Senestraro Family Orthodontics
Sherwood, Oregon

Preliminary Stormwater Report

Date:	May 2020
Client:	Senestraro Family Orthodontics 29585 SW Park Place, Ste F Wilsonville, OR 97070
Engineering Contact:	Jonathon Morse, PE JonM@aks-eng.com
Engineering Firm:	AKS Engineering & Forestry, LLC
AKS Job Number:	6946

AKS ENGINEERING & FORESTRY
12965 SW Herman Road, Suite 100
Tualatin, OR 97062
P: (503) 563-6151
www.aks-eng.com

Table of Contents

Tables

Figure

Appendices

Preliminary Stormwater Report
SENESTRARO FAMILY ORTHODONTICS
SHERWOOD, 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 preliminary hydraulic analysis are also presented.

2.0 Project Location/Description
The subject site is located southwest of the intersection of SW Meinecke Parkway and Pacific Highway West (OR 99w) in Sherwood, Oregon. The subject site has a total site area of approximately 1.24 acres (Washington County Tax Lots 8000, 8100, 8200 2S 1 31AB and Tax Lot 8200 2S 1 31BA).

Planned onsite improvements include the construction of a commercial office building with associated parking and site utilities.

3.0 Regulatory Design Criteria
3.1 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 Water 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 CWS standards, the stormwater facility has been designed to detain the subject site's post-developed 25-year storm event flow to the pre-developed 25-year storm event flow.

3.2 STORMWATER HYDROMODIFICATION
Per *Clean Water Services (CWS) Design and Construction Standards Manual for Sanitary Sewer and Surface Water Management (R&O 19-05), Section 4.03 Water Quantity Control Requirements*, stormwater hydromodification analysis/design 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 CWS Hydromodification Approach Project Category Table 4-2, the subject site is identified as Category 2. Therefore, the subject project will meet CWS hydromodification requirements by providing peak-flow matching detention, using the criteria established within CWS Section 4.08.6.

3.3 STORMWATER QUALITY

Stormwater quality management for this project will be provided by routing stormwater runoff through filter cartridges prior to entering the subsurface detention pipe located beneath the proposed parking area.

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 and are included in Appendix E.

5.0 Design Parameters

5.1 DESIGN STORMS

Per CWS requirements, the following rainfall intensities and durations were used in analyzing the existing and proposed stormwater facilities:

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 ±4%, with the subject site sloping southwest to northeast.

5.2.2 Land Use

The subject site is currently zoned general commercial and consists of vacant lots with existing paved asphalt and concrete surfaces.

5.3 SOIL TYPE

The existing soils on the project site and the associated drainage basins are classified as Hillsboro Silt Loam and Quatama Silt Loam according to the USDA Soil Survey for Washington County. The following table outlines the Hydrologic Soil Group rating for the soil type:

Table 5-2: Hydrologic Soil Group Ratings

NRCS Map Unit Identification	NRCS Soil Classification	Hydrologic Soil Group Rating
21A	Hillsboro Silt Loam	B
37A	Quatama Silt Loam	C

5.4 POST-DEVELOPED SITE CONDITIONS

5.4.1 Site Topography

The onsite slopes will be modified with minor cuts and fills to accommodate the construction of the access/parking areas and commercial office building. The proposed site grading will not change the existing stormwater drainage patterns/basin.

5.4.2 Land Use

The site land-use will consist of the construction of a new commercial office building with onsite parking and property line adjustment.

5.4.3 Post-Developed Input Parameters

Appendices A, B, and C provide the HydroCAD reports and input parameters that were generated for the analyzed storm events with respect to the drainage basins contributing to the planned onsite improvements. 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

No major off-site contributory basins drain onto the subject site. The surrounding subdivisions/properties drain utilizing the existing public storm drainage systems and facilities.

6.0 Stormwater Analyses

6.1 STORMWATER CONDUIT SIZING AND INLET SPACING

The storm system pipes and area drains will be sized to meet CWS sizing and spacing requirements using the Manning's equation to adequately convey the peak flows from the 25-year storm event.

6.2 STORMWATER QUALITY MANAGEMENT

Treatment for water quality will be achieved by routing stormwater through stormwater filter cartridges prior to entering the subsurface detention pipe. The system has been designed to provide water quality treatment per Clean Water Services Design and Construction Standards for Sanitary Sewer and Surface Water Management (R&O 19-05).

Stormwater runoff generated beyond the 25-year detention volume, will be routed through the subsurface detention pipe via an overflow structure and discharged into the existing public storm drainage system located east of the subject site. Detailed calculations and checks against CWS criteria are included in the Appendices.

A small amount of new impervious area in the north corner of the site cannot be routed to the new on-site stormwater management system due to topographic constraints. This untreatable area will be addressed by a fee-in-lieu payment.

6.3 STORMWATER HYDROMODIFICATION MANAGEMENT

The planned project will generate approximately 28,958 square feet of impervious area, thus classifying as a Large Project.

Per CWS Hydromodification Planning Tool, the subject site is located within a developed region, discharging into a moderate risk level existing stream via an existing public storm system with a known downstream deficiency. Based on these parameters and CWS Table 4-2, the subject site falls within a

Category 2 Hydromodification approach. Category 2 CWS hydromodification approach requirements are outlined in Table 6-1.

Table 6-1: CWS Hydromodification Requirements	
Post-Developed Peak Runoff Rate	**Pre-Developed Peak Runoff Rate Target**
2-year, 24-hour	50% of 2-year, 24-hour
5-year, 24-hour	5-year, 24-hour
10-year, 24-hour	10-year, 24-hour

Per CWS Category 2, the subject site will provide peak-flow matching detention, using design criteria in CWS Section 4.08.6.

6.4 STORMWATER QUANTITY CONTROL FACILITY DESIGN

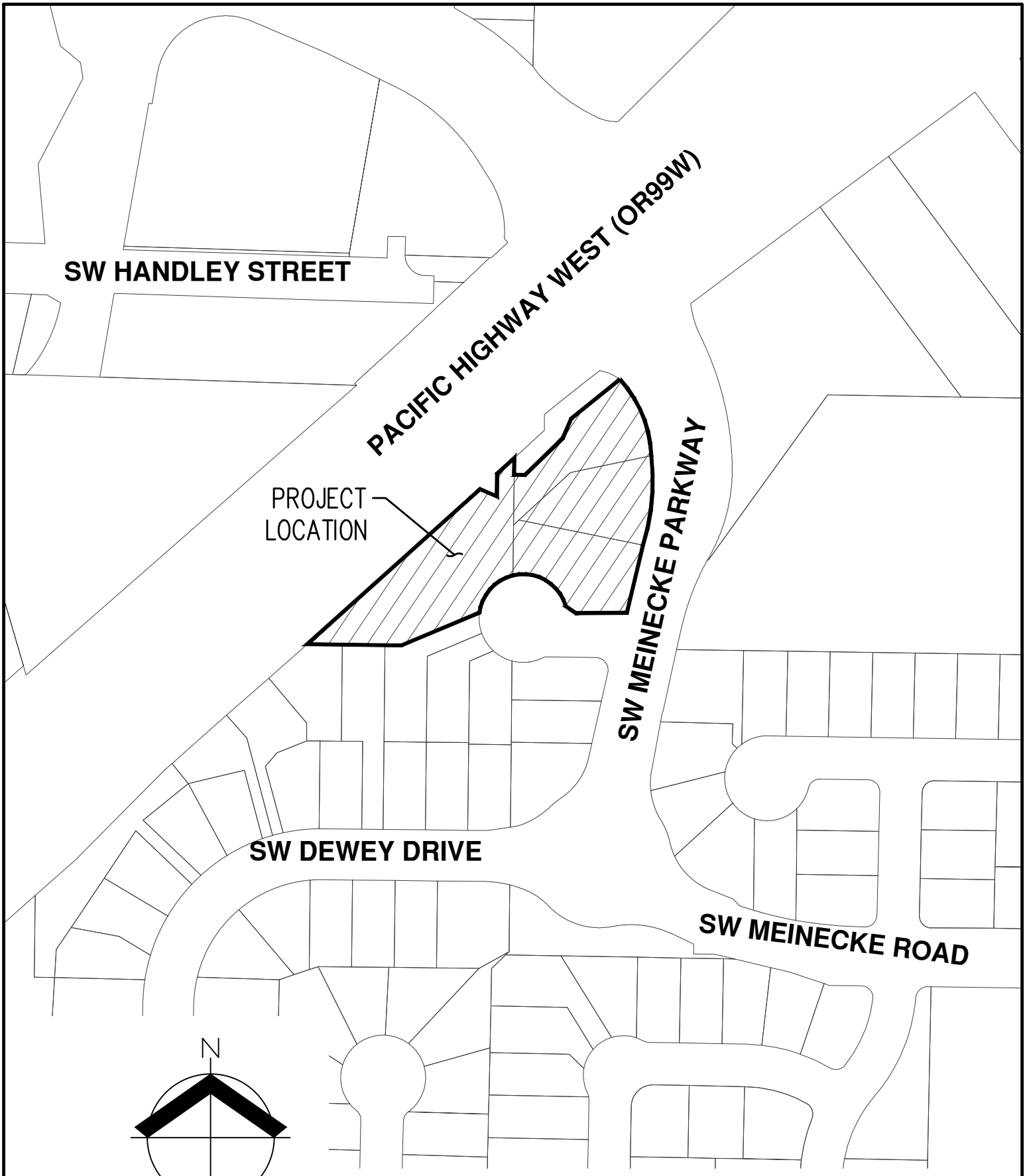
The planned project provides stormwater quantity management by utilizing a subsurface detention pipe which has been designed per CWS standards.

The following table outlines the results of the detention pipes outflow which limits the post-development peak flows to less than the allowable pre-development peak flows for each storm event, as outlined within CWS stormwater detention and hydromodification management requirements.

Table 6-2: 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	0.28 (50% of 2-yr = 0.14)	0.14	(0.00)
5	0.43	0.24	(0.19)
10	0.52	0.25	(0.27)
25	0.64	0.27	(0.37)

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

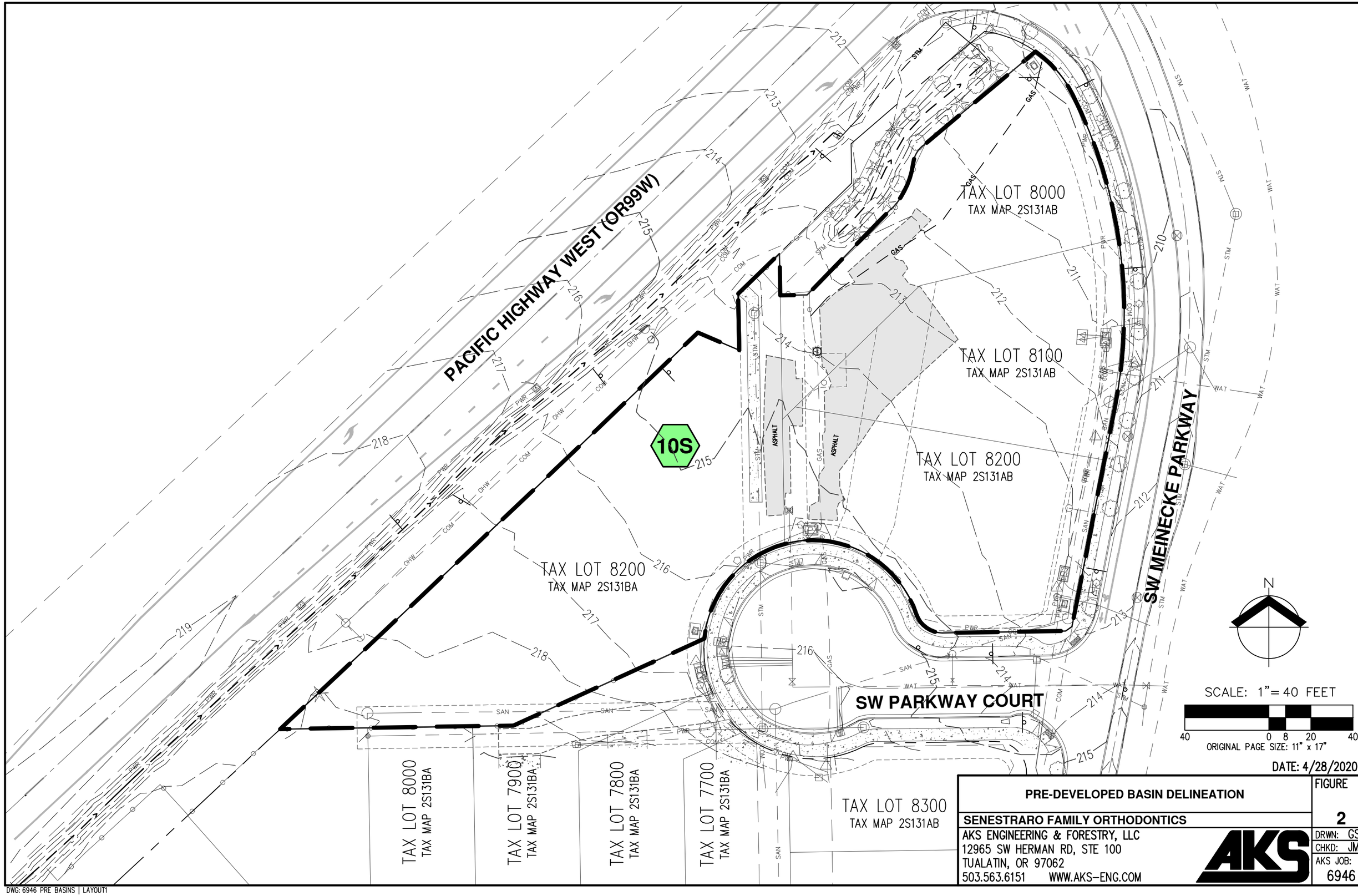
The subsurface detention pipe has been designed per CWS requirements with sufficient capacity to provide 1-foot of freeboard between the hydraulic grade line and the top of the structure for the 25-year post development peak rate of runoff, as well as detain the required post-developed site flows to the allowable pre-developed flow requirements established by Clean Water Service's Design and Construction for Sanitary Sewer and Surface Water Management Manual (R&O 19-05).



DATE: 4/13/2020

SENESTRARO FAMILY ORTHODONTICS **SITE VICINITY MAP**	FIGURE **1**
AKS ENGINEERING & FORESTRY, LLC 12965 SW HERMAN RD, STE 100 TUALATIN, OR 97062 503.563.6151 WWW.AKS-ENG.COM	DRWN: GSH CHKD: JMM AKS JOB: 6946

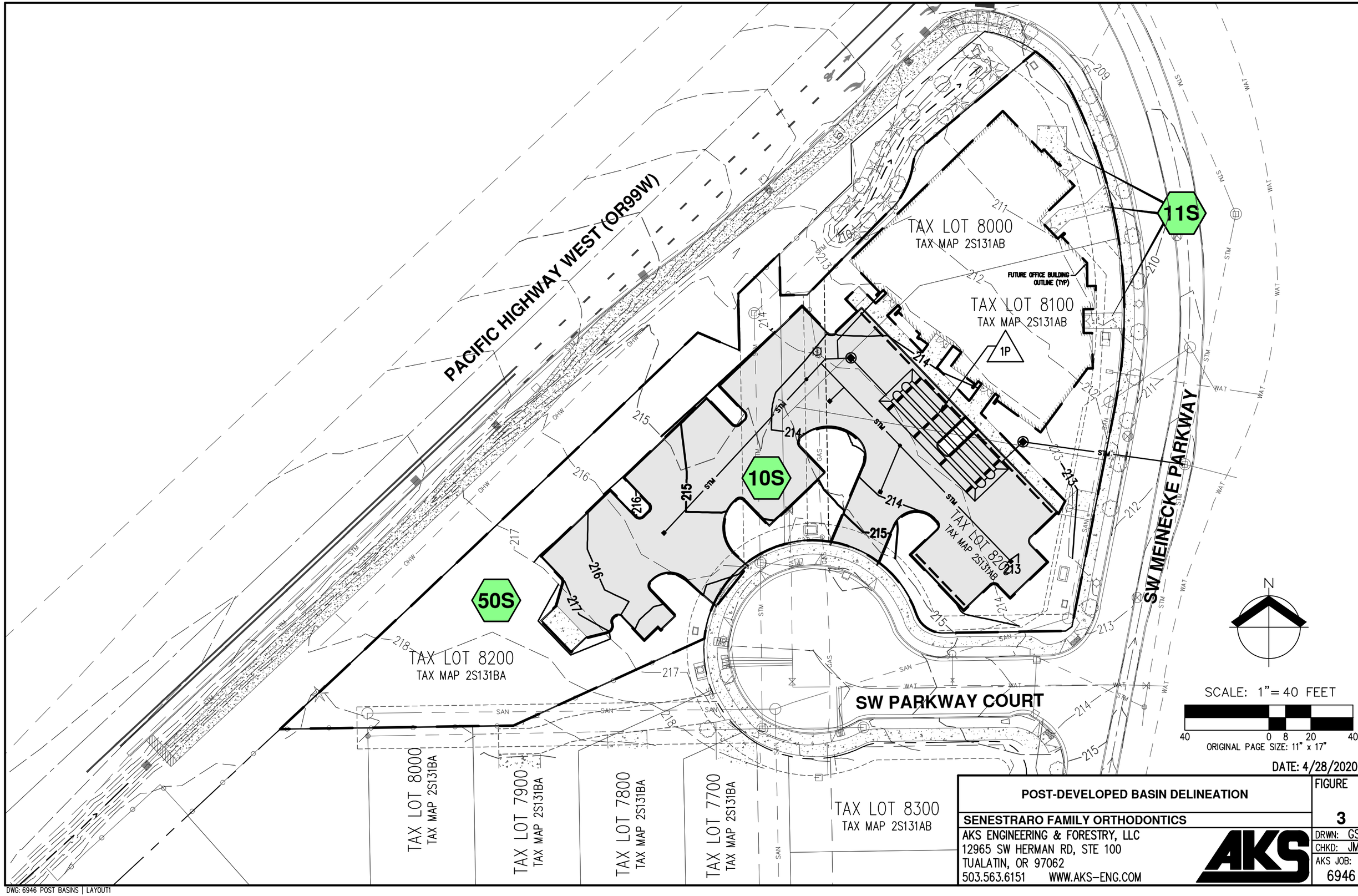
DWG: 6946 VICINITY | COVER



DATE: 4/28/2020

PRE-DEVELOPED BASIN DELINEATION	FIGURE 2
SENESTRARO FAMILY ORTHODONTICS	
AKS ENGINEERING & FORESTRY, LLC 12965 SW HERMAN RD, STE 100 TUALATIN, OR 97062 503.563.6151 WWW.AKS-ENG.COM	DRWN: GSH CHKD: JMM AKS JOB: 6946

