

Preliminary Stormwater Technical Information Report

Trammell Crow Company
Woodland Bozarth Site Development
Woodland, WA

Submitted to:
City of Woodland

Prepared By:



GIBBS & OLSON
CIVIL ENGINEERS • LAND SURVEYORS

November 2023

Gibbs & Olson Project No. 0788.0259

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Section A – Project Overview

Introduction

Trammel Crow Company is proposing to develop Cowlitz County (CC) Parcel No.'s 507350102, 507350103, and 507350104 located between Rose Way and N. Pekin Road, south of Guild Road in Woodland, Washington. See the Vicinity Map in Appendix A. The development of this property will consist of the design and construction of two industrial warehouse buildings at approximately 655,000 and 276,000 square feet, respectively, and associated automobile and trailer parking. Required public improvements include: approximately 1,800 linear feet of half road width extension of Rose Way along the western property line; frontage improvements to N. Pekin Road along the eastern property line (approximately 1,500 linear feet); stormwater management, sanitary sewer and potable water extensions within Rose Way; and connecting the potable waterline between Rose Way and N. Pekin Road within an onsite public easement. Private site improvements include site grading, the construction of automobile and trailer parking, the construction of internal access roads, stormwater management, the installation of sanitary sewer and potable water services, fire protection, and lighting.

Existing Conditions

Onsite

The overall property consists of three existing parcels, totaling approximately 70 acres of industrial zoned land along N. Pekin Road. The proposed property is undeveloped aside from a small residence in the southeastern corner, which is to be maintained. The existing ground is predominately covered with fescue. There are several forested wetlands onsite including an approximate 2.5-acre wetland (Wetland A) along the south property line, an approximate 0.75-acre wetland (Wetland B) deemed a Fish & Wildlife Habitat Conservation Area by Washington Department of Fish and Wildlife (WDFW) and the City of Woodland along the north property line, and two approximate 315 square feet wetlands (Wetlands C and D) along the west property line. There are also multiple white oak trees onsite. Appendix A contains an Existing Conditions map developed by Ecological Land Services (ELS) showing critical areas. The topography of the site gently slopes either south towards Wetland A or west towards the west property line. Wetland A outlets to a Consolidated Diking Improvement District (CDID) No. 2 owned ditch running adjacent to the southern property line which drains west adjacent towards the Columbia River. The existing runoff from the site is primarily overland flow with rainfall runoff sheet flowing towards one of the wetlands, which detain some of the storm runoff until it either infiltrates or evaporates. It can be reasonably assumed that storm runoff from larger rainfall events is discharged from Wetland A into the CDID No. 2 ditch, see the Pre-Developed Basin Map in Appendix A.

Offsite

The fully developed CalPortland Cement Plant located on CC Parcel No. 507750100, site address 1441 Guild Road, Woodland, WA 98674 appears to have a two celled stormwater pond located in the southeastern portion of the site adjacent to Wetland B. It is assumed this stormwater pond collects stormwater from the fully developed CalPortland Cement Plant and discharges into Wetland B at rates

matching conditions before the CalPortland Site was developed, per City of Woodland standards. It is also assumed that stormwater runoff from CC Parcel No.'s 507780100, 507770100, and 507760100 sheet flows into Wetland B. These parcels are partially developed with gravel driveways and covered storage buildings.

Proposed Conditions

The required public improvements include extending Rose Way along the western property line, approximately 1,800 linear feet of half width road improvements consisting of a 25-ft pavement width, 1-ft gutter, curb, and sidewalk to City standards. Frontage improvements will be made to N. Pekin Road along the eastern property line, approximately 1,500 linear feet. These improvements consist of sawcutting the existing pavement, widening the road to a 21-ft pavement width, and the installation of a 1-ft gutter, curb, and sidewalk to City standards. Stormwater runoff from these public improvements will be addressed by installing curb cuts at intervals and roadway low points which will direct roadway runoff underneath the sidewalk into bioretention facilities located behind the sidewalks. The bioretention facilities will be located within an easement offset from the proposed right of way dedication and will be sized to provide 100% water quality treatment and infiltration. Five driveways along Rose Way and four driveways along N. Pekin Road are proposed for access to the site.

Proposed private site improvements include approximately 4,400 linear feet of internal access roads and automobile and trailer parking. Three stormwater combined wetpond/detention ponds will provide for treatment and flow control of runoff from the developed site. The three ponds will be located in the northeast corner (NE Pond), northwest corner (NW Pond), and center of the site (Center Pond), respectively. A series of catch basins will collect and convey stormwater runoff into one of the three ponds, see the Post-Developed Basin Map in Appendix A. After treatment and flow control, stormwater will be discharged into the CDID No. 2 ditch along the south property line.

The proposed improvements redirect stormwater runoff from Wetlands A and B, and stormwater improvements are designed such that treated stormwater will be discharged into Wetlands A and B at rates matching pre-developed rates, which will continue to feed the wetlands and not alter their existing condition. The NE and NW Pond will be designed to treat stormwater and outlet to Wetland B at rates matching pre-developed rates. A culvert pipe will be installed from Wetland B to the Center Pond to provide stormwater an outlet during large rainfall events. The Center Pond will discharge to the CDID No. 2 ditch at rates matching pre-developed rates. In addition, a portion of the roof runoff from Building B will be discharged to Wetland A at rates matching pre-developed rates.

This project will add more than 5,000 square feet of new impervious surface; therefore, all minimum requirements apply to this project.

Section B – Approval Conditions Summary

Preliminary approval conditions associated with this project will be included in the Type II Site Plan review and will be addressed during final design. The proposed project follows the City of Woodland Stormwater Code and the Department of Ecology's Stormwater Management Manual for the Puget Sound Basin,

February 1992 Edition (The Puget Sound Manual). The bioretention facilities follow the Department of Ecology's Stormwater Management Manual for Western Washington, 2019 Edition (SWMMWW) which provides guidance for bioretention and is more conservative than The Puget Sound Manual.

Section C – Downstream Analysis

The stormwater runoff from proposed improvements is detained onsite such that the peak release rates for the developed site for the 2-, 10-, 25- and 100-year 24-hour storm events do not exceed the respective predeveloped rates. Therefore, a downstream analysis is not applicable to this project.

Section D – Quantity Control Analysis and Design

Hydrologic Analysis

Criteria

WMC Chapter 15.12 Stormwater Management states for surface runoff leaving a developed site "The peak release rate for the two-, ten-, twenty-five-, and one-hundred-year design storms after development shall not exceed the respective predevelopment rates." To ensure these standards are met "the volume available for storing runoff in a stormwater facility shall be reduced by an assumed starting condition equivalent to an immediately prior two-year event." This condition was applied to the sizing of the stormwater ponds for the runoff from proposed improvements.

Rainfall totals for 2-, 10-, 25- and 100-year, 24-hour design storm events for the Woodland area were determined from the isopluvial maps for design storms in Cowlitz County listed in the NOAA Atlas 2, "Precipitation Frequency Atlas for the Western United States, Volume IX – Washington". The rainfall totals were 2.40 inches per hour (in/hr), 3.41 in/hr, 3.79 in/hr, and 4.55 in/hr for the 2-, 10-, 25- and 100-year, 24-hour design storm events, respectively.

The existing conditions were described in Section A, Existing Conditions. The existing land use is modeled as meadow or pasture. The proposed improvements for the site are described in Section A, Proposed Conditions. For preliminary modeling purposes, the proposed land use is considered to be a combination of roofs, road/parking, landscape/grass, and pond water surface area. The developed site for the proposed road improvements is divided into three basins (NW, NE, and Center), as shown on the basin maps in Appendix A. See the modeling results in Appendix B for land use values.

