Exhibit H: Preliminary Stormwater Report

Cipole Property
Tualatin, Oregon

Preliminary Stormwater Report

Date: March 10, 2023

Client:
Cipole, LLC
19990 SW Cipole Road
Tualatin, Oregon 97062

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AKS Job Number: 7949

AKS ENGINEERING & FORESTRY

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CIPOLE PROPERTY
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1.0 Purpose of Report

The purpose of this report is to analyze the effects the proposed development will have on the existing and proposed stormwater conveyance system; document the criteria, methodology, and informational sources used to design the proposed stormwater system; and present the results of the final hydraulic analysis.

2.0 Project Location/Description

The subject site is located at 19990 SW Cipole Road and is a 1.44-acre plot of land in Tualatin, Oregon, Tax Lot 700 (Washington County Assessor's Map 2S121DC).

This development will include the creation of a commercial building, associated parking, landscaped areas, and utilities. Underground detention and treatment will be constructed to manage on-site stormwater runoff and meet quality and quantity requirements.

3.0 Regulatory Design Criteria

3.1. Stormwater Quantity

Per the 2019 Clean Water Services (CWS) *Design & Construction Standards* (R&O 19-5, as Amended by R&O 19-22) Section 4.02, Water Quantity Control Requirements for Conveyance Capacity, on-site detention for conveyance capacity of the 25-year storm event is required when any of the following conditions exist:

1. *There is an identified downstream deficiency and the District or City determines that detention rather than conveyance system enlargement is the more effective solution.*
2. *There is an identified regional detention site within the boundary of the development.*
3. *Water quantity facilities are required by District-adopted watershed management plans or adopted subbasin master plans.*

The proposed project does not meet any of the conditions listed above; therefore, the project is not required to meet stormwater quantity requirements. However, the stormwater facility has been designed to meet CWS hydromodification requirements and results in the detention of flows from the post-developed site's 25-year storm event to the level of flows from the predeveloped site's 25-year storm event.

3.2. Stormwater Hydromodification

Per CWS *Design & Construction Standards* Section 4.03, Hydromodification Approach Requirements, stormwater hydromodification is required unless the project meets any of the following criteria:

1. *The project results in the addition and/or modification of less than 12,000 square feet of impervious surface.*
2. *The project is located in an area with a District-approved subbasin strategy with an identified regional stormwater management approach for hydromodification.*

Per listed criteria in CWS *Design & Construction Standards* Table 4-2, Hydromodification Approach Project Category Table, the project is identified as Category 2. Therefore, the project will meet CWS hydromodification requirements by providing a combination of infiltration facility and peak flow–matching detention using the criteria established within CWS *Design & Construction Standards* Section 4.08.6.

3.3. Stormwater Quality

Stormwater quality management for this project will be provided by a proprietary mechanical treatment device. Proprietary treatment systems are an allowed use per CWS Section 4.04.3 and are designed to comply with CWS Section 4.07.8.

4.0 Design Methodology

The Santa Barbara Urban Hydrograph (SBUH) method was used to analyze stormwater runoff from the site. This method uses the Soil Conservation Service (SCS) Type 1A 24-hour design storm. HydroCAD 10.00.22 computer software aided in the analysis. Representative runoff curve numbers (CN) were obtained from the 1986 Natural Resources Conservation Service (NRCS) Technical Release 55 (TR-55), *Urban Hydrology for Small Watersheds,* and are included in Appendix D.

5.0 Design Parameters

5.1. Design Storms

Per CWS *Design & Construction Standards* Section 4.08.2, Storm Events Used in Design, the following rainfall intensities and durations were used in analyzing the proposed stormwater facility:

Table 5-1: Rainfall Intensities

Recurrence Interval (Years)	Storm Period (hours)	Total Precipitation Depth (Inches)
WQ*	4	0.36
2	24	2.50
5	24	3.10
10	24	3.45
25	24	3.90

** WQ recurrence interval refers to the water quality storm*

5.2. Pre-Developed Site Conditions

5.2.1. Site Topography

Existing on-site grades generally vary from ±0.7 to ±5 percent, with a high point of elevation ±144 feet located at the south property line and a low point of elevation ±138 feet located at the northwest property corner. The site slopes from the south property line to a low point in the northwest corner of the site.

5.2.2. Land Use

The existing site consists of an undeveloped grass field.

5.3. Soil Type

The soil beneath the project site and associated drainage basins is classified as Hillsboro loam, according to the NRCS Soil Survey for Washington County. The following table outlines the Hydrologic Soil Group rating for each soil type:

Table 5-2: Hydrologic Soil Groupings

NRCS Map Unit Identification	NRCS Soil Classification	Hydrologic Soil Group Rating
21B	Hillsboro loam, 3 to 7 percent slopes	B

Further information on this soil type is included in the NRCS Soil Resource Report located in Appendix C of this report.

5.4. Post-Developed Site Conditions

5.4.1. Site Topography

The on-site slopes will be modified with minor cuts and fills to accommodate the construction of a building and a parking lot. The majority of the proposed site grading will not change the existing site topography.

5.4.2. Land Use

The site's land use will consist of general manufacturing industrial with the construction of a new industrial building, associated parking, and utilities.

5.4.3. Post-Developed Site Parameters

Appendix A provides the HydroCAD reports and input parameters that were generated for the analyzed storm events with respect to the drainage basins contributing to the subdivision. These reports include all parameters used to model site hydrology (e.g. impervious and pervious areas, time of concentration, etc.).

5.4.4. Description of Off-Site Contributing Basins

The existing lot to the south (Tax Lot 900 Washington County Assessor's Map 1S 1 21 DC) drains onto the subject site. This lot consists of multiple buildings, associated driveways, parking, and landscaping.

6.0 Stormwater Analyses

6.1. Proposed Stormwater Conduit Sizing and Inlet Spacing

To properly convey stormwater runoff, the proposed on-site catch basins have been spaced to properly convey stormwater runoff. The proposed storm pipes will be sized using Manning's equation to convey the peak flows of the 25-year storm event, meeting CWS *Design & Construction Standards* Section 5.06.1, Pipe Size.

6.2. Proposed Stormwater Quality Control Facility

A proprietary mechanical treatment device has been designed per CWS *Design & Construction Standards* Section 4.07.8 to provide water quality treatment for runoff from impervious areas created by the proposed project.

The water quality volume (WQV) will be routed through the proprietary mechanical treatment device, which will provide water quality treatment per CWS *Design & Construction Standards* Section 4.07.8. Detailed calculations and checks against CWS criteria are included in Appendix B.

6.3. Stormwater Hydromodification Management

The proposed project will generate approximately 50,879 square feet of impervious area and is therefore classified as a large project. Per the CWS online Hydromodification Planning Tool, the subject site is located within a developed area, and the site's runoff flows through a series of stormwater mains, outfalling to an existing wetland, through unnamed tributaries before discharging into the Tualatin River

with a low hydromodification risk level. Based on these parameters and CWS *Design & Construction Standards* Table 4-2, the project is classified as a Category 2 Hydromodification Approach.

Per the Category 2 requirements of CWS *Design & Construction Standards* Section 4.03.5, the subject site will provide a combination of infiltration facility and peak flow–matching detention, using design criteria listed in Sections 4.08.5 and 4.08.6 for the development of underground detention chambers and a proprietary mechanical treatment device. Specifically, flows from the subject site's post-developed 2-, 5-, and 10-year storm events will not exceed the site's flows from the predeveloped 50 percent of 2-, 5-, and 10-year storm events.

6.4. Stormwater Quantity Control Facility Design

The proposed project provides stormwater quantity management for the commercial development by using underground detention chambers designed per CWS and City of Tualatin standards. The following table outlines how the underground detention chamber's outflow will limit the site development's post-developed peak flows to less than the allowable pre-developed peak flows for each storm event and meet CWS requirements, as outlined in the Stormwater Quantity and Stormwater Hydromodification Management sections of this report.

Table 6-1: Pre- and Post-Developed Flows

Recurrence Interval (Years)	Peak Pre-Developed Flows (cubic feet per second)	Peak Post-Developed Flows (cubic feet per second)*	Peak Flow Increase or (Decrease) (cubic feet per second)
2	0.30 (50% of 2-year = 0.15)	0.14	(0.01)
5	0.37	0.34	(0.03)
10	0.47	0.45	(0.02)
25	0.64	0.59	(0.05)

** Peak post-developed flow for 2-year storm event is less than or equal to 50 percent of 2-year peak pre-developed flow*

The proposed underground stormwater chambers have sufficient capacity to detain the commercial development's post-developed flows to the level of pre-developed flows, meeting the requirements established by the CWS *Design & Construction Standards*.

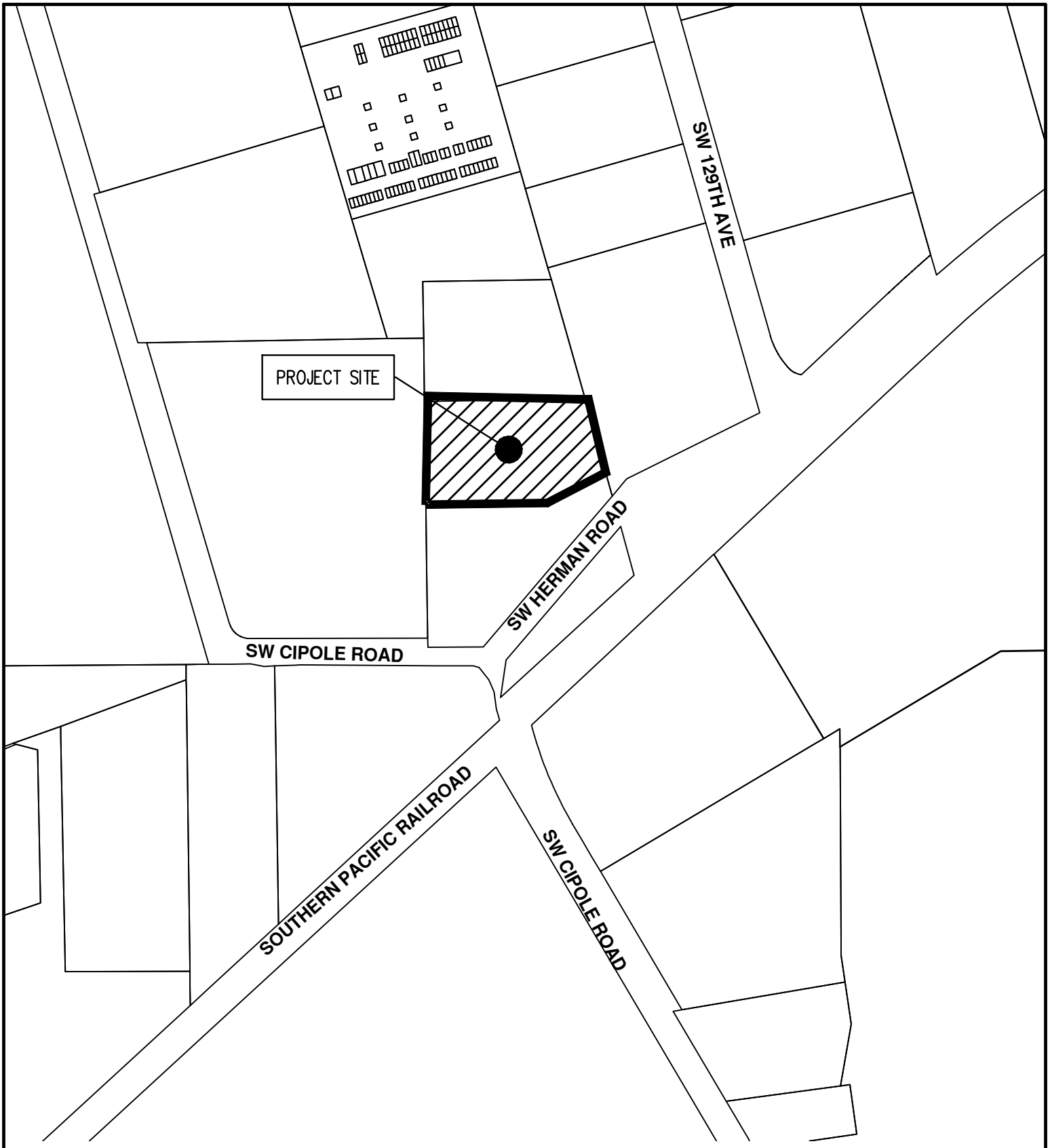
6.5. Downstream Analysis

Per CWS standards and City of Tualatin requirements, a downstream analysis of the existing stormwater system has been performed and no downstream deficiencies have been identified. Since the proposed development will provide stormwater detention up to the 25-year storm event, only a visual investigation of the downstream system is required.

Historically, the proposed site drains to the northwest corner of the site before draining through a series of storm utilities and unnamed tributaries before ultimately ending up in the Tualatin River.

A visual investigation has been performed of the downstream system to a distance of ¼ mile from the site. The investigation determined that there are no observable downstream obstructions or failures in the drainage system.

Figure 1: Vicinity Map



DATE: 03/10/2023

VICINITY MAP	FIGURE 1
AKS ENGINEERING & FORESTRY, LLC 12965 SW HERMAN RD, STE 100 TUALATIN, OR 97062 503.563.6151 WWW.AKS-ENG.COM	DRWN: MDT CHKD: MTA AKS JOB: 7949

DWG: 7949 FIGURE 1 – VICINITY MAP | 1

Figure 2: Pre-Developed Catchment Map

LEGEND

7S — BASIN

DIRECTION OF FLOW

BASIN BOUNDARY

N

SCALE: 1" = 80 FEET

80 0 16 40 80

ORIGINAL PAGE SIZE: 11" x 17"

DATE: 03/10/2023

PRE-DEVELOPED CATCHMENT MAP

FIGURE 2

CIPOLE PROPERTY

AKS ENGINEERING & FORESTRY, LLC
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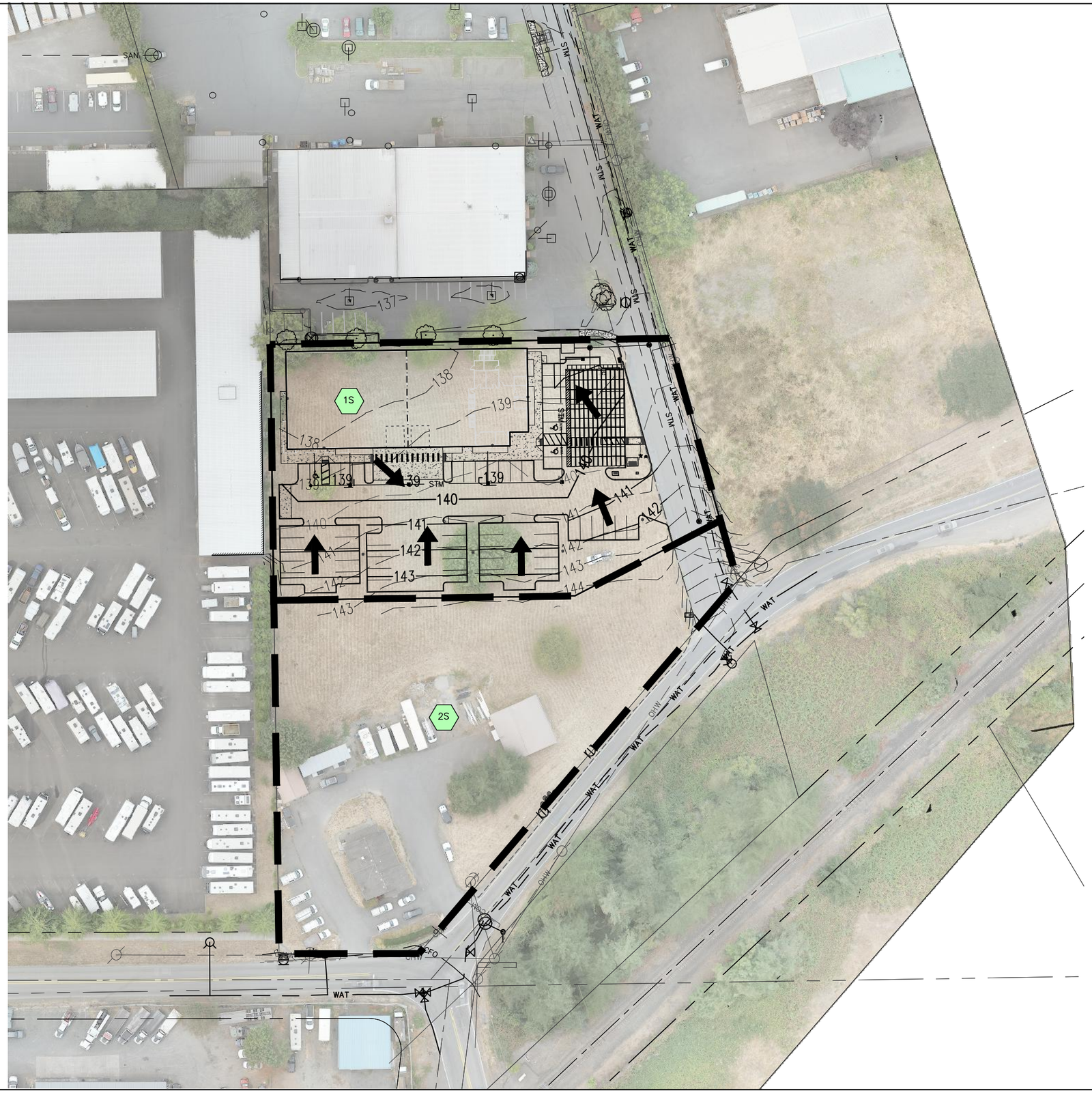
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: MDT
CHKD: MTA
AKS JOB: 7949

DWG: 7949 FIGURE 2 - PRE-DEVELOPED | 2

Figure 3: Post-Developed Catchment Map



LEGEND

POST — BASIN

DIRECTION OF FLOW

BASIN BOUNDARY

N

SCALE: 1" = 80 FEET

80 0 16 40 80

ORIGINAL PAGE SIZE: 11" x 17"

DATE: 03/10/2023

POST-DEVELOPED CATCHMENT MAP

FIGURE 3

CIPOLE PROPERTY

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DRWN: MDT
CHKD: MTA
AKS JOB: 7949

DWG: 7949 FIGURE 3 - POST-DEVELOPED | 3

Figure 4: Stormwater Extension Map

LEGEND

- 3X — BASIN
- 1P — STORMWATER FACILITY
- 1R — REACH
- BASIN BOUNDARY

N

SCALE: 1"=100 FEET

100 0 20 50 100

ORIGINAL PAGE SIZE: 11" x 17"

DATE: 03/10/2023

STORMWATER EXTENSION MAP	FIGURE
CIPOLE PROPERTY	4

AKS ENGINEERING & FORESTRY, LLC
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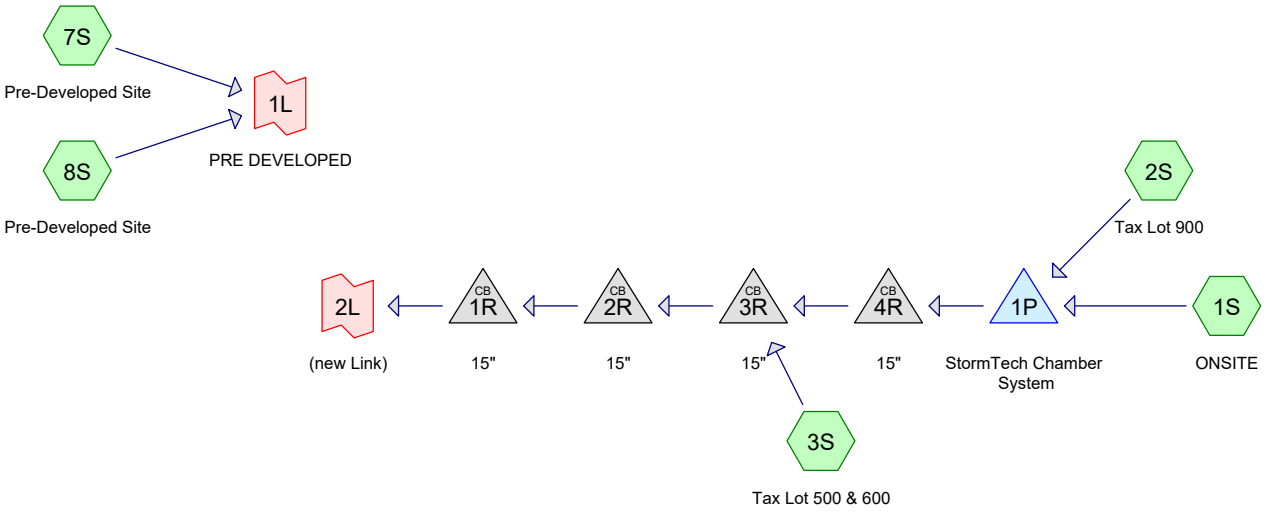
DRWN: MDT
CHKD: MTA
AKS JOB: 7949

DWG: 7949 FIGURE 4 - STORM EXTENSION | LAYOUT1

Appendix A: HydroCAD Report



Subcat Reach Pond Link

Routing Diagram for 7949 Post Developed Storm Facility Routing
Prepared by AKS Engineering & Forestry, Printed 3/14/2023

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.553	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S)
1.870	98	AC Parking Lot (3S)
0.964	98	Building (3S)
1.168	98	IMPERVIOUS (1S)
0.403	98	Impervious (2S)
0.527	98	impervious (7S, 8S)
2.437	61	pervious (7S, 8S)

Summary for Subcatchment 1S: ONSITE

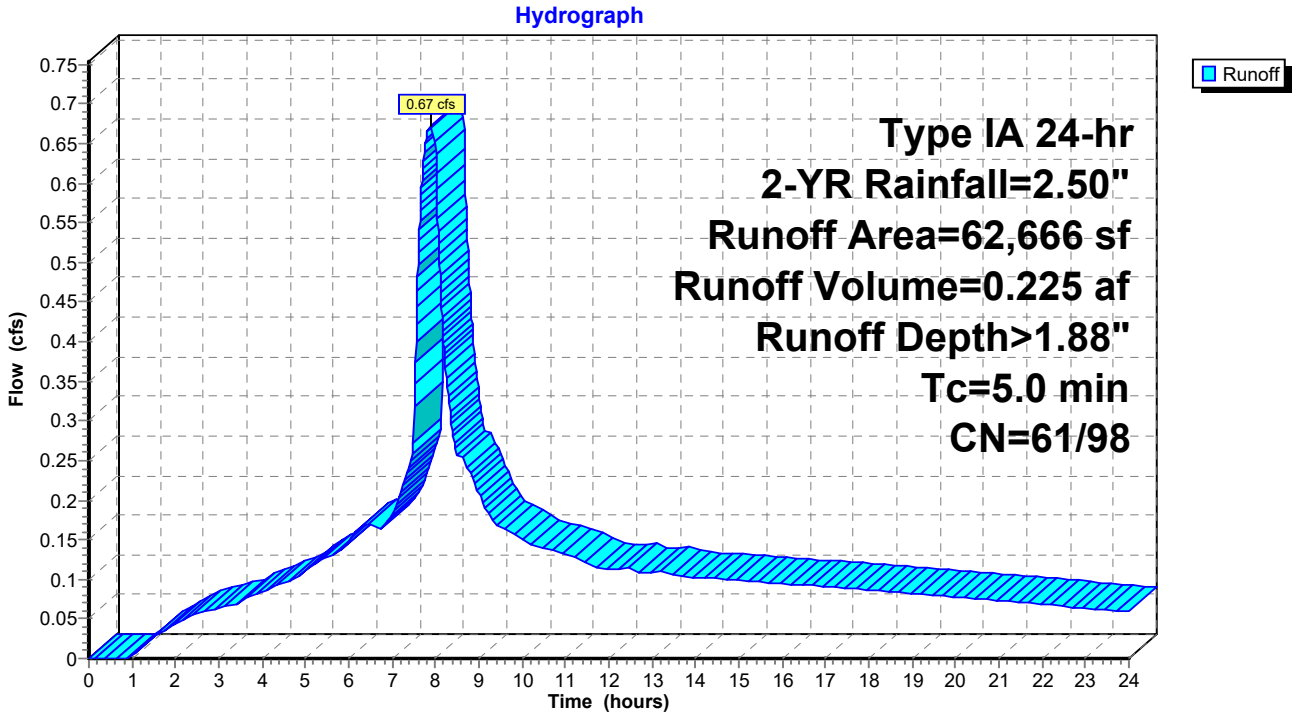
Runoff = 0.67 cfs @ 7.88 hrs, Volume= 0.225 af, Depth> 1.88"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	50,879	98	IMPERVIOUS
	11,787	61	>75% Grass cover, Good, HSG B
	62,666	91	Weighted Average
	11,787		18.81% Pervious Area
	50,879		81.19% Impervious Area