DWG: 6946 PRE BASINS | LAYOUT1



POST-DEVELOPED BASIN DELINEATION

SENESTRARO FAMILY ORTHODONTICS

FIGURE 3

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

DRWN: GSH
CHKD: JMM
AKS JOB: 6946

DWG: 6946 POST BASINS | LAYOUT1

POST-DEVELOPED IMPERVIOUS AREA TABLE

PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT	28,146 SF
PROPOSED UNTREATABLE IMPERVIOUS AREA	812 SF
REQUIRED IMPERVIOUS AREA TO TREAT	28,958 SF
IMPERVIOUS AREA TREATMENT PROVIDED	28,146 SF
NET TOTAL	-812 SF

INDICATES PROPOSED IMPERVIOUS AREA RECEIVING TREATMENT

INDICATES PROPOSED IMPERVIOUS AREA UNABLE TO BE TREATED

PACIFIC HIGHWAY WEST (OR99W)

TAX LOT 8000
TAX MAP 2S131AB

FUTURE OFFICE BUILDING OUTLINE (TYP)

TAX LOT 8100
TAX MAP 2S131AB

TAX LOT 8200
TAX MAP 2S131AB

SW MEINECKE PARKWAY

SW PARKWAY COURT

TAX LOT 8200
TAX MAP 2S131BA

TAX LOT 8000
TAX MAP 2S131BA

TAX LOT 7900
TAX MAP 2S131BA

TAX LOT 7800
TAX MAP 2S131BA

TAX LOT 7700
TAX MAP 2S131BA

TAX LOT 8300
TAX MAP 2S131AB

N

SCALE: 1"= 40 FEET

40 0 8 20 40

ORIGINAL PAGE SIZE: 11" x 17"

DATE: 4/28/2020

STORMWATER TREATMENT MAP

FIGURE 4

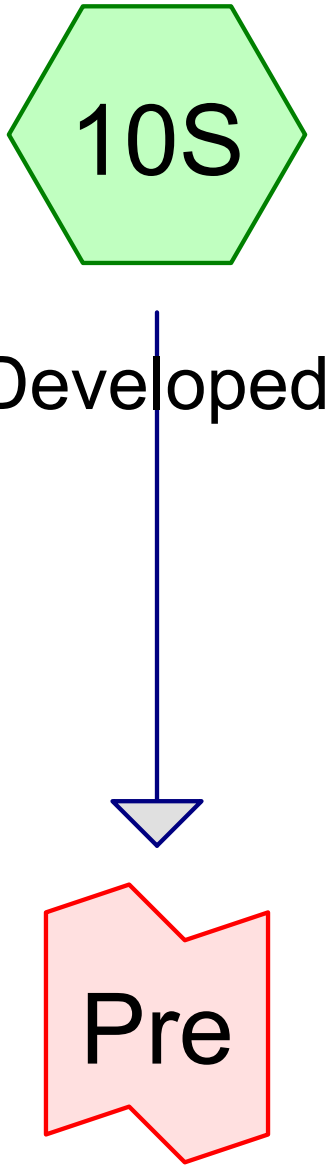
SENESTRARO FAMILY ORTHODONTICS

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

DRWN: GSH
CHKD: JMM
AKS JOB: 6946

DWG: 6946 TREATMENT MAP | LAYOUT1

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)



Site Pre-Developed Flow Summary

Subcat Reach Pond Link

Routing Diagram for 6946 Pre Developed
Prepared by AKS Engineering and Forestry, LLC, Printed 4/14/2020

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
48,074	85	MEADOW/PASTURE (10S)
5,908	75	MODIFIED IMPERVIOUS SURFACE (10S)
53,982	**84**	**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Pre-Developed Site Runoff Area=53,982 sf 0.00% Impervious Runoff Depth=1.12"
Flow Length=300' Slope=0.0167 '/' Tc=11.9 min CN=84 Runoff=0.28 cfs 5,020 cf

Link Pre: Site Pre-Developed Flow Summary Inflow=0.28 cfs 5,020 cf
Primary=0.28 cfs 5,020 cf

Total Runoff Area = 53,982 sf Runoff Volume = 5,020 cf Average Runoff Depth = 1.12"
100.00% Pervious = 53,982 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 10S: Pre-Developed Site

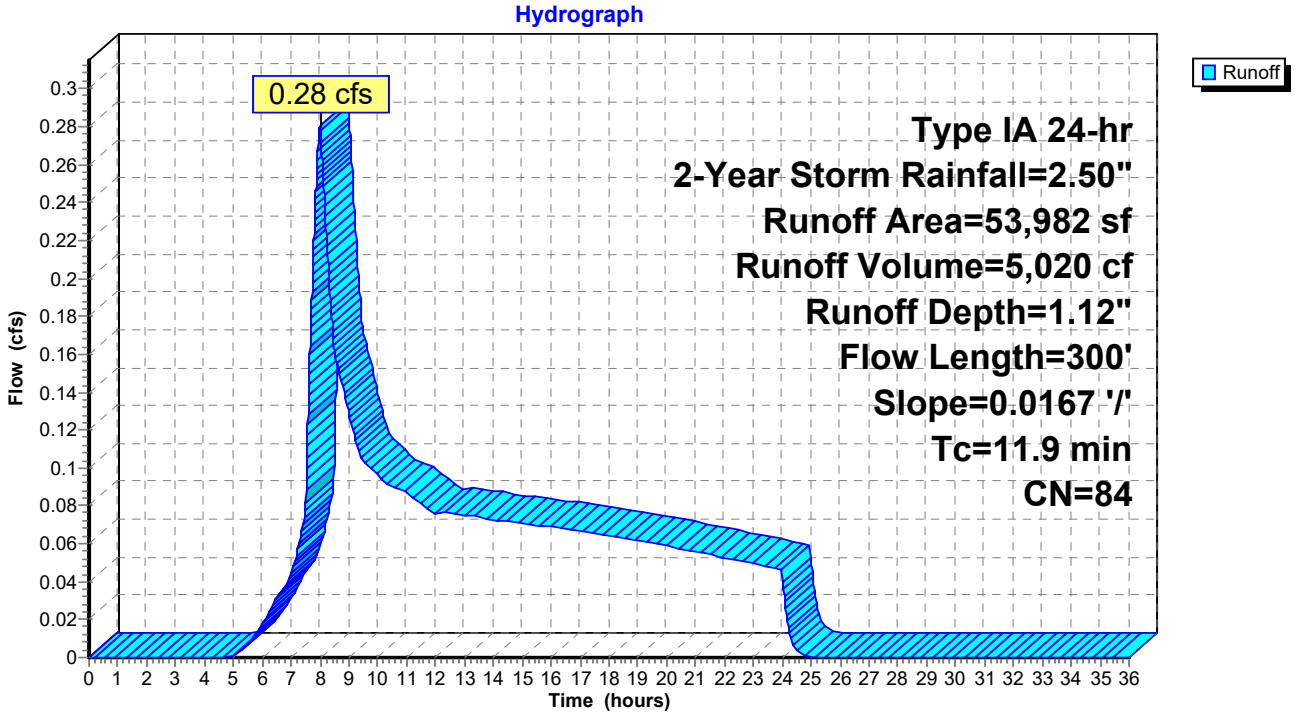
Runoff = 0.28 cfs @ 8.00 hrs, Volume= 5,020 cf, Depth= 1.12"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Storm Rainfall=2.50"

	Area (sf)	CN	Description
*	48,074	85	MEADOW/PASTURE
*	5,908	75	MODIFIED IMPERVIOUS SURFACE
	53,982	84	Weighted Average
	53,982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	300	0.0167	0.42		**Sheet Flow,** Fallow n= 0.050 P2= 2.50"

Subcatchment 10S: Pre-Developed Site

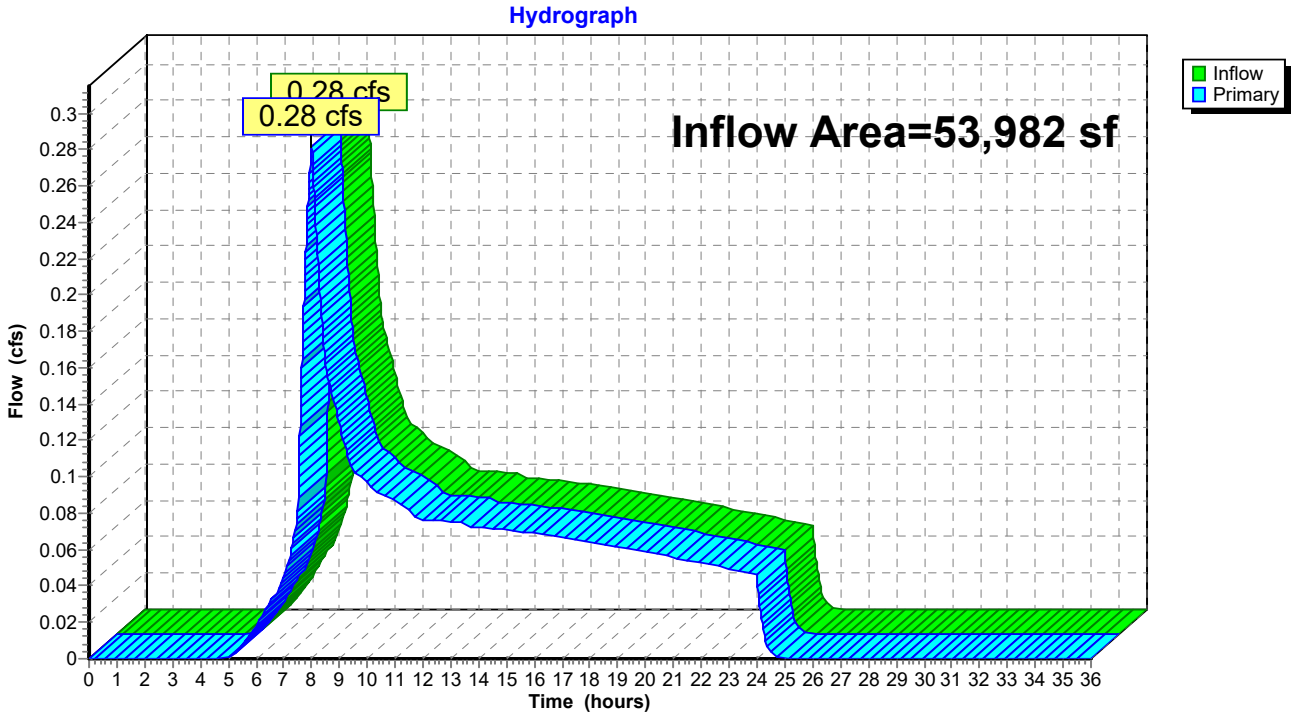


Summary for Link Pre: Site Pre-Developed Flow Summary

Inflow Area = 53,982 sf, 0.00% Impervious, Inflow Depth = 1.12" for 2-Year Storm event
Inflow = 0.28 cfs @ 8.00 hrs, Volume= 5,020 cf
Primary = 0.28 cfs @ 8.00 hrs, Volume= 5,020 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link Pre: Site Pre-Developed Flow Summary



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Pre-Developed Site Runoff Area=53,982 sf 0.00% Impervious Runoff Depth=1.60"
Flow Length=300' Slope=0.0167 '/' Tc=11.9 min CN=84 Runoff=0.43 cfs 7,193 cf

Link Pre: Site Pre-Developed Flow Summary Inflow=0.43 cfs 7,193 cf
Primary=0.43 cfs 7,193 cf

Total Runoff Area = 53,982 sf Runoff Volume = 7,193 cf Average Runoff Depth = 1.60"
100.00% Pervious = 53,982 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 10S: Pre-Developed Site

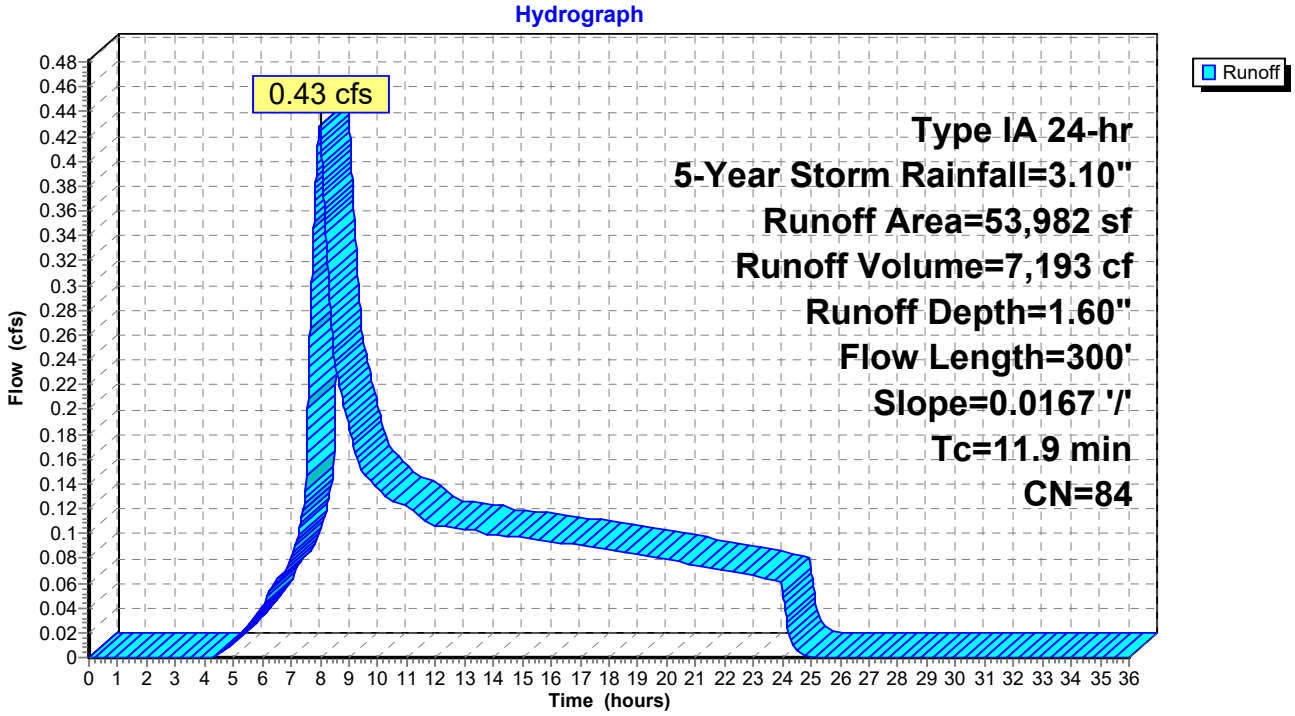
Runoff = 0.43 cfs @ 8.00 hrs, Volume= 7,193 cf, Depth= 1.60"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	48,074	85	MEADOW/PASTURE
*	5,908	75	MODIFIED IMPERVIOUS SURFACE
	53,982	84	Weighted Average
	53,982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	300	0.0167	0.42		**Sheet Flow,** Fallow n= 0.050 P2= 2.50"