Results

The proposed bioretention facilities were designed per BMP T7.30 of the SWMMWW to fully infiltrate stormwater runoff from the Rose Way and N. Pekin Road public road improvements. The bioretention facilities will be constructed with 6-inches of freeboard, a 1-foot ponding depth, a 2-foot minimum bottom width, 3 horizontal to 1 vertical side slopes, 3-inches of coarse compost, 18-inches of Ecology's default bioretention soil mix, which has an initial saturated hydraulic conductivity (Ksat) of 12 inches per hour, and a 6-inch underdrain pipe installed within 2-ft of crushed rock. See the bioretention facility detail on the Type II Site Plan submittal drawings.

Preliminary bioretention facility sizing to treat and infiltrate 100% of the stormwater runoff was modeled with the Western Washington Hydrology Model (WWHM). A Ksat safety factor of 4 (for greater than 5,000 square feet of pollution-generating impervious surface) was used. The bioretention facilities with a total bottom length of 1,410 linear feet (as shown in the Site Plan Drawings) are modeled to treat and infiltrate 100% of the stormwater runoff. Preliminary sizing uses infiltration rates as described in Section G – Soils Evaluation with a safety factor of 2.5 per SWMMWW and biofiltration facility sizing will be verified with measured infiltration rates with the final Technical Information Report (TIR).

The proposed detention ponds were designed to detain the runoff from the three basins. Based on the single event hydrograph modeling using HydroCAD, the required storage volume was sized such that the combined peak release rates from the ponds in the developed condition shall not exceed the peak onsite and offsite runoff rates from the pre-developed 2-year 24-hour storm condition; and the 10-year, 25-year, and 100-year 24-hour storm. A storm culvert will be installed between Wetland B and the Center Pond allowing Wetland B to outlet stormwater runoff from large rainfall events into the Center Pond. Wetland B currently receives offsite stormwater runoff as described in Section A Existing Conditions; therefore, peak runoff rates from these offsite areas were included in the HydroCAD model and will be bypassed through the storm conveyance system. A starting condition equivalent to an immediately prior two-year event was assumed for each of the proposed stormwater facilities. Modeling results for the ponds, with the surface areas as shown in the Site Plan Drawings, indicate a total depth required of 3-feet is needed to provide the required storage volume.

The existing area draining to Wetlands A and B were modeled in HydroCAD and an area of roof was selected such that the peak runoff rate from the developed roof area shall not exceed the peak runoff rate into Wetland A from a pre-developed 2-year 24-hour storm condition; as well as the 10-year, 25-year, and 100-year storms.

Quantity Control System Design

The proposed stormwater quantity control design meets or exceeds the City of Woodland Stormwater Code requirements and the 1992 Puget Sound Manual. Flow control for stream bank protection is accomplished through detention of stormwater runoff from the proposed private site improvements to achieve the required pre-developed release rates.

Groundwater is anticipated to be between 5 to 10 feet below ground surface, see Section G. Existing ground elevations range from 18 to 23 with the exception of wetland and ditch bottoms; therefore, the anticipated groundwater elevation is approximately elevation 13. Detention volumes have been designed at or above elevation 17; therefore, adequate separation between live detention volume and the anticipated groundwater elevation will be provided.

Quantity Control System Plan

Further design details for the facilities, ponds and outlet structures will be included with the final design.

Section E – Conveyance System Analysis and Design

Per City of Woodland Stormwater Code, the conveyance system was sized to pass the 100-year, 24-hour design storm in open flow conditions. The stormwater conveyance system is designed with 12-inch through 36-inch diameter corrugated polyethylene storm sewer pipe at minimum slopes and capacities as shown in the table below such that the minimum velocity within the pipe is 2.5 feet per second to prevent siltation.

Pipe Diameter (in)	Minimum Slope (ft/ft)	Capacity (cfs)
12	0.0030	1.95
15	0.0023	3.10
18	0.0018	4.46
24	0.0012	7.84
30	0.0009	12.31
36	0.0007	17.65

The conveyance system connects the catch basins and conveys stormwater to one of the three ponds. In general, stormwater pipes furthest upstream from the ponds begin at 12-inch diameter and upsize as additional flow from each drainage area requires a higher capacity pipe up to a maximum of 36-inch diameter pipe.

Section F – Water Quality Design

This project will add more than 5,000 square feet of new pollution-generating impervious surface (PGIS); therefore, basic treatment is required.

The treatment of the new public impervious surface will be addressed through the use of bioretention facilities as described in Section D. The bioretention facilities were sized using WWHM to infiltrate 100% of stormwater runoff from public improvements; therefore, the water quality treatment criteria per the SWMMWW to treat 91% of stormwater runoff from PGIS's is also satisfied.

The treatment of the new private impervious surface for this project will be addressed through the use of wetponds. Wetponds are designed by utilizing a storage area underneath required detention storage for treatment, thus creating ponds with both live storage for detention and dead storage for treatment. The treatment BMP's are designed using the 6-month, 24-hour water quality design storm runoff volume defined as 64% of the 2-year, 24-hour design storm, or 1.54 inches. This volume is modeled in HydroCAD; see Appendix B for modeling results.

The proposed wetponds are designed per BMP RD.05 of the Puget Sound Manual to meet or exceed the water quality design storm runoff volume, with the layout consisting of two to three cells, a minimum 3-foot depth and length to width ratios between 3:1 and 7:1. Pond inlets are typically located on opposite sides of the pond from the pond outlet, where possible, to promote hydraulic residence time. Specific wetpond construction details and notes will be prepared with the final design and final TIR.

Section G – Soils Evaluation

Using the USDA Natural Resources Conservation Service (NRCS) the soils for this property have been identified as Clato silt loam with 0 to 3 percent slopes, Caples silty clay loam with 0 to 3 percent slopes, and Newberg fine sandy loam with 0 to 3 percent slopes. The majority of the developable site is underlain by Clato silt loam, Wetlands A, C, and D are underlain by Caples silty clay loam, and Wetland B is underlain by Newberg fine sandy loam as shown in the soils map in Appendix A. The Clato soil is classified as a soils hydrologic group B, the Caples soil is classified as a soils hydrologic group C/D, and the Newberg soil is classified as hydrologic soil group A.

A Due Diligence Geotechnical Report for the Woodland Bozarth Site Development project performed for the proposed improvements by NV5 dated January 26, 2023, is included in Appendix C. As noted in the report, mud rotary drilling methods prevented the direct measurement of groundwater in drilled borings; however, increased moisture of soil samples was observed at depths of approximately 10 to 15 feet below ground surface. Porewater dissipation testing in core penetration tests indicated groundwater was present at depths of 9.5 to 12 feet below ground surface at the time of testing. NV5 anticipates static groundwater will generally be between 5 and 10 feet below ground surface. See the report in Appendix C for additional information.

Infiltration testing was not performed as a part of NV5's Due Diligence Geotechnical Report. For preliminary stormwater modeling, infiltration testing from Rose Way Industrial Park, a nearby industrial development located just north on Parcel No. 508310100, Site Address 1435 Guild Road, was used. Infiltration tests were performed by Columbia West Engineering, Inc. on May 11, 2017. An Exploration Location Map showing measured infiltration rates and locations is provided in Appendix C. For preliminary stormwater modeling, a measured infiltration rate equal to the average measured infiltration rate at the Rose Way Industrial project site of 2.46 inches per hour was used. The onsite infiltration rate will be measured with infiltration testing for final design.