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

Subcatchment 1S: ONSITE



Summary for Subcatchment 2S: Tax Lot 900

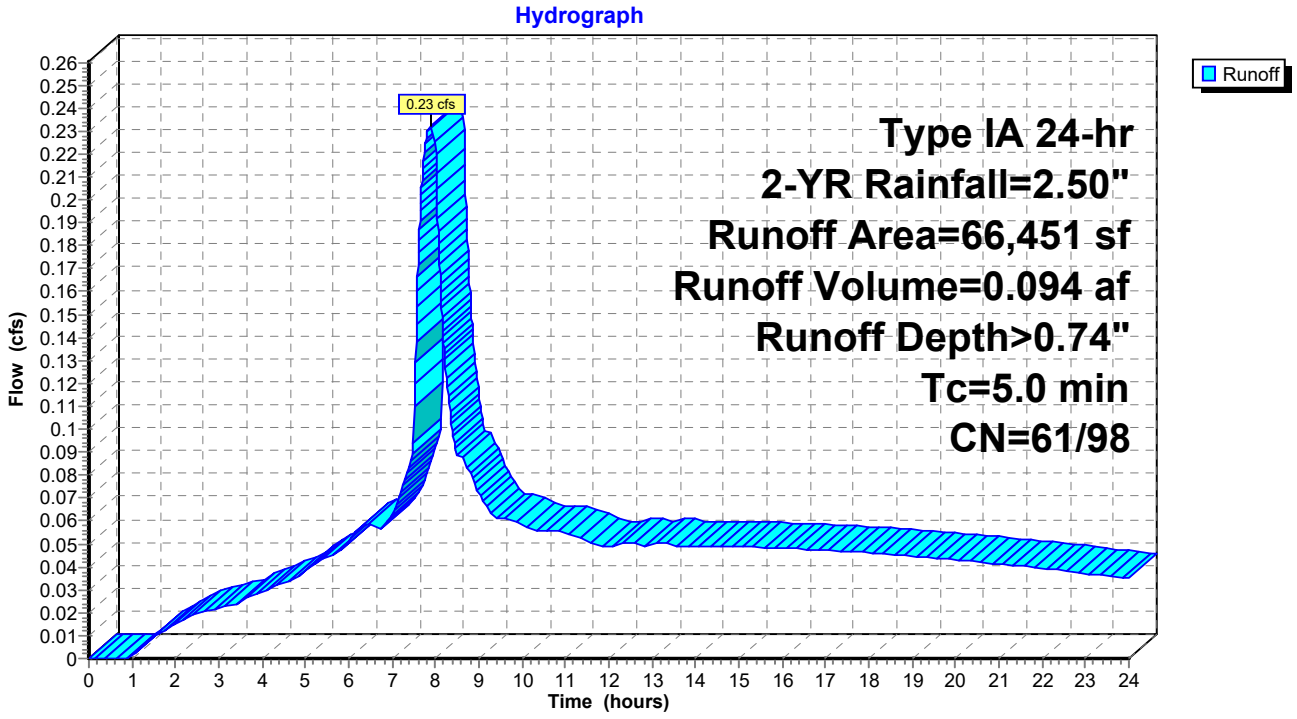
Runoff = 0.23 cfs @ 7.88 hrs, Volume= 0.094 af, Depth> 0.74"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	17,573	98	Impervious
	48,878	61	>75% Grass cover, Good, HSG B
	66,451	71	Weighted Average
	48,878		73.55% Pervious Area
	17,573		26.45% Impervious Area

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

Subcatchment 2S: Tax Lot 900



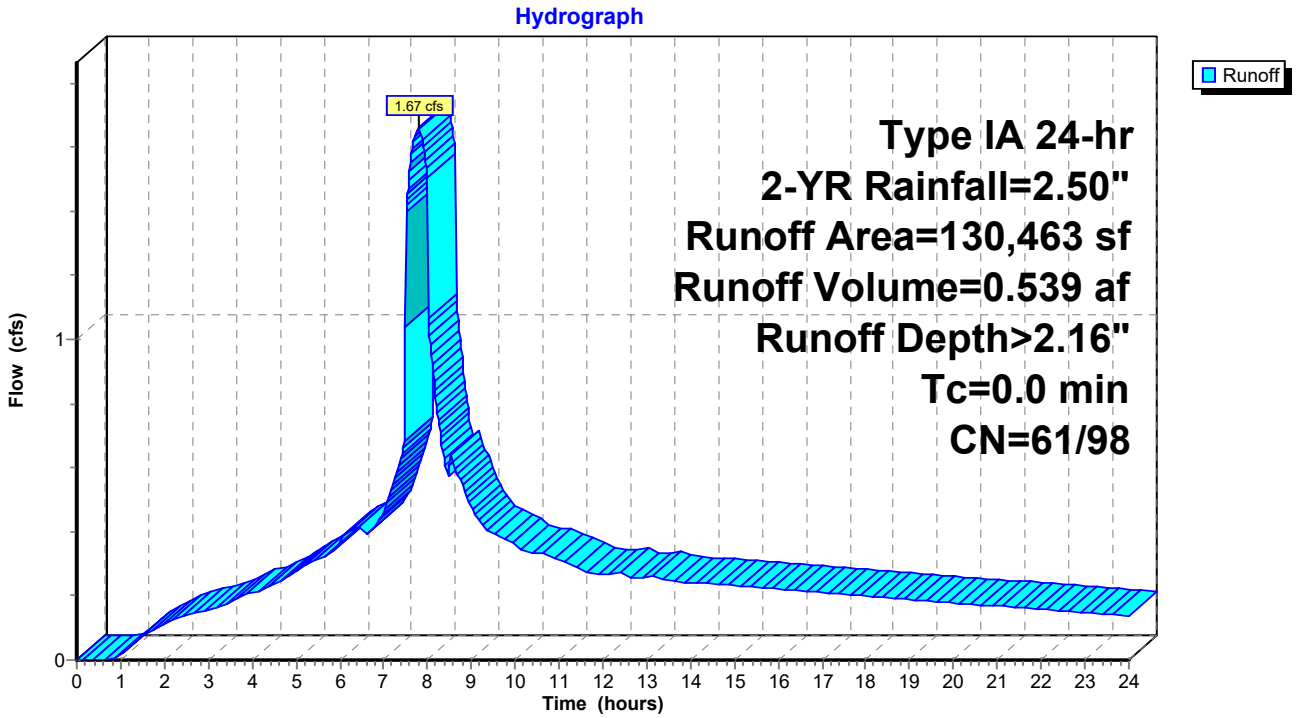
Summary for Subcatchment 3S: Tax Lot 500 & 600

Runoff = 1.67 cfs @ 7.79 hrs, Volume= 0.539 af, Depth> 2.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	81,458	98	AC Parking Lot
*	42,005	98	Building
	7,000	61	>75% Grass cover, Good, HSG B
	130,463	96	Weighted Average
	7,000		5.37% Pervious Area
	123,463		94.63% Impervious Area

Subcatchment 3S: Tax Lot 500 & 600



Summary for Subcatchment 7S: Pre-Developed Site

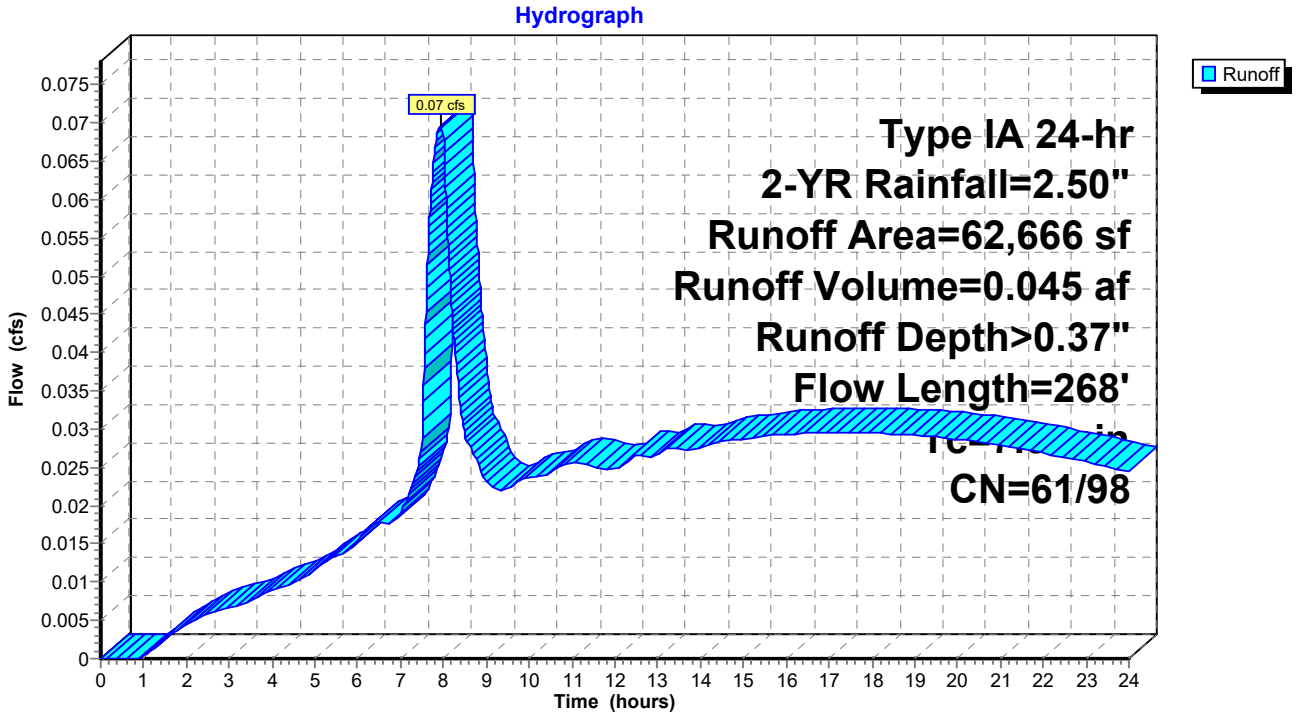
Runoff = 0.07 cfs @ 7.93 hrs, Volume= 0.045 af, Depth> 0.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	57,266	61	pervious
*	5,400	98	impervious
	62,666	64	Weighted Average
	57,266		91.38% Pervious Area
	5,400		8.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0450	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
3.8	218	0.0190	0.96		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.5	268	Total			

Subcatchment 7S: Pre-Developed Site



Summary for Subcatchment 8S: Pre-Developed Site

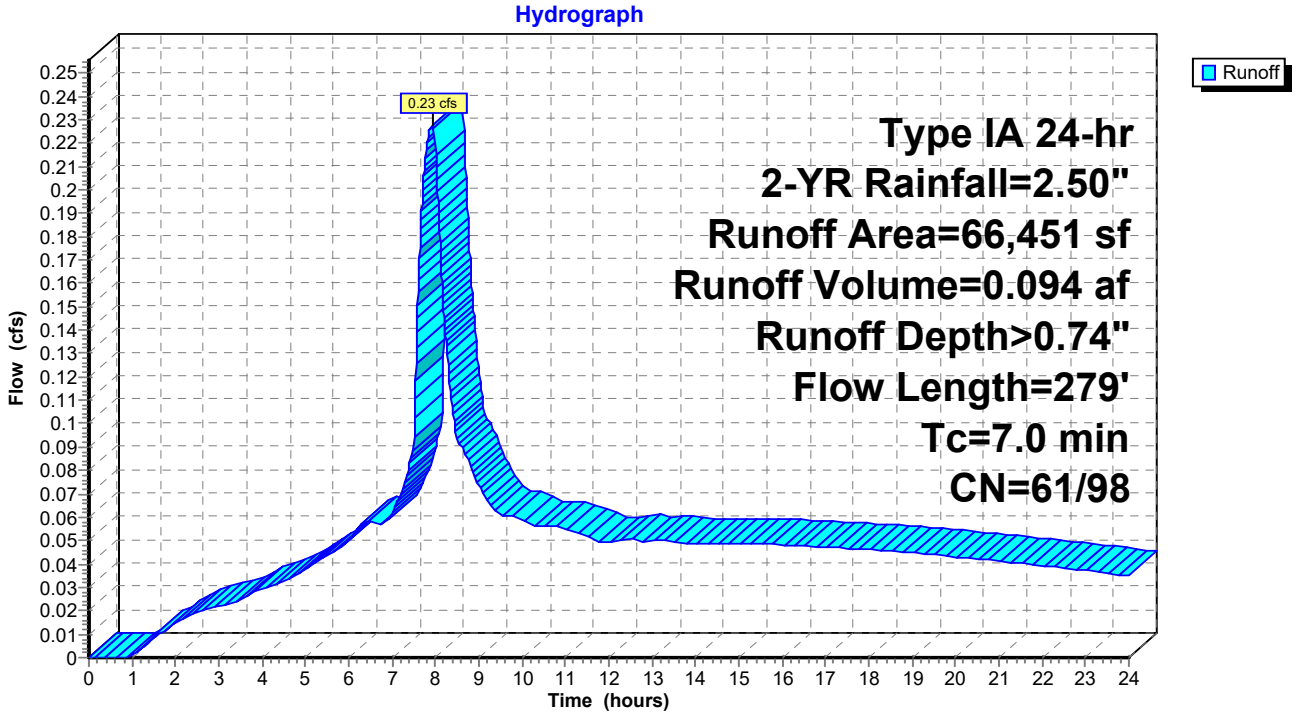
Runoff = 0.23 cfs @ 7.92 hrs, Volume= 0.094 af, Depth> 0.74"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	48,882	61	pervious
*	17,569	98	impervious
	66,451	71	Weighted Average
	48,882		73.56% Pervious Area
	17,569		26.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0230	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
1.7	160	0.0530	1.61		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	11	0.4940	4.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	58	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	279	Total			

Subcatchment 8S: Pre-Developed Site



Summary for Pond 1P: StormTech Chamber System

Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 1.29" for 2-YR event
Inflow = 0.91 cfs @ 7.88 hrs, Volume= 0.319 af
Outflow = 0.18 cfs @ 11.22 hrs, Volume= 0.274 af, Atten= 80%, Lag= 200.6 min
Discarded = 0.05 cfs @ 2.94 hrs, Volume= 0.085 af
Primary = 0.14 cfs @ 11.22 hrs, Volume= 0.190 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 133.75' @ 11.22 hrs Surf.Area= 3,241 sf Storage= 3,625 cf
Flood Elev= 139.00' Surf.Area= 3,241 sf Storage= 5,435 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 139.8 min (837.6 - 697.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.75'	3,578 cf	**48.17'W x 67.28'L x 3.33'H Field A** 10,802 cf Overall - 1,857 cf Embedded = 8,945 cf x 40.0% Voids
#2A	132.75'	1,857 cf	**ADS_StormTech SC-310 +Cap** x 126 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 14 Rows of 9 Chambers
		5,435 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	137.00'	**4.0' long (Profile 17) MH Wier** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31
#2	Primary	131.75'	**10.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 131.75' / 131.71' S= 0.0057 '/' Cc= 0.900 n= 0.013, Flow Area= 0.55 sf
#3	Device 2	131.75'	**1.9" Vert. Detention Orifice** C= 0.620
#4	Device 2	133.85'	**4.0" Vert. Orifice** C= 0.600
#5	Discarded	131.75'	**0.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 2.94 hrs HW=131.82' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.14 cfs @ 11.22 hrs HW=133.75' TW=130.37' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.14 cfs of 3.30 cfs potential flow)
  ├**1=MH Wier** (Controls 0.00 cfs)
  ├**3=Detention Orifice** (Orifice Controls 0.14 cfs @ 6.89 fps)
  └**4=Orifice** (Controls 0.00 cfs)

Pond 1P: StormTech Chamber System - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

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

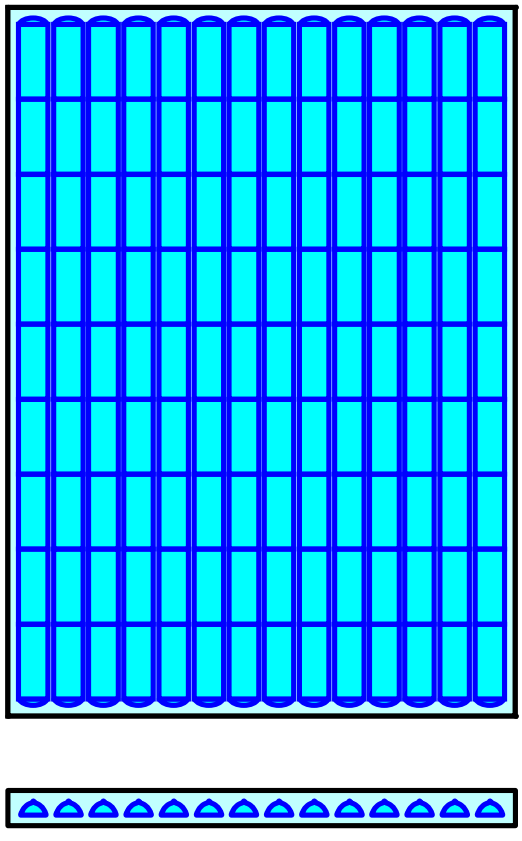
9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length
14 Rows x 34.0" Wide + 6.0" Spacing x 13 + 12.0" Side Stone x 2 = 48.17' Base Width
12.0" Base + 16.0" Chamber Height + 12.0" Cover = 3.33' Field Height

126 Chambers x 14.7 cf = 1,857.5 cf Chamber Storage

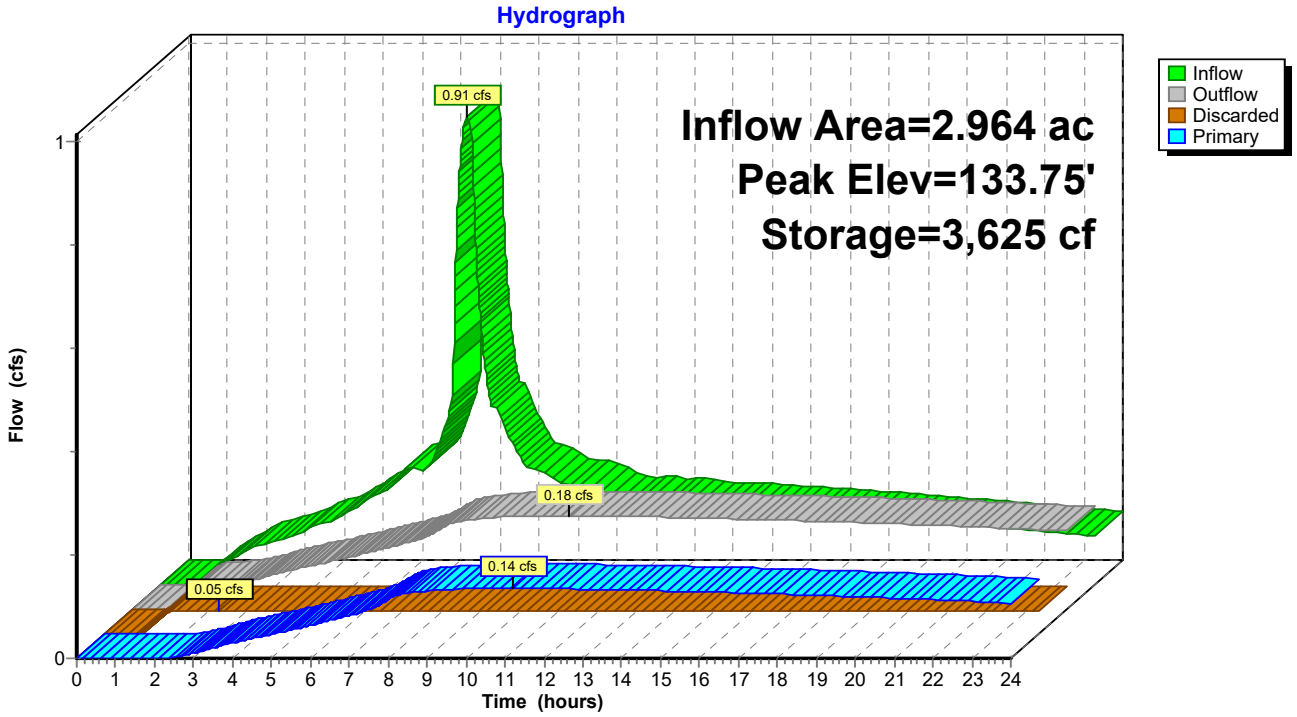
10,802.2 cf Field - 1,857.5 cf Chambers = 8,944.7 cf Stone x 40.0% Voids = 3,577.9 cf Stone Storage

Chamber Storage + Stone Storage = 5,435.4 cf = 0.125 af
Overall Storage Efficiency = 50.3%
Overall System Size = 67.28' x 48.17' x 3.33'

126 Chambers
400.1 cy Field
331.3 cy Stone



Pond 1P: StormTech Chamber System



Summary for Pond 1R: 15"

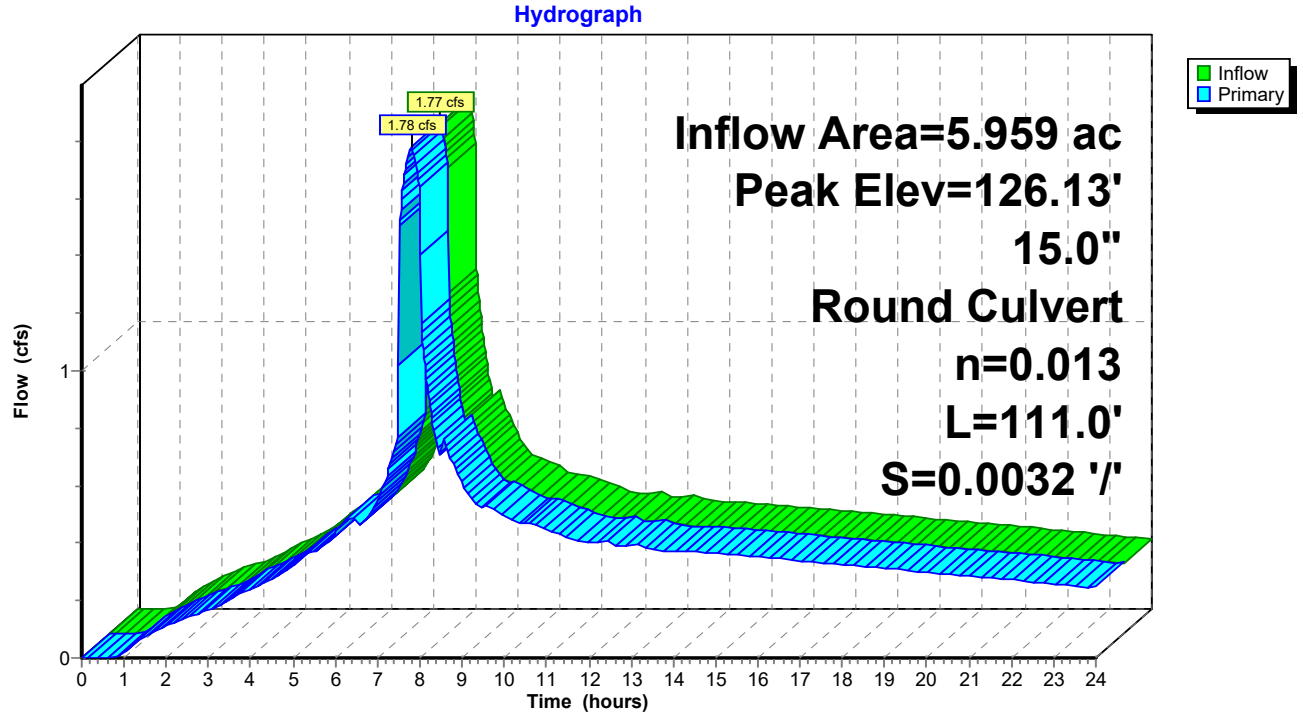
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.47" for 2-YR event
Inflow = 1.77 cfs @ 7.80 hrs, Volume= 0.729 af
Outflow = 1.78 cfs @ 7.80 hrs, Volume= 0.729 af, Atten= 0%, Lag= 0.0 min
Primary = 1.78 cfs @ 7.80 hrs, Volume= 0.729 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.13' @ 7.80 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	124.32'	**15.0" Round Culvert** L= 111.0' Ke= 0.500 Inlet / Outlet Invert= 124.32' / 123.97' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=1.78 cfs @ 7.80 hrs HW=126.13' TW=126.00' (Dynamic Tailwater)
↳**1=Culvert** (Outlet Controls 1.78 cfs @ 1.45 fps)

Pond 1R: 15"



Summary for Pond 2R: 15"

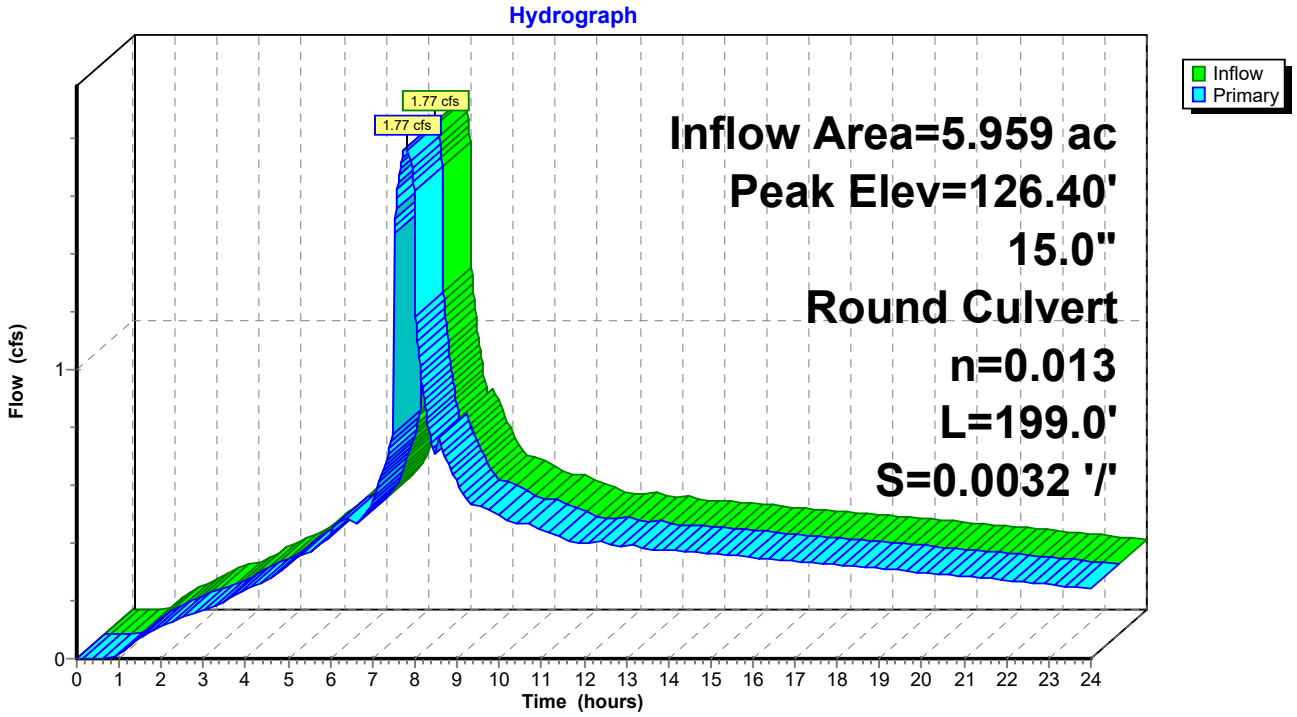
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.47" for 2-YR event
Inflow = 1.77 cfs @ 7.79 hrs, Volume= 0.729 af
Outflow = 1.77 cfs @ 7.80 hrs, Volume= 0.729 af, Atten= 0%, Lag= 0.3 min
Primary = 1.77 cfs @ 7.80 hrs, Volume= 0.729 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.40' @ 7.79 hrs
Flood Elev= 130.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	125.16'	**15.0" Round Culvert** L= 199.0' Ke= 0.500 Inlet / Outlet Invert= 125.16' / 124.52' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=1.77 cfs @ 7.80 hrs HW=126.39' TW=126.13' (Dynamic Tailwater)
1=Culvert (Outlet Controls 1.77 cfs @ 1.81 fps)