Subcatchment 10S: Pre-Developed Site

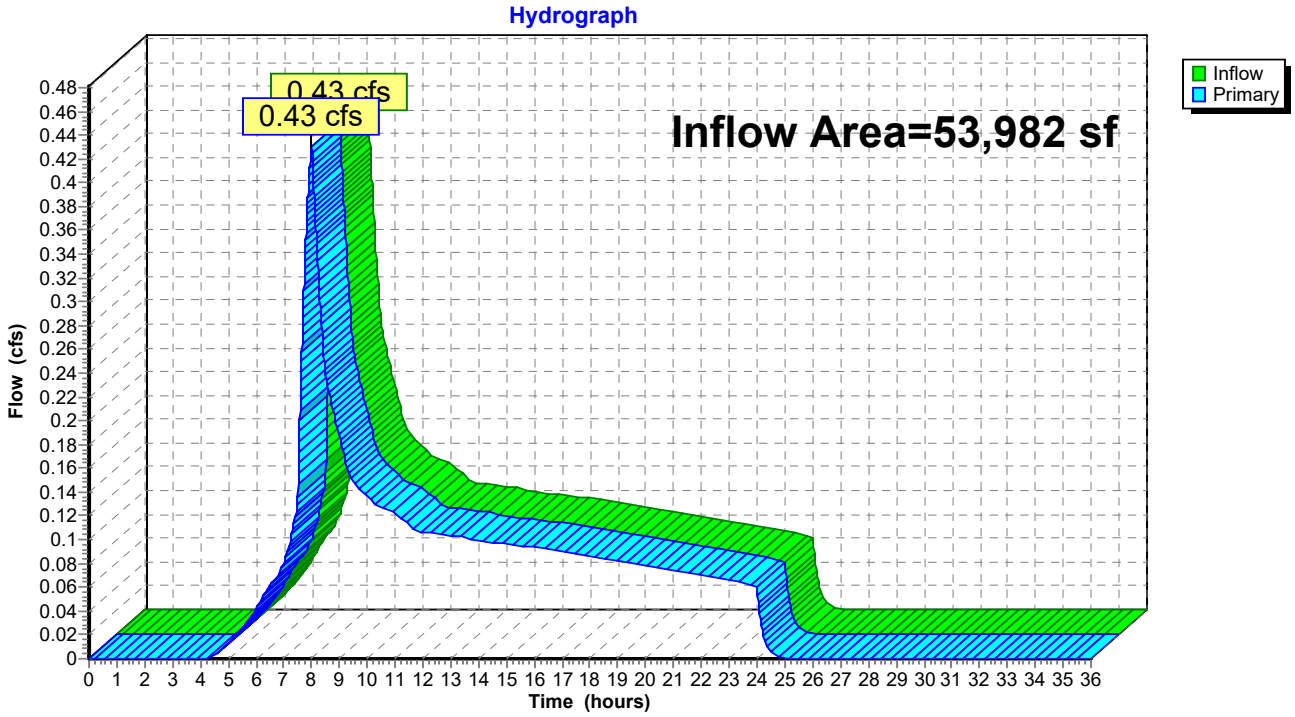


Summary for Link Pre: Site Pre-Developed Flow Summary

Inflow Area = 53,982 sf, 0.00% Impervious, Inflow Depth = 1.60" for 5-Year Storm event
Inflow = 0.43 cfs @ 8.00 hrs, Volume= 7,193 cf
Primary = 0.43 cfs @ 8.00 hrs, Volume= 7,193 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link Pre: Site Pre-Developed Flow Summary



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Pre-Developed Site Runoff Area=53,982 sf 0.00% Impervious Runoff Depth=1.89"
Flow Length=300' Slope=0.0167 '/' Tc=11.9 min CN=84 Runoff=0.52 cfs 8,519 cf

Link Pre: Site Pre-Developed Flow Summary Inflow=0.52 cfs 8,519 cf
Primary=0.52 cfs 8,519 cf

Total Runoff Area = 53,982 sf Runoff Volume = 8,519 cf Average Runoff Depth = 1.89"
100.00% Pervious = 53,982 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 10S: Pre-Developed Site

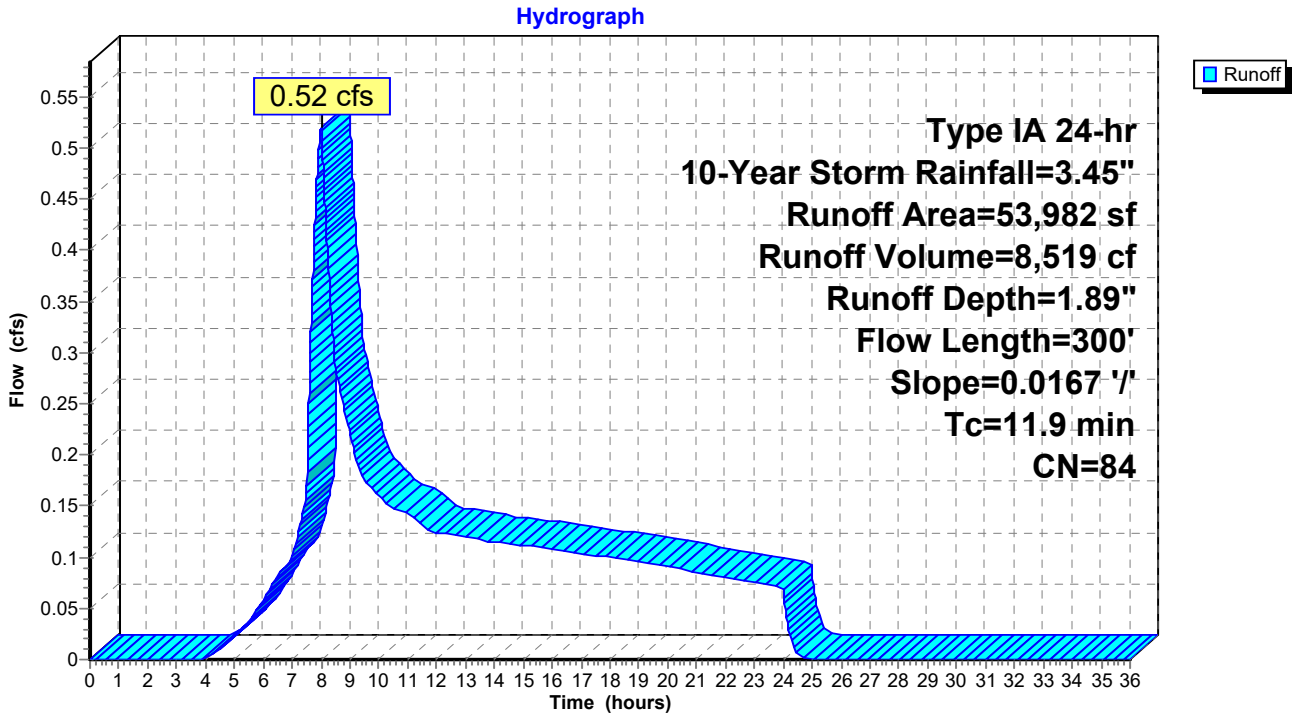
Runoff = 0.52 cfs @ 8.00 hrs, Volume= 8,519 cf, Depth= 1.89"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Storm Rainfall=3.45"

	Area (sf)	CN	Description
*	48,074	85	MEADOW/PASTURE
*	5,908	75	MODIFIED IMPERVIOUS SURFACE
	53,982	84	Weighted Average
	53,982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	300	0.0167	0.42		**Sheet Flow,** Fallow n= 0.050 P2= 2.50"

Subcatchment 10S: Pre-Developed Site

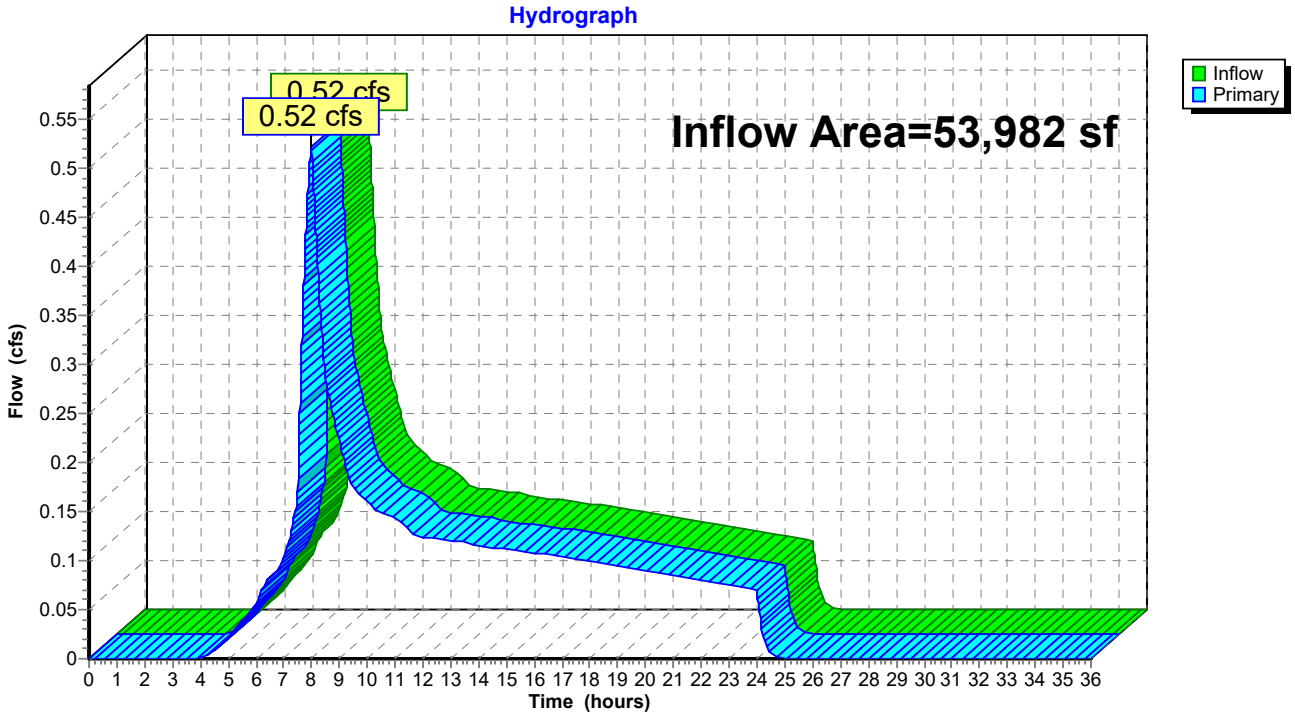


Summary for Link Pre: Site Pre-Developed Flow Summary

Inflow Area = 53,982 sf, 0.00% Impervious, Inflow Depth = 1.89" for 10-Year Storm event
Inflow = 0.52 cfs @ 8.00 hrs, Volume= 8,519 cf
Primary = 0.52 cfs @ 8.00 hrs, Volume= 8,519 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link Pre: Site Pre-Developed Flow Summary



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Pre-Developed Site Runoff Area=53,982 sf 0.00% Impervious Runoff Depth=2.28"
Flow Length=300' Slope=0.0167 '/' Tc=11.9 min CN=84 Runoff=0.64 cfs 10,271 cf

Link Pre: Site Pre-Developed Flow Summary Inflow=0.64 cfs 10,271 cf
Primary=0.64 cfs 10,271 cf

Total Runoff Area = 53,982 sf Runoff Volume = 10,271 cf Average Runoff Depth = 2.28"
100.00% Pervious = 53,982 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 10S: Pre-Developed Site

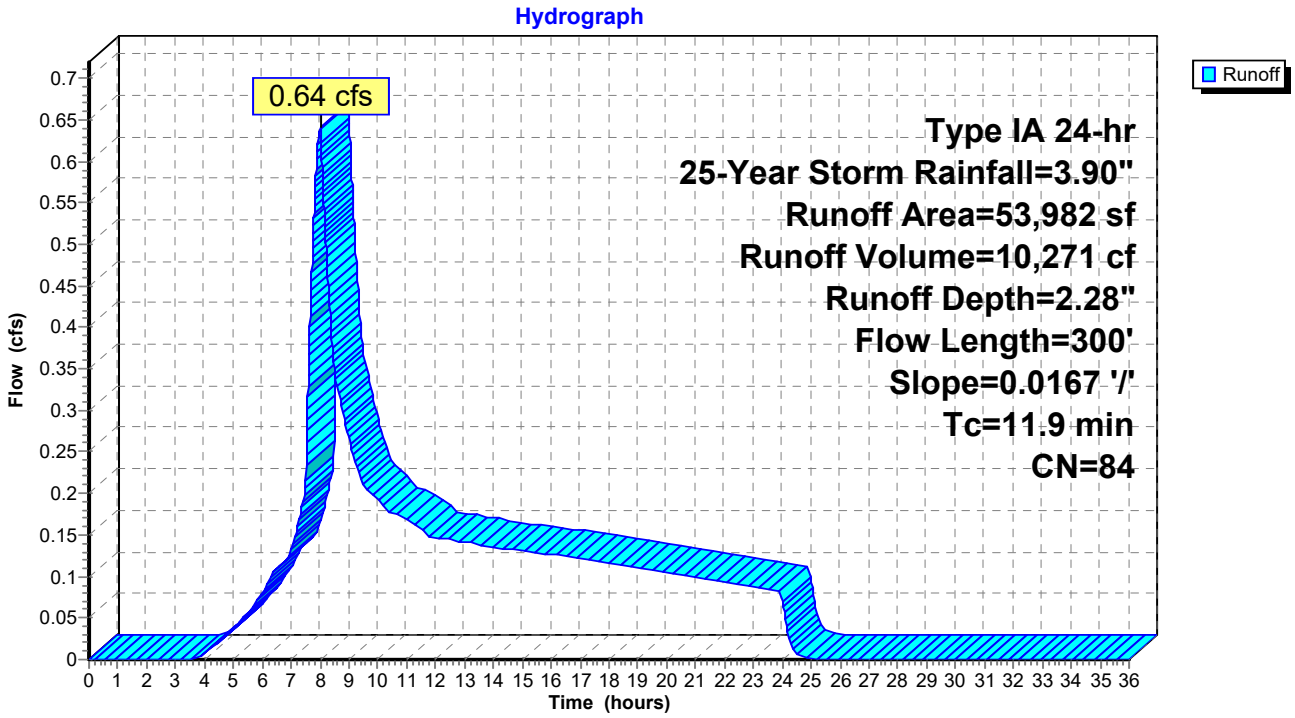
Runoff = 0.64 cfs @ 8.00 hrs, Volume= 10,271 cf, Depth= 2.28"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-Year Storm Rainfall=3.90"

	Area (sf)	CN	Description
*	48,074	85	MEADOW/PASTURE
*	5,908	75	MODIFIED IMPERVIOUS SURFACE
	53,982	84	Weighted Average
	53,982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	300	0.0167	0.42		**Sheet Flow,** Fallow n= 0.050 P2= 2.50"

