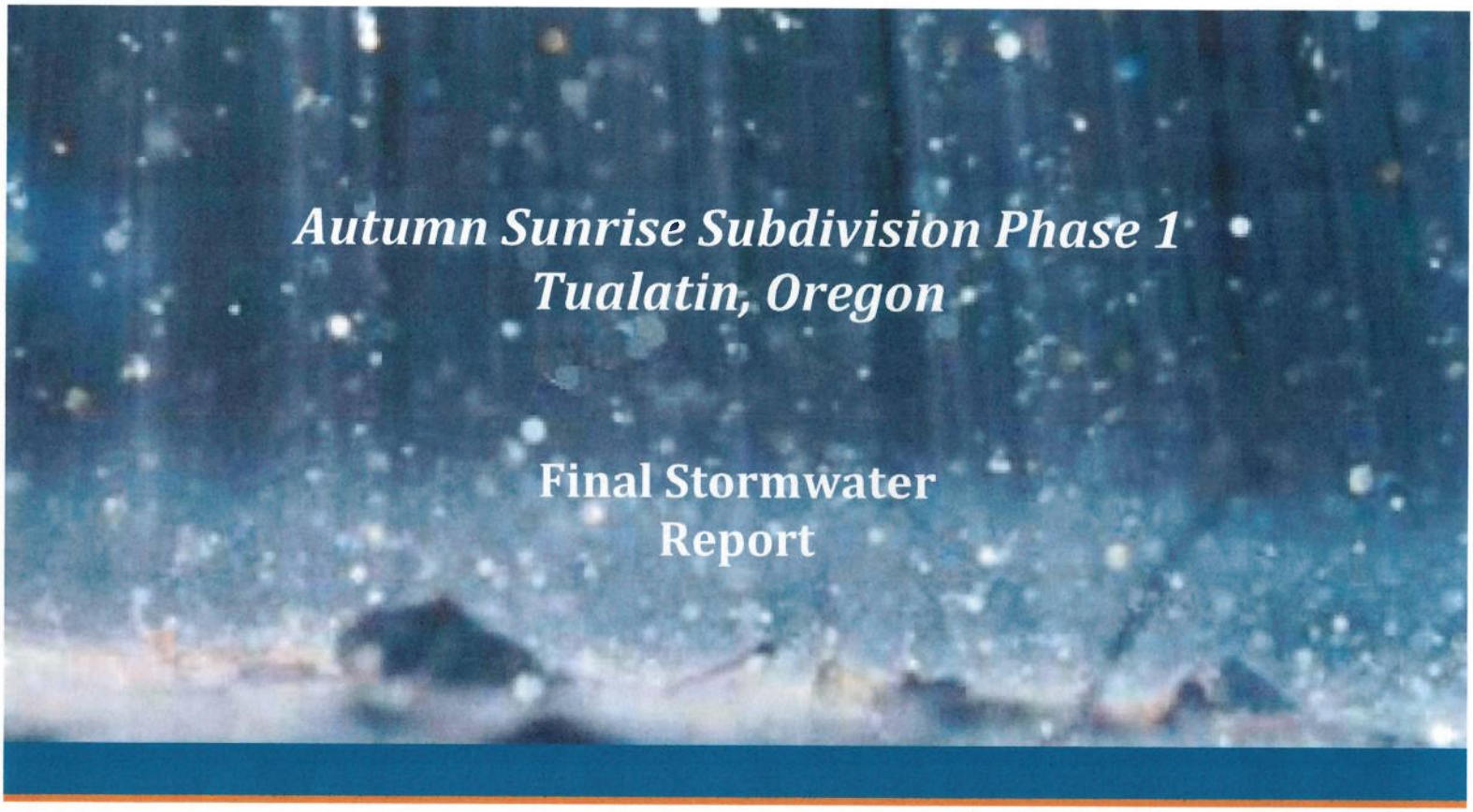
Exhibit H: Stormwater Reports



Autumn Sunrise Subdivision Phase 1
Tualatin, Oregon

Final Stormwater Report

Date:	May 2022
Client:	Lennar Northwest, INC. 11807 NE 99th Street, Suite 1170 Vancouver, WA 98682
Engineering Contact:	Darko Simic, PE DarkoS@aks-eng.com
Engineering Firm:	AKS Engineering & Forestry, LLC
AKS Job Number:	7454

05/05/2022

REGISTERED PROFESSIONAL ENGINEER
84806PE
OREGON
JULY 12, 2016
DARKO SIMIC

Renew: 06/2022

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Final Stormwater Report
AUTUMN SUNRISE SUBDIVISION PHASE 1
TUALATIN, OREGON

1.0 Purpose of Report
This report analyzes the effects of the proposed development with respect to the existing and proposed stormwater conveyance system. Evaluation of the stormwater system includes documentation of regulatory criteria, methodology, and informational sources used to design/evaluate the stormwater system. The results of the final hydraulic analysis are presented.

2.0 Project Location/Description
The Autumn Sunrise subdivision is located south of SW Norwood Road, east of Boones Ferry Road, north of Greenhill Lane, and west of Interstate 5 in Tualatin, Oregon. The subject site consists of seven parcels which total approximately 61.7-acres in Washington County, Tax Lots 100, 400, 401, 500, 600, 800, and 900 (Tax Map 2S 1 35D). The total area, which incorporates off-site flows onto the subject site, is approximately 70.2-acres. The subdivision will be developed in 4 phases. This report addresses the northern portion of subdivision, being managed by the stormwater facility constructed within Phase 1.

Stormwater management for the entire subdivision will be provided by two stormwater facilities, located in the northeast and southwest portions of the subject site. The northeast stormwater facility will be constructed as part of Phase 1 and will manage stormwater runoff for Phases 1 and 2 and the northern portions of Phases 3 and 4. The facility will release flows into the existing ODOT drainage ditch along Interstate 5, running south along the subject site's eastern property line.

The southwestern facility will be constructed as part of Phase 3 and will manage the remaining stormwater runoff for Phases 3 and 4. The facility will be releasing flows into the existing Boones Ferry Road storm system flowing to the west into the regional waterway.

For purposes of this report, the final northeast stormwater facility quality and quantity design will be presented. To illustrate the overall Autumn Sunrise subdivision development compliance with Clean Water Services (CWS) hydromodification standards the preliminary southwest stormwater facility design has been included in the hydraulic analysis.

Phase 1 of the Autumn Sunrise development will include the creation of a 109-lot residential subdivision with single-family detached and attached homes. Site improvements will include development of internal streets, underground utilities, a private street tract to Tax Lot 107, a CWS pump station tract, and the northern site stormwater facility. Additionally, SW Norwood Road improvements will be developed along the site's frontage.

Future Phase 2 and northern portions of Phases 3 and 4 of the Autumn Sunrise subdivision, directing stormwater runoff towards the northeast storm facility, will include the creation of single-family detached and attached homes with associated street and underground utility improvements. This report illustrates and includes the future development of these phases and shows that the northeast stormwater facility will comply with all applicable City of Tualatin, CWS, and ODOT standards.

3.0 Regulatory Design Criteria

3.1 STORMWATER QUALITY

The proposed project must meet CWS and ODOT stormwater quality standards, providing water quality treatment to all runoff from impervious surfaces. Comparing the two jurisdictional standards, it has been determined CWS has the stricter design and construction policy. Therefore, the northeast stormwater facility has been designed as an extended dry detention basin per CWS standards as established in section 4.04.

3.2 STORMWATER HYDROMODIFICATION

Per *CWS R&O 19-05, 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 the Hydromodification Approach Project Category Table 4-2, the full development of the Autumn Sunrise subdivision is identified as Category 3. Therefore, the subject project will meet CWS hydromodification requirements by providing peak-flow matching detention, using the design criteria established within CWS Section 4.08.6.

3.3 STORMWATER QUANTITY

Per *Clean Water Services (CWS) Design and Construction Standards Manual for Sanitary Sewer and Surface Water Management (R&O 19-05), Section 4.02, Quantity Control Requirements for Conveyance Capacity;* on-site detention for conveyance capacity (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.*

Per City standards, the stormwater facility must be designed to detain the subject site's post-developed peak flows to the site's pre-developed peak flows for the 2, 10, and 25-year storm events.

Per ODOT hydraulic manual Standards, the stormwater facility must be designed to detain the subject site's post-developed peak flows to the site's pre-developed peak flows for the 2, 10, 25 and 50-year storm events.

Comparing the jurisdictional standards, it has been determined ODOT has the stricter policy. Thus, the northeast stormwater facility has been designed to provide stormwater detention per ODOT Hydraulic Manual standards.

4.0 Design Methodology

The Santa Barbara Urban Hydrograph (SBUH) Method was used to analyze stormwater runoff from the site. This method utilizes the SCS Type 1A 24-hour design storm. HydroCAD 10.0 computer software aided in the analysis. Representative CN numbers were obtained from the USDA-NCRS Technical Release 55 (TR-55) and are included in Appendix E.

5.0 Design Parameters

5.1 DESIGN STORMS

Per City of Tualatin, CWS, and ODOT requirements, the following rainfall intensities and durations were used in analyzing the existing and proposed hydrologic site conditions:

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
50	24	4.40

5.2 PRE-DEVELOPED SITE CONDITIONS

5.2.1 Site Topography

Existing on-site grades vary from ±1% to ±30%, with a high point of ±355 feet along the northern and western property line and a low point of ±309 feet near the northeast property corner. The northern portion of the site slopes from west to east, towards the Interstate 5 drainage ditch.

5.2.2 Land Use

The existing site consists of a residential zone with native forest, agricultural field, and dirt recreational area.

5.3 SOIL TYPE

The soils beneath the project site and the associated drainage basin consist of silty clay residual soils with abundant rock fragments underlain by weathered basalt bedrock. The site geotechnical report classifies the soils underlying the site as Hydrologic Soil Group C. Further information regarding site soil conditions can be found in Appendix D of this report.

5.4 POST-DEVELOPED SITE CONDITIONS

5.4.1 Site Topography

The onsite slopes will be modified with cuts and fills to accommodate the construction of the streets and residential lots. Site drainage will be relatively the same as predeveloped conditions, draining to the east I-5 corridor.

5.4.2 Land Use

Phase 1 of the subdivision will consist of a 109 single family detached and attached lot subdivision with associated street and utilities. Future phases of the development consisting of Phase 2 and northern portions of Phases 3 and 4, will consist of single-family detached and attached lots with associated street and underground utilities.

5.4.3 Post-Developed Input Parameters

Appendices A and B provide 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 the parameters (e.g., impervious/pervious areas, time of concentration, etc.) used to model the site hydrology.

5.4.4 Description of Off-Site Contributing Basins

Adjacent to the subject site is Horizon School (Tax Lot 106), Interstate 5, City of Tualatin reservoir site (Tax Lot 107), and Washington County owned streets. Approximately 1800 feet of SW Norwood Rd storm runoff will be routed into the northeast stormwater facility. The city reservoir site (Tax Lot 107) drains onto Phase 1 of the subject site. Additionally, the city reservoirs' tank drainpipe and stormwater system will be connected into the proposed Phase 1 stormwater system.

6.0 Stormwater Analyses

6.1 PROPOSED STORMWATER CONDUIT SIZING AND INLET SPACING

The proposed on-site curb inlets have been spaced per City of Tualatin and CWS requirements to properly convey stormwater runoff. The proposed storm pipes have been sized to meet City of Tualatin requirements using Manning's equation to convey the peak flows from the 25-year storm event at maximum of 82 percent compacity.

6.2 PROPOSED STORMWATER QUALITY MANAGEMENT

Stormwater quality for Phase 1 will be provided via the northeast extended dry detention basin facility which is designed per CWS Design and Construction Standards. Prior to stormwater runoff reaching the facility, pre-treatment is provided by a water quality manhole designed per CWS standards for the 25-year storm event flow. The northeast stormwater facility is sized to treat all off-site contributing flows into the subdivision, Phase 1 impervious area, and future phases of the Autumn Sunrise subdivision. The storm facility will be planted per City of Tualatin and CWS standards.

Detailed calculations and checks against CWS criteria are included in the Appendices.

6.3 STORMWATER HYDROMODIFICATION MANAGEMENT

The total site will generate approximately 41 acres of impervious area, thus classifying as a Large Project. Per CWS Hydromod Planning Tool, the subject site is located within an expansion area and drains into a high-risk level exiting stream. Based on these parameters and CWS Table 4-2, the subject project is within Category 3 Hydromodification Approach.

Per CWS Category 3, the subject site will provide peak-flow matching detention, using design criteria in CWS Section 4.08.6 and a LIDA facility. Specifically, the subject site post-developed 2-year storm event runoff flows will not exceed the site pre-developed 50% of 2, 5, and 10-year storm event flows. The following table illustrates the results from the total site flows (including future phases) for each storm event as outlined within the CWS stormwater hydromodification requirements.

Table 6-1: Total Pre and Post Developed Flows			
Recurrence Interval (Years)	**Peak Pre-Development Flows (cfs)**	**Peak Post-Development Flows (cfs)**	**Peak Flow Increase or (Decrease) – (cfs)**
2	*4.69	4.38	(0.31)
5	12.70	7.91	(4.79)
10	15.98	10.94	(5.04)

*Peak pre-developed flow for 2-year storm event is calculated by subtracting 50% of the subject site (Basins 10S, 20S, 30S, 40S, 50S, 60S, 70S, and 110S) peak flow from the total pre-developed peak flow.

6.4 STORMWATER QUANTITY CONTROL FACILITY DESIGN

The proposed northeast stormwater facility quantity management by utilizing an extended dry basin designed per CWS standards and meeting ODOT flow criteria. The following table outline the results of the extended dry basin outflow which limits the post-development peak flows to less than the allowable pre-development peak flows for each storm event, as outlined within City of Tualatin, CWS, and ODOT stormwater detention management requirements. The peak flows were computed by analyzing flows at the eastern release point (i.e. eastern basin).

The extended dry basin has been designed per CWS requirements with at least 1-foot of freeboard, during the 25-year storm event, and a permanent pool storage depth of 0.2 feet.

Table 6-2: Northeast Facility Pre and Post Developed Flows			
Recurrence Interval (Years)	**Peak Pre-Development Flows (cfs)**	**Peak Post-Development Flows (cfs)**	**Peak Flow Increase or (Decrease) – (cfs)**
2	2.08	2.08	(0.00)
10	5.30	4.50	(0.80)
25	7.18	6.55	(0.63)
50	9.43	9.37	(0.06)

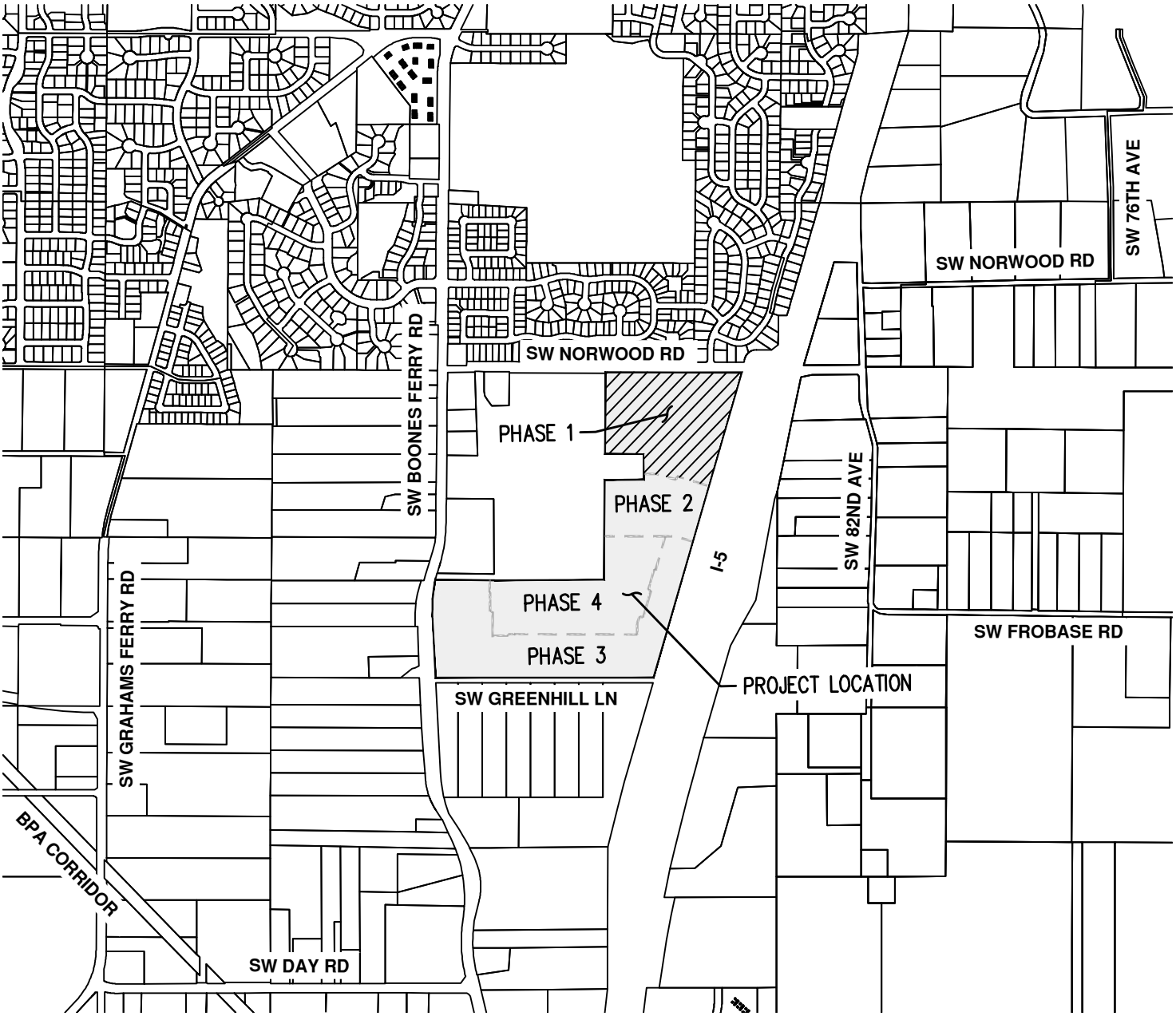
The proposed extended dry basin has sufficient capacity to detain the required post-developed site flows to less than or equal to the allowable pre-developed site flows, for each respective basin, and meets the requirements established by Clean Water Service's *Design and Construction for Sanitary Sewer and Surface Water Management Manual* (R&O 19-05) and ODOT Hydraulics Manual.

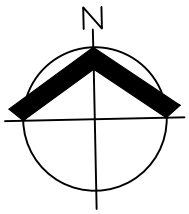
6.5 DOWNSTREAM ANALYSIS

Since the proposed development provides stormwater detention up to the 50-year peak storm event, only a visual investigation of the downstream system is required as additional peak flows are not being added to the existing systems. Stormwater runoff from the northeast facility will be conveyed and directed into the existing Interstate 5 drainage channel. The proposed site storm runoff is conveyed from the northeast facility via a 24 inch pipe, releasing into an existing ODOT I-5 channel. From there, runoff is conveyed to the within the I-5 roadside ditch.

A quarter mile downstream visual investigation of the storm system was performed, and no obstructions were found.

Figure 1: Site Vicinity Map





SCALE: 1"=1200 FEET

1200 0 300 600 1200

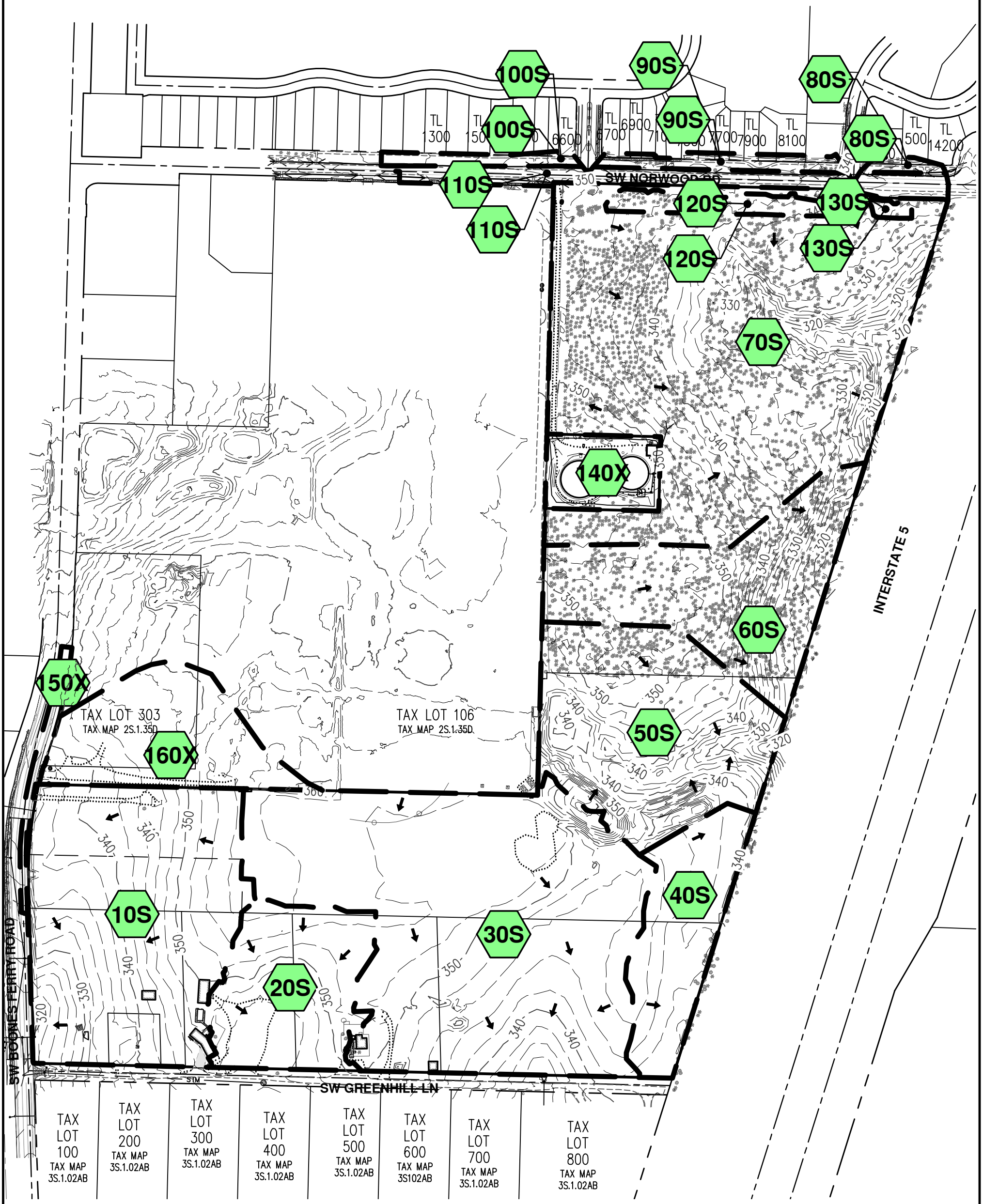
ORIGINAL PAGE SIZE: 11" x 8.5"

DATE: 5/5/2022

SITE VICINITY MAP AUTUMN SUNRISE	FIGURE 1
AKS ENGINEERING & FORESTRY, LLC 12965 SW HERMAN RD, STE 100 TUALATIN, OR 97062 503.563.6151 WWW.AKS-ENG.COM	DRWN: JSM CHKD: DS AKS JOB: 7454

DWG: VICINITY MAP | LAYOUT1

Figure 2: Pre-Developed Basin Delineation



N

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250 0 50 125 250

DATE: 5/5/2022

PRE-DEVELOPED BASIN DELINEATION

AUTUMN SUNRISE SUBDIVISION

FIGURE 2

AKS ENGINEERING & FORESTRY, LLC
12965 SW HERMAN RD, STE 100
TUALATIN, OR 97062
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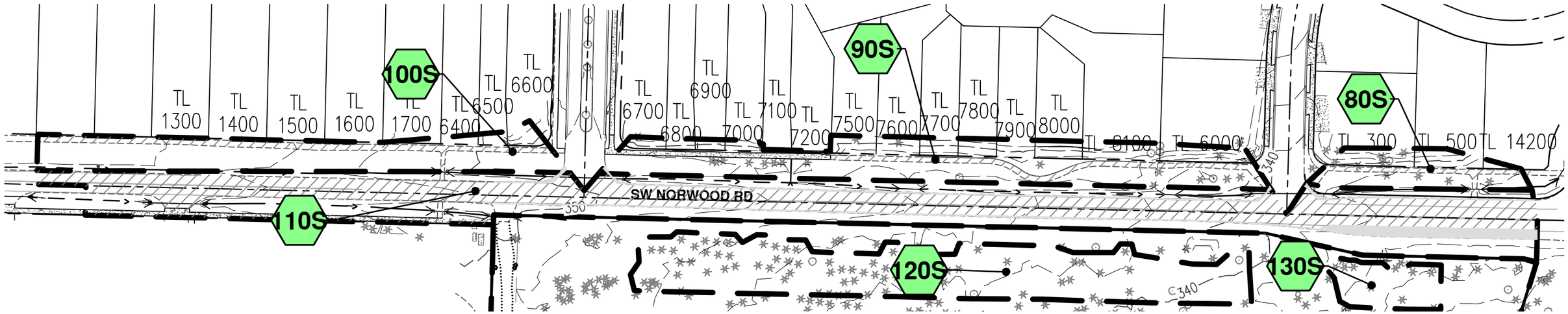
DRWN: JSM
CHKD: DS
AKS JOB: 7454

DWG: PRE-DEVELOPED | LAYOUT1



INDICATES EXISTING IMPERVIOUS AREA TO BE MODIFIED.
CN VALUE OF 75.

INDICATES EXISTING IMPERVIOUS AREA TO BE OVERLAID.
CN VALUE OF 98.

N

SCALE: 1"=100 FEET

100 0 20 50 100

DATE: 5/5/2022

PRE-DEVELOPED BASIN DELINEATION

AUTUMN SUNRISE SUBDIVISION

FIGURE **2A**

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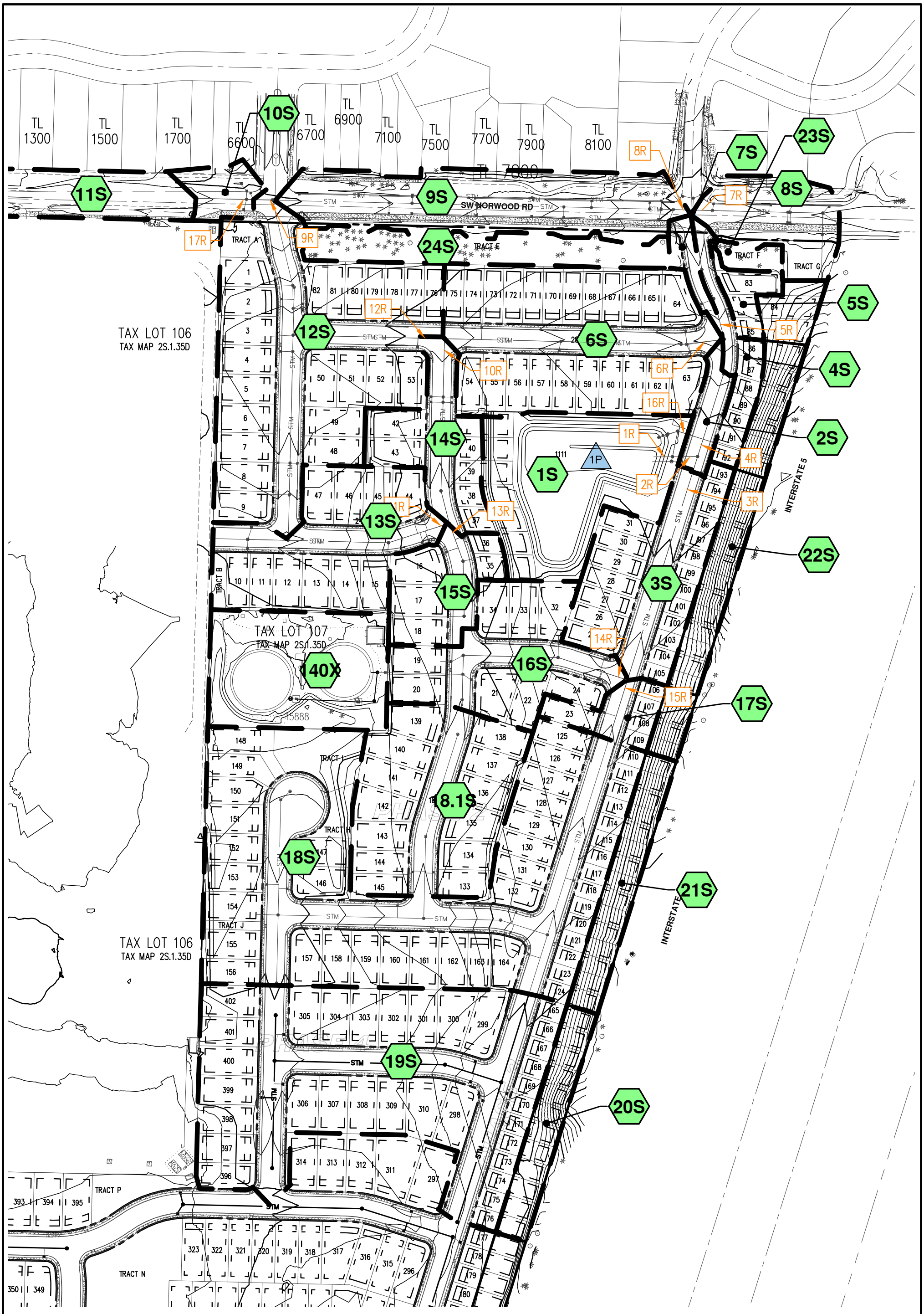
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: JSM
CHKD: DS
AKS JOB: 7454

DWG: PRE-DEVELOPED | LAYOUT1 (2)

Figure 3: Post-Developed Basin Delineation



N

SCALE: 1"=150 FEET

150 0 30 75 150

DATE: 5/5/2022

POST-DEVELOPED BASIN DELINEATION

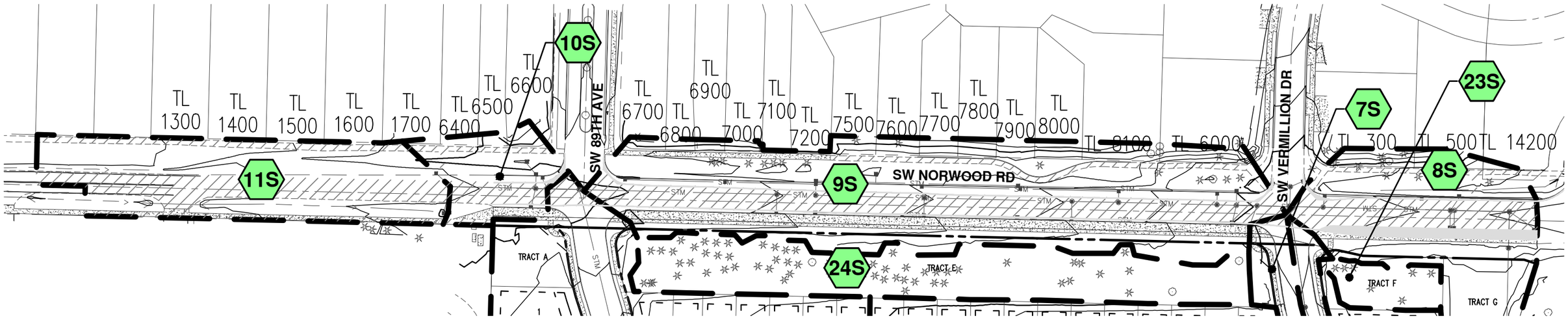
FIGURE 3

AUTUMN SUNRISE SUBDIVISION

AKS ENGINEERING & FORESTRY, LLC
12965 SW HERMAN RD, STE 100
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: JSM
CHKD: DS
AKS JOB: 7454

DWG: PH1 – POST-DEVELOPED | LAYOUT1



INDICATES EXISTING IMPERVIOUS AREA TO BE MODIFIED. CN VALUE OF 98.

INDICATES EXISTING IMPERVIOUS AREA TO BE OVERLAID. CN VALUE OF 98.

N

SCALE: 1"=100 FEET

100 0 20 50 100

DATE: 5/5/2022

POST DEVELOPED BASIN DELINEATION

AUTUMN SUNRISE SUBDIVISION

FIGURE 3A

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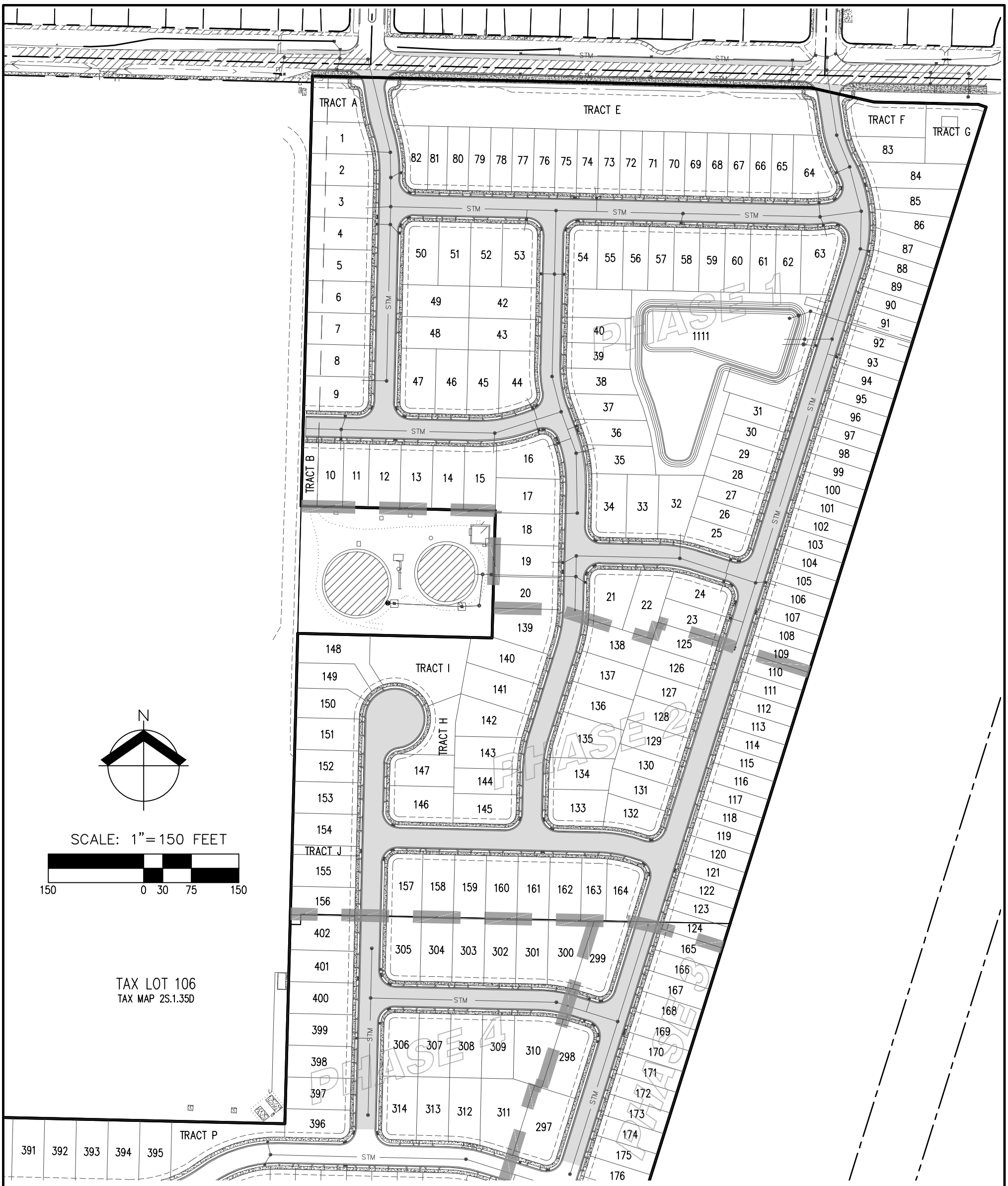
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: JSM
CHKD: DS
AKS JOB: 7454

DWG: PH1 - POST-DEVELOPED | LAYOUT1 (2)

Figure 4: Stormwater Treatment Map



POST-DEVELOPED IMPERVIOUS AREA TABLE

PHASE 1 PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT	464,681 SF
PHASE 2 PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT	222,806 SF
PHASE 3 PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT	60,139 SF
PHASE 4 PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT	86,469 SF
TOTAL PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT	834,095 SF
EXISTING UNTREATED IMPERVIOUS AREA RECEIVING TREATMENT WITHIN PROPOSED FACILITY	61,383 SF
REQUIRED IMPERVIOUS AREA TO TREAT	834,095 SF
IMPERVIOUS AREA TREATMENT PROVIDED	895,478 SF
NET TOTAL	+61,383 SF

INDICATES PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT
2,640 SQ. FT. ASSUMED FOR ALL LOTS

INDICATES EXISTING UNTREATED IMPERVIOUS AREA TO BE TREATED WITHIN THE PROPOSED FACILITY

DATE: 5/5/2022

WATER QUALITY TREATMENT MAP

PHASE 1 AUTUMN SUNRISE SUBDIVISION

FIGURE 4

AKS ENGINEERING & FORESTRY, LLC
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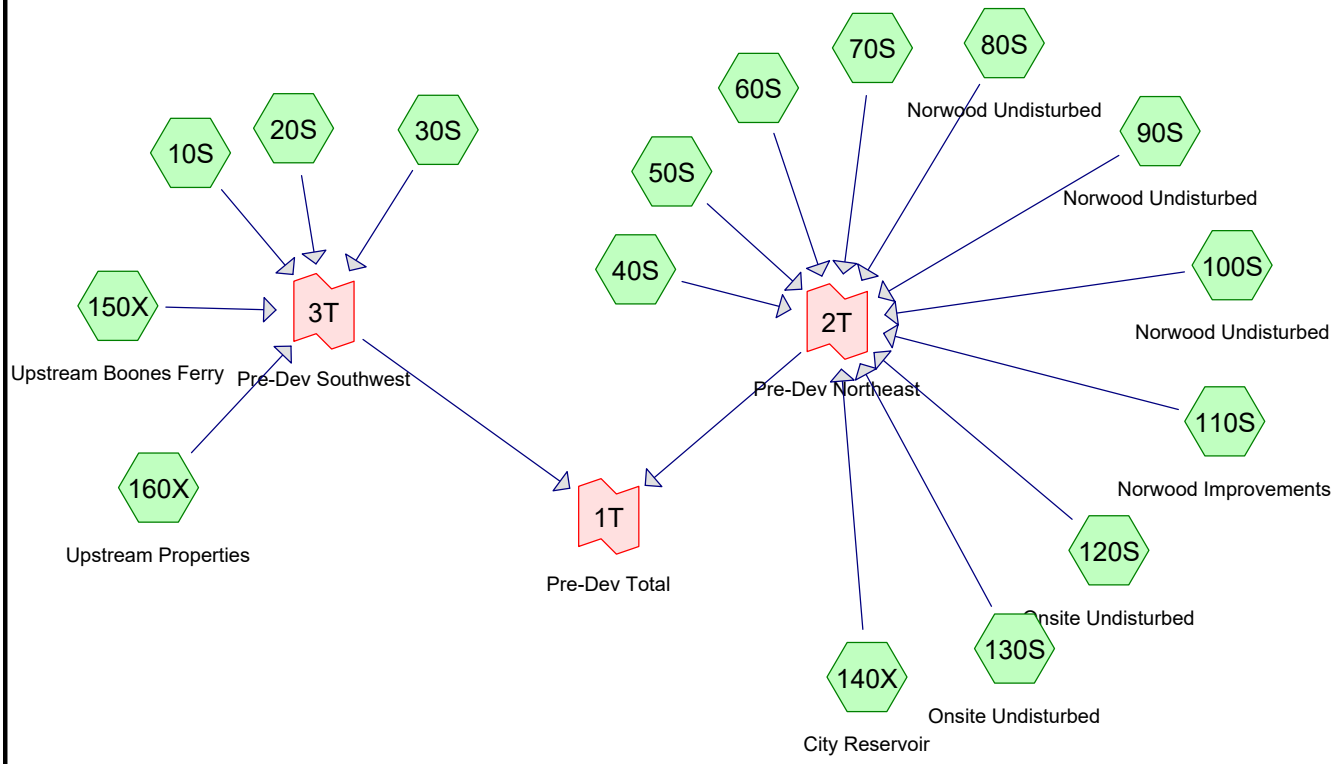
CHKD: DS
AKS JOB: 7454

Appendix A: HydroCAD Reports for Pre-Developed Condition Storm Events (25-Year Storm Event Analysis) (50-Year Storm Event Summary) (10-Year Storm Event Summary) (5-Year Storm Event Summary) (2-Year Storm Event Summary)



Subcat Reach Pond Link

Routing Diagram for 7454 Pre-Developed
Prepared by AKS Engineering and Forestry, Printed 4/26/2022

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
199,375	79	50-75% Grass cover, Fair, HSG C (80S, 90S, 100S, 110S, 160X)
46,914	86	<50% Grass cover, Poor, HSG C (140X)
8,685	74	>75% Grass cover, Good, HSG C (150X)
168,971	75	Dirt roads, HSG C (10S, 20S, 30S)
123,564	82	Farmsteads, HSG C (10S)
2,000	75	Gravel roads, HSG C (30S)
5,905	75	Gravel surface, HSG C (10S)
12,930	96	Gravel surface, HSG C (160X)
77,724	98	Impervious Area (80S, 90S, 100S, 110S, 150X, 160X)
4,232	75	Impervious Area (Modified) (110S)
1,920	75	Paved parking, HSG C (20S, 30S)
14,216	98	Paved roads w/curbs & sewers, HSG C (140X)
1,044,944	85	Row crops, straight row, Good, HSG C (10S, 20S, 30S, 40S)
7,483	75	Unconnected roofs, HSG C (10S, 30S)
123,094	73	Woods, Fair, HSG C (50S)
1,042,216	70	Woods, Good, HSG C (60S, 70S, 120S, 130S)
171,927	72	Woods/grass comb., Good, HSG C (50S)
3,056,100	**78**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Link 1T: Pre-Dev Total Inflow=20.45 cfs 460,732 cf
Primary=20.45 cfs 460,732 cf

Link 2T: Pre-Dev Northeast Inflow=7.18 cfs 206,235 cf
Primary=7.18 cfs 206,235 cf

Link 3T: Pre-Dev Southwest Inflow=13.28 cfs 254,497 cf
Primary=13.28 cfs 254,497 cf

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>2.18"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=4.20 cfs 74,070 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>1.86"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=1.24 cfs 25,742 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>2.25"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=6.03 cfs 120,873 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>2.36"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=1.72 cfs 26,979 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>1.37"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=1.22 cfs 33,560 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.71 cfs 25,581 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=2.05 cfs 76,724 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>2.16"
Tc=5.0 min CN=79/98 Runoff=0.09 cfs 1,356 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>2.11"
Tc=5.0 min CN=79/98 Runoff=0.31 cfs 4,728 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>2.18"
Tc=5.0 min CN=79/98 Runoff=0.22 cfs 3,321 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>2.73"
Tc=51.0 min CN=79/98 Runoff=0.66 cfs 16,665 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.09 cfs 3,253 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.01 cfs 494 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>2.66"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.51 cfs 13,576 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>2.62"
Tc=5.0 min CN=74/98 Runoff=0.26 cfs 3,931 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>2.26"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.60 cfs 29,881 cf

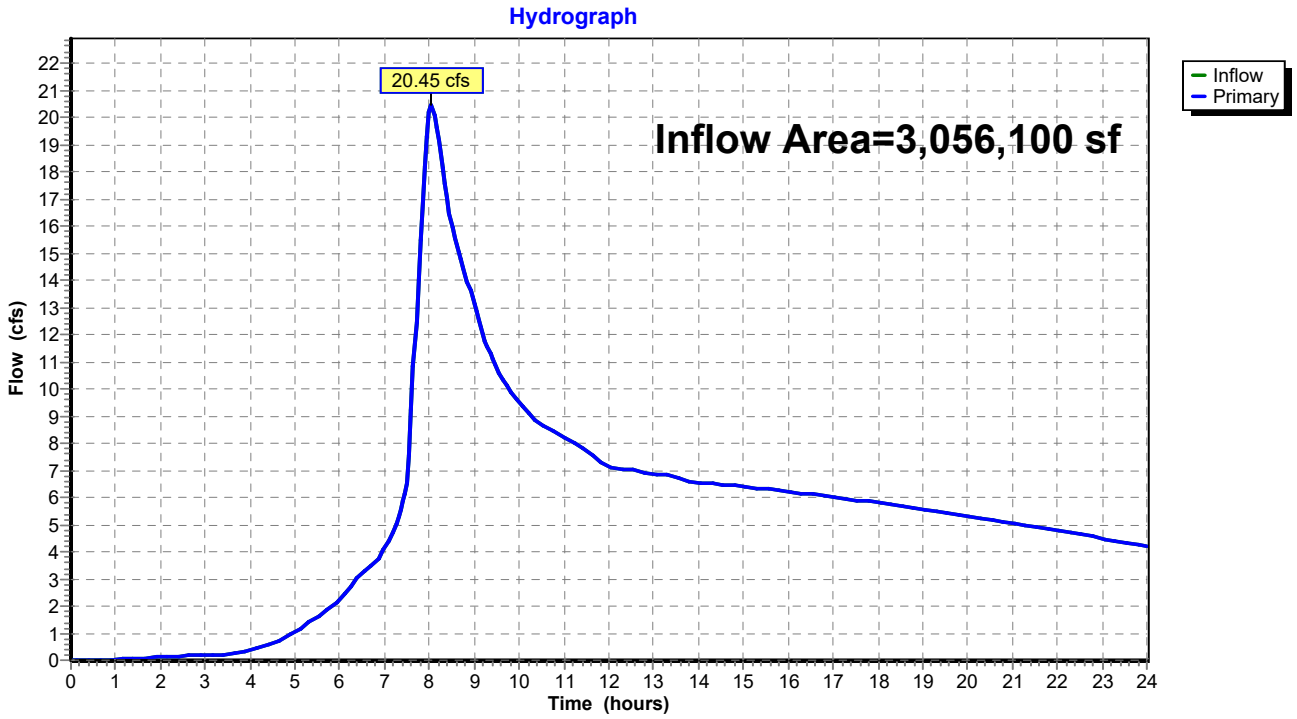
Total Runoff Area = 3,056,100 sf Runoff Volume = 460,732 cf Average Runoff Depth = 1.81"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Summary for Link 1T: Pre-Dev Total

Inflow Area = 3,056,100 sf, 3.01% Impervious, Inflow Depth > 1.81" for 25-YEAR event
Inflow = 20.45 cfs @ 8.04 hrs, Volume= 460,732 cf
Primary = 20.45 cfs @ 8.04 hrs, Volume= 460,732 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1T: Pre-Dev Total

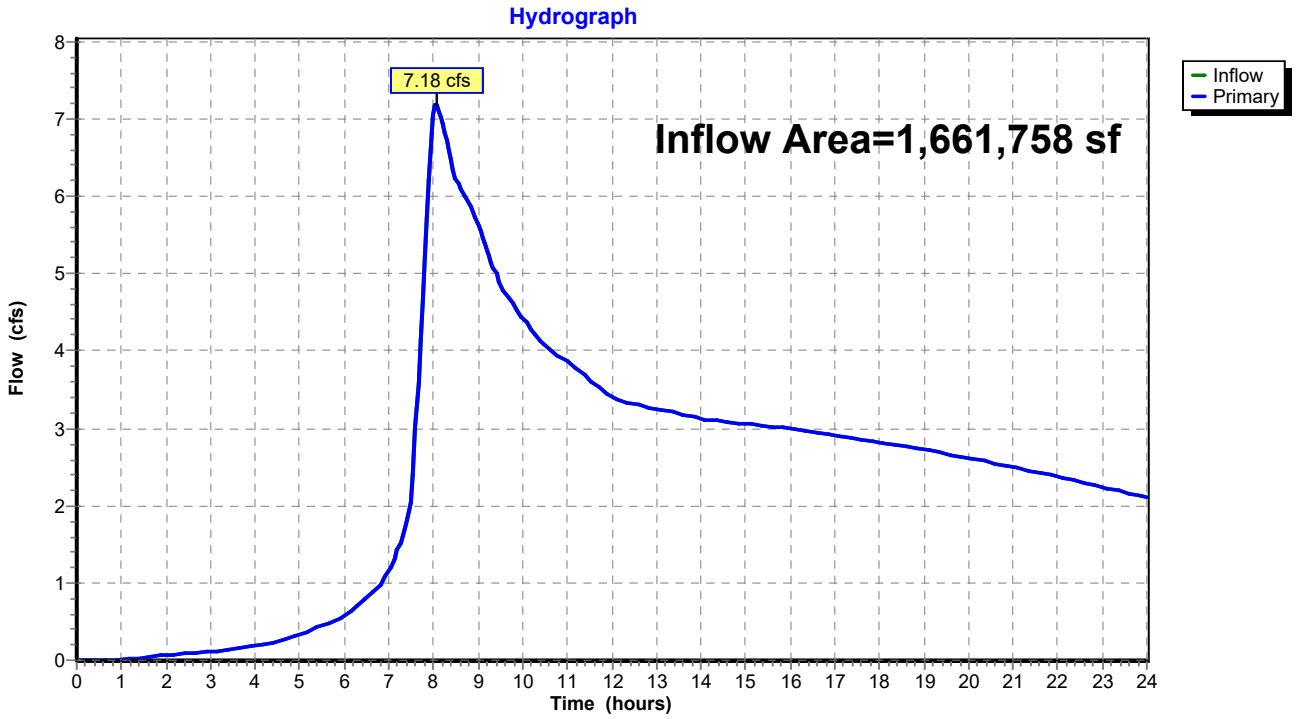


Summary for Link 2T: Pre-Dev Northeast

Inflow Area = 1,661,758 sf, 3.57% Impervious, Inflow Depth > 1.49" for 25-YEAR event
Inflow = 7.18 cfs @ 8.06 hrs, Volume= 206,235 cf
Primary = 7.18 cfs @ 8.06 hrs, Volume= 206,235 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2T: Pre-Dev Northeast

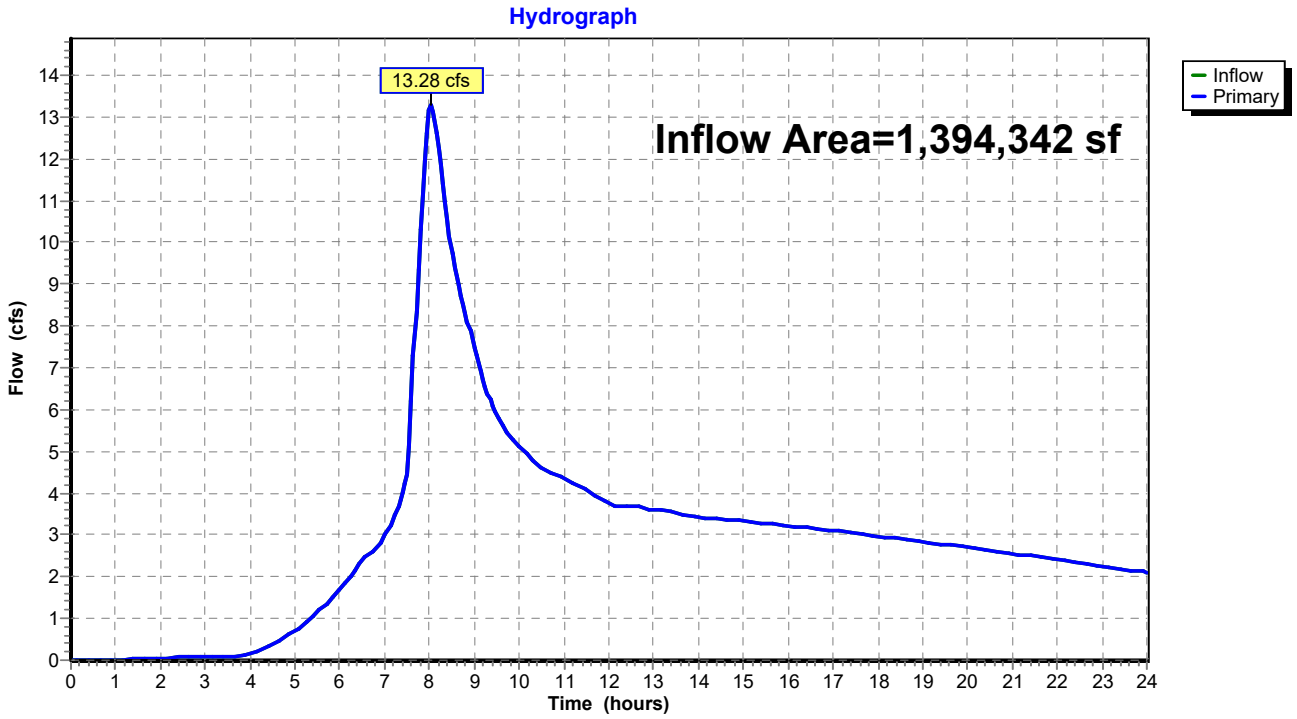


Summary for Link 3T: Pre-Dev Southwest

Inflow Area = 1,394,342 sf, 2.34% Impervious, Inflow Depth > 2.19" for 25-YEAR event
Inflow = 13.28 cfs @ 8.04 hrs, Volume= 254,497 cf
Primary = 13.28 cfs @ 8.04 hrs, Volume= 254,497 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3T: Pre-Dev Southwest



Summary for Subcatchment 10S:

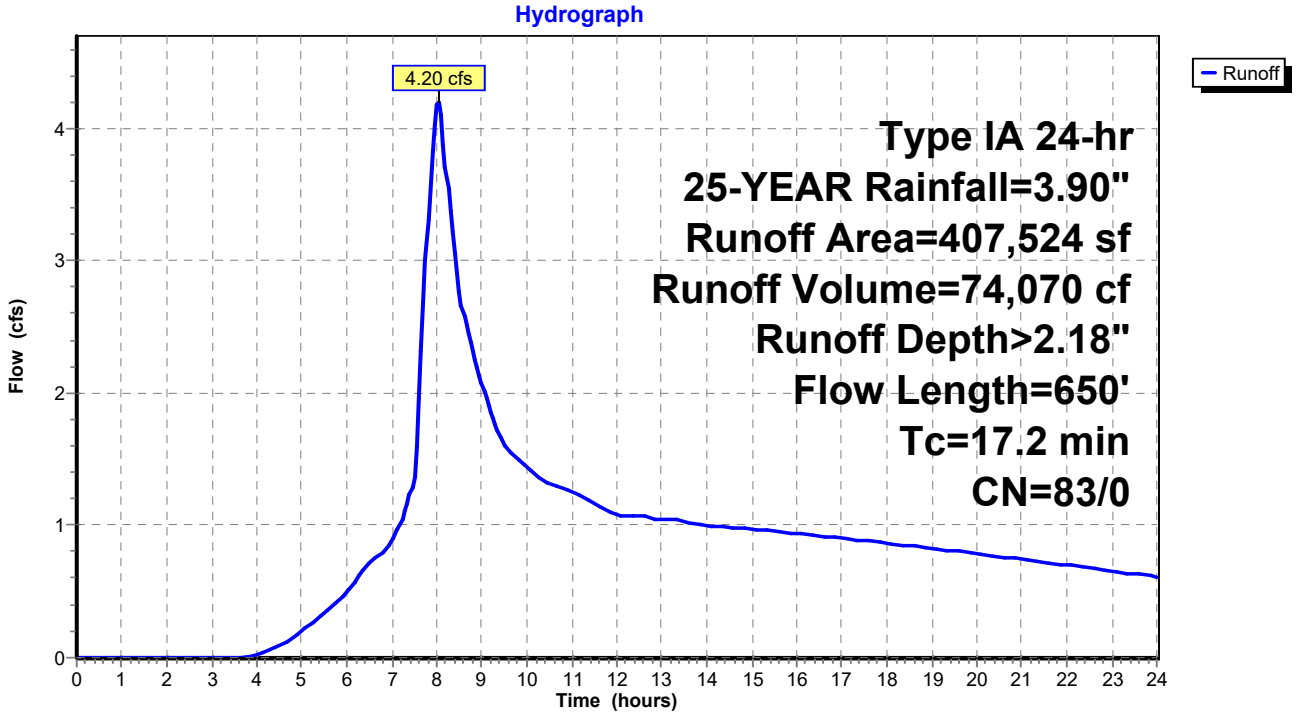
Runoff = 4.20 cfs @ 8.02 hrs, Volume= 74,070 cf, Depth> 2.18"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	123,564	82	Farmsteads, HSG C
	256,474	85	Row crops, straight row, Good, HSG C
*	5,905	75	Gravel surface, HSG C
*	5,200	75	Unconnected roofs, HSG C
*	16,381	75	Dirt roads, HSG C
	407,524	83	Weighted Average
	407,524	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	200	0.0500	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
3.7	450	0.0400	2.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
17.2	650	Total			

Subcatchment 10S:



Summary for Subcatchment 20S:

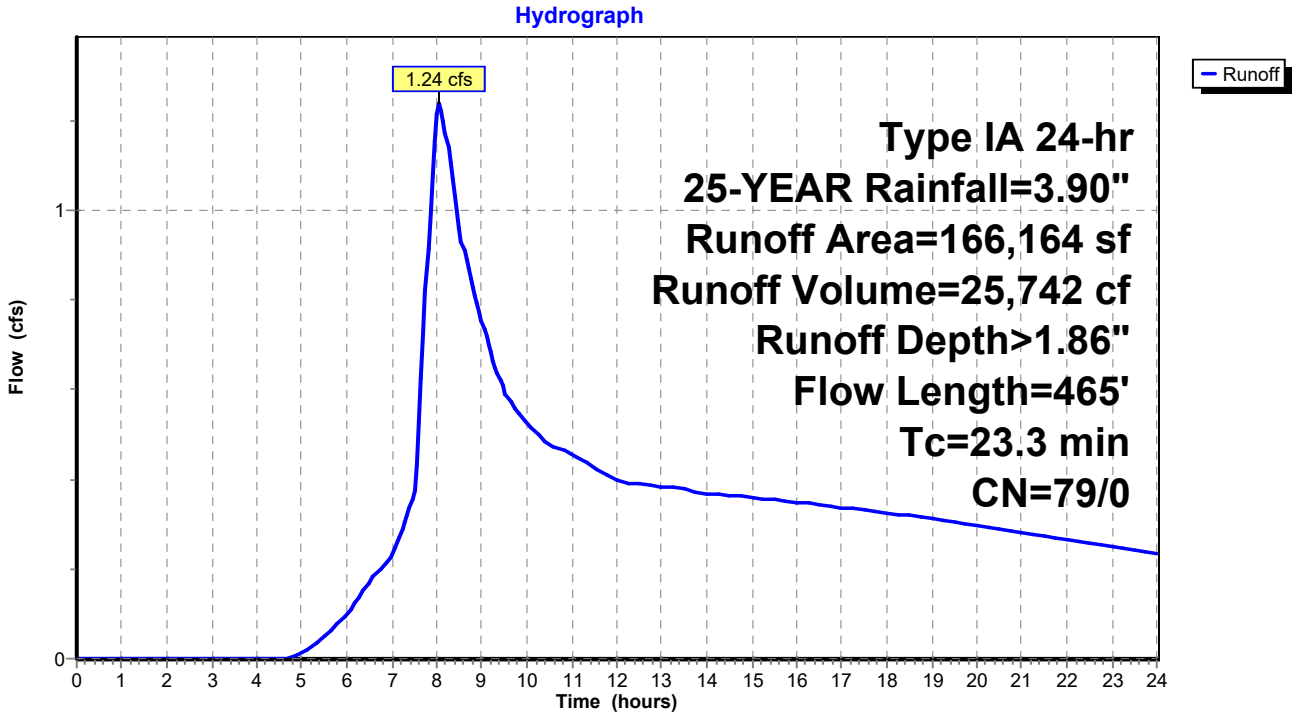
Runoff = 1.24 cfs @ 8.05 hrs, Volume= 25,742 cf, Depth> 1.86"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	93,934	75	Dirt roads, HSG C
	70,900	85	Row crops, straight row, Good, HSG C
*	1,330	75	Paved parking, HSG C
	166,164	79	Weighted Average
	166,164	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.4	230	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
3.9	235	0.0100	1.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
23.3	465	Total			

Subcatchment 20S:



Summary for Subcatchment 30S:

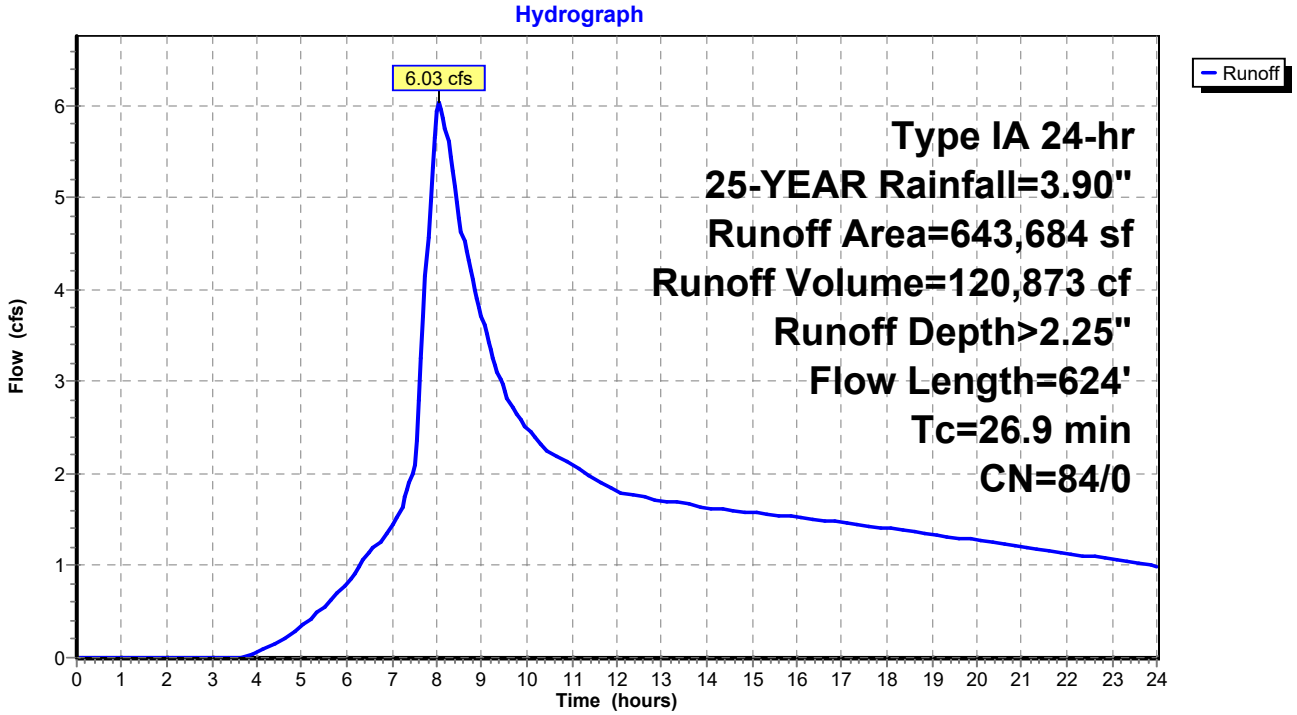
Runoff = 6.03 cfs @ 8.05 hrs, Volume= 120,873 cf, Depth> 2.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	58,656	75	Dirt roads, HSG C
*	2,000	75	Gravel roads, HSG C
*	2,283	75	Unconnected roofs, HSG C
*	590	75	Paved parking, HSG C
	580,155	85	Row crops, straight row, Good, HSG C
	643,684	84	Weighted Average
	643,684	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	300	0.0260	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
2.9	324	0.0350	1.87		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
26.9	624	Total			

Subcatchment 30S:



Summary for Subcatchment 40S:

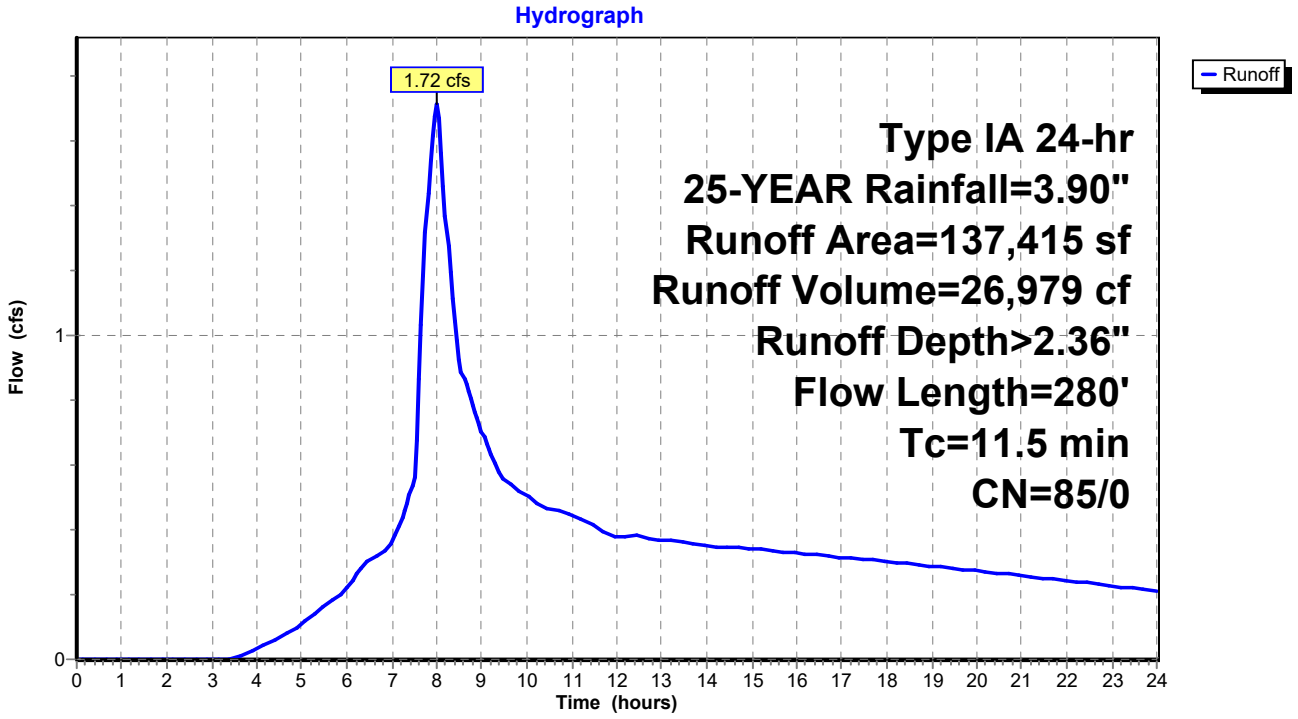
Runoff = 1.72 cfs @ 8.00 hrs, Volume= 26,979 cf, Depth> 2.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
137,415	85	Row crops, straight row, Good, HSG C
137,415	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	150	0.0420	0.25		**Sheet Flow,** Range n= 0.130 P2= 2.50"
1.3	130	0.0300	1.73		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
11.5	280	Total			

Subcatchment 40S:



Summary for Subcatchment 50S:

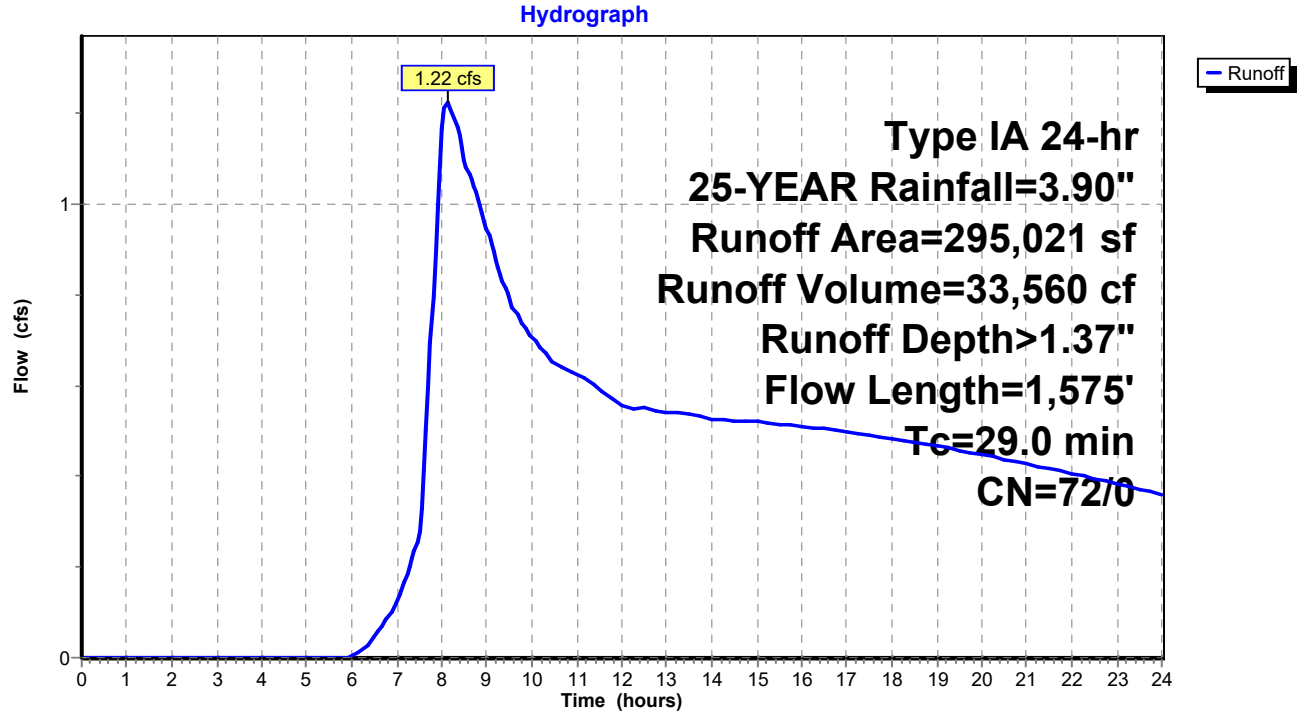
Runoff = 1.22 cfs @ 8.14 hrs, Volume= 33,560 cf, Depth> 1.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
171,927	72	Woods/grass comb., Good, HSG C
123,094	73	Woods, Fair, HSG C
295,021	72	Weighted Average
295,021	72	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.0650	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.4	535	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	940	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
29.0	1,575	Total			

Subcatchment 50S:



Summary for Subcatchment 60S:

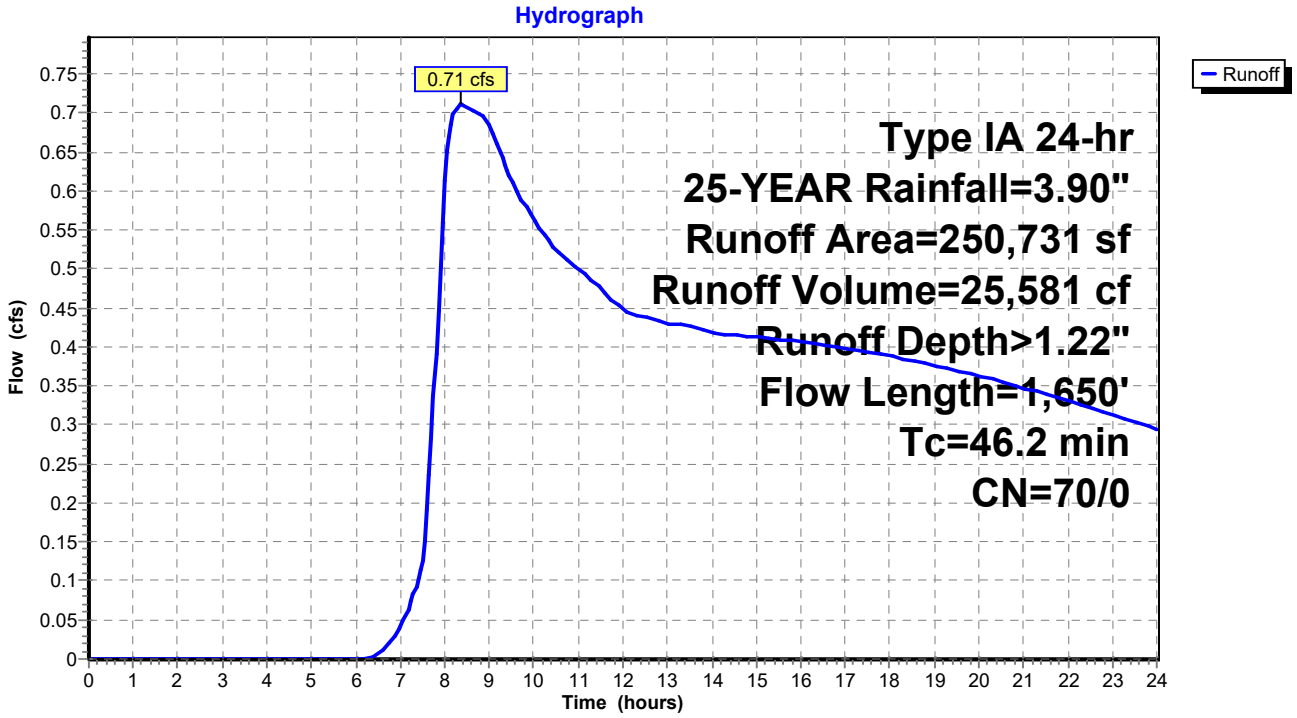
Runoff = 0.71 cfs @ 8.36 hrs, Volume= 25,581 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
250,731	70	Woods, Good, HSG C
250,731	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.5	1,500	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
46.2	1,650	Total			

Subcatchment 60S:



Summary for Subcatchment 70S:

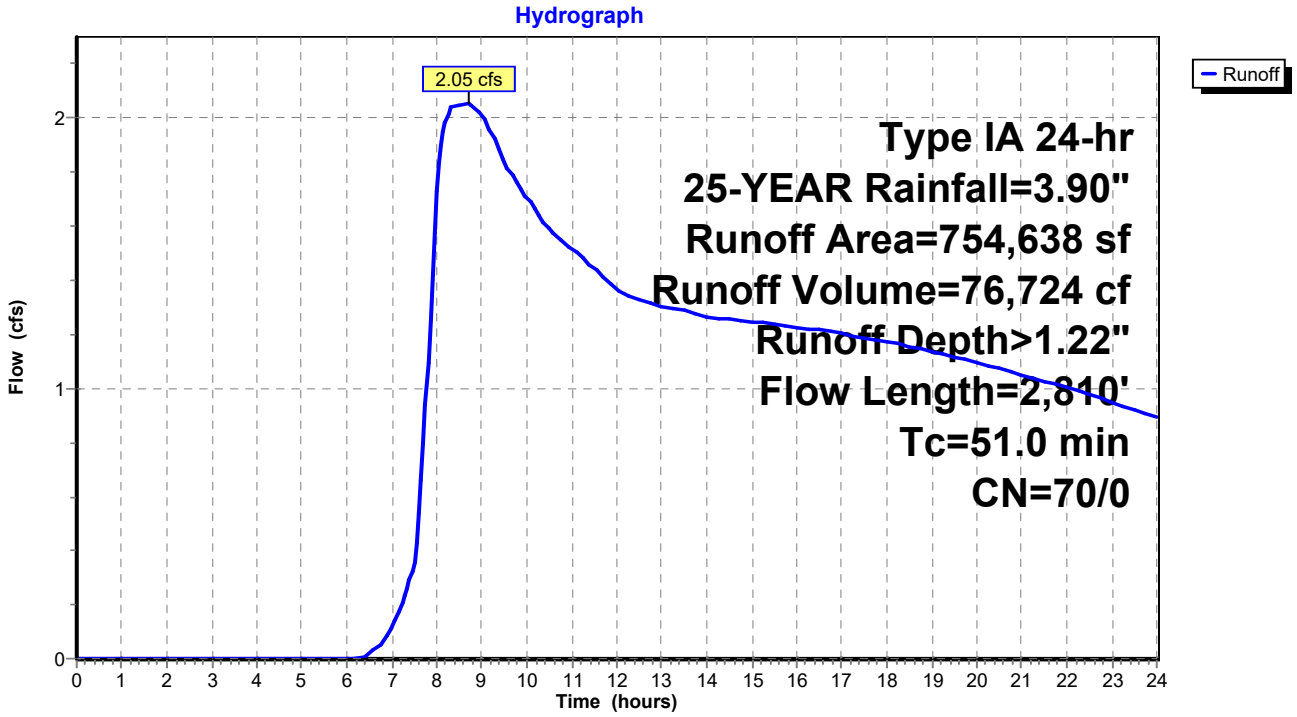
Runoff = 2.05 cfs @ 8.70 hrs, Volume= 76,724 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
754,638	70	Woods, Good, HSG C
754,638	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
51.0	2,810	Total			

Subcatchment 70S:



Summary for Subcatchment 80S: Norwood Undisturbed

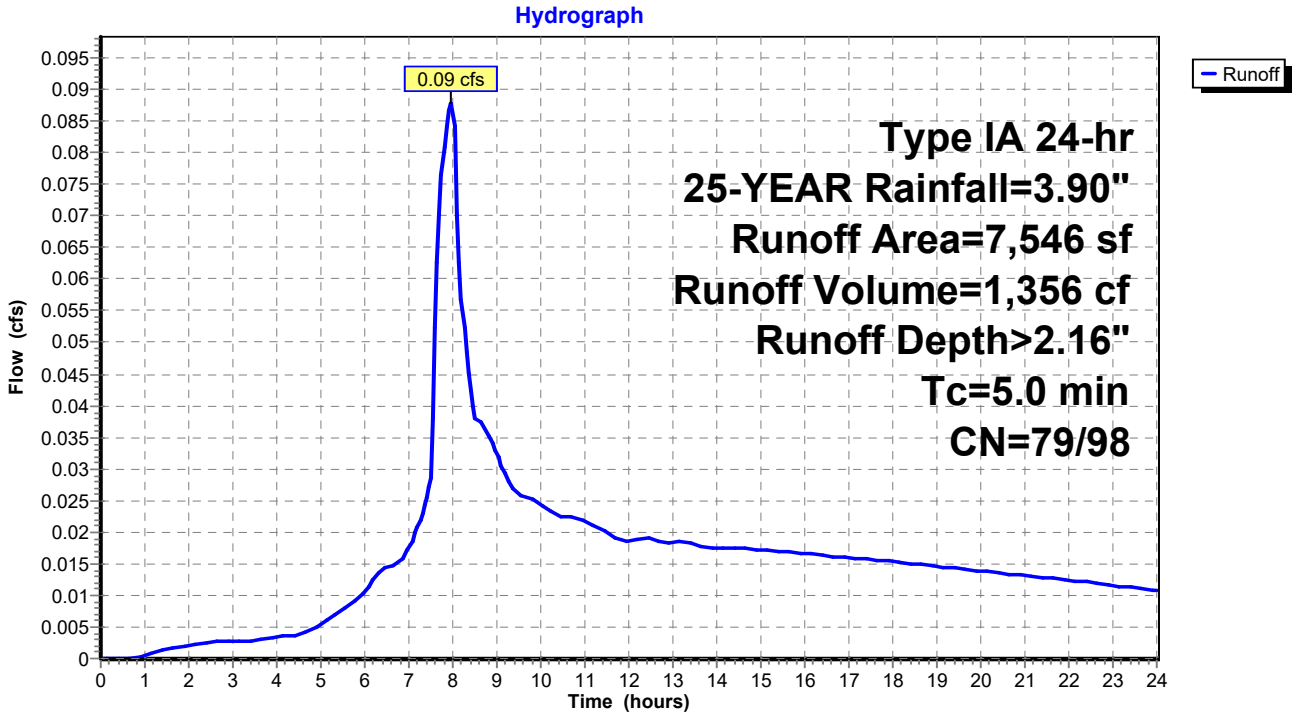
Runoff = 0.09 cfs @ 7.97 hrs, Volume= 1,356 cf, Depth> 2.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	1,182	98	Impervious Area
	6,364	79	50-75% Grass cover, Fair, HSG C
	7,546	82	Weighted Average
	6,364	79	84.34% Pervious Area
	1,182	98	15.66% Impervious Area

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

Subcatchment 80S: Norwood Undisturbed



Summary for Subcatchment 90S: Norwood Undisturbed

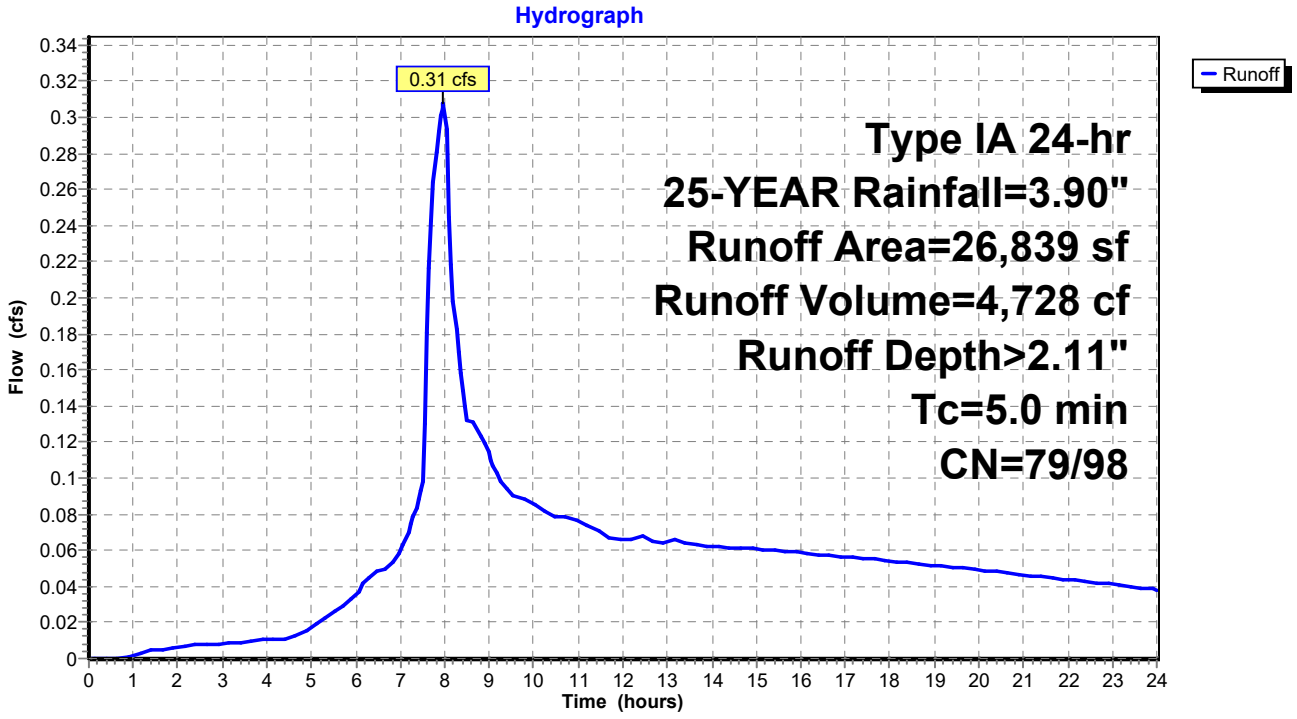
Runoff = 0.31 cfs @ 7.98 hrs, Volume= 4,728 cf, Depth> 2.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	3,558	98	Impervious Area
	23,281	79	50-75% Grass cover, Fair, HSG C
	26,839	82	Weighted Average
	23,281	79	86.74% Pervious Area
	3,558	98	13.26% Impervious Area

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

Subcatchment 90S: Norwood Undisturbed



Summary for Subcatchment 100S: Norwood Undisturbed

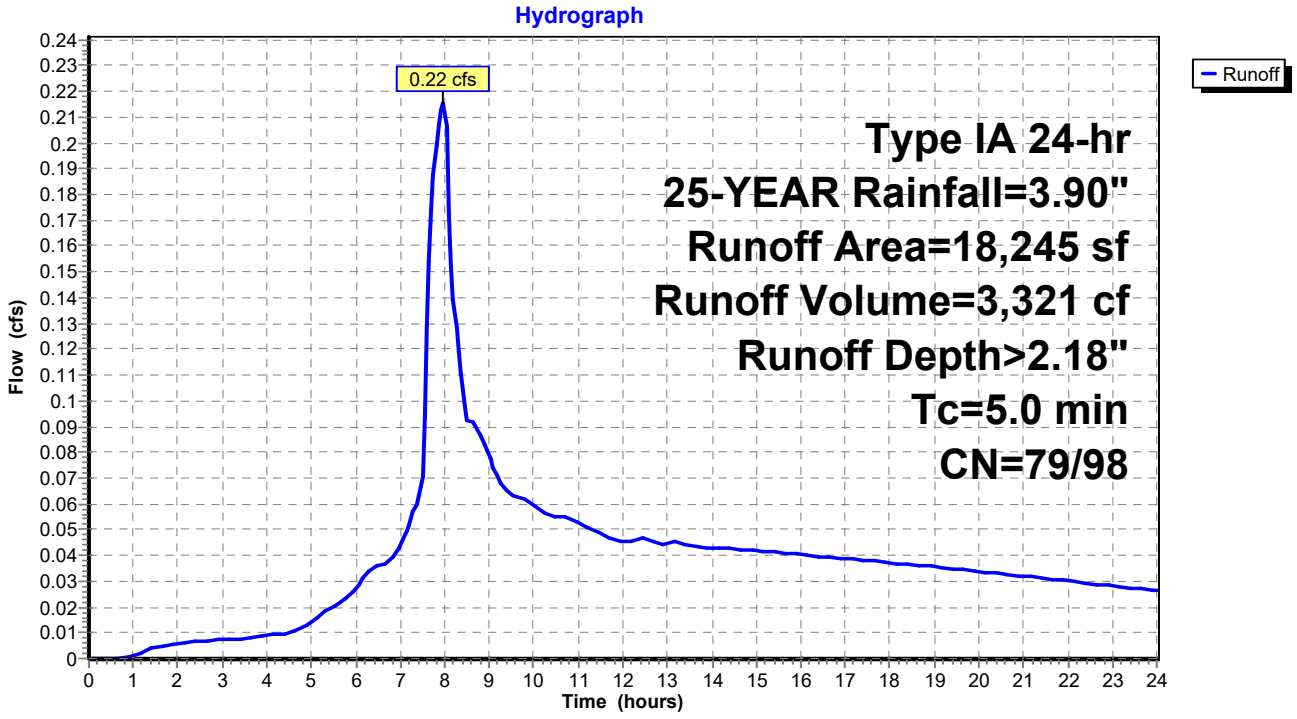
Runoff = 0.22 cfs @ 7.97 hrs, Volume= 3,321 cf, Depth> 2.18"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	3,143	98	Impervious Area
	15,102	79	50-75% Grass cover, Fair, HSG C
	18,245	82	Weighted Average
	15,102	79	82.77% Pervious Area
	3,143	98	17.23% Impervious Area

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

Subcatchment 100S: Norwood Undisturbed



Summary for Subcatchment 110S: Norwood Improvements

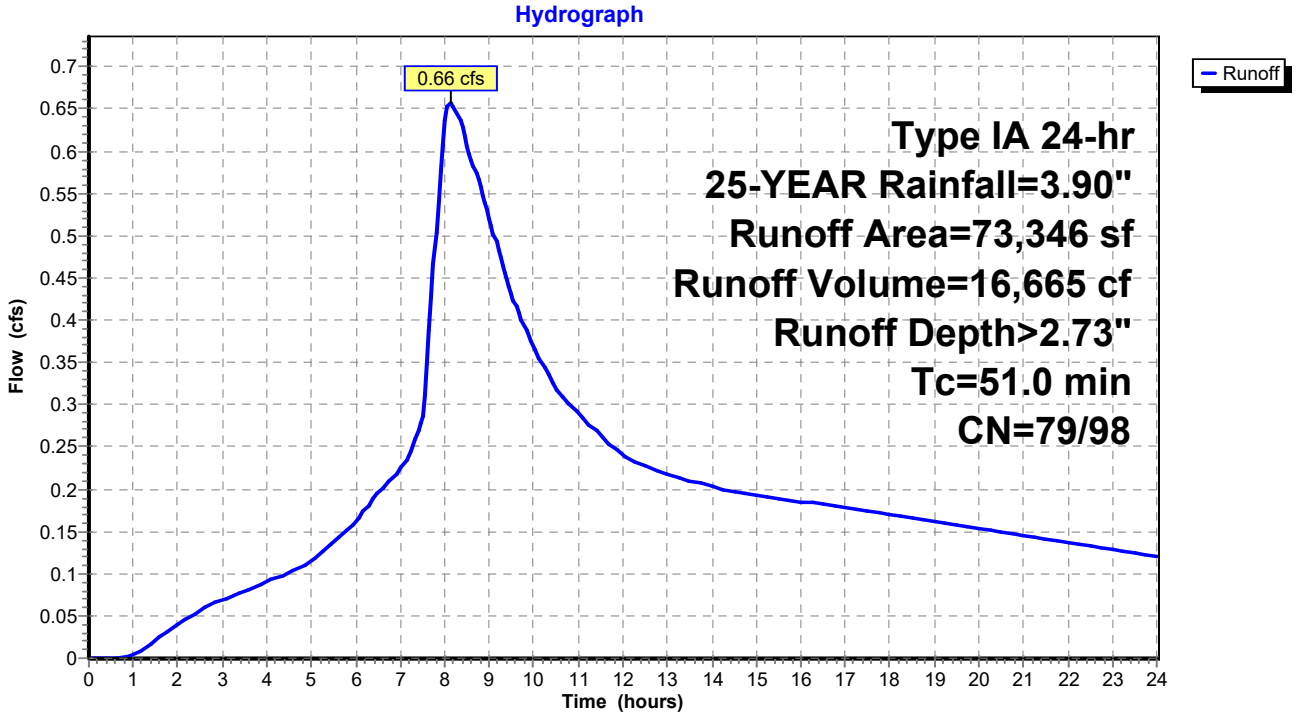
Runoff = 0.66 cfs @ 8.14 hrs, Volume= 16,665 cf, Depth> 2.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	37,185	98	Impervious Area
*	4,232	75	Impervious Area (Modified)
	31,929	79	50-75% Grass cover, Fair, HSG C
	73,346	88	Weighted Average
	36,161	79	49.30% Pervious Area
	37,185	98	50.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
51.0					**Direct Entry, Tc through Site (Basin 70S)**

Subcatchment 110S: Norwood Improvements



Summary for Subcatchment 120S: Onsite Undisturbed

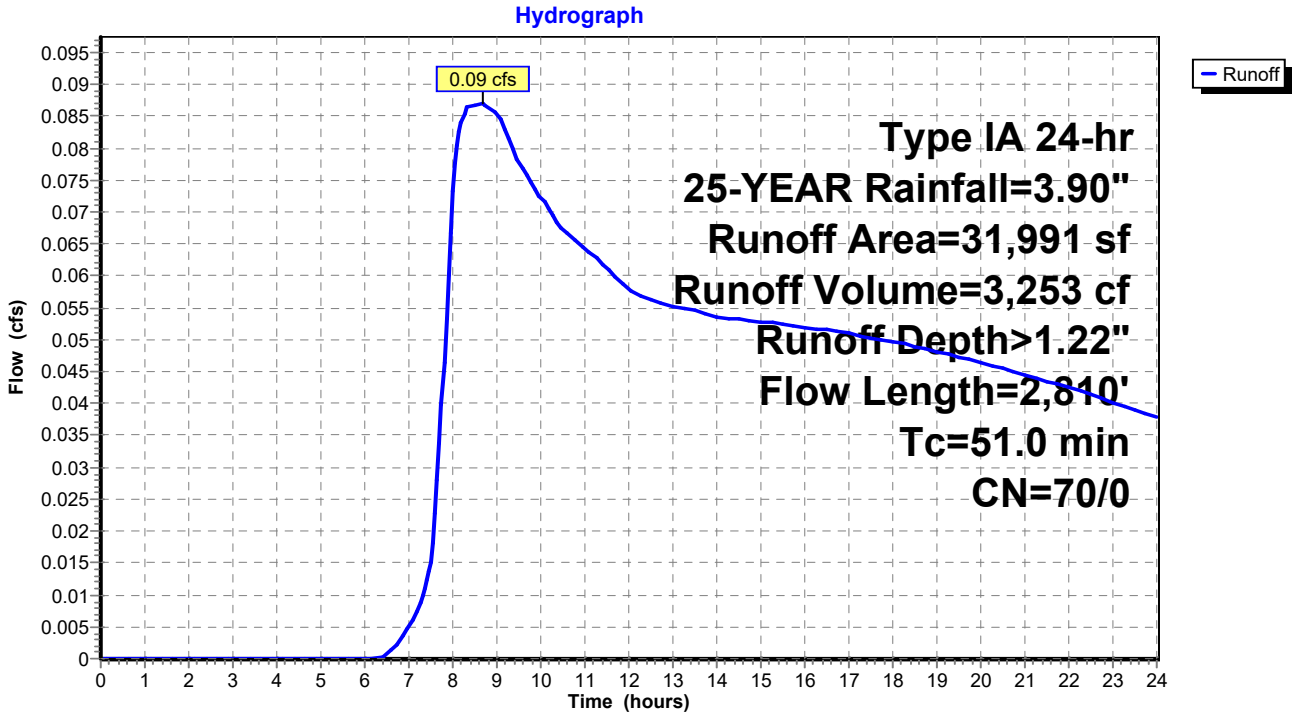
Runoff = 0.09 cfs @ 8.70 hrs, Volume= 3,253 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
31,991	70	Woods, Good, HSG C
31,991	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
51.0	2,810	Total			

Subcatchment 120S: Onsite Undisturbed



Summary for Subcatchment 130S: Onsite Undisturbed

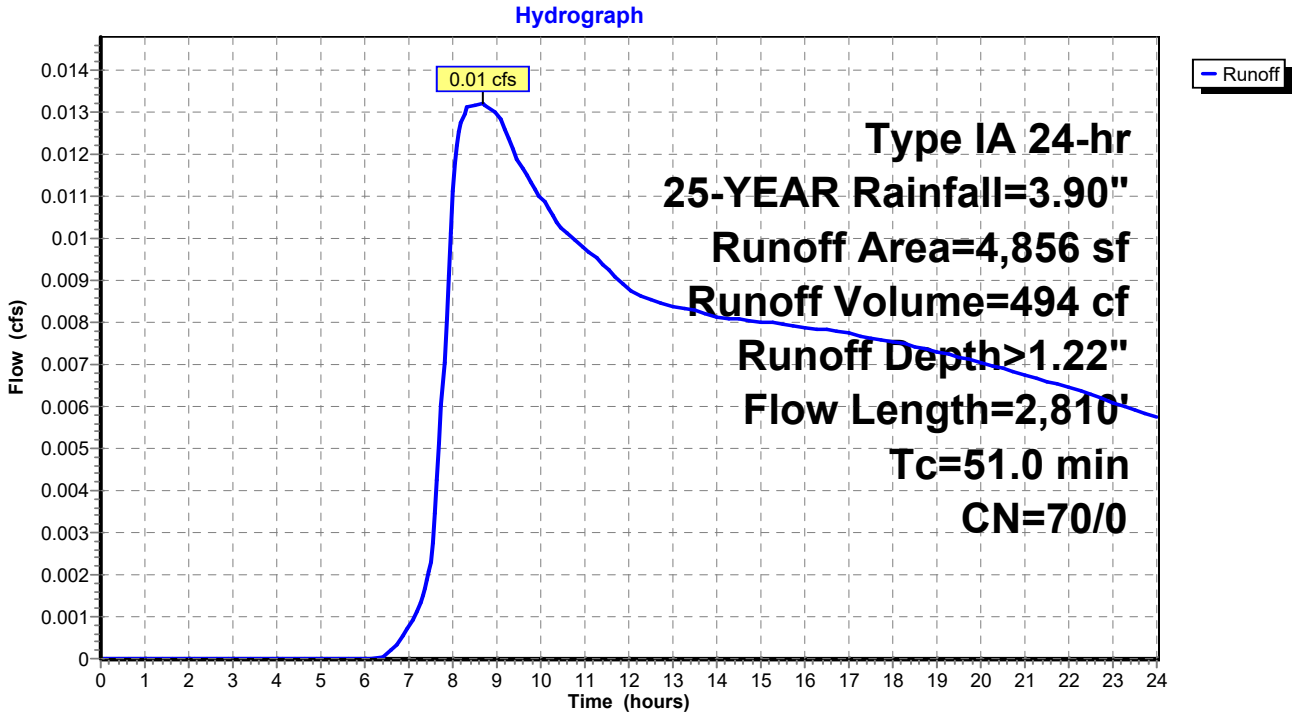
Runoff = 0.01 cfs @ 8.70 hrs, Volume= 494 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
4,856	70	Woods, Good, HSG C
4,856	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
51.0	2,810	Total			

Subcatchment 130S: Onsite Undisturbed



Summary for Subcatchment 140X: City Reservoir

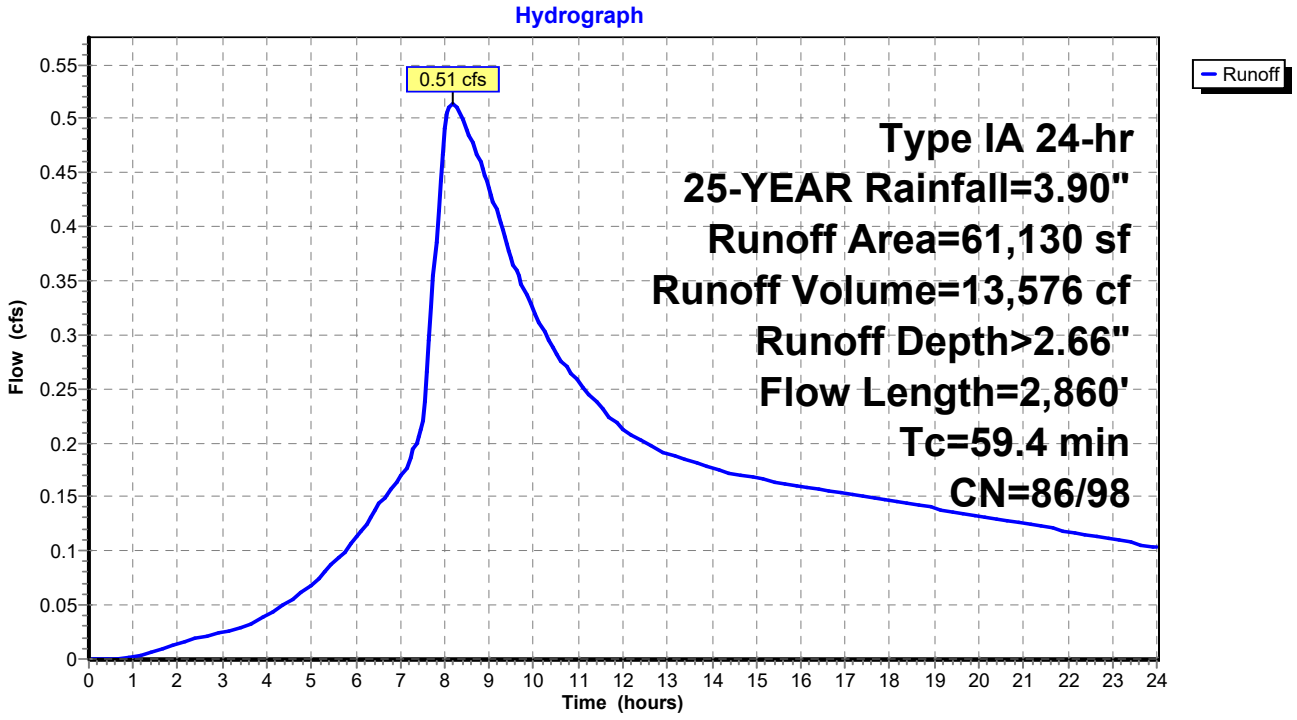
Runoff = 0.51 cfs @ 8.20 hrs, Volume= 13,576 cf, Depth> 2.66"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
14,216	98	Paved roads w/curbs & sewers, HSG C
46,914	86	<50% Grass cover, Poor, HSG C
61,130	89	Weighted Average
46,914	86	76.74% Pervious Area
14,216	98	23.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0100	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
59.4	2,860	Total			

Subcatchment 140X: City Reservoir



Summary for Subcatchment 150X: Upstream Boones Ferry

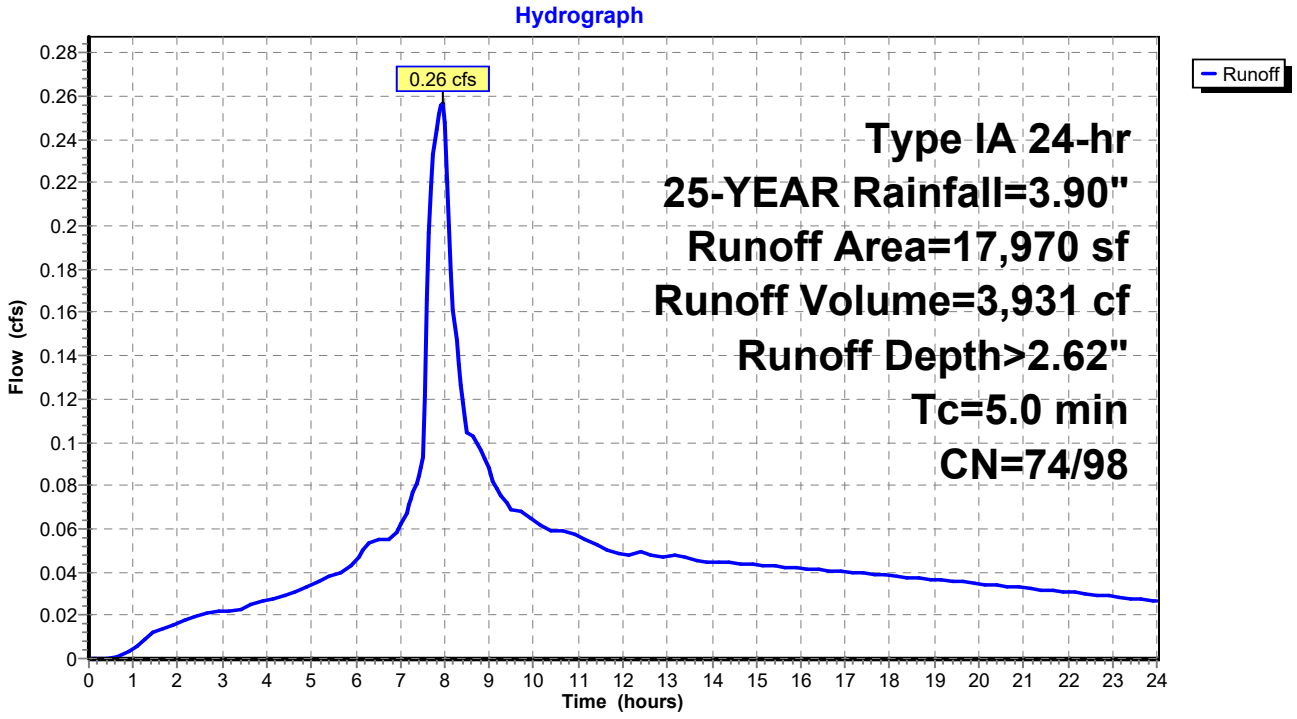
Runoff = 0.26 cfs @ 7.93 hrs, Volume= 3,931 cf, Depth> 2.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	9,285	98	Impervious Area
	8,685	74	>75% Grass cover, Good, HSG C
	17,970	86	Weighted Average
	8,685	74	48.33% Pervious Area
	9,285	98	51.67% Impervious Area

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

Subcatchment 150X: Upstream Boones Ferry



Summary for Subcatchment 160X: Upstream Properties

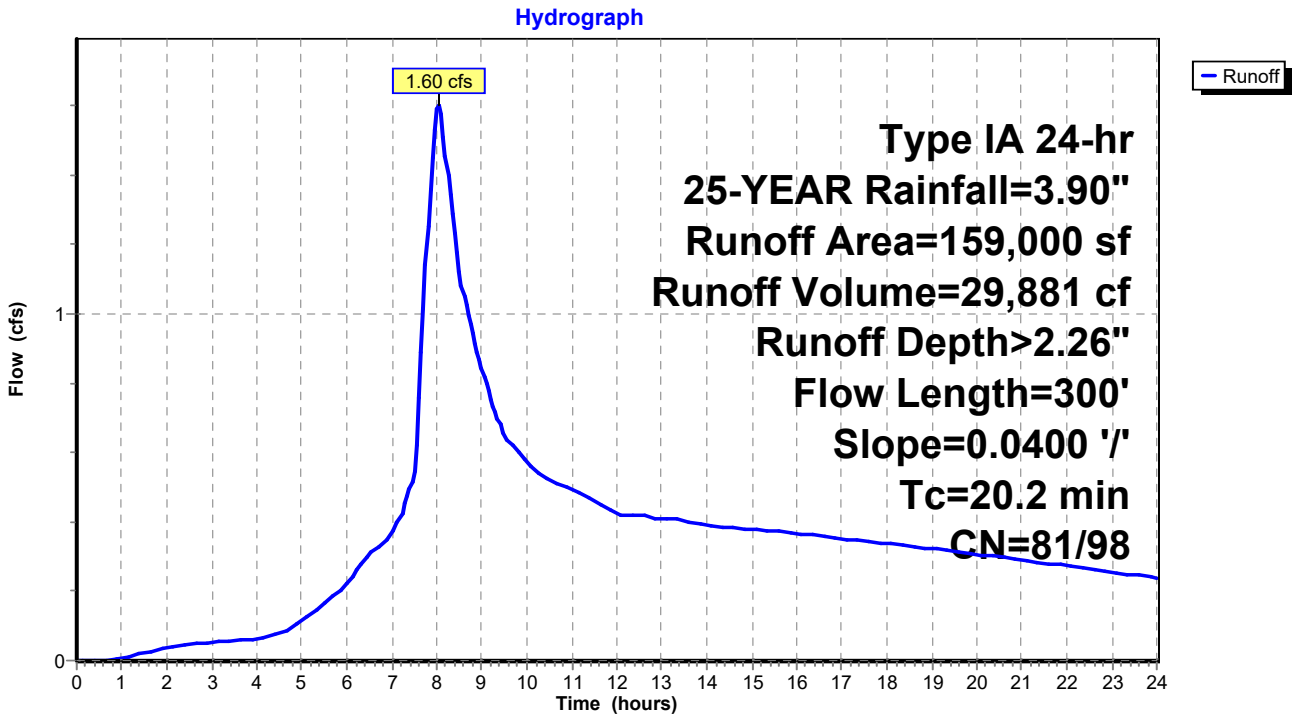
Runoff = 1.60 cfs @ 8.03 hrs, Volume= 29,881 cf, Depth> 2.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	23,371	98	Impervious Area
	12,930	96	Gravel surface, HSG C
	122,699	79	50-75% Grass cover, Fair, HSG C
	159,000	83	Weighted Average
	135,629	81	85.30% Pervious Area
	23,371	98	14.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	300	0.0400	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 160X: Upstream Properties



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Link 1T: Pre-Dev Total Inflow=25.69 cfs 560,474 cf
Primary=25.69 cfs 560,474 cf

Link 2T: Pre-Dev Northeast Inflow=9.43 cfs 255,682 cf
Primary=9.43 cfs 255,682 cf

Link 3T: Pre-Dev Southwest Inflow=16.27 cfs 304,792 cf
Primary=16.27 cfs 304,792 cf

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>2.62"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=5.14 cfs 88,821 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>2.27"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=1.57 cfs 31,367 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>2.69"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=7.36 cfs 144,418 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>2.80"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=2.07 cfs 32,105 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>1.72"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=1.66 cfs 42,201 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>1.56"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=1.00 cfs 32,519 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>1.55"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=2.86 cfs 97,549 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=79/98 Runoff=0.11 cfs 1,622 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>2.53"
Tc=5.0 min CN=79/98 Runoff=0.37 cfs 5,670 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>2.61"
Tc=5.0 min CN=79/98 Runoff=0.26 cfs 3,967 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>3.17"
Tc=51.0 min CN=79/98 Runoff=0.77 cfs 19,393 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>1.55"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.12 cfs 4,135 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>1.55"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.02 cfs 628 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>3.12"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.61 cfs 15,894 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>3.06"
Tc=5.0 min CN=74/98 Runoff=0.30 cfs 4,585 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>2.69"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.94 cfs 35,601 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 560,474 cf Average Runoff Depth = 2.20"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Link 1T: Pre-Dev Total Inflow=15.98 cfs 374,586 cf
Primary=15.98 cfs 374,586 cf