Pond 2R: 15"



Summary for Pond 3R: 15"

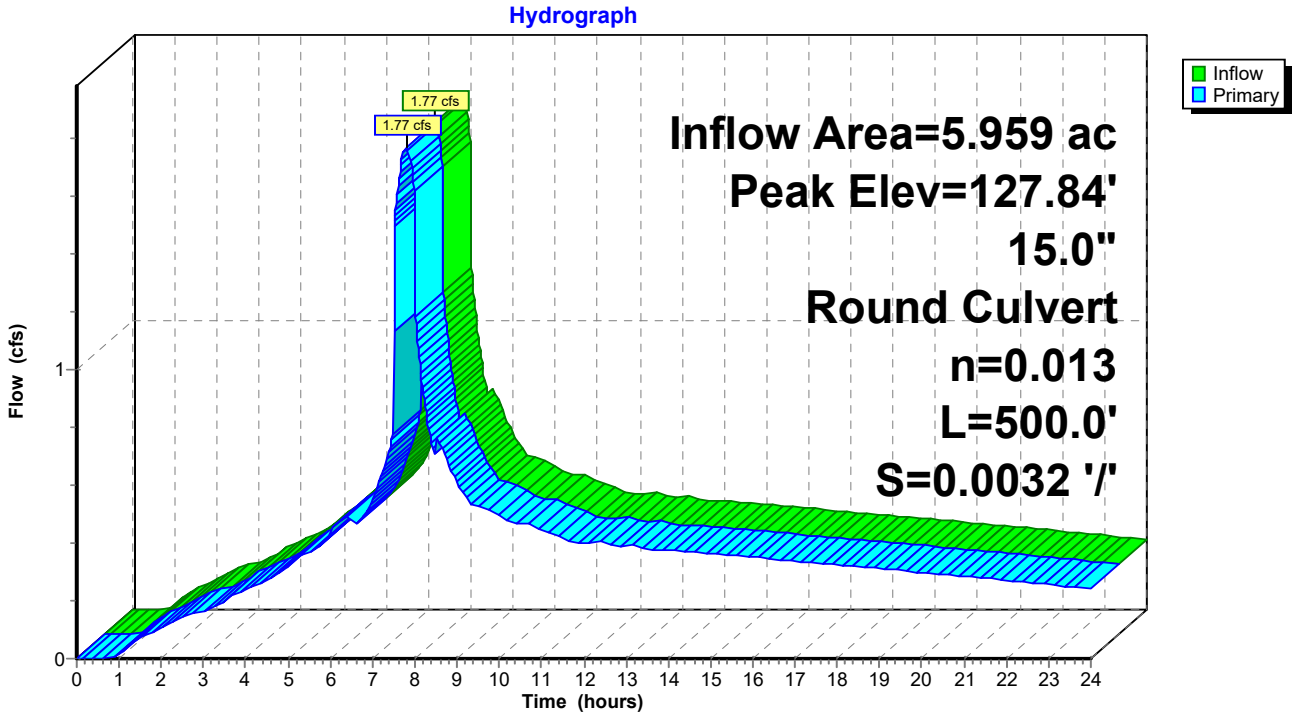
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.47" for 2-YR event
Inflow = 1.77 cfs @ 7.79 hrs, Volume= 0.729 af
Outflow = 1.77 cfs @ 7.79 hrs, Volume= 0.729 af, Atten= 0%, Lag= 0.0 min
Primary = 1.77 cfs @ 7.79 hrs, Volume= 0.729 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.84' @ 7.80 hrs
Flood Elev= 134.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	126.96'	**15.0" Round Culvert** L= 500.0' Ke= 0.500 Inlet / Outlet Invert= 126.96' / 125.34' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=1.77 cfs @ 7.79 hrs HW=127.84' TW=126.39' (Dynamic Tailwater)
1=Culvert (Outlet Controls 1.77 cfs @ 2.71 fps)

Pond 3R: 15"



Summary for Pond 4R: 15"

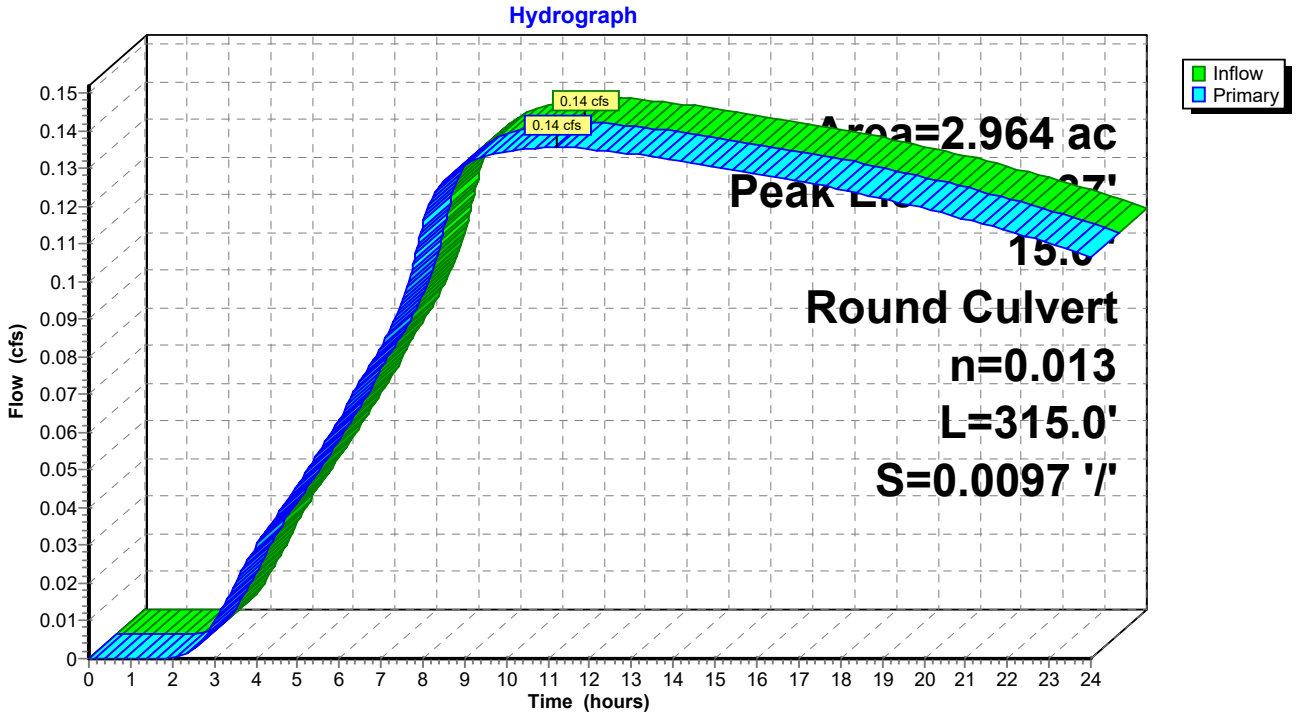
Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 0.77" for 2-YR event
Inflow = 0.14 cfs @ 11.22 hrs, Volume= 0.190 af
Outflow = 0.14 cfs @ 11.22 hrs, Volume= 0.190 af, Atten= 0%, Lag= 0.0 min
Primary = 0.14 cfs @ 11.22 hrs, Volume= 0.190 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 130.37' @ 10.93 hrs
Flood Elev= 139.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.20'	**15.0" Round Culvert** L= 315.0' Ke= 0.500 Inlet / Outlet Invert= 130.20' / 127.16' S= 0.0097 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.14 cfs @ 11.22 hrs HW=130.37' TW=127.37' (Dynamic Tailwater)
↳**1=Culvert** (Outlet Controls 0.14 cfs @ 2.05 fps)

Pond 4R: 15"

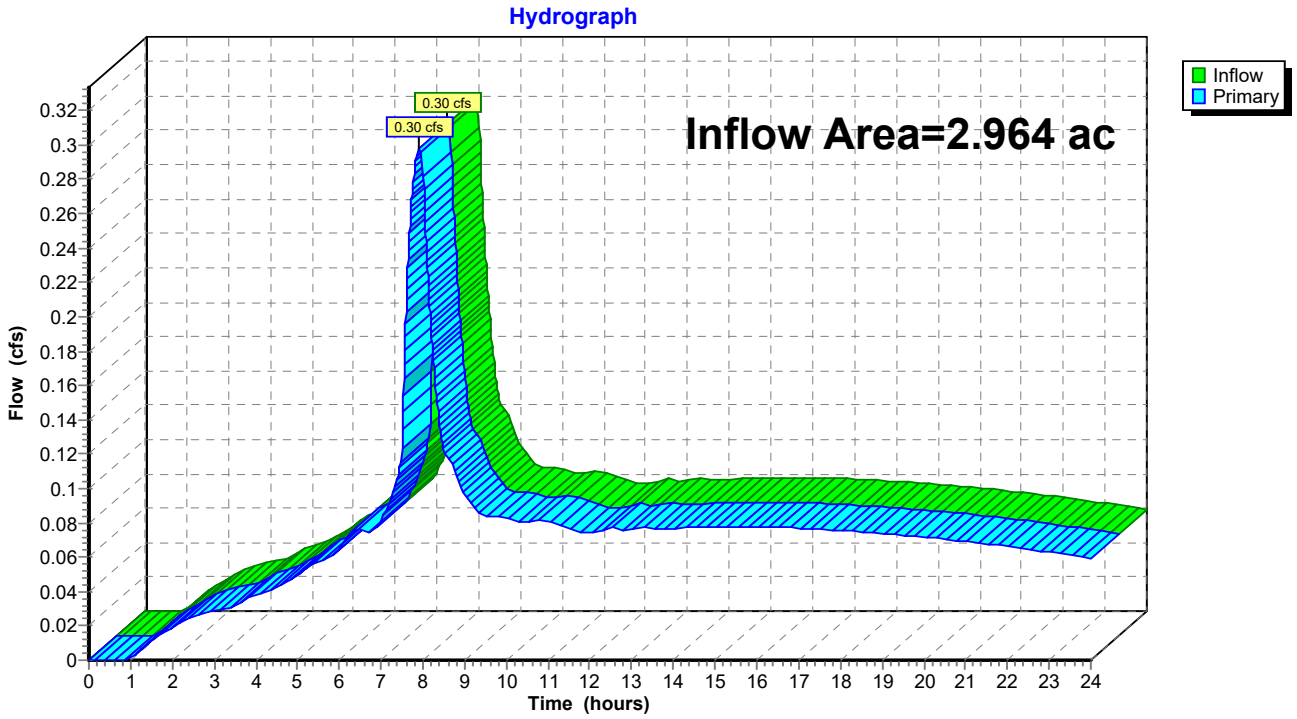


Summary for Link 1L: PRE DEVELOPED

Inflow Area = 2.964 ac, 17.79% Impervious, Inflow Depth > 0.56" for 2-YR event
Inflow = 0.30 cfs @ 7.92 hrs, Volume= 0.139 af
Primary = 0.30 cfs @ 7.92 hrs, Volume= 0.139 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: PRE DEVELOPED



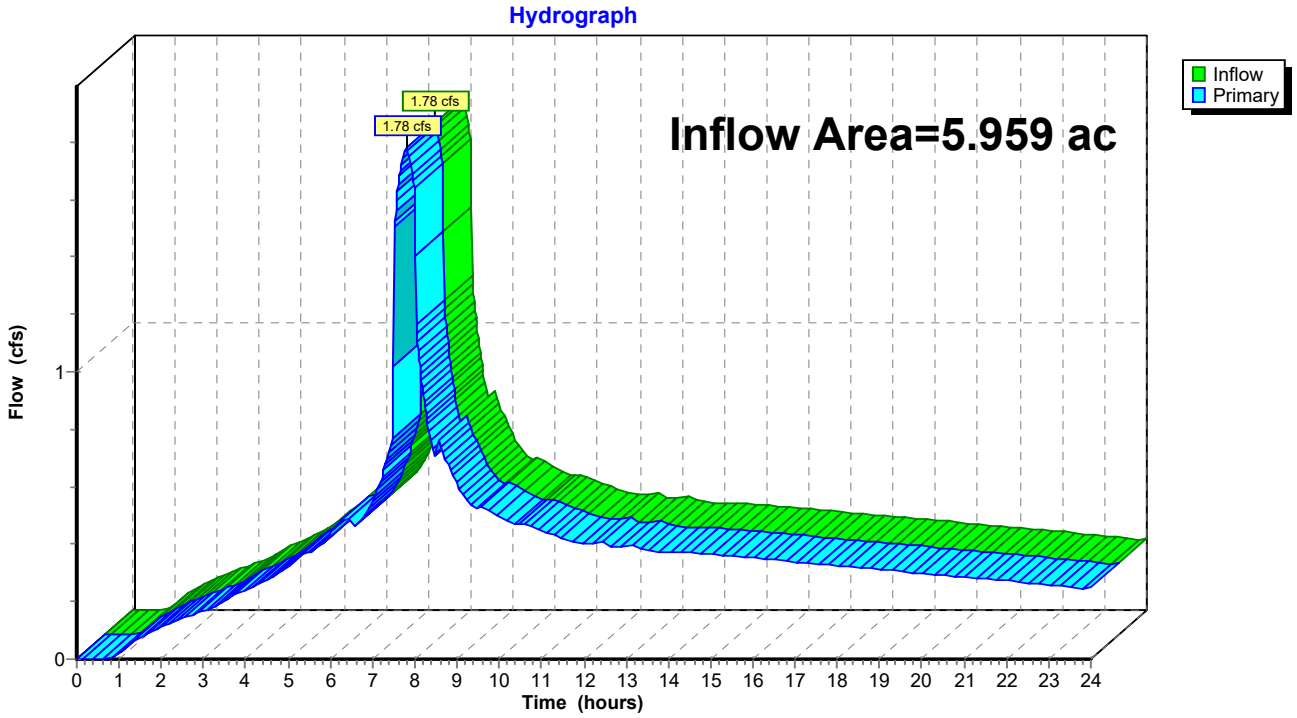
Summary for Link 2L: (new Link)

Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.47" for 2-YR event
Inflow = 1.78 cfs @ 7.80 hrs, Volume= 0.729 af
Primary = 1.78 cfs @ 7.80 hrs, Volume= 0.729 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 126.00'

Link 2L: (new Link)



Summary for Subcatchment 1S: ONSITE

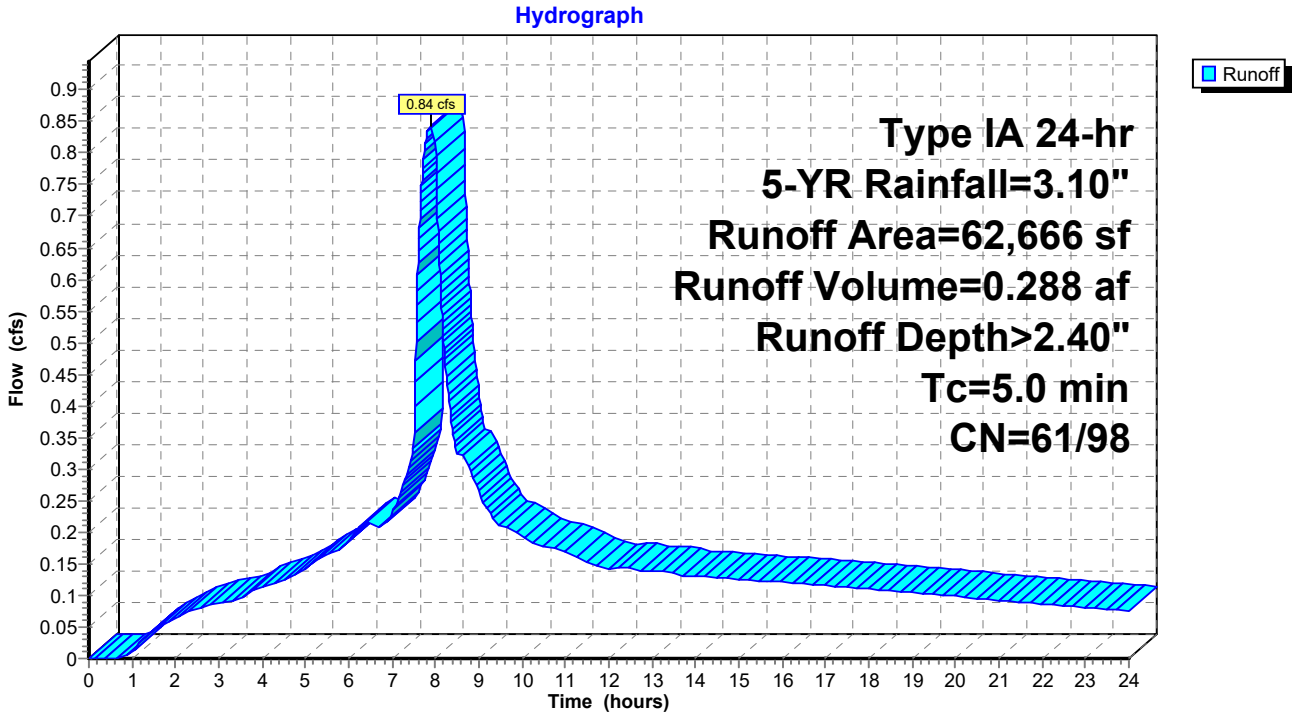
Runoff = 0.84 cfs @ 7.88 hrs, Volume= 0.288 af, Depth> 2.40"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-YR Rainfall=3.10"

	Area (sf)	CN	Description
*	50,879	98	IMPERVIOUS
	11,787	61	>75% Grass cover, Good, HSG B
	62,666	91	Weighted Average
	11,787		18.81% Pervious Area
	50,879		81.19% Impervious Area

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

Subcatchment 1S: ONSITE



Summary for Subcatchment 2S: Tax Lot 900

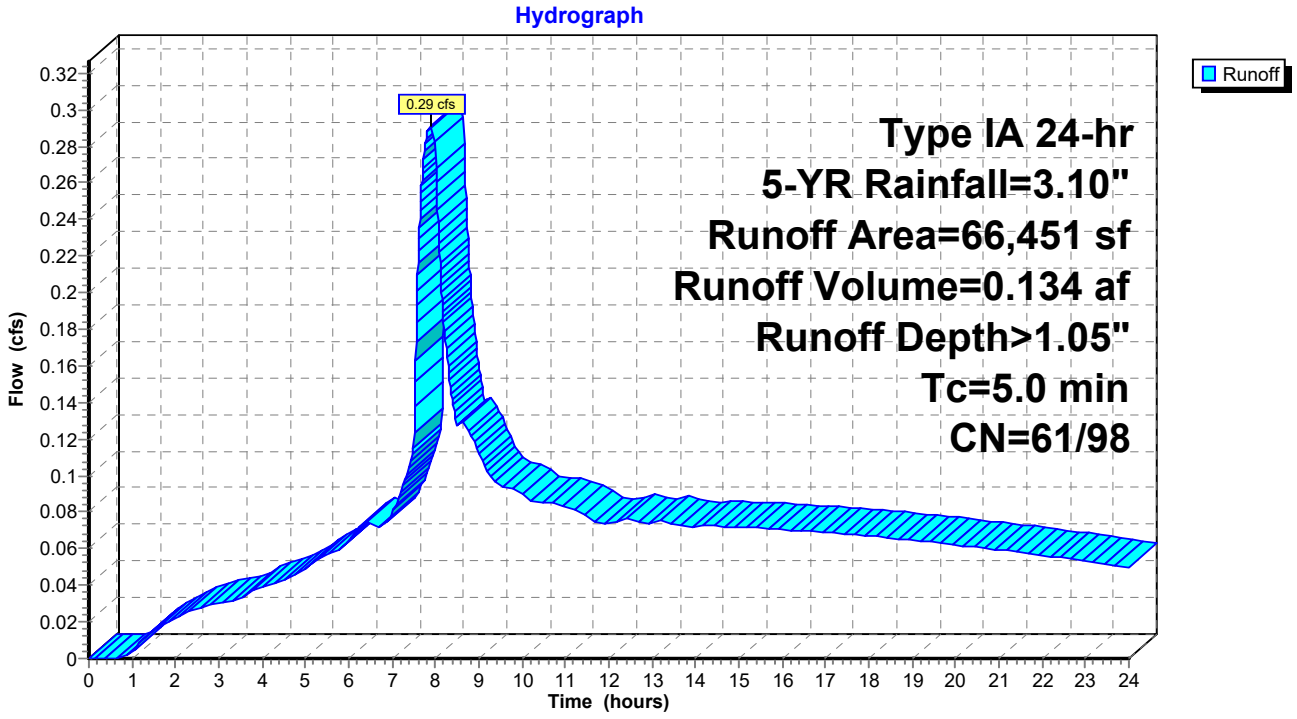
Runoff = 0.29 cfs @ 7.88 hrs, Volume= 0.134 af, Depth> 1.05"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-YR Rainfall=3.10"

	Area (sf)	CN	Description
*	17,573	98	Impervious
	48,878	61	>75% Grass cover, Good, HSG B
	66,451	71	Weighted Average
	48,878		73.55% Pervious Area
	17,573		26.45% Impervious Area

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

Subcatchment 2S: Tax Lot 900



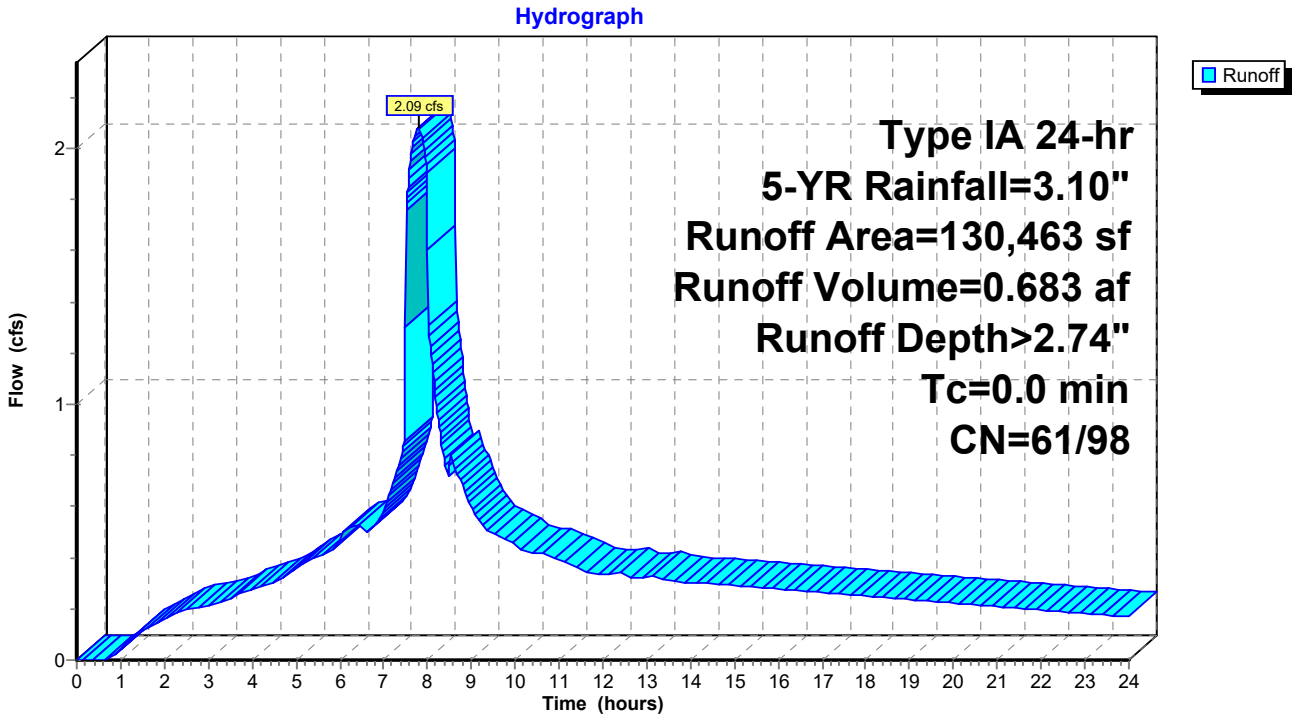
Summary for Subcatchment 3S: Tax Lot 500 & 600

Runoff = 2.09 cfs @ 7.79 hrs, Volume= 0.683 af, Depth> 2.74"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-YR Rainfall=3.10"

	Area (sf)	CN	Description
*	81,458	98	AC Parking Lot
*	42,005	98	Building
	7,000	61	>75% Grass cover, Good, HSG B
	130,463	96	Weighted Average
	7,000		5.37% Pervious Area
	123,463		94.63% Impervious Area