Subcatchment 10S: Pre-Developed Site

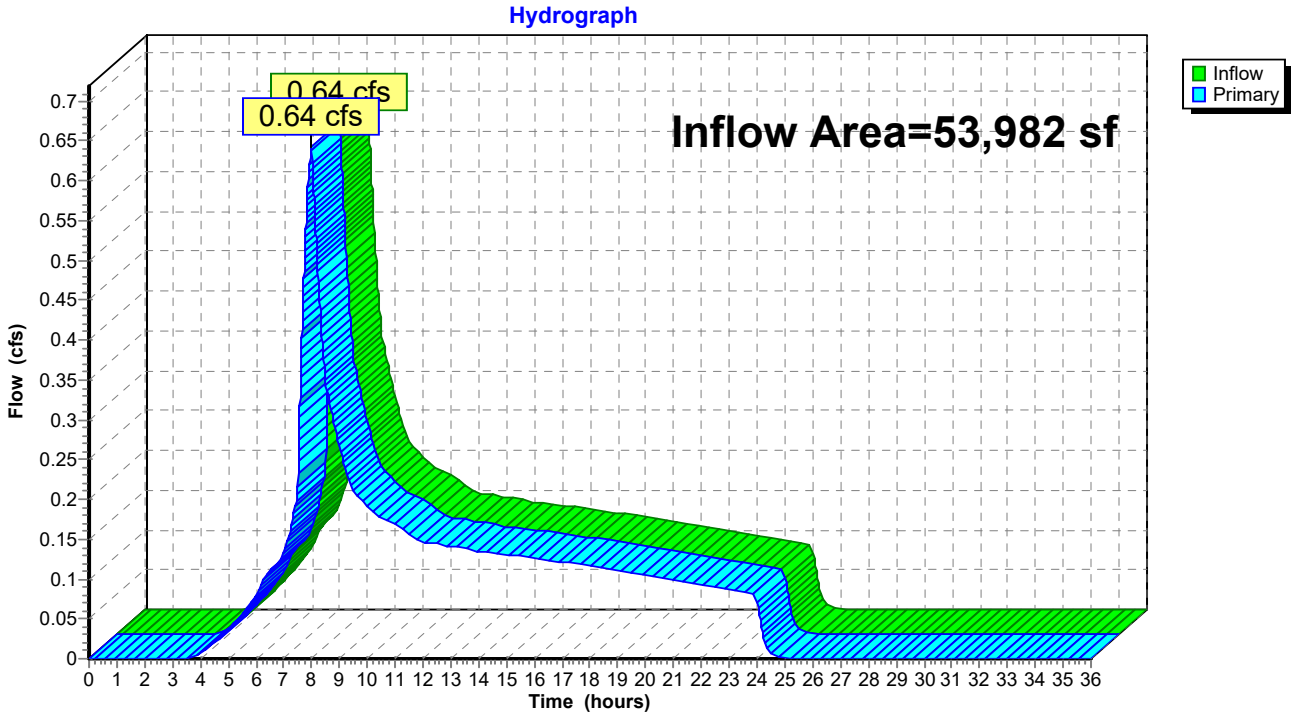


Summary for Link Pre: Site Pre-Developed Flow Summary

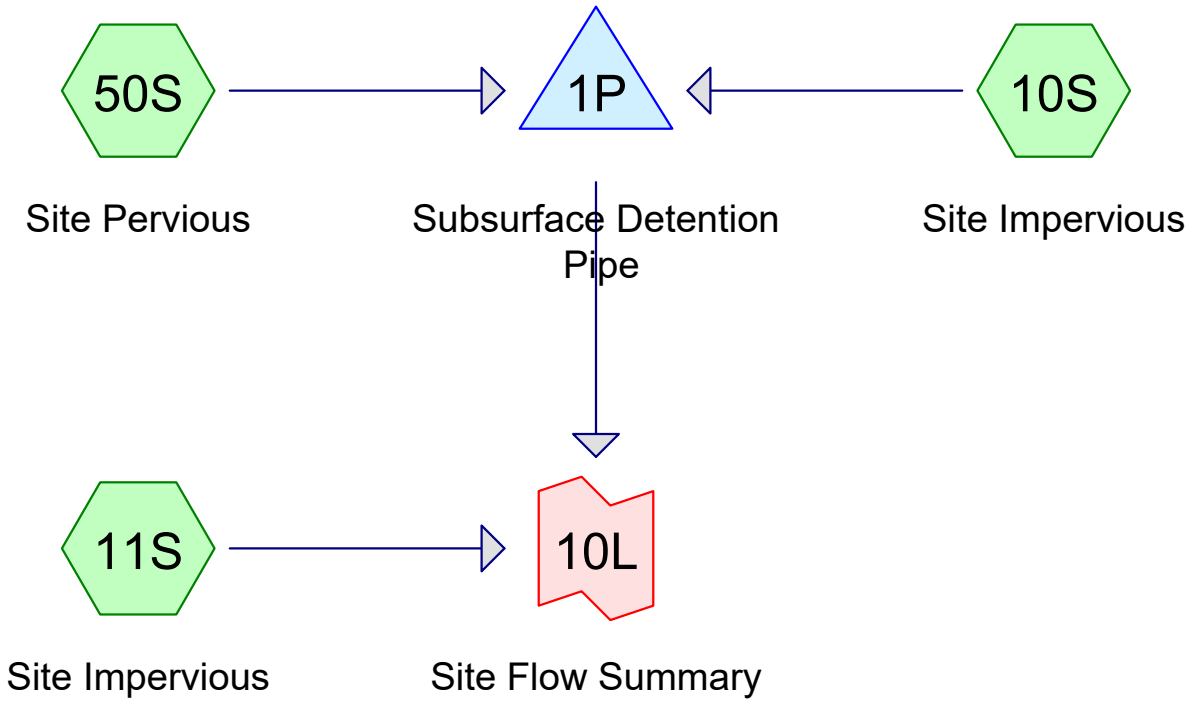
Inflow Area = 53,982 sf, 0.00% Impervious, Inflow Depth = 2.28" for 25-Year Storm event
Inflow = 0.64 cfs @ 8.00 hrs, Volume= 10,271 cf
Primary = 0.64 cfs @ 8.00 hrs, Volume= 10,271 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link Pre: Site Pre-Developed Flow Summary



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 6946 Post Developed Det

Prepared by AKS Engineering and Forestry, LLC, Printed 4/28/2020

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
25,025	79	<50% Grass cover, Poor, HSG B (50S)
9,634	98	Impervious Roof (10S)
2,001	98	Impervious Sidewalk (10S, 11S)
17,322	98	Paved parking (10S)
53,982	**89**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	206.20	203.75	98.0	0.0250	0.130	8.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Site Impervious Runoff Area=28,145 sf 100.00% Impervious Runoff Depth=2.27"
Tc=5.0 min CN=98 Runoff=0.37 cfs 5,326 cf

Subcatchment 11S: Site Impervious Runoff Area=812 sf 100.00% Impervious Runoff Depth=2.27"
Tc=5.0 min CN=98 Runoff=0.01 cfs 154 cf

Subcatchment 50S: Site Pervious Runoff Area=25,025 sf 0.00% Impervious Runoff Depth=0.84"
Flow Length=50' Slope=0.0200 '/' Tc=6.4 min CN=79 Runoff=0.09 cfs 1,746 cf

Pond 1P: Subsurface Detention Pipe Peak Elev=207.81' Storage=1,252 cf Inflow=0.46 cfs 7,072 cf
Outflow=0.13 cfs 7,072 cf

Link 10L: Site Flow Summary Inflow=0.14 cfs 7,226 cf
Primary=0.14 cfs 7,226 cf

Total Runoff Area = 53,982 sf Runoff Volume = 7,226 cf Average Runoff Depth = 1.61"
46.36% Pervious = 25,025 sf 53.64% Impervious = 28,957 sf

Summary for Subcatchment 10S: Site Impervious

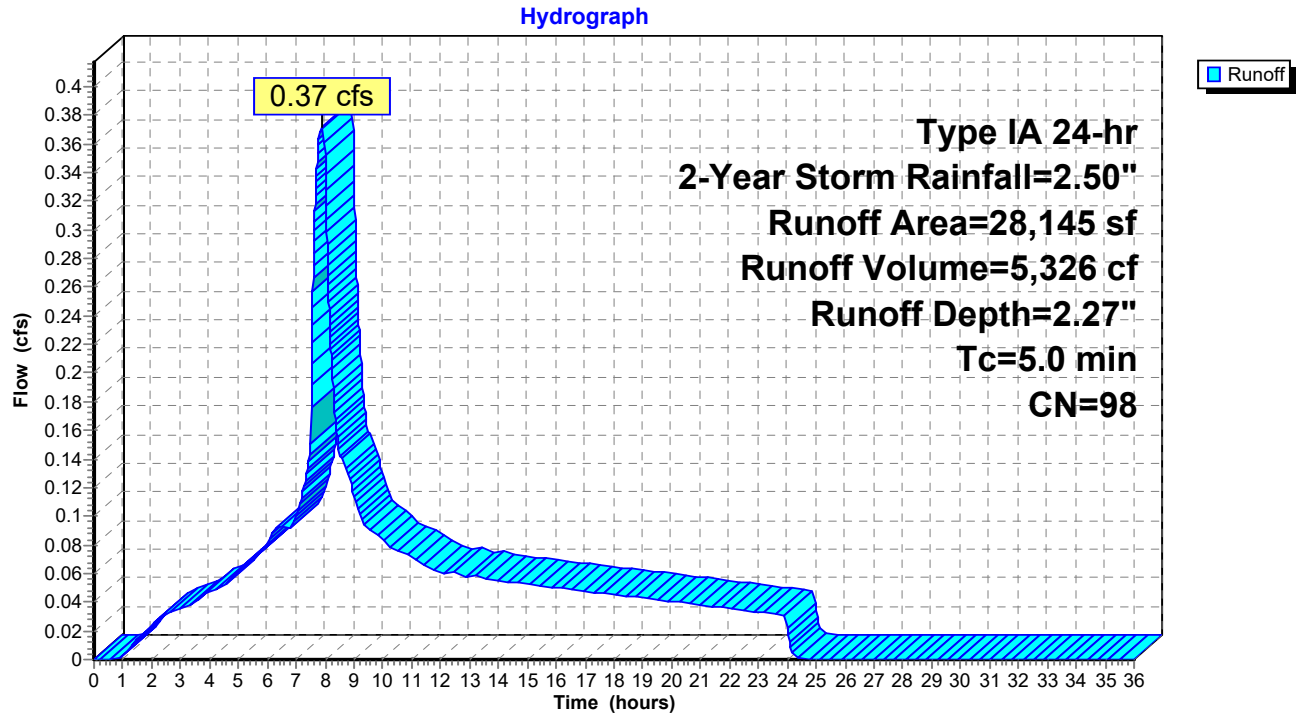
Runoff = 0.37 cfs @ 7.88 hrs, Volume= 5,326 cf, Depth= 2.27"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Storm Rainfall=2.50"

	Area (sf)	CN	Description
*	17,322	98	Paved parking
*	9,634	98	Impervious Roof
*	1,189	98	Impervious Sidewalk
	28,145	98	Weighted Average
	28,145		100.00% Impervious Area

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

Subcatchment 10S: Site Impervious



Summary for Subcatchment 11S: Site Impervious

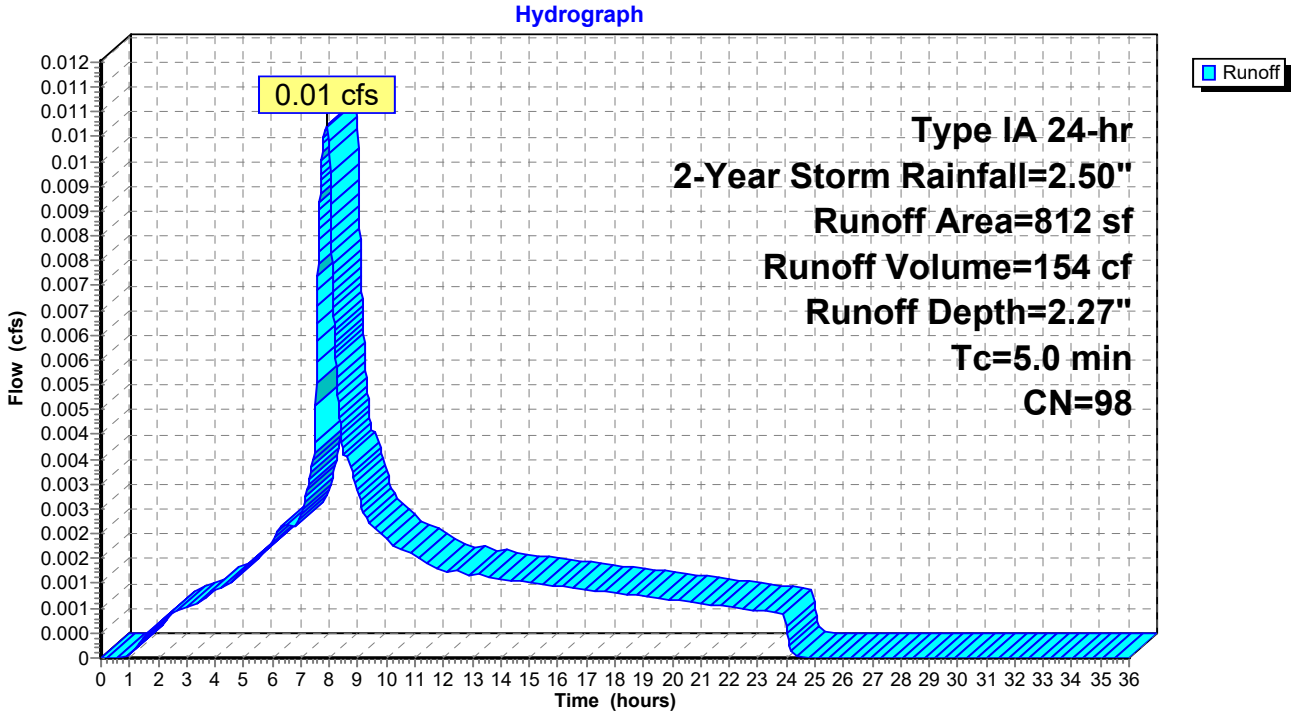
Runoff = 0.01 cfs @ 7.88 hrs, Volume= 154 cf, Depth= 2.27"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Storm Rainfall=2.50"

	Area (sf)	CN	Description
*	812	98	Impervious Sidewalk
	812		100.00% Impervious Area

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

Subcatchment 11S: Site Impervious



Summary for Subcatchment 50S: Site Pervious

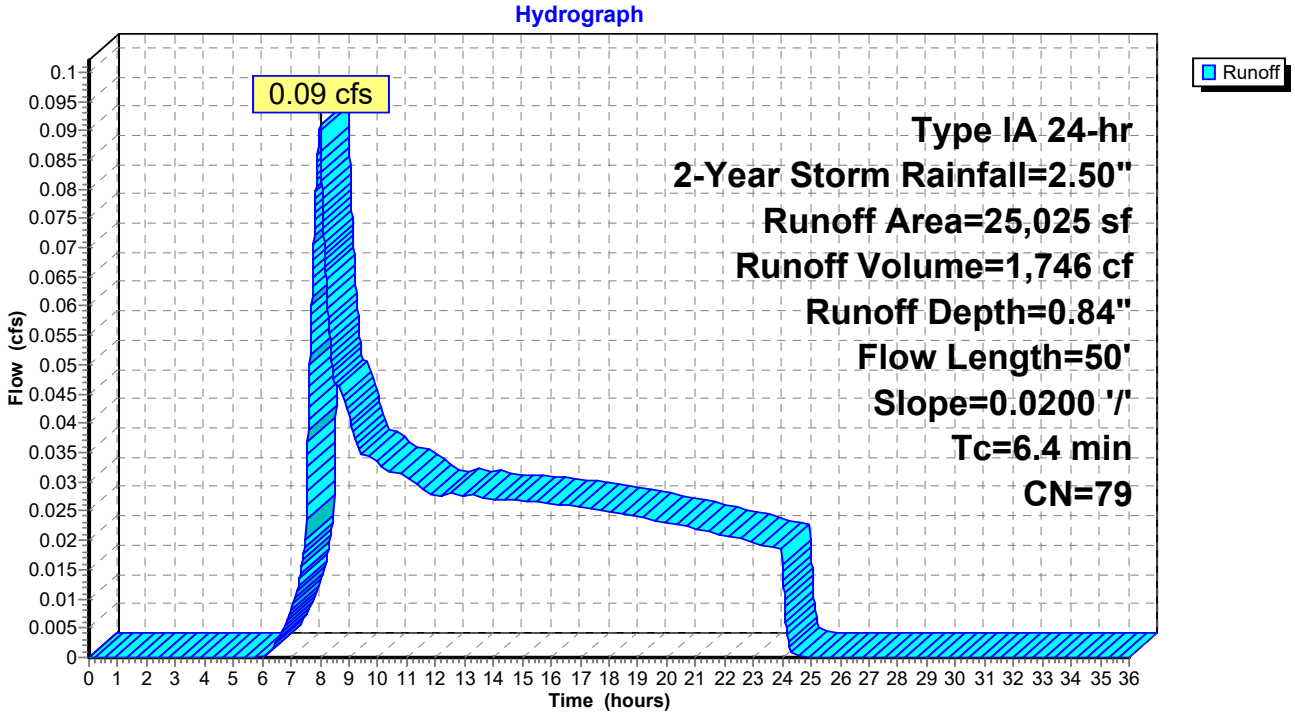
Runoff = 0.09 cfs @ 8.00 hrs, Volume= 1,746 cf, Depth= 0.84"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Storm Rainfall=2.50"

Area (sf)	CN	Description
25,025	79	<50% Grass cover, Poor, HSG B
25,025		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 50S: Site Pervious



Summary for Pond 1P: Subsurface Detention Pipe

Inflow Area = 53,170 sf, 52.93% Impervious, Inflow Depth = 1.60" for 2-Year Storm event
Inflow = 0.46 cfs @ 7.92 hrs, Volume= 7,072 cf
Outflow = 0.13 cfs @ 9.28 hrs, Volume= 7,072 cf, Atten= 71%, Lag= 81.7 min
Primary = 0.13 cfs @ 9.28 hrs, Volume= 7,072 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 207.81' @ 9.28 hrs Surf.Area= 1,036 sf Storage= 1,252 cf
Flood Elev= 210.20' Surf.Area= 0 sf Storage= 3,318 cf