Section H – Special Reports and Studies

An Oak Tree Protection Plan was prepared by Arbor Science Tree Care dated September 13, 2023.

A Cultural Resources Report was prepared by Archaeological Investigations Northwest, Inc. dated January 19, 2023, and will be submitted with the Type II Site Plan.

Ecological Land Services has performed a wetland categorization and delineation and is working with the City of Woodland, United States Army Corps of Engineers (USACE), Department of Ecology (DOE), and Washington Department of Fish and Wildlife (WDFW) to prepare the required environmental reports and permits, see Section I.

The proposed site is protected by a dike and therefore is not considered to be in a floodplain and the site is not located within the shoreline management area.

Section I – Other Permits

The proposed construction for this project will disturb over an acre of land; therefore, a Construction Stormwater Permit and a Stormwater Pollution Prevention Plan is required for this project. A Temporary Sediment and Erosion Control (TESC) plan will be prepared as part of the civil design.

Additional permits that should be considered for design include:

- Excavation and grading permit
- Right of way permit

The proposed construction will also impact Wetlands C and D and the buffers of Wetlands A and B; therefore, additional permits that should be considered for environmental impacts are summarized in the table below:

Agency	Complete Application Documents	Permit
City of Woodland	<ul style="list-style-type: none"> • SEPA Checklist • Variance Application • JARPA Form • Critical Areas Report • Onsite Mitigation and Bank Use Plan 	SEPA Decision Variance
USACE	<ul style="list-style-type: none"> • JARPA Form • Critical Areas Report • Onsite Mitigation and Bank Use Plan 	Nationwide Permit 39
DOE	<ul style="list-style-type: none"> • JARPA Form • Critical Areas Report • Onsite Mitigation and Bank Use Plan 	Letter of Authorization or 401 Water Quality Certification
DOE	<ul style="list-style-type: none"> • SEPA Decision • Notice of Intent • Stormwater Pollution Prevention Plan 	Construction Stormwater Permit
WDFW	<ul style="list-style-type: none"> • SEPA Decision • JARPA Form • Critical Areas Report • Onsite Mitigation and Banks Use Plan 	Hydraulic Project Approval

* SEPA = State Environmental Policy Act

** JARPA = Joint Aquatic Resource Permit Application

Section J – Ground Water Monitoring Program

A ground water monitoring program is not required for this project at this time.

Section K – Operations and Maintenance Manual

An Operation and Maintenance Manual and maintenance agreement will be prepared with the final TIR for stormwater facilities to be privately maintained.

Section L – Technical Appendix

Appendix A

Maps

Appendix B

Modeling Results

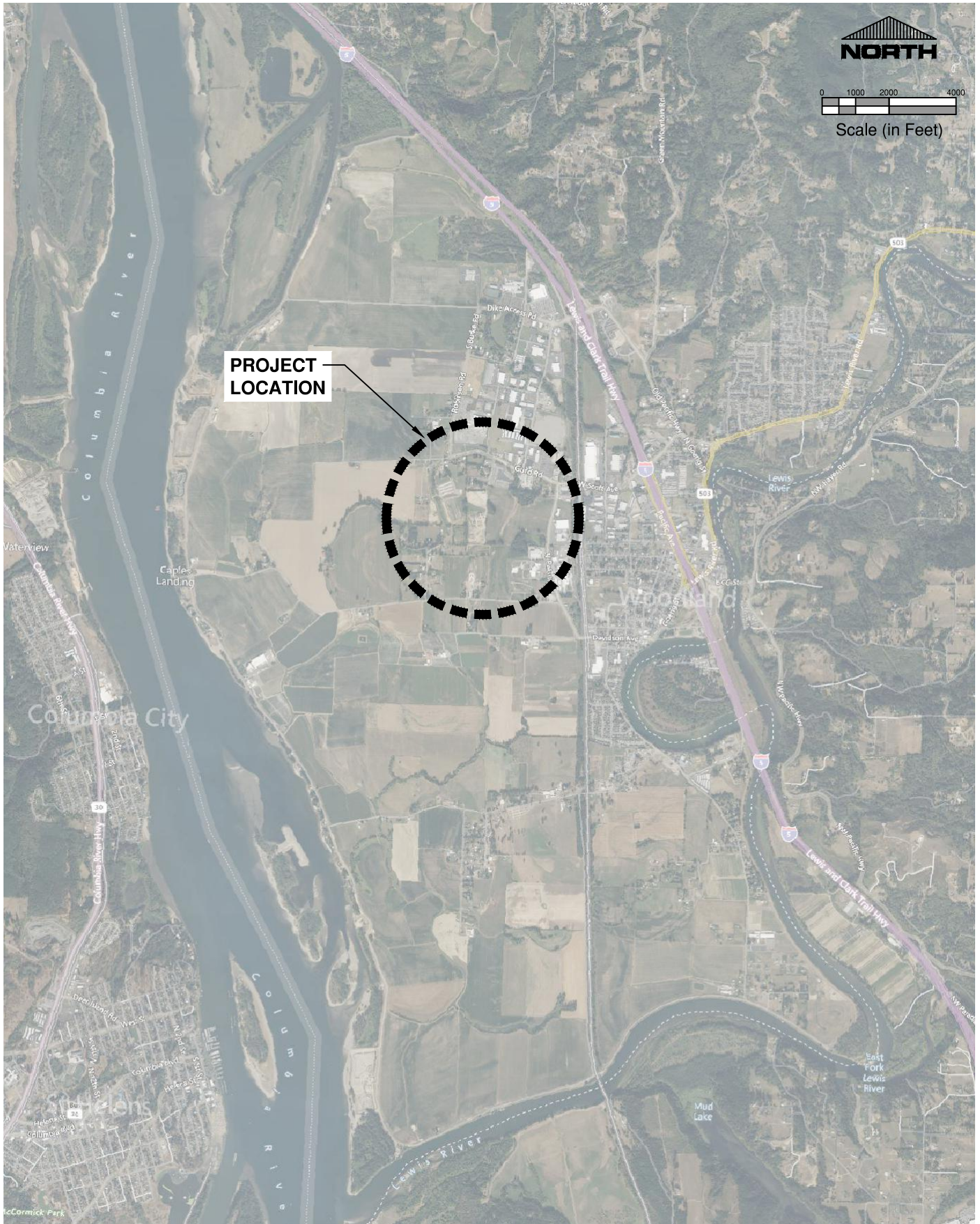
Appendix C

Geotechnical Investigations and Reports

Appendix A

Maps

DRAWING: T:\PROJECTS\0788 MISC ENG PROJECT\0259 BOZORTH PROPERTY SURVEY\FIGURES & EXHIBITS\BASIN & VICINITY MAPS.DWG; LAYOUT TAB: VICINITY MAP; PLOT DATE: 11/15/2023 3:40:50 PM; DRAWING SAVE DATE: 11/15/2023 3:36:43 PM; PLOTTED BY: KRÖGERS
PLOT DEVICE: GIBBS & OLSON - DWG TO PDF.PLOT STYLE TABLE: GIBBS-OLSON STANDARD MONOCHROME.PLOT STYLE: GIBBS-OLSON - FIGURE A SIZE (PORTRAIT) - 8.50 X 11.00 INCHES