Link 2T: Pre-Dev Northeast Inflow=5.30 cfs 164,135 cf
Primary=5.30 cfs 164,135 cf

Link 3T: Pre-Dev Southwest Inflow=10.68 cfs 210,452 cf
Primary=10.68 cfs 210,452 cf

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>1.80"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=3.37 cfs 61,151 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>1.51"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=0.96 cfs 20,871 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>1.87"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=4.87 cfs 100,204 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>1.96"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=1.40 cfs 22,467 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>1.07"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=0.86 cfs 26,241 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>0.95"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.49 cfs 19,750 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>0.94"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=1.44 cfs 59,224 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>1.79"
Tc=5.0 min CN=79/98 Runoff=0.07 cfs 1,124 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>1.75"
Tc=5.0 min CN=79/98 Runoff=0.25 cfs 3,907 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>1.81"
Tc=5.0 min CN=79/98 Runoff=0.18 cfs 2,758 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>2.33"
Tc=51.0 min CN=79/98 Runoff=0.56 cfs 14,252 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.94"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.06 cfs 2,511 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.94"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.01 cfs 381 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>2.26"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.43 cfs 11,521 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>2.24"
Tc=5.0 min CN=74/98 Runoff=0.22 cfs 3,354 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.88"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.30 cfs 24,871 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 374,586 cf Average Runoff Depth = 1.47"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Link 1T: Pre-Dev Total Inflow=12.70 cfs 310,499 cf
Primary=12.70 cfs 310,499 cf

Link 2T: Pre-Dev Northeast Inflow=3.97 cfs 133,288 cf
Primary=3.97 cfs 133,288 cf

Link 3T: Pre-Dev Southwest Inflow=8.74 cfs 177,211 cf
Primary=8.74 cfs 177,211 cf

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>1.51"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=2.75 cfs 51,402 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>1.24"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=0.75 cfs 17,237 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>1.58"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=4.00 cfs 84,565 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>1.66"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=1.16 cfs 19,043 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>0.85"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=0.61 cfs 20,911 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.35 cfs 15,540 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=1.02 cfs 46,586 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>1.51"
Tc=5.0 min CN=79/98 Runoff=0.06 cfs 949 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>1.47"
Tc=5.0 min CN=79/98 Runoff=0.20 cfs 3,290 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>1.53"
Tc=5.0 min CN=79/98 Runoff=0.15 cfs 2,334 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>2.03"
Tc=51.0 min CN=79/98 Runoff=0.48 cfs 12,409 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.04 cfs 1,975 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.01 cfs 300 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>1.95"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.37 cfs 9,950 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>1.95"
Tc=5.0 min CN=74/98 Runoff=0.19 cfs 2,917 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.59"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.07 cfs 21,089 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 310,499 cf Average Runoff Depth = 1.22"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Link 1T: Pre-Dev Total Inflow=7.68 cfs 208,210 cf
Primary=7.68 cfs 208,210 cf

Link 2T: Pre-Dev Northeast Inflow=2.08 cfs 85,226 cf
Primary=2.08 cfs 85,226 cf

Link 3T: Pre-Dev Southwest Inflow=5.60 cfs 122,984 cf
Primary=5.60 cfs 122,984 cf

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>1.05"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=1.76 cfs 35,504 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>0.82"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=0.43 cfs 11,422 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>1.10"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=2.58 cfs 58,954 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>1.17"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=0.77 cfs 13,412 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>0.52"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=0.27 cfs 12,697 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.17 cfs 9,135 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.51 cfs 27,369 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>1.06"
Tc=5.0 min CN=79/98 Runoff=0.04 cfs 666 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>1.02"
Tc=5.0 min CN=79/98 Runoff=0.13 cfs 2,292 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>1.08"
Tc=5.0 min CN=79/98 Runoff=0.10 cfs 1,644 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>1.53"
Tc=51.0 min CN=79/98 Runoff=0.36 cfs 9,343 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.02 cfs 1,160 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.00 cfs 176 cf

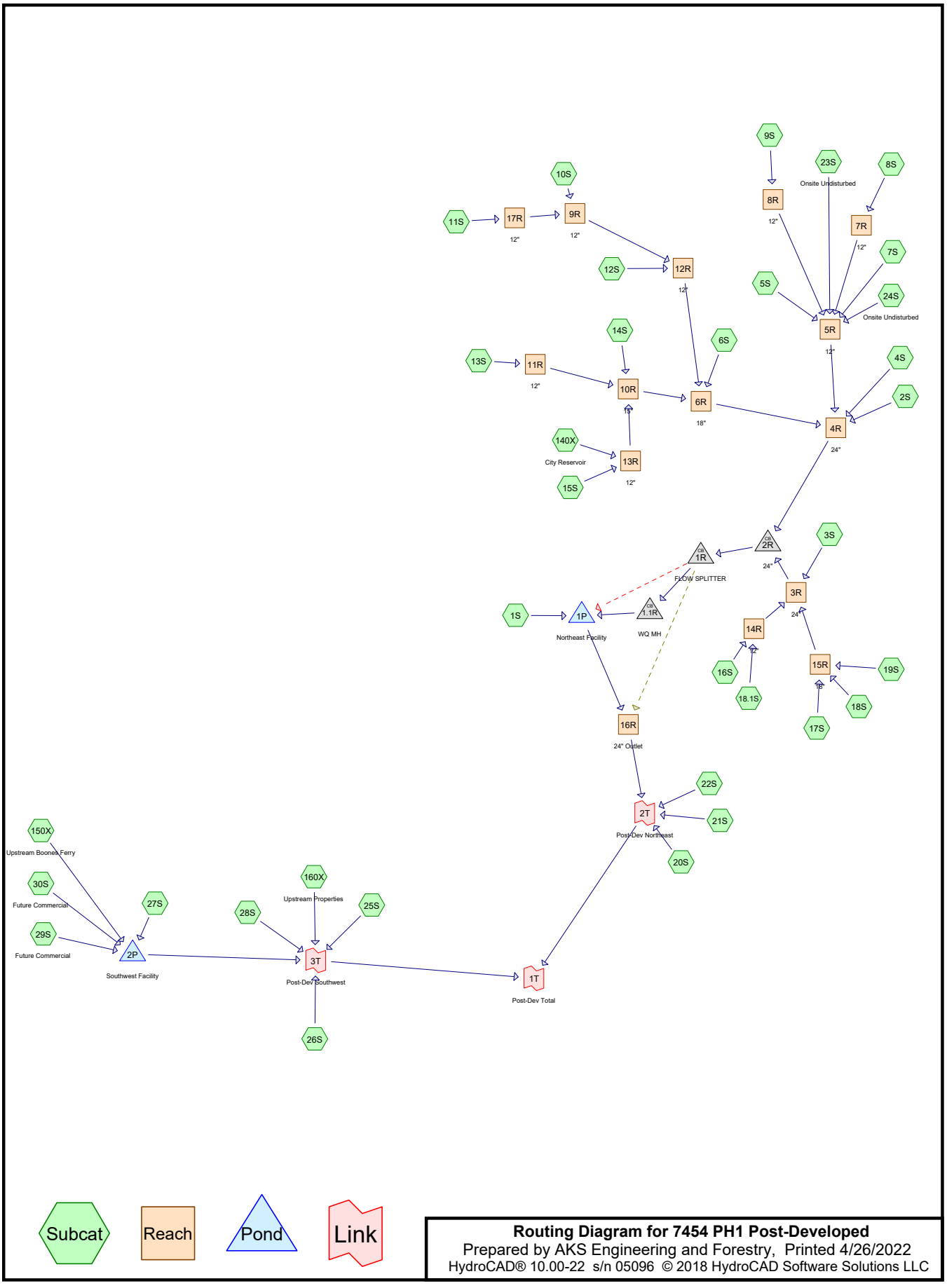
Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>1.44"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.26 cfs 7,333 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>1.46"
Tc=5.0 min CN=74/98 Runoff=0.14 cfs 2,193 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.13"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=0.71 cfs 14,912 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 208,210 cf Average Runoff Depth = 0.82"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Appendix B: HydroCAD Reports for Post-Developed Condition Storm Events
(25-Year Storm Event Analysis)
(50-Year Storm Event Summary)
(10-Year Storm Event Summary)
(5-Year Storm Event Summary)
(2-Year Storm Event Summary)
(WQ Storm Event Pond Summary)
(Stormwater Conveyance Calculations)



Routing Diagram for 7454 PH1 Post-Developed

Prepared by AKS Engineering and Forestry, Printed 4/26/2022

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
122,699	79	50-75% Grass cover, Fair, HSG C (160X)
74,761	98	85% Impervious - Future Commercial (29S, 30S)
46,914	86	<50% Grass cover, Poor, HSG C (140X)
1,027,970	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 18.1S, 18S, 19S, 20S, 21S, 22S, 25S, 26S, 27S, 28S, 29S, 30S, 150X)
12,930	96	Gravel surface, HSG C (160X)
32,656	98	Impervious Area (150X, 160X)
1,040,320	98	Impervious Area on Lots (2,640 sq.ft. per lot) (3S, 5S, 6S, 12S, 13S, 14S, 15S, 16S, 17S, 18.1S, 18S, 19S, 27S)
664,363	98	Paved roads w/curbs & sewers, HSG C (2S, 3S, 4S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 18.1S, 18S, 19S, 26S, 27S, 28S, 140X)
36,847	70	Woods, Good, HSG C (23S, 24S)
3,059,460	**89**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond 1.1R: WQ MH Peak Elev=325.12' Inflow=2.90 cfs 59,816 cf
12.0" Round Culvert n=0.013 L=33.0' S=0.0348 '/' Outflow=2.90 cfs 59,816 cf

Pond 1P: Northeast Facility Peak Elev=325.10' Storage=112,274 cf Inflow=19.03 cfs 245,405 cf
Outflow=3.16 cfs 151,008 cf

Pond 1R: FLOW SPLITTER Peak Elev=325.31' Inflow=22.10 cfs 334,804 cf
Primary=2.90 cfs 59,816 cf Secondary=15.64 cfs 176,102 cf Tertiary=4.31 cfs 98,886 cf Outflow=22.10 cfs 334,804 cf

Subcatchment 1S: Runoff Area=74,952 sf 0.00% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=74/0 Runoff=0.55 cfs 9,487 cf

Link 1T: Post-Dev Total Inflow=15.87 cfs 532,843 cf
Primary=15.87 cfs 532,843 cf

Pond 2P: Southwest Facility Peak Elev=319.94' Storage=106,847 cf Inflow=21.97 cfs 328,941 cf
Outflow=9.35 cfs 237,722 cf

Pond 2R: 24" Peak Elev=327.38' Inflow=22.10 cfs 334,804 cf
24.0" Round Culvert n=0.013 L=43.1' S=0.0116 '/' Outflow=22.10 cfs 334,804 cf

Subcatchment 2S: Runoff Area=9,948 sf 94.99% Impervious Runoff Depth>3.55"
Tc=5.0 min CN=74/98 Runoff=0.20 cfs 2,945 cf

Link 2T: Post-Dev Northeast Inflow=6.55 cfs 253,088 cf
Primary=6.55 cfs 253,088 cf

Reach 3R: 24" Avg. Flow Depth=1.09' Max Vel=6.68 fps Inflow=11.74 cfs 175,320 cf
24.0" Round Pipe n=0.013 L=401.6' S=0.0080 '/' Capacity=20.23 cfs Outflow=11.74 cfs 175,192 cf

Subcatchment 3S: Runoff Area=77,616 sf 87.47% Impervious Runoff Depth>3.39"
Tc=5.0 min CN=74/98 Runoff=1.50 cfs 21,934 cf

Link 3T: Post-Dev Southwest Inflow=10.92 cfs 279,755 cf
Primary=10.92 cfs 279,755 cf

Reach 4R: 24" Avg. Flow Depth=0.82' Max Vel=8.57 fps Inflow=10.37 cfs 159,648 cf
24.0" Round Pipe n=0.013 L=148.6' S=0.0170 '/' Capacity=29.52 cfs Outflow=10.37 cfs 159,612 cf

Subcatchment 4S: Runoff Area=27,436 sf 62.66% Impervious Runoff Depth>2.86"
Tc=5.0 min CN=74/98 Runoff=0.43 cfs 6,539 cf

Reach 5R: 12" Avg. Flow Depth=0.41' Max Vel=5.89 fps Inflow=1.78 cfs 29,293 cf
12.0" Round Pipe n=0.013 L=72.1' S=0.0202 '/' Capacity=5.07 cfs Outflow=1.78 cfs 29,288 cf

Subcatchment 5S: Runoff Area=12,720 sf 62.26% Impervious Runoff Depth>2.85"
Tc=5.0 min CN=74/98 Runoff=0.20 cfs 3,023 cf

Reach 6R: 18" Avg. Flow Depth=0.75' Max Vel=9.05 fps Inflow=7.96 cfs 120,888 cf
18.0" Round Pipe n=0.013 L=74.5' S=0.0232 '/' Capacity=16.01 cfs Outflow=7.96 cfs 120,876 cf

Subcatchment6S: Runoff Area=110,312 sf 68.48% Impervious Runoff Depth>2.98"
Tc=5.0 min CN=74/98 Runoff=1.83 cfs 27,437 cf

Reach 7R: 12" Avg. Flow Depth=0.28' Max Vel=2.14 fps Inflow=0.38 cfs 5,999 cf
12.0" Round Pipe n=0.013 L=223.0' S=0.0040 '/' Capacity=2.25 cfs Outflow=0.38 cfs 5,990 cf

Subcatchment7S: Runoff Area=6,333 sf 56.62% Impervious Runoff Depth>2.73"
Tc=5.0 min CN=74/98 Runoff=0.09 cfs 1,441 cf

Reach 8R: 12" Avg. Flow Depth=0.22' Max Vel=7.55 fps Inflow=0.97 cfs 15,016 cf
12.0" Round Pipe n=0.013 L=54.3' S=0.0650 '/' Capacity=9.08 cfs Outflow=0.97 cfs 15,014 cf

Subcatchment8S: Runoff Area=30,674 sf 38.68% Impervious Runoff Depth>2.35"
Tc=5.0 min CN=74/98 Runoff=0.38 cfs 5,999 cf

Reach 9R: 12" Avg. Flow Depth=0.25' Max Vel=3.63 fps Inflow=0.56 cfs 8,714 cf
12.0" Round Pipe n=0.013 L=98.7' S=0.0130 '/' Capacity=4.06 cfs Outflow=0.56 cfs 8,711 cf

Subcatchment9S: Runoff Area=71,032 sf 47.56% Impervious Runoff Depth>2.54"
Tc=5.0 min CN=74/98 Runoff=0.97 cfs 15,016 cf

Reach 10R: 15" Avg. Flow Depth=0.72' Max Vel=4.32 fps Inflow=3.19 cfs 48,979 cf
15.0" Round Pipe n=0.013 L=99.9' S=0.0060 '/' Capacity=5.01 cfs Outflow=3.19 cfs 48,965 cf

Subcatchment10S: Runoff Area=10,785 sf 46.92% Impervious Runoff Depth>2.52"
Tc=5.0 min CN=74/98 Runoff=0.15 cfs 2,268 cf

Reach 11R: 12" Avg. Flow Depth=0.32' Max Vel=5.17 fps Inflow=1.13 cfs 17,111 cf
12.0" Round Pipe n=0.013 L=109.5' S=0.0200 '/' Capacity=5.04 cfs Outflow=1.13 cfs 17,106 cf

Subcatchment11S: Runoff Area=31,511 sf 43.79% Impervious Runoff Depth>2.46"
Tc=5.0 min CN=74/98 Runoff=0.42 cfs 6,450 cf

Reach 12R: 12" Avg. Flow Depth=0.81' Max Vel=4.33 fps Inflow=2.94 cfs 44,518 cf
12.0" Round Pipe n=0.013 L=260.0' S=0.0070 '/' Capacity=2.98 cfs Outflow=2.94 cfs 44,487 cf

Subcatchment12S: Runoff Area=147,313 sf 65.31% Impervious Runoff Depth>2.92"
Tc=5.0 min CN=74/98 Runoff=2.38 cfs 35,807 cf

Reach 13R: 12" Avg. Flow Depth=0.50' Max Vel=3.52 fps Inflow=1.38 cfs 21,574 cf
12.0" Round Pipe n=0.013 L=69.4' S=0.0061 '/' Capacity=2.77 cfs Outflow=1.38 cfs 21,569 cf

Subcatchment13S: Runoff Area=73,746 sf 59.12% Impervious Runoff Depth>2.78"
Tc=5.0 min CN=74/98 Runoff=1.13 cfs 17,111 cf

Reach 14R: 12" Avg. Flow Depth=0.55' Max Vel=5.15 fps Inflow=2.26 cfs 34,086 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=2.26 cfs 34,075 cf

Subcatchment14S: Runoff Area=36,520 sf 87.22% Impervious Runoff Depth>3.39"
Tc=5.0 min CN=74/98 Runoff=0.70 cfs 10,304 cf

Reach 15R: 18" Avg. Flow Depth=1.02' Max Vel=6.27 fps Inflow=7.99 cfs 119,336 cf
18.0" Round Pipe n=0.013 L=110.0' S=0.0090 '/' Capacity=9.97 cfs Outflow=7.99 cfs 119,311 cf

Subcatchment15S: Runoff Area=29,901 sf 73.59% Impervious Runoff Depth>3.09"
Tc=5.0 min CN=74/98 Runoff=0.52 cfs 7,709 cf

Reach 16R: 24" Outlet Avg. Flow Depth=0.45' Max Vel=11.89 fps Inflow=6.38 cfs 249,894 cf
24.0" Round Pipe n=0.013 L=167.5' S=0.0622 '/' Capacity=56.42 cfs Outflow=6.37 cfs 249,846 cf

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>2.90"
Tc=5.0 min CN=74/98 Runoff=0.98 cfs 14,724 cf

Reach 17R: 12" Avg. Flow Depth=0.27' Max Vel=2.38 fps Inflow=0.42 cfs 6,450 cf
12.0" Round Pipe n=0.013 L=87.5' S=0.0050 '/' Capacity=2.53 cfs Outflow=0.42 cfs 6,447 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>3.47"
Tc=5.0 min CN=74/98 Runoff=0.37 cfs 5,463 cf

Subcatchment18.1S: Runoff Area=82,553 sf 60.53% Impervious Runoff Depth>2.81"
Tc=5.0 min CN=74/98 Runoff=1.28 cfs 19,362 cf

Subcatchment18S: Runoff Area=255,030 sf 68.76% Impervious Runoff Depth>2.99"
Tc=5.0 min CN=74/98 Runoff=4.25 cfs 63,556 cf

Subcatchment19S: Runoff Area=199,554 sf 70.41% Impervious Runoff Depth>3.03"
Tc=5.0 min CN=74/98 Runoff=3.37 cfs 50,317 cf

Subcatchment20S: Runoff Area=6,263 sf 0.00% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=74/0 Runoff=0.05 cfs 793 cf

Subcatchment21S: Runoff Area=4,712 sf 0.00% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 596 cf

Subcatchment22S: Runoff Area=14,633 sf 0.00% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=74/0 Runoff=0.11 cfs 1,852 cf

Subcatchment23S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>1.25"
Flow Length=50' Slope=0.0440 '/' Tc=15.2 min CN=70/0 Runoff=0.02 cfs 506 cf

Subcatchment24S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>1.24"
Flow Length=100' Slope=0.0440 '/' Tc=22.7 min CN=70/0 Runoff=0.12 cfs 3,318 cf

Subcatchment25S: Runoff Area=6,705 sf 0.00% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=74/0 Runoff=0.05 cfs 849 cf

Subcatchment26S: Runoff Area=68,508 sf 7.88% Impervious Runoff Depth>1.69"
Tc=5.0 min CN=74/98 Runoff=0.58 cfs 9,634 cf

Subcatchment27S: Runoff Area=1,218,560 sf 67.32% Impervious Runoff Depth>2.96"
Tc=5.0 min CN=74/98 Runoff=20.05 cfs 300,543 cf

Subcatchment28S: Runoff Area=9,392 sf 28.66% Impervious Runoff Depth>2.13"
Tc=5.0 min CN=74/98 Runoff=0.10 cfs 1,669 cf

Subcatchment29S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>3.34"
Tc=5.0 min CN=74/98 Runoff=1.16 cfs 16,981 cf

Subcatchment30S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>3.34"
Tc=5.0 min CN=74/98 Runoff=0.51 cfs 7,486 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>2.72"
Flow Length=50' Slope=0.0100 '/' Tc=13.4 min CN=86/98 Runoff=0.87 cfs 13,865 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>2.62"
Tc=5.0 min CN=74/98 Runoff=0.26 cfs 3,931 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>2.26"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.60 cfs 29,881 cf

Total Runoff Area = 3,059,460 sf Runoff Volume = 718,793 cf Average Runoff Depth = 2.82"
40.77% Pervious = 1,247,360 sf 59.23% Impervious = 1,812,100 sf

Summary for Pond 1.1R: WQ MH

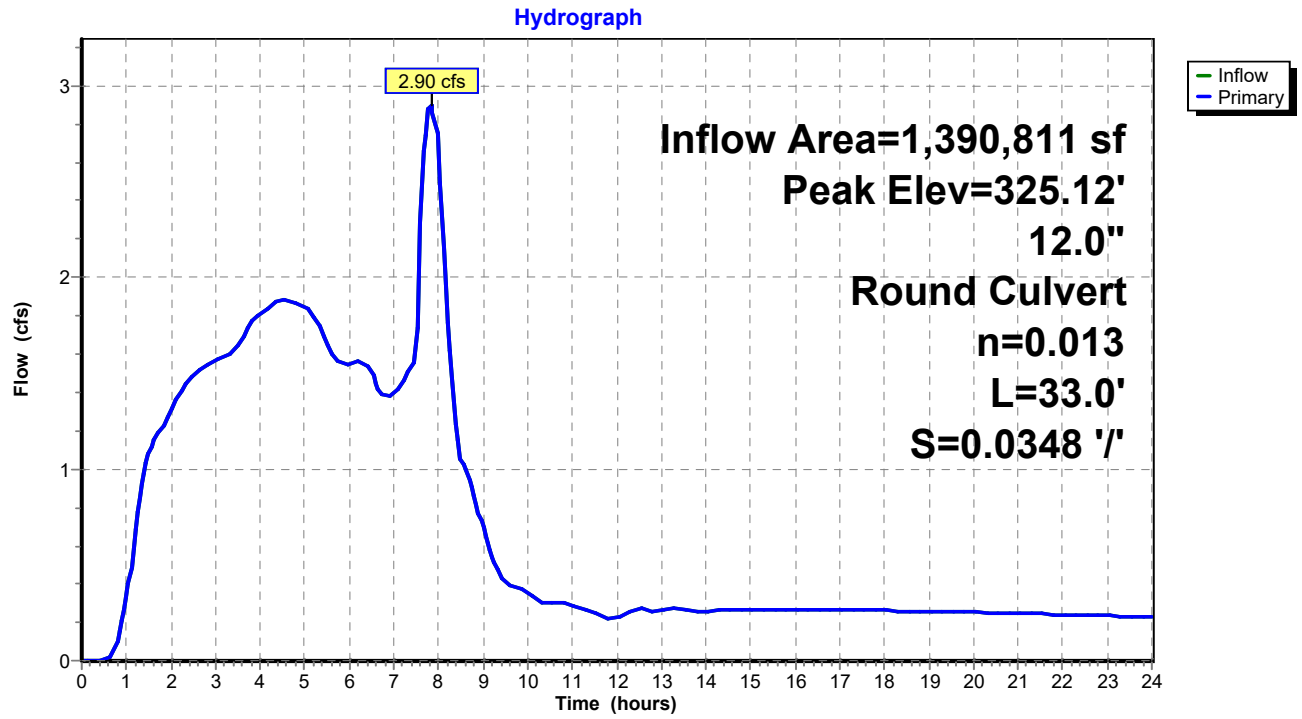
Inflow Area = 1,390,811 sf, 63.01% Impervious, Inflow Depth > 0.52" for 25-YEAR event
Inflow = 2.90 cfs @ 7.84 hrs, Volume= 59,816 cf
Outflow = 2.90 cfs @ 7.84 hrs, Volume= 59,816 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.90 cfs @ 7.84 hrs, Volume= 59,816 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 325.12' @ 9.33 hrs
Flood Elev= 327.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	321.50'	**12.0" Round Culvert** L= 33.0' Ke= 0.500 Inlet / Outlet Invert= 321.50' / 320.35' S= 0.0348 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.66 cfs @ 7.84 hrs HW=324.63' TW=324.14' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.66 cfs @ 3.38 fps)

Pond 1.1R: WQ MH



Summary for Pond 1P: Northeast Facility

Inflow Area = 1,465,763 sf, 59.79% Impervious, Inflow Depth > 2.01" for 25-YEAR event
Inflow = 19.03 cfs @ 7.85 hrs, Volume= 245,405 cf
Outflow = 3.16 cfs @ 9.39 hrs, Volume= 151,008 cf, Atten= 83%, Lag= 92.6 min
Primary = 3.16 cfs @ 9.39 hrs, Volume= 151,008 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 325.10' @ 9.39 hrs Surf.Area= 35,636 sf Storage= 112,274 cf
Flood Elev= 325.30' Surf.Area= 36,154 sf Storage= 119,358 cf

Plug-Flow detention time= 474.1 min calculated for 150,694 cf (61% of inflow)
Center-of-Mass det. time= 237.5 min (888.6 - 651.1)

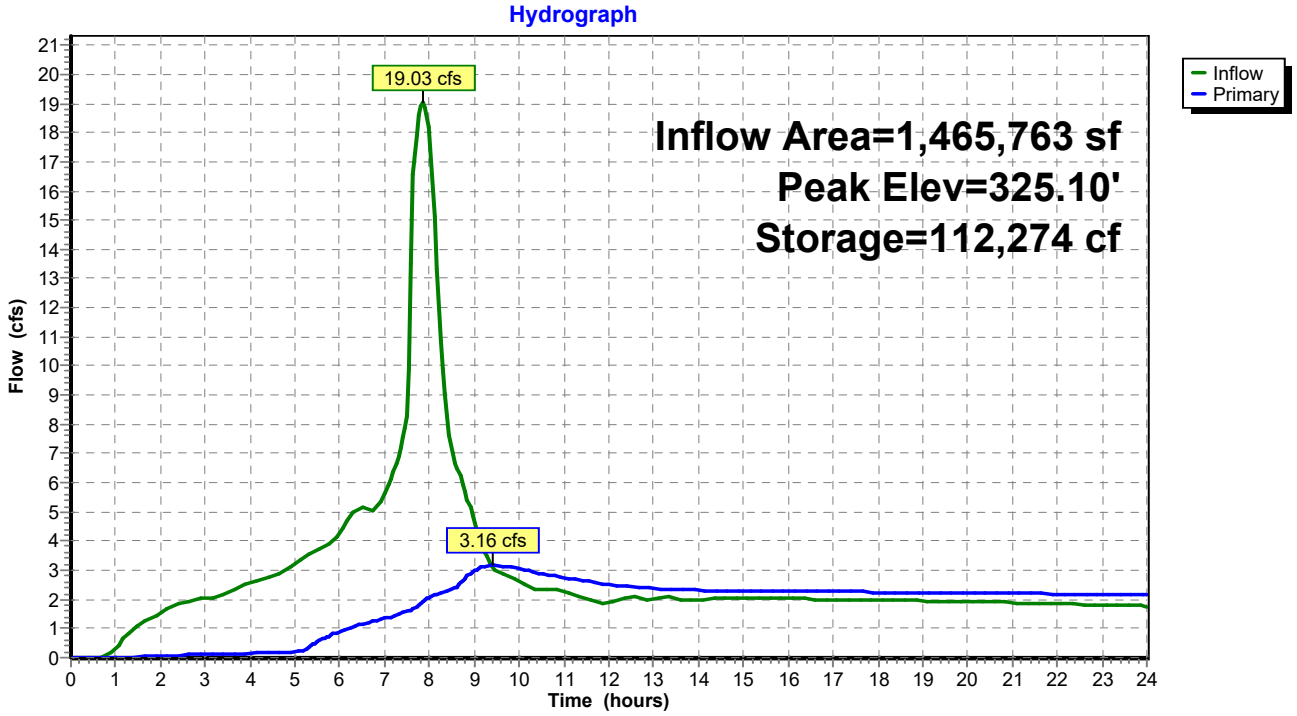
Volume	Invert	Avail.Storage	Storage Description
#1	320.30'	156,827 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
320.30	10,849	855.0	0	0	10,849
321.30	13,441	873.0	12,122	12,122	13,471
322.30	16,090	892.0	14,746	26,868	16,281
322.50	16,627	896.0	3,272	30,139	16,878
322.80	29,792	825.0	6,868	37,007	26,605
323.30	31,036	834.0	15,206	52,213	27,864
324.30	33,567	853.0	32,293	84,506	30,550
325.30	36,154	872.0	34,852	119,358	33,297
326.30	38,798	890.0	37,468	156,827	35,970

Device	Routing	Invert	Outlet Devices
#1	Primary	319.96'	**24.0" Round Culvert** L= 19.6' Ke= 0.500 Inlet / Outlet Invert= 319.96' / 319.57' S= 0.0199 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 4	320.30'	**2.2' long Broad-Crested Rectangular Weir** 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
#3	Device 1	320.30'	**2.2" Vert. WQ Orifice** C= 0.620
#4	Device 1	322.30'	**7.0" Vert. Detention Orifice** C= 0.620
#5	Device 1	324.85'	**Grated Manhole, Cv= 3.19 (C= 3.99)** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.89 Width (feet) 0.00 1.83 2.54 3.05 3.45 3.79 4.06 4.29 4.48 4.63 4.76 4.86 4.93 4.98 5.00 5.00 4.97 4.92 4.84 4.74 4.61 4.45 4.26 4.02 3.74 3.40 2.98 2.45 1.69 0.00

Primary OutFlow Max=3.16 cfs @ 9.39 hrs HW=325.10' TW=319.82' (Dynamic Tailwater)
- **1=Culvert** (Passes 3.16 cfs of 30.79 cfs potential flow)
  - **3=WQ Orifice** (Orifice Controls 0.29 cfs @ 10.80 fps)
  - **4=Detention Orifice** (Orifice Controls 2.11 cfs @ 7.88 fps)
    - **2=Broad-Crested Rectangular Weir** (Passes 2.11 cfs of 67.94 cfs potential flow)
  - **5=Grated Manhole** (Weir Controls 0.77 cfs @ 1.71 fps)

Pond 1P: Northeast Facility



Summary for Pond 1R: FLOW SPLITTER

Inflow Area = 1,390,811 sf, 63.01% Impervious, Inflow Depth > 2.89" for 25-YEAR event
Inflow = 22.10 cfs @ 7.94 hrs, Volume= 334,804 cf
Outflow = 22.10 cfs @ 7.94 hrs, Volume= 334,804 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.90 cfs @ 7.84 hrs, Volume= 59,816 cf
Secondary = 15.64 cfs @ 7.84 hrs, Volume= 176,102 cf
Tertiary = 4.31 cfs @ 8.01 hrs, Volume= 98,886 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 325.31' @ 8.01 hrs
Flood Elev= 327.68'

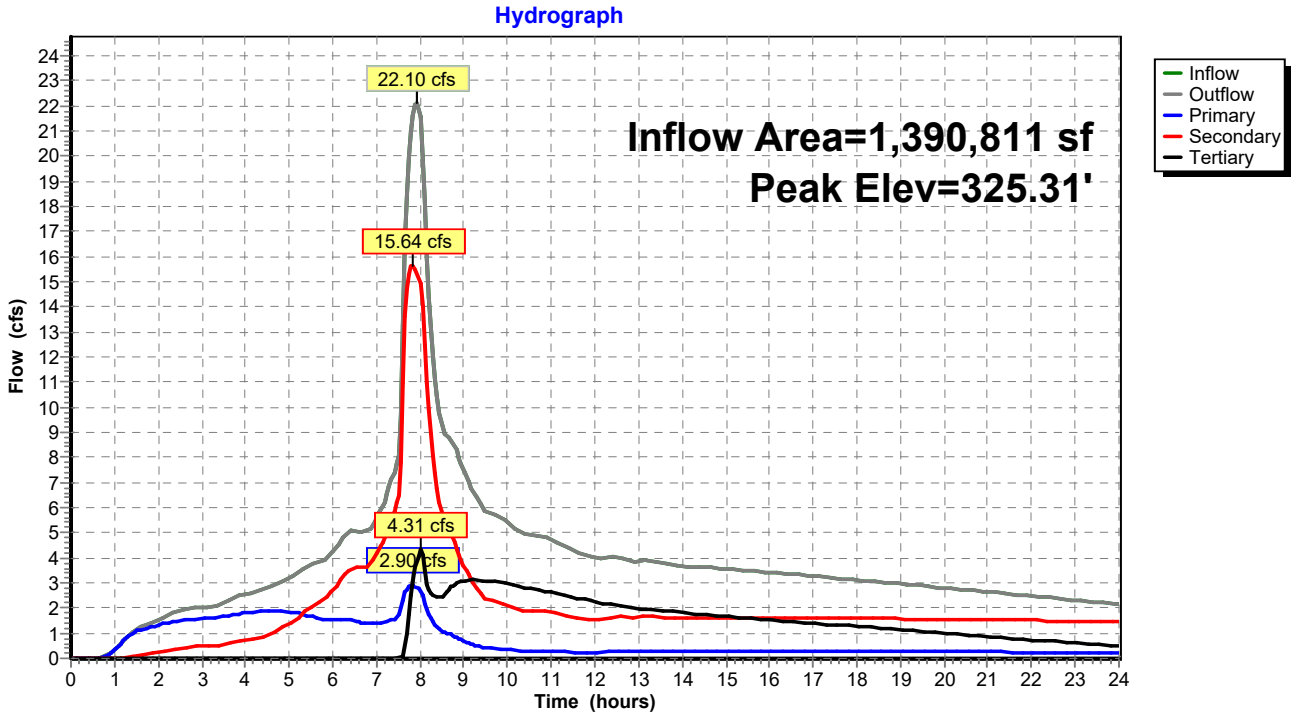
Device	Routing	Invert	Outlet Devices
#1	Primary	321.80'	**12.0" Round Culvert** L= 8.3' Ke= 0.500 Inlet / Outlet Invert= 321.80' / 321.70' S= 0.0120 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	322.30'	**24.0" Round Culvert** L= 32.2' Ke= 0.500 Inlet / Outlet Invert= 322.30' / 320.37' S= 0.0599 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#3	Tertiary	324.30'	**18.0" Round Culvert** L= 44.8' Ke= 0.500 Inlet / Outlet Invert= 324.30' / 319.56' S= 0.1058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.62 cfs @ 7.84 hrs HW=325.11' TW=324.63' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.62 cfs @ 3.34 fps)

Secondary OutFlow Max=14.93 cfs @ 7.84 hrs HW=325.10' TW=324.13' (Dynamic Tailwater)
2=Culvert (Inlet Controls 14.93 cfs @ 4.75 fps)

Tertiary OutFlow Max=4.28 cfs @ 8.01 hrs HW=325.30' TW=319.82' (Dynamic Tailwater)
3=Culvert (Inlet Controls 4.28 cfs @ 3.41 fps)

Pond 1R: FLOW SPLITTER



Summary for Subcatchment 1S:

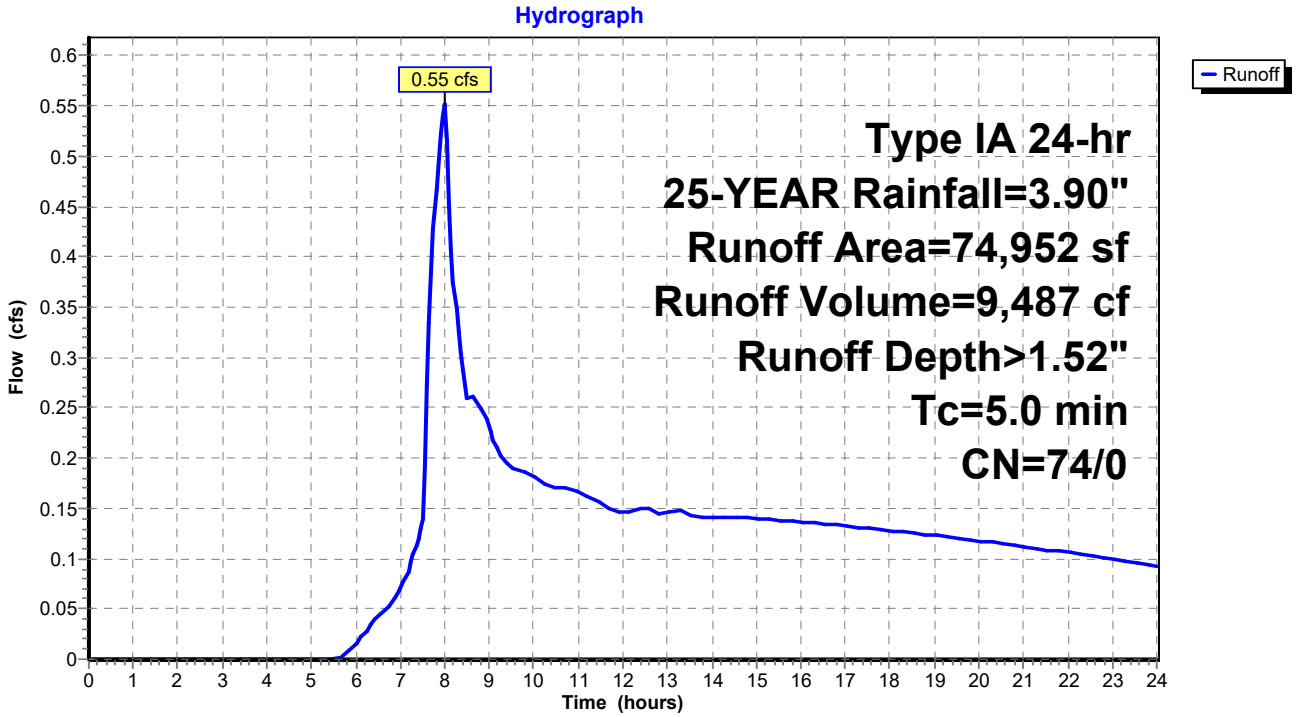
Runoff = 0.55 cfs @ 7.99 hrs, Volume= 9,487 cf, Depth> 1.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
74,952	74	>75% Grass cover, Good, HSG C
74,952	74	100.00% Pervious Area

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

Subcatchment 1S:

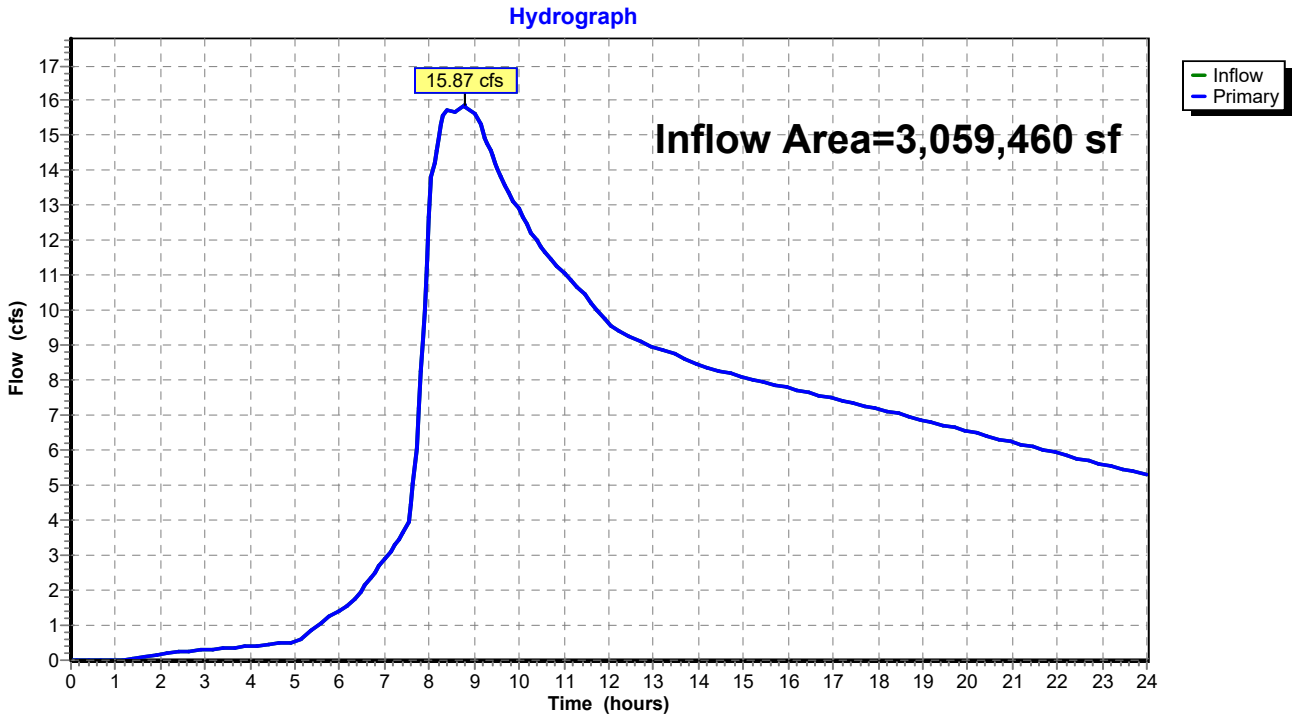


Summary for Link 1T: Post-Dev Total

Inflow Area = 3,059,460 sf, 59.23% Impervious, Inflow Depth > 2.09" for 25-YEAR event
Inflow = 15.87 cfs @ 8.78 hrs, Volume= 532,843 cf
Primary = 15.87 cfs @ 8.78 hrs, Volume= 532,843 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1T: Post-Dev Total



Summary for Pond 2P: Southwest Facility

Inflow Area = 1,324,484 sf, 68.28% Impervious, Inflow Depth > 2.98" for 25-YEAR event
Inflow = 21.97 cfs @ 7.92 hrs, Volume= 328,941 cf
Outflow = 9.35 cfs @ 8.44 hrs, Volume= 237,722 cf, Atten= 57%, Lag= 31.6 min
Primary = 9.35 cfs @ 8.44 hrs, Volume= 237,722 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 319.94' @ 8.44 hrs Surf.Area= 26,264 sf Storage= 106,847 cf
Flood Elev= 320.00' Surf.Area= 26,377 sf Storage= 108,348 cf

Plug-Flow detention time= 327.5 min calculated for 237,722 cf (72% of inflow)
Center-of-Mass det. time= 152.7 min (841.3 - 688.6)

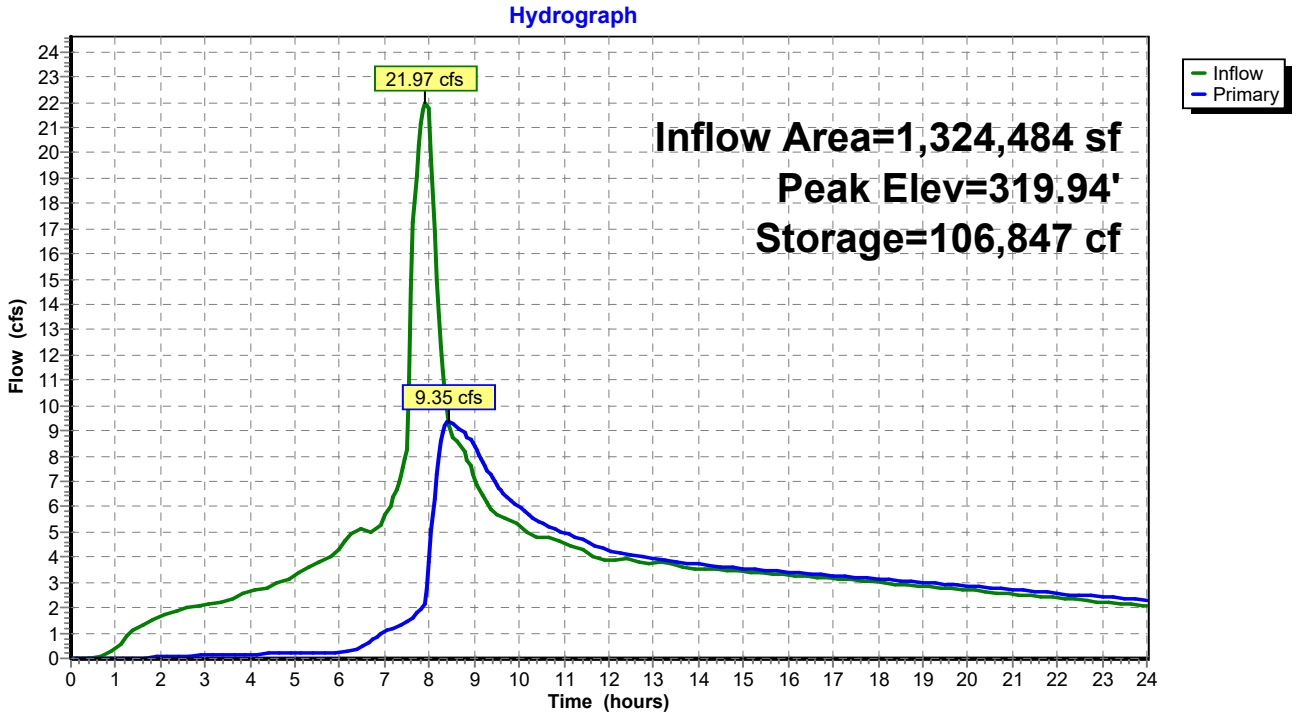
Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	135,722 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
315.00	17,201	564.0	0	0	17,201
316.00	18,923	583.0	18,055	18,055	19,028
317.00	20,702	602.0	19,806	37,861	20,915
318.00	22,537	621.0	21,613	59,474	22,862
319.00	24,430	640.0	23,477	82,951	24,870
320.00	26,377	659.0	25,397	108,348	26,939
321.00	28,382	678.0	27,373	135,722	29,068

Device	Routing	Invert	Outlet Devices
#1	Primary	314.50'	**24.0" Round Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 314.50' / 314.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 4	315.00'	**2.2' long Broad-Crested Rectangular Weir** 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
#3	Device 1	315.00'	**2.5" Vert. WQ Orifice** C= 0.620
#4	Device 1	317.30'	**7.0" Vert. Detention Orifice** C= 0.620
#5	Device 1	319.20'	**Grated Manhole, Cv= 3.19 (C= 3.99)** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.89 Width (feet) 0.00 1.83 2.54 3.05 3.45 3.79 4.06 4.29 4.48 4.63 4.76 4.86 4.93 4.98 5.00 5.00 4.97 4.92 4.84 4.74 4.61 4.45 4.26 4.02 3.74 3.40 2.98 2.45 1.69 0.00

Primary OutFlow Max=9.35 cfs @ 8.44 hrs HW=319.94' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 9.35 cfs of 31.88 cfs potential flow)
  - **3=WQ Orifice** (Orifice Controls 0.37 cfs @ 10.94 fps)
  - **4=Detention Orifice** (Orifice Controls 2.04 cfs @ 7.63 fps)
    - **2=Broad-Crested Rectangular Weir** (Passes 2.04 cfs of 69.08 cfs potential flow)
  - **5=Grated Manhole** (Weir Controls 6.94 cfs @ 3.05 fps)

Pond 2P: Southwest Facility



Summary for Pond 2R: 24"

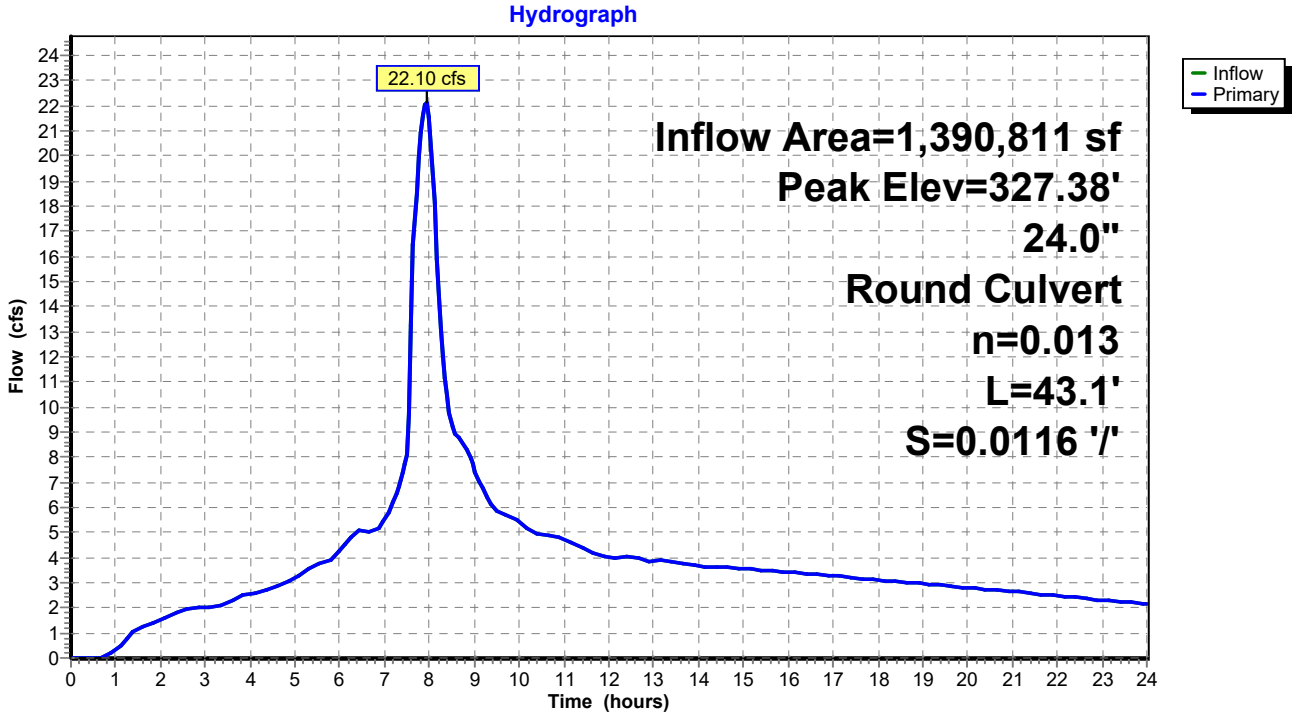
Inflow Area = 1,390,811 sf, 63.01% Impervious, Inflow Depth > 2.89" for 25-YEAR event
Inflow = 22.10 cfs @ 7.94 hrs, Volume= 334,804 cf
Outflow = 22.10 cfs @ 7.94 hrs, Volume= 334,804 cf, Atten= 0%, Lag= 0.0 min
Primary = 22.10 cfs @ 7.94 hrs, Volume= 334,804 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 327.38' @ 7.98 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	322.50'	**24.0" Round Culvert** L= 43.1' Ke= 0.500 Inlet / Outlet Invert= 322.50' / 322.00' S= 0.0116 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=21.77 cfs @ 7.94 hrs HW=327.33' TW=325.26' (Dynamic Tailwater)
↳**1=Culvert** (Inlet Controls 21.77 cfs @ 6.93 fps)

Pond 2R: 24"



Summary for Subcatchment 2S:

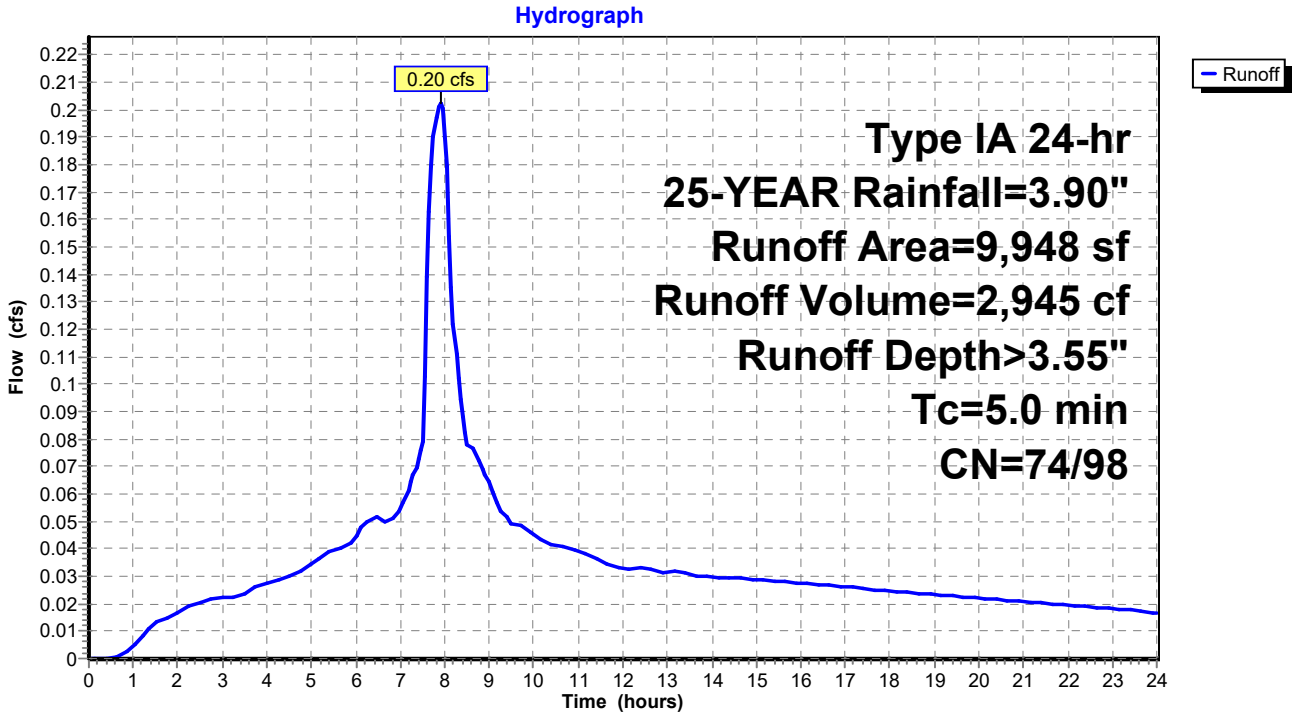
Runoff = 0.20 cfs @ 7.90 hrs, Volume= 2,945 cf, Depth> 3.55"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
9,450	98	Paved roads w/curbs & sewers, HSG C
498	74	>75% Grass cover, Good, HSG C
9,948	97	Weighted Average
498	74	5.01% Pervious Area
9,450	98	94.99% Impervious Area

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

Subcatchment 2S:

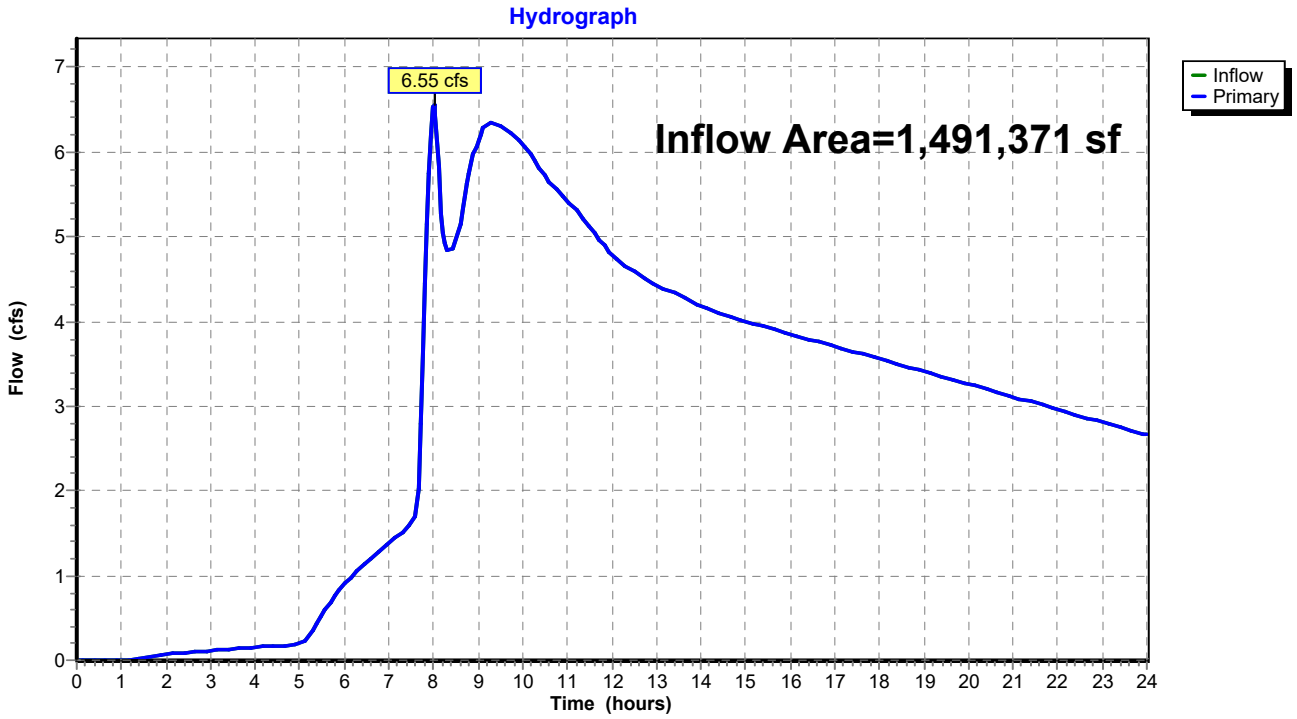


Summary for Link 2T: Post-Dev Northeast

Inflow Area = 1,491,371 sf, 58.76% Impervious, Inflow Depth > 2.04" for 25-YEAR event
Inflow = 6.55 cfs @ 8.02 hrs, Volume= 253,088 cf
Primary = 6.55 cfs @ 8.02 hrs, Volume= 253,088 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2T: Post-Dev Northeast



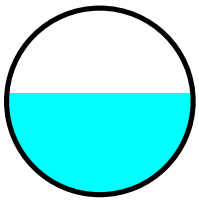
Summary for Reach 3R: 24"

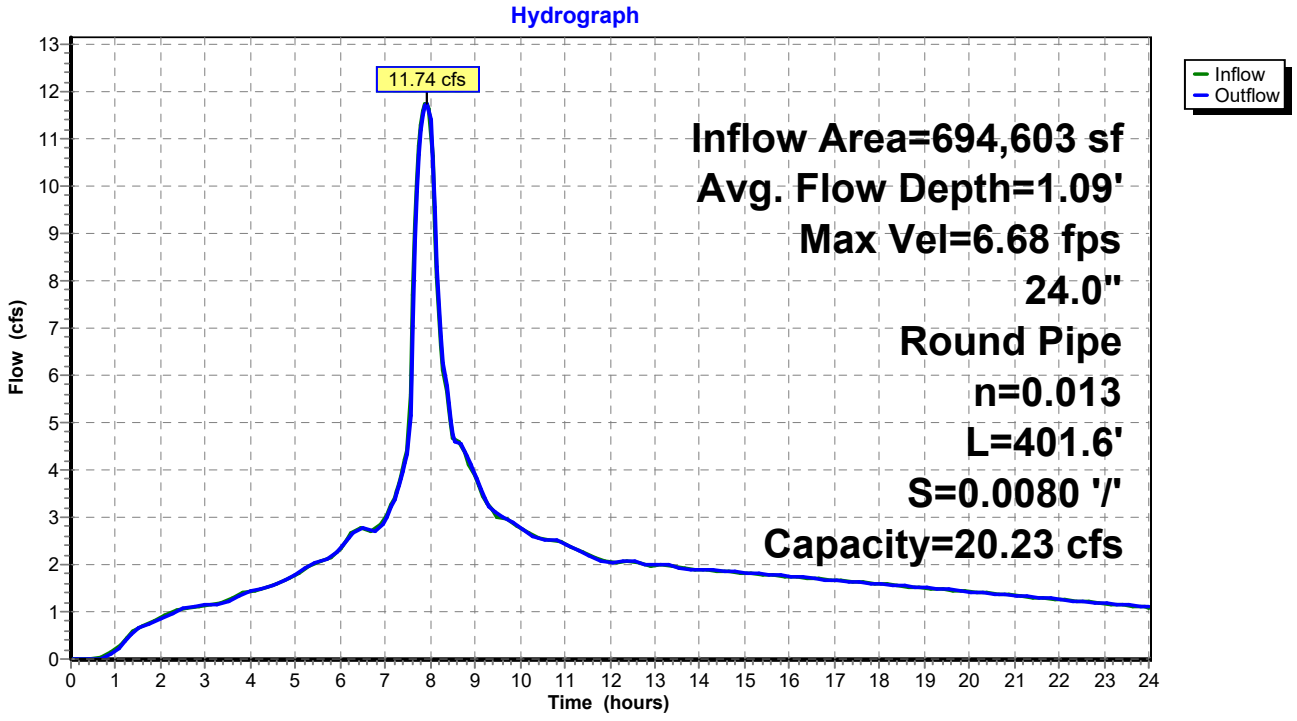
Inflow Area = 694,603 sf, 70.58% Impervious, Inflow Depth > 3.03" for 25-YEAR event
Inflow = 11.74 cfs @ 7.92 hrs, Volume= 175,320 cf
Outflow = 11.74 cfs @ 7.93 hrs, Volume= 175,192 cf, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.68 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 3.97 fps, Avg. Travel Time= 1.7 min

Peak Storage= 706 cf @ 7.93 hrs
Average Depth at Peak Storage= 1.09'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 20.23 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 401.6' Slope= 0.0080 '/'
Inlet Invert= 325.91', Outlet Invert= 322.70'





Summary for Subcatchment 3S:

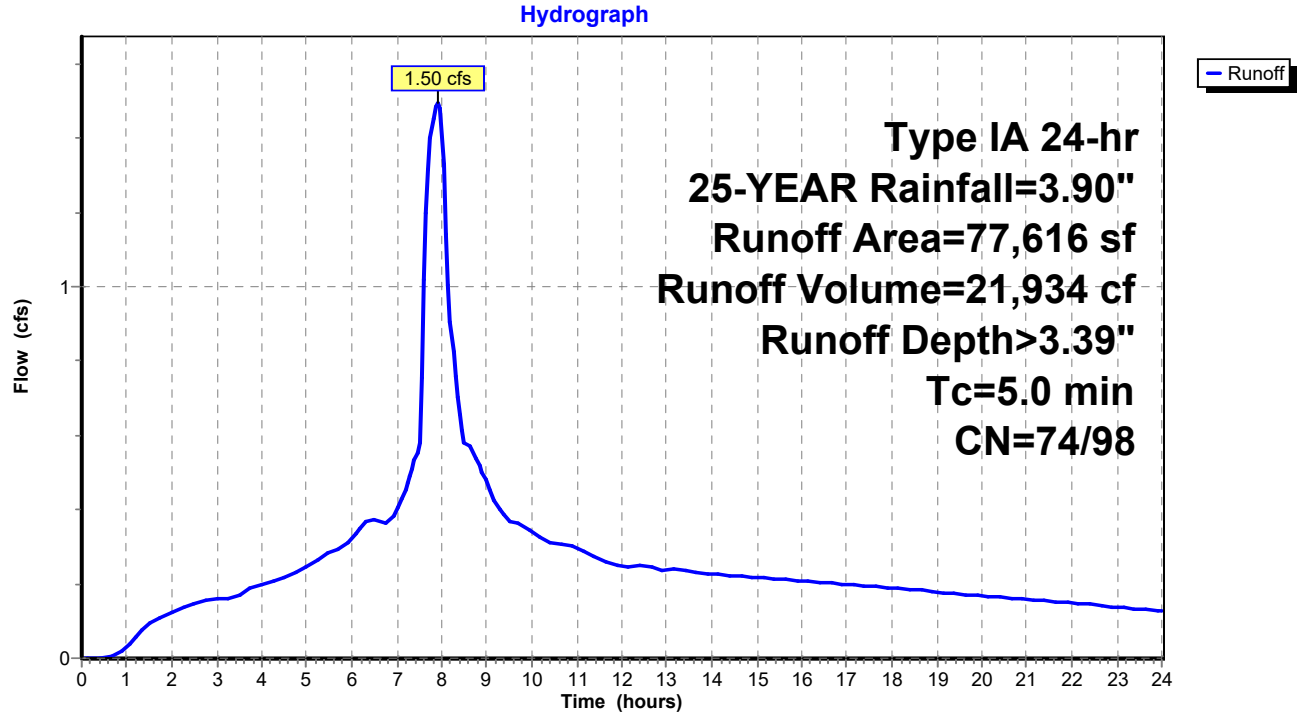
Runoff = 1.50 cfs @ 7.90 hrs, Volume= 21,934 cf, Depth> 3.39"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	15,093	98	Paved roads w/curbs & sewers, HSG C
	9,723	74	>75% Grass cover, Good, HSG C
*	52,800	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	77,616	95	Weighted Average
	9,723	74	12.53% Pervious Area
	67,893	98	87.47% Impervious Area

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

Subcatchment 3S:

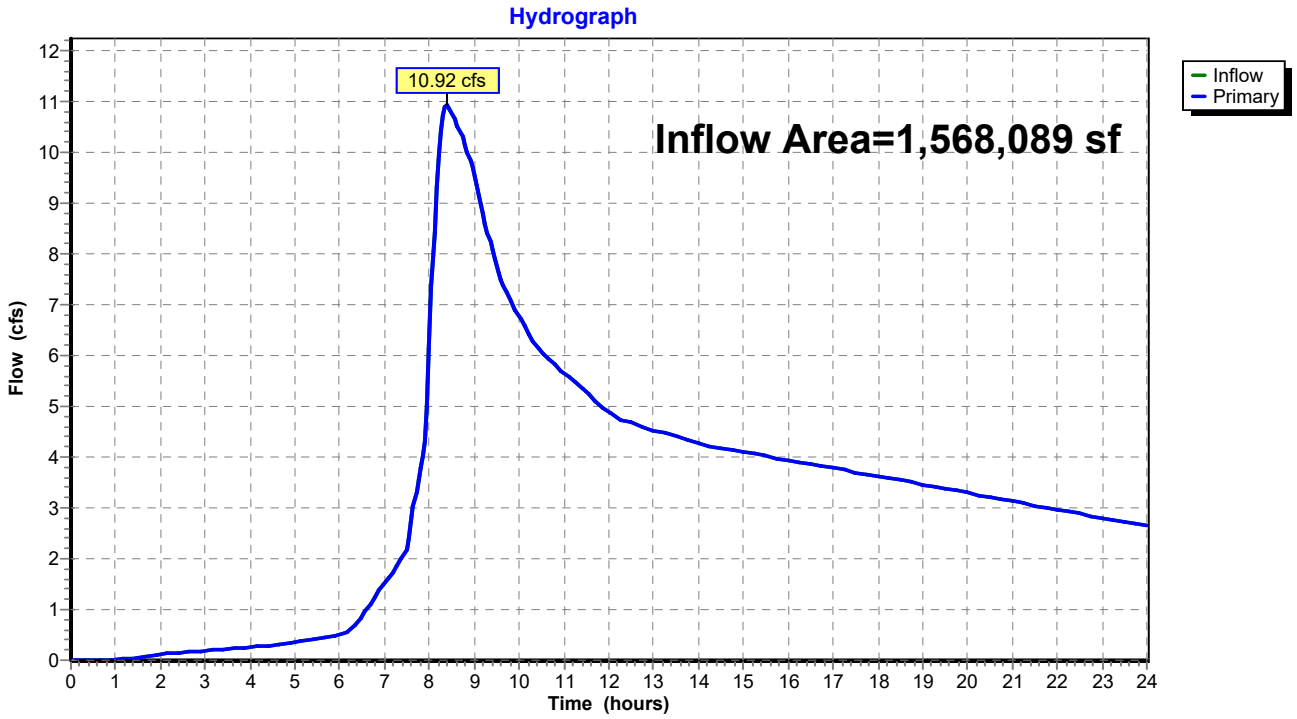


Summary for Link 3T: Post-Dev Southwest

Inflow Area = 1,568,089 sf, 59.68% Impervious, Inflow Depth > 2.14" for 25-YEAR event
Inflow = 10.92 cfs @ 8.40 hrs, Volume= 279,755 cf
Primary = 10.92 cfs @ 8.40 hrs, Volume= 279,755 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3T: Post-Dev Southwest



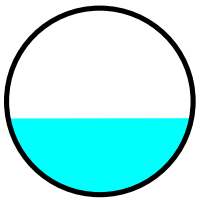
Summary for Reach 4R: 24"

Inflow Area = 696,208 sf, 55.46% Impervious, Inflow Depth > 2.75" for 25-YEAR event
Inflow = 10.37 cfs @ 7.95 hrs, Volume= 159,648 cf
Outflow = 10.37 cfs @ 7.95 hrs, Volume= 159,612 cf, Atten= 0%, Lag= 0.2 min

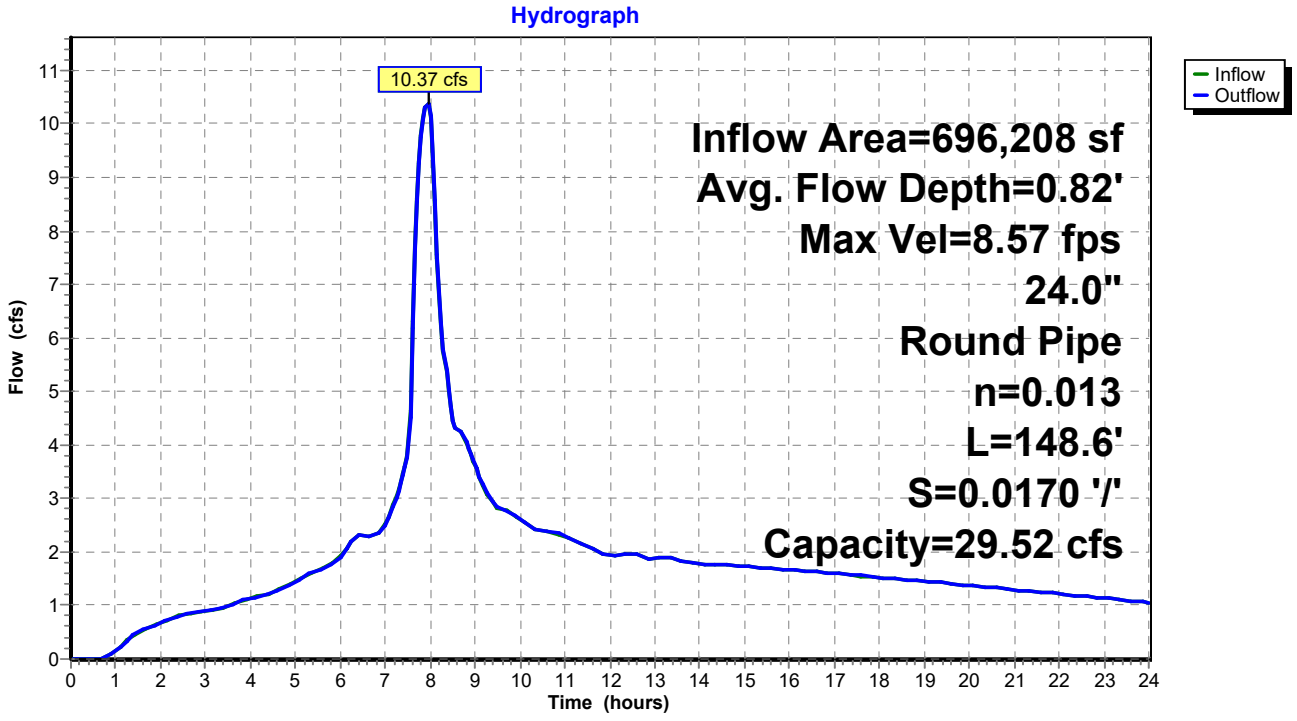
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.57 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 5.04 fps, Avg. Travel Time= 0.5 min

Peak Storage= 180 cf @ 7.95 hrs
Average Depth at Peak Storage= 0.82'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 29.52 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 148.6' Slope= 0.0170 '/'
Inlet Invert= 325.23', Outlet Invert= 322.70'



Reach 4R: 24"



Summary for Subcatchment 4S:

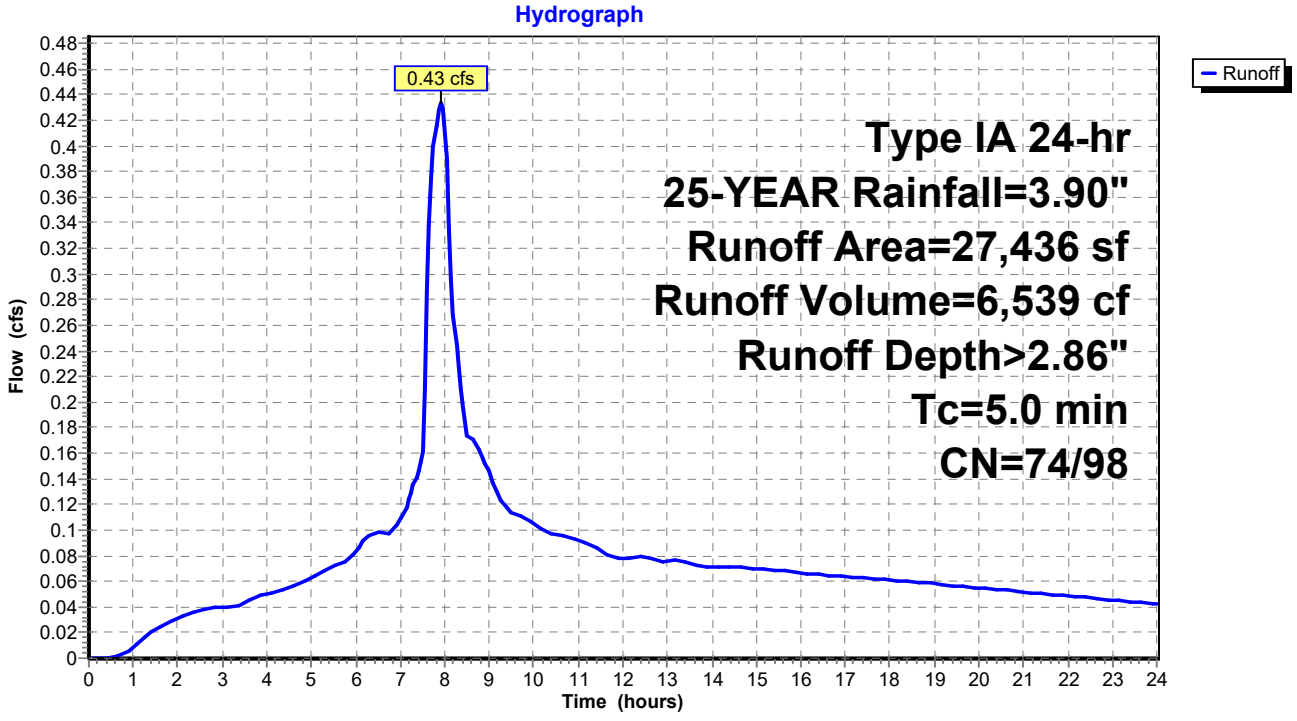
Runoff = 0.43 cfs @ 7.92 hrs, Volume= 6,539 cf, Depth> 2.86"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	17,192	98	Paved roads w/curbs & sewers, HSG C
	10,244	74	>75% Grass cover, Good, HSG C
*	0	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	27,436	89	Weighted Average
	10,244	74	37.34% Pervious Area
	17,192	98	62.66% Impervious Area

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

Subcatchment 4S:



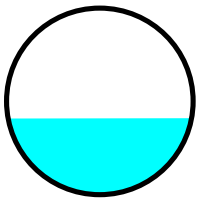
Summary for Reach 5R: 12"

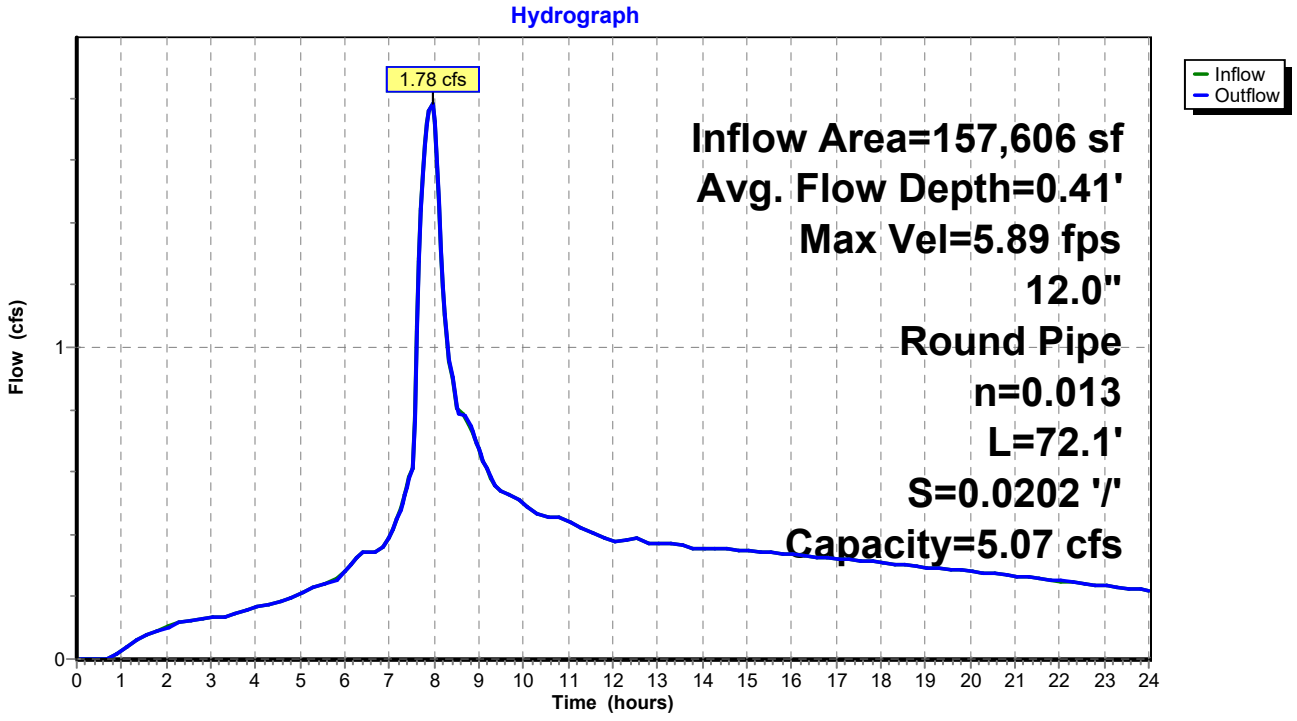
Inflow Area = 157,606 sf, 36.26% Impervious, Inflow Depth > 2.23" for 25-YEAR event
Inflow = 1.78 cfs @ 7.97 hrs, Volume= 29,293 cf
Outflow = 1.78 cfs @ 7.97 hrs, Volume= 29,288 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.89 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.53 fps, Avg. Travel Time= 0.3 min

Peak Storage= 22 cf @ 7.97 hrs
Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.07 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 72.1' Slope= 0.0202 '/'
Inlet Invert= 325.93', Outlet Invert= 324.47'





Summary for Subcatchment 5S:

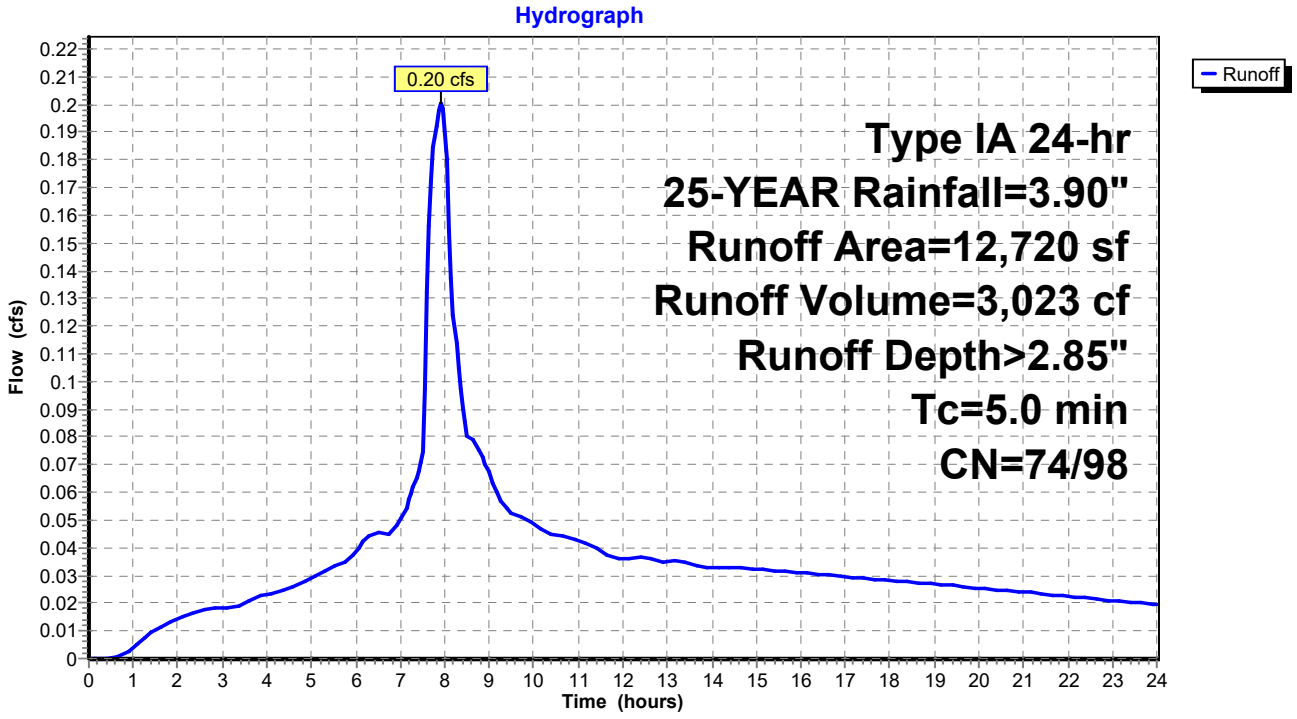
Runoff = 0.20 cfs @ 7.92 hrs, Volume= 3,023 cf, Depth> 2.85"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	4,800	74	>75% Grass cover, Good, HSG C
*	7,920	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	12,720	89	Weighted Average
	4,800	74	37.74% Pervious Area
	7,920	98	62.26% Impervious Area

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

Subcatchment 5S:



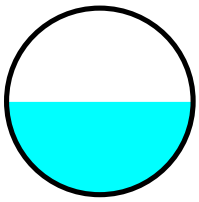
Summary for Reach 6R: 18"

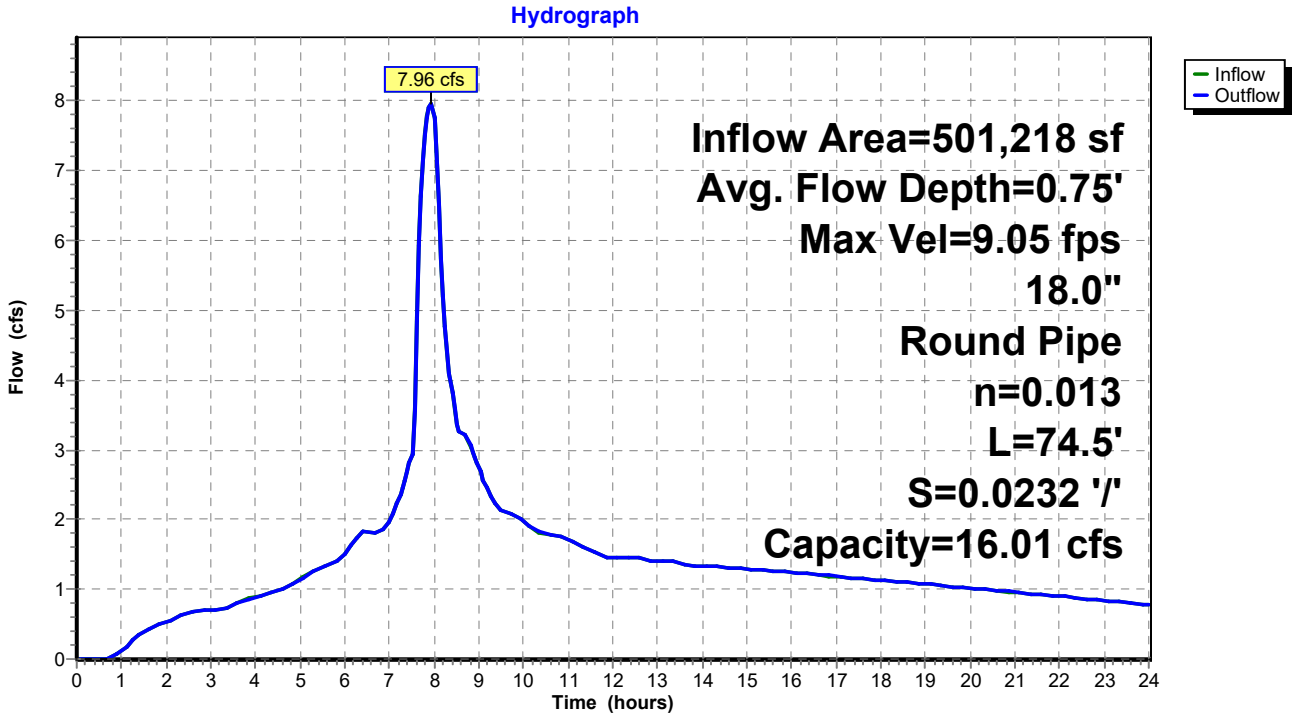
Inflow Area = 501,218 sf, 60.31% Impervious, Inflow Depth > 2.89" for 25-YEAR event
Inflow = 7.96 cfs @ 7.95 hrs, Volume= 120,888 cf
Outflow = 7.96 cfs @ 7.95 hrs, Volume= 120,876 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.05 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 5.36 fps, Avg. Travel Time= 0.2 min

Peak Storage= 66 cf @ 7.95 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 16.01 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 74.5' Slope= 0.0232 '/'
Inlet Invert= 327.72', Outlet Invert= 325.99'





Summary for Subcatchment 6S:

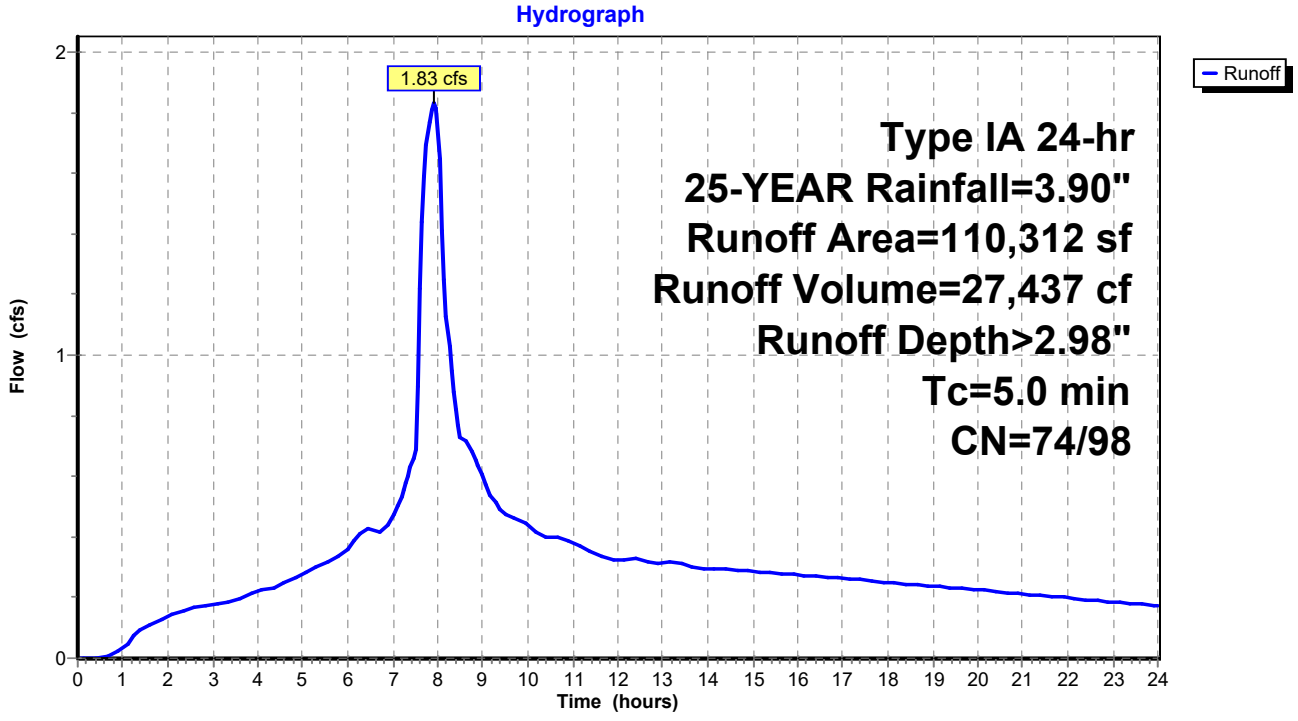
Runoff = 1.83 cfs @ 7.92 hrs, Volume= 27,437 cf, Depth> 2.98"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	17,465	98	Paved roads w/curbs & sewers, HSG C
	34,767	74	>75% Grass cover, Good, HSG C
*	58,080	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	110,312	90	Weighted Average
	34,767	74	31.52% Pervious Area
	75,545	98	68.48% Impervious Area

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

Subcatchment 6S:



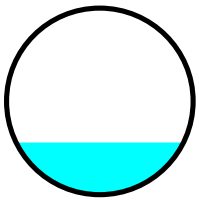
Summary for Reach 7R: 12"

Inflow Area = 30,674 sf, 38.68% Impervious, Inflow Depth > 2.35" for 25-YEAR event
Inflow = 0.38 cfs @ 7.95 hrs, Volume= 5,999 cf
Outflow = 0.38 cfs @ 7.97 hrs, Volume= 5,990 cf, Atten= 0%, Lag= 1.3 min

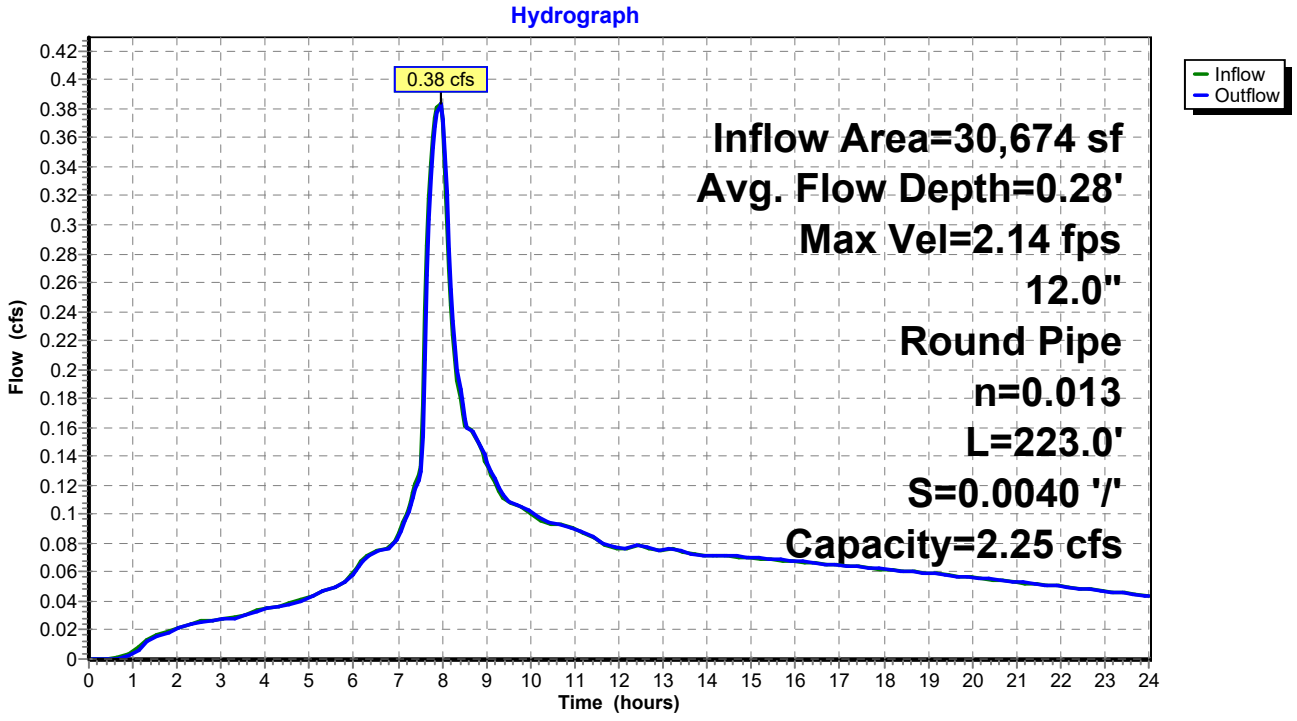
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.14 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.25 fps, Avg. Travel Time= 3.0 min

Peak Storage= 40 cf @ 7.97 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.25 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 223.0' Slope= 0.0040 '/'
Inlet Invert= 328.73', Outlet Invert= 327.84'



Reach 7R: 12"



Summary for Subcatchment 7S:

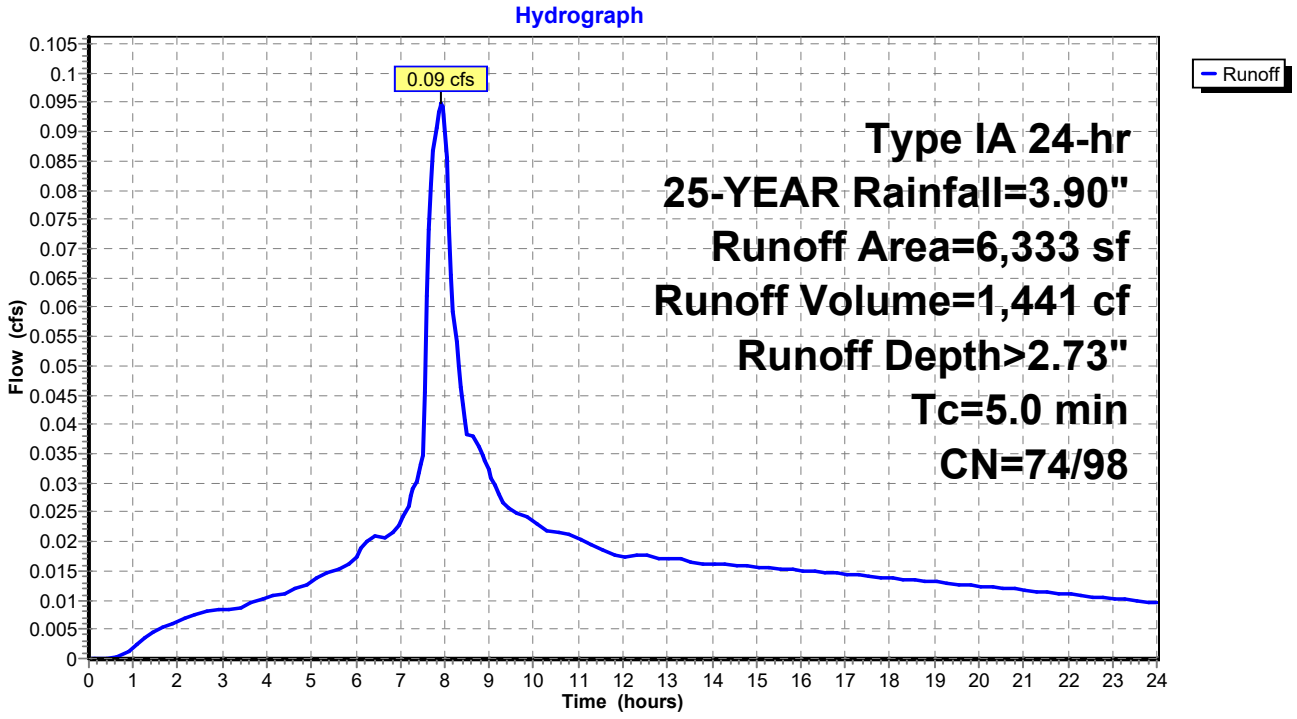
Runoff = 0.09 cfs @ 7.93 hrs, Volume= 1,441 cf, Depth> 2.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
3,586	98	Paved roads w/curbs & sewers, HSG C
2,747	74	>75% Grass cover, Good, HSG C
6,333	88	Weighted Average
2,747	74	43.38% Pervious Area
3,586	98	56.62% Impervious Area

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

Subcatchment 7S:



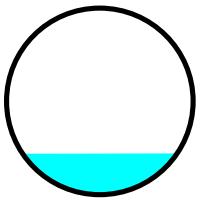
Summary for Reach 8R: 12"

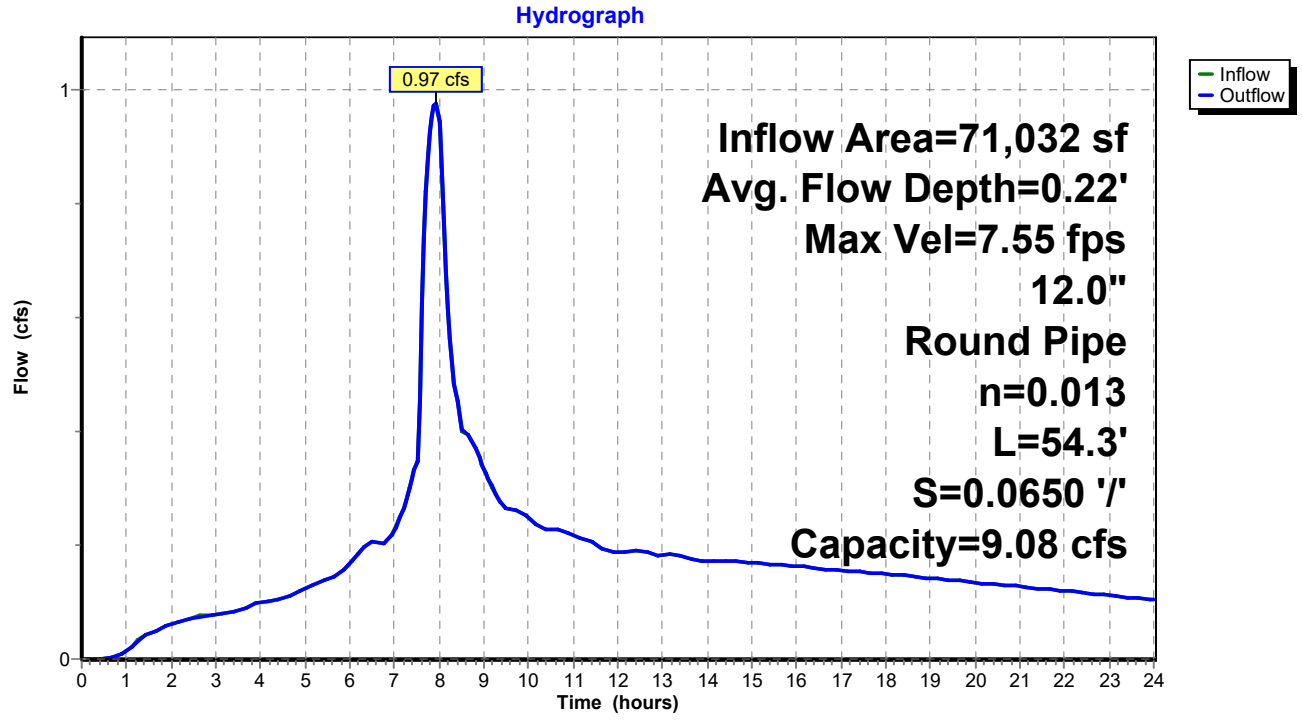
Inflow Area = 71,032 sf, 47.56% Impervious, Inflow Depth > 2.54" for 25-YEAR event
Inflow = 0.97 cfs @ 7.94 hrs, Volume= 15,016 cf
Outflow = 0.97 cfs @ 7.94 hrs, Volume= 15,014 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.55 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.36 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.08 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 54.3' Slope= 0.0650 '/'
Inlet Invert= 334.85', Outlet Invert= 331.32'





Summary for Subcatchment 8S:

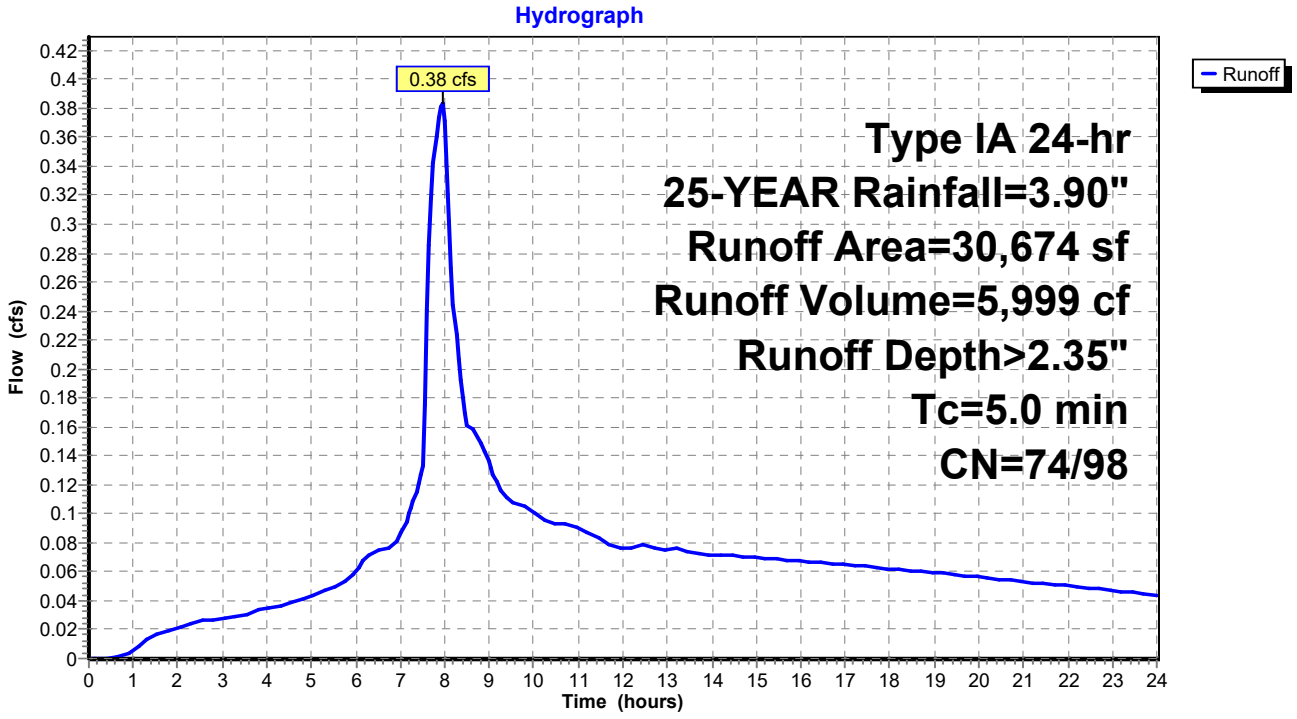
Runoff = 0.38 cfs @ 7.95 hrs, Volume= 5,999 cf, Depth> 2.35"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
11,865	98	Paved roads w/curbs & sewers, HSG C
18,809	74	>75% Grass cover, Good, HSG C
30,674	83	Weighted Average
18,809	74	61.32% Pervious Area
11,865	98	38.68% Impervious Area

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

Subcatchment 8S:



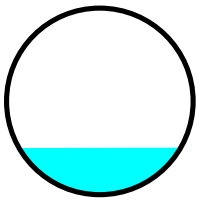
Summary for Reach 9R: 12"

Inflow Area = 42,296 sf, 44.59% Impervious, Inflow Depth > 2.47" for 25-YEAR event
Inflow = 0.56 cfs @ 7.95 hrs, Volume= 8,714 cf
Outflow = 0.56 cfs @ 7.95 hrs, Volume= 8,711 cf, Atten= 0%, Lag= 0.3 min

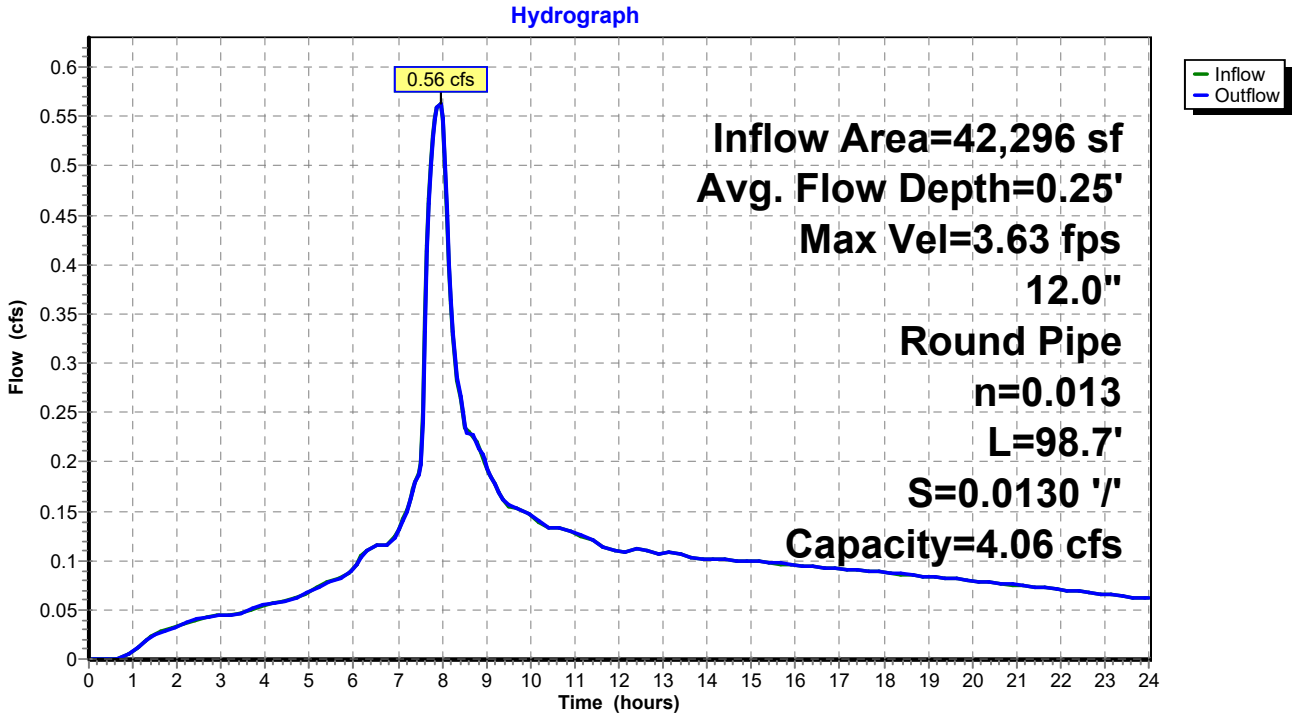
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.63 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 0.8 min

Peak Storage= 15 cf @ 7.95 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.06 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 98.7' Slope= 0.0130 '/'
Inlet Invert= 345.78', Outlet Invert= 344.50'



Reach 9R: 12"



Summary for Subcatchment 9S:

