FINAL STORMWATER MANAGEMENT STUDY FOR 50TH AND RAINBOW DEVELOPMENT

PREPARED FOR

KARBANK REAL ESTATE COMPANY

Project Location:

50TH AND RAINBOW
WESTWOOD, KANSAS 66205

FINAL PLAT, HENRY'S ADDITION
SECTION 3, TOWNSHIP 12 SOUTH, RANGE 25 EAST

BHC Project # 037920.00.01

September 15, 2023
REV 1: October 5, 2023

Austin Lage
KS PE 28006
10/05/2023

CIVIL ENGINEERING / SURVEYING / UTILITIES

Table of Contents

Table of Appendices

Executive Summary

BHC has been retained as the Civil Engineer for the development at 50th and Rainbow in Westwood, KS. The 7.62-acre site is located on the west side of Rainbow Blvd between W 50th street and W 51st street. The project site has two water sheds, one being the east half of the site with the other the west half. The east watershed has approximately 5.19-acres, collecting into the public storm system within the site and being conveyed to the northwest corner of 51st and Rainbow Blvd. The west watershed has approximately 2.44-acres discharging to the public storm system running along the west side of the property.

The proposed development will be divided into two properties; the west property is to be a city park where the east property is to include the construction of one 4-story building & two single story pavilion buildings, associated parking, underground utilities, and water quality and quantity facilities.

This report documents the existing and proposed drainage conditions on the site. Furthermore, the report proves that the project will not have an adverse impact on surrounding properties, the existing storm sewer network, and the watershed adjacent to and downstream from the property.

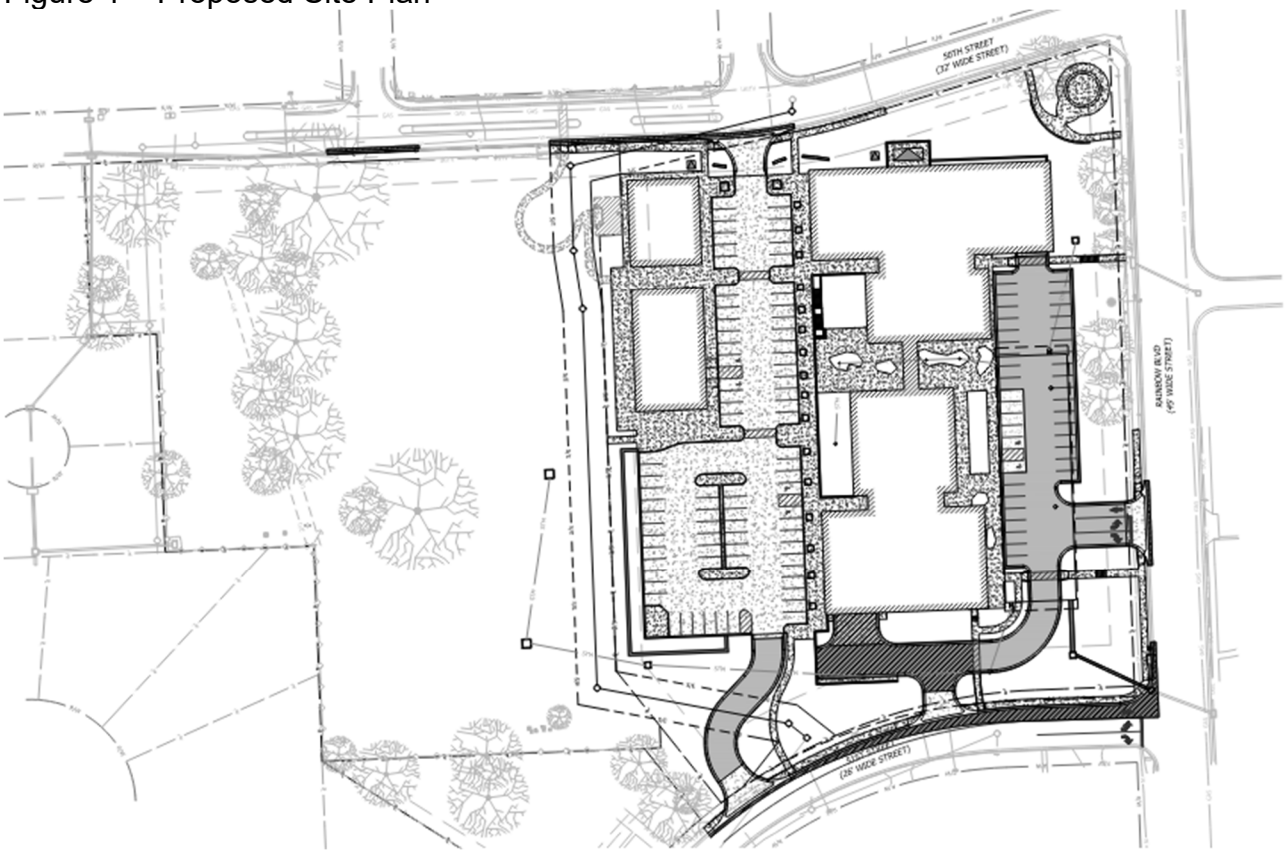
Per the City of Westwood, the proposed design is in accordance with the Westwood codes and ordinances as well as the 2012 MARC Manual. To meet the allowable release rates, an underground detention pond providing roughly 1.0 acre-feet of storage will be constructed east of the 4-story building, under the surface parking lot.

1.0 Introduction

This Stormwater Management Study is prepared for the development of 50th and Rainbow in Westwood, Kansas. The purpose of this study is to determine the stormwater infrastructure needs for the project, evaluate the existing drainage patterns, and determine that the development will not have an adverse impact on the adjacent properties and downstream watersheds.

The proposed development will be divided into two properties; the west property is to be a city park where the east property is to include the construction of one 4-story building & two single story pavilion buildings, associated parking, underground utilities, and water quality and quantity facilities.

Figure 1 – Proposed Site Plan



1. 1 Design Criteria

City of Westwood Codes & Ordinances

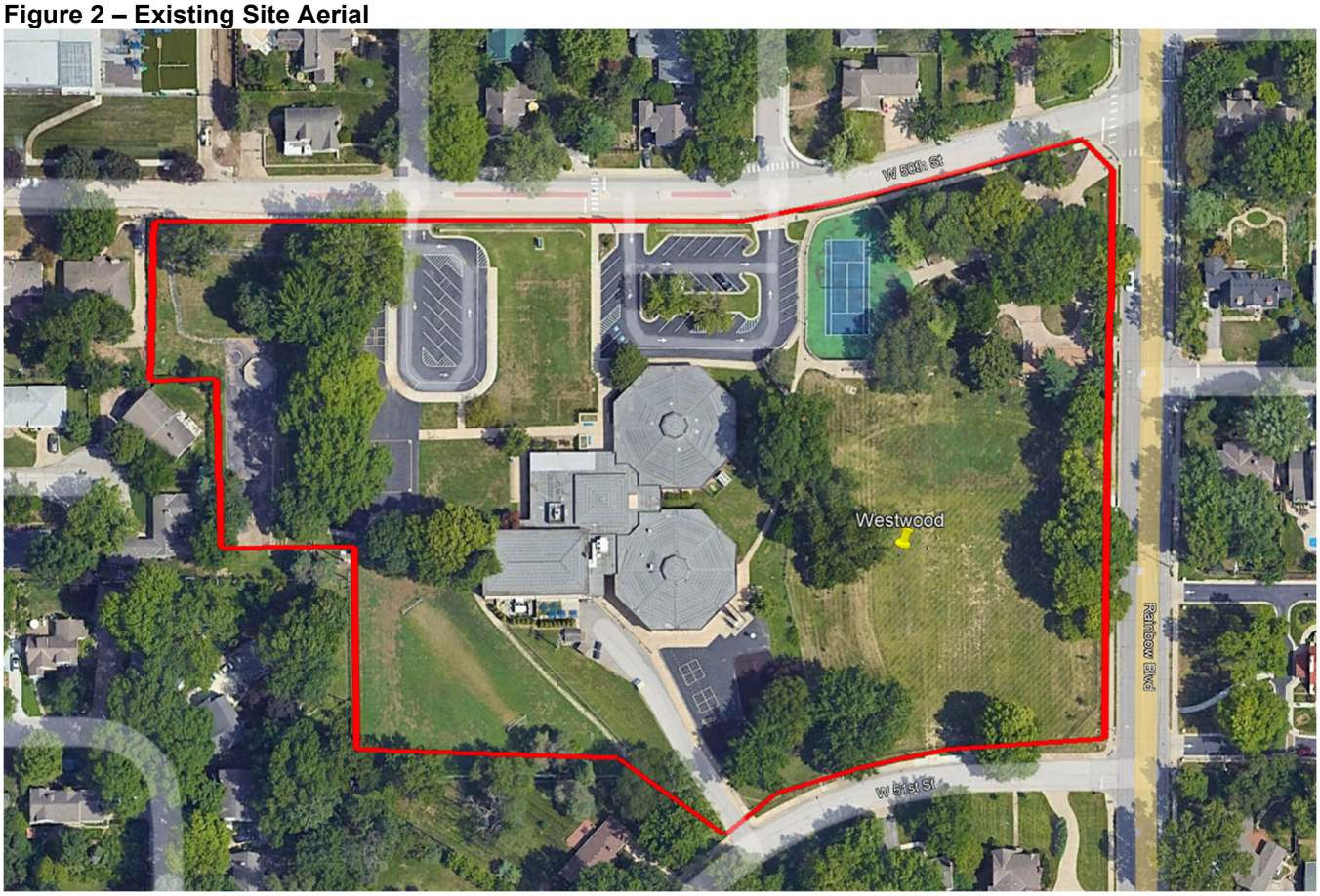
Mid-America Regional Council Manual for Best Management Practices For Stormwater Quality (October 2012).

2.0 Existing Conditions

2.1 Project Site

The project site at W 50th street and Rainbow Blvd consists of the existing school property and the park property. These lots have been combined into one 7.62 acres lot and platted as Henry's Addition. See Existing Site Aerial below for illustration. The site has one existing building, paved areas, and utilities all to be demolished and removed by the developer. The current site is roughly 36.5% Impervious.

Figure 2 – Existing Site Aerial



2.2 Hydrology

The site is divided by a north-south ridge line creating two separate watersheds – One watershed area, EX-1, drains to the west side of the lot and the other, EX-2, drains to the southeast corner of the lot. See Appendix A for Existing Drainage Map. There are no existing detention or BMP facilities on site. Table 1 demonstrates existing impervious cover of the two described drainage areas in the existing condition.

Table 1 – Existing Drainage Area Calculations

DRAINAGE AREAS										
Basin ID	AREA			PERVIOUS			IMPERVIOUS			CN-Value	C-VALUE
EX 1	106,112	SF	(2.44 ac)	71,408	SF	(1.64 ac)	34,704	SF	(0.80 ac)	86	0.50
EX 2	226,017	SF	(5.19 ac)	139,421	SF	(3.20 ac)	86,596	SF	(1.99 ac)	87	0.53
Total	**332,129**	**SF**	**(7.62 ac)**	**210,829**	**SF**	**(4.84 ac)**	**121,300**	**SF**	**(2.78 ac)**	**87**	**0.52**

*EX-1 & EX-2 drain to separate watersheds
**Refer to Appendix A for Existing Drainage Map

The existing soils located on the site were identified as Sharpsburg-Urban land complex (4% to 8% slopes) by the USDA Soil Map Survey which can be found in Appendix D of this report. The Hydraulic Soil Group (HSG) was classification C from the USDA soil survey attached, however due to the site being fully developed a classification of D has been used. It should be noted that the open green space in the southeast quadrant of the site was previously developed and then demolished. Table 2-2a of TR-55 gives the runoff curve numbers for urban areas. The curve numbers given were determined from class D lawn cover and impervious area corresponding to the overall site area, 80 and 98 respectively.

Table 2 below shows existing conditions peak flows release rates from the site associated with the 2-, 10-, and 100-year storms. As the existing site does not provide any on-site detention, all peak flow rates are of un-detained runoff. The drainage areas are separated into EX-1 and EX-2 drainage to correspond with the two drainage areas. All modeling was performed using HydroCAD Stormwater Modeling Software, the results of which can be found in the attached Appendix A and C. NOAA rain data was used in calculating peak discharge for the 2-, 10-, & 100-year event storms.

Table 2 – Existing Release Rate Calculations

Release Rates			
Basin ID	2 - Year	10 - Year	100 - year
EX 1	9.84 cfs	16.90 cfs	29.42 cfs
EX 2	15.40 cfs	26.39 cfs	45.91 cfs
Total	**25.24 cfs**	**43.29 cfs**	**75.33 cfs**

3.0 Proposed Condition

3.1 Project Site

This project will result in change for both watersheds. The west watershed will be reduced in size and impervious area, a reduction of 22,774 square feet & 34,704 square feet respectively. The east watershed will both increase in size and impervious area, an increase of 22,774 square feet & 44,624 square feet respectively. To offset the additional impervious area water quality and quantity facilities are proposed. The site will be controlled by the public storm system downstream, and that system has been analyzed to not overload it during the 10-year storm event. See Figure 1 for the Proposed Site Plan.

3.2 Hydrology

The site will continue to drain to two separate watersheds and proposed drainage patterns are similar to exiting drainage patterns. The two watershed areas have been split into smaller drainage areas that are collected by the proposed onsite storm system or drain offsite at specific locations. See below for Table 3 – Proposed Drainage Areas & Appendix A for the Proposed Drainage Map.

As stated above the watersheds will change in size and due to this change the west watershed will not need to be detained nor treated, however, the east watershed will require both stormwater detention and BMP treatment facilities.

Table 3 – Proposed Drainage Areas

ON-SITE WATERSHED AREAS

Basin ID	AREA		PERVIOUS		IMPERVIOUS		CN-Value	C-VALUE
WS 1	83,347 SF	(1.91 ac)	83,347 SF	(1.91 ac)	000 SF	(0.00 ac)	80	0.30
WS 2a	210,529 SF	(4.83 ac)	89,255 SF	(2.05 ac)	121,275 SF	(2.78 ac)	90	0.65
WS 2b	38,253 SF	(0.88 ac)	28,307 SF	(0.65 ac)	9,946 SF	(0.23 ac)	85	0.46
Total	**332,129 SF**	**(7.62 ac)**	**200,909 SF**	**(4.61 ac)**	**131,220 SF**	**(3.01 ac)**	**87**	**0.54**

ON-SITE DRAINAGE AREAS

Basin ID	AREA		PERVIOUS		IMPERVIOUS		CN-Value	C-VALUE
DA 1	83,347 SF	(1.91 ac)	83,347 SF	(1.91 ac)	000 SF	(0.00 ac)	80	0.30
DA 2	8,169 SF	(0.19 ac)	4,660 SF	(0.11 ac)	3,509 SF	(0.08 ac)	88	0.56
DA 3	11,696 SF	(0.27 ac)	9,795 SF	(0.22 ac)	1,902 SF	(0.04 ac)	83	0.40
DA 4	49,115 SF	(1.13 ac)	44,764 SF	(1.03 ac)	4,351 SF	(0.10 ac)	82	0.35
DA 5	48,863 SF	(1.12 ac)	365 SF	(0.01 ac)	48,499 SF	(1.11 ac)	98	0.90
DA 6	6,716 SF	(0.15 ac)	3,830 SF	(0.09 ac)	2,886 SF	(0.07 ac)	88	0.56
DA 7	36,773 SF	(0.84 ac)	000 SF	(0.00 ac)	36,773 SF	(0.84 ac)	98	0.90
DA 8	15,932 SF	(0.37 ac)	4,330 SF	(0.10 ac)	11,602 SF	(0.27 ac)	93	0.74
DA 9	2,763 SF	(0.06 ac)	2,258 SF	(0.05 ac)	505 SF	(0.01 ac)	83	0.41
DA 10	7,448 SF	(0.17 ac)	808 SF	(0.02 ac)	6,640 SF	(0.15 ac)	96	0.83
DA 11	17,567 SF	(0.40 ac)	17,567 SF	(0.40 ac)	000 SF	(0.00 ac)	80	0.30
DA 12	30,084 SF	(0.69 ac)	23,647 SF	(0.54 ac)	6,437 SF	(0.15 ac)	84	0.43
DA 13	3,353 SF	(0.08 ac)	371 SF	(0.01 ac)	2,982 SF	(0.07 ac)	96	0.83
DA 14	10,303 SF	(0.24 ac)	5,168 SF	(0.12 ac)	5,135 SF	(0.12 ac)	89	0.60
Total	**332,129 SF**	**(7.62 ac)**	**200,909 SF**	**(4.61 ac)**	**131,220 SF**	**(3.01 ac)**	**87**	**0.54**

*WS 1 – Not to be detained or treated. Contains DA 1
WS 2a – To be detained and treated. Contains DA 3-11, 13, 14
WS 2b – Not to be detained or treated. Contains DA 2, 12
**Refer to Appendix A for Proposed Drainage Map

3.3 Detention System

Per the codes and ordinances of the City of Westwood detention will be required on site. The amount of detention is based on pre-construction release rates vs. post-construction release rates as well as what the downstream public system can handle. Due to the nature of the proposed improvements, there is no area for above ground detention and therefor underground detention is proposed with a custom outlet device. 270 prefabricated MC-4500 (100” wide, 52” deep, & 60” tall) semi-elliptical chambers manufactured by Advanced Drainage Solutions will be used. The proposed release rates can be found in Table 4 – Drainage Area 1: Proposed Release Rate Calculations, Table 5 – Drainage Area 2: Proposed Release Rate Calculations, and the output from HydroCAD can be found in Appendix C.

Table 4 – Drainage Area 1: Proposed Release Rate Calculations

Release Rates - West Watershed			
Basin ID	**2 - Year**	**10 - Year**	**100 - year**
WS 1	5.16 cfs	9.74 cfs	18.18 cfs
Total	**5.16 cfs**	**9.74 cfs**	**18.18 cfs**
Change in Rate	**-4.68 cfs**	**-7.16 cfs**	**-11.24 cfs**

Table 5 – Drainage Area 2: Proposed Release Rate Calculations

Release Rates - East Watershed			
Basin ID	**2 - Year**	**10 - Year**	**100 - year**
WS 2a	10.50 cfs	14.60 cfs	22.31 cfs
WS 2b	3.43 cfs	5.97 cfs	10.49 cfs
Total	**13.93 cfs**	**20.57 cfs**	**32.80 cfs**
Change in Rate	**-1.47 cfs**	**-5.82 cfs**	**-13.11 cfs**

The proposed condition release rates, as shown in the tables above, are below the required release rates as determined by the City of Westwood. The table above compares the existing flow rates and the proposed flow rates for each storm event; 2-, 10-, & 100-year events. Overall, there will be a large reduction in release rates for each drainage area with the addition of detention. Table 6 – Release Rate Comparison shows a comparison between pre- and post-construction release rates.