**PROJECT
LOCATION**

Vicinity Map

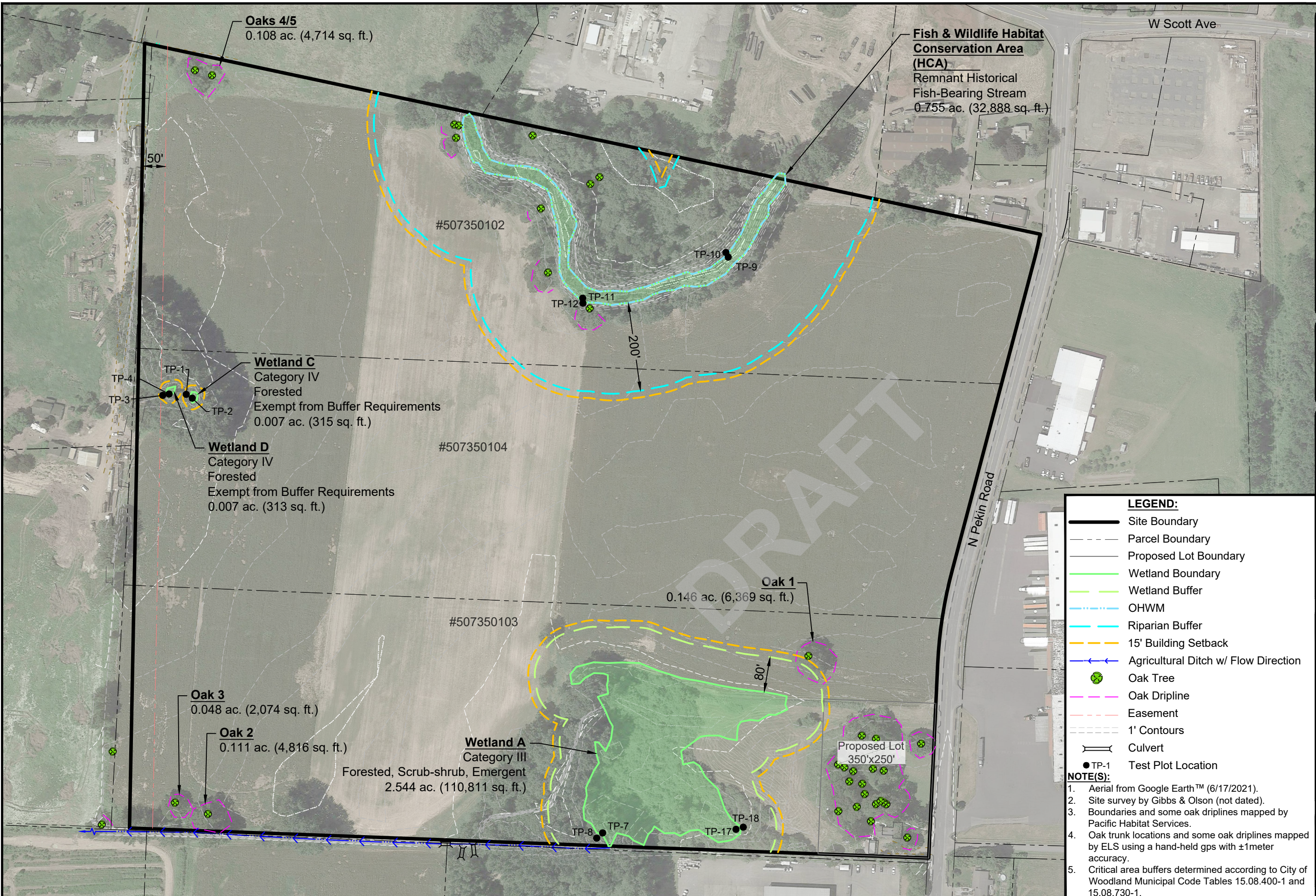


Figure 2
EXISTING CONDITIONS
 N Pekin Road Site
 Trammell Crow
 City of Woodland, Cowitz County, Washington
 Sections 13 & 14, Township 5N, Range 1W, W.M.

DATE: 8/9/23
 DWN: JKJ
 REQ. BY: SS
 PRJ. MGR: SS
 CHK:
 PROJECT NO:
 3665.04

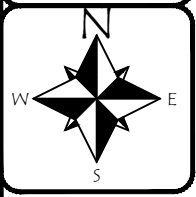
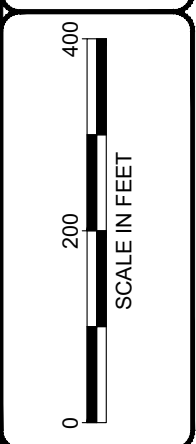
1157 3rd Ave., Suite 220A
 Longview, WA 98632
 Phone: (360) 578-1371
 Fax: (360) 414-9305
 www.eco-land.com



LEGEND:

- Site Boundary
- Parcel Boundary
- Proposed Lot Boundary
- Wetland Boundary
- Wetland Buffer
- OHWM
- Riparian Buffer
- 15' Building Setback
- Agricultural Ditch w/ Flow Direction
- ⊗ Oak Tree
- ⊗ Oak Dripline
- Easement
- 1' Contours
- Culvert
- TP-1 Test Plot Location

- NOTE(S):**
1. Aerial from Google Earth™ (6/17/2021).
 2. Site survey by Gibbs & Olson (not dated).
 3. Boundaries and some oak driplines mapped by Pacific Habitat Services.
 4. Oak trunk locations and some oak driplines mapped by ELS using a hand-held gps with ±1 meter accuracy.
 5. Critical area buffers determined according to City of Woodland Municipal Code Tables 15.08.400-1 and 15.08.730-1.



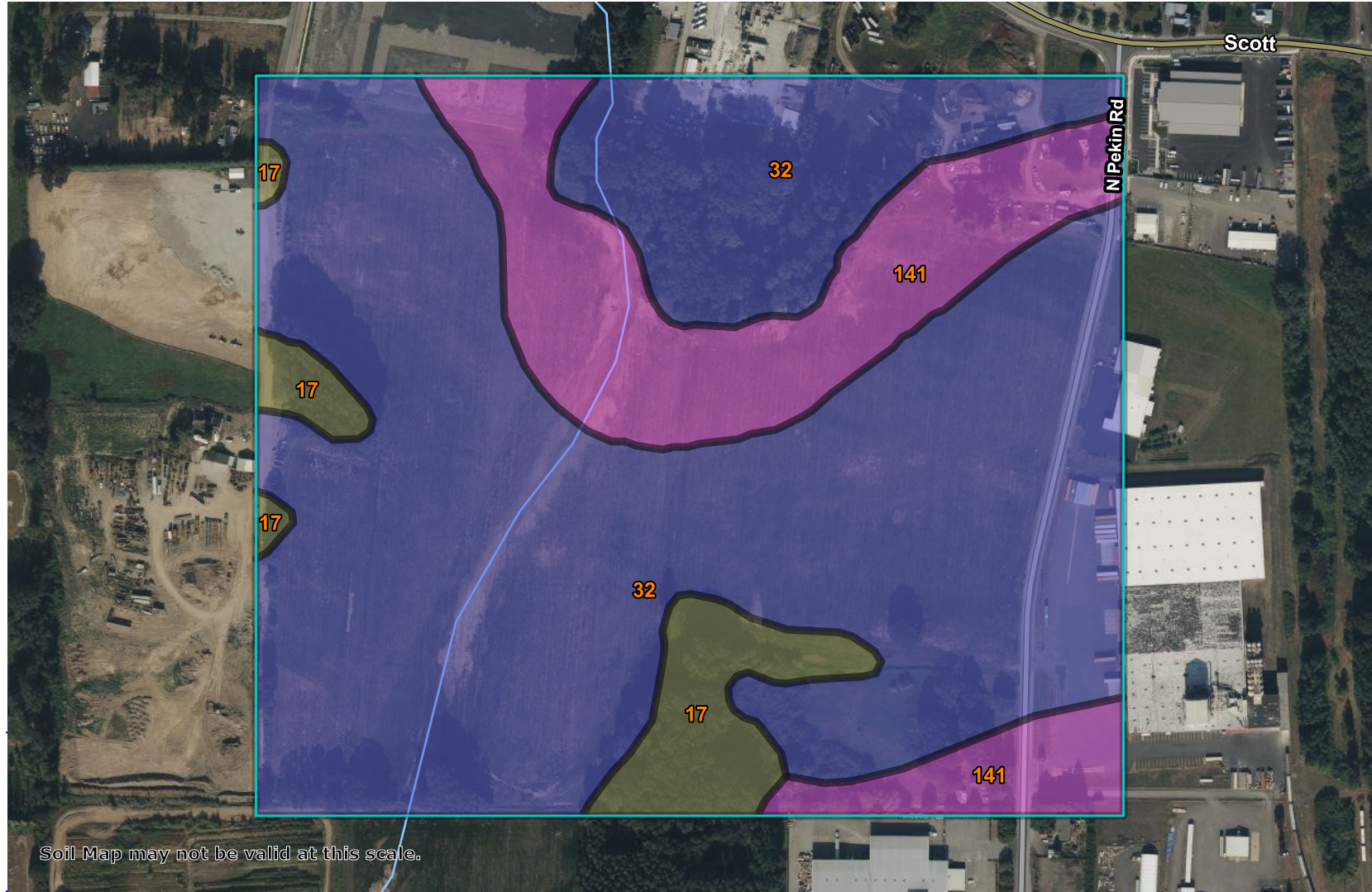
Hydrologic Soil Group—Cowlitz County, Washington
(Bozorth Property)