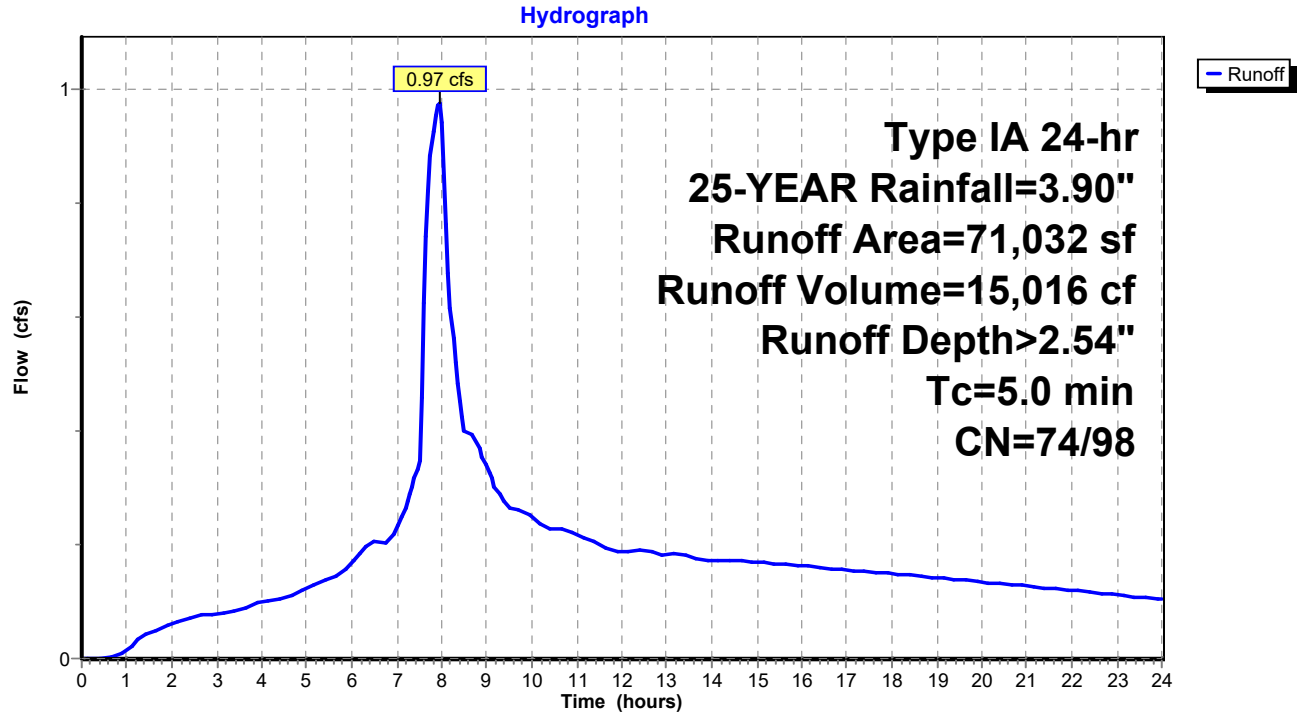
Runoff = 0.97 cfs @ 7.94 hrs, Volume= 15,016 cf, Depth> 2.54"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
33,780	98	Paved roads w/curbs & sewers, HSG C
37,252	74	>75% Grass cover, Good, HSG C
71,032	85	Weighted Average
37,252	74	52.44% Pervious Area
33,780	98	47.56% Impervious Area

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

Subcatchment 9S:



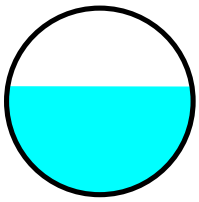
Summary for Reach 10R: 15"

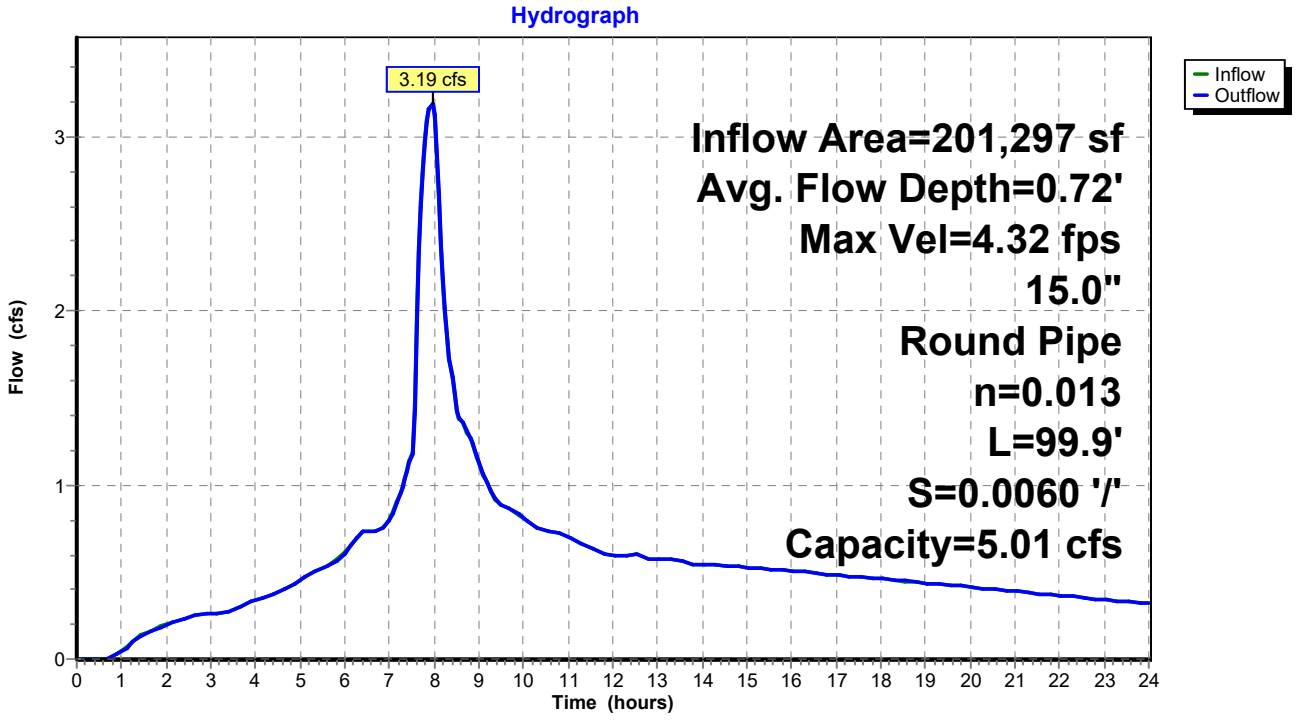
Inflow Area = 201,297 sf, 55.48% Impervious, Inflow Depth > 2.92" for 25-YEAR event
Inflow = 3.19 cfs @ 7.96 hrs, Volume= 48,979 cf
Outflow = 3.19 cfs @ 7.96 hrs, Volume= 48,965 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.32 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.60 fps, Avg. Travel Time= 0.6 min

Peak Storage= 74 cf @ 7.96 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.01 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 99.9' Slope= 0.0060 '/'
Inlet Invert= 331.16', Outlet Invert= 330.56'





Summary for Subcatchment 10S:

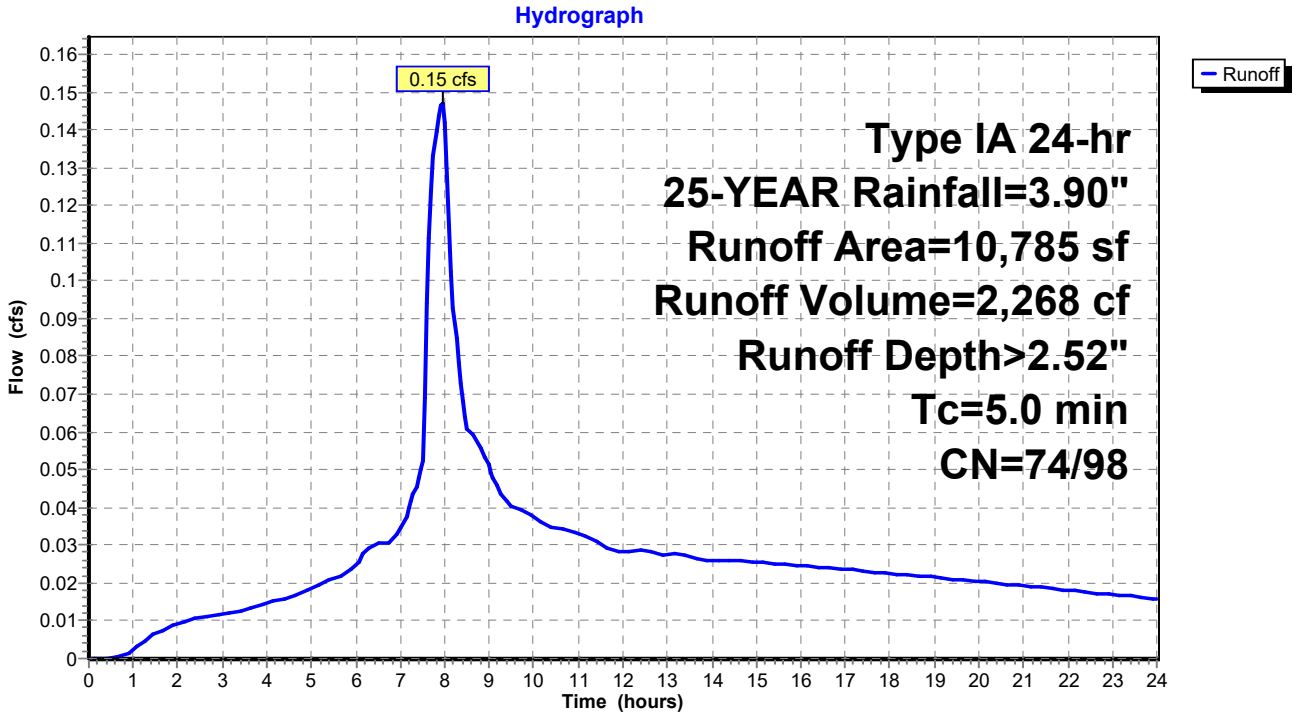
Runoff = 0.15 cfs @ 7.94 hrs, Volume= 2,268 cf, Depth> 2.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
5,060	98	Paved roads w/curbs & sewers, HSG C
5,725	74	>75% Grass cover, Good, HSG C
10,785	85	Weighted Average
5,725	74	53.08% Pervious Area
5,060	98	46.92% Impervious Area

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

Subcatchment 10S:



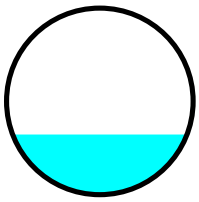
Summary for Reach 11R: 12"

Inflow Area = 73,746 sf, 59.12% Impervious, Inflow Depth > 2.78" for 25-YEAR event
Inflow = 1.13 cfs @ 7.93 hrs, Volume= 17,111 cf
Outflow = 1.13 cfs @ 7.93 hrs, Volume= 17,106 cf, Atten= 0%, Lag= 0.3 min

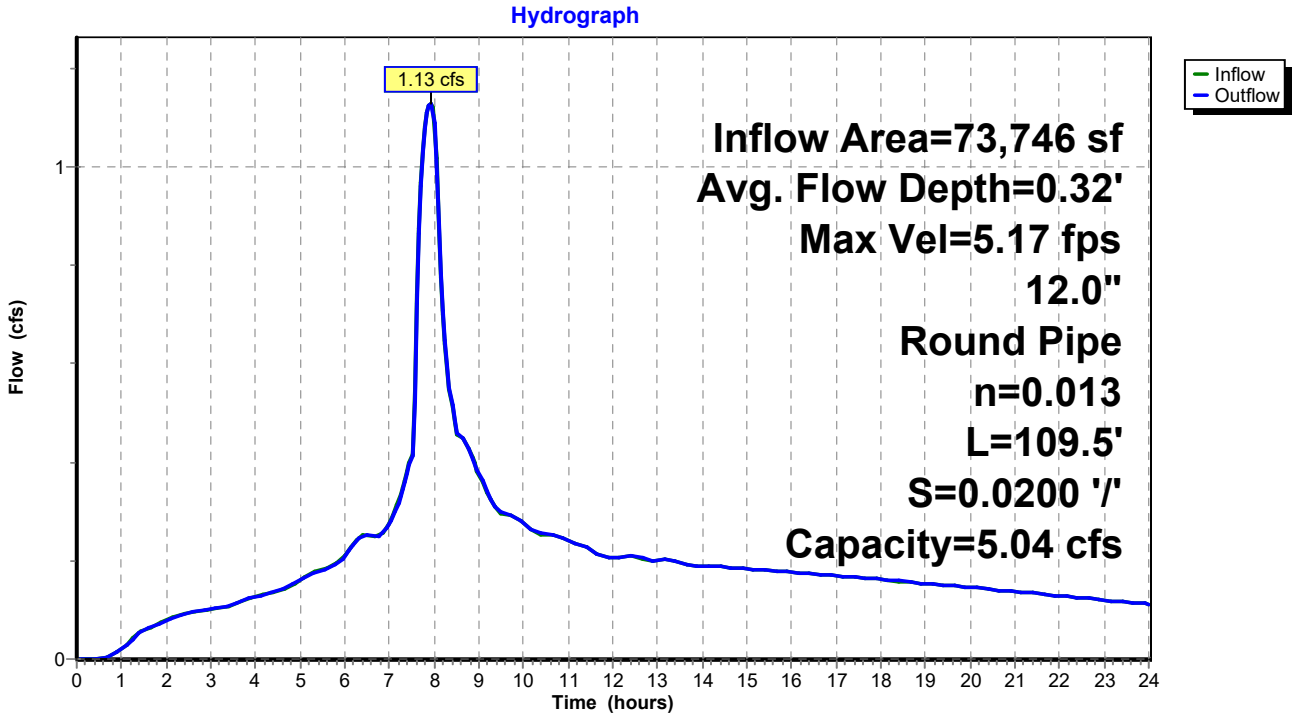
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.17 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.00 fps, Avg. Travel Time= 0.6 min

Peak Storage= 24 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.04 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 109.5' Slope= 0.0200 '/'
Inlet Invert= 335.26', Outlet Invert= 333.07'



Reach 11R: 12"



Summary for Subcatchment 11S:

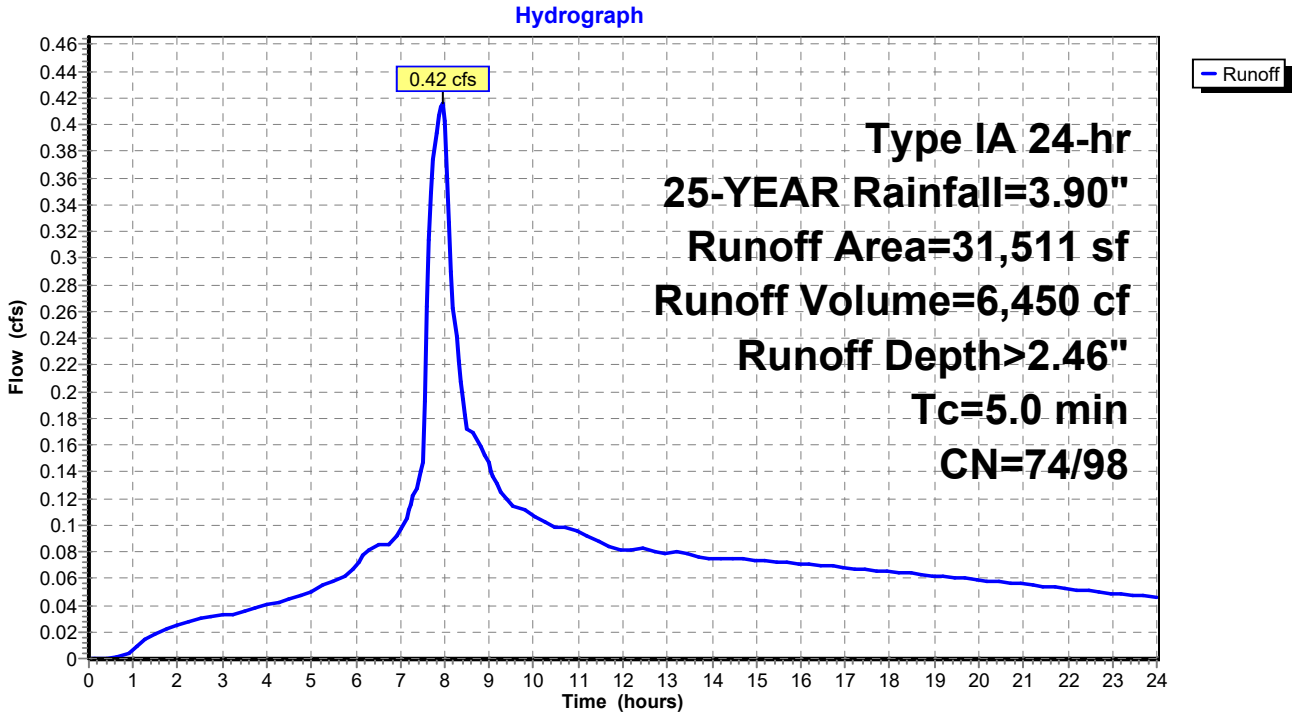
Runoff = 0.42 cfs @ 7.94 hrs, Volume= 6,450 cf, Depth> 2.46"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
13,800	98	Paved roads w/curbs & sewers, HSG C
17,711	74	>75% Grass cover, Good, HSG C
31,511	85	Weighted Average
17,711	74	56.21% Pervious Area
13,800	98	43.79% Impervious Area

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

Subcatchment 11S:



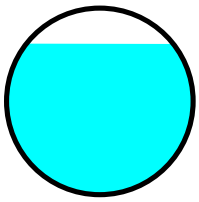
Summary for Reach 12R: 12"

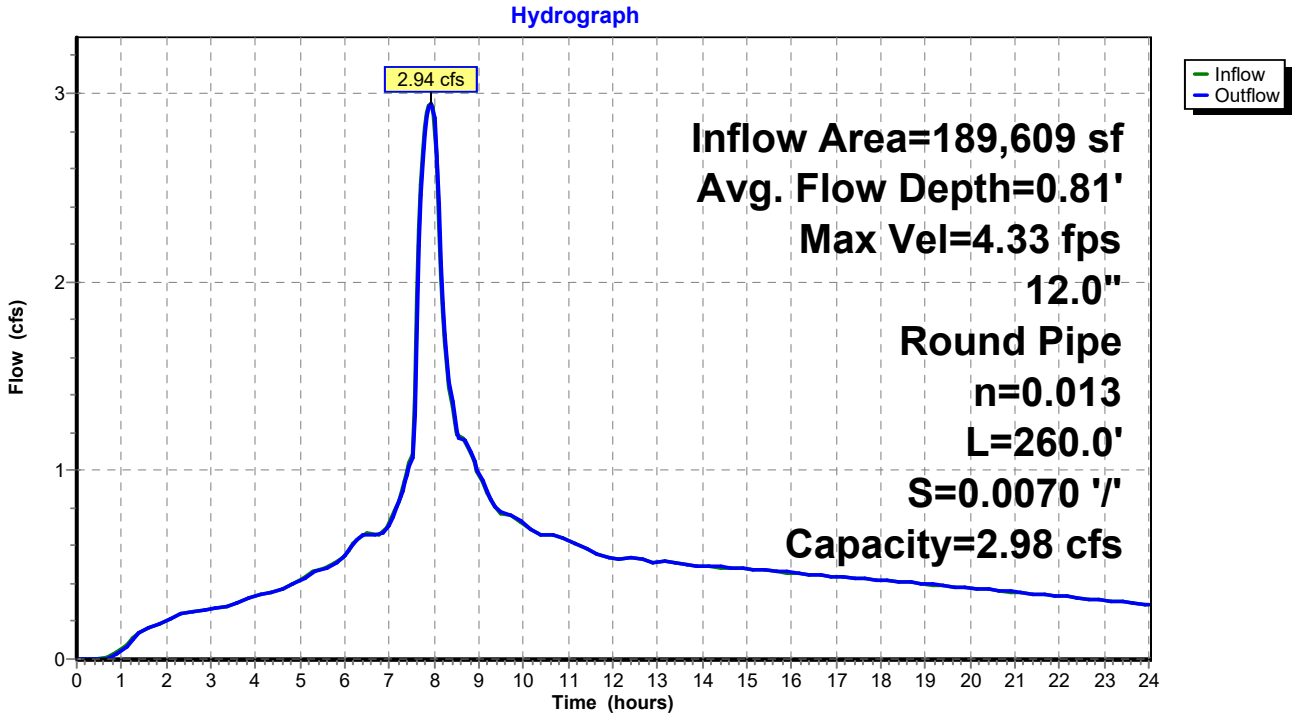
Inflow Area = 189,609 sf, 60.69% Impervious, Inflow Depth > 2.82" for 25-YEAR event
Inflow = 2.94 cfs @ 7.93 hrs, Volume= 44,518 cf
Outflow = 2.94 cfs @ 7.94 hrs, Volume= 44,487 cf, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.33 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 2.73 fps, Avg. Travel Time= 1.6 min

Peak Storage= 177 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.98 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 260.0' Slope= 0.0070 '/'
Inlet Invert= 334.61', Outlet Invert= 332.79'





Summary for Subcatchment 12S:

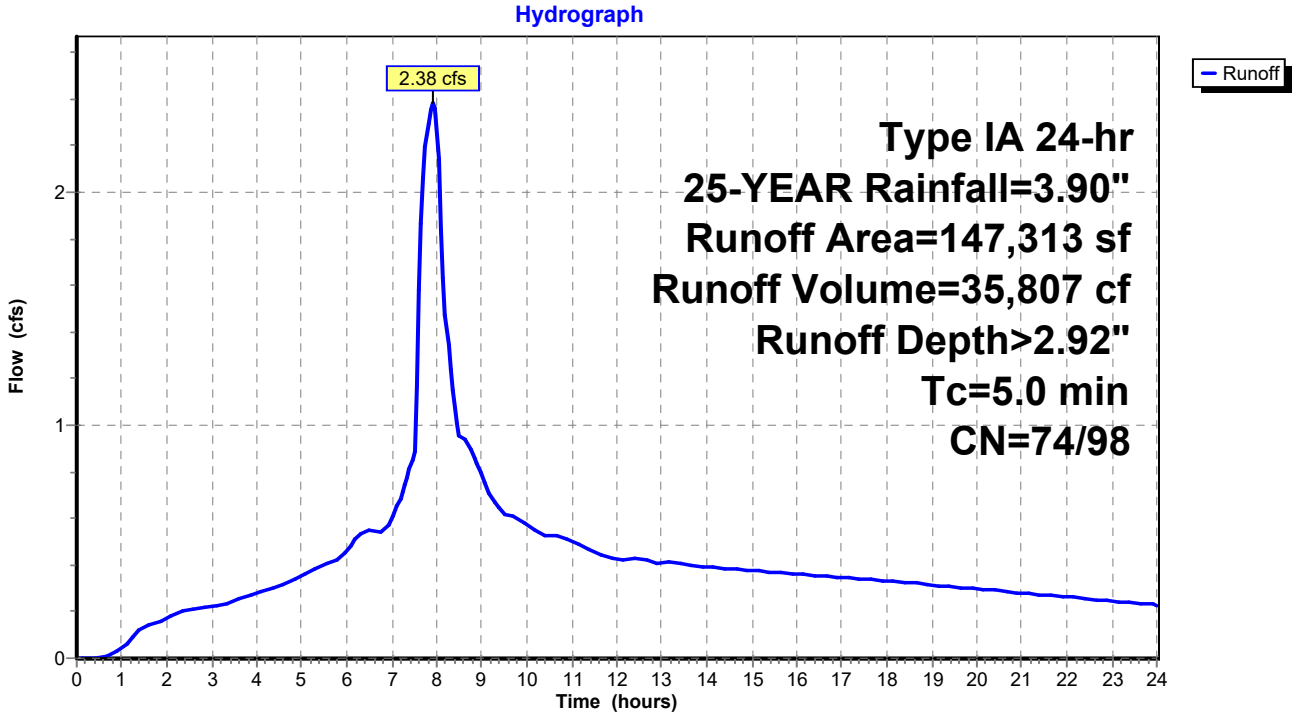
Runoff = 2.38 cfs @ 7.92 hrs, Volume= 35,807 cf, Depth> 2.92"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	38,136	98	Paved roads w/curbs & sewers, HSG C
	51,097	74	>75% Grass cover, Good, HSG C
*	58,080	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	147,313	90	Weighted Average
	51,097	74	34.69% Pervious Area
	96,216	98	65.31% Impervious Area

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

Subcatchment 12S:



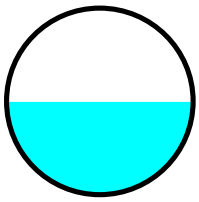
Summary for Reach 13R: 12"

Inflow Area = 91,031 sf, 39.79% Impervious, Inflow Depth > 2.84" for 25-YEAR event
Inflow = 1.38 cfs @ 7.98 hrs, Volume= 21,574 cf
Outflow = 1.38 cfs @ 7.98 hrs, Volume= 21,569 cf, Atten= 0%, Lag= 0.1 min

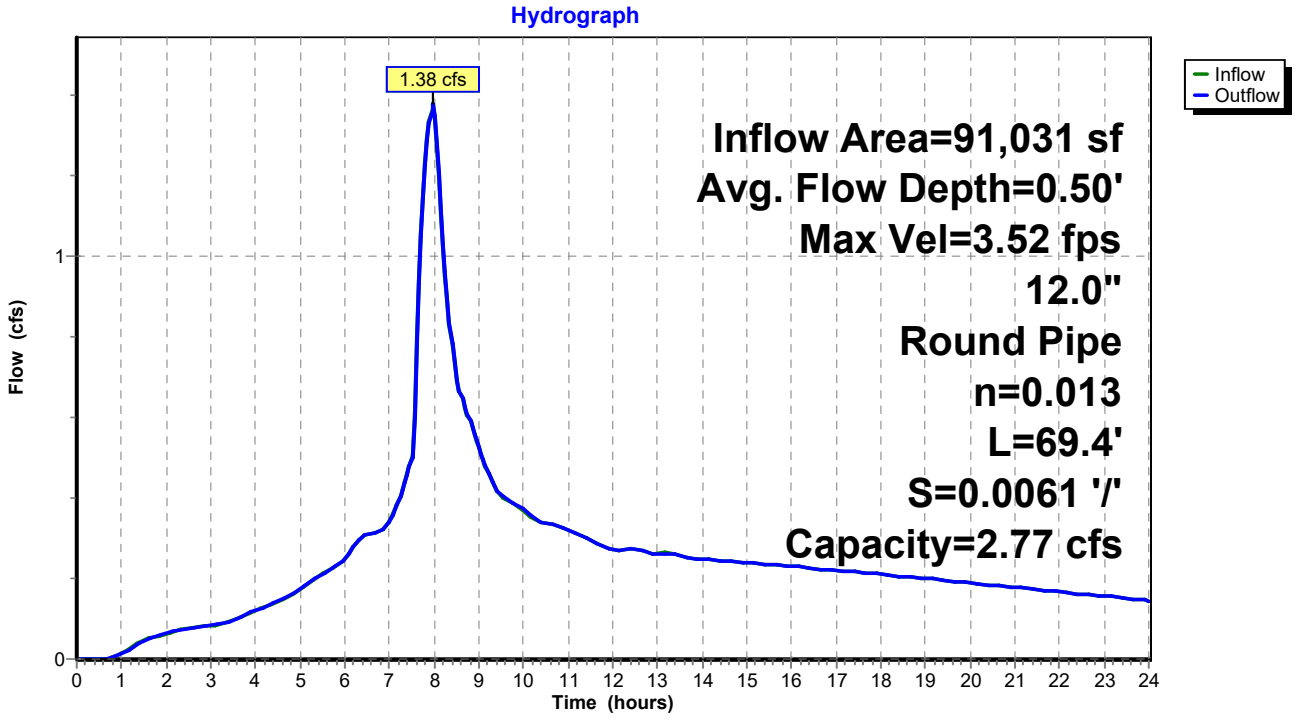
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.52 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 0.6 min

Peak Storage= 27 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.77 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 69.4' Slope= 0.0061 '/'
Inlet Invert= 333.49', Outlet Invert= 333.07'



Reach 13R: 12"



Summary for Subcatchment 13S:

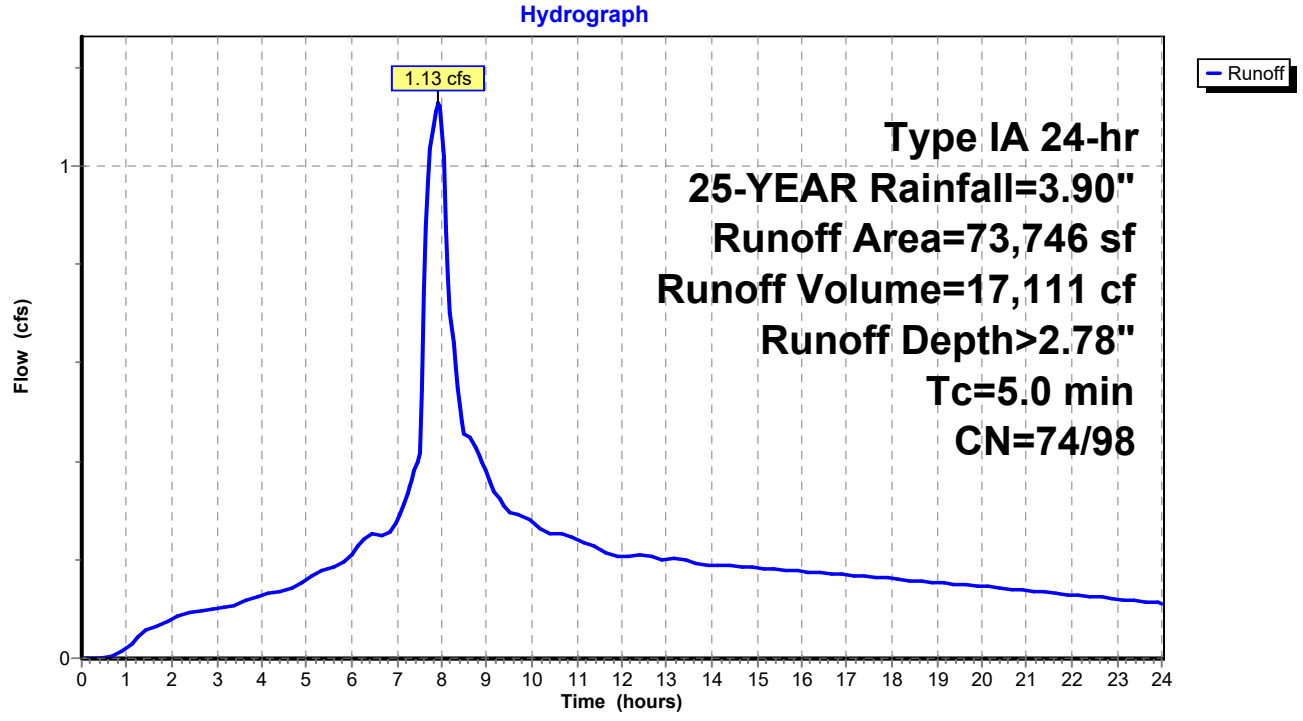
Runoff = 1.13 cfs @ 7.93 hrs, Volume= 17,111 cf, Depth> 2.78"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	17,200	98	Paved roads w/curbs & sewers, HSG C
	30,146	74	>75% Grass cover, Good, HSG C
*	26,400	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	73,746	88	Weighted Average
	30,146	74	40.88% Pervious Area
	43,600	98	59.12% Impervious Area

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

Subcatchment 13S:



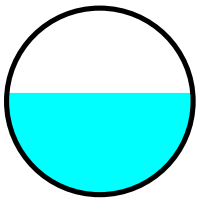
Summary for Reach 14R: 12"

Inflow Area = 143,506 sf, 62.20% Impervious, Inflow Depth > 2.85" for 25-YEAR event
Inflow = 2.26 cfs @ 7.92 hrs, Volume= 34,086 cf
Outflow = 2.26 cfs @ 7.93 hrs, Volume= 34,075 cf, Atten= 0%, Lag= 0.4 min

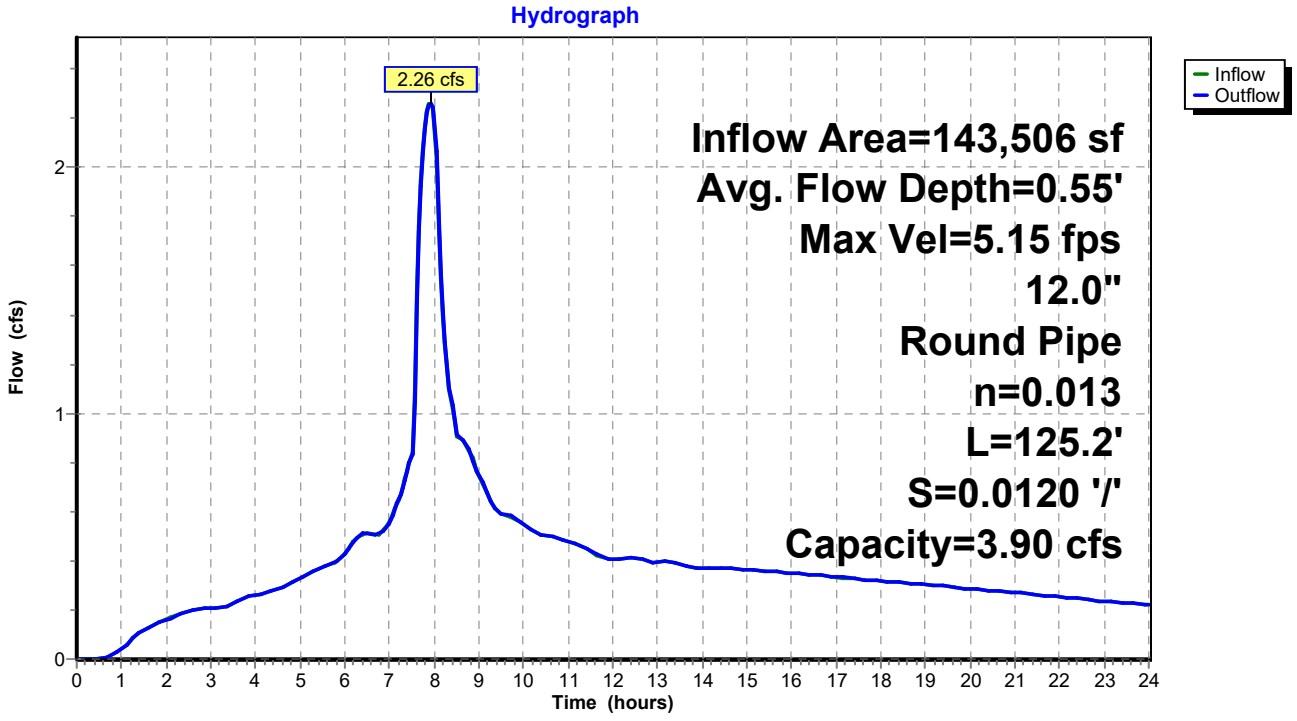
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.15 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.07 fps, Avg. Travel Time= 0.7 min

Peak Storage= 55 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.90 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 125.2' Slope= 0.0120 '/'
Inlet Invert= 327.61', Outlet Invert= 326.11'



Reach 14R: 12"



Summary for Subcatchment 14S:

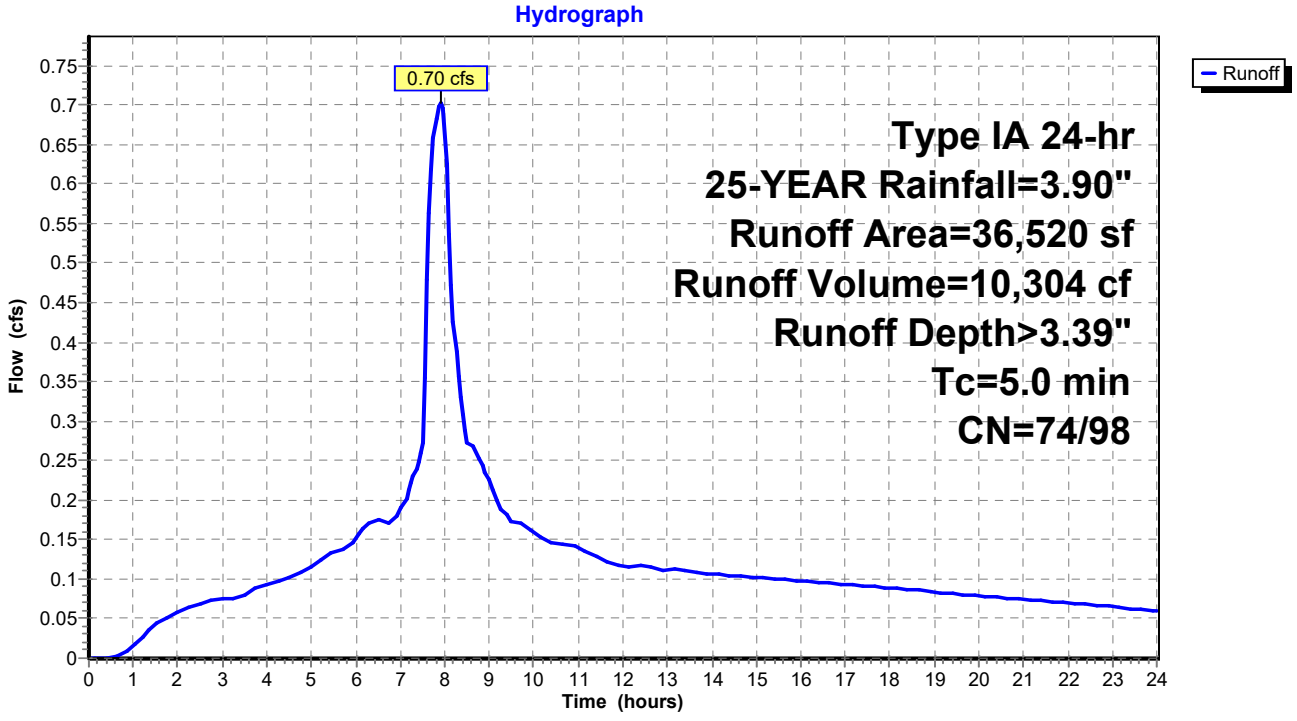
Runoff = 0.70 cfs @ 7.90 hrs, Volume= 10,304 cf, Depth> 3.39"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	13,373	98	Paved roads w/curbs & sewers, HSG C
	4,667	74	>75% Grass cover, Good, HSG C
*	18,480	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	36,520	95	Weighted Average
	4,667	74	12.78% Pervious Area
	31,853	98	87.22% Impervious Area

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

Subcatchment 14S:



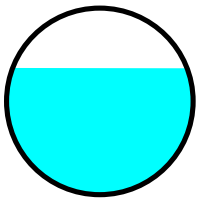
Summary for Reach 15R: 18"

Inflow Area = 473,481 sf, 70.34% Impervious, Inflow Depth > 3.02" for 25-YEAR event
Inflow = 7.99 cfs @ 7.92 hrs, Volume= 119,336 cf
Outflow = 7.99 cfs @ 7.92 hrs, Volume= 119,311 cf, Atten= 0%, Lag= 0.3 min

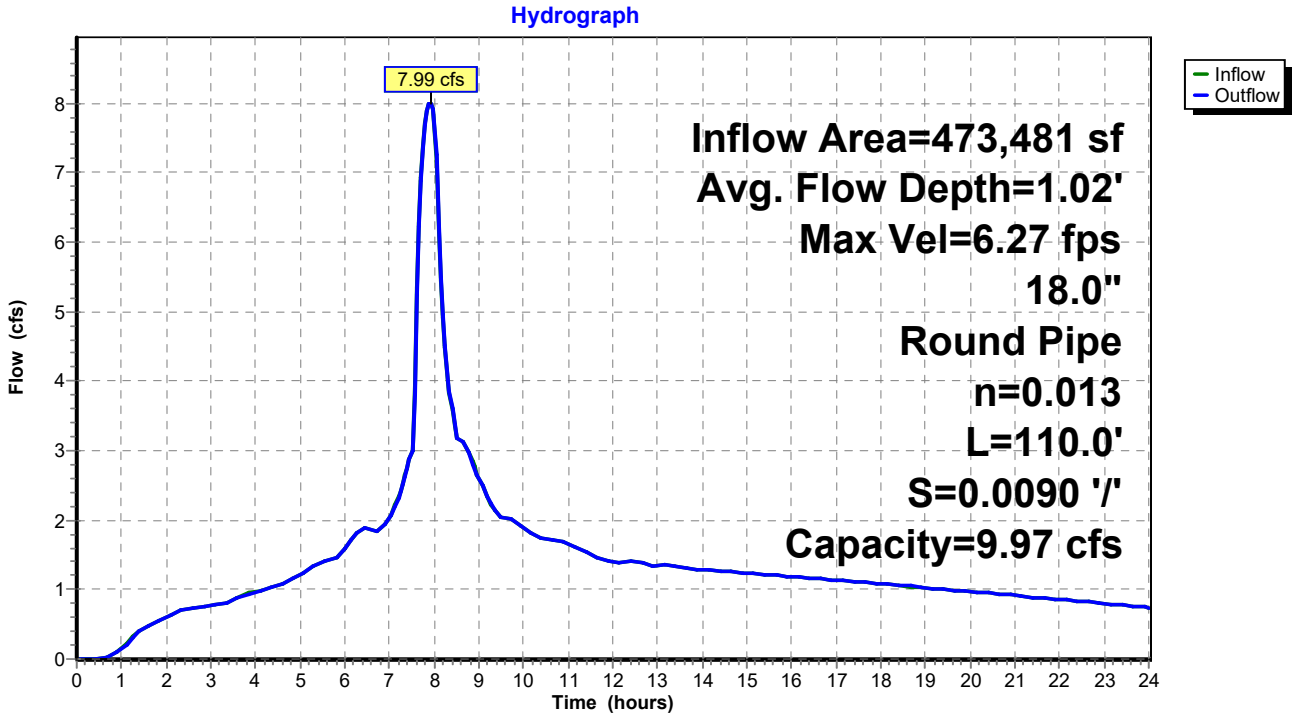
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.27 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.81 fps, Avg. Travel Time= 0.5 min

Peak Storage= 140 cf @ 7.92 hrs
Average Depth at Peak Storage= 1.02'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 9.97 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 110.0' Slope= 0.0090 '/'
Inlet Invert= 327.10', Outlet Invert= 326.11'



Reach 15R: 18"



Summary for Subcatchment 15S:

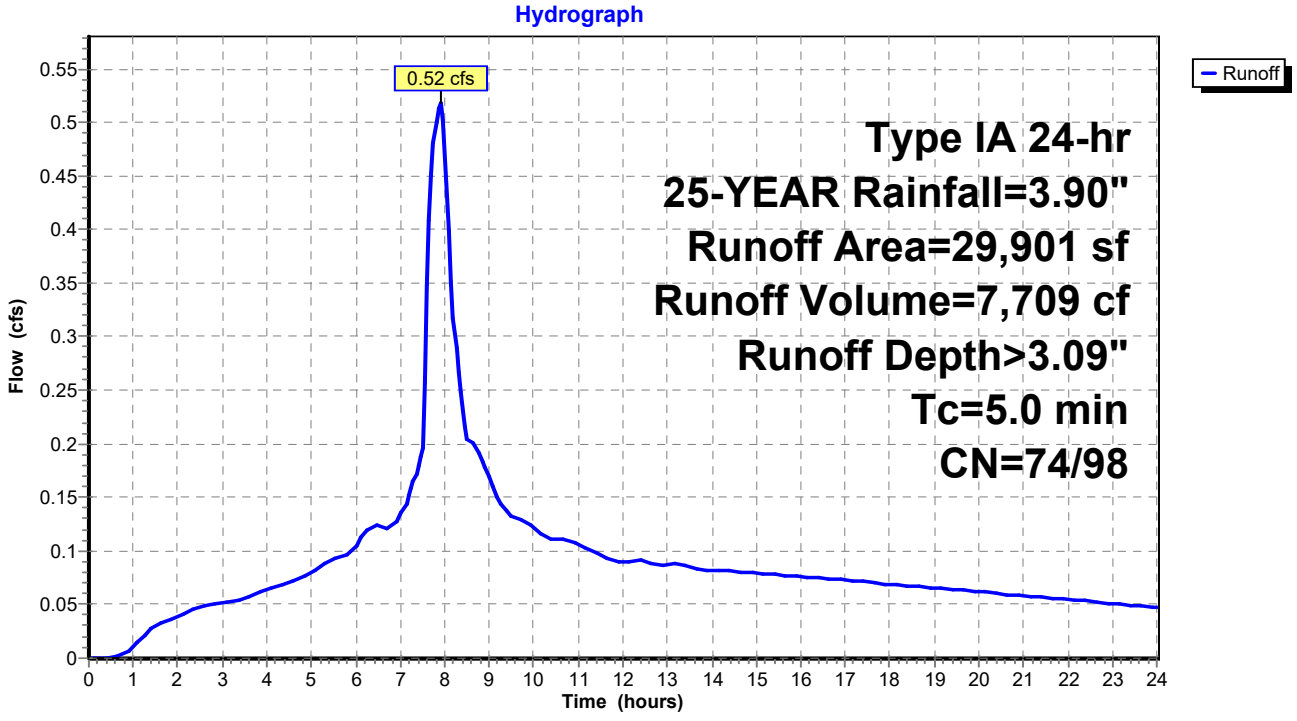
Runoff = 0.52 cfs @ 7.91 hrs, Volume= 7,709 cf, Depth> 3.09"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	8,803	98	Paved roads w/curbs & sewers, HSG C
	7,898	74	>75% Grass cover, Good, HSG C
*	13,200	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	29,901	92	Weighted Average
	7,898	74	26.41% Pervious Area
	22,003	98	73.59% Impervious Area

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

Subcatchment 15S:



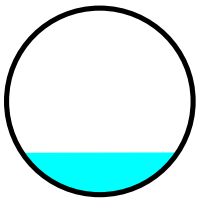
Summary for Reach 16R: 24" Outlet

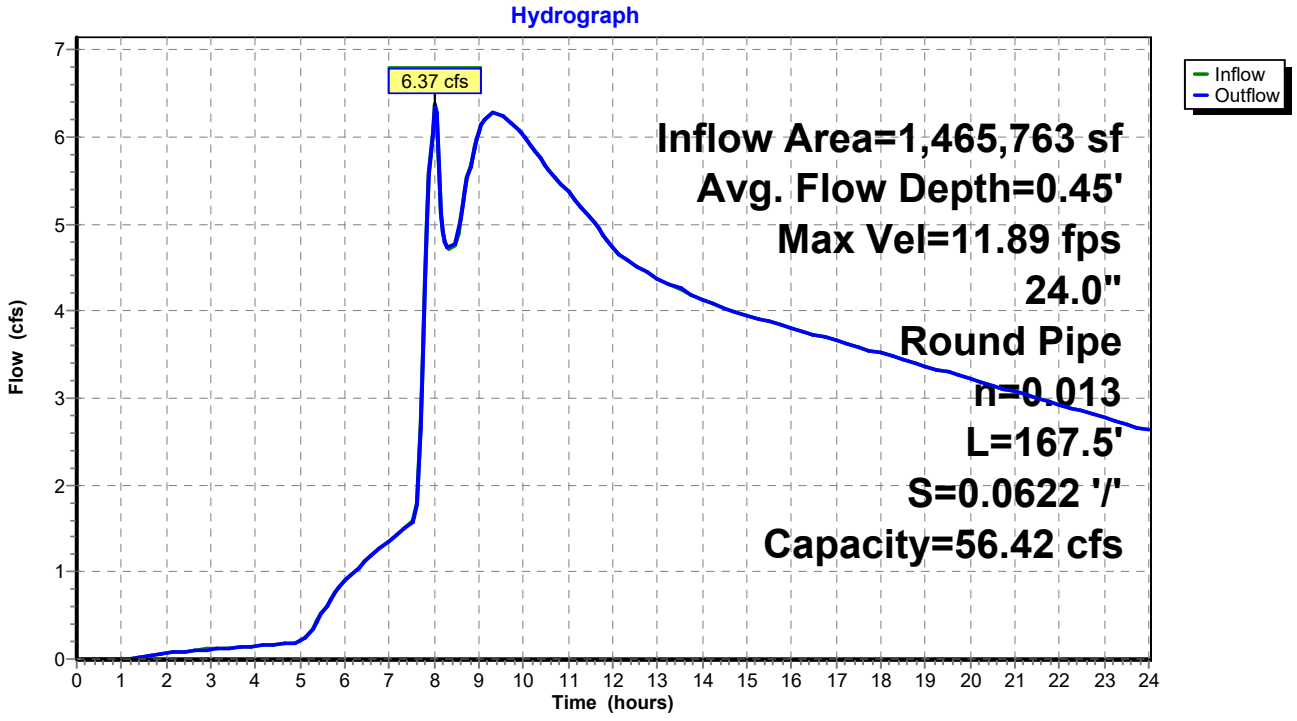
Inflow Area = 1,465,763 sf, 59.79% Impervious, Inflow Depth > 2.05" for 25-YEAR event
Inflow = 6.38 cfs @ 8.01 hrs, Volume= 249,894 cf
Outflow = 6.37 cfs @ 8.02 hrs, Volume= 249,846 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.89 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 8.69 fps, Avg. Travel Time= 0.3 min

Peak Storage= 90 cf @ 8.02 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 56.42 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 167.5' Slope= 0.0622 '/'
Inlet Invert= 319.37', Outlet Invert= 308.95'





Summary for Subcatchment 16S:

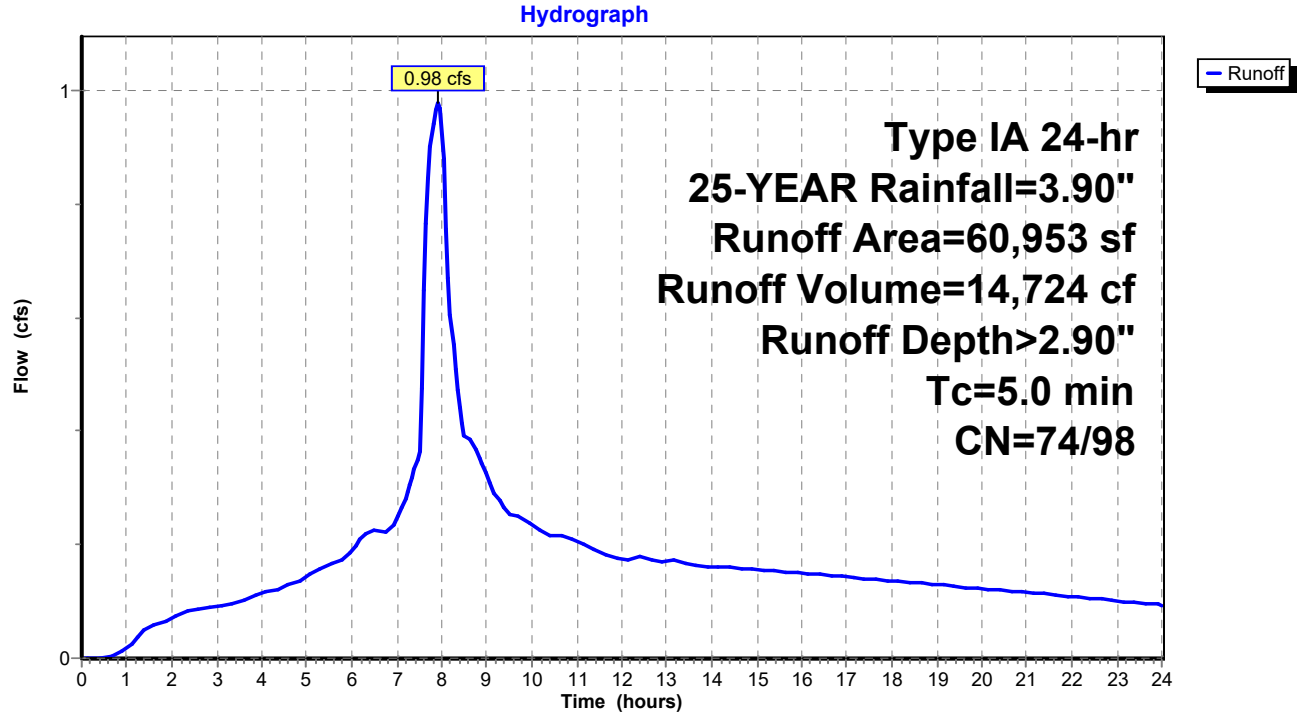
Runoff = 0.98 cfs @ 7.92 hrs, Volume= 14,724 cf, Depth> 2.90"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	18,176	98	Paved roads w/curbs & sewers, HSG C
	21,657	74	>75% Grass cover, Good, HSG C
*	21,120	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	60,953	89	Weighted Average
	21,657	74	35.53% Pervious Area
	39,296	98	64.47% Impervious Area

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

Subcatchment 16S:



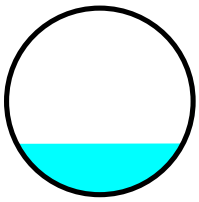
Summary for Reach 17R: 12"

Inflow Area = 31,511 sf, 43.79% Impervious, Inflow Depth > 2.46" for 25-YEAR event
Inflow = 0.42 cfs @ 7.94 hrs, Volume= 6,450 cf
Outflow = 0.42 cfs @ 7.95 hrs, Volume= 6,447 cf, Atten= 0%, Lag= 0.4 min

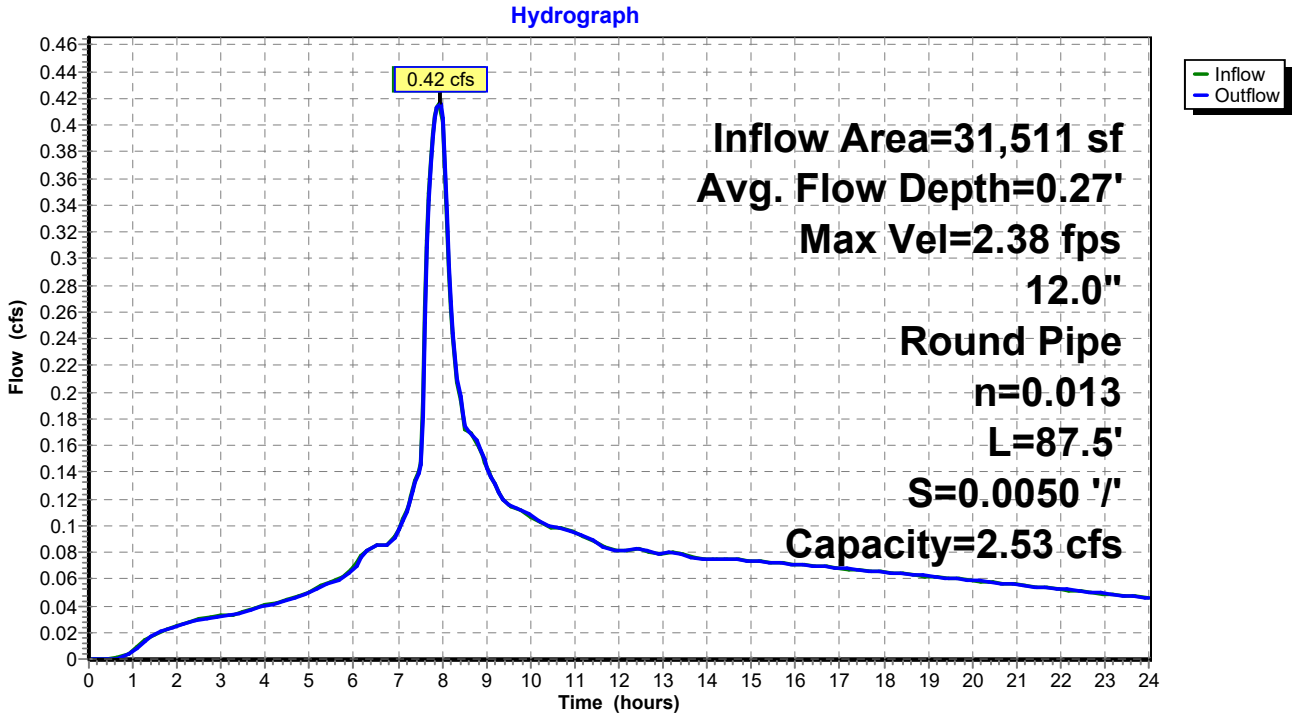
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.38 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 1.1 min

Peak Storage= 15 cf @ 7.95 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.53 cfs

12.0" Round Pipe
n= 0.013
Length= 87.5' Slope= 0.0050 '/'
Inlet Invert= 344.95', Outlet Invert= 344.51'



Reach 17R: 12"



Summary for Subcatchment 17S:

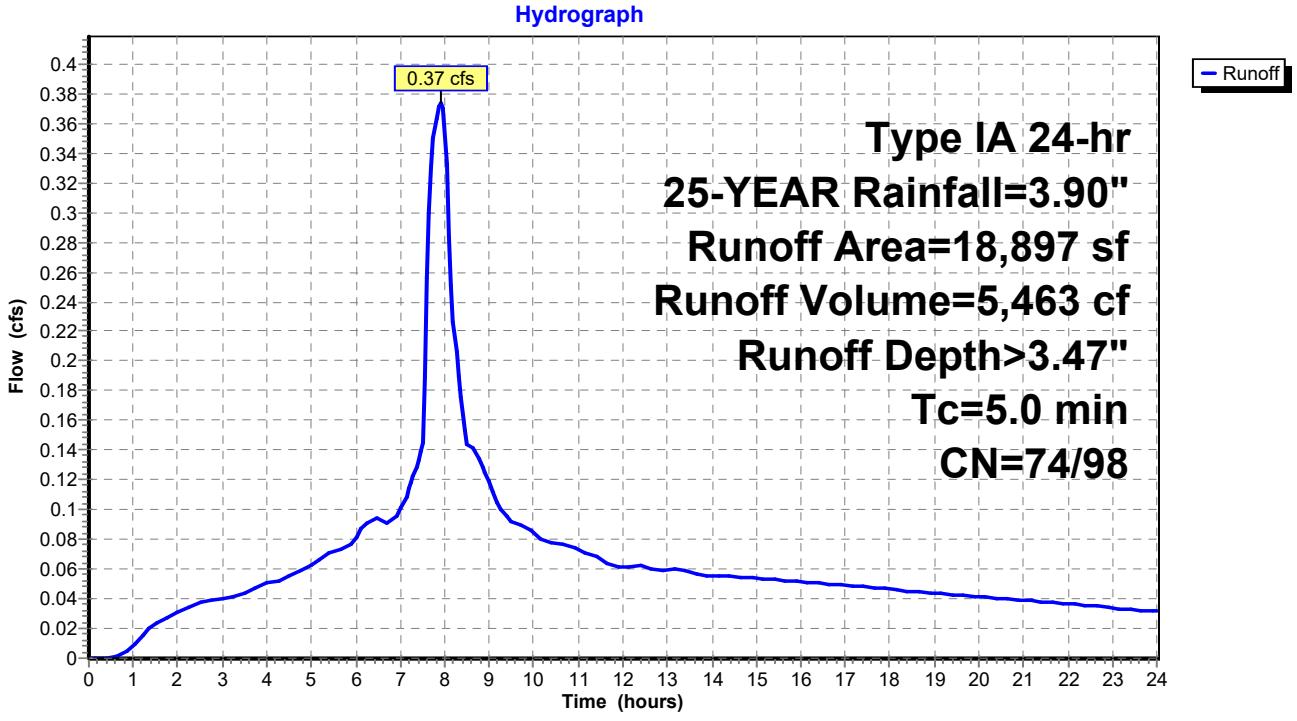
Runoff = 0.37 cfs @ 7.90 hrs, Volume= 5,463 cf, Depth> 3.47"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	1,217	98	Paved roads w/curbs & sewers, HSG C
	1,680	74	>75% Grass cover, Good, HSG C
*	16,000	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	18,897	96	Weighted Average
	1,680	74	8.89% Pervious Area
	17,217	98	91.11% Impervious Area

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

Subcatchment 17S:



Summary for Subcatchment 18.1S:

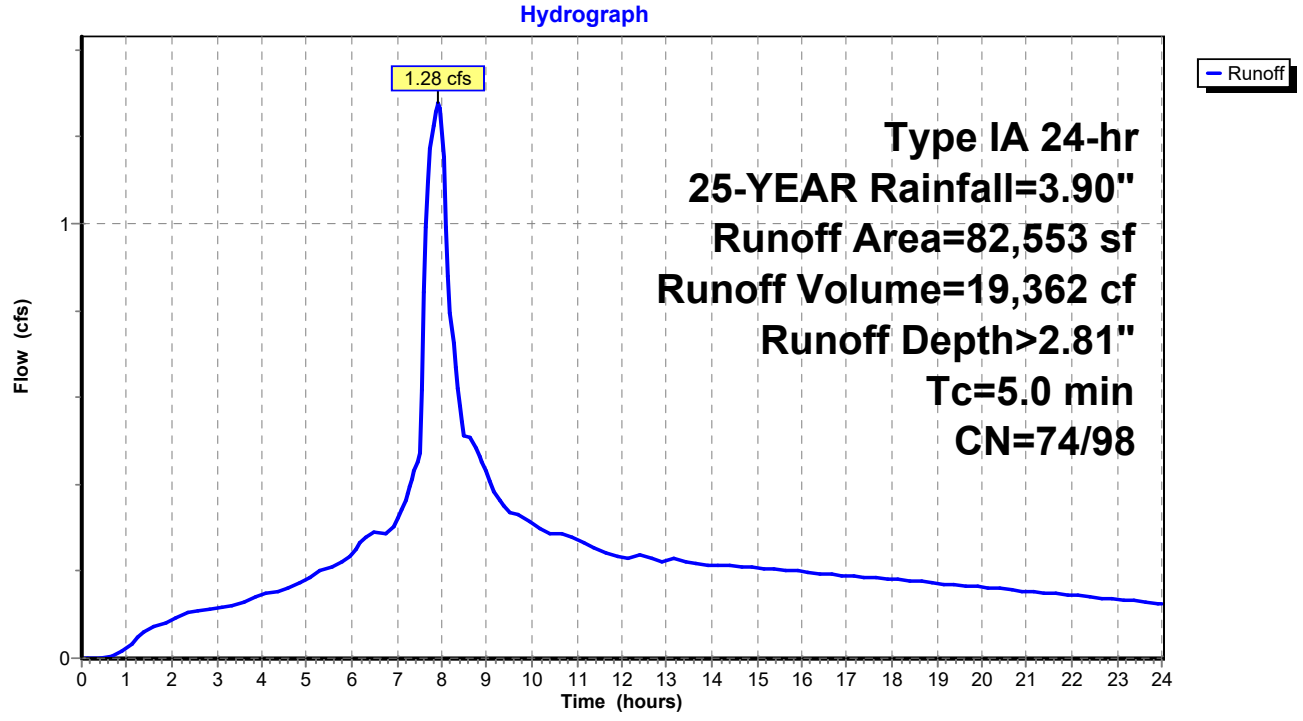
Runoff = 1.28 cfs @ 7.93 hrs, Volume= 19,362 cf, Depth> 2.81"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	15,650	98	Paved roads w/curbs & sewers, HSG C
	32,583	74	>75% Grass cover, Good, HSG C
*	34,320	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	82,553	89	Weighted Average
	32,583	74	39.47% Pervious Area
	49,970	98	60.53% Impervious Area

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

Subcatchment 18.1S:



Summary for Subcatchment 18S:

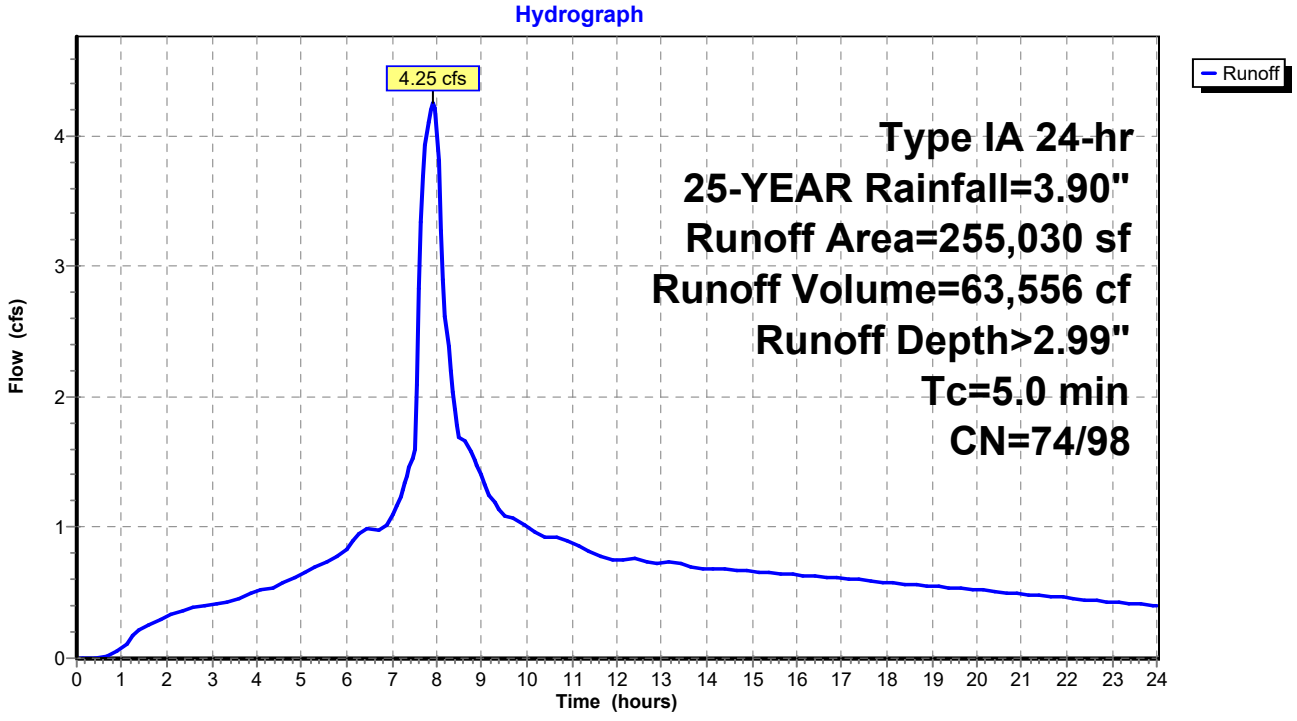
Runoff = 4.25 cfs @ 7.92 hrs, Volume= 63,556 cf, Depth> 2.99"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	64,470	98	Paved roads w/curbs & sewers, HSG C
	79,680	74	>75% Grass cover, Good, HSG C
*	110,880	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	255,030	91	Weighted Average
	79,680	74	31.24% Pervious Area
	175,350	98	68.76% Impervious Area

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

Subcatchment 18S:



Summary for Subcatchment 19S:

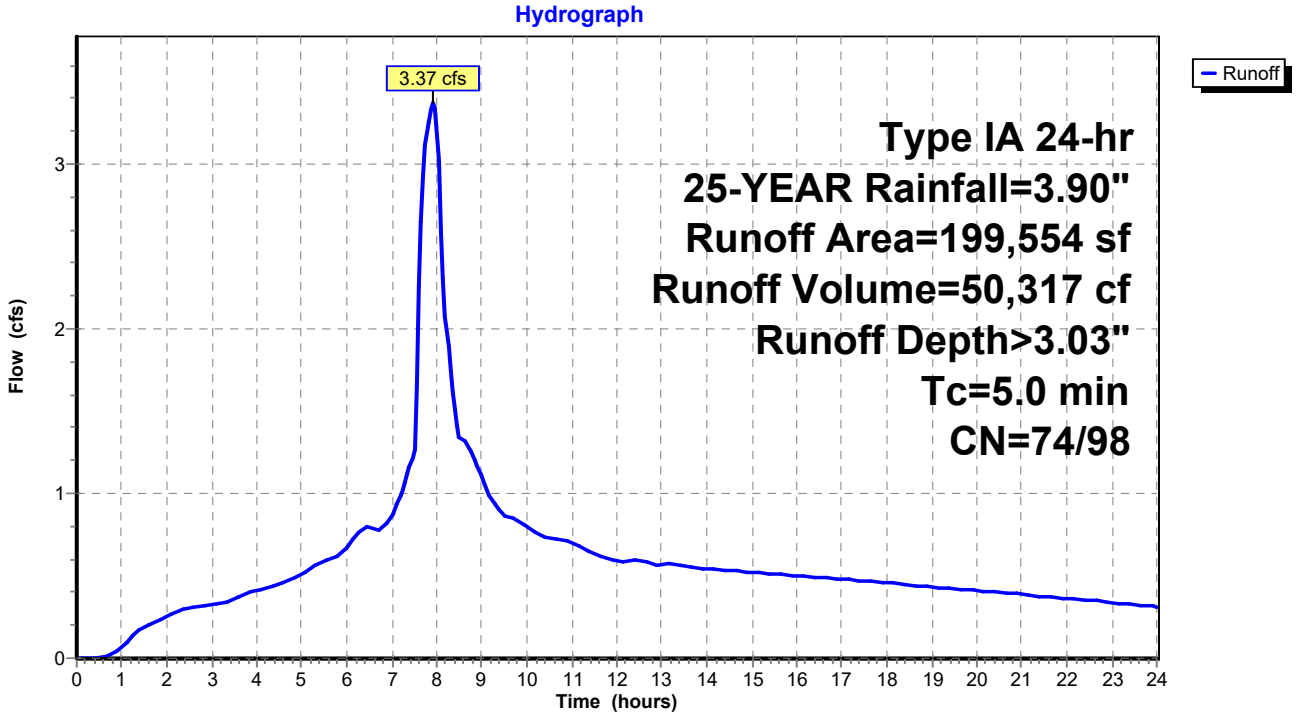
Runoff = 3.37 cfs @ 7.92 hrs, Volume= 50,317 cf, Depth> 3.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	56,017	98	Paved roads w/curbs & sewers, HSG C
	59,057	74	>75% Grass cover, Good, HSG C
*	84,480	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	199,554	91	Weighted Average
	59,057	74	29.59% Pervious Area
	140,497	98	70.41% Impervious Area

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

Subcatchment 19S:



Summary for Subcatchment 20S:

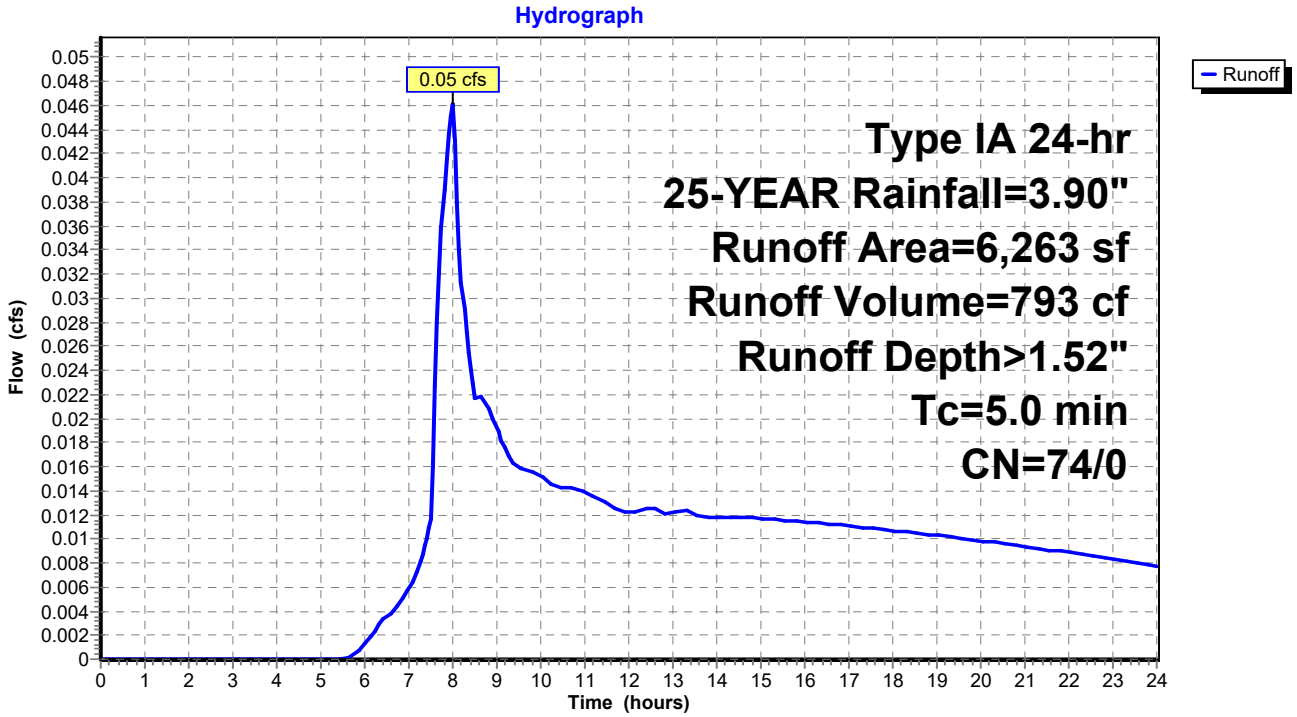
Runoff = 0.05 cfs @ 7.99 hrs, Volume= 793 cf, Depth> 1.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
6,263	74	>75% Grass cover, Good, HSG C
6,263	74	100.00% Pervious Area

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

Subcatchment 20S:



Summary for Subcatchment 21S:

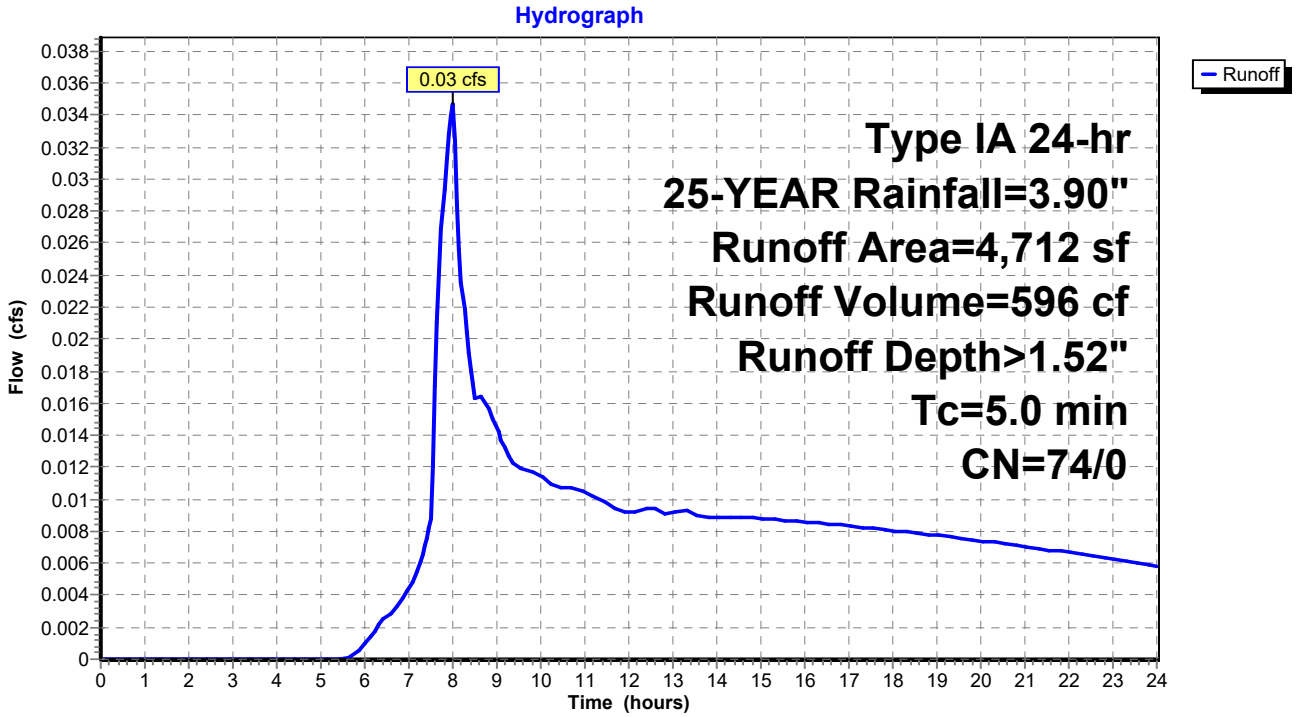
Runoff = 0.03 cfs @ 7.99 hrs, Volume= 596 cf, Depth> 1.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
4,712	74	>75% Grass cover, Good, HSG C
4,712	74	100.00% Pervious Area

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

Subcatchment 21S:



Summary for Subcatchment 22S:

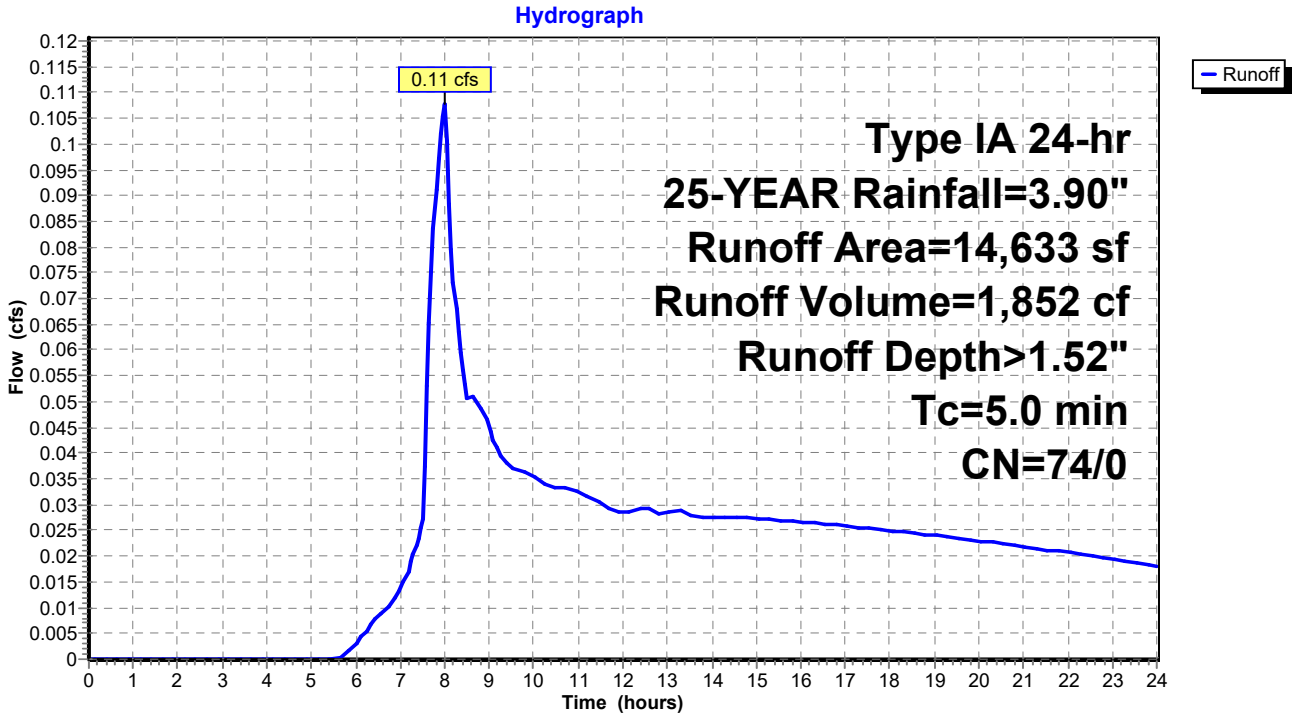
Runoff = 0.11 cfs @ 7.99 hrs, Volume= 1,852 cf, Depth> 1.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
14,633	74	>75% Grass cover, Good, HSG C
14,633	74	100.00% Pervious Area

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

Subcatchment 22S:



Summary for Subcatchment 23S: Onsite Undisturbed

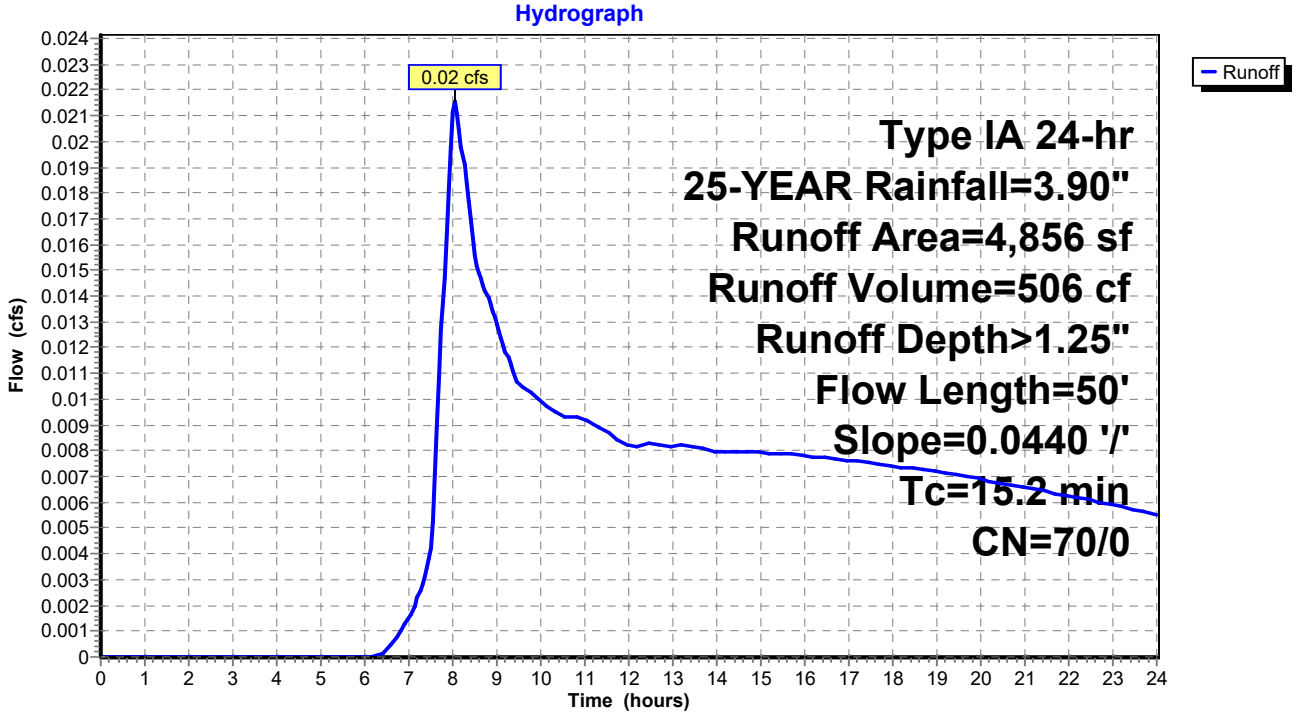
Runoff = 0.02 cfs @ 8.05 hrs, Volume= 506 cf, Depth> 1.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
4,856	70	Woods, Good, HSG C
4,856	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0440	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
5.0					**Direct Entry,**
15.2	50	Total			

Subcatchment 23S: Onsite Undisturbed



Summary for Subcatchment 24S: Onsite Undisturbed

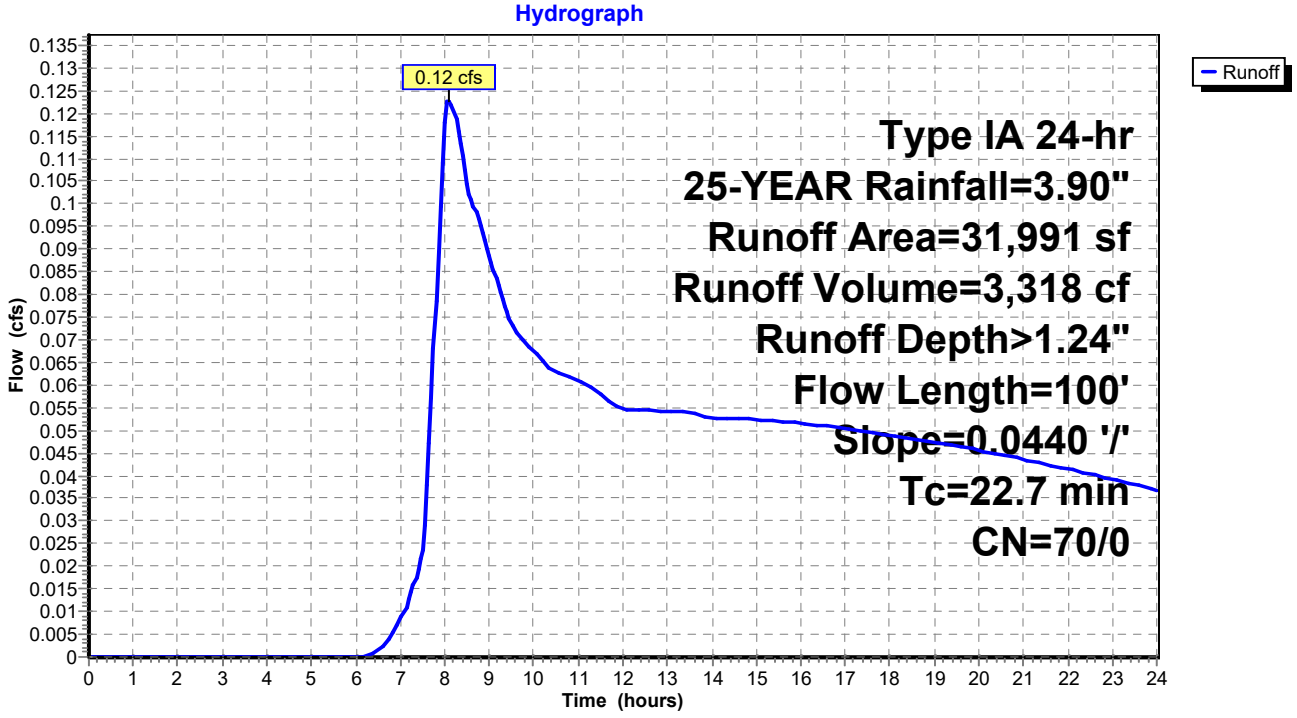
Runoff = 0.12 cfs @ 8.08 hrs, Volume= 3,318 cf, Depth> 1.24"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
31,991	70	Woods, Good, HSG C
31,991	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	100	0.0440	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
5.0					**Direct Entry,**
22.7	100	Total			

Subcatchment 24S: Onsite Undisturbed



Summary for Subcatchment 25S:

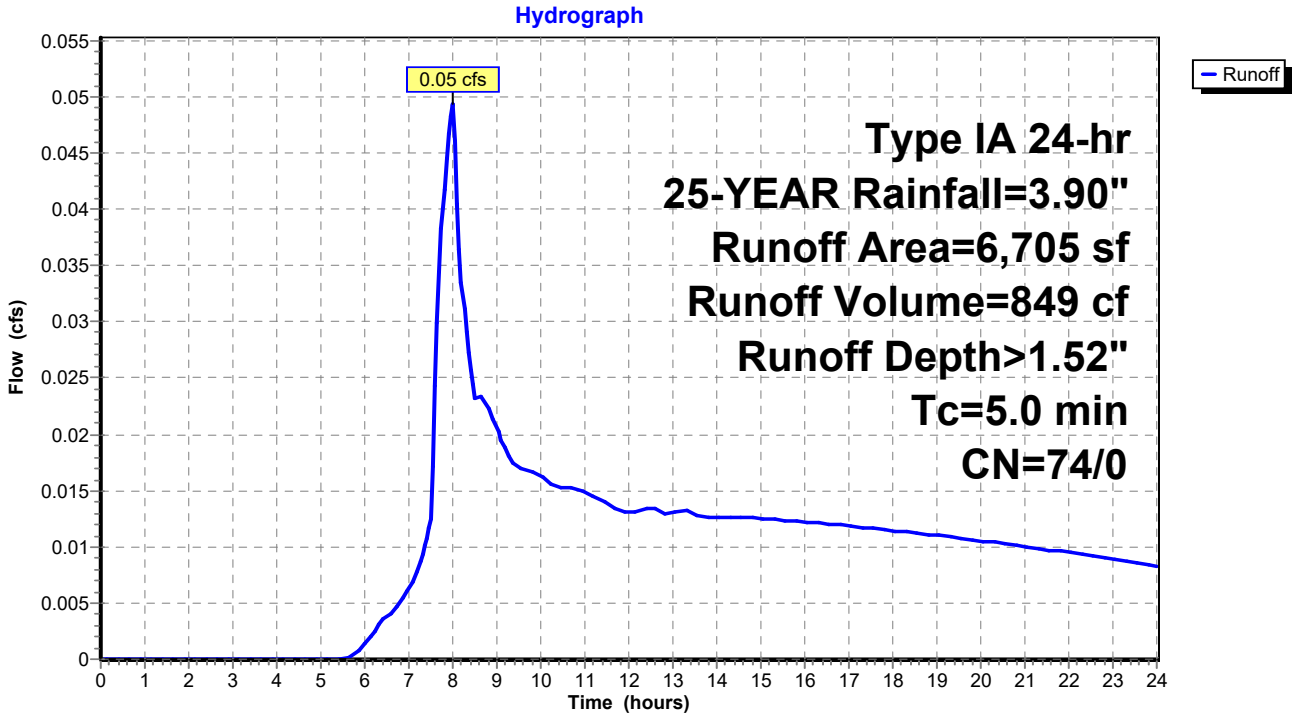
Runoff = 0.05 cfs @ 7.99 hrs, Volume= 849 cf, Depth> 1.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
6,705	74	>75% Grass cover, Good, HSG C
6,705	74	100.00% Pervious Area

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

Subcatchment 25S:



Summary for Subcatchment 26S:

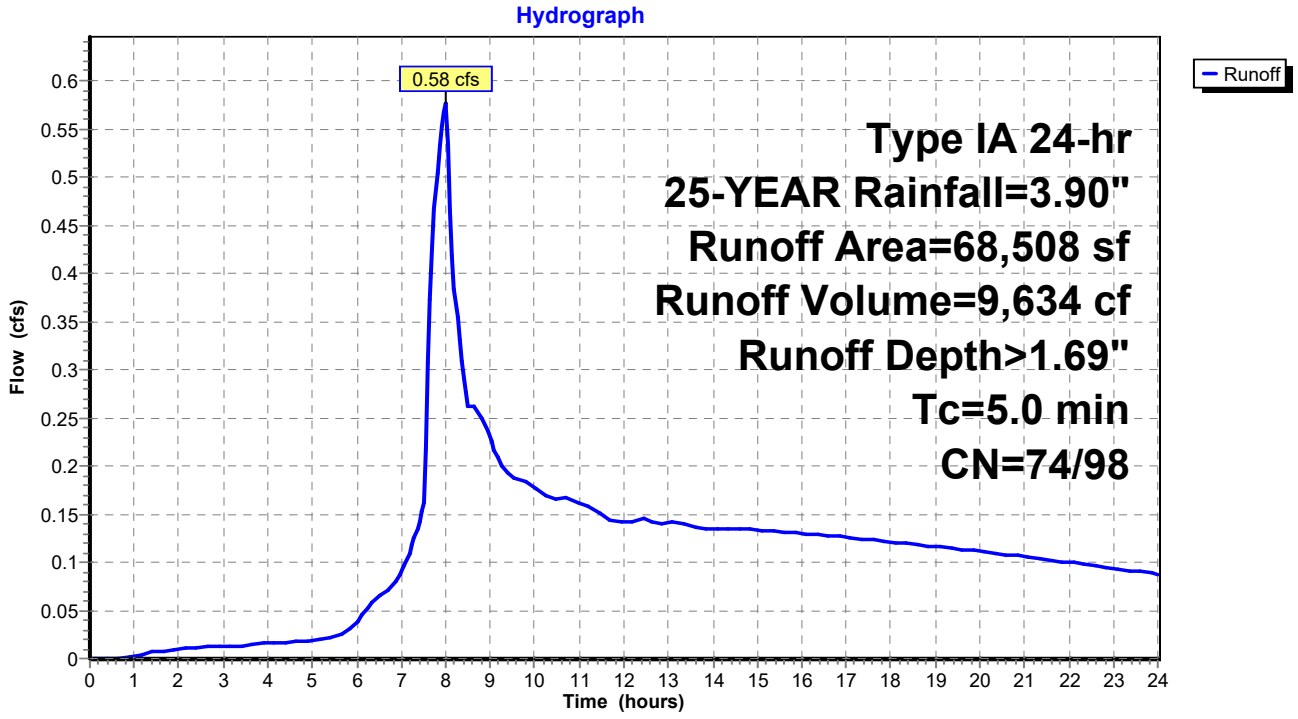
Runoff = 0.58 cfs @ 7.98 hrs, Volume= 9,634 cf, Depth> 1.69"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
5,399	98	Paved roads w/curbs & sewers, HSG C
63,109	74	>75% Grass cover, Good, HSG C
68,508	76	Weighted Average
63,109	74	92.12% Pervious Area
5,399	98	7.88% Impervious Area

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

Subcatchment 26S:



Summary for Subcatchment 27S:

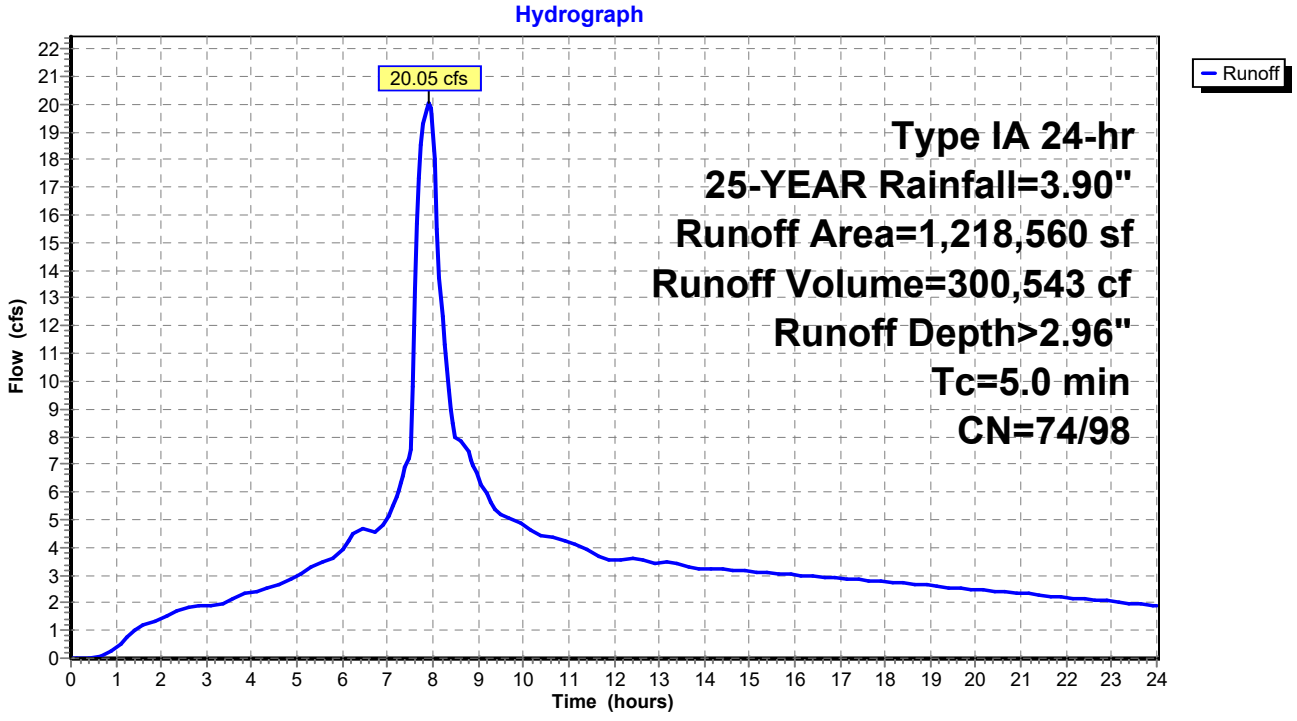
Runoff = 20.05 cfs @ 7.92 hrs, Volume= 300,543 cf, Depth> 2.96"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	281,723	98	Paved roads w/curbs & sewers, HSG C
	398,277	74	>75% Grass cover, Good, HSG C
*	538,560	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	1,218,560	90	Weighted Average
	398,277	74	32.68% Pervious Area
	820,283	98	67.32% Impervious Area

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

Subcatchment 27S:



Summary for Subcatchment 28S:

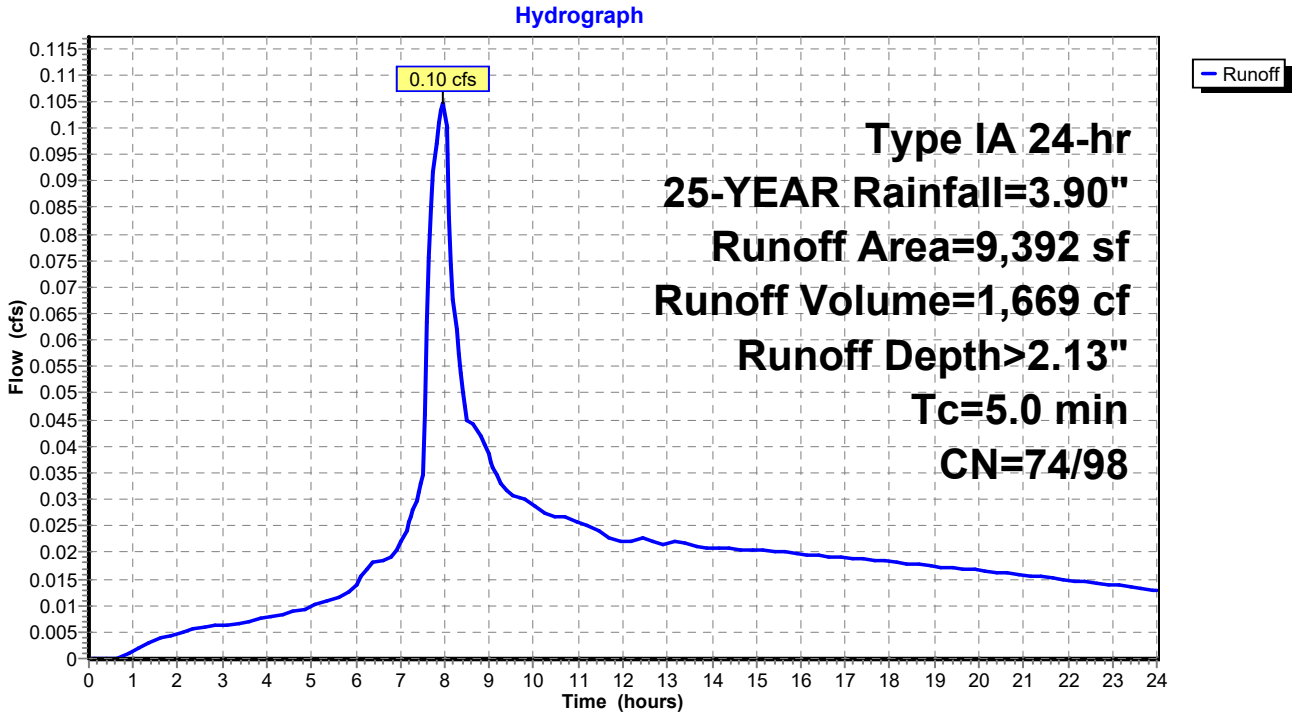
Runoff = 0.10 cfs @ 7.97 hrs, Volume= 1,669 cf, Depth> 2.13"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
2,692	98	Paved roads w/curbs & sewers, HSG C
6,700	74	>75% Grass cover, Good, HSG C
9,392	81	Weighted Average
6,700	74	71.34% Pervious Area
2,692	98	28.66% Impervious Area

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

Subcatchment 28S:



Summary for Subcatchment 29S: Future Commercial

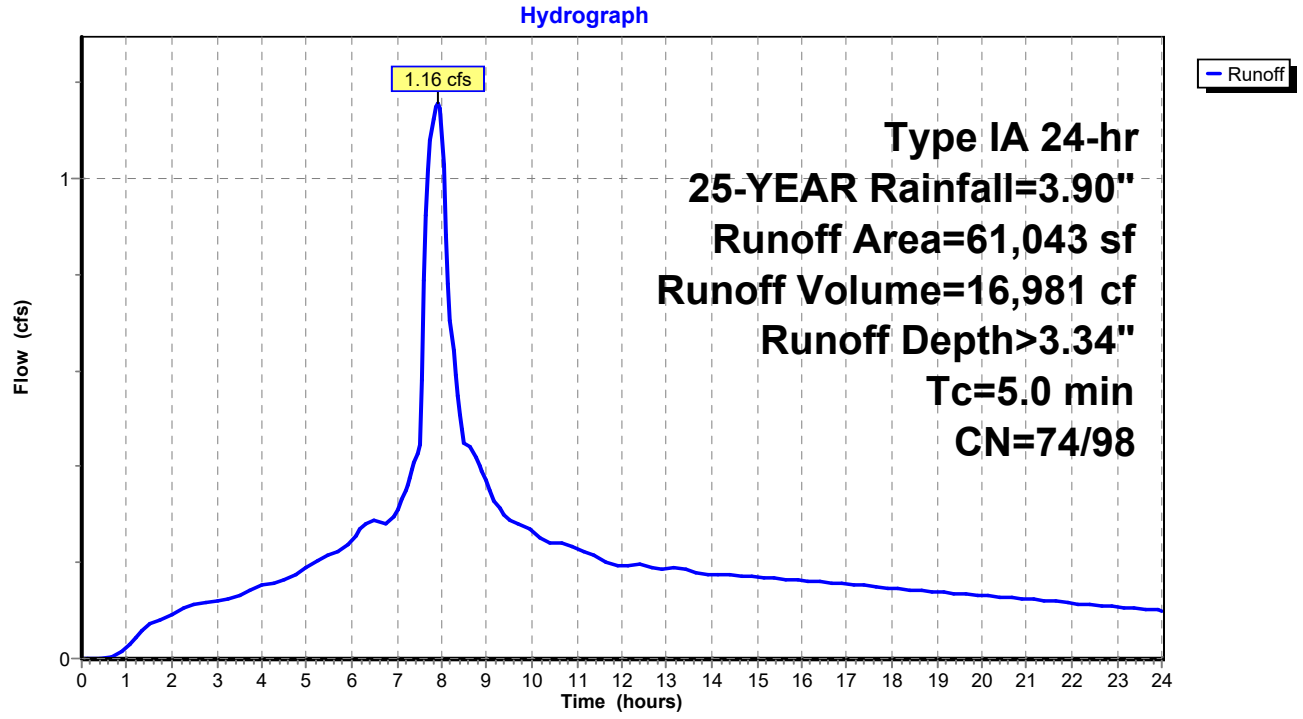
Runoff = 1.16 cfs @ 7.91 hrs, Volume= 16,981 cf, Depth> 3.34"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	51,887	98	85% Impervious - Future Commercial
	9,156	74	>75% Grass cover, Good, HSG C
	61,043	94	Weighted Average
	9,156	74	15.00% Pervious Area
	51,887	98	85.00% Impervious Area

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

Subcatchment 29S: Future Commercial



Summary for Subcatchment 30S: Future Commercial

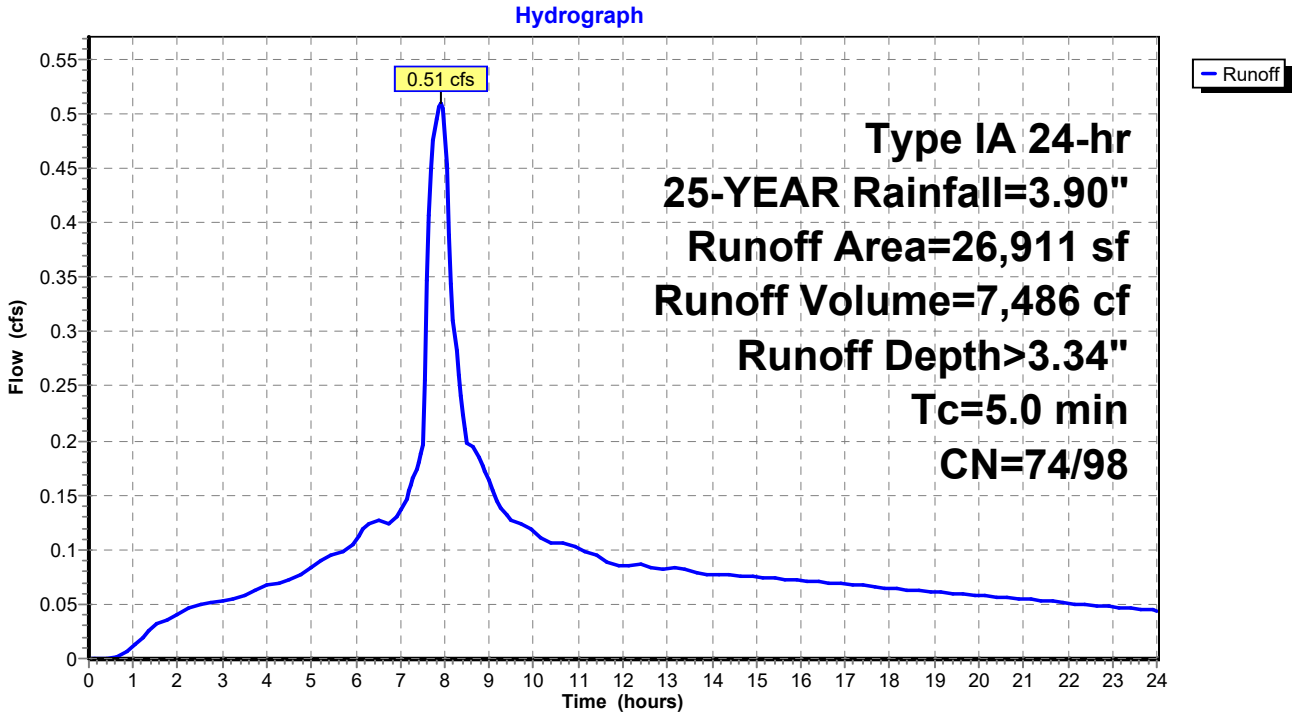
Runoff = 0.51 cfs @ 7.91 hrs, Volume= 7,486 cf, Depth> 3.34"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	22,874	98	85% Impervious - Future Commercial
	4,037	74	>75% Grass cover, Good, HSG C
	26,911	94	Weighted Average
	4,037	74	15.00% Pervious Area
	22,874	98	85.00% Impervious Area

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

Subcatchment 30S: Future Commercial



Summary for Subcatchment 140X: City Reservoir

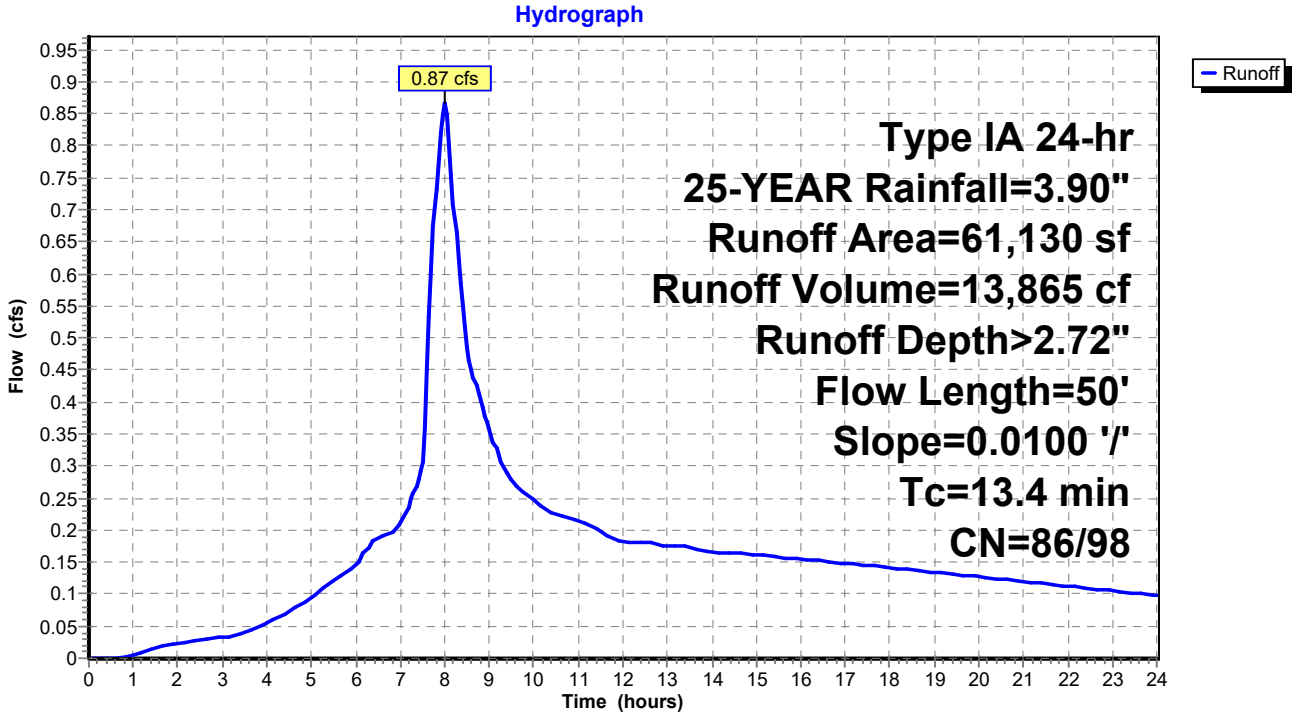
Runoff = 0.87 cfs @ 8.00 hrs, Volume= 13,865 cf, Depth> 2.72"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
14,216	98	Paved roads w/curbs & sewers, HSG C
46,914	86	<50% Grass cover, Poor, HSG C
61,130	89	Weighted Average
46,914	86	76.74% Pervious Area
14,216	98	23.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0100	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
5.0					**Direct Entry,**
13.4	50	Total			