Table 6 – Release Rate Comparison

Release Rate Comparison			
AREA ID	**2 - Year (cfs) Exst./Prop.**	**10 - Year (cfs) Exst./Prop.**	**100 - year (cfs) Exst./Prop.**
WS 1	9.84 / 5.16	16.90 / 9.74	29.42 / 18.18
WS 2	15.40 / 13.93	26.39 / 20.57	45.91 / 32.80
Total	**25.24 / 19.09**	**43.29 / 30.31**	**75.33 / 50.98**
Change in Rate	**-6.15 cfs**	**-12.98 cfs**	**-24.35 cfs**

4.0 Stormwater Quality

4.1 LOS of BMP Package

Stormwater quality considerations are required for this project using the MARC BMP Manual for reference. In a meeting with the City of Westwood, the watersheds would be analyzed separately, with the west watershed being looked at as a developed site and the east an undeveloped site. Due to the reduction in impervious area in the west watershed, BMPs will not be required, however the east watershed will need water quality infrastructure.

Level of service for the project site is determined using net increase in impervious and Worksheet 1 for an undeveloped site in the MARC BMP Manual. From the level of service, a total value rating of BMP package can be found by using the difference in CN value from existing to proposed and finding the corresponding LOS. Per the BMP Worksheet #1 included in Appendix B the required LOS of the BMP package of 5.

4.2 Stormwater Quality System Design

To achieve the required level of service our proposed design underground detention isolator rows will be used. This system will be used as a treatment train and give a value of 9 per acre treated. BMP Worksheet #2 included in Appendix B demonstrates the water quality design provides an LOS of the BMP package of 7.6, which is greater than the required LOS of the BMP package of 5.

5.0 Permitting

5.1 United State Army Corps of Engineers (USACE)

The National Wetland Inventory and USGS Mapping does not Identify and jurisdictional waters within the site area. There are no known USACE regulated levees with 500-feet of the site.

5.2 Federal Emergency Management Agency (FEMA)

The site is located within the Zone X, and outside of the 1% and 0.2% annual chance flood hazard, as shown on FEMA FIRM Map 20091C0010G (Panel Number 10 of 161), effective August 3, 2009. The FEMA Firmette for the project site can be found in Appendix A, Figure 6.

5.3 Kansas Department of Health and Environment (KDHE)

The area to be disturbed by the project site exceeds 1-arce; a Notice of Intent (NOI) is required to be submitted to KDHE and a Stormwater Pollution Prevention Plan (SWPPP) will be prepared for the project.

5.4 Kansas Division of Water Resources (DWR)

The tributary area above and including the site is less than 240 acres and the land is not inundated by any backwater effects. The project is considered non-jurisdictional by the DWR. No permits are required.

5.5 Kansas State Historical Preservation Office (SHPO)

In compliance with federal requirements, SHPO will be provided with advance notice of construction.

5.6 Kansas Department of Wildlife, Parks and Tourism (KDWPT)

In compliance with federal requirements, KDWPT will be provided with advanced notice of construction.

6.0 Conclusion

The development of the site will result in an overall decrease in impervious; however, due to watersheds and site boundaries water quality and quantity facilities will offset a small increase in impervious within the east watershed. The addition of underground detention will reduce peak runoff from the site by at least 30% across all storm events which exceeds the City of Westwood's requirement to not exceed the existing peak runoff rates. Underground detention isolator rows will help filter and clean the storm water before discharging into the public storm system. This report demonstrates that the 50th and Rainbow project will not negatively impact adjacent watersheds or downstream public storm systems and reduce peak runoff rates from existing conditions.

Appendix A – Reference Documents

A1 – Existing Drainage Areas Map

A2 – Proposed Drainage Areas Map

A3 – FEMA Firmette

A4 – National Wetlands Inventory Map

DRAINAGE AREAS

Basin ID	AREA		PERVIOUS		IMPERVIOUS		CN-Value	C-VALUE
EX 1	106,112 SF	(2.44 ac)	71,408 SF	(1.64 ac)	34,704 SF	(0.80 ac)	86	0.50
EX 2	226,017 SF	(5.19 ac)	139,421 SF	(3.20 ac)	86,596 SF	(1.99 ac)	87	0.53
Total	**332,129 SF**	**(7.62 ac)**	**210,829 SF**	**(4.84 ac)**	**121,300 SF**	**(2.78 ac)**	**87**	**0.52**

DRAINAGE LEGEND

- DRAINAGE AREA BOUNDARY
- 980 — EXISTING GRADE MAJOR CONTOUR
- 982 — EXISTING GRADE MINOR CONTOUR
- ℄ — PROPERTY LINE
- R/W — RIGHT-OF-WAY LINE

GRAPHIC SCALE
40 0 40

Rev.	Date	Description	By	App.
1	10/05/23	CITY COMMENTS	AKL	AKL

AUSTIN K. LAGE LICENSED 28006 KANSAS PROFESSIONAL ENGINEER

BHC
CIVIL ENGINEERING / SURVEYING / UTILITIES
7101 College Blvd., Suite 400
Overland Park, Kansas 66210
P: 913.381.1480
BHC is a business unit of Stanley Consultants of Company, P.A.

Prepared For:
KARBANK REAL ESTATE COMPANY
ADAM FELDMAN
2000 SM PKWY; SUITE 400
MISSION WOODS, KS 66205
816-221-4488

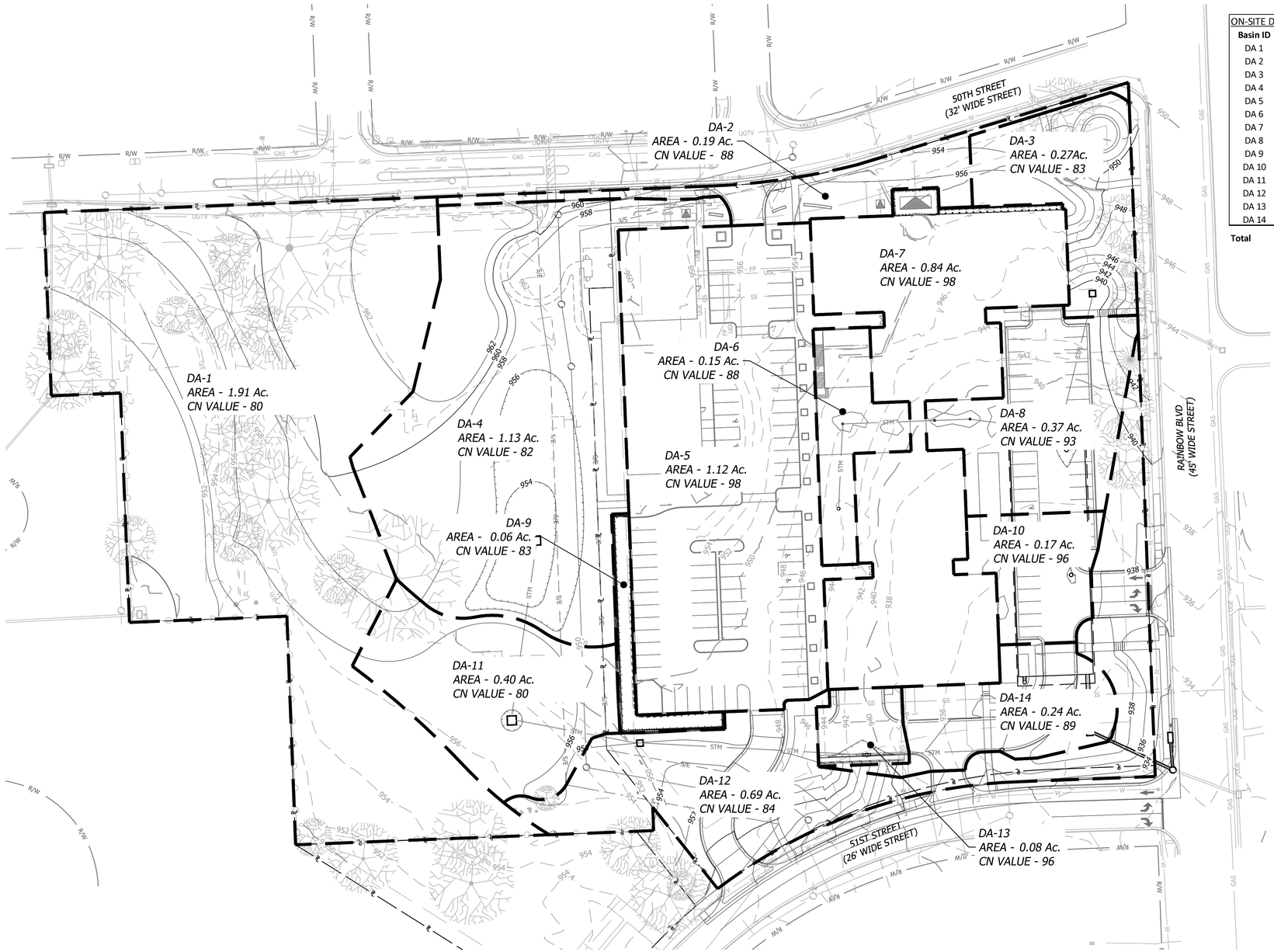
FDP SUBMITTAL
50TH & RAINBOW DEVELOPMENT
WESTWOOD, KS 66205

EXISTING DRAINAGE MAP

Design: DSN	Drawn: DRN
Checked:	CHK
Issue Date:	09/15/2023
Project Number:	037920

C5.0

Oct 05, 2023 - 9:46am Plotted By: austin.lage V:\037920-Westwood\04-DWG\Eng\Sheet\FDP\037920-SHTS-DMAP.dwg Layout: EXISTING DRAINAGE MAP



ON-SITE DRAINAGE AREAS

Basin ID	AREA		PERVIOUS		IMPERVIOUS		CN-Value	C-VALUE
DA 1	83,347 SF	(1.91 ac)	83,347 SF	(1.91 ac)	000 SF	(0.00 ac)	80	0.30
DA 2	8,169 SF	(0.19 ac)	4,660 SF	(0.11 ac)	3,509 SF	(0.08 ac)	88	0.56
DA 3	11,696 SF	(0.27 ac)	9,795 SF	(0.22 ac)	1,902 SF	(0.04 ac)	83	0.40
DA 4	49,115 SF	(1.13 ac)	44,764 SF	(1.03 ac)	4,351 SF	(0.10 ac)	82	0.35
DA 5	48,863 SF	(1.12 ac)	365 SF	(0.01 ac)	48,499 SF	(1.11 ac)	98	0.90
DA 6	6,716 SF	(0.15 ac)	3,830 SF	(0.09 ac)	2,886 SF	(0.07 ac)	88	0.56
DA 7	36,773 SF	(0.84 ac)	000 SF	(0.00 ac)	36,773 SF	(0.84 ac)	98	0.90
DA 8	15,932 SF	(0.37 ac)	4,330 SF	(0.10 ac)	11,602 SF	(0.27 ac)	93	0.74
DA 9	2,763 SF	(0.06 ac)	2,258 SF	(0.05 ac)	505 SF	(0.01 ac)	83	0.41
DA 10	7,448 SF	(0.17 ac)	808 SF	(0.02 ac)	6,640 SF	(0.15 ac)	96	0.83
DA 11	17,567 SF	(0.40 ac)	17,567 SF	(0.40 ac)	000 SF	(0.00 ac)	80	0.30
DA 12	30,084 SF	(0.69 ac)	23,647 SF	(0.54 ac)	6,437 SF	(0.15 ac)	84	0.43
DA 13	3,353 SF	(0.08 ac)	371 SF	(0.01 ac)	2,982 SF	(0.07 ac)	96	0.83
DA 14	10,303 SF	(0.24 ac)	5,168 SF	(0.12 ac)	5,135 SF	(0.12 ac)	89	0.60
Total	**332,129 SF**	**(7.62 ac)**	**200,909 SF**	**(4.61 ac)**	**131,220 SF**	**(3.01 ac)**	**87**	**0.54**

DRAINAGE LEGEND

- DRAINAGE AREA BOUNDARY
- 980 — PROPOSED FINISH GRADE MAJOR CONTOUR
- 982 — PROPOSED FINISH GRADE MINOR CONTOUR
- 980 — EXISTING GRADE MAJOR CONTOUR
- 982 — EXISTING GRADE MINOR CONTOUR
- STM — PROPOSED STORM SEWER LINE
- PROPERTY LINE
- R/W — RIGHT-OF-WAY LINE

GRAPHIC SCALE
40 0 40

Rev.	Date	Description	By	App.
1	10/05/23	CITY COMMENTS	AKL	AKL

AUSTIN K. LAGE LICENSED 28006 KANSAS PROFESSIONAL ENGINEER

BHC
CIVIL ENGINEERING / SURVEYING / UTILITIES
7101 College Blvd., Suite 400
Overland Park, Kansas 66210
P: (913) 663-1900
BHC is a business unit of Stanley Consultants of Company, P.A.

Prepared For:
KARBANK REAL ESTATE COMPANY
ADAM FELDMAN
2000 SM PKWY; SUITE 400
MISSION WOODS, KS 66205
816-221-4488

FDP SUBMITTAL
50TH & RAINBOW DEVELOPMENT
WESTWOOD, KS 66205

PROPOSED DRAINAGE MAP

Design: DSN	Drawn: DRN
Checked:	CHK
Issue Date:	09/15/2023
Project Number:	037920

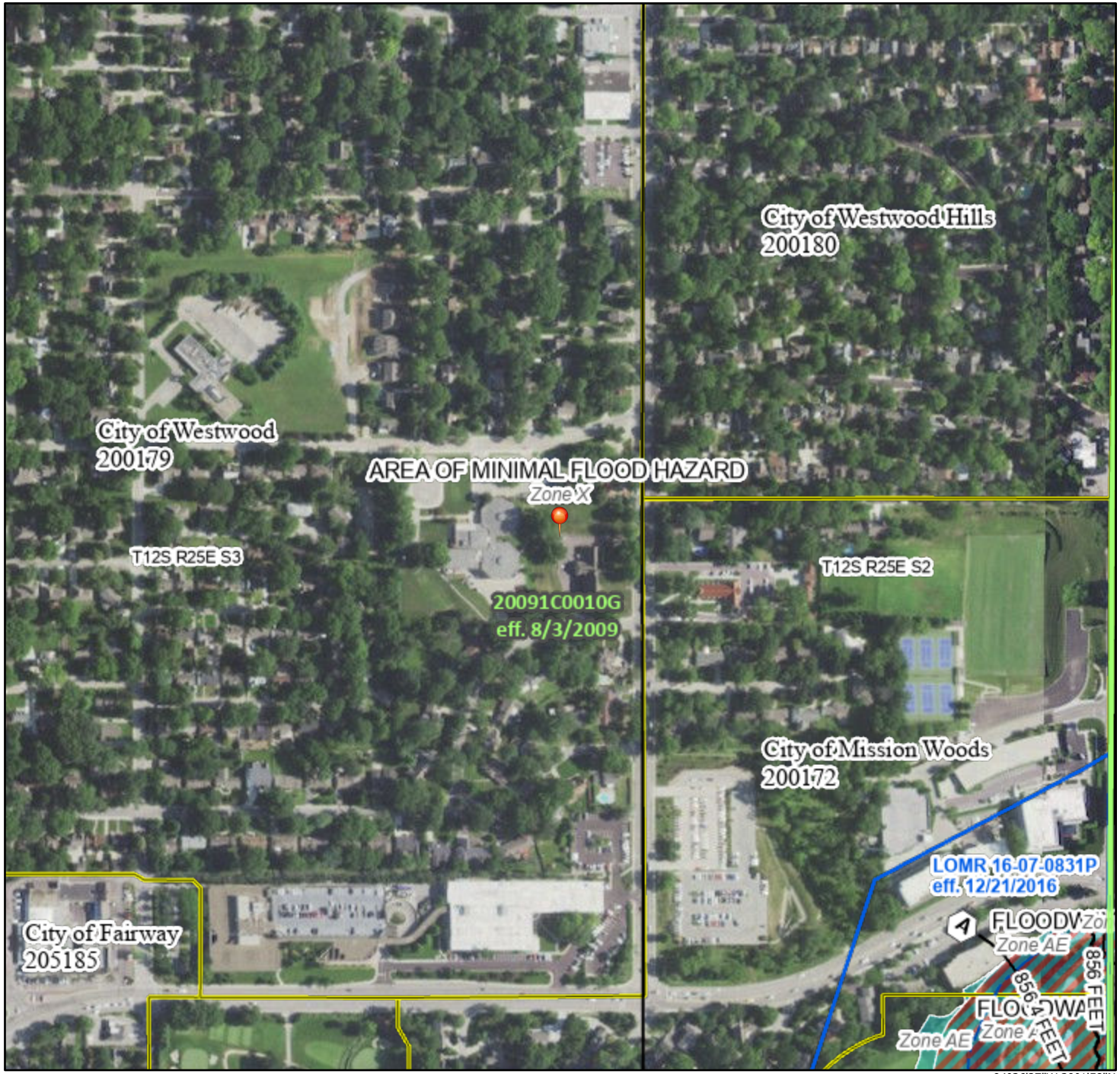
C5.1

Oct 05, 2023 – 9:25am Plotted By: austin.lage V:\037920-Westwood\04-DWG\Eng\Sheet\FDP\037920-ShtTS-DMAP.dwg Layout: PROPOSED DRAINAGE MAP