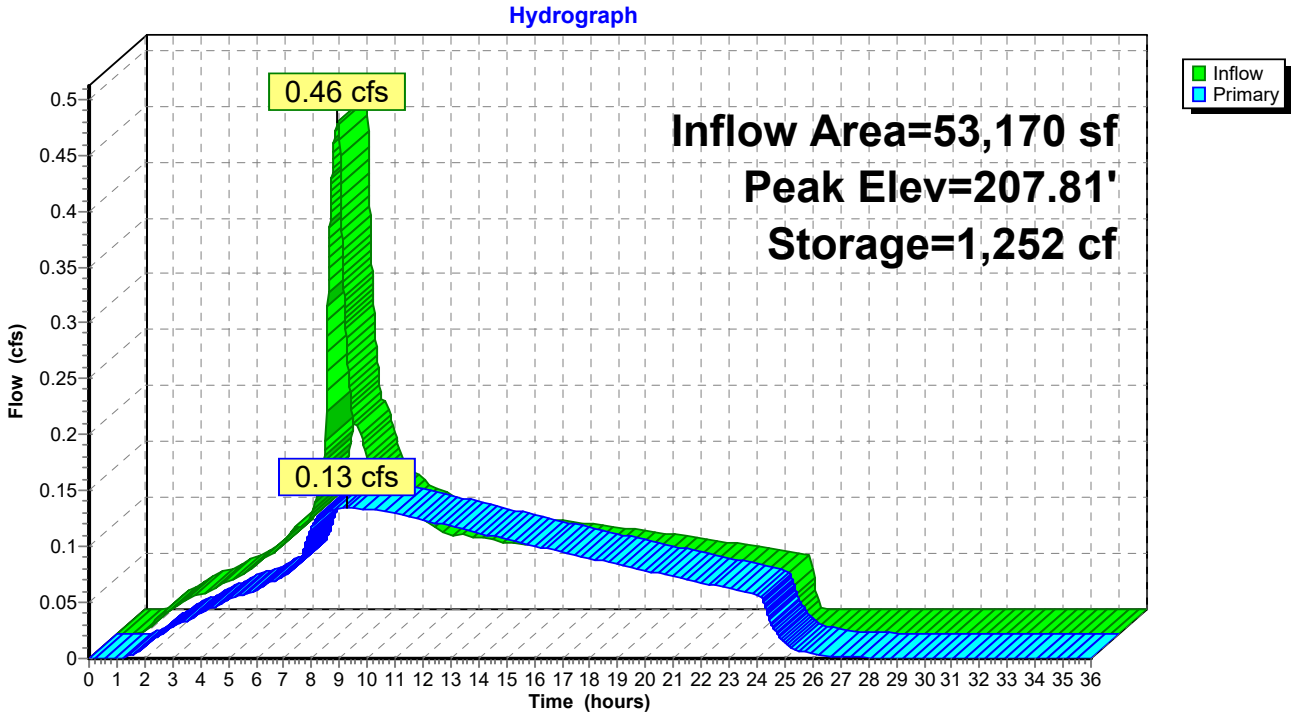
Plug-Flow detention time= 100.0 min calculated for 7,072 cf (100% of inflow)
Center-of-Mass det. time= 100.0 min (818.9 - 718.9)

Volume	Invert	Avail.Storage	Storage Description
#1	206.20'	3,318 cf	**48.0" Round Pipe Storage** x 4 L= 66.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	206.20'	**8.0" Round Outlet to Public System** L= 98.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 206.20' / 203.75' S= 0.0250 '/' Cc= 0.900 n= 0.130, Flow Area= 0.35 sf
#2	Device 1	206.20'	**2.0" Vert. Lower Oriface** C= 0.620
#3	Device 1	207.83'	**4.0" Vert. Mid Oriface** C= 0.620
#4	Device 1	209.20'	**8.0" Horiz. Overflow Riser Rim** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.13 cfs @ 9.28 hrs HW=207.81' (Free Discharge)
└**1=Outlet to Public System** (Passes 0.13 cfs of 0.22 cfs potential flow)
  ├**2=Lower Oriface** (Orifice Controls 0.13 cfs @ 6.15 fps)
  ├**3=Mid Oriface** (Controls 0.00 cfs)
  └**4=Overflow Riser Rim** (Controls 0.00 cfs)

Pond 1P: Subsurface Detention Pipe

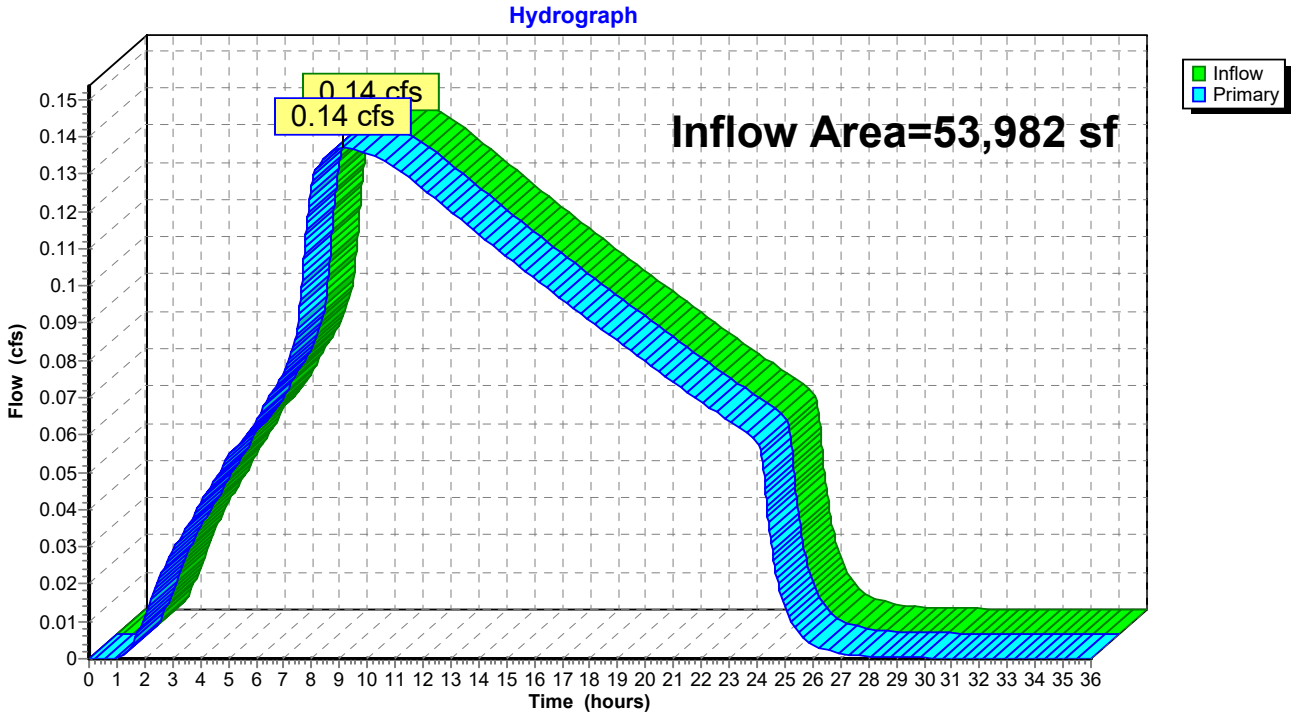


Summary for Link 10L: Site Flow Summary

Inflow Area = 53,982 sf, 53.64% Impervious, Inflow Depth > 1.61" for 2-Year Storm event
Inflow = 0.14 cfs @ 9.11 hrs, Volume= 7,226 cf
Primary = 0.14 cfs @ 9.11 hrs, Volume= 7,226 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 10L: Site Flow Summary



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Site Impervious Runoff Area=28,145 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.47 cfs 6,726 cf

Subcatchment 11S: Site Impervious Runoff Area=812 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.01 cfs 194 cf

Subcatchment 50S: Site Pervious Runoff Area=25,025 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=50' Slope=0.0200 '/' Tc=6.4 min CN=79 Runoff=0.15 cfs 2,632 cf

Pond 1P: Subsurface Detention Pipe Peak Elev=208.15' Storage=1,603 cf Inflow=0.61 cfs 9,358 cf
Outflow=0.24 cfs 9,358 cf

Link 10L: Site Flow Summary Inflow=0.24 cfs 9,552 cf
Primary=0.24 cfs 9,552 cf

Total Runoff Area = 53,982 sf Runoff Volume = 9,552 cf Average Runoff Depth = 2.12"
46.36% Pervious = 25,025 sf 53.64% Impervious = 28,957 sf

Summary for Subcatchment 10S: Site Impervious

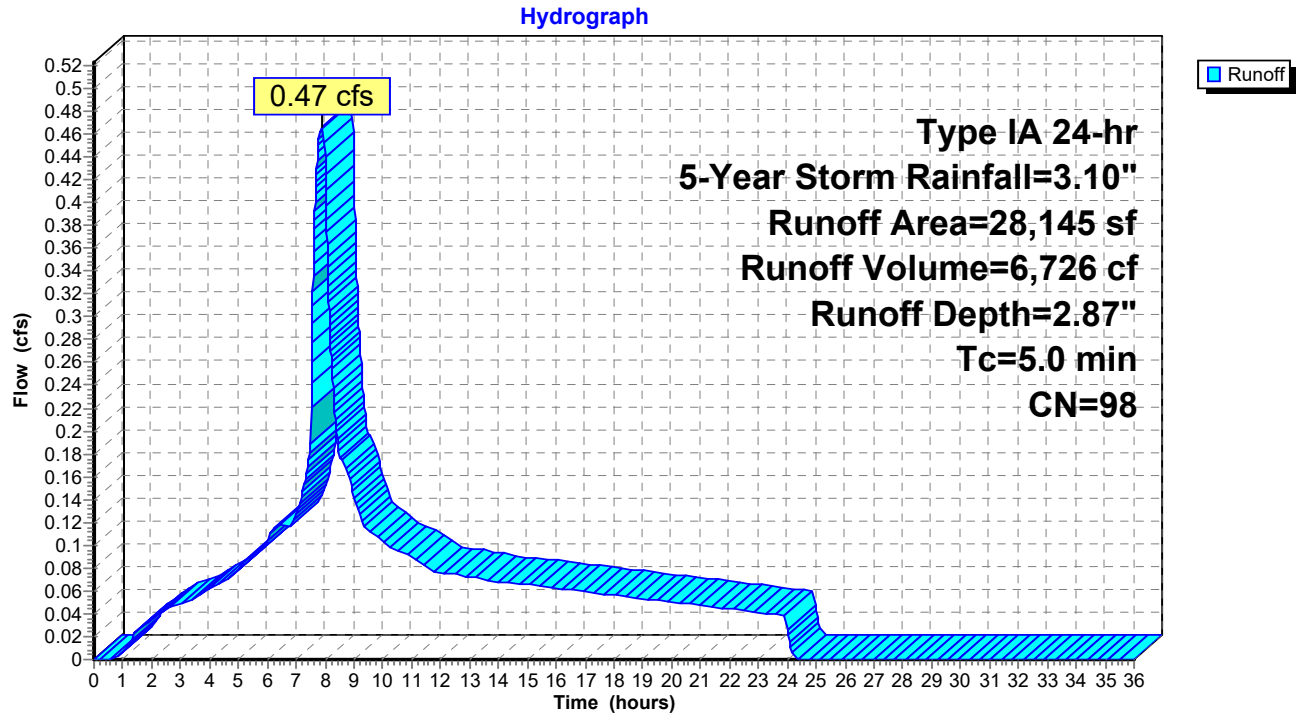
Runoff = 0.47 cfs @ 7.88 hrs, Volume= 6,726 cf, Depth= 2.87"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	17,322	98	Paved parking
*	9,634	98	Impervious Roof
*	1,189	98	Impervious Sidewalk
	28,145	98	Weighted Average
	28,145		100.00% Impervious Area

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

Subcatchment 10S: Site Impervious



Summary for Subcatchment 11S: Site Impervious

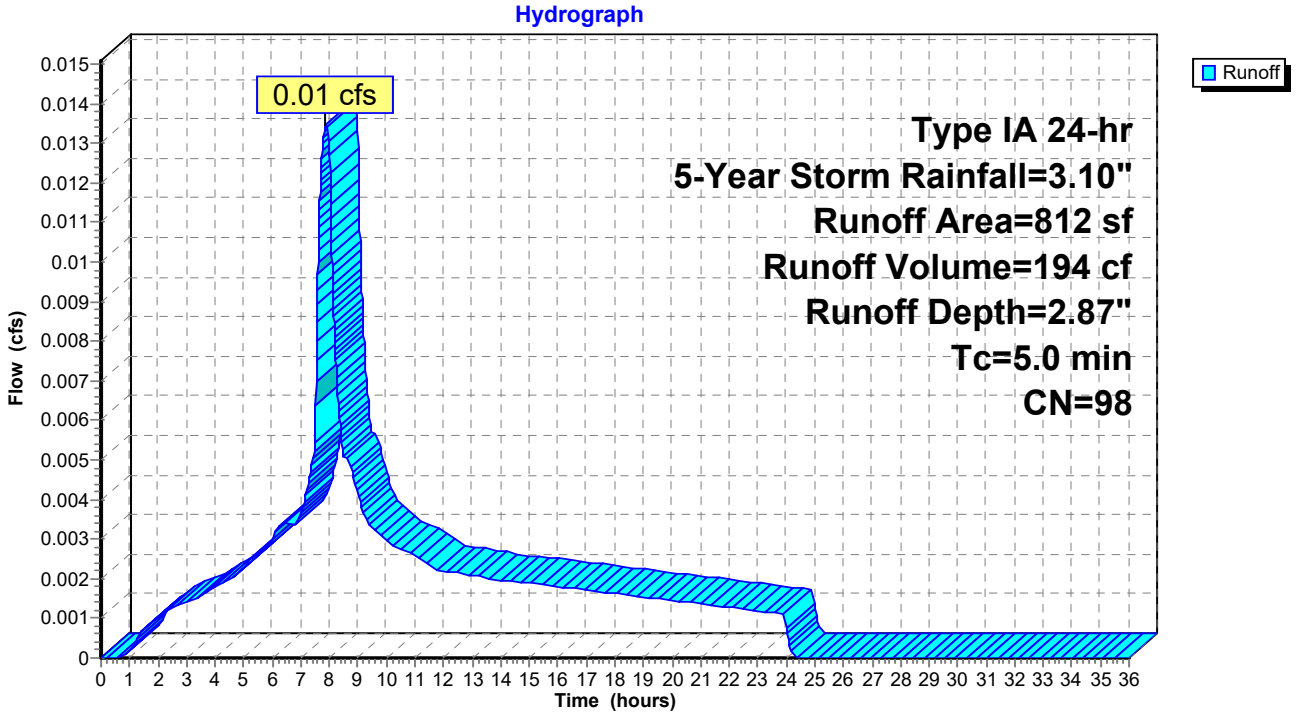
Runoff = 0.01 cfs @ 7.88 hrs, Volume= 194 cf, Depth= 2.87"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	812	98	Impervious Sidewalk
	812		100.00% Impervious Area

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

Subcatchment 11S: Site Impervious



Summary for Subcatchment 50S: Site Pervious

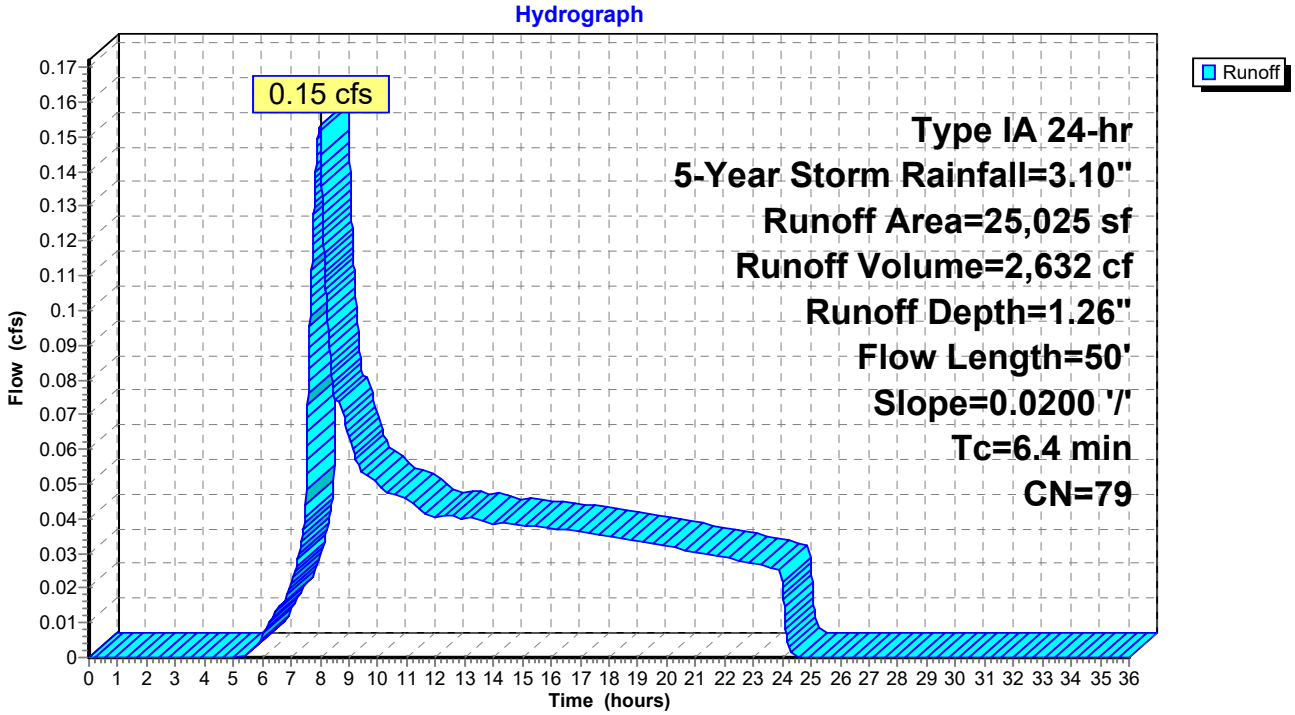
Runoff = 0.15 cfs @ 8.00 hrs, Volume= 2,632 cf, Depth= 1.26"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Storm Rainfall=3.10"