Subcatchment 140X: City Reservoir



Summary for Subcatchment 150X: Upstream Boones Ferry

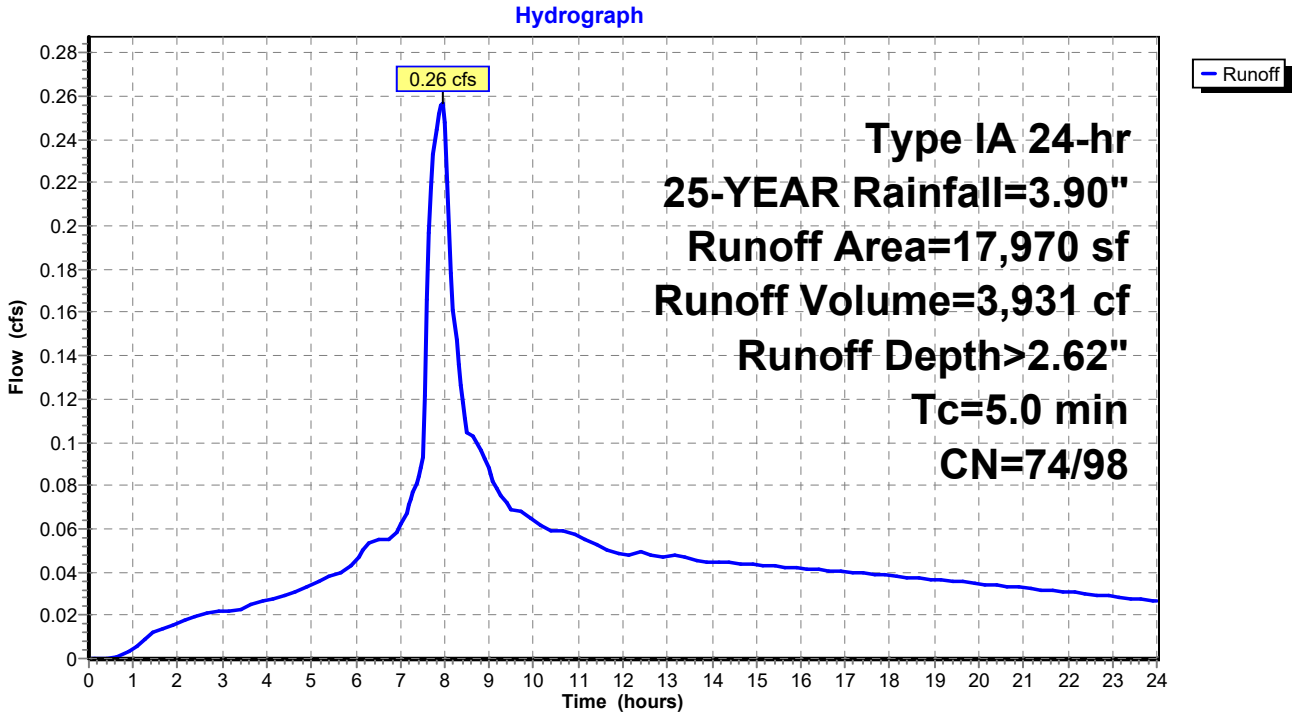
Runoff = 0.26 cfs @ 7.93 hrs, Volume= 3,931 cf, Depth> 2.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	9,285	98	Impervious Area
	8,685	74	>75% Grass cover, Good, HSG C
	17,970	86	Weighted Average
	8,685	74	48.33% Pervious Area
	9,285	98	51.67% Impervious Area

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

Subcatchment 150X: Upstream Boones Ferry



Summary for Subcatchment 160X: Upstream Properties

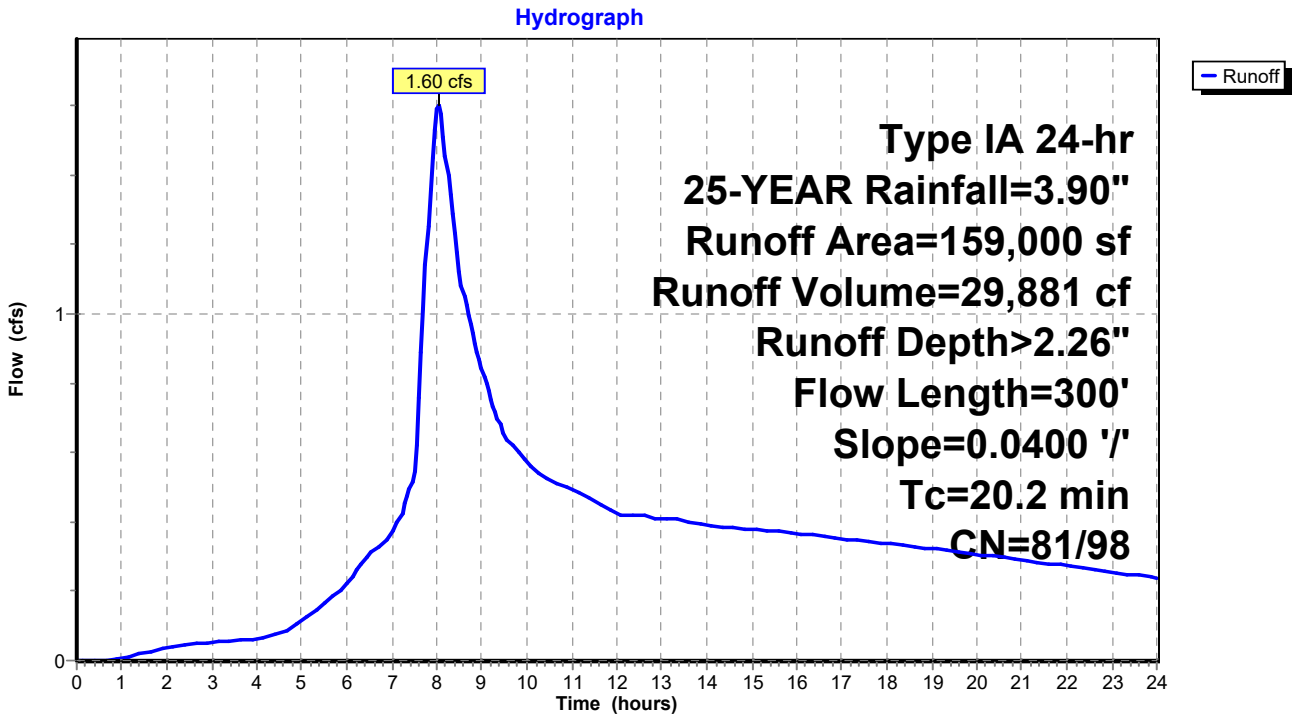
Runoff = 1.60 cfs @ 8.03 hrs, Volume= 29,881 cf, Depth> 2.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	23,371	98	Impervious Area
	12,930	96	Gravel surface, HSG C
	122,699	79	50-75% Grass cover, Fair, HSG C
	159,000	83	Weighted Average
	135,629	81	85.30% Pervious Area
	23,371	98	14.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	300	0.0400	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 160X: Upstream Properties



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond 1.1R: WQ MH Peak Elev=325.30' Inflow=2.99 cfs 62,079 cf
12.0" Round Culvert n=0.013 L=33.0' S=0.0348 '/' Outflow=2.99 cfs 62,079 cf

Pond 1P: Northeast Facility Peak Elev=325.26' Storage=118,087 cf Inflow=19.75 cfs 266,477 cf
Outflow=4.63 cfs 169,167 cf

Pond 1R: FLOW SPLITTER Peak Elev=325.69' Inflow=25.23 cfs 387,290 cf
Primary=2.99 cfs 62,079 cf Secondary=16.13 cfs 192,590 cf Tertiary=6.88 cfs 132,621 cf Outflow=25.23 cfs 387,290 cf

Subcatchment 1S: Runoff Area=74,952 sf 0.00% Impervious Runoff Depth>1.89"
Tc=5.0 min CN=74/0 Runoff=0.72 cfs 11,808 cf

Link 1T: Post-Dev Total Inflow=25.11 cfs 643,026 cf
Primary=25.11 cfs 643,026 cf

Pond 2P: Southwest Facility Peak Elev=320.19' Storage=113,429 cf Inflow=25.41 cfs 379,489 cf
Outflow=14.66 cfs 286,797 cf

Pond 2R: 24" Peak Elev=328.41' Inflow=25.23 cfs 387,290 cf
24.0" Round Culvert n=0.013 L=43.1' S=0.0116 '/' Outflow=25.23 cfs 387,290 cf

Subcatchment 2S: Runoff Area=9,948 sf 94.99% Impervious Runoff Depth>4.04"
Tc=5.0 min CN=74/98 Runoff=0.23 cfs 3,352 cf

Link 2T: Post-Dev Northeast Inflow=9.37 cfs 305,770 cf
Primary=9.37 cfs 305,770 cf

Reach 3R: 24" Avg. Flow Depth=1.20' Max Vel=6.90 fps Inflow=13.56 cfs 201,993 cf
24.0" Round Pipe n=0.013 L=401.6' S=0.0080 '/' Capacity=20.23 cfs Outflow=13.55 cfs 201,853 cf

Subcatchment 3S: Runoff Area=77,616 sf 87.47% Impervious Runoff Depth>3.87"
Tc=5.0 min CN=74/98 Runoff=1.71 cfs 25,053 cf

Link 3T: Post-Dev Southwest Inflow=16.98 cfs 337,256 cf
Primary=16.98 cfs 337,256 cf

Reach 4R: 24" Avg. Flow Depth=0.87' Max Vel=8.85 fps Inflow=11.68 cfs 185,476 cf
24.0" Round Pipe n=0.013 L=148.6' S=0.0170 '/' Capacity=29.52 cfs Outflow=11.69 cfs 185,437 cf

Subcatchment 4S: Runoff Area=27,436 sf 62.66% Impervious Runoff Depth>3.31"
Tc=5.0 min CN=74/98 Runoff=0.50 cfs 7,570 cf

Reach 5R: 12" Avg. Flow Depth=0.45' Max Vel=6.18 fps Inflow=2.14 cfs 34,666 cf
12.0" Round Pipe n=0.013 L=72.1' S=0.0202 '/' Capacity=5.07 cfs Outflow=2.14 cfs 34,661 cf

Subcatchment 5S: Runoff Area=12,720 sf 62.26% Impervious Runoff Depth>3.30"
Tc=5.0 min CN=74/98 Runoff=0.23 cfs 3,500 cf

Reach 6R: 18" Avg. Flow Depth=0.79' Max Vel=9.28 fps Inflow=8.80 cfs 139,907 cf
18.0" Round Pipe n=0.013 L=74.5' S=0.0232 '/' Capacity=16.01 cfs Outflow=8.81 cfs 139,893 cf

Subcatchment6S: Runoff Area=110,312 sf 68.48% Impervious Runoff Depth>3.44"
Tc=5.0 min CN=74/98 Runoff=2.12 cfs 31,649 cf

Reach 7R: 12" Avg. Flow Depth=0.31' Max Vel=2.25 fps Inflow=0.46 cfs 7,074 cf
12.0" Round Pipe n=0.013 L=223.0' S=0.0040 '/' Capacity=2.25 cfs Outflow=0.46 cfs 7,064 cf

Subcatchment7S: Runoff Area=6,333 sf 56.62% Impervious Runoff Depth>3.17"
Tc=5.0 min CN=74/98 Runoff=0.11 cfs 1,675 cf

Reach 8R: 12" Avg. Flow Depth=0.24' Max Vel=7.92 fps Inflow=1.15 cfs 17,571 cf
12.0" Round Pipe n=0.013 L=54.3' S=0.0650 '/' Capacity=9.08 cfs Outflow=1.15 cfs 17,570 cf

Subcatchment8S: Runoff Area=30,674 sf 38.68% Impervious Runoff Depth>2.77"
Tc=5.0 min CN=74/98 Runoff=0.46 cfs 7,074 cf

Reach 9R: 12" Avg. Flow Depth=0.27' Max Vel=3.82 fps Inflow=0.67 cfs 10,222 cf
12.0" Round Pipe n=0.013 L=98.7' S=0.0130 '/' Capacity=4.06 cfs Outflow=0.67 cfs 10,219 cf

Subcatchment9S: Runoff Area=71,032 sf 47.56% Impervious Runoff Depth>2.97"
Tc=5.0 min CN=74/98 Runoff=1.15 cfs 17,571 cf

Reach 10R: 15" Avg. Flow Depth=0.80' Max Vel=4.47 fps Inflow=3.71 cfs 56,705 cf
15.0" Round Pipe n=0.013 L=99.9' S=0.0060 '/' Capacity=5.01 cfs Outflow=3.71 cfs 56,690 cf

Subcatchment10S: Runoff Area=10,785 sf 46.92% Impervious Runoff Depth>2.95"
Tc=5.0 min CN=74/98 Runoff=0.17 cfs 2,655 cf

Reach 11R: 12" Avg. Flow Depth=0.35' Max Vel=5.40 fps Inflow=1.32 cfs 19,854 cf
12.0" Round Pipe n=0.013 L=109.5' S=0.0200 '/' Capacity=5.04 cfs Outflow=1.32 cfs 19,849 cf

Subcatchment11S: Runoff Area=31,511 sf 43.79% Impervious Runoff Depth>2.88"
Tc=5.0 min CN=74/98 Runoff=0.49 cfs 7,571 cf

Reach 12R: 12" Avg. Flow Depth=1.00' Max Vel=4.32 fps Inflow=3.43 cfs 51,602 cf
12.0" Round Pipe n=0.013 L=260.0' S=0.0070 '/' Capacity=2.98 cfs Outflow=3.21 cfs 51,568 cf

Subcatchment12S: Runoff Area=147,313 sf 65.31% Impervious Runoff Depth>3.37"
Tc=5.0 min CN=74/98 Runoff=2.76 cfs 41,383 cf

Reach 13R: 12" Avg. Flow Depth=0.55' Max Vel=3.66 fps Inflow=1.61 cfs 25,092 cf
12.0" Round Pipe n=0.013 L=69.4' S=0.0061 '/' Capacity=2.77 cfs Outflow=1.61 cfs 25,086 cf

Subcatchment13S: Runoff Area=73,746 sf 59.12% Impervious Runoff Depth>3.23"
Tc=5.0 min CN=74/98 Runoff=1.32 cfs 19,854 cf

Reach 14R: 12" Avg. Flow Depth=0.60' Max Vel=5.33 fps Inflow=2.63 cfs 39,470 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=2.63 cfs 39,459 cf

Subcatchment14S: Runoff Area=36,520 sf 87.22% Impervious Runoff Depth>3.87"
Tc=5.0 min CN=74/98 Runoff=0.80 cfs 11,770 cf

Reach 15R: 18" Avg. Flow Depth=1.14' Max Vel=6.40 fps Inflow=9.23 cfs 137,509 cf
18.0" Round Pipe n=0.013 L=110.0' S=0.0090 '/' Capacity=9.97 cfs Outflow=9.22 cfs 137,481 cf

Subcatchment15S: Runoff Area=29,901 sf 73.59% Impervious Runoff Depth>3.56"
Tc=5.0 min CN=74/98 Runoff=0.60 cfs 8,867 cf

Reach 16R: 24" Outlet Avg. Flow Depth=0.54' Max Vel=13.20 fps Inflow=9.12 cfs 301,788 cf
24.0" Round Pipe n=0.013 L=167.5' S=0.0622 '/' Capacity=56.42 cfs Outflow=9.13 cfs 301,736 cf

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>3.35"
Tc=5.0 min CN=74/98 Runoff=1.14 cfs 17,026 cf

Reach 17R: 12" Avg. Flow Depth=0.30' Max Vel=2.50 fps Inflow=0.49 cfs 7,571 cf
12.0" Round Pipe n=0.013 L=87.5' S=0.0050 '/' Capacity=2.53 cfs Outflow=0.49 cfs 7,568 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>3.96"
Tc=5.0 min CN=74/98 Runoff=0.43 cfs 6,229 cf

Subcatchment18.1S: Runoff Area=82,553 sf 60.53% Impervious Runoff Depth>3.26"
Tc=5.0 min CN=74/98 Runoff=1.49 cfs 22,445 cf

Subcatchment18S: Runoff Area=255,030 sf 68.76% Impervious Runoff Depth>3.45"
Tc=5.0 min CN=74/98 Runoff=4.91 cfs 73,301 cf

Subcatchment19S: Runoff Area=199,554 sf 70.41% Impervious Runoff Depth>3.49"
Tc=5.0 min CN=74/98 Runoff=3.89 cfs 57,978 cf

Subcatchment20S: Runoff Area=6,263 sf 0.00% Impervious Runoff Depth>1.89"
Tc=5.0 min CN=74/0 Runoff=0.06 cfs 987 cf

Subcatchment21S: Runoff Area=4,712 sf 0.00% Impervious Runoff Depth>1.89"
Tc=5.0 min CN=74/0 Runoff=0.05 cfs 742 cf

Subcatchment22S: Runoff Area=14,633 sf 0.00% Impervious Runoff Depth>1.89"
Tc=5.0 min CN=74/0 Runoff=0.14 cfs 2,305 cf

Subcatchment23S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>1.59"
Flow Length=50' Slope=0.0440 '/' Tc=15.2 min CN=70/0 Runoff=0.03 cfs 643 cf

Subcatchment24S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>1.58"
Flow Length=100' Slope=0.0440 '/' Tc=22.7 min CN=70/0 Runoff=0.17 cfs 4,214 cf

Subcatchment25S: Runoff Area=6,705 sf 0.00% Impervious Runoff Depth>1.89"
Tc=5.0 min CN=74/0 Runoff=0.06 cfs 1,056 cf

Subcatchment26S: Runoff Area=68,508 sf 7.88% Impervious Runoff Depth>2.07"
Tc=5.0 min CN=74/98 Runoff=0.73 cfs 11,813 cf

Subcatchment27S: Runoff Area=1,218,560 sf 67.32% Impervious Runoff Depth>3.42"
Tc=5.0 min CN=74/98 Runoff=23.21 cfs 346,925 cf

Subcatchment28S: Runoff Area=9,392 sf 28.66% Impervious Runoff Depth>2.54"
Tc=5.0 min CN=74/98 Runoff=0.13 cfs 1,988 cf

Subcatchment29S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>3.82"
Tc=5.0 min CN=74/98 Runoff=1.32 cfs 19,418 cf

Subcatchment30S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>3.82"
Tc=5.0 min CN=74/98 Runoff=0.58 cfs 8,561 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>3.19"
Flow Length=50' Slope=0.0100 '/' Tc=13.4 min CN=86/98 Runoff=1.02 cfs 16,225 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>3.06"
Tc=5.0 min CN=74/98 Runoff=0.30 cfs 4,585 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>2.69"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.94 cfs 35,601 cf

Total Runoff Area = 3,059,460 sf Runoff Volume = 833,395 cf Average Runoff Depth = 3.27"
40.77% Pervious = 1,247,360 sf 59.23% Impervious = 1,812,100 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond 1.1R: WQ MH Peak Elev=324.95' Inflow=2.78 cfs 58,173 cf
12.0" Round Culvert n=0.013 L=33.0' S=0.0348 '/' Outflow=2.78 cfs 58,173 cf

Pond 1P: Northeast Facility Peak Elev=324.94' Storage=106,576 cf Inflow=18.05 cfs 230,489 cf
Outflow=2.39 cfs 139,194 cf

Pond 1R: FLOW SPLITTER Peak Elev=324.96' Inflow=18.96 cfs 288,304 cf
Primary=2.78 cfs 58,173 cf Secondary=14.91 cfs 164,809 cf Tertiary=2.06 cfs 65,322 cf Outflow=18.96 cfs 288,304 cf

Subcatchment1S: Runoff Area=74,952 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.41 cfs 7,507 cf

Link 1T: Post-Dev Total Inflow=10.94 cfs 436,428 cf
Primary=10.94 cfs 436,428 cf

Pond 2P: Southwest Facility Peak Elev=319.75' Storage=101,763 cf Inflow=18.92 cfs 284,078 cf
Outflow=6.12 cfs 194,692 cf

Pond 2R: 24" Peak Elev=326.42' Inflow=18.96 cfs 288,304 cf
24.0" Round Culvert n=0.013 L=43.1' S=0.0116 '/' Outflow=18.96 cfs 288,304 cf

Subcatchment2S: Runoff Area=9,948 sf 94.99% Impervious Runoff Depth>3.11"
Tc=5.0 min CN=74/98 Runoff=0.18 cfs 2,579 cf

Link 2T: Post-Dev Northeast Inflow=4.50 cfs 207,036 cf
Primary=4.50 cfs 207,036 cf

Reach 3R: 24" Avg. Flow Depth=1.00' Max Vel=6.44 fps Inflow=10.13 cfs 151,621 cf
24.0" Round Pipe n=0.013 L=401.6' S=0.0080 '/' Capacity=20.23 cfs Outflow=10.13 cfs 151,505 cf

Subcatchment3S: Runoff Area=77,616 sf 87.47% Impervious Runoff Depth>2.96"
Tc=5.0 min CN=74/98 Runoff=1.31 cfs 19,142 cf

Link 3T: Post-Dev Southwest Inflow=7.04 cfs 229,391 cf
Primary=7.04 cfs 229,391 cf

Reach 4R: 24" Avg. Flow Depth=0.75' Max Vel=8.21 fps Inflow=8.84 cfs 136,831 cf
24.0" Round Pipe n=0.013 L=148.6' S=0.0170 '/' Capacity=29.52 cfs Outflow=8.84 cfs 136,799 cf

Subcatchment4S: Runoff Area=27,436 sf 62.66% Impervious Runoff Depth>2.46"
Tc=5.0 min CN=74/98 Runoff=0.37 cfs 5,627 cf

Reach 5R: 12" Avg. Flow Depth=0.37' Max Vel=5.59 fps Inflow=1.47 cfs 24,611 cf
12.0" Round Pipe n=0.013 L=72.1' S=0.0202 '/' Capacity=5.07 cfs Outflow=1.47 cfs 24,606 cf

Subcatchment5S: Runoff Area=12,720 sf 62.26% Impervious Runoff Depth>2.45"
Tc=5.0 min CN=74/98 Runoff=0.17 cfs 2,600 cf

Reach 6R: 18" Avg. Flow Depth=0.68' Max Vel=8.70 fps Inflow=6.82 cfs 104,031 cf
18.0" Round Pipe n=0.013 L=74.5' S=0.0232 '/' Capacity=16.01 cfs Outflow=6.82 cfs 104,020 cf

Subcatchment6S: Runoff Area=110,312 sf 68.48% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=1.58 cfs 23,698 cf

Reach 7R: 12" Avg. Flow Depth=0.25' Max Vel=2.03 fps Inflow=0.32 cfs 5,059 cf
12.0" Round Pipe n=0.013 L=223.0' S=0.0040 '/' Capacity=2.25 cfs Outflow=0.32 cfs 5,051 cf

Subcatchment7S: Runoff Area=6,333 sf 56.62% Impervious Runoff Depth>2.34"
Tc=5.0 min CN=74/98 Runoff=0.08 cfs 1,235 cf

Reach 8R: 12" Avg. Flow Depth=0.20' Max Vel=7.18 fps Inflow=0.82 cfs 12,770 cf
12.0" Round Pipe n=0.013 L=54.3' S=0.0650 '/' Capacity=9.08 cfs Outflow=0.82 cfs 12,769 cf

Subcatchment8S: Runoff Area=30,674 sf 38.68% Impervious Runoff Depth>1.98"
Tc=5.0 min CN=74/98 Runoff=0.32 cfs 5,059 cf

Reach 9R: 12" Avg. Flow Depth=0.23' Max Vel=3.45 fps Inflow=0.47 cfs 7,391 cf
12.0" Round Pipe n=0.013 L=98.7' S=0.0130 '/' Capacity=4.06 cfs Outflow=0.47 cfs 7,388 cf

Subcatchment9S: Runoff Area=71,032 sf 47.56% Impervious Runoff Depth>2.16"
Tc=5.0 min CN=74/98 Runoff=0.82 cfs 12,770 cf

Reach 10R: 15" Avg. Flow Depth=0.66' Max Vel=4.17 fps Inflow=2.73 cfs 42,121 cf
15.0" Round Pipe n=0.013 L=99.9' S=0.0060 '/' Capacity=5.01 cfs Outflow=2.73 cfs 42,108 cf

Subcatchment10S: Runoff Area=10,785 sf 46.92% Impervious Runoff Depth>2.14"
Tc=5.0 min CN=74/98 Runoff=0.12 cfs 1,927 cf

Reach 11R: 12" Avg. Flow Depth=0.30' Max Vel=4.95 fps Inflow=0.96 cfs 14,687 cf
12.0" Round Pipe n=0.013 L=109.5' S=0.0200 '/' Capacity=5.04 cfs Outflow=0.96 cfs 14,682 cf

Subcatchment11S: Runoff Area=31,511 sf 43.79% Impervious Runoff Depth>2.08"
Tc=5.0 min CN=74/98 Runoff=0.35 cfs 5,467 cf

Reach 12R: 12" Avg. Flow Depth=0.70' Max Vel=4.26 fps Inflow=2.52 cfs 38,253 cf
12.0" Round Pipe n=0.013 L=260.0' S=0.0070 '/' Capacity=2.98 cfs Outflow=2.52 cfs 38,225 cf

Subcatchment12S: Runoff Area=147,313 sf 65.31% Impervious Runoff Depth>2.51"
Tc=5.0 min CN=74/98 Runoff=2.05 cfs 30,865 cf

Reach 13R: 12" Avg. Flow Depth=0.45' Max Vel=3.38 fps Inflow=1.17 cfs 18,452 cf
12.0" Round Pipe n=0.013 L=69.4' S=0.0061 '/' Capacity=2.77 cfs Outflow=1.17 cfs 18,447 cf

Subcatchment13S: Runoff Area=73,746 sf 59.12% Impervious Runoff Depth>2.39"
Tc=5.0 min CN=74/98 Runoff=0.96 cfs 14,687 cf

Reach 14R: 12" Avg. Flow Depth=0.50' Max Vel=4.95 fps Inflow=1.93 cfs 29,320 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=1.93 cfs 29,311 cf

Subcatchment14S: Runoff Area=36,520 sf 87.22% Impervious Runoff Depth>2.95"
Tc=5.0 min CN=74/98 Runoff=0.61 cfs 8,991 cf

Reach 15R: 18" Avg. Flow Depth=0.92' Max Vel=6.08 fps Inflow=6.89 cfs 103,191 cf
18.0" Round Pipe n=0.013 L=110.0' S=0.0090 '/' Capacity=9.97 cfs Outflow=6.89 cfs 103,169 cf

Subcatchment15S: Runoff Area=29,901 sf 73.59% Impervious Runoff Depth>2.68"
Tc=5.0 min CN=74/98 Runoff=0.45 cfs 6,679 cf

Reach 16R: 24" Outlet Avg. Flow Depth=0.38' Max Vel=10.71 fps Inflow=4.45 cfs 204,516 cf
24.0" Round Pipe n=0.013 L=167.5' S=0.0622 '/' Capacity=56.42 cfs Outflow=4.45 cfs 204,472 cf

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>2.50"
Tc=5.0 min CN=74/98 Runoff=0.84 cfs 12,685 cf

Reach 17R: 12" Avg. Flow Depth=0.25' Max Vel=2.26 fps Inflow=0.35 cfs 5,467 cf
12.0" Round Pipe n=0.013 L=87.5' S=0.0050 '/' Capacity=2.53 cfs Outflow=0.35 cfs 5,464 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>3.03"
Tc=5.0 min CN=74/98 Runoff=0.33 cfs 4,776 cf

Subcatchment18.1S: Runoff Area=82,553 sf 60.53% Impervious Runoff Depth>2.42"
Tc=5.0 min CN=74/98 Runoff=1.09 cfs 16,635 cf

Subcatchment18S: Runoff Area=255,030 sf 68.76% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=3.66 cfs 54,904 cf

Subcatchment19S: Runoff Area=199,554 sf 70.41% Impervious Runoff Depth>2.62"
Tc=5.0 min CN=74/98 Runoff=2.91 cfs 43,512 cf

Subcatchment20S: Runoff Area=6,263 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 627 cf

Subcatchment21S: Runoff Area=4,712 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 472 cf

Subcatchment22S: Runoff Area=14,633 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.08 cfs 1,466 cf

Subcatchment23S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.97"
Flow Length=50' Slope=0.0440 '/' Tc=15.2 min CN=70/0 Runoff=0.01 cfs 391 cf

Subcatchment24S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.96"
Flow Length=100' Slope=0.0440 '/' Tc=22.7 min CN=70/0 Runoff=0.08 cfs 2,565 cf

Subcatchment25S: Runoff Area=6,705 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.04 cfs 672 cf

Subcatchment26S: Runoff Area=68,508 sf 7.88% Impervious Runoff Depth>1.36"
Tc=5.0 min CN=74/98 Runoff=0.44 cfs 7,765 cf

Subcatchment27S: Runoff Area=1,218,560 sf 67.32% Impervious Runoff Depth>2.55"
Tc=5.0 min CN=74/98 Runoff=17.25 cfs 259,396 cf

Subcatchment28S: Runoff Area=9,392 sf 28.66% Impervious Runoff Depth>1.78"
Tc=5.0 min CN=74/98 Runoff=0.09 cfs 1,391 cf

Subcatchment29S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>2.91"
Tc=5.0 min CN=74/98 Runoff=1.01 cfs 14,802 cf

Subcatchment30S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>2.91"
Tc=5.0 min CN=74/98 Runoff=0.44 cfs 6,525 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>2.31"
Flow Length=50' Slope=0.0100 '/' Tc=13.4 min CN=86/98 Runoff=0.73 cfs 11,773 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>2.24"
Tc=5.0 min CN=74/98 Runoff=0.22 cfs 3,354 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.88"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.30 cfs 24,871 cf

Total Runoff Area = 3,059,460 sf Runoff Volume = 617,413 cf Average Runoff Depth = 2.42"
40.77% Pervious = 1,247,360 sf 59.23% Impervious = 1,812,100 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond 1.1R: WQ MH Peak Elev=324.79' Inflow=2.60 cfs 57,132 cf
12.0" Round Culvert n=0.013 L=33.0' S=0.0348 '/' Outflow=2.60 cfs 57,132 cf

Pond 1P: Northeast Facility Peak Elev=324.78' Storage=101,009 cf Inflow=16.72 cfs 221,532 cf
Outflow=2.24 cfs 133,214 cf

Pond 1R: FLOW SPLITTER Peak Elev=324.80' Inflow=16.57 cfs 252,730 cf
Primary=2.60 cfs 57,132 cf Secondary=13.85 cfs 158,347 cf Tertiary=1.23 cfs 37,251 cf Outflow=16.57 cfs 252,730 cf

Subcatchment1S: Runoff Area=74,952 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.31 cfs 6,053 cf

Link 1T: Post-Dev Total Inflow=7.91 cfs 364,327 cf
Primary=7.91 cfs 364,327 cf

Pond 2P: Southwest Facility Peak Elev=319.58' Storage=97,570 cf Inflow=16.59 cfs 249,690 cf
Outflow=4.09 cfs 162,636 cf

Pond 2R: 24" Peak Elev=325.68' Inflow=16.57 cfs 252,730 cf
24.0" Round Culvert n=0.013 L=43.1' S=0.0116 '/' Outflow=16.57 cfs 252,730 cf

Subcatchment2S: Runoff Area=9,948 sf 94.99% Impervious Runoff Depth>2.77"
Tc=5.0 min CN=74/98 Runoff=0.16 cfs 2,295 cf

Link 2T: Post-Dev Northeast Inflow=3.51 cfs 172,492 cf
Primary=3.51 cfs 172,492 cf

Reach 3R: 24" Avg. Flow Depth=0.93' Max Vel=6.23 fps Inflow=8.90 cfs 133,436 cf
24.0" Round Pipe n=0.013 L=401.6' S=0.0080 '/' Capacity=20.23 cfs Outflow=8.90 cfs 133,329 cf

Subcatchment3S: Runoff Area=77,616 sf 87.47% Impervious Runoff Depth>2.63"
Tc=5.0 min CN=74/98 Runoff=1.16 cfs 16,983 cf

Link 3T: Post-Dev Southwest Inflow=4.67 cfs 191,835 cf
Primary=4.67 cfs 191,835 cf

Reach 4R: 24" Avg. Flow Depth=0.70' Max Vel=7.90 fps Inflow=7.68 cfs 119,430 cf
24.0" Round Pipe n=0.013 L=148.6' S=0.0170 '/' Capacity=29.52 cfs Outflow=7.68 cfs 119,401 cf

Subcatchment4S: Runoff Area=27,436 sf 62.66% Impervious Runoff Depth>2.16"
Tc=5.0 min CN=74/98 Runoff=0.32 cfs 4,929 cf

Reach 5R: 12" Avg. Flow Depth=0.34' Max Vel=5.34 fps Inflow=1.25 cfs 21,092 cf
12.0" Round Pipe n=0.013 L=72.1' S=0.0202 '/' Capacity=5.07 cfs Outflow=1.25 cfs 21,088 cf

Subcatchment5S: Runoff Area=12,720 sf 62.26% Impervious Runoff Depth>2.15"
Tc=5.0 min CN=74/98 Runoff=0.15 cfs 2,277 cf

Reach 6R: 18" Avg. Flow Depth=0.63' Max Vel=8.39 fps Inflow=5.95 cfs 91,129 cf
18.0" Round Pipe n=0.013 L=74.5' S=0.0232 '/' Capacity=16.01 cfs Outflow=5.95 cfs 91,118 cf

Subcatchment6S: Runoff Area=110,312 sf 68.48% Impervious Runoff Depth>2.27"
Tc=5.0 min CN=74/98 Runoff=1.38 cfs 20,832 cf

Reach 7R: 12" Avg. Flow Depth=0.23' Max Vel=1.93 fps Inflow=0.27 cfs 4,350 cf
12.0" Round Pipe n=0.013 L=223.0' S=0.0040 '/' Capacity=2.25 cfs Outflow=0.27 cfs 4,343 cf

Subcatchment7S: Runoff Area=6,333 sf 56.62% Impervious Runoff Depth>2.04"
Tc=5.0 min CN=74/98 Runoff=0.07 cfs 1,077 cf

Reach 8R: 12" Avg. Flow Depth=0.19' Max Vel=6.86 fps Inflow=0.70 cfs 11,068 cf
12.0" Round Pipe n=0.013 L=54.3' S=0.0650 '/' Capacity=9.08 cfs Outflow=0.70 cfs 11,067 cf

Subcatchment8S: Runoff Area=30,674 sf 38.68% Impervious Runoff Depth>1.70"
Tc=5.0 min CN=74/98 Runoff=0.27 cfs 4,350 cf

Reach 9R: 12" Avg. Flow Depth=0.21' Max Vel=3.30 fps Inflow=0.40 cfs 6,390 cf
12.0" Round Pipe n=0.013 L=98.7' S=0.0130 '/' Capacity=4.06 cfs Outflow=0.40 cfs 6,387 cf

Subcatchment9S: Runoff Area=71,032 sf 47.56% Impervious Runoff Depth>1.87"
Tc=5.0 min CN=74/98 Runoff=0.70 cfs 11,068 cf

Reach 10R: 15" Avg. Flow Depth=0.61' Max Vel=4.03 fps Inflow=2.38 cfs 36,865 cf
15.0" Round Pipe n=0.013 L=99.9' S=0.0060 '/' Capacity=5.01 cfs Outflow=2.38 cfs 36,854 cf

Subcatchment10S: Runoff Area=10,785 sf 46.92% Impervious Runoff Depth>1.86"
Tc=5.0 min CN=74/98 Runoff=0.11 cfs 1,670 cf

Reach 11R: 12" Avg. Flow Depth=0.28' Max Vel=4.75 fps Inflow=0.84 cfs 12,837 cf
12.0" Round Pipe n=0.013 L=109.5' S=0.0200 '/' Capacity=5.04 cfs Outflow=0.84 cfs 12,833 cf

Subcatchment11S: Runoff Area=31,511 sf 43.79% Impervious Runoff Depth>1.80"
Tc=5.0 min CN=74/98 Runoff=0.30 cfs 4,723 cf

Reach 12R: 12" Avg. Flow Depth=0.64' Max Vel=4.15 fps Inflow=2.19 cfs 33,469 cf
12.0" Round Pipe n=0.013 L=260.0' S=0.0070 '/' Capacity=2.98 cfs Outflow=2.19 cfs 33,443 cf

Subcatchment12S: Runoff Area=147,313 sf 65.31% Impervious Runoff Depth>2.21"
Tc=5.0 min CN=74/98 Runoff=1.79 cfs 27,082 cf

Reach 13R: 12" Avg. Flow Depth=0.42' Max Vel=3.25 fps Inflow=1.01 cfs 16,060 cf
12.0" Round Pipe n=0.013 L=69.4' S=0.0061 '/' Capacity=2.77 cfs Outflow=1.01 cfs 16,056 cf

Subcatchment13S: Runoff Area=73,746 sf 59.12% Impervious Runoff Depth>2.09"
Tc=5.0 min CN=74/98 Runoff=0.84 cfs 12,837 cf

Reach 14R: 12" Avg. Flow Depth=0.46' Max Vel=4.78 fps Inflow=1.69 cfs 25,678 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=1.69 cfs 25,669 cf

Subcatchment14S: Runoff Area=36,520 sf 87.22% Impervious Runoff Depth>2.62"
Tc=5.0 min CN=74/98 Runoff=0.55 cfs 7,976 cf

Reach 15R: 18" Avg. Flow Depth=0.84' Max Vel=5.91 fps Inflow=6.06 cfs 90,804 cf
18.0" Round Pipe n=0.013 L=110.0' S=0.0090 '/' Capacity=9.97 cfs Outflow=6.05 cfs 90,783 cf

Subcatchment15S: Runoff Area=29,901 sf 73.59% Impervious Runoff Depth>2.36"
Tc=5.0 min CN=74/98 Runoff=0.39 cfs 5,887 cf

Reach 16R: 24" Outlet Avg. Flow Depth=0.34' Max Vel=9.96 fps Inflow=3.47 cfs 170,465 cf
24.0" Round Pipe n=0.013 L=167.5' S=0.0622 '/' Capacity=56.42 cfs Outflow=3.47 cfs 170,424 cf

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>2.19"
Tc=5.0 min CN=74/98 Runoff=0.73 cfs 11,124 cf

Reach 17R: 12" Avg. Flow Depth=0.23' Max Vel=2.16 fps Inflow=0.30 cfs 4,723 cf
12.0" Round Pipe n=0.013 L=87.5' S=0.0050 '/' Capacity=2.53 cfs Outflow=0.30 cfs 4,720 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>2.69"
Tc=5.0 min CN=74/98 Runoff=0.29 cfs 4,243 cf

Subcatchment18.1S: Runoff Area=82,553 sf 60.53% Impervious Runoff Depth>2.12"
Tc=5.0 min CN=74/98 Runoff=0.95 cfs 14,553 cf

Subcatchment18S: Runoff Area=255,030 sf 68.76% Impervious Runoff Depth>2.27"
Tc=5.0 min CN=74/98 Runoff=3.21 cfs 48,271 cf

Subcatchment19S: Runoff Area=199,554 sf 70.41% Impervious Runoff Depth>2.30"
Tc=5.0 min CN=74/98 Runoff=2.55 cfs 38,290 cf

Subcatchment20S: Runoff Area=6,263 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 506 cf

Subcatchment21S: Runoff Area=4,712 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.02 cfs 381 cf

Subcatchment22S: Runoff Area=14,633 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.06 cfs 1,182 cf

Subcatchment23S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.76"
Flow Length=50' Slope=0.0440 '/' Tc=15.2 min CN=70/0 Runoff=0.01 cfs 308 cf

Subcatchment24S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.76"
Flow Length=100' Slope=0.0440 '/' Tc=22.7 min CN=70/0 Runoff=0.06 cfs 2,020 cf

Subcatchment25S: Runoff Area=6,705 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 542 cf

Subcatchment26S: Runoff Area=68,508 sf 7.88% Impervious Runoff Depth>1.12"
Tc=5.0 min CN=74/98 Runoff=0.35 cfs 6,385 cf

Subcatchment27S: Runoff Area=1,218,560 sf 67.32% Impervious Runoff Depth>2.24"
Tc=5.0 min CN=74/98 Runoff=15.11 cfs 227,871 cf

Subcatchment28S: Runoff Area=9,392 sf 28.66% Impervious Runoff Depth>1.51"
Tc=5.0 min CN=74/98 Runoff=0.07 cfs 1,183 cf

Subcatchment29S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=0.89 cfs 13,119 cf

Subcatchment30S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=0.39 cfs 5,783 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>2.00"
Flow Length=50' Slope=0.0100 '/' Tc=13.4 min CN=86/98 Runoff=0.62 cfs 10,173 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>1.95"
Tc=5.0 min CN=74/98 Runoff=0.19 cfs 2,917 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.59"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.07 cfs 21,089 cf

Total Runoff Area = 3,059,460 sf Runoff Volume = 539,979 cf Average Runoff Depth = 2.12"
40.77% Pervious = 1,247,360 sf 59.23% Impervious = 1,812,100 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Pond 1.1R: WQ MH Peak Elev=324.37' Inflow=2.46 cfs 54,670 cf
12.0" Round Culvert n=0.013 L=33.0' S=0.0348 '/' Outflow=2.46 cfs 54,670 cf

Pond 1P: Northeast Facility Peak Elev=324.36' Storage=86,616 cf Inflow=12.72 cfs 196,578 cf
Outflow=2.03 cfs 118,066 cf

Pond 1R: FLOW SPLITTER Peak Elev=324.37' Inflow=12.58 cfs 193,281 cf
Primary=2.46 cfs 54,670 cf Secondary=10.22 cfs 138,123 cf Tertiary=0.03 cfs 489 cf Outflow=12.58 cfs 193,281 cf

Subcatchment 1S: Runoff Area=74,952 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.15 cfs 3,785 cf

Link 1T: Post-Dev Total Inflow=4.38 cfs 254,015 cf
Primary=4.38 cfs 254,015 cf

Pond 2P: Southwest Facility Peak Elev=319.19' Storage=87,536 cf Inflow=12.69 cfs 192,048 cf
Outflow=2.02 cfs 113,902 cf

Pond 2R: 24" Peak Elev=324.62' Inflow=12.58 cfs 193,281 cf
24.0" Round Culvert n=0.013 L=43.1' S=0.0116 '/' Outflow=12.58 cfs 193,281 cf

Subcatchment 2S: Runoff Area=9,948 sf 94.99% Impervious Runoff Depth>2.18"
Tc=5.0 min CN=74/98 Runoff=0.13 cfs 1,810 cf

Link 2T: Post-Dev Northeast Inflow=2.08 cfs 119,809 cf
Primary=2.08 cfs 119,809 cf

Reach 3R: 24" Avg. Flow Depth=0.80' Max Vel=5.81 fps Inflow=6.84 cfs 102,901 cf
24.0" Round Pipe n=0.013 L=401.6' S=0.0080 '/' Capacity=20.23 cfs Outflow=6.84 cfs 102,811 cf

Subcatchment 3S: Runoff Area=77,616 sf 87.47% Impervious Runoff Depth>2.06"
Tc=5.0 min CN=74/98 Runoff=0.91 cfs 13,316 cf

Link 3T: Post-Dev Southwest Inflow=2.31 cfs 134,206 cf
Primary=2.31 cfs 134,206 cf

Reach 4R: 24" Avg. Flow Depth=0.60' Max Vel=7.28 fps Inflow=5.75 cfs 90,495 cf
24.0" Round Pipe n=0.013 L=148.6' S=0.0170 '/' Capacity=29.52 cfs Outflow=5.75 cfs 90,470 cf

Subcatchment 4S: Runoff Area=27,436 sf 62.66% Impervious Runoff Depth>1.65"
Tc=5.0 min CN=74/98 Runoff=0.25 cfs 3,765 cf

Reach 5R: 12" Avg. Flow Depth=0.28' Max Vel=4.84 fps Inflow=0.88 cfs 15,374 cf
12.0" Round Pipe n=0.013 L=72.1' S=0.0202 '/' Capacity=5.07 cfs Outflow=0.88 cfs 15,371 cf

Subcatchment 5S: Runoff Area=12,720 sf 62.26% Impervious Runoff Depth>1.64"
Tc=5.0 min CN=74/98 Runoff=0.11 cfs 1,739 cf

Reach 6R: 18" Avg. Flow Depth=0.54' Max Vel=7.78 fps Inflow=4.50 cfs 69,557 cf
18.0" Round Pipe n=0.013 L=74.5' S=0.0232 '/' Capacity=16.01 cfs Outflow=4.50 cfs 69,549 cf

Subcatchment6S: Runoff Area=110,312 sf 68.48% Impervious Runoff Depth>1.74"
Tc=5.0 min CN=74/98 Runoff=1.06 cfs 16,026 cf

Reach 7R: 12" Avg. Flow Depth=0.20' Max Vel=1.75 fps Inflow=0.19 cfs 3,191 cf
12.0" Round Pipe n=0.013 L=223.0' S=0.0040 '/' Capacity=2.25 cfs Outflow=0.19 cfs 3,185 cf

Subcatchment7S: Runoff Area=6,333 sf 56.62% Impervious Runoff Depth>1.55"
Tc=5.0 min CN=74/98 Runoff=0.05 cfs 816 cf

Reach 8R: 12" Avg. Flow Depth=0.16' Max Vel=6.25 fps Inflow=0.51 cfs 8,262 cf
12.0" Round Pipe n=0.013 L=54.3' S=0.0650 '/' Capacity=9.08 cfs Outflow=0.51 cfs 8,261 cf

Subcatchment8S: Runoff Area=30,674 sf 38.68% Impervious Runoff Depth>1.25"
Tc=5.0 min CN=74/98 Runoff=0.19 cfs 3,191 cf

Reach 9R: 12" Avg. Flow Depth=0.18' Max Vel=3.00 fps Inflow=0.29 cfs 4,744 cf
12.0" Round Pipe n=0.013 L=98.7' S=0.0130 '/' Capacity=4.06 cfs Outflow=0.29 cfs 4,742 cf

Subcatchment9S: Runoff Area=71,032 sf 47.56% Impervious Runoff Depth>1.40"
Tc=5.0 min CN=74/98 Runoff=0.51 cfs 8,262 cf

Reach 10R: 15" Avg. Flow Depth=0.52' Max Vel=3.74 fps Inflow=1.80 cfs 28,064 cf
15.0" Round Pipe n=0.013 L=99.9' S=0.0060 '/' Capacity=5.01 cfs Outflow=1.80 cfs 28,055 cf

Subcatchment10S: Runoff Area=10,785 sf 46.92% Impervious Runoff Depth>1.39"
Tc=5.0 min CN=74/98 Runoff=0.08 cfs 1,245 cf

Reach 11R: 12" Avg. Flow Depth=0.24' Max Vel=4.38 fps Inflow=0.63 cfs 9,759 cf
12.0" Round Pipe n=0.013 L=109.5' S=0.0200 '/' Capacity=5.04 cfs Outflow=0.63 cfs 9,755 cf

Subcatchment11S: Runoff Area=31,511 sf 43.79% Impervious Runoff Depth>1.33"
Tc=5.0 min CN=74/98 Runoff=0.21 cfs 3,501 cf

Reach 12R: 12" Avg. Flow Depth=0.53' Max Vel=3.89 fps Inflow=1.65 cfs 25,498 cf
12.0" Round Pipe n=0.013 L=260.0' S=0.0070 '/' Capacity=2.98 cfs Outflow=1.65 cfs 25,476 cf

Subcatchment12S: Runoff Area=147,313 sf 65.31% Impervious Runoff Depth>1.69"
Tc=5.0 min CN=74/98 Runoff=1.36 cfs 20,756 cf

Reach 13R: 12" Avg. Flow Depth=0.35' Max Vel=2.99 fps Inflow=0.75 cfs 12,060 cf
12.0" Round Pipe n=0.013 L=69.4' S=0.0061 '/' Capacity=2.77 cfs Outflow=0.75 cfs 12,056 cf

Subcatchment13S: Runoff Area=73,746 sf 59.12% Impervious Runoff Depth>1.59"
Tc=5.0 min CN=74/98 Runoff=0.63 cfs 9,759 cf

Reach 14R: 12" Avg. Flow Depth=0.39' Max Vel=4.44 fps Inflow=1.28 cfs 19,602 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=1.28 cfs 19,595 cf

Subcatchment14S: Runoff Area=36,520 sf 87.22% Impervious Runoff Depth>2.05"
Tc=5.0 min CN=74/98 Runoff=0.43 cfs 6,253 cf

Reach 15R: 18" Avg. Flow Depth=0.72' Max Vel=5.54 fps Inflow=4.65 cfs 70,008 cf
18.0" Round Pipe n=0.013 L=110.0' S=0.0090 '/' Capacity=9.97 cfs Outflow=4.65 cfs 69,990 cf

Subcatchment15S: Runoff Area=29,901 sf 73.59% Impervious Runoff Depth>1.83"
Tc=5.0 min CN=74/98 Runoff=0.30 cfs 4,555 cf

Reach 16R: 24" Outlet Avg. Flow Depth=0.26' Max Vel=8.53 fps Inflow=2.06 cfs 118,554 cf
24.0" Round Pipe n=0.013 L=167.5' S=0.0622 '/' Capacity=56.42 cfs Outflow=2.06 cfs 118,516 cf

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>1.68"
Tc=5.0 min CN=74/98 Runoff=0.56 cfs 8,517 cf

Reach 17R: 12" Avg. Flow Depth=0.20' Max Vel=1.96 fps Inflow=0.21 cfs 3,501 cf
12.0" Round Pipe n=0.013 L=87.5' S=0.0050 '/' Capacity=2.53 cfs Outflow=0.21 cfs 3,499 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>2.12"
Tc=5.0 min CN=74/98 Runoff=0.23 cfs 3,337 cf

Subcatchment18.1S: Runoff Area=82,553 sf 60.53% Impervious Runoff Depth>1.61"
Tc=5.0 min CN=74/98 Runoff=0.72 cfs 11,085 cf

Subcatchment18S: Runoff Area=255,030 sf 68.76% Impervious Runoff Depth>1.75"
Tc=5.0 min CN=74/98 Runoff=2.46 cfs 37,148 cf

Subcatchment19S: Runoff Area=199,554 sf 70.41% Impervious Runoff Depth>1.78"
Tc=5.0 min CN=74/98 Runoff=1.96 cfs 29,523 cf

Subcatchment20S: Runoff Area=6,263 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.01 cfs 316 cf

Subcatchment21S: Runoff Area=4,712 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.01 cfs 238 cf

Subcatchment22S: Runoff Area=14,633 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 739 cf

Subcatchment23S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.45"
Flow Length=50' Slope=0.0440 '/' Tc=15.2 min CN=70/0 Runoff=0.00 cfs 182 cf

Subcatchment24S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.45"
Flow Length=100' Slope=0.0440 '/' Tc=22.7 min CN=70/0 Runoff=0.02 cfs 1,190 cf

Subcatchment25S: Runoff Area=6,705 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.01 cfs 339 cf

Subcatchment26S: Runoff Area=68,508 sf 7.88% Impervious Runoff Depth>0.74"
Tc=5.0 min CN=74/98 Runoff=0.20 cfs 4,207 cf

Subcatchment27S: Runoff Area=1,218,560 sf 67.32% Impervious Runoff Depth>1.72"
Tc=5.0 min CN=74/98 Runoff=11.54 cfs 175,067 cf

Subcatchment28S: Runoff Area=9,392 sf 28.66% Impervious Runoff Depth>1.08"
Tc=5.0 min CN=74/98 Runoff=0.05 cfs 847 cf

Subcatchment29S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>2.02"
Tc=5.0 min CN=74/98 Runoff=0.70 cfs 10,264 cf

Subcatchment30S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>2.02"
Tc=5.0 min CN=74/98 Runoff=0.31 cfs 4,525 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>1.47"
Flow Length=50' Slope=0.0100 '/' Tc=13.4 min CN=86/98 Runoff=0.45 cfs 7,505 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>1.46"
Tc=5.0 min CN=74/98 Runoff=0.14 cfs 2,193 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.13"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=0.71 cfs 14,912 cf

Total Runoff Area = 3,059,460 sf Runoff Volume = 410,913 cf Average Runoff Depth = 1.61"
40.77% Pervious = 1,247,360 sf 59.23% Impervious = 1,812,100 sf

Summary for Pond 1P: Northeast Facility

Inflow Area = 1,465,763 sf, 59.79% Impervious, Inflow Depth = 0.12" for WQ event
Inflow = 3.68 cfs @ 1.42 hrs, Volume= 14,221 cf
Outflow = 0.13 cfs @ 4.24 hrs, Volume= 8,684 cf, Atten= 96%, Lag= 169.6 min
Primary = 0.13 cfs @ 4.24 hrs, Volume= 8,684 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 321.37' @ 4.24 hrs Surf.Area= 13,621 sf Storage= 13,080 cf
Flood Elev= 325.30' Surf.Area= 36,154 sf Storage= 119,358 cf

Plug-Flow detention time= 622.0 min calculated for 8,684 cf (61% of inflow)
Center-of-Mass det. time= 585.7 min (725.4 - 139.7)

Volume	Invert	Avail.Storage	Storage Description
#1	320.30'	156,827 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
320.30	10,849	855.0	0	0	10,849
321.30	13,441	873.0	12,122	12,122	13,471
322.30	16,090	892.0	14,746	26,868	16,281
322.50	16,627	896.0	3,272	30,139	16,878
322.80	29,792	825.0	6,868	37,007	26,605
323.30	31,036	834.0	15,206	52,213	27,864
324.30	33,567	853.0	32,293	84,506	30,550
325.30	36,154	872.0	34,852	119,358	33,297
326.30	38,798	890.0	37,468	156,827	35,970

Device	Routing	Invert	Outlet Devices
#1	Primary	319.96'	**24.0" Round Culvert** L= 19.6' Ke= 0.500 Inlet / Outlet Invert= 319.96' / 319.57' S= 0.0199 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 4	320.30'	**2.2' long Broad-Crested Rectangular Weir** 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
#3	Device 1	320.30'	**2.2" Vert. WQ Orifice** C= 0.620
#4	Device 1	322.30'	**7.0" Vert. Detention Orifice** C= 0.620
#5	Device 1	324.85'	**Grated Manhole, Cv= 3.19 (C= 3.99)** Head (feet) 0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.89 Width (feet) 0.00 1.83 2.54 3.05 3.45 3.79 4.06 4.29 4.48 4.63 4.76 4.86 4.93 4.98 5.00 5.00 4.97 4.92 4.84 4.74 4.61 4.45 4.26 4.02 3.74 3.40 2.98 2.45 1.69 0.00

STORMWATER CONVEYANCE CALCULATIONS

Project: PH 1 Autumn Sunrise
Date: 5/4/2022

Design Storm: 25-Year
Storm Duration: 24-Hour
Precipitation: 3.9-Inch
Mannning's "n" 0.013
Max flow depth 82%

DESIGN							RESULTS					
REACH	UPSTREAM TO DOWNSTREAM STRUCTURE	LENGTH (ft.)	PIPE DIAMETER (in.) D_o	PIPE SLOPE (ft/ft)	MAX. FLOW (cfs)	MAX VELOCITY (fps)	FLOW (cfs)	VELOCITY (fps)	Q_f/Q_{max}	PIPE FLOW DEPTH (in.)	y/D_o	Meets Criteria (<82%)
1R	MH 1.1 TO POND	32.16	24	0.06	55.43	20.10	14.93	4.75	0.27	8.40	35%	Yes
2R	MH 1.2 TO MH 1.1	43.11	24	0.016	28.62	10.38	21.77	6.93	0.76	15.60	65%	Yes
3R	MH 8.1 TO MH 1.2	401.61	24	0.008	20.24	7.34	11.74	3.97	0.58	12.96	54%	Yes
4R	MH 1.3 TO MH 1.2	148.56	24	0.017	29.50	10.70	10.37	5.04	0.35	9.84	41%	Yes
5R	MH 1.5 TO MH 1.4	72.07	12	0.005	2.52	3.65	1.78	2.15	0.71	7.44	62%	Yes
6R	MH 4.1 TO MH 1.4	65.4	18	0.02	14.86	9.58	7.96	5.39	0.54	9.00	50%	Yes
7R	MH 3.1 TO MH 1.7	163.13	12	0.004	2.25	3.27	0.38	1.25	0.17	3.36	28%	Yes
8R	MH 2.1 TO MH 1.7	54.3	12	0.065	9.08	13.18	0.97	4.36	0.11	2.64	22%	Yes
9R	MH 4.8 TO MH 4.7	44.16	12	0.01	3.56	5.17	0.56	2.11	0.16	3.00	25%	Yes
10R	MH 5.1 TO MH 4.3	99.89	15	0.006	5.00	4.64	3.19	2.60	0.64	8.55	57%	Yes
11R	MH 6.1 TO MH 5.3	109.5	12	0.02	5.04	7.31	1.13	3.00	0.22	3.84	32%	Yes
12R	MH 4.4 TO MH 4.3	260	12	0.007	2.98	4.32	2.94	2.73	0.99	9.72	81%	Yes
13R	MH 5.4 TO MH 5.3	69.38	12	0.006	2.76	4.00	1.38	2.09	0.50	6.00	50%	Yes
14R	MH 9.1 TO MH 8.1	125.14	12	0.012	3.90	5.66	2.26	3.07	0.58	6.60	55%	Yes
15R	MH 8.2(FUT) TO MH 8.1	110.32	18	0.009	9.96	6.42	7.99	3.81	0.80	10.20	57%	Yes
16R	MH 0.2 TO OUTFALL	167.49	24	0.062	56.34	20.43	6.38	8.69	0.11	5.52	23%	Yes
17R	MH 4.9 TO MH 4.8	87.52	12	0.005	2.52	3.65	0.42	1.38	0.17	3.24	27%	Yes

Appendix C:
Stormwater Quality Calculations

STORMWATER QUALITY CALCULATIONS

Client: Lennar Northwest, INC
Project: Autumn Sunrise - Northeast Facility
AKS Job No.: 7454
Date: 5/4/2022
Done By: DS
Checked By: PAS

IMPERVIOUS AREA

Total Site Area:	61.71	acres
Total Site Area:	2,688,206	square feet (sf)
Number of Lots:	196	
Impervious Area Per Lot:	2,640	sf
Total Impervious Lot Area:	517,440	sf
Road & Sidewalk Impervious Area:	378,038	sf
Total Impervious Area:	895,478	sf

WATER DESIGN QUALITY VOLUME (WQV)

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

$$WQV = \frac{0.36" \text{ X Area (ft)}}{12" \text{ per ft}} = \mathbf{26864} \ \mathbf{cubic\ feet}$$

WATER QUALITY FLOW (WQF)

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

$$WQF = \frac{WQV\ (sf)}{4*60*60} = \mathbf{1.87} \ \mathbf{cfs}$$

WATER QUALITY MANHOLE SUMP VOLUME CALCULATIONS

(Per CWS 4.09.1 - R&O 19-05)

CWS Criteria: Sump Volume = 20 cubic feet per 1.0 cfs of flow

25-year Flow through WQ Manhole = **2.9** **cfs**

Calculated Manhole Sump Volume = **58** **cubic feet**
Calculated Manhole Sump Depth (60" Dia. Manhole) = **3.0** **ft** < 5 feet maximum

EXTENDED DRY BASIN DESIGN & CALCULATIONS

Hydraulic Design Criteria (Per CWS 4.09.5a/b/c - R&O 19-05)

Permanent Pool Depth: 0.2 ft
Permanent Pool covers bottom of basin
Design Detention Volume: 1.0 x Water Quality Volume (WQV)
Water Quality Drawdown Time: 48 hours
Maximum Depth of WQ Pool: 5 ft
Avoid direct flow across WQ pond to avoid short circuiting

Extended Dry Basin Sizing Design:

Bottom Slope (ft/ft)	Minimum Bottom Width (ft)	Side Slopes H:V	Top of Pond Elev. (ft)	Perm. Pool Depth (ft)	Pool Bottom Area (sf)	Bottom of Pool Elev. (ft)
0.0	14	3.0	326.30	0.2	10849	320.1

Water Quality Flow Hydraulic Calculations:

Q (cfs)	Pool Elev. at WQV (ft)	Orifice CL Height (ft)	Calculated Orifice Diameter (in)	Max. Pool Elev., 25-yr Event (ft)	Calculated Pond WQV (cubic feet)	Calculated WQV Pool Depth (ft)
0.16	322.3	320.19	2.24	325.10	26868	2.2

Check Against Design Criteria:

	Calculated		Meet CWS Criteria?		
Minimum Freeboard:	1.2	feet	**Yes**	more than	1 foot
Minimum Bottom Width:	14	feet	**Yes**	greater than	4 feet
Maximum Pool Depth at WQV:	2.2	feet	**Yes**	less than	5 feet
Detained Water Quality Volume:	26868	cubic feet	**Yes**	greater than	26864 cf

Appendix D:
Site Geotechnical Report

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

Geotechnical Engineering Report

Autumn Sunrise Subdivision
Phase 1 & 2
SW Norwood Road & SW Boones Ferry Road
Tualatin, Oregon

GeoPacific Engineering, Inc. Project No. 20-5436
January 27, 2022

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel (503) 598-8445
Fax (503) 941-9281

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Revised January 27, 2022
Project No. 20-5436

Ms. Terry New
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SUBJECT: GEOTECHNICAL ENGINEERING REPORT
AUTUMN SUNRISE SUBDIVISION – PHASE 1 & 2
SW NORWOOD ROAD & SW BOONES FERRY ROAD
TUALATIN, OREGON

Reference: *Preliminary Geotechnical Engineering Report, Autumn Sunrise Subdivision, SW Norwood Road & SW Boones Ferry Road, Tualatin, Oregon,* GeoPacific Engineering, Inc. report updated May 18, 2021.

1.0 PROJECT INFORMATION

This report presents the results of a geotechnical engineering study conducted by GeoPacific Engineering, Inc. (GeoPacific) for the above-referenced project. The purpose of our investigation was to evaluate subsurface conditions at the site, and to provide geotechnical recommendations for site development. This geotechnical study was performed in accordance with GeoPacific Proposal No. P-7209, dated January 22, 2020, and your subsequent authorization of our proposal and *General Conditions for Geotechnical Services*.

Site Location:	Northeast of SW Boones Ferry Rd & SW Greenhill Lane, South of SW Norwood Road Washington County Property No. R560164, R560253, R560262, R560271, R560280, R560299, R560306, & R560315 Tualatin, Oregon (Figures 1 and 2)
Developer:	Lennar Northwest 11807 NE 99th Street, Suite 1170 Vancouver, Washington 98682 Phone: (360) 258-7871
Jurisdictional Agency:	City of Tualatin, Oregon
Civil Engineer:	Darko Simic AKS Engineering & Forestry, LLC. 12965 SW Herman Road, Unit 100 Tualatin, Oregon 97062 Tel (503) 563-6151

2.0 SITE AND PROJECT DESCRIPTION

The subject site is located northeast of the intersection of SW Boones Ferry Road and SW Greenhill Lane extending north to SW Norwood Road in the City of Tualatin, Washington County, Oregon (Figure 1). The site consists of Washington County Properties R560164, R560253, R560262, R560271, R560280, R560299, R560306, and R560315, totaling approximately 60.5 acres in size. The site latitude and longitude are 45.3496, -122.7694, and the legal description is the SE ¼ of Section 35, T2S, R1W, Willamette Meridian. The regulatory jurisdictional agency is the City of Tualatin, Oregon. The site is bordered by SW Greenhill Lane to the south, by SW Boones Ferry Road to the west, by Interstate 5 to the east, and by residential homes, Horizon Christian High School, and SW Norwood Road to the north. Topography is predominantly gently to moderately sloping towards the east with grades up to approximately 20 percent (Figures 1 and 2). The site contains three existing residential homes in the southern portion of the site with street addresses of 9185 SW Greenhill Lane, 9335 SW Greenhill Lane, and 9415 SW Greenhill Lane. Each residential property contains various barns and outbuildings. Two of the homes have swimming pools. The majority of the property has been historically used for agricultural purposes and appears to have been regularly plowed and farmed with several individual plots. Two homes were historically present in the south western portion of the site on Property No. R560262, which had a street address of 23620 SW Boones Ferry Road; and Property No. R56253, which had a street address of 23740 SW Boones Ferry Road.

Based on our review of available historical aerial photography the southern portion of the site has been altered over the years by agricultural and residential activity. Prior to the year 2000 the eastern portion of the site was heavily wooded with coniferous trees. During the 2000's residential development of properties to the north and construction of the high school was conducted, and the northern portion of this site was used as a stockpile and fill location. The northeastern corner of the property was used to stockpile soil and a bike track was present for many years. It appears that

several periods of farming, grading, and various land use was conducted during this time period which likely resulted in placement of undocumented fill soils particularly in the northern portions. At this time vegetation at the site consists of open grass areas in the central portion, heavily wooded areas adjacent Interstate 5 and SW Norwood Road, blackberries and brush in the northeastern portion, and minor trees and landscaping around the existing homes in the southern portion. Topography at the site is level to gently sloping with site elevations range from approximately 310 to 360 feet above mean sea level (amsl).

Phase 1 consists of the northern portion of the Autumn Sunrise property. Based upon review of preliminary site plans, GeoPacific understands that the proposed development at Phase 1 will consist of a residential development supporting construction of ± 109 attached and detached homes, new streets, stormwater facilities, Clean Water Services Sanitary Sewer Pump Station, open space, and associated new underground utilities. We anticipate that the homes will be constructed with typical spread foundations and wood framing, with maximum structural loading on column footings and continuous strip footings on the order of 10 to 35 kips, and 2 to 4 kips respectively. It is our understanding that some grading operations will be performed on future Phase 2 and portions of Phases 3 and 4 during Phase 1. The grading plan provided for our review indicates maximum cuts will be on the order of 15 feet and fills will be on the order of 18 feet or less. Retaining walls up to 12 feet in height are planned.

3.0 REGIONAL AND LOCAL GEOLOGIC SETTING

The subject site lies within the Willamette Valley/Puget Sound lowland, a broad structural depression situated between the Coast Range on the west and the Cascade Range on the east. A series of discontinuous faults subdivide the Willamette Valley into a mosaic of fault-bounded, structural blocks (Yeats et al., 1996). Uplifted structural blocks form bedrock highlands, while down-warped structural blocks form sedimentary basins.

The subject site is underlain by the Miocene aged (about 14.5 to 16.5 million years ago) Columbia River Basalt Formation, which are a thick sequence of lava flows which form the crystalline basement of the Tualatin Valley (Beeson et al., 1989; Gannett and Caldwell, 1998). The basalts are composed of dense, finely crystalline rock that is commonly fractured along blocky and columnar vertical joints. Individual basalt flow units typically range from 25 to 125 feet thick and interflow zones are typically vesicular, scoriaceous, brecciated, and sometimes include sedimentary rocks.

4.0 REGIONAL SEISMIC SETTING

At least three major fault zones capable of generating damaging earthquakes are thought to exist in the vicinity of the subject site. These include the Portland Hills Fault Zone, the Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone.

4.1 Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that include the central Portland Hills Fault, the western Oatfield Fault, and the eastern East Bank Fault. These faults occur in a northwest-trending zone that varies in width between 3.5 and 5.0 miles. The combined three faults vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years) sediment (Madin, 1990). The Portland Hills Fault occurs along the Willamette River at the base of the Portland Hills and is approximately 9.4 miles northeast of the site. The East Bank Fault is oriented roughly parallel to the Portland Hills Fault, on the east

bank of the Willamette River, and is located approximately 13.2 miles northeast of the site. The Oatfield Fault occurs along the western side of the Portland Hills and is approximately 7.7 miles northeast of the site. The Oatfield Fault is considered to be potentially seismogenic (Wong, et al., 2000). Madin and Mabey (1996) indicate the Portland Hills Fault Zone has experienced Late Quaternary (last 780,000 years) fault movement; however, movement has not been detected in the last 20,000 years. The accuracy of the fault mapping is stated to be within 500 meters (Wong, et al., 2000). No historical seismicity is correlated with the mapped portion of the Portland Hills Fault Zone, but in 1991 a M3.5 earthquake occurred on a NW-trending shear plane located 1.3 miles east of the fault (Yelin, 1992). Although there is no definitive evidence of recent activity, the Portland Hills Fault Zone is assumed to be potentially active (Geomatrix Consultants, 1995).

According to the USGS Earthquake Hazards Program, the fault was originally mapped as a down-to-the-northeast normal fault but has also been mapped as part of a regional-scale zone of right-lateral, oblique slip faults, and as a steep escarpment caused by asymmetrical folding above a south-west dipping, blind thrust fault. The Portland Hills fault offsets Miocene Columbia River Basalts, and Miocene to Pliocene sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary deposits have been described along the fault trace, and the fault is mapped as buried by the Pleistocene aged Missoula flood deposits. No historical seismicity is correlated with the mapped portion of the Portland Hills Fault Zone, but in 1991 a M3.5 earthquake occurred on a NW-trending shear plane located 1.3 miles east of the fault (Yelin, 1992). Although there is no definitive evidence of recent activity, the Portland Hills Fault Zone is assumed to be potentially active (Geomatrix Consultants, 1995).

4.2 Gales Creek-Newberg-Mt. Angel Structural Zone

The Gales Creek-Newberg-Mt. Angel Structural Zone is a 50-mile-long zone of discontinuous, NW-trending faults that lies approximately 10.1 miles southwest of the subject site. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment (Yeats et al., 1996; Werner et al., 1992). A geologic reconnaissance and photogeologic analysis study conducted for the Scoggins Dam site in the Tualatin Basin revealed no evidence of deformed geomorphic surfaces along the structural zone (Unruh et al., 1994). No seismicity has been recorded on the Gales Creek Fault or Newberg Fault (the fault closest to the subject site); however, these faults are considered to be potentially active because they may connect with the seismically active Mount Angel Fault and the rupture plane of the 1993 M5.6 Scotts Mills earthquake (Werner et al. 1992; Geomatrix Consultants, 1995).

4.3 Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year (Goldfinger et al., 1996). A growing body of geologic evidence suggests that prehistoric subduction zone earthquakes have occurred (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). This evidence includes: (1) buried tidal marshes recording episodic, sudden subsidence along the coast of northern California, Oregon, and Washington, (2) burial of subsided tidal marshes by tsunami wave deposits, (3) paleoliquefaction features, and (4) geodetic uplift patterns on the Oregon coast. Radiocarbon dates on buried tidal marshes indicate a recurrence interval for major subduction zone earthquakes of 250 to 650 years with the last event occurring 300 years ago (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). The inferred seismogenic portion of the plate interface lies approximately along the Oregon Coast at depths of between 20 and 40 kilometers below the surface.

5.0 FIELD EXPLORATION AND SUBSURFACE CONDITIONS

Our site-specific exploration for this report was conducted on March 11 & 12, April 13, and July 28, 2020. For the entire Autumn Sunrise site, a total of six exploratory borings were drilled to depths of 5.5 to 25.5 feet and thirty seven exploratory test pits were excavated with a medium sized backhoe and a large excavator to depths ranging between 6.5 and 17 feet at the approximate locations presented on Figure 2. This report for Phase 1 will include explorations conducted on areas of the site proposed for grading in conjunction with Phase 1 (Phase 2 and portions of Phases 3 and 4) since the exploration information is pertinent to site preparation recommendations. It should be noted that exploration locations were located in the field by pacing or taping distances from apparent property corners and other site features shown on the plans provided. As such, the locations of the explorations should be considered approximate.

The boreholes were drilled using a trailer-mounted drill rig and solid stem auger methods. At each boring location, SPT (Standard Penetration Test) sampling was performed in general accordance with ASTM D1586 using a 2-inch outside diameter split-spoon sampler and a 140-pound hammer equipped with a rope and cathead mechanism. During the test, a sample is obtained by driving the sampler 18 inches into the soil with the hammer free-falling 30 inches. The number of blows for each 6 inches of penetration is recorded. The Standard Penetration Resistance ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration. If 50 or more blows are recorded within a single 6-inch interval, the test is terminated, and the blow count is recorded as 50 blows for the number of inches driven. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. At the completion of the borings, the holes were backfilled with bentonite.

A GeoPacific geologist continuously monitored the field exploration program and logged the explorations. Soils observed in the explorations were classified in general accordance with the Unified Soil Classification System (USCS). Rock hardness was classified in accordance with Table 1, modified from the ODOT Rock Hardness Classification Chart. During exploration, our geologist also noted geotechnical conditions such as soil consistency, moisture and groundwater conditions. Logs of the explorations are attached to this report. The following report sections are based on the exploration program and summarize subsurface conditions encountered at the site.

Table 1. Rock Hardness Classification Chart

ODOT Rock Hardness Rating	Field Criteria	Unconfined Compressive Strength	Typical Equipment Needed For Excavation
Extremely Soft (R0)	Indented by thumbnail	<100 psi	Small excavator
Very Soft (R1)	Scratched by thumbnail, crumbled by rock hammer	100-1,000 psi	Small excavator
Soft (R2)	Not scratched by thumbnail, indented by rock hammer	1,000-4,000 psi	Medium excavator (slow digging with small excavator)
Medium Hard (R3)	Scratched or fractured by rock hammer	4,000-8,000 psi	Medium to large excavator (slow to very slow digging), typically requires chipping with hydraulic hammer or mass excavation)
Hard (R4)	Scratched or fractured w/ difficulty	8,000-16,000 psi	Slow chipping with hydraulic hammer and/or blasting
Very Hard (R5)	Not scratched or fractured after many blows, hammer rebounds	>16,000 psi	Blasting

5.1 Soil Characteristics

Undocumented Fill: Undocumented fill soils were encountered in some portions of the site outside of Phase 1 but in areas proposed for grading. As presented on Figure 2, GeoPacific encountered undocumented fill soils in the southeastern portion of the property where soil stockpiles were created by the high school project (test pits TP-9, TP-12, TP-18, and TP-19). Fill depths including buried topsoil horizons encountered ranged from approximately 3 to 14 feet bgs.

Fill materials in the eastern portion of the property were observed to consist primarily of brown, very moist, moderately plastic, gravelly CLAY, and brown, moderately plastic Lean CLAY, extending to depths ranging from approximately 3 to 9 feet bgs. Layers of buried topsoil and buried organic soils were encountered within some of the explorations to depths of 14 feet. In general, the fill material appeared to contain soils considered suitable for re-use as engineered fill, provided that the layers of buried organic soil and inorganic debris are separated during excavation.

Topsoil Horizon: The site is primarily vegetated with grasses and dense trees, however some areas contain brush, trees, blackberries, etc. The topsoil horizon in the grassy and open portions of the site was observed to consist of brown, organic Lean CLAY (OL-CL), containing fine roots extending to depths ranging from approximately 8 to 12 inches bgs, however some areas were observed to have roots extending to 18 inches, likely due to old farming till zones. In the highly treed northern portion of the site, the topsoil horizon consisted of moderately to highly organic silt (OL-ML), was generally loose, contained many fine roots, and extended to a depth of 8 to 12 inches. Root zones may be as deep as 18 inches in areas where extensive blackberries are present.

GeoPacific collect one sample of the topsoil from test pit TP-13 and submitted the samples to our soils laboratory for organic content and pH testing. The location of the collected sample, and results of the laboratory testing are presented below in Table 2.

Table 2. Topsoil Organic Content and Soil pH

Test Pit	Depth of Sample (inches)	Soil Type	Organic Content by Weight % ASTM D2974	pH	Soil Moisture %
TP-13	0-12	OL-CL	12.8	6.1	41.9

Lean CLAY/Gravelly CLAY (Residual Soil): Underlying the topsoil horizon and undocumented fill soils were residual soil resulting from in-place weathering of the underlying Columbia River Basalt Formation. The soils were observed to consist of brown, medium stiff to very stiff, moist to very moist, clayey SILT (ML), lean CLAY, and gravelly CLAY containing varying degrees of subangular gravel to cobble-sized basalt fragments. Pocket penetrometer measurements conducted in the upper four feet of the ground surface indicated unconfined compressive strengths ranging from 1.5 to 4.5 tons/ft^2 (tsf). SPT N-Values ranged from 14 to 27 in the soil layer.

Columbia River Basalt Formation: Weathered basalt belonging to the Columbia River Basalt Formation was encountered underlying the residual soil. The weathered bedrock was encountered within soil boring B-4 at a depth of 15 feet and drilling refusal with the solid-stem auger was encountered at a depth of 25.5 feet bgs. The bedrock was also encountered within test pits TP-11, TP-13, and TP-21 through TP-37 at depths ranging from 0.5 to 10 feet bgs. Excavation refusal was achieved with a medium to large sized trackhoe equipped with rock teeth in test pits TP-11, TP-23, TP-25, and TP-28 at depths of 6.5 to 16 feet bgs. The basalt was weathered to extremely soft (R0) to medium hard (R3) consistency in accordance with the ODOT Rock Hardness Classification System (Table 1). A summary of the total depths of which basaltic bedrock was first encountered and the depth at which practical refusal was achieved is presented in Table 3. Please refer to the excavation logs for additional detail.

Table 3. Weathered Bedrock Excavation Depth Results

Exploration	Depth to Weathered Bedrock (Feet bgs)	Depth of Refusal (Feet bgs)	Excavator/ Drill Rig	ODOT Rock Hardness
B-4	15	25.5	Solid Stem Auger Drill	R1-R3
TP-11	0.5	6.5	16,000 lbs Case Backhoe-Rock Teeth	R1-R3
TP-23	9	15	30,900 lbs Kobelco SK140 Trackhoe-Rock Teeth	R3
TP-25	13	16	30,900 lbs Kobelco SK140 Trackhoe-Rock Teeth	R3
TP-28	14	15.5	30,900 lbs Kobelco SK140 Trackhoe-Rock Teeth	R3

5.1 Shrink-Swell Potential

Lean CLAY soils present in the upper 10 feet of the ground surface display low to moderate plasticity characteristics. Atterberg Limit testing indicated a plasticity index ranging from 1 to 31 for the soil type. Based on our review of soil conditions, and experience on other local nearby projects, the shrink-swell potential of near surface soils are not anticipated to require special design

measures where structures are proposed. However, the soil types are moisture sensitive, and will be difficult to work with during periods of wet weather.

5.2 Groundwater and Soil Moisture

On March 11 and 12, April 13, and July 28, 2020, observed soil moisture conditions were generally moist to very moist. Groundwater seepage was observed within some of our explorations which extended to a maximum depth of 25.5 feet bgs. Perched groundwater was encountered within soil boring B-4 at an approximate depth of 20 feet bgs and within test pit TP-12 at an approximate depth of 5.5 feet bgs. Light perched groundwater seepage was observed within test pits TP-11 and TP-22 at varying depths. Regional groundwater mapping indicates that static groundwater is present at a depth of approximately 120 feet below the ground surface (Snyder, 2008). Based on our review of available well logs from the State of Oregon, we understand that static groundwater is commonly encountered at depths ranging from 140 to 190 feet bgs in the vicinity of the subject site (Oregon Water Resources Department, 2022). During periods of wet weather, perched groundwater seepage may be encountered in localized areas. Seeps and springs may exist in areas not explored and may become evident during site grading. Shallow perched groundwater seepage may be encountered in utility trenches and deep excavations.

5.3 Infiltration Testing

Soil infiltration testing was performed using the open pit infiltration method in test pits TP-36 at a depth of 11 feet and test pit TP-37 at a depth of 5 feet. The soil was pre-saturated for a period of over 3 hours. The water level was measured to the nearest tenth of an inch every fifteen minutes to half hour with reference to the ground surface. Table 4 presents the results of our falling head infiltration testing and do not incorporate a factor of safety.

Table 4. Summary of Infiltration Test Results

Test Pit	Test Depth (feet)	Test Elevation (feet amsl)	Soil Type	Infiltration Rate (in/hr)	Hydraulic Head Range (inches)
TP-36	11	315	Weathered BASALT	***5.25***	5-27
TP-37	5	314	Weathered BASALT	0.75	5-12

Note: Storage capacity of fractured rock is extremely limited and the rate is unsustainable and not considered adequate for infiltration systems.

5.4 Hydrologic Soil Group Classification

Based on our soil infiltration testing, on site soils exhibit low permeability. The soils underlying the site contain consist of silty clay residual soils with abundant rock fragments underlain by weathered basalt bedrock. Although much of the site is mapped as having soils within Hydrologic Soil Group B by the Natural Resources Conservation Service Web Soil Survey (2022), the results of our test pit explorations indicate that the soils underlying the site classify as Hydrologic Soil Group C since they contain greater than 35 percent rock fragments (Natural Resources Conservation Service, 2009).

6.0 CONCLUSIONS AND RECOMMENDATIONS

Our investigation indicates that the proposed development is geotechnically feasible, provided that the recommendations of this report are incorporated into the design and sufficient geotechnical monitoring is incorporated into the construction phases of the project. In our opinion, the greatest geotechnical constraints for project completion include:

1. Undocumented fill soils. Undocumented fill was encountered in test pits TP-9, TP-18, and TP-19. Removal depths ranged from 3 to 14 feet, which include removal of the underlying buried topsoil.

2. The presence of shallow bedrock beneath the site. Weathered basalt bedrock was encountered throughout the site and basalt was first encountered at depths of 0.5 to 10 feet. Practical refusal was encountered on medium hard (R3) basalt at depths of 6.5 to 16 feet in test pits TP-11, TP-23, TP-25, and TP-28 and in boring B-4 at depths of 5.5 to 25.5 feet. A larger excavator may be able to achieve greater depths; however, difficult excavating conditions should be expected.

3. The difficulty of moisture conditioning and compacting fill comprised of a soil-rock mixture. The fill should be wet of optimum with large cobbles culled from the upper 3 feet of fill. Below a depth of 3 feet, only large boulders need to be removed from fill material. The soil-rock mixture should be blended to achieve uniform proportions prior to compacting and compaction effort on each lift should be substantial.

4. Low permeability soils.

5. Native soils are considered moisture-sensitive and will be difficult to handle in wet weather.

6.1 Stormwater Disposal

The results of our infiltration testing indicate that soils have a limited infiltration capacity at depths of 5 and 11 feet below the ground surface (elevations of 314-315 feet above mean sea level) in weathered basalt, as presented in Table 4. Testing conducted in test pit TP-36 yielded a higher infiltration rate than testing conducted nearby in test pit TP-37 under similar geologic conditions. These higher rates may be due to fractures in the weathered basalt or rooted zones that would likely silt up over time or become saturated quickly in a storm event. Storage capacity of fractured rock is extremely limited and the rate is unsustainable and not considered adequate for infiltration systems.

Infiltration test methods and procedures attempt to simulate the as-built conditions of the planned subsurface disposal system. However, due to natural variations in soil properties, actual infiltration rates may vary from the measured and/or recommended design rates. All systems should be constructed such that potential overflow is discharged in a controlled manner away from structures, and all systems should include an adequate factor of safety. Infiltration rates presented in this report should not be applied to inappropriate or complex hydrological models such as a closed basin without extensive further studies. This report presents infiltration test results only, and should not be construed as an approval of a system design.

6.2 Site Preparation Recommendations

Areas of proposed construction and areas to receive fill should be cleared of any organic and inorganic debris, undocumented fill soils, and/or loose stockpiled soils. Inorganic debris and organic materials from clearing should be removed from the site. Organic-rich soils and root zones should then be stripped from construction areas of the site or where engineered fill is to be placed. Depth of stripping of existing topsoil is estimated to average approximately 6 to 9 inches in cut areas, between 9 to 12 inches in fill areas, and between 12 to 36 inches in areas where large trees are present.

As mentioned above and as presented on Figure 2, undocumented fill soils were encountered at the site. Fill was encountered where stockpiles had been previously created in the eastern portion of the site. We anticipate that much of the fill material may be suitable for re-use as engineered fill provided it is free of highly organic soils and debris. Some layers of highly organic soils were encountered within the large fill area and should be separated from the clean fill material during grading. The area in the eastern portion of the site contains as much as 14 feet of undocumented fill underlain by highly organic buried topsoil.

The final depth of soil removal will be determined during site inspection after the stripping/excavation has been performed. Stripped topsoil should be removed from areas proposed for placement of engineered fill. Any remaining topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by the geotechnical engineer or his representative.

Where encountered, undocumented fills and any subsurface structures (dry wells, basements, swimming pools, driveway and landscaping fill, old utility lines, septic leach fields, etc.) should be completely removed and the excavations backfilled with engineered fill.

We recommend that areas proposed for placement of engineered fill are scarified and recompacted prior to placement of structural fill. The areas should be prepared by removing highly organic soil layers which contain abundant root concentration, or organic content in excess of approximately 4 to 5 percent by weight. Prior to placement of engineered fill, the underlying soils

be over-excavated, ripped, aerated to optimum moisture content, and recompacted to project specifications for engineered fill as determined by the Standard Proctor (ASTM D698).

Areas proposed to be left at grade may require additional over-excavation of foundation areas in order to reach soils which will provide adequate bearing support for the proposed foundations. It is unlikely that site earthwork will be impacted by shallow groundwater, however native soils are moisture sensitive and will be difficult to handle during periods of wet weather. Stabilization of subgrade soils will require aeration and recompaction. If subgrade soils are found to be difficult to stabilize, over-excavation, placement of granular soils, or cement treatment of subgrade soils may be feasible options. GeoPacific should be onsite to observe preparation of subgrade soil conditions prior to placement of engineered fill.

6.3 Engineered Fill

All grading for the proposed development should be performed as engineered grading in accordance with the applicable building code at time of construction with the exceptions and additions noted herein. Proper test frequency and earthwork documentation usually requires daily observation and testing during stripping, rough grading, and placement of engineered fill. Imported fill material must be approved by the geotechnical engineer prior to being imported to the site. Oversize material greater than 6 inches in size should not be used within 3 feet of foundation footings, and material greater than 12 inches in diameter should not be used in engineered fill.

Engineered fill should be compacted in horizontal lifts not exceeding 8 inches using standard compaction equipment. We recommend that engineered fill be compacted to at least 95% of the maximum dry density determined by ASTM D698 (Standard Proctor) or equivalent. Field density testing should conform to ASTM D2922 and D3017, or D1556. All engineered fill should be observed and tested by the project geotechnical engineer or his representative. Typically, one density test is performed for at least every 2 vertical feet of fill placed or every 500 yd^3, whichever requires more testing. Because testing is performed on an on-call basis, we recommend that the earthwork contractor be held contractually responsible for test scheduling and frequency.

Site earthwork will be impacted by soil moisture and shallow groundwater conditions. Earthwork in wet weather would likely require extensive use of cement or lime treatment, or other special measures, at a considerable additional cost compared to earthwork performed under dry-weather conditions.

6.4 Excavating Conditions and Utility Trench Backfill

We anticipate that on-site soils can be excavated using conventional heavy equipment such as scrapers and trackhoes. Highly weathered basalt bedrock was encountered in test pits throughout the site at depths of 0.5 to 10 feet and practical refusal was encountered on medium hard (R3) basalt at depths of 6.5 to 16 feet in test pits TP-11, TP-23, TP-25, and TP-28 and in borings B-1 through B-6 at depths of 5.5 to 25.5 feet. A larger excavator may be able to achieve greater depths; however, difficult excavating conditions should be expected.

All temporary cuts in excess of 4 feet in height should be sloped in accordance with U.S. Occupational Safety and Health Administration (OSHA) regulations (29 CFR Part 1926), or be shored. The existing upper native soils are classified as Type B Soil and temporary excavation side slope inclinations as steep as 1H:1V may be assumed for planning purposes. This cut slope inclination is applicable to excavations above groundwater seepage zones only. Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the

contractor. Actual slope inclinations at the time of construction should be determined based on safety requirements and actual soil and groundwater conditions.

Saturated soils and groundwater may be encountered in utility trenches, particularly during the wet season. We anticipate that dewatering systems consisting of ditches, sumps and pumps would be adequate for control of perched groundwater. Regardless of the dewatering system used, it should be installed and operated such that in-place soils are prevented from being removed along with the groundwater.

Vibrations created by traffic and construction equipment may cause some caving and raveling of excavation walls. In such an event, lateral support for the excavation walls should be provided by the contractor to prevent loss of ground support and possible distress to existing or previously constructed structural improvements.

PVC pipe should be installed in accordance with the procedures specified in ASTM D2321. We recommend that trench backfill be compacted to at least 95% of the maximum dry density obtained by Modified Proctor ASTM D1557 or equivalent. Initial backfill lift thickness for a ¾"-0 crushed aggregate base may need to be as great as 4 feet to reduce the risk of flattening underlying flexible pipe. Subsequent lift thickness should not exceed 1 foot. If imported granular fill material is used, then the lifts for large vibrating plate-compaction equipment (e.g. hoe compactor attachments) may be up to 2 feet, provided that proper compaction is being achieved and each lift is tested. Use of large vibrating compaction equipment should be carefully monitored near existing structures and improvements due to the potential for vibration-induced damage.

Adequate density testing should be performed during construction to verify that the recommended relative compaction is achieved. Typically, one density test is taken for every 4 vertical feet of backfill on each 200-lineal-foot section of trench.

6.5 Erosion Control Considerations

During our field exploration program, we did not observe soil types that would be considered highly susceptible to erosion except in areas of moderately sloping topography. In our opinion, the primary concern regarding erosion potential will occur during construction, in areas that have been stripped of vegetation. Erosion at the site during construction can be minimized by implementing the project erosion control plan, which should include judicious use of straw wattles and silt fences. If used, these erosion control devices should be in place and remain in place throughout site preparation and construction.

Erosion and sedimentation of exposed soils can also be minimized by quickly re-vegetating exposed areas of soil, and by staging construction such that large areas of the project site are not denuded and exposed at the same time. Areas of exposed soil requiring immediate and/or temporary protection against exposure should be covered with either mulch or erosion control netting/blankets. Areas of exposed soil requiring permanent stabilization should be seeded with an approved grass seed mixture, or hydroseeded with an approved seed-mulch-fertilizer mixture.

6.6 Wet Weather Earthwork

Soils underlying the site are likely to be moisture sensitive and may be difficult to handle or traverse with construction equipment during periods of wet weather. Earthwork is typically most economical when performed under dry weather conditions. Earthwork performed during the wet-weather season will probably require expensive measures such as cement treatment or imported granular material to compact fill to the recommended engineering specifications. If earthwork is to

be performed or fill is to be placed in wet weather or under wet conditions when soil moisture content is difficult to control, the following recommendations should be incorporated into the contract specifications:

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean engineered fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance. Under some circumstances, it may be necessary to excavate soils with a backhoe to minimize subgrade disturbance caused by equipment traffic;
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water;
- Material used as engineered fill should consist of clean, granular soil containing less than 5 percent fines. The fines should be non-plastic. Alternatively, cement treatment of on-site soils may be performed to facilitate wet weather placement;
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller, or equivalent, and under no circumstances should be left uncompacted and exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials;
- Excavation and placement of fill should be observed by the geotechnical engineer to verify that all unsuitable materials are removed and suitable compaction and site drainage is achieved; and
- Geotextile silt fences, straw wattles, and fiber rolls should be strategically located to control erosion.

If cement or lime treatment is used to facilitate wet weather construction, GeoPacific should be contacted to provide additional recommendations and field monitoring.

6.7 Spread Foundations

Based upon review of preliminary site plans, GeoPacific understands that the proposed development on Phase 1 will consist of a residential development supporting construction of 109 homes. We anticipate that the homes will be constructed with typical spread foundations and wood framing, with maximum structural loading on column footings and continuous strip footings on the order of 10 to 35 kips, and 2 to 4 kips respectively. The grading plan provided for our review indicates maximum cuts will be on the order of 15 feet and fills will be on the order of 18 feet or less. Retaining walls up to 12 feet in height are planned.

The proposed structures may be supported on shallow foundations bearing on stiff, native soils and/or engineered fill, appropriately designed and constructed as recommended in this report. Foundation design, construction, and setback requirements should conform to the applicable building code at the time of construction. For maximization of bearing strength and protection against frost heave, spread footings should be embedded at a minimum depth of 12 inches below exterior grade. If soft soil conditions are encountered at footing subgrade elevation, they should be removed and replaced with compacted crushed aggregate.

The anticipated allowable soil bearing pressure is 1,500 lbs/ft^2 for footings bearing on competent, native soil and/or engineered fill. The recommended maximum allowable bearing pressure may be increased by 1/3 for short-term transient conditions such as wind and seismic loading. For loads heavier than 35 kips, the geotechnical engineer should be consulted. If heavier loads than

described above are proposed, it may be necessary to over-excavate point load areas and replace with additional compacted crushed aggregate. The coefficient of friction between on-site soil and poured-in-place concrete may be taken as 0.42, which includes no factor of safety. The maximum anticipated total and differential footing movements (generally from soil expansion and/or settlement) are 1 inch and ¾ inch over a span of 20 feet, respectively. We anticipate that the majority of the estimated settlement will occur during construction, as loads are applied. Excavations near structural footings should not extend within a 1H:1V plane projected downward from the bottom edge of footings.

Footing excavations should penetrate through topsoil and any disturbed soil to competent subgrade that is suitable for bearing support. All footing excavations should be trimmed neat, and all loose or softened soil should be removed from the excavation bottom prior to placing reinforcing steel bars. Due to the moisture sensitivity of on-site native soils, foundations constructed during the wet weather season may require over-excavation of footings and backfill with compacted, crushed aggregate.

Our recommendations are for residential construction incorporating raised wood floors and conventional spread footing foundations. After site development, a Final Soil Engineer's Report should either confirm or modify the above recommendations.

6.8 Permanent Below-Grade Walls

Lateral earth pressures against below-grade retaining walls will depend upon the inclination of any adjacent slopes, type of backfill, degree of wall restraint, method of backfill placement, degree of backfill compaction, drainage provisions, and magnitude and location of any adjacent surcharge loads. At-rest soil pressure is exerted on a retaining wall when it is restrained against rotation. In contrast, active soil pressure will be exerted on a wall if its top is allowed to rotate or yield a distance of roughly 0.001 times its height or greater.

If the subject retaining walls will be free to rotate at the top, they should be designed for an active earth pressure equivalent to that generated by a fluid weighing 35 pcf for level backfill against the wall. For restrained wall, an at-rest equivalent fluid pressure of 55 pcf should be used in design, again assuming level backfill against the wall. These values assume that the recommended drainage provisions are incorporated, and hydrostatic pressures are not allowed to develop against the wall.

During a seismic event, lateral earth pressures acting on below-grade structural walls will increase by an incremental amount that corresponds to the earthquake loading. Based on the Mononobe-Okabe equation and peak horizontal accelerations appropriate for the site location, seismic loading should be modeled using the active or at-rest earth pressures recommended above, plus an incremental rectangular-shaped seismic load of magnitude 6.5H, where H is the total height of the wall.

We assume relatively level ground surface below the base of the walls. As such, we recommend passive earth pressure of 300 pcf for use in design, assuming wall footings are cast against competent native soils or engineered fill. If the ground surface slopes down and away from the base of any of the walls, a lower passive earth pressure should be used and GeoPacific should be contacted for additional recommendations.

A coefficient of friction of 0.42 may be assumed along the interface between the base of the wall footing and subgrade soils. The recommended coefficient of friction and passive earth pressure values do not include a safety factor, and an appropriate safety factor should be included in design.

The upper 12 inches of soil should be neglected in passive pressure computations unless it is protected by pavement or slabs on grade.

The above recommendations for lateral earth pressures assume that the backfill behind the subsurface walls will consist of properly compacted structural fill, and no adjacent surcharge loading. If the walls will be subjected to the influence of surcharge loading within a horizontal distance equal to or less than the height of the wall, the walls should be designed for the additional horizontal pressure. For uniform surcharge pressures, a uniformly distributed lateral pressure of 0.3 times the surcharge pressure should be added. Traffic surcharges may be estimated using an additional vertical load of 250 psf (2 feet of additional fill), in accordance with local practice.

The recommended equivalent fluid densities assume a free-draining condition behind the walls so that hydrostatic pressures do not build-up. This can be accomplished by placing a 12 to 18-inch wide zone of sand and gravel containing less than 5 percent passing the No. 200 sieve against the walls. A 3-inch minimum diameter perforated, plastic drain pipe should be installed at the base of the walls and connected to a suitable discharge point to remove water in this zone of sand and gravel. The drain pipe should be wrapped in filter fabric (Mirafi 140N or other as approved by the geotechnical engineer) to minimize clogging.

Wall drains are recommended to prevent detrimental effects of surface water runoff on foundations – not to dewater groundwater. Drains should not be expected to eliminate all potential sources of water entering a basement or beneath a slab-on-grade. An adequate grade to a low point outlet drain in the crawlspace is required by code. Underslab drains are sometimes added beneath the slab when placed over soils of low permeability and shallow, perched groundwater.

Water collected from the wall drains should be directed into the local storm drain system or other suitable outlet. A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet. Down spouts and roof drains should not be connected to the wall drains in order to reduce the potential for clogging. The drains should include clean-outs to allow periodic maintenance and inspection. Grades around the proposed structure should be sloped such that surface water drains away from the building.

GeoPacific should be contacted during construction to verify subgrade strength in wall keyway excavations, to verify that backslope soils are in accordance with our assumptions, and to take density tests on the wall backfill materials.

Structures should be located a horizontal distance of at least 1.5H away from the back of the retaining wall, where H is the total height of the wall. GeoPacific should be contacted for additional foundation recommendations where structures are located closer than 1.5H to the top of any wall.

6.9 Concrete Slabs-on-Grade

Preparation of areas beneath concrete slab-on-grade floors should be performed as recommended in the *Site Preparation Recommendations* section. Care should be taken during excavation for foundations and floor slabs, to avoid disturbing subgrade soils. If subgrade soils have been adversely impacted by wet weather or otherwise disturbed, the surficial soils should be scarified to a minimum depth of 8 inches, moisture conditioned to within about 3 percent of optimum moisture content, and compacted to engineered fill specifications. Alternatively, disturbed soils may be removed and the removal zone backfilled with additional crushed rock.

For evaluation of the concrete slab-on-grade floors using the beam on elastic foundation method, a modulus of subgrade reaction of 150 kcf (87 pci) should be assumed for the medium stiff,

fine-grained soils anticipated to be present at foundation subgrade elevation following adequate site preparation as described above. This value assumes the concrete slab system is designed and constructed as recommended herein, with a minimum thickness of 8 inches of 1½"-0 crushed aggregate beneath the slab. The total thickness of crushed aggregate will be dependent on the subgrade conditions at the time of construction, and should be verified visually by proof-rolling. Under-slab aggregate should be compacted to at least 95 percent of its maximum dry density as determined by ASTM D1557 (Modified Proctor) or equivalent.

In areas where moisture will be detrimental to floor coverings or equipment inside the proposed structure, appropriate vapor barrier and damp-proofing measures should be implemented. A commonly applied vapor barrier system consists of a 10-mil polyethylene vapor barrier placed directly over the capillary break material. Other damp/vapor barrier systems may also be feasible. Appropriate design professionals should be consulted regarding vapor barrier and damp proofing systems, ventilation, building material selection and mold prevention issues, which are outside GeoPacific's area of expertise.

6.10 Footing and Roof Drains

Construction should include typical measures for controlling subsurface water beneath the structure, including positive crawlspace drainage to an adequate low-point drain exiting the foundation, visqueen covering the expose ground in the crawlspace, and crawlspace ventilation (foundation vents). The client should be informed and educated that some slow flowing water in the crawlspaces is considered normal and not necessarily detrimental to the home given these other design elements incorporated into its construction. Appropriate design professionals should be consulting regarding crawlspace ventilation, building material selection and mold prevention issues, which are outside GeoPacific's area of expertise.

Down spouts and roof drains should collect roof water in a system separate from the footing drains to reduce the potential for clogging. Roof drain water should be directed to an appropriate discharge point and storm system well away from structural foundations. Grades should be sloped downward and away from buildings to reduce the potential for ponded water near structures.

If the proposed structure will have a raised floor, and no concrete slab-on-grade floors are used, perimeter footing drains may be eliminated at the discretion of the geotechnical engineer based on soil conditions encountered at the site and experience with standard local construction practices. Where it is desired to reduce the potential for moist crawl spaces, footing drains may be installed. If concrete slab-on-grade floors are used, perimeter footing drains should be installed as recommended below.

Where necessary, perimeter footing drains should consist of 3 or 4-inch diameter, perforated plastic pipe embedded in a minimum of 1 ft^3 per lineal foot of clean, free-draining drain rock. The drain pipe and surrounding drain rock should be wrapped in non-woven geotextile (Mirafi 140N, or approved equivalent) to minimize the potential for clogging and/or ground loss due to piping. A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet. Figure 3 presents a typical perimeter footing drain detail. In our opinion, footing drains may outlet at the curb, or on the back sides of lots where sufficient fall is not available to allow drainage to meet the street.

6.11 Public Streets

GeoPacific conducted design calculations for the proposed new public streets in the project interior. Based upon our understanding of the anticipated traffic which includes light-duty

passenger vehicles, weekly trash pickups, and occasional fire trucks weighing up to 75,000 lbs, we calculated an anticipated 18-kip ESAL count of approximately 143,620 over 20 years. Table 5 presents our flexible pavement design input parameters. Table 6 presents our recommended minimum dry-weather pavement section supporting 20 years of vehicle traffic per Washington County standards.

Table 5: Flexible Pavement Section Design Input Parameters for Interior Public Streets

Input Parameter	Design Value
18-kip ESAL Initial Performance Period (20 Years)	143,620
Initial Serviceability	4.2
Terminal Serviceability	2.5
Reliability Level	85 Percent
Overall Standard Deviation	0.5
Roadbed Soil Resilient Modulus (PSI)	7,500
Structural Number	**2.46**

Table 6: Recommended Minimum Dry-Weather Pavement Section: Interior Public Streets

Material Layer	Section Thickness (in.)	Structural Coefficient	Compaction Standard
Asphaltic Concrete (AC)	3.5 in.	.42	91%/ 92% of Rice Density AASHTO T-209
Crushed Aggregate Base ¾"-0 (leveling course)	2 in.	.10	95% of Modified Proctor AASHTO T-180
Crushed Aggregate Base 1½"-0	8 in.	.10	95% of Modified Proctor AASHTO T-180
Subgrade	12 in.	7,500 PSI	95% of Standard Proctor AASHTO T-99 or equivalent
Total Calculated Structural Number		**2.47**	

6.12 Subgrade Preparation

Roadway subgrade soils should be compacted and inspected by GeoPacific prior to the placement of crushed aggregate base for pavement. Typically, a proofroll with a fully loaded water or haul truck is conducted by travelling slowly across the grade and observing the subgrade for rutting, deflection, or movement. Any pockets of organic debris or loose fill encountered during ripping or tilling should be removed and replaced with engineered fill (see Section 6.1, *Site Preparation Recommendations*). In order to verify subgrade strength, we recommend proof-rolling directly on subgrade with a loaded dump truck during dry weather and on top of base course in wet weather. Soft areas that pump, rut, or weave should be stabilized prior to paving.

If pavement areas are to be constructed during wet weather, the subgrade and construction plan should be reviewed by the project geotechnical engineer at the time of construction so that condition specific recommendations can be provided. The moisture sensitive subgrade soils make the site a difficult wet weather construction project. General recommendations for wet weather pavement sections are provided below.

During placement of pavement section materials, density testing should be performed to verify compliance with project specifications. Generally, one subgrade, one base course, and one asphalt compaction test is performed for every 100 to 200 linear feet of paving.

6.13 Wet Weather Construction Pavement Section

This section presents our recommendations for wet weather pavement sections and construction for new pavement sections at the project. These wet weather pavement section recommendations are intended for use in situations where it is not feasible to compact the subgrade soils to project requirements, due to wet subgrade soil conditions, and/or construction during wet weather. Based on our site review, we recommend a wet weather section with a minimum subgrade deepening of 6 to 12 inches to accommodate a working subbase of additional 1½"-0 crushed rock. Geotextile fabric, Mirafi 500X or equivalent, should be placed on subgrade soils prior to placement of base rock.

In some instances, it may be preferable to use a subbase material in combination with over-excavation and increasing the thickness of the rock section. GeoPacific should be consulted for additional recommendations regarding use of additional subbase in wet weather pavement sections if it is desired to pursue this alternative. Cement treatment of the subgrade may also be considered instead of over-excavation. For planning purposes, we anticipate that treatment of the onsite soils would involve mixing cement powder to approximately 6 percent cement content and a mixing depth on the order of 12 to 18 inches.

With implementation of the above recommendations, it is our opinion that the resulting pavement section will provide equivalent or greater structural strength than the dry weather pavement section currently planned. However, it should be noted that construction in wet weather is risky and the performance of pavement subgrades depend on a number of factors including the weather conditions, the contractor's methods, and the amount of traffic the road is subjected to. There is a potential that soft spots may develop even with implementation of the wet weather provisions recommended in this letter. If soft spots in the subgrade are identified during roadway excavation, or develop prior to paving, the soft spots should be over-excavated and backfilled with additional crushed rock.

During subgrade excavation, care should be taken to avoid disturbing the subgrade soils. Removals should be performed using an excavator with a smooth-bladed bucket. Truck traffic should be limited until an adequate working surface has been established. We suggest that the crushed rock be spread using bulldozer equipment rather than dump trucks, to reduce the amount of traffic and potential disturbance of subgrade soils. Care should be taken to avoid over-compaction of the base course materials, which could create pumping, unstable subgrade soil conditions. Heavy and/or vibratory compaction efforts should be applied with caution. Following placement and compaction of the crushed rock to project specifications (95 percent of Modified Proctor), a finish proof-roll should be performed before paving.

The above recommendations are subject to field verification. GeoPacific should be on-site during construction to verify subgrade strength and to take density tests on the engineered fill, base rock and asphaltic pavement materials.

7.0 SEISMIC DESIGN

The Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon HazVu: 2022 Statewide GeoHazards Viewer indicates that the site is in an area where *very strong* to *severe* ground shaking is anticipated during an earthquake. Structures should be designed to resist earthquake loading in accordance with the methodology described in the 2018 International Building Code (IBC) with applicable Oregon Structural Specialty Code (OSSC) revisions (current 2019). We recommend Site Class C be used for design as defined in ASCE 7-16, Chapter 20, and Table 20.3-1. Design values determined for the site using the Applied Technology Council (ATC) 2022 Hazards By Location Online Tool are summarized in Table 7.

Table 7. Recommended Earthquake Ground Motion Parameters (ASCE 7-16)

Parameter	Value
Location (Lat, Long), degrees	45.350, -122.769
Probabilistic Ground Motion Values, 2% Probability of Exceedance in 50 yrs	
Peak Ground Acceleration PGA_M	0.454 g
Short Period, S_s	0.83 g
1.0 Sec Period, S_1	0.385 g
Soil Factors for Site Class C:	
F_a	1.2
F_v	1.5
$SD_s = 2/3 \times F_a \times S_s$	0.664 g
$SD_1 = 2/3 \times F_v \times S_1$	0.385 g
Residential Seismic Design Category	D

7.1 Soil Liquefaction

The Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon HazVu: 2022 Statewide GeoHazards Viewer indicates that the site is in an area considered to be at *low* risk for soil liquefaction during an earthquake. Soil liquefaction is a phenomenon wherein saturated soil deposits temporarily lose strength and behave as a liquid in response to ground shaking caused by strong earthquakes. Soil liquefaction is generally limited to loose, sands and granular soils located below the water table, and fine-grained soils with a plasticity index less than 15. The upper 12 feet of the site was observed to be underlain by very stiff, fine-grained soils with moderate plasticity. Groundwater was not encountered within our subsurface explorations. Regional geologic mapping indicates static groundwater is present at a depth of 120 feet below the ground surface (Snyder, 2008). Based upon the results of our study, it is our opinion that the soils underlying the site are not prone to liquefaction.