National Flood Hazard Layer FIRMette

FEMA

94°37'4"W 39°2'26"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

94°36'27"W 39°1'58"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

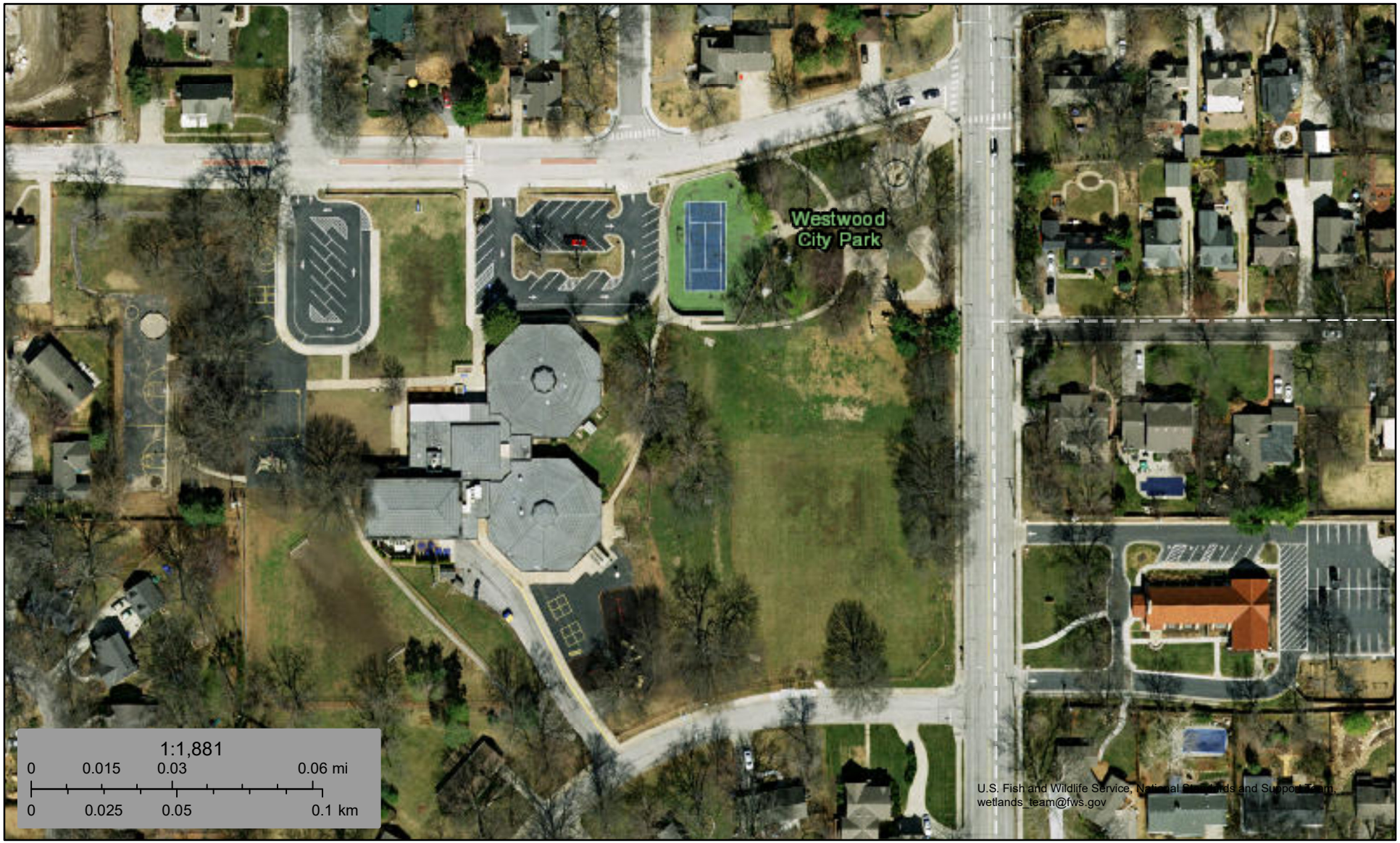
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/20/2023 at 12:28 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

U.S. Fish and Wildlife Service
National Wetlands Inventory

Westwood Development



September 8, 2023

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

Appendix B – LOS Calculations

B1 – BMP Worksheet #1

B2 – BMP Worksheet #2

1. Runoff Curve Number - East Watershed

A. Predevelopment CN

Cover Description	Soil HSG	CN From Table 1	Area (sf)	Area (ac.)	Product of CN x Area
Open Space (turf), Good	D	80	162186	3.72	297.9
Impervious	D	98	86596	1.99	194.8
				0.00	0.0
				0.00	0.0
				0.00	0.0
				0.00	0.0
				0.00	0.0
		Totals:		5.71	492.7

Area-Weighted CN = total product/total area = **86** (Round to integer)

B. Postdevelopment CN

Cover Description	Soil HSG[1]	CN From Table 1	Area (sf)	Area (ac.)	Product of CN x Area
Open Space (turf), Good	D	80	117562	2.70	215.9
Impervious	D	98	131220	3.01	295.2
				0.00	0.0
				0.00	0.0
				0.00	0.0
				0.00	0.0
				0.00	0.0
				0.00	0.0
				0.00	0.0
		Totals:		5.71	511.1

1 Postdevelopment CN is one HSG higher for all cover types except preserved vegetation, absent documentation showing how postdevelopment soil structure will be preserved.

Area-Weighted CN = total product/total area = **89** (Round to integer)

C.

Level of Service Calculation

Predevelopment CN:	86
Post Development CN:	89
Difference:	3
LS Required (see scale at right):	**5**

Change in CN	LS
17+	8
7 to 16	7
4 to 6	6
1 to 3	5
0	4
-7 to -1	3
-8 to -17	2
-18 to -21	1
-22 -	0

1. Required LS (New Development, Wksht 1) or Total VR (Redevelopment, Wksht 1A): 5

2. Proposed BMP Option Package No. 1

BMP ID	Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6[1]	Product of VR x Area
1	ADS Isolator Row	4.82	9.0	43.4
2	No BMP	0.89	0.0	0.0
	Total[2]:	5.71	Total:	7.6

1 VR calculated for final BMP only in Treatment Train
2 Total treatment area cannot exceed 100 percent of the actual site area.
* Blank In Redevelopment

Meets required LS (Yes/No)? **Yes** (If No, or if additional options are being tested, proceed below.)

Appendix C – Computer Output Summaries

C1 – Existing HydroCAD output

C2 – Proposed HydroCAD output

Subcat Reach Pond Link

Routing Diagram for Westwood Existing
Prepared by {enter your company name here}, Printed 9/15/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.840	80	>75% Grass cover, Good, HSG D (E, W)
2.785	98	Paved parking, HSG D (E, W)
7.625	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
7.625	HSG D	E, W
0.000	Other	
7.625		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	4.840	0.000	4.840	>75% Grass cover, Good	E, W
0.000	0.000	0.000	2.785	0.000	2.785	Paved parking	E, W
0.000	**0.000**	**0.000**	**7.625**	**0.000**	**7.625**	**TOTAL AREA**	

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentE: EX 2 Runoff Area=226,017 sf 38.31% Impervious Runoff Depth=2.31"
Tc=15.0 min CN=87 Runoff=15.40 cfs 0.998 af

SubcatchmentW: EX 1 Runoff Area=106,112 sf 32.72% Impervious Runoff Depth=2.22"
Tc=5.0 min CN=86 Runoff=9.84 cfs 0.451 af

Total Runoff Area = 7.625 ac Runoff Volume = 1.449 af Average Runoff Depth = 2.28"
63.47% Pervious = 4.840 ac 36.53% Impervious = 2.785 ac

Summary for Subcatchment E: EX 2

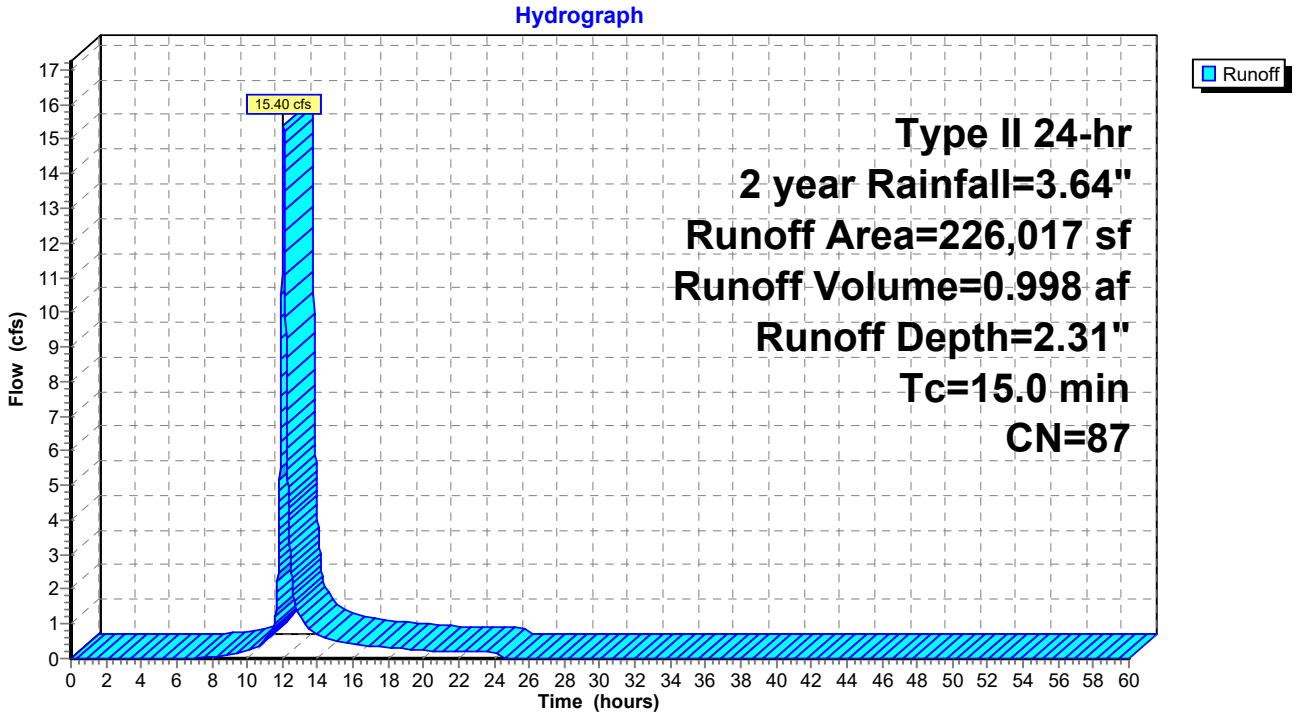
Runoff = 15.40 cfs @ 12.07 hrs, Volume= 0.998 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=3.64"

Area (sf)	CN	Description
139,421	80	>75% Grass cover, Good, HSG D
86,596	98	Paved parking, HSG D
226,017	87	Weighted Average
139,421		61.69% Pervious Area
86,596		38.31% Impervious Area

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

Subcatchment E: EX 2



Summary for Subcatchment W: EX 1

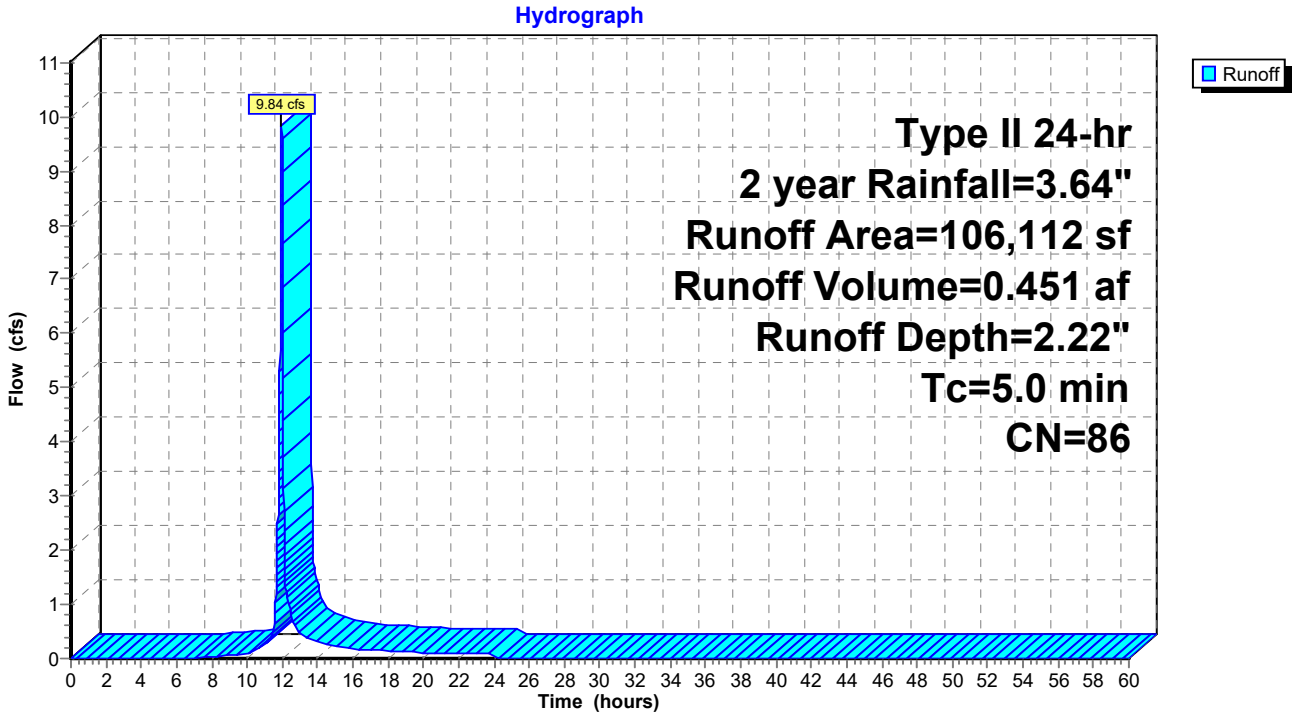
Runoff = 9.84 cfs @ 11.96 hrs, Volume= 0.451 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=3.64"

Area (sf)	CN	Description
71,394	80	>75% Grass cover, Good, HSG D
34,718	98	Paved parking, HSG D
106,112	86	Weighted Average
71,394		67.28% Pervious Area
34,718		32.72% Impervious Area

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

Subcatchment W: EX 1



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentE: EX 2 Runoff Area=226,017 sf 38.31% Impervious Runoff Depth=4.04"
Tc=15.0 min CN=87 Runoff=26.39 cfs 1.747 af

SubcatchmentW: EX 1 Runoff Area=106,112 sf 32.72% Impervious Runoff Depth=3.94"
Tc=5.0 min CN=86 Runoff=16.90 cfs 0.799 af

Total Runoff Area = 7.625 ac Runoff Volume = 2.546 af Average Runoff Depth = 4.01"
63.47% Pervious = 4.840 ac 36.53% Impervious = 2.785 ac

Summary for Subcatchment E: EX 2

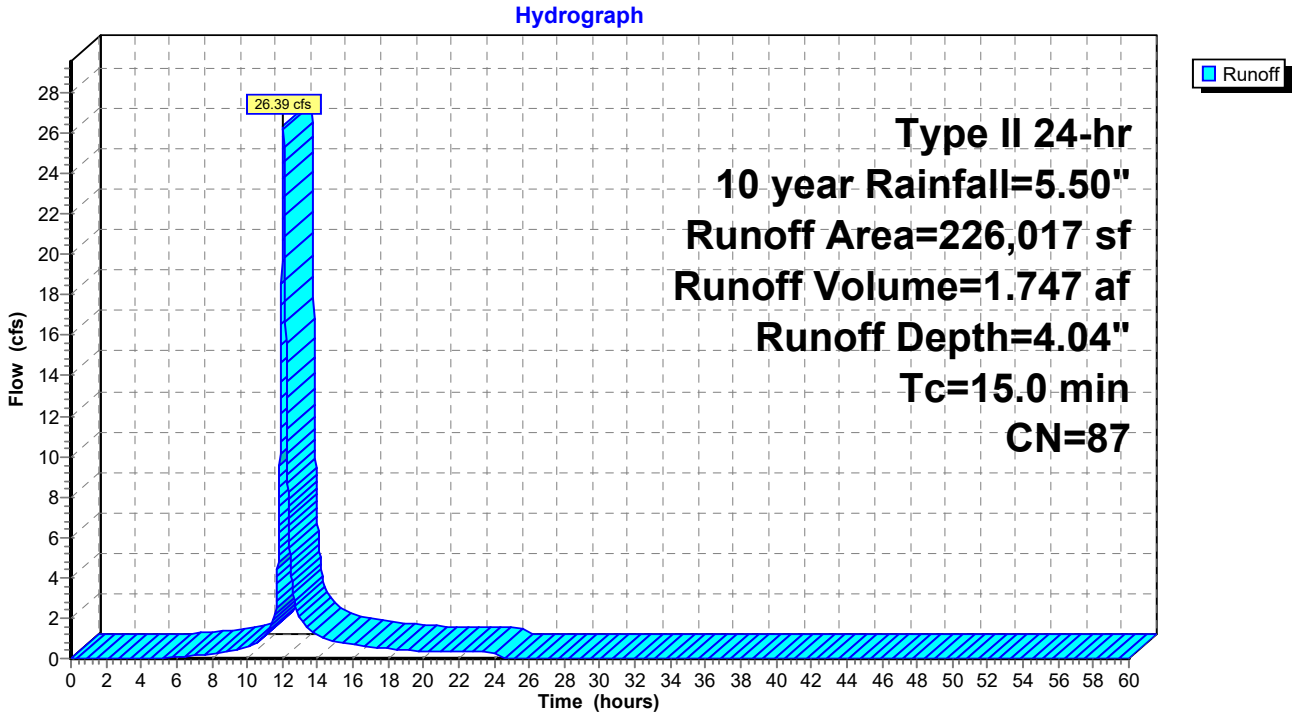
Runoff = 26.39 cfs @ 12.07 hrs, Volume= 1.747 af, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=5.50"

Area (sf)	CN	Description
139,421	80	>75% Grass cover, Good, HSG D
86,596	98	Paved parking, HSG D
226,017	87	Weighted Average
139,421		61.69% Pervious Area
86,596		38.31% Impervious Area