Area (sf)	CN	Description
25,025	79	<50% Grass cover, Poor, HSG B
25,025		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 50S: Site Pervious



Summary for Pond 1P: Subsurface Detention Pipe

Inflow Area = 53,170 sf, 52.93% Impervious, Inflow Depth = 2.11" for 5-Year Storm event
Inflow = 0.61 cfs @ 7.92 hrs, Volume= 9,358 cf
Outflow = 0.24 cfs @ 8.77 hrs, Volume= 9,358 cf, Atten= 62%, Lag= 51.3 min
Primary = 0.24 cfs @ 8.77 hrs, Volume= 9,358 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 208.15' @ 8.77 hrs Surf.Area= 1,056 sf Storage= 1,603 cf
Flood Elev= 210.20' Surf.Area= 0 sf Storage= 3,318 cf

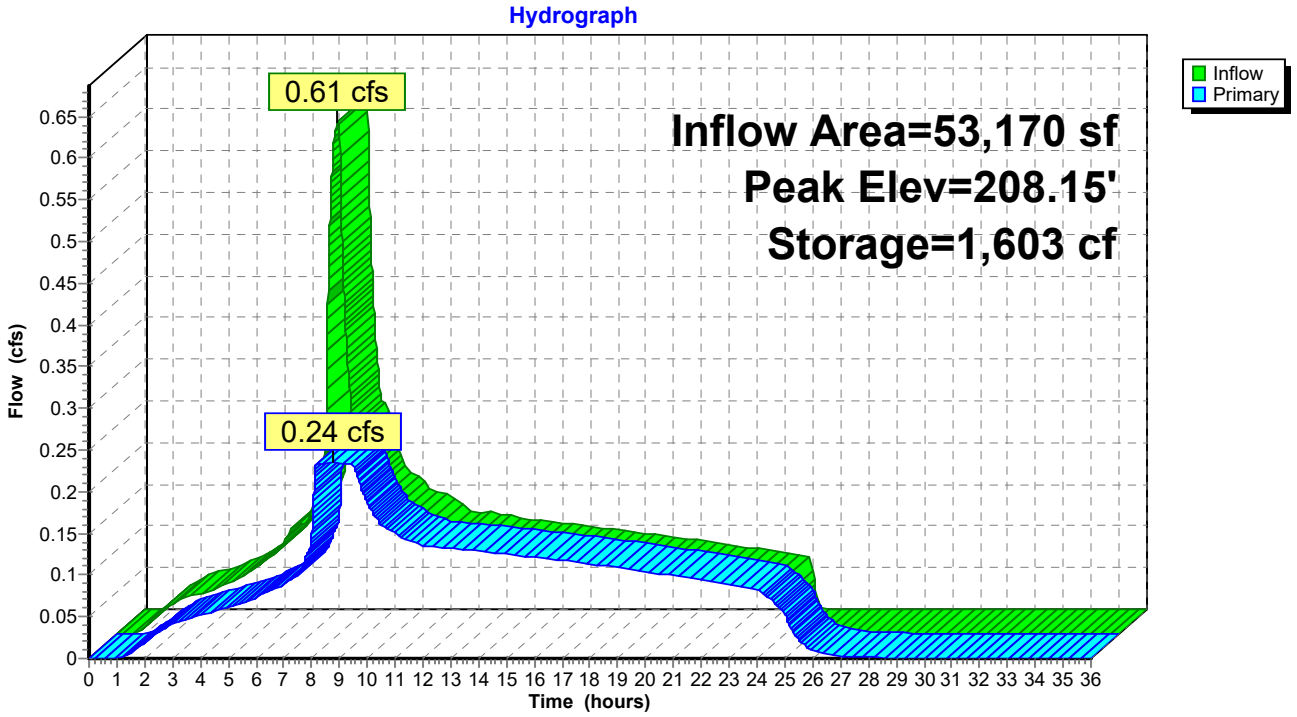
Plug-Flow detention time= 112.3 min calculated for 9,356 cf (100% of inflow)
Center-of-Mass det. time= 112.4 min (825.4 - 713.0)

Volume	Invert	Avail.Storage	Storage Description
#1	206.20'	3,318 cf	**48.0" Round Pipe Storage** x 4 L= 66.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	206.20'	**8.0" Round Outlet to Public System** L= 98.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 206.20' / 203.75' S= 0.0250 '/' Cc= 0.900 n= 0.130, Flow Area= 0.35 sf
#2	Device 1	206.20'	**2.0" Vert. Lower Oriface** C= 0.620
#3	Device 1	207.83'	**4.0" Vert. Mid Oriface** C= 0.620
#4	Device 1	209.20'	**8.0" Horiz. Overflow Riser Rim** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.24 cfs @ 8.77 hrs HW=208.15' (Free Discharge)
└**1=Outlet to Public System** (Barrel Controls 0.24 cfs @ 0.67 fps)
  ├**2=Lower Oriface** (Passes < 0.15 cfs potential flow)
  ├**3=Mid Oriface** (Passes < 0.17 cfs potential flow)
  └**4=Overflow Riser Rim** (Controls 0.00 cfs)

Pond 1P: Subsurface Detention Pipe

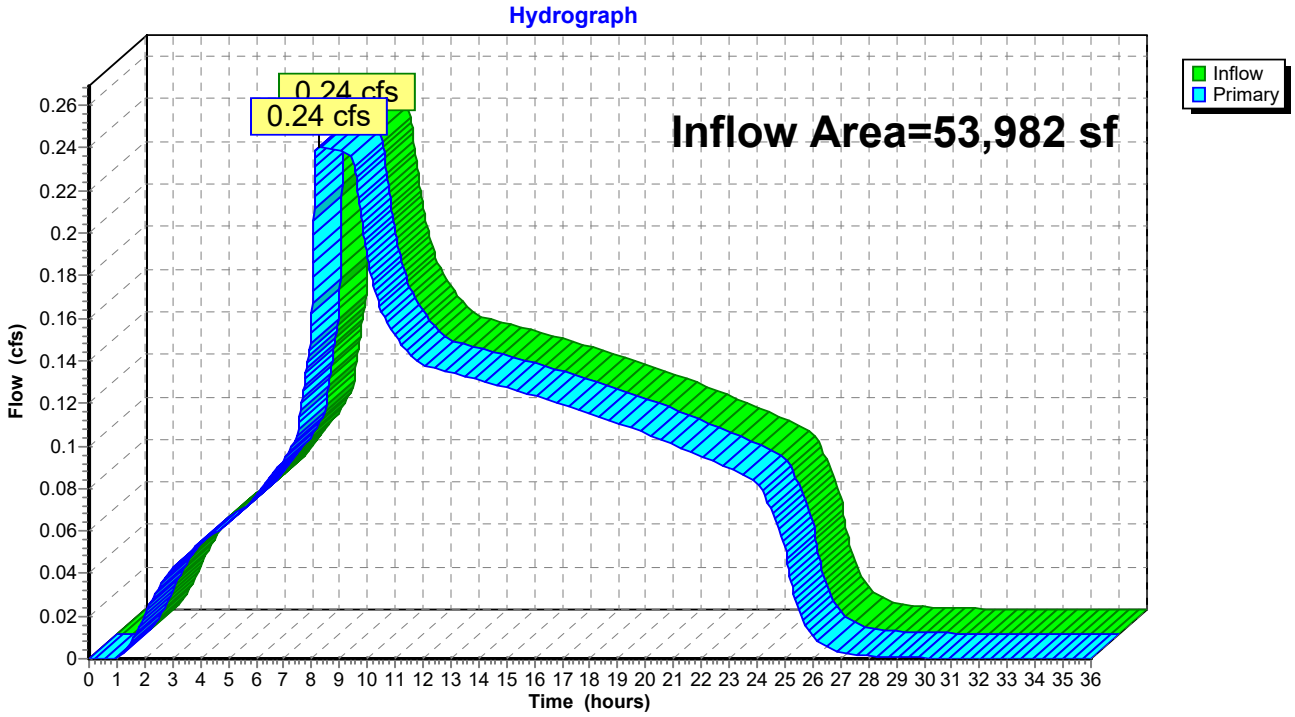


Summary for Link 10L: Site Flow Summary

Inflow Area = 53,982 sf, 53.64% Impervious, Inflow Depth = 2.12" for 5-Year Storm event
Inflow = 0.24 cfs @ 8.26 hrs, Volume= 9,552 cf
Primary = 0.24 cfs @ 8.26 hrs, Volume= 9,552 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 10L: Site Flow Summary



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Site Impervious Runoff Area=28,145 sf 100.00% Impervious Runoff Depth=3.22"
Tc=5.0 min CN=98 Runoff=0.52 cfs 7,544 cf

Subcatchment 11S: Site Impervious Runoff Area=812 sf 100.00% Impervious Runoff Depth=3.22"
Tc=5.0 min CN=98 Runoff=0.02 cfs 218 cf

Subcatchment 50S: Site Pervious Runoff Area=25,025 sf 0.00% Impervious Runoff Depth=1.53"
Flow Length=50' Slope=0.0200 '/' Tc=6.4 min CN=79 Runoff=0.19 cfs 3,185 cf

Pond 1P: Subsurface Detention Pipe Peak Elev=208.48' Storage=1,955 cf Inflow=0.71 cfs 10,729 cf
Outflow=0.25 cfs 10,729 cf

Link 10L: Site Flow Summary Inflow=0.25 cfs 10,947 cf
Primary=0.25 cfs 10,947 cf

Total Runoff Area = 53,982 sf Runoff Volume = 10,947 cf Average Runoff Depth = 2.43"
46.36% Pervious = 25,025 sf 53.64% Impervious = 28,957 sf

Summary for Subcatchment 10S: Site Impervious

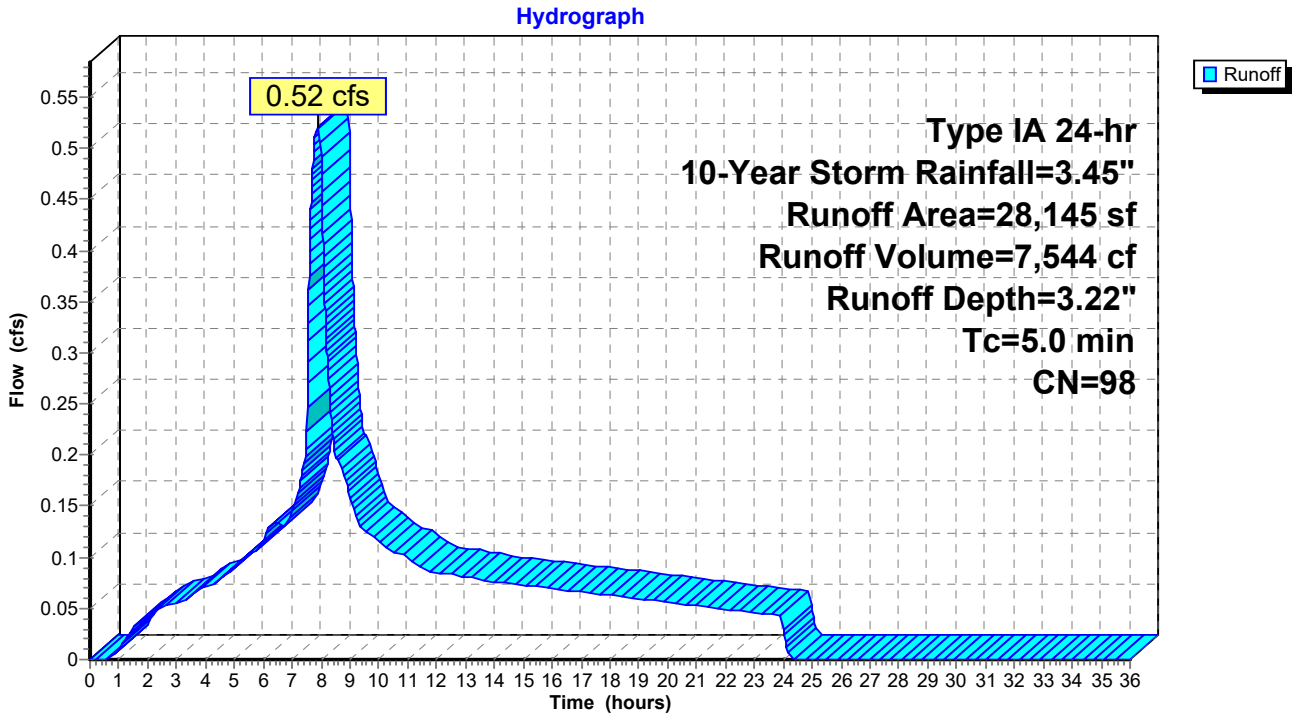
Runoff = 0.52 cfs @ 7.88 hrs, Volume= 7,544 cf, Depth= 3.22"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Storm Rainfall=3.45"

	Area (sf)	CN	Description
*	17,322	98	Paved parking
*	9,634	98	Impervious Roof
*	1,189	98	Impervious Sidewalk
	28,145	98	Weighted Average
	28,145		100.00% Impervious Area

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

Subcatchment 10S: Site Impervious



Summary for Subcatchment 11S: Site Impervious

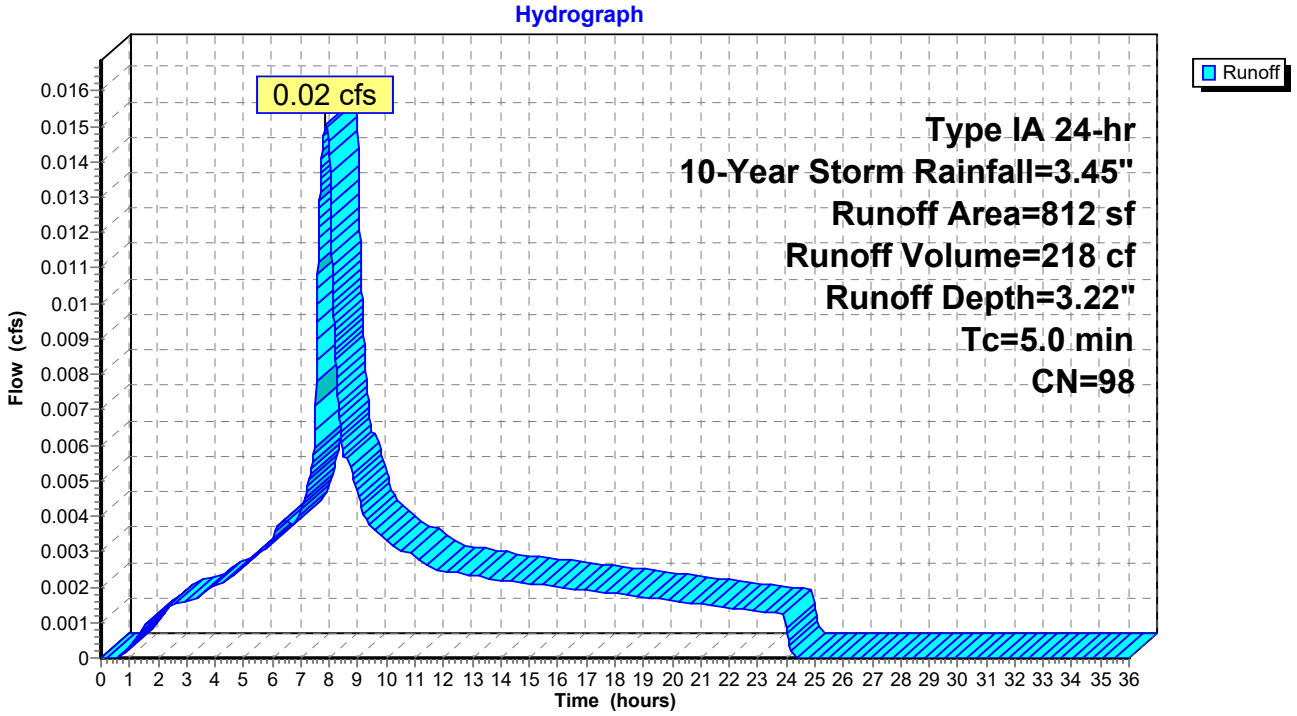
Runoff = 0.02 cfs @ 7.88 hrs, Volume= 218 cf, Depth= 3.22"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Storm Rainfall=3.45"

