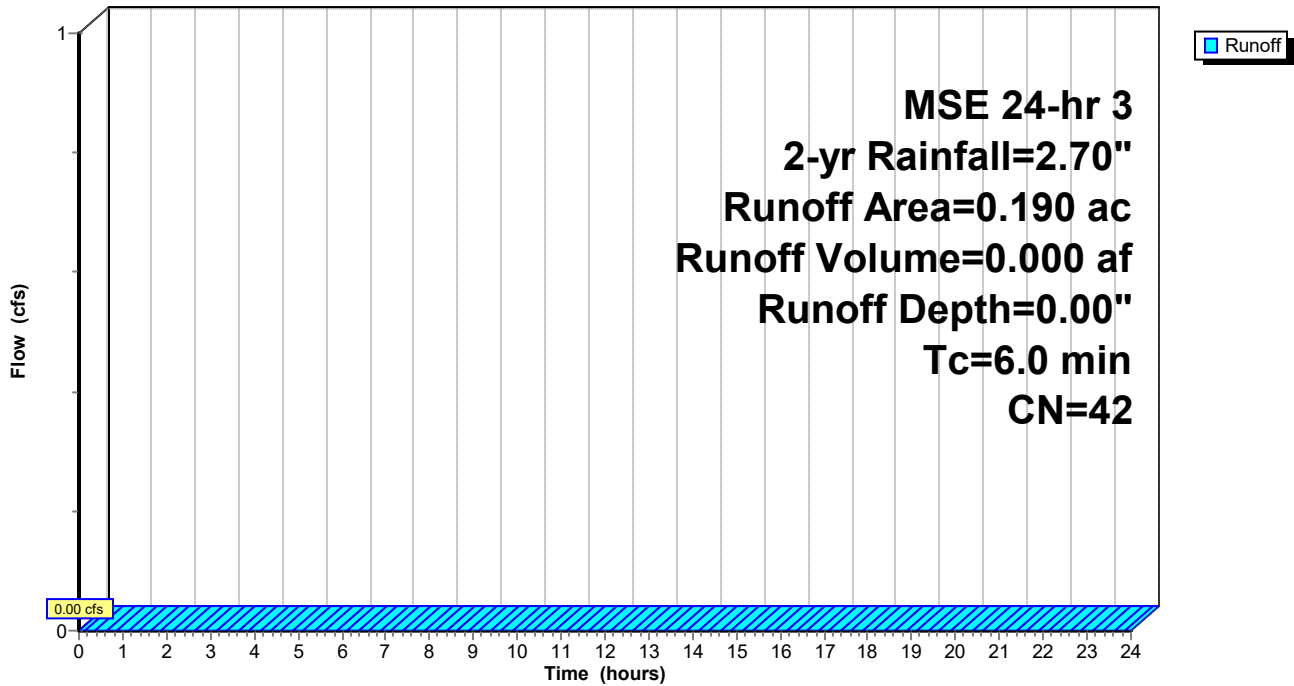
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.180	39	>75% Grass cover, Good, HSG A
0.010	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
0.190	42	Weighted Average
0.180		94.74% Pervious Area
0.010		5.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-2: PU-2

Hydrograph



Summary for Subcatchment PU-1: PU-1

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

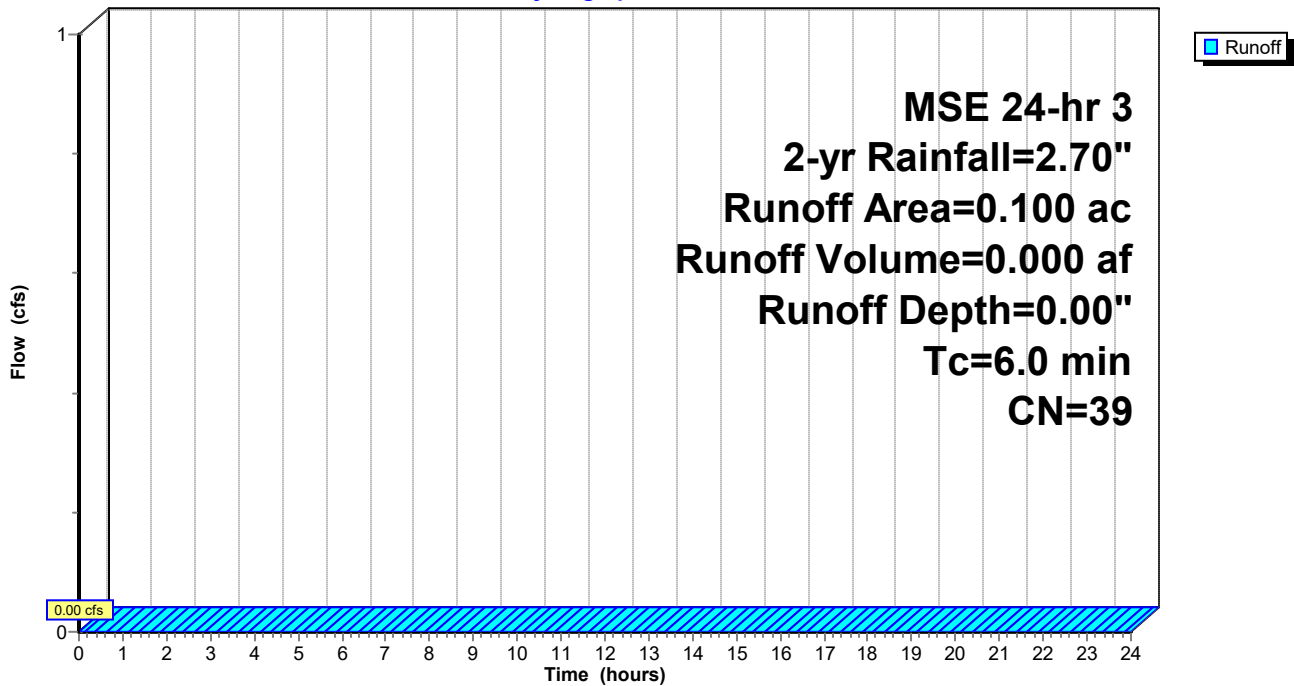
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 2-yr Rainfall=2.70"

Area (ac)	CN	Description
0.100	39	>75% Grass cover, Good, HSG A
0.000	98	Paved parking, HSG A
0.000	98	Unconnected roofs, HSG A
0.100	39	Weighted Average
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment PU-1: PU-1

Hydrograph



Summary for Reach E-TOTAL: E-TOTAL

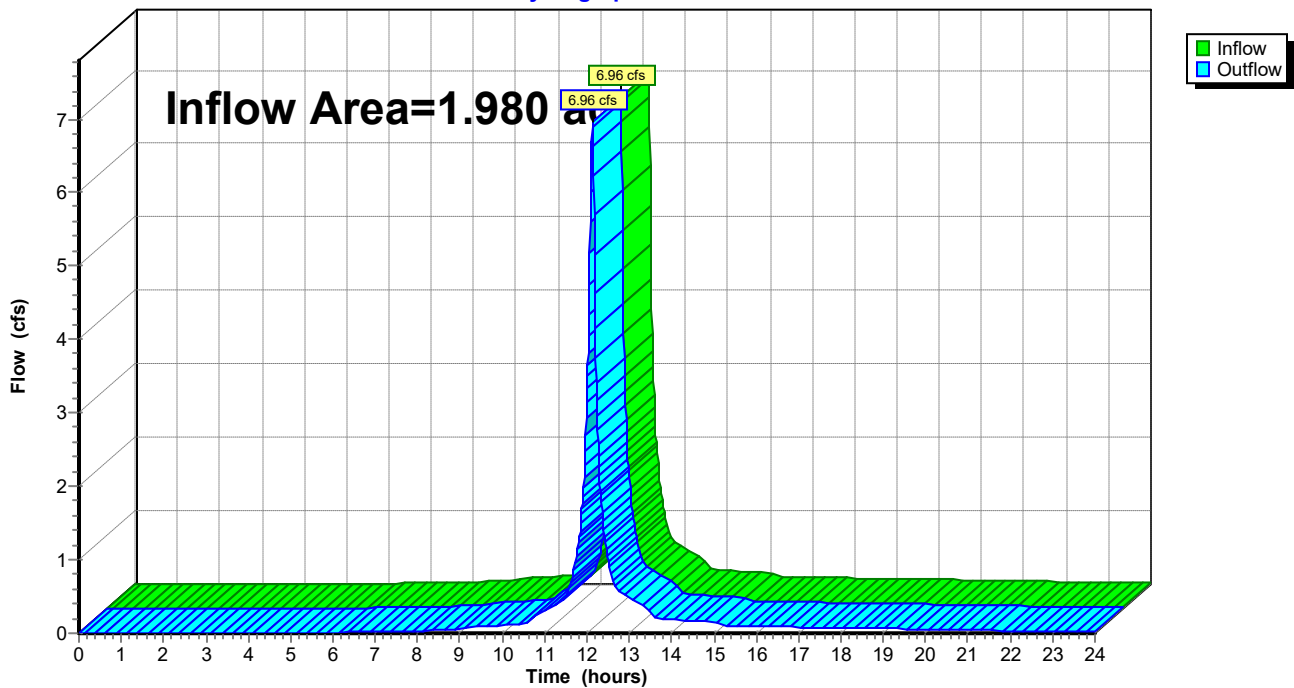
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.980 ac, 91.41% Impervious, Inflow Depth > 2.06" for 2-yr event
Inflow = 6.96 cfs @ 12.13 hrs, Volume= 0.340 af
Outflow = 6.96 cfs @ 12.13 hrs, Volume= 0.340 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach E-TOTAL: E-TOTAL

Hydrograph



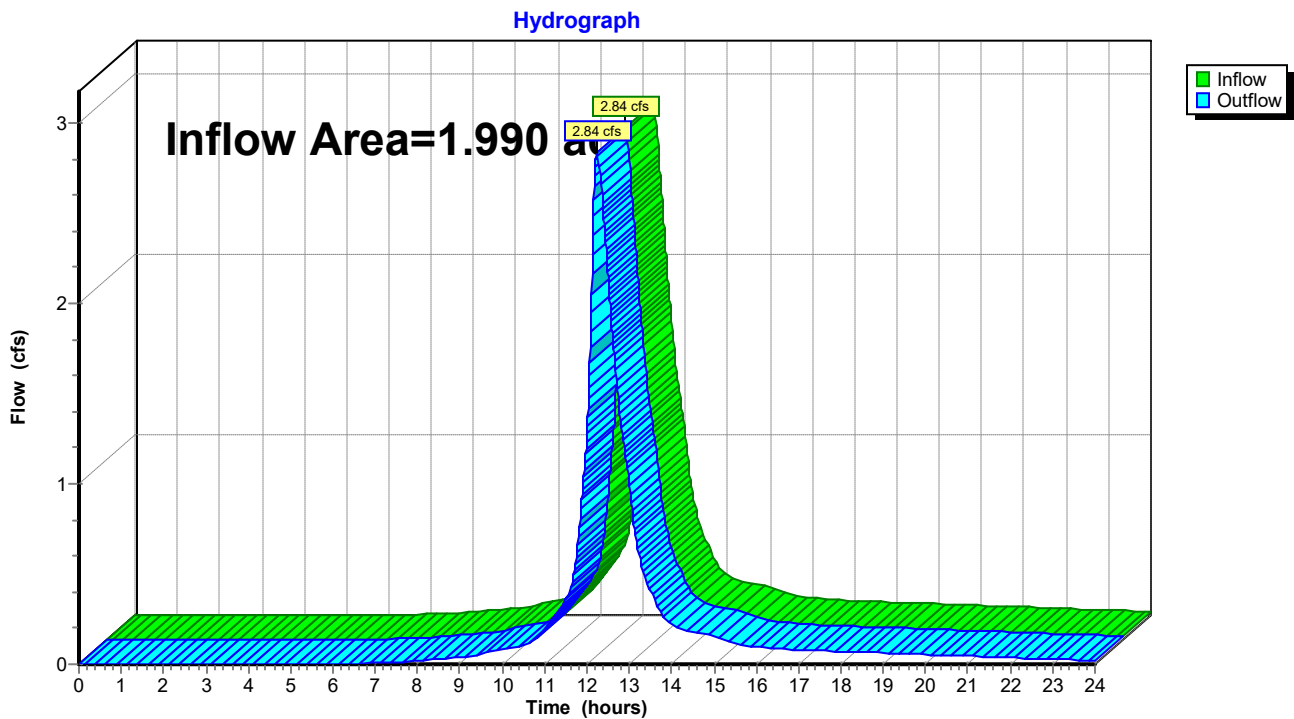
Summary for Reach P-TOTAL: P-TOTAL

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 83.32% Impervious, Inflow Depth > 1.90" for 2-yr event
Inflow = 2.84 cfs @ 12.23 hrs, Volume= 0.315 af
Outflow = 2.84 cfs @ 12.23 hrs, Volume= 0.315 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach P-TOTAL: P-TOTAL



Summary for Pond 1P: UG Detention

Inflow Area = 1.700 ac, 96.94% Impervious, Inflow Depth > 2.25" for 2-yr event
 Inflow = 6.48 cfs @ 12.13 hrs, Volume= 0.319 af
 Outflow = 2.84 cfs @ 12.23 hrs, Volume= 0.315 af, Atten= 56%, Lag= 6.3 min
 Primary = 2.84 cfs @ 12.23 hrs, Volume= 0.315 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.17' @ 12.23 hrs Surf.Area= 0.141 ac Storage= 0.087 af

Plug-Flow detention time= 33.2 min calculated for 0.315 af (99% of inflow)
 Center-of-Mass det. time= 26.5 min (795.5 - 769.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.13'	0.079 af	44.83'W x 110.00'L x 2.33'H Stone Bed 0.264 af Overall - 0.066 af Embedded = 0.198 af x 40.0% Voids
#2A	94.63'	0.066 af	ADS_StormTech SC-310 +Cap x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 13 Rows
#3B	94.13'	0.020 af	18.17'W x 67.28'L x 2.33'H Field B 0.065 af Overall - 0.015 af Embedded = 0.050 af x 40.0% Voids
#4B	94.63'	0.015 af	ADS_StormTech SC-310 +Cap x 45 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 5 Rows
		0.181 af	Total Available Storage

Storage Group A created with Chamber Wizard
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.13'	12.0" Round Culvert L= 25.3' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 94.13' / 94.07' S= 0.0024 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Primary	94.13'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	95.30'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.84 cfs @ 12.23 hrs HW=95.17' (Free Discharge)

- 1=Culvert (Barrel Controls 2.00 cfs @ 3.04 fps)
- 2=Orifice/Grate (Orifice Controls 0.84 cfs @ 4.28 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1P: UG Detention - Chamber Wizard Stone Bed

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

15 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 108.00' Row Length +12.0" End Stone x 2 = 110.00' Base Length

13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

195 Chambers x 14.7 cf = 2,874.7 cf Chamber Storage

11,507.2 cf Field - 2,874.7 cf Chambers = 8,632.5 cf Stone x 40.0% Voids = 3,453.0 cf Stone Storage

Chamber Storage + Stone Storage = 6,327.7 cf = 0.145 af

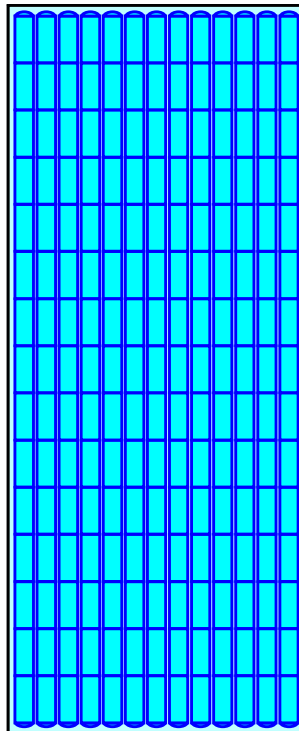
Overall Storage Efficiency = 55.0%

Overall System Size = 110.00' x 44.83' x 2.33'

195 Chambers

426.2 cy Field

319.7 cy Stone



Pond 1P: UG Detention - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.9 cf Field - 663.4 cf Chambers = 2,188.5 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af

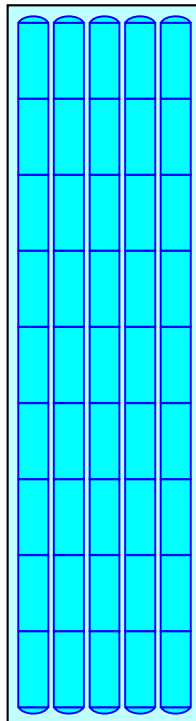
Overall Storage Efficiency = 54.0%

Overall System Size = 67.28' x 18.17' x 2.33'

45 Chambers

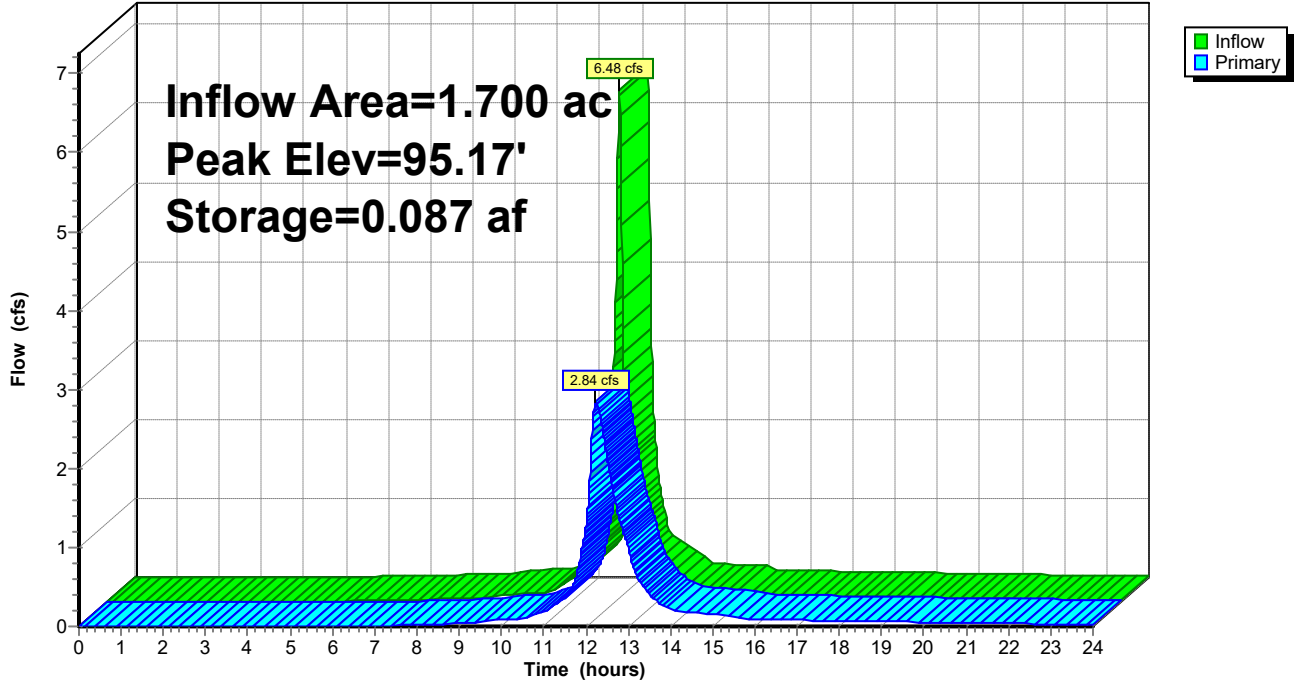
105.6 cy Field

81.1 cy Stone



Pond 1P: UG Detention

Hydrograph



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: E-1 Runoff Area=1.360 ac 96.32% Impervious Runoff Depth>3.35"
Tc=6.0 min CN=96 Runoff=7.51 cfs 0.380 af

Subcatchment EU-1: EU-1 Runoff Area=0.490 ac 91.84% Impervious Runoff Depth>3.03"
Tc=6.0 min CN=93 Runoff=2.56 cfs 0.124 af

Subcatchment EU-2: EU-2 Runoff Area=0.080 ac 25.00% Impervious Runoff Depth>0.42"
Tc=0.0 min CN=54 Runoff=0.07 cfs 0.003 af

Subcatchment EU-3: EU-3 Runoff Area=0.050 ac 60.00% Impervious Runoff Depth>1.46"
Tc=6.0 min CN=74 Runoff=0.14 cfs 0.006 af

Subcatchment O-1: O-1 Runoff Area=0.010 ac 80.00% Impervious Runoff Depth>2.37"
Tc=6.0 min CN=86 Runoff=0.04 cfs 0.002 af

Subcatchment P-1: P-1 Runoff Area=1.690 ac 97.04% Impervious Runoff Depth>3.35"
Tc=6.0 min CN=96 Runoff=9.34 cfs 0.472 af

Subcatchment P-2: PU-2 Runoff Area=0.190 ac 5.26% Impervious Runoff Depth>0.07"
Tc=6.0 min CN=42 Runoff=0.00 cfs 0.001 af

Subcatchment PU-1: PU-1 Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>0.03"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Reach E-TOTAL: E-TOTAL Inflow=10.24 cfs 0.513 af
Outflow=10.24 cfs 0.513 af

Reach P-TOTAL: P-TOTAL Inflow=5.39 cfs 0.471 af
Outflow=5.39 cfs 0.471 af

Pond 1P: UG Detention Peak Elev=95.51' Storage=0.120 af Inflow=9.38 cfs 0.474 af
Outflow=5.39 cfs 0.470 af

Total Runoff Area = 3.970 ac Runoff Volume = 0.988 af Average Runoff Depth = 2.99"
12.64% Pervious = 0.502 ac 87.36% Impervious = 3.468 ac