Subcatchment 3S: Tax Lot 500 & 600



Summary for Subcatchment 7S: Pre-Developed Site

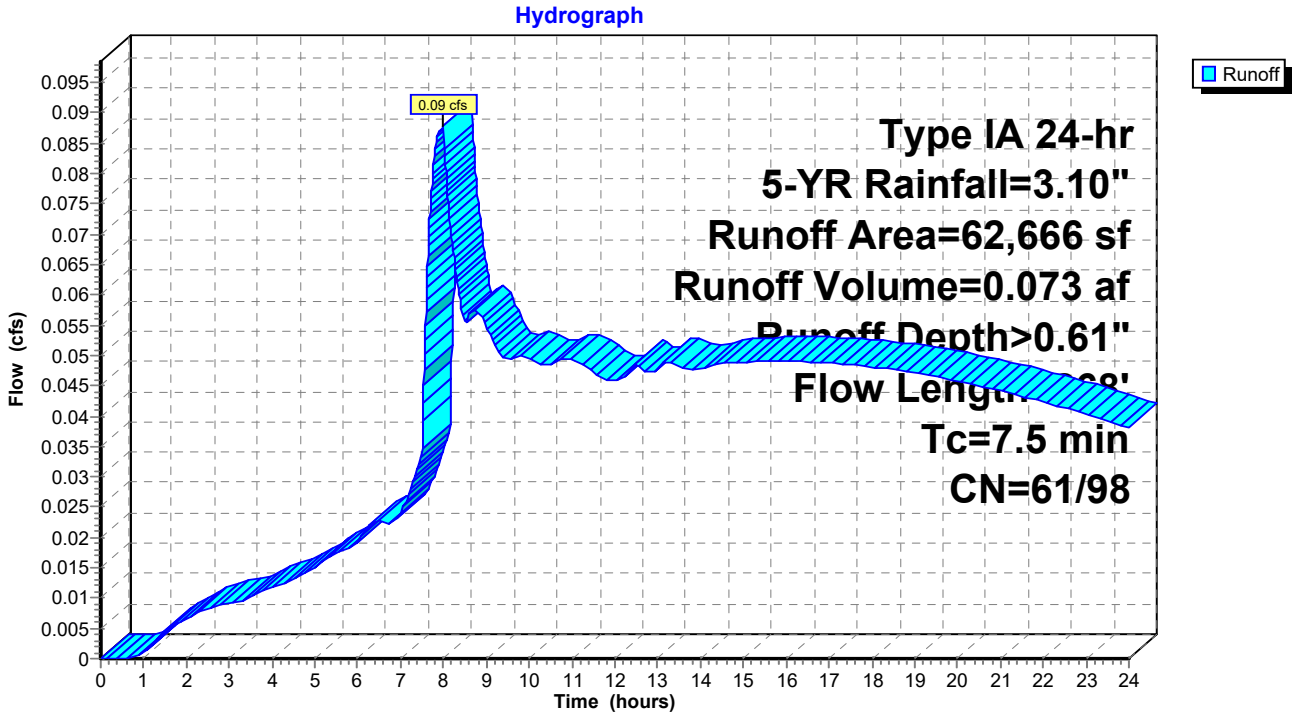
Runoff = 0.09 cfs @ 8.00 hrs, Volume= 0.073 af, Depth> 0.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-YR Rainfall=3.10"

	Area (sf)	CN	Description
*	57,266	61	pervious
*	5,400	98	impervious
	62,666	64	Weighted Average
	57,266		91.38% Pervious Area
	5,400		8.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0450	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
3.8	218	0.0190	0.96		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.5	268	Total			

Subcatchment 7S: Pre-Developed Site



Summary for Subcatchment 8S: Pre-Developed Site

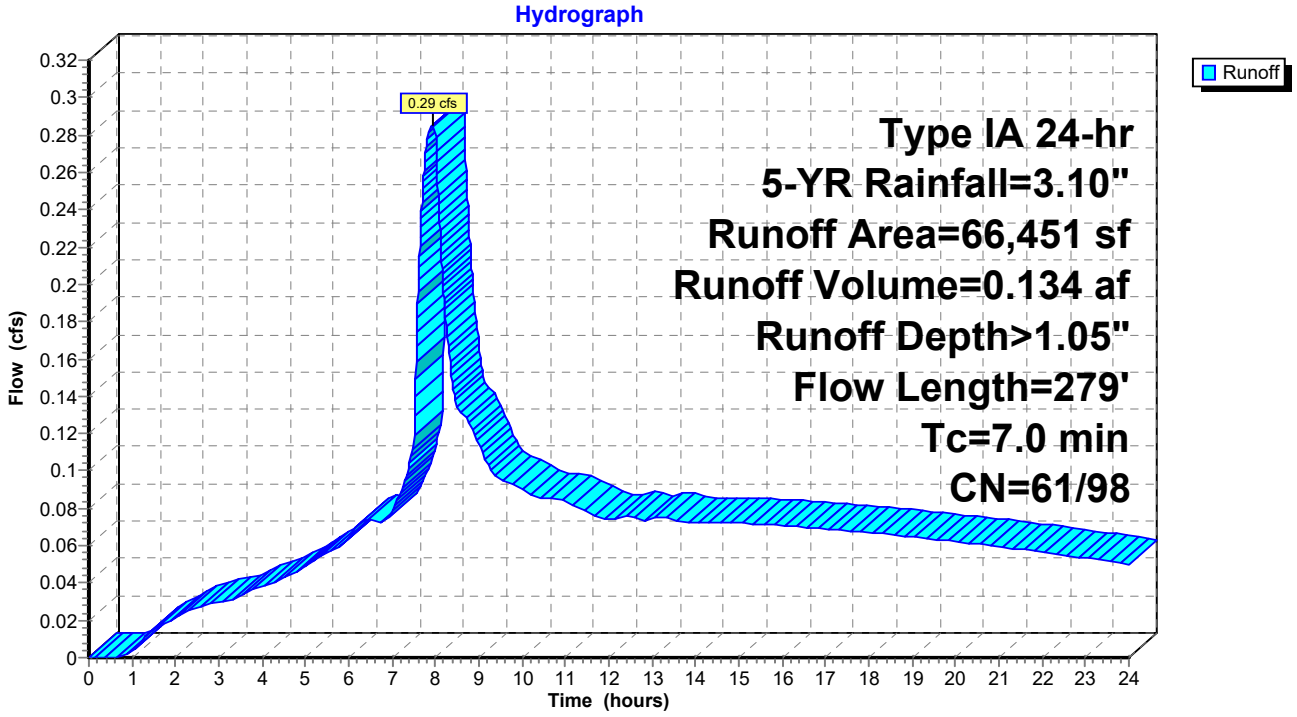
Runoff = 0.29 cfs @ 7.92 hrs, Volume= 0.134 af, Depth> 1.05"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-YR Rainfall=3.10"

	Area (sf)	CN	Description
*	48,882	61	pervious
*	17,569	98	impervious
	66,451	71	Weighted Average
	48,882		73.56% Pervious Area
	17,569		26.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0230	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
1.7	160	0.0530	1.61		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	11	0.4940	4.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	58	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	279	Total			

Subcatchment 8S: Pre-Developed Site



Summary for Pond 1P: StormTech Chamber System

Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 1.71" for 5-YR event
Inflow = 1.14 cfs @ 7.88 hrs, Volume= 0.422 af
Outflow = 0.38 cfs @ 8.98 hrs, Volume= 0.348 af, Atten= 66%, Lag= 66.3 min
Discarded = 0.05 cfs @ 2.27 hrs, Volume= 0.085 af
Primary = 0.34 cfs @ 8.98 hrs, Volume= 0.262 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.21' @ 8.98 hrs Surf.Area= 3,241 sf Storage= 4,306 cf
Flood Elev= 139.00' Surf.Area= 3,241 sf Storage= 5,435 cf

Plug-Flow detention time= 225.4 min calculated for 0.347 af (82% of inflow)
Center-of-Mass det. time= 107.7 min (807.5 - 699.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.75'	3,578 cf	**48.17'W x 67.28'L x 3.33'H Field A** 10,802 cf Overall - 1,857 cf Embedded = 8,945 cf x 40.0% Voids
#2A	132.75'	1,857 cf	**ADS_StormTech SC-310 +Cap** x 126 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 14 Rows of 9 Chambers
		5,435 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	137.00'	**4.0' long (Profile 17) MH Wier** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31
#2	Primary	131.75'	**10.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 131.75' / 131.71' S= 0.0057 '/' Cc= 0.900 n= 0.013, Flow Area= 0.55 sf
#3	Device 2	131.75'	**1.9" Vert. Detention Orifice** C= 0.620
#4	Device 2	133.85'	**4.0" Vert. Orifice** C= 0.600
#5	Discarded	131.75'	**0.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 2.27 hrs HW=131.82' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.34 cfs @ 8.98 hrs HW=134.21' TW=130.47' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.34 cfs of 3.76 cfs potential flow)
  ├**1=MH Wier** (Controls 0.00 cfs)
  ├**3=Detention Orifice** (Orifice Controls 0.15 cfs @ 7.68 fps)
  └**4=Orifice** (Orifice Controls 0.19 cfs @ 2.13 fps)

Pond 1P: StormTech Chamber System - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

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

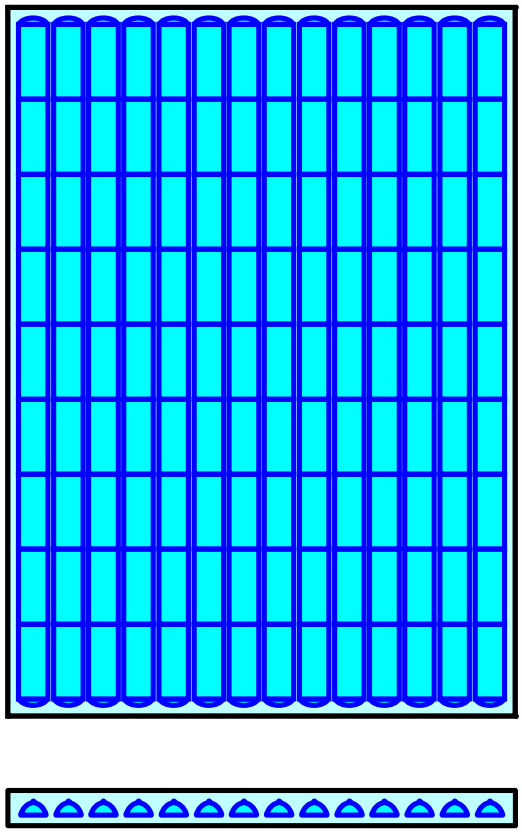
9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length
14 Rows x 34.0" Wide + 6.0" Spacing x 13 + 12.0" Side Stone x 2 = 48.17' Base Width
12.0" Base + 16.0" Chamber Height + 12.0" Cover = 3.33' Field Height

126 Chambers x 14.7 cf = 1,857.5 cf Chamber Storage

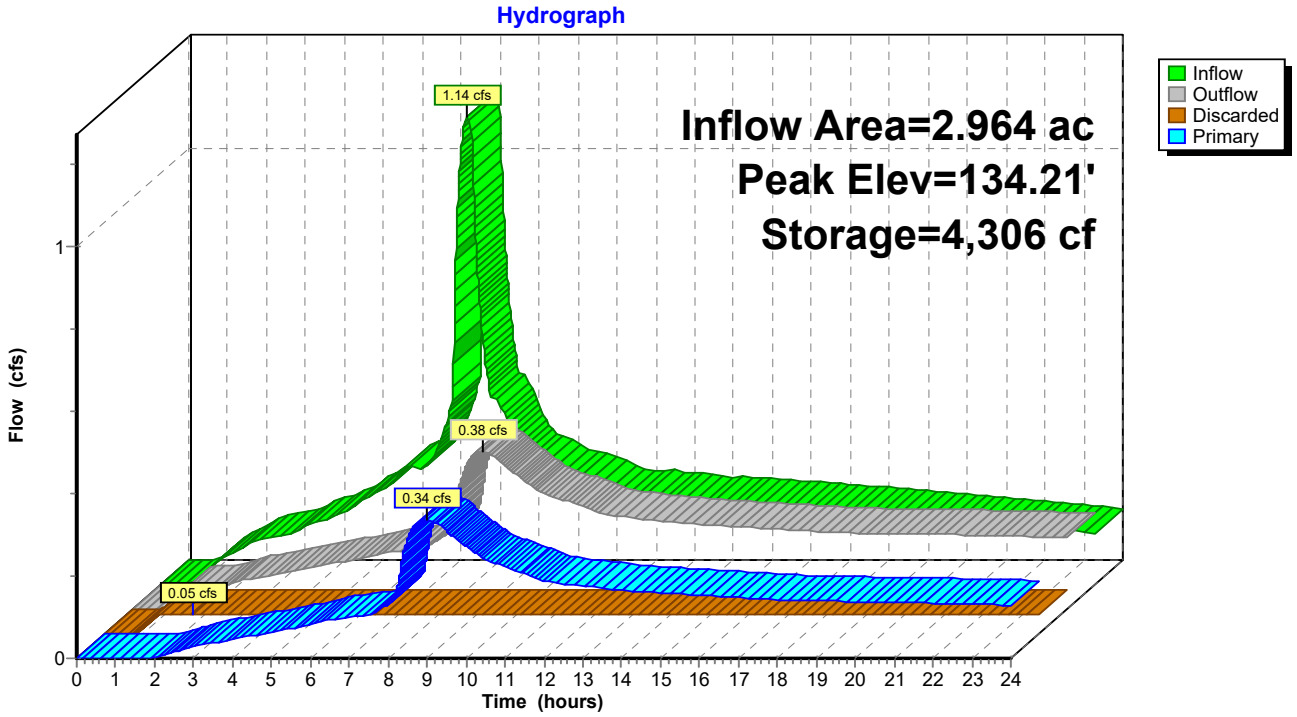
10,802.2 cf Field - 1,857.5 cf Chambers = 8,944.7 cf Stone x 40.0% Voids = 3,577.9 cf Stone Storage

Chamber Storage + Stone Storage = 5,435.4 cf = 0.125 af
Overall Storage Efficiency = 50.3%
Overall System Size = 67.28' x 48.17' x 3.33'

126 Chambers
400.1 cy Field
331.3 cy Stone



Pond 1P: StormTech Chamber System



Summary for Pond 1R: 15"

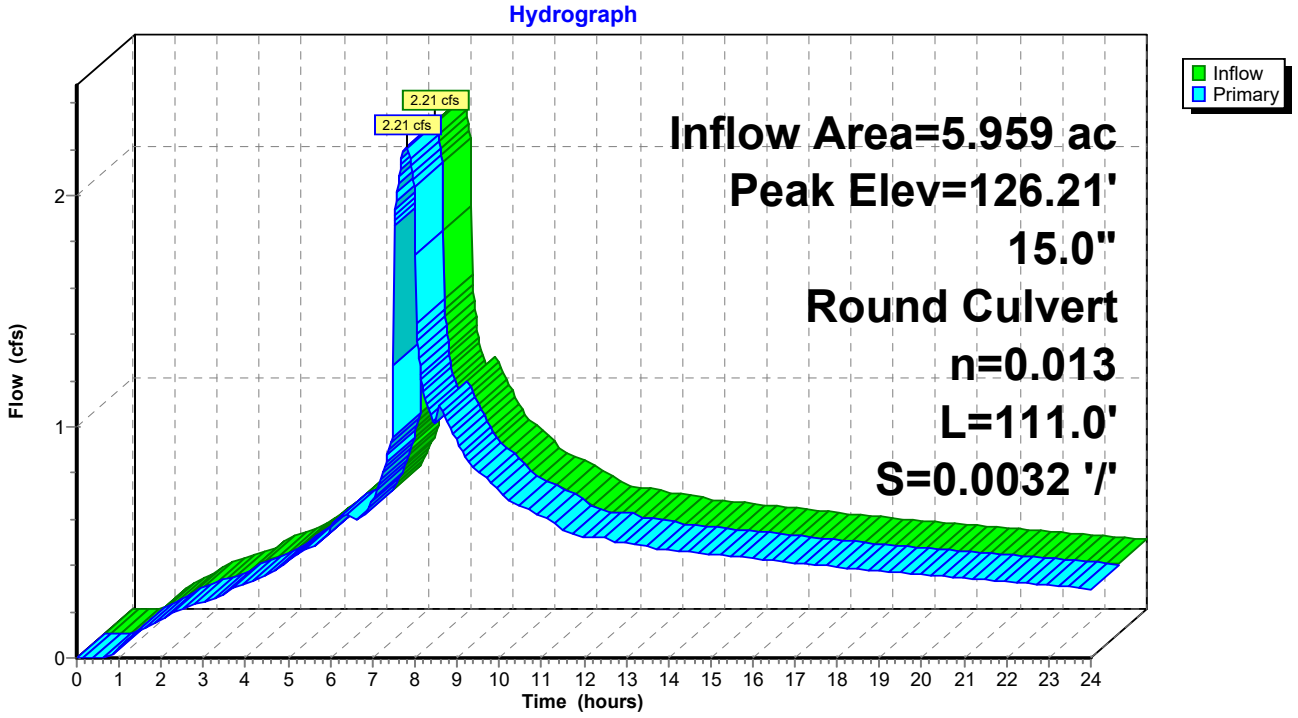
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.90" for 5-YR event
Inflow = 2.21 cfs @ 7.80 hrs, Volume= 0.945 af
Outflow = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af, Atten= 0%, Lag= 0.0 min
Primary = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.21' @ 7.79 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	124.32'	**15.0" Round Culvert** L= 111.0' Ke= 0.500 Inlet / Outlet Invert= 124.32' / 123.97' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.21 cfs @ 7.79 hrs HW=126.21' TW=126.00' (Dynamic Tailwater)
↳**1=Culvert** (Outlet Controls 2.21 cfs @ 1.80 fps)

Pond 1R: 15"



Summary for Pond 2R: 15"

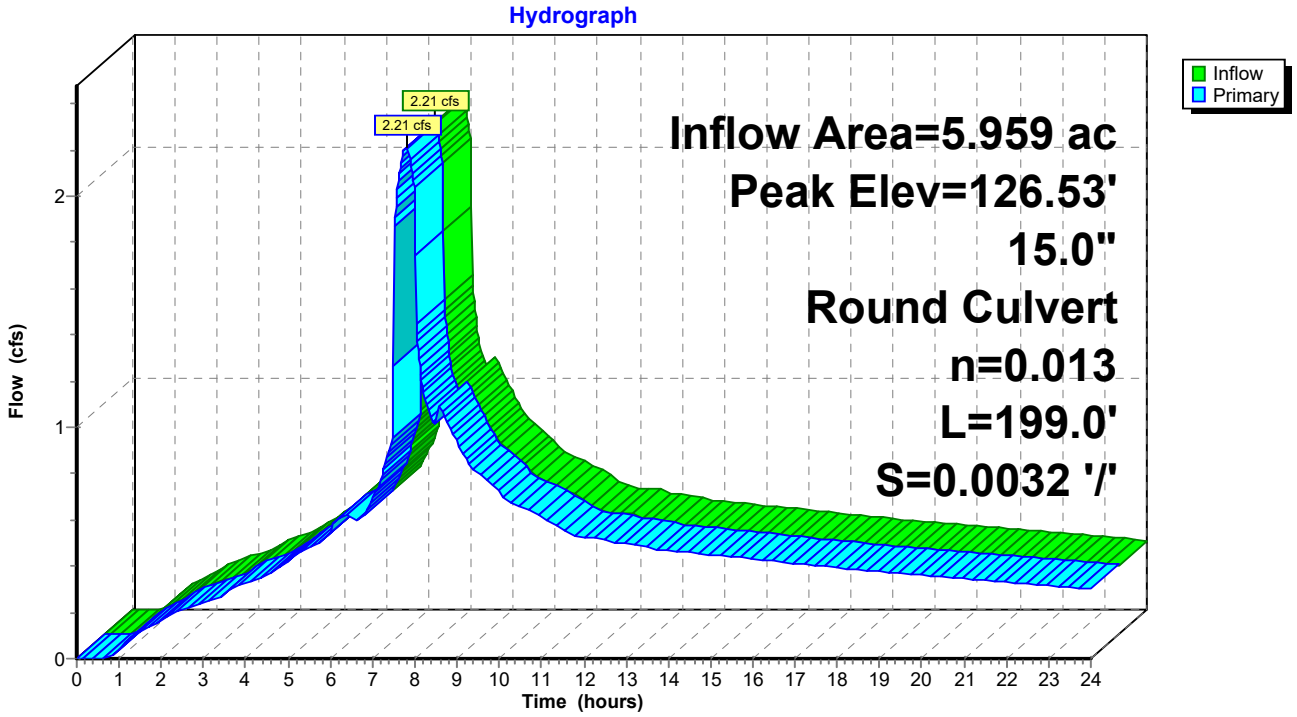
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.90" for 5-YR event
Inflow = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af
Outflow = 2.21 cfs @ 7.80 hrs, Volume= 0.945 af, Atten= 0%, Lag= 0.4 min
Primary = 2.21 cfs @ 7.80 hrs, Volume= 0.945 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.53' @ 7.80 hrs
Flood Elev= 130.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	125.16'	**15.0" Round Culvert** L= 199.0' Ke= 0.500 Inlet / Outlet Invert= 125.16' / 124.52' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.21 cfs @ 7.80 hrs HW=126.53' TW=126.21' (Dynamic Tailwater)
1=Culvert (Outlet Controls 2.21 cfs @ 2.04 fps)

Pond 2R: 15"



Summary for Pond 3R: 15"

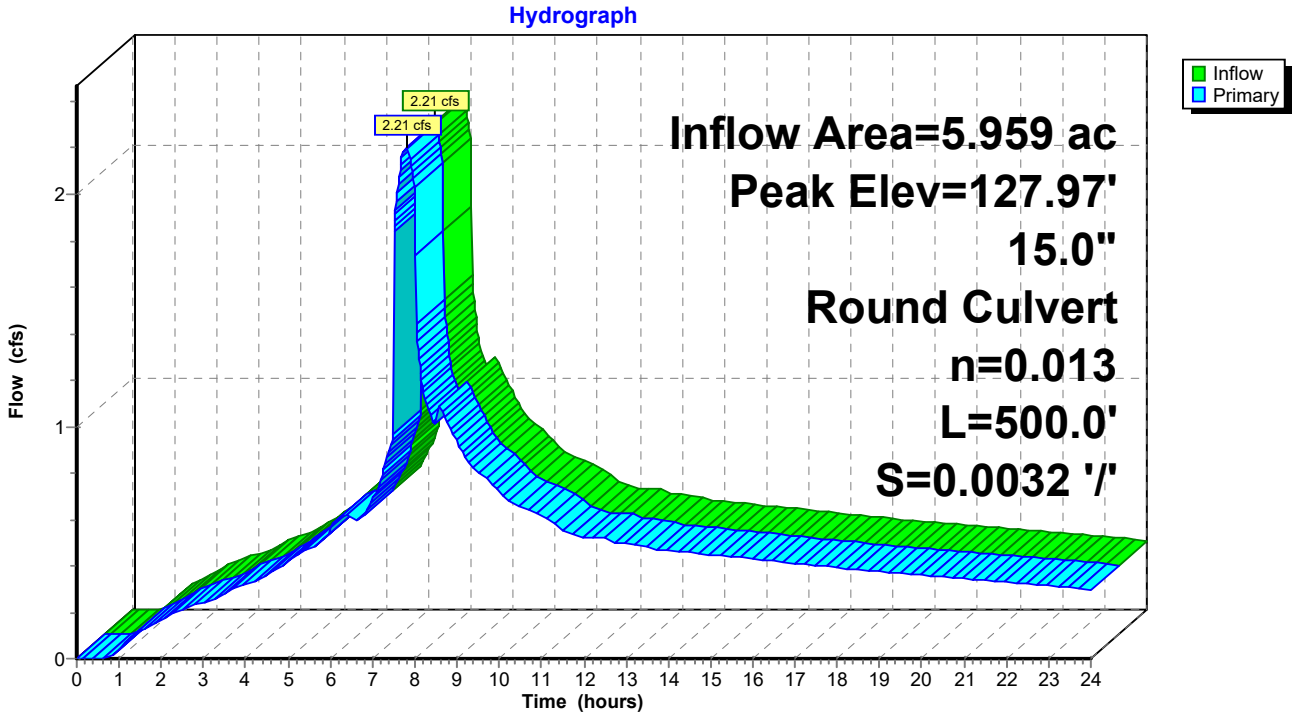
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.90" for 5-YR event
Inflow = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af
Outflow = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af, Atten= 0%, Lag= 0.0 min
Primary = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.97' @ 7.79 hrs
Flood Elev= 134.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	126.96'	**15.0" Round Culvert** L= 500.0' Ke= 0.500 Inlet / Outlet Invert= 126.96' / 125.34' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.21 cfs @ 7.79 hrs HW=127.97' TW=126.53' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 2.21 cfs @ 2.83 fps)

Pond 3R: 15"



Summary for Pond 4R: 15"