If deemed necessary, quantitative liquefaction assessment, beyond the scope of this study, may be conducted at the subject site to determine whether or not liquefiable soil layers are present underneath the subject site beyond the depths explored. Cone penetrometer testing (CPT) would be conducted at a selected location within the site boundaries to explore deeper subsurface soil layers, and the data would be used to estimate anticipated dynamic settlement at the subject site during a seismic ground shaking event.

8.0 UNCERTAINTIES AND LIMITATIONS

We have prepared this report for the owner and their consultants for use in design of this project only. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, GeoPacific should be notified for review of the recommendations of this report, and revision of such if necessary.

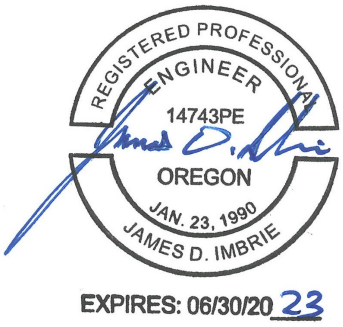
Sufficient geotechnical monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations. The checklist attached to this report outlines recommended geotechnical observations and testing for the project. Recommendations for design changes will be provided should conditions revealed during construction differ from those anticipated, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications.

Within the limitations of scope, schedule and budget, GeoPacific attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, expressed or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.



Beth K. Rapp, C.E.G.
Senior Engineering Geologist

James D. Imbrie, G.E., C.E.G.
Principal Geotechnical Engineer

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CHECKLIST OF RECOMMENDED GEOTECHNICAL TESTING AND OBSERVATION

Item No.	Procedure	Timing	By Whom	Done
1	Preconstruction meeting	Prior to beginning site work	Contractor, Developer, Civil and Geotechnical Engineers	
2	Fill removal from site or sorting and stockpiling	Prior to mass stripping	Soil Technician/ Geotechnical Engineer	
3	Stripping, aeration, and root-picking operations	During stripping	Soil Technician	
4	Compaction testing of engineered fill (95% of Standard Proctor)	During filling, tested every 2 vertical feet	Soil Technician	
5	Retaining Wall Keyway and Subbase	During Excavation	Soil Technician/ Geotechnical Engineer	
6	Retaining Wall Backfill and Geogrid Placement	During Construction	Soil Technician/ Geotechnical Engineer	
7	Compaction testing of trench backfill (95% of Modified Proctor)	During backfilling, tested every 4 vertical feet for every 200 linear feet	Soil Technician	
8	Street Subgrade Inspection (95% of Standard Proctor)	Prior to placing base course	Soil Technician	
9	Base course compaction (95% of Modified Proctor)	Prior to paving, tested every 200 linear feet	Soil Technician	
10	Asphalt Compaction (92% Rice Value)	During paving, tested every 100 linear feet	Soil Technician	
11	Final Geotechnical Engineer's Report	Completion of project	Geotechnical Engineer	

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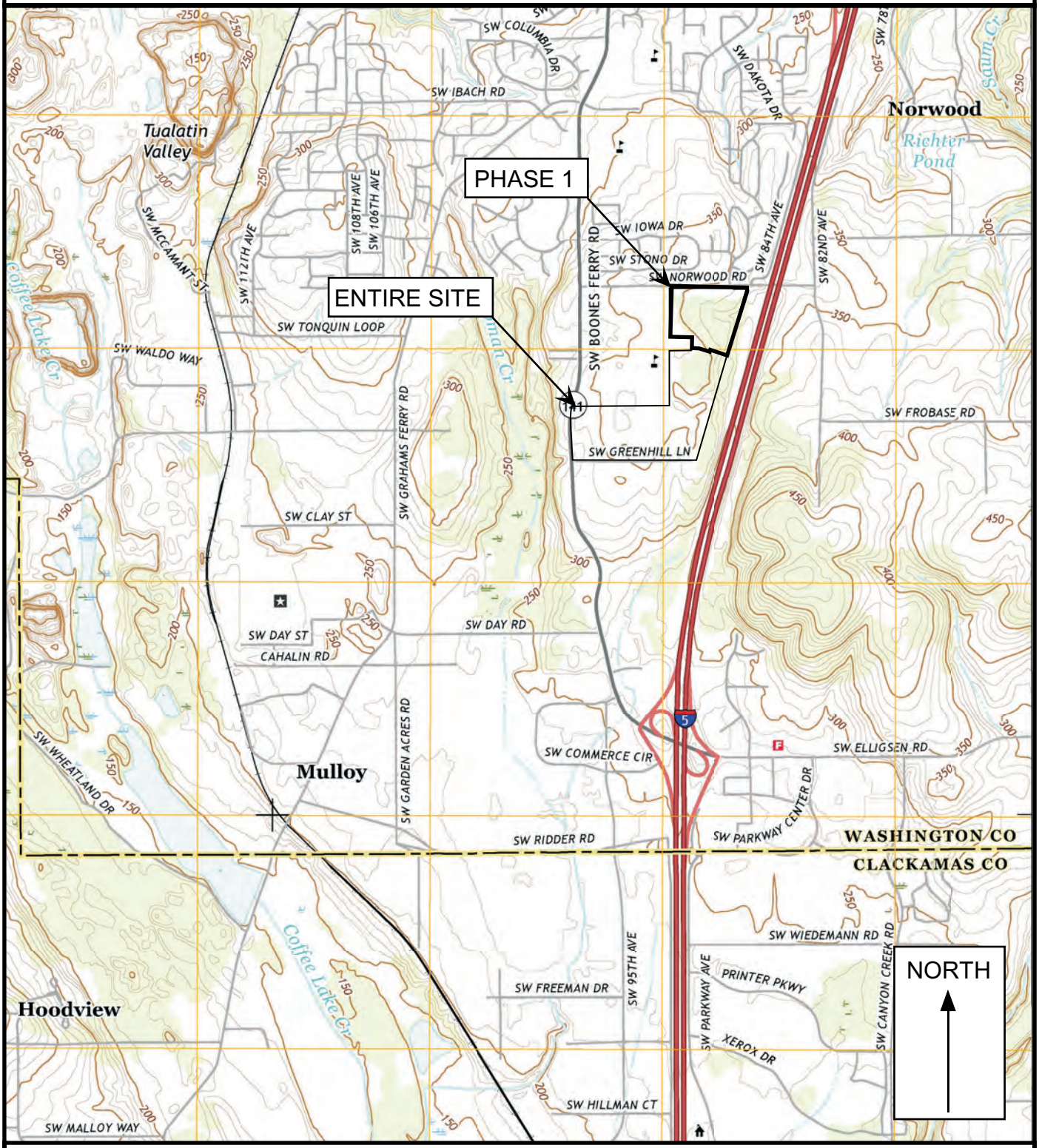
VICINITY MAP



Legend

Approximate Scale 1 in = 2,000 feet

Date: 1/14/2022
Drawn by: EKR

Base map: U.S. Geological Survey 7.5 minute Topographic Map Series, Sherwood, Oregon Quadrangle, 2017.

Project: Autumn Sunrise Phase 1 Tualatin, Oregon	Project No. 20-5436	FIGURE 1

GEOPACIFIC
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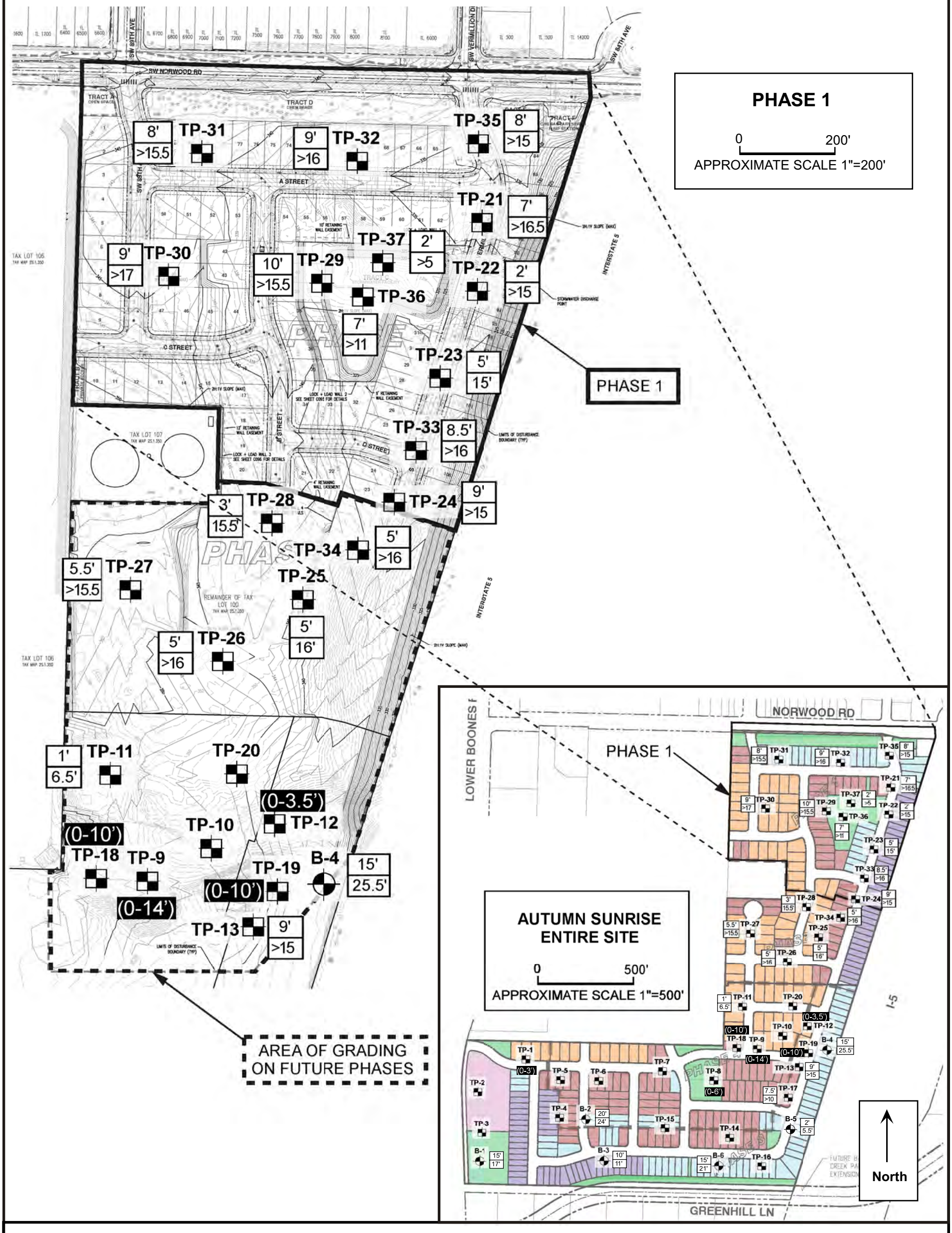
SITE PLAN AND EXPLORATION LOCATIONS



Legend

TP-1 — Test Pit Designation and Approximate Location

B-1 — Boring Designation and Approximate Location

(0-3') — Depth of Undocumented Fill Encountered (Including Buried Topsoil Horizon)

5' — 5' = Depth at Which Rock is First Encountered

16' — 16' = Depth of Practical Refusal on Rock

>16'= Depth is Beyond Maximum Exploration Depth

Date: 1/14/2022
Drawn by: EKR

Project: Autumn Sunrise Phase 1 Tualatin, Oregon	Project No. 20-5436	FIGURE 2

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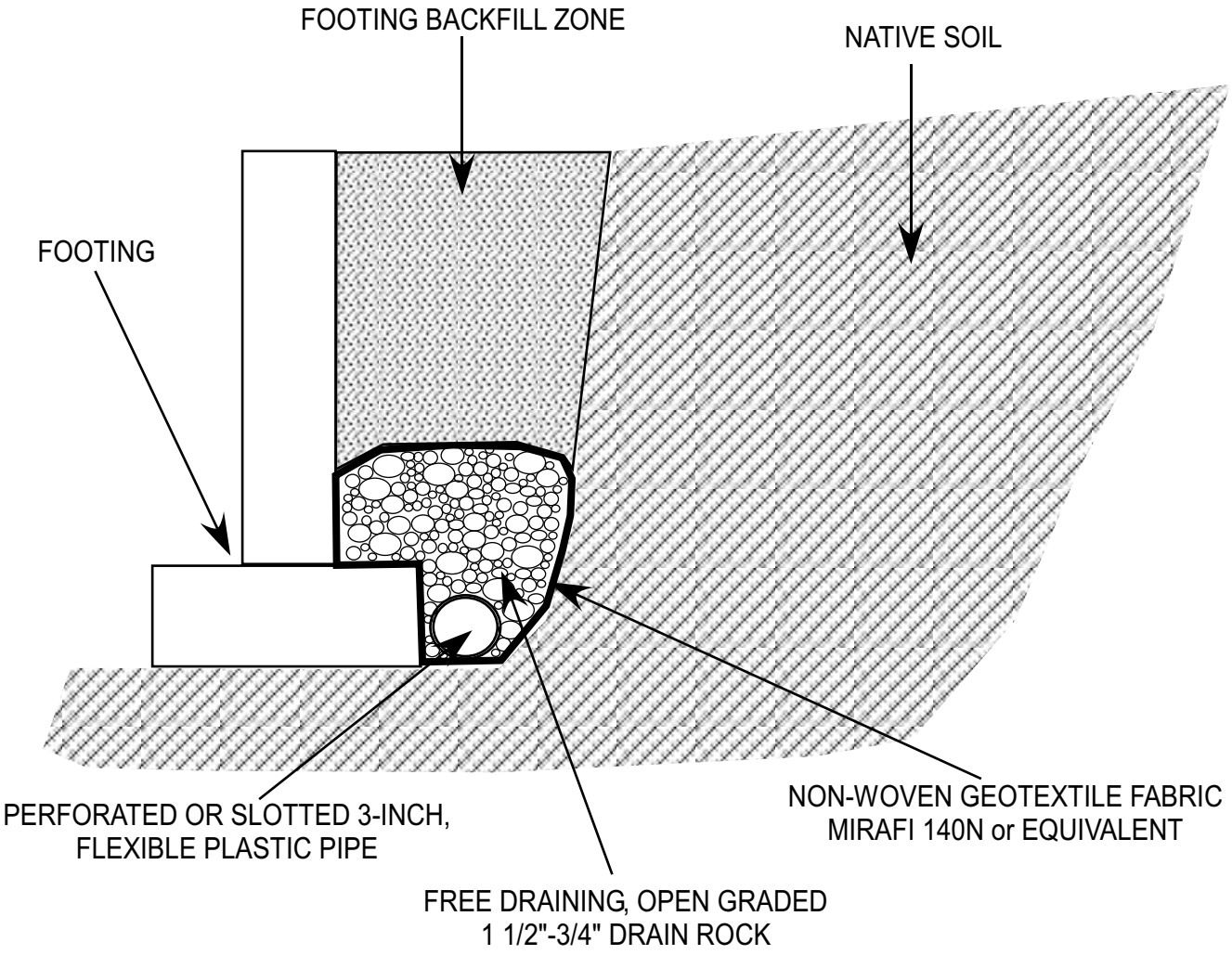
TYPICAL PERIMETER FOOTING DRAIN DETAIL



Notes:
1) Drain rock should contain no more than 5 percent fines passing the U.S. No. 200 Sieve.
2) Trench bottom and drain pipe should be sloped to drain to approved discharge location.

Date: 1/14/2021
Drawn by: BLC

Project: Autumn Sunrise Phase 1 Tualatin, Oregon	Project No. 20-5436	FIGURE 3

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BORING LOG

Project: Autumn Sunrise Phase 1 Tualatin, Oregon	Project No. 20-5436	Boring No. **B-4**

Depth (ft)	Sample Type	N-Value	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
						TOPSOIL. Grassy surface, underlain by approximately 8 inches dark brown, moderately organic, Lean CLAY (OL-CL), containing fine roots.
5		20				Gravelly CLAY (GC), brown/orange, stiff to very stiff, moist, moderate plasticity, gravel fragments consist of soft (R0-R1) weathered basalt with black staining (Residual Soil)
10		20				
15		21				
20		36			20 ▼	Weathered basaltic bedrock, gray with orange and black staining, medium hard (R1-R3), moist (Columbia River Basalt)
25		50-4"				
30						Soil boring terminated at -25.5 feet bgs due to drilling refusal. Groundwater Observed at -20 feet bgs Drill rig: Dan Fischer Excavating, Solid-Stem Auger, Trailer Mounted
35						
40						

LEGEND

Bag Sample (100 to 1,000 g) | Split-Spoon | Shelby Tube Sample | Static Water Table at Drilling | Static Water Table (10-20-99) | Water Bearing Zone

Date Drilled: 03/12/2020
Logged By: L. Glynn
Surface Elevation: 346 Feet

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TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-9**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.0						UNDOCUMENTED FILL. Gravely CLAY (CL), brown to light brown, soft, moist to very moist, moderate plasticity, inorganic debris, low organic content.
2	1.5						
3	1.5		100 to 1,000 g				
4	1.5						
5							
6			100 to 1,000 g				
7							
8							
9							BURIED TOPSOIL. Organic Lean CLAY (OL-CL), dark gray, moist, soft, moderately to highly organic, fine and large roots observed.
10							
11							
12							
13							
14							Lean CLAY (CL), brown with orange staining, medium stiff, moist to very moist, moderate plasticity. (Residual Soil)
15							Test pit terminated at 15 feet bgs. No groundwater seepage observed. Excavator: Dan Fisher Excavating,16,000 lbs CASE 580 Extendahoe Backhoe
16							
17							

LEGEND

100 to 1,000 g — Bag Sample

5 Gal. Bucket — Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 03/11/2020
Logged By: L.Glynn
Surface Elevation: 368 Feet

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TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-10**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.0						TOPSOIL. Organic Lean CLAY (OL-CL), brown, damp to moist, fine roots, extends to approximately 12 inches bgs.
2	2.5						Lean CLAY (CL), brown with orange staining, medium stiff, moist to very moist, moderate plasticity. (Residual Soil)
3	2.5						
4	2.5						
5							
6							
7							Gravelly CLAY (GC), light brown, stiff to very stiff, very moist, low plasticity, gravel fragments consist of subangular soft (R0-R1) weathered basalt with black staining. (Residual Soil)
8							
9							Grades to (R1-R2)
10							Fragment sizes increase to approximately 6 to 10 inches (R2-R3)
11							
12							Test pit terminated at 11.5 feet bgs. No groundwater seepage observed. Excavator: Dan Fisher Excavating,16,000 lbs CASE 580 Extendahoe Backhoe
13							
14							
15							
16							
17							

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/11/2020
Logged By: L.Glynn
Surface Elevation: 346 Feet

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TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-11**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	3.5						TOPSOIL. Organic Lean CLAY (OL-CL), brown, fine roots, extends to approximately 3 inches bgs.
2	4.0						Weathered basaltic bedrock, gray with orange and black staining, medium hard (R0-R1), moist, breaks into subangular fragments ranging from 6 to 12 inches. (Columbia River Basalt)
3	4.0						Grades to (R1-R2)
4	4.0						Grades to (R2-R3)
5							
6							
7							Test pit terminated at 6.5 feet bgs due to practical refusal on bedrock. Light groundwater seepage observed at approximately 6 feet bgs. Excavator: Dan Fisher Excavating,16,000 lbs CASE 580 Extendahoe Backhoe
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/11/2020
Logged By: L.Glynn
Surface Elevation: 343 Feet

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Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-12**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	0.5						UNDOCUMENTED FILL. Gravelly CLAY (CL), brown to light brown, soft, very moist, moderate plasticity, inorganic debris, low organic content.
2	0.5						
3	1.0						
4	4.0						Gravelly CLAY (GC), light brown, stiff to very stiff, very moist, low plasticity, gravel fragments consist of subangular soft (R0-R1) weathered basalt with black staining. (Residual Soil)
5							
6							
7							
8							
9			100 to 1,000 g	38.7	57.1		AASHTO Classification= A-4(0); LL=NV; PI=NV
10							Test pit terminated at 10 feet bgs. Significant groundwater observed at approximately 5.5 feet bgs. Excavator: Dan Fisher Excavating,16,000 lbs CASE 580 Extendahoe Backhoe
11							
12							
13							
14							
15							
16							
17							

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/11/2020
Logged By: L.Glynn
Surface Elevation: 333 Feet

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-13**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.0		100 to 1,000 g				TOPSOIL. Organic Lean CLAY (OL-CL), brown, moist, fine roots, extends to approximately 8 to 12 inches bgs. Organic content=12.8, pH=6.1
2	3.0						Gravelly CLAY (GC), brown/orange, stiff to very stiff, very moist, low plasticity, gravel fragments consist of subangular soft (R0-R1) weathered basalt with black staining. (Residual Soil)
3	3.5		100 to 1,000 g				
4	3.5						
5							
6							
7							
8							
9							
10							Weathered basaltic bedrock, gray with orange and black staining, medium hard (R1-R2), very moist, breaks into subangular fragments ranging from 6 to 12 inches. (Columbia River Basalt)
11							
12			100 to 1,000 g				
13							
14			100 to 1,000 g				Grades to very moist to wet
15							Test pit terminated at 15 feet bgs.
16							No groundwater seepage observed.
17							Excavator: Dan Fisher Excavating,16,000 lbs CASE 580 Extendahoe Backhoe

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/11/2020
Logged By: L.Glynn
Surface Elevation: 348 Feet

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-18**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1–10							UNDOCUMENTED FILL. Gravely CLAY (CL), dark brown, soft, moist to very moist, highly organic, inorganic debris including large concrete pieces and silt fence, tire pile at surface directly adjacent to test pit.
9–10							BURIED TOPSOIL. Organic Lean CLAY (OL-CL), dark gray, moist, soft, highly organic, fine and large roots observed, organic odor.
10–11							Lean CLAY (CL), brown with orange staining, medium stiff, moist to very moist, moderate plasticity. (Residual Soil)
11							Test pit terminated at 11 feet bgs. No groundwater seepage observed. Excavator: Dan Fisher Excavating, 9,678 lbs Hitachi ZX40U Excavator

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 03/12/2020
Logged By: L.Glynn
Surface Elevation: 360 Feet

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-19**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1–10							UNDOCUMENTED FILL. Gravely CLAY (CL), brown to light brown, soft, moist to very moist, moderate plasticity, inorganic debris, low organic content.
9							BURIED TOPSOIL. Organic Lean CLAY (OL-CL), dark gray, moist, soft, highly organic, fine and large roots observed.
10							Lean CLAY (CL), brown, medium stiff to stiff, moist to very moist, moderate plasticity. (Residual Soil)
11							Test pit terminated at 11 feet bgs. No groundwater seepage observed. Excavator: Dan Fisher Excavating, 9,678 lbs Hitachi ZX40U Excavator
12–17							

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/12/2020
Logged By: L.Glynn
Surface Elevation: 358 Feet

GEOPACIFIC
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No.20-5436

Test Pit No. **TP-20**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Torvane Shear (tons/ft²)	Sample Type	% Passing No. 200 Sieve	Moisture Content (%)	Water Bearing Zone	Material Description
1							TOPSOIL. Organic Lean CLAY (OL-CL), brown, damp to moist, fine roots, extends to approximately 6 inches bgs.
2							Lean CLAY (CL), brown with orange staining, medium stiff to stiff, moist to very moist, moderate plasticity. (Residual Soil)
3							
4							
5							Gravelly CLAY (GC), light brown, stiff to very stiff, very moist, low plasticity, gravel fragments consist of subangular soft (R0-R1) weathered basalt with black staining. (Residual Soil)
6							
7							
8							
9							Grades to R1-R2
10							Test pit terminated at 10 feet bgs. No groundwater seepage observed. Excavator: Dan Fisher Excavating, 9,678 lbs Hitachi ZX40U Excavator
11							
12							
13							
14							
15							
16							
17							

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/12/2020
Logged By: L.Glynn
Surface Elevation: 352 Feet

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-21**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	1.5					
3	3.5					Medium stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
4	3.5					
5						
6						
7						
8						
9						
10						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
11						
12						
13						
14						
15						
16						
17						Test Pit Terminated at 16.5 Feet.
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-22**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.5					Moderately to highly organic, SILT (OL-ML), dark brown, abundant roots throughout, loose, moist (Topsoil Horizon)
2	2.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), trace gravel, light reddish brown, trace black staining, moist (Residual Soil)
3						
4						Very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray, vesicular, trace black staining, moist (Columbia River Basalt Formation)
5						
6						
7						
8						Transitions to soft (R2) below 8 feet
9						
10						
11						
12						
13						
14						
15						Test Pit Terminated at 15 Feet.
16						
17						Note: Groundwater seepage encountered at 11 to 13 feet. Discharge visually estimated at 1 to 2 gallons per minute.
18						
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-23**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.5					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	2.5					
3	3.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, trace roots to 2 feet, moist (Residual Soil)
4	3.5					
5						
6						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray, vesicular, trace black staining, moist (Columbia River Basalt Formation)
7						
8						
9						Transitions to very soft (R1) to soft (R2) below 9 feet
10						
11						
12						
13						
14						
15						Practical Refusal on Medium Hard (R3) Basalt at 15 Feet.
16						
17						Note: No seepage or groundwater encountered.
18						
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

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Tel: (503) 598-8445

TEST PIT LOG

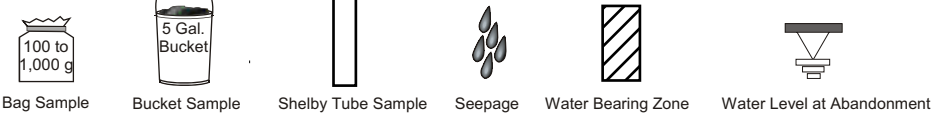
Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-24**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	3.0					
3	2.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace roots to 2 feet, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
4	4.0					
5						
6						
7						
8						
9						
10						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
11						
12						
13						
14						
15						Test Pit Terminated at 15 Feet.
16						
17						Note: No seepage or groundwater encountered.
18						
19						
20						

LEGEND



Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

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Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-25**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	4.0					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), trace gravel, light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
3	4.5					
4	4.5					
5						
6						
7						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
8						
9						
10						
11						
12						
13						Transitions to soft (R2) to medium hard (R3) below 13 feet
14						
15						
16						
16						Practical Refusal on Medium Hard (R3) Basalt at 16 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-26**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	3.0					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
3	3.0					
4	2.0					
5						
6						
7						
8						
9						
10						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
11						
12						
13						
14						
15						
16						Test Pit Terminated at 16 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

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Tel: (503) 598-8445

TEST PIT LOG

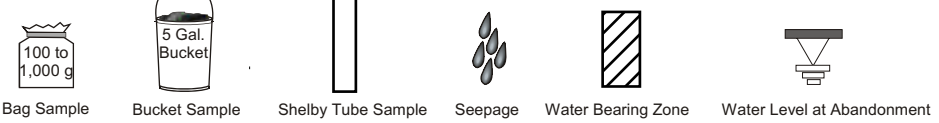
Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-27**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	3.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	2.0					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, trace roots to 3.5 feet, subtle orange and gray mottling, moist (Residual Soil)
3	3.0					
4	4.0					
5						
6						
7						
8						
9						
10						Extremely soft (R0) to soft (R2), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
11						
12						
13						
14						
15						
16						Test Pit Terminated at 15.5 Feet.
17						Note: No seepage or groundwater encountered.
18						
19						
20						

LEGEND



Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

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Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-28**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.5					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	1.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, trace roots, subtle orange and gray mottling, moist (Residual Soil)
3	3.5					
4						
5						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
6						
7						
8						
9						
10						
11						
12						
13						
14						Transitions to soft (R2) to medium hard (R3) below 14 feet
15						
16						Practical Refusal on Medium Hard (R3) Basalt at 15.5 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

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Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-29**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	3.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	2.0					
3	2.5					
4	2.5					
5						Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
6						
7						
8						
9						
10						
11						
12						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
13						
14						
15						
16						Test Pit Terminated at 15.5 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

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Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-30**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.5					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	1.5					
3	2.5					
4	2.0					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, trace large roots to 2 feet, subtle orange and gray mottling, moist (Residual Soil)
5						
6						
7						
8						
9						
10						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
11						
12						
13						
14						
15						
16						
17						Test Pit Terminated at 17 Feet.
18						
19						Note: No seepage or groundwater encountered.
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
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Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-31**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	3.5					
3	4.0					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
4	4.5					
5						
6						
7						
8						
9						
10						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
11						
12						
13						
14						Transitions to very soft (R1) to soft (R2) below 14 feet
15						
16						Test Pit Terminated at 15.5 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-32**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	2.0					
3	3.0					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, large roots to 2 feet, subtle orange and gray mottling, moist (Residual Soil)
4	3.5					
5						
6						
7						
8						
9						
10						
11						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
12						
13						Transitions to very soft (R1) to soft (R2) below 13 feet
14						
15						
16						Test Pit Terminated at 16 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1 Tualatin, Oregon	Project No. 20-5436	Test Pit No. **TP-33**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.0					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	3.0					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, roots to 3 feet, subtle orange and gray mottling, moist (Residual Soil)
3	3.0					
4	2.0					
5						
6						
7						
8						
9						Extremely soft (R0) to soft (R2), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brown, vesicular, trace black staining, moist (Columbia River Basalt Formation)
10						
11						
12						
13						
14						
15						
16						Test Pit Terminated at 16 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-34**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.4					Moderately to highly organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	3.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
3	4.5					
4	4.5					
5						
6						
7						
8						
9						Extremely soft (R0) to soft (R2), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
10						
11						
12						
13						
14						
15						
16						Test Pit Terminated at 16 Feet.
17						
18						Note: No seepage or groundwater encountered.
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-35**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	2.5					Moderately to highly organic, SILT (OL-ML), trace gravel, dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	1.5					
3	2.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
4	3.0					
5						
6						
7						
8						
9						Extremely soft (R0) to soft (R2), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
10						
11						
12						
13						
14						
15						Test Pit Terminated at 15 Feet.
16						
17						Note: No seepage or groundwater encountered.
18						
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 4/13/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1 Tualatin, Oregon	Project No. 20-5436	Test Pit No. **TP-36**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Moderately organic, SILT (OL-ML), brown, with roots, damp (Topsoil Horizon)
2	4.5					
3	4.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
4	4.5					
5						
6						
7						
8						Extremely soft (R0) to very soft (R1), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
9						
10						
11						Test Pit Terminated at 11 Feet.
12						
13						Note: No seepage or groundwater encountered.
14						
15						
16						
17						
18						
19						
20						

LEGEND

Date Excavated: 7/28/2020
Logged By: B. Rapp
Surface Elevation:

14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445

TEST PIT LOG

Project: Autumn Sunrise Phase 1
Tualatin, Oregon

Project No. 20-5436

Test Pit No. **TP-37**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	4.5					Moderately organic, SILT (OL-ML), dark brown, roots throughout, loose, moist (Topsoil Horizon)
2	4.5					Stiff to very stiff, clayey SILT (ML) to silty CLAY (CL), light reddish brown, trace black staining, subtle orange and gray mottling, moist (Residual Soil)
3						Extremely soft (R0) to soft (R2), highly weathered BASALT, trace reddish-brown matrix of silty clay to clayey silt, gray to brownish orange, vesicular, trace black staining, moist (Columbia River Basalt Formation)
4						
5						Test Pit Terminated at 5 Feet.
6						
7						Note: No seepage or groundwater encountered.
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 7/28/2020
Logged By: B. Rapp
Surface Elevation:

==========

DARWin(tm) - Pavement Design

A Proprietary AASHTOWARE(tm)
Computer Software Product

Flexible Structural Design Module

Project Description
20-5436, Autumn Sunrise, New Public Residential Streets, Flexible Pavement
20-Year Design Life

Flexible Structural Design Module Data
18-kip ESALs Over Initial Performance Period: 143,620
Initial Serviceability: 4.2
Terminal Serviceability: 2.5
Reliability Level (%): 85
Overall Standard Deviation: .5
Roadbed Soil Resilient Modulus (PSI): 7,500
Stage Construction: 1

Calculated Structural Number: 2.46

Specified Layer Design
Layer: 1
Material Description: Asphaltic Concrete (A/C)
Structural Coefficient (Ai): .42
Drainage Coefficient (Mi): 1
Layer Thickness (Di) (in): 3.50
Calculated Layer SN: 1.47

Layer: 2
Material Description: 3/4"-0 Crushed Aggregate
Structural Coefficient (Ai): .1
Drainage Coefficient (Mi): 1
Layer Thickness (Di) (in): 2.00
Calculated Layer SN: .20

Layer: 3
Material Description: 1.5"-0 Crushed Aggregate
Structural Coefficient (Ai): .1
Drainage Coefficient (Mi): 1
Layer Thickness (Di) (in): 8.00
Calculated Layer SN: .80

Total Thickness (in): 13.50
Total Calculated SN: 2.47

Simple ESAL Calculation
Initial Performance Period (years): 20
Initial Two-Way Daily Traffic (ADT): 850
% Heavy Trucks (of ADT) FHWA Class 5 or Greater: 3
Number of Lanes In Design Direction: 1
Percent of All Trucks In Design Lane (%): 100
Percent Trucks In Design Direction (%): 50
Average Initial Truck Factor (ESALs/truck): 1.2
Annual Truck Factor Growth Rate (%): 0
Annual Truck Volume Growth Rate (%): 3
Growth: Simple

Total Calculated Cumulative Esals: 143,620

Appendix E:
TR55 Runoff Curve Numbers

TR55 RUNOFF CURVE NUMBERS

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 (vegetat ion 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
Developin g 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.

Memorandum

Date:	August 22nd, 2022
To:	City of Tualatin
From:	Darko Simic, PE (DarkoS@aks-eng.com)
Project:	Autumn Sunrise, Phase 2
Subject:	Stormwater Management
Site Location:	Tualatin, OR

This memorandum summarizes the Autumn Sunrise Phase 2 stormwater management plan and its compliance with the subdivision stormwater master plan established in the Autumn Sunrise Phase 1 final stormwater report, dated May 2022. The Phase 2 expansion of the Autumn Sunrise subdivision will occupy ±7.9 acres and will include the creation of additional 55 residential single-family attached and detached homes with associated street and public infrastructure improvements to support the future homes.

The Autumn Sunrise northeast stormwater facility, constructed with Phase 1 development, was designed to accommodate stormwater runoff from the future phases of Autumn Sunrise (Phase 2 and a portion of Phases 3 and 4). Stormwater runoff from the proposed Phase 2 development will maintain Phase 1 assumed drainage patterns.

The proposed on-site curb inlets have been spaces per City of Tualatin and CWS requirements to properly capture stormwater runoff. The proposed storm pipes have been sized to meet City of Tualatin requirements using Manning's equation to convey the peak flows from the 25-year storm event at maximum of 82 percent compacity.

The Autumn Sunrise Phase 1 final stormwater report included and defined the Phase 2 proposed impervious improvements and basin areas draining to the northeast stormwater facility. These areas were encompassed by basins 16S, 17S, 18S, and 19S from the Phase 1 stormwater model. Table 1-1 below compares the Phase 2 proposed basin flows with the established Phase 1 basin flows, contributing to the northeast stormwater facility, and illustrates that the proposed Autumn Sunrise Phase 2 development improvements follow the established basin flows per the Phase 1 final stormwater report.

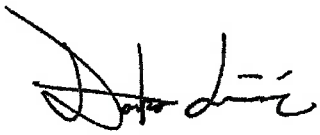
Table 1-1: Flow Comparison between Phase 1 and Phase 2

Recurrence Interval (Years)	Established flow within Phase 1 (cfs)	Proposed flow with Phase 2 development (cfs)	Peak Flow Increase or (Decrease) – (cfs)
2	5.88	5.75	(0.13)
10	8.76	8.57	(0.19)
25	10.18	9.96	(0.22)
50	11.77	11.52	(0.25)

The proposed Autumn Sunrise Phase 2 development improvements follow the established basin areas and flows per the Phase 1 final stormwater report. Therefore, the Autumn Sunrise Phase 2 development is in compliance with the subdivision stormwater master plan and will maintain functionality of the existing stormwater facilities as designed per the City of Tualatin and CWS requirements.

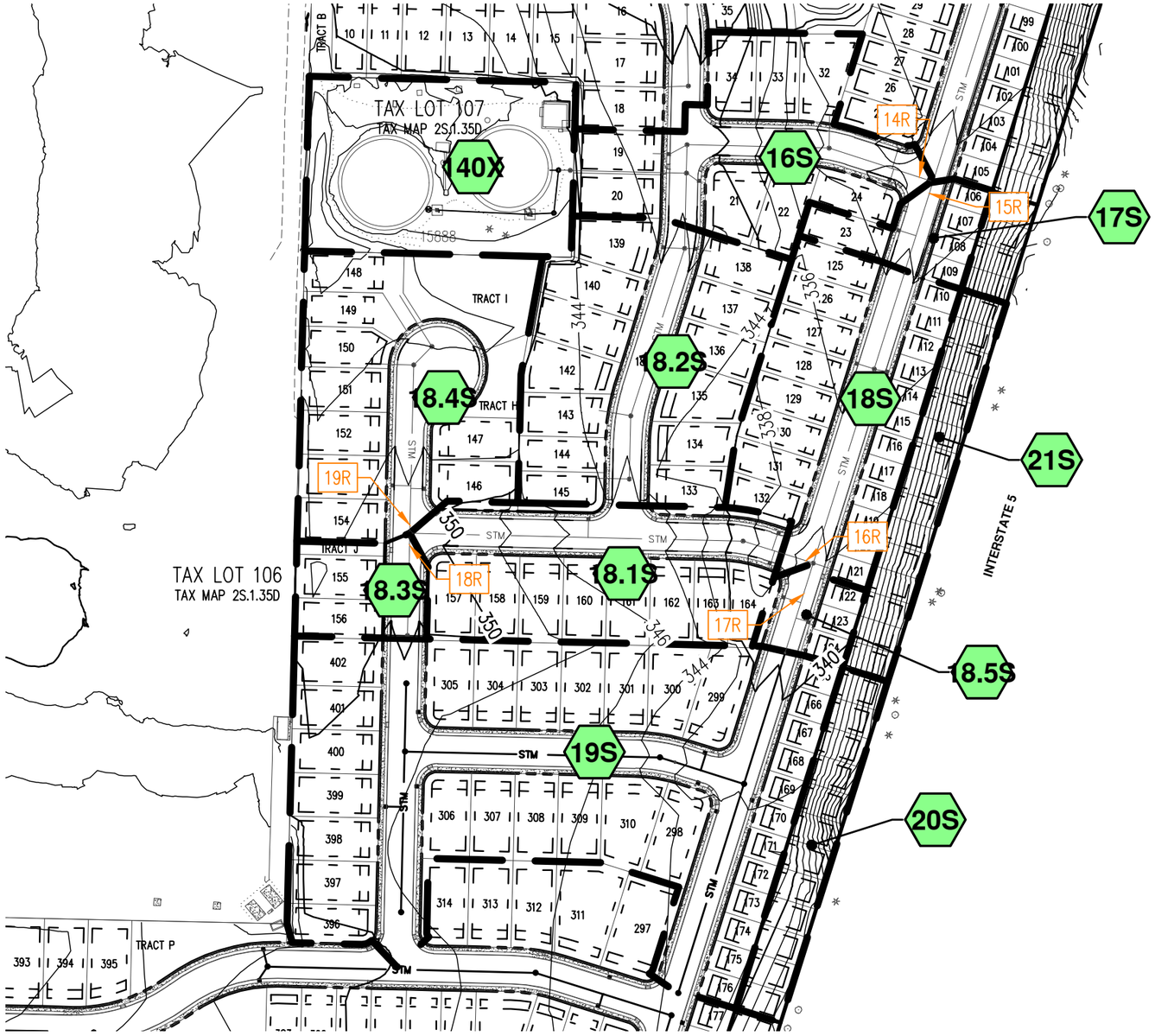
Please do not hesitate to call or email with any questions.

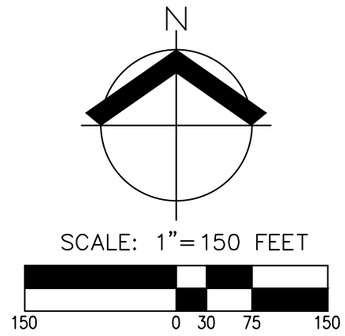
Sincerely,
AKS ENGINEERING & FORESTRY, LLC



Darko Simic, P.E.
503-563-6151| DarkoS@aks-eng.com

Attachments:
Exhibit 1 - Phase 2 Post-Developed Basin Delineation Map
Exhibit 2 - Phase 2 Post-Developed 25-year storm event HydroCAD report with summary reports for 2, 10, and 50 year storm event
Exhibit 3 - Phase 2 Post-Developed 25-year storm event Conveyance Calculations

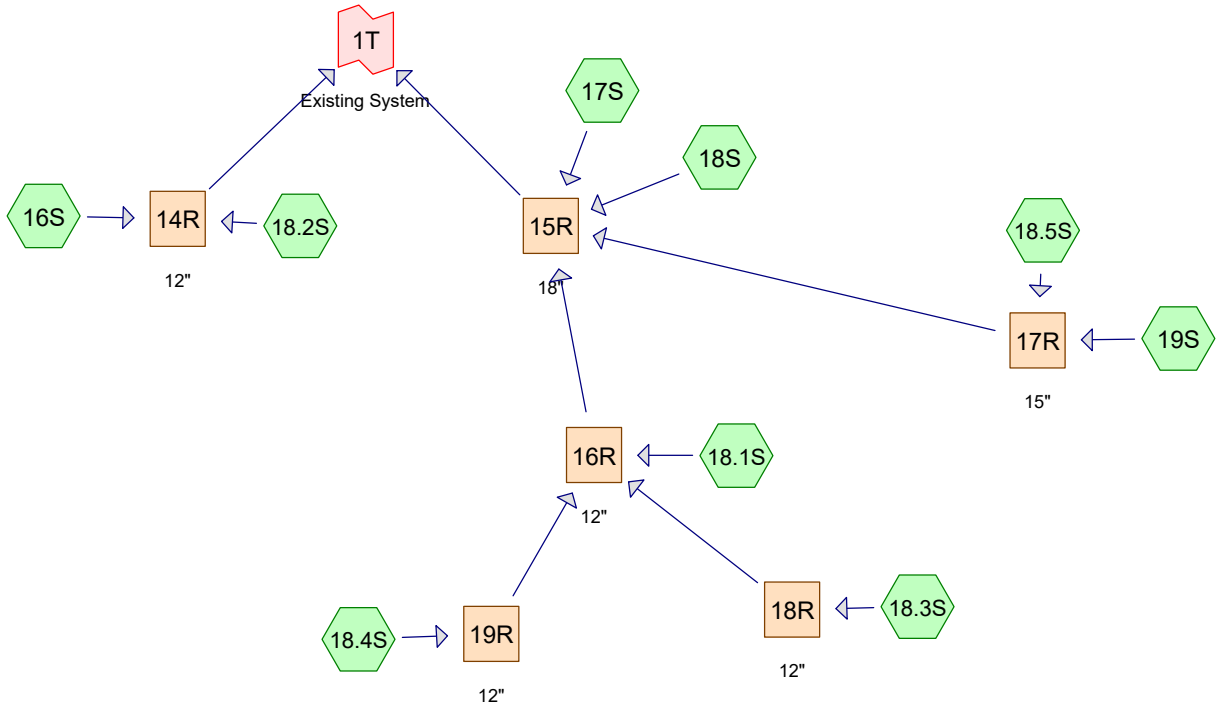




DATE: 8/22/2022

POST-DEVELOPED BASIN DELINEATION	EXHIBIT 1
AUTUMN SUNRISE SUBDIVISION - PHASE 2	
AKS ENGINEERING & FORESTRY, LLC 12965 SW HERMAN RD, STE 100 TUALATIN, OR 97062 503.563.6151 WWW.AKS-ENG.COM	DRWN: JSM CHKD: DS AKS JOB: 7454

DWG: PH2 - POST-DEVELOPED | LAYOUT1



Subcat Reach Pond Link

Routing Diagram for 7454 PH2 Post-Developed
Prepared by AKS Engineering and Forestry, Printed 8/22/2022

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
192,690	74	>75% Grass cover, Good, HSG C (16S, 17S, 18.1S, 18.2S, 18.3S, 18.4S, 18.5S, 18S, 19S)
266,800	98	Impervious Area on Lots (2,640 sq.ft. per lot) (16S, 17S, 18.1S, 18.2S, 18.3S, 18.4S, 18.5S, 18S, 19S)
142,364	98	Paved roads w/curbs & sewers, HSG C (16S, 17S, 18.1S, 18.2S, 18.3S, 18.4S, 18.5S, 18S, 19S)
601,854	**90**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Link 1T: Existing System Inflow=9.96 cfs 149,091 cf
Primary=9.96 cfs 149,091 cf

Reach 14R: 12" Avg. Flow Depth=0.54' Max Vel=5.13 fps Inflow=2.24 cfs 33,822 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=2.24 cfs 33,812 cf

Reach 15R: 18" Avg. Flow Depth=0.99' Max Vel=6.22 fps Inflow=7.72 cfs 115,304 cf
18.0" Round Pipe n=0.013 L=114.7' S=0.0090 '/' Capacity=9.95 cfs Outflow=7.72 cfs 115,279 cf

Reach 16R: 12" Avg. Flow Depth=0.50' Max Vel=6.08 fps Inflow=2.36 cfs 35,978 cf
12.0" Round Pipe n=0.013 L=84.0' S=0.0181 '/' Capacity=4.79 cfs Outflow=2.37 cfs 35,972 cf

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>2.90"
Tc=5.0 min CN=74/98 Runoff=0.98 cfs 14,724 cf

Reach 17R: 15" Avg. Flow Depth=0.59' Max Vel=6.07 fps Inflow=3.44 cfs 51,214 cf
15.0" Round Pipe n=0.013 L=107.7' S=0.0140 '/' Capacity=7.65 cfs Outflow=3.44 cfs 51,203 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>3.47"
Tc=5.0 min CN=74/98 Runoff=0.37 cfs 5,463 cf

Subcatchment18.1S: Runoff Area=62,715 sf 63.76% Impervious Runoff Depth>2.88"
Tc=5.0 min CN=74/98 Runoff=1.00 cfs 15,070 cf

Subcatchment18.2S: Runoff Area=82,554 sf 58.74% Impervious Runoff Depth>2.78"
Tc=5.0 min CN=74/98 Runoff=1.26 cfs 19,099 cf

Subcatchment18.3S: Runoff Area=16,422 sf 61.06% Impervious Runoff Depth>2.83"
Tc=5.0 min CN=74/98 Runoff=0.26 cfs 3,867 cf

Subcatchment18.4S: Runoff Area=79,594 sf 49.17% Impervious Runoff Depth>2.57"
Tc=5.0 min CN=74/98 Runoff=1.11 cfs 17,055 cf

Subcatchment18.5S: Runoff Area=13,585 sf 93.29% Impervious Runoff Depth>3.52"
Tc=5.0 min CN=74/98 Runoff=0.27 cfs 3,980 cf

Reach 18R: 12" Avg. Flow Depth=0.22' Max Vel=2.05 fps Inflow=0.26 cfs 3,867 cf
12.0" Round Pipe n=0.013 L=117.0' S=0.0050 '/' Capacity=2.51 cfs Outflow=0.26 cfs 3,864 cf

Subcatchment18S: Runoff Area=81,960 sf 84.09% Impervious Runoff Depth>3.32"
Tc=5.0 min CN=74/98 Runoff=1.54 cfs 22,667 cf

Reach 19R: 12" Avg. Flow Depth=0.38' Max Vel=4.01 fps Inflow=1.11 cfs 17,055 cf
12.0" Round Pipe n=0.013 L=192.0' S=0.0101 '/' Capacity=3.57 cfs Outflow=1.11 cfs 17,044 cf

Subcatchment19S: Runoff Area=185,174 sf 72.05% Impervious Runoff Depth>3.06"
Tc=5.0 min CN=74/98 Runoff=3.17 cfs 47,234 cf

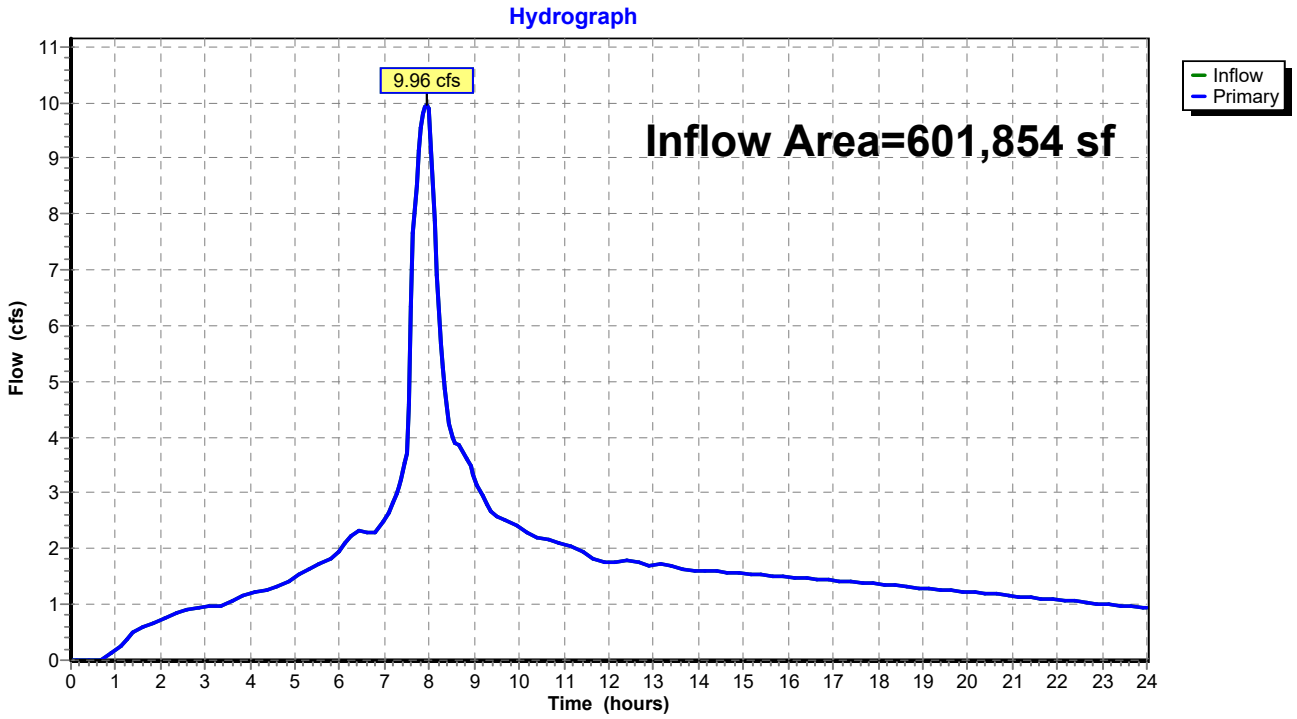
Total Runoff Area = 601,854 sf Runoff Volume = 149,157 cf Average Runoff Depth = 2.97"
32.02% Pervious = 192,690 sf 67.98% Impervious = 409,164 sf

Summary for Link 1T: Existing System

Inflow Area = 601,854 sf, 67.98% Impervious, Inflow Depth > 2.97" for 25-YEAR event
Inflow = 9.96 cfs @ 7.93 hrs, Volume= 149,091 cf
Primary = 9.96 cfs @ 7.93 hrs, Volume= 149,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1T: Existing System



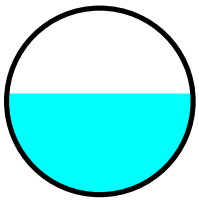
Summary for Reach 14R: 12"

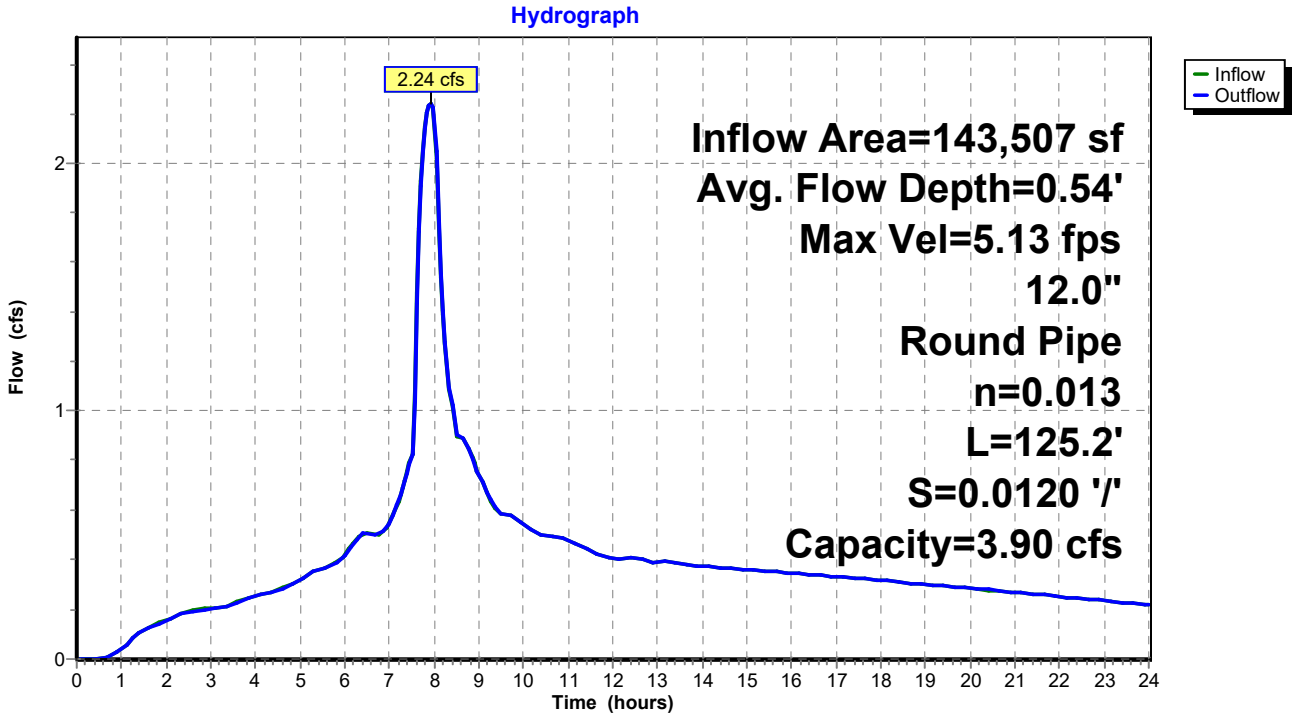
Inflow Area = 143,507 sf, 61.17% Impervious, Inflow Depth > 2.83" for 25-YEAR event
Inflow = 2.24 cfs @ 7.92 hrs, Volume= 33,822 cf
Outflow = 2.24 cfs @ 7.93 hrs, Volume= 33,812 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.13 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.06 fps, Avg. Travel Time= 0.7 min

Peak Storage= 55 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.90 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 125.2' Slope= 0.0120 '/'
Inlet Invert= 327.61', Outlet Invert= 326.11'





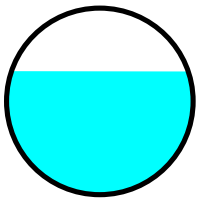
Summary for Reach 15R: 18"

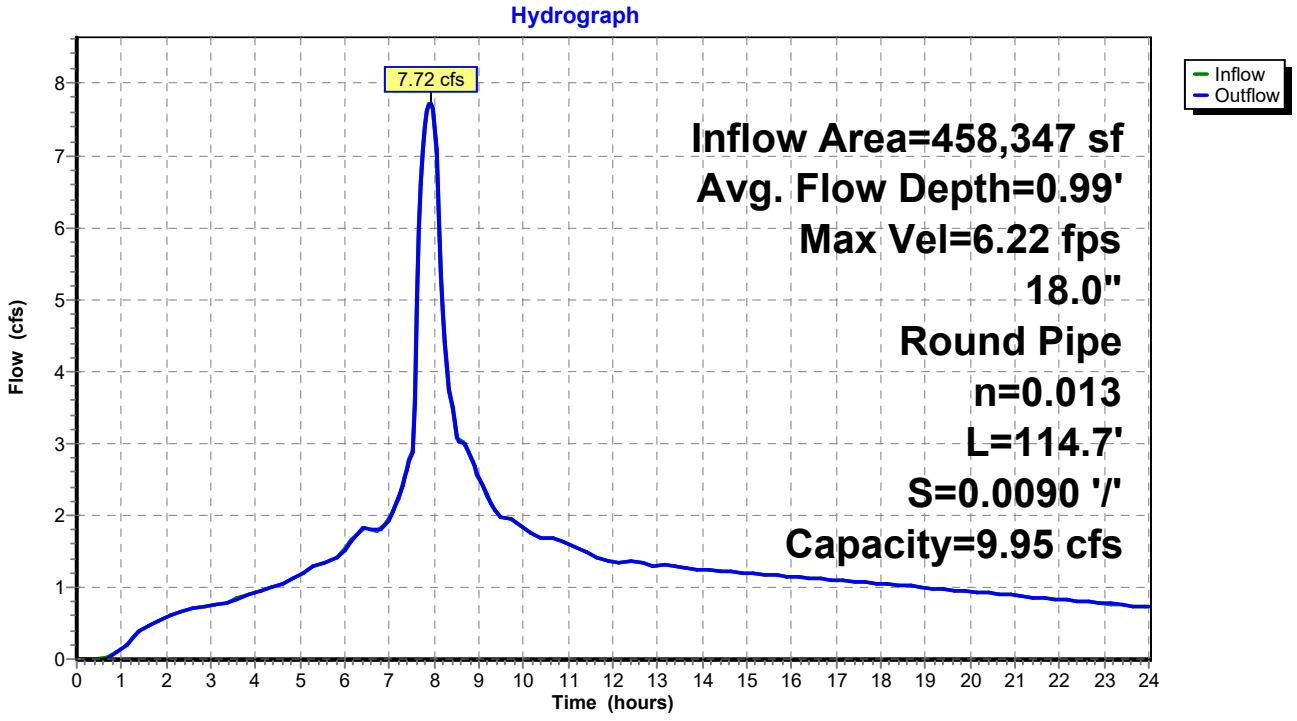
Inflow Area = 458,347 sf, 70.12% Impervious, Inflow Depth > 3.02" for 25-YEAR event
Inflow = 7.72 cfs @ 7.92 hrs, Volume= 115,304 cf
Outflow = 7.72 cfs @ 7.93 hrs, Volume= 115,279 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.22 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.77 fps, Avg. Travel Time= 0.5 min

Peak Storage= 142 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.99'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 9.95 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 114.7' Slope= 0.0090 '/'
Inlet Invert= 328.13', Outlet Invert= 327.10'





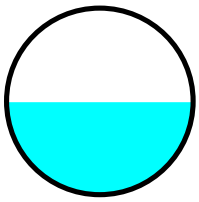
Summary for Reach 16R: 12"

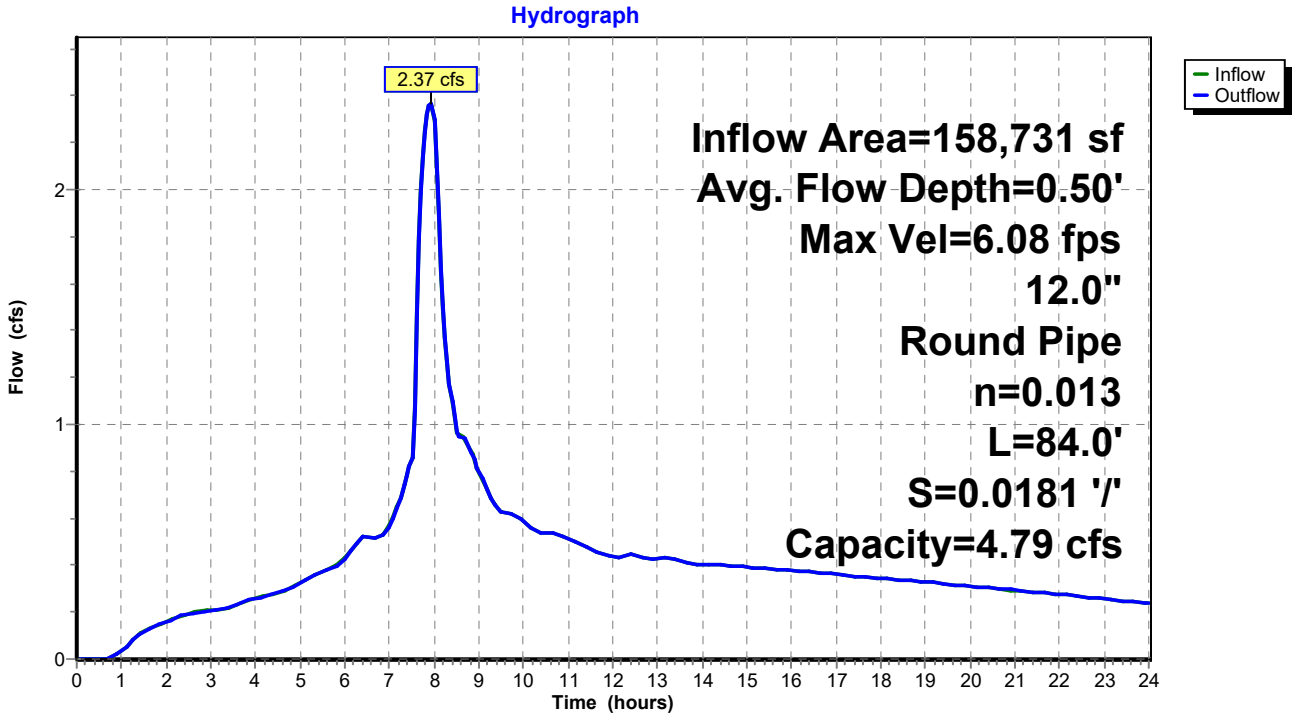
Inflow Area = 158,731 sf, 56.16% Impervious, Inflow Depth > 2.72" for 25-YEAR event
Inflow = 2.36 cfs @ 7.94 hrs, Volume= 35,978 cf
Outflow = 2.37 cfs @ 7.94 hrs, Volume= 35,972 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.08 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.61 fps, Avg. Travel Time= 0.4 min

Peak Storage= 33 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.79 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 84.0' Slope= 0.0181 '/'
Inlet Invert= 333.31', Outlet Invert= 331.79'





Summary for Subcatchment 16S:

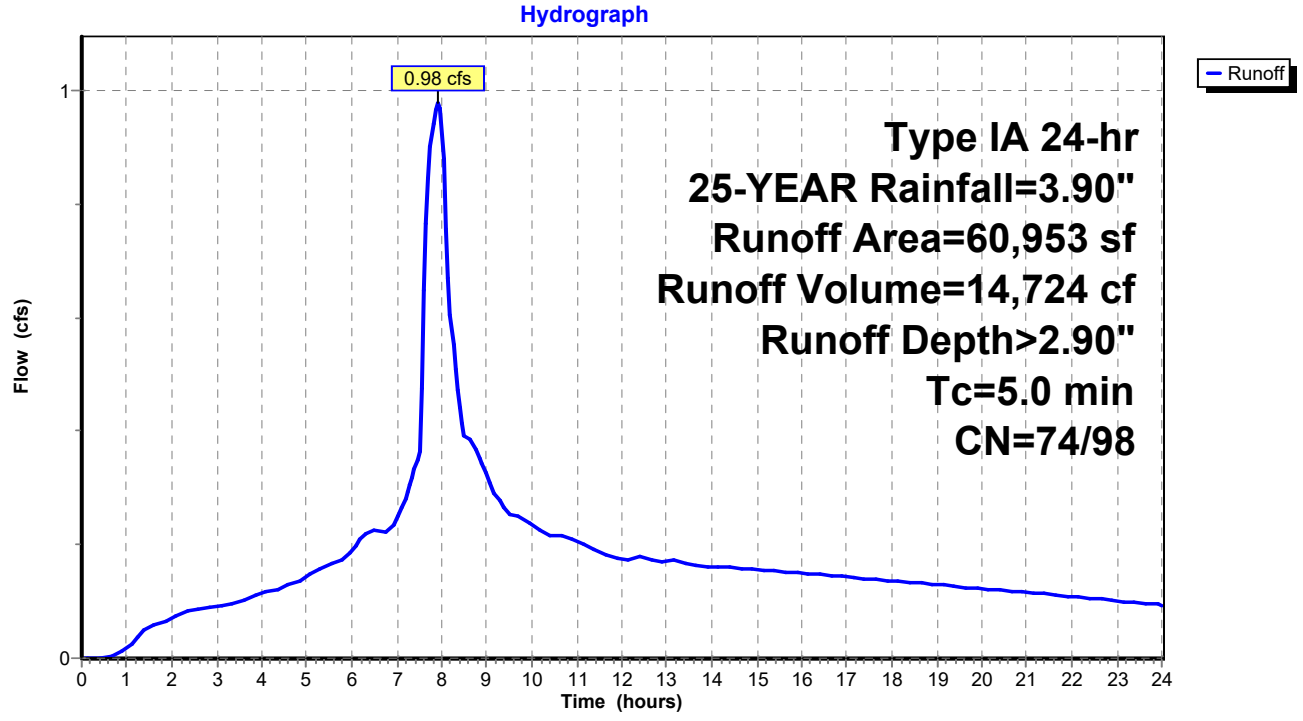
Runoff = 0.98 cfs @ 7.92 hrs, Volume= 14,724 cf, Depth> 2.90"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	18,176	98	Paved roads w/curbs & sewers, HSG C
	21,657	74	>75% Grass cover, Good, HSG C
*	21,120	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	60,953	89	Weighted Average
	21,657	74	35.53% Pervious Area
	39,296	98	64.47% Impervious Area

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

Subcatchment 16S:



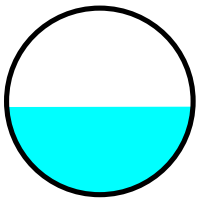
Summary for Reach 17R: 15"

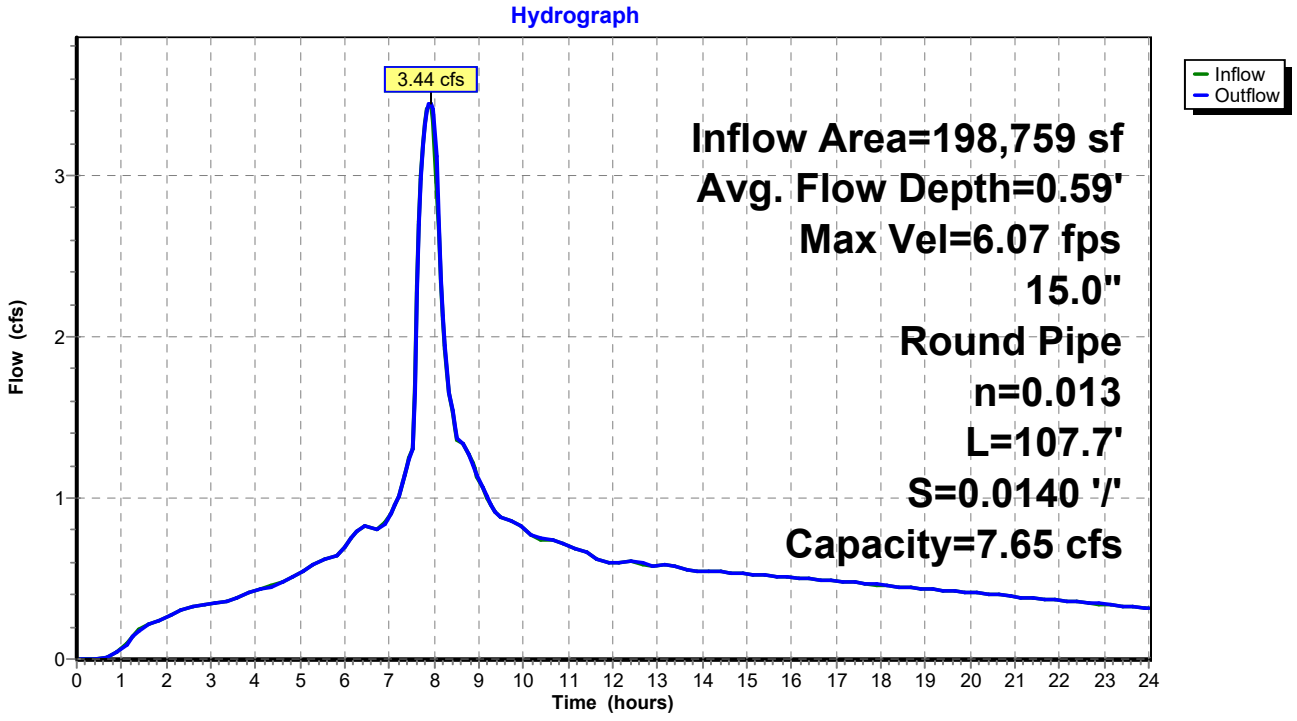
Inflow Area = 198,759 sf, 73.50% Impervious, Inflow Depth > 3.09" for 25-YEAR event
Inflow = 3.44 cfs @ 7.91 hrs, Volume= 51,214 cf
Outflow = 3.44 cfs @ 7.92 hrs, Volume= 51,203 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.07 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.56 fps, Avg. Travel Time= 0.5 min

Peak Storage= 61 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 7.65 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 107.7' Slope= 0.0140 '/'
Inlet Invert= 333.30', Outlet Invert= 331.79'





Summary for Subcatchment 17S:

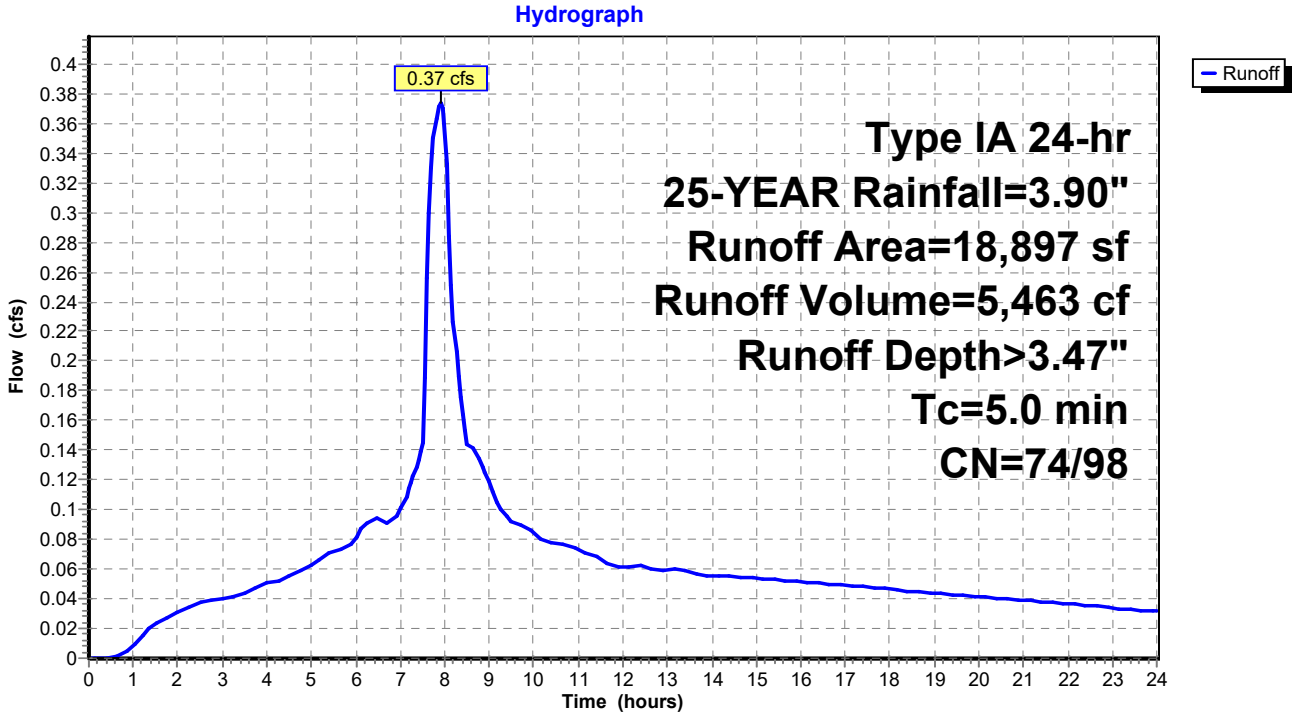
Runoff = 0.37 cfs @ 7.90 hrs, Volume= 5,463 cf, Depth> 3.47"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	1,217	98	Paved roads w/curbs & sewers, HSG C
	1,680	74	>75% Grass cover, Good, HSG C
*	16,000	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	18,897	96	Weighted Average
	1,680	74	8.89% Pervious Area
	17,217	98	91.11% Impervious Area

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

Subcatchment 17S:



Summary for Subcatchment 18.1S:

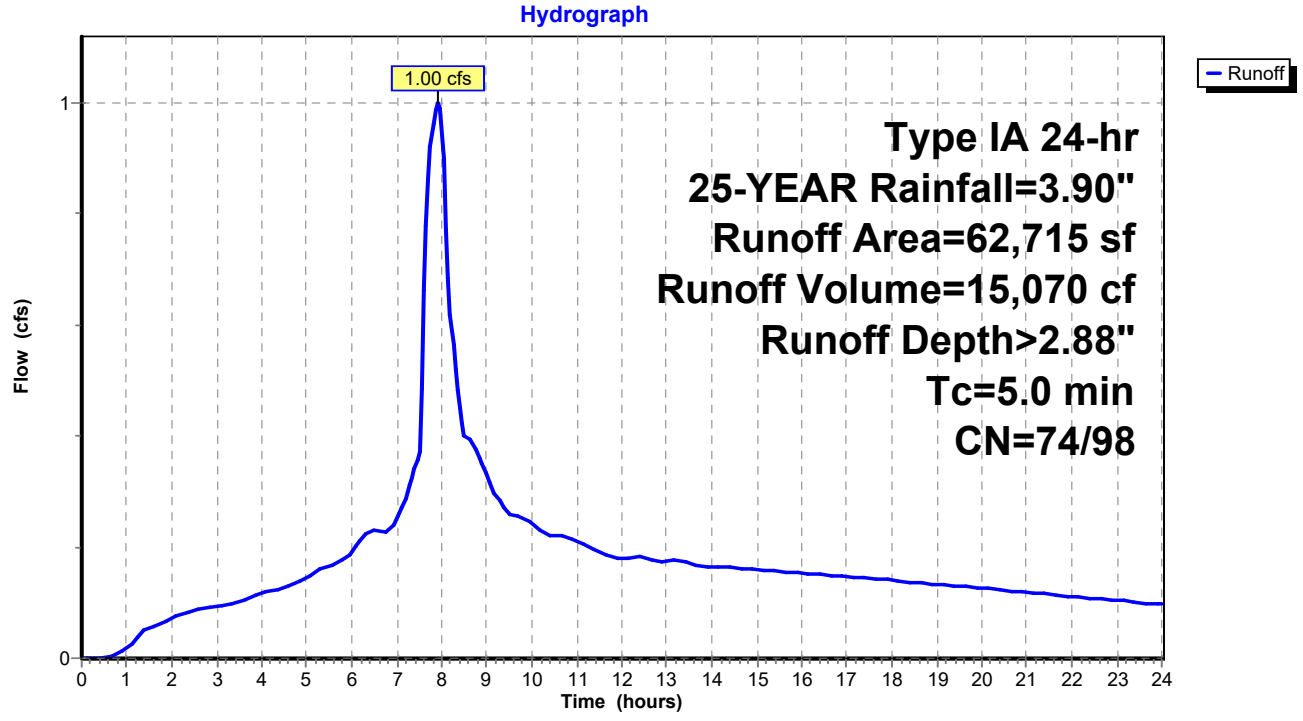
Runoff = 1.00 cfs @ 7.92 hrs, Volume= 15,070 cf, Depth> 2.88"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	18,867	98	Paved roads w/curbs & sewers, HSG C
	22,728	74	>75% Grass cover, Good, HSG C
*	21,120	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	62,715	89	Weighted Average
	22,728	74	36.24% Pervious Area
	39,987	98	63.76% Impervious Area

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

Subcatchment 18.1S:



Summary for Subcatchment 18.2S:

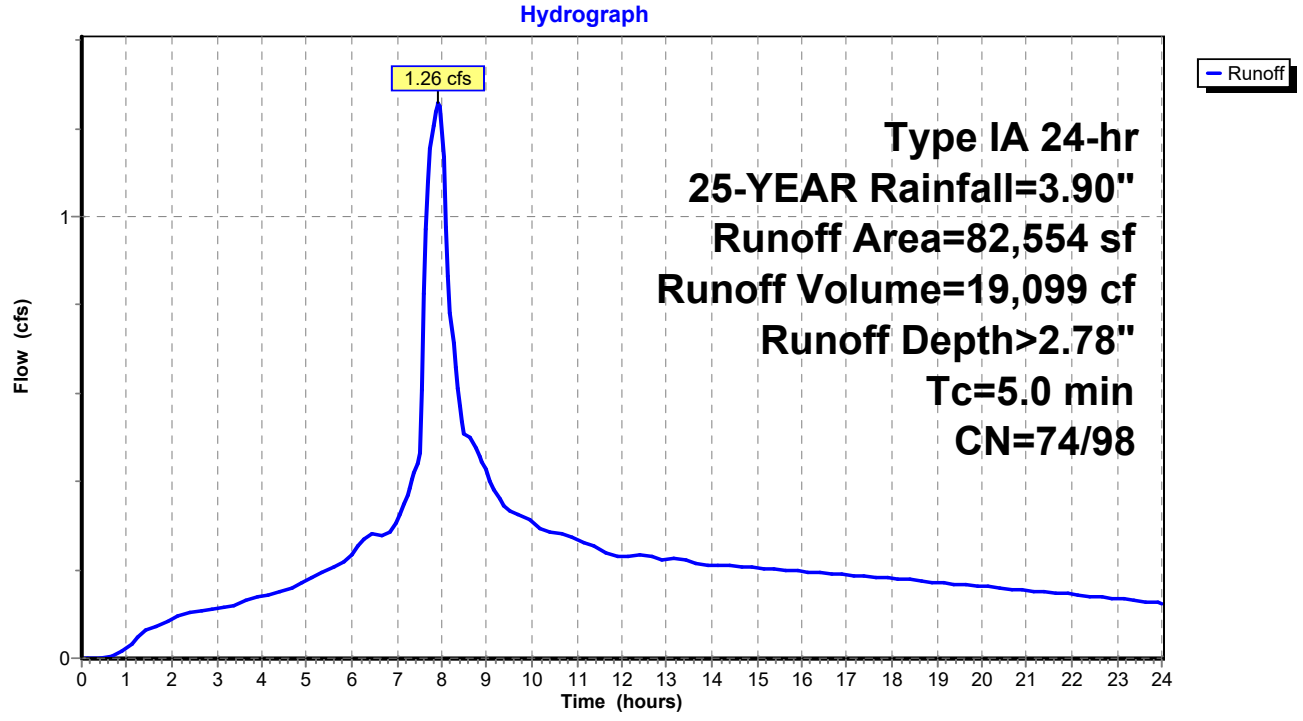
Runoff = 1.26 cfs @ 7.93 hrs, Volume= 19,099 cf, Depth> 2.78"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	14,174	98	Paved roads w/curbs & sewers, HSG C
	34,060	74	>75% Grass cover, Good, HSG C
*	34,320	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	82,554	88	Weighted Average
	34,060	74	41.26% Pervious Area
	48,494	98	58.74% Impervious Area

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

Subcatchment 18.2S:



Summary for Subcatchment 18.3S:

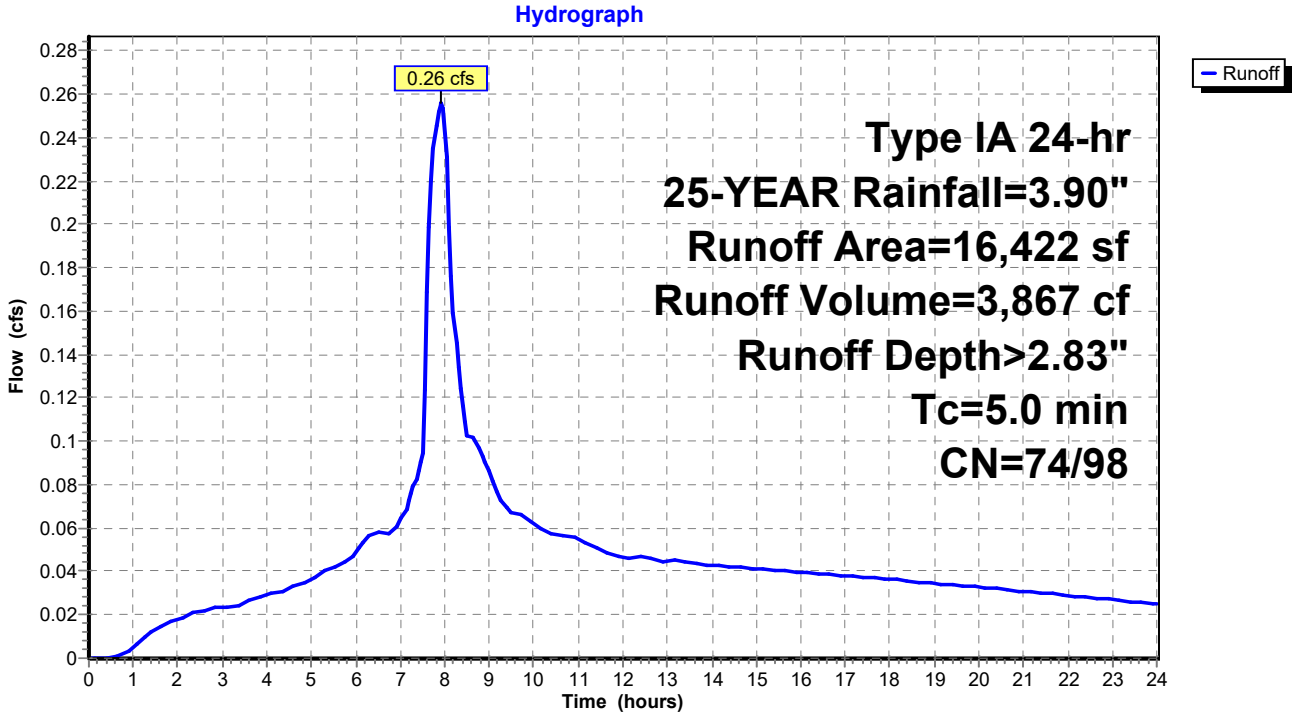
Runoff = 0.26 cfs @ 7.92 hrs, Volume= 3,867 cf, Depth> 2.83"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	4,748	98	Paved roads w/curbs & sewers, HSG C
	6,394	74	>75% Grass cover, Good, HSG C
*	5,280	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	16,422	89	Weighted Average
	6,394	74	38.94% Pervious Area
	10,028	98	61.06% Impervious Area

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

Subcatchment 18.3S:



Summary for Subcatchment 18.4S:

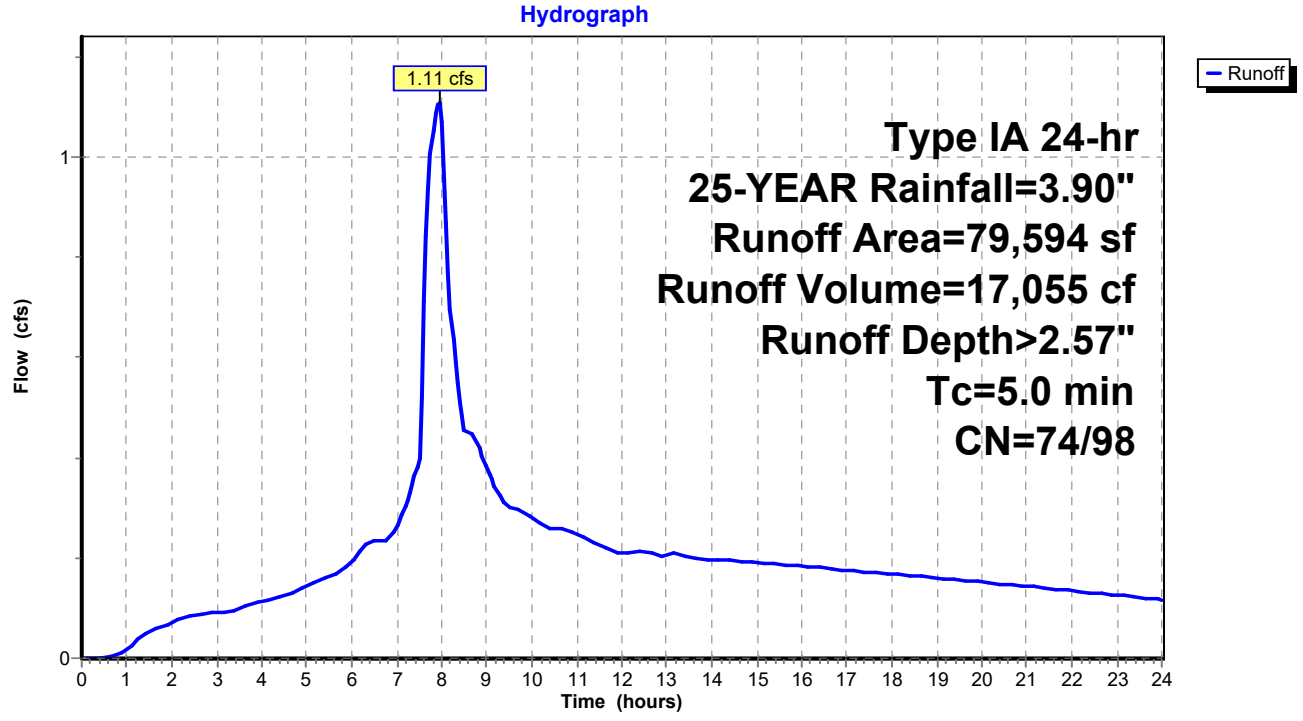
Runoff = 1.11 cfs @ 7.94 hrs, Volume= 17,055 cf, Depth> 2.57"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	15,375	98	Paved roads w/curbs & sewers, HSG C
	40,459	74	>75% Grass cover, Good, HSG C
*	23,760	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	79,594	86	Weighted Average
	40,459	74	50.83% Pervious Area
	39,135	98	49.17% Impervious Area

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

Subcatchment 18.4S:



Summary for Subcatchment 18.5S:

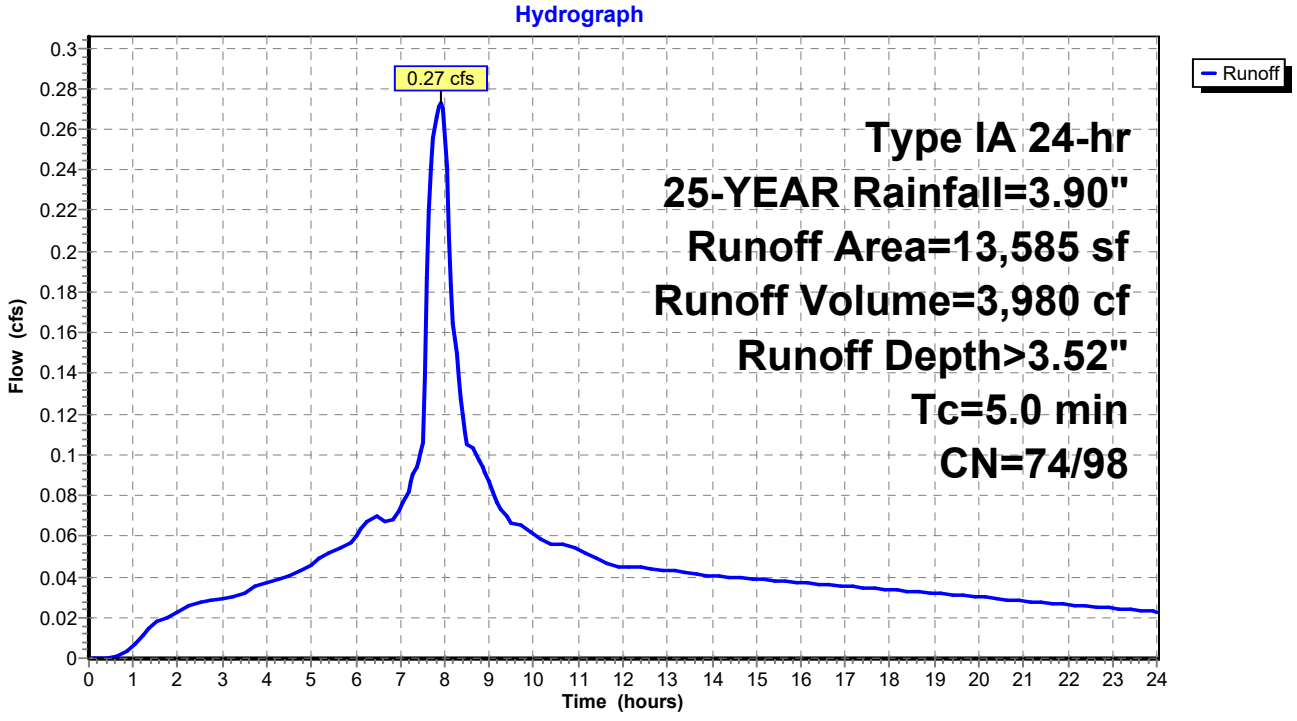
Runoff = 0.27 cfs @ 7.90 hrs, Volume= 3,980 cf, Depth> 3.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	4,753	98	Paved roads w/curbs & sewers, HSG C
	912	74	>75% Grass cover, Good, HSG C
*	7,920	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	13,585	96	Weighted Average
	912	74	6.71% Pervious Area
	12,673	98	93.29% Impervious Area

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

Subcatchment 18.5S:



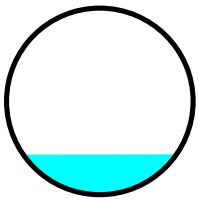
Summary for Reach 18R: 12"

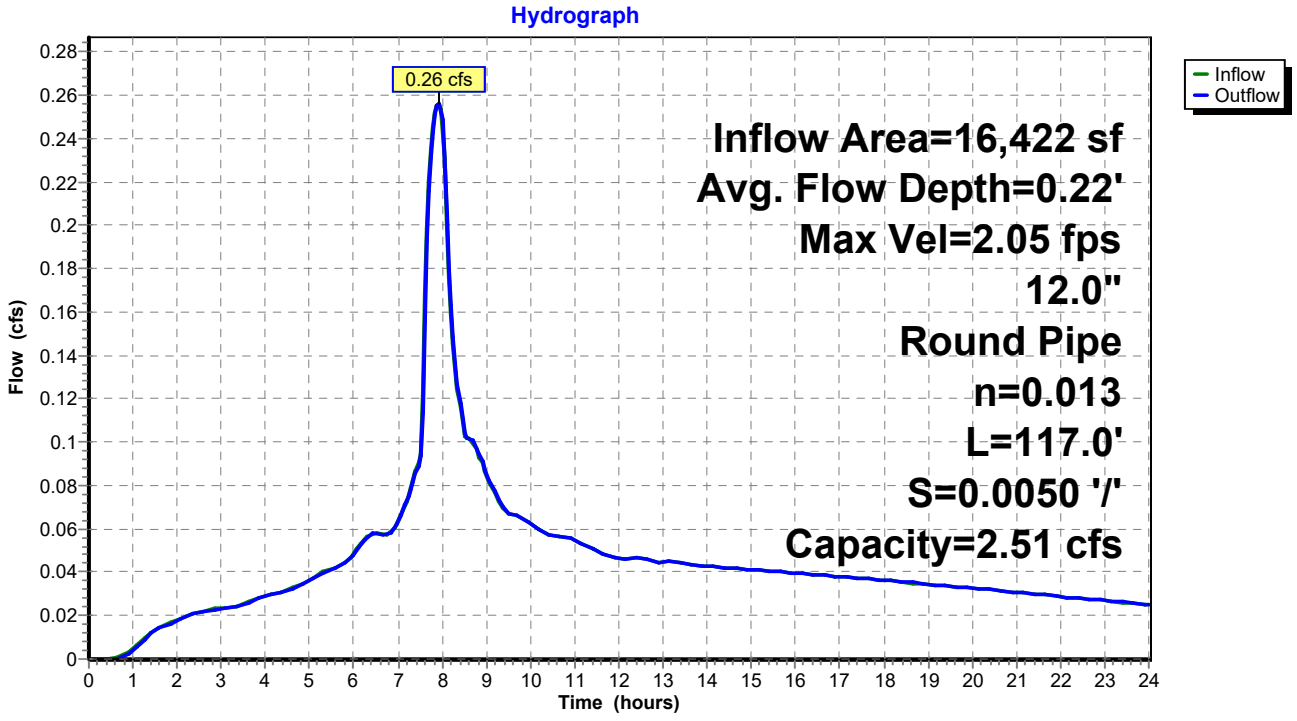
Inflow Area = 16,422 sf, 61.06% Impervious, Inflow Depth > 2.83" for 25-YEAR event
Inflow = 0.26 cfs @ 7.92 hrs, Volume= 3,867 cf
Outflow = 0.26 cfs @ 7.94 hrs, Volume= 3,864 cf, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.05 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 1.7 min

Peak Storage= 15 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.51 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 117.0' Slope= 0.0050 '/'
Inlet Invert= 346.21', Outlet Invert= 345.63'





Summary for Subcatchment 18S:

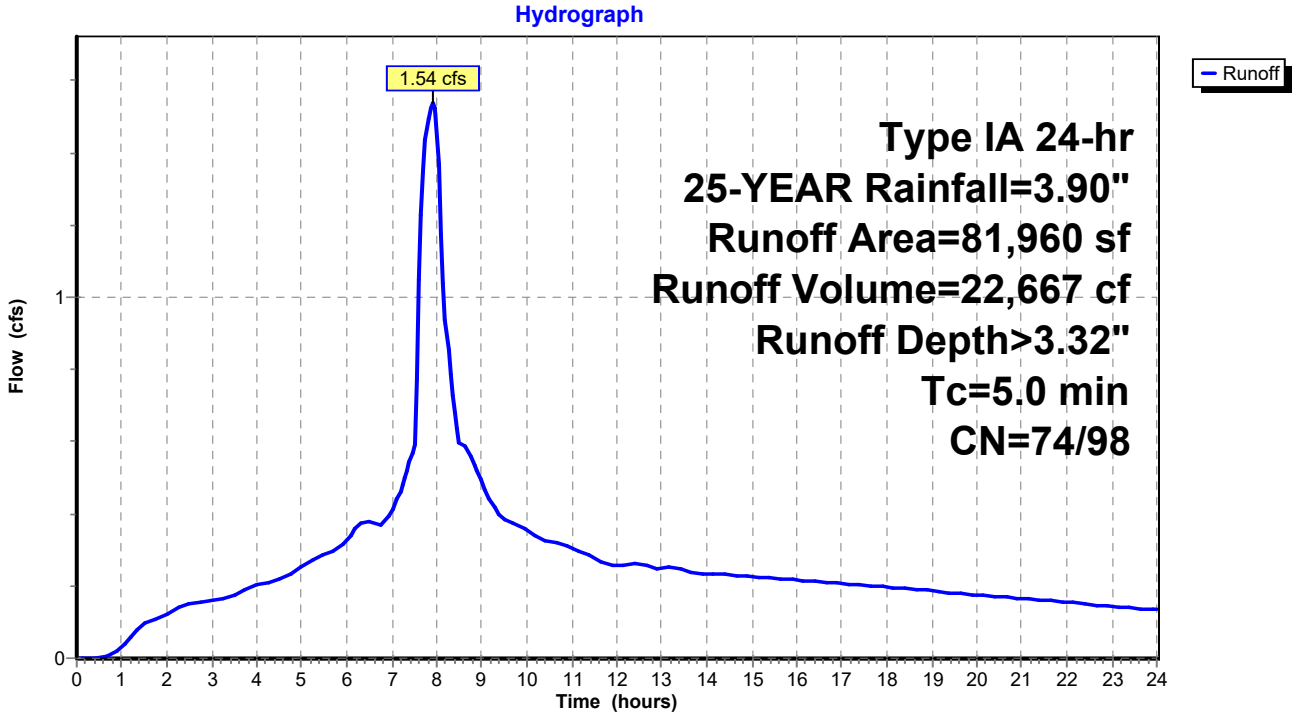
Runoff = 1.54 cfs @ 7.91 hrs, Volume= 22,667 cf, Depth> 3.32"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	16,120	98	Paved roads w/curbs & sewers, HSG C
	13,040	74	>75% Grass cover, Good, HSG C
*	52,800	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	81,960	94	Weighted Average
	13,040	74	15.91% Pervious Area
	68,920	98	84.09% Impervious Area

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

Subcatchment 18S:



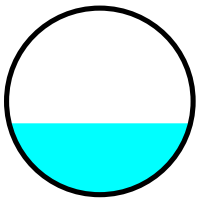
Summary for Reach 19R: 12"

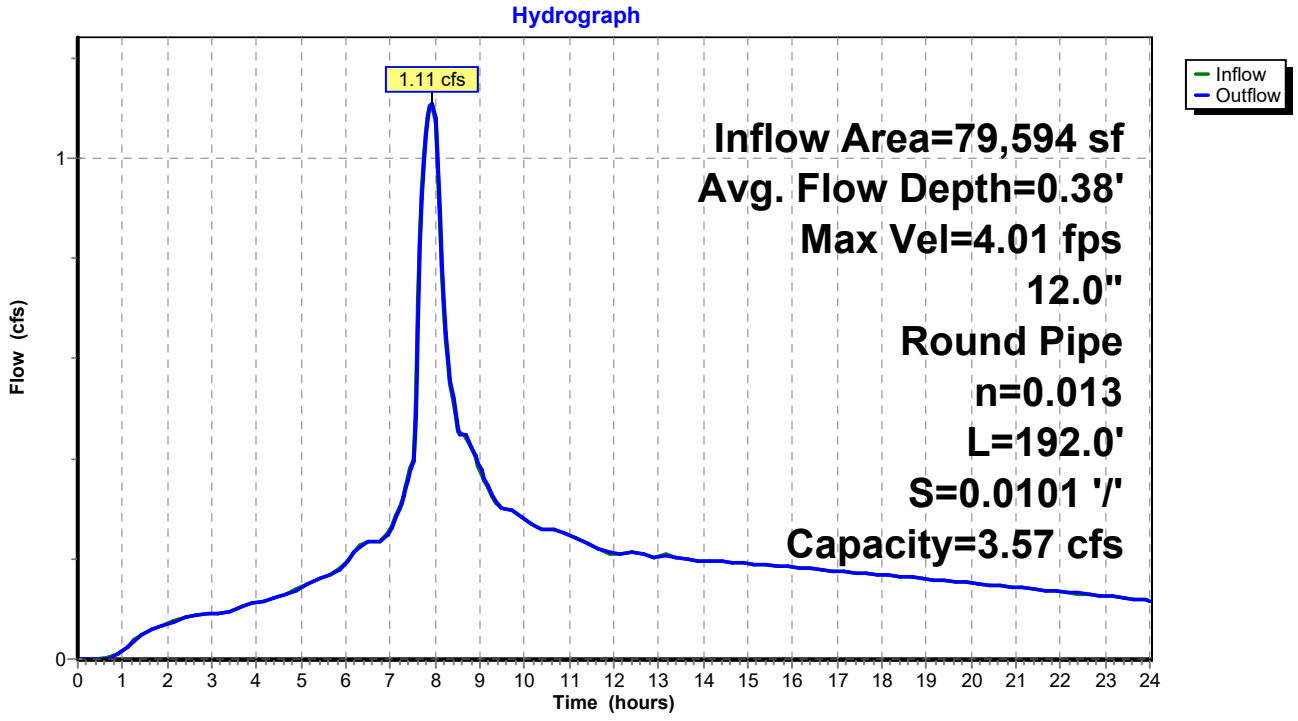
Inflow Area = 79,594 sf, 49.17% Impervious, Inflow Depth > 2.57" for 25-YEAR event
Inflow = 1.11 cfs @ 7.94 hrs, Volume= 17,055 cf
Outflow = 1.11 cfs @ 7.95 hrs, Volume= 17,044 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.01 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 2.35 fps, Avg. Travel Time= 1.4 min

Peak Storage= 53 cf @ 7.95 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.57 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 192.0' Slope= 0.0101 '/'
Inlet Invert= 347.56', Outlet Invert= 345.63'





Summary for Subcatchment 19S:

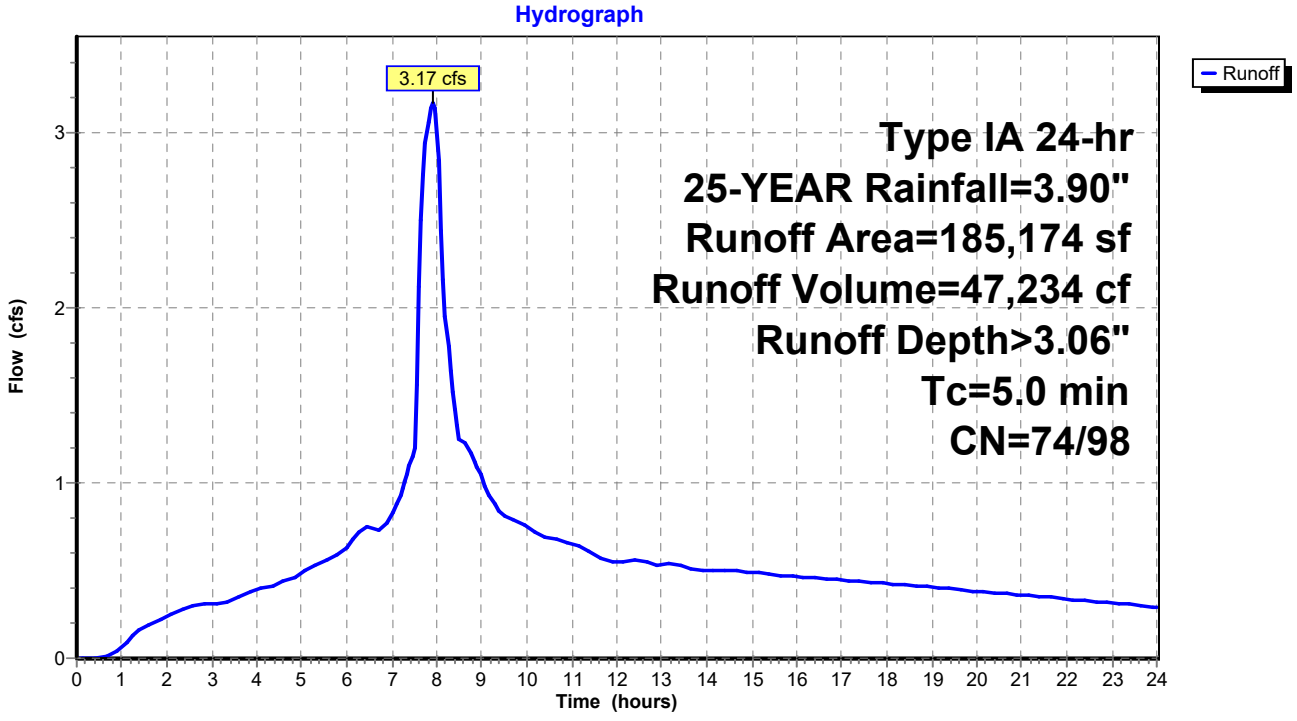
Runoff = 3.17 cfs @ 7.91 hrs, Volume= 47,234 cf, Depth> 3.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	48,934	98	Paved roads w/curbs & sewers, HSG C
	51,760	74	>75% Grass cover, Good, HSG C
*	84,480	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	185,174	91	Weighted Average
	51,760	74	27.95% Pervious Area
	133,414	98	72.05% Impervious Area

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

Subcatchment 19S:



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>1.68"
Tc=5.0 min CN=74/98 Runoff=0.56 cfs 8,517 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>2.12"
Tc=5.0 min CN=74/98 Runoff=0.23 cfs 3,337 cf

Subcatchment18.1S: Runoff Area=62,715 sf 63.76% Impervious Runoff Depth>1.66"
Tc=5.0 min CN=74/98 Runoff=0.57 cfs 8,701 cf

Subcatchment18.2S: Runoff Area=82,554 sf 58.74% Impervious Runoff Depth>1.58"
Tc=5.0 min CN=74/98 Runoff=0.70 cfs 10,881 cf

Subcatchment18.3S: Runoff Area=16,422 sf 61.06% Impervious Runoff Depth>1.62"
Tc=5.0 min CN=74/98 Runoff=0.14 cfs 2,217 cf

Subcatchment18.4S: Runoff Area=79,594 sf 49.17% Impervious Runoff Depth>1.42"
Tc=5.0 min CN=74/98 Runoff=0.59 cfs 9,436 cf

Subcatchment18.5S: Runoff Area=13,585 sf 93.29% Impervious Runoff Depth>2.16"
Tc=5.0 min CN=74/98 Runoff=0.17 cfs 2,440 cf

Subcatchment18S: Runoff Area=81,960 sf 84.09% Impervious Runoff Depth>2.00"
Tc=5.0 min CN=74/98 Runoff=0.93 cfs 13,678 cf

Subcatchment19S: Runoff Area=185,174 sf 72.05% Impervious Runoff Depth>1.80"
Tc=5.0 min CN=74/98 Runoff=1.85 cfs 27,816 cf

Reach 14R: 12" Avg. Flow Depth=0.39' Max Vel=4.43 fps Inflow=1.26 cfs 19,398 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=1.26 cfs 19,390 cf

Reach 15R: 18" Avg. Flow Depth=0.71' Max Vel=5.49 fps Inflow=4.49 cfs 67,604 cf
18.0" Round Pipe n=0.013 L=114.7' S=0.0090 '/' Capacity=9.95 cfs Outflow=4.49 cfs 67,586 cf

Reach 16R: 12" Avg. Flow Depth=0.36' Max Vel=5.19 fps Inflow=1.30 cfs 20,345 cf
12.0" Round Pipe n=0.013 L=84.0' S=0.0181 '/' Capacity=4.79 cfs Outflow=1.30 cfs 20,341 cf

Reach 17R: 15" Avg. Flow Depth=0.44' Max Vel=5.26 fps Inflow=2.02 cfs 30,256 cf
15.0" Round Pipe n=0.013 L=107.7' S=0.0140 '/' Capacity=7.65 cfs Outflow=2.02 cfs 30,248 cf

Reach 18R: 12" Avg. Flow Depth=0.16' Max Vel=1.73 fps Inflow=0.14 cfs 2,217 cf
12.0" Round Pipe n=0.013 L=117.0' S=0.0050 '/' Capacity=2.51 cfs Outflow=0.14 cfs 2,215 cf

Reach 19R: 12" Avg. Flow Depth=0.27' Max Vel=3.36 fps Inflow=0.59 cfs 9,436 cf
12.0" Round Pipe n=0.013 L=192.0' S=0.0101 '/' Capacity=3.57 cfs Outflow=0.59 cfs 9,429 cf

Link 1T: Existing System Inflow=5.75 cfs 86,977 cf
Primary=5.75 cfs 86,977 cf

Total Runoff Area = 601,854 sf Runoff Volume = 87,023 cf Average Runoff Depth = 1.74"
32.02% Pervious = 192,690 sf 67.98% Impervious = 409,164 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>2.50"
Tc=5.0 min CN=74/98 Runoff=0.84 cfs 12,685 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>3.03"
Tc=5.0 min CN=74/98 Runoff=0.33 cfs 4,776 cf

Subcatchment18.1S: Runoff Area=62,715 sf 63.76% Impervious Runoff Depth>2.48"
Tc=5.0 min CN=74/98 Runoff=0.86 cfs 12,977 cf

Subcatchment18.2S: Runoff Area=82,554 sf 58.74% Impervious Runoff Depth>2.38"
Tc=5.0 min CN=74/98 Runoff=1.07 cfs 16,388 cf

Subcatchment18.3S: Runoff Area=16,422 sf 61.06% Impervious Runoff Depth>2.43"
Tc=5.0 min CN=74/98 Runoff=0.22 cfs 3,324 cf

Subcatchment18.4S: Runoff Area=79,594 sf 49.17% Impervious Runoff Depth>2.19"
Tc=5.0 min CN=74/98 Runoff=0.94 cfs 14,525 cf

Subcatchment18.5S: Runoff Area=13,585 sf 93.29% Impervious Runoff Depth>3.08"
Tc=5.0 min CN=74/98 Runoff=0.24 cfs 3,483 cf

Subcatchment18S: Runoff Area=81,960 sf 84.09% Impervious Runoff Depth>2.89"
Tc=5.0 min CN=74/98 Runoff=1.34 cfs 19,749 cf

Subcatchment19S: Runoff Area=185,174 sf 72.05% Impervious Runoff Depth>2.65"
Tc=5.0 min CN=74/98 Runoff=2.74 cfs 40,885 cf

Reach 14R: 12" Avg. Flow Depth=0.49' Max Vel=4.94 fps Inflow=1.91 cfs 29,073 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=1.91 cfs 29,063 cf

Reach 15R: 18" Avg. Flow Depth=0.90' Max Vel=6.03 fps Inflow=6.66 cfs 99,690 cf
18.0" Round Pipe n=0.013 L=114.7' S=0.0090 '/' Capacity=9.95 cfs Outflow=6.66 cfs 99,667 cf

Reach 16R: 12" Avg. Flow Depth=0.45' Max Vel=5.84 fps Inflow=2.01 cfs 30,813 cf
12.0" Round Pipe n=0.013 L=84.0' S=0.0181 '/' Capacity=4.79 cfs Outflow=2.01 cfs 30,807 cf

Reach 17R: 15" Avg. Flow Depth=0.54' Max Vel=5.84 fps Inflow=2.98 cfs 44,368 cf
15.0" Round Pipe n=0.013 L=107.7' S=0.0140 '/' Capacity=7.65 cfs Outflow=2.98 cfs 44,358 cf

Reach 18R: 12" Avg. Flow Depth=0.20' Max Vel=1.96 fps Inflow=0.22 cfs 3,324 cf
12.0" Round Pipe n=0.013 L=117.0' S=0.0050 '/' Capacity=2.51 cfs Outflow=0.22 cfs 3,321 cf

Reach 19R: 12" Avg. Flow Depth=0.35' Max Vel=3.83 fps Inflow=0.94 cfs 14,525 cf
12.0" Round Pipe n=0.013 L=192.0' S=0.0101 '/' Capacity=3.57 cfs Outflow=0.94 cfs 14,515 cf

Link 1T: Existing System Inflow=8.57 cfs 128,730 cf
Primary=8.57 cfs 128,730 cf

Total Runoff Area = 601,854 sf Runoff Volume = 128,791 cf Average Runoff Depth = 2.57"
32.02% Pervious = 192,690 sf 67.98% Impervious = 409,164 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment16S: Runoff Area=60,953 sf 64.47% Impervious Runoff Depth>3.35"
Tc=5.0 min CN=74/98 Runoff=1.14 cfs 17,026 cf

Subcatchment17S: Runoff Area=18,897 sf 91.11% Impervious Runoff Depth>3.96"
Tc=5.0 min CN=74/98 Runoff=0.43 cfs 6,229 cf

Subcatchment18.1S: Runoff Area=62,715 sf 63.76% Impervious Runoff Depth>3.34"
Tc=5.0 min CN=74/98 Runoff=1.16 cfs 17,434 cf

Subcatchment18.2S: Runoff Area=82,554 sf 58.74% Impervious Runoff Depth>3.22"
Tc=5.0 min CN=74/98 Runoff=1.47 cfs 22,166 cf

Subcatchment18.3S: Runoff Area=16,422 sf 61.06% Impervious Runoff Depth>3.27"
Tc=5.0 min CN=74/98 Runoff=0.30 cfs 4,481 cf

Subcatchment18.4S: Runoff Area=79,594 sf 49.17% Impervious Runoff Depth>3.01"
Tc=5.0 min CN=74/98 Runoff=1.31 cfs 19,932 cf

Subcatchment18.5S: Runoff Area=13,585 sf 93.29% Impervious Runoff Depth>4.01"
Tc=5.0 min CN=74/98 Runoff=0.31 cfs 4,534 cf

Subcatchment18S: Runoff Area=81,960 sf 84.09% Impervious Runoff Depth>3.80"
Tc=5.0 min CN=74/98 Runoff=1.76 cfs 25,931 cf

Subcatchment19S: Runoff Area=185,174 sf 72.05% Impervious Runoff Depth>3.52"
Tc=5.0 min CN=74/98 Runoff=3.65 cfs 54,374 cf

Reach 14R: 12" Avg. Flow Depth=0.60' Max Vel=5.32 fps Inflow=2.61 cfs 39,192 cf
12.0" Round Pipe n=0.013 L=125.2' S=0.0120 '/' Capacity=3.90 cfs Outflow=2.61 cfs 39,181 cf

Reach 15R: 18" Avg. Flow Depth=1.11' Max Vel=6.37 fps Inflow=8.91 cfs 132,882 cf
18.0" Round Pipe n=0.013 L=114.7' S=0.0090 '/' Capacity=9.95 cfs Outflow=8.91 cfs 132,854 cf

Reach 16R: 12" Avg. Flow Depth=0.55' Max Vel=6.32 fps Inflow=2.77 cfs 41,832 cf
12.0" Round Pipe n=0.013 L=84.0' S=0.0181 '/' Capacity=4.79 cfs Outflow=2.77 cfs 41,825 cf

Reach 17R: 15" Avg. Flow Depth=0.64' Max Vel=6.29 fps Inflow=3.96 cfs 58,909 cf
15.0" Round Pipe n=0.013 L=107.7' S=0.0140 '/' Capacity=7.65 cfs Outflow=3.96 cfs 58,896 cf

Reach 18R: 12" Avg. Flow Depth=0.23' Max Vel=2.15 fps Inflow=0.30 cfs 4,481 cf
12.0" Round Pipe n=0.013 L=117.0' S=0.0050 '/' Capacity=2.51 cfs Outflow=0.30 cfs 4,478 cf

Reach 19R: 12" Avg. Flow Depth=0.42' Max Vel=4.20 fps Inflow=1.31 cfs 19,932 cf
12.0" Round Pipe n=0.013 L=192.0' S=0.0101 '/' Capacity=3.57 cfs Outflow=1.31 cfs 19,920 cf

Link 1T: Existing System Inflow=11.52 cfs 172,035 cf
Primary=11.52 cfs 172,035 cf

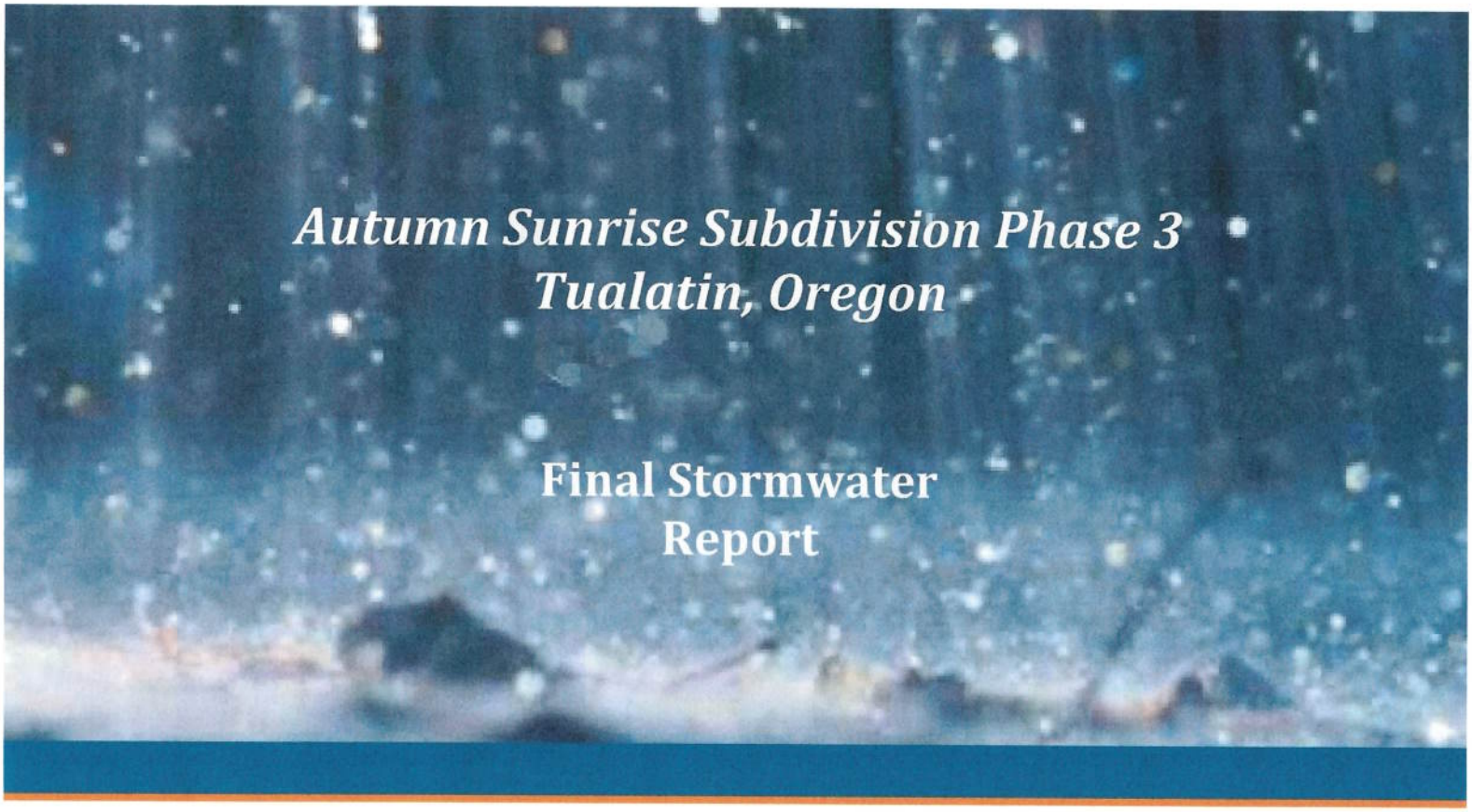
Total Runoff Area = 601,854 sf Runoff Volume = 172,108 cf Average Runoff Depth = 3.43"
32.02% Pervious = 192,690 sf 67.98% Impervious = 409,164 sf

STORMWATER CONVEYANCE CALCULATIONS

Project: PH 2 Autumn Sunrise
Date: 8/22/2022

Design Storm: 25-Year
Storm Duration: 24-Hour
Precipitation: 3.9-Inch
Mannning's "n" 0.013
Max flow depth 82%

DESIGN							RESULTS					
REACH	UPSTREAM TO DOWNSTREAM STRUCTURE	LENGTH (ft.)	PIPE DIAMETER (in.) D_o	PIPE SLOPE (ft/ft)	MAX. FLOW (cfs)	MAX VELOCITY (fps)	FLOW (cfs)	VELOCITY (fps)	Q_f/Q_{max}	PIPE FLOW DEPTH (in.)	y/D_o	Meets Criteria (<82%)
14R	MH 9.1 TO MH 8.1	125.14	12	0.012	3.90	5.66	2.24	5.13	0.57	6.48	54%	Yes
15R	MH 8.2 TO MH 8.1	225.016	18	0.016	13.29	8.57	7.72	6.22	0.58	12.00	67%	Yes
16R	MH 11.1 TO MH 8.3	84.304	12	0.018	4.78	6.93	2.37	6.08	0.50	6.00	50%	Yes
17R	CO 8.4 TO MH 8.3	107.775	15	0.014	7.64	7.01	3.44	6.07	0.45	7.08	47%	Yes
18R	MH 12.1 TO MH 11.2	117	12	0.005	2.52	3.65	0.26	2.05	0.10	2.64	22%	Yes
19R	MH 11.3 TO MH 11.2	192.99	12	0.01	3.56	5.17	1.11	4.01	0.31	4.56	38%	Yes



Autumn Sunrise Subdivision Phase 3
Tualatin, Oregon

Final Stormwater Report

Date:	March 2023
Client:	Lennar Northwest, INC. 11807 NE 99th Street, Suite 1170 Vancouver, WA 98682
Engineering Contact:	Darko Simic, PE DarkoS@aks-eng.com
Engineering Firm:	AKS Engineering & Forestry, LLC
AKS Job Number:	7454

REGISTERED PROFESSIONAL ENGINEER
84806PE
DIGITALLY SIGNED
OREGON
JULY 12, 2016
DARKO SIMIC
RENEWAL DATE: 6/30/24

AKS ENGINEERING & FORESTRY
12965 SW Herman Road, Suite 100
Tualatin, OR 97062
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Final Stormwater Report
AUTUMN SUNRISE SUBDIVISION PHASE 3
TUALATIN, OREGON

1.0 Purpose of Report
This report analyzes the effects of the proposed development with respect to the existing and proposed stormwater conveyance system. Evaluation of the stormwater system includes documentation of regulatory criteria, methodology, and informational sources used to design/evaluate the stormwater system. The results of the final hydraulic analysis are presented.