Summary for Subcatchment E-1: E-1

Runoff = 7.51 cfs @ 12.13 hrs, Volume= 0.380 af, Depth> 3.35"

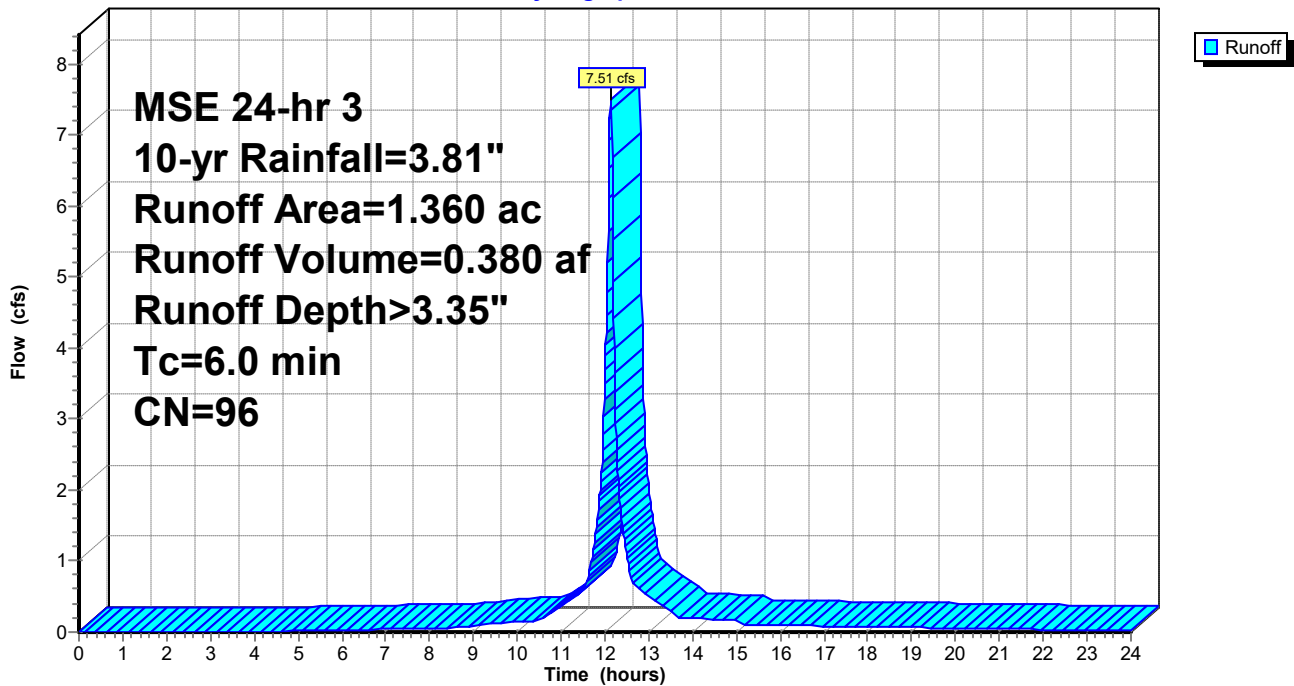
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-yr Rainfall=3.81"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.020	98	Roofs, HSG A
1.220	98	Paved parking, HSG A
0.070	98	Unconnected pavement, HSG A
1.360	96	Weighted Average
0.050		3.68% Pervious Area
1.310		96.32% Impervious Area
0.070		5.34% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment E-1: E-1

Hydrograph



Summary for Subcatchment EU-1: EU-1

Runoff = 2.56 cfs @ 12.13 hrs, Volume= 0.124 af, Depth> 3.03"

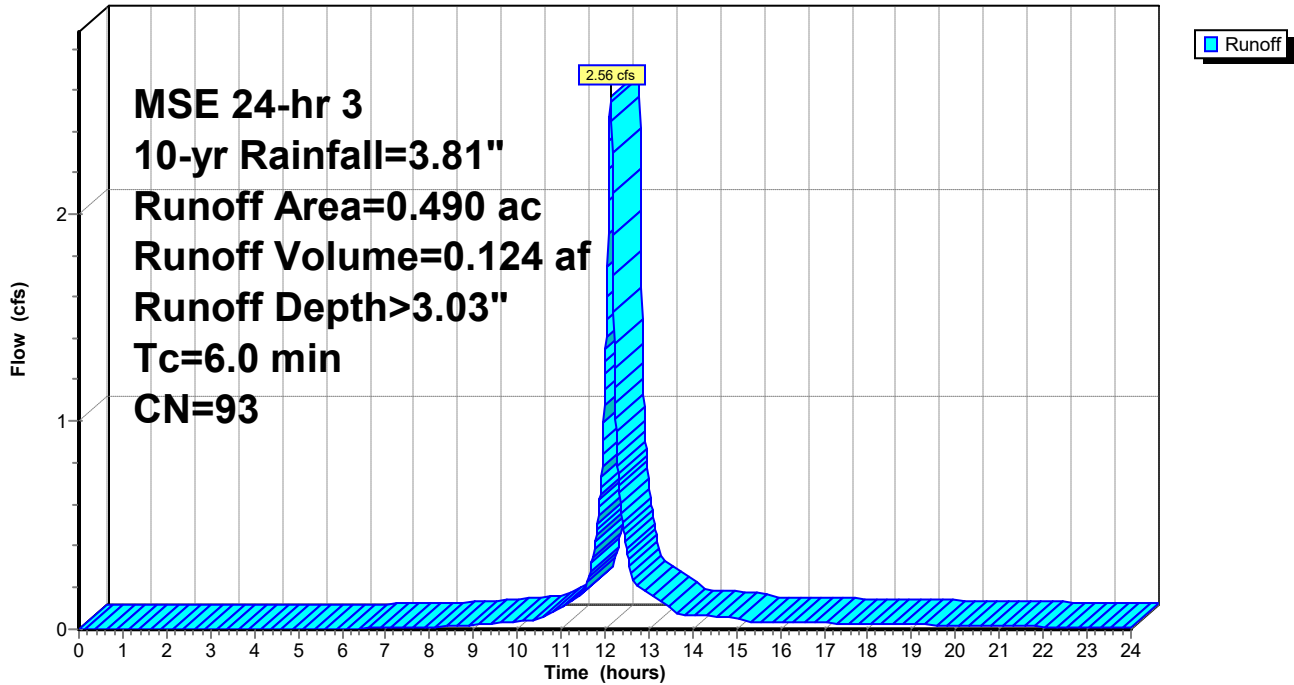
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-yr Rainfall=3.81"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
0.120	98	Paved parking, HSG A
0.330	98	Roofs, HSG A
0.490	93	Weighted Average
0.040		8.16% Pervious Area
0.450		91.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment EU-1: EU-1

Hydrograph



Summary for Subcatchment EU-2: EU-2

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

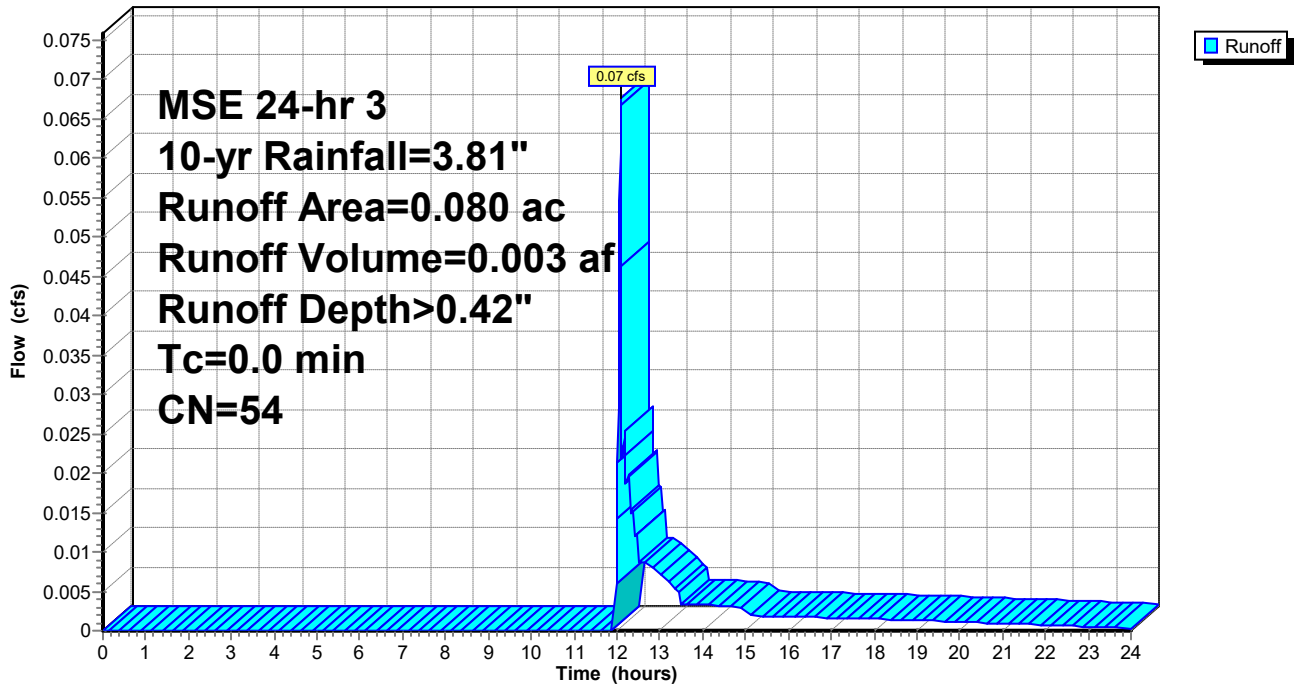
Runoff = 0.07 cfs @ 12.09 hrs, Volume= 0.003 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-yr Rainfall=3.81"

Area (ac)	CN	Description
0.060	39	>75% Grass cover, Good, HSG A
0.020	98	Paved parking, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

Subcatchment EU-2: EU-2

Hydrograph



Summary for Subcatchment EU-3: EU-3

Runoff = 0.14 cfs @ 12.14 hrs, Volume= 0.006 af, Depth> 1.46"

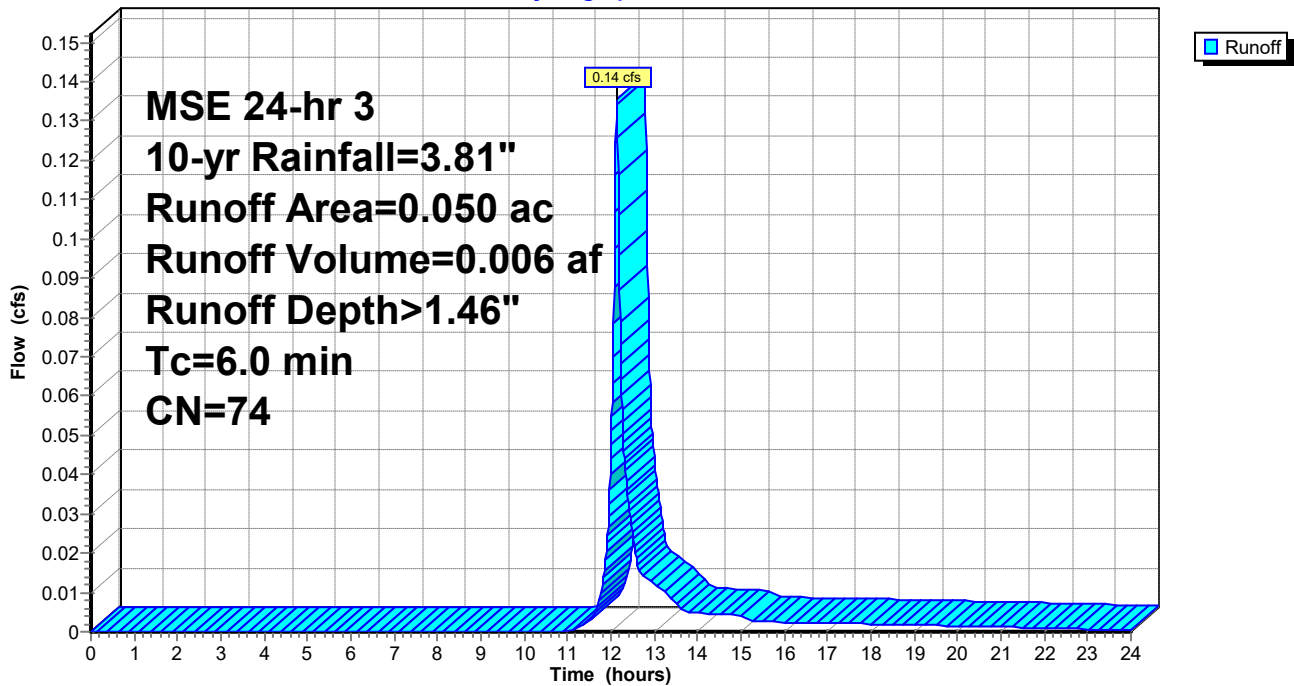
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-yr Rainfall=3.81"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.030	98	Paved parking, HSG A
0.050	74	Weighted Average
0.020		40.00% Pervious Area
0.030		60.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment EU-3: EU-3

Hydrograph



Summary for Subcatchment O-1: O-1

Runoff = 0.04 cfs @ 12.13 hrs, Volume= 0.002 af, Depth> 2.37"

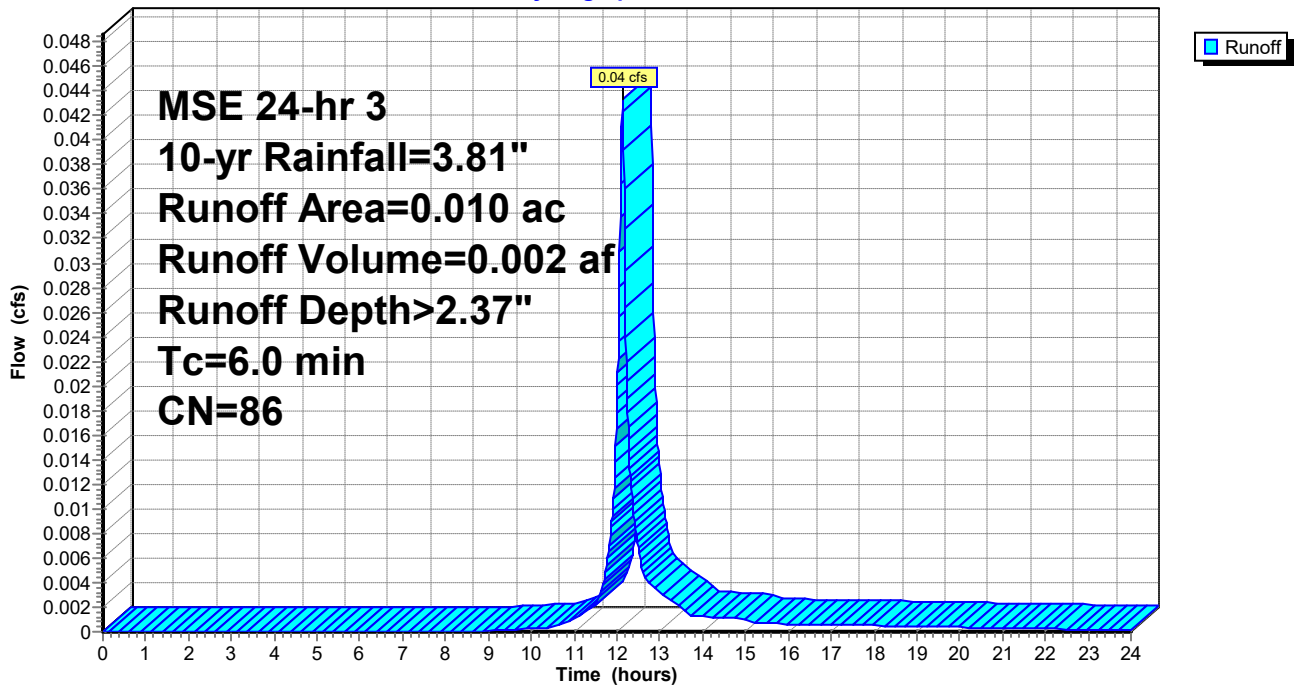
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-yr Rainfall=3.81"

Area (ac)	CN	Description
0.002	39	>75% Grass cover, Good, HSG A
0.008	98	Paved parking, HSG A
0.010	86	Weighted Average
0.002		20.00% Pervious Area
0.008		80.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment O-1: O-1

Hydrograph



Summary for Subcatchment P-1: P-1

Runoff = 9.34 cfs @ 12.13 hrs, Volume= 0.472 af, Depth> 3.35"

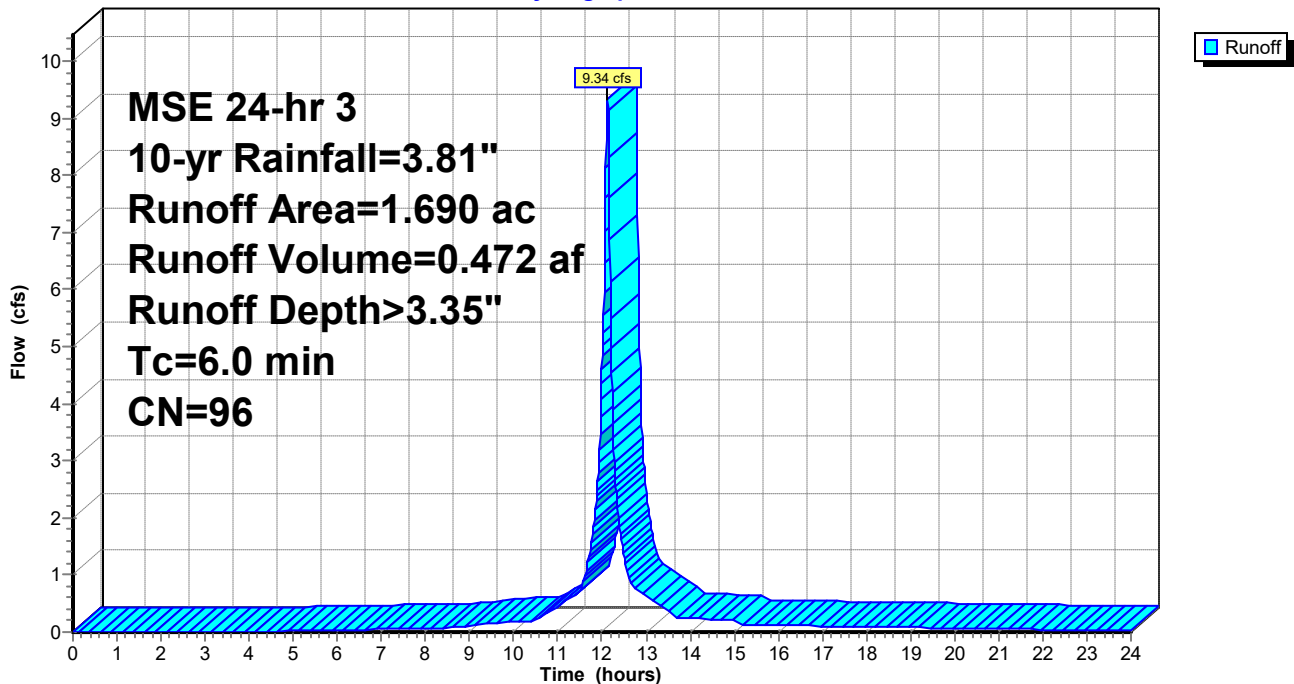
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-yr Rainfall=3.81"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
1.110	98	Paved parking, HSG A
0.040	98	Unconnected pavement, HSG A
0.490	98	Unconnected roofs, HSG A
1.690	96	Weighted Average
0.050		2.96% Pervious Area
1.640		97.04% Impervious Area
0.530		32.32% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-1: P-1

Hydrograph



Summary for Subcatchment P-2: PU-2

Runoff = 0.00 cfs @ 13.24 hrs, Volume= 0.001 af, Depth> 0.07"

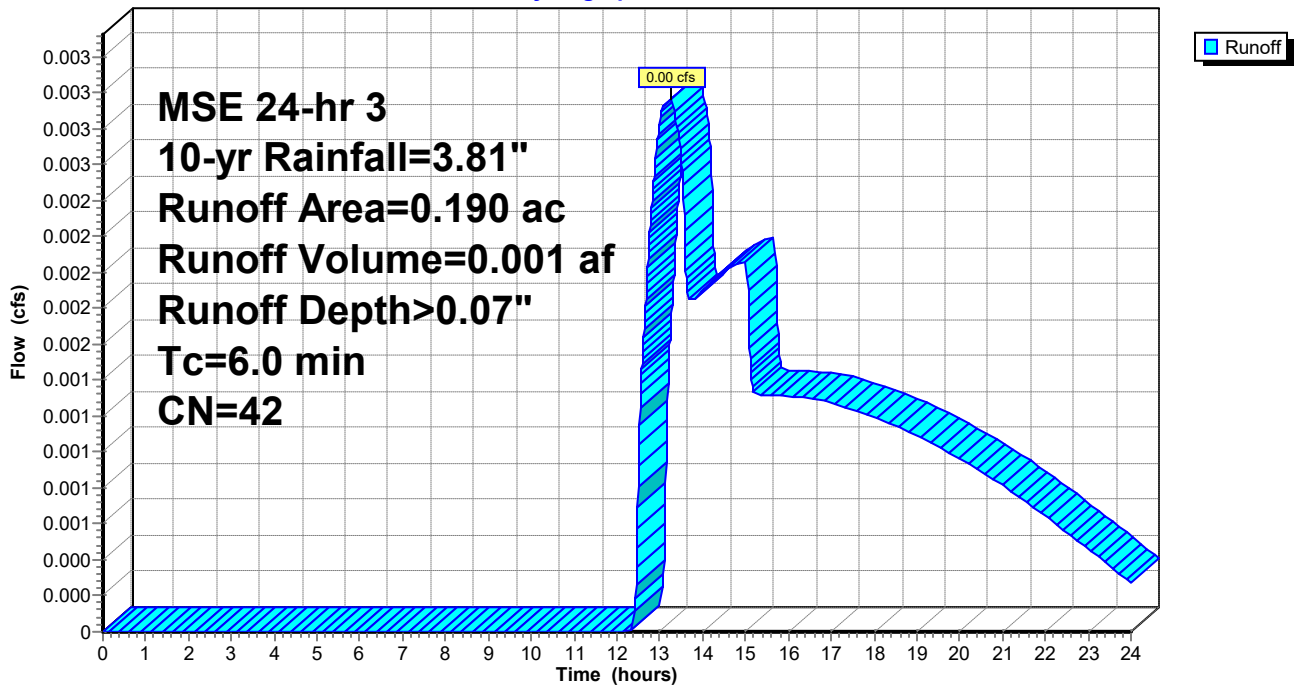
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10-yr Rainfall=3.81"