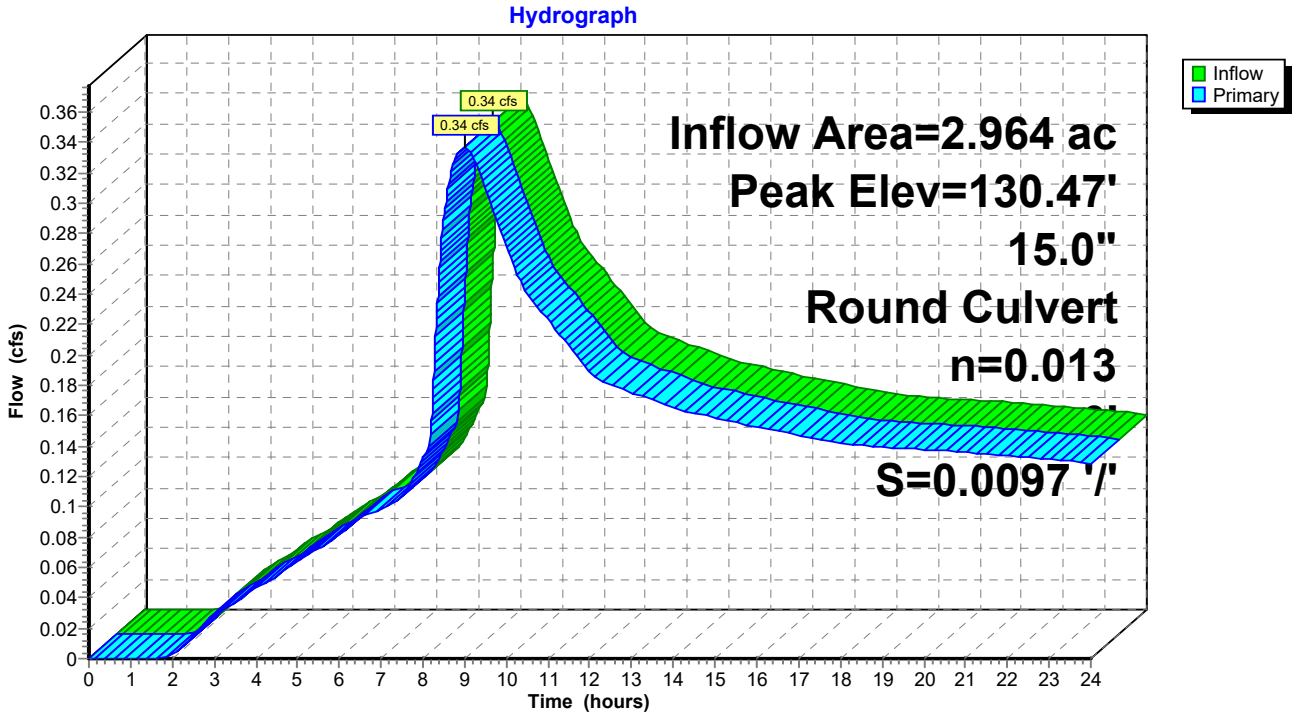
Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 1.06" for 5-YR event
Inflow = 0.34 cfs @ 8.98 hrs, Volume= 0.262 af
Outflow = 0.34 cfs @ 8.98 hrs, Volume= 0.262 af, Atten= 0%, Lag= 0.0 min
Primary = 0.34 cfs @ 8.98 hrs, Volume= 0.262 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 130.47' @ 8.96 hrs
Flood Elev= 139.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.20'	**15.0" Round Culvert** L= 315.0' Ke= 0.500 Inlet / Outlet Invert= 130.20' / 127.16' S= 0.0097 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.34 cfs @ 8.98 hrs HW=130.47' TW=127.57' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.34 cfs @ 2.64 fps)

Pond 4R: 15"

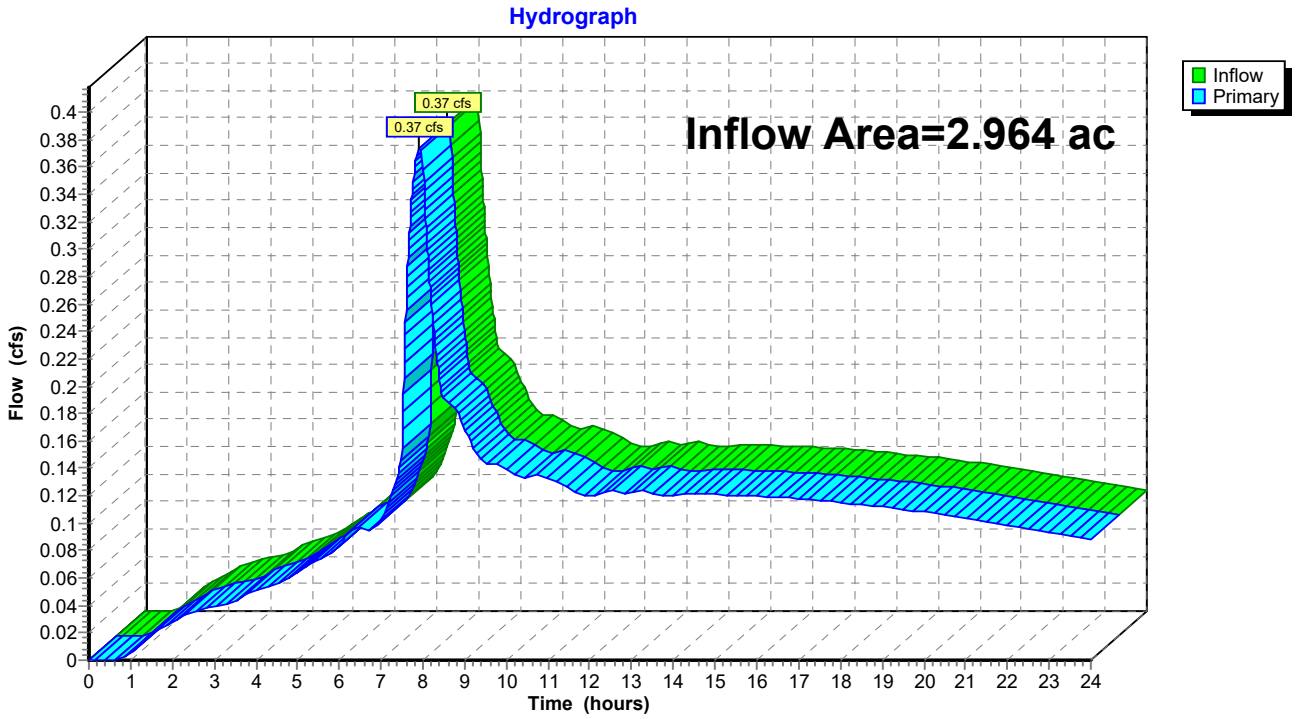


Summary for Link 1L: PRE DEVELOPED

Inflow Area = 2.964 ac, 17.79% Impervious, Inflow Depth > 0.84" for 5-YR event
Inflow = 0.37 cfs @ 7.92 hrs, Volume= 0.207 af
Primary = 0.37 cfs @ 7.92 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: PRE DEVELOPED



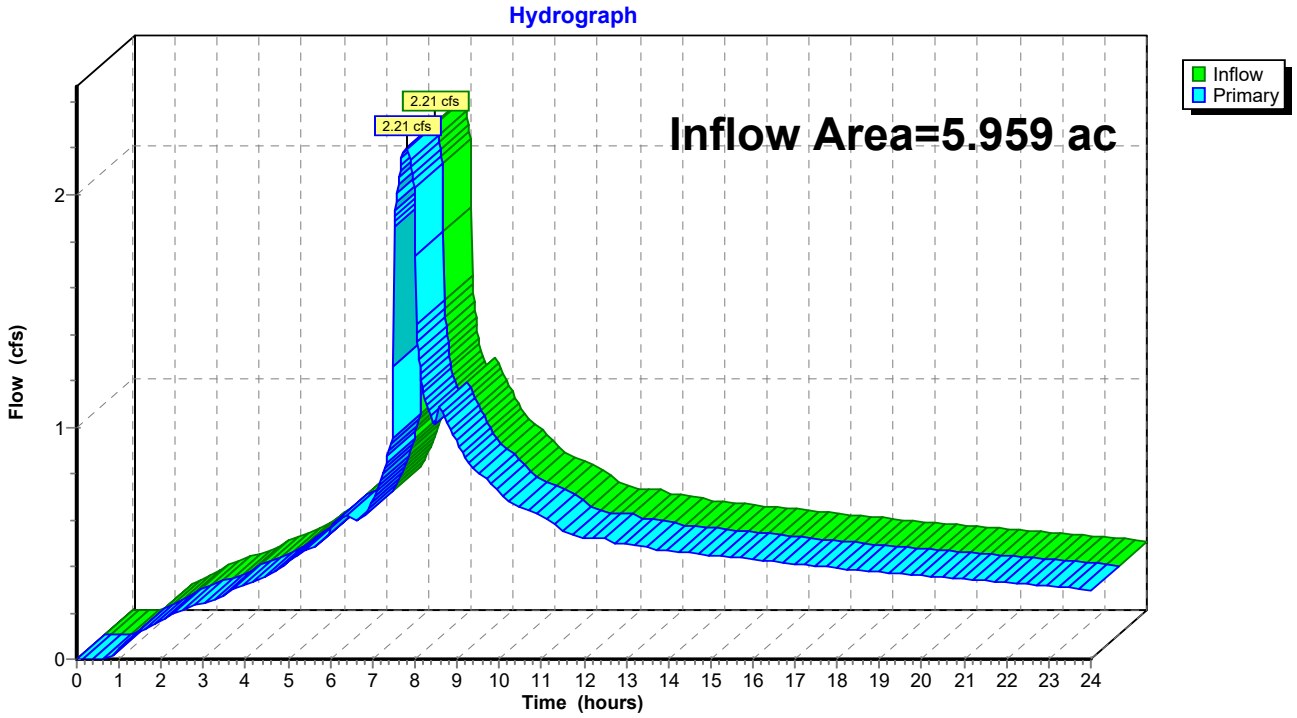
Summary for Link 2L: (new Link)

Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 1.90" for 5-YR event
Inflow = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af
Primary = 2.21 cfs @ 7.79 hrs, Volume= 0.945 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 126.00'

Link 2L: (new Link)



Summary for Subcatchment 1S: ONSITE

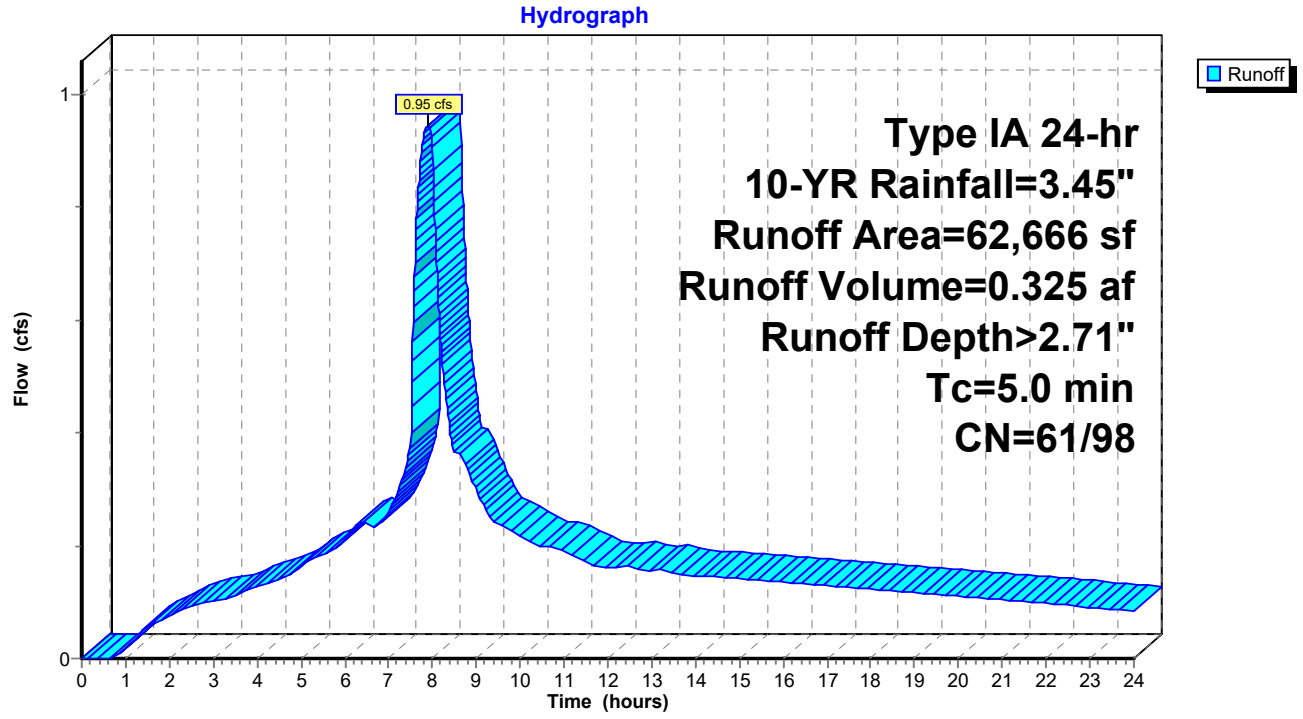
Runoff = 0.95 cfs @ 7.89 hrs, Volume= 0.325 af, Depth> 2.71"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	50,879	98	IMPERVIOUS
	11,787	61	>75% Grass cover, Good, HSG B
	62,666	91	Weighted Average
	11,787		18.81% Pervious Area
	50,879		81.19% Impervious Area

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

Subcatchment 1S: ONSITE



Summary for Subcatchment 2S: Tax Lot 900

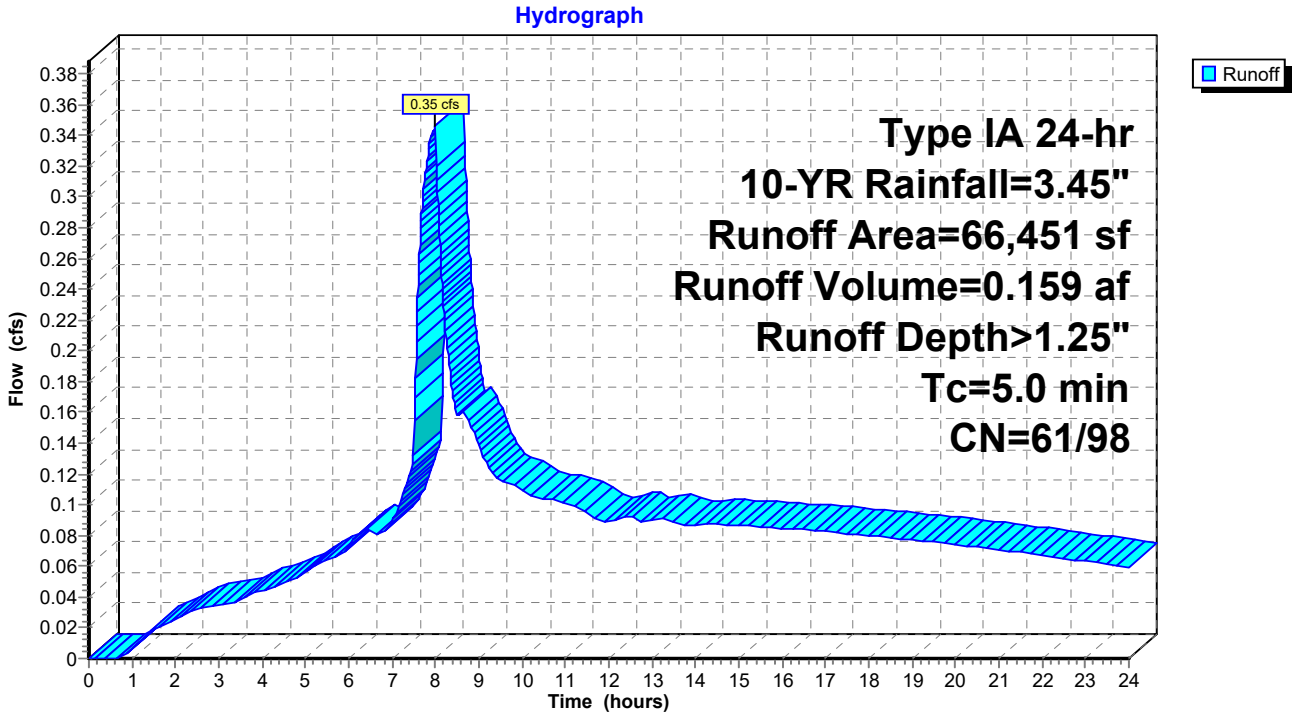
Runoff = 0.35 cfs @ 7.99 hrs, Volume= 0.159 af, Depth> 1.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	17,573	98	Impervious
	48,878	61	>75% Grass cover, Good, HSG B
	66,451	71	Weighted Average
	48,878		73.55% Pervious Area
	17,573		26.45% Impervious Area

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

Subcatchment 2S: Tax Lot 900



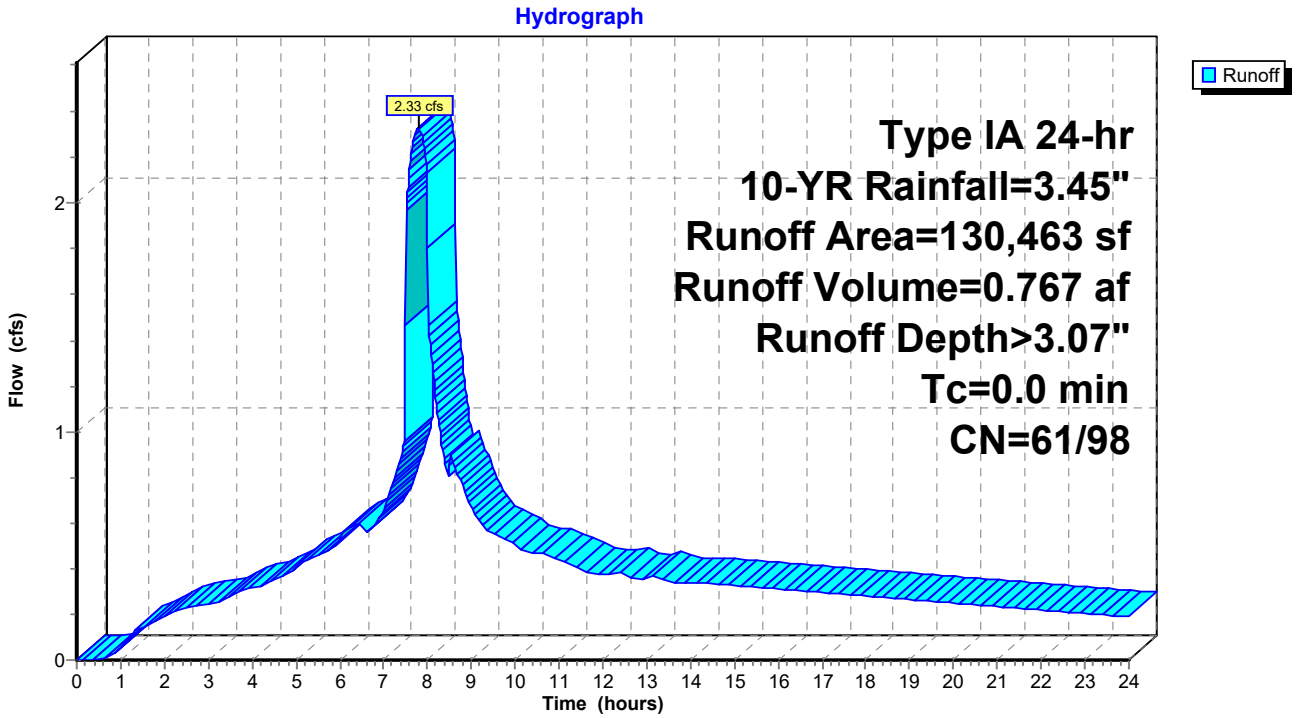
Summary for Subcatchment 3S: Tax Lot 500 & 600

Runoff = 2.33 cfs @ 7.79 hrs, Volume= 0.767 af, Depth> 3.07"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	81,458	98	AC Parking Lot
*	42,005	98	Building
	7,000	61	>75% Grass cover, Good, HSG B
	130,463	96	Weighted Average
	7,000		5.37% Pervious Area
	123,463		94.63% Impervious Area

Subcatchment 3S: Tax Lot 500 & 600



Summary for Subcatchment 7S: Pre-Developed Site

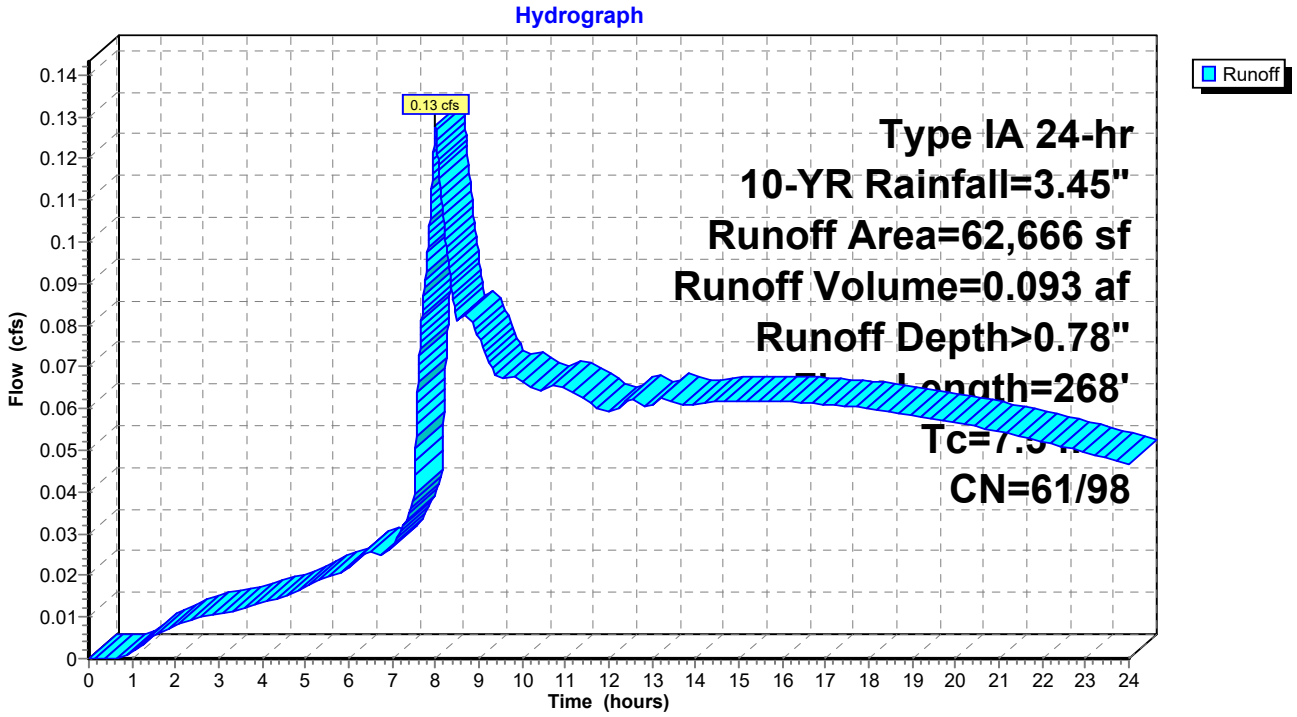
Runoff = 0.13 cfs @ 8.00 hrs, Volume= 0.093 af, Depth> 0.78"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	57,266	61	pervious
*	5,400	98	impervious
	62,666	64	Weighted Average
	57,266		91.38% Pervious Area
	5,400		8.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0450	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
3.8	218	0.0190	0.96		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.5	268	Total			

Subcatchment 7S: Pre-Developed Site



Summary for Subcatchment 8S: Pre-Developed Site

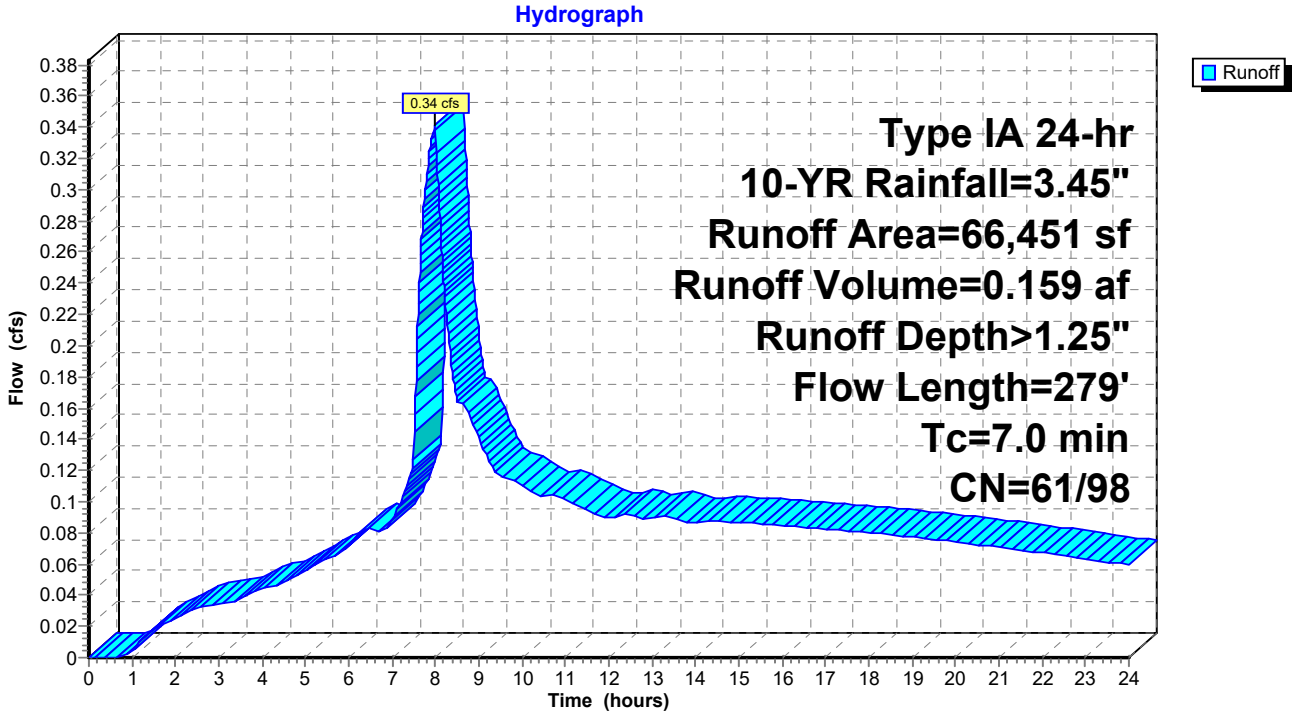
Runoff = 0.34 cfs @ 8.00 hrs, Volume= 0.159 af, Depth> 1.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	48,882	61	pervious
*	17,569	98	impervious
	66,451	71	Weighted Average
	48,882		73.56% Pervious Area
	17,569		26.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0230	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
1.7	160	0.0530	1.61		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	11	0.4940	4.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	58	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	279	Total			