2.0 Project Location/Description
The Autumn Sunrise subdivision is located south of SW Norwood Road, east of Boones Ferry Road, north of Greenhill Lane, and west of Interstate 5 in Tualatin, Oregon. The subject site consists of seven parcels which total approximately 61.7-acres in Washington County, Tax Lots 100, 400, 401, 500, 600, 800, and 900 (Tax Map 2S 1 35D). The total area, which incorporates off-site flows onto the subject site, is approximately 70.2-acres. The subdivision is developed in 4 phases, with Phases 1 and 2 currently developed. This report addresses the southern portion of subdivision, managed by the stormwater facility constructed within Phase 3.

Stormwater management for the entire subdivision is provided by two stormwater facilities, located in the northeast and southwest portions of the subject site. The existing northeast stormwater facility manages stormwater runoff from Phases 1 and 2, and the northern portions of Phases 3 and 4.

The southwest facility will be constructed as part of Phase 3 and will manage the majority stormwater runoff of Phases 3 and 4. This facility will release flows into the regional waterway via the existing Boones Ferry Road storm system. The southwest facility is designed to comply with SLOPES V guidelines established within the United States Army Corps of Engineers Permit (#2020-304) and meets City of Tualatin and CWS standards.

For purposes of this report, the final southwest stormwater facility quality and quantity design will be presented. To illustrate the overall Autumn Sunrise subdivision development compliance with Clean Water Services (CWS) hydromodification standards of the existing northeast stormwater facility design has been included in the hydraulic analysis.

Phase 3 of the Autumn Sunrise development will include the creation of a 135-lot residential subdivision with single-family detached and attached homes, with two commercial lots. Site improvements will include development of internal streets, underground utilities, a private street tract to Tax Lot 106, and a stormwater facility. Additionally, SW Boones Ferry Road improvements, including a signalized intersection, will be developed along the site's western frontage.

3.0 Regulatory Design Criteria
3.1 STORMWATER QUALITY
The project must meet CWS stormwater quality standards, providing water quality treatment to all runoff from proposed impervious surfaces draining towards the facility using an approved LID facility, designed per CWS section 4.04. Stormwater treatment for the project will be provided via an extended dry detention basin located in SW corner of project site.

3.2 STORMWATER HYDROMODIFICATION

Per *CWS R&O 19-05, 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 the Hydromodification Approach Project Category Table 4-2, the full development of the Autumn Sunrise subdivision is identified as Category 3. Therefore, the subject project will meet CWS hydromodification requirements by providing peak-flow matching detention, using the design criteria established within CWS Section 4.08.6.

3.3 STORMWATER QUANTITY

Per *Clean Water Services (CWS) Design and Construction Standards Manual for Sanitary Sewer and Surface Water Management (R&O 19-05), Section 4.02, Quantity Control Requirements for Conveyance Capacity;* on-site detention for conveyance capacity (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.*

Per City standards, the stormwater facility must be designed to detain the subject site's post-developed peak flows to the site's pre-developed peak flows for the 2, 10, and 25-year storm events.

4.0 Design Methodology

The Santa Barbara Urban Hydrograph (SBUH) Method was used to analyze stormwater runoff from the site. This method utilizes the SCS Type 1A 24-hour design storm. HydroCAD 10.0 computer software aided in the analysis. Representative CN numbers were obtained from the USDA-NCRS Technical Release 55 (TR-55) and are included in Appendix E.

5.0 Design Parameters

5.1 DESIGN STORMS

Per City of Tualatin and CWS requirements, the following rainfall intensities and durations were used in analyzing the existing and proposed hydrologic site conditions:

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

5.2 PRE-DEVELOPED SITE CONDITIONS

5.2.1 Site Topography

Existing on-site grades vary from ±1% to ±30%, with a high point of ±358 feet along the northern property line bordering tax lot 106 and a low point of ±319 feet near the southwest property corner along SW Boones Ferry Road. The site slopes from north to southwest.

5.2.2 Land Use

The existing site consists of commercial and residential zones with single-family detached and attached homes with associated buildings and vacant land, partially used for agricultural purposes.

5.3 SOIL TYPE

The soils beneath the project site and the associated drainage basin consist of silty clay residual soils with abundant rock fragments underlain by weathered basalt bedrock. The site geotechnical report classifies the soils underlying the site as Hydrologic Soil Group C. Further information regarding site soil conditions can be found in Appendix D of this report.

5.4 POST-DEVELOPED SITE CONDITIONS

5.4.1 Site Topography

The onsite slopes will be modified with cuts and fills to accommodate the construction of the streets and residential lots. The proposed site grading will change the existing site topography within the southeast portion of the site.

5.4.2 Land Use

Phase 3 of the subdivision will consist of 135 single-family detached and attached homes, with two commercial lots and associated street and utilities. Future Phase 4 will consist of 103 single-family detached and attached lots with associated street and underground utilities.

5.4.3 Post-Developed Input Parameters

Appendices A and B provide 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 the parameters (e.g., impervious/pervious areas, time of concentration, etc.) used to model the site hydrology. To show compliance with CWS hydromodification standards, Appendix B includes the post-developed flows generated from the northwest post-developed conditions of the Phase 1 Final Stormwater Report, in addition to the Phase 3 post-developed conditions.

5.4.4 Description of Off-Site Contributing Basins

Adjacent to the subject site is Horizon School, Interstate 5, and Washington County owned streets. A portion of the existing streets, and adjacent property frontage will be routed and managed through the proposed development and into the proposed stormwater facility. A portion of SW Boones Ferry Road, frontage improvements of Tax Lot 303 development, and a portion of Tax Lot 106 will be conveyed into the proposed stormwater facility via catch basins and storm drainage pipes.

6.0 Stormwater Analyses

6.1 PROPOSED STORMWATER CONDUIT SIZING AND INLET SPACING

The proposed on-site curb inlets have been spaced per City of Tualatin and CWS requirements to properly convey stormwater runoff. The proposed storm pipes have been sized to meet City of Tualatin requirements using Manning's equation to convey the peak flows from the 25-year storm event at maximum of 82 percent compacity.

6.2 PROPOSED STORMWATER QUALITY MANAGEMENT

Stormwater quality for Phase 3 will be provided via the southwest extended dry detention basin facility which is designed per CWS Design and Construction Standards. Prior to stormwater runoff reaching the facility, pre-treatment is provided by a water quality manhole designed per CWS standards for the 25-year storm event flow. The southwest stormwater facility is sized to treat all off-site contributing flows into the subdivision, and a majority of Phase 3 and 4 impervious area of the Autumn Sunrise subdivision.

The existing northeast stormwater facility provides treatment to Phases 1 and 2, SW Norwood Road improvements, and the northern portions of Phases 3 and 4. The provided treatment and remaining capacity of the northeast and southwest stormwater facility can be found in Figures 4 and 5.
The stormwater facilities are planted per City of Tualatin and CWS standards. Detailed calculations and checks against CWS criteria are included in the Appendices.

6.3 STORMWATER HYDROMODIFICATION MANAGEMENT

The total site will generate approximately 41 acres of impervious area, thus classifying as a Large Project. Per CWS Hydromod Planning Tool, the subject site is located within an expansion area and drains into a high-risk level exiting stream. Based on these parameters and CWS Table 4-2, the subject project is within Category 3 Hydromodification Approach.

Per CWS Category 3, the subject site will provide peak-flow matching detention, using design criteria in CWS Section 4.08.6 and a LIDA facility. Specifically, the subject site post-developed 2-year storm event runoff flows will not exceed the site pre-developed 50% of 2, 5, and 10-year storm event flows. The following table illustrates the results from the total site flows (including future phases) for each storm event as outlined within the CWS stormwater hydromodification requirements. The total peak post-development flows are combined flows from the northeast and the southwest stormwater facility. The existing northeast facility manages flow from Phases 1 and 2, and the north portions of Phases 3 and 4. The southwest facility manages flow from the remainder of Phases 3 and 4, and SW Boones Ferry Road improvements.

Table 6-1: Total Pre and Post Developed Flows			
Recurrence Interval (Years)	**Peak Pre-Development Flows (cfs)**	**Peak Post-Development Flows (cfs)**	**Peak Flow Increase or (Decrease) – (cfs)**
2	*4.69	4.52	(0.17)
5	12.70	7.78	(4.92)
10	15.98	10.94	(5.18)

*Peak pre-developed flow for 2-year storm event is calculated by subtracting 50% of the subject site (Basins 10S, 20S, 30S, 40S, 50S, 60S, 70S, and 110S) peak flow from the total pre-developed peak flow.

The routing diagram within Appendix B shows the total, post-developed flows represented by Link 3T. Link 2T represents the total outflows from the northeast facility and on-site basins from the Phase 1 Final Stormwater Report.

6.4 PHASE 3 AND 4 STORMWATER TO NORTHEAST FACILITY

The Phase 1 Final Stormwater Report assumes areas for future phases draining into the northeast stormwater facility. Within this report, the future areas have been refined and compared to the Phase 1 Final Stormwater Report. Basin areas 19S and 20S from Phase 1 Final Stormwater Report and basin areas 20S and 21S from Phase 3 Final Stormwater Report are compared to show the development of Phases 3 and 4 will not result in flows exceeding assumption from the Phase 1 Final Stormwater Report. See Table 6-2 and 6-3 for flow comparisons.

Table 6-2: Basin Comparison – Post-Developed Flows			
Recurrence Interval (Years)	**Basin 19S Peak Post-Development Flows (cfs)**	**Basin 20S Peak Post-Development Flows (cfs)**	**Peak Flow Increase or (Decrease) – (cfs)**
2	1.96	1.88	(0.08)
5	2.55	2.46	(0.09)
10	2.91	2.81	(0.10)

Table 6-3: Basin Comparison – Post-Developed Flows			
Recurrence Interval (Years)	**Basin 20S Peak Post-Development Flows (cfs)**	**Basin 21S Peak Post-Development Flows (cfs)**	**Peak Flow Increase or (Decrease) – (cfs)**
2	0.01	0.01	(0.00)
5	0.03	0.03	(0.00)
10	0.03	0.03	(0.00)

6.5 STORMWATER QUANTITY CONTROL FACILITY DESIGN

The proposed southwest stormwater facility quantity is managed by utilizing an extended dry basin designed per CWS standards. The following table outlines the results of the extended dry basin outflow which limits the post-development peak flows to less than the allowable pre-development peak flows for each storm event, as outlined within City of Tualatin and CWS stormwater detention management requirements. The peak flows were computed by analyzing flows discharging into the existing culvert within Boones Ferry Road.

The extended dry basin has been designed per CWS requirements (*Design and Construction for Sanitary Sewer and Surface Water Management Manual* (R&O 19-05), section 4.09.5) with at least 1-foot of freeboard, during the 25-year storm event, and a permanent pool storage depth of 0.2 feet.

Table 6-4: Southwest Facility Pre and Post Developed Flows			
Recurrence Interval (Years)	**Peak Pre-Development Flows (cfs)**	**Peak Post-Development Flows (cfs)**	**Peak Flow Increase or (Decrease) – (cfs)**
2	5.60	2.47	(3.13)
5	8.74	4.35	(4.39)
10	10.68	6.52	(4.16)
25	13.28	9.94	(3.34)

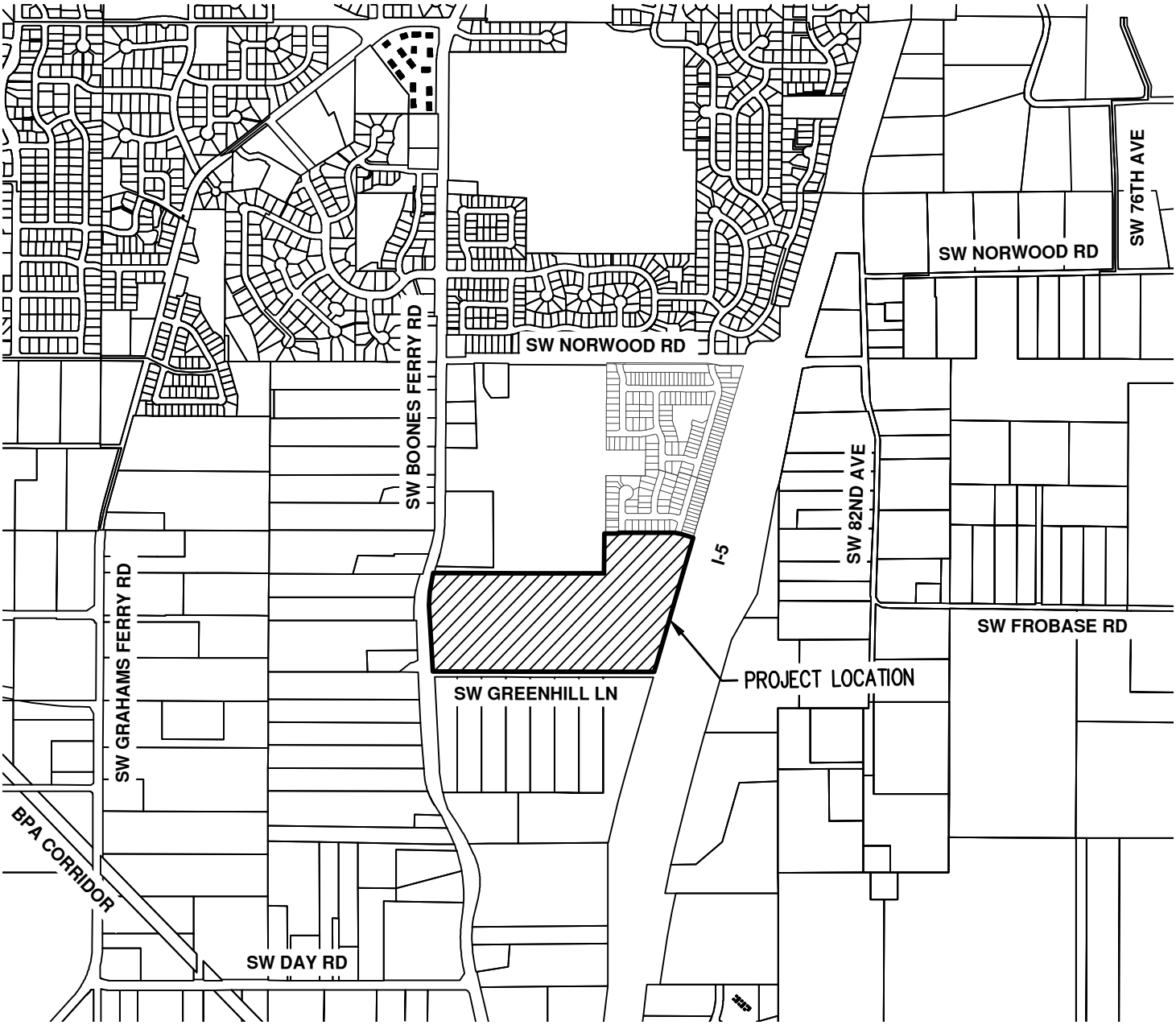
The proposed extended dry basin has sufficient capacity to detain the required post-developed site flows to less than or equal to the allowable pre-developed site flows, for each respective basin, and exceeds the requirements established by Clean Water Service's *Design and Construction for Sanitary Sewer and Surface Water Management Manual* (R&O 19-05).

The southwest stormwater facility is designed per SLOPES V standards to meet the requirements for the wetland fill permit. As a result, this stormwater facility is over-detaining for all storm events.

6.6 DOWNSTREAM ANALYSIS

Stormwater runoff from the stormwater facility will be conveyed and directed to Tapman creek via a 24-inch pipe under SW Boones Ferry Road. A quarter mile downstream investigation of the storm system was performed, and no obstructions were found.

Figure 1: Site Vicinity Map



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SCALE: 1"=1200 FEET

1200 0 300 600 1200

ORIGINAL PAGE SIZE: 11" x 8.5"

DATE: 3/1/2023

SITE VICINITY MAP AUTUMN SUNRISE PH3

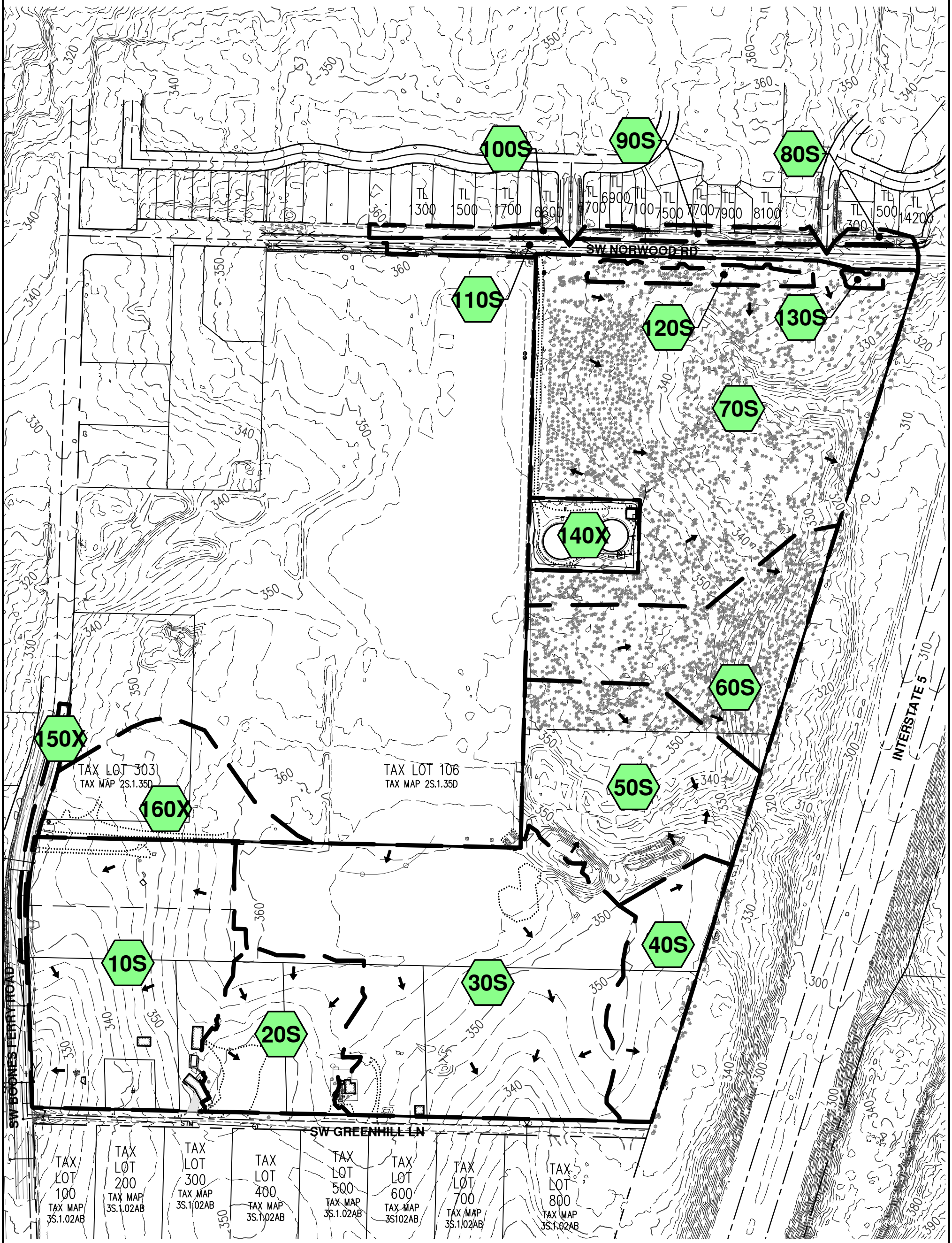
FIGURE 1

AKS ENGINEERING & FORESTRY, LLC
12965 SW HERMAN RD, STE 100
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: JSM
CHKD: DS
AKS JOB: 7454

DWG: VICINITY MAP | LAYOUT1

Figure 2: Pre-Developed Basin Delineation



N

SCALE: 1"= 250 FEET

250 0 50 125 250

DATE: 3/7/2023

PRE-DEVELOPED BASIN DELINEATION

AUTUMN SUNRISE PH3 SUBDIVISION

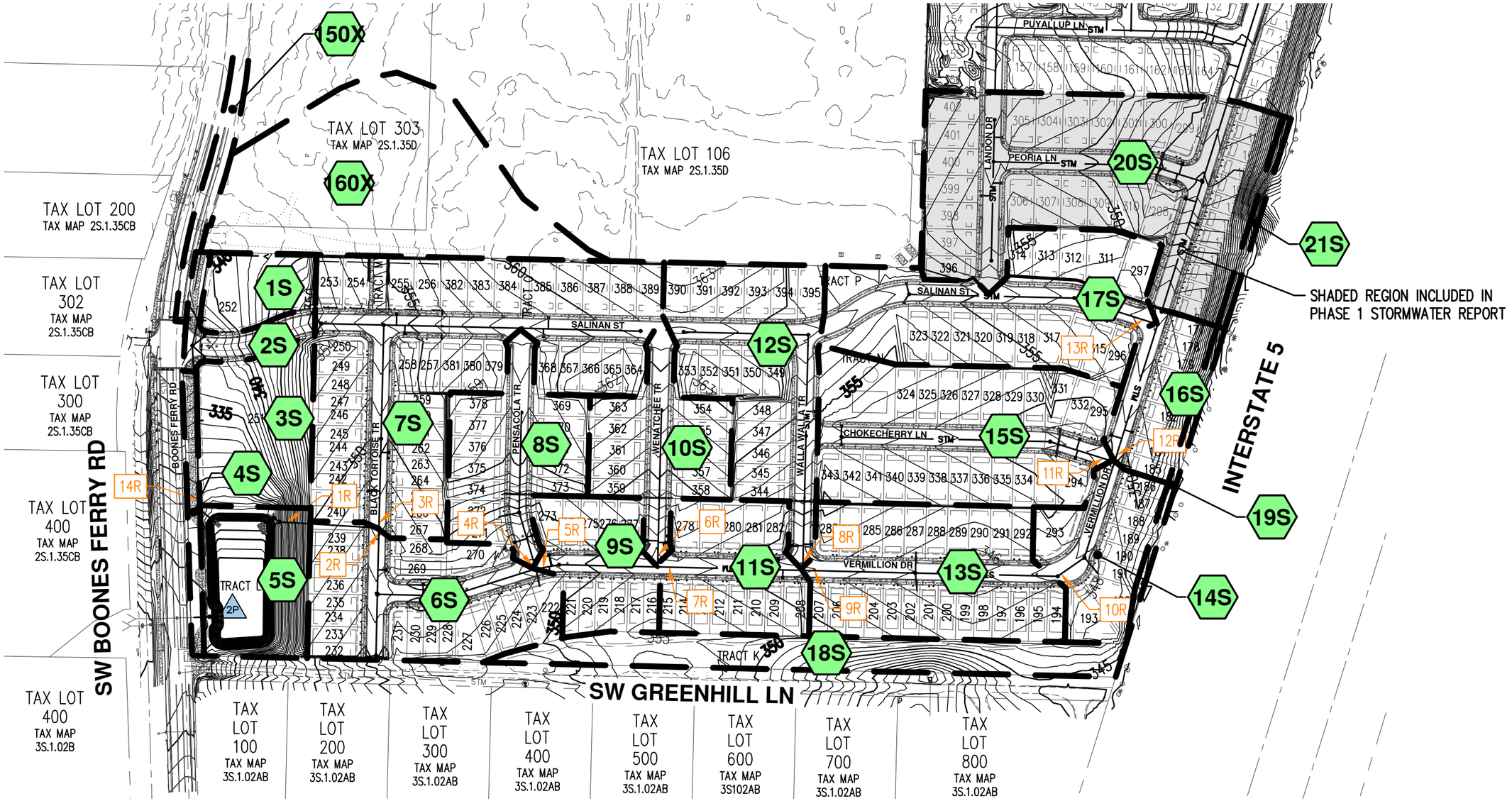
FIGURE 2

AKS ENGINEERING & FORESTRY, LLC
12965 SW HERMAN RD, STE 100
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: JSM
CHKD: DS
AKS JOB: 7454

DWG: PRE-DEVELOPED SITE | LAYOUT1

Figure 3: Post-Developed Basin Delineation



DATE: 3/7/2023

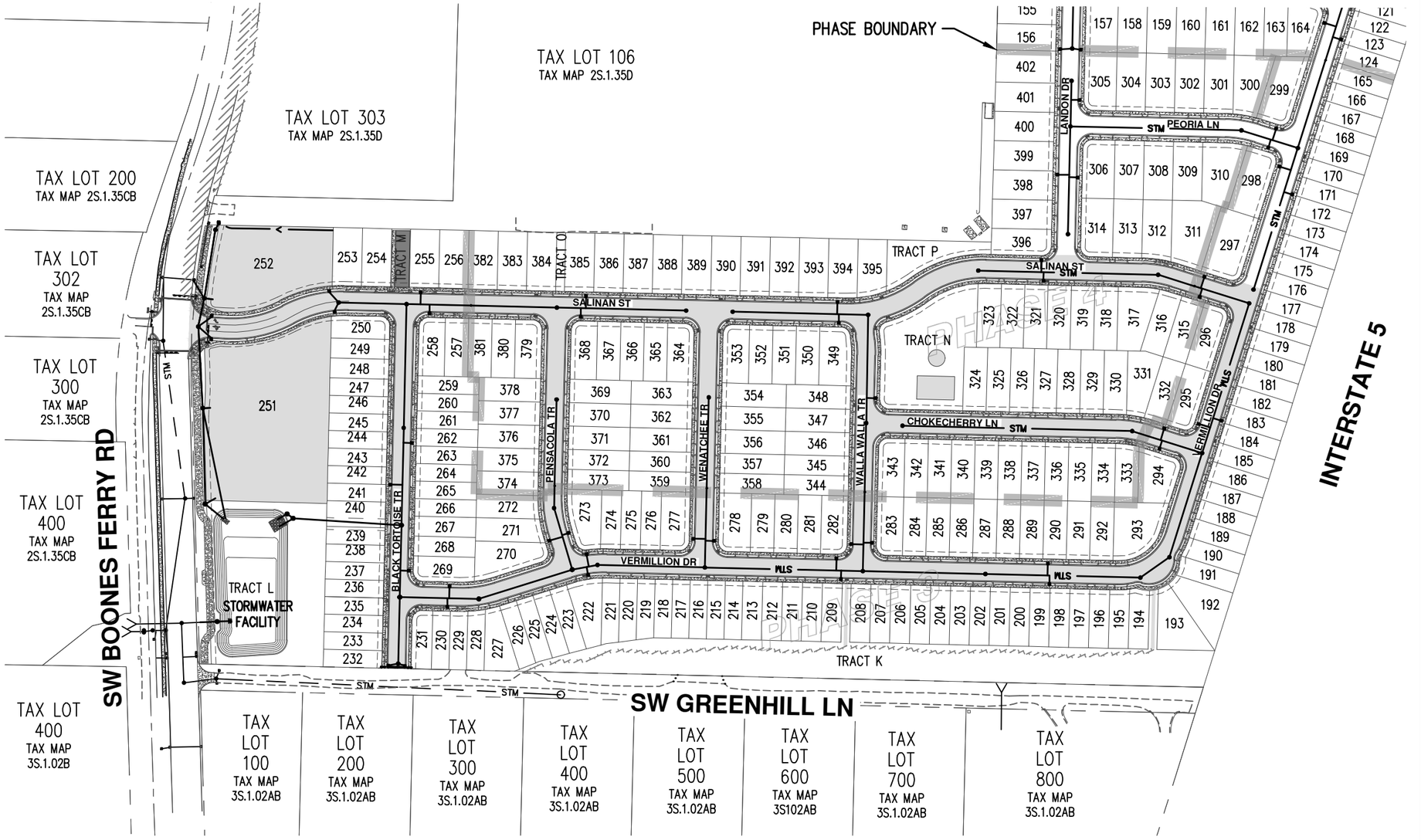
POST-DEVELOPED BASIN DELINEATION	FIGURE 3
AUTUMN SUNRISE SUBDIVISION	
AKS ENGINEERING & FORESTRY, LLC 12965 SW HERMAN RD, STE 100 TUALATIN, OR 97062 503.563.6151 WWW.AKS-ENG.COM	DRWN: JSM CHKD: DS AKS JOB: JSM

DWG: POST-DEVELOPED | LAYOUT1

Figure 4 & 5: Stormwater Treatment Maps

POST-DEVELOPED IMPERVIOUS AREA TABLE

PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT	828,334 SF
PROPOSED COMMERCIAL (LOTS 251 AND 252) IMPERVIOUS AREA RECEIVING TREATMENT	74,761 SF
PROPOSED UNTREATABLE IMPERVIOUS AREA	11,859 SF
EXISTING UNTREATED IMPERVIOUS AREA RECEIVING TREATMENT WITHIN PROPOSED FACILITY	9,286 SF
FUTURE CPAH FRONTAGE IMPROVEMENTS RECEIVING TREATMENT WITHIN PROPOSED FACILITY	3,847 SF
REQUIRED IMPERVIOUS AREA TO TREAT	914,954 SF
IMPERVIOUS AREA TREATMENT PROVIDED	916,228 SF
NET TOTAL	1,274 SF



INDICATES PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT
2,640 SQ. FT. ASSUMED FOR ALL LOTS
74,761 SQ. FT. (85% OF NET) ASSUMED FOR FUTURE LOTS 251 AND 252 – COMMERCIAL AREAS

INDICATES PROPOSED IMPERVIOUS AREA UNABLE TO BE TREATED

INDICATES EXISTING UNTREATED IMPERVIOUS AREA TO BE TREATED WITHIN THE PROPOSED FACILITY

N

SCALE: 1"= 200 FEET

200 0 40 100 200

DATE: 3/7/2023

SOUTHWEST WATER QUALITY TREATMENT MAP

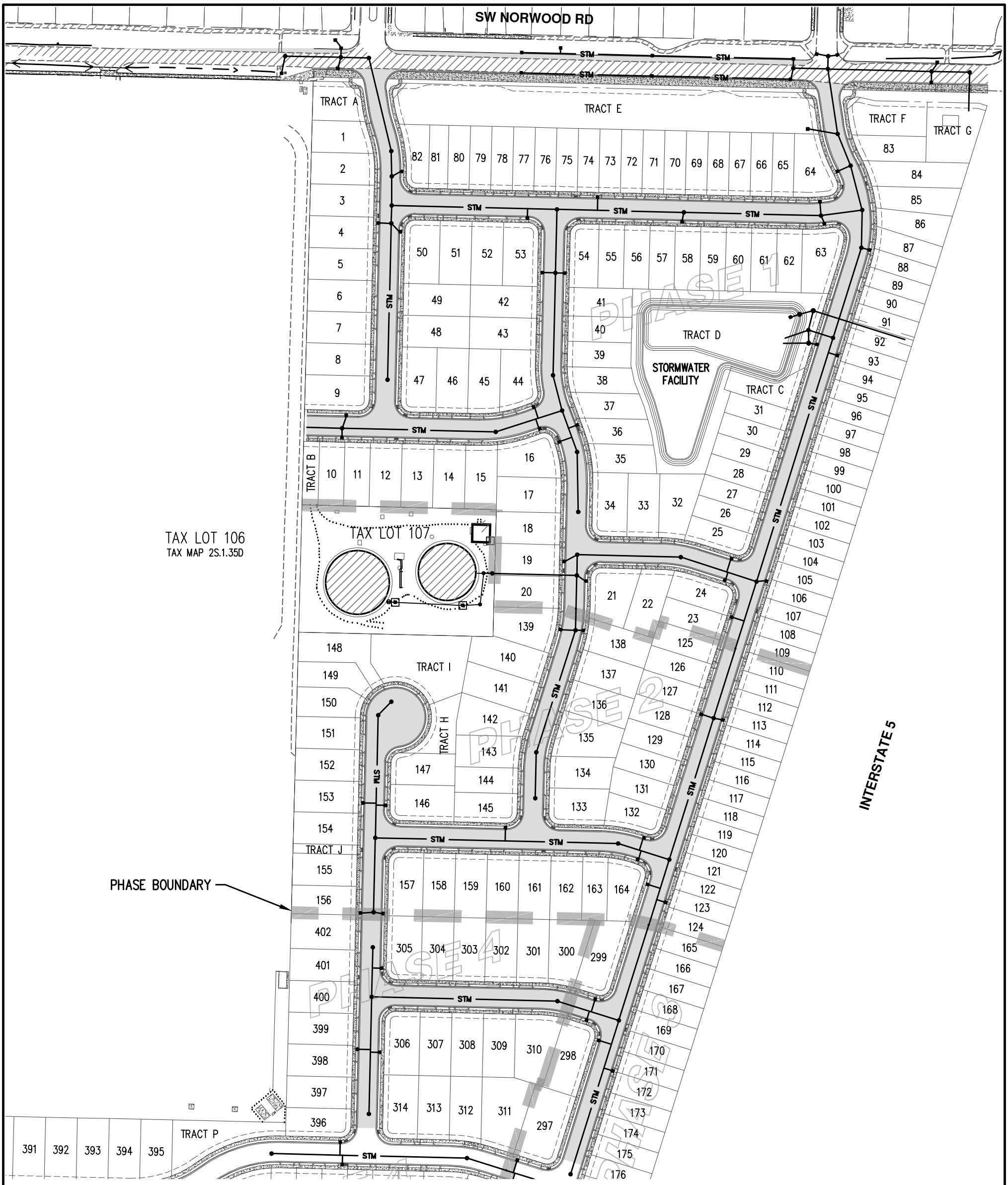
FIGURE 4

AUTUMN SUNRISE SUBDIVISION

AKS ENGINEERING & FORESTRY, LLC
12965 SW HERMAN RD, STE 100
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: JSM
CHKD: DS
AKS JOB: JSM

DWG: TREATMENT MAP | SW



POST-DEVELOPED IMPERVIOUS AREA TABLE	
FACILITY CAPABLE OF TREATING	895,600 SF PER PH1
PHASE 1 IMPERVIOUS AREA RECEIVING TREATMENT	464,861 SF PER PH1
PHASE 2 IMPERVIOUS AREA RECEIVING TREATMENT	223,685 SF PER PLANS
EXISTING UNTREATED IMPERVIOUS AREA RECEIVING TREATMENT WITHIN PROPOSED FACILITY	61,383 SF
REMAINING FACILITY TREATMENT CAPABILITY	145,671 SF
PHASE 3 FINAL IMPERVIOUS AREA	60,232 SF
PHASE 4 ANTICIPATED IMPERVIOUS AREA	75,986 SF
TOTAL IMPERVIOUS AREA TO BE TREATED WITHIN FACILITY	886,147 SF
NET REMAINING FACILITY TREATMENT CAPABILITY	+9,453 SF

— INDICATES PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT
2,640 SQ. FT. ASSUMED FOR ALL LOTS

— INDICATES EXISTING UNTREATED IMPERVIOUS AREA TO BE TREATED WITHIN THE PROPOSED FACILITY

N

SCALE: 1"=150 FEET

150 0 30 75 150

DATE: 3/7/2023

NORTHEAST WATER QUALITY TREATMENT MAP

AUTUMN SUNRISE SUBDIVISION

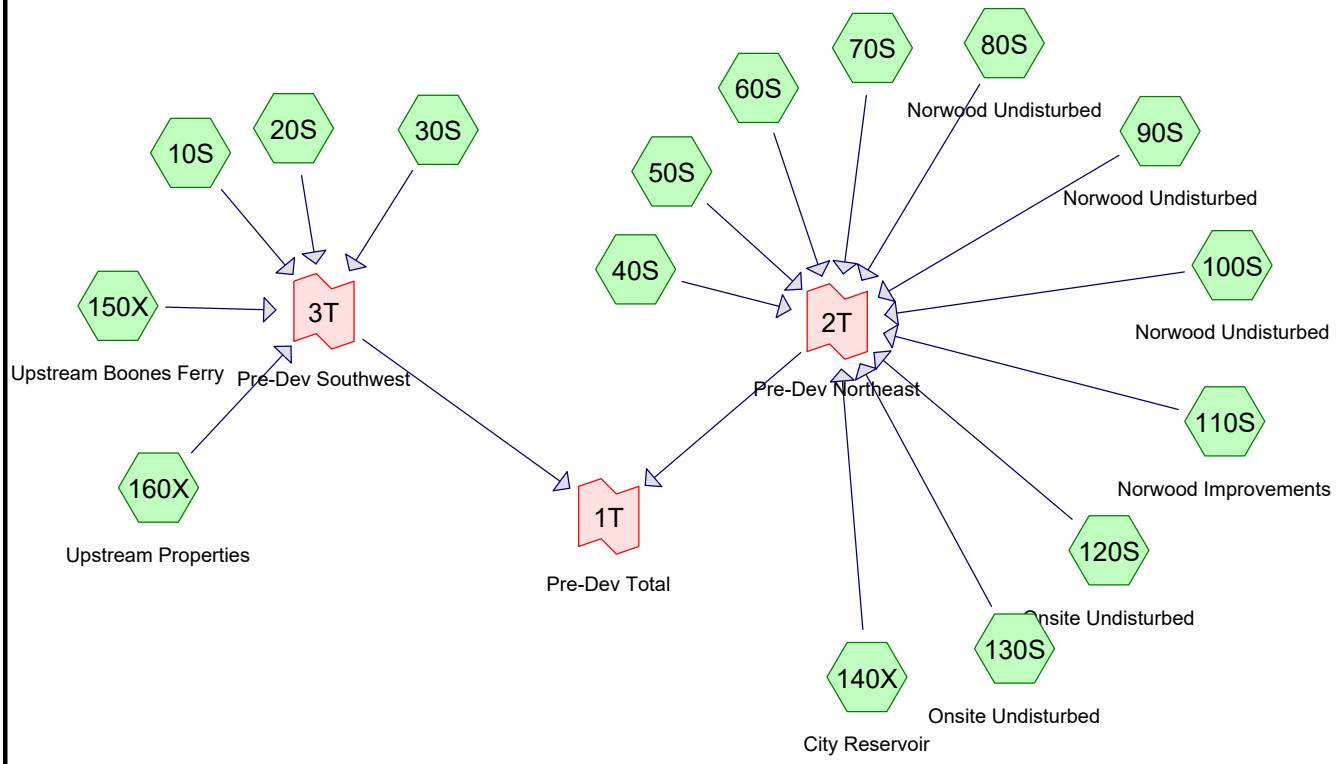
FIGURE 5

AKS ENGINEERING & FORESTRY, LLC
12965 SW HERMAN RD, STE 100
TUALATIN, OR 97062
503.563.6151 WWW.AKS-ENG.COM

DRWN: JSM
CHKD: DS
AKS JOB: 7454

DWG: TREATMENT MAP | NE

Appendix A:
HydroCAD Reports for
Pre-Developed Condition Storm Events
(25-Year Storm Event Analysis)
(10-Year Storm Event Summary)
(5-Year Storm Event Summary)
(2-Year Storm Event Summary)



Subcat Reach Pond Link

Routing Diagram for 7454 Pre-Developed
Prepared by AKS Engineering & Forestry, Printed 3/7/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
199,375	79	50-75% Grass cover, Fair, HSG C (80S, 90S, 100S, 110S, 160X)
46,914	86	<50% Grass cover, Poor, HSG C (140X)
8,685	74	>75% Grass cover, Good, HSG C (150X)
168,971	75	Dirt roads, HSG C (10S, 20S, 30S)
123,564	82	Farmsteads, HSG C (10S)
2,000	75	Gravel roads, HSG C (30S)
5,905	75	Gravel surface, HSG C (10S)
12,930	96	Gravel surface, HSG C (160X)
77,724	98	Impervious Area (80S, 90S, 100S, 110S, 150X, 160X)
4,232	75	Impervious Area (Modified) (110S)
1,920	75	Paved parking, HSG C (20S, 30S)
14,216	98	Paved roads w/curbs & sewers, HSG C (140X)
1,044,944	85	Row crops, straight row, Good, HSG C (10S, 20S, 30S, 40S)
7,483	75	Unconnected roofs, HSG C (10S, 30S)
123,094	73	Woods, Fair, HSG C (50S)
1,042,216	70	Woods, Good, HSG C (60S, 70S, 120S, 130S)
171,927	72	Woods/grass comb., Good, HSG C (50S)
3,056,100	**78**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>2.18"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=4.20 cfs 74,070 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>1.86"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=1.24 cfs 25,742 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>2.25"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=6.03 cfs 120,873 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>2.36"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=1.72 cfs 26,979 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>1.37"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=1.22 cfs 33,560 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.71 cfs 25,581 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=2.05 cfs 76,724 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>2.16"
Tc=5.0 min CN=79/98 Runoff=0.09 cfs 1,356 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>2.11"
Tc=5.0 min CN=79/98 Runoff=0.31 cfs 4,728 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>2.18"
Tc=5.0 min CN=79/98 Runoff=0.22 cfs 3,321 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>2.73"
Tc=51.0 min CN=79/98 Runoff=0.66 cfs 16,665 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.09 cfs 3,253 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.01 cfs 494 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>2.66"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.51 cfs 13,576 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>2.62"
Tc=5.0 min CN=74/98 Runoff=0.26 cfs 3,931 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>2.26"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.60 cfs 29,881 cf

Link 1T: Pre-Dev Total Inflow=20.45 cfs 460,732 cf
Primary=20.45 cfs 460,732 cf

Link 2T: Pre-Dev Northeast Inflow=7.18 cfs 206,235 cf
Primary=7.18 cfs 206,235 cf

Link 3T: Pre-Dev Southwest Inflow=13.28 cfs 254,497 cf
Primary=13.28 cfs 254,497 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 460,732 cf Average Runoff Depth = 1.81"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Summary for Subcatchment 10S:

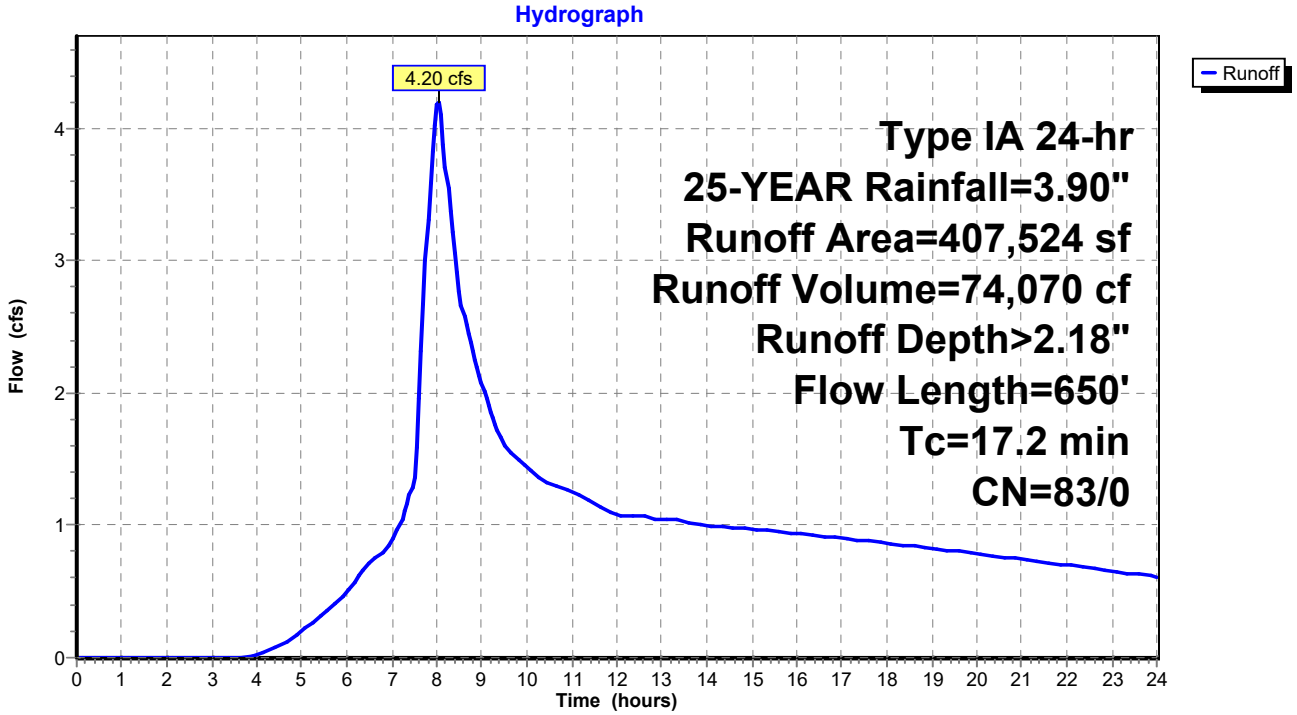
Runoff = 4.20 cfs @ 8.02 hrs, Volume= 74,070 cf, Depth> 2.18"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
	123,564	82	Farmsteads, HSG C
	256,474	85	Row crops, straight row, Good, HSG C
*	5,905	75	Gravel surface, HSG C
*	5,200	75	Unconnected roofs, HSG C
*	16,381	75	Dirt roads, HSG C
	407,524	83	Weighted Average
	407,524	83	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	200	0.0500	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
3.7	450	0.0400	2.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
17.2	650	Total			

Subcatchment 10S:



Summary for Subcatchment 20S:

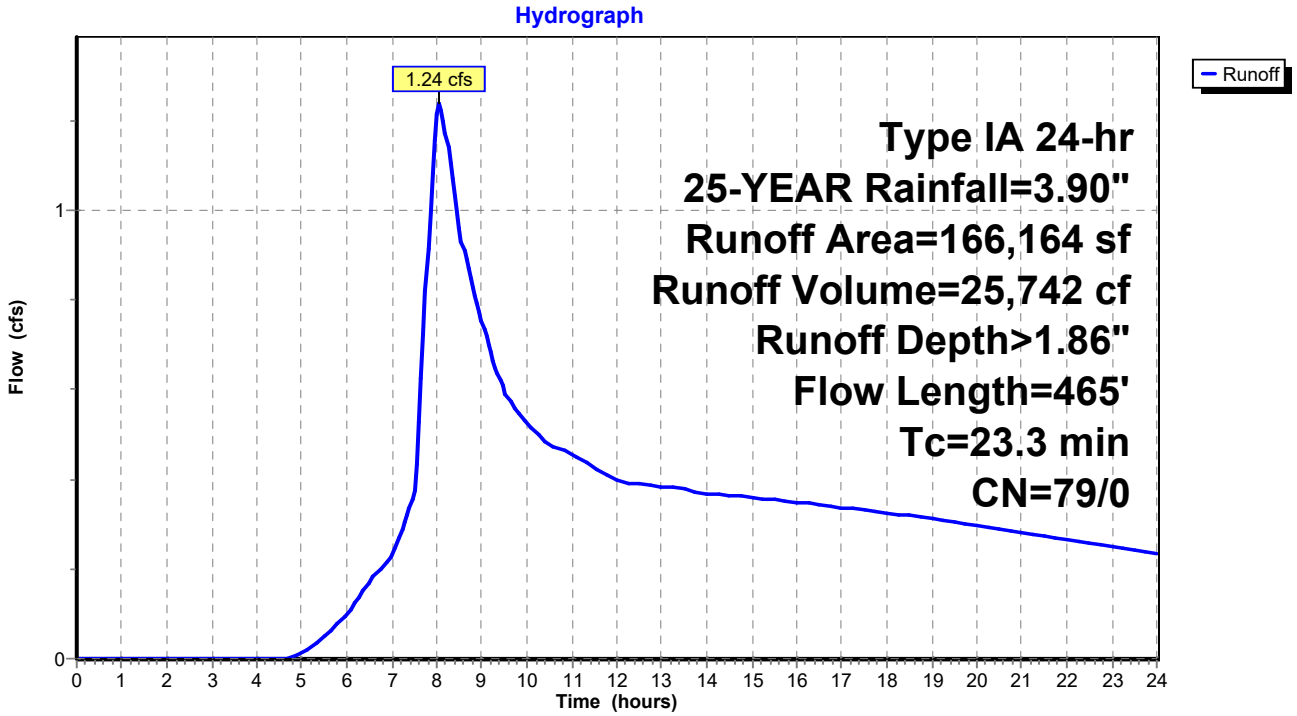
Runoff = 1.24 cfs @ 8.05 hrs, Volume= 25,742 cf, Depth> 1.86"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	93,934	75	Dirt roads, HSG C
	70,900	85	Row crops, straight row, Good, HSG C
*	1,330	75	Paved parking, HSG C
	166,164	79	Weighted Average
	166,164	79	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.4	230	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
3.9	235	0.0100	1.00		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
23.3	465	Total			

Subcatchment 20S:



Summary for Subcatchment 30S:

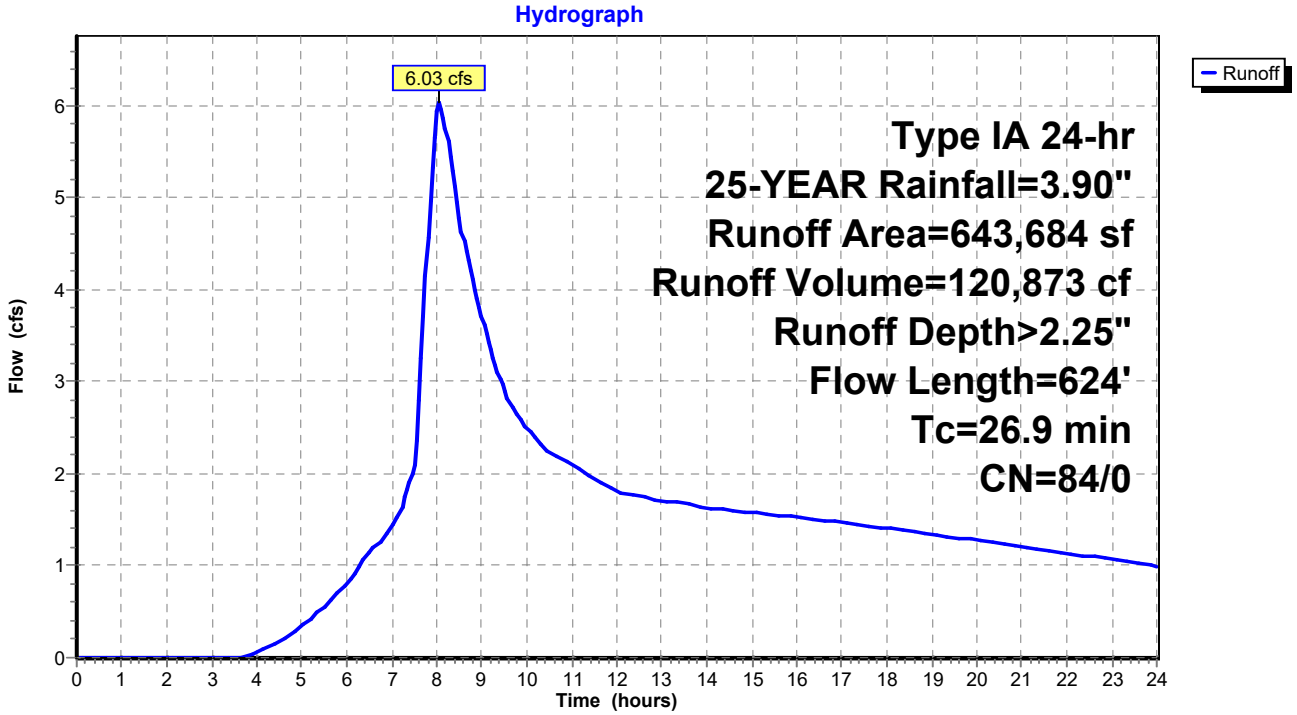
Runoff = 6.03 cfs @ 8.05 hrs, Volume= 120,873 cf, Depth> 2.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	58,656	75	Dirt roads, HSG C
*	2,000	75	Gravel roads, HSG C
*	2,283	75	Unconnected roofs, HSG C
*	590	75	Paved parking, HSG C
	580,155	85	Row crops, straight row, Good, HSG C
	643,684	84	Weighted Average
	643,684	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.0	300	0.0260	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
2.9	324	0.0350	1.87		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
26.9	624	Total			

Subcatchment 30S:



Summary for Subcatchment 40S:

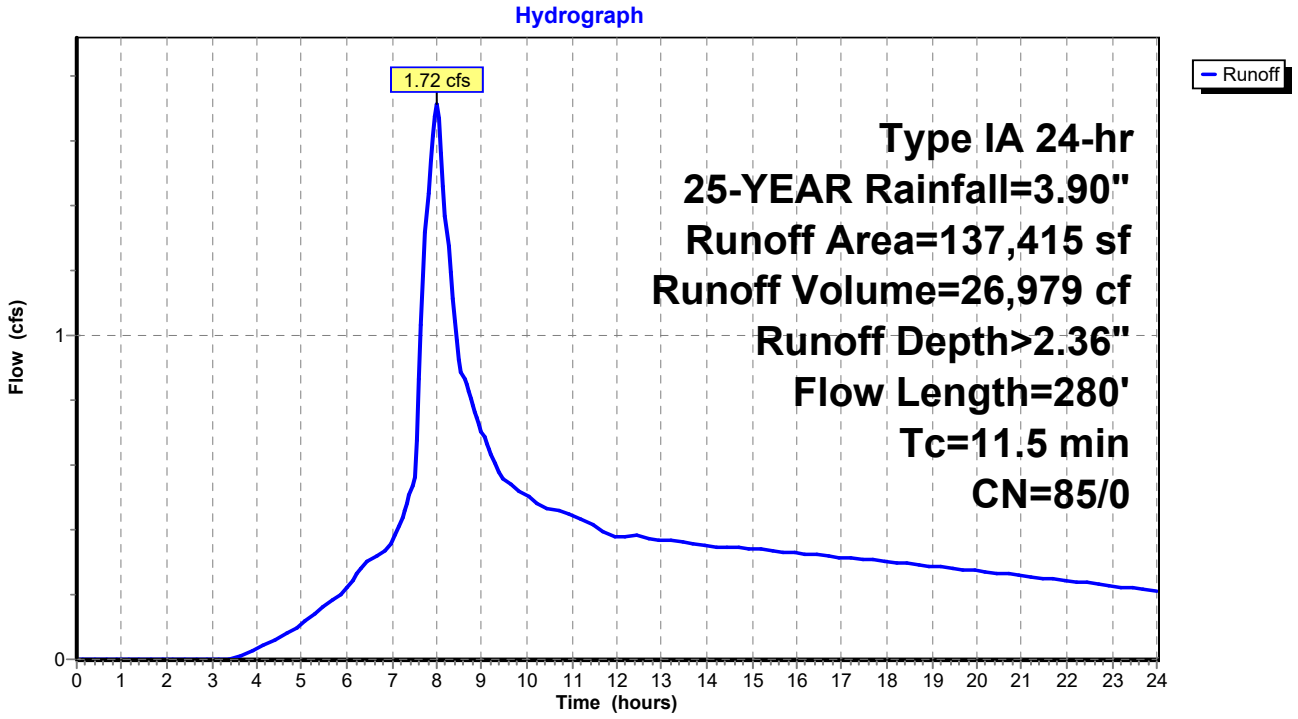
Runoff = 1.72 cfs @ 8.00 hrs, Volume= 26,979 cf, Depth> 2.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
137,415	85	Row crops, straight row, Good, HSG C
137,415	85	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	150	0.0420	0.25		**Sheet Flow,** Range n= 0.130 P2= 2.50"
1.3	130	0.0300	1.73		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
11.5	280	Total			

Subcatchment 40S:



Summary for Subcatchment 50S:

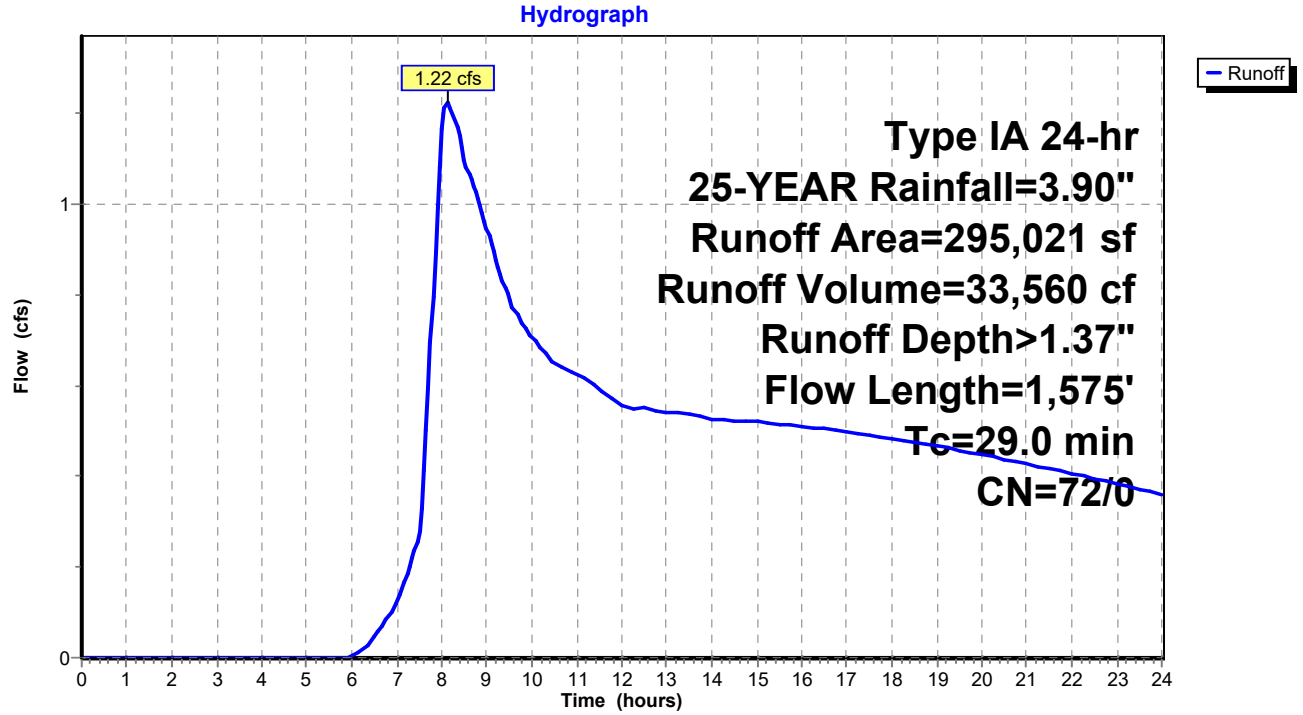
Runoff = 1.22 cfs @ 8.14 hrs, Volume= 33,560 cf, Depth> 1.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
171,927	72	Woods/grass comb., Good, HSG C
123,094	73	Woods, Fair, HSG C
295,021	72	Weighted Average
295,021	72	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.0650	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.4	535	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.4	940	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
29.0	1,575	Total			

Subcatchment 50S:



Summary for Subcatchment 60S:

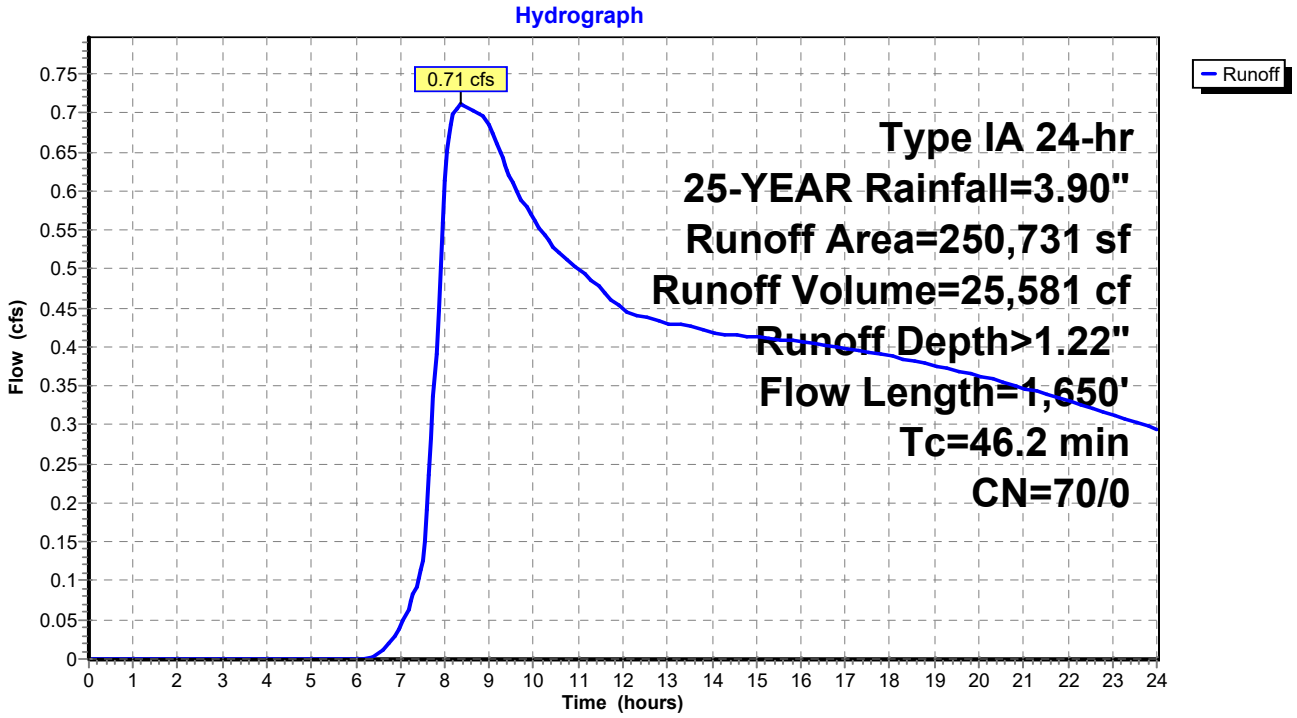
Runoff = 0.71 cfs @ 8.36 hrs, Volume= 25,581 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
250,731	70	Woods, Good, HSG C
250,731	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.7	150	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.5	1,500	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
46.2	1,650	Total			

Subcatchment 60S:



Summary for Subcatchment 70S:

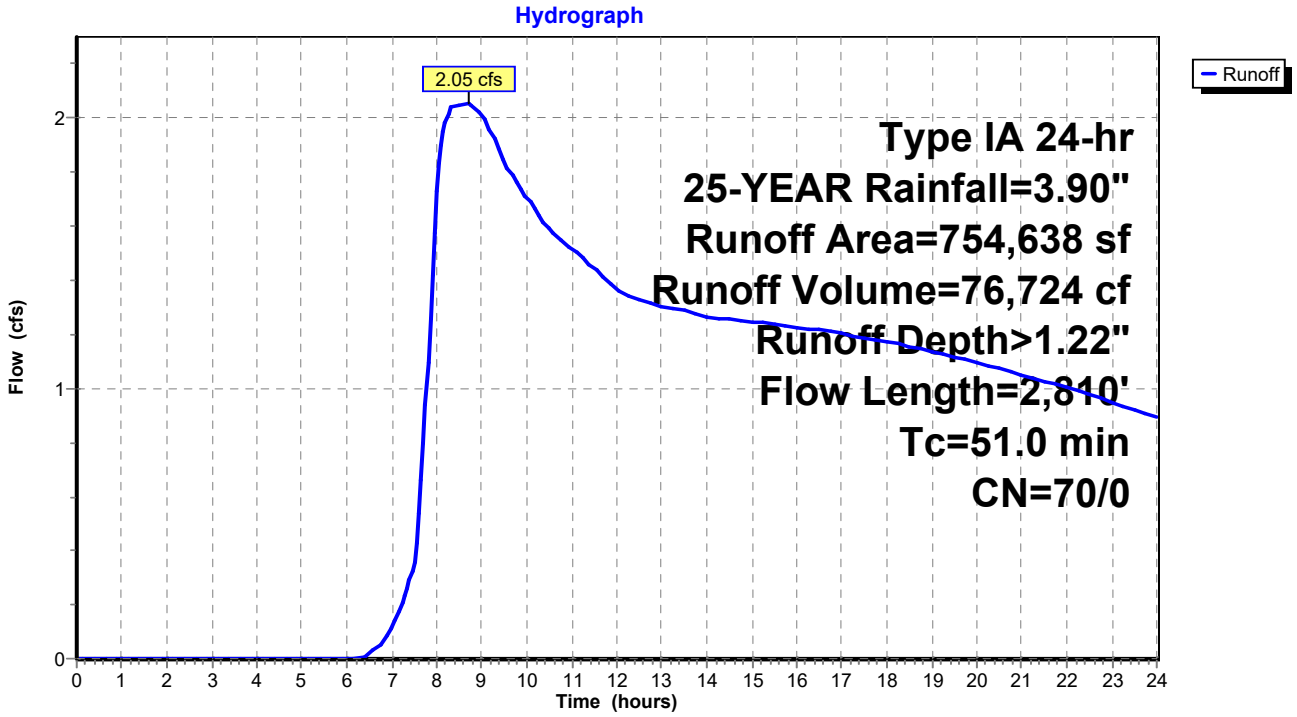
Runoff = 2.05 cfs @ 8.70 hrs, Volume= 76,724 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
754,638	70	Woods, Good, HSG C
754,638	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
51.0	2,810	Total			

Subcatchment 70S:



Summary for Subcatchment 80S: Norwood Undisturbed

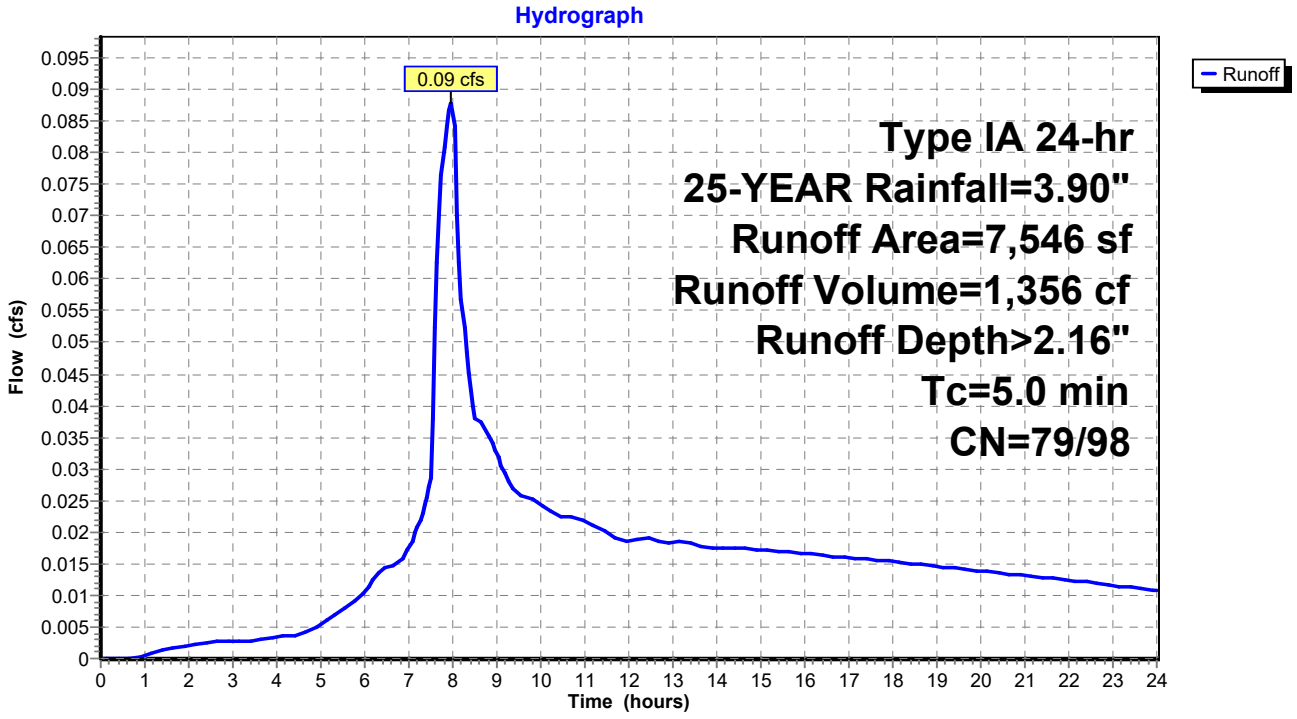
Runoff = 0.09 cfs @ 7.97 hrs, Volume= 1,356 cf, Depth> 2.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	1,182	98	Impervious Area
	6,364	79	50-75% Grass cover, Fair, HSG C
	7,546	82	Weighted Average
	6,364	79	84.34% Pervious Area
	1,182	98	15.66% Impervious Area

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

Subcatchment 80S: Norwood Undisturbed



Summary for Subcatchment 90S: Norwood Undisturbed

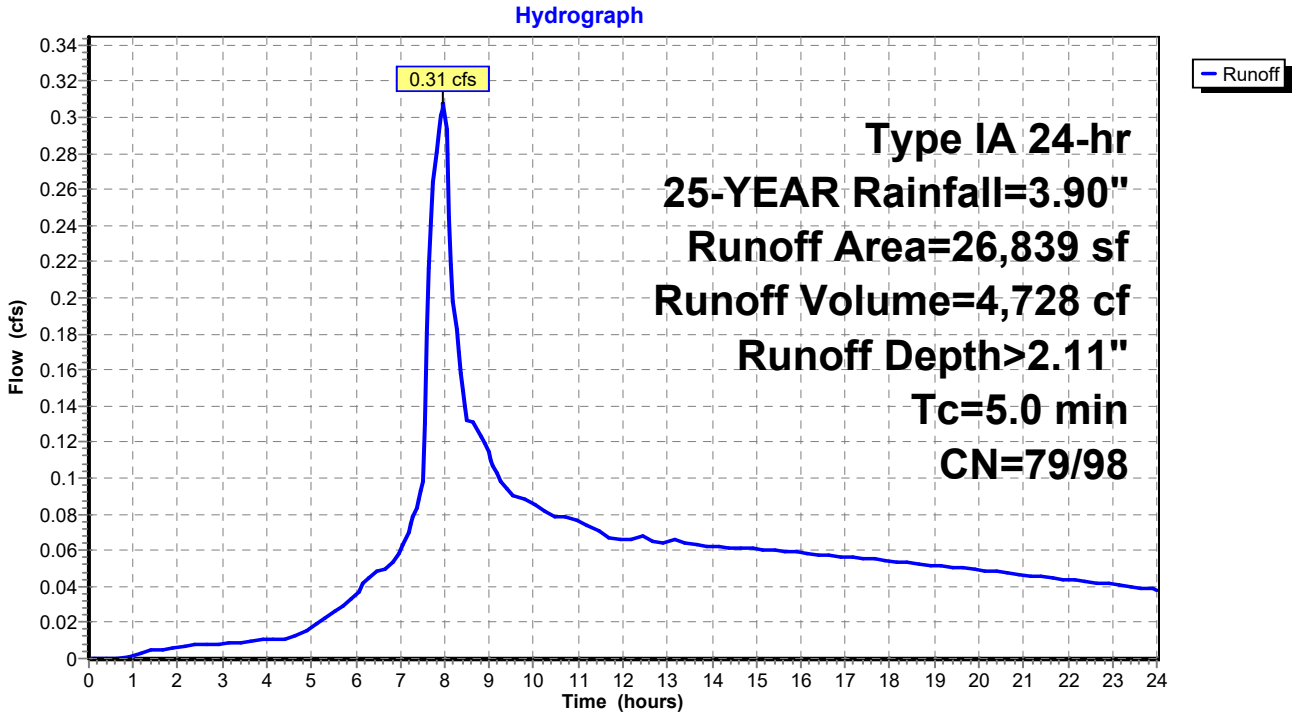
Runoff = 0.31 cfs @ 7.98 hrs, Volume= 4,728 cf, Depth> 2.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	3,558	98	Impervious Area
	23,281	79	50-75% Grass cover, Fair, HSG C
	26,839	82	Weighted Average
	23,281	79	86.74% Pervious Area
	3,558	98	13.26% Impervious Area

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

Subcatchment 90S: Norwood Undisturbed



Summary for Subcatchment 100S: Norwood Undisturbed

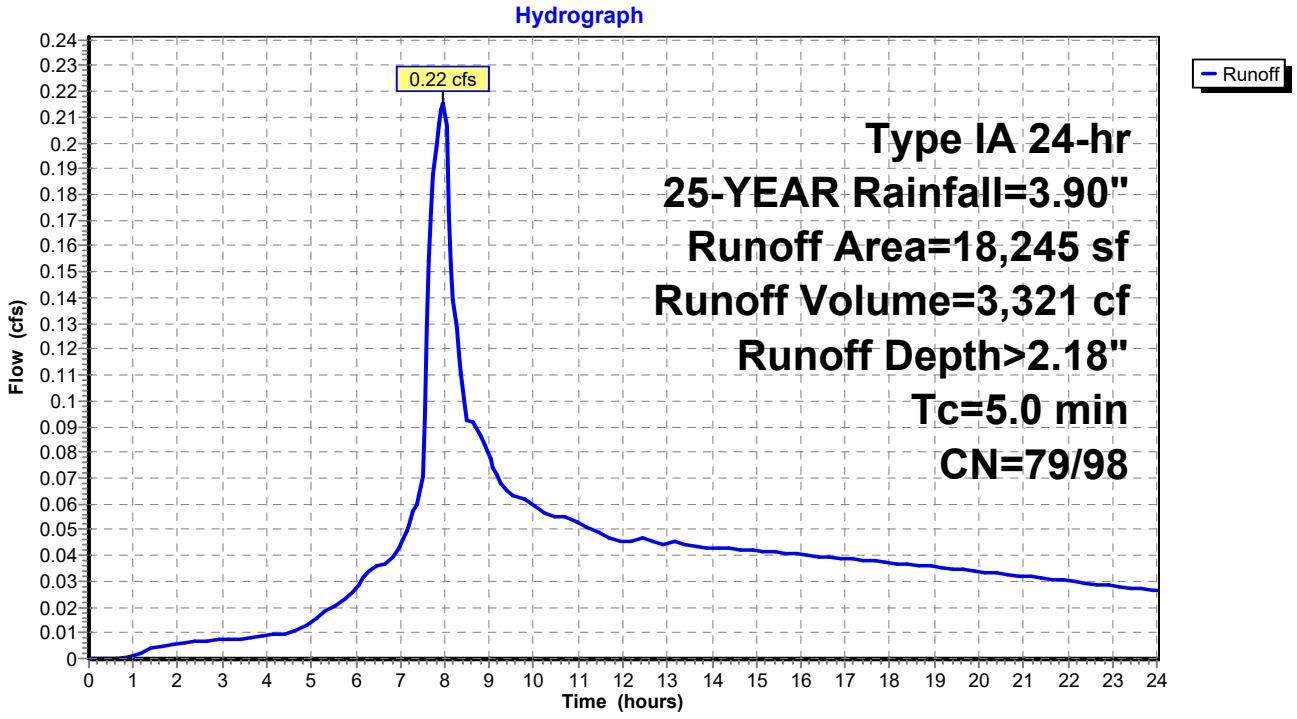
Runoff = 0.22 cfs @ 7.97 hrs, Volume= 3,321 cf, Depth> 2.18"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	3,143	98	Impervious Area
	15,102	79	50-75% Grass cover, Fair, HSG C
	18,245	82	Weighted Average
	15,102	79	82.77% Pervious Area
	3,143	98	17.23% Impervious Area

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

Subcatchment 100S: Norwood Undisturbed



Summary for Subcatchment 110S: Norwood Improvements

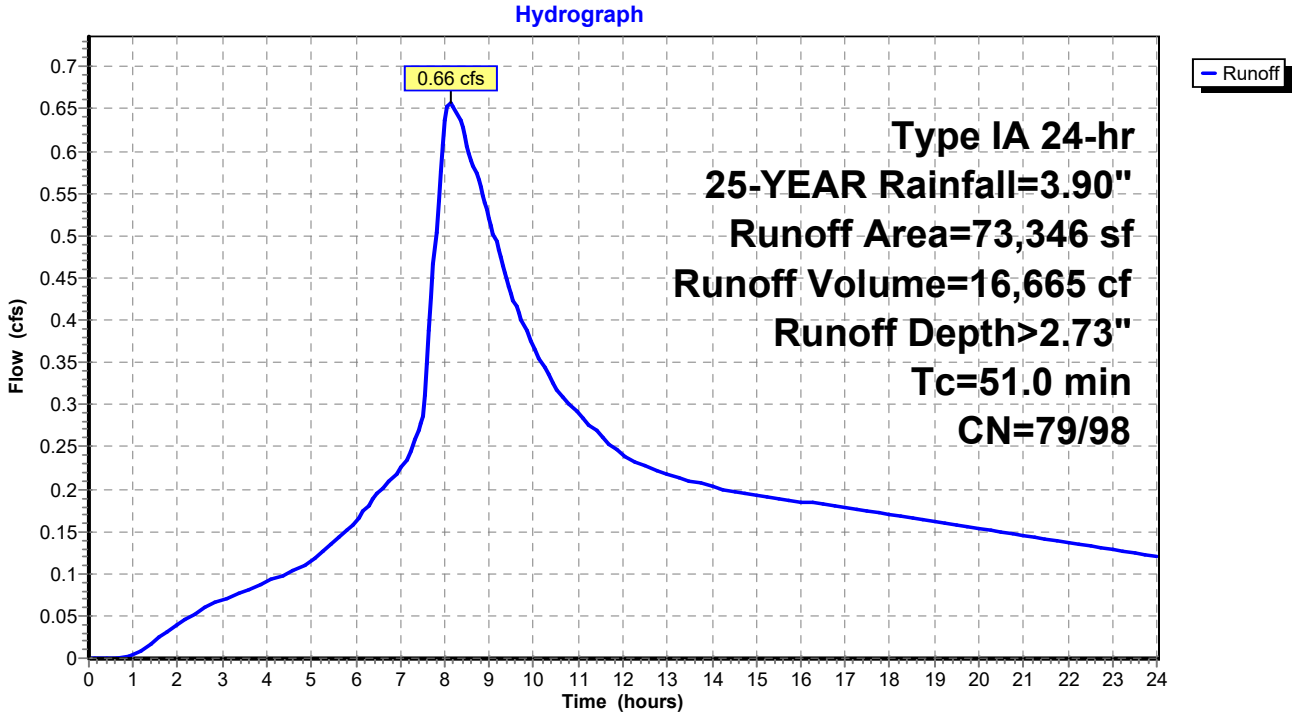
Runoff = 0.66 cfs @ 8.14 hrs, Volume= 16,665 cf, Depth> 2.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	37,185	98	Impervious Area
*	4,232	75	Impervious Area (Modified)
	31,929	79	50-75% Grass cover, Fair, HSG C
	73,346	88	Weighted Average
	36,161	79	49.30% Pervious Area
	37,185	98	50.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
51.0					**Direct Entry, Tc through Site (Basin 70S)**

Subcatchment 110S: Norwood Improvements



Summary for Subcatchment 120S: Onsite Undisturbed

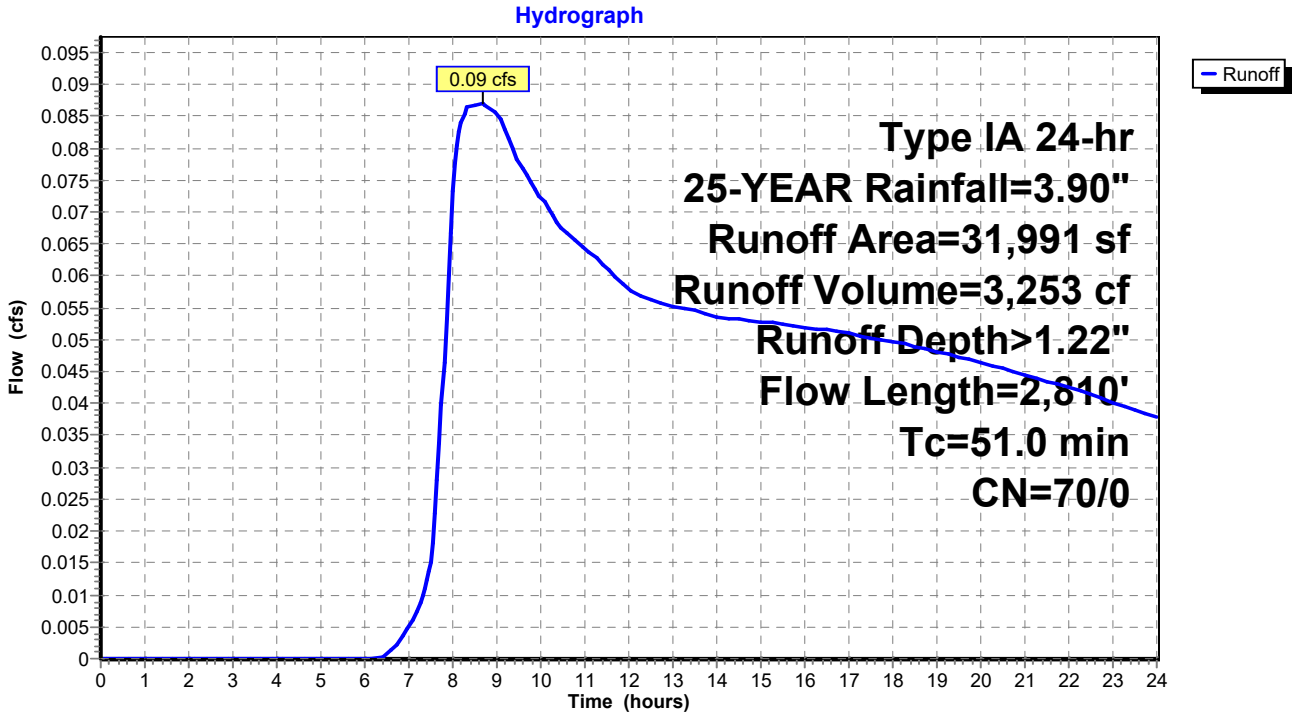
Runoff = 0.09 cfs @ 8.70 hrs, Volume= 3,253 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
31,991	70	Woods, Good, HSG C
31,991	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
51.0	2,810	Total			

Subcatchment 120S: Onsite Undisturbed



Summary for Subcatchment 130S: Onsite Undisturbed

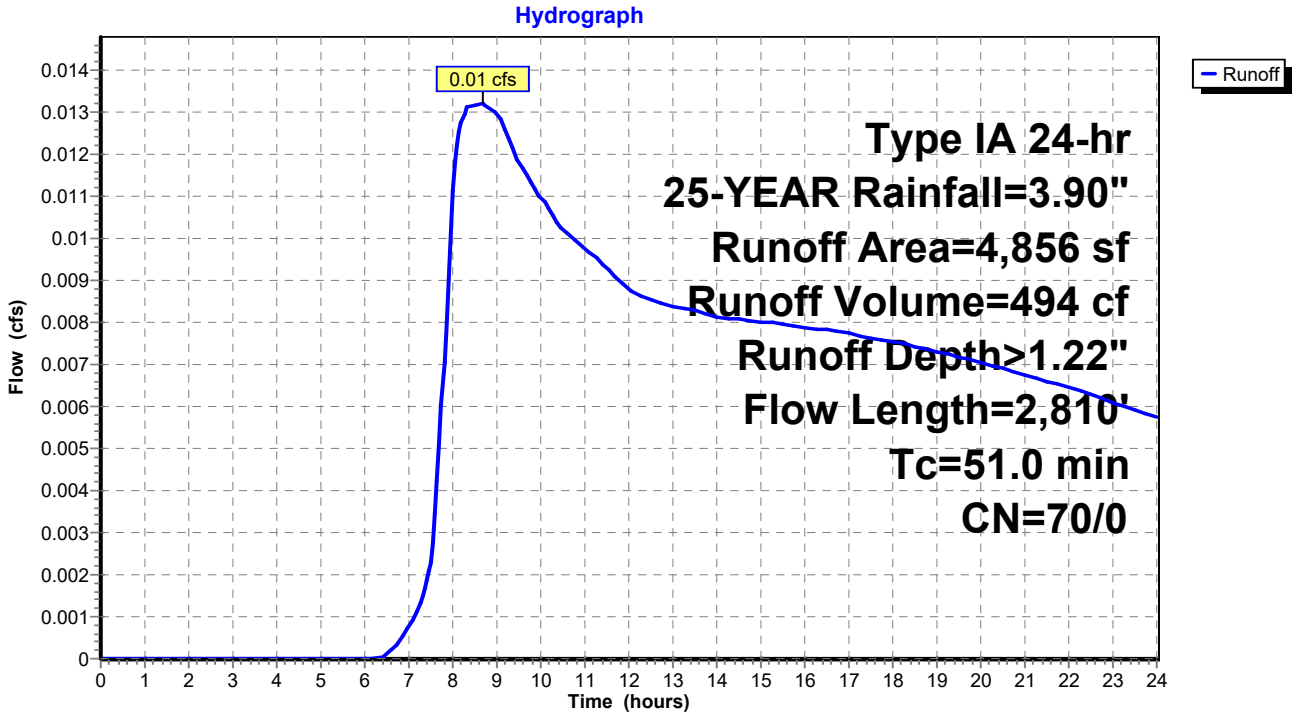
Runoff = 0.01 cfs @ 8.70 hrs, Volume= 494 cf, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
4,856	70	Woods, Good, HSG C
4,856	70	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
51.0	2,810	Total			

Subcatchment 130S: Onsite Undisturbed



Summary for Subcatchment 140X: City Reservoir

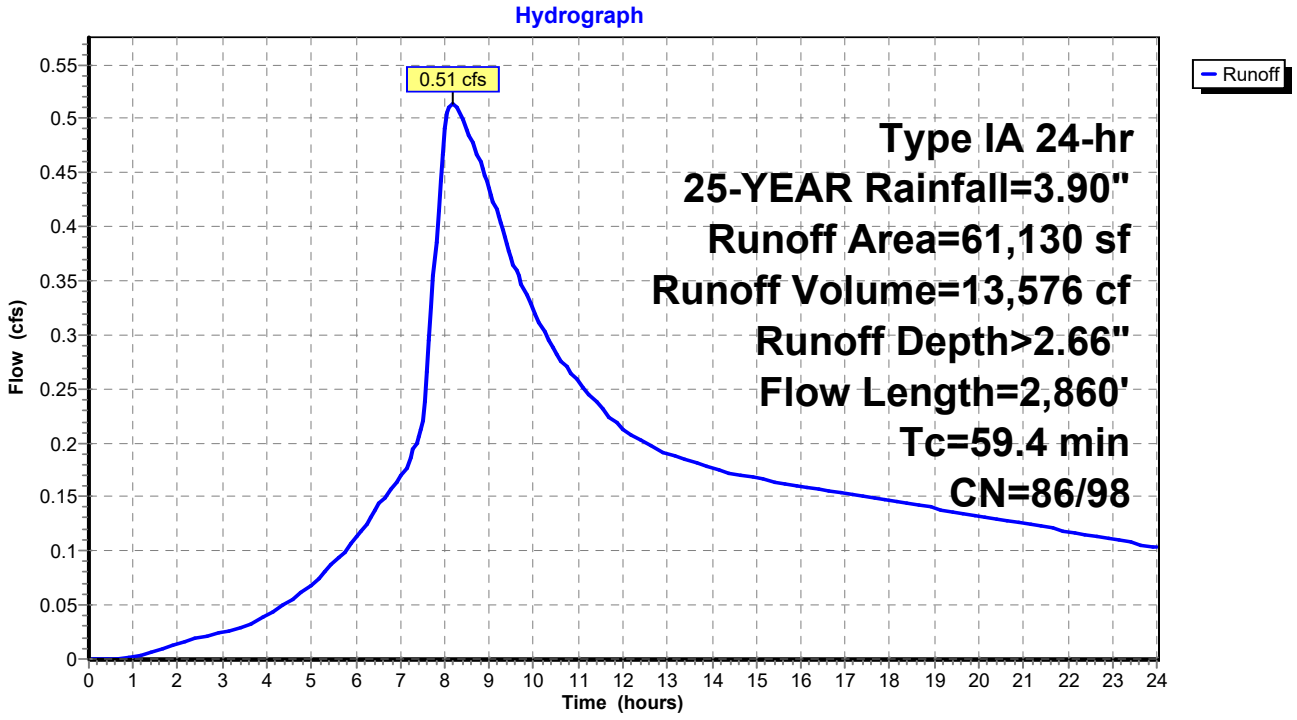
Runoff = 0.51 cfs @ 8.20 hrs, Volume= 13,576 cf, Depth> 2.66"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

Area (sf)	CN	Description
14,216	98	Paved roads w/curbs & sewers, HSG C
46,914	86	<50% Grass cover, Poor, HSG C
61,130	89	Weighted Average
46,914	86	76.74% Pervious Area
14,216	98	23.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0100	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"
30.9	200	0.0440	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.50"
8.1	500	0.0420	1.02		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.0	2,110	0.0100	2.93	11.71	**Channel Flow,** Area= 4.0 sf Perim= 8.8' r= 0.45' n= 0.030 Earth, grassed & winding
59.4	2,860	Total			

Subcatchment 140X: City Reservoir



Summary for Subcatchment 150X: Upstream Boones Ferry

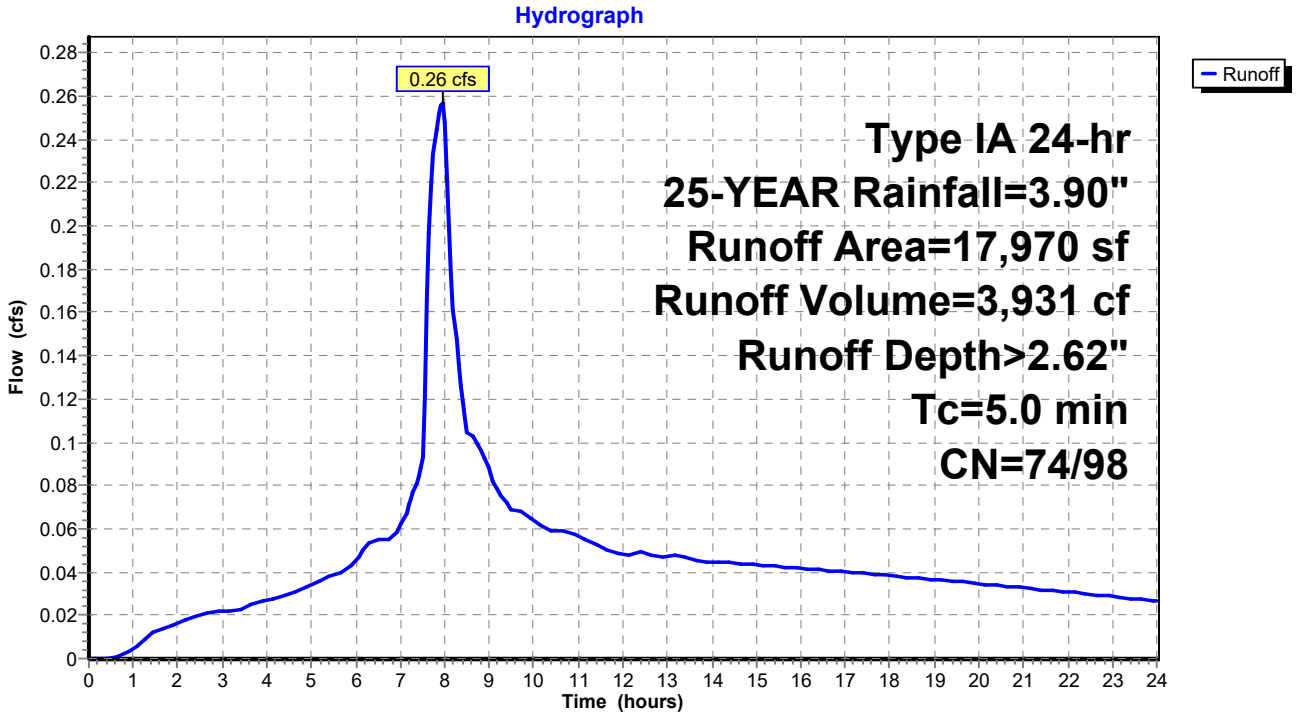
Runoff = 0.26 cfs @ 7.93 hrs, Volume= 3,931 cf, Depth> 2.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	9,285	98	Impervious Area
	8,685	74	>75% Grass cover, Good, HSG C
	17,970	86	Weighted Average
	8,685	74	48.33% Pervious Area
	9,285	98	51.67% Impervious Area

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

Subcatchment 150X: Upstream Boones Ferry



Summary for Subcatchment 160X: Upstream Properties

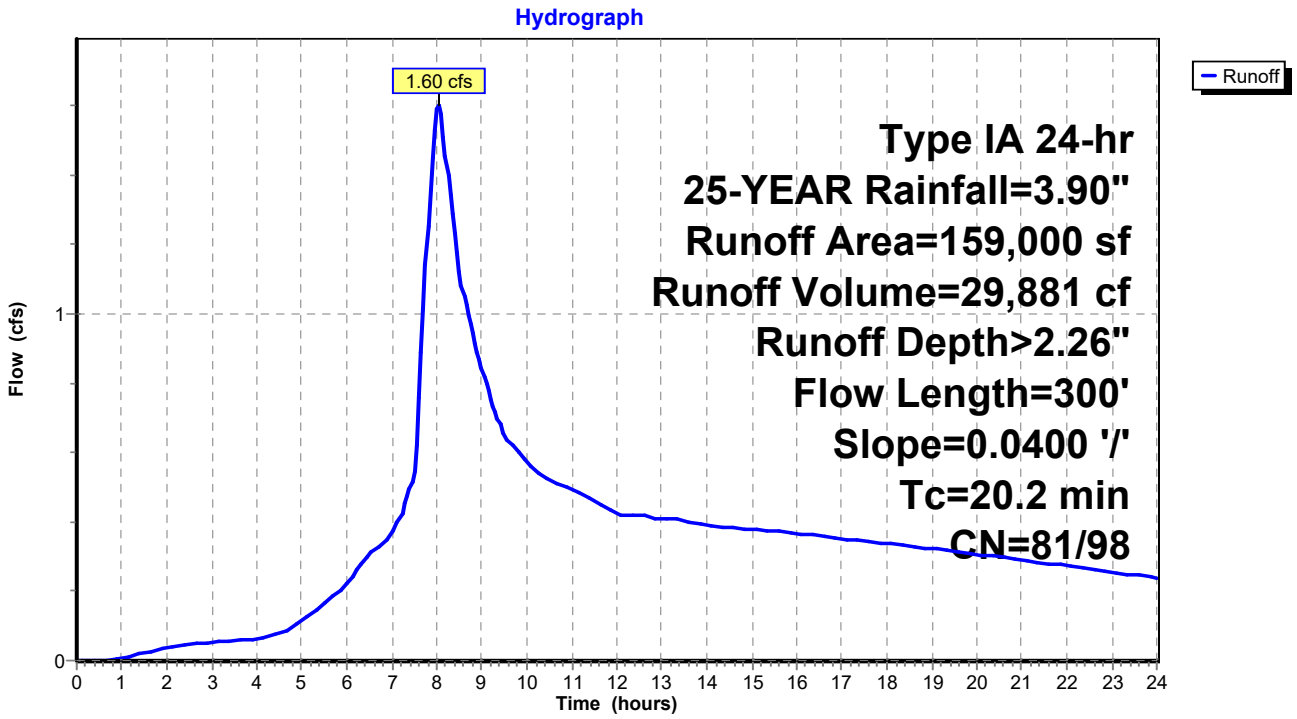
Runoff = 1.60 cfs @ 8.03 hrs, Volume= 29,881 cf, Depth> 2.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-YEAR Rainfall=3.90"

	Area (sf)	CN	Description
*	23,371	98	Impervious Area
	12,930	96	Gravel surface, HSG C
	122,699	79	50-75% Grass cover, Fair, HSG C
	159,000	83	Weighted Average
	135,629	81	85.30% Pervious Area
	23,371	98	14.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	300	0.0400	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 160X: Upstream Properties