Area (ac)	CN	Description
0.180	39	>75% Grass cover, Good, HSG A
0.010	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
0.190	42	Weighted Average
0.180		94.74% Pervious Area
0.010		5.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-2: PU-2

Hydrograph



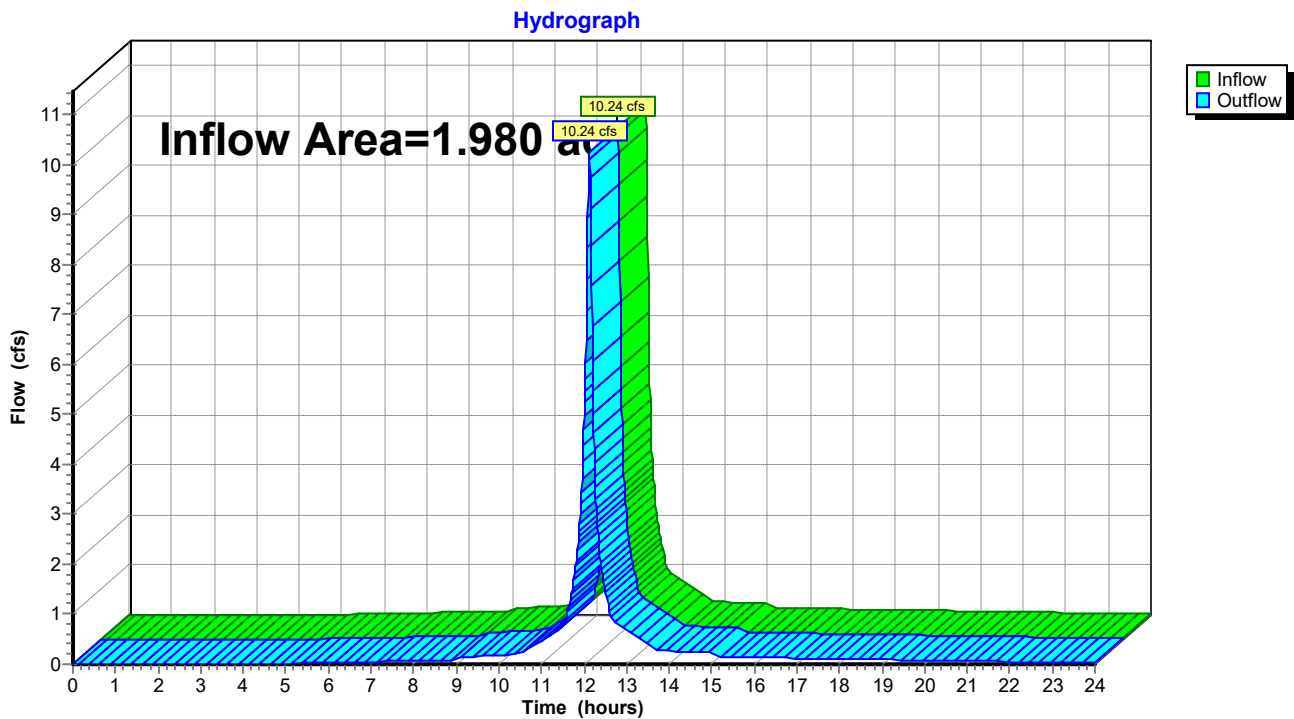
Summary for Reach E-TOTAL: E-TOTAL

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.980 ac, 91.41% Impervious, Inflow Depth > 3.11" for 10-yr event
Inflow = 10.24 cfs @ 12.13 hrs, Volume= 0.513 af
Outflow = 10.24 cfs @ 12.13 hrs, Volume= 0.513 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach E-TOTAL: E-TOTAL



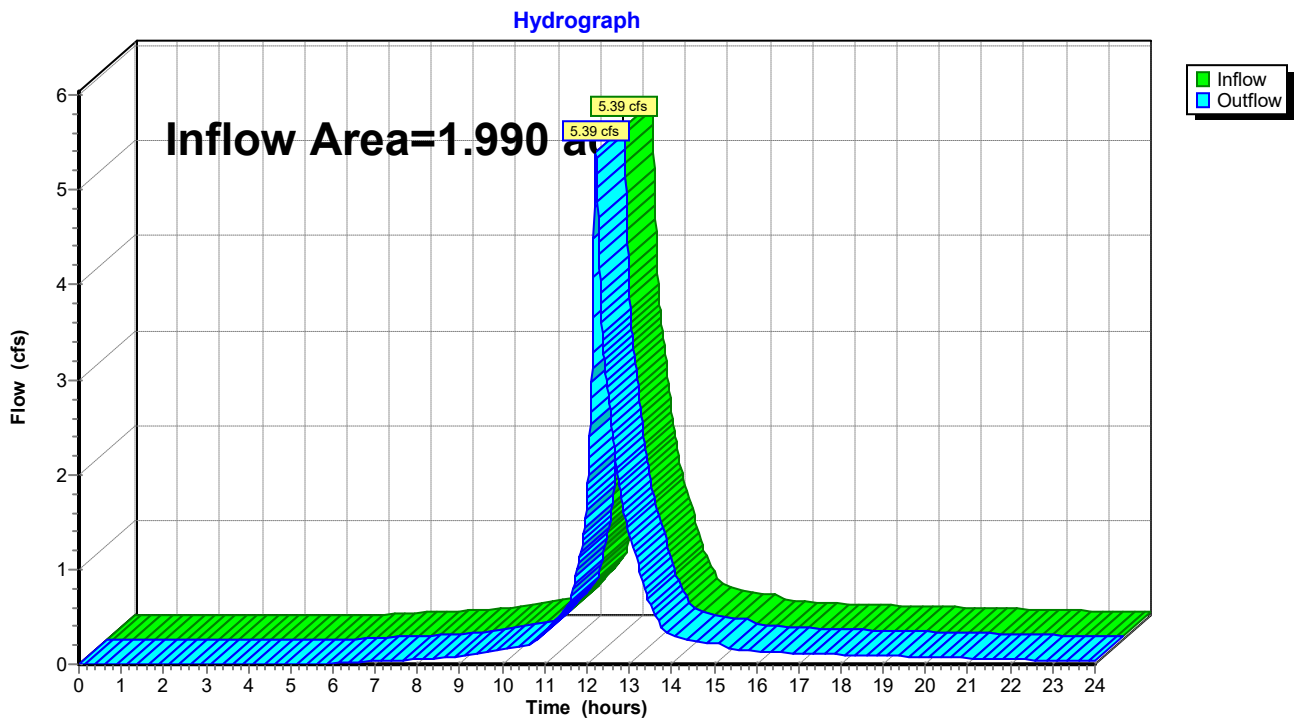
Summary for Reach P-TOTAL: P-TOTAL

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 83.32% Impervious, Inflow Depth > 2.84" for 10-yr event
Inflow = 5.39 cfs @ 12.20 hrs, Volume= 0.471 af
Outflow = 5.39 cfs @ 12.20 hrs, Volume= 0.471 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach P-TOTAL: P-TOTAL



Summary for Pond 1P: UG Detention

Inflow Area = 1.700 ac, 96.94% Impervious, Inflow Depth > 3.35" for 10-yr event
 Inflow = 9.38 cfs @ 12.13 hrs, Volume= 0.474 af
 Outflow = 5.39 cfs @ 12.20 hrs, Volume= 0.470 af, Atten= 43%, Lag= 4.4 min
 Primary = 5.39 cfs @ 12.20 hrs, Volume= 0.470 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.51' @ 12.20 hrs Surf.Area= 0.141 ac Storage= 0.120 af

Plug-Flow detention time= 29.7 min calculated for 0.470 af (99% of inflow)
 Center-of-Mass det. time= 24.3 min (786.0 - 761.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.13'	0.079 af	44.83'W x 110.00'L x 2.33'H Stone Bed 0.264 af Overall - 0.066 af Embedded = 0.198 af x 40.0% Voids
#2A	94.63'	0.066 af	ADS_StormTech SC-310 +Cap x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 13 Rows
#3B	94.13'	0.020 af	18.17'W x 67.28'L x 2.33'H Field B 0.065 af Overall - 0.015 af Embedded = 0.050 af x 40.0% Voids
#4B	94.63'	0.015 af	ADS_StormTech SC-310 +Cap x 45 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 5 Rows
		0.181 af	Total Available Storage

Storage Group A created with Chamber Wizard
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.13'	12.0" Round Culvert L= 25.3' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 94.13' / 94.07' S= 0.0024 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Primary	94.13'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	95.30'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=5.38 cfs @ 12.20 hrs HW=95.51' (Free Discharge)

- 1=Culvert (Barrel Controls 2.72 cfs @ 3.46 fps)
- 2=Orifice/Grate (Orifice Controls 1.01 cfs @ 5.12 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 1.65 cfs @ 1.29 fps)

Pond 1P: UG Detention - Chamber Wizard Stone Bed

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

15 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 108.00' Row Length +12.0" End Stone x 2 = 110.00' Base Length

13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

195 Chambers x 14.7 cf = 2,874.7 cf Chamber Storage

11,507.2 cf Field - 2,874.7 cf Chambers = 8,632.5 cf Stone x 40.0% Voids = 3,453.0 cf Stone Storage

Chamber Storage + Stone Storage = 6,327.7 cf = 0.145 af

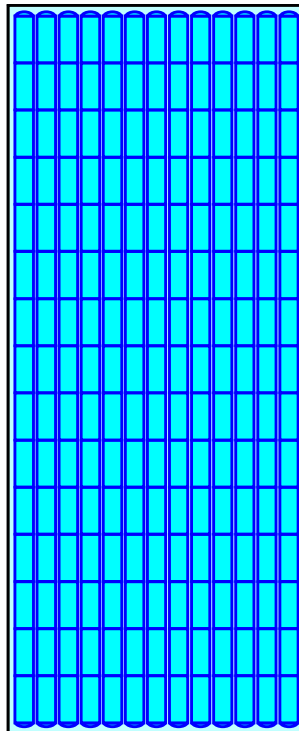
Overall Storage Efficiency = 55.0%

Overall System Size = 110.00' x 44.83' x 2.33'

195 Chambers

426.2 cy Field

319.7 cy Stone



Pond 1P: UG Detention - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.9 cf Field - 663.4 cf Chambers = 2,188.5 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af

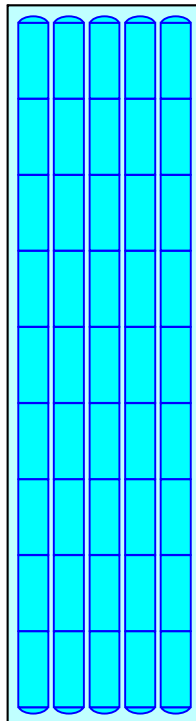
Overall Storage Efficiency = 54.0%

Overall System Size = 67.28' x 18.17' x 2.33'

45 Chambers

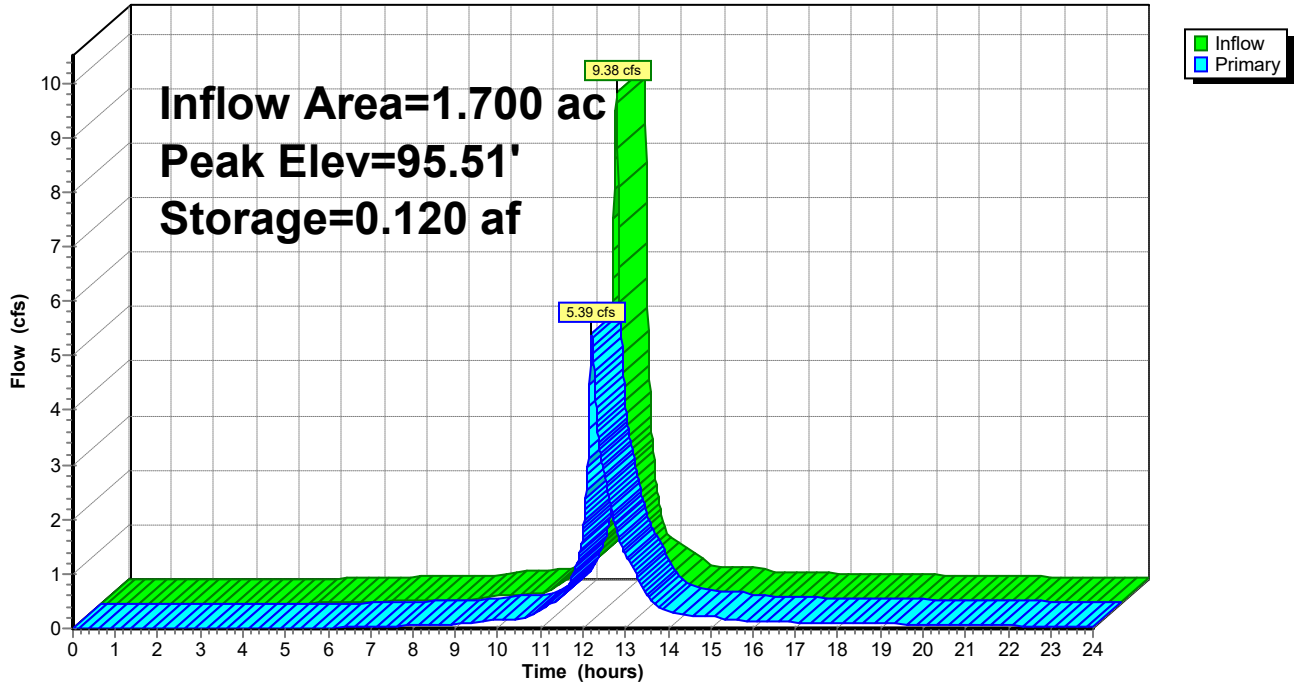
105.6 cy Field

81.1 cy Stone



Pond 1P: UG Detention

Hydrograph



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: E-1	Runoff Area=1.360 ac 96.32% Impervious Runoff Depth>5.71" Tc=6.0 min CN=96 Runoff=12.42 cfs 0.647 af
Subcatchment EU-1: EU-1	Runoff Area=0.490 ac 91.84% Impervious Runoff Depth>5.36" Tc=6.0 min CN=93 Runoff=4.36 cfs 0.219 af
Subcatchment EU-2: EU-2	Runoff Area=0.080 ac 25.00% Impervious Runoff Depth>1.54" Tc=0.0 min CN=54 Runoff=0.30 cfs 0.010 af
Subcatchment EU-3: EU-3	Runoff Area=0.050 ac 60.00% Impervious Runoff Depth>3.34" Tc=6.0 min CN=74 Runoff=0.31 cfs 0.014 af
Subcatchment O-1: O-1	Runoff Area=0.010 ac 80.00% Impervious Runoff Depth>4.58" Tc=6.0 min CN=86 Runoff=0.08 cfs 0.004 af
Subcatchment P-1: P-1	Runoff Area=1.690 ac 97.04% Impervious Runoff Depth>5.71" Tc=6.0 min CN=96 Runoff=15.43 cfs 0.803 af
Subcatchment P-2: PU-2	Runoff Area=0.190 ac 5.26% Impervious Runoff Depth>0.68" Tc=6.0 min CN=42 Runoff=0.15 cfs 0.011 af
Subcatchment PU-1: PU-1	Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>0.50" Tc=6.0 min CN=39 Runoff=0.04 cfs 0.004 af
Reach E-TOTAL: E-TOTAL	Inflow=17.18 cfs 0.890 af Outflow=17.18 cfs 0.890 af
Reach P-TOTAL: P-TOTAL	Inflow=14.22 cfs 0.817 af Outflow=14.22 cfs 0.817 af
Pond 1P: UG Detention	Peak Elev=95.92' Storage=0.150 af Inflow=15.51 cfs 0.807 af Outflow=14.03 cfs 0.802 af

Total Runoff Area = 3.970 ac Runoff Volume = 1.712 af Average Runoff Depth = 5.17"
12.64% Pervious = 0.502 ac 87.36% Impervious = 3.468 ac

Summary for Subcatchment E-1: E-1

Runoff = 12.42 cfs @ 12.13 hrs, Volume= 0.647 af, Depth> 5.71"

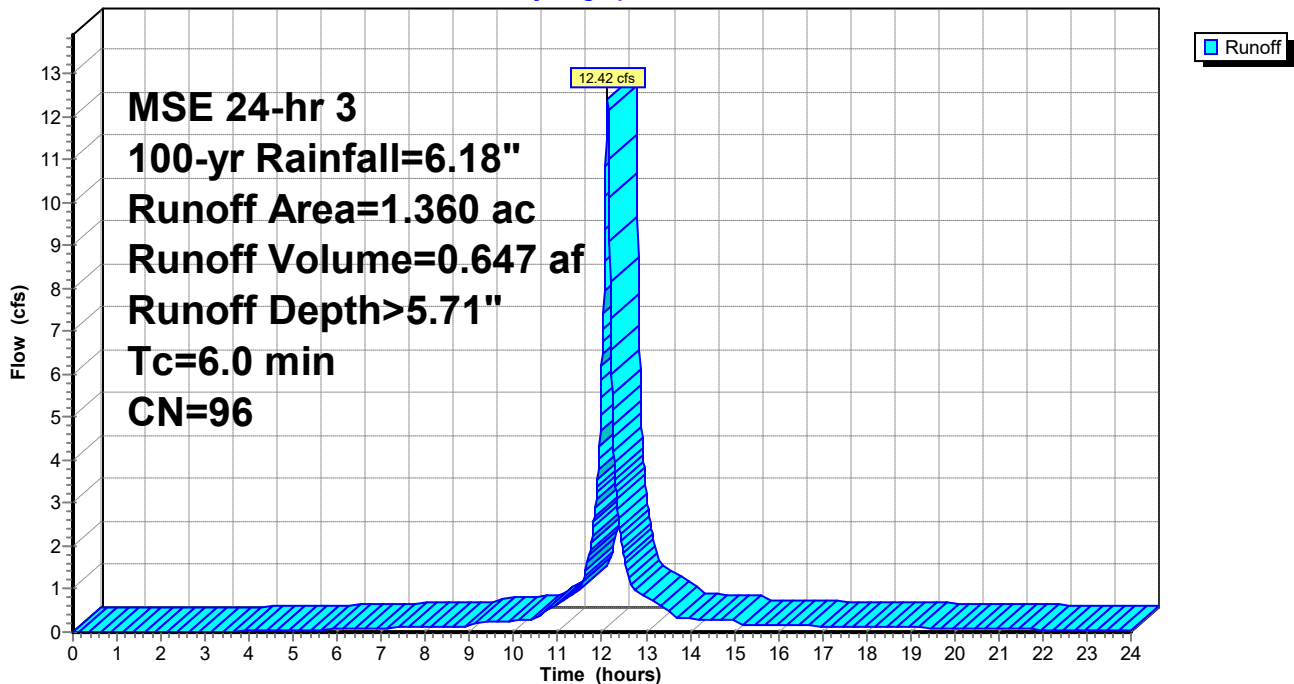
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
0.020	98	Roofs, HSG A
1.220	98	Paved parking, HSG A
0.070	98	Unconnected pavement, HSG A
1.360	96	Weighted Average
0.050		3.68% Pervious Area
1.310		96.32% Impervious Area
0.070		5.34% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment E-1: E-1

Hydrograph



Summary for Subcatchment EU-1: EU-1

Runoff = 4.36 cfs @ 12.13 hrs, Volume= 0.219 af, Depth> 5.36"