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

Subcatchment E: EX 2



Summary for Subcatchment W: EX 1

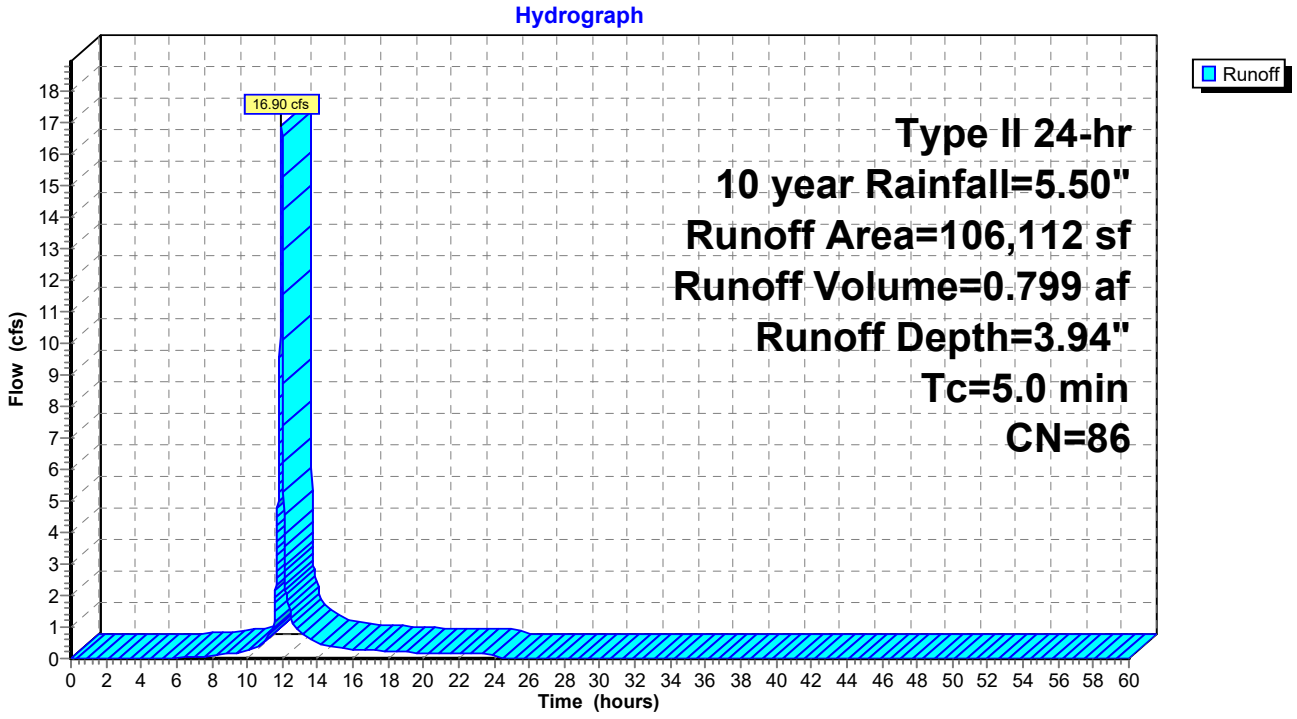
Runoff = 16.90 cfs @ 11.96 hrs, Volume= 0.799 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=5.50"

Area (sf)	CN	Description
71,394	80	>75% Grass cover, Good, HSG D
34,718	98	Paved parking, HSG D
106,112	86	Weighted Average
71,394		67.28% Pervious Area
34,718		32.72% Impervious Area

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

Subcatchment W: EX 1



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

SubcatchmentE: EX 2 Runoff Area=226,017 sf 38.31% Impervious Runoff Depth=7.25"
Tc=15.0 min CN=87 Runoff=45.91 cfs 3.135 af

SubcatchmentW: EX 1 Runoff Area=106,112 sf 32.72% Impervious Runoff Depth=7.13"
Tc=5.0 min CN=86 Runoff=29.42 cfs 1.447 af

Total Runoff Area = 7.625 ac Runoff Volume = 4.582 af Average Runoff Depth = 7.21"
63.47% Pervious = 4.840 ac 36.53% Impervious = 2.785 ac

Summary for Subcatchment E: EX 2

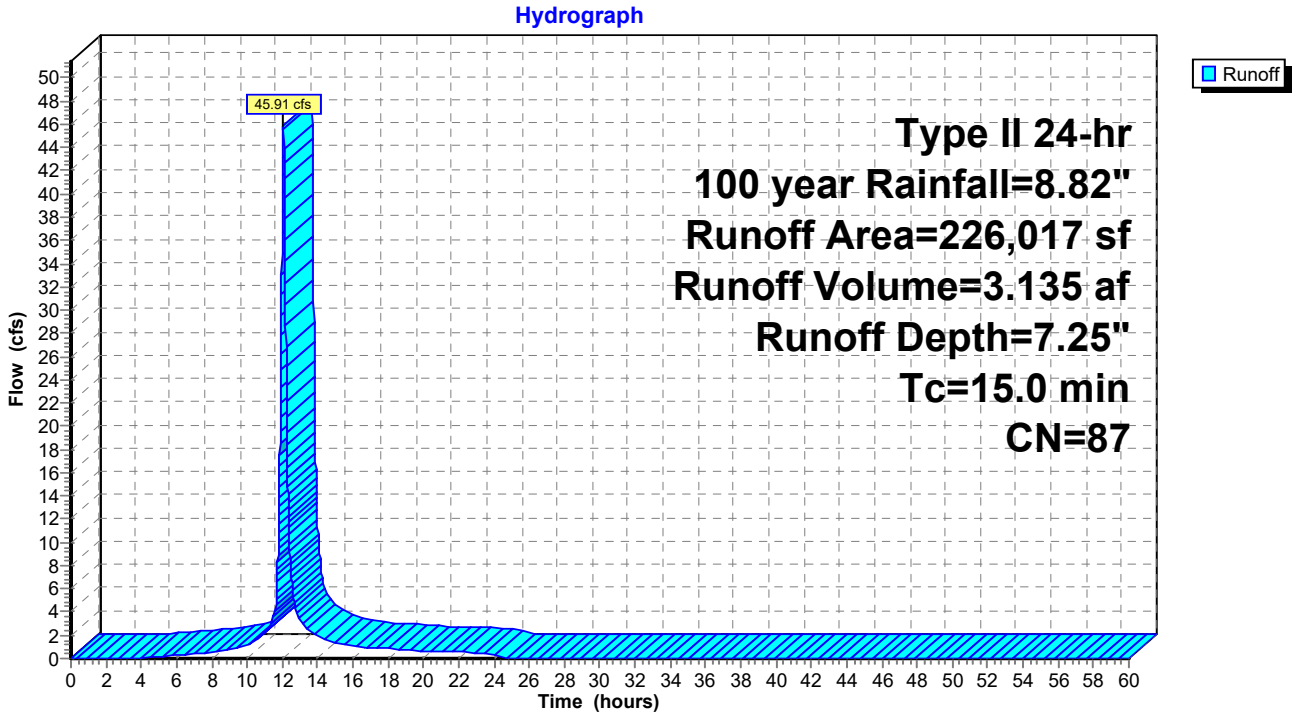
Runoff = 45.91 cfs @ 12.06 hrs, Volume= 3.135 af, Depth= 7.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=8.82"

Area (sf)	CN	Description
139,421	80	>75% Grass cover, Good, HSG D
86,596	98	Paved parking, HSG D
226,017	87	Weighted Average
139,421		61.69% Pervious Area
86,596		38.31% Impervious Area

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

Subcatchment E: EX 2



Summary for Subcatchment W: EX 1

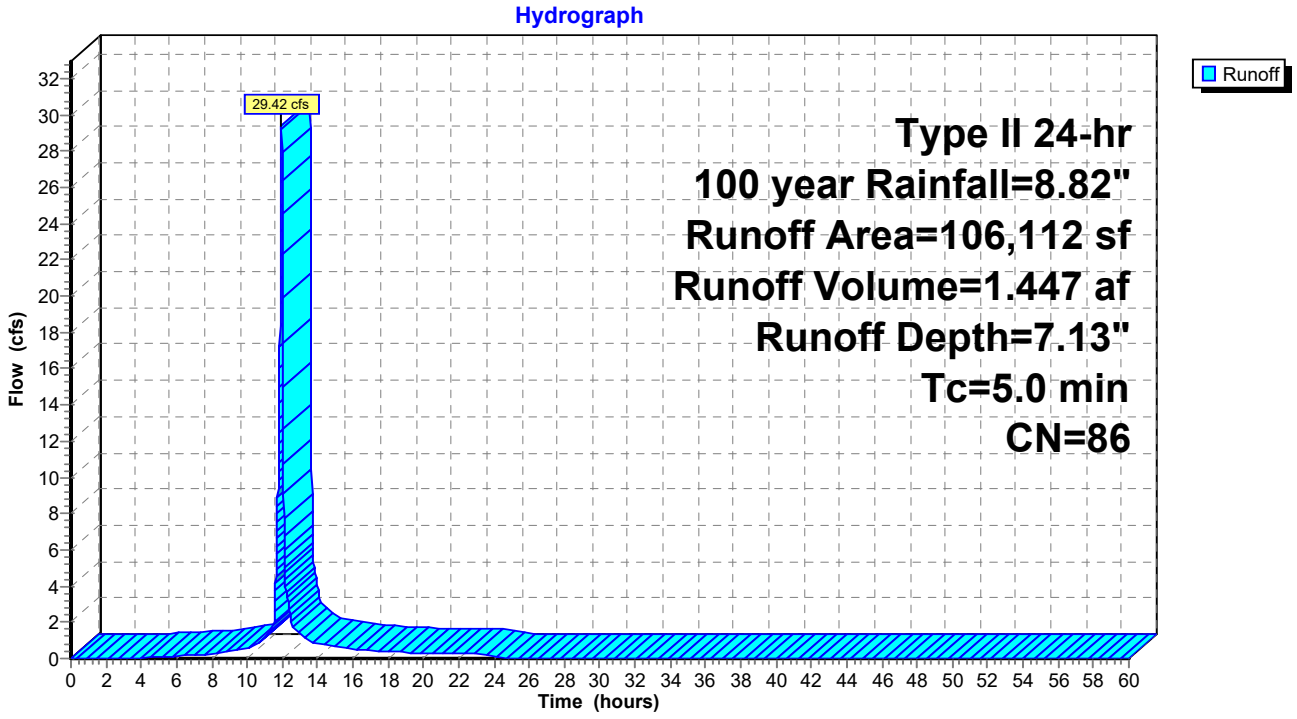
Runoff = 29.42 cfs @ 11.96 hrs, Volume= 1.447 af, Depth= 7.13"

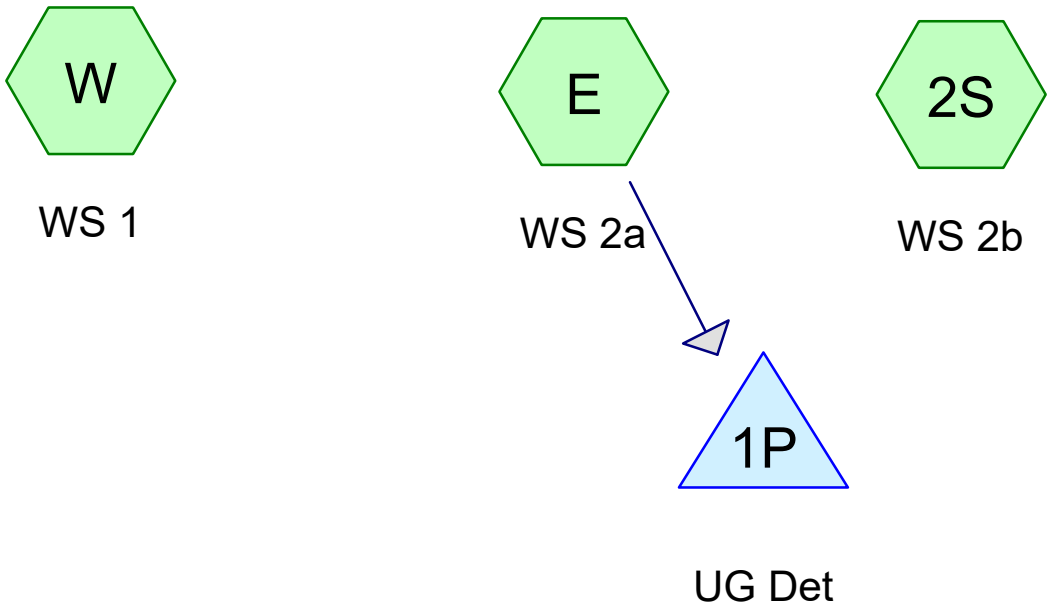
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=8.82"

Area (sf)	CN	Description
71,394	80	>75% Grass cover, Good, HSG D
34,718	98	Paved parking, HSG D
106,112	86	Weighted Average
71,394		67.28% Pervious Area
34,718		32.72% Impervious Area

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

Subcatchment W: EX 1





Subcat Reach Pond Link

Routing Diagram for Westwood Proposed
Prepared by {enter your company name here}, Printed 9/15/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.564	80	>75% Grass cover, Good, HSG D (2S, E, W)
3.061	98	Paved parking, HSG D (2S, E, W)
7.625	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
7.625	HSG D	2S, E, W
0.000	Other	
7.625		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	4.564	0.000	4.564	>75% Grass cover, Good	2S, E, W
0.000	0.000	0.000	3.061	0.000	3.061	Paved parking	2S, E, W
0.000	**0.000**	**0.000**	**7.625**	**0.000**	**7.625**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	930.00	929.19	50.0	0.0162	0.013	18.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment2S: WS 2b Runoff Area=38,253 sf 26.00% Impervious Runoff Depth=2.14"
Tc=5.0 min CN=85 Runoff=3.43 cfs 0.157 af

SubcatchmentE: WS 2a Runoff Area=210,529 sf 57.96% Impervious Runoff Depth=2.58"
Tc=5.0 min CN=90 Runoff=22.02 cfs 1.039 af

SubcatchmentW: WS 1 Runoff Area=83,359 sf 1.65% Impervious Runoff Depth=1.75"
Tc=10.0 min CN=80 Runoff=5.16 cfs 0.279 af

Pond 1P: UG Det Peak Elev=931.68' Storage=0.418 af Inflow=22.02 cfs 1.039 af
Outflow=10.50 cfs 0.958 af

Total Runoff Area = 7.625 ac Runoff Volume = 1.474 af Average Runoff Depth = 2.32"
59.85% Pervious = 4.564 ac 40.15% Impervious = 3.061 ac

Summary for Subcatchment 2S: WS 2b

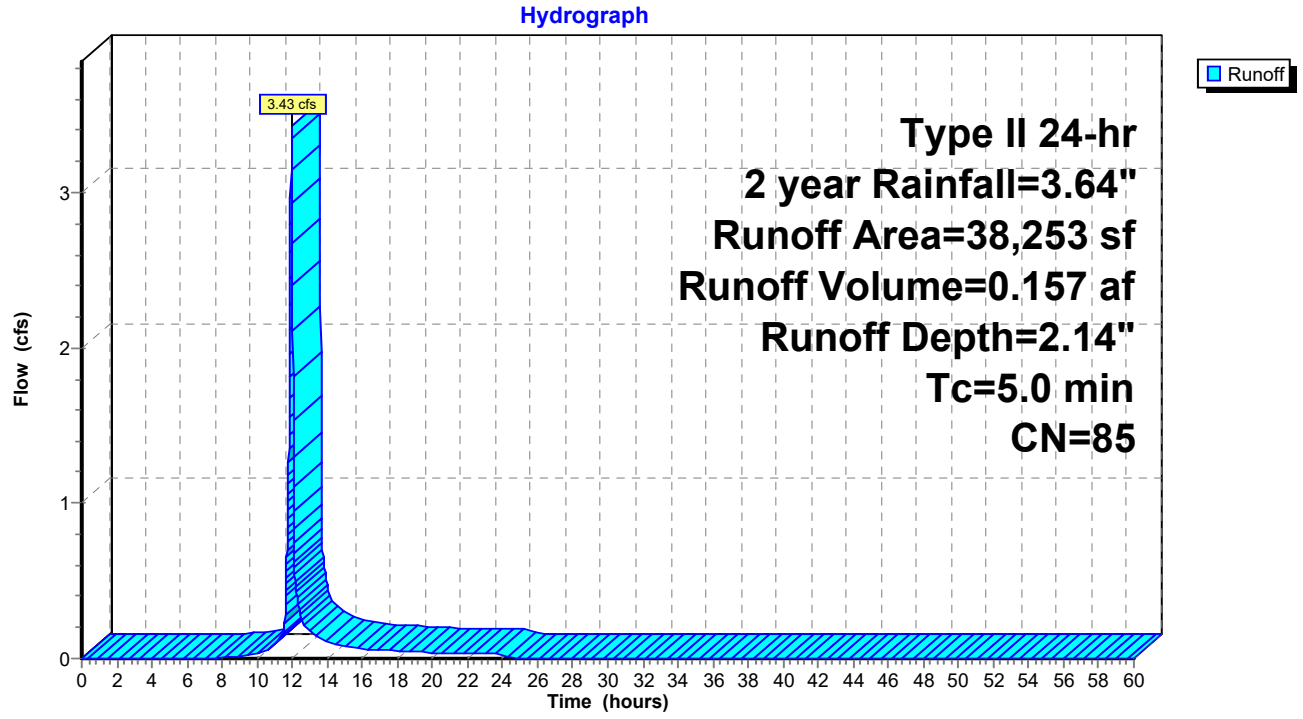
Runoff = 3.43 cfs @ 11.96 hrs, Volume= 0.157 af, Depth= 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=3.64"

Area (sf)	CN	Description
28,307	80	>75% Grass cover, Good, HSG D
9,946	98	Paved parking, HSG D
38,253	85	Weighted Average
28,307		74.00% Pervious Area
9,946		26.00% Impervious Area