122° 46' 9" W

122° 45' 21" W

45° 54' 50" N

45° 54' 50" N



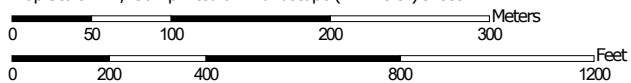
45° 54' 28" N

45° 54' 28" N

122° 46' 9" W



Map Scale: 1:4,750 if printed on A landscape (11" x 8.5") sheet.




Map projection: Web Mercator Corner coordinates: WGS84

122° 45' 21" W



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines


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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Cowlitz County, Washington
 Survey Area Data: Version 23, Aug 31, 2022

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

Date(s) aerial images were photographed: Sep 26, 2022—Oct 11, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
17	Caples silty clay loam, 0 to 3 percent slopes	C/D	5.9	6.5%
32	Clato silt loam, 0 to 3 percent slopes	B	68.2	74.2%
141	Newberg fine sandy loam, 0 to 3 percent slopes	A	17.8	19.4%
Totals for Area of Interest			92.0	100.0%

Description

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

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

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

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

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

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

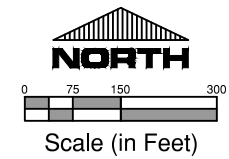
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



ROSE WAY INDUSTRIAL PARK

ROSE WAY

EXISTING STORMWATER POND

TO WETLAND B

WETLAND B

TO WETLAND A





WETLAND A

PEKIN RD

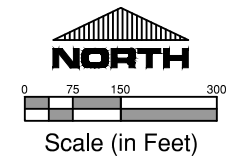
CDID NO. 2 DITCH

WETLANDS C & D

PRE-DEVELOPED BASIN INFORMATION

	PRE-DEVELOPED ONSITE BASIN:	67.6 ACRES
	PRE-DEVELOPED OFFSITE BASIN:	9.9 ACRES
	EXISTING WETLAND A BASIN:	32.8 ACRES
	EXISTING WETLAND B BASIN:	15.6 ACRES

DRAWING: 11/16/2023 2:01:36 PM, PLOTTED BY: KRIGERS
 DATE: 11/16/2023 2:01:36 PM, PLOT DATE: 11/16/2023 2:01:36 PM, PAPER SIZE: A, SHEET NO. 1 OF 1, PROJECT NO. 2023-001, PROJECT NAME: WOODLAND BOZARTH SITE DEVELOPMENT, PREPARED BY: GIBBS & OLSON, CHECKED BY: J. OLSON, DATE: 11/16/2023 2:01:36 PM, SCALE: 1"=100' (AS SHOWN)



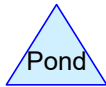
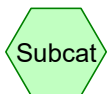
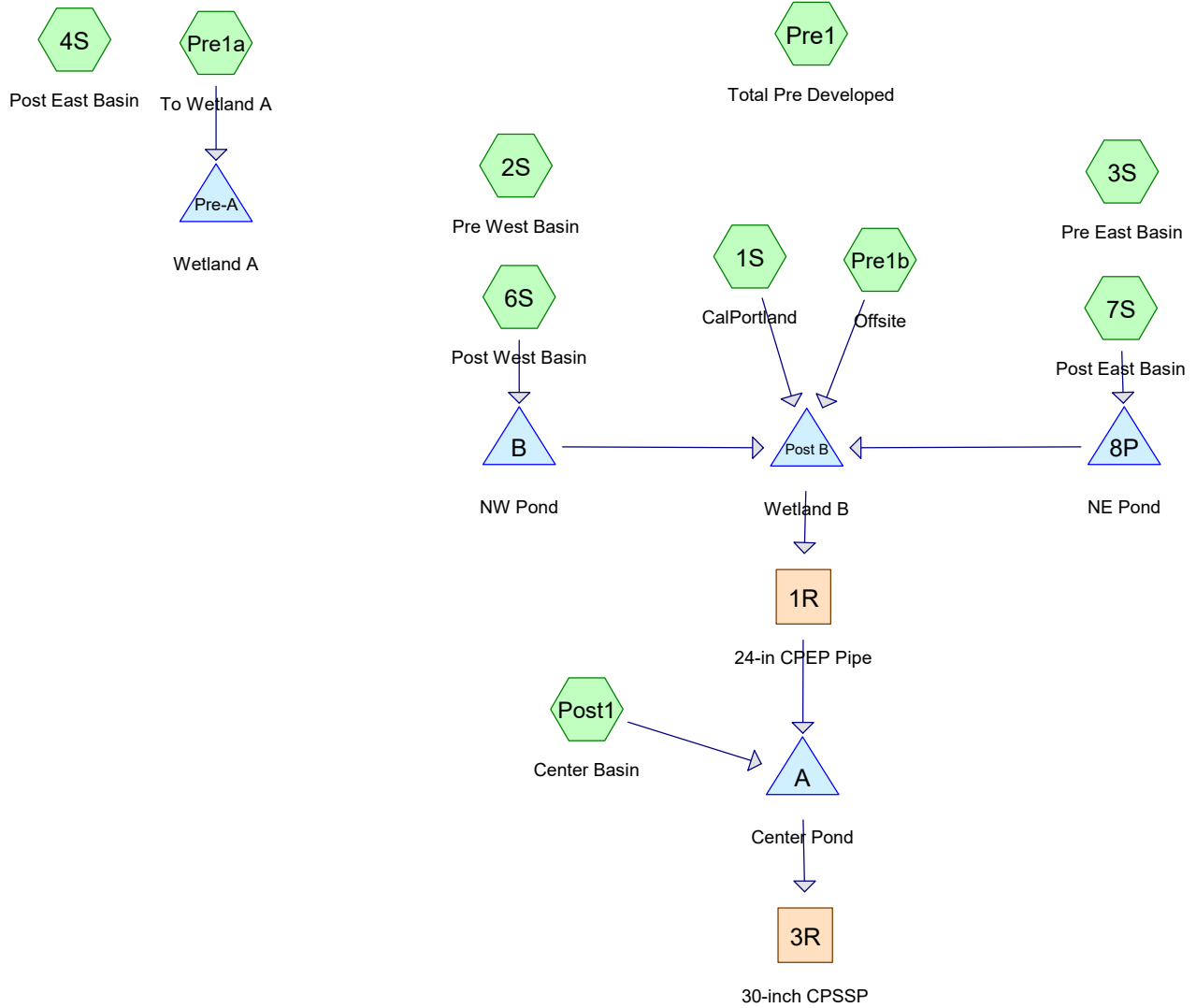
DEVELOPED BASIN INFORMATION