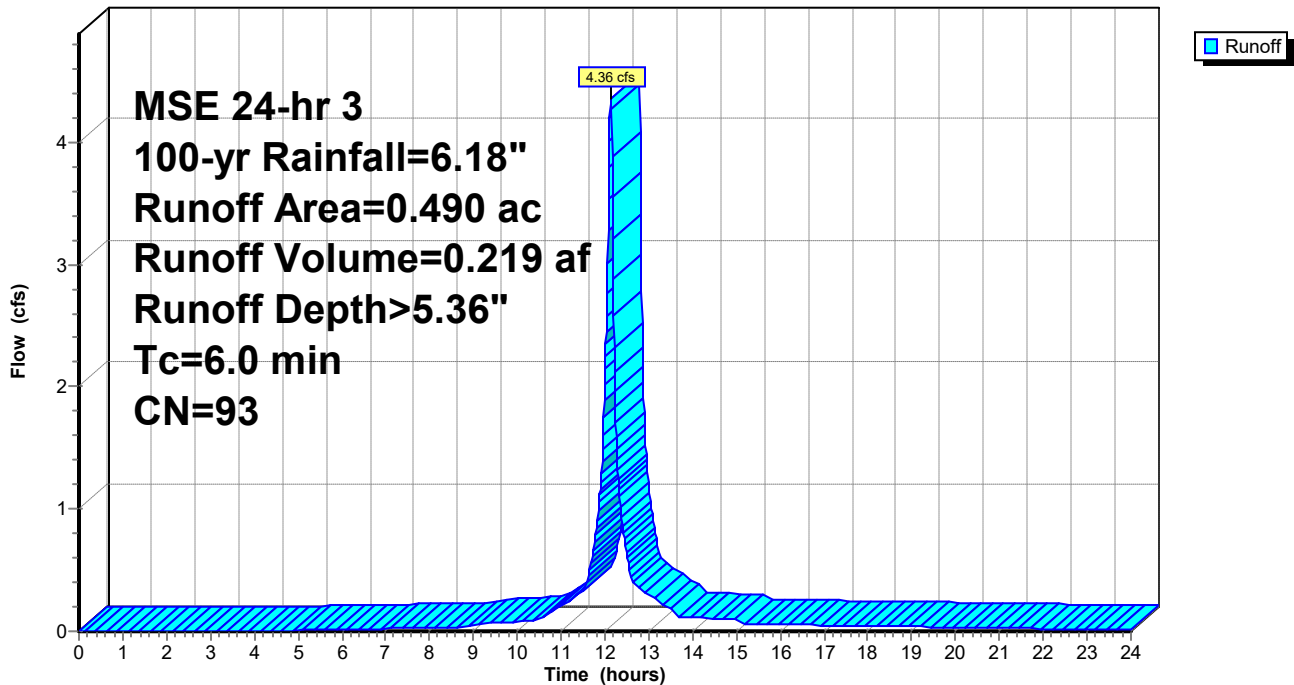
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.040	39	>75% Grass cover, Good, HSG A
0.120	98	Paved parking, HSG A
0.330	98	Roofs, HSG A
0.490	93	Weighted Average
0.040		8.16% Pervious Area
0.450		91.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment EU-1: EU-1

Hydrograph



Summary for Subcatchment EU-2: EU-2

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

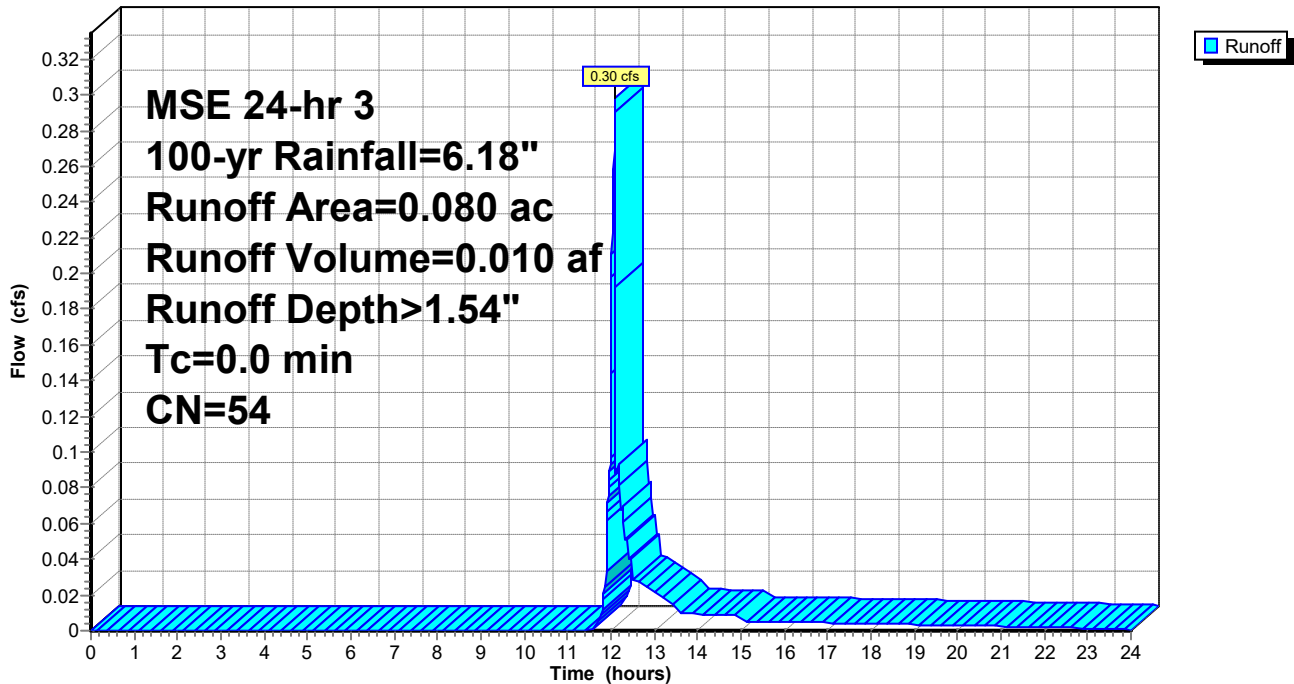
Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.010 af, Depth> 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.060	39	>75% Grass cover, Good, HSG A
0.020	98	Paved parking, HSG A
0.080	54	Weighted Average
0.060		75.00% Pervious Area
0.020		25.00% Impervious Area

Subcatchment EU-2: EU-2

Hydrograph



Summary for Subcatchment EU-3: EU-3

Runoff = 0.31 cfs @ 12.13 hrs, Volume= 0.014 af, Depth> 3.34"

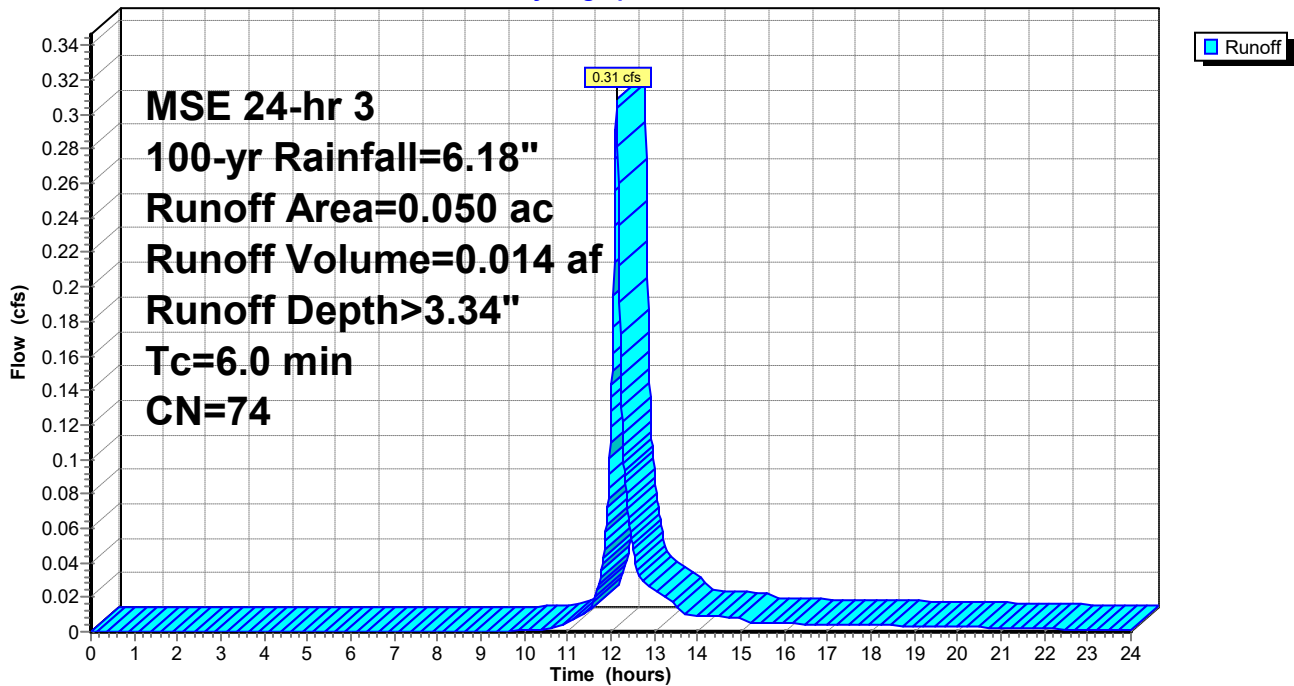
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.020	39	>75% Grass cover, Good, HSG A
0.030	98	Paved parking, HSG A
0.050	74	Weighted Average
0.020		40.00% Pervious Area
0.030		60.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Subcatchment EU-3: EU-3

Hydrograph



Summary for Subcatchment O-1: O-1

Runoff = 0.08 cfs @ 12.13 hrs, Volume= 0.004 af, Depth> 4.58"

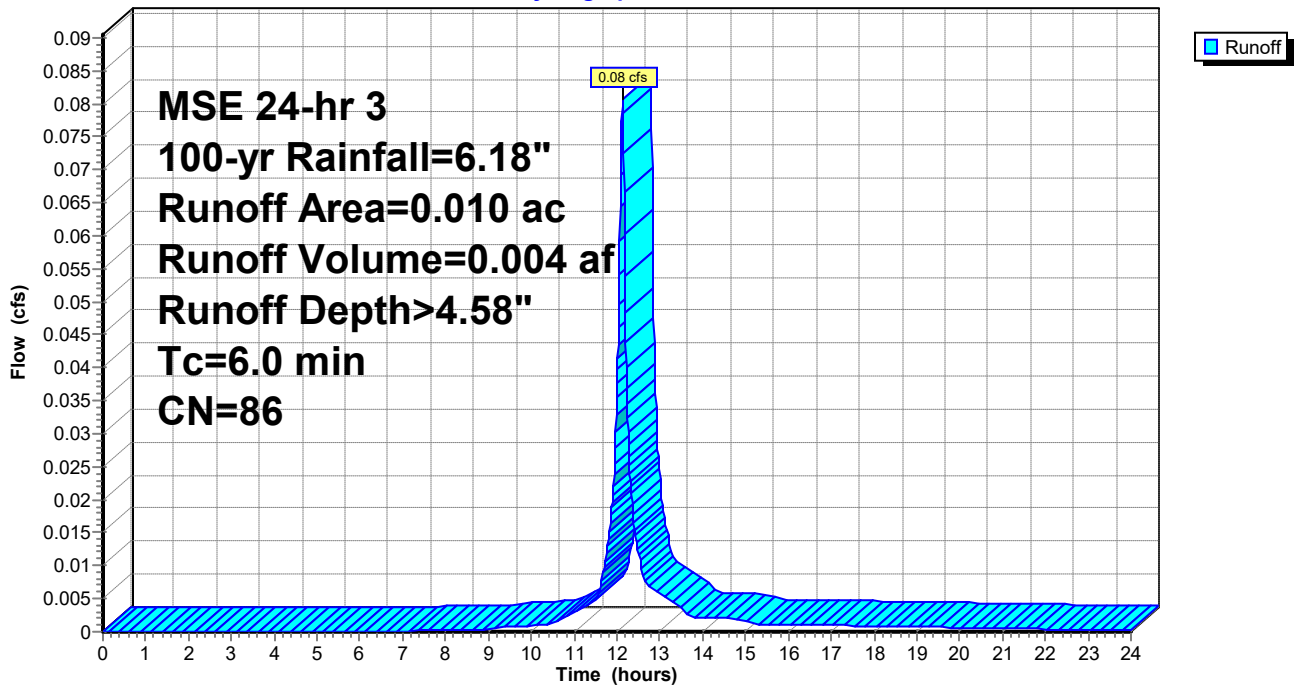
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.002	39	>75% Grass cover, Good, HSG A
0.008	98	Paved parking, HSG A
0.010	86	Weighted Average
0.002		20.00% Pervious Area
0.008		80.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment O-1: O-1

Hydrograph



Summary for Subcatchment P-1: P-1

Runoff = 15.43 cfs @ 12.13 hrs, Volume= 0.803 af, Depth> 5.71"

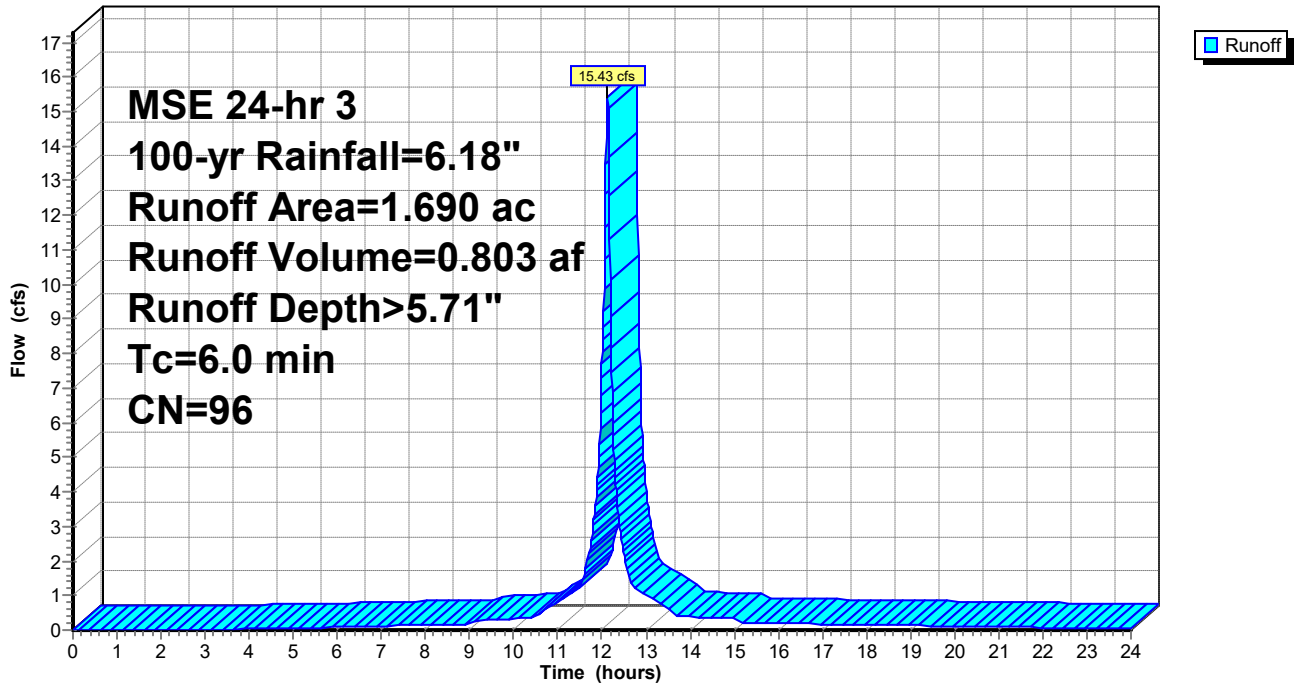
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.050	39	>75% Grass cover, Good, HSG A
1.110	98	Paved parking, HSG A
0.040	98	Unconnected pavement, HSG A
0.490	98	Unconnected roofs, HSG A
1.690	96	Weighted Average
0.050		2.96% Pervious Area
1.640		97.04% Impervious Area
0.530		32.32% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-1: P-1

Hydrograph



Summary for Subcatchment P-2: PU-2

Runoff = 0.15 cfs @ 12.16 hrs, Volume= 0.011 af, Depth> 0.68"

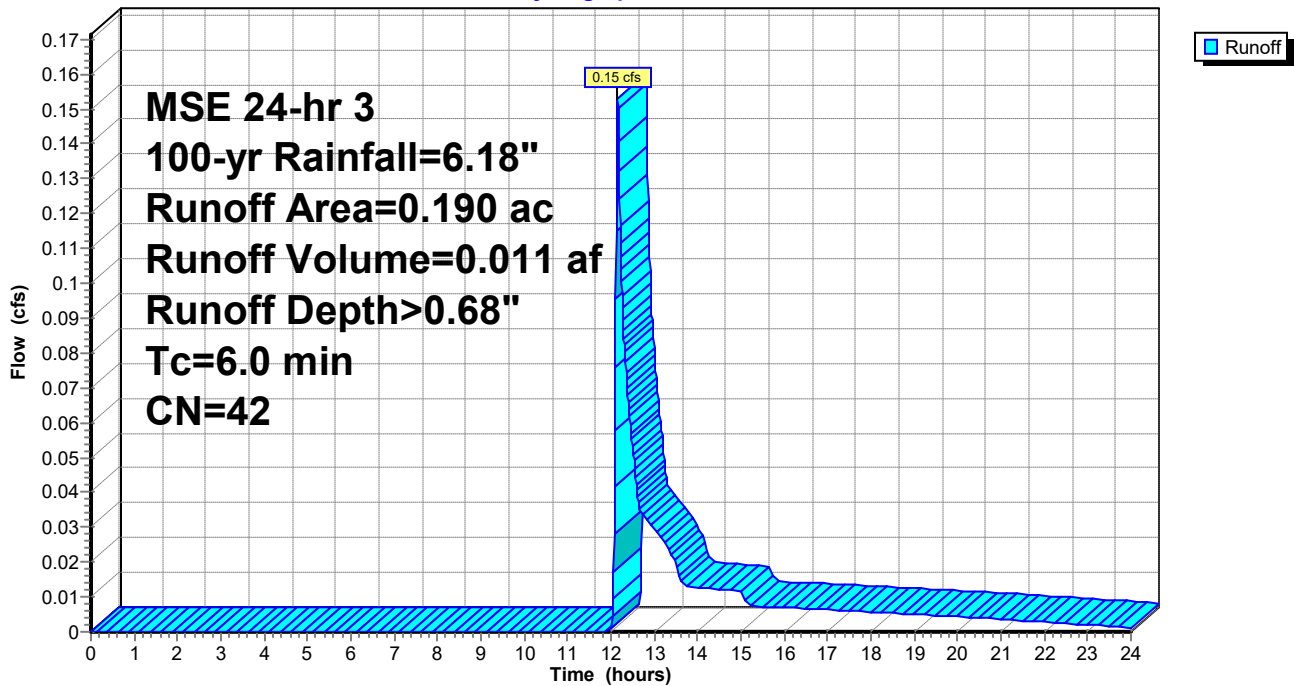
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.180	39	>75% Grass cover, Good, HSG A
0.010	98	Paved parking, HSG A
0.000	98	Roofs, HSG A
0.000	98	Unconnected pavement, HSG A
0.190	42	Weighted Average
0.180		94.74% Pervious Area
0.010		5.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment P-2: PU-2

Hydrograph



Summary for Subcatchment PU-1: PU-1

Runoff = 0.04 cfs @ 12.17 hrs, Volume= 0.004 af, Depth> 0.50"

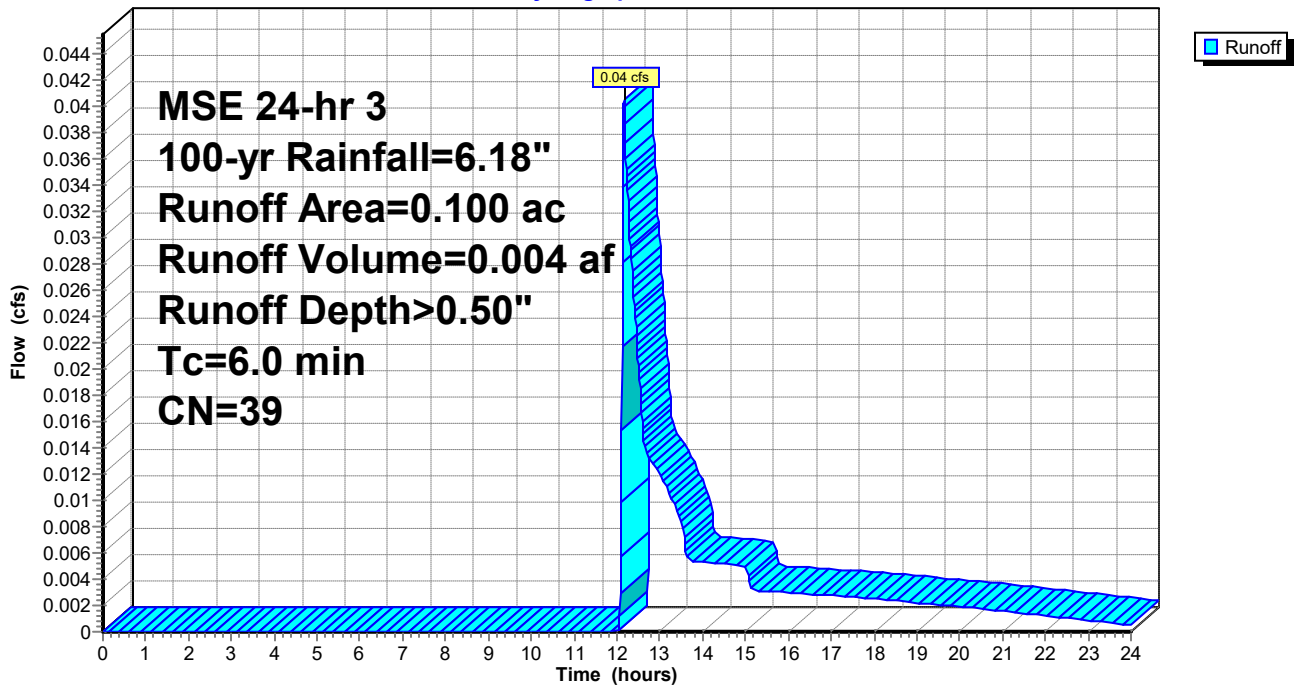
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 100-yr Rainfall=6.18"