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

Subcatchment 2S: WS 2b



Summary for Subcatchment E: WS 2a

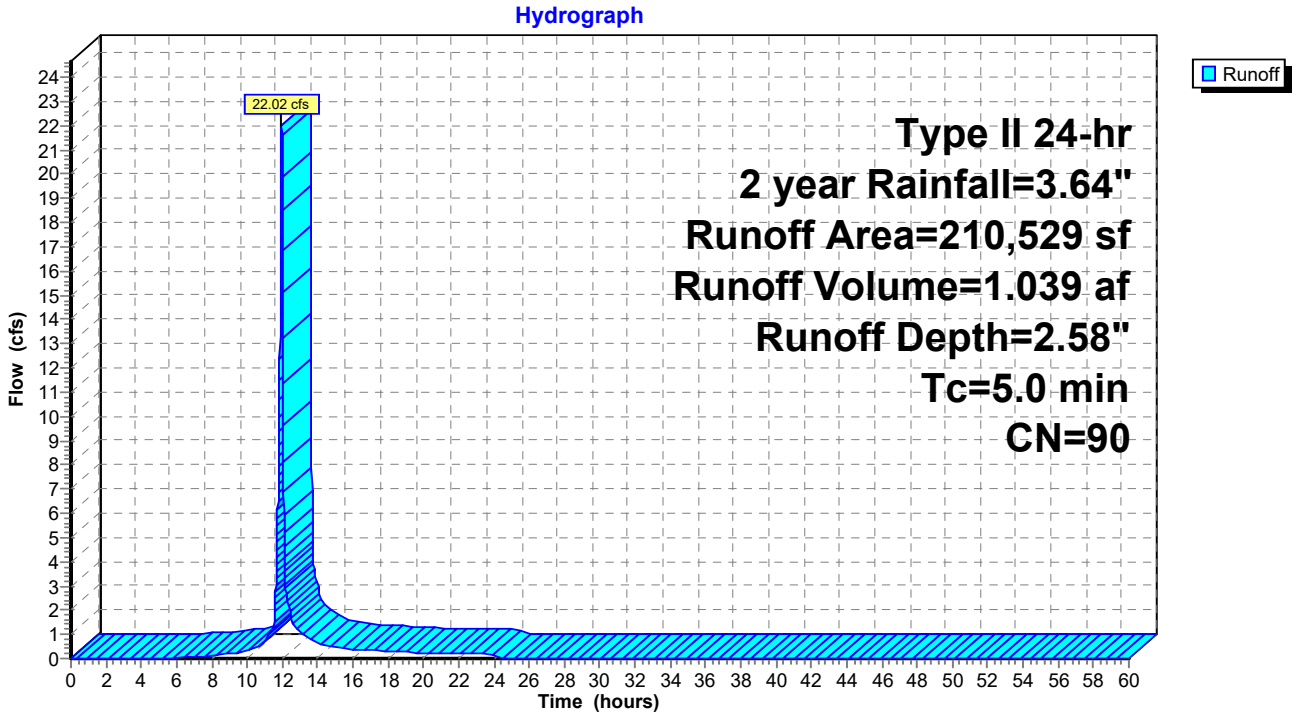
Runoff = 22.02 cfs @ 11.96 hrs, Volume= 1.039 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=3.64"

Area (sf)	CN	Description
88,504	80	>75% Grass cover, Good, HSG D
122,025	98	Paved parking, HSG D
210,529	90	Weighted Average
88,504		42.04% Pervious Area
122,025		57.96% Impervious Area

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

Subcatchment E: WS 2a



Summary for Subcatchment W: WS 1

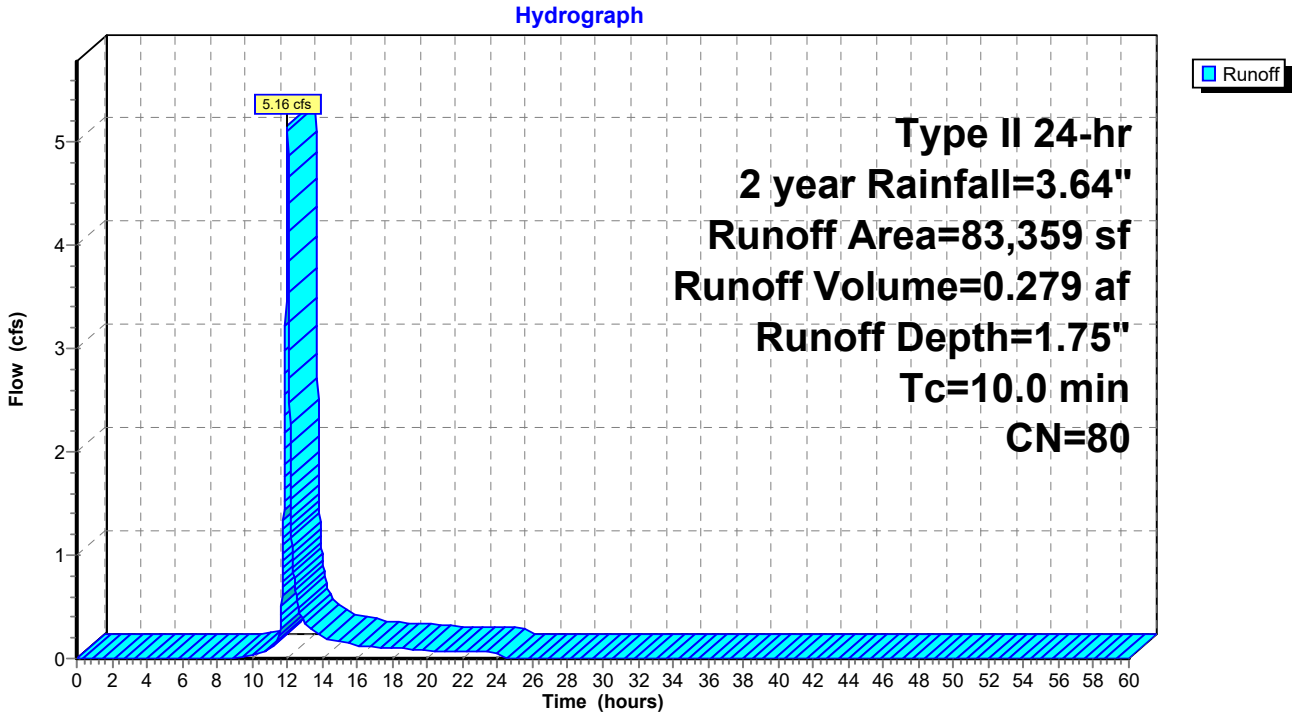
Runoff = 5.16 cfs @ 12.02 hrs, Volume= 0.279 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year Rainfall=3.64"

Area (sf)	CN	Description
81,980	80	>75% Grass cover, Good, HSG D
1,379	98	Paved parking, HSG D
83,359	80	Weighted Average
81,980		98.35% Pervious Area
1,379		1.65% Impervious Area

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

Subcatchment W: WS 1



Summary for Pond 1P: UG Det

Inflow Area = 4.833 ac, 57.96% Impervious, Inflow Depth = 2.58" for 2 year event
Inflow = 22.02 cfs @ 11.96 hrs, Volume= 1.039 af
Outflow = 10.50 cfs @ 12.05 hrs, Volume= 0.958 af, Atten= 52%, Lag= 5.5 min
Primary = 10.50 cfs @ 12.05 hrs, Volume= 0.958 af

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 931.68' @ 12.05 hrs Surf.Area= 0.241 ac Storage= 0.418 af

Plug-Flow detention time= 189.9 min calculated for 0.958 af (92% of inflow)
Center-of-Mass det. time= 148.3 min (946.2 - 798.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	929.25'	0.383 af	**55.75'W x 188.24'L x 6.75'H Field A** 1.626 af Overall - 0.670 af Embedded = 0.956 af x 40.0% Voids
#2A	930.00'	0.670 af	**ADS_StormTech MC-4500 +Cap** x 270 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 6 Rows of 45 Chambers Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf
		1.052 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	930.00'	**18.0" Round RCP_Round 18"** L= 50.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 930.00' / 929.19' S= 0.0162 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	930.00'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.40'	**36.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=10.50 cfs @ 12.05 hrs HW=931.68' (Free Discharge)
└**1=RCP_Round 18"** (Barrel Controls 10.50 cfs @ 6.62 fps)
  ├**2=Orifice/Grate** (Passes < 0.21 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 13.96 cfs potential flow)

Pond 1P: UG Det - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

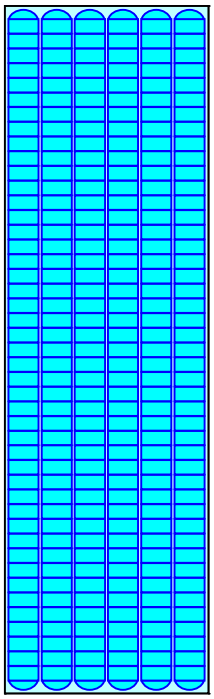
45 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 186.24' Row Length +12.0" End Stone x 2 = 188.24' Base Length
6 Rows x 100.0" Wide + 9.0" Spacing x 5 + 12.0" Side Stone x 2 = 55.75' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

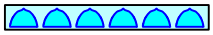
270 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 6 Rows = 29,180.8 cf Chamber Storage

70,837.7 cf Field - 29,180.8 cf Chambers = 41,656.9 cf Stone x 40.0% Voids = 16,662.8 cf Stone Storage

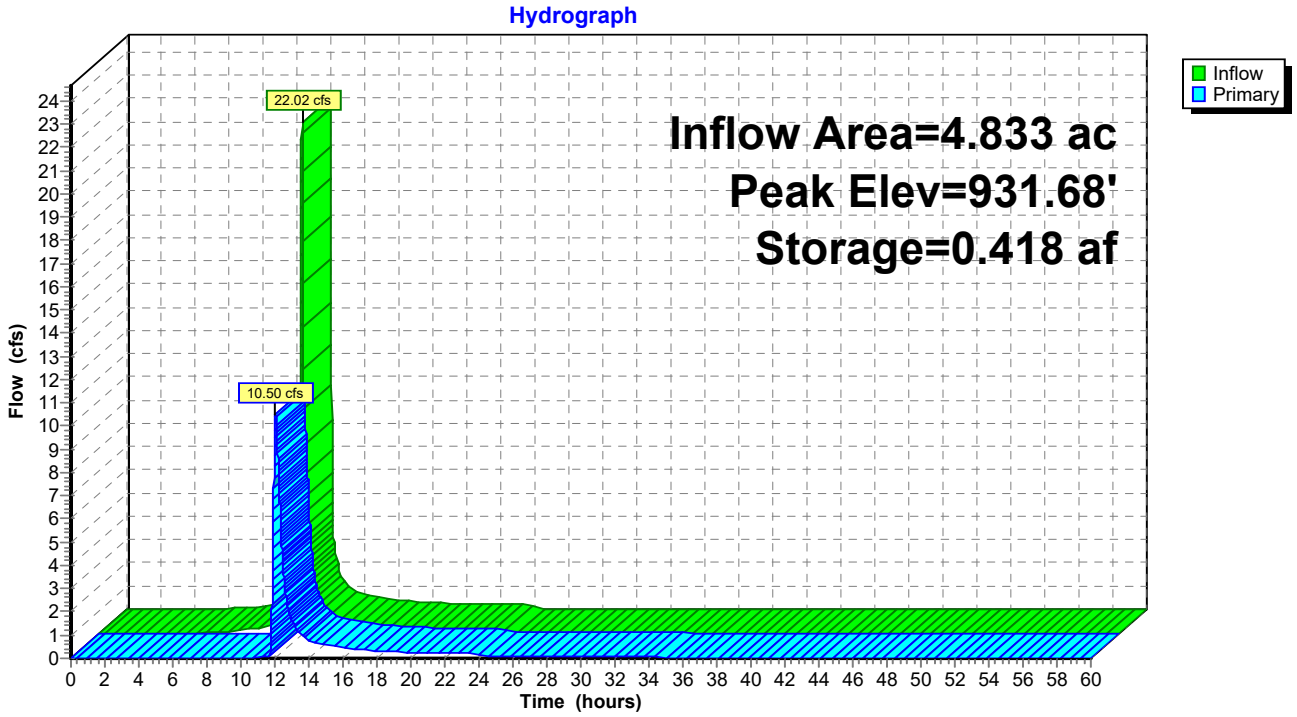
Chamber Storage + Stone Storage = 45,843.6 cf = 1.052 af
Overall Storage Efficiency = 64.7%
Overall System Size = 188.24' x 55.75' x 6.75'

270 Chambers
2,623.6 cy Field
1,542.8 cy Stone





Pond 1P: UG Det



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment2S: WS 2b Runoff Area=38,253 sf 26.00% Impervious Runoff Depth=3.83"
Tc=5.0 min CN=85 Runoff=5.97 cfs 0.280 af

SubcatchmentE: WS 2a Runoff Area=210,529 sf 57.96% Impervious Runoff Depth=4.36"
Tc=5.0 min CN=90 Runoff=35.97 cfs 1.756 af

SubcatchmentW: WS 1 Runoff Area=83,359 sf 1.65% Impervious Runoff Depth=3.33"
Tc=10.0 min CN=80 Runoff=9.74 cfs 0.532 af

Pond 1P: UG Det Peak Elev=932.82' Storage=0.636 af Inflow=35.97 cfs 1.756 af
Outflow=14.60 cfs 1.675 af

Total Runoff Area = 7.625 ac Runoff Volume = 2.568 af Average Runoff Depth = 4.04"
59.85% Pervious = 4.564 ac 40.15% Impervious = 3.061 ac

Summary for Subcatchment 2S: WS 2b

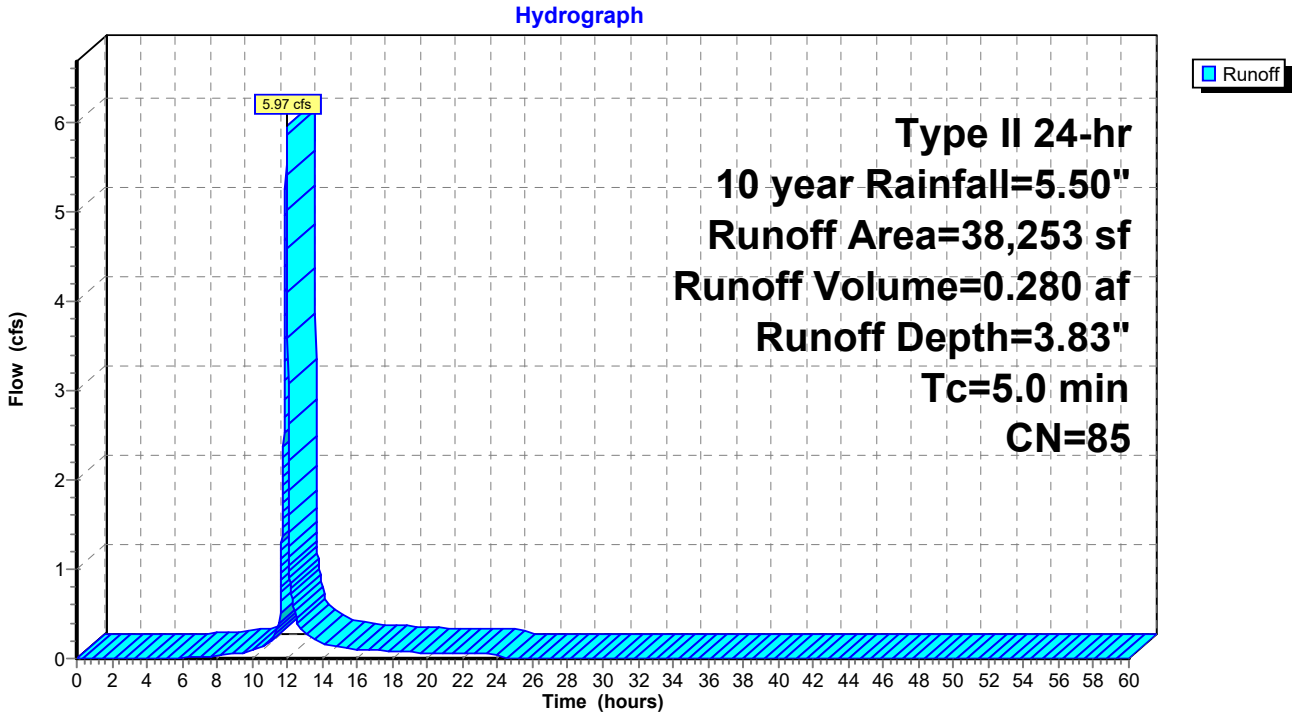
Runoff = 5.97 cfs @ 11.96 hrs, Volume= 0.280 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=5.50"

Area (sf)	CN	Description
28,307	80	>75% Grass cover, Good, HSG D
9,946	98	Paved parking, HSG D
38,253	85	Weighted Average
28,307		74.00% Pervious Area
9,946		26.00% Impervious Area

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

Subcatchment 2S: WS 2b



Summary for Subcatchment E: WS 2a

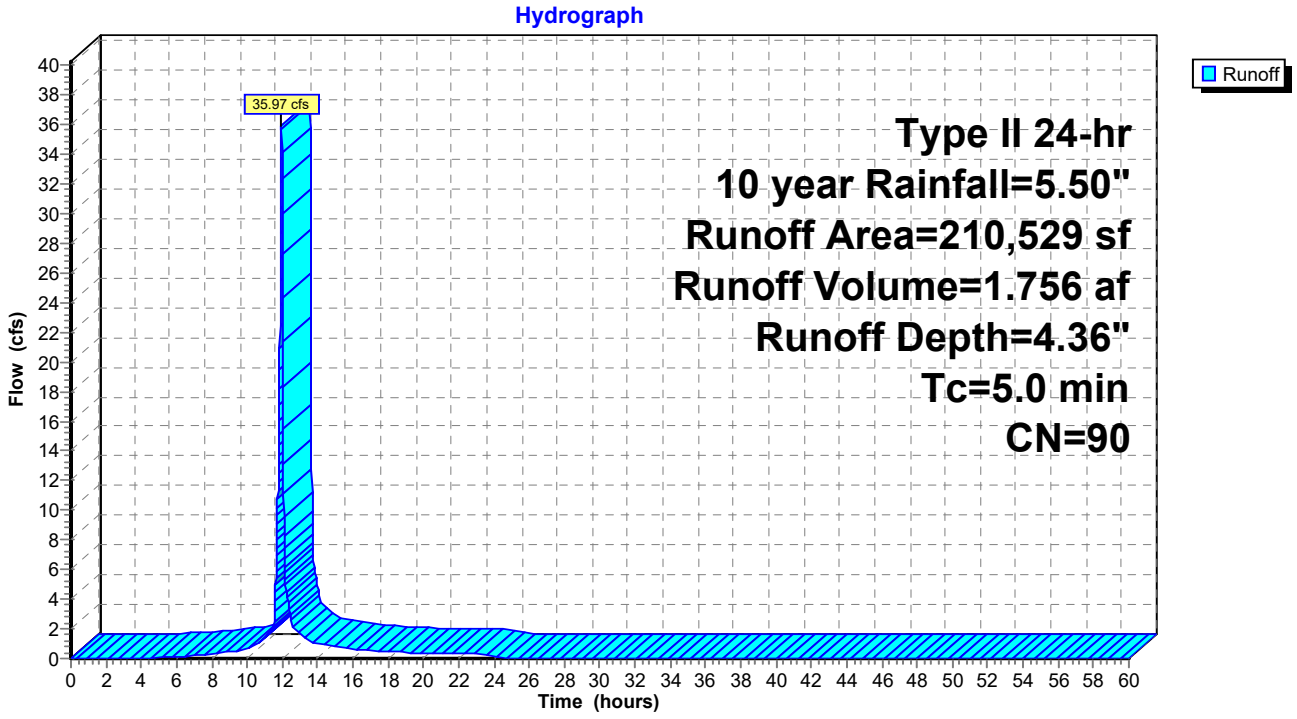
Runoff = 35.97 cfs @ 11.96 hrs, Volume= 1.756 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=5.50"