	Area (sf)	CN	Description
*	812	98	Impervious Sidewalk
	812		100.00% Impervious Area

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

Subcatchment 11S: Site Impervious



Summary for Subcatchment 50S: Site Pervious

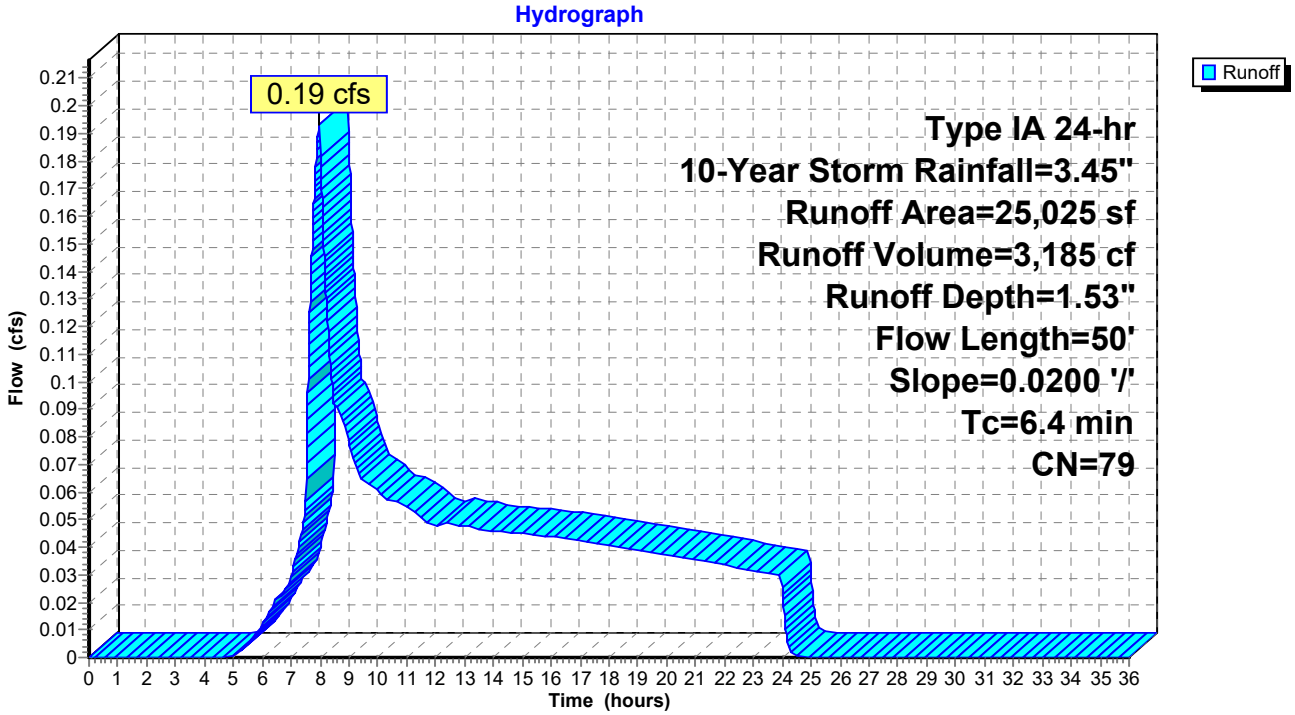
Runoff = 0.19 cfs @ 8.00 hrs, Volume= 3,185 cf, Depth= 1.53"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Storm Rainfall=3.45"

Area (sf)	CN	Description
25,025	79	<50% Grass cover, Poor, HSG B
25,025		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 50S: Site Pervious



Summary for Pond 1P: Subsurface Detention Pipe

Inflow Area = 53,170 sf, 52.93% Impervious, Inflow Depth = 2.42" for 10-Year Storm event
Inflow = 0.71 cfs @ 7.92 hrs, Volume= 10,729 cf
Outflow = 0.25 cfs @ 8.95 hrs, Volume= 10,729 cf, Atten= 65%, Lag= 61.8 min
Primary = 0.25 cfs @ 8.95 hrs, Volume= 10,729 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 208.48' @ 8.95 hrs Surf.Area= 1,045 sf Storage= 1,955 cf
Flood Elev= 210.20' Surf.Area= 0 sf Storage= 3,318 cf

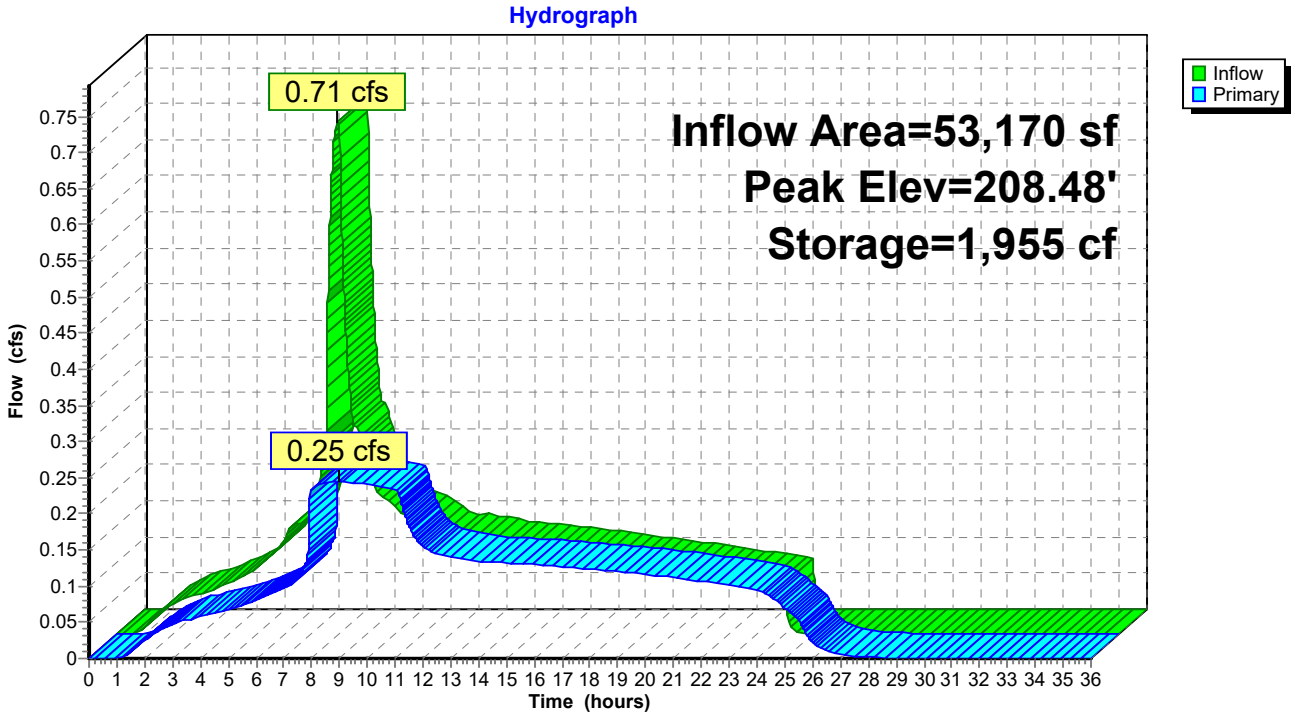
Plug-Flow detention time= 119.3 min calculated for 10,729 cf (100% of inflow)
Center-of-Mass det. time= 119.3 min (829.2 - 709.9)

Volume	Invert	Avail.Storage	Storage Description
#1	206.20'	3,318 cf	**48.0" Round Pipe Storage** x 4 L= 66.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	206.20'	**8.0" Round Outlet to Public System** L= 98.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 206.20' / 203.75' S= 0.0250 '/' Cc= 0.900 n= 0.130, Flow Area= 0.35 sf
#2	Device 1	206.20'	**2.0" Vert. Lower Oriface** C= 0.620
#3	Device 1	207.83'	**4.0" Vert. Mid Oriface** C= 0.620
#4	Device 1	209.20'	**8.0" Horiz. Overflow Riser Rim** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.25 cfs @ 8.95 hrs HW=208.48' (Free Discharge)
└**1=Outlet to Public System** (Barrel Controls 0.25 cfs @ 0.70 fps)
  ├**2=Lower Oriface** (Passes < 0.16 cfs potential flow)
  ├**3=Mid Oriface** (Passes < 0.30 cfs potential flow)
  └**4=Overflow Riser Rim** (Controls 0.00 cfs)

Pond 1P: Subsurface Detention Pipe

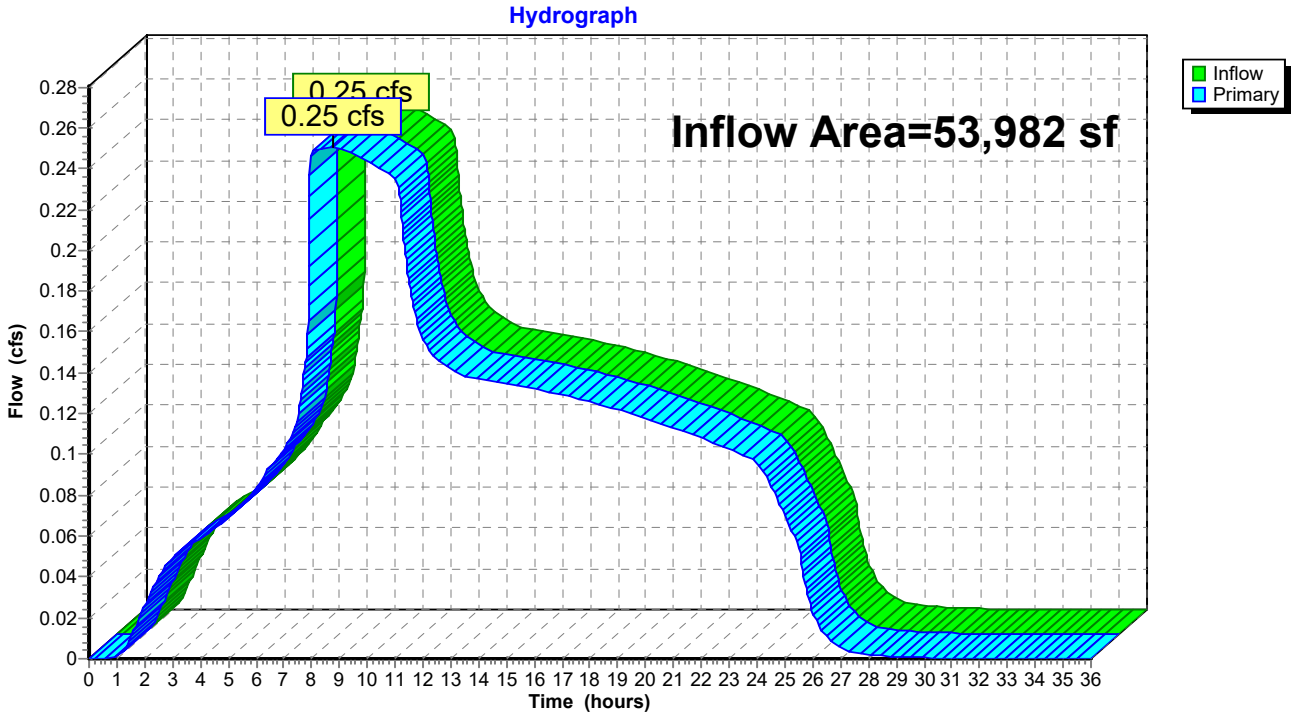


Summary for Link 10L: Site Flow Summary

Inflow Area = 53,982 sf, 53.64% Impervious, Inflow Depth > 2.43" for 10-Year Storm event
Inflow = 0.25 cfs @ 8.75 hrs, Volume= 10,947 cf
Primary = 0.25 cfs @ 8.75 hrs, Volume= 10,947 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 10L: Site Flow Summary



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SBUH method, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Site Impervious Runoff Area=28,145 sf 100.00% Impervious Runoff Depth=3.67"
Tc=5.0 min CN=98 Runoff=0.59 cfs 8,597 cf

Subcatchment 11S: Site Impervious Runoff Area=812 sf 100.00% Impervious Runoff Depth=3.67"
Tc=5.0 min CN=98 Runoff=0.02 cfs 248 cf

Subcatchment 50S: Site Pervious Runoff Area=25,025 sf 0.00% Impervious Runoff Depth=1.88"
Flow Length=50' Slope=0.0200 '/' Tc=6.4 min CN=79 Runoff=0.25 cfs 3,926 cf

Pond 1P: Subsurface Detention Pipe Peak Elev=208.99' Storage=2,472 cf Inflow=0.83 cfs 12,523 cf
Outflow=0.26 cfs 12,523 cf

Link 10L: Site Flow Summary Inflow=0.27 cfs 12,771 cf
Primary=0.27 cfs 12,771 cf

Total Runoff Area = 53,982 sf Runoff Volume = 12,771 cf Average Runoff Depth = 2.84"
46.36% Pervious = 25,025 sf 53.64% Impervious = 28,957 sf

Summary for Subcatchment 10S: Site Impervious

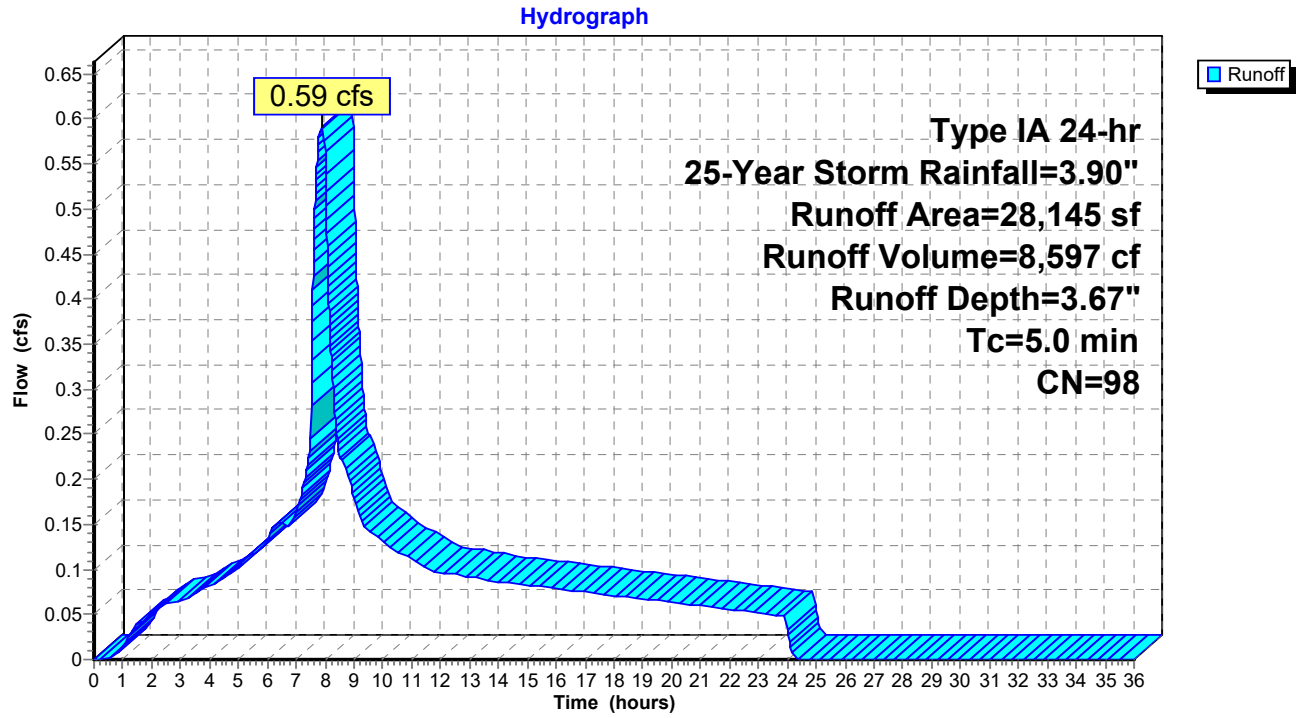
Runoff = 0.59 cfs @ 7.88 hrs, Volume= 8,597 cf, Depth= 3.67"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-Year Storm Rainfall=3.90"

	Area (sf)	CN	Description
*	17,322	98	Paved parking
*	9,634	98	Impervious Roof
*	1,189	98	Impervious Sidewalk
	28,145	98	Weighted Average
	28,145		100.00% Impervious Area