Area (ac)	CN	Description
0.100	39	>75% Grass cover, Good, HSG A
0.000	98	Paved parking, HSG A
0.000	98	Unconnected roofs, HSG A
0.100	39	Weighted Average
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min Tc

Subcatchment PU-1: PU-1

Hydrograph



Summary for Reach E-TOTAL: E-TOTAL

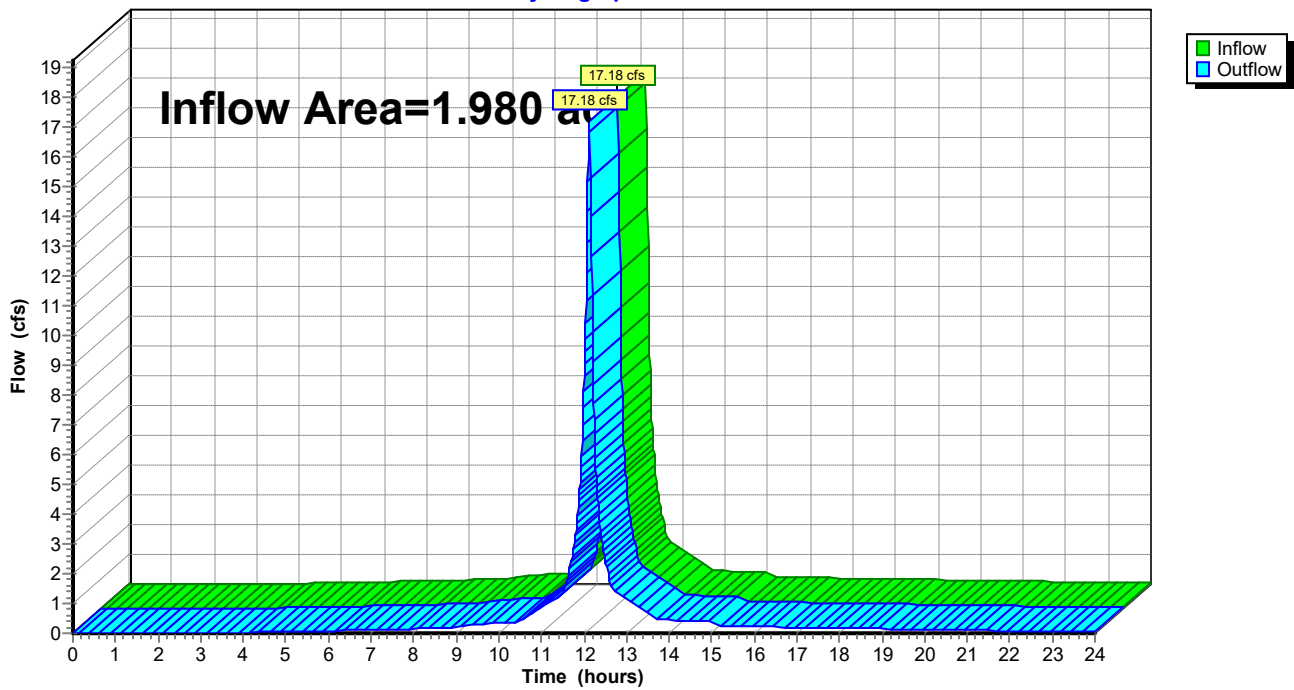
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.980 ac, 91.41% Impervious, Inflow Depth > 5.39" for 100-yr event
Inflow = 17.18 cfs @ 12.13 hrs, Volume= 0.890 af
Outflow = 17.18 cfs @ 12.13 hrs, Volume= 0.890 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach E-TOTAL: E-TOTAL

Hydrograph



Summary for Reach P-TOTAL: P-TOTAL

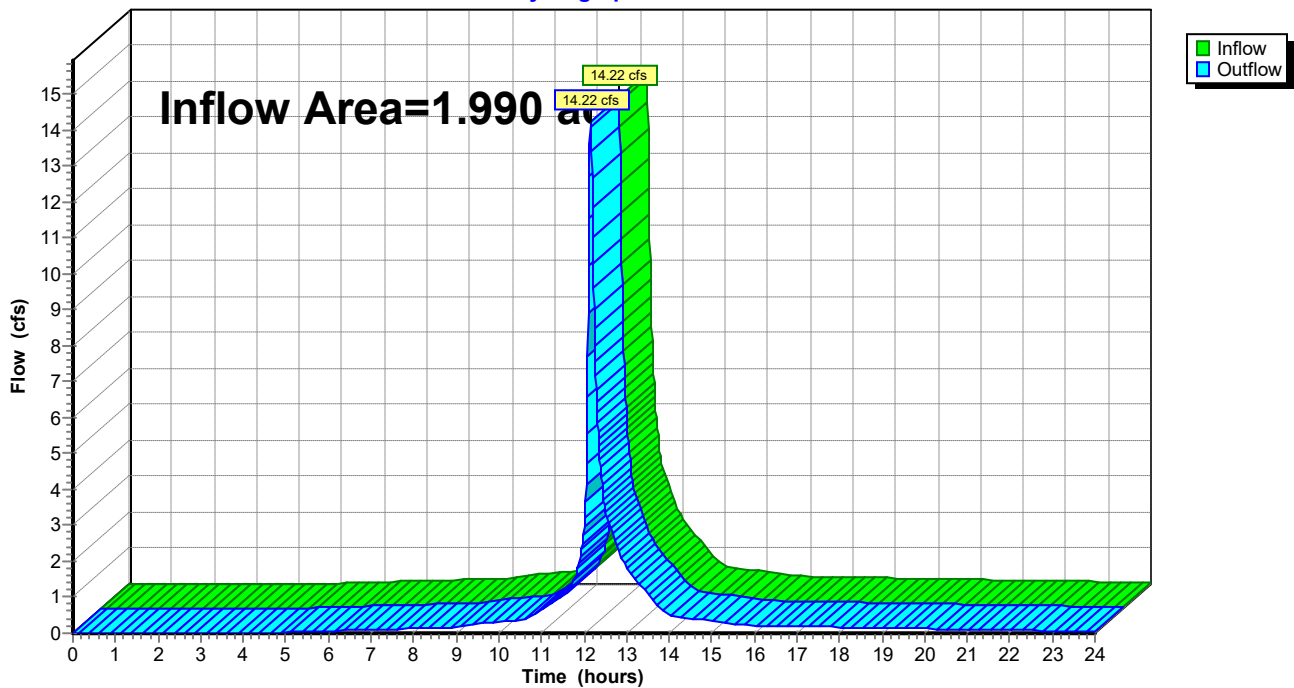
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 83.32% Impervious, Inflow Depth > 4.93" for 100-yr event
Inflow = 14.22 cfs @ 12.16 hrs, Volume= 0.817 af
Outflow = 14.22 cfs @ 12.16 hrs, Volume= 0.817 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach P-TOTAL: P-TOTAL

Hydrograph



Summary for Pond 1P: UG Detention

Inflow Area = 1.700 ac, 96.94% Impervious, Inflow Depth > 5.70" for 100-yr event
 Inflow = 15.51 cfs @ 12.13 hrs, Volume= 0.807 af
 Outflow = 14.03 cfs @ 12.16 hrs, Volume= 0.802 af, Atten= 10%, Lag= 1.7 min
 Primary = 14.03 cfs @ 12.16 hrs, Volume= 0.802 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.92' @ 12.16 hrs Surf.Area= 0.141 ac Storage= 0.150 af

Plug-Flow detention time= 24.0 min calculated for 0.802 af (99% of inflow)
 Center-of-Mass det. time= 20.0 min (772.7 - 752.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.13'	0.079 af	44.83'W x 110.00'L x 2.33'H Stone Bed 0.264 af Overall - 0.066 af Embedded = 0.198 af x 40.0% Voids
#2A	94.63'	0.066 af	ADS_StormTech SC-310 +Cap x 195 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 195 Chambers in 13 Rows
#3B	94.13'	0.020 af	18.17'W x 67.28'L x 2.33'H Field B 0.065 af Overall - 0.015 af Embedded = 0.050 af x 40.0% Voids
#4B	94.63'	0.015 af	ADS_StormTech SC-310 +Cap x 45 Inside #3 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 5 Rows
		0.181 af	Total Available Storage

Storage Group A created with Chamber Wizard
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	94.13'	12.0" Round Culvert L= 25.3' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 94.13' / 94.07' S= 0.0024 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Primary	94.13'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	95.30'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=13.99 cfs @ 12.16 hrs HW=95.92' (Free Discharge)

- 1=Culvert (Barrel Controls 3.77 cfs @ 4.80 fps)
- 2=Orifice/Grate (Orifice Controls 1.17 cfs @ 5.97 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 9.05 cfs @ 2.44 fps)

Pond 1P: UG Detention - Chamber Wizard Stone Bed

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

15 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 108.00' Row Length +12.0" End Stone x 2 = 110.00' Base Length

13 Rows x 34.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 44.83' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

195 Chambers x 14.7 cf = 2,874.7 cf Chamber Storage

11,507.2 cf Field - 2,874.7 cf Chambers = 8,632.5 cf Stone x 40.0% Voids = 3,453.0 cf Stone Storage

Chamber Storage + Stone Storage = 6,327.7 cf = 0.145 af

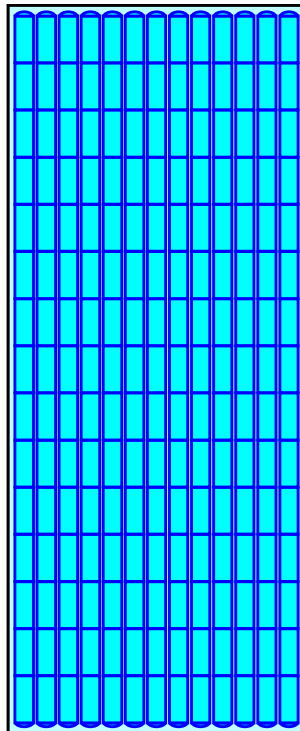
Overall Storage Efficiency = 55.0%

Overall System Size = 110.00' x 44.83' x 2.33'

195 Chambers

426.2 cy Field

319.7 cy Stone



Pond 1P: UG Detention - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length

5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width

6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.9 cf Field - 663.4 cf Chambers = 2,188.5 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af

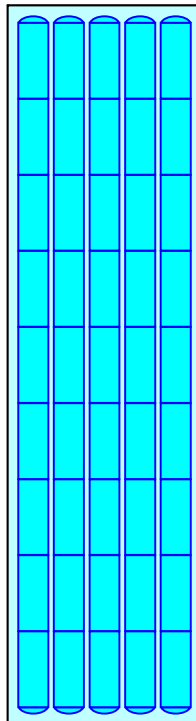
Overall Storage Efficiency = 54.0%

Overall System Size = 67.28' x 18.17' x 2.33'

45 Chambers

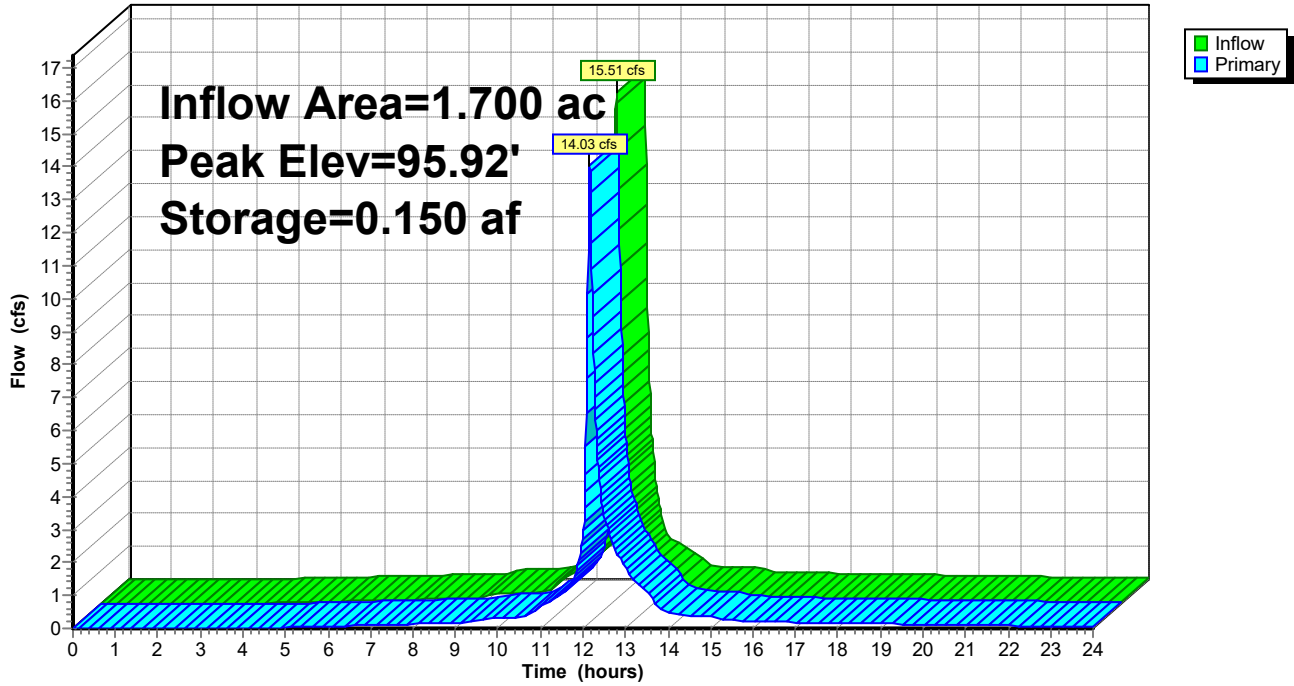
105.6 cy Field

81.1 cy Stone



Pond 1P: UG Detention

Hydrograph



APPENDIX D
SLAMM Water Quality Analysis

SLAMM FILE DATA

Current File Data

SLAMM Data File Name:
P:\3220213\Eng Data\Hydrology\WinSLAMM\3220213_Proposed_230209.mdb

Site Descript.:

Edit Seed:

Edit Rain File: C:\WinSLAMM Files\Rain Files\WI Milwaukee 69.RAN

Edit Start Date: Winter Season Range
Edit End Date: Start of Winter (mm/dd) End of Winter (mm/dd)

Edit Pollutant Probability Distribution File: C:\WinSLAMM Files\WI_GEO03.ppdX

Edit Runoff Coefficient File: C:\WinSLAMM Files\WI_SL06 Dec06.rsvX

Edit Particulate Solids Concentration File: C:\WinSLAMM Files\10.1 WI_AVG01.pscX

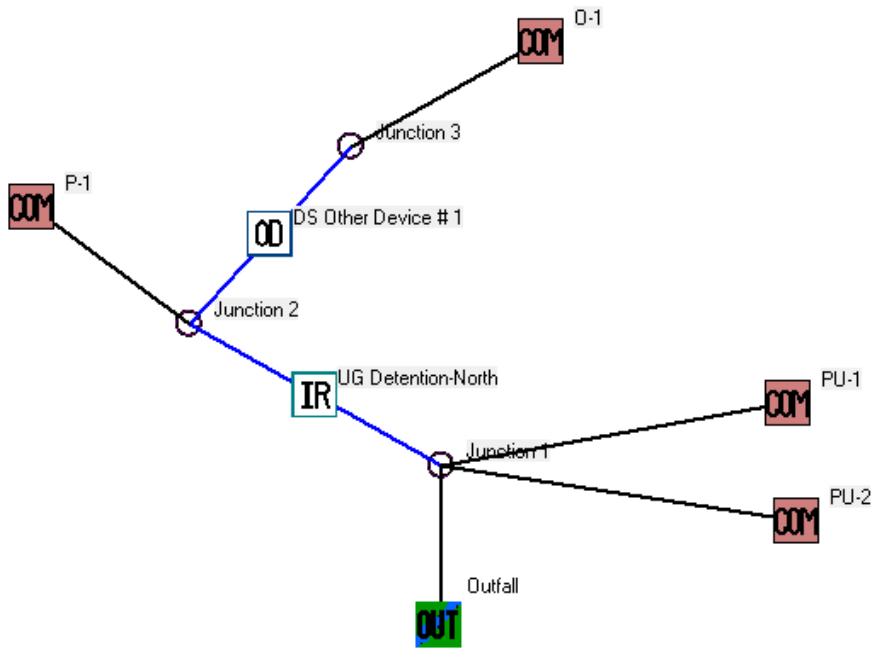
Edit Street Delivery File (Select LU) C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std

Residential LU Other Urban LU
 Institutional LU Freeways
 Commercial LU
 Industrial LU

Edit Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv

Use Cost Estimation Option

PROPOSED SLAMM NETWORK



P-1 LAND USE INPUT

Land Use:					
P-1					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
Roofs		0.420			
1	Roofs 1	0.420	Entered	--	--
Parking		1.180			
13	Paved Parking 1	1.180	Entered	--	--
Driveways/Sidewalks		0.040			
31	Sidewalks 1	0.040	Entered	--	--
Streets		0.000			
Landscaped Areas		0.050			
51	Small Landscaped Areas 1	0.050	Entered	--	--
Other Areas		0.000			

O-1 LAND USE INPUT

Land Use:					
O-1					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
Roofs		0.000			
Parking		0.008			
13	Paved Parking 1	0.008	Entered	--	--
Driveways/Sidewalks		0.000			
Streets		0.000			
Landscaped Areas		0.002			
51	Small Landscaped Areas 1	0.002	Entered	--	--
Other Areas		0.000			

PU-1 LAND USE INPUT

Land Use:					
PU-1					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.000			
	Parking	0.000			
	Driveways/Sidewalks	0.000			
	Streets	0.000			
	Landscaped Areas	0.100			
51	Small Landscaped Areas 1	0.100	Entered	-- ▾	-- ▾
	Other Areas	0.000			

PU-2 LAND USE INPUT

Land Use:					
PU-2					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.000			
	Parking	0.010			
13	Paved Parking 1	0.010	Entered	-- ▾	-- ▾
	Driveways/Sidewalks	0.000			
	Streets	0.000			
	Landscaped Areas	0.180			
51	Small Landscaped Areas 1	0.180	Entered	-- ▾	-- ▾
	Other Areas	0.000			

UG DETENTION – CONTROL DEVICE INPUT

ADS StormTech Isolator Row

Drainage System Control Practice: UG Detention-North
CP Index #: 1

Total Available System Length (ft): 130
Available Height from Chamber Base to Surface (ft): 4.00
Native Soil Infiltration Rate (in/hr): 0.000

Total Available System Width (ft): 50
Number of Isolator Rows: 2
Assumed Stone Porosity: 0.40

Select Either of These Sizing Options:
 Use All Available Area
 Enter Required Storage Volume
 Enter Number of Rows and Row Length

Buttons: Copy Data, Paste Data, Update Graphics, Show Cross Section Detail

Select Product

Product	Height (in)	Width (in)	Length (in)	Final Storage Volume (cf)	Number of Rows	Row Length (ft)	Total Chamber Length (ft)	Total System Width (ft)	Number of Chambers
<input type="radio"/> SC-160LP	12	25	85.4						
<input checked="" type="radio"/> SC-310	16	34	85.4	7714	14	123.0	1693.8	46.7	238
<input type="radio"/> SC-740	30	51	85.4						
<input type="radio"/> DC-780	30	51	85.4						
<input type="radio"/> MC-3500	45	77	86						
<input type="radio"/> MC-4500	60	100	48.3						

Chamber Segment Dimensions

Calculated System Size

Outlet	Invert Elevation (ft)	Orifice Diameter (ft)
Overflow Weir	1.17	N/A
Orifice 1	0.00	0.50
Orifice 2	0.00	0.00

Cross Section

Press 'F1' for Help

Approximate Pipe Configuration

Buttons: Cancel, Delete Control, Continue

Control Practice #: 1 CP Index #: 1

SLAMM TSS RESULTS

File Name: P:\3220213\Eng Data\Hydrology\WinSLAMM\3220213_Proposed_230209.mdb

Outfall Output Summary

	Runoff Volume (cu. ft.)	Percent Runoff Reduction	Runoff Coefficient (Rv)	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of All Land Uses without Controls	160793		0.77	119.5	1199	
Outfall Total with Controls	160948	-0.10 %	0.77	66.55	668.7	44.23 %

Current File Output: Annualized Total After Outfall Controls: 241754
Years in Model Run: 0.67
1004

Buttons: Print Output Summary to .csv File, Print Output Summary to Text File, Print Output Summary to Printer

Total Area Modeled (ac): 1.990

Total Control Practice Costs

Capital Cost: N/A
Land Cost: N/A
Annual Maintenance Cost: N/A
Present Value of All Costs: N/A
Annualized Value of All Costs: N/A

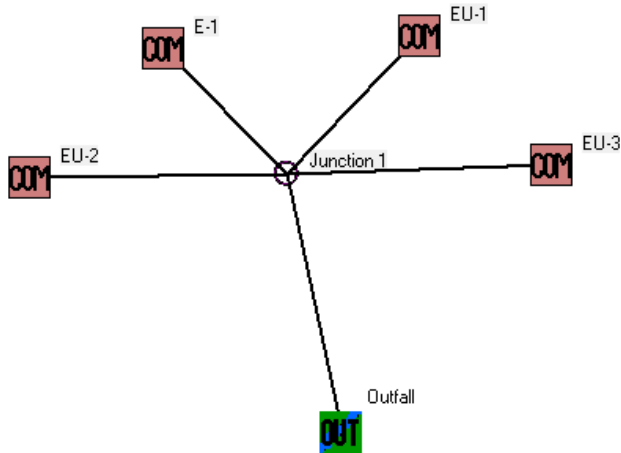
Perform Outfall Flow Duration Curve Calculations