Area (sf)	CN	Description
88,504	80	>75% Grass cover, Good, HSG D
122,025	98	Paved parking, HSG D
210,529	90	Weighted Average
88,504		42.04% Pervious Area
122,025		57.96% Impervious Area

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

Subcatchment E: WS 2a



Summary for Subcatchment W: WS 1

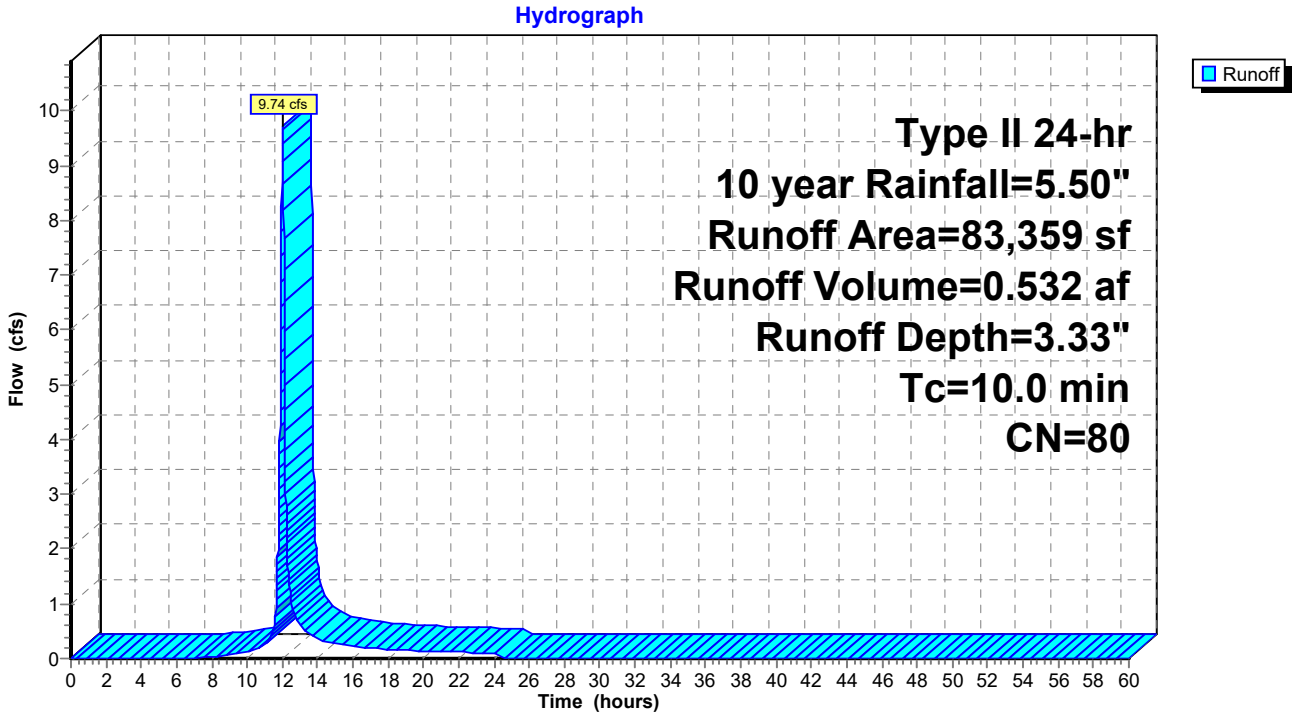
Runoff = 9.74 cfs @ 12.01 hrs, Volume= 0.532 af, Depth= 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year Rainfall=5.50"

Area (sf)	CN	Description
81,980	80	>75% Grass cover, Good, HSG D
1,379	98	Paved parking, HSG D
83,359	80	Weighted Average
81,980		98.35% Pervious Area
1,379		1.65% Impervious Area

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

Subcatchment W: WS 1



Summary for Pond 1P: UG Det

Inflow Area = 4.833 ac, 57.96% Impervious, Inflow Depth = 4.36" for 10 year event
Inflow = 35.97 cfs @ 11.96 hrs, Volume= 1.756 af
Outflow = 14.60 cfs @ 12.06 hrs, Volume= 1.675 af, Atten= 59%, Lag= 6.1 min
Primary = 14.60 cfs @ 12.06 hrs, Volume= 1.675 af

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 932.82' @ 12.06 hrs Surf.Area= 0.241 ac Storage= 0.636 af

Plug-Flow detention time= 131.7 min calculated for 1.675 af (95% of inflow)
Center-of-Mass det. time= 104.9 min (888.2 - 783.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	929.25'	0.383 af	**55.75'W x 188.24'L x 6.75'H Field A** 1.626 af Overall - 0.670 af Embedded = 0.956 af x 40.0% Voids
#2A	930.00'	0.670 af	**ADS_StormTech MC-4500 +Cap** x 270 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 6 Rows of 45 Chambers Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf
		1.052 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	930.00'	**18.0" Round RCP_Round 18"** L= 50.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 930.00' / 929.19' S= 0.0162 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	930.00'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.40'	**36.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=14.60 cfs @ 12.06 hrs HW=932.82' (Free Discharge)
└─**1=RCP_Round 18"** (Barrel Controls 14.60 cfs @ 8.26 fps)
  ├─**2=Orifice/Grate** (Passes < 0.27 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 36.34 cfs potential flow)

Pond 1P: UG Det - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

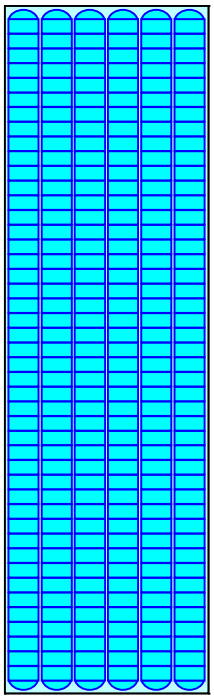
45 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 186.24' Row Length +12.0" End Stone x 2 = 188.24' Base Length
6 Rows x 100.0" Wide + 9.0" Spacing x 5 + 12.0" Side Stone x 2 = 55.75' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

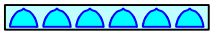
270 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 6 Rows = 29,180.8 cf Chamber Storage

70,837.7 cf Field - 29,180.8 cf Chambers = 41,656.9 cf Stone x 40.0% Voids = 16,662.8 cf Stone Storage

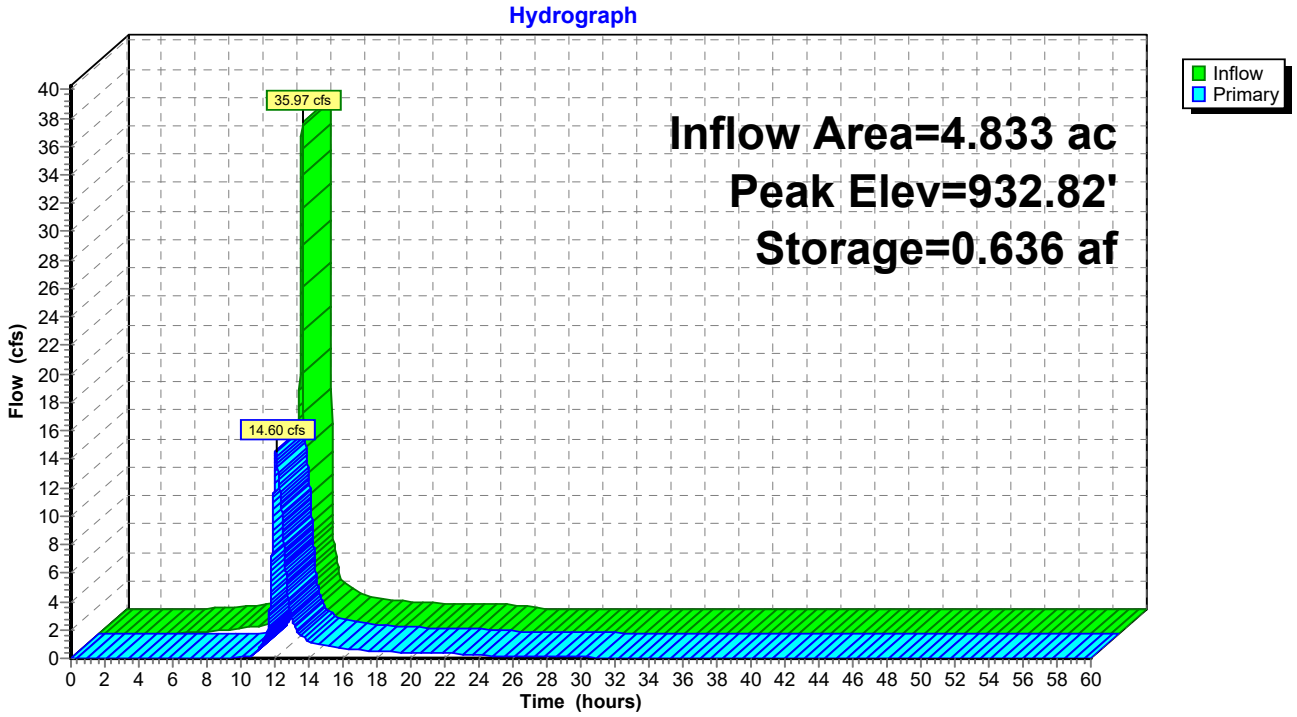
Chamber Storage + Stone Storage = 45,843.6 cf = 1.052 af
Overall Storage Efficiency = 64.7%
Overall System Size = 188.24' x 55.75' x 6.75'

270 Chambers
2,623.6 cy Field
1,542.8 cy Stone





Pond 1P: UG Det



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment2S: WS 2b Runoff Area=38,253 sf 26.00% Impervious Runoff Depth=7.01"
Tc=5.0 min CN=85 Runoff=10.49 cfs 0.513 af

SubcatchmentE: WS 2a Runoff Area=210,529 sf 57.96% Impervious Runoff Depth=7.61"
Tc=5.0 min CN=90 Runoff=60.48 cfs 3.067 af

SubcatchmentW: WS 1 Runoff Area=83,359 sf 1.65% Impervious Runoff Depth=6.40"
Tc=10.0 min CN=80 Runoff=18.18 cfs 1.020 af

Pond 1P: UG Det Peak Elev=935.67' Storage=1.021 af Inflow=60.48 cfs 3.067 af
Outflow=22.31 cfs 2.985 af

Total Runoff Area = 7.625 ac Runoff Volume = 4.600 af Average Runoff Depth = 7.24"
59.85% Pervious = 4.564 ac 40.15% Impervious = 3.061 ac

Summary for Subcatchment 2S: WS 2b

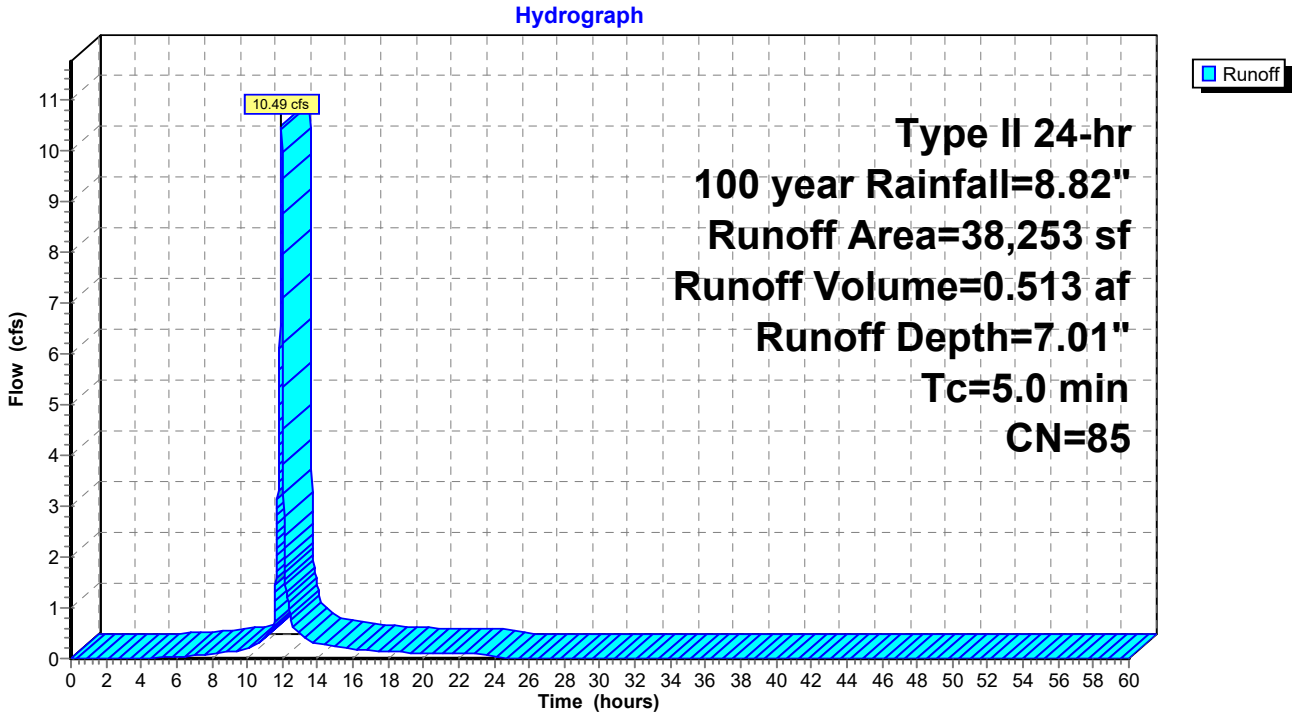
Runoff = 10.49 cfs @ 11.96 hrs, Volume= 0.513 af, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=8.82"

Area (sf)	CN	Description
28,307	80	>75% Grass cover, Good, HSG D
9,946	98	Paved parking, HSG D
38,253	85	Weighted Average
28,307		74.00% Pervious Area
9,946		26.00% Impervious Area

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

Subcatchment 2S: WS 2b



Summary for Subcatchment E: WS 2a

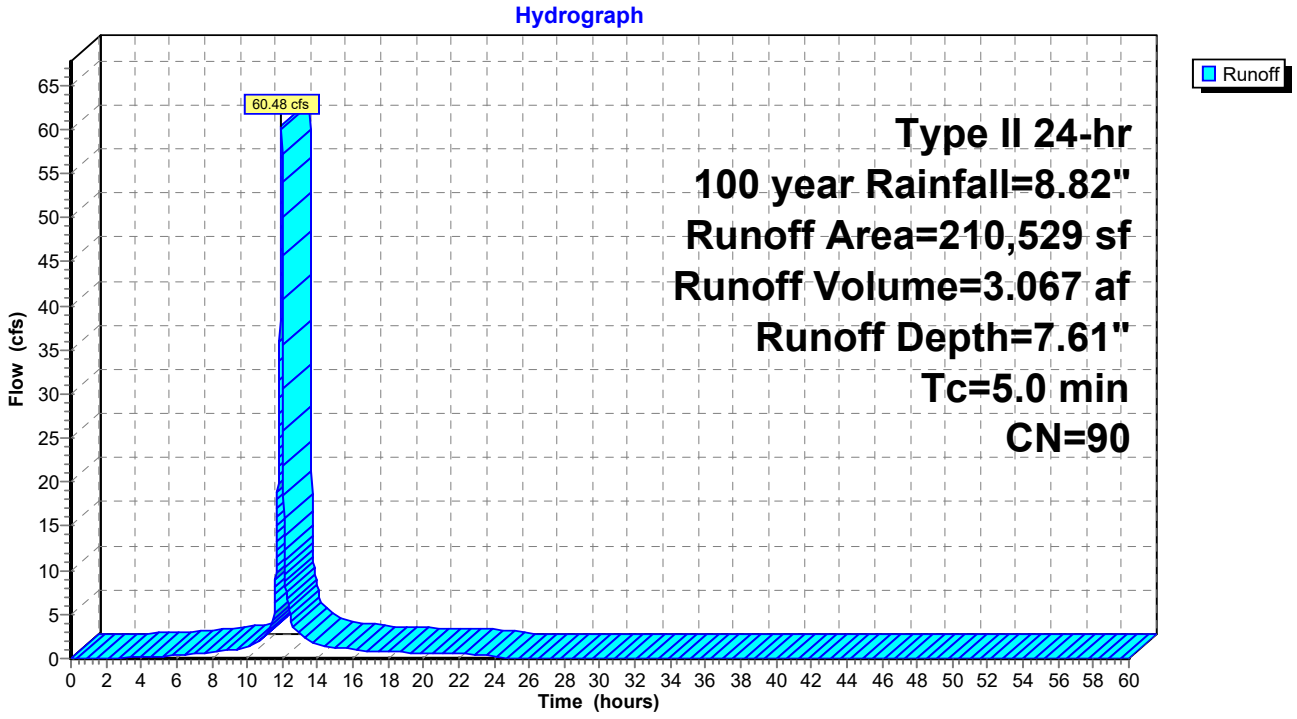
Runoff = 60.48 cfs @ 11.96 hrs, Volume= 3.067 af, Depth= 7.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=8.82"

Area (sf)	CN	Description
88,504	80	>75% Grass cover, Good, HSG D
122,025	98	Paved parking, HSG D
210,529	90	Weighted Average
88,504		42.04% Pervious Area
122,025		57.96% Impervious Area