	NW BASIN: PAVED PARKING, DRIVE AISLES, SIDEWALK, OR OTHER CONCRETE: LANDSCAPING: ROOF: POND:	14.34 ACRES 4.97 ACRES 1.06 ACRES 7.56 ACRES 0.75 ACRES
	NE BASIN: PAVED PARKING, DRIVE AISLES, SIDEWALK, OR OTHER CONCRETE: LANDSCAPING: ROOF: POND:	6.86 ACRES 1.94 ACRES 1.28 ACRES 3.10 ACRES 0.54 ACRES
	CENTER BASIN: PAVED PARKING, DRIVE AISLES, SIDEWALK, OR OTHER CONCRETE: LANDSCAPING: ROOF: POND:	33.28 ACRES 14.28 ACRES 6.94 ACRES 10.72 ACRES 1.34 ACRES

DRAWING: 11/16/2023 2:02:49 PM, PLOTTED BY: GIBBS & OLSON
 PROJECT: WOODLAND BOZARTH SITE DEVELOPMENT, FIGURE B SITE LANDSCAPE - 17.00 X 11.00 (INCHES)
 DATE: 11/16/2023 2:02:49 PM, REV: 11/16/2023 2:02:49 PM, DRAWING SCALE: 1/8"=1'-0" (LANDSCAPE)
 DESIGNED BY: GIBBS & OLSON, CHECKED BY: GIBBS & OLSON, PAPER SIZE: A, STANDARD COLOR: WHITE, PLOT DATE: 11/16/2023 2:02:49 PM, REV: 11/16/2023 2:02:49 PM, DRAWING SCALE: 1/8"=1'-0" (LANDSCAPE)

Appendix B

Modeling Results



07880259 60% Stormwater Sizing

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Type IA 24-hr 2-yr Rainfall=2.40"

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Page 2

Summary for Subcatchment 1S: CalPortland

Runoff = 0.40 cfs @ 9.06 hrs, Volume= 0.306 af, Depth> 0.69"

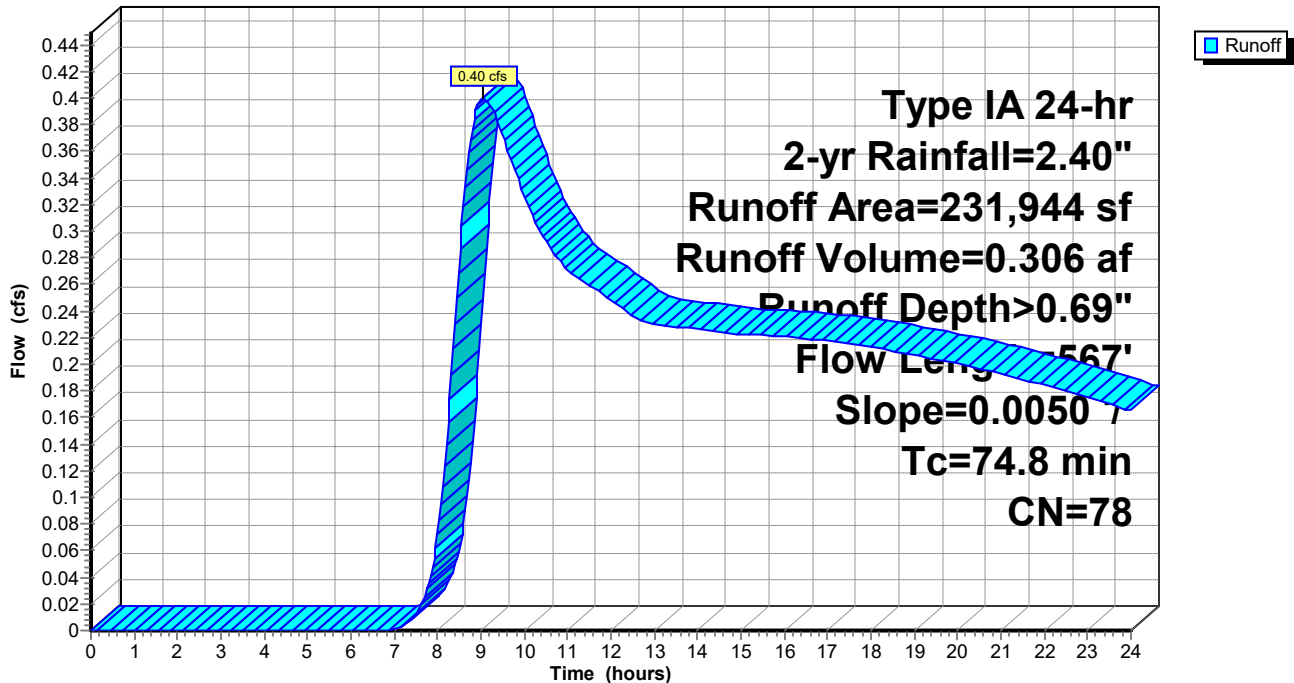
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (sf)	CN	Description
* 231,944	78	Meadow or Pasture, HSG B
231,944		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
69.1	300	0.0050	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 2.40"
5.7	267	0.0050	0.78		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
74.8	567	Total			

Subcatchment 1S: CalPortland

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment 2S: Pre West Basin

Runoff = 1.89 cfs @ 8.00 hrs, Volume= 0.859 af, Depth> 0.72"

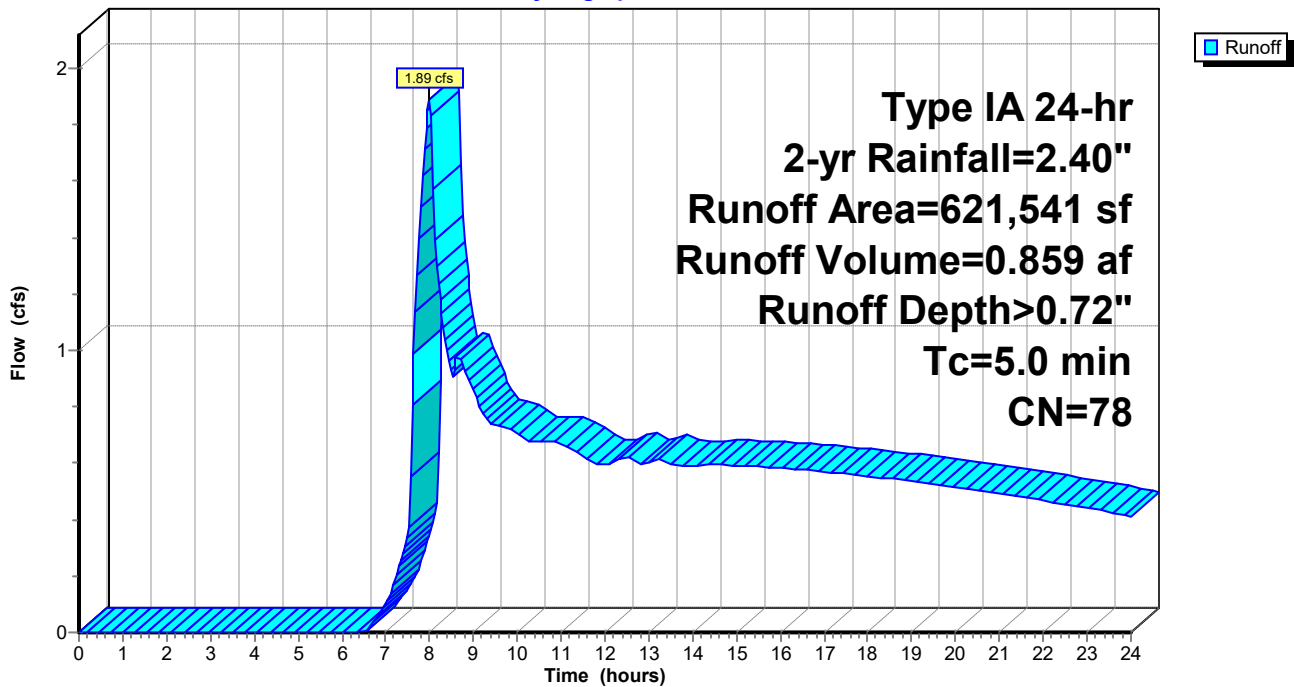
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (sf)	CN	Description
* 621,541	78	Meadow or Pasture, HSG B
621,541		100.00% Pervious Area