Receiving Water Impacts Due To Stormwater Runoff (CWP Impervious Cover Model)

	Calculated Rv	Approximate Urban Stream Classification
Without Controls	0.77	Poor
With Controls	0.77	Poor

APPENDIX E
SLAMM Infiltration Analysis

EXISTING SLAMM NETWORK



E-1 LAND USE INPUT

Land Use:					
E-1					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.020			
1	Roofs 1	0.020	Entered	-- ▾	-- ▾
	Parking	1.220			
13	Paved Parking 1	1.220	Entered	-- ▾	-- ▾
	Driveways/Sidewalks	0.070			
31	Sidewalks 1	0.070	Entered	-- ▾	-- ▾
	Streets	0.000			
	Landscaped Areas	0.050			
51	Small Landscaped Areas 1	0.050	Entered	-- ▾	-- ▾
	Other Areas	0.000			

EU-1 LAND USE INPUT

Land Use:					
EU-1					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.330			
1	Roofs 1	0.330	Entered	-- ▾	-- ▾
	Parking	0.110			
13	Paved Parking 1	0.110	Entered	-- ▾	-- ▾
	Driveways/Sidewalks	0.010			
31	Sidewalks 1	0.010	Entered	-- ▾	-- ▾
	Streets	0.000			
	Landscaped Areas	0.040			
51	Small Landscaped Areas 1	0.040	Entered	-- ▾	-- ▾
	Other Areas	0.000			

EU-2 LAND USE INPUT

Land Use:					
EU-2					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.000			
	Parking	0.020			
13	Paved Parking 1	0.020	Entered	-- ▾	-- ▾
	Driveways/Sidewalks	0.000			
	Streets	0.000			
	Landscaped Areas	0.060			
51	Small Landscaped Areas 1	0.060	Entered	-- ▾	-- ▾
	Other Areas	0.000			

EU-3 LAND USE INPUT

Land Use:					
EU-3					
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.000			
	Parking	0.020			
13	Paved Parking 1	0.020	Entered	-- ▾	-- ▾
	Driveways/Sidewalks	0.010			
31	Sidewalks 1	0.010	Entered	-- ▾	-- ▾
	Streets	0.000			
	Landscaped Areas	0.020			
51	Small Landscaped Areas 1	0.020	Entered	-- ▾	-- ▾
	Other Areas	0.000			

PRE-DEVELOPED STAY-ON DEPTH

Runoff Volume (cf)			Part. Solids Yield (lbs)	Part. Solids Conc. (mg/L)	Pollutant Yield (lbs)		
Data File: P:\3220213\Eng Data\Hydrology\WinSLAMM\3220213_Existing_230208.mdb							
Rain File: WI Milwaukee 69.RAN							
Date: 02-09-23 Time: 5:37:13 PM							
Site Description:							
Runoff Volume Total (cf) at the Outfall							
Rain Number	Start Date	Rain Total (in)	Outfall Total (cf)	Rv	Total Losses (in.)	Calculated CN*	Event Peak Flow (cfs)
73	07/27/69	1.38	8318	0.839	0.22	98.0	0.293
74	07/31/69	0.04	83.30	0.290	0.03	99.5	0.037
75	08/04/69	0.03	47.34	0.220	0.02	99.5	0.021
76	08/07/69	0.10	316.0	0.440	0.06	99.2	0.040
77	08/09/69	0.08	225.3	0.392	0.05	99.3	0.066
78	08/16/69	0.32	1448	0.630	0.12	98.7	0.637
79	09/04/69	0.36	1676	0.648	0.13	98.6	0.147
80	09/05/69	0.74	3925	0.738	0.19	98.1	1.726
81	09/14/69	0.01	5.260	0.073	0.01	99.7	0.005
82	09/15/69	0.03	47.34	0.220	0.02	99.5	0.042
83	09/16/69	0.03	47.34	0.220	0.02	99.5	0.021
84	09/23/69	0.16	611.2	0.531	0.07	99.1	0.108
85	09/25/69	0.01	5.260	0.073	0.01	99.7	0.005
86	09/29/69	0.84	4570	0.757	0.20	98.0	0.804
87	10/06/69	0.01	5.260	0.073	0.01	99.7	0.005
88	10/06/69	0.01	5.260	0.073	0.01	99.7	0.005
89	10/09/69	0.05	113.3	0.315	0.03	99.4	0.033
90	10/10/69	0.14	511.5	0.508	0.07	99.1	0.112
91	10/10/69	1.34	8038	0.835	0.22	98.0	0.505
92	10/12/69	1.63	10102	0.862	0.22	98.0	0.355
93	10/15/69	0.16	611.2	0.531	0.07	99.1	0.054
94	10/19/69	0.44	2130	0.673	0.14	98.5	0.170
95	10/19/69	0.35	1618	0.643	0.12	98.6	0.203
96	10/21/69	0.02	21.04	0.146	0.02	99.6	0.019
97	10/24/69	0.01	5.260	0.073	0.01	99.7	0.005
98	10/30/69	0.32	1448	0.630	0.12	98.7	0.080
99	11/02/69	0.77	4118	0.744	0.20	98.0	0.104
100	11/11/69	0.05	113.3	0.315	0.03	99.4	0.025
101	11/11/69	0.04	83.30	0.290	0.03	99.5	0.037
102	11/13/69	0.03	47.34	0.220	0.02	99.5	0.014
103	11/17/69	0.15	560.5	0.520	0.07	99.1	0.164
104	11/18/69	0.02	21.04	0.146	0.02	99.6	0.003
105	11/19/69	0.01	5.260	0.073	0.01	99.7	0.005
106	11/26/69	0.07	184.3	0.366	0.04	99.3	0.054
Minimum:		0.01	5.260	0.073	0.01	98.0	0.003
Maximum:		1.96	12450	0.884	0.23	99.7	3.628
Average:		0.33	1723	0.452	0.09	98.2	0.836
Total:		29.02	153351		7.65		
* Note: NRCS does not recommend using CN method for rains < 0.5 in.							
See 'PreDevelopment Areas and CN' Help for more info.							

POST-DEVELOPED STAY-ON DEPTH

Runoff Volume (cf)			Part. Solids Yield (lbs)	Part. Solids Conc. (mg/L)	Pollutant Yield (lbs)		
Data File: P:\3220213\Eng Data\Hydrology\WinSLAMM\3220213_Proposed_230209.mdb							
Rain File: WI Milwaukee 69.RAN							
Date: 02-09-23 Time: 5:39:52 PM							
Site Description:							
Runoff Volume Total (cf) at the Outfall							
Rain Number	Start Date	Rain Total (in)	Outfall Total (cf)	Rv	Total Losses (in.)	Calculated CN*	Event Peak Flow (cfs)
73	07/27/69	1.38	8594	0.862	0.19	98.3	0.288
74	07/31/69	0.04	96.05	0.332	0.03	99.6	0.037
75	08/04/69	0.03	54.49	0.251	0.02	99.6	0.021
76	08/07/69	0.10	372.1	0.515	0.05	99.4	0.045
77	08/09/69	0.08	279.3	0.483	0.04	99.5	0.075
78	08/16/69	0.32	1557	0.674	0.10	98.9	0.418
79	09/04/69	0.36	1788	0.688	0.11	98.8	0.149
80	09/05/69	0.74	4134	0.773	0.17	98.4	0.891
81	09/14/69	0.01	6.164	0.085	0.01	99.8	0.004
82	09/15/69	0.03	55.74	0.257	0.02	99.6	0.037
83	09/16/69	0.03	54.49	0.251	0.02	99.6	0.021
84	09/23/69	0.16	677.0	0.586	0.07	99.2	0.113
85	09/25/69	0.01	6.164	0.085	0.01	99.8	0.004
86	09/29/69	0.84	4781	0.788	0.18	98.3	0.587
87	10/06/69	0.01	6.164	0.085	0.01	99.8	0.004
88	10/06/69	0.01	6.164	0.085	0.01	99.8	0.004
89	10/09/69	0.05	133.8	0.371	0.03	99.5	0.036
90	10/10/69	0.14	573.3	0.567	0.06	99.3	0.116
91	10/10/69	1.34	8312	0.859	0.19	98.3	0.458
92	10/12/69	1.63	10384	0.882	0.19	98.3	0.345
93	10/15/69	0.16	676.8	0.586	0.07	99.2	0.058
94	10/19/69	0.44	2262	0.712	0.13	98.7	0.170
95	10/19/69	0.35	1728	0.684	0.11	98.8	0.196
96	10/21/69	0.02	24.76	0.171	0.02	99.6	0.016
97	10/24/69	0.01	6.164	0.085	0.01	99.8	0.004
98	10/30/69	0.32	1552	0.671	0.11	98.9	0.084
99	11/02/69	0.77	4314	0.776	0.17	98.3	0.108
100	11/11/69	0.05	133.7	0.370	0.03	99.5	0.028
101	11/11/69	0.04	96.05	0.332	0.03	99.6	0.037
102	11/13/69	0.03	54.41	0.251	0.02	99.6	0.015
103	11/17/69	0.15	625.4	0.577	0.06	99.3	0.156
104	11/18/69	0.02	24.08	0.167	0.02	99.6	0.003
105	11/19/69	0.01	6.164	0.085	0.01	99.8	0.004
106	11/26/69	0.07	226.3	0.448	0.04	99.5	0.061
Minimum:		0.01	6.164	0.085	0.01	98.3	0.003
Maximum:		1.96	12761	0.901	0.19	99.8	1.536
Average:		0.33	1808	0.492	0.08	98.5	0.534
Total:		29.02	160948		6.80		
* Note: NRCS does not recommend using CN method for rains < 0.5 in.							
See 'PreDevelopment Areas and CN' Help for more info.							

APPENDIX F

Operations and Maintenance Manual and Checklist

Storm Water Management Practice Maintenance Agreement

Document Number

Boucher Holdings LLC, as “Owner” of the property described below, in accordance with Chapter 32 City of Waukesha Storm Water Management and Erosion Control, agrees to install and maintain storm water management practice(s) on the subject property in accordance with approved plans and Storm Water Management Plan conditions. The owner further agrees to the terms stated in this document to ensure that the storm water management practice(s) continues serving the intended functions in perpetuity. This Agreement includes the following exhibits:

Exhibit A: Legal Description of the real estate for which this Agreement applies (“Property”).

Exhibit B: Location Map(s) – shows an accurate location of each storm water management practice affected by this Agreement.

Exhibit C: Maintenance Plan – prescribes those activities that must be carried out to maintain compliance with this Agreement.

Note: After construction verification has been accepted by the City of Waukesha, for all planned storm water management practices, an addendum(s) to this agreement shall be recorded by the Owner showing design and construction details. The addendum(s) may contain several additional exhibits, including certification by City of Waukesha of Storm Water and Erosion Control Permit termination, as described below.

Name and Return Address

City of Waukesha
201 Delafield Street
Waukesha, WI 53188

Parcel Identification Number(s) – (PIN)
WAKC1007054

Through this Agreement, the Owner hereby subjects the Property to the following covenants, conditions and restrictions:

1. The Owner shall be responsible for the routine and extraordinary maintenance and repair of the storm water management practice(s) and drainage easements identified in Exhibit B until Storm Water and Erosion Control Permit termination by the City of Waukesha in accordance with Chapter 32 of the City Code of Ordinances.
2. After Storm Water and Erosion Control Permit termination under 1., the current Owner(s) shall be solely responsible for maintenance and repair of the storm water management practices and drainage easements in accordance with the maintenance plan contained in Exhibit C.
3. The Owner(s) shall, at their own cost, complete inspections of the storm water management practices at the time intervals listed in Exhibit C, and conduct the inspections by a qualified professional, file the reports with the City of Waukesha after each inspection and complete any maintenance or repair work recommended in the report. The Owner(s) shall be liable for the failure to undertake any maintenance or repairs. After the work is completed by the Contractor, the qualified professional shall verify that the work was properly completed and submit the follow-up report to the City within 30 days.
4. In addition, and independent of the requirements under paragraph 3 above, the City of Waukesha, or its designee, is authorized to access the property as necessary to conduct inspections of the storm water management practices or drainage easements to ascertain compliance with the intent of this Agreement and the activities prescribed in Exhibit C. The City of Waukesha may require work to be done which differs from the report described in paragraph 3 above, if the City of Waukesha reasonably concludes that such work is necessary and consistent with the intent of this agreement. Upon notification by the City of Waukesha of required maintenance or repairs, the Owner(s) shall complete the specified maintenance or repairs within a reasonable time frame determined by the City of Waukesha.
5. If the Owner(s) do not complete an inspection under 3. above or required maintenance or repairs under 4. above within the specified time period, the City of Waukesha is authorized, but not required, to perform the specified inspections, maintenance or repairs. In the case of an emergency situation, as determined by the City of Waukesha, no notice shall be required prior to the City of Waukesha performing emergency maintenance or repairs. The City of Waukesha may levy the costs and expenses of such inspections, maintenance or repair related actions as a special charge against the Property and collected as such in accordance with the procedures under s. 66.0627 Wis. Stats. or subch. VII of ch. 66 Wis. Stats.

6. This Agreement shall run with the Property and be binding upon all heirs, successors and assigns. After the Owner records the addendum noted above, the City of Waukesha shall have the sole authority to modify this agreement upon a 30-day notice to the current Owner(s).

Dated this ____ day of _____, 202_.

Owner:

(Owners Signature)

Daniel G. Nienhuis, General Counsel, Boucher Holdings, LLC.

(Owners Typed Name)

Acknowledgements

State of Wisconsin:
County of Waukesha

Personally came before me this ____ day of _____, 202_, the above named Daniel G. Nienhuis to me known to be the person who executed the foregoing instrument and acknowledged the same.

[Name]
Notary Public, Waukesha County, WI
My commission expires:_____.

This document was drafted by:

Jeremy Jeffery, P.E.

16745 W Bluemound Road,
Brookfield, WI 53005

[Name and address of drafter]

City of Waukesha Common Council Approval

Dated this ____ day of _____, 202_.

Shawn N. Reilly, Mayor

Gina Kozlik, City Clerk

Acknowledgements

State of Wisconsin:
County of Waukesha

Personally came before me this ____ day of _____, 202_, the above named _ Daniel G. Nienhuis to me known to be the person who executed the foregoing instrument and acknowledged the same.

[Name]
Notary Public, Waukesha County, WI
My commission expires:_____.

Exhibit A – Legal Description

The following description and reduced copy map identifies the land parcel(s) affected by this Agreement. For a larger scale view of the referenced document, contact the Waukesha County Register of Deeds office.

Project Identifier: **Waukesha Nissan** Acres: **8.84**
 Date of Recording: **January 11, 2023**
 Map Produced By: **raSmith, Brookfield, WI**
 Legal Description: **Recorded as Plat of Survey w/ Utilities & Topographic Data, dated 1/11/2023**
Lot 1 of certified survey map no. 11016. Being part of the NE ¼ of the SE ¼ of section 35, Town 7 N. Range 19 E, in the city of Waukesha, Waukesha County, Wisconsin

Waukesha Nissan

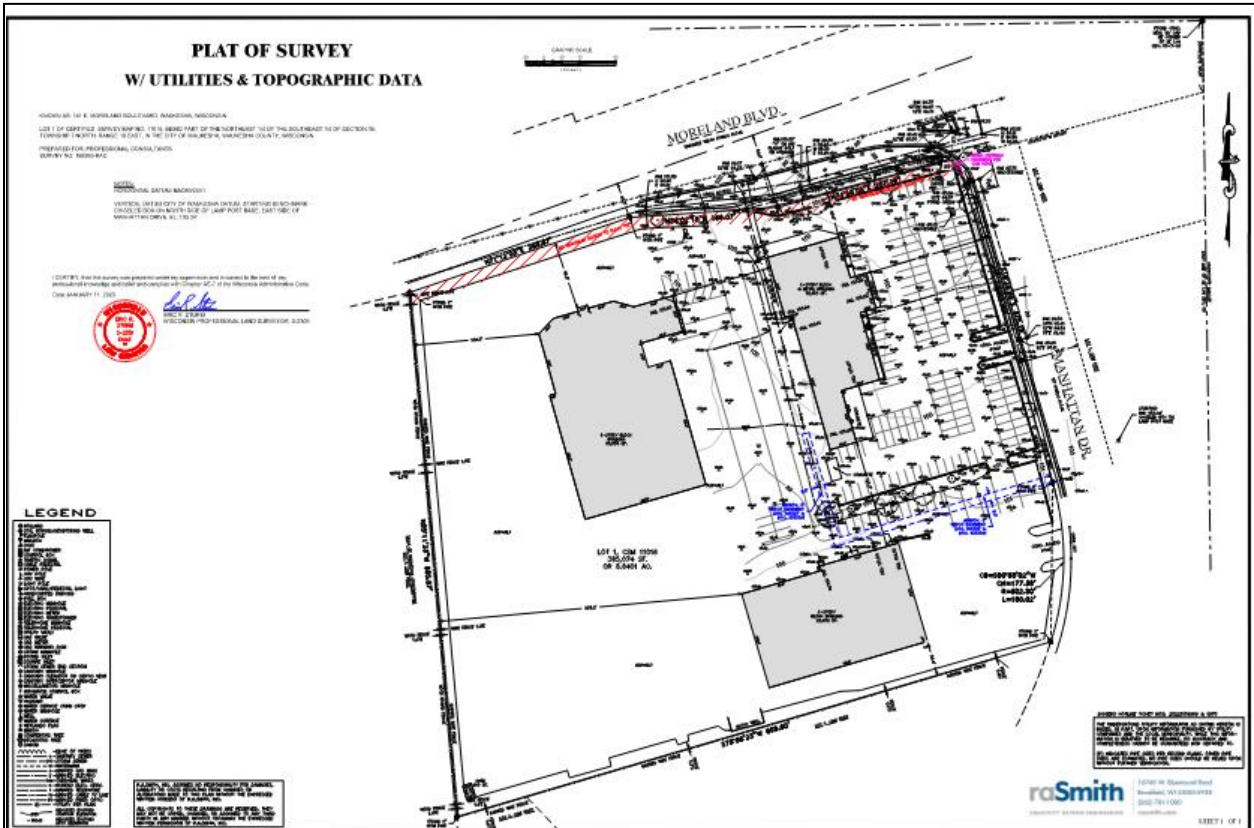


Exhibit B - Location Map

Storm Water Management Practices Covered by this Agreement

The storm water management practices covered by this Agreement are depicted in the reduced copy of a portion of the construction plans, as shown below. The practices include two independent underground detention tanks.

Project Name: Waukesha Nissan
Storm water Practices: Underground Detention Tank
Location of Practices: Under parking lot

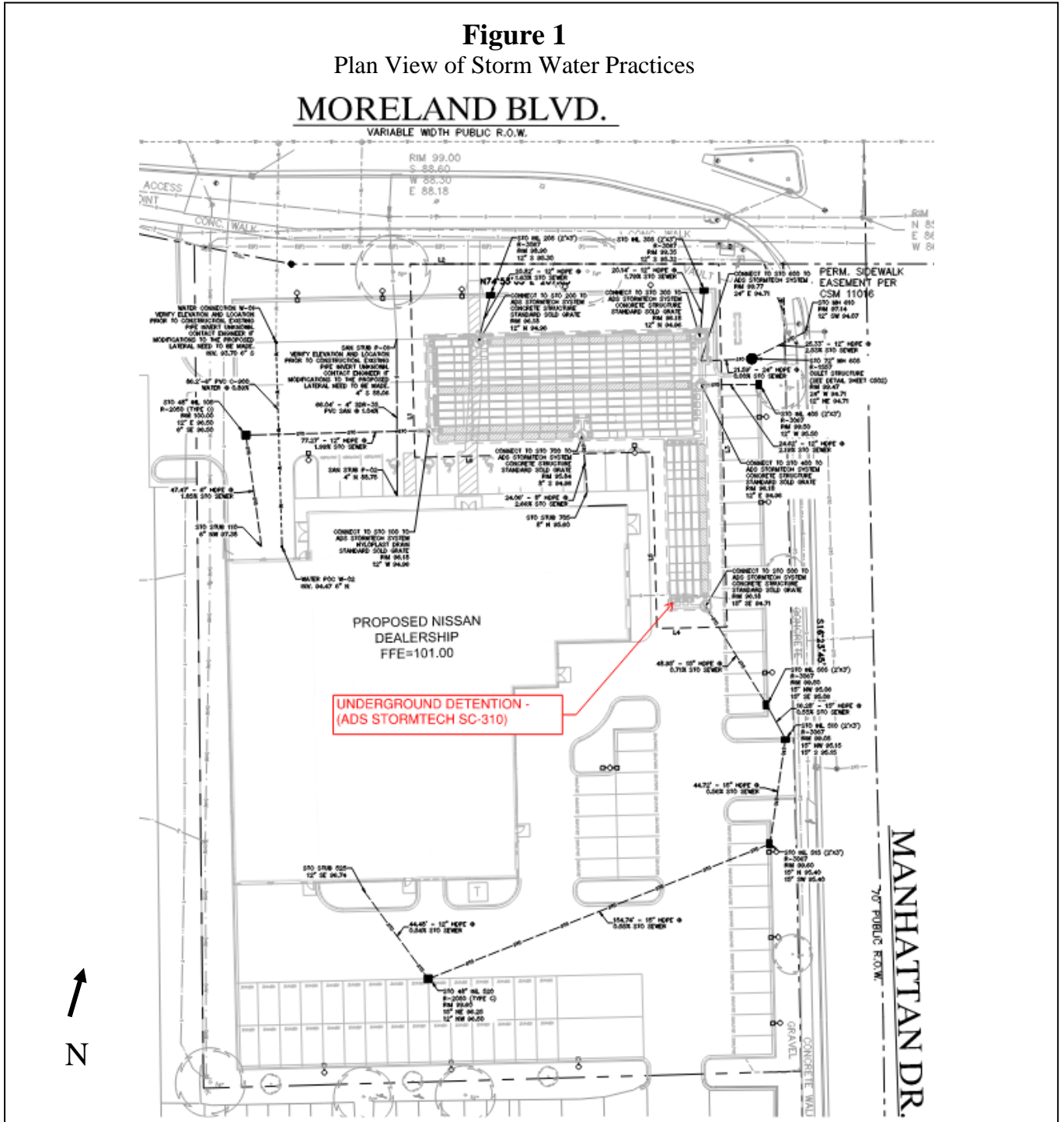


Exhibit C

Storm Water Practice Maintenance Plan

This exhibit explains the basic function of each of the storm water practices listed in Exhibit B and prescribes the minimum maintenance requirements to remain compliant with this Agreement. The maintenance activities listed below are aimed to ensure these practices continue serving their intended functions in perpetuity. The list of activities is not all inclusive, but rather indicates the minimum type of maintenance that can be expected for this particular site. The titleholder(s) or their designee must document all inspections as specified above. Documentation shall include as a minimum: (a) Inspectors Name, Address and Telephone Number, (b) Date of Inspections, (c) Condition Report of the Storm Water Management Practice, (d) Corrective Actions to be Taken and Time Frame for Completion, (e) Follow-up Documentation after Completion of the Maintenance Activities. All documentation is to be delivered to the attention of the City Engineer at the City of Waukesha Engineering Department on January 10th and July 10th each year. Any repair, maintenance, or failure of a storm water practice that is caused by a lack of maintenance will subject the Owner(s) to enforcement of the provisions listed on page 1 of this Agreement by the City of Waukesha.