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

Subcatchment E: WS 2a



Summary for Subcatchment W: WS 1

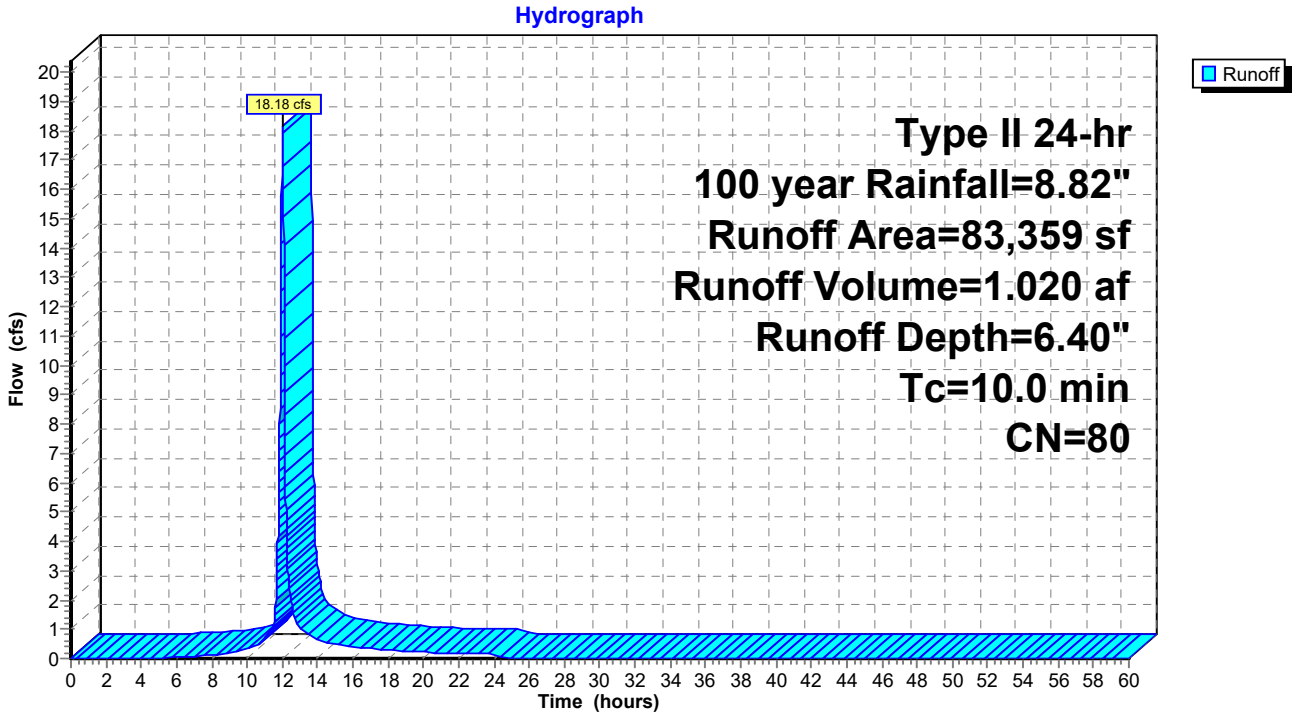
Runoff = 18.18 cfs @ 12.01 hrs, Volume= 1.020 af, Depth= 6.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Rainfall=8.82"

Area (sf)	CN	Description
81,980	80	>75% Grass cover, Good, HSG D
1,379	98	Paved parking, HSG D
83,359	80	Weighted Average
81,980		98.35% Pervious Area
1,379		1.65% Impervious Area

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

Subcatchment W: WS 1



Summary for Pond 1P: UG Det

Inflow Area = 4.833 ac, 57.96% Impervious, Inflow Depth = 7.61" for 100 year event
Inflow = 60.48 cfs @ 11.96 hrs, Volume= 3.067 af
Outflow = 22.31 cfs @ 12.06 hrs, Volume= 2.985 af, Atten= 63%, Lag= 6.4 min
Primary = 22.31 cfs @ 12.06 hrs, Volume= 2.985 af

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 935.67' @ 12.06 hrs Surf.Area= 0.241 ac Storage= 1.021 af

Plug-Flow detention time= 93.7 min calculated for 2.985 af (97% of inflow)
Center-of-Mass det. time= 77.4 min (846.1 - 768.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	929.25'	0.383 af	**55.75'W x 188.24'L x 6.75'H Field A** 1.626 af Overall - 0.670 af Embedded = 0.956 af x 40.0% Voids
#2A	930.00'	0.670 af	**ADS_StormTech MC-4500 +Cap** x 270 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 6 Rows of 45 Chambers Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf
		1.052 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	930.00'	**18.0" Round RCP_Round 18"** L= 50.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 930.00' / 929.19' S= 0.0162 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	930.00'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.40'	**36.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=22.30 cfs @ 12.06 hrs HW=935.67' (Free Discharge)
└─**1=RCP_Round 18"** (Barrel Controls 22.30 cfs @ 12.62 fps)
  ├─**2=Orifice/Grate** (Passes < 0.39 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 115.15 cfs potential flow)

Pond 1P: UG Det - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

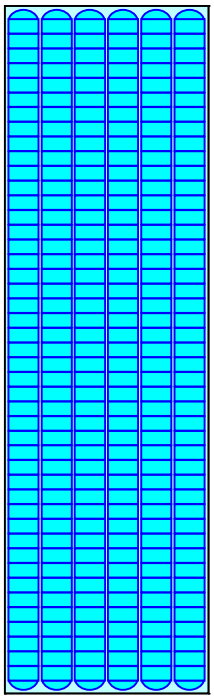
45 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 186.24' Row Length +12.0" End Stone x 2 = 188.24' Base Length
6 Rows x 100.0" Wide + 9.0" Spacing x 5 + 12.0" Side Stone x 2 = 55.75' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

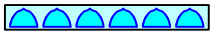
270 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 6 Rows = 29,180.8 cf Chamber Storage

70,837.7 cf Field - 29,180.8 cf Chambers = 41,656.9 cf Stone x 40.0% Voids = 16,662.8 cf Stone Storage

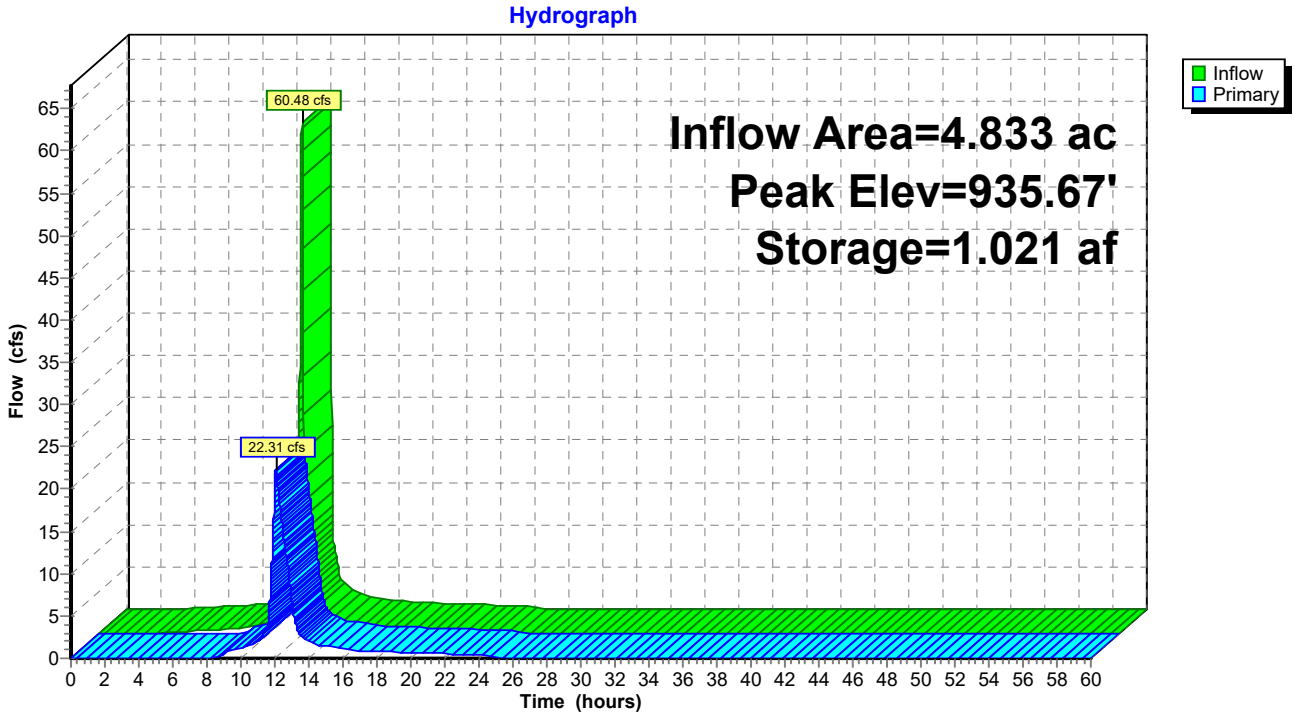
Chamber Storage + Stone Storage = 45,843.6 cf = 1.052 af
Overall Storage Efficiency = 64.7%
Overall System Size = 188.24' x 55.75' x 6.75'

270 Chambers
2,623.6 cy Field
1,542.8 cy Stone





Pond 1P: UG Det



Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment2S: WS 2b Runoff Area=38,253 sf 26.00% Impervious Runoff Depth=0.37"
Tc=5.0 min CN=85 Runoff=0.59 cfs 0.027 af

SubcatchmentE: WS 2a Runoff Area=210,529 sf 57.96% Impervious Runoff Depth=0.58"
Tc=5.0 min CN=90 Runoff=5.25 cfs 0.235 af

SubcatchmentW: WS 1 Runoff Area=83,359 sf 1.65% Impervious Runoff Depth=0.22"
Tc=10.0 min CN=80 Runoff=0.54 cfs 0.036 af

Pond 1P: UG Det Peak Elev=930.41' Storage=0.159 af Inflow=5.25 cfs 0.235 af
Outflow=0.10 cfs 0.155 af

Total Runoff Area = 7.625 ac Runoff Volume = 0.298 af Average Runoff Depth = 0.47"
59.85% Pervious = 4.564 ac 40.15% Impervious = 3.061 ac

Summary for Subcatchment 2S: WS 2b

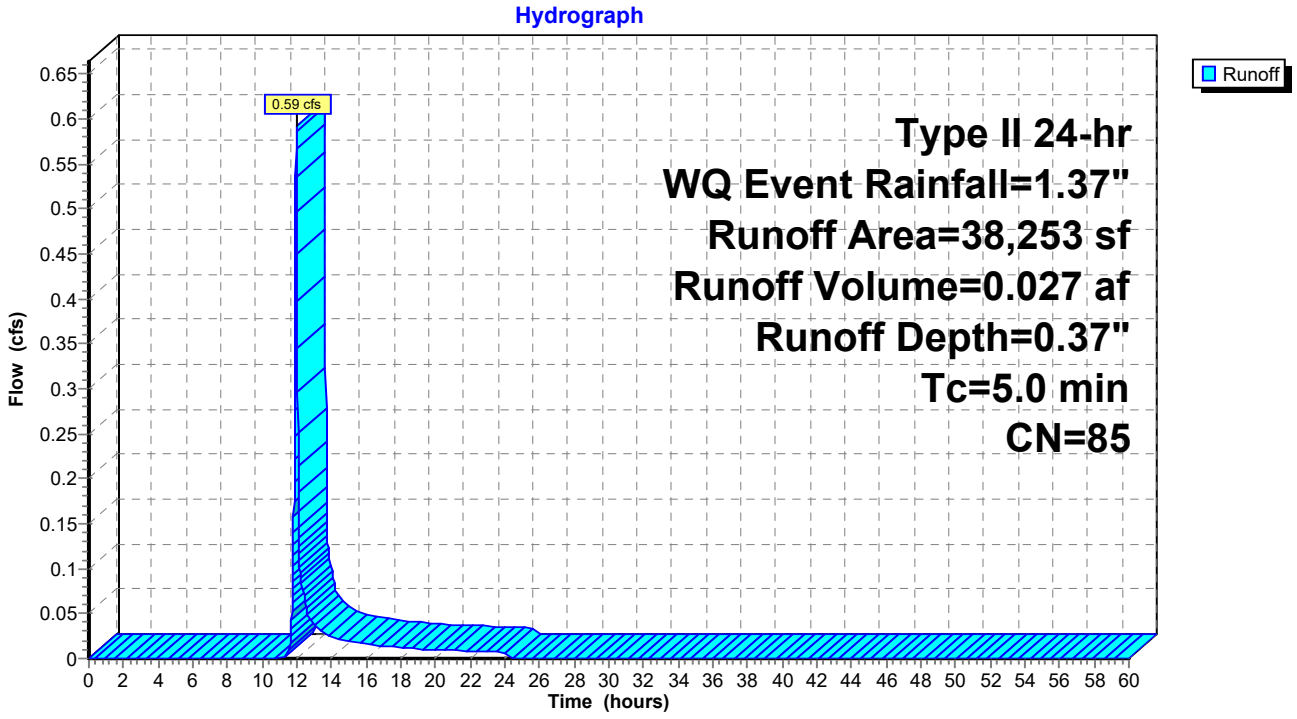
Runoff = 0.59 cfs @ 11.97 hrs, Volume= 0.027 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr WQ Event Rainfall=1.37"

Area (sf)	CN	Description
28,307	80	>75% Grass cover, Good, HSG D
9,946	98	Paved parking, HSG D
38,253	85	Weighted Average
28,307		74.00% Pervious Area
9,946		26.00% Impervious Area

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

Subcatchment 2S: WS 2b



Summary for Subcatchment E: WS 2a

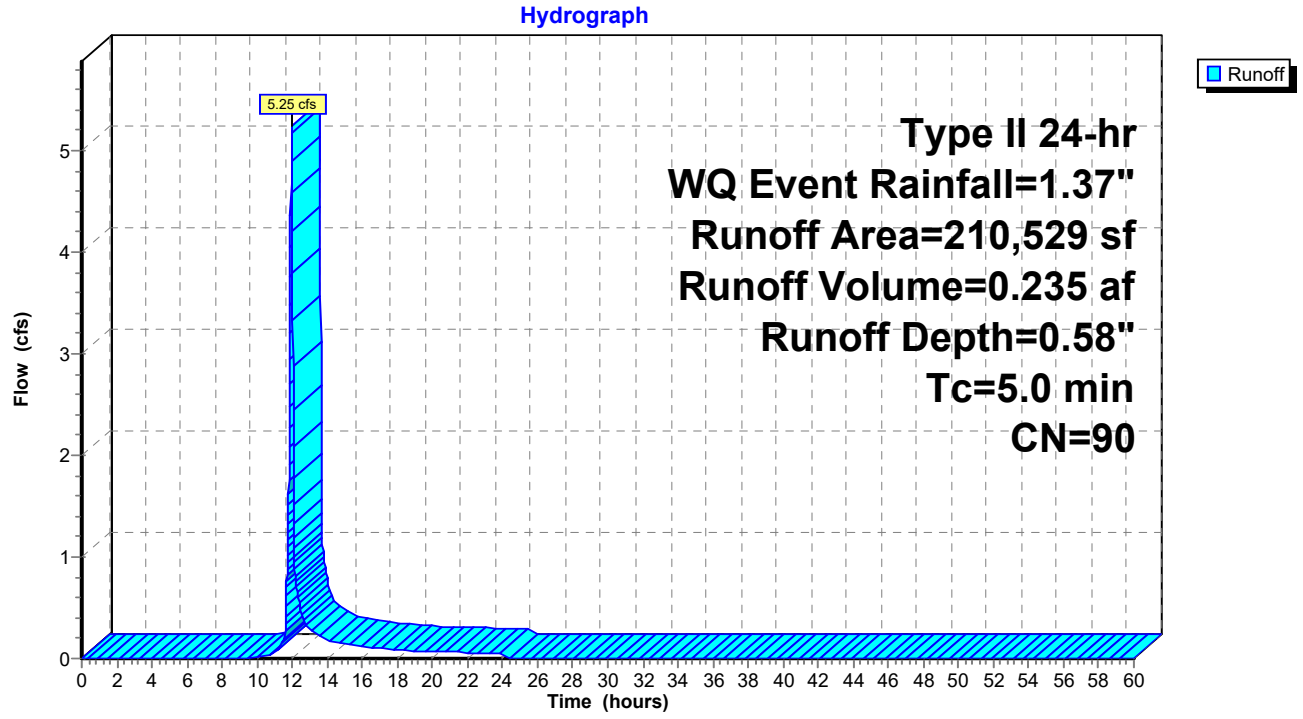
Runoff = 5.25 cfs @ 11.96 hrs, Volume= 0.235 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr WQ Event Rainfall=1.37"

Area (sf)	CN	Description
88,504	80	>75% Grass cover, Good, HSG D
122,025	98	Paved parking, HSG D
210,529	90	Weighted Average
88,504		42.04% Pervious Area
122,025		57.96% Impervious Area

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

Subcatchment E: WS 2a



Summary for Subcatchment W: WS 1

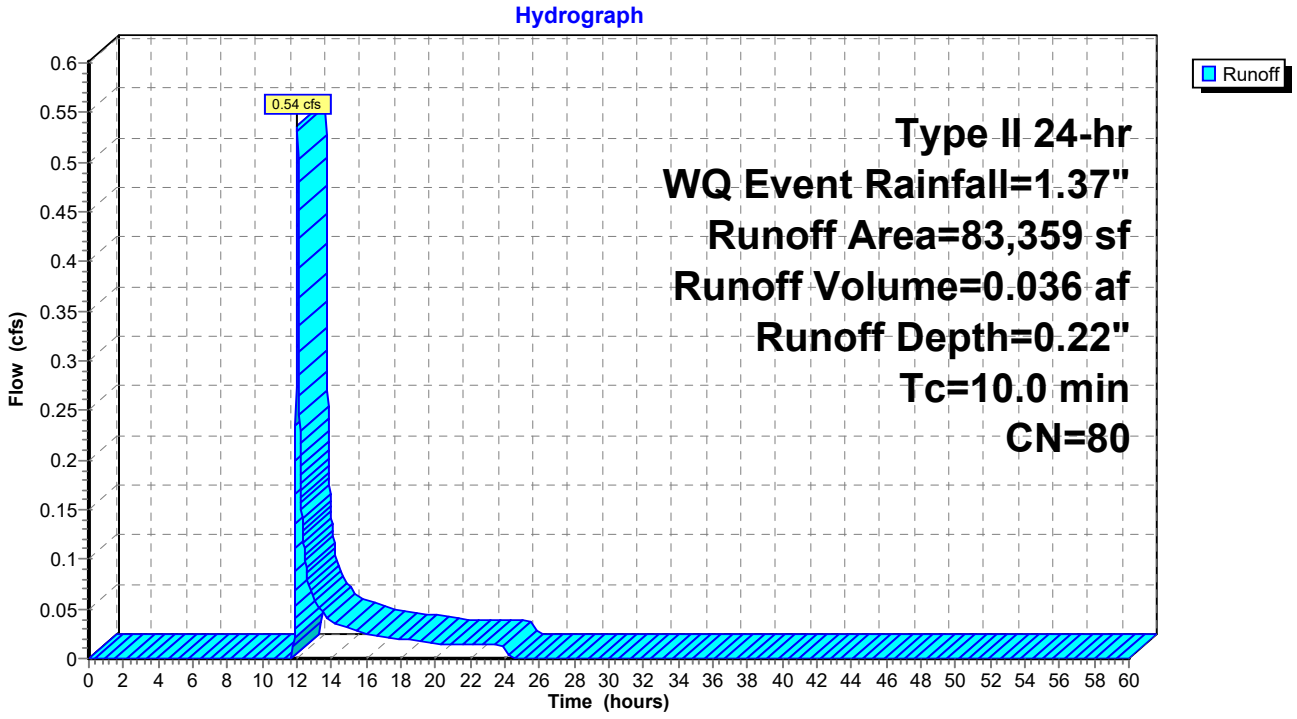
Runoff = 0.54 cfs @ 12.04 hrs, Volume= 0.036 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr WQ Event Rainfall=1.37"