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

Subcatchment 2S: Pre West Basin

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment 3S: Pre East Basin

Runoff = 0.91 cfs @ 8.00 hrs, Volume= 0.413 af, Depth> 0.72"

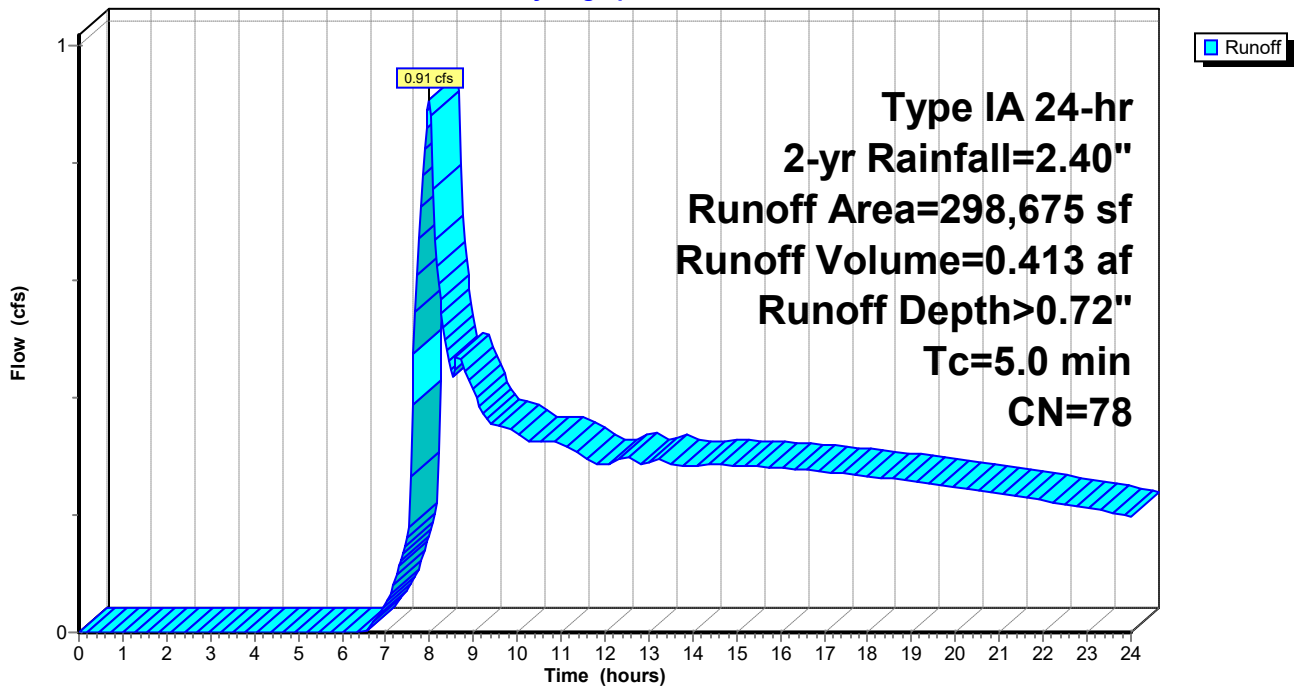
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (sf)	CN	Description
* 298,675	78	Meadow or Pasture, HSG B
298,675		100.00% Pervious Area

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

Subcatchment 3S: Pre East Basin

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment 4S: Post East Basin

Runoff = 1.74 cfs @ 7.86 hrs, Volume= 0.559 af, Depth> 2.17"

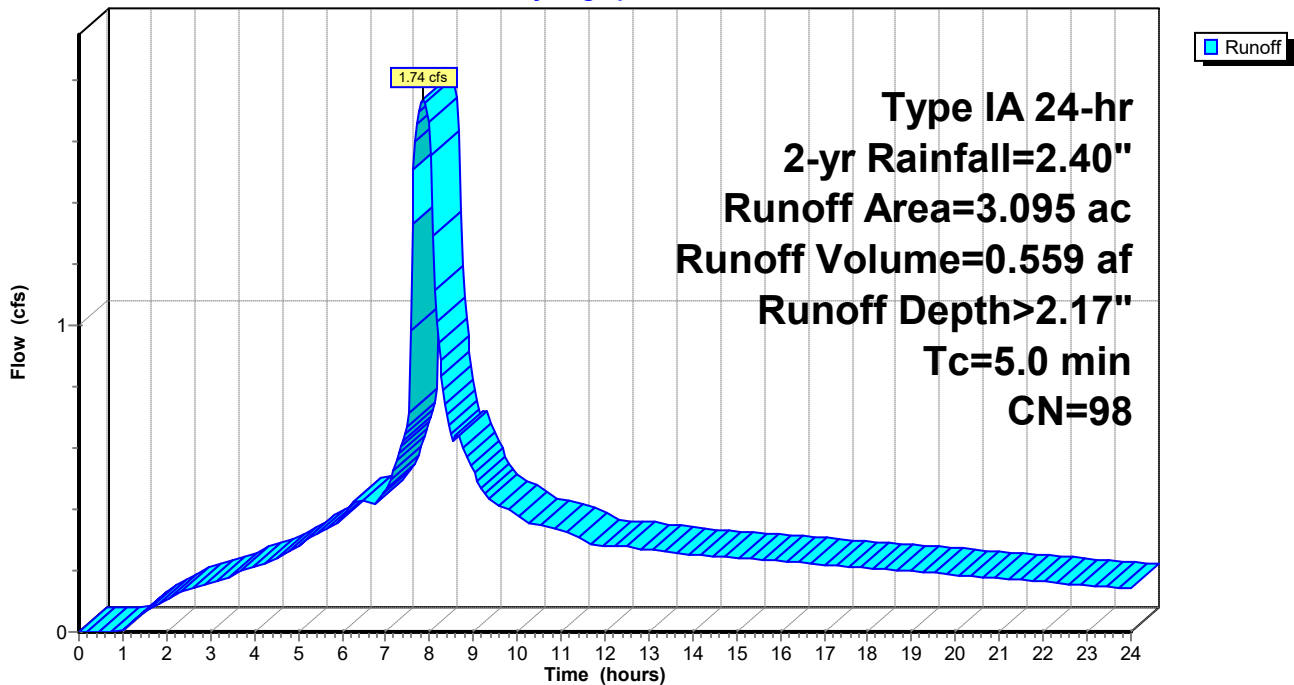
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (ac)	CN	Description
3.095	98	Unconnected roofs, HSG B
3.095		100.00% Impervious Area
3.095		100.00% Unconnected