I. ROUTINE MAINTENANCE

A. Inspections (A competent inspector or inspection service qualified to review drainage systems shall be chosen and hired by the Owner.)

1. Inspection priorities include visual observation and documentation of:
 - a. Accumulation of sediment and debris in the storm sewer inlets, wet underground detention systems, and outlet control structures.
 - b. Any modification to the contributory watershed. Confirm and document any modifications.
 - c. Inspect underground detention systems for settling, cracking, erosion, leakage, and structural condition of outlet control structure. Make repairs as necessary.
 - d. Inspect site for areas of erosion. If present, eroded areas shall be repaired using low-impact earth moving techniques commensurate with the scale of the repair task. Any bare soil areas shall be revegetated according to the original design specifications.
2. Inspect all storm sewer structures, underground detention system basins, and outlet control structures after significant rainfall events and at least twice annually, once in the Spring and once in the Fall. Conduct inspections during wet weather conditions to determine if the storm sewer system is functioning properly.

B. Debris and Litter Removal.

1. Remove debris and litter from the area, including the storm sewer system, underground detention systems, and outlet control structures.
2. Remove debris and litter from the grates and inverts of all the storm sewer inlets, catch basins, and manholes.
3. Remove accumulated sediment from all storm sewer inlets, catch basins, and manholes.

II. NON-ROUTINE MAINTENANCE

A. Post Construction Monitoring

1. For the first 12 months following installation of the underground detention systems and storm sewers, the system is to be inspected on a quarterly basis to verify the integrity of the conveyance system. Following the initial 12 months, the system is to be inspected at least every 6 months or more frequently as determined by the initial 12-month monitoring period.

B. Structural Repairs and Replacement.

1. Conduct routine inspection and maintenance of all storm sewer structures to promote longevity.

III. DOCUMENTATION OF MAINTENANCE

A. Complete attached "Inspection Form for Storm Water Management Systems" The Owner will maintain the records.

1. Document Number

Document number

Addendum 1 Storm Water Management Practice Maintenance Agreement

The purpose of this addendum is to record verified “as-built” construction details, supporting design data and permit termination documentation for the storm water management practice(s) located at Waukesha Nissan, Lot 1 of certified survey map no. 11016, being part of the Northeast ¼ of the Southeast ¼ of Section 35, Township 7 North, Range 19 East, in the City of Waukesha, Waukesha County, Wisconsin. This document shall serve as an addendum to document # _____, herein referred to as the “Maintenance Agreement”. This addendum includes all of the following exhibits:

Exhibit D: Design Summary – contains a summary of key engineering calculations and other data used to design the wet detention basin.

Exhibit E: As-built Survey – shows detailed “as-built” cross-section and plan view of the wet detention basin.

Exhibit F: Engineering/Construction Verification – provides verification from the project engineer that the design and construction of the wet detention basin complies with all applicable technical standards and Waukesha County ordinance requirements.

Exhibit G: Storm Water Management & Erosion Control Permit Termination – provides certification by the City of Waukesha that the Storm Water and Erosion Control Permit for the above noted site has been terminated.

Name and Return Address

Dated this ___ day of _____, 202_.

Parcel Identification Number(s) – (PIN)

Owner:

[Owners Signature – per the Maintenance Agreement]

[Owners Typed Name]

Acknowledgements

State of Wisconsin County of Waukesha

Personally came before me this ___ day of _____, 202_, the above named Daniel G. Nienhuis to me known to be the person who executed the foregoing instrument and acknowledged the same.

[Name]

Notary Public, Waukesha County, WI

My commission expires: _____.

This document was drafted by:

____ Jeremy Jeffery, P.E.

16745 W Bluemound Road,
Brookfield, WI 53005

[Name and address of drafter]



Exhibit D

Design Summaries for Underground Detention Tank - North

Project Identifier: Waukesha Nissan **Project Size:** 1.98 Acres **No. of Lots:** N/A
Number of Runoff Discharge Points: 1 **Watershed (ultimate discharge):** Fox River
Watershed Area (including off-site runoff traveling through project area): 1.99 acres

Watershed Data Summary. The following table summarizes the watershed data used to determine peak flows and runoff volumes required to design Underground Detention Tank

Summary Data Elements	Existing and Proposed	
	Pre-develop	Post-develop
Watershed Areas (in acres) <i>(see attached map)</i>	1.98	1.99
Average Watershed Slopes (%)	2-4%	2-4%
Land Uses (% of each) <i>(see attached map)</i>	0.17ac Grass 1.37ac Pavement 0.09ac Sidewalk 0.35ac Roof	0.332ac Grass 1.11ac Pavement 0.04ac Sidewalk 0.49ac Roof
Runoff Curve Numbers	RCN = 93	RCN = 88
Conveyance Systems Types	50% overland 50% storm sewer	50% overland 50% storm sewer
Time of Concentration (T_c) <i>(see attached map & worksheets)</i>	6 min.	6 min.
1-year/24 hour Runoff Volume	6.08 cfs	5.68 cfs
2-yr./24 hour Peak Flow <i>(see attached hydrographs)</i>	6.96 cfs	6.48 cfs
10-yr./24 hour Peak Flow	10.24 cfs	9.38 cfs
100-yr./24 hour Peak Flow	17.18 cfs	15.70 cfs

Practice Design Summary. The following table summarizes the data used to design Underground Detention Tank

Design Element	Design Data
Site assessment data: (see attached maps)	
Contributing drainage area to basin	1.70 acres
Distance to nearest private well (including off-site wells)	> 100 feet
Distance to municipal well (including off-site wells)	> 1200 feet
Wellhead protection area involved?	No
Ground slope at site of proposed basin	average 2-3%
Any buried or overhead utilities in the area?	Yes
Proposed outfall conveyance system/discharge (w/ distances)	25.33' – 12 HDPE pipe into back of existing Inlet along Manhattan
Any downstream roads or other structures? (describe)	Inlet on Manhattan connects to storm sewer at the intersection of Moreland/Manhattan
Floodplain, shoreland or wetlands?	No
General basin design data (see attached detailed drawings):	
Top of Stone	96.46
Top of Chamber	95.96
Chamber Invert	94.63
Bottom of Stone	94.13

Design Basin Inflow, Outflow & Storage Data (see attached hydrographs and detail drawings)				
Inflow Peak/Volume	Maximum Outflow Rate	Max. Water Elevation	Storage Volume at Max. Elev. (above perm. pool)	Outflow Control Structures*
1-yr./24 hr.	2.50	95.07	0.076 af	#1 & #3
2-yr./24 hr.	2.84	95.17	0.087 af	#1 & #3
10-yr./24 hr.	5.39	95.51	0.120 af	#1, #2 and #3
100-yr./24 hr.	14.03	95.92	0.150 af	#1, #2 and #3

- *#1 = 6 inch orifice in water level control weir plate – flow line elev. @ 94.13'
- #2 = 6 foot wide rectangular weir – flow line elev. @ 95.30'
- #3 = 12 inch diameter rcp pipe – flow line elev. @ 95.30'

Exhibit D (continued)

Watershed Map. The watershed map shown below was used to determine the post-development data contained in this exhibit.

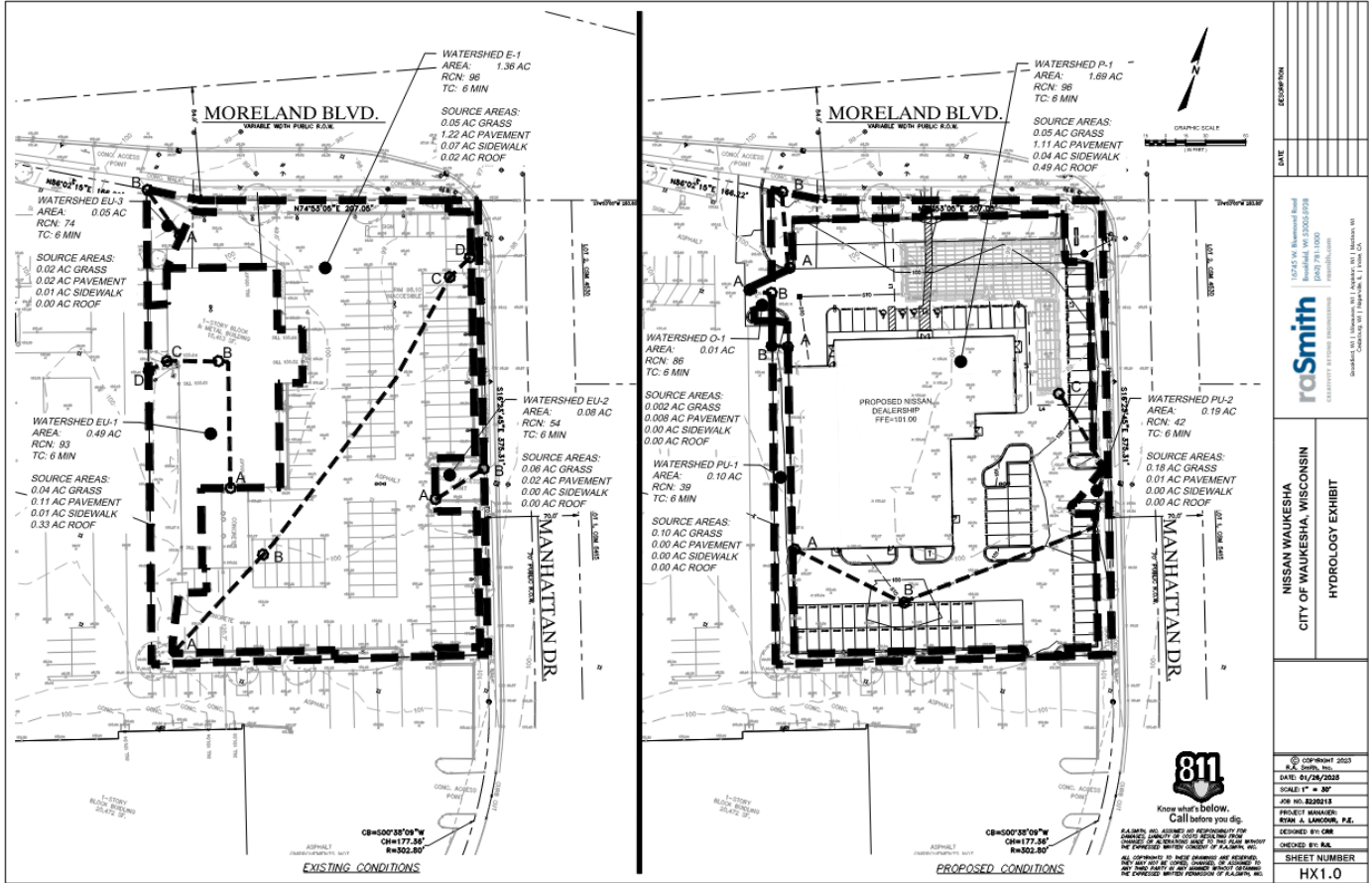


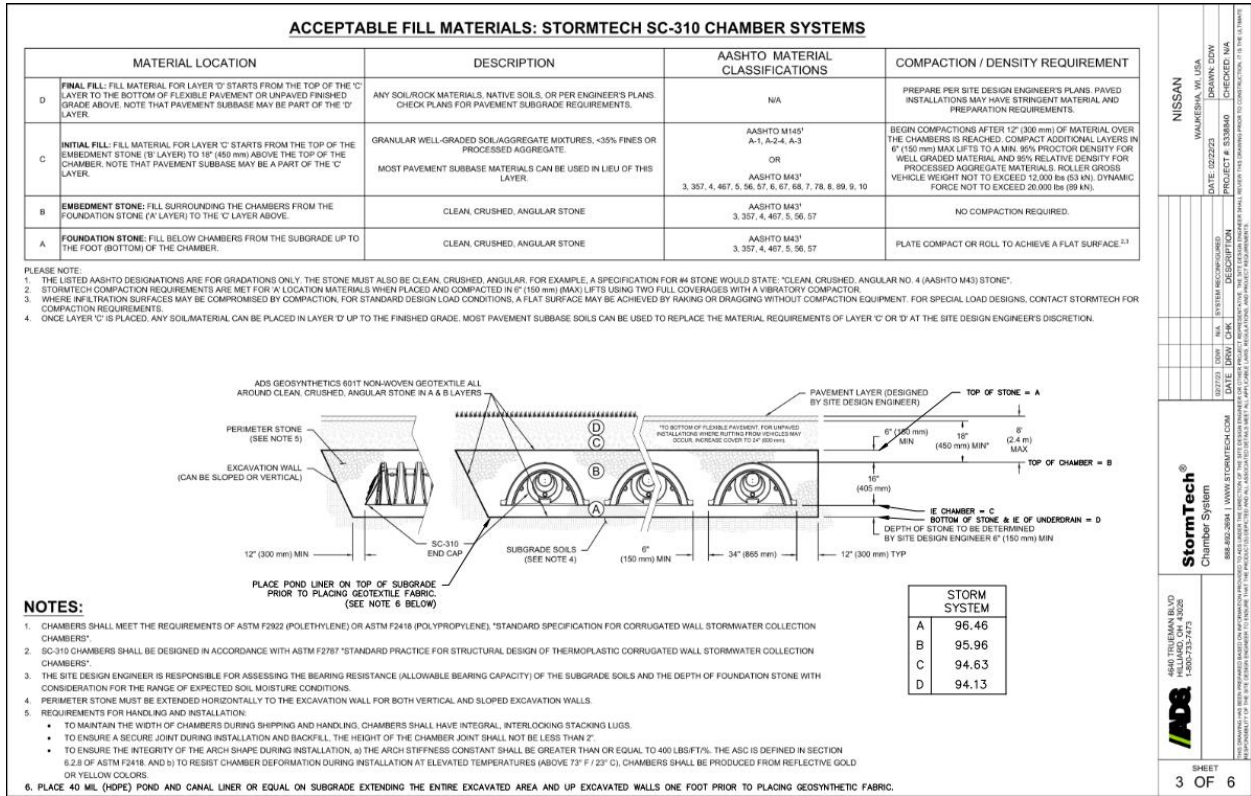
Exhibit E

As-built Survey for Underground Detention Tank

The underground detention basin depicted in Figure 1 is a reduced copy of the as-built plan.

Project Identifier: Waukesha Nissan
Storm water Practice: Underground Detention Tanks
Location of Practice: Under parking lot

Cross-Section A – A'



**Exhibit “F”
Engineering/Construction Verification**

DATE: _____

TO: City of Waukesha

FROM: _____ [Project Engineer’s Name/Company]

RE: Engineering/Construction Verification for the following project:
Project Name: _____
Section _____, Town of _____
Storm Water Management & Erosion Control Permit # _____
Storm Water Management Practices: _____

For the above-referenced project and storm water management practices, this correspondence shall serve as verification that: 1) all site inspections outlined in approved inspection plans have been successfully completed; and 2) the storm water management practice design data presented in Exhibit D, and the “as-built” construction documentation presented in Exhibit E comply with all applicable state and local technical standards, in accordance with the City of Waukesha Storm Water Management and Erosion Control Ordinance.

[Must include one of the following two statements:]

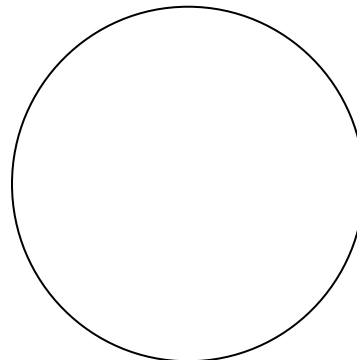
1. Any variations from the originally approved construction plans are noted in Exhibit E. These variations are considered to be within the tolerances of standard construction techniques and do not affect the original design as presented in Exhibit D in any way.

[Note: The City may request additional documentation to support this statement depending on the extent of deviations from the approved plans.]

Or

2. Any design or construction changes from the originally approved construction plans are documented in Exhibits D and E and have been approved by the City of Waukesha.

[Note: If warm season and wetland planting verification is required, it may be included in this exhibit.]



(Signed P.E. stamp must be included)

Exhibit G
Storm Water Management and Erosion Control Permit Termination

Project Identifier: Waukesha Nissan

Location: **Recorded as Plat of Survey w/ Utilities & Topographic Data, dated 1/11/2023**
Lot 1 of certified survey map no. 11016. Being part of the NE ¼ of the SE ¼ of section 35, Town 7 N. Range 19 E, in the city of Waukesha, Waukesha County, Wisconsin

Storm Water Management and Erosion Control Permit Holder's Name:

Storm Water Management & Erosion Control Permit #: _____

Chapter 32 – City of Waukesha Storm Water Management and Erosion Control requires that all newly constructed storm water management practices be maintained by the Storm Water and Erosion Control Permit Holder until permit termination, after which maintenance responsibilities shall be transferred to the responsible party identified on the subdivision plat [or CSM] and referenced in this Maintenance Agreement.

Upon execution below, this exhibit shall serve to certify that the Storm Water Permit Holder has satisfied all requirements of the Storm Water Management and Erosion Control Ordinance and that the City of Waukesha has terminated the Storm Water Management and Erosion Control Permit for the property covered by this Maintenance Agreement.

Dated this ___ day of _____, 202_.

City of Waukesha representative:

(Signature)

(Typed Name and Title)

Acknowledgements

State of Wisconsin
County of Waukesha

Personally came before me this ____ day of _____, 202_, the above named _____ to me known to be the person who executed the foregoing instrument and acknowledged the same.