Subcatchment 8S: Pre-Developed Site



Summary for Pond 1P: StormTech Chamber System

Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 1.96" for 10-YR event
Inflow = 1.29 cfs @ 7.91 hrs, Volume= 0.484 af
Outflow = 0.49 cfs @ 8.78 hrs, Volume= 0.402 af, Atten= 62%, Lag= 51.8 min
Discarded = 0.05 cfs @ 2.03 hrs, Volume= 0.086 af
Primary = 0.45 cfs @ 8.78 hrs, Volume= 0.316 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.49' @ 8.78 hrs Surf.Area= 3,241 sf Storage= 4,670 cf
Flood Elev= 139.00' Surf.Area= 3,241 sf Storage= 5,435 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 91.2 min (791.5 - 700.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.75'	3,578 cf	**48.17'W x 67.28'L x 3.33'H Field A** 10,802 cf Overall - 1,857 cf Embedded = 8,945 cf x 40.0% Voids
#2A	132.75'	1,857 cf	**ADS_StormTech SC-310 +Cap** x 126 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 14 Rows of 9 Chambers
		5,435 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	137.00'	**4.0' long (Profile 17) MH Wier** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31
#2	Primary	131.75'	**10.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 131.75' / 131.71' S= 0.0057 '/' Cc= 0.900 n= 0.013, Flow Area= 0.55 sf
#3	Device 2	131.75'	**1.9" Vert. Detention Orifice** C= 0.620
#4	Device 2	133.85'	**4.0" Vert. Orifice** C= 0.600
#5	Discarded	131.75'	**0.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 2.03 hrs HW=131.82' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.45 cfs @ 8.78 hrs HW=134.49' TW=130.51' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.45 cfs of 4.01 cfs potential flow)
  ├**1=MH Wier** (Controls 0.00 cfs)
  ├**3=Detention Orifice** (Orifice Controls 0.16 cfs @ 8.12 fps)
  └**4=Orifice** (Orifice Controls 0.29 cfs @ 3.32 fps)

Pond 1P: StormTech Chamber System - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

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

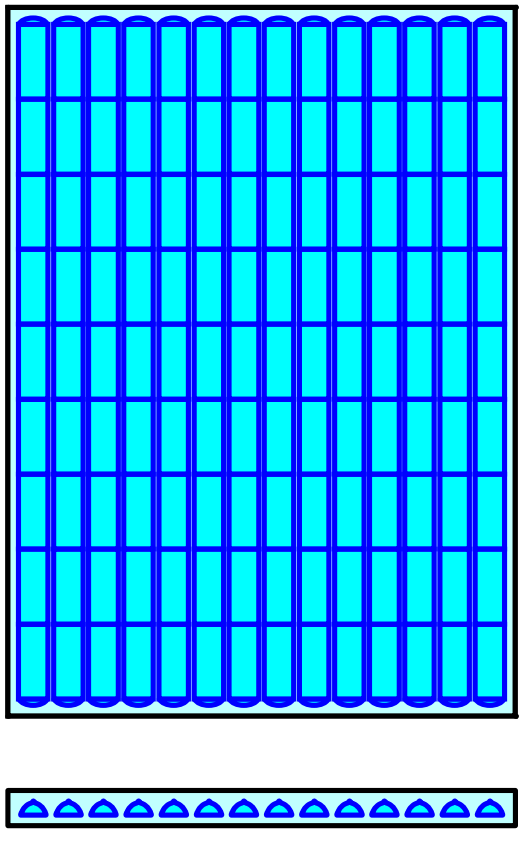
9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length
14 Rows x 34.0" Wide + 6.0" Spacing x 13 + 12.0" Side Stone x 2 = 48.17' Base Width
12.0" Base + 16.0" Chamber Height + 12.0" Cover = 3.33' Field Height

126 Chambers x 14.7 cf = 1,857.5 cf Chamber Storage

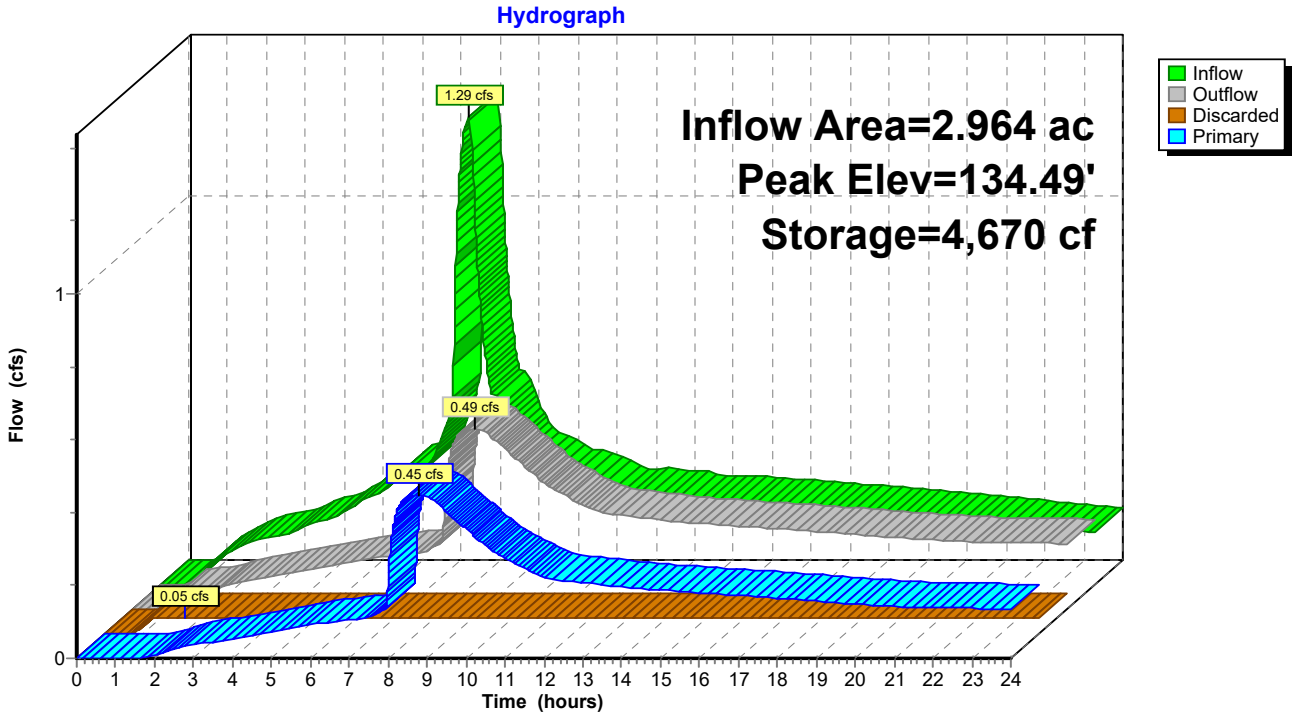
10,802.2 cf Field - 1,857.5 cf Chambers = 8,944.7 cf Stone x 40.0% Voids = 3,577.9 cf Stone Storage

Chamber Storage + Stone Storage = 5,435.4 cf = 0.125 af
Overall Storage Efficiency = 50.3%
Overall System Size = 67.28' x 48.17' x 3.33'

126 Chambers
400.1 cy Field
331.3 cy Stone



Pond 1P: StormTech Chamber System



Summary for Pond 1R: 15"

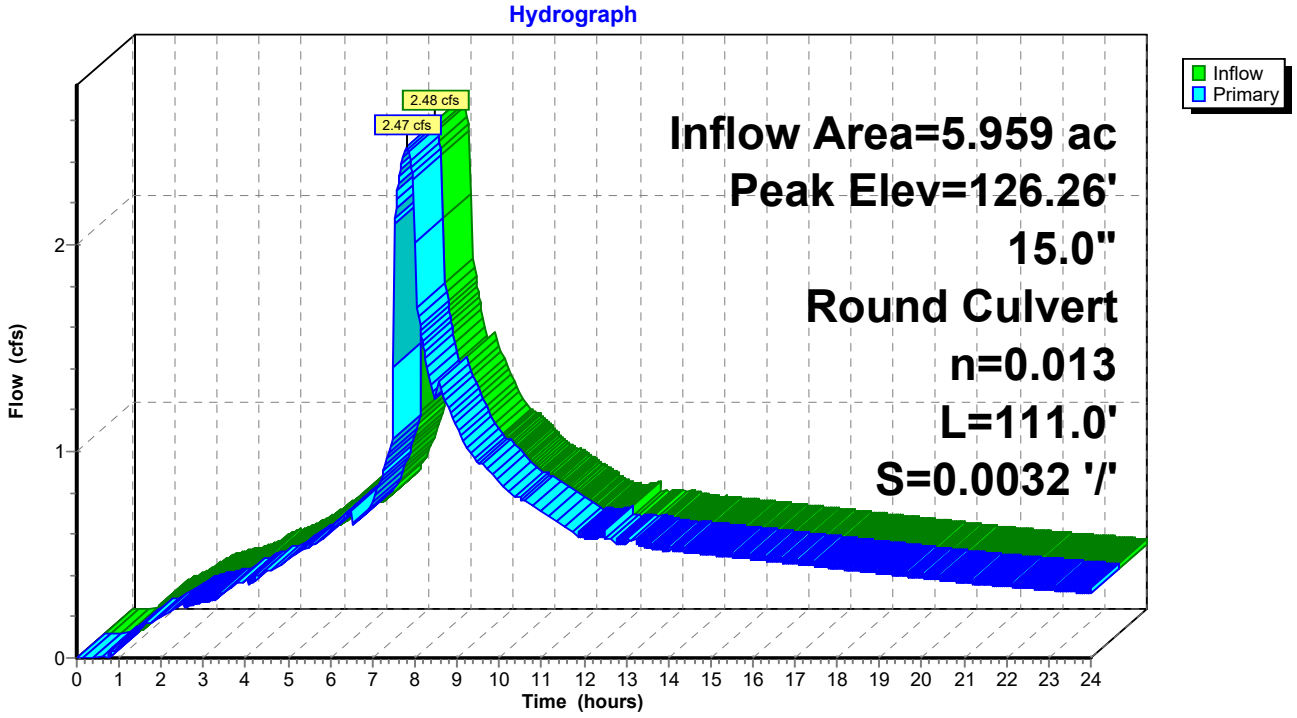
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.18" for 10-YR event
Inflow = 2.48 cfs @ 7.80 hrs, Volume= 1.083 af
Outflow = 2.47 cfs @ 7.80 hrs, Volume= 1.083 af, Atten= 0%, Lag= 0.0 min
Primary = 2.47 cfs @ 7.80 hrs, Volume= 1.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.26' @ 7.80 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	124.32'	**15.0" Round Culvert** L= 111.0' Ke= 0.500 Inlet / Outlet Invert= 124.32' / 123.97' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.47 cfs @ 7.80 hrs HW=126.26' TW=126.00' (Dynamic Tailwater)
1=Culvert (Outlet Controls 2.47 cfs @ 2.02 fps)

Pond 1R: 15"



Summary for Pond 2R: 15"

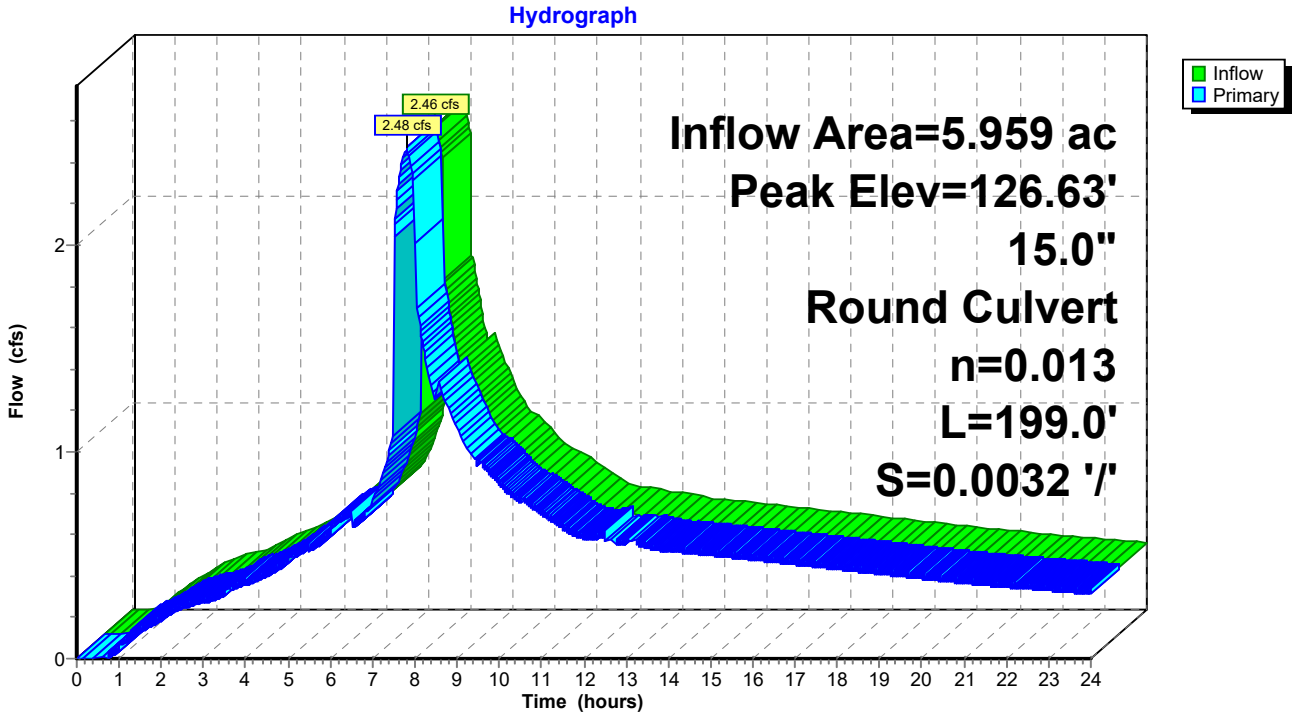
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.18" for 10-YR event
Inflow = 2.46 cfs @ 7.79 hrs, Volume= 1.083 af
Outflow = 2.48 cfs @ 7.80 hrs, Volume= 1.083 af, Atten= 0%, Lag= 0.3 min
Primary = 2.48 cfs @ 7.80 hrs, Volume= 1.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.63' @ 7.80 hrs
Flood Elev= 130.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	125.16'	**15.0" Round Culvert** L= 199.0' Ke= 0.500 Inlet / Outlet Invert= 125.16' / 124.52' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.46 cfs @ 7.80 hrs HW=126.63' TW=126.26' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 2.46 cfs @ 2.15 fps)

Pond 2R: 15"



Summary for Pond 3R: 15"

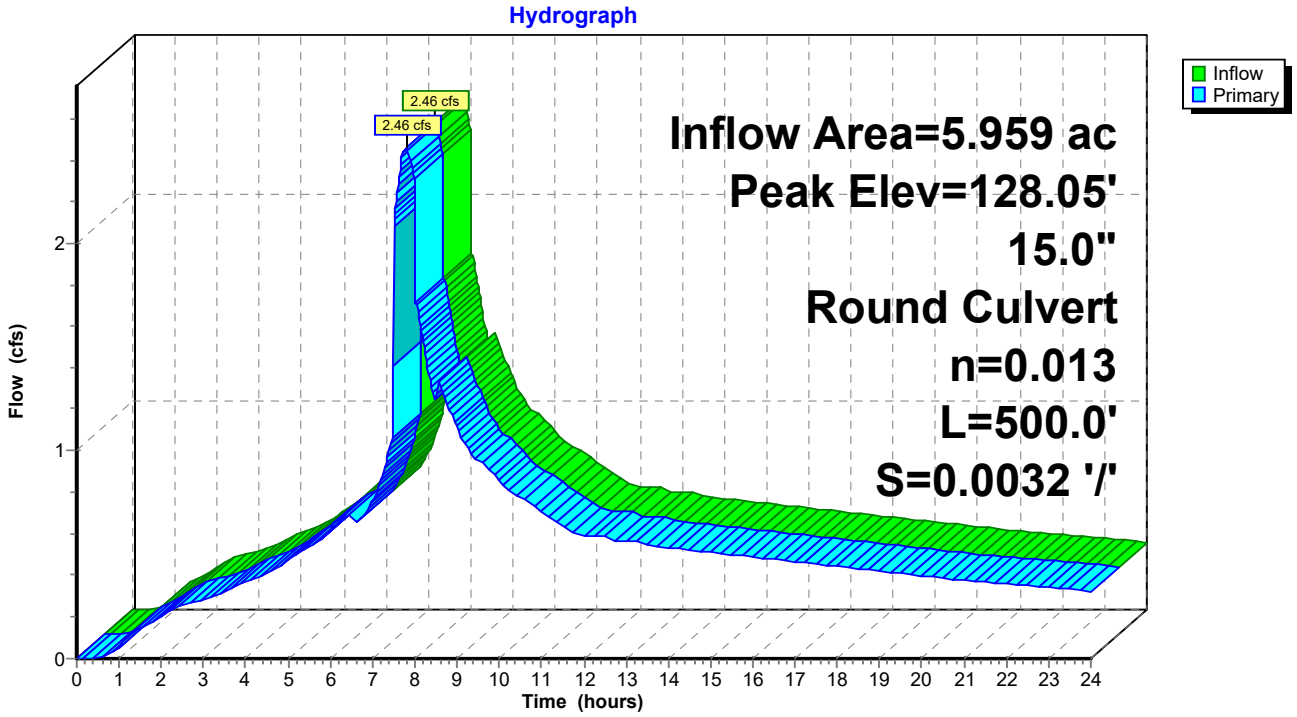
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.18" for 10-YR event
Inflow = 2.46 cfs @ 7.79 hrs, Volume= 1.083 af
Outflow = 2.46 cfs @ 7.79 hrs, Volume= 1.083 af, Atten= 0%, Lag= 0.0 min
Primary = 2.46 cfs @ 7.79 hrs, Volume= 1.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.05' @ 7.79 hrs
Flood Elev= 134.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	126.96'	**15.0" Round Culvert** L= 500.0' Ke= 0.500 Inlet / Outlet Invert= 126.96' / 125.34' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.46 cfs @ 7.79 hrs HW=128.05' TW=126.62' (Dynamic Tailwater)
↳**1=Culvert** (Outlet Controls 2.46 cfs @ 2.88 fps)

Pond 3R: 15"



Summary for Pond 4R: 15"

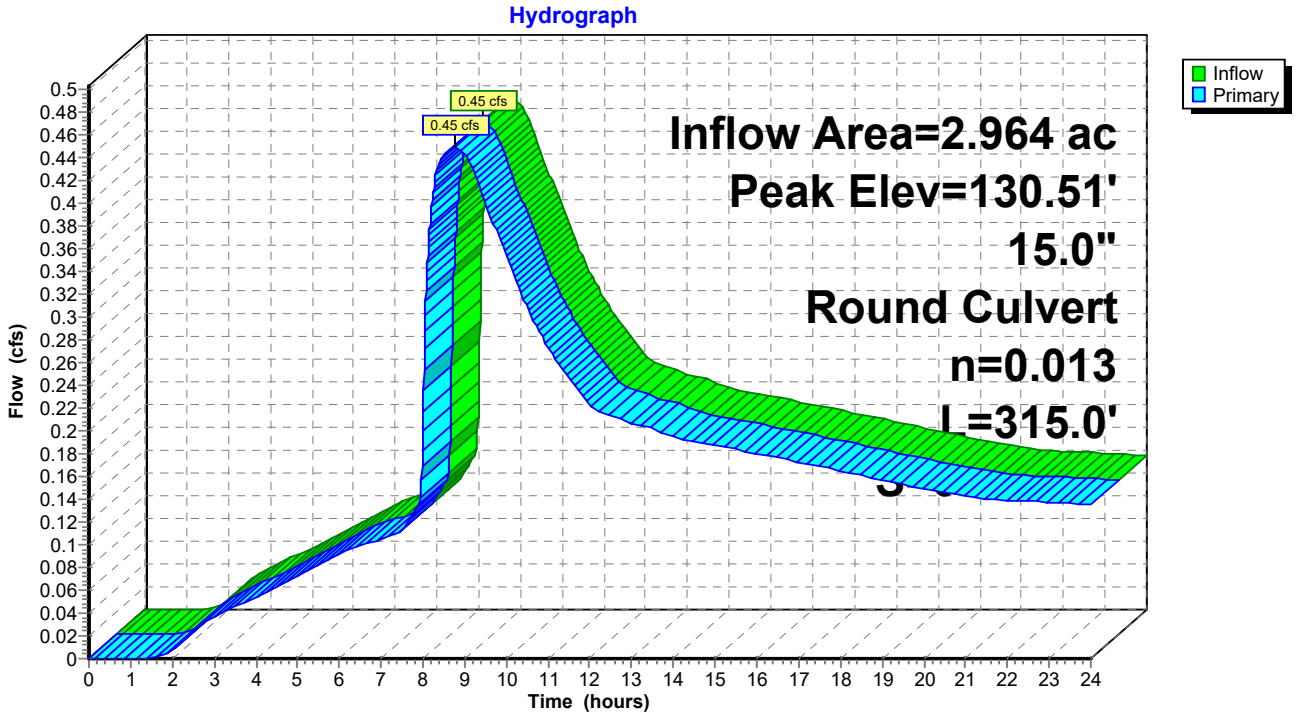
Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 1.28" for 10-YR event
Inflow = 0.45 cfs @ 8.78 hrs, Volume= 0.316 af
Outflow = 0.45 cfs @ 8.78 hrs, Volume= 0.316 af, Atten= 0%, Lag= 0.0 min
Primary = 0.45 cfs @ 8.78 hrs, Volume= 0.316 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 130.51' @ 8.72 hrs
Flood Elev= 139.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.20'	**15.0" Round Culvert** L= 315.0' Ke= 0.500 Inlet / Outlet Invert= 130.20' / 127.16' S= 0.0097 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.45 cfs @ 8.78 hrs HW=130.51' TW=127.67' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.45 cfs @ 2.85 fps)

Pond 4R: 15"

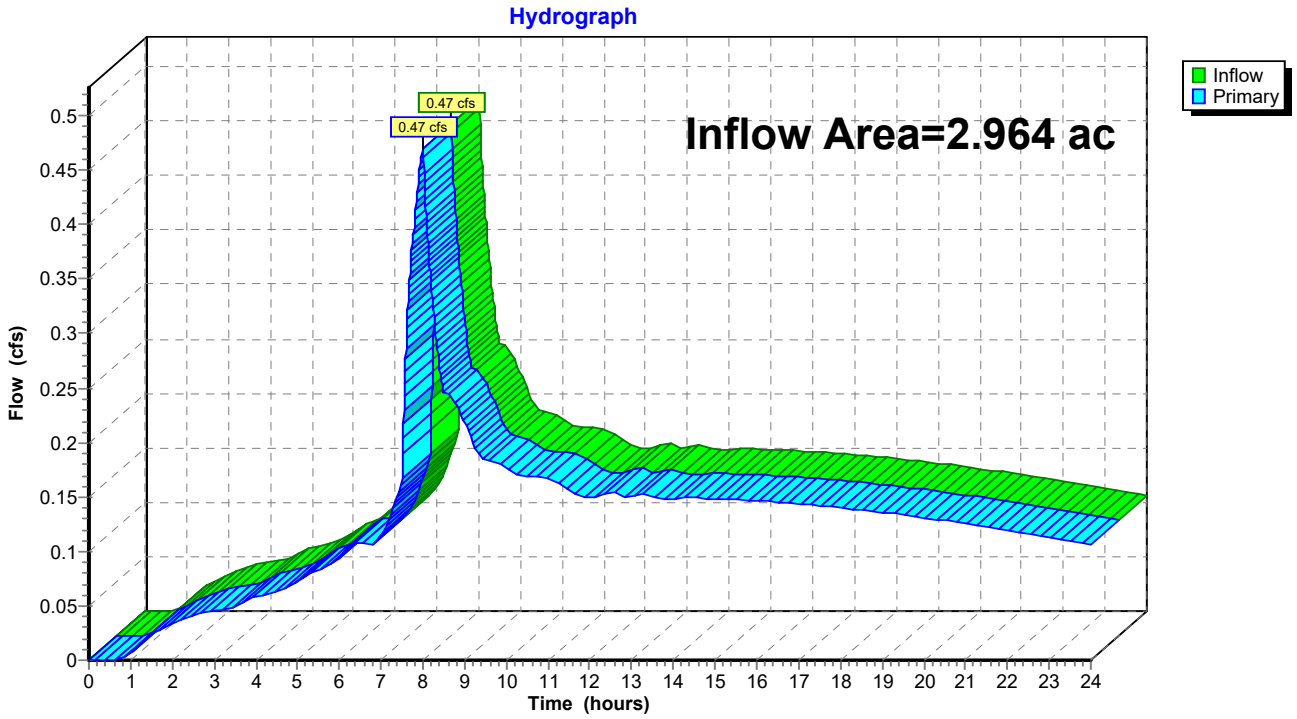


Summary for Link 1L: PRE DEVELOPED

Inflow Area = 2.964 ac, 17.79% Impervious, Inflow Depth > 1.02" for 10-YR event
Inflow = 0.47 cfs @ 8.00 hrs, Volume= 0.252 af
Primary = 0.47 cfs @ 8.00 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: PRE DEVELOPED