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

Subcatchment 10S: Site Impervious



Summary for Subcatchment 11S: Site Impervious

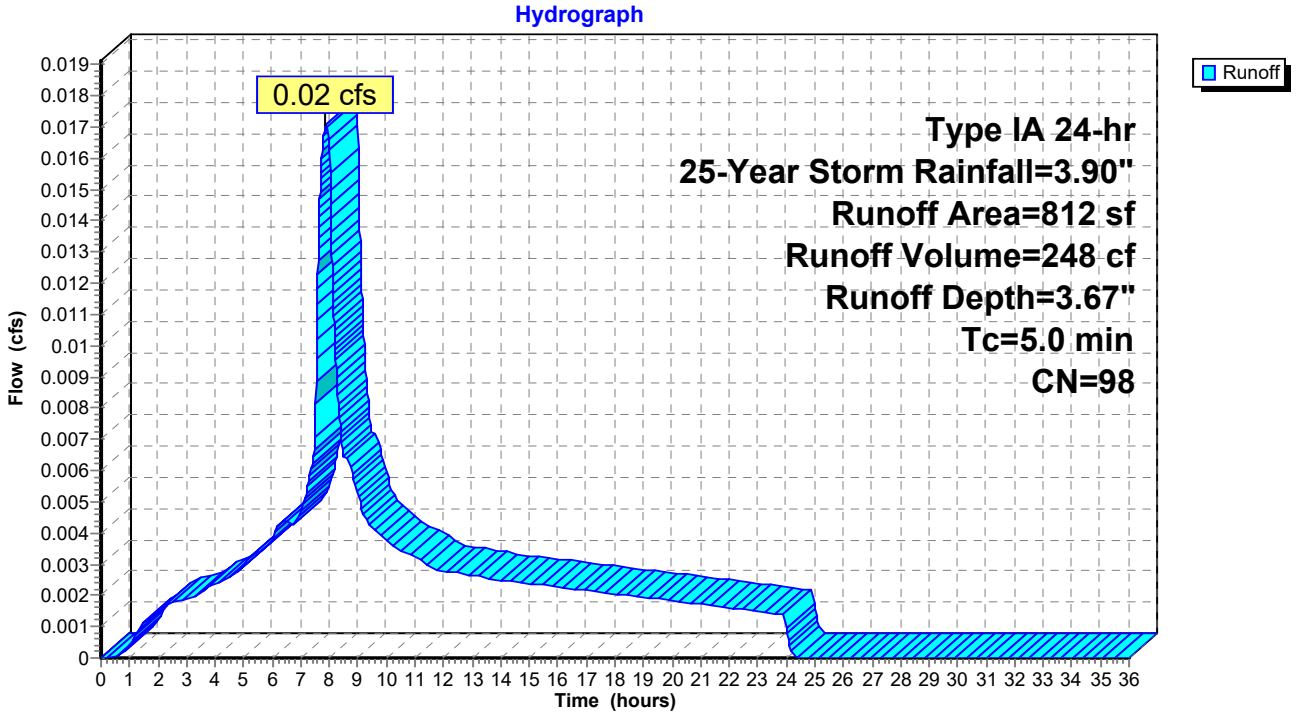
Runoff = 0.02 cfs @ 7.88 hrs, Volume= 248 cf, Depth= 3.67"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-Year Storm Rainfall=3.90"

	Area (sf)	CN	Description
*	812	98	Impervious Sidewalk
	812		100.00% Impervious Area

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

Subcatchment 11S: Site Impervious



Summary for Subcatchment 50S: Site Pervious

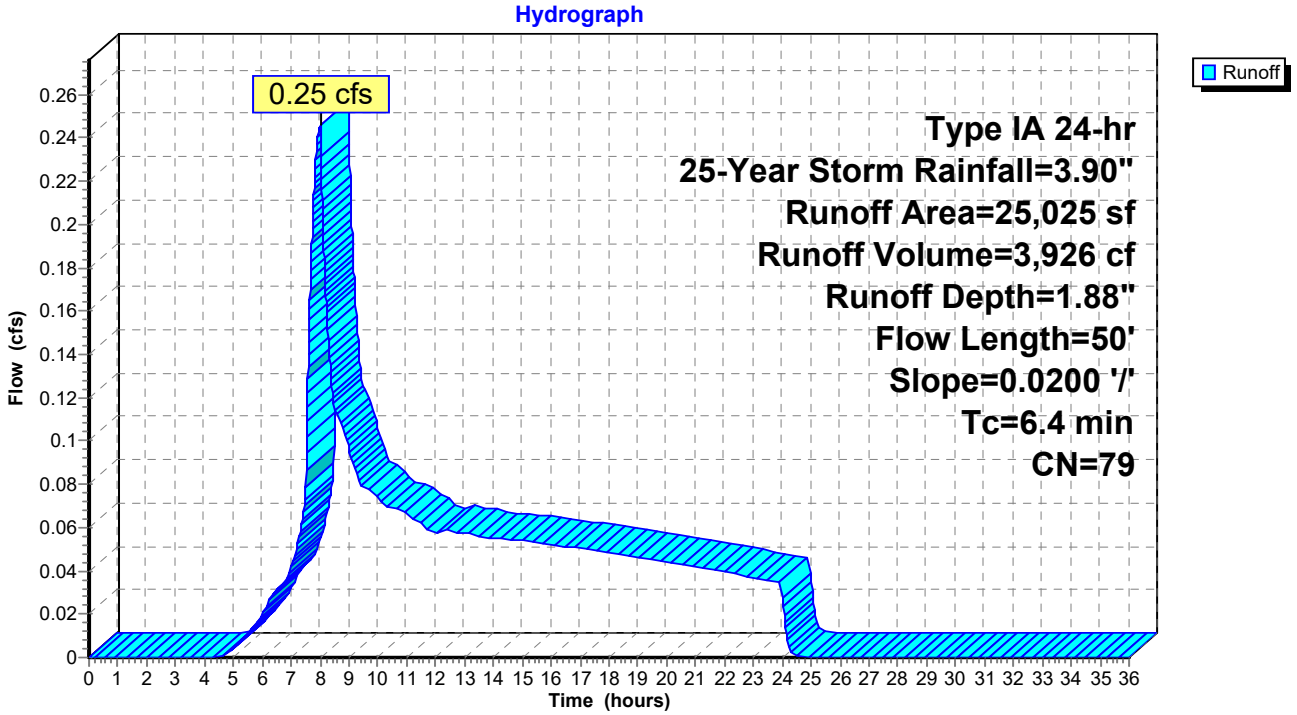
Runoff = 0.25 cfs @ 8.00 hrs, Volume= 3,926 cf, Depth= 1.88"

Runoff by SBUH method, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-Year Storm Rainfall=3.90"

Area (sf)	CN	Description
25,025	79	<50% Grass cover, Poor, HSG B
25,025		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	50	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.50"

Subcatchment 50S: Site Pervious



Summary for Pond 1P: Subsurface Detention Pipe

Inflow Area = 53,170 sf, 52.93% Impervious, Inflow Depth = 2.83" for 25-Year Storm event
Inflow = 0.83 cfs @ 7.92 hrs, Volume= 12,523 cf
Outflow = 0.26 cfs @ 9.11 hrs, Volume= 12,523 cf, Atten= 69%, Lag= 71.5 min
Primary = 0.26 cfs @ 9.11 hrs, Volume= 12,523 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 208.99' @ 9.11 hrs Surf.Area= 970 sf Storage= 2,472 cf
Flood Elev= 210.20' Surf.Area= 0 sf Storage= 3,318 cf

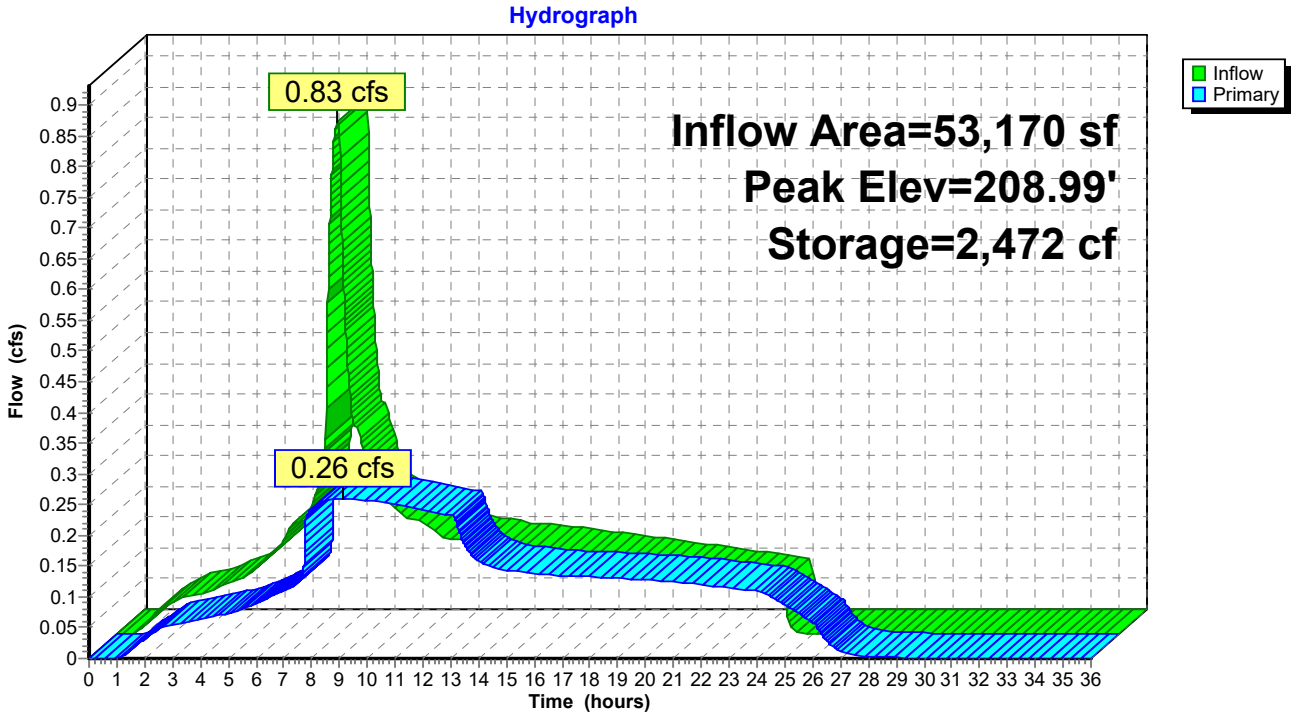
Plug-Flow detention time= 129.0 min calculated for 12,519 cf (100% of inflow)
Center-of-Mass det. time= 129.1 min (835.5 - 706.4)

Volume	Invert	Avail.Storage	Storage Description
#1	206.20'	3,318 cf	**48.0" Round Pipe Storage** x 4 L= 66.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	206.20'	**8.0" Round Outlet to Public System** L= 98.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 206.20' / 203.75' S= 0.0250 '/' Cc= 0.900 n= 0.130, Flow Area= 0.35 sf
#2	Device 1	206.20'	**2.0" Vert. Lower Oriface** C= 0.620
#3	Device 1	207.83'	**4.0" Vert. Mid Oriface** C= 0.620
#4	Device 1	209.20'	**8.0" Horiz. Overflow Riser Rim** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.26 cfs @ 9.11 hrs HW=208.99' (Free Discharge)
└**1=Outlet to Public System** (Barrel Controls 0.26 cfs @ 0.75 fps)
├**2=Lower Oriface** (Passes < 0.18 cfs potential flow)
├**3=Mid Oriface** (Passes < 0.43 cfs potential flow)
└**4=Overflow Riser Rim** (Controls 0.00 cfs)

Pond 1P: Subsurface Detention Pipe

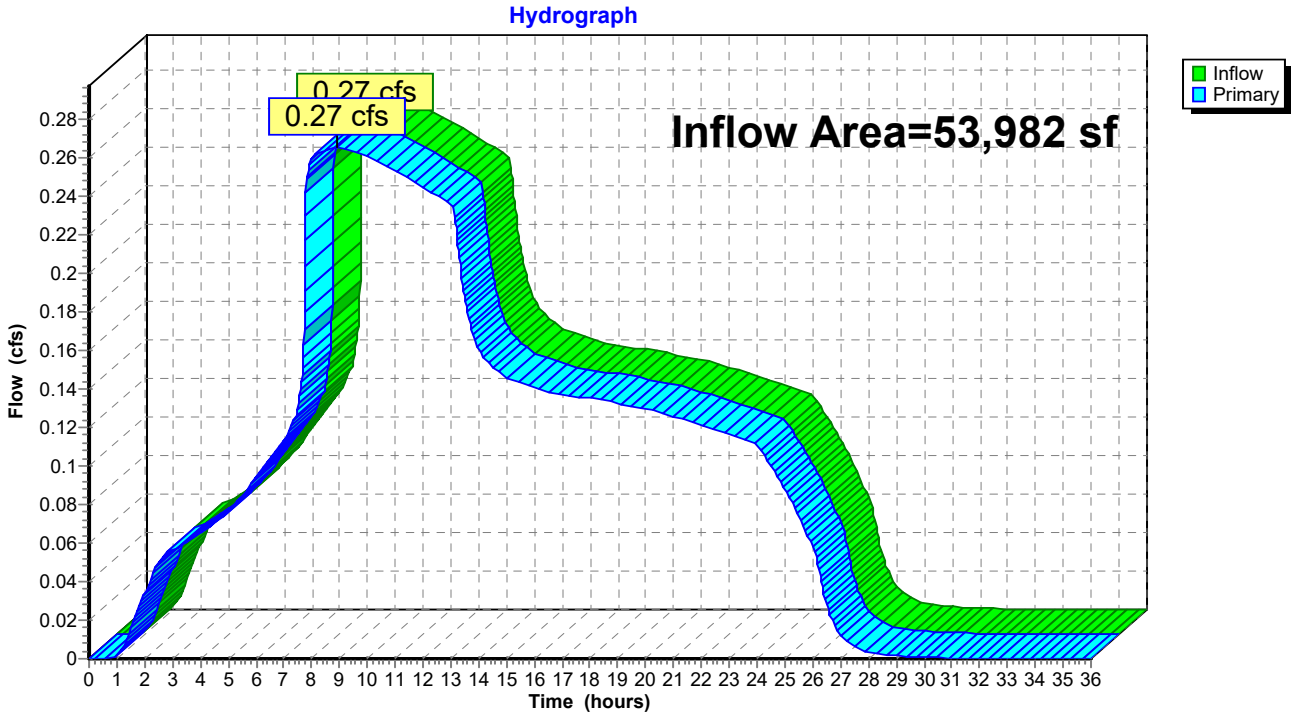


Summary for Link 10L: Site Flow Summary

Inflow Area = 53,982 sf, 53.64% Impervious, Inflow Depth > 2.84" for 25-Year Storm event
Inflow = 0.27 cfs @ 8.92 hrs, Volume= 12,771 cf
Primary = 0.27 cfs @ 8.92 hrs, Volume= 12,771 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link 10L: Site Flow Summary



Appendix C:
Stormwater Quality Calculations

STORMWATER QUALITY CALCULATIONS

Client: Senestraro Family Orthodontics

AKS Job No.: 6946
Date: 4/28/2020
Done By: GSH
Checked By: JMM

IMPERVIOUS AREA

Total Site Area:	1.24	acres
Total Site Area:	54,014	square feet (sf)

Total Impervious Area Receiving Treatment	28,146	sf
		sf
Total Impervious Area:	28,146	sf

WATER DESIGN QUALITY VOLUME (WQV)

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

$$WQV = \frac{0.36" \text{ X Area (ft)}}{12" \text{ per ft}} = \mathbf{844} \ \mathbf{cubic\ feet}$$

WATER QUALITY FLOW (WQF)

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

$$WQF = \frac{WQV\ (sf)}{4*60*60} = \mathbf{0.06}\ \mathbf{cfs}$$

Appendix D:
USDA-NRCS Soil Resource Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Washington County, Oregon

April 13, 2020

Preface

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

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

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

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

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

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

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

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

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:933 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 17, Sep 10, 2019

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

Date(s) aerial images were photographed: Sep 19, 2018—Oct 20, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
21A	Hillsboro loam, 0 to 3 percent slopes	0.8	38.0%
37A	Quatama loam, 0 to 3 percent slopes	1.3	62.0%
Totals for Area of Interest		**2.1**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

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

Washington County, Oregon

21A—Hillsboro loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 21y5
Elevation: 160 to 240 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Hillsboro

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

37A—Quatama loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 21zl
Elevation: 140 to 250 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Quatama and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Quatama

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

H1 - 0 to 15 inches: loam
H2 - 15 to 30 inches: clay loam
H3 - 30 to 62 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Huberly

Percent of map unit: 4 percent
Landform: Terraces

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 2-2c 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.