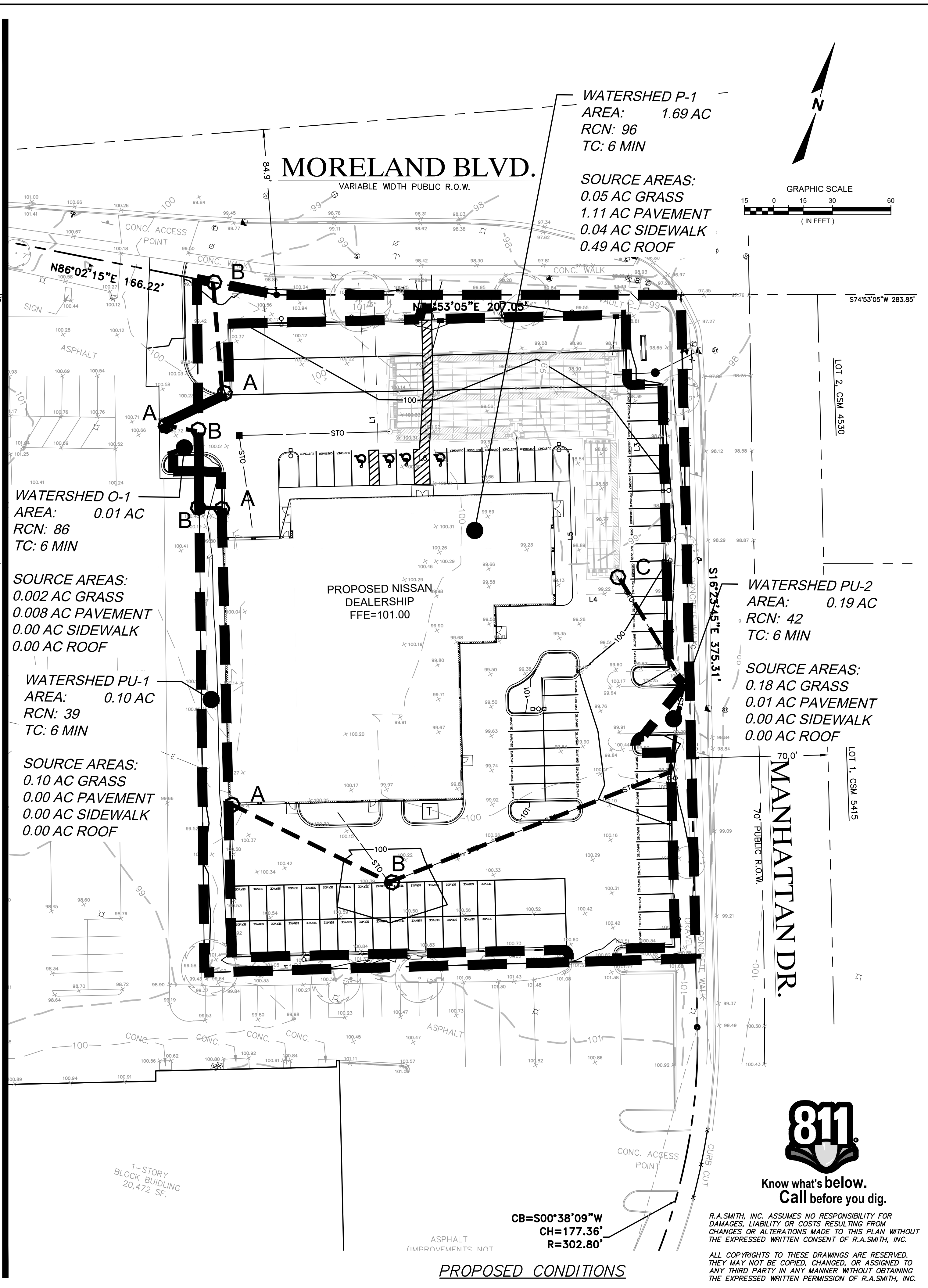
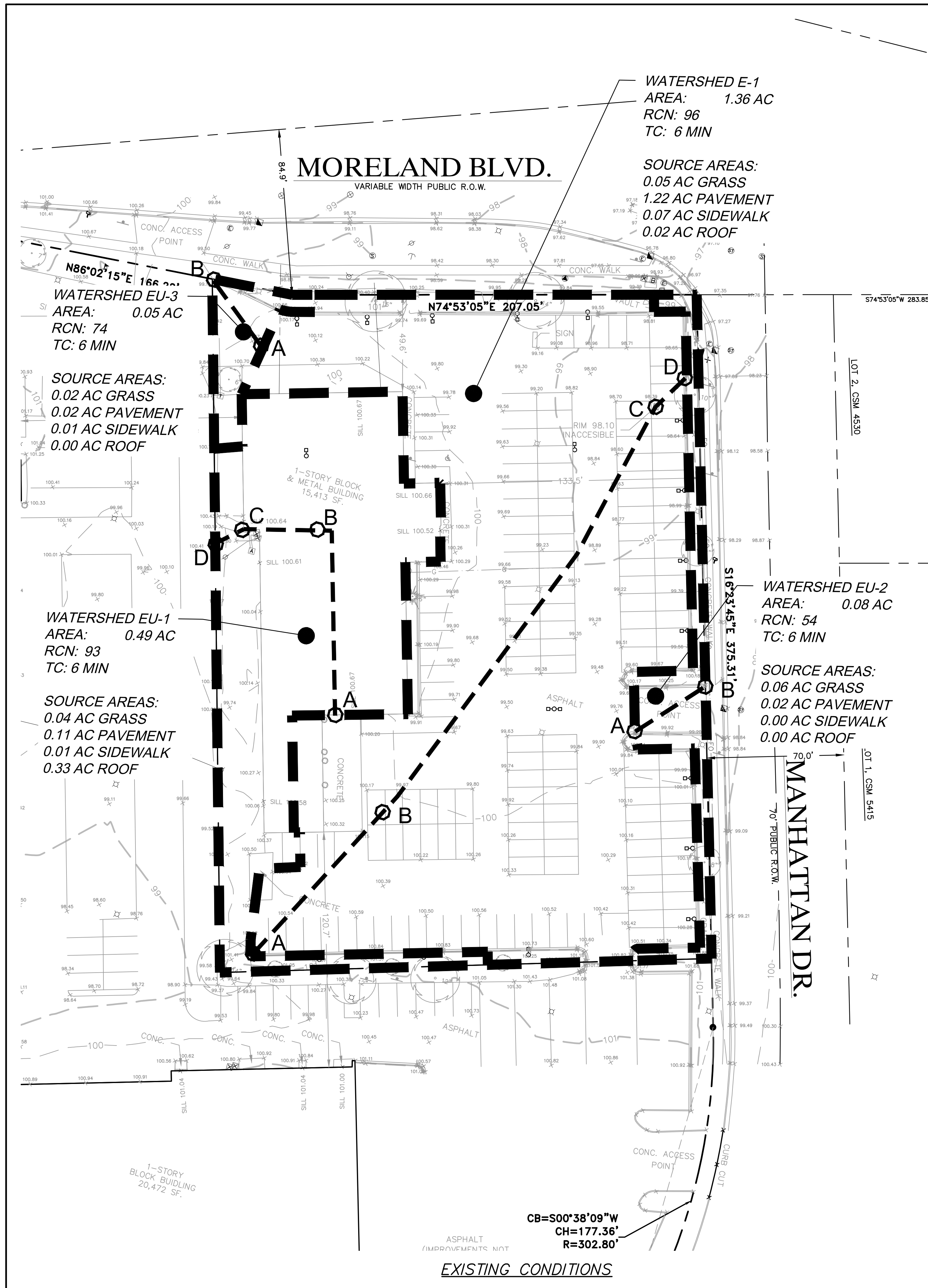
_____.

[Name]

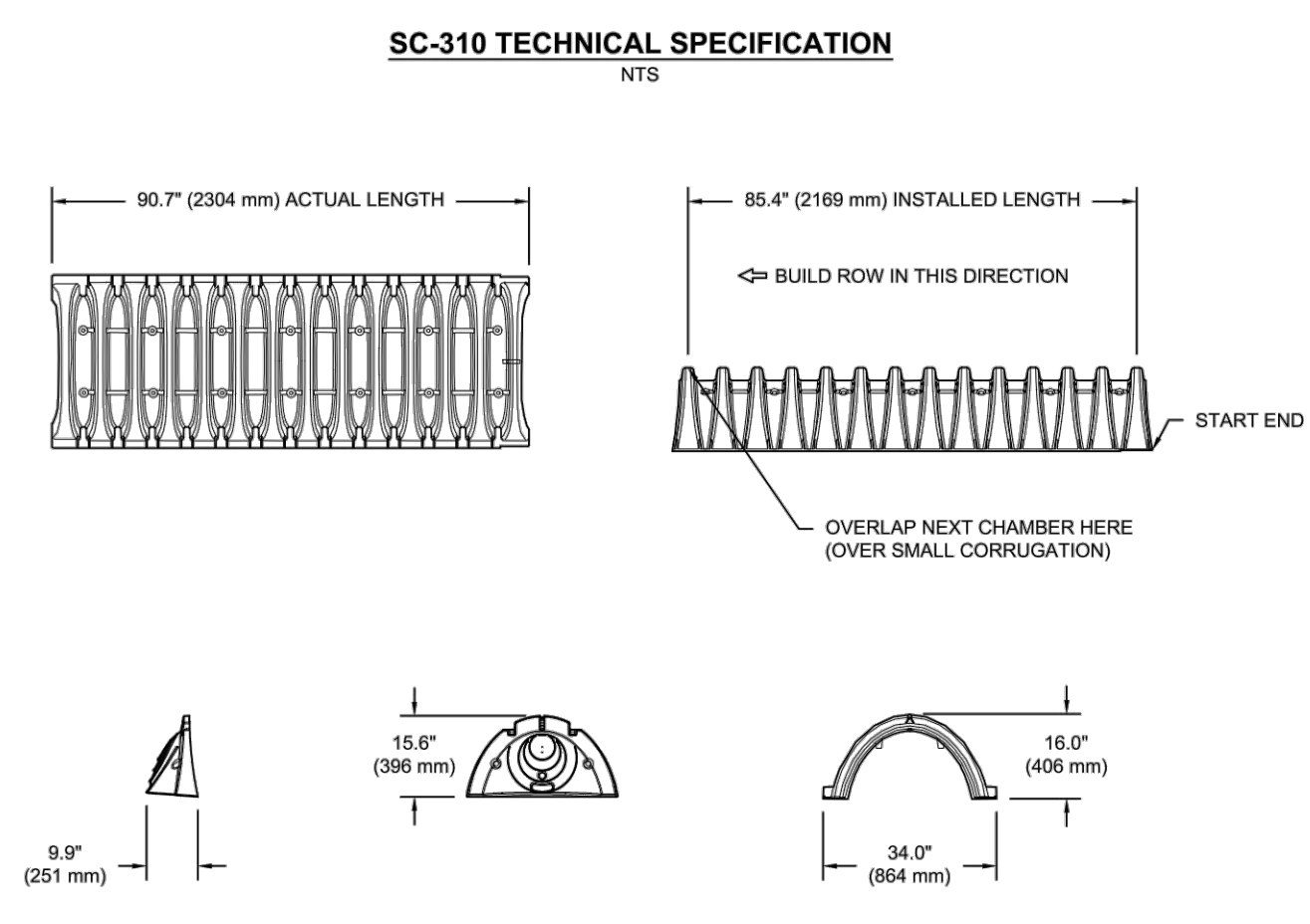
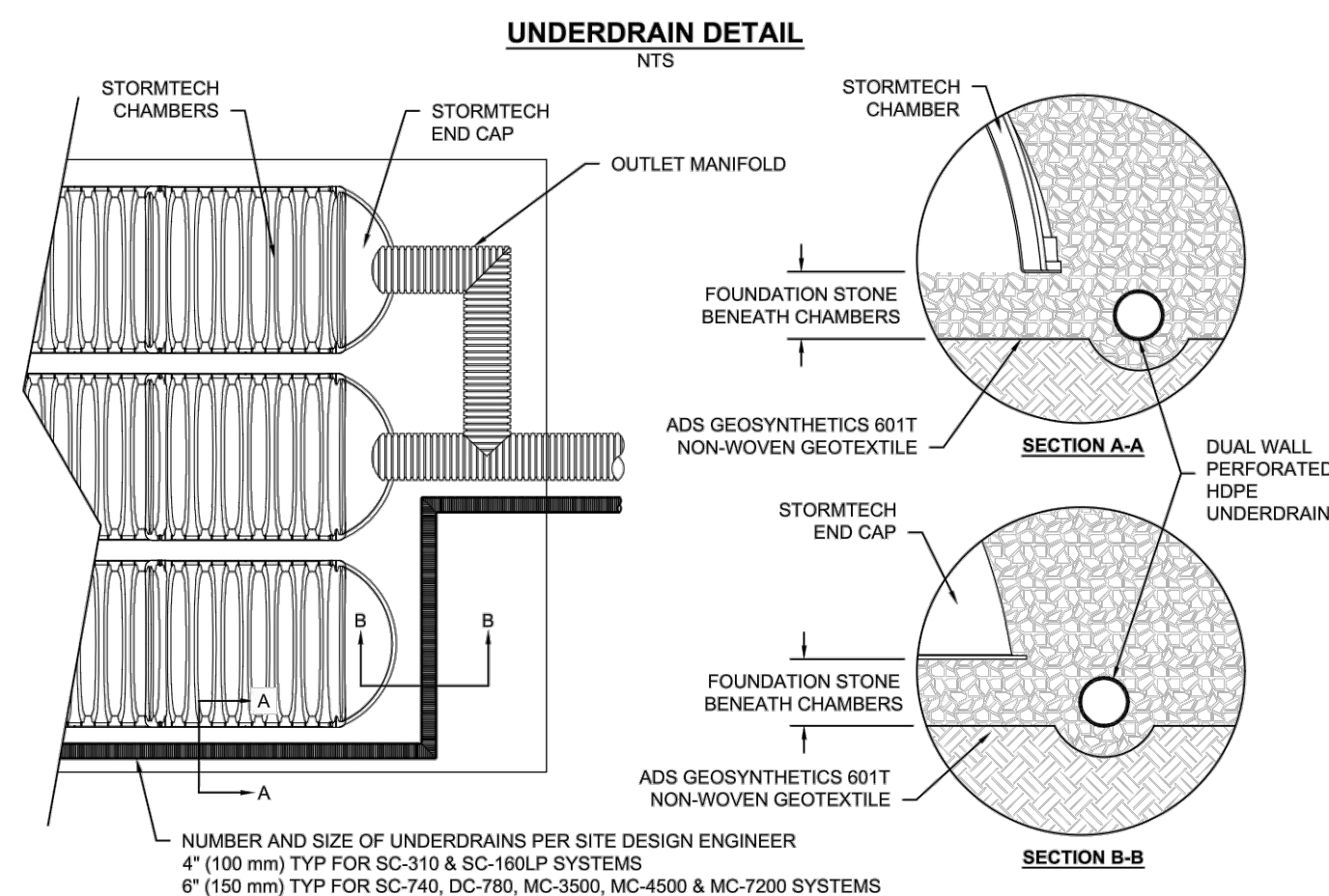
Notary Public, Waukesha County, WI

My commission expires: _____

APPENDIX G
Hydrology Exhibit



DESCRIPTION
DATE
16745 W. Bluemound Road Brookfield, WI 53005-5938 (262) 781-1000 rasmith.com
raSmith CREATIVITY BEYOND ENGINEERING
Brookfield, WI Milwaukee, WI Appleton, WI Madison, WI Cedarburg, WI Naperville, IL Irvine, CA
NISSAN WAUKESHA CITY OF WAUKESHA, WISCONSIN
HYDROLOGY EXHIBIT
© COPYRIGHT 2023 R.A. Smith, Inc. DATE: 01/26/2023 SCALE: 1" = 30' JOB NO. 3220213 PROJECT MANAGER: RYAN J. LANCOUR, P.E. DESIGNED BY: CRR CHECKED BY: RJL
811 Know what's below. Call before you dig. R.A. SMITH, INC. ASSUMES NO RESPONSIBILITY FOR DAMAGES, LIABILITY OR COSTS RESULTING FROM CHANGES OR ALTERATIONS MADE TO THIS PLAN, WITHOUT THE EXPRESSED WRITTEN CONSENT OF R.A. SMITH, INC. ALL COPYRIGHTS TO THESE DRAWINGS ARE RESERVED. THEY MAY NOT BE COPIED, CHANGED, OR ASSIGNED TO ANY THIRD PARTY IN ANY MANNER WITHOUT OBTAINING THE EXPRESSED WRITTEN PERMISSION OF R.A. SMITH, INC.
SHEET NUMBER HX1.0



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

PART #	STUB	A	B	C
SC310EP06T / SC310EP06TPC	6" (150 mm)	9.6" (244 mm)	5.8" (147 mm)	---
SC310EP06B / SC310EP06BPC	---	---	---	0.5" (13 mm)
SC310EP08T / SC310EP08TPC	8" (200 mm)	11.9" (302 mm)	3.5" (89 mm)	---
SC310EP08B / SC310EP08BPC	---	---	---	0.6" (15 mm)
SC310EP10T / SC310EP10TPC	10" (250 mm)	12.7" (323 mm)	1.4" (36 mm)	---
SC310EP10B / SC310EP10BPC	---	---	---	0.7" (18 mm)
SC310ECEZ	12" (300 mm)	13.5" (343 mm)	---	0.9" (23 mm)

ALL STUBS, EXCEPT FOR THE SC310ECEZ ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC310ECEZ THE 12" (300 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 0.25" (6 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

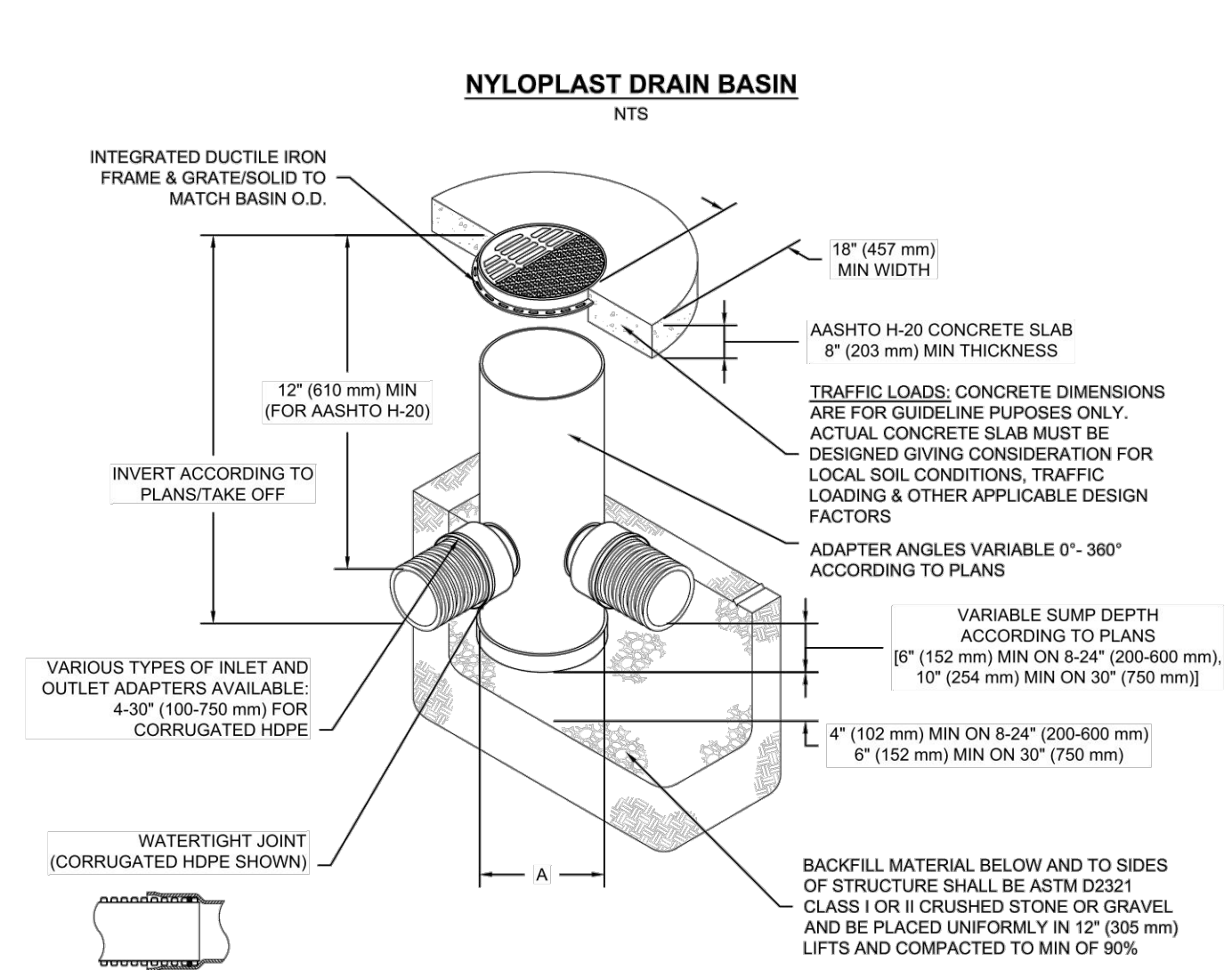
NOTE: ALL DIMENSIONS ARE NOMINAL

StormTech Chamber System

4640 TREUEMAN BLVD
MILLIARD, OH 43026
1-800-735-7473

NISSAN WAUKESHA, WI, USA
DATE: 02/22/23 DRAWN: DDW
SYSTEM RECOMMENDED PROJECT #: 5338840 CHECKED: N/A
DATE: 02/22/23 DRAWN: DDW
DATE: 02/22/23 DRAWN: DDW
DATE: 02/22/23 DRAWN: DDW

SHEET 5 OF 6



NOTES

- 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A338 GRADE 70-50-05
- 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A338 GRADE 70-50-05
- DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
- DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE ADS & HANCOCK DUAL WALL & SDR 35 PVC
- FOR COMPLETE DESIGN AND PRODUCT INFORMATION: WWW.NYLOPLAST-US.COM
- TO ORDER CALL: 800-821-6710

A	PART #	GRATE/SOLID COVER OPTIONS
8"	2808AG	PEDESTRIAN LIGHT DUTY, STANDARD LIGHT DUTY, SOLID LIGHT DUTY
10"	2819AG	PEDESTRIAN LIGHT DUTY, STANDARD LIGHT DUTY, SOLID LIGHT DUTY
12"	2812AG	PEDESTRIAN AASHTO H-10, STANDARD AASHTO H-20, SOLID AASHTO H-20
15"	2815AG	PEDESTRIAN AASHTO H-10, STANDARD AASHTO H-20, SOLID AASHTO H-20
18"	2818AG	PEDESTRIAN AASHTO H-10, STANDARD AASHTO H-20, SOLID AASHTO H-20
24"	2824AG	PEDESTRIAN AASHTO H-10, STANDARD AASHTO H-20, SOLID AASHTO H-20
30"	2830AG	PEDESTRIAN AASHTO H-20, STANDARD AASHTO H-20, SOLID AASHTO H-20

ADBS 4640 TREUEMAN BLVD, MILLIARD, OH 43026, 1-800-735-7473

Nyloplast 770-892-2443 | WWW.NYLOPLAST-US.COM

SHEET 6 OF 6

NISSAN WAUKESHA
CITY OF WAUKESHA, WISCONSIN
UNDERGROUND STORAGE DETAILS

16745 W. Bluemound Road
Brookfield, WI 53005-5938
(262) 781-1000
rasmith.com

Brookfield, WI | Milwaukee, WI | Appleton, WI | Madison, WI
Cedarburg, WI | Naperville, IL | Irvine, CA

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R.A. Smith, Inc.
DATE: 5/22/2023
SCALE: N.T.S.
JOB NO. 3220213
PROJECT MANAGER:
RYAN J. LANCOUR, P.E.
DESIGNED BY: CRR
CHECKED BY: RJL

SHEET NUMBER
C504

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