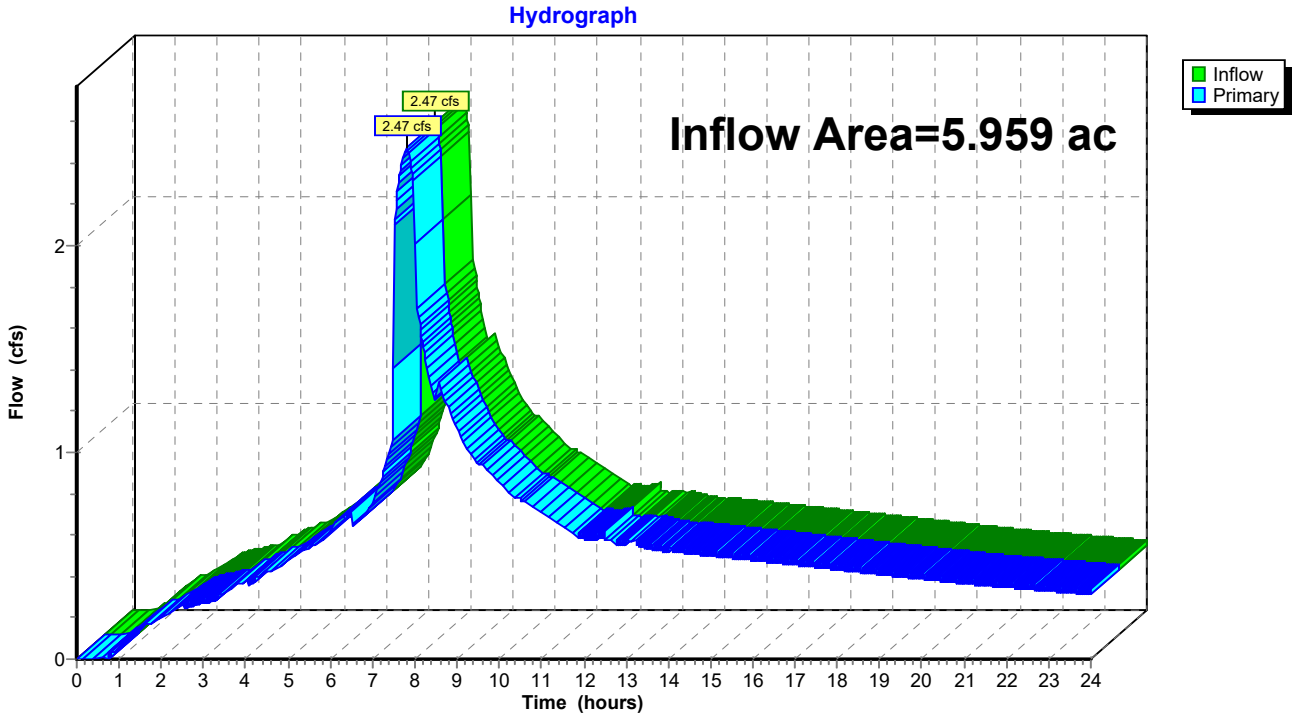
Summary for Link 2L: (new Link)

Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.18" for 10-YR event
Inflow = 2.47 cfs @ 7.80 hrs, Volume= 1.083 af
Primary = 2.47 cfs @ 7.80 hrs, Volume= 1.083 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 126.00'

Link 2L: (new Link)



Summary for Subcatchment 1S: ONSITE

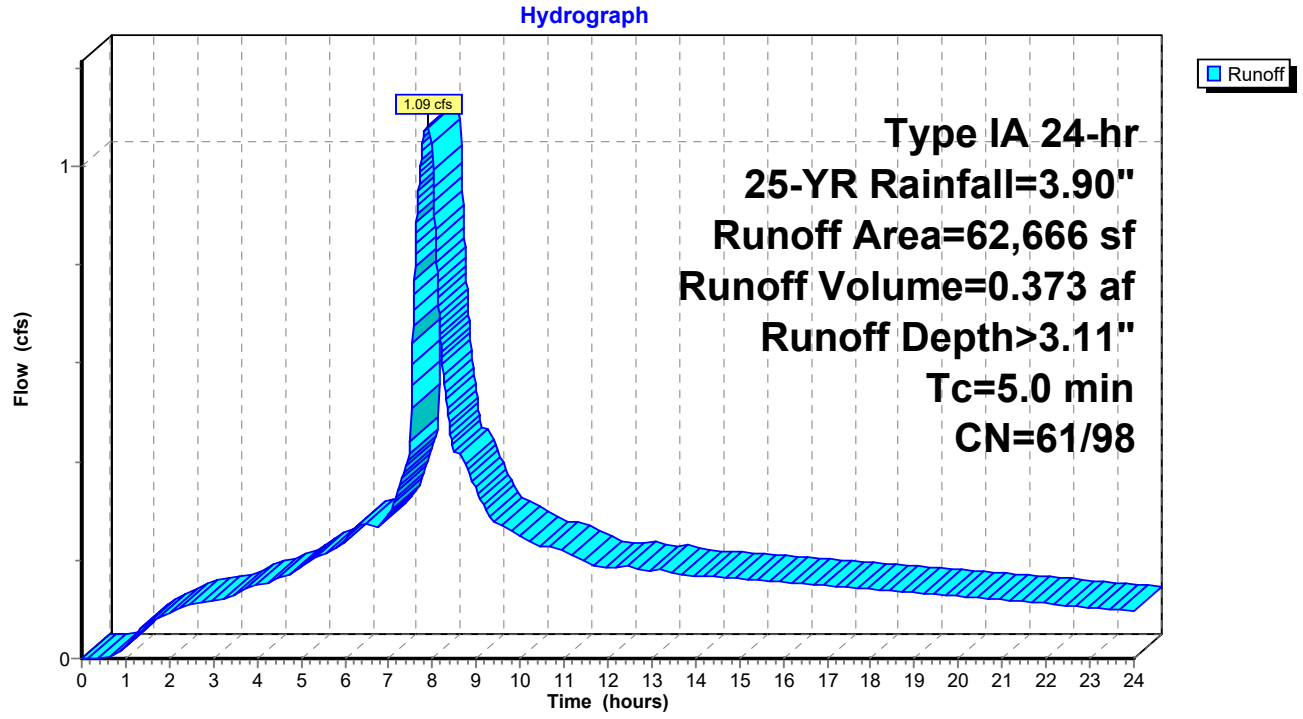
Runoff = 1.09 cfs @ 7.89 hrs, Volume= 0.373 af, Depth> 3.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	50,879	98	IMPERVIOUS
	11,787	61	>75% Grass cover, Good, HSG B
	62,666	91	Weighted Average
	11,787		18.81% Pervious Area
	50,879		81.19% Impervious Area

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

Subcatchment 1S: ONSITE



Summary for Subcatchment 2S: Tax Lot 900

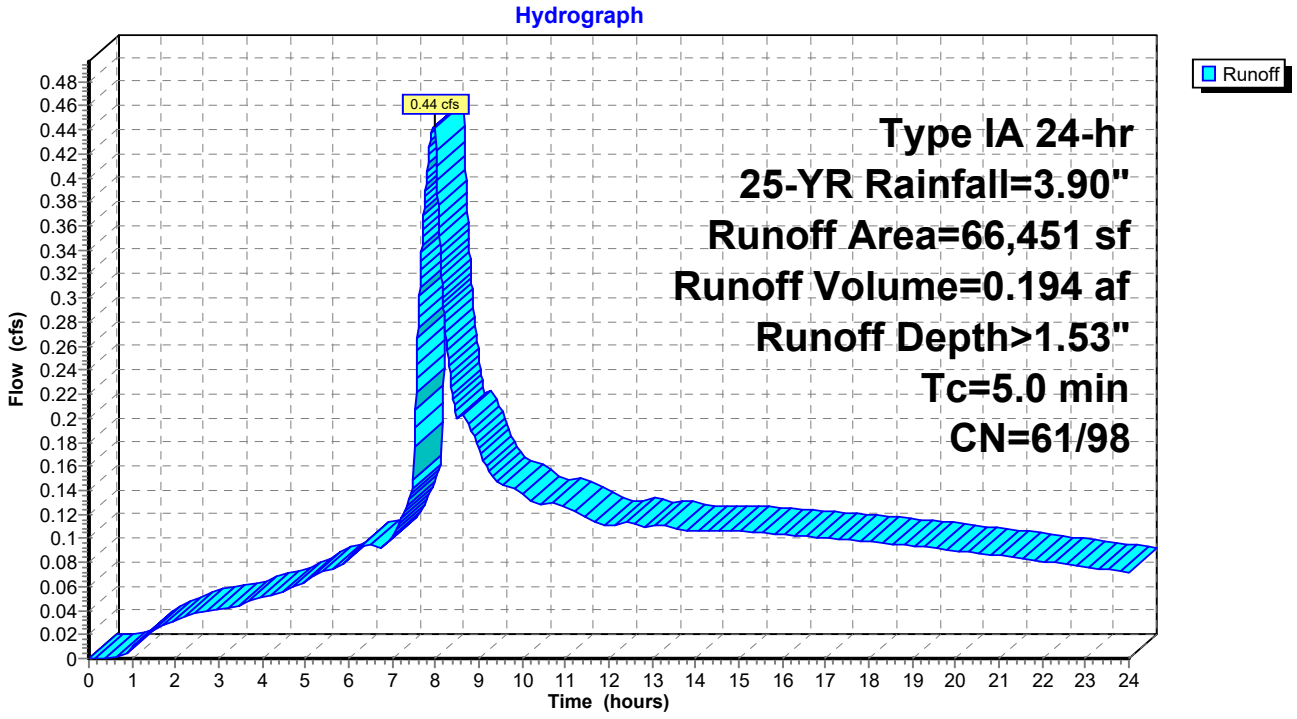
Runoff = 0.44 cfs @ 7.98 hrs, Volume= 0.194 af, Depth> 1.53"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	17,573	98	Impervious
	48,878	61	>75% Grass cover, Good, HSG B
	66,451	71	Weighted Average
	48,878		73.55% Pervious Area
	17,573		26.45% Impervious Area

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

Subcatchment 2S: Tax Lot 900



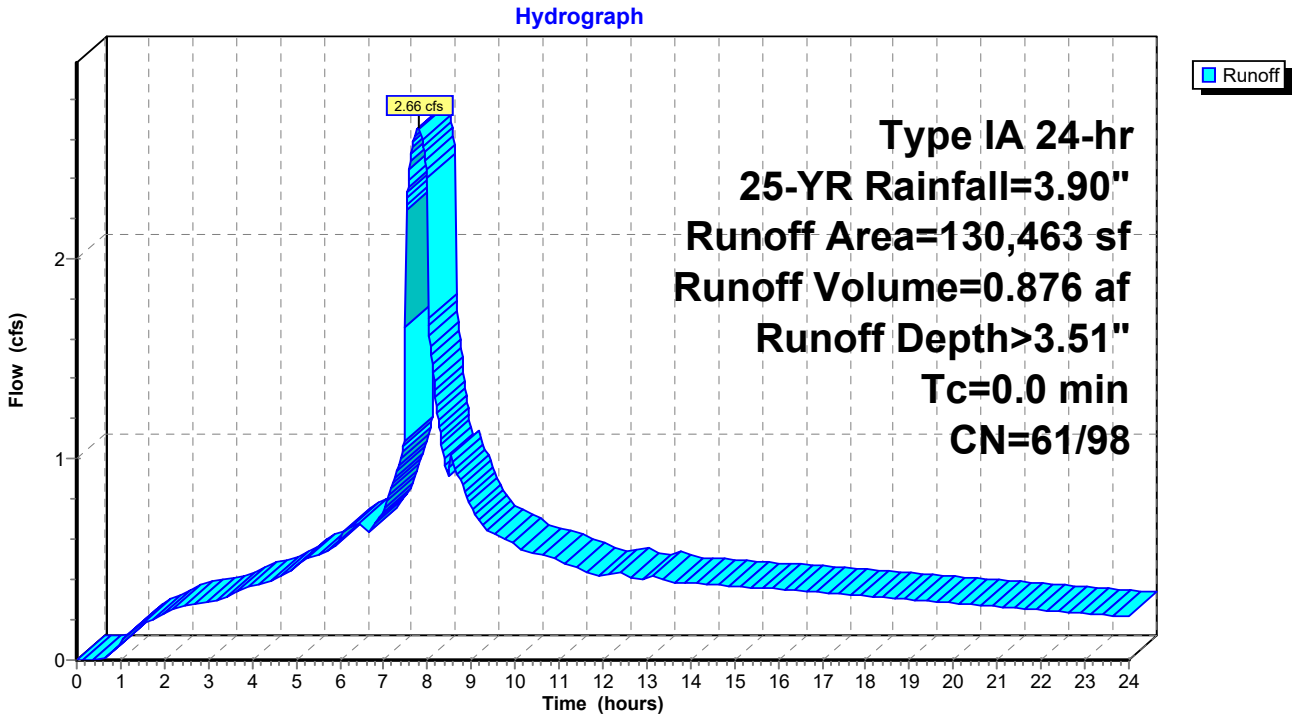
Summary for Subcatchment 3S: Tax Lot 500 & 600

Runoff = 2.66 cfs @ 7.79 hrs, Volume= 0.876 af, Depth> 3.51"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	81,458	98	AC Parking Lot
*	42,005	98	Building
	7,000	61	>75% Grass cover, Good, HSG B
	130,463	96	Weighted Average
	7,000		5.37% Pervious Area
	123,463		94.63% Impervious Area

Subcatchment 3S: Tax Lot 500 & 600



Summary for Subcatchment 7S: Pre-Developed Site

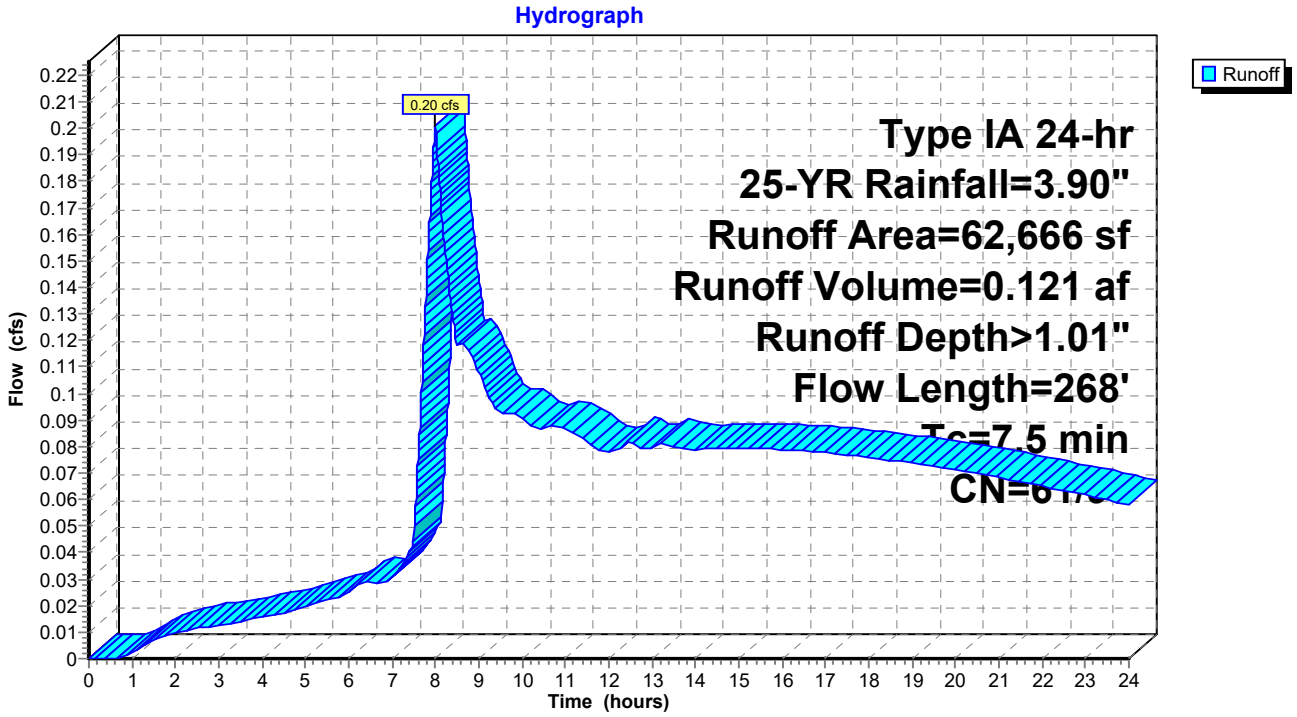
Runoff = 0.20 cfs @ 8.00 hrs, Volume= 0.121 af, Depth> 1.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	57,266	61	pervious
*	5,400	98	impervious
	62,666	64	Weighted Average
	57,266		91.38% Pervious Area
	5,400		8.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0450	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
3.8	218	0.0190	0.96		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.5	268	Total			

Subcatchment 7S: Pre-Developed Site



Summary for Subcatchment 8S: Pre-Developed Site

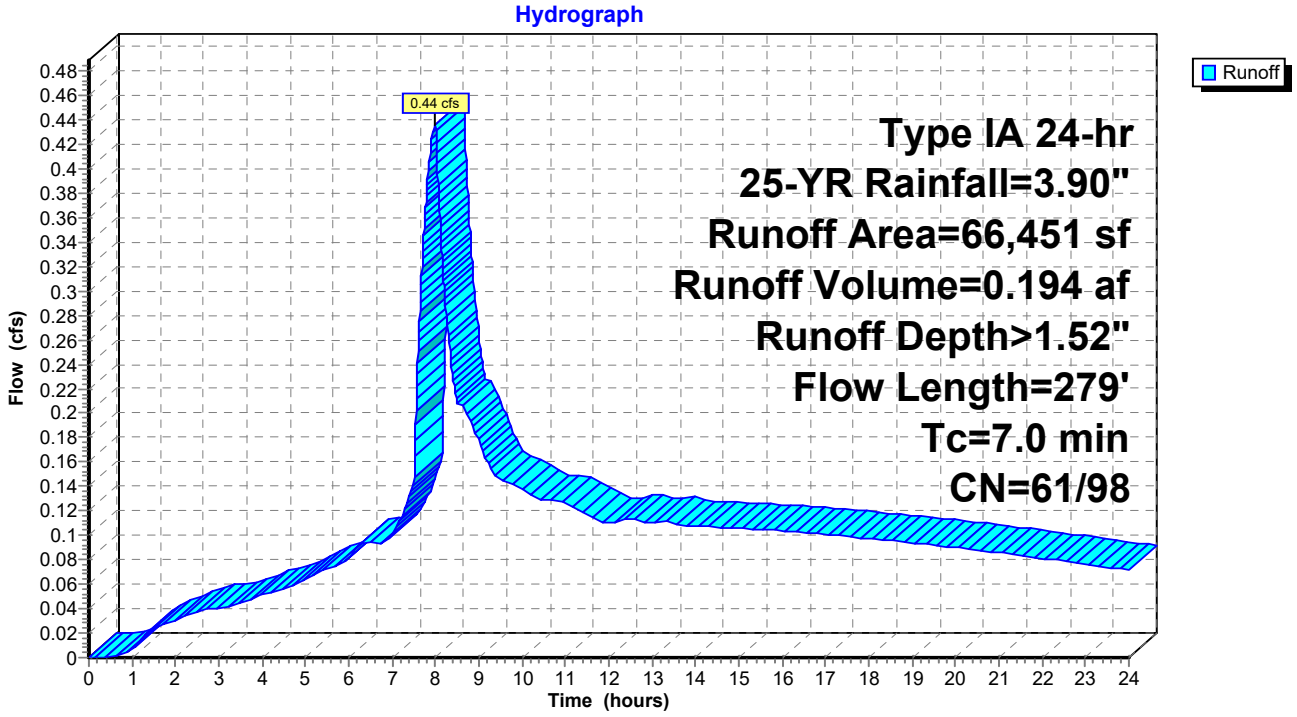
Runoff = 0.44 cfs @ 8.00 hrs, Volume= 0.194 af, Depth> 1.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	48,882	61	pervious
*	17,569	98	impervious
	66,451	71	Weighted Average
	48,882		73.56% Pervious Area
	17,569		26.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0230	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.90"
1.7	160	0.0530	1.61		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	11	0.4940	4.92		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	58	0.0900	2.10		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.0	279	Total			

Subcatchment 8S: Pre-Developed Site



Summary for Pond 1P: StormTech Chamber System

Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 2.30" for 25-YR event
Inflow = 1.52 cfs @ 7.92 hrs, Volume= 0.567 af
Outflow = 0.63 cfs @ 8.47 hrs, Volume= 0.479 af, Atten= 58%, Lag= 33.1 min
Discarded = 0.05 cfs @ 1.78 hrs, Volume= 0.086 af
Primary = 0.59 cfs @ 8.47 hrs, Volume= 0.393 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.98' @ 8.47 hrs Surf.Area= 3,241 sf Storage= 5,304 cf
Flood Elev= 139.00' Surf.Area= 3,241 sf Storage= 5,435 cf

Plug-Flow detention time= 185.9 min calculated for 0.479 af (84% of inflow)
Center-of-Mass det. time= 80.9 min (781.5 - 700.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.75'	3,578 cf	**48.17'W x 67.28'L x 3.33'H Field A** 10,802 cf Overall - 1,857 cf Embedded = 8,945 cf x 40.0% Voids
#2A	132.75'	1,857 cf	**ADS_StormTech SC-310 +Cap** x 126 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 14 Rows of 9 Chambers
		5,435 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	137.00'	**4.0' long (Profile 17) MH Wier** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31
#2	Primary	131.75'	**10.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 131.75' / 131.71' S= 0.0057 '/' Cc= 0.900 n= 0.013, Flow Area= 0.55 sf
#3	Device 2	131.75'	**1.9" Vert. Detention Orifice** C= 0.620
#4	Device 2	133.85'	**4.0" Vert. Orifice** C= 0.600
#5	Discarded	131.75'	**0.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 1.78 hrs HW=131.82' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.59 cfs @ 8.47 hrs HW=134.98' TW=130.56' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.59 cfs of 4.41 cfs potential flow)
  ├**1=MH Wier** (Controls 0.00 cfs)
  ├**3=Detention Orifice** (Orifice Controls 0.17 cfs @ 8.83 fps)
  └**4=Orifice** (Orifice Controls 0.41 cfs @ 4.73 fps)

Pond 1P: StormTech Chamber System - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

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

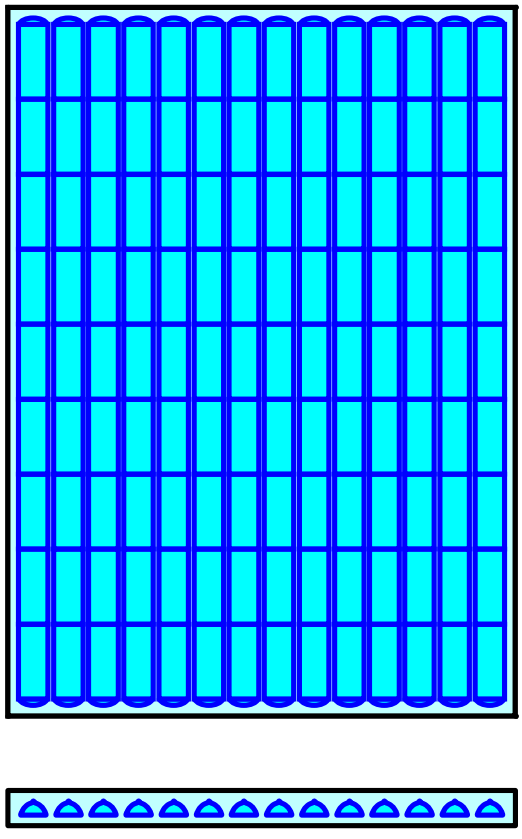
9 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 65.28' Row Length +12.0" End Stone x 2 = 67.28' Base Length
14 Rows x 34.0" Wide + 6.0" Spacing x 13 + 12.0" Side Stone x 2 = 48.17' Base Width
12.0" Base + 16.0" Chamber Height + 12.0" Cover = 3.33' Field Height