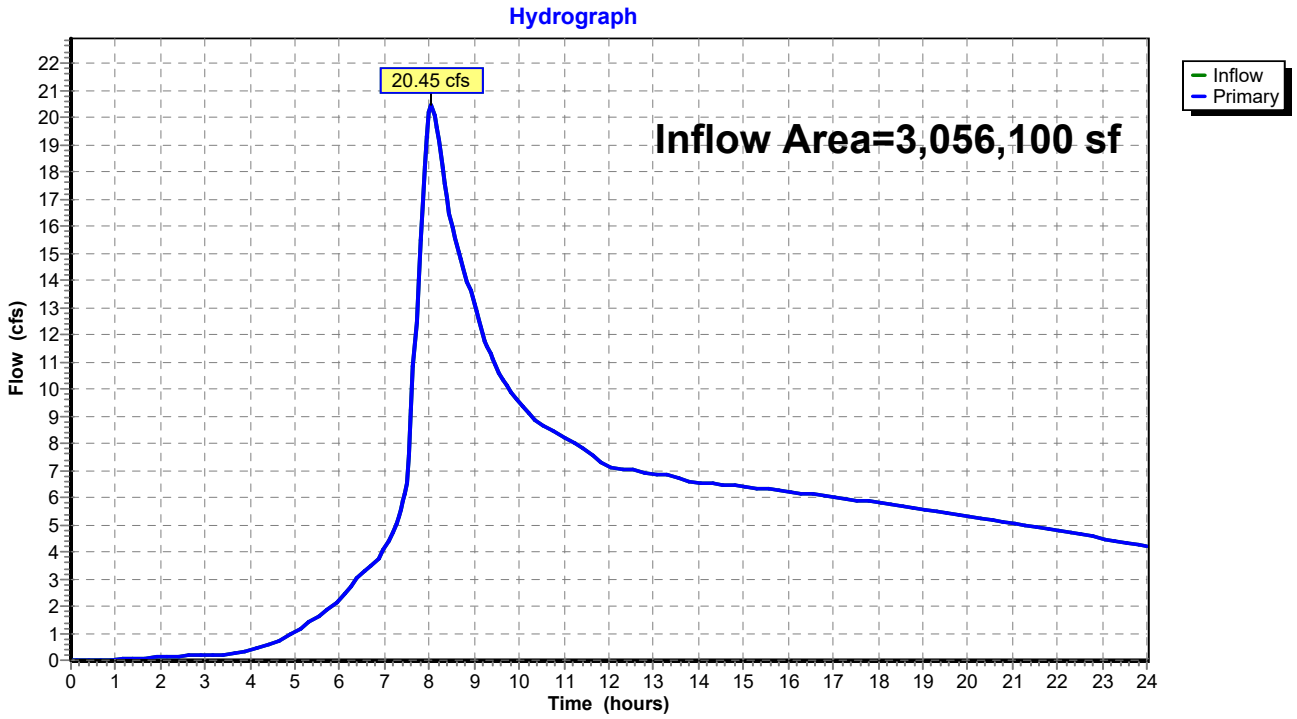


Summary for Link 1T: Pre-Dev Total

Inflow Area = 3,056,100 sf, 3.01% Impervious, Inflow Depth > 1.81" for 25-YEAR event
Inflow = 20.45 cfs @ 8.04 hrs, Volume= 460,732 cf
Primary = 20.45 cfs @ 8.04 hrs, Volume= 460,732 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1T: Pre-Dev Total

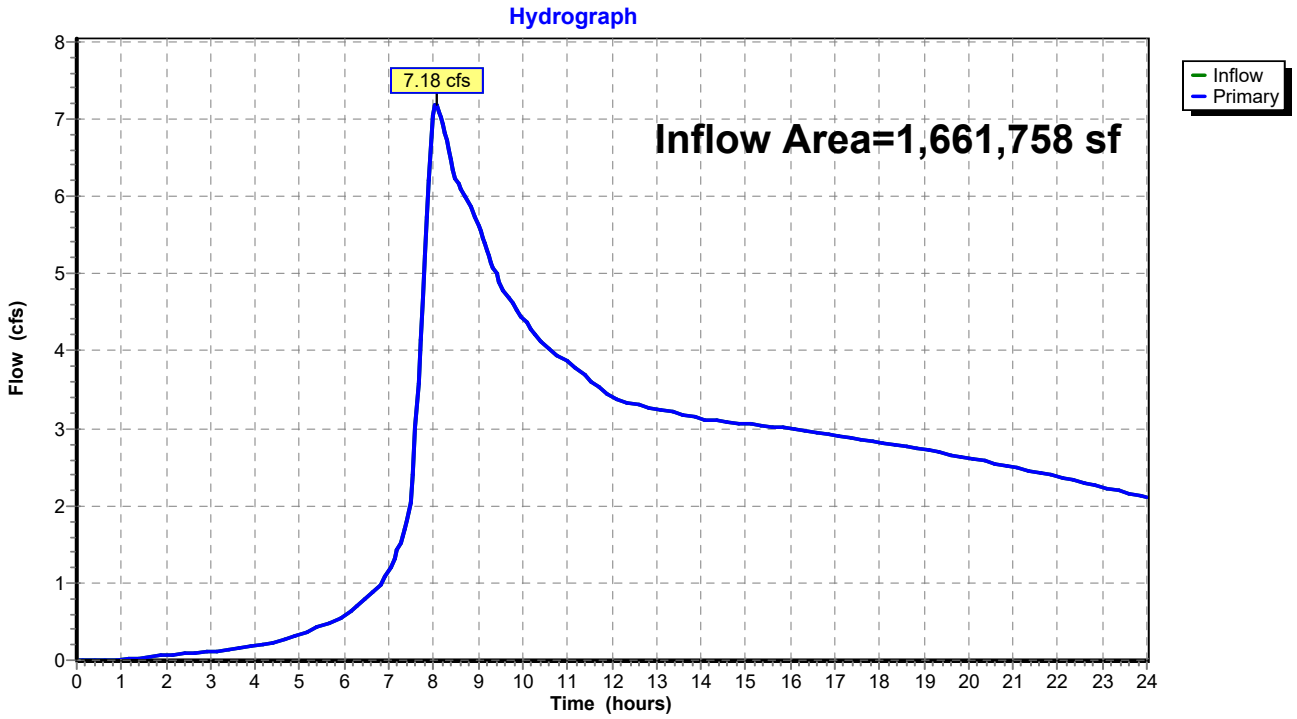


Summary for Link 2T: Pre-Dev Northeast

Inflow Area = 1,661,758 sf, 3.57% Impervious, Inflow Depth > 1.49" for 25-YEAR event
Inflow = 7.18 cfs @ 8.06 hrs, Volume= 206,235 cf
Primary = 7.18 cfs @ 8.06 hrs, Volume= 206,235 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2T: Pre-Dev Northeast

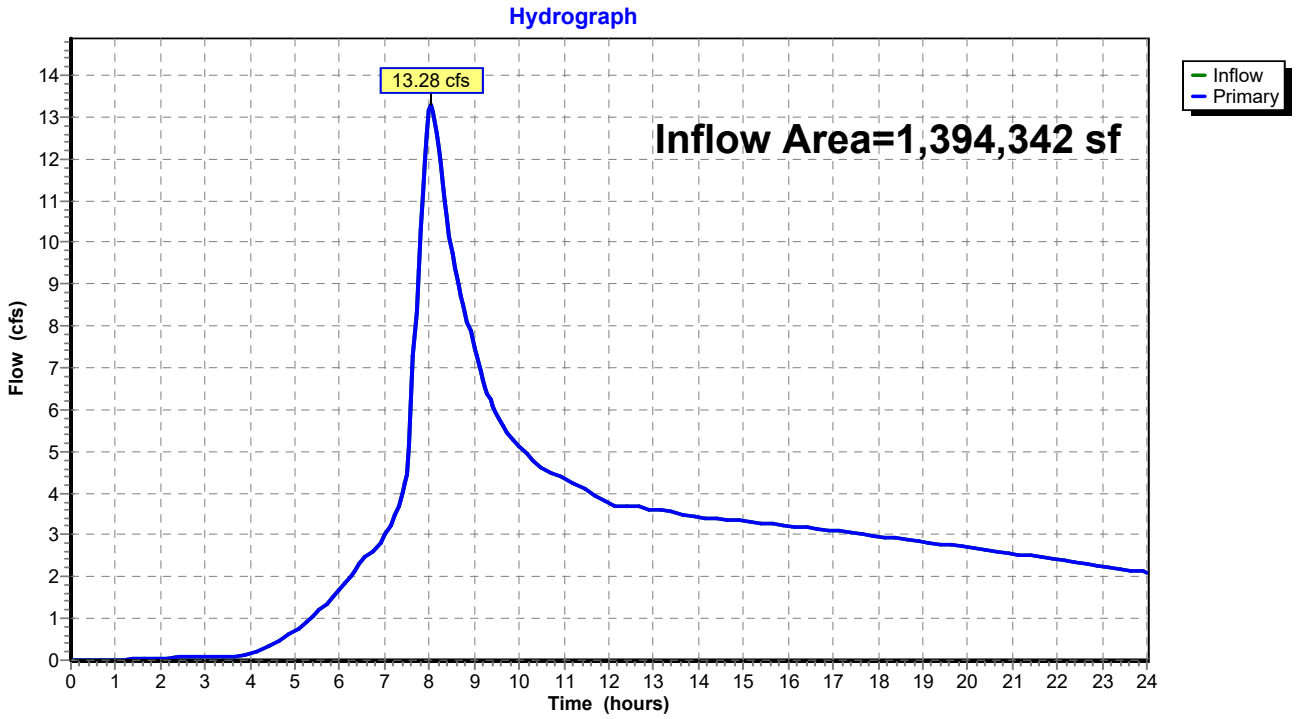


Summary for Link 3T: Pre-Dev Southwest

Inflow Area = 1,394,342 sf, 2.34% Impervious, Inflow Depth > 2.19" for 25-YEAR event
Inflow = 13.28 cfs @ 8.04 hrs, Volume= 254,497 cf
Primary = 13.28 cfs @ 8.04 hrs, Volume= 254,497 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3T: Pre-Dev Southwest



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>1.80"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=3.37 cfs 61,151 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>1.51"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=0.96 cfs 20,871 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>1.87"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=4.87 cfs 100,204 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>1.96"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=1.40 cfs 22,467 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>1.07"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=0.86 cfs 26,241 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>0.95"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.49 cfs 19,750 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>0.94"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=1.44 cfs 59,224 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>1.79"
Tc=5.0 min CN=79/98 Runoff=0.07 cfs 1,124 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>1.75"
Tc=5.0 min CN=79/98 Runoff=0.25 cfs 3,907 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>1.81"
Tc=5.0 min CN=79/98 Runoff=0.18 cfs 2,758 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>2.33"
Tc=51.0 min CN=79/98 Runoff=0.56 cfs 14,252 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.94"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.06 cfs 2,511 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.94"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.01 cfs 381 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>2.26"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.43 cfs 11,521 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>2.24"
Tc=5.0 min CN=74/98 Runoff=0.22 cfs 3,354 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.88"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.30 cfs 24,871 cf

Link 1T: Pre-Dev Total Inflow=15.98 cfs 374,586 cf
Primary=15.98 cfs 374,586 cf

Link 2T: Pre-Dev Northeast Inflow=5.30 cfs 164,135 cf
Primary=5.30 cfs 164,135 cf

Link 3T: Pre-Dev Southwest Inflow=10.68 cfs 210,452 cf
Primary=10.68 cfs 210,452 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 374,586 cf Average Runoff Depth = 1.47"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>1.51"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=2.75 cfs 51,402 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>1.24"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=0.75 cfs 17,237 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>1.58"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=4.00 cfs 84,565 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>1.66"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=1.16 cfs 19,043 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>0.85"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=0.61 cfs 20,911 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.35 cfs 15,540 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=1.02 cfs 46,586 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>1.51"
Tc=5.0 min CN=79/98 Runoff=0.06 cfs 949 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>1.47"
Tc=5.0 min CN=79/98 Runoff=0.20 cfs 3,290 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>1.53"
Tc=5.0 min CN=79/98 Runoff=0.15 cfs 2,334 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>2.03"
Tc=51.0 min CN=79/98 Runoff=0.48 cfs 12,409 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.04 cfs 1,975 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.74"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.01 cfs 300 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>1.95"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.37 cfs 9,950 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>1.95"
Tc=5.0 min CN=74/98 Runoff=0.19 cfs 2,917 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.59"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.07 cfs 21,089 cf

Link 1T: Pre-Dev Total Inflow=12.70 cfs 310,499 cf
Primary=12.70 cfs 310,499 cf

Link 2T: Pre-Dev Northeast Inflow=3.97 cfs 133,288 cf
Primary=3.97 cfs 133,288 cf

Link 3T: Pre-Dev Southwest Inflow=8.74 cfs 177,211 cf
Primary=8.74 cfs 177,211 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 310,499 cf Average Runoff Depth = 1.22"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10S: Runoff Area=407,524 sf 0.00% Impervious Runoff Depth>1.05"
Flow Length=650' Tc=17.2 min CN=83/0 Runoff=1.76 cfs 35,504 cf

Subcatchment20S: Runoff Area=166,164 sf 0.00% Impervious Runoff Depth>0.82"
Flow Length=465' Tc=23.3 min CN=79/0 Runoff=0.43 cfs 11,422 cf

Subcatchment30S: Runoff Area=643,684 sf 0.00% Impervious Runoff Depth>1.10"
Flow Length=624' Tc=26.9 min CN=84/0 Runoff=2.58 cfs 58,954 cf

Subcatchment40S: Runoff Area=137,415 sf 0.00% Impervious Runoff Depth>1.17"
Flow Length=280' Tc=11.5 min CN=85/0 Runoff=0.77 cfs 13,412 cf

Subcatchment50S: Runoff Area=295,021 sf 0.00% Impervious Runoff Depth>0.52"
Flow Length=1,575' Tc=29.0 min CN=72/0 Runoff=0.27 cfs 12,697 cf

Subcatchment60S: Runoff Area=250,731 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=1,650' Tc=46.2 min CN=70/0 Runoff=0.17 cfs 9,135 cf

Subcatchment70S: Runoff Area=754,638 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.51 cfs 27,369 cf

Subcatchment80S: Norwood Undisturbed Runoff Area=7,546 sf 15.66% Impervious Runoff Depth>1.06"
Tc=5.0 min CN=79/98 Runoff=0.04 cfs 666 cf

Subcatchment90S: Norwood Undisturbed Runoff Area=26,839 sf 13.26% Impervious Runoff Depth>1.02"
Tc=5.0 min CN=79/98 Runoff=0.13 cfs 2,292 cf

Subcatchment100S: Norwood Runoff Area=18,245 sf 17.23% Impervious Runoff Depth>1.08"
Tc=5.0 min CN=79/98 Runoff=0.10 cfs 1,644 cf

Subcatchment110S: Norwood Runoff Area=73,346 sf 50.70% Impervious Runoff Depth>1.53"
Tc=51.0 min CN=79/98 Runoff=0.36 cfs 9,343 cf

Subcatchment120S: Onsite Undisturbed Runoff Area=31,991 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.02 cfs 1,160 cf

Subcatchment130S: Onsite Undisturbed Runoff Area=4,856 sf 0.00% Impervious Runoff Depth>0.44"
Flow Length=2,810' Tc=51.0 min CN=70/0 Runoff=0.00 cfs 176 cf

Subcatchment140X: City Reservoir Runoff Area=61,130 sf 23.26% Impervious Runoff Depth>1.44"
Flow Length=2,860' Tc=59.4 min CN=86/98 Runoff=0.26 cfs 7,333 cf

Subcatchment150X: Upstream Boones Runoff Area=17,970 sf 51.67% Impervious Runoff Depth>1.46"
Tc=5.0 min CN=74/98 Runoff=0.14 cfs 2,193 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.13"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=0.71 cfs 14,912 cf

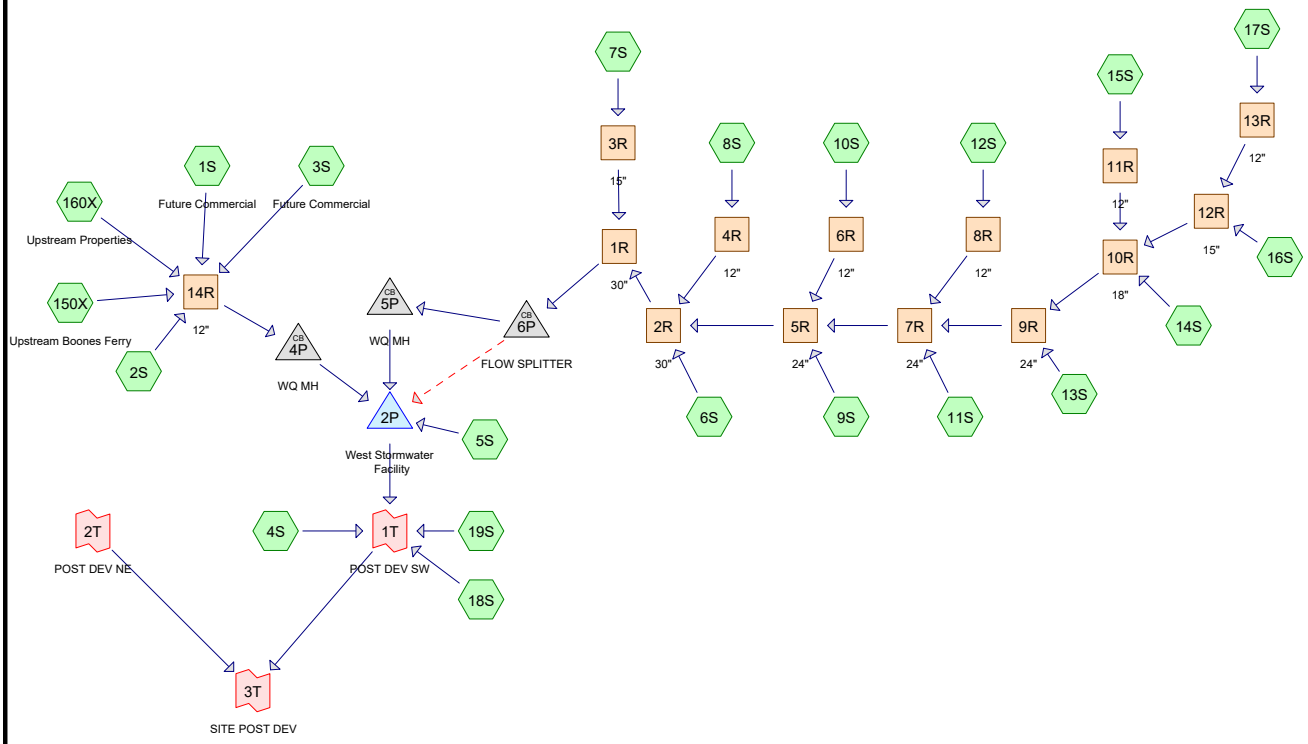
Link 1T: Pre-Dev Total Inflow=7.68 cfs 208,210 cf
Primary=7.68 cfs 208,210 cf

Link 2T: Pre-Dev Northeast Inflow=2.08 cfs 85,226 cf
Primary=2.08 cfs 85,226 cf

Link 3T: Pre-Dev Southwest Inflow=5.60 cfs 122,984 cf
Primary=5.60 cfs 122,984 cf

Total Runoff Area = 3,056,100 sf Runoff Volume = 208,210 cf Average Runoff Depth = 0.82"
96.99% Pervious = 2,964,160 sf 3.01% Impervious = 91,940 sf

Appendix B:
HydroCAD Reports for
Post-Developed Condition Storm Events
(25-Year Storm Event Analysis)
(10-Year Storm Event Summary)
(5-Year Storm Event Summary)
(2-Year Storm Event Summary)



Subcat Reach Pond Link

Routing Diagram for 7454 PH3 Post-Developed Model
Prepared by AKS Engineering & Forestry, Printed 3/7/2023
HydroCAD® 10.00-22 s/n 01338 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
122,699	79	50-75% Grass cover, Fair, HSG C (160X)
74,761	98	85% Impervious - Future Commercial (1S, 3S)
492,853	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 18S, 19S, 150X)
5,428	98	AC Path, HSG C (18S)
12,930	96	Gravel surface, HSG C (160X)
36,602	98	Impervious Area (150X, 160X)
541,200	98	Impervious Area on Lots (2,640 sq.ft. per lot) (6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S)
278,700	98	Paved roads w/curbs & sewers, HSG C (2S, 4S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S, 16S, 17S)
1,565,173	**89**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>3.34"
Tc=5.0 min CN=74/98 Runoff=0.51 cfs 7,486 cf

Subcatchment2S: Runoff Area=18,013 sf 90.00% Impervious Runoff Depth>3.45"
Tc=5.0 min CN=74/98 Runoff=0.35 cfs 5,172 cf

Subcatchment3S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>3.34"
Tc=5.0 min CN=74/98 Runoff=1.16 cfs 16,981 cf

Subcatchment4S: Runoff Area=12,600 sf 50.00% Impervious Runoff Depth>2.59"
Tc=5.0 min CN=74/98 Runoff=0.18 cfs 2,718 cf

Subcatchment5S: Runoff Area=55,448 sf 0.00% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=74/0 Runoff=0.41 cfs 7,018 cf

Subcatchment6S: Runoff Area=101,637 sf 77.66% Impervious Runoff Depth>3.18"
Tc=5.0 min CN=74/98 Runoff=1.82 cfs 26,943 cf

Subcatchment7S: Runoff Area=219,254 sf 70.79% Impervious Runoff Depth>3.03"
Tc=5.0 min CN=74/98 Runoff=3.71 cfs 55,436 cf

Subcatchment8S: Runoff Area=70,949 sf 71.75% Impervious Runoff Depth>3.05"
Tc=5.0 min CN=74/98 Runoff=1.21 cfs 18,060 cf

Subcatchment9S: Runoff Area=49,396 sf 78.05% Impervious Runoff Depth>3.19"
Tc=5.0 min CN=74/98 Runoff=0.89 cfs 13,129 cf

Subcatchment10S: Runoff Area=61,962 sf 73.84% Impervious Runoff Depth>3.10"
Tc=5.0 min CN=74/98 Runoff=1.08 cfs 16,003 cf

Subcatchment11S: Runoff Area=62,812 sf 73.24% Impervious Runoff Depth>3.09"
Tc=5.0 min CN=74/98 Runoff=1.09 cfs 16,155 cf

Subcatchment12S: Runoff Area=107,045 sf 68.50% Impervious Runoff Depth>2.98"
Tc=5.0 min CN=74/98 Runoff=1.78 cfs 26,627 cf

Subcatchment13S: Runoff Area=110,619 sf 75.56% Impervious Runoff Depth>3.14"
Tc=5.0 min CN=74/98 Runoff=1.95 cfs 28,909 cf

Subcatchment14S: Runoff Area=52,083 sf 68.79% Impervious Runoff Depth>2.99"
Tc=5.0 min CN=74/98 Runoff=0.87 cfs 12,983 cf

Subcatchment15S: Runoff Area=139,826 sf 59.12% Impervious Runoff Depth>2.78"
Tc=5.0 min CN=74/98 Runoff=2.14 cfs 32,441 cf

Subcatchment16S: Runoff Area=39,881 sf 91.05% Impervious Runoff Depth>3.47"
Tc=5.0 min CN=74/98 Runoff=0.79 cfs 11,524 cf

Subcatchment17S: Runoff Area=124,499 sf 56.48% Impervious Runoff Depth>2.73"
Tc=5.0 min CN=74/98 Runoff=1.86 cfs 28,301 cf

Subcatchment18S: Runoff Area=68,508 sf 7.92% Impervious Runoff Depth>1.69"
Tc=5.0 min CN=74/98 Runoff=0.57 cfs 9,639 cf

Subcatchment19S: Runoff Area=8,600 sf 0.00% Impervious Runoff Depth>1.52"
Tc=5.0 min CN=74/0 Runoff=0.06 cfs 1,089 cf

Subcatchment150X: Upstream Boones Runoff Area=15,087 sf 87.70% Impervious Runoff Depth>3.40"
Tc=5.0 min CN=74/98 Runoff=0.29 cfs 4,270 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>2.26"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.61 cfs 29,881 cf

Reach 1R: 30" Avg. Flow Depth=0.71' Max Vel=16.54 fps Inflow=19.15 cfs 286,155 cf
30.0" Round Pipe n=0.013 L=185.5' S=0.0686 '/' Capacity=107.45 cfs Outflow=19.15 cfs 286,115 cf

Reach 2R: 30" Avg. Flow Depth=1.39' Max Vel=5.50 fps Inflow=15.44 cfs 230,802 cf
30.0" Round Pipe n=0.013 L=123.0' S=0.0040 '/' Capacity=25.89 cfs Outflow=15.44 cfs 230,739 cf

Reach 3R: 15" Avg. Flow Depth=0.68' Max Vel=5.44 fps Inflow=3.71 cfs 55,436 cf
15.0" Round Pipe n=0.013 L=166.2' S=0.0100 '/' Capacity=6.46 cfs Outflow=3.71 cfs 55,416 cf

Reach 4R: 12" Avg. Flow Depth=0.29' Max Vel=6.45 fps Inflow=1.21 cfs 18,060 cf
12.0" Round Pipe n=0.013 L=109.0' S=0.0350 '/' Capacity=6.67 cfs Outflow=1.21 cfs 18,056 cf

Reach 5R: 24" Avg. Flow Depth=1.46' Max Vel=5.05 fps Inflow=12.42 cfs 185,822 cf
24.0" Round Pipe n=0.013 L=44.0' S=0.0039 '/' Capacity=14.06 cfs Outflow=12.42 cfs 185,803 cf

Reach 6R: 12" Avg. Flow Depth=0.28' Max Vel=5.90 fps Inflow=1.08 cfs 16,003 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0300 '/' Capacity=6.17 cfs Outflow=1.08 cfs 15,998 cf

Reach 7R: 24" Avg. Flow Depth=1.27' Max Vel=4.97 fps Inflow=10.46 cfs 156,797 cf
24.0" Round Pipe n=0.013 L=270.0' S=0.0040 '/' Capacity=14.31 cfs Outflow=10.46 cfs 156,695 cf

Reach 8R: 12" Avg. Flow Depth=0.40' Max Vel=6.07 fps Inflow=1.78 cfs 26,627 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0220 '/' Capacity=5.28 cfs Outflow=1.78 cfs 26,620 cf

Reach 9R: 24" Avg. Flow Depth=1.04' Max Vel=4.63 fps Inflow=7.60 cfs 114,086 cf
24.0" Round Pipe n=0.013 L=209.6' S=0.0040 '/' Capacity=14.32 cfs Outflow=7.60 cfs 114,022 cf

Reach 10R: 18" Avg. Flow Depth=1.07' Max Vel=4.20 fps Inflow=5.66 cfs 85,191 cf
18.0" Round Pipe n=0.013 L=60.6' S=0.0040 '/' Capacity=6.61 cfs Outflow=5.66 cfs 85,177 cf

Reach 11R: 12" Avg. Flow Depth=0.71' Max Vel=3.61 fps Inflow=2.14 cfs 32,441 cf
12.0" Round Pipe n=0.013 L=125.3' S=0.0050 '/' Capacity=2.53 cfs Outflow=2.14 cfs 32,428 cf

Reach 12R: 15" Avg. Flow Depth=0.73' Max Vel=3.54 fps Inflow=2.65 cfs 39,818 cf
15.0" Round Pipe n=0.013 L=268.1' S=0.0040 '/' Capacity=4.08 cfs Outflow=2.65 cfs 39,781 cf

Reach 13R: 12" Avg. Flow Depth=0.51' Max Vel=4.59 fps Inflow=1.86 cfs 28,301 cf
12.0" Round Pipe n=0.013 L=98.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=1.86 cfs 28,293 cf

Reach 14R: 12" Avg. Flow Depth=0.52' Max Vel=9.25 fps Inflow=3.85 cfs 63,789 cf
12.0" Round Pipe n=0.013 L=163.8' S=0.0400 '/' Capacity=7.12 cfs Outflow=3.85 cfs 63,775 cf

Pond 2P: West Stormwater Facility Peak Elev=323.98' Storage=117,534 cf Inflow=23.37 cfs 356,908 cf
Outflow=9.58 cfs 256,784 cf

Pond 4P: WQ MH Peak Elev=324.52' Inflow=3.85 cfs 63,775 cf
12.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=3.85 cfs 63,775 cf

Pond 5P: WQ MH Peak Elev=324.02' Inflow=2.18 cfs 61,720 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0040 '/' Outflow=2.18 cfs 61,720 cf

Pond 6P: FLOW SPLITTER Peak Elev=324.07' Inflow=19.15 cfs 286,115 cf
Primary=2.18 cfs 61,720 cf Secondary=17.15 cfs 224,395 cf Outflow=19.15 cfs 286,115 cf

Link 1T: POST DEV SW Inflow=9.94 cfs 270,230 cf
Primary=9.94 cfs 270,230 cf

Link 2T: POST DEV NE Manual Hydrograph
Primary=0.00 cfs 0 cf

Link 3T: SITE POST DEV Inflow=9.94 cfs 270,230 cf
Primary=9.94 cfs 270,230 cf

Total Runoff Area = 1,565,173 sf Runoff Volume = 370,765 cf Average Runoff Depth = 2.84"
40.15% Pervious = 628,482 sf 59.85% Impervious = 936,691 sf

Summary for Subcatchment 1S: Future Commercial

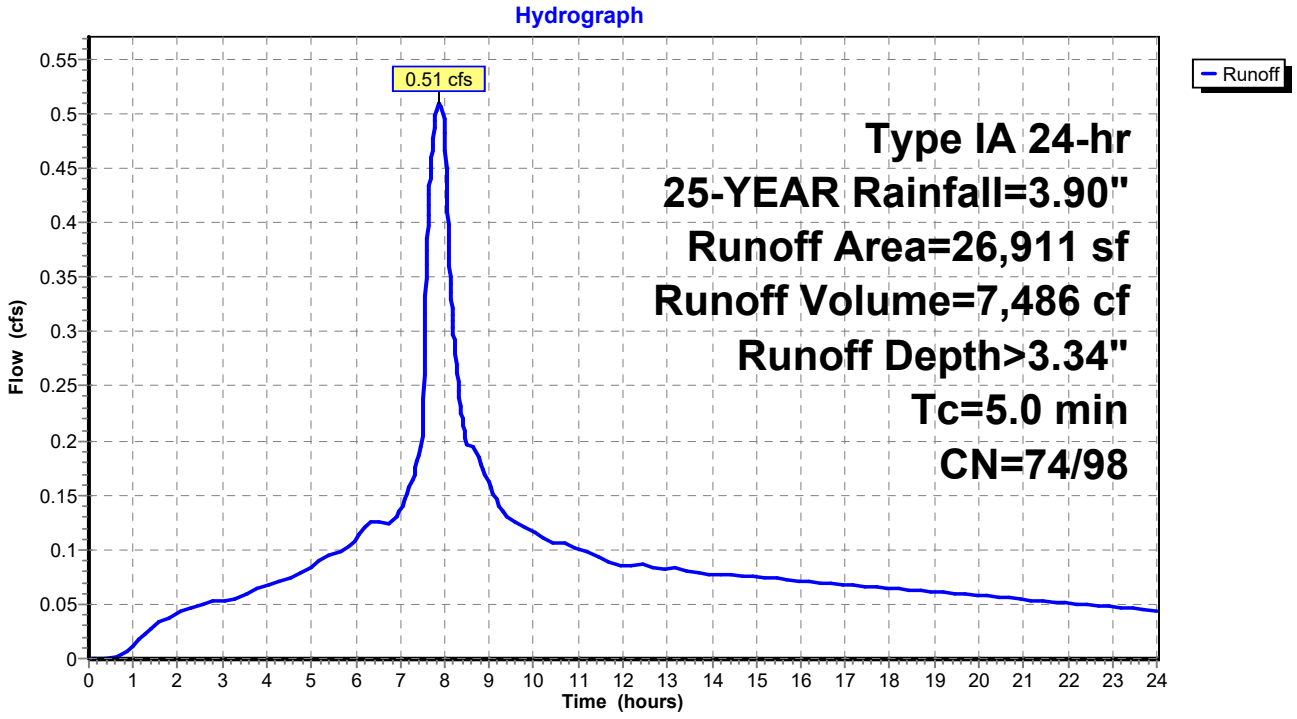
Runoff = 0.51 cfs @ 7.89 hrs, Volume= 7,486 cf, Depth> 3.34"

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

	Area (sf)	CN	Description
*	22,874	98	85% Impervious - Future Commercial
	4,037	74	>75% Grass cover, Good, HSG C
	26,911	94	Weighted Average
	4,037	74	15.00% Pervious Area
	22,874	98	85.00% Impervious Area

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

Subcatchment 1S: Future Commercial



Summary for Subcatchment 2S:

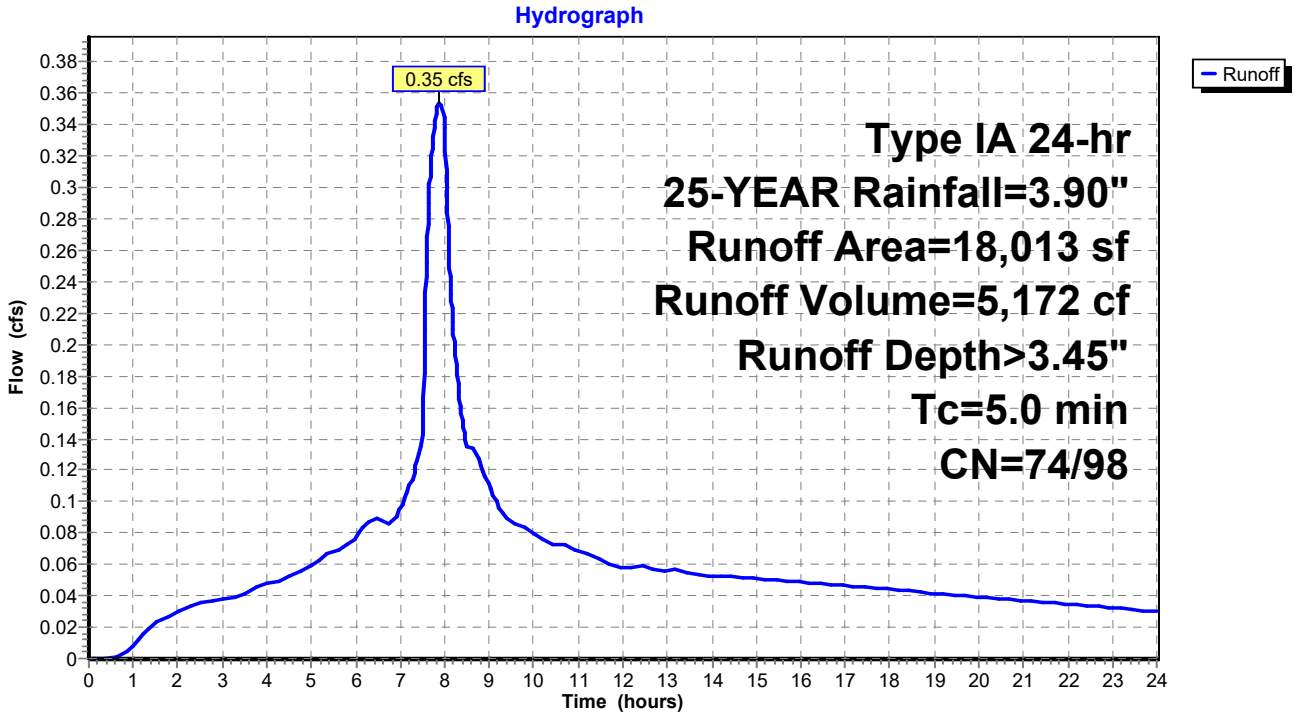
Runoff = 0.35 cfs @ 7.88 hrs, Volume= 5,172 cf, Depth> 3.45"

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

Area (sf)	CN	Description
16,212	98	Paved roads w/curbs & sewers, HSG C
1,801	74	>75% Grass cover, Good, HSG C
18,013	96	Weighted Average
1,801	74	10.00% Pervious Area
16,212	98	90.00% Impervious Area

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

Subcatchment 2S:



Summary for Subcatchment 3S: Future Commercial

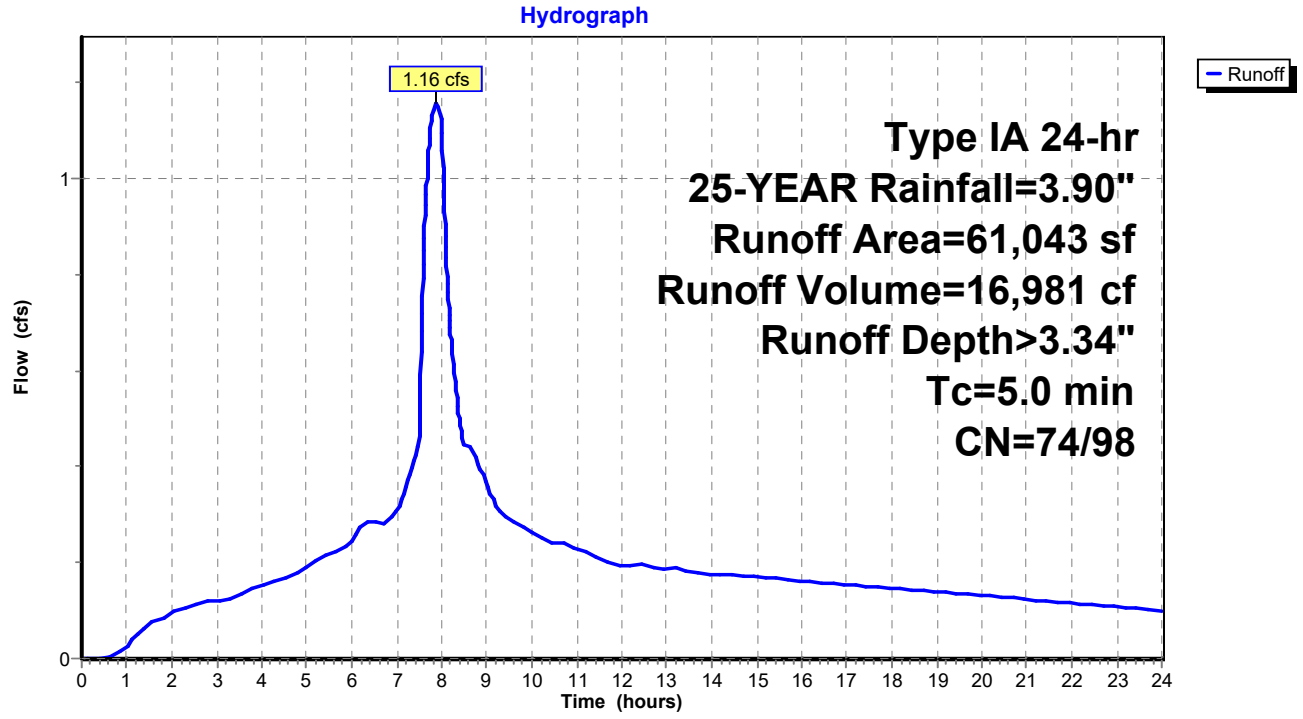
Runoff = 1.16 cfs @ 7.89 hrs, Volume= 16,981 cf, Depth> 3.34"

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

	Area (sf)	CN	Description
*	51,887	98	85% Impervious - Future Commercial
	9,156	74	>75% Grass cover, Good, HSG C
	61,043	94	Weighted Average
	9,156	74	15.00% Pervious Area
	51,887	98	85.00% Impervious Area

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

Subcatchment 3S: Future Commercial



Summary for Subcatchment 4S:

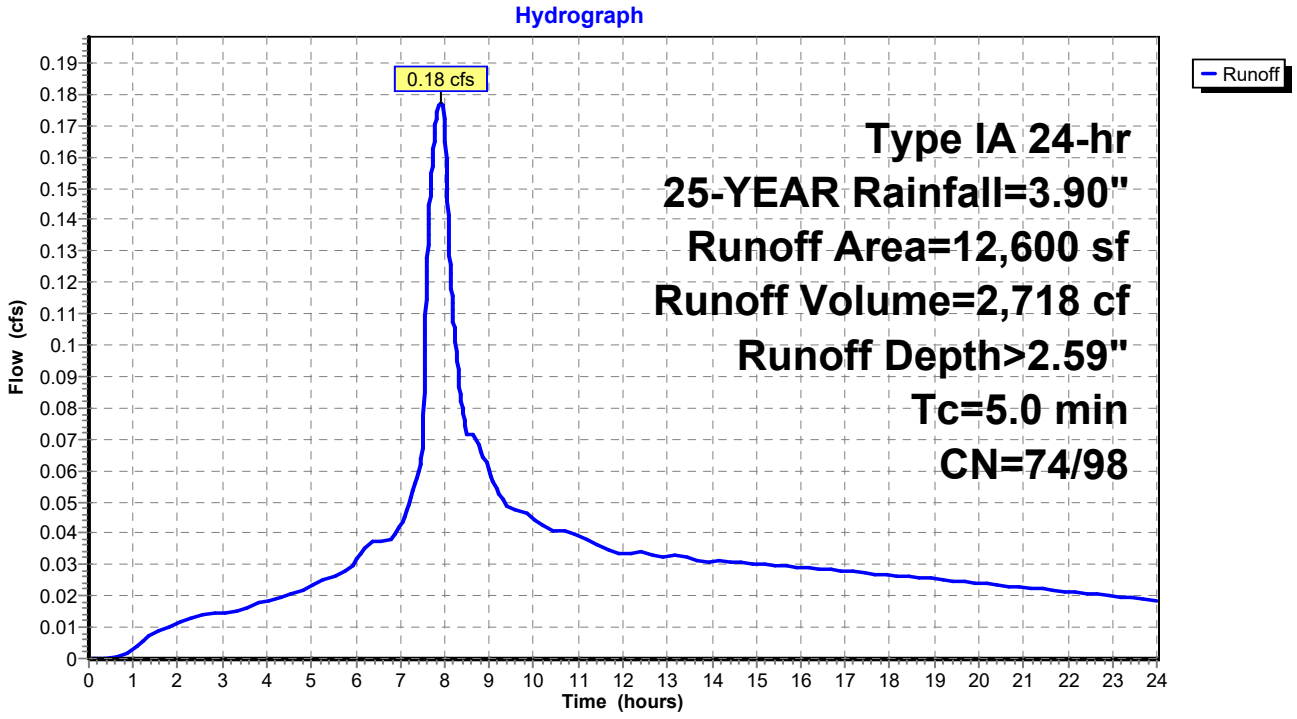
Runoff = 0.18 cfs @ 7.92 hrs, Volume= 2,718 cf, Depth> 2.59"

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

Area (sf)	CN	Description
6,300	98	Paved roads w/curbs & sewers, HSG C
6,300	74	>75% Grass cover, Good, HSG C
12,600	86	Weighted Average
6,300	74	50.00% Pervious Area
6,300	98	50.00% Impervious Area

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

Subcatchment 4S:



Summary for Subcatchment 5S:

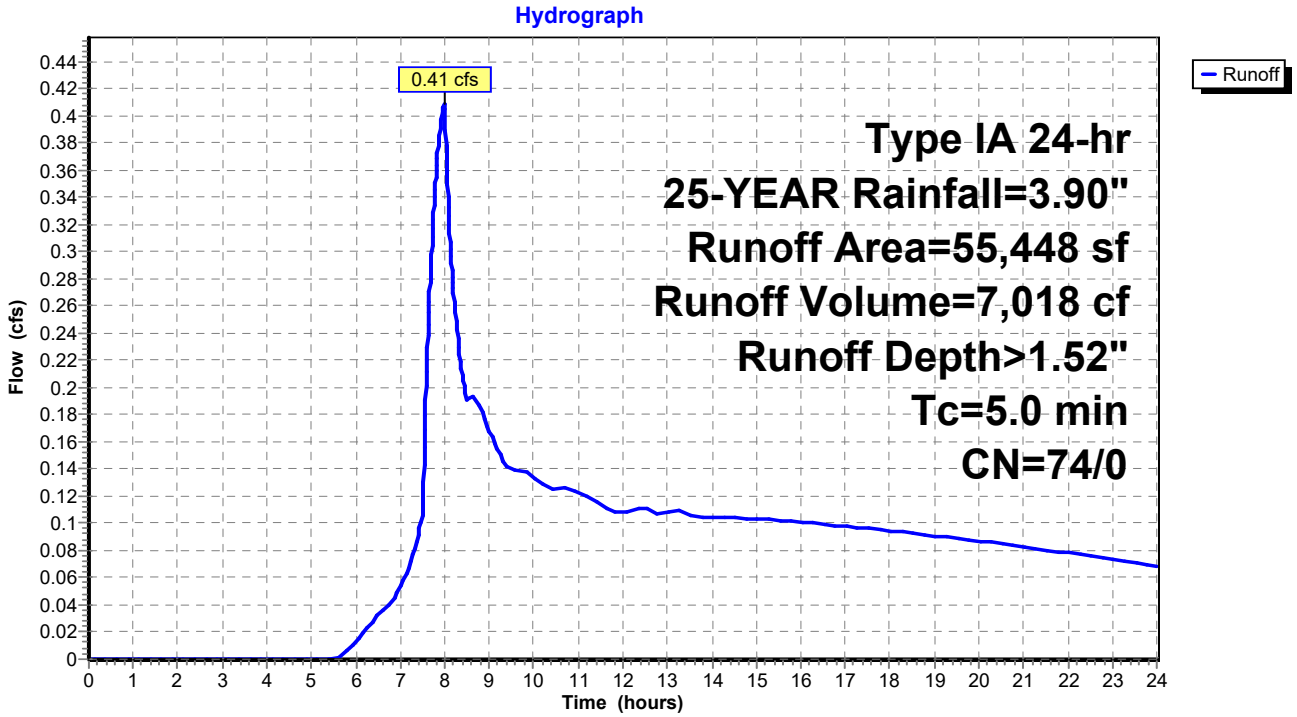
Runoff = 0.41 cfs @ 8.00 hrs, Volume= 7,018 cf, Depth> 1.52"

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

Area (sf)	CN	Description
55,448	74	>75% Grass cover, Good, HSG C
55,448	74	100.00% Pervious Area

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

Subcatchment 5S:



Summary for Subcatchment 6S:

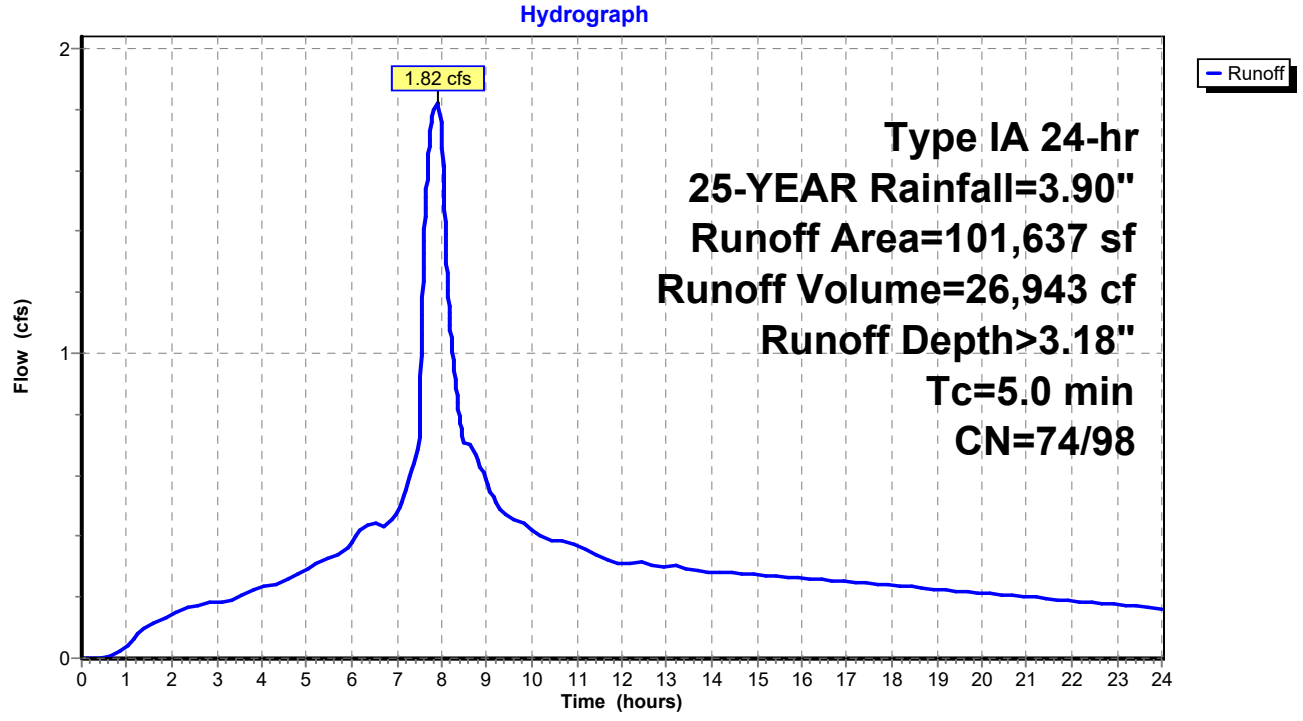
Runoff = 1.82 cfs @ 7.89 hrs, Volume= 26,943 cf, Depth> 3.18"

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

	Area (sf)	CN	Description
	23,492	98	Paved roads w/curbs & sewers, HSG C
	22,705	74	>75% Grass cover, Good, HSG C
*	55,440	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	101,637	93	Weighted Average
	22,705	74	22.34% Pervious Area
	78,932	98	77.66% Impervious Area

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

Subcatchment 6S:



Summary for Subcatchment 7S:

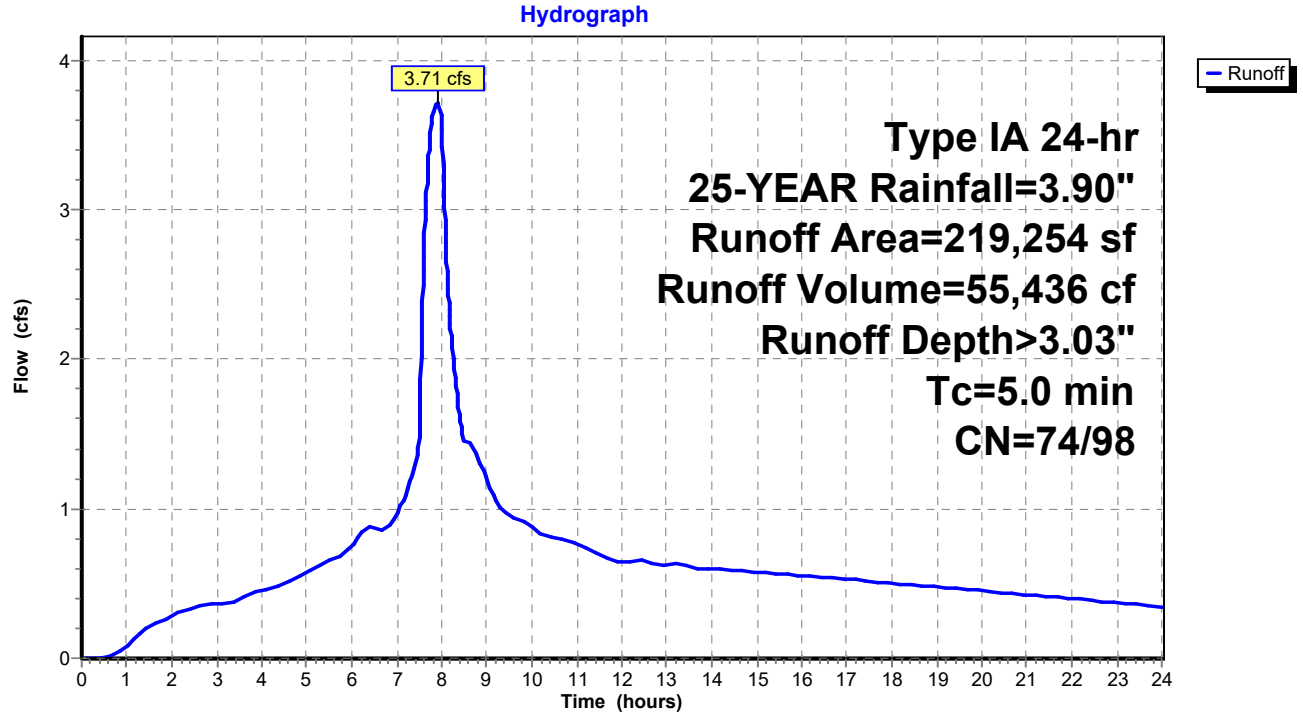
Runoff = 3.71 cfs @ 7.90 hrs, Volume= 55,436 cf, Depth> 3.03"

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

	Area (sf)	CN	Description
	44,336	98	Paved roads w/curbs & sewers, HSG C
	64,038	74	>75% Grass cover, Good, HSG C
*	110,880	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	219,254	91	Weighted Average
	64,038	74	29.21% Pervious Area
	155,216	98	70.79% Impervious Area

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

Subcatchment 7S:



Summary for Subcatchment 8S:

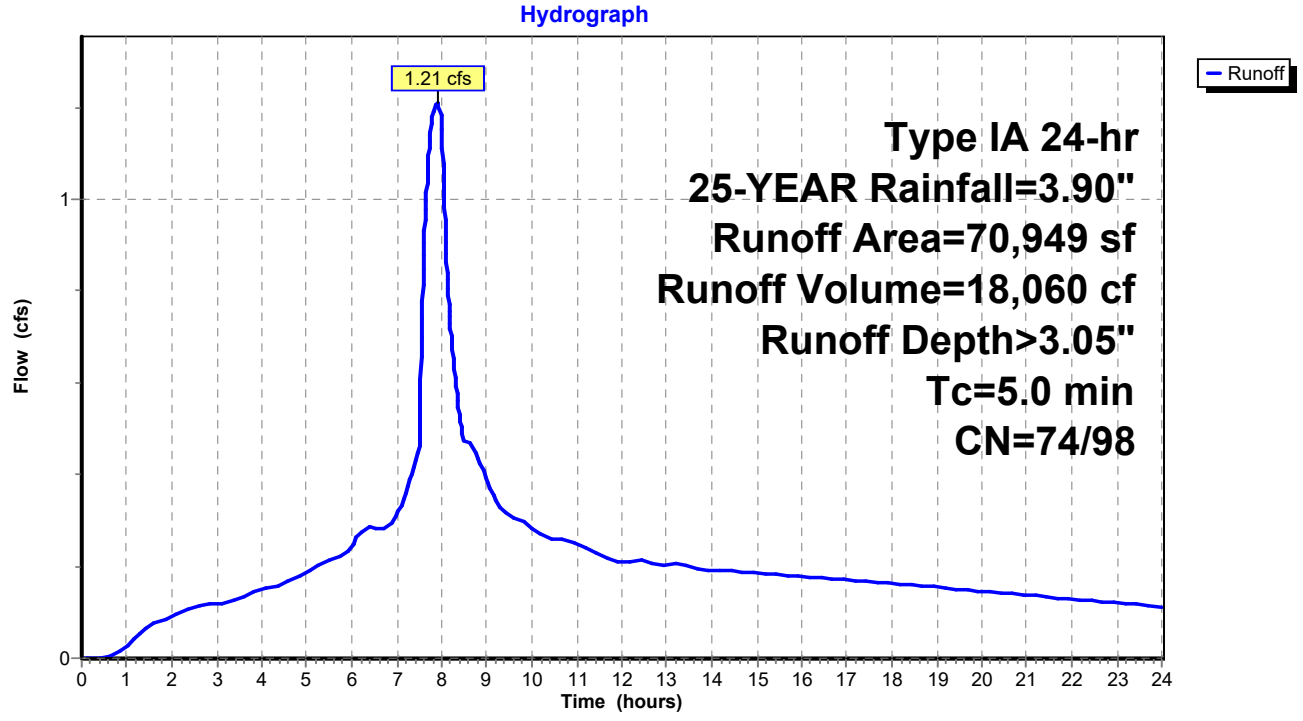
Runoff = 1.21 cfs @ 7.90 hrs, Volume= 18,060 cf, Depth> 3.05"

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

	Area (sf)	CN	Description
	19,227	98	Paved roads w/curbs & sewers, HSG C
	20,042	74	>75% Grass cover, Good, HSG C
*	31,680	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	70,949	91	Weighted Average
	20,042	74	28.25% Pervious Area
	50,907	98	71.75% Impervious Area

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

Subcatchment 8S:



Summary for Subcatchment 9S:

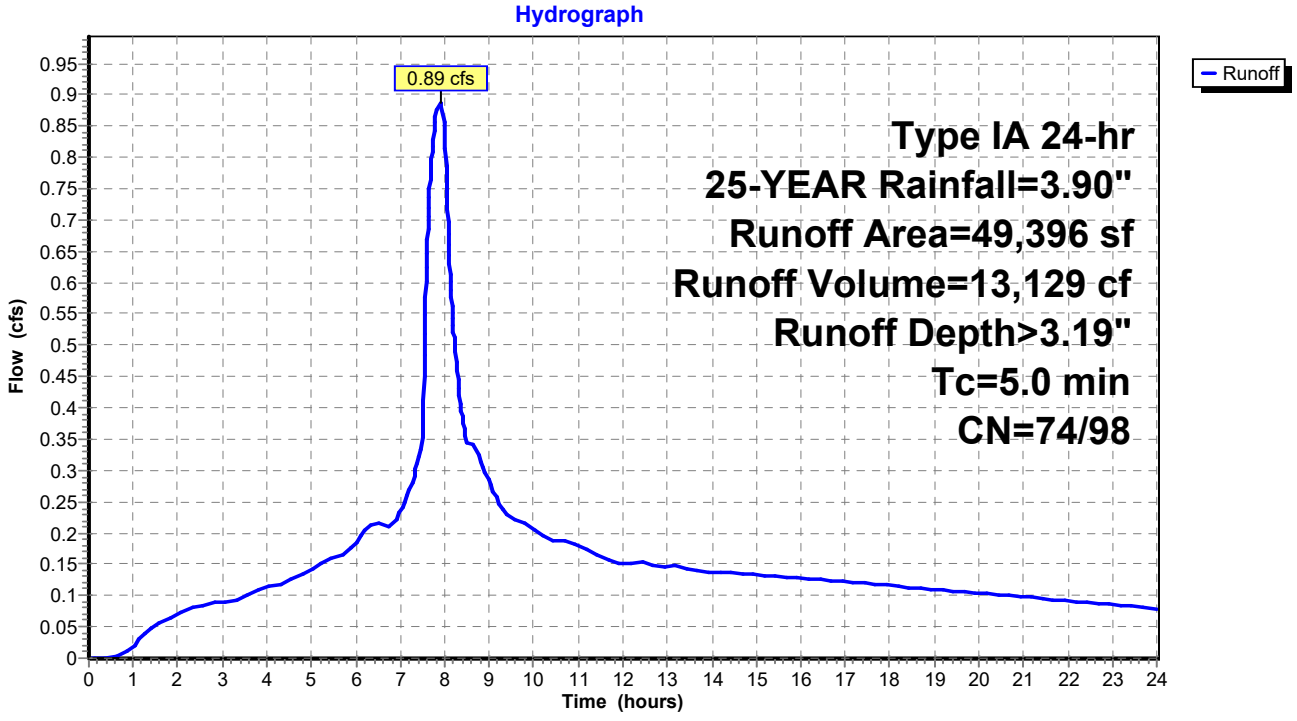
Runoff = 0.89 cfs @ 7.89 hrs, Volume= 13,129 cf, Depth> 3.19"

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

	Area (sf)	CN	Description
	9,513	98	Paved roads w/curbs & sewers, HSG C
	10,843	74	>75% Grass cover, Good, HSG C
*	29,040	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	49,396	93	Weighted Average
	10,843	74	21.95% Pervious Area
	38,553	98	78.05% Impervious Area

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

Subcatchment 9S:



Summary for Subcatchment 10S:

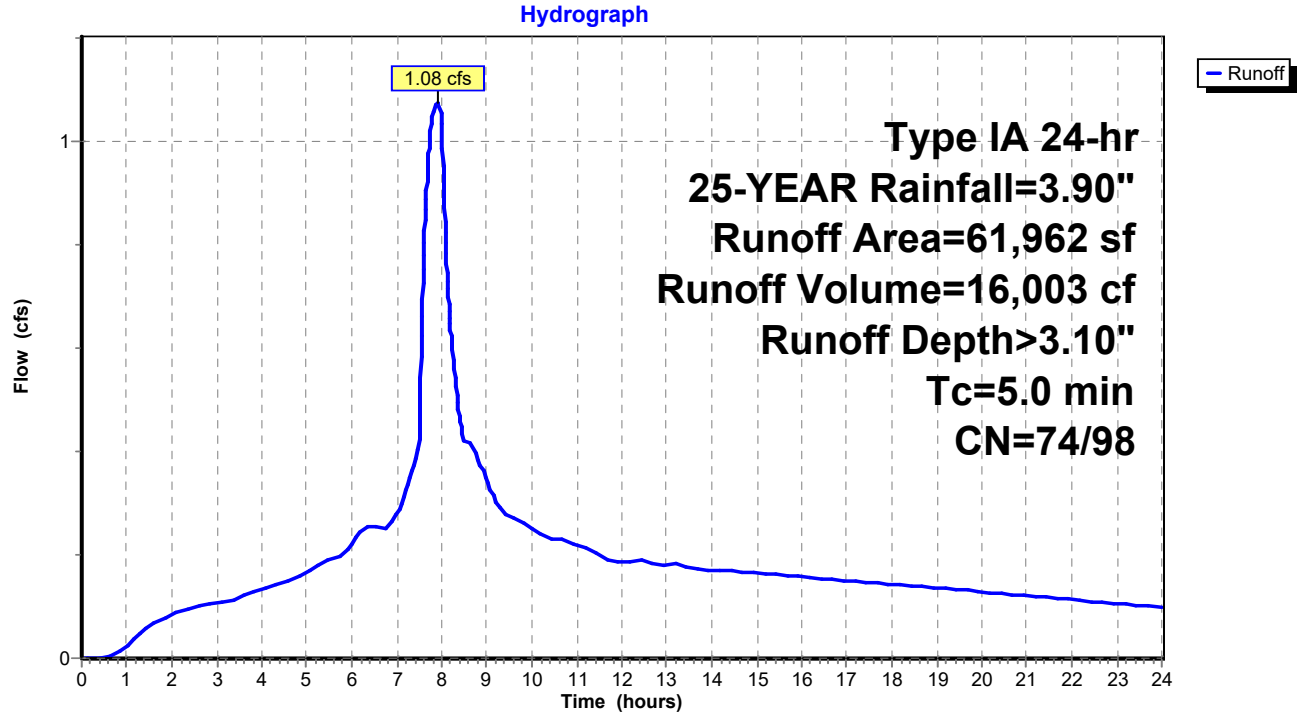
Runoff = 1.08 cfs @ 7.89 hrs, Volume= 16,003 cf, Depth> 3.10"

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

	Area (sf)	CN	Description
	19,351	98	Paved roads w/curbs & sewers, HSG C
	16,211	74	>75% Grass cover, Good, HSG C
*	26,400	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	61,962	92	Weighted Average
	16,211	74	26.16% Pervious Area
	45,751	98	73.84% Impervious Area

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

Subcatchment 10S:



Summary for Subcatchment 11S:

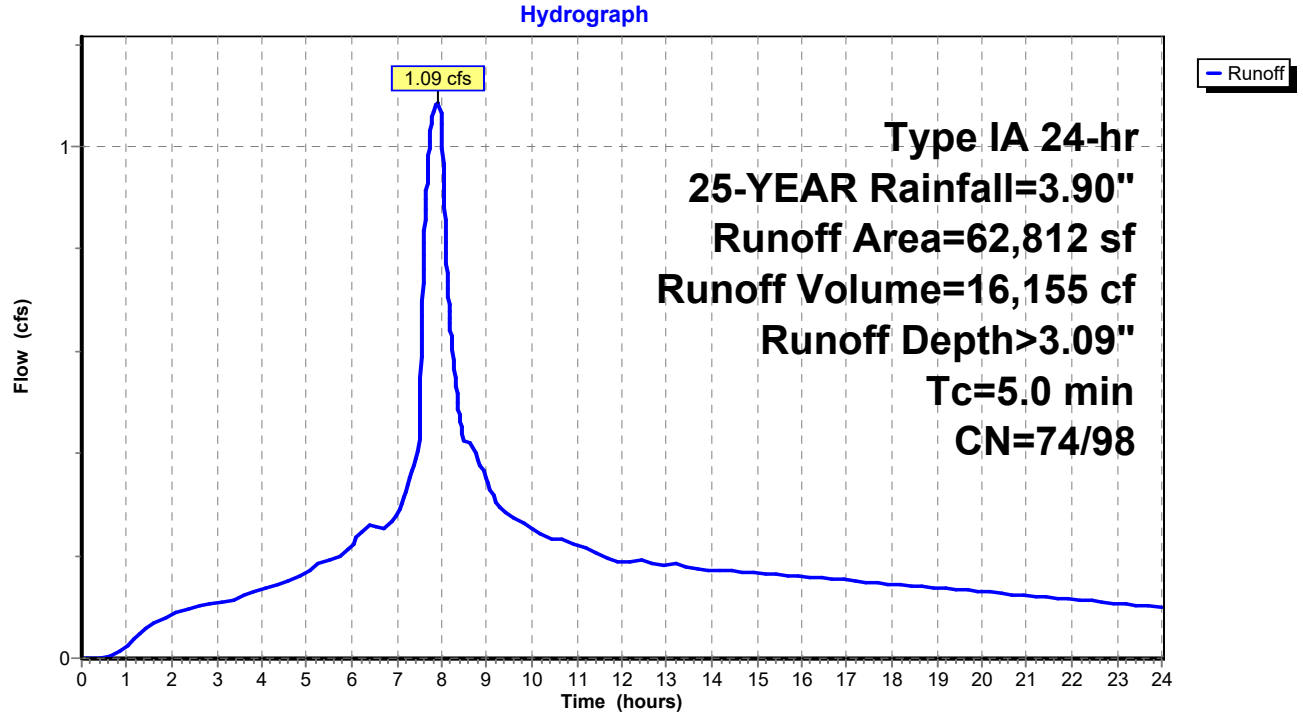
Runoff = 1.09 cfs @ 7.89 hrs, Volume= 16,155 cf, Depth> 3.09"

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

	Area (sf)	CN	Description
	11,681	98	Paved roads w/curbs & sewers, HSG C
	16,811	74	>75% Grass cover, Good, HSG C
*	34,320	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	62,812	92	Weighted Average
	16,811	74	26.76% Pervious Area
	46,001	98	73.24% Impervious Area

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

Subcatchment 11S:



Summary for Subcatchment 12S:

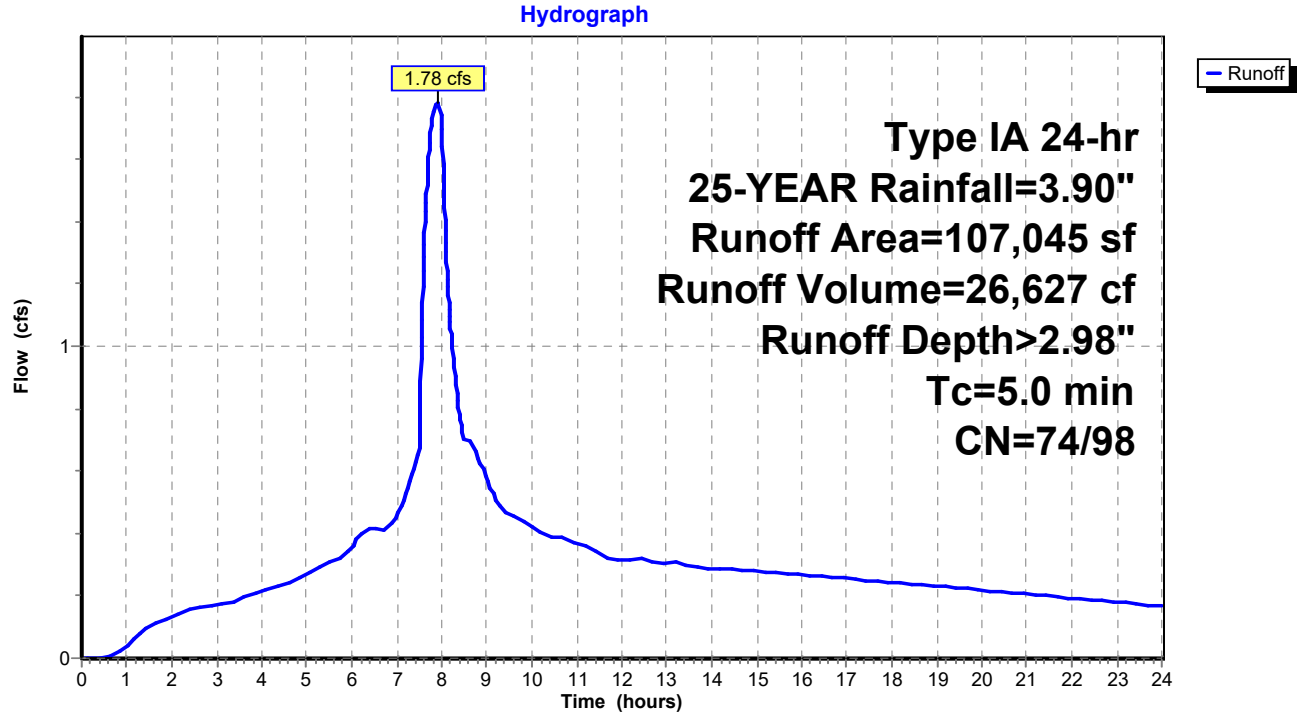
Runoff = 1.78 cfs @ 7.90 hrs, Volume= 26,627 cf, Depth> 2.98"

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

	Area (sf)	CN	Description
	31,084	98	Paved roads w/curbs & sewers, HSG C
	33,721	74	>75% Grass cover, Good, HSG C
*	42,240	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	107,045	90	Weighted Average
	33,721	74	31.50% Pervious Area
	73,324	98	68.50% Impervious Area

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

Subcatchment 12S:



Summary for Subcatchment 13S:

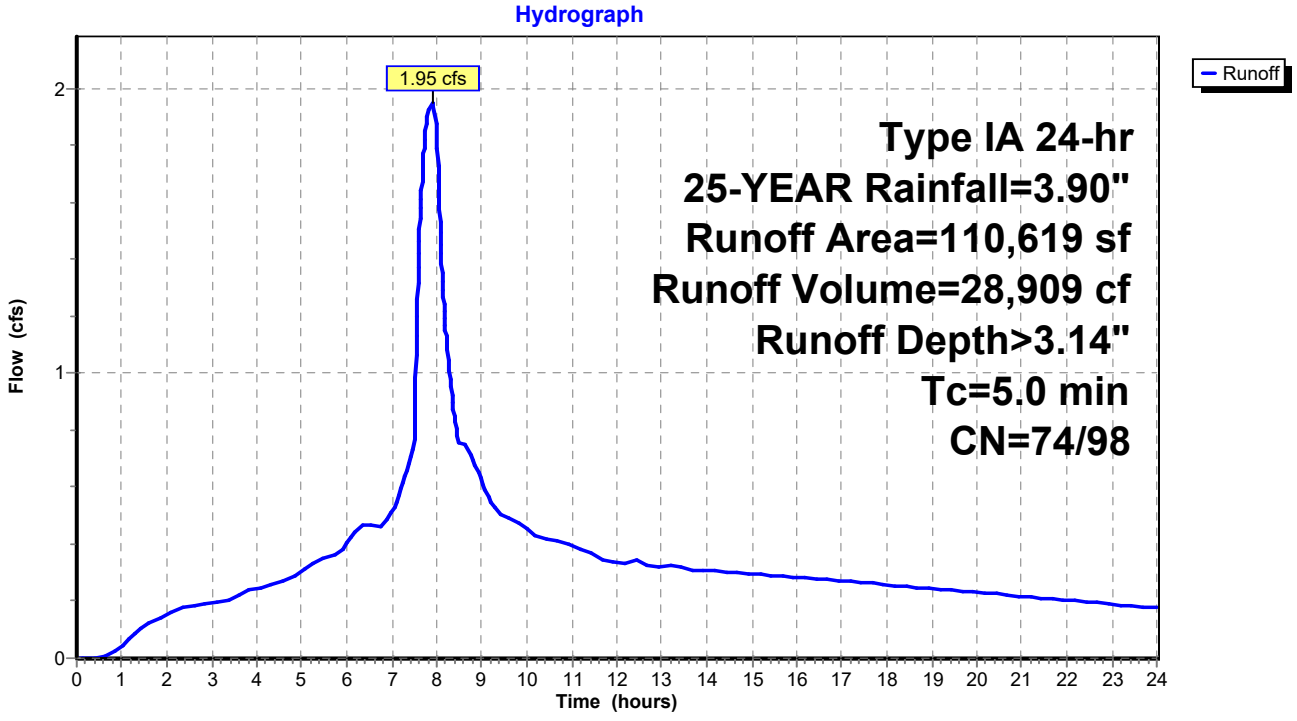
Runoff = 1.95 cfs @ 7.89 hrs, Volume= 28,909 cf, Depth> 3.14"

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

	Area (sf)	CN	Description
	20,222	98	Paved roads w/curbs & sewers, HSG C
	27,037	74	>75% Grass cover, Good, HSG C
*	63,360	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	110,619	92	Weighted Average
	27,037	74	24.44% Pervious Area
	83,582	98	75.56% Impervious Area

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

Subcatchment 13S:



Summary for Subcatchment 14S:

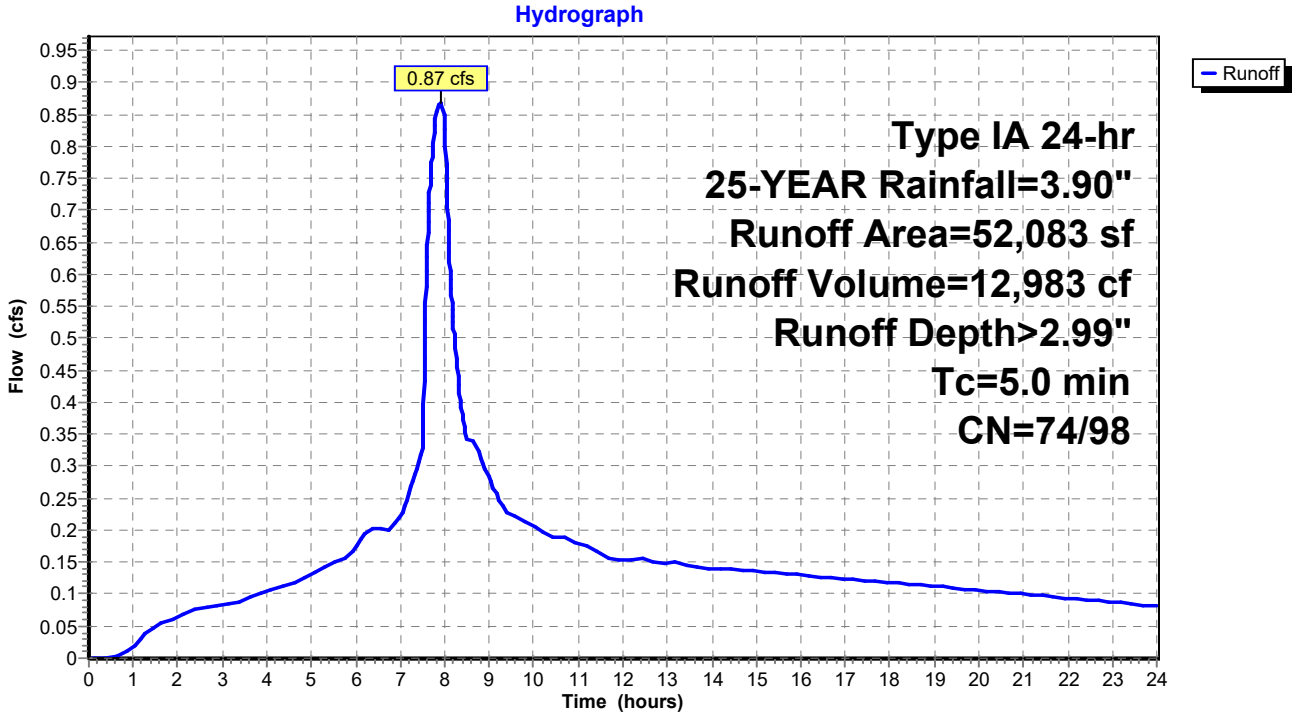
Runoff = 0.87 cfs @ 7.90 hrs, Volume= 12,983 cf, Depth> 2.99"

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

	Area (sf)	CN	Description
	12,070	98	Paved roads w/curbs & sewers, HSG C
	16,253	74	>75% Grass cover, Good, HSG C
*	23,760	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	52,083	91	Weighted Average
	16,253	74	31.21% Pervious Area
	35,830	98	68.79% Impervious Area

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

Subcatchment 14S:



Summary for Subcatchment 15S:

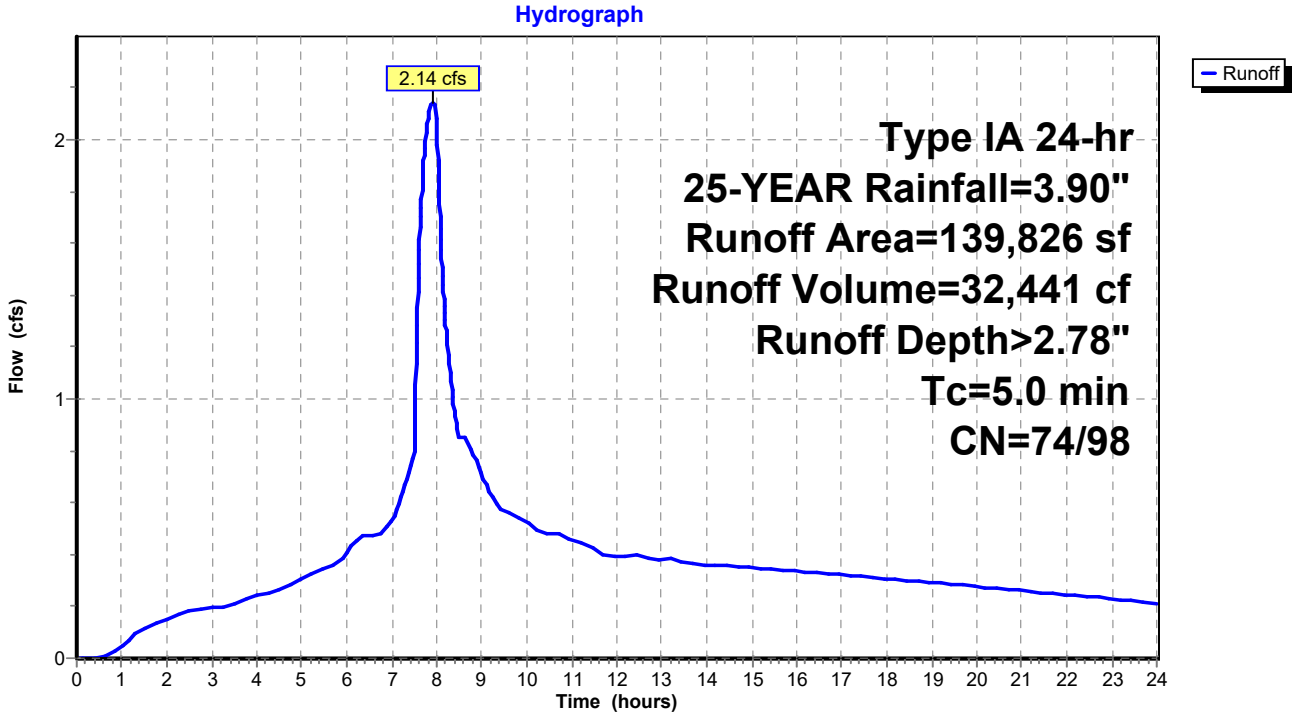
Runoff = 2.14 cfs @ 7.91 hrs, Volume= 32,441 cf, Depth> 2.78"

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

	Area (sf)	CN	Description
	24,579	98	Paved roads w/curbs & sewers, HSG C
	57,167	74	>75% Grass cover, Good, HSG C
*	58,080	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	139,826	88	Weighted Average
	57,167	74	40.88% Pervious Area
	82,659	98	59.12% Impervious Area

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

Subcatchment 15S:



Summary for Subcatchment 16S:

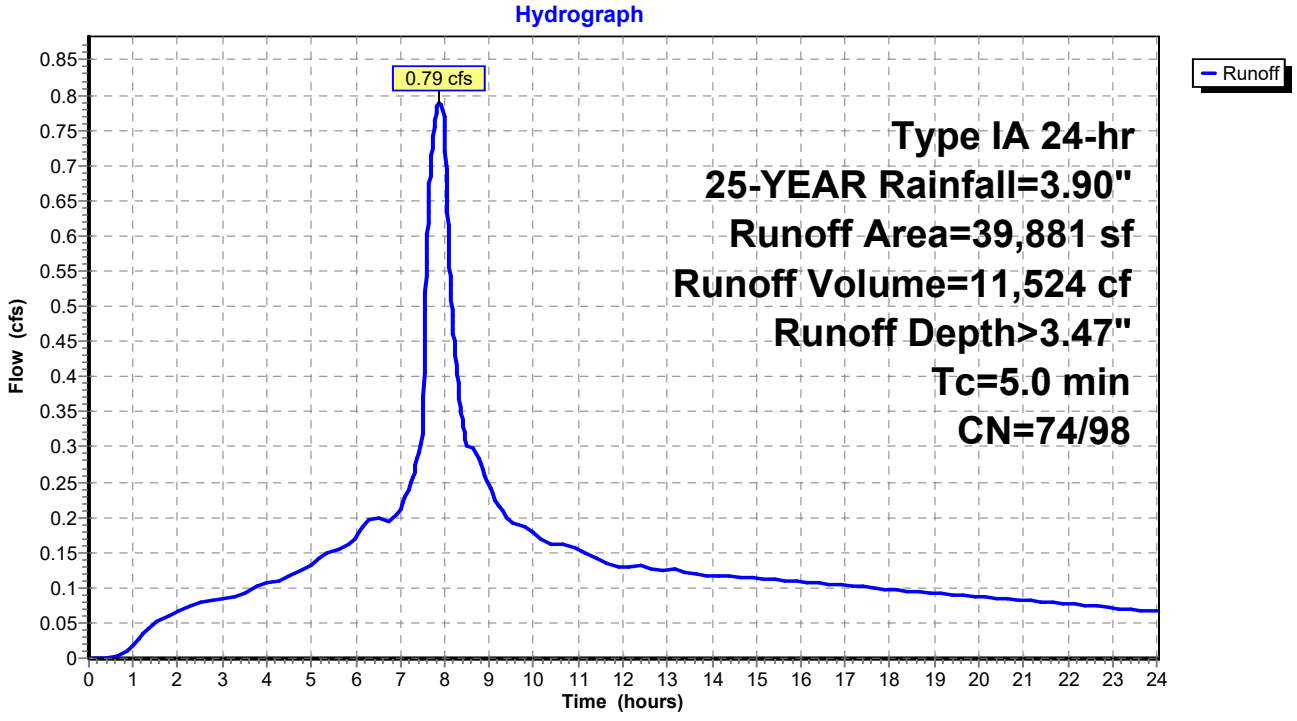
Runoff = 0.79 cfs @ 7.88 hrs, Volume= 11,524 cf, Depth> 3.47"

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

	Area (sf)	CN	Description
	12,551	98	Paved roads w/curbs & sewers, HSG C
	3,570	74	>75% Grass cover, Good, HSG C
*	23,760	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	39,881	96	Weighted Average
	3,570	74	8.95% Pervious Area
	36,311	98	91.05% Impervious Area

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

Subcatchment 16S:



Summary for Subcatchment 17S:

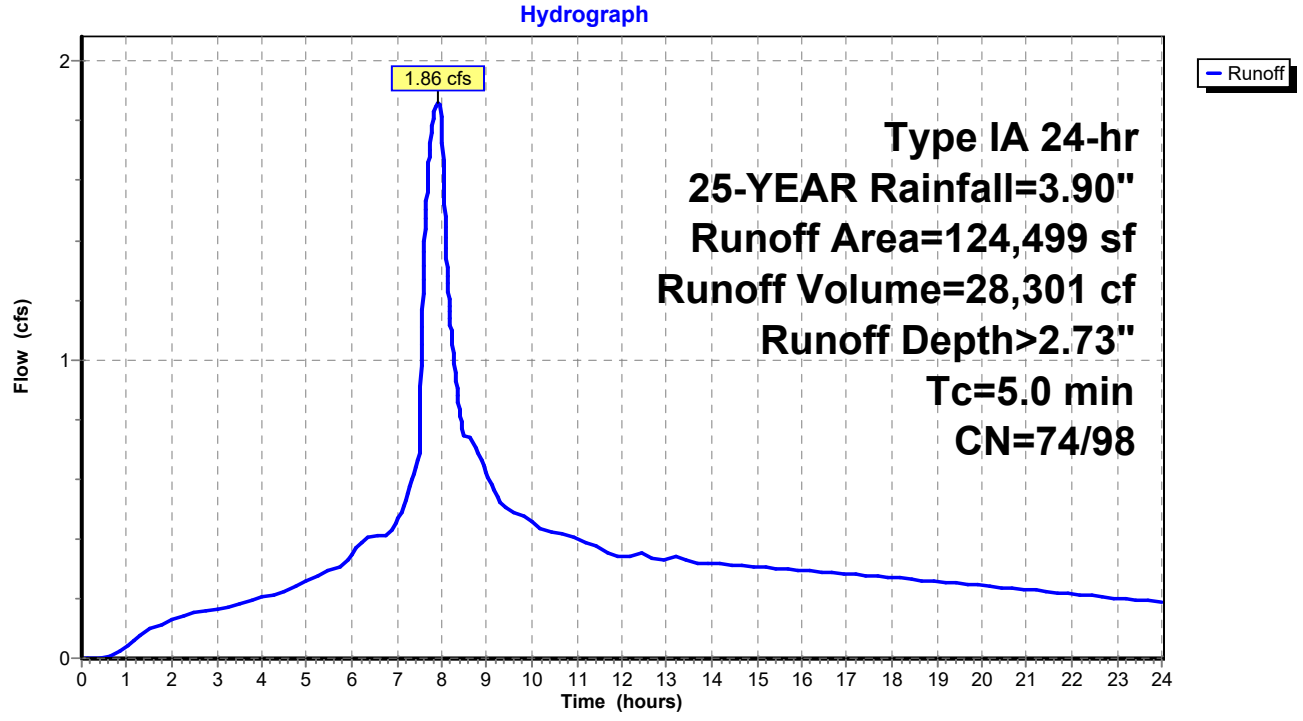
Runoff = 1.86 cfs @ 7.91 hrs, Volume= 28,301 cf, Depth> 2.73"

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

	Area (sf)	CN	Description
	28,082	98	Paved roads w/curbs & sewers, HSG C
	54,177	74	>75% Grass cover, Good, HSG C
*	42,240	98	Impervious Area on Lots (2,640 sq.ft. per lot)
	124,499	88	Weighted Average
	54,177	74	43.52% Pervious Area
	70,322	98	56.48% Impervious Area

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

Subcatchment 17S:



Summary for Subcatchment 18S:

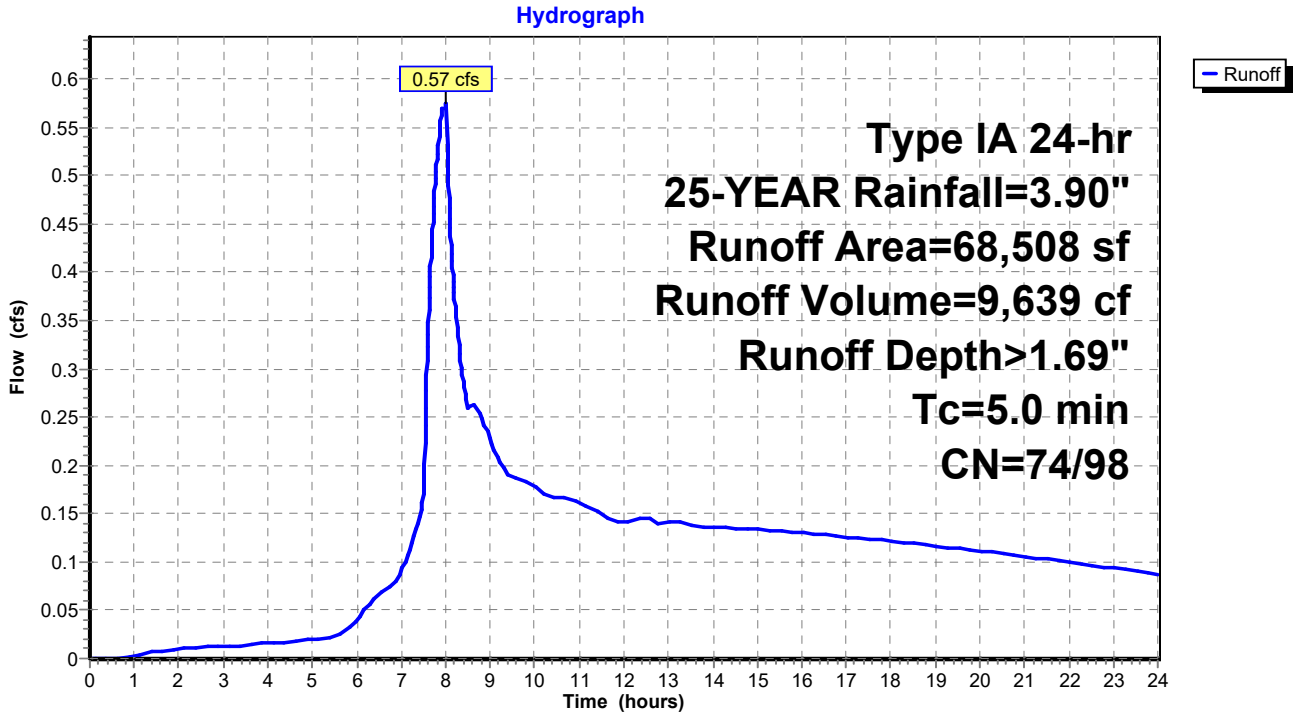
Runoff = 0.57 cfs @ 7.99 hrs, Volume= 9,639 cf, Depth> 1.69"

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

	Area (sf)	CN	Description
*	5,428	98	AC Path, HSG C
	63,080	74	>75% Grass cover, Good, HSG C
	68,508	76	Weighted Average
	63,080	74	92.08% Pervious Area
	5,428	98	7.92% Impervious Area

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

Subcatchment 18S:



Summary for Subcatchment 19S:

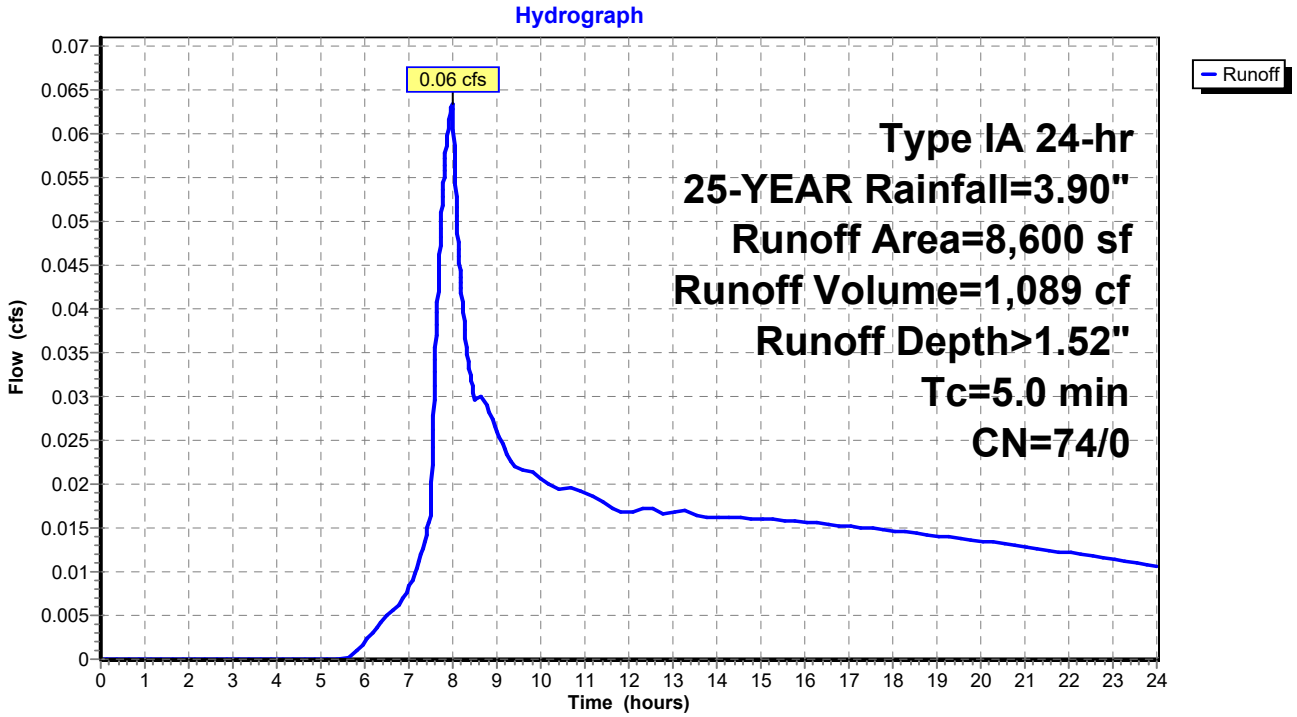
Runoff = 0.06 cfs @ 8.00 hrs, Volume= 1,089 cf, Depth> 1.52"

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

Area (sf)	CN	Description
8,600	74	>75% Grass cover, Good, HSG C
8,600	74	100.00% Pervious Area

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

Subcatchment 19S:



Summary for Subcatchment 150X: Upstream Boones Ferry

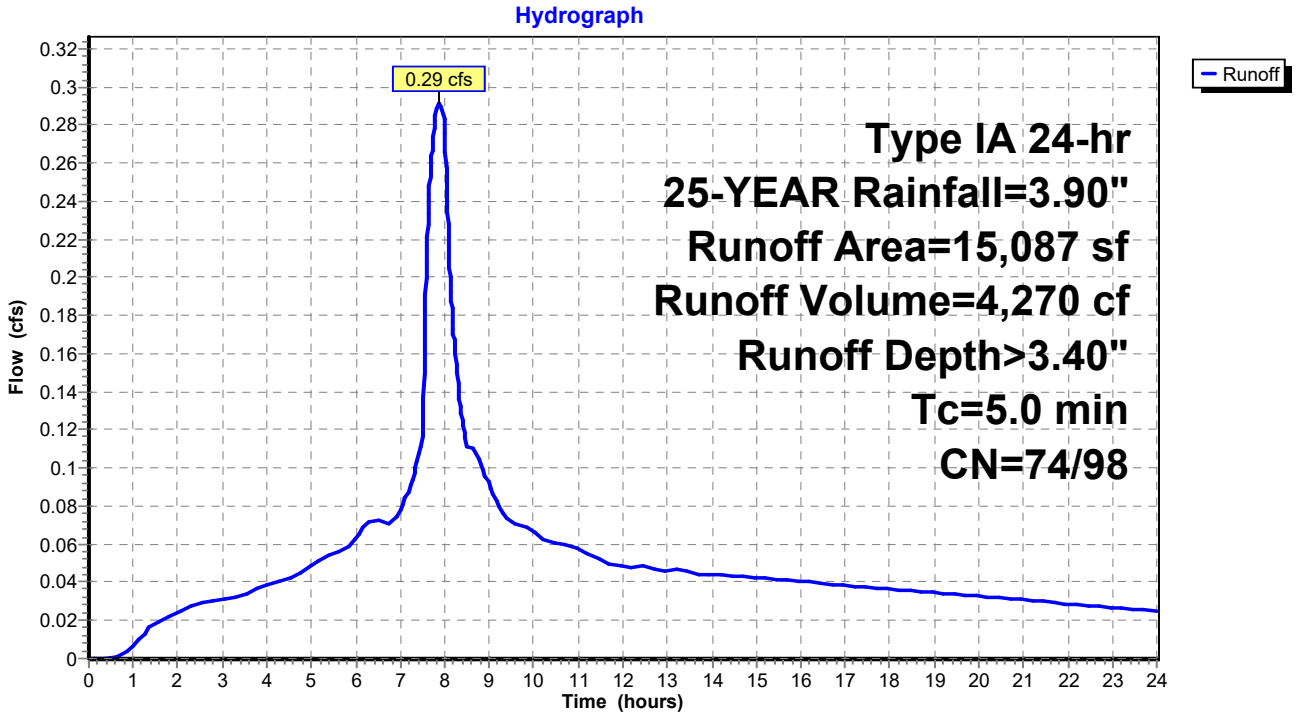
Runoff = 0.29 cfs @ 7.88 hrs, Volume= 4,270 cf, Depth> 3.40"

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

	Area (sf)	CN	Description
*	13,231	98	Impervious Area
	1,856	74	>75% Grass cover, Good, HSG C
	15,087	95	Weighted Average
	1,856	74	12.30% Pervious Area
	13,231	98	87.70% Impervious Area

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

Subcatchment 150X: Upstream Boones Ferry



Summary for Subcatchment 160X: Upstream Properties

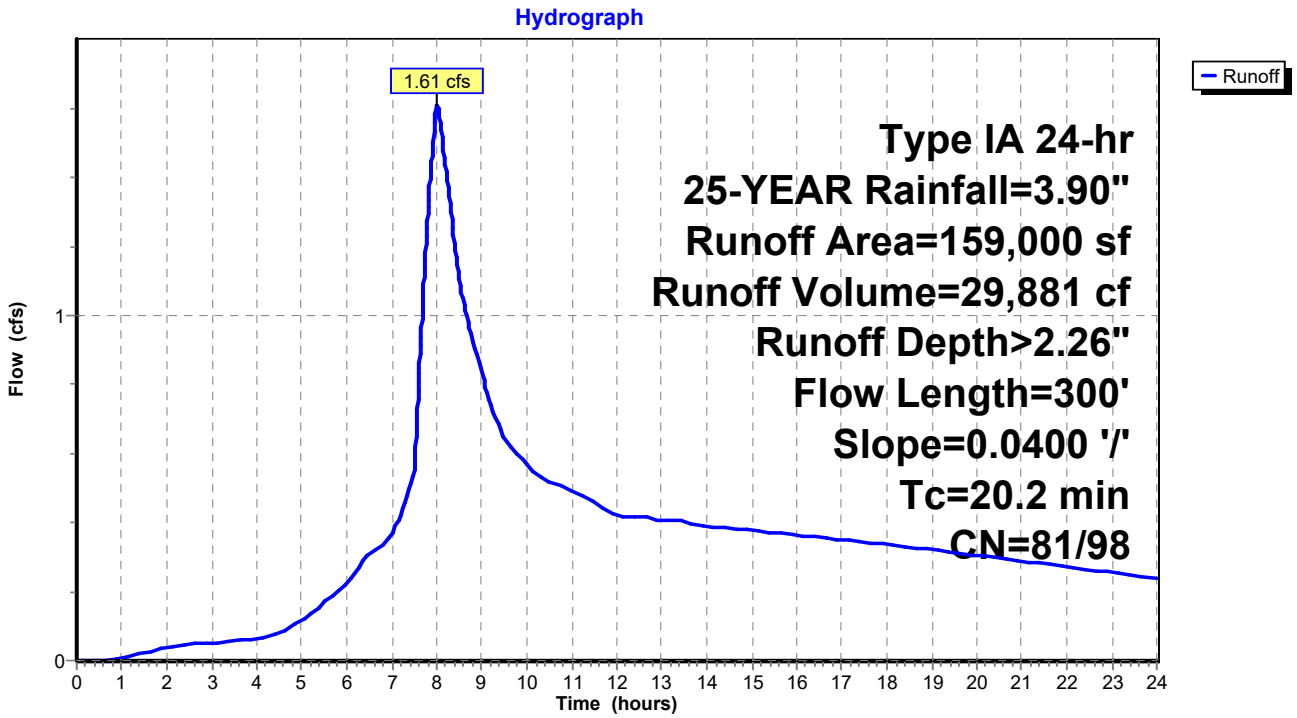
Runoff = 1.61 cfs @ 8.01 hrs, Volume= 29,881 cf, Depth> 2.26"

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

	Area (sf)	CN	Description
*	23,371	98	Impervious Area
	12,930	96	Gravel surface, HSG C
	122,699	79	50-75% Grass cover, Fair, HSG C
	159,000	83	Weighted Average
	135,629	81	85.30% Pervious Area
	23,371	98	14.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	300	0.0400	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 160X: Upstream Properties



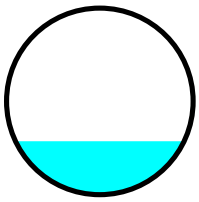
Summary for Reach 1R: 30"

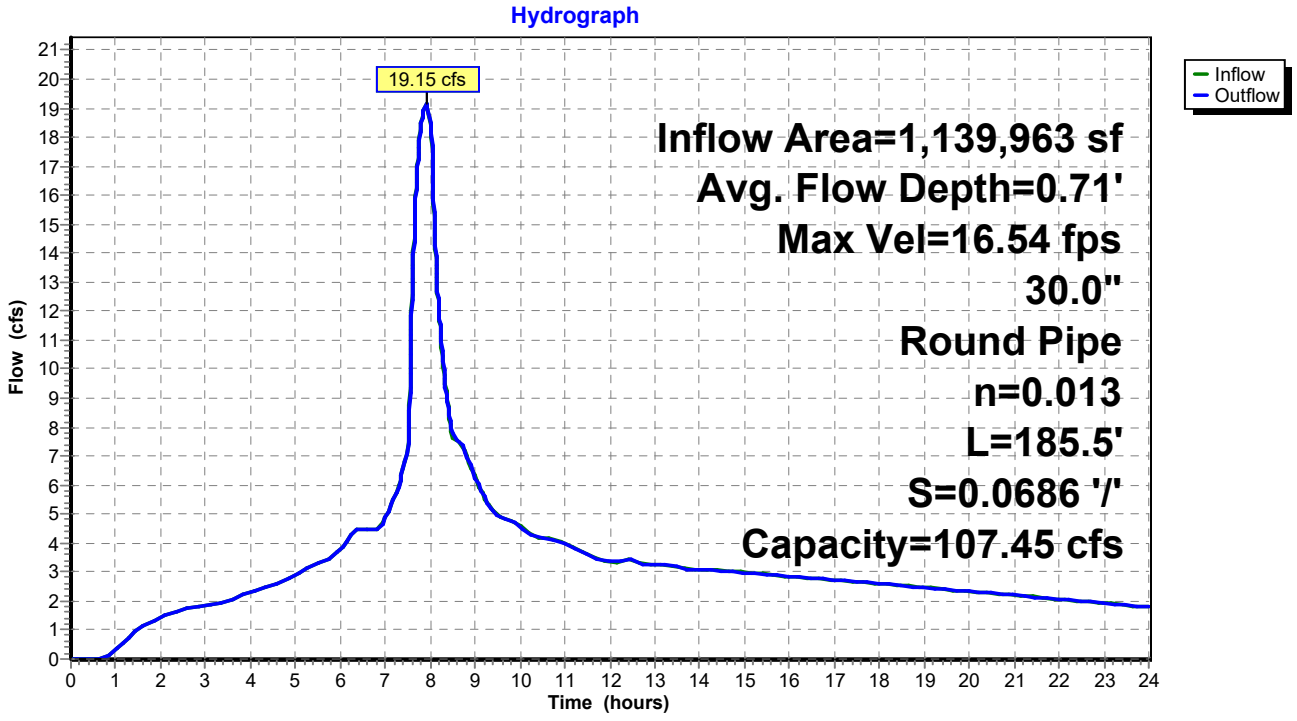
Inflow Area = 1,139,963 sf, 69.95% Impervious, Inflow Depth > 3.01" for 25-YEAR event
Inflow = 19.15 cfs @ 7.92 hrs, Volume= 286,155 cf
Outflow = 19.15 cfs @ 7.92 hrs, Volume= 286,115 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.54 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 9.53 fps, Avg. Travel Time= 0.3 min

Peak Storage= 215 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.71'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 107.45 cfs

30.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 185.5' Slope= 0.0686 '/'
Inlet Invert= 334.46', Outlet Invert= 321.73'





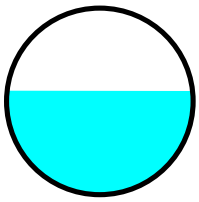
Summary for Reach 2R: 30"

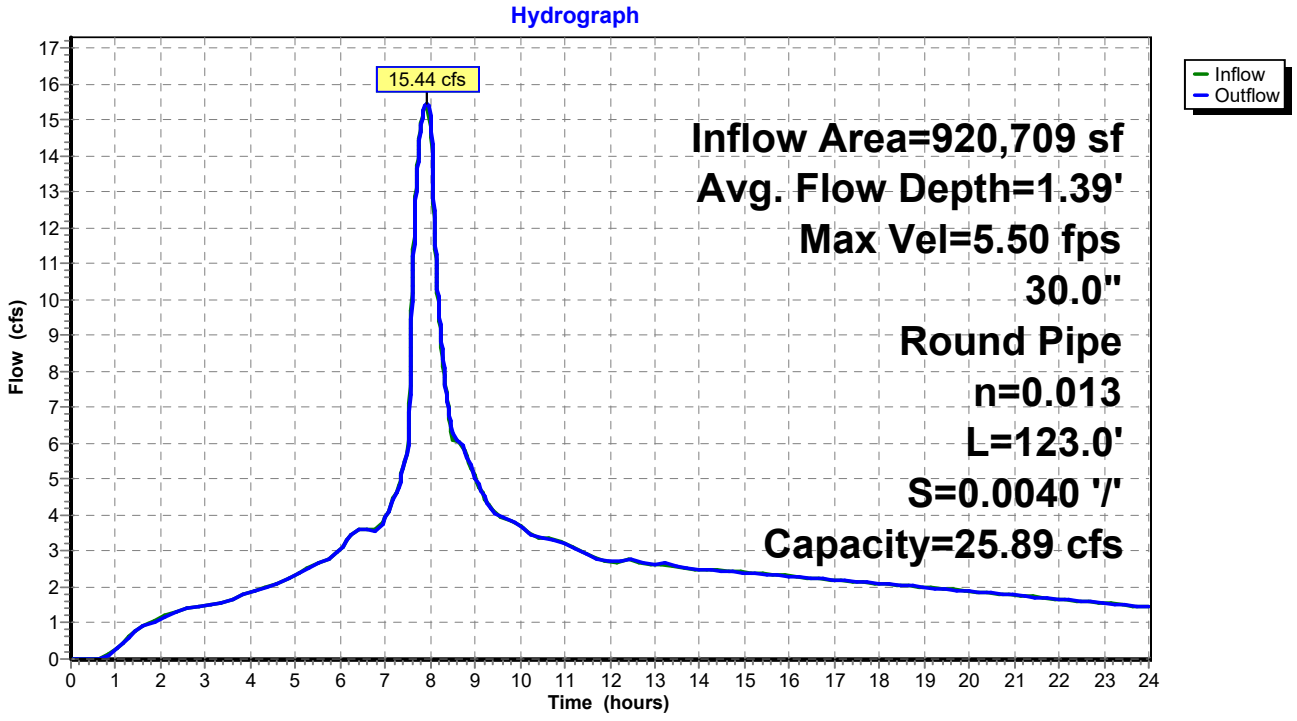
Inflow Area = 920,709 sf, 69.75% Impervious, Inflow Depth > 3.01" for 25-YEAR event
Inflow = 15.44 cfs @ 7.92 hrs, Volume= 230,802 cf
Outflow = 15.44 cfs @ 7.92 hrs, Volume= 230,739 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.50 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.28 fps, Avg. Travel Time= 0.6 min

Peak Storage= 345 cf @ 7.92 hrs
Average Depth at Peak Storage= 1.39'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 25.89 cfs

30.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 123.0' Slope= 0.0040 '/'
Inlet Invert= 335.15', Outlet Invert= 334.66'





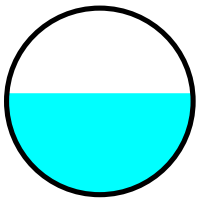
Summary for Reach 3R: 15"