Area (sf)	CN	Description
81,980	80	>75% Grass cover, Good, HSG D
1,379	98	Paved parking, HSG D
83,359	80	Weighted Average
81,980		98.35% Pervious Area
1,379		1.65% Impervious Area

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

Subcatchment W: WS 1



Summary for Pond 1P: UG Det

Inflow Area = 4.833 ac, 57.96% Impervious, Inflow Depth = 0.58" for WQ Event event
Inflow = 5.25 cfs @ 11.96 hrs, Volume= 0.235 af
Outflow = 0.10 cfs @ 16.63 hrs, Volume= 0.155 af, Atten= 98%, Lag= 280.2 min
Primary = 0.10 cfs @ 16.63 hrs, Volume= 0.155 af

Routing by Sim-Route method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 930.41' @ 16.63 hrs Surf.Area= 0.241 ac Storage= 0.159 af

Plug-Flow detention time= 735.8 min calculated for 0.155 af (66% of inflow)
Center-of-Mass det. time= 621.9 min (1,462.3 - 840.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	929.25'	0.383 af	**55.75'W x 188.24'L x 6.75'H Field A** 1.626 af Overall - 0.670 af Embedded = 0.956 af x 40.0% Voids
#2A	930.00'	0.670 af	**ADS_StormTech MC-4500 +Cap** x 270 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 6 Rows of 45 Chambers Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf
		1.052 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	930.00'	**18.0" Round RCP_Round 18"** L= 50.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 930.00' / 929.19' S= 0.0162 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	930.00'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	930.40'	**36.0" W x 60.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.10 cfs @ 16.63 hrs HW=930.41' (Free Discharge)
└**1=RCP_Round 18"** (Passes 0.10 cfs of 1.09 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.09 cfs @ 2.67 fps)
  └**3=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.36 fps)

Pond 1P: UG Det - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 6 rows = 428.4 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

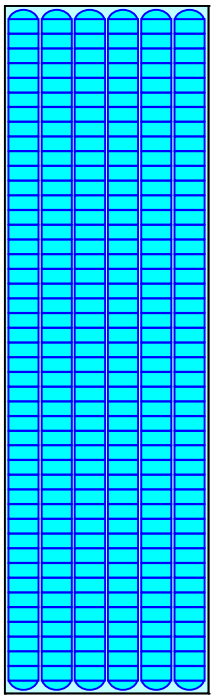
45 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 186.24' Row Length +12.0" End Stone x 2 = 188.24' Base Length
6 Rows x 100.0" Wide + 9.0" Spacing x 5 + 12.0" Side Stone x 2 = 55.75' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

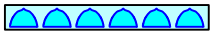
270 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 6 Rows = 29,180.8 cf Chamber Storage

70,837.7 cf Field - 29,180.8 cf Chambers = 41,656.9 cf Stone x 40.0% Voids = 16,662.8 cf Stone Storage

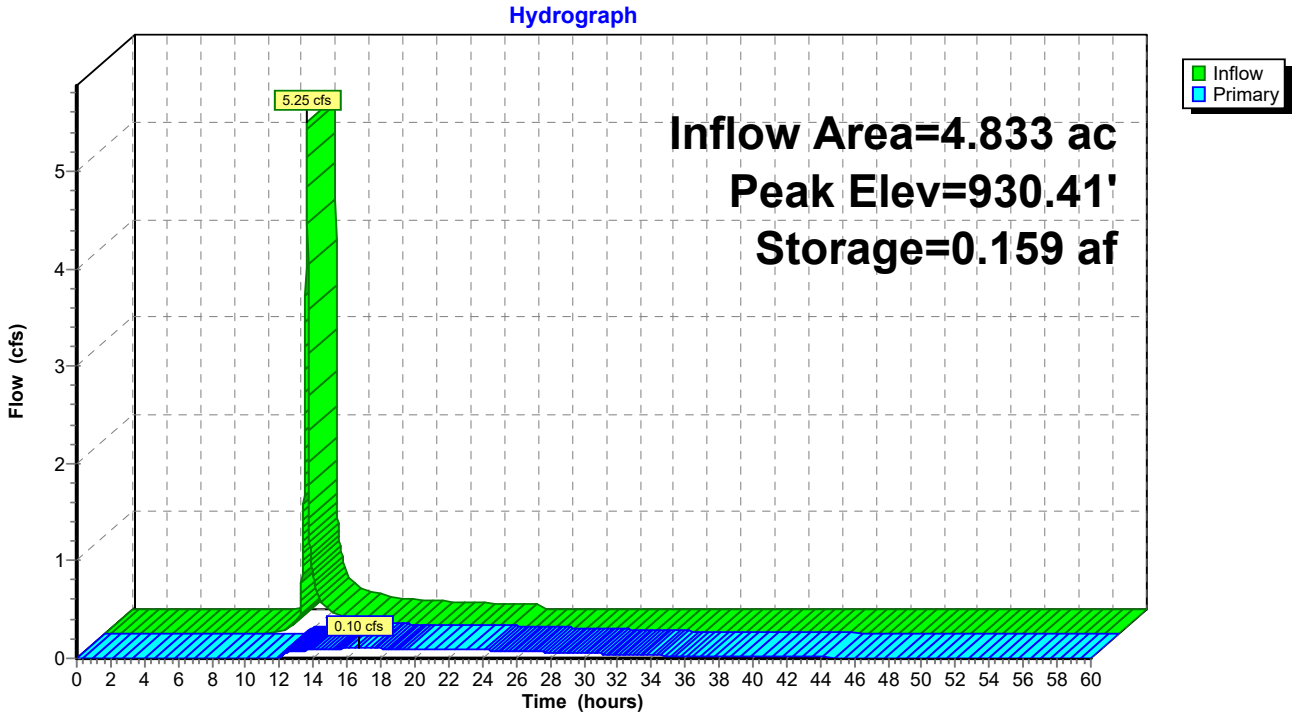
Chamber Storage + Stone Storage = 45,843.6 cf = 1.052 af
Overall Storage Efficiency = 64.7%
Overall System Size = 188.24' x 55.75' x 6.75'

270 Chambers
2,623.6 cy Field
1,542.8 cy Stone





Pond 1P: UG Det



Appendix D – USDA NRCS Soils Report

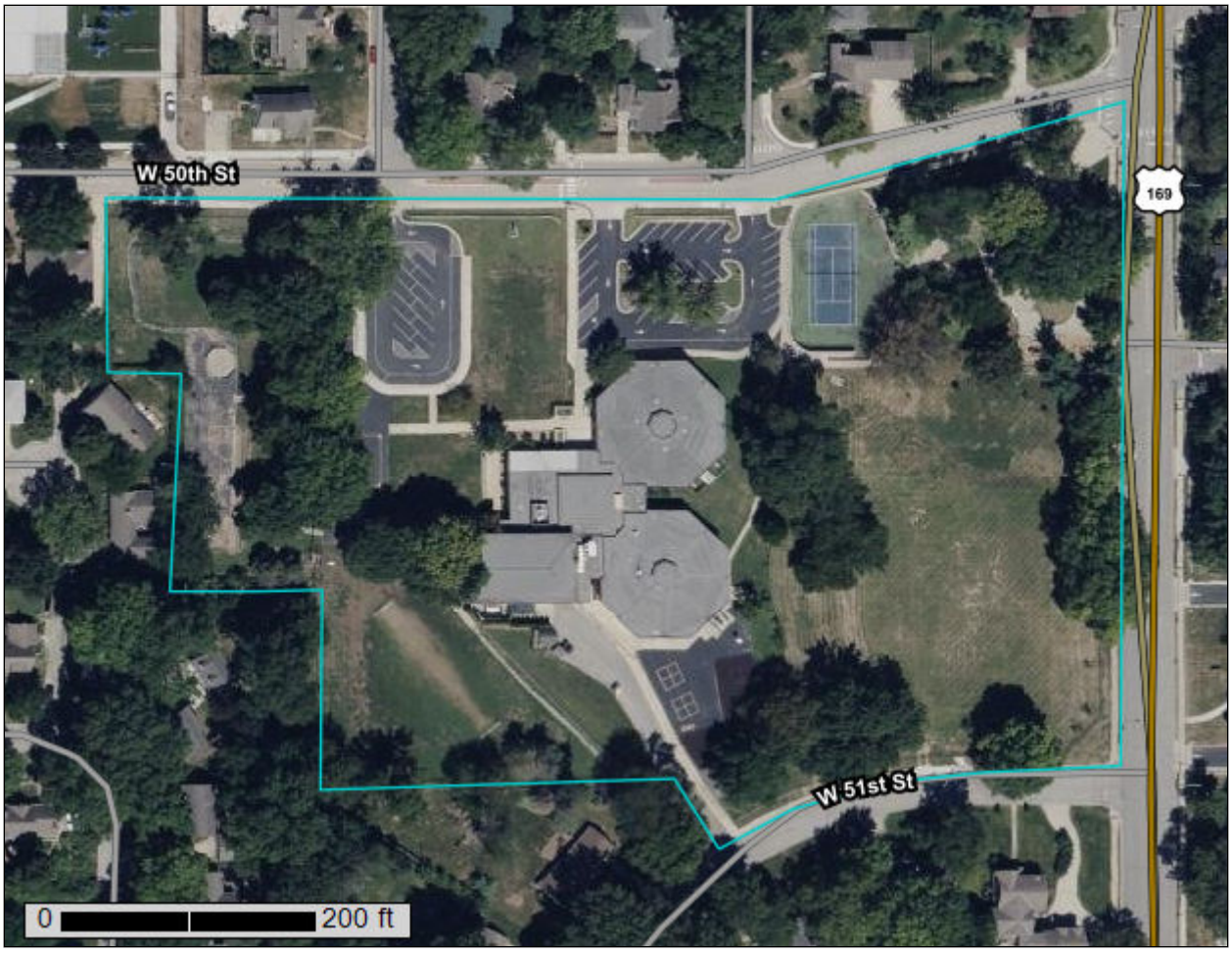
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Johnson County, Kansas



September 8, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,510 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:24,000.

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: Johnson County, Kansas
Survey Area Data: Version 21, Sep 12, 2022

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

Date(s) aerial images were photographed: Aug 30, 2022—Sep 16, 2022

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
7545	Sharpsburg-Urban land complex, 4 to 8 percent slopes	7.9	100.0%
Totals for Area of Interest		**7.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Johnson County, Kansas

7545—Sharpsburg-Urban land complex, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: tq4z
Elevation: 1,000 to 1,300 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 64 degrees F
Frost-free period: 185 to 255 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sharpsburg and similar soils: 55 percent
Urban land: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Silty and clayey loess

Typical profile

A - 0 to 9 inches: silt loam
AB - 9 to 13 inches: silty clay loam
Bt - 13 to 35 inches: silty clay loam
BC - 35 to 60 inches: silty clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 36 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R106XY015KS - Loamy Upland (PE 30-37)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix E – MC-4500 StormTech Detail Sheet

Advanced Drainage Systems, Inc.

SiteAssist®
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

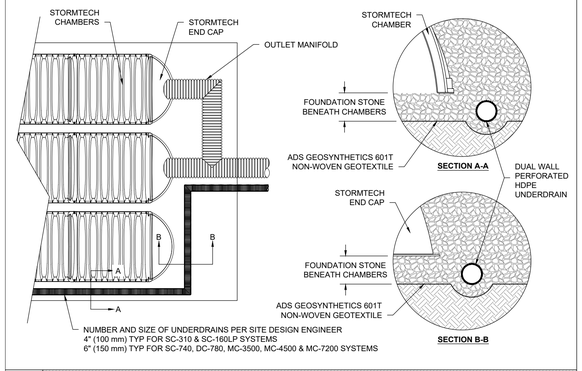
1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

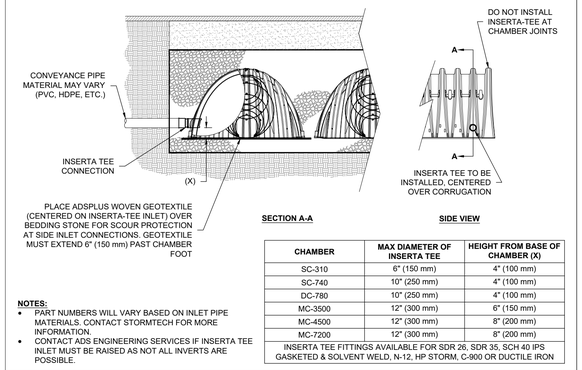
1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

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

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



5 UNDERDRAIN DETAIL

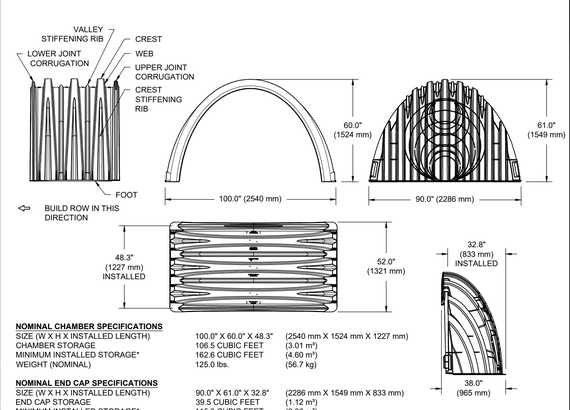


NOTES:
- PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.
- CONTACT ADS ENGINEERING SERVICES IF INSERTA TEE INLET MUST BE RAISED AS NOT ALL INVERTS ARE POSSIBLE.

CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
MC-7200	12" (300 mm)	8" (200 mm)

INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON

6 INSERTA-TEE SIDE INLET DETAIL



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT (NOMINAL)	125.0 lbs.	(56.7 kg)

NOMINAL END CAP SPECIFICATIONS

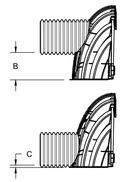
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC4500IEPP06B		---	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC4500IEPP08B		---	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC4500IEPP10B		---	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC4500IEPP12B		---	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC4500IEPP15B		---	1.70" (43 mm)
MC4500IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC4500IEPP18TW			
MC4500IEPP18B		---	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC4500IEPP24TW			
MC4500IEPP24B		---	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

2 MC-4500 TECHNICAL SPECIFICATIONS

INSPECTION & MAINTENANCE

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

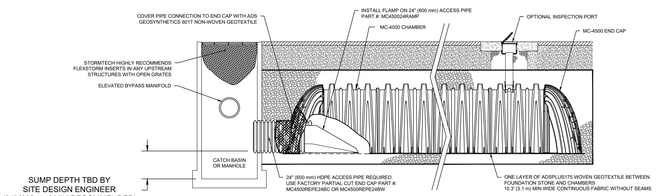
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45° (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

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

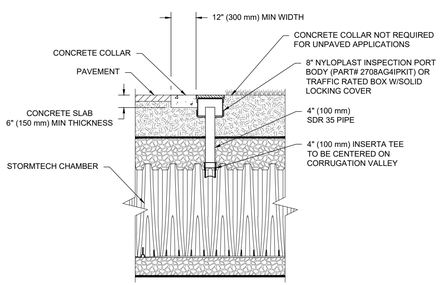
STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

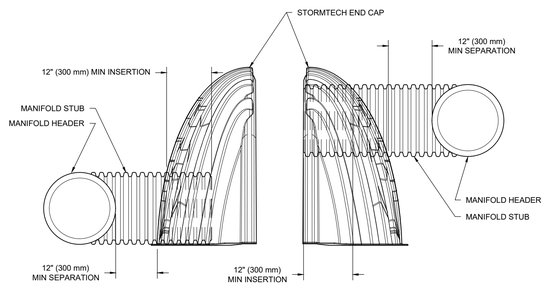


3 MC-4500 ISOLATOR ROW PLUS DETAIL



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4 4" PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)



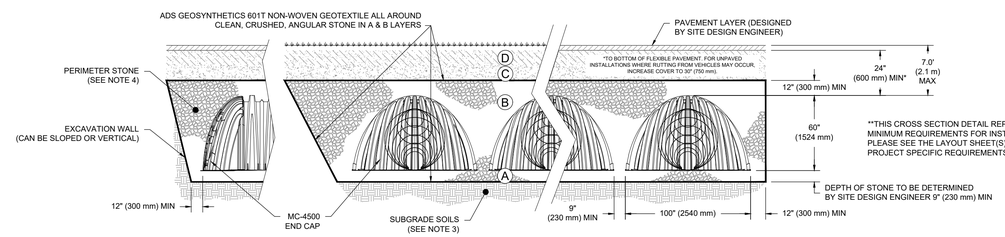
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

7 MC-SERIES END CAP INSERTION DETAIL

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

1 MC-4500 CROSS SECTION DETAIL

DRAWN: | DATE:
REVIEWED: | PROJECT NO:
REV: | NOT TO SCALE

MC-4500 STANDARD DETAILS

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

4640 TRUEMAN BLVD
HILLIARD, OH 43026

Advanced Drainage Systems, Inc.

SHEET