126 Chambers x 14.7 cf = 1,857.5 cf Chamber Storage

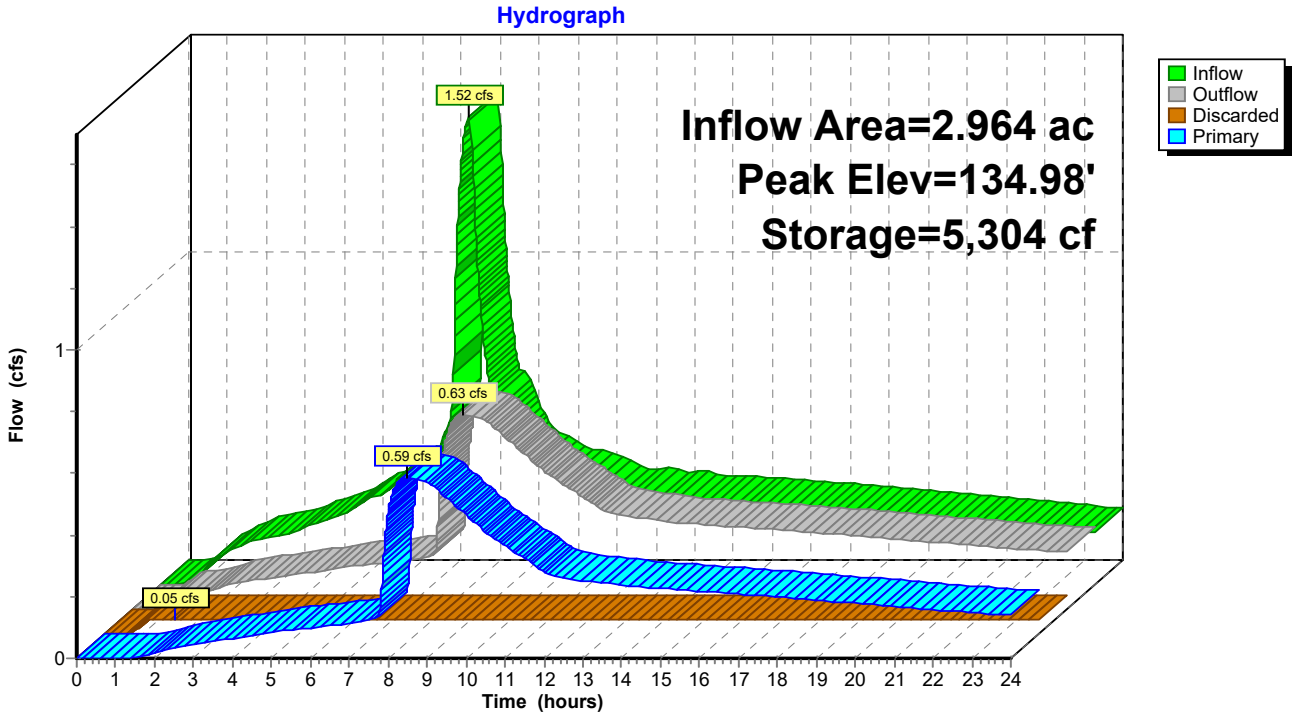
10,802.2 cf Field - 1,857.5 cf Chambers = 8,944.7 cf Stone x 40.0% Voids = 3,577.9 cf Stone Storage

Chamber Storage + Stone Storage = 5,435.4 cf = 0.125 af
Overall Storage Efficiency = 50.3%
Overall System Size = 67.28' x 48.17' x 3.33'

126 Chambers
400.1 cy Field
331.3 cy Stone



Pond 1P: StormTech Chamber System



Summary for Pond 1R: 15"

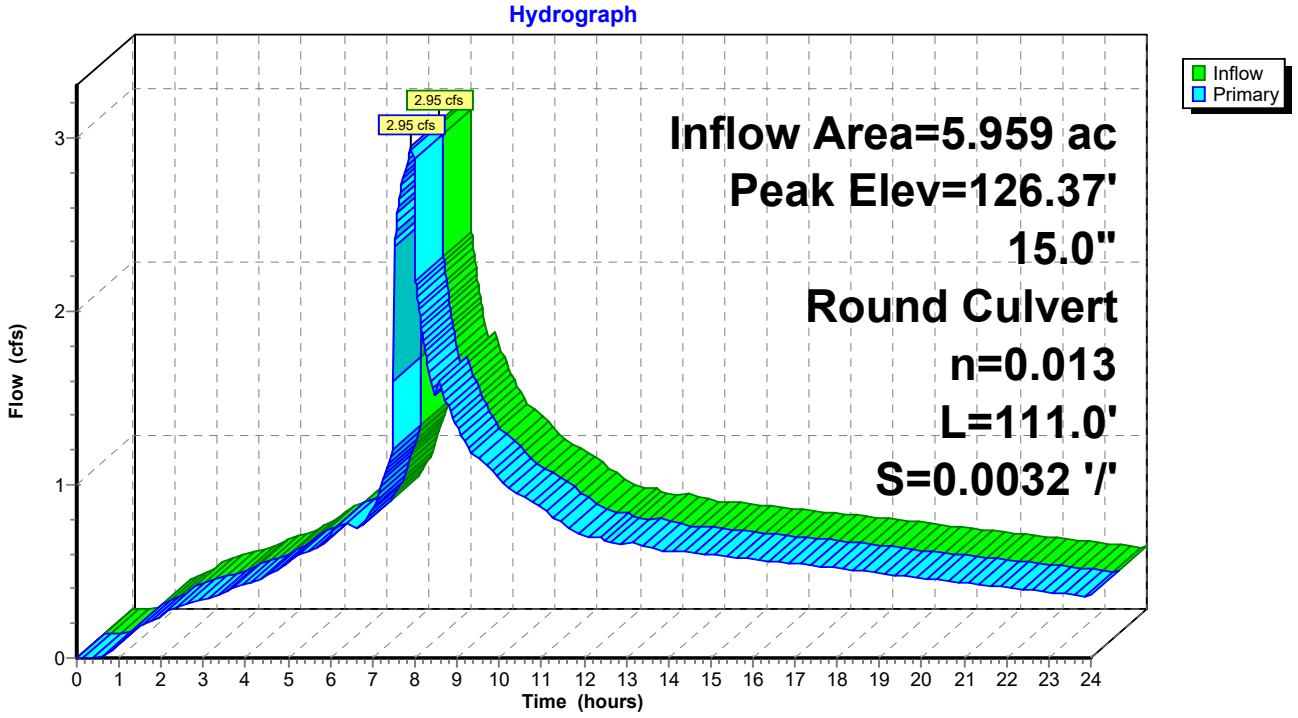
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.56" for 25-YR event
Inflow = 2.95 cfs @ 7.90 hrs, Volume= 1.269 af
Outflow = 2.95 cfs @ 7.90 hrs, Volume= 1.269 af, Atten= 0%, Lag= 0.0 min
Primary = 2.95 cfs @ 7.90 hrs, Volume= 1.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.37' @ 7.90 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	124.32'	**15.0" Round Culvert** L= 111.0' Ke= 0.500 Inlet / Outlet Invert= 124.32' / 123.97' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.95 cfs @ 7.90 hrs HW=126.37' TW=126.00' (Dynamic Tailwater)
↳**1=Culvert** (Outlet Controls 2.95 cfs @ 2.40 fps)

Pond 1R: 15"



Summary for Pond 2R: 15"

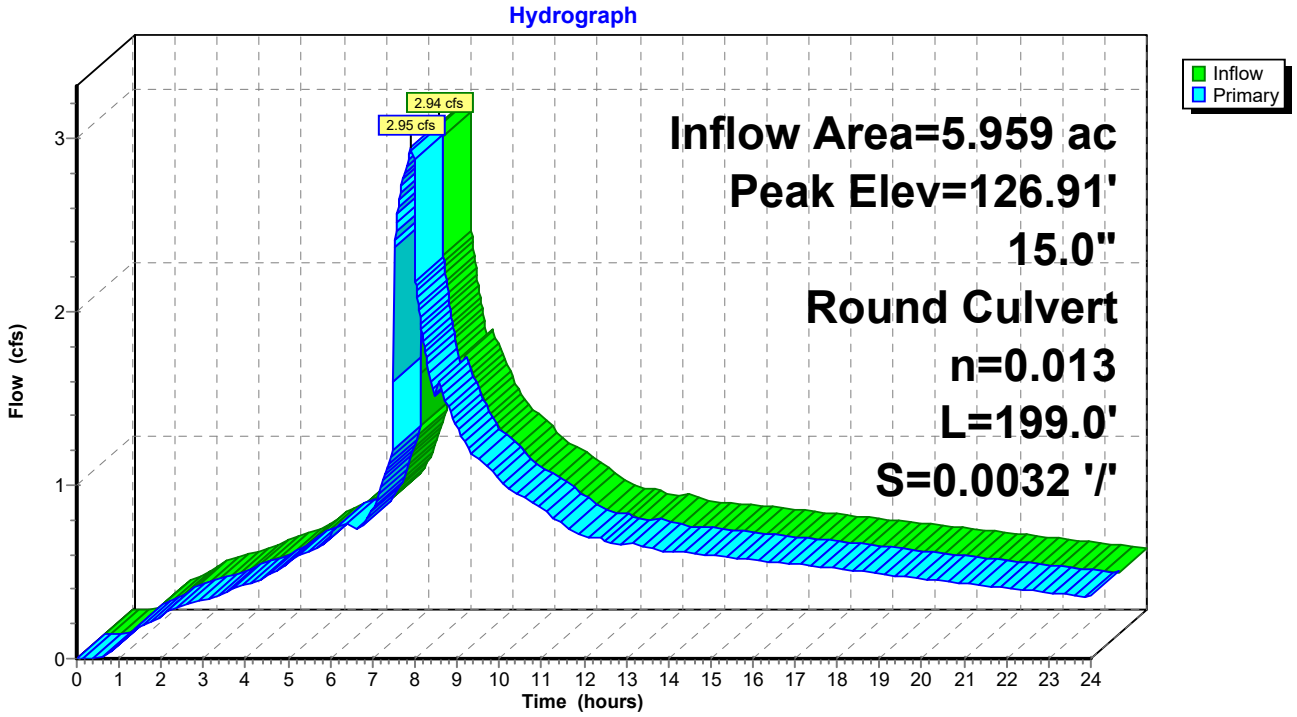
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.56" for 25-YR event
Inflow = 2.94 cfs @ 7.90 hrs, Volume= 1.269 af
Outflow = 2.95 cfs @ 7.90 hrs, Volume= 1.269 af, Atten= 0%, Lag= 0.0 min
Primary = 2.95 cfs @ 7.90 hrs, Volume= 1.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 126.91' @ 7.90 hrs
Flood Elev= 130.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	125.16'	**15.0" Round Culvert** L= 199.0' Ke= 0.500 Inlet / Outlet Invert= 125.16' / 124.52' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.94 cfs @ 7.90 hrs HW=126.91' TW=126.37' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 2.94 cfs @ 2.40 fps)

Pond 2R: 15"



Summary for Pond 3R: 15"

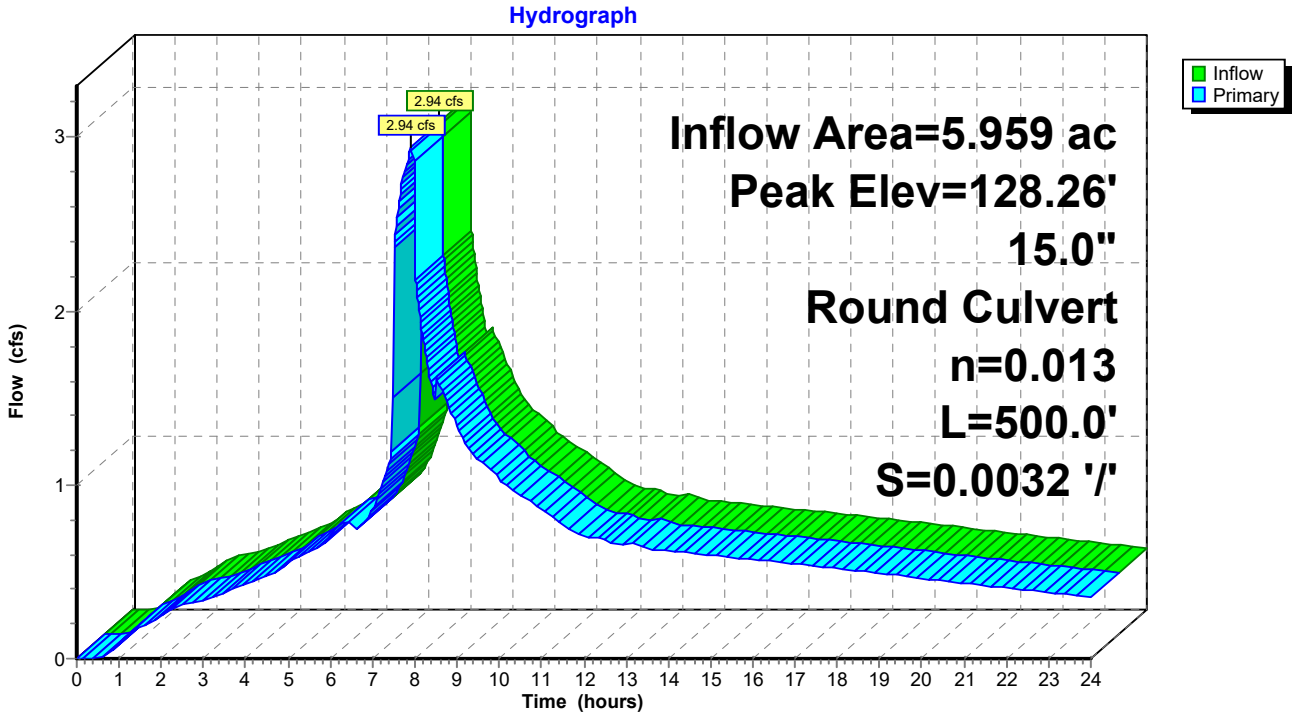
Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.56" for 25-YR event
Inflow = 2.94 cfs @ 7.90 hrs, Volume= 1.269 af
Outflow = 2.94 cfs @ 7.90 hrs, Volume= 1.269 af, Atten= 0%, Lag= 0.0 min
Primary = 2.94 cfs @ 7.90 hrs, Volume= 1.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.26' @ 7.91 hrs
Flood Elev= 134.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	126.96'	**15.0" Round Culvert** L= 500.0' Ke= 0.500 Inlet / Outlet Invert= 126.96' / 125.34' S= 0.0032 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=2.94 cfs @ 7.90 hrs HW=128.26' TW=126.91' (Dynamic Tailwater)
1=Culvert (Outlet Controls 2.94 cfs @ 2.87 fps)

Pond 3R: 15"



Summary for Pond 4R: 15"

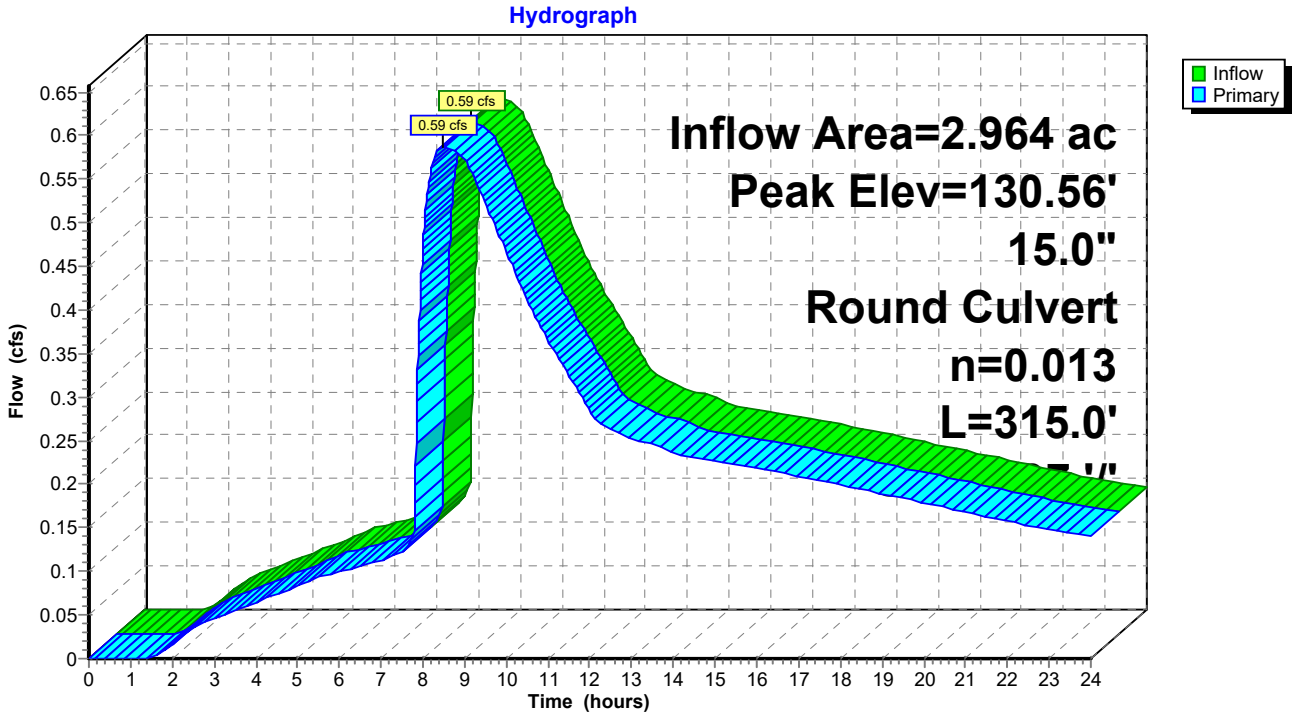
Inflow Area = 2.964 ac, 53.02% Impervious, Inflow Depth > 1.59" for 25-YR event
Inflow = 0.59 cfs @ 8.47 hrs, Volume= 0.393 af
Outflow = 0.59 cfs @ 8.47 hrs, Volume= 0.393 af, Atten= 0%, Lag= 0.0 min
Primary = 0.59 cfs @ 8.47 hrs, Volume= 0.393 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 130.56' @ 8.53 hrs
Flood Elev= 139.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.20'	**15.0" Round Culvert** L= 315.0' Ke= 0.500 Inlet / Outlet Invert= 130.20' / 127.16' S= 0.0097 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.59 cfs @ 8.47 hrs HW=130.56' TW=127.75' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.59 cfs @ 3.05 fps)

Pond 4R: 15"

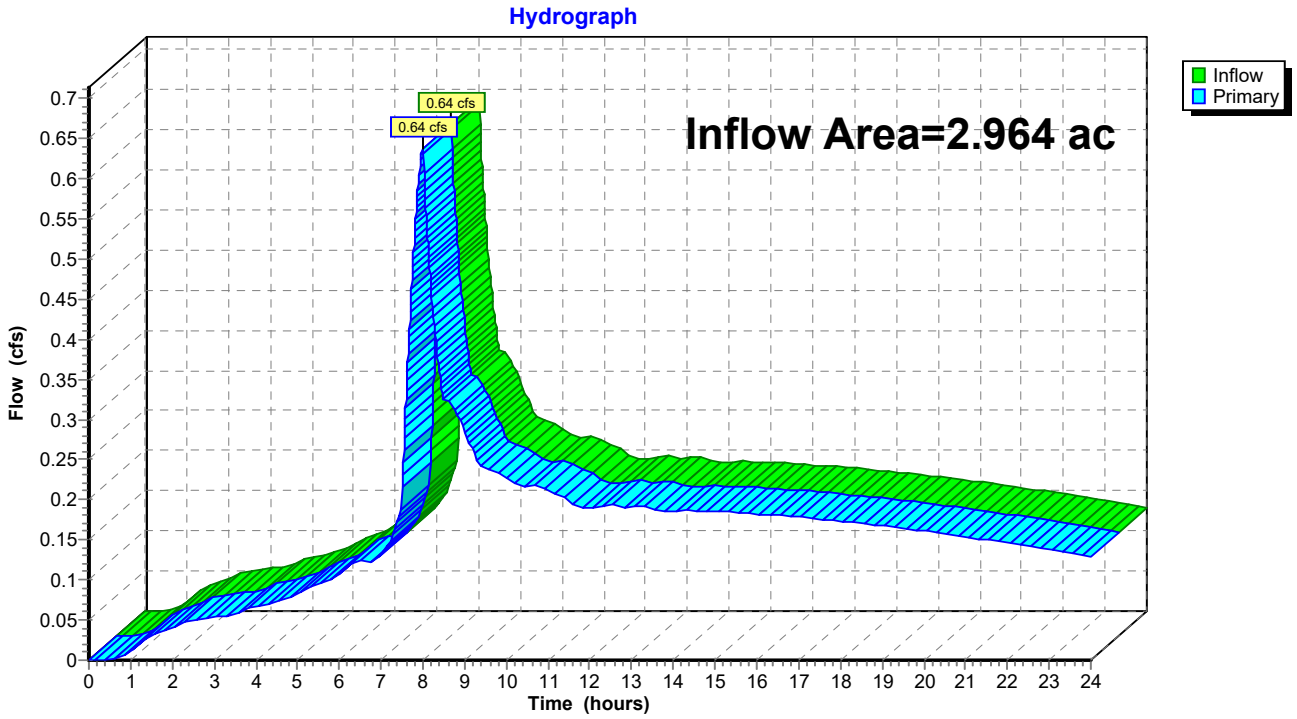


Summary for Link 1L: PRE DEVELOPED

Inflow Area = 2.964 ac, 17.79% Impervious, Inflow Depth > 1.27" for 25-YR event
Inflow = 0.64 cfs @ 8.00 hrs, Volume= 0.315 af
Primary = 0.64 cfs @ 8.00 hrs, Volume= 0.315 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: PRE DEVELOPED



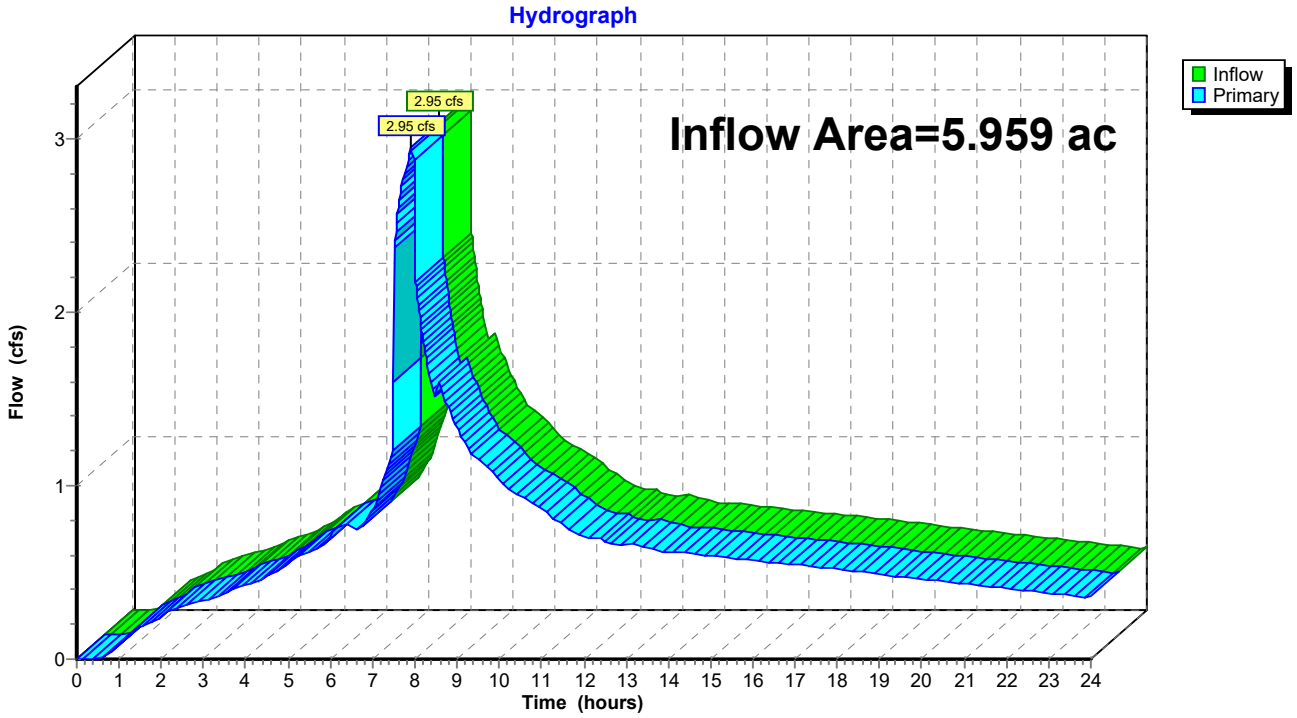
Summary for Link 2L: (new Link)

Inflow Area = 5.959 ac, 73.93% Impervious, Inflow Depth > 2.56" for 25-YR event
Inflow = 2.95 cfs @ 7.90 hrs, Volume= 1.269 af
Primary = 2.95 cfs @ 7.90 hrs, Volume= 1.269 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 126.00'

Link 2L: (new Link)



Appendix B: Stormwater Quality Calculations

STORMWATER QUALITY CALCULATIONS

Client: Rayborn's Plumbing
Project: Payborn's Plumbing
AKS Job No.: 7949
Date: 2/8/2023
Done By: DRP
Checked By: PAS

IMPERVIOUS AREA

Total Site Area:	1.44	acres
Total Site Area:	62,669	square feet (sf)
Stormwater Facility & Landscaping (0% impervious):	0	sf
Residential Development (65% impervious):	0	sf
Road & Sidewalk (100% impervious):	50,464	sf
Total Impervious Area:	50,464	sf

WATER DESIGN QUALITY VOLUME (WQV)

(Per CWS 4.08.5a2 - R&O 19-05)

$$WQV = \frac{0.36" \text{ X Area (ft)}}{12" \text{ per ft}} = \mathbf{1514}\ \mathbf{cubic\ feet}$$

WATER QUALITY FLOW (WQF)

(Per CWS 4.08.5a3 - R&O 19-05)

$$WQF = \frac{WQV\ (sf)}{4*60*60} = \mathbf{0.11}\ \mathbf{cfs}$$

Appendix C: NRCS Soil Resource 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 Washington County, Oregon

February 9, 2023

Custom Soil Resource Report
Soil Map

Map Scale: 1:966 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N 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 1:20,000.

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: Washington County, Oregon
Survey Area Data: Version 22, Sep 14, 2022

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

Date(s) aerial images were photographed: Apr 16, 2021—Apr 18, 2021

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
21B	Hillsboro loam, 3 to 7 percent slopes	3.9	100.0%
Totals for Area of Interest		**3.9**	**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.

Washington County, Oregon

21B—Hillsboro loam, 3 to 7 percent slopes

Map Unit Setting

National map unit symbol: 21y6
Elevation: 160 to 240 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Hillsboro and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hillsboro

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty and loamy old alluvium

Typical profile

H1 - 0 to 15 inches: loam
H2 - 15 to 48 inches: loam
H3 - 48 to 57 inches: fine sandy loam
H4 - 57 to 81 inches: fine sand

Properties and qualities

Slope: 3 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: R002XC008OR - Valley Terrace Group
Hydric soil rating: No

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Appendix D: Runoff Curve Numbers From TR-55

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2/]	A [3/]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.