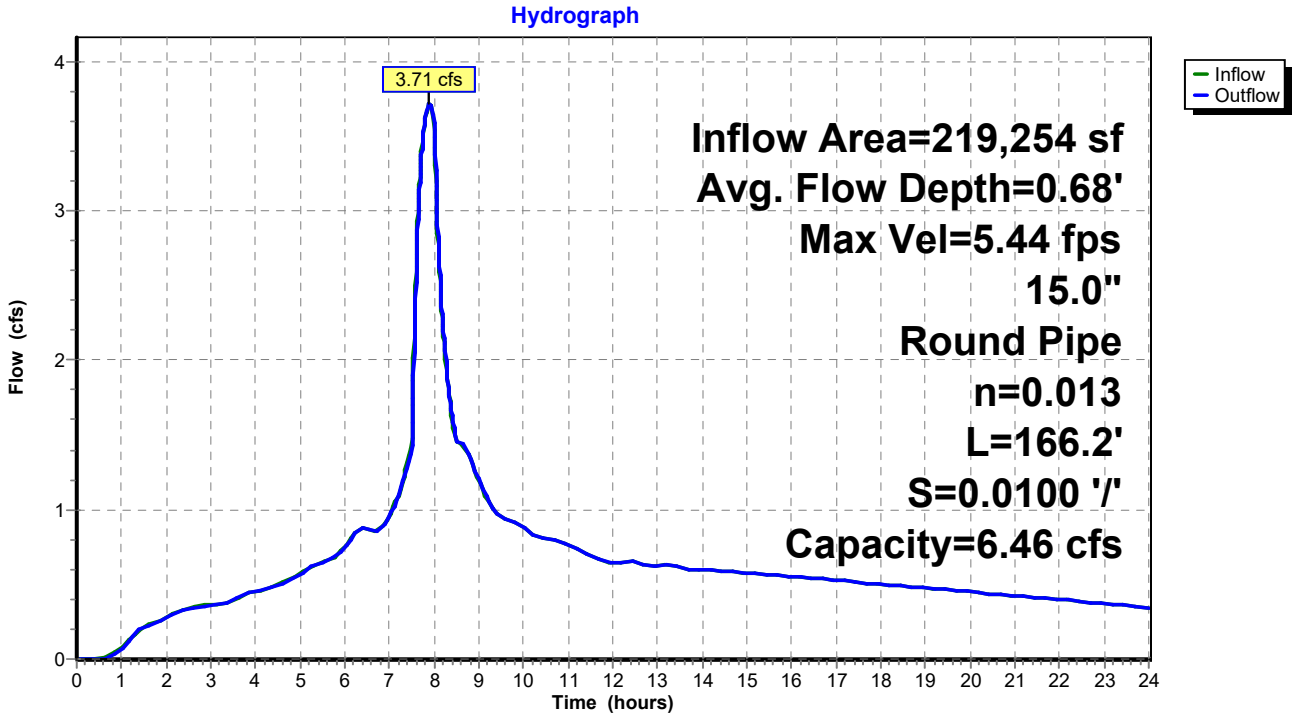
Inflow Area = 219,254 sf, 70.79% Impervious, Inflow Depth > 3.03" for 25-YEAR event
Inflow = 3.71 cfs @ 7.90 hrs, Volume= 55,436 cf
Outflow = 3.71 cfs @ 7.90 hrs, Volume= 55,416 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.44 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.24 fps, Avg. Travel Time= 0.9 min

Peak Storage= 113 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.46 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 166.2' Slope= 0.0100 '/'
Inlet Invert= 343.90', Outlet Invert= 342.24'





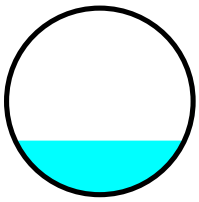
Summary for Reach 4R: 12"

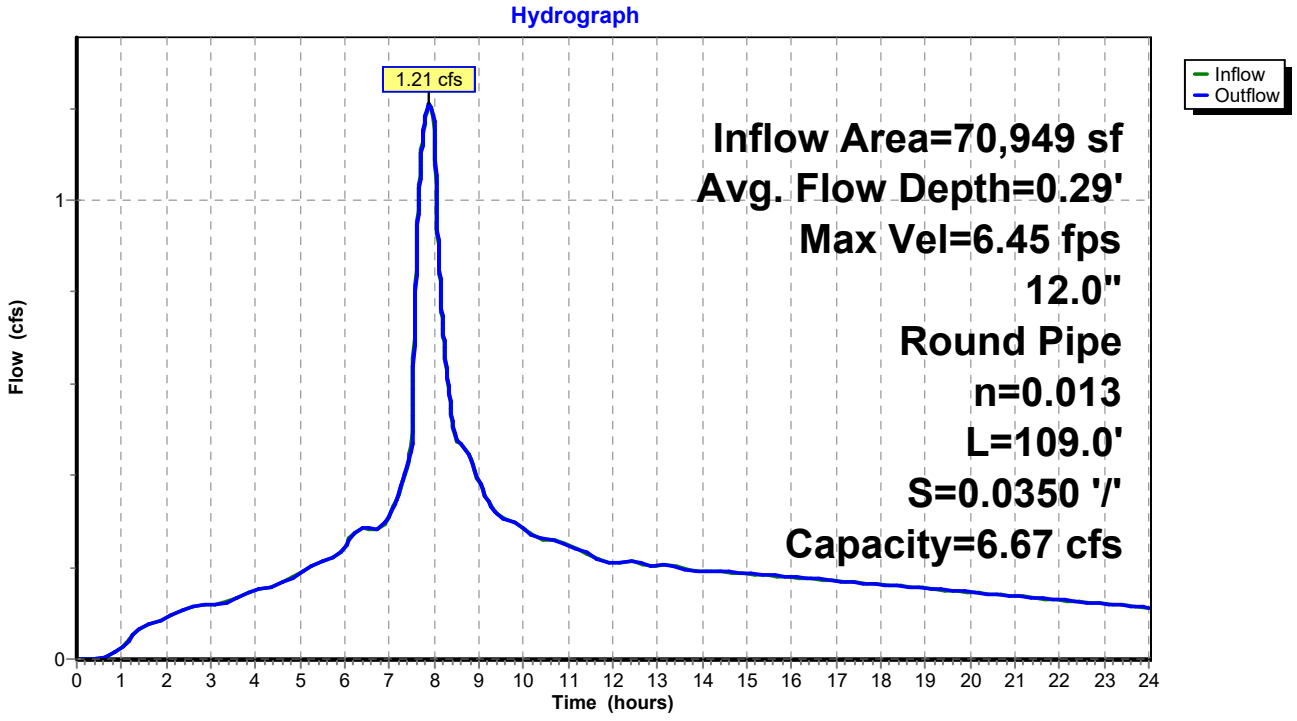
Inflow Area = 70,949 sf, 71.75% Impervious, Inflow Depth > 3.05" for 25-YEAR event
Inflow = 1.21 cfs @ 7.90 hrs, Volume= 18,060 cf
Outflow = 1.21 cfs @ 7.90 hrs, Volume= 18,056 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.45 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.72 fps, Avg. Travel Time= 0.5 min

Peak Storage= 20 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.67 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 109.0' Slope= 0.0350 '/'
Inlet Invert= 344.80', Outlet Invert= 340.98'





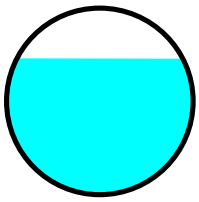
Summary for Reach 5R: 24"

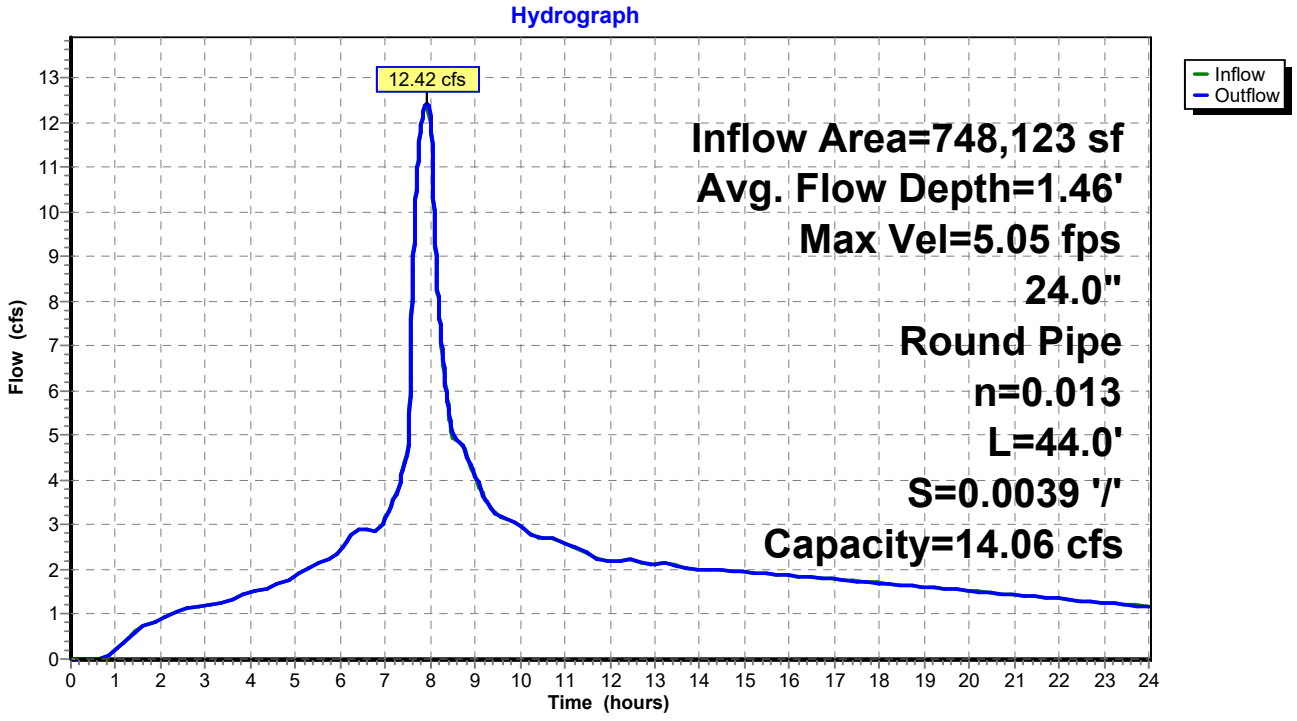
Inflow Area = 748,123 sf, 68.48% Impervious, Inflow Depth > 2.98" for 25-YEAR event
Inflow = 12.42 cfs @ 7.92 hrs, Volume= 185,822 cf
Outflow = 12.42 cfs @ 7.92 hrs, Volume= 185,803 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.05 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.11 fps, Avg. Travel Time= 0.2 min

Peak Storage= 108 cf @ 7.92 hrs
Average Depth at Peak Storage= 1.46'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 14.06 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 44.0' Slope= 0.0039 '/'
Inlet Invert= 337.14', Outlet Invert= 336.97'





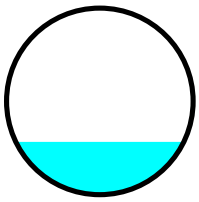
Summary for Reach 6R: 12"

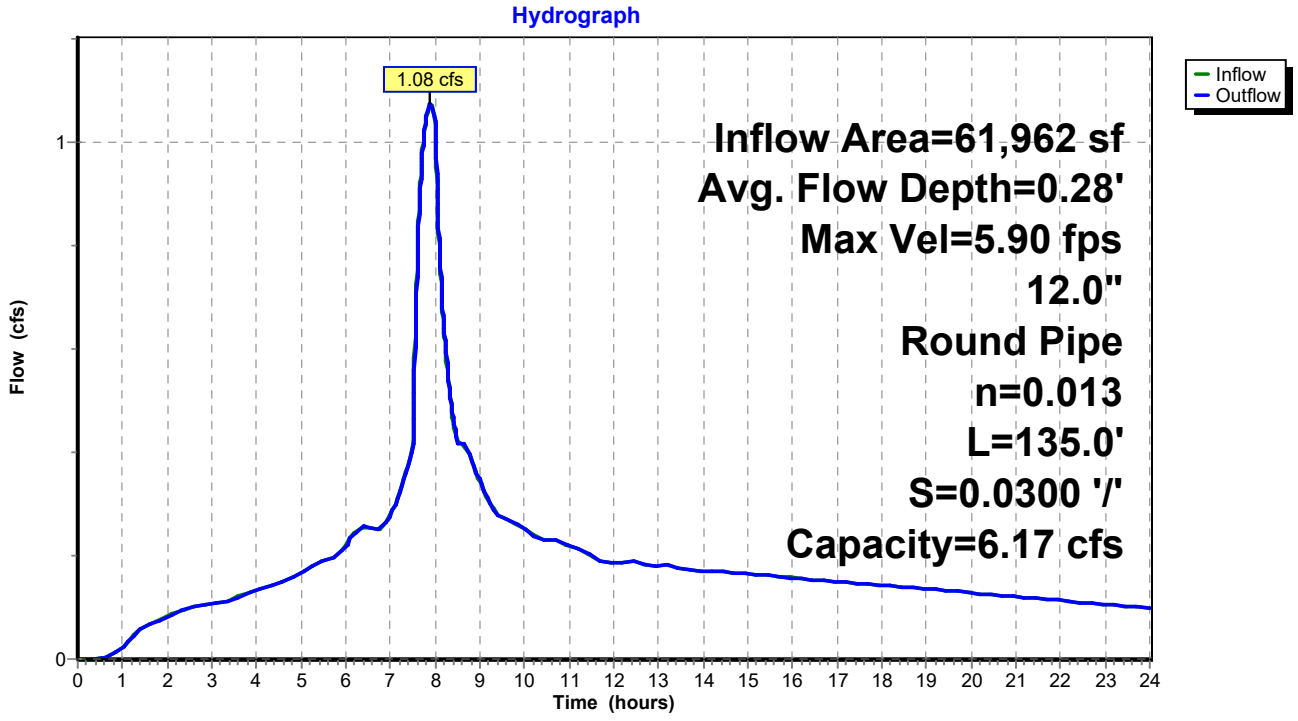
Inflow Area = 61,962 sf, 73.84% Impervious, Inflow Depth > 3.10" for 25-YEAR event
Inflow = 1.08 cfs @ 7.89 hrs, Volume= 16,003 cf
Outflow = 1.08 cfs @ 7.90 hrs, Volume= 15,998 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.90 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.40 fps, Avg. Travel Time= 0.7 min

Peak Storage= 25 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.17 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 135.0' Slope= 0.0300 '/'
Inlet Invert= 347.55', Outlet Invert= 343.50'





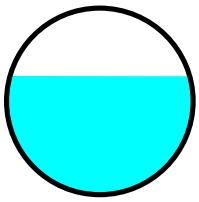
Summary for Reach 7R: 24"

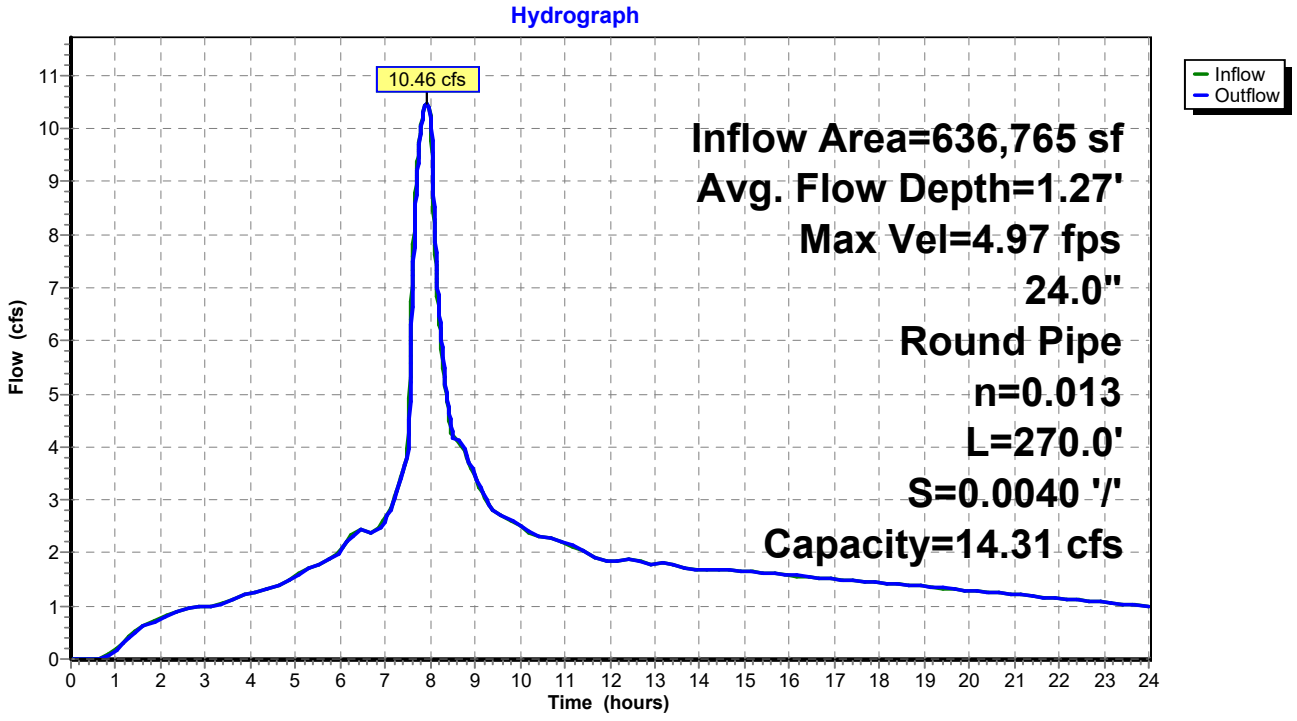
Inflow Area = 636,765 sf, 67.22% Impervious, Inflow Depth > 2.95" for 25-YEAR event
Inflow = 10.46 cfs @ 7.92 hrs, Volume= 156,797 cf
Outflow = 10.46 cfs @ 7.93 hrs, Volume= 156,695 cf, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.97 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 3.00 fps, Avg. Travel Time= 1.5 min

Peak Storage= 568 cf @ 7.93 hrs
Average Depth at Peak Storage= 1.27'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 14.31 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 270.0' Slope= 0.0040 '/'
Inlet Invert= 339.35', Outlet Invert= 338.27'





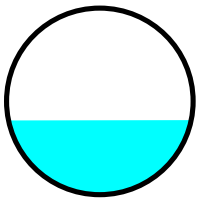
Summary for Reach 8R: 12"

Inflow Area = 107,045 sf, 68.50% Impervious, Inflow Depth > 2.98" for 25-YEAR event
Inflow = 1.78 cfs @ 7.90 hrs, Volume= 26,627 cf
Outflow = 1.78 cfs @ 7.90 hrs, Volume= 26,620 cf, Atten= 0%, Lag= 0.3 min

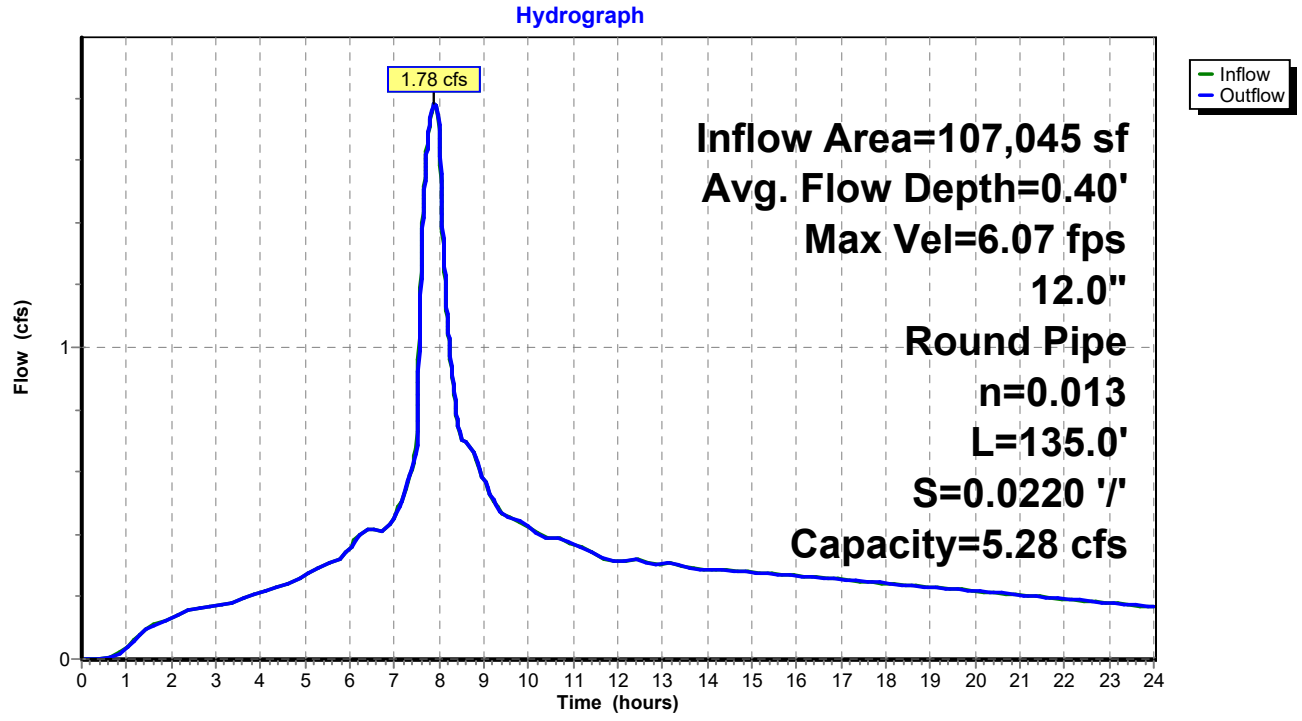
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.07 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.54 fps, Avg. Travel Time= 0.6 min

Peak Storage= 40 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.28 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 135.0' Slope= 0.0220 '/'
Inlet Invert= 344.97', Outlet Invert= 342.00'



Reach 8R: 12"



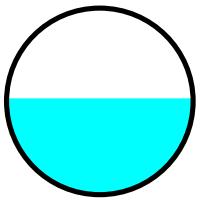
Summary for Reach 9R: 24"

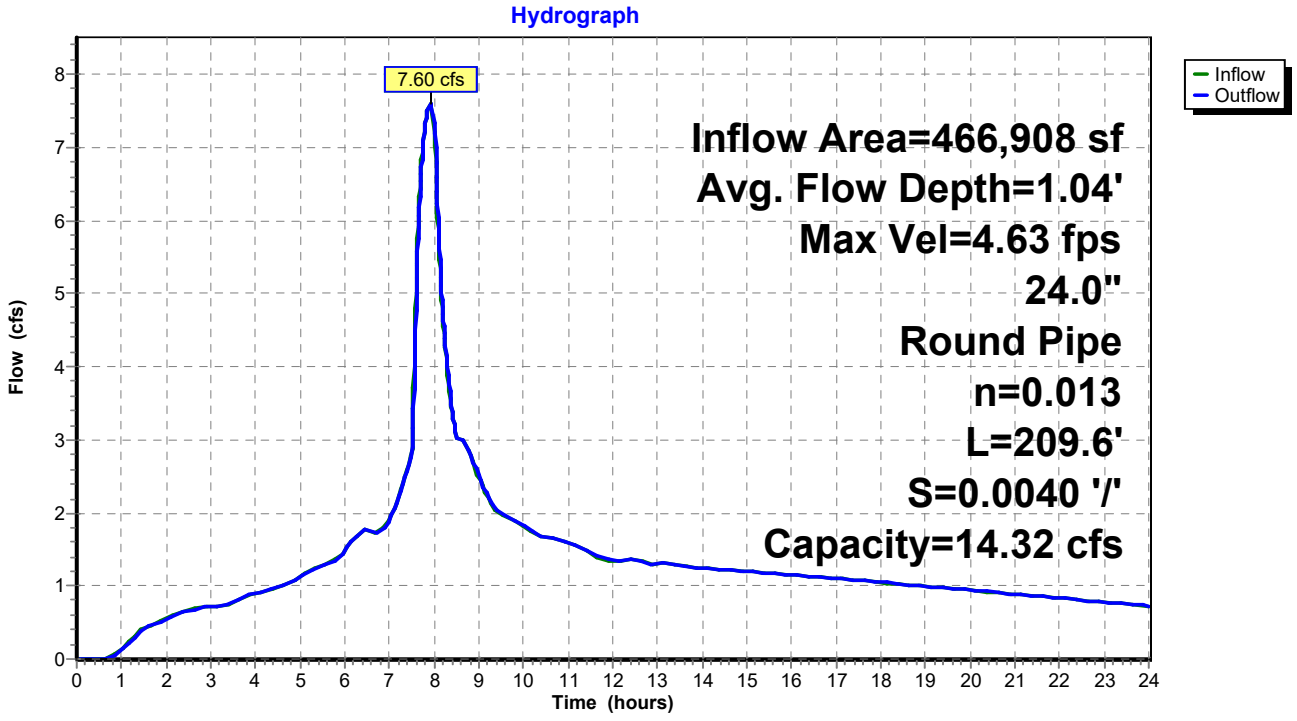
Inflow Area = 466,908 sf, 66.12% Impervious, Inflow Depth > 2.93" for 25-YEAR event
Inflow = 7.60 cfs @ 7.91 hrs, Volume= 114,086 cf
Outflow = 7.60 cfs @ 7.92 hrs, Volume= 114,022 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.63 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 2.74 fps, Avg. Travel Time= 1.3 min

Peak Storage= 344 cf @ 7.92 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 14.32 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 209.6' Slope= 0.0040 '/'
Inlet Invert= 340.39', Outlet Invert= 339.55'





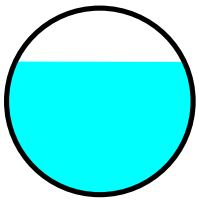
Summary for Reach 10R: 18"

Inflow Area = 356,289 sf, 63.19% Impervious, Inflow Depth > 2.87" for 25-YEAR event
Inflow = 5.66 cfs @ 7.92 hrs, Volume= 85,191 cf
Outflow = 5.66 cfs @ 7.92 hrs, Volume= 85,177 cf, Atten= 0%, Lag= 0.2 min

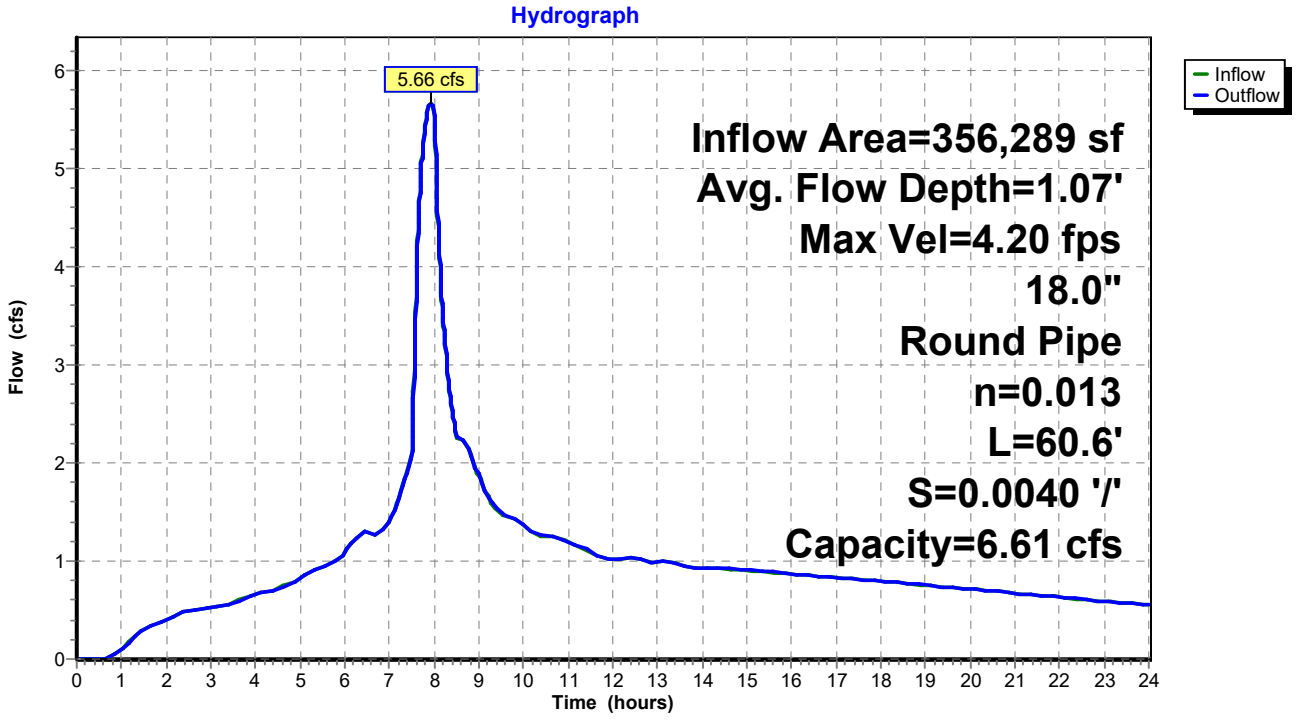
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.20 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.59 fps, Avg. Travel Time= 0.4 min

Peak Storage= 82 cf @ 7.92 hrs
Average Depth at Peak Storage= 1.07'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.61 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 60.6' Slope= 0.0040 '/'
Inlet Invert= 342.35', Outlet Invert= 342.11'



Reach 10R: 18"



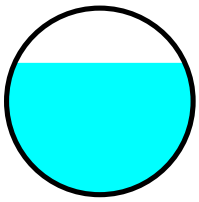
Summary for Reach 11R: 12"

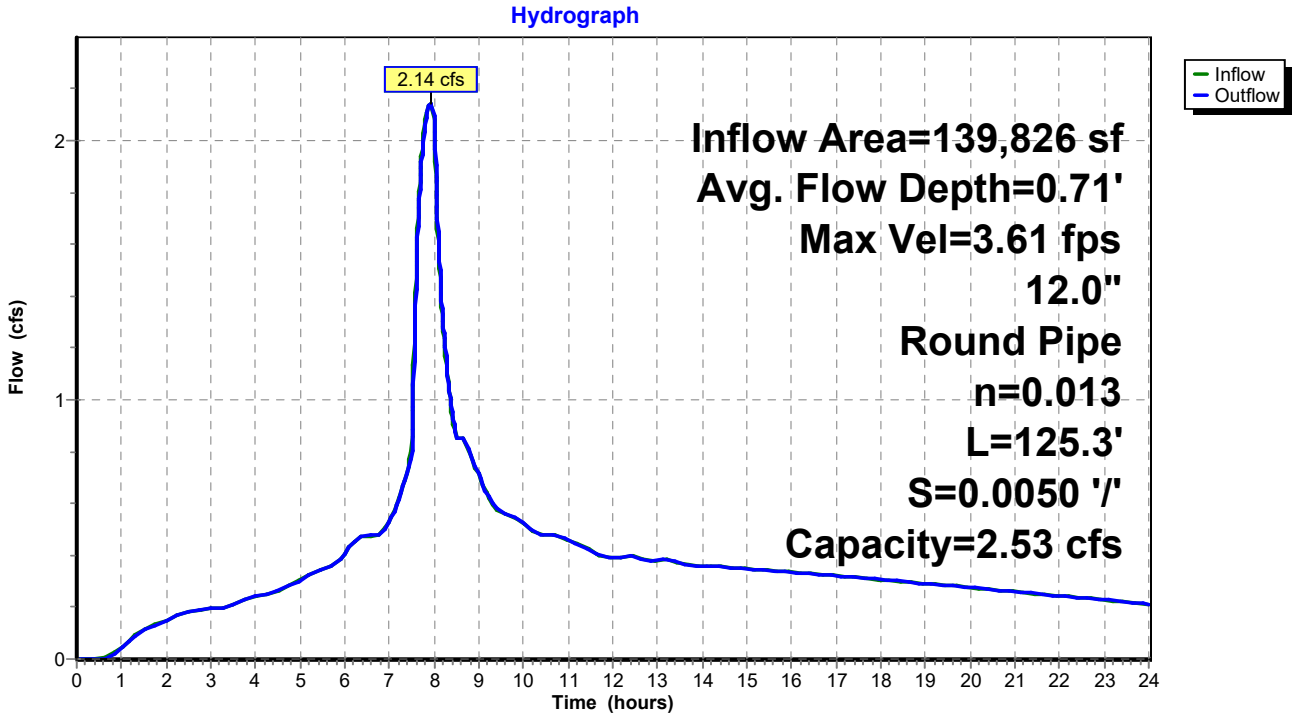
Inflow Area = 139,826 sf, 59.12% Impervious, Inflow Depth > 2.78" for 25-YEAR event
Inflow = 2.14 cfs @ 7.91 hrs, Volume= 32,441 cf
Outflow = 2.14 cfs @ 7.92 hrs, Volume= 32,428 cf, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.22 fps, Avg. Travel Time= 0.9 min

Peak Storage= 74 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.71'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.53 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 125.3' Slope= 0.0050 '/'
Inlet Invert= 344.13', Outlet Invert= 343.50'





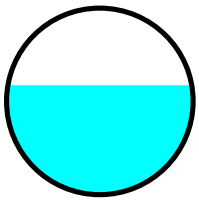
Summary for Reach 12R: 15"

Inflow Area = 164,380 sf, 64.87% Impervious, Inflow Depth > 2.91" for 25-YEAR event
Inflow = 2.65 cfs @ 7.90 hrs, Volume= 39,818 cf
Outflow = 2.65 cfs @ 7.92 hrs, Volume= 39,781 cf, Atten= 0%, Lag= 1.0 min

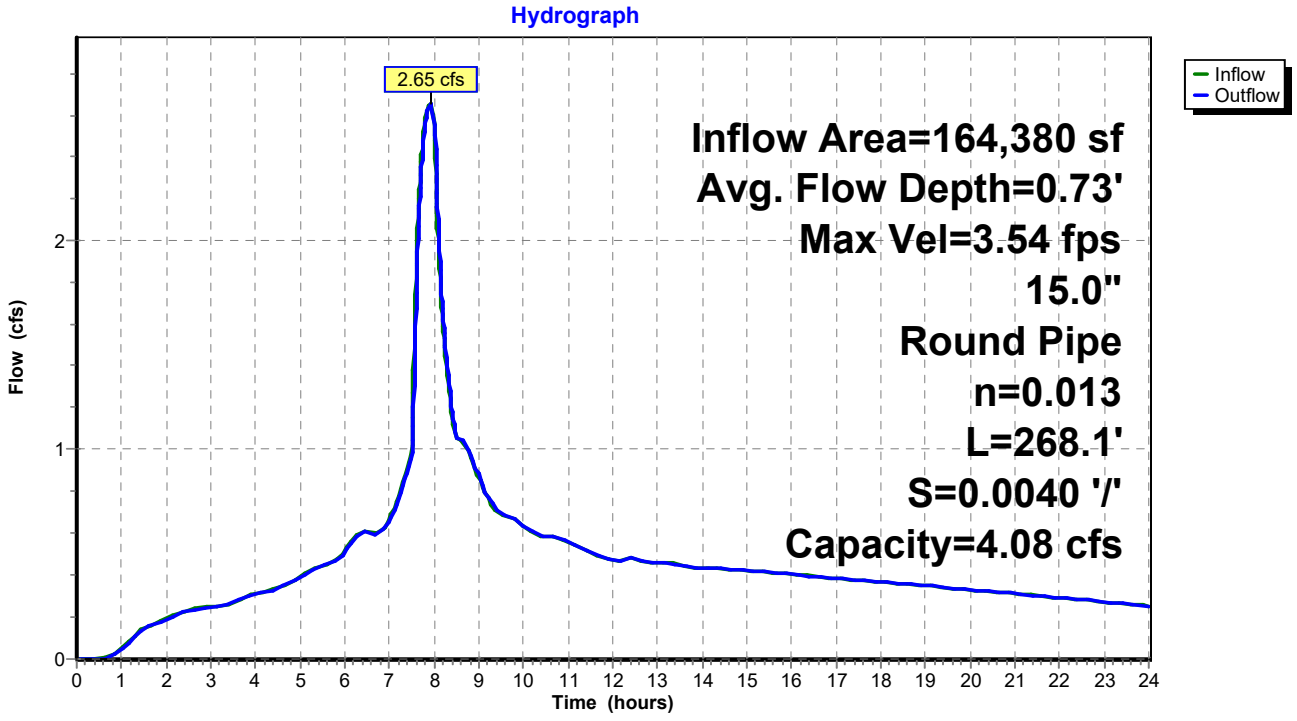
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.54 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.12 fps, Avg. Travel Time= 2.1 min

Peak Storage= 201 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.73'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.08 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 268.1' Slope= 0.0040 '/'
Inlet Invert= 345.90', Outlet Invert= 344.83'



Reach 12R: 15"



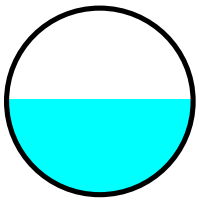
Summary for Reach 13R: 12"

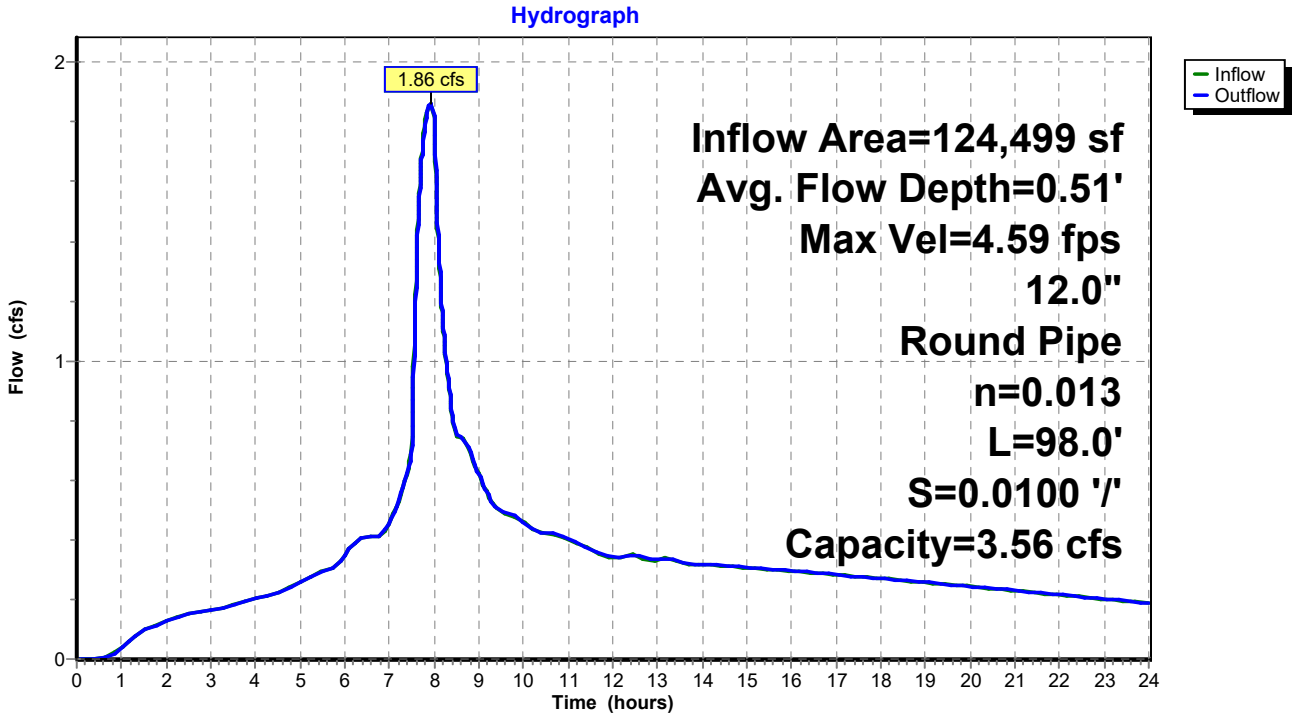
Inflow Area = 124,499 sf, 56.48% Impervious, Inflow Depth > 2.73" for 25-YEAR event
Inflow = 1.86 cfs @ 7.91 hrs, Volume= 28,301 cf
Outflow = 1.86 cfs @ 7.91 hrs, Volume= 28,293 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.59 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.73 fps, Avg. Travel Time= 0.6 min

Peak Storage= 40 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 98.0' Slope= 0.0100 '/'
Inlet Invert= 347.08', Outlet Invert= 346.10'





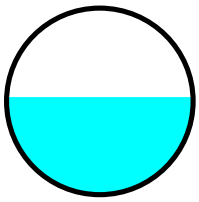
Summary for Reach 14R: 12"

Inflow Area = 280,054 sf, 45.55% Impervious, Inflow Depth > 2.73" for 25-YEAR event
Inflow = 3.85 cfs @ 7.98 hrs, Volume= 63,789 cf
Outflow = 3.85 cfs @ 7.98 hrs, Volume= 63,775 cf, Atten= 0%, Lag= 0.2 min

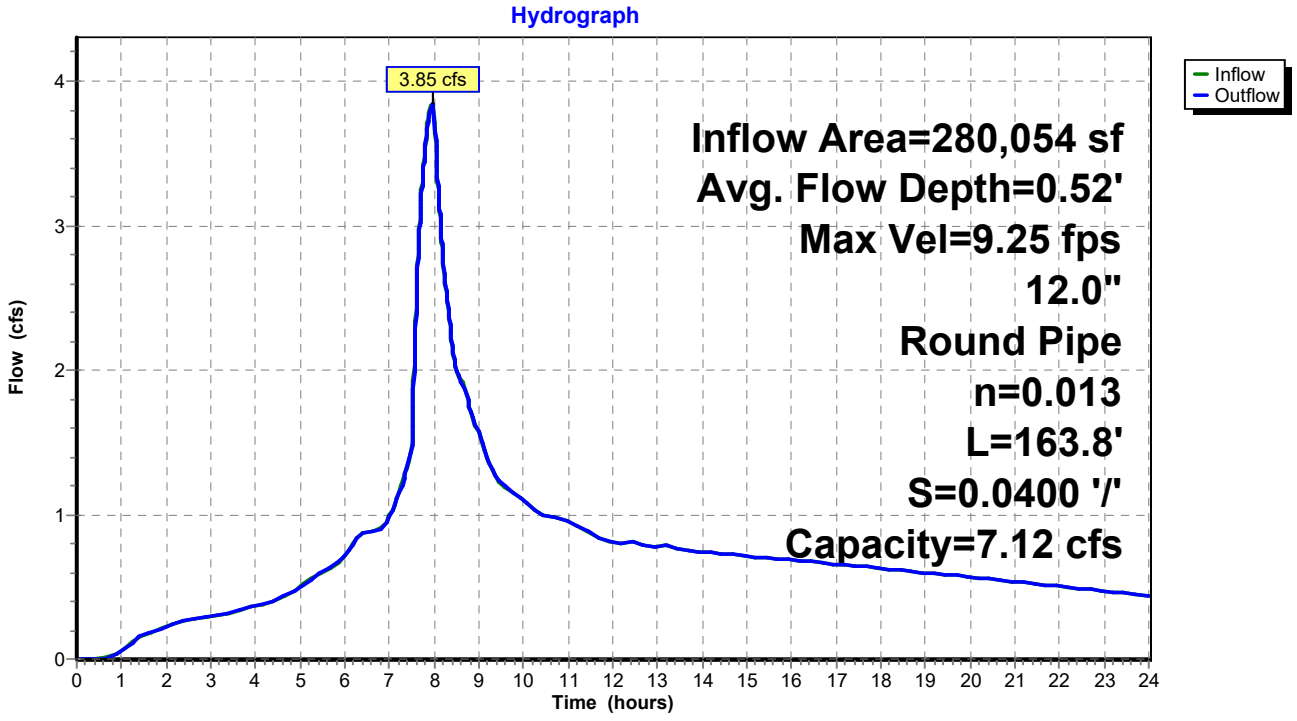
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.25 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 5.63 fps, Avg. Travel Time= 0.5 min

Peak Storage= 68 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 7.12 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 163.8' Slope= 0.0400 '/'
Inlet Invert= 330.36', Outlet Invert= 323.81'



Reach 14R: 12"



Summary for Pond 2P: West Stormwater Facility

Inflow Area = 1,475,465 sf, 62.69% Impervious, Inflow Depth > 2.90" for 25-YEAR event
Inflow = 23.37 cfs @ 7.93 hrs, Volume= 356,908 cf
Outflow = 9.58 cfs @ 8.66 hrs, Volume= 256,784 cf, Atten= 59%, Lag= 43.7 min
Primary = 9.58 cfs @ 8.66 hrs, Volume= 256,784 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 323.98' @ 8.66 hrs Surf.Area= 27,954 sf Storage= 117,534 cf
Flood Elev= 320.50' Surf.Area= 21,039 sf Storage= 32,422 cf

Plug-Flow detention time= 333.2 min calculated for 256,784 cf (72% of inflow)
Center-of-Mass det. time= 157.6 min (853.3 - 695.7)

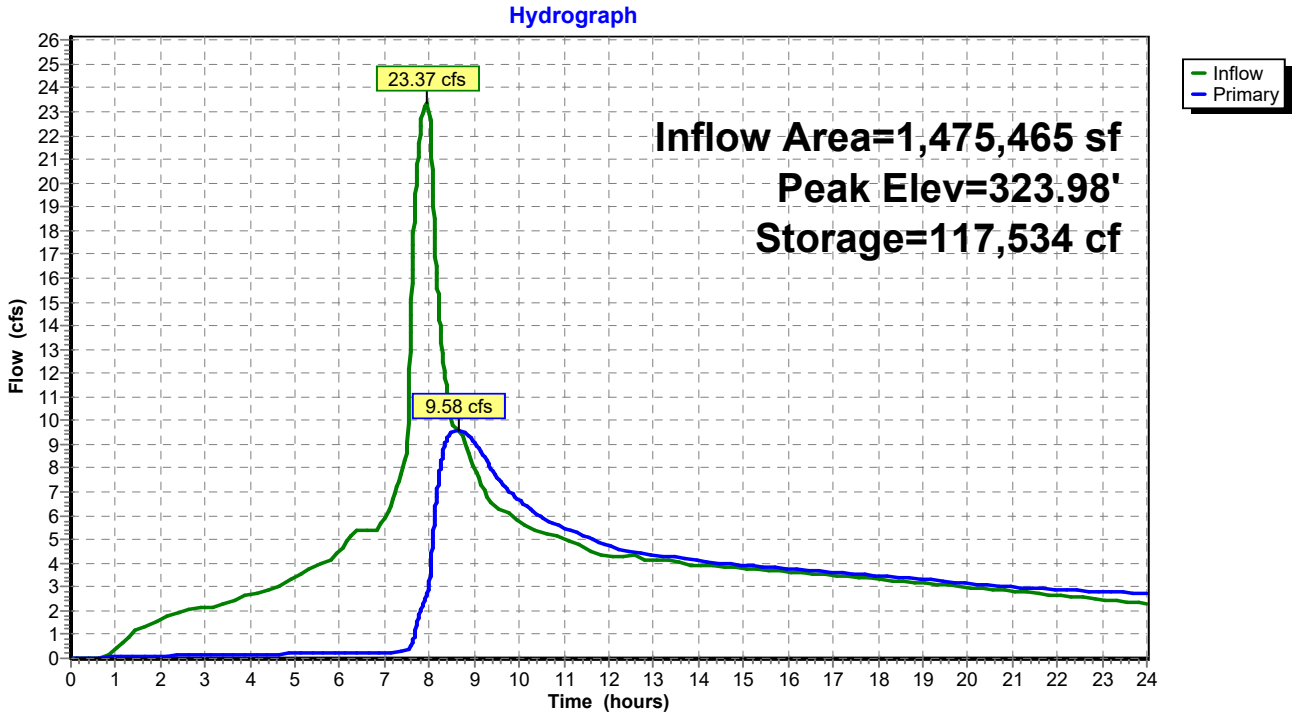
Volume	Invert	Avail.Storage	Storage Description
#1	318.52'	162,596 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
318.52	12,015	456.0	0	0	12,015
319.52	16,373	541.0	14,138	14,138	18,777
320.52	21,140	625.0	18,706	32,844	26,593
321.52	23,040	642.0	22,083	54,927	28,420
322.52	25,000	660.0	24,013	78,940	30,396
323.52	27,015	680.0	26,001	104,941	32,631
324.52	29,085	700.0	28,044	132,985	34,933
325.52	30,141	710.0	29,611	162,596	36,259

Device	Routing	Invert	Outlet Devices
#1	Primary	318.17'	**24.0" Round Culvert** L= 58.5' Ke= 0.500 Inlet / Outlet Invert= 318.17' / 316.79' S= 0.0236 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf
#2	Device 1	323.42'	**5.0' long Broad-Crested Rectangular Weir** 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
#3	Device 1	318.17'	**2.2" Vert. WQ Orifice [A]** C= 0.620
#4	Device 1	322.12'	**10.0" Vert. Detention Orifice [B]** C= 0.620

Primary OutFlow Max=9.58 cfs @ 8.66 hrs HW=323.98' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 9.58 cfs of 33.17 cfs potential flow)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 6.01 cfs @ 2.15 fps)
3=WQ Orifice [A] (Orifice Controls 0.31 cfs @ 11.90 fps)
4=Detention Orifice [B] (Orifice Controls 3.26 cfs @ 5.97 fps)

Pond 2P: West Stormwater Facility



Summary for Pond 4P: WQ MH

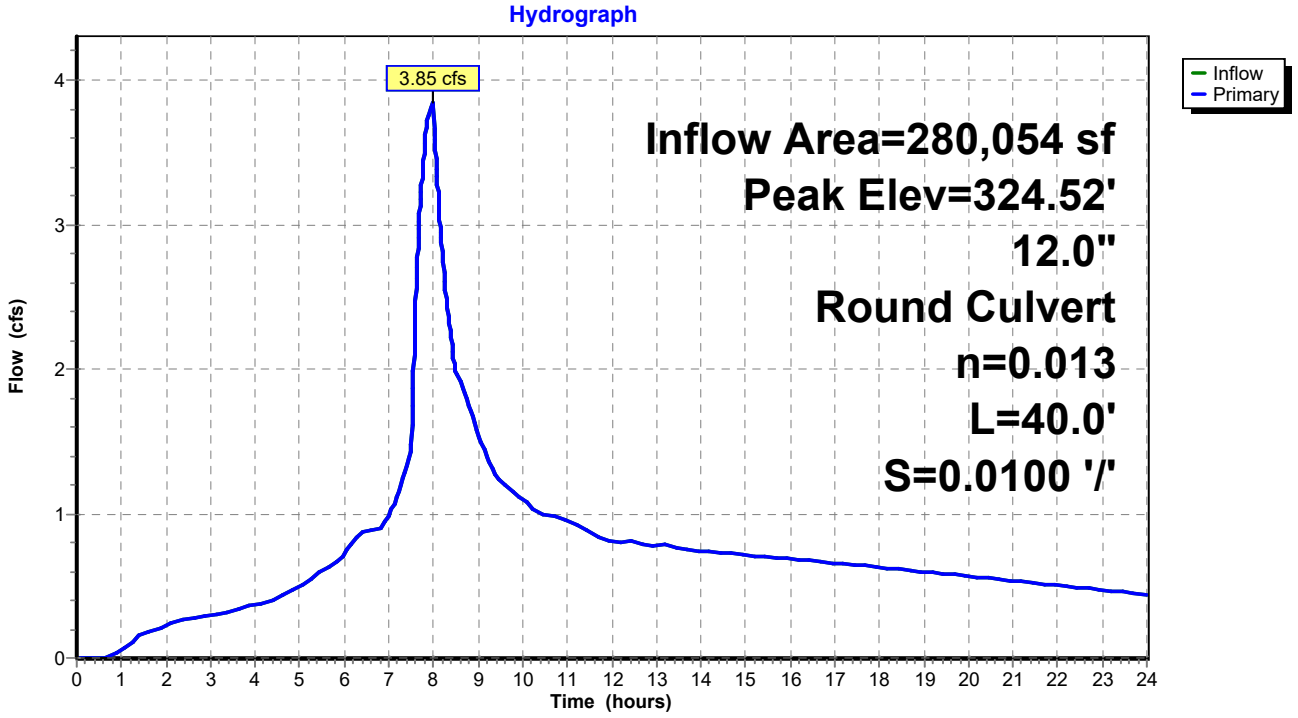
Inflow Area = 280,054 sf, 45.55% Impervious, Inflow Depth > 2.73" for 25-YEAR event
Inflow = 3.85 cfs @ 7.98 hrs, Volume= 63,775 cf
Outflow = 3.85 cfs @ 7.98 hrs, Volume= 63,775 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.85 cfs @ 7.98 hrs, Volume= 63,775 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 324.52' @ 8.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.92'	**12.0" Round Culvert** L= 40.0' Ke= 0.500 Inlet / Outlet Invert= 320.92' / 320.52' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=3.80 cfs @ 7.98 hrs HW=324.46' TW=323.46' (Dynamic Tailwater)
↳**1=Culvert** (Inlet Controls 3.80 cfs @ 4.83 fps)

Pond 4P: WQ MH



Summary for Pond 5P: WQ MH

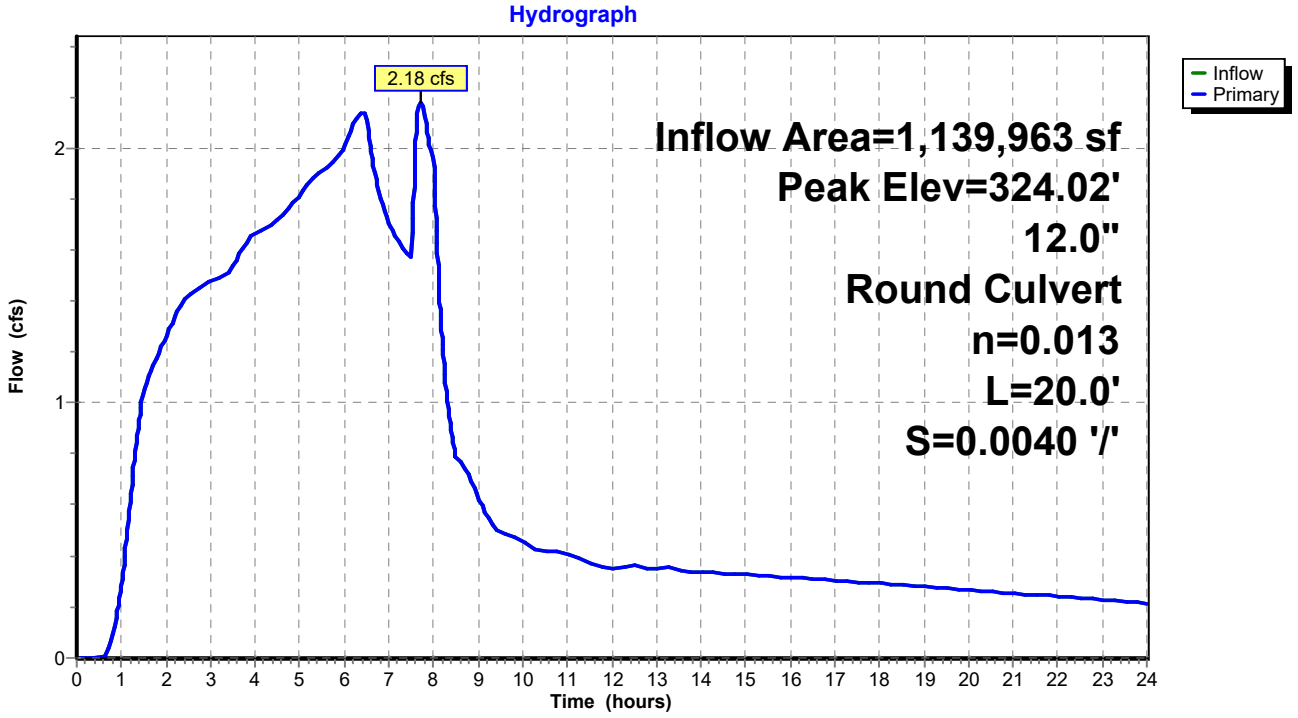
Inflow Area = 1,139,963 sf, 69.95% Impervious, Inflow Depth > 0.65" for 25-YEAR event
Inflow = 2.18 cfs @ 7.71 hrs, Volume= 61,720 cf
Outflow = 2.18 cfs @ 7.71 hrs, Volume= 61,720 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.18 cfs @ 7.71 hrs, Volume= 61,720 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 324.02' @ 8.63 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.60'	**12.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 320.60' / 320.52' S= 0.0040 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.09 cfs @ 7.71 hrs HW=323.00' TW=322.69' (Dynamic Tailwater)
↳**1=Culvert** (Inlet Controls 2.09 cfs @ 2.66 fps)

Pond 5P: WQ MH



Summary for Pond 6P: FLOW SPLITTER

Inflow Area = 1,139,963 sf, 69.95% Impervious, Inflow Depth > 3.01" for 25-YEAR event
Inflow = 19.15 cfs @ 7.92 hrs, Volume= 286,115 cf
Outflow = 19.15 cfs @ 7.92 hrs, Volume= 286,115 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.18 cfs @ 7.71 hrs, Volume= 61,720 cf
Secondary = 17.15 cfs @ 7.93 hrs, Volume= 224,395 cf

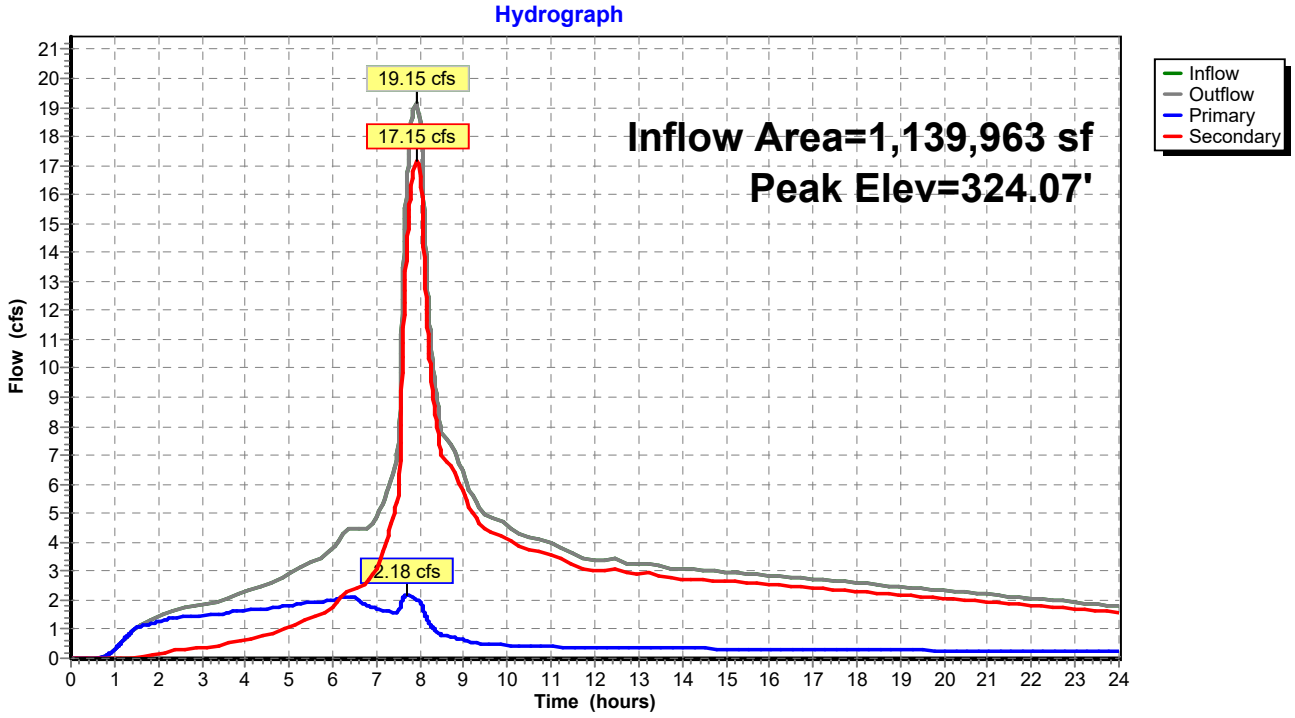
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 324.07' @ 8.37 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.65'	**12.0" Round Culvert** L= 12.0' Ke= 0.500 Inlet / Outlet Invert= 320.65' / 320.60' S= 0.0042 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	321.35'	**30.0" Round Culvert** L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 321.35' / 320.52' S= 0.0307 '/' Cc= 0.900 n= 0.013, Flow Area= 4.91 sf

Primary OutFlow Max=2.09 cfs @ 7.71 hrs HW=323.30' TW=323.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 2.09 cfs @ 2.66 fps)

Secondary OutFlow Max=16.69 cfs @ 7.93 hrs HW=323.81' TW=323.30' (Dynamic Tailwater)
└**2=Culvert** (Inlet Controls 16.69 cfs @ 3.41 fps)

Pond 6P: FLOW SPLITTER

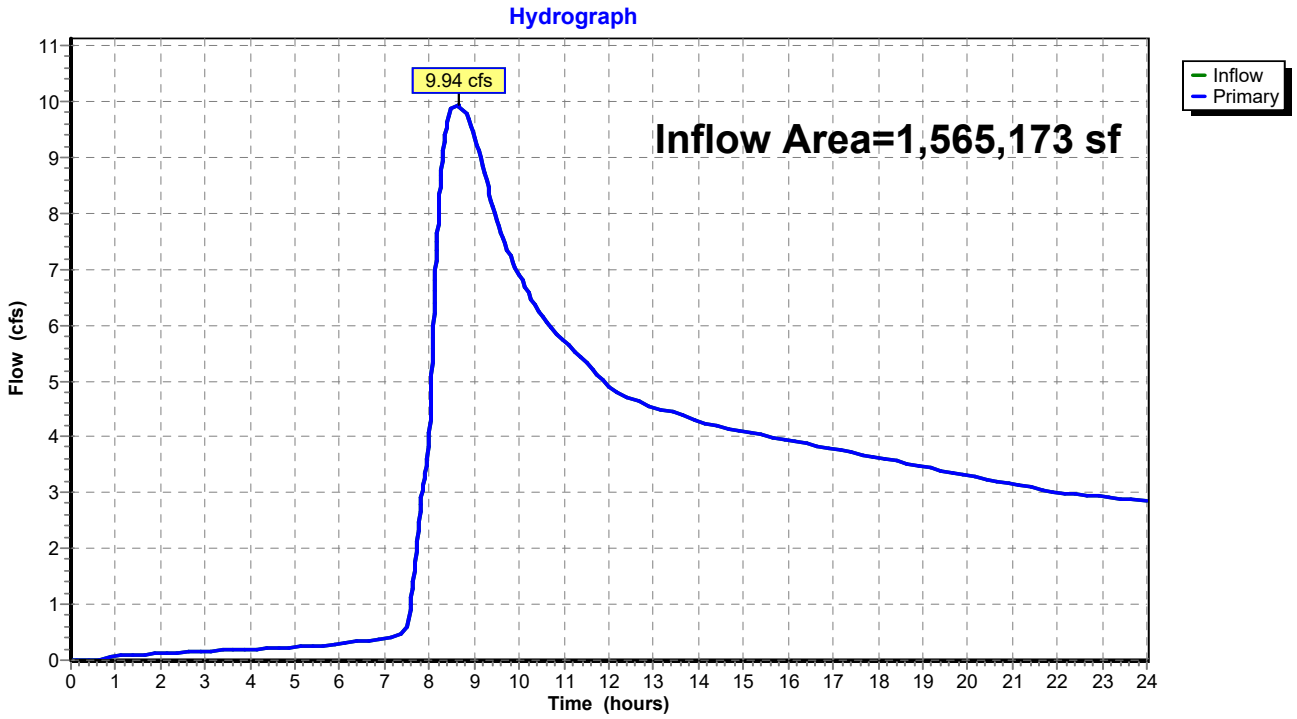


Summary for Link 1T: POST DEV SW

Inflow Area = 1,565,173 sf, 59.85% Impervious, Inflow Depth > 2.07" for 25-YEAR event
Inflow = 9.94 cfs @ 8.65 hrs, Volume= 270,230 cf
Primary = 9.94 cfs @ 8.65 hrs, Volume= 270,230 cf, Atten= 0%, Lag= 0.0 min

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

Link 1T: POST DEV SW

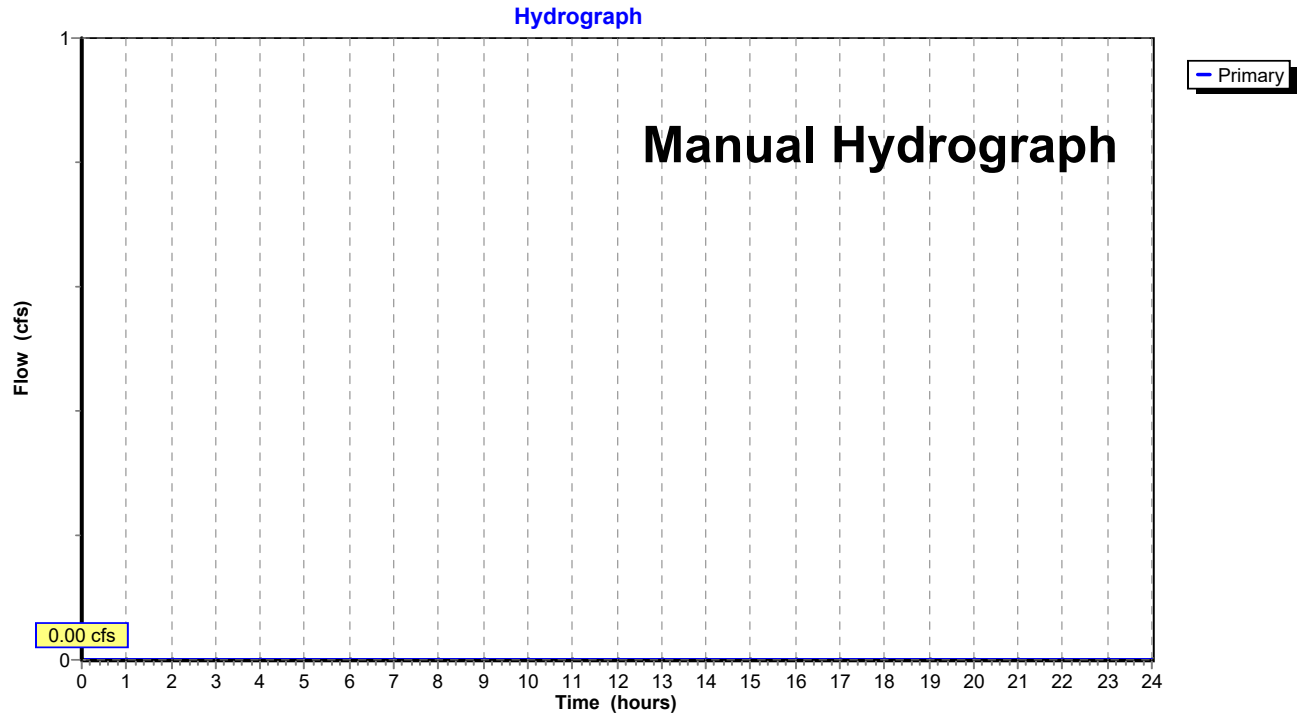


Summary for Link 2T: POST DEV NE

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

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

Link 2T: POST DEV NE

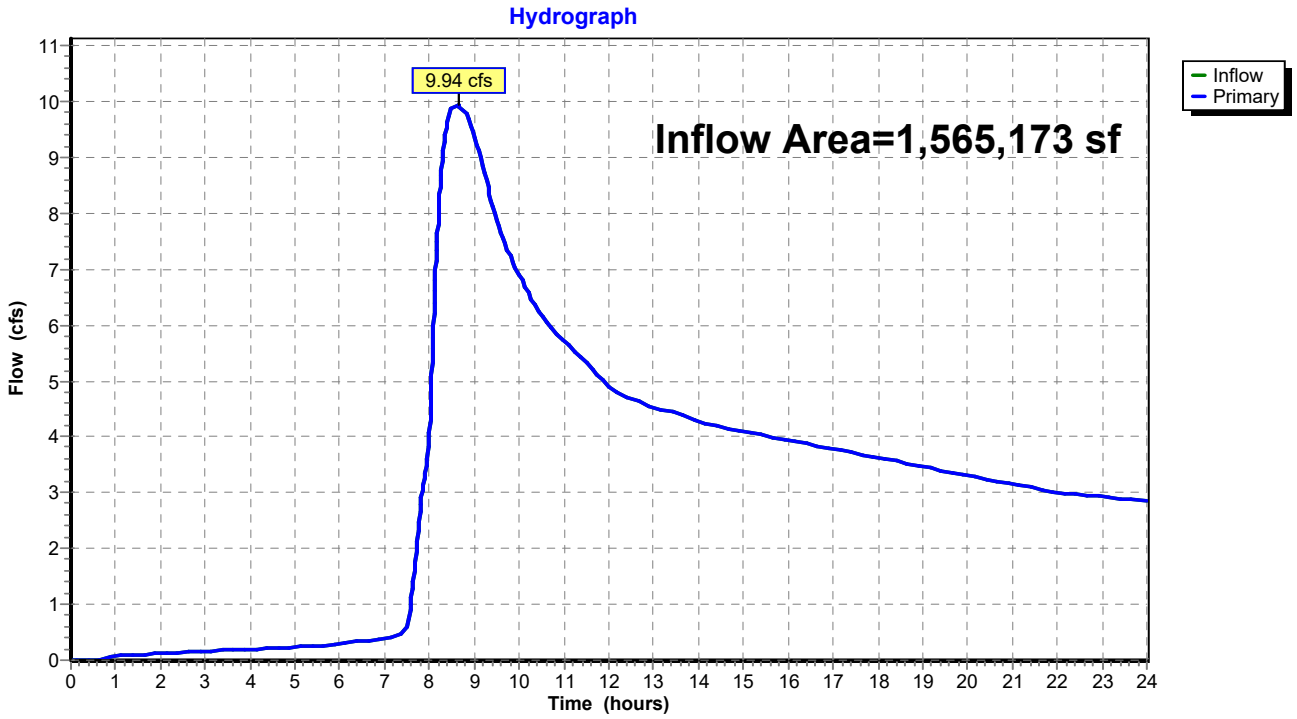


Summary for Link 3T: SITE POST DEV

Inflow Area = 1,565,173 sf, 59.85% Impervious, Inflow Depth > 2.07" for 25-YEAR event
Inflow = 9.94 cfs @ 8.65 hrs, Volume= 270,230 cf
Primary = 9.94 cfs @ 8.65 hrs, Volume= 270,230 cf, Atten= 0%, Lag= 0.0 min

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

Link 3T: SITE POST DEV



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>2.91"
Tc=5.0 min CN=74/98 Runoff=0.44 cfs 6,525 cf

Subcatchment2S: Runoff Area=18,013 sf 90.00% Impervious Runoff Depth>3.01"
Tc=5.0 min CN=74/98 Runoff=0.31 cfs 4,519 cf

Subcatchment3S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>2.91"
Tc=5.0 min CN=74/98 Runoff=1.01 cfs 14,802 cf

Subcatchment4S: Runoff Area=12,600 sf 50.00% Impervious Runoff Depth>2.21"
Tc=5.0 min CN=74/98 Runoff=0.15 cfs 2,317 cf

Subcatchment5S: Runoff Area=55,448 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.30 cfs 5,553 cf

Subcatchment6S: Runoff Area=101,637 sf 77.66% Impervious Runoff Depth>2.76"
Tc=5.0 min CN=74/98 Runoff=1.58 cfs 23,396 cf

Subcatchment7S: Runoff Area=219,254 sf 70.79% Impervious Runoff Depth>2.62"
Tc=5.0 min CN=74/98 Runoff=3.21 cfs 47,949 cf

Subcatchment8S: Runoff Area=70,949 sf 71.75% Impervious Runoff Depth>2.64"
Tc=5.0 min CN=74/98 Runoff=1.05 cfs 15,630 cf

Subcatchment9S: Runoff Area=49,396 sf 78.05% Impervious Runoff Depth>2.77"
Tc=5.0 min CN=74/98 Runoff=0.77 cfs 11,403 cf

Subcatchment10S: Runoff Area=61,962 sf 73.84% Impervious Runoff Depth>2.69"
Tc=5.0 min CN=74/98 Runoff=0.93 cfs 13,867 cf

Subcatchment11S: Runoff Area=62,812 sf 73.24% Impervious Runoff Depth>2.67"
Tc=5.0 min CN=74/98 Runoff=0.94 cfs 13,994 cf

Subcatchment12S: Runoff Area=107,045 sf 68.50% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=1.53 cfs 22,999 cf

Subcatchment13S: Runoff Area=110,619 sf 75.56% Impervious Runoff Depth>2.72"
Tc=5.0 min CN=74/98 Runoff=1.69 cfs 25,074 cf

Subcatchment14S: Runoff Area=52,083 sf 68.79% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=0.75 cfs 11,216 cf

Subcatchment15S: Runoff Area=139,826 sf 59.12% Impervious Runoff Depth>2.39"
Tc=5.0 min CN=74/98 Runoff=1.83 cfs 27,845 cf

Subcatchment16S: Runoff Area=39,881 sf 91.05% Impervious Runoff Depth>3.03"
Tc=5.0 min CN=74/98 Runoff=0.69 cfs 10,074 cf

Subcatchment17S: Runoff Area=124,499 sf 56.48% Impervious Runoff Depth>2.34"
Tc=5.0 min CN=74/98 Runoff=1.58 cfs 24,244 cf

Subcatchment18S: Runoff Area=68,508 sf 7.92% Impervious Runoff Depth>1.36"
Tc=5.0 min CN=74/98 Runoff=0.44 cfs 7,770 cf

Subcatchment19S: Runoff Area=8,600 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.05 cfs 861 cf

Subcatchment150X: Upstream Boones Runoff Area=15,087 sf 87.70% Impervious Runoff Depth>2.96"
Tc=5.0 min CN=74/98 Runoff=0.25 cfs 3,727 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.88"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.31 cfs 24,871 cf

Reach 1R: 30" Avg. Flow Depth=0.66' Max Vel=15.86 fps Inflow=16.52 cfs 247,367 cf
30.0" Round Pipe n=0.013 L=185.5' S=0.0686 '/' Capacity=107.45 cfs Outflow=16.52 cfs 247,330 cf

Reach 2R: 30" Avg. Flow Depth=1.27' Max Vel=5.31 fps Inflow=13.32 cfs 199,493 cf
30.0" Round Pipe n=0.013 L=123.0' S=0.0040 '/' Capacity=25.89 cfs Outflow=13.31 cfs 199,436 cf

Reach 3R: 15" Avg. Flow Depth=0.62' Max Vel=5.25 fps Inflow=3.21 cfs 47,949 cf
15.0" Round Pipe n=0.013 L=166.2' S=0.0100 '/' Capacity=6.46 cfs Outflow=3.21 cfs 47,931 cf

Reach 4R: 12" Avg. Flow Depth=0.27' Max Vel=6.19 fps Inflow=1.05 cfs 15,630 cf
12.0" Round Pipe n=0.013 L=109.0' S=0.0350 '/' Capacity=6.67 cfs Outflow=1.05 cfs 15,626 cf

Reach 5R: 24" Avg. Flow Depth=1.31' Max Vel=4.93 fps Inflow=10.69 cfs 160,488 cf
24.0" Round Pipe n=0.013 L=44.0' S=0.0039 '/' Capacity=14.06 cfs Outflow=10.69 cfs 160,471 cf

Reach 6R: 12" Avg. Flow Depth=0.26' Max Vel=5.66 fps Inflow=0.93 cfs 13,867 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0300 '/' Capacity=6.17 cfs Outflow=0.93 cfs 13,862 cf

Reach 7R: 24" Avg. Flow Depth=1.15' Max Vel=4.81 fps Inflow=9.00 cfs 135,316 cf
24.0" Round Pipe n=0.013 L=270.0' S=0.0040 '/' Capacity=14.31 cfs Outflow=9.00 cfs 135,223 cf

Reach 8R: 12" Avg. Flow Depth=0.37' Max Vel=5.83 fps Inflow=1.53 cfs 22,999 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0220 '/' Capacity=5.28 cfs Outflow=1.53 cfs 22,992 cf

Reach 9R: 24" Avg. Flow Depth=0.95' Max Vel=4.45 fps Inflow=6.53 cfs 98,388 cf
24.0" Round Pipe n=0.013 L=209.6' S=0.0040 '/' Capacity=14.32 cfs Outflow=6.53 cfs 98,330 cf

Reach 10R: 18" Avg. Flow Depth=0.95' Max Vel=4.09 fps Inflow=4.85 cfs 73,327 cf
18.0" Round Pipe n=0.013 L=60.6' S=0.0040 '/' Capacity=6.61 cfs Outflow=4.85 cfs 73,313 cf

Reach 11R: 12" Avg. Flow Depth=0.63' Max Vel=3.50 fps Inflow=1.83 cfs 27,845 cf
12.0" Round Pipe n=0.013 L=125.3' S=0.0050 '/' Capacity=2.53 cfs Outflow=1.83 cfs 27,833 cf

Reach 12R: 15" Avg. Flow Depth=0.67' Max Vel=3.41 fps Inflow=2.27 cfs 34,312 cf
15.0" Round Pipe n=0.013 L=268.1' S=0.0040 '/' Capacity=4.08 cfs Outflow=2.27 cfs 34,278 cf

Reach 13R: 12" Avg. Flow Depth=0.47' Max Vel=4.40 fps Inflow=1.58 cfs 24,244 cf
12.0" Round Pipe n=0.013 L=98.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=1.58 cfs 24,237 cf

Reach 14R: 12" Avg. Flow Depth=0.48' Max Vel=8.87 fps Inflow=3.26 cfs 54,444 cf
12.0" Round Pipe n=0.013 L=163.8' S=0.0400 '/' Capacity=7.12 cfs Outflow=3.26 cfs 54,431 cf

Pond 2P: West Stormwater Facility Peak Elev=323.77' Storage=111,808 cf Inflow=20.05 cfs 307,315 cf
Outflow=6.29 cfs 210,890 cf

Pond 4P: WQ MH Peak Elev=323.89' Inflow=3.26 cfs 54,431 cf
12.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=3.26 cfs 54,431 cf

Pond 5P: WQ MH Peak Elev=323.79' Inflow=2.37 cfs 58,237 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0040 '/' Outflow=2.37 cfs 58,237 cf

Pond 6P: FLOW SPLITTER Peak Elev=323.81' Inflow=16.52 cfs 247,330 cf
Primary=2.37 cfs 58,237 cf Secondary=14.43 cfs 189,094 cf Outflow=16.52 cfs 247,330 cf

Link 1T: POST DEV SW Inflow=6.52 cfs 221,838 cf
Primary=6.52 cfs 221,838 cf

Link 2T: POST DEV NE Manual Hydrograph Inflow=4.46 cfs 207,016 cf
Primary=4.46 cfs 207,016 cf

Link 3T: SITE POST DEV Inflow=10.80 cfs 428,854 cf
Primary=10.80 cfs 428,854 cf

Total Runoff Area = 1,565,173 sf Runoff Volume = 318,636 cf Average Runoff Depth = 2.44"
40.15% Pervious = 628,482 sf 59.85% Impervious = 936,691 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=0.39 cfs 5,783 cf

Subcatchment2S: Runoff Area=18,013 sf 90.00% Impervious Runoff Depth>2.67"
Tc=5.0 min CN=74/98 Runoff=0.28 cfs 4,013 cf

Subcatchment3S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>2.58"
Tc=5.0 min CN=74/98 Runoff=0.90 cfs 13,119 cf

Subcatchment4S: Runoff Area=12,600 sf 50.00% Impervious Runoff Depth>1.92"
Tc=5.0 min CN=74/98 Runoff=0.13 cfs 2,012 cf

Subcatchment5S: Runoff Area=55,448 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.23 cfs 4,478 cf

Subcatchment6S: Runoff Area=101,637 sf 77.66% Impervious Runoff Depth>2.44"
Tc=5.0 min CN=74/98 Runoff=1.39 cfs 20,666 cf

Subcatchment7S: Runoff Area=219,254 sf 70.79% Impervious Runoff Depth>2.31"
Tc=5.0 min CN=74/98 Runoff=2.82 cfs 42,204 cf

Subcatchment8S: Runoff Area=70,949 sf 71.75% Impervious Runoff Depth>2.33"
Tc=5.0 min CN=74/98 Runoff=0.92 cfs 13,764 cf

Subcatchment9S: Runoff Area=49,396 sf 78.05% Impervious Runoff Depth>2.45"
Tc=5.0 min CN=74/98 Runoff=0.68 cfs 10,074 cf

Subcatchment10S: Runoff Area=61,962 sf 73.84% Impervious Runoff Depth>2.37"
Tc=5.0 min CN=74/98 Runoff=0.82 cfs 12,225 cf

Subcatchment11S: Runoff Area=62,812 sf 73.24% Impervious Runoff Depth>2.36"
Tc=5.0 min CN=74/98 Runoff=0.83 cfs 12,333 cf

Subcatchment12S: Runoff Area=107,045 sf 68.50% Impervious Runoff Depth>2.27"
Tc=5.0 min CN=74/98 Runoff=1.34 cfs 20,217 cf

Subcatchment13S: Runoff Area=110,619 sf 75.56% Impervious Runoff Depth>2.40"
Tc=5.0 min CN=74/98 Runoff=1.49 cfs 22,125 cf

Subcatchment14S: Runoff Area=52,083 sf 68.79% Impervious Runoff Depth>2.27"
Tc=5.0 min CN=74/98 Runoff=0.66 cfs 9,861 cf

Subcatchment15S: Runoff Area=139,826 sf 59.12% Impervious Runoff Depth>2.09"
Tc=5.0 min CN=74/98 Runoff=1.59 cfs 24,338 cf

Subcatchment16S: Runoff Area=39,881 sf 91.05% Impervious Runoff Depth>2.69"
Tc=5.0 min CN=74/98 Runoff=0.62 cfs 8,952 cf

Subcatchment17S: Runoff Area=124,499 sf 56.48% Impervious Runoff Depth>2.04"
Tc=5.0 min CN=74/98 Runoff=1.37 cfs 21,153 cf

Subcatchment18S: Runoff Area=68,508 sf 7.92% Impervious Runoff Depth>1.12"
Tc=5.0 min CN=74/98 Runoff=0.35 cfs 6,389 cf

Subcatchment19S: Runoff Area=8,600 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.04 cfs 695 cf

Subcatchment150X: Upstream Boones Runoff Area=15,087 sf 87.70% Impervious Runoff Depth>2.63"
Tc=5.0 min CN=74/98 Runoff=0.23 cfs 3,307 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.59"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=1.08 cfs 21,089 cf

Reach 1R: 30" Avg. Flow Depth=0.62' Max Vel=15.27 fps Inflow=14.50 cfs 217,613 cf
30.0" Round Pipe n=0.013 L=185.5' S=0.0686 '/' Capacity=107.45 cfs Outflow=14.50 cfs 217,579 cf

Reach 2R: 30" Avg. Flow Depth=1.18' Max Vel=5.14 fps Inflow=11.69 cfs 175,479 cf
30.0" Round Pipe n=0.013 L=123.0' S=0.0040 '/' Capacity=25.89 cfs Outflow=11.69 cfs 175,426 cf

Reach 3R: 15" Avg. Flow Depth=0.58' Max Vel=5.08 fps Inflow=2.82 cfs 42,204 cf
15.0" Round Pipe n=0.013 L=166.2' S=0.0100 '/' Capacity=6.46 cfs Outflow=2.82 cfs 42,187 cf

Reach 4R: 12" Avg. Flow Depth=0.25' Max Vel=5.96 fps Inflow=0.92 cfs 13,764 cf
12.0" Round Pipe n=0.013 L=109.0' S=0.0350 '/' Capacity=6.67 cfs Outflow=0.92 cfs 13,761 cf

Reach 5R: 24" Avg. Flow Depth=1.19' Max Vel=4.79 fps Inflow=9.38 cfs 141,068 cf
24.0" Round Pipe n=0.013 L=44.0' S=0.0039 '/' Capacity=14.06 cfs Outflow=9.38 cfs 141,052 cf

Reach 6R: 12" Avg. Flow Depth=0.25' Max Vel=5.46 fps Inflow=0.82 cfs 12,225 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0300 '/' Capacity=6.17 cfs Outflow=0.82 cfs 12,221 cf

Reach 7R: 24" Avg. Flow Depth=1.06' Max Vel=4.66 fps Inflow=7.88 cfs 118,859 cf
24.0" Round Pipe n=0.013 L=270.0' S=0.0040 '/' Capacity=14.31 cfs Outflow=7.88 cfs 118,773 cf

Reach 8R: 12" Avg. Flow Depth=0.34' Max Vel=5.62 fps Inflow=1.34 cfs 20,217 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0220 '/' Capacity=5.28 cfs Outflow=1.34 cfs 20,211 cf

Reach 9R: 24" Avg. Flow Depth=0.88' Max Vel=4.30 fps Inflow=5.72 cfs 86,368 cf
24.0" Round Pipe n=0.013 L=209.6' S=0.0040 '/' Capacity=14.32 cfs Outflow=5.72 cfs 86,315 cf

Reach 10R: 18" Avg. Flow Depth=0.87' Max Vel=3.97 fps Inflow=4.23 cfs 64,255 cf
18.0" Round Pipe n=0.013 L=60.6' S=0.0040 '/' Capacity=6.61 cfs Outflow=4.23 cfs 64,243 cf

Reach 11R: 12" Avg. Flow Depth=0.58' Max Vel=3.40 fps Inflow=1.59 cfs 24,338 cf
12.0" Round Pipe n=0.013 L=125.3' S=0.0050 '/' Capacity=2.53 cfs Outflow=1.59 cfs 24,327 cf

Reach 12R: 15" Avg. Flow Depth=0.62' Max Vel=3.30 fps Inflow=1.99 cfs 30,098 cf
15.0" Round Pipe n=0.013 L=268.1' S=0.0040 '/' Capacity=4.08 cfs Outflow=1.99 cfs 30,068 cf

Reach 13R: 12" Avg. Flow Depth=0.43' Max Vel=4.24 fps Inflow=1.37 cfs 21,153 cf
12.0" Round Pipe n=0.013 L=98.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=1.37 cfs 21,147 cf

Reach 14R: 12" Avg. Flow Depth=0.44' Max Vel=8.54 fps Inflow=2.82 cfs 47,311 cf
12.0" Round Pipe n=0.013 L=163.8' S=0.0400 '/' Capacity=7.12 cfs Outflow=2.82 cfs 47,299 cf

Pond 2P: West Stormwater Facility Peak Elev=323.60' Storage=107,131 cf Inflow=17.52 cfs 269,357 cf
Outflow=4.19 cfs 176,577 cf

Pond 4P: WQ MH Peak Elev=323.64' Inflow=2.82 cfs 47,299 cf
12.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=2.82 cfs 47,299 cf

Pond 5P: WQ MH Peak Elev=323.61' Inflow=2.58 cfs 55,584 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0040 '/' Outflow=2.58 cfs 55,584 cf

Pond 6P: FLOW SPLITTER Peak Elev=323.62' Inflow=14.50 cfs 217,579 cf
Primary=2.58 cfs 55,584 cf Secondary=12.26 cfs 161,995 cf Outflow=14.50 cfs 217,579 cf

Link 1T: POST DEV SW Inflow=4.35 cfs 185,673 cf
Primary=4.35 cfs 185,673 cf

Link 2T: POST DEV NE Manual Hydrograph Inflow=3.48 cfs 171,867 cf
Primary=3.48 cfs 171,867 cf

Link 3T: SITE POST DEV Inflow=7.78 cfs 357,540 cf
Primary=7.78 cfs 357,540 cf

Total Runoff Area = 1,565,173 sf Runoff Volume = 278,795 cf Average Runoff Depth = 2.14"
40.15% Pervious = 628,482 sf 59.85% Impervious = 936,691 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Future Commercial Runoff Area=26,911 sf 85.00% Impervious Runoff Depth>2.02"
Tc=5.0 min CN=74/98 Runoff=0.31 cfs 4,525 cf

Subcatchment2S: Runoff Area=18,013 sf 90.00% Impervious Runoff Depth>2.10"
Tc=5.0 min CN=74/98 Runoff=0.22 cfs 3,153 cf

Subcatchment3S: Future Commercial Runoff Area=61,043 sf 85.00% Impervious Runoff Depth>2.02"
Tc=5.0 min CN=74/98 Runoff=0.70 cfs 10,264 cf

Subcatchment4S: Runoff Area=12,600 sf 50.00% Impervious Runoff Depth>1.44"
Tc=5.0 min CN=74/98 Runoff=0.09 cfs 1,508 cf

Subcatchment5S: Runoff Area=55,448 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.11 cfs 2,800 cf

Subcatchment6S: Runoff Area=101,637 sf 77.66% Impervious Runoff Depth>1.90"
Tc=5.0 min CN=74/98 Runoff=1.08 cfs 16,057 cf

Subcatchment7S: Runoff Area=219,254 sf 70.79% Impervious Runoff Depth>1.78"
Tc=5.0 min CN=74/98 Runoff=2.16 cfs 32,555 cf

Subcatchment8S: Runoff Area=70,949 sf 71.75% Impervious Runoff Depth>1.80"
Tc=5.0 min CN=74/98 Runoff=0.71 cfs 10,629 cf

Subcatchment9S: Runoff Area=49,396 sf 78.05% Impervious Runoff Depth>1.90"
Tc=5.0 min CN=74/98 Runoff=0.53 cfs 7,830 cf

Subcatchment10S: Runoff Area=61,962 sf 73.84% Impervious Runoff Depth>1.83"
Tc=5.0 min CN=74/98 Runoff=0.63 cfs 9,461 cf

Subcatchment11S: Runoff Area=62,812 sf 73.24% Impervious Runoff Depth>1.82"
Tc=5.0 min CN=74/98 Runoff=0.64 cfs 9,539 cf

Subcatchment12S: Runoff Area=107,045 sf 68.50% Impervious Runoff Depth>1.74"
Tc=5.0 min CN=74/98 Runoff=1.03 cfs 15,554 cf

Subcatchment13S: Runoff Area=110,619 sf 75.56% Impervious Runoff Depth>1.86"
Tc=5.0 min CN=74/98 Runoff=1.15 cfs 17,154 cf

Subcatchment14S: Runoff Area=52,083 sf 68.79% Impervious Runoff Depth>1.75"
Tc=5.0 min CN=74/98 Runoff=0.50 cfs 7,589 cf

Subcatchment15S: Runoff Area=139,826 sf 59.12% Impervious Runoff Depth>1.59"
Tc=5.0 min CN=74/98 Runoff=1.19 cfs 18,502 cf

Subcatchment16S: Runoff Area=39,881 sf 91.05% Impervious Runoff Depth>2.12"
Tc=5.0 min CN=74/98 Runoff=0.49 cfs 7,040 cf

Subcatchment17S: Runoff Area=124,499 sf 56.48% Impervious Runoff Depth>1.54"
Tc=5.0 min CN=74/98 Runoff=1.03 cfs 16,020 cf

Subcatchment18S: Runoff Area=68,508 sf 7.92% Impervious Runoff Depth>0.74"
Tc=5.0 min CN=74/98 Runoff=0.20 cfs 4,211 cf

Subcatchment19S: Runoff Area=8,600 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.02 cfs 434 cf

Subcatchment150X: Upstream Boones Runoff Area=15,087 sf 87.70% Impervious Runoff Depth>2.06"
Tc=5.0 min CN=74/98 Runoff=0.18 cfs 2,593 cf

Subcatchment160X: Upstream Properties Runoff Area=159,000 sf 14.70% Impervious Runoff Depth>1.13"
Flow Length=300' Slope=0.0400 '/' Tc=20.2 min CN=81/98 Runoff=0.72 cfs 14,912 cf

Reach 1R: 30" Avg. Flow Depth=0.54' Max Vel=14.14 fps Inflow=11.13 cfs 167,679 cf
30.0" Round Pipe n=0.013 L=185.5' S=0.0686 '/' Capacity=107.45 cfs Outflow=11.13 cfs 167,651 cf

Reach 2R: 30" Avg. Flow Depth=1.01' Max Vel=4.79 fps Inflow=8.97 cfs 135,183 cf
30.0" Round Pipe n=0.013 L=123.0' S=0.0040 '/' Capacity=25.89 cfs Outflow=8.96 cfs 135,139 cf

Reach 3R: 15" Avg. Flow Depth=0.50' Max Vel=4.74 fps Inflow=2.16 cfs 32,555 cf
15.0" Round Pipe n=0.013 L=166.2' S=0.0100 '/' Capacity=6.46 cfs Outflow=2.16 cfs 32,540 cf

Reach 4R: 12" Avg. Flow Depth=0.22' Max Vel=5.53 fps Inflow=0.71 cfs 10,629 cf
12.0" Round Pipe n=0.013 L=109.0' S=0.0350 '/' Capacity=6.67 cfs Outflow=0.71 cfs 10,626 cf

Reach 5R: 24" Avg. Flow Depth=1.01' Max Vel=4.50 fps Inflow=7.18 cfs 108,513 cf
24.0" Round Pipe n=0.013 L=44.0' S=0.0039 '/' Capacity=14.06 cfs Outflow=7.18 cfs 108,500 cf

Reach 6R: 12" Avg. Flow Depth=0.22' Max Vel=5.06 fps Inflow=0.63 cfs 9,461 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0300 '/' Capacity=6.17 cfs Outflow=0.63 cfs 9,458 cf

Reach 7R: 24" Avg. Flow Depth=0.90' Max Vel=4.36 fps Inflow=6.02 cfs 91,297 cf
24.0" Round Pipe n=0.013 L=270.0' S=0.0040 '/' Capacity=14.31 cfs Outflow=6.02 cfs 91,225 cf

Reach 8R: 12" Avg. Flow Depth=0.30' Max Vel=5.21 fps Inflow=1.03 cfs 15,554 cf
12.0" Round Pipe n=0.013 L=135.0' S=0.0220 '/' Capacity=5.28 cfs Outflow=1.03 cfs 15,549 cf

Reach 9R: 24" Avg. Flow Depth=0.76' Max Vel=4.00 fps Inflow=4.36 cfs 66,254 cf
24.0" Round Pipe n=0.013 L=209.6' S=0.0040 '/' Capacity=14.32 cfs Outflow=4.36 cfs 66,209 cf

Reach 10R: 18" Avg. Flow Depth=0.74' Max Vel=3.71 fps Inflow=3.21 cfs 49,110 cf
18.0" Round Pipe n=0.013 L=60.6' S=0.0040 '/' Capacity=6.61 cfs Outflow=3.21 cfs 49,100 cf

Reach 11R: 12" Avg. Flow Depth=0.48' Max Vel=3.17 fps Inflow=1.19 cfs 18,502 cf
12.0" Round Pipe n=0.013 L=125.3' S=0.0050 '/' Capacity=2.53 cfs Outflow=1.19 cfs 18,492 cf

Reach 12R: 15" Avg. Flow Depth=0.53' Max Vel=3.08 fps Inflow=1.51 cfs 23,054 cf
15.0" Round Pipe n=0.013 L=268.1' S=0.0040 '/' Capacity=4.08 cfs Outflow=1.51 cfs 23,029 cf

Reach 13R: 12" Avg. Flow Depth=0.37' Max Vel=3.92 fps Inflow=1.03 cfs 16,020 cf
12.0" Round Pipe n=0.013 L=98.0' S=0.0100 '/' Capacity=3.56 cfs Outflow=1.03 cfs 16,015 cf

Reach 14R: 12" Avg. Flow Depth=0.37' Max Vel=7.87 fps Inflow=2.08 cfs 35,447 cf
12.0" Round Pipe n=0.013 L=163.8' S=0.0400 '/' Capacity=7.12 cfs Outflow=2.08 cfs 35,437 cf

Pond 2P: West Stormwater Facility Peak Elev=323.13' Storage=94,569 cf Inflow=13.30 cfs 205,888 cf
Outflow=2.38 cfs 119,887 cf

Pond 4P: WQ MH Peak Elev=323.14' Inflow=2.08 cfs 35,437 cf
12.0" Round Culvert n=0.013 L=40.0' S=0.0100 '/' Outflow=2.08 cfs 35,437 cf

Pond 5P: WQ MH Peak Elev=323.14' Inflow=3.08 cfs 52,122 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0040 '/' Outflow=3.08 cfs 52,122 cf

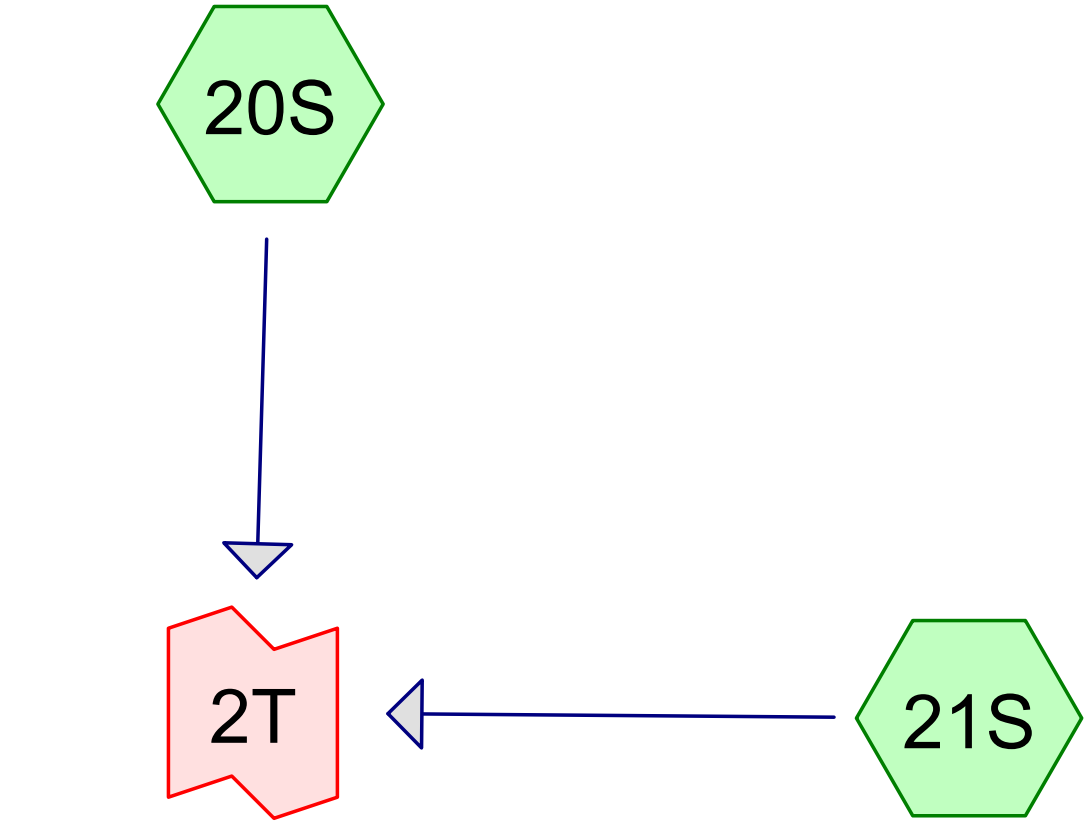
Pond 6P: FLOW SPLITTER Peak Elev=323.14' Inflow=11.13 cfs 167,651 cf
Primary=3.08 cfs 52,122 cf Secondary=8.50 cfs 115,529 cf Outflow=11.13 cfs 167,651 cf

Link 1T: POST DEV SW Inflow=2.47 cfs 126,040 cf
Primary=2.47 cfs 126,040 cf

Link 2T: POST DEV NE Manual Hydrograph Inflow=2.07 cfs 119,257 cf
Primary=2.07 cfs 119,257 cf

Link 3T: SITE POST DEV Inflow=4.52 cfs 245,298 cf
Primary=4.52 cfs 245,298 cf

Total Runoff Area = 1,565,173 sf Runoff Volume = 212,330 cf Average Runoff Depth = 1.63"
40.15% Pervious = 628,482 sf 59.85% Impervious = 936,691 sf



Post-Dev Northeast

Subcat Reach Pond Link

Routing Diagram for 7454 PH1 Post-Developed_Ph 3_4 mod
Prepared by AKS Engineering & Forestry, Printed 3/7/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
72,395	74	>75% Grass cover, Good, HSG C (20S, 21S)
84,480	98	Impervious Area on Lots (2,640 sq.ft. per lot) (20S)
48,934	98	Paved roads w/curbs & sewers, HSG C (20S)
205,809	**90**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment20S: Runoff Area=199,542 sf 66.86% Impervious Runoff Depth>1.72"
Tc=5.0 min CN=74/98 Runoff=1.88 cfs 28,542 cf

Subcatchment21S: Runoff Area=6,267 sf 0.00% Impervious Runoff Depth>0.61"
Tc=5.0 min CN=74/0 Runoff=0.01 cfs 316 cf

Link 2T: Post-Dev Northeast Inflow=1.89 cfs 28,858 cf
Primary=1.89 cfs 28,858 cf

Total Runoff Area = 205,809 sf Runoff Volume = 28,858 cf Average Runoff Depth = 1.68"
35.18% Pervious = 72,395 sf 64.82% Impervious = 133,414 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment20S: Runoff Area=199,542 sf 66.86% Impervious Runoff Depth>2.24"
Tc=5.0 min CN=74/98 Runoff=2.46 cfs 37,171 cf

Subcatchment21S: Runoff Area=6,267 sf 0.00% Impervious Runoff Depth>0.97"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 506 cf

Link 2T: Post-Dev Northeast Inflow=2.49 cfs 37,677 cf
Primary=2.49 cfs 37,677 cf

Total Runoff Area = 205,809 sf Runoff Volume = 37,677 cf Average Runoff Depth = 2.20"
35.18% Pervious = 72,395 sf 64.82% Impervious = 133,414 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment20S: Runoff Area=199,542 sf 66.86% Impervious Runoff Depth>2.55"
Tc=5.0 min CN=74/98 Runoff=2.81 cfs 42,324 cf

Subcatchment21S: Runoff Area=6,267 sf 0.00% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=74/0 Runoff=0.03 cfs 628 cf

Link 2T: Post-Dev Northeast Inflow=2.85 cfs 42,952 cf
Primary=2.85 cfs 42,952 cf

Total Runoff Area = 205,809 sf Runoff Volume = 42,952 cf Average Runoff Depth = 2.50"
35.18% Pervious = 72,395 sf 64.82% Impervious = 133,414 sf

STORMWATER CONVEYANCE CALCULATIONS

Project: PH 3 Autumn Sunrise
Date: 3/8/2023

Design Storm: 25-Year
Storm Duration: 24-Hour
Precipitation: 3.9-Inch
Mannning's "n" 0.013
Max flow depth 82%

DESIGN							RESULTS					
REACH	UPSTREAM TO DOWNSTREAM STRUCTURE	LENGTH (ft.)	PIPE DIAMETER (in.) D_o	PIPE SLOPE (ft/ft)	MAX. FLOW (cfs)	MAX VELOCITY (fps)	FLOW (cfs)	VELOCITY (fps)	Q_f/Q_{max}	PIPE FLOW DEPTH (in.)	y/D_o	Meets Criteria (<82%)
1R	MH 14.2 TO MH 14.1	185	30	0.068	107.00	24.83	18.77	16.45	0.18	8.52	28%	Yes
2R	MH 14.3 TO MH 14.2	123	30	0.004	25.95	6.02	15.05	5.47	0.58	16.44	55%	Yes
3R	MH 15.1 TO MH 14.2	166	15	0.01	6.46	6.00	3.71	5.17	0.57	10.32	69%	Yes
4R	MH 18.1 TO MH 14.5	109	12	0.035	6.67	9.67	1.21	6.45	0.18	3.48	29%	Yes
5R	MH 14.6 TO MH 14.5	44	24	0.004	14.31	5.19	12.03	5.03	0.84	17.04	71%	Yes
6R	CO 19.1 TO MH 14.7	135	12	0.03	6.17	8.95	1.08	5.90	0.18	3.36	28%	Yes
7R	MH 14.8 TO MH 14.7	270	24	0.004	14.31	5.19	10.07	4.93	0.70	14.88	62%	Yes
8R	CO 20.1 TO MH 14.8	135	12	0.022	5.28	7.66	1.78	6.07	0.34	4.80	40%	Yes
9R	MH 14.9 TO MH 14.8	209	24	0.004	14.31	5.19	7.21	4.57	0.50	12.00	50%	Yes
10R	MH 14.11 TO MH 14.10	60	18	0.004	6.64	4.28	5.28	4.15	0.80	12.00	67%	Yes
11R	MH 21.1 TO MH 14.12	125	12	0.005	2.52	3.65	2.14	3.61	0.85	8.52	71%	Yes
12R	MH 14.13 TO MH 14.12	268	15	0.004	4.08	3.79	2.65	3.54	0.65	8.76	58%	Yes
13R	CO 22.1 TO MH 14.13	98	12	0.01	3.56	5.17	1.86	4.59	0.52	6.12	51%	Yes
14R	EX MH 13.1 TO MH 13.0	163	12	0.04	7.12	10.34	3.79	9.21	0.53	6.24	52%	Yes

Appendix C:
Stormwater Quality Calculations

STORMWATER QUALITY CALCULATIONS

Client: Lennar Northwest, INC
Project: Autumn Sunrise
AKS Job No.: 7454
Date: 3/7/2023
Done By: JSM
Checked By: PAS

IMPERVIOUS AREA

Total Site Area:	31.94	acres
Total Site Area:	1,391,119	square feet (sf)
Number of Lots:	206	
Impervious Area Per Lot:	2,640	sf
Total Impervious Lot Area:	543,840	sf
CPAH Frontage Improvements	3,847	
Total Off-Site Impervious Area	9,286	sf
Future Commercial Impervious Area:	74,761	sf
Road & Sidewalk Impervious Area:	284,494	sf
Total Impervious Area:	916,228	sf

R DESIGN QUALITY VOLUME (WQV)

(Per CWS 4.08.5a2 - R&O 19-22)

$$WQV = \frac{0.36" \text{ X Area (ft)}}{12" \text{ per ft}} = \mathbf{27487} \ \mathbf{cubic\ feet}$$

WATER QUALITY FLOW (WQF)

(Per CWS 4.08.5a3 - R&O 19-22)

$$WQF = \frac{WQV\ (sf)}{4*60*60} = \mathbf{1.91} \ \mathbf{cfs}$$

Y MANHOLE SUMP VOLUME CALCULATIONS

(Per CWS 4.09.1 - R&O 19-22)

CWS Criteria: Sump Volume = 20 cubic feet per 1.0 cfs of flow

25-year Flow through WQ Manhole = **3.8** **cfs**

Calculated Manhole Sump Volume = **76** **cubic feet**

Calculated Manhole Sump Depth (60" Dia. Manhole) = **3.9** **ft** < 5 feet maximum

EXTENDED DRY BASIN DESIGN & CALCULATIONS

Hydraulic Design Criteria (Per CWS 4.09.5a/b/c - R&O 19-22)

Permanent Pool Depth: 0.2 ft
Permanent Pool covers bottom of basin
Design Detention Volume: 1.0 x Water Quality Volume (WQV)
Water Quality Drawdown Time: 48 hours
Maximum Depth of WQ Pool: 5 ft
Avoid direct flow across WQ pond to avoid short circuiting

Extended Dry Basin Sizing Design:

Bottom Slope (ft/ft)	Minimum Bottom Width (ft)	Side Slopes H:V	Top of Pond Elev. (ft)	Perm. Pool Depth (ft)	Pool Bottom Area (sf)	Bottom of Pool Elev. (ft)
0.0	85	3.0	325.00	0.2	12015	318.5

Water Quality Flow Hydraulic Calculations:

Q (cfs)	Pool Elev. at WQV (ft)	Orifice CL Height (ft)	Calculated Orifice Diameter (in)	Max. Pool Elev., 25-yr Event (ft)	Calculated Pond WQV (cubic feet)	Calculated WQV Pool Depth (ft)
0.16	320.3	318.17	2.25	323.98	28319	1.8

Check Against Design Criteria:

	Calculated		Meet CWS Criteria?		
Minimum Freeboard:	1.0	feet	**Yes**	more than	1 foot
Minimum Bottom Width:	85	feet	**Yes**	greater than	4 feet
Maximum Pool Depth at WQV:	1.8	feet	**Yes**	less than	5 feet
Detained Water Quality Volume:	28319	cubic feet	**Yes**	greater than	27487 cf

Appendix D:
Site Geotechnical Report

Appendix E:
TR55 Runoff Curve Numbers

TR55 RUNOFF CURVE NUMBERS

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 (vegetat ion 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
Developin g 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.