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

Subcatchment 4S: Post East Basin

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment 6S: Post West Basin

Runoff = 7.03 cfs @ 7.89 hrs, Volume= 2.227 af, Depth> 1.86"

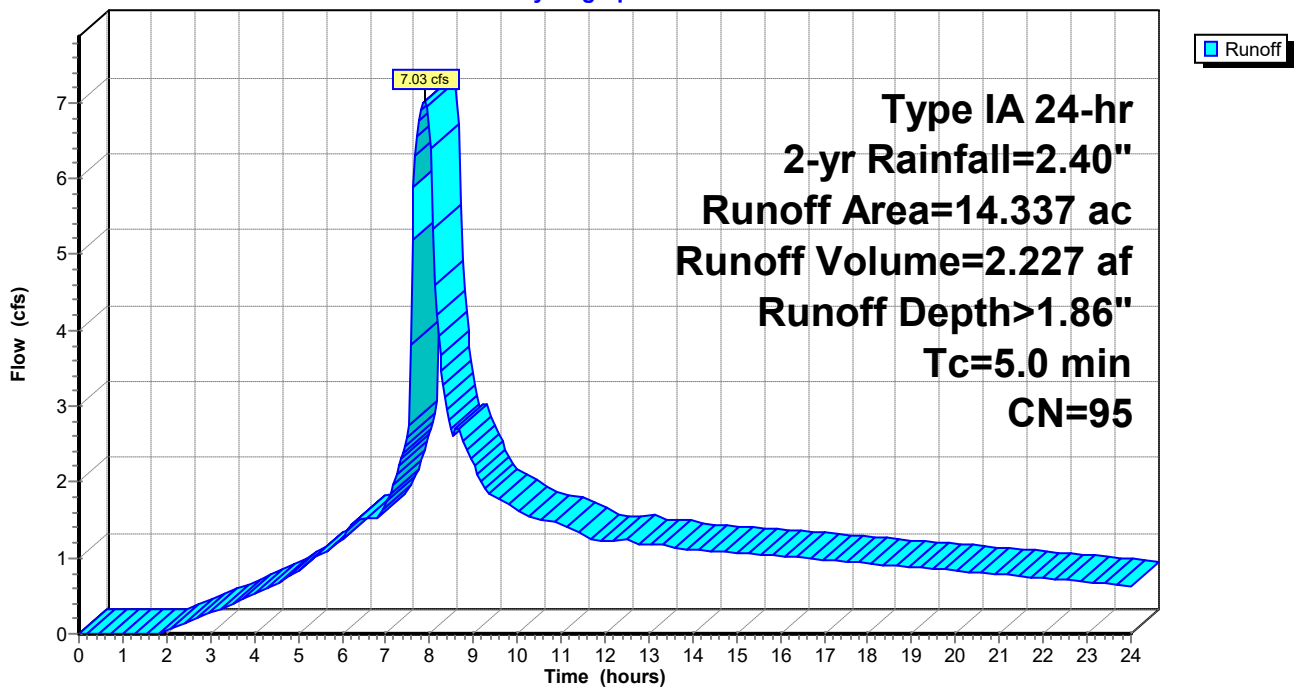
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (ac)	CN	Description
7.563	98	Roofs, HSG B
4.969	98	Paved parking, HSG B
1.059	61	>75% Grass cover, Good, HSG B
0.746	98	Water Surface, HSG B
14.337	95	Weighted Average
1.059		7.39% Pervious Area
13.278		92.61% Impervious Area

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

Subcatchment 6S: Post West Basin

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment 7S: Post East Basin

Runoff = 2.65 cfs @ 7.92 hrs, Volume= 0.867 af, Depth> 1.52"

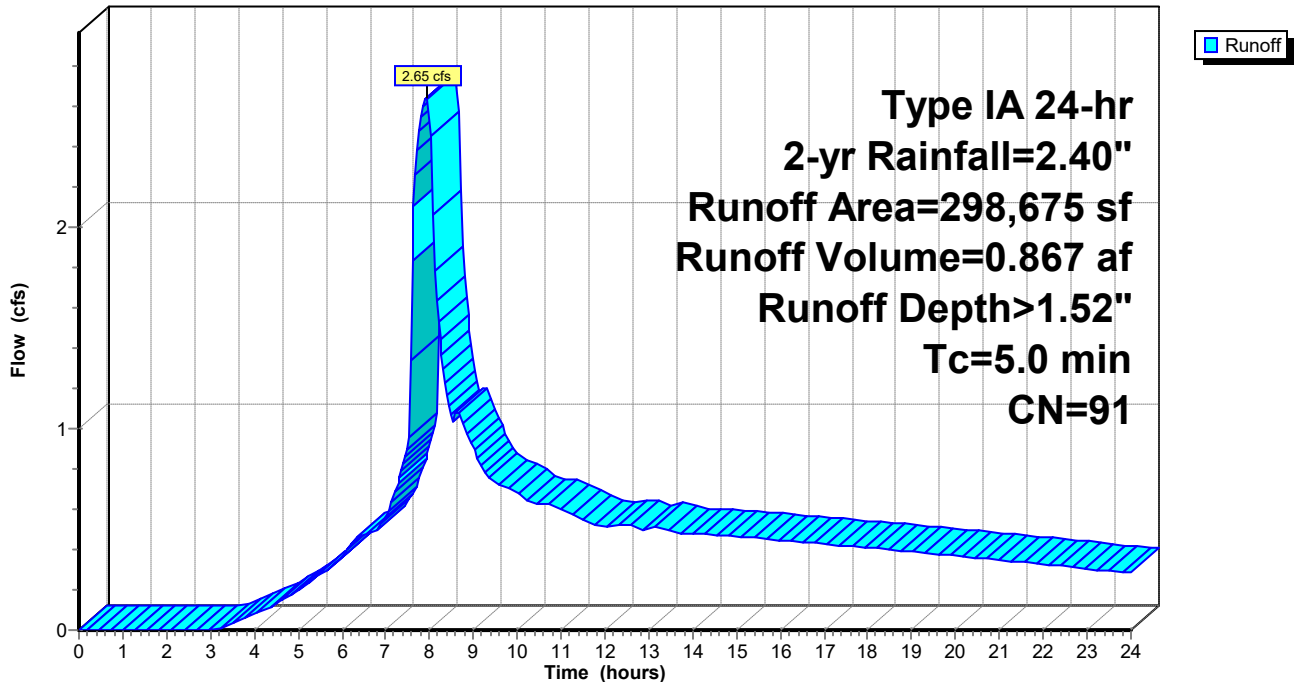
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (sf)	CN	Description
134,833	98	Unconnected roofs, HSG B
84,437	98	Paved parking, HSG B
55,925	61	>75% Grass cover, Good, HSG B
23,480	98	Water Surface, HSG B
298,675	91	Weighted Average
55,925		18.72% Pervious Area
242,750		81.28% Impervious Area
134,833		55.54% Unconnected

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

Subcatchment 7S: Post East Basin

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment Post1: Center Basin

Runoff = 12.05 cfs @ 7.93 hrs, Volume= 3.992 af, Depth> 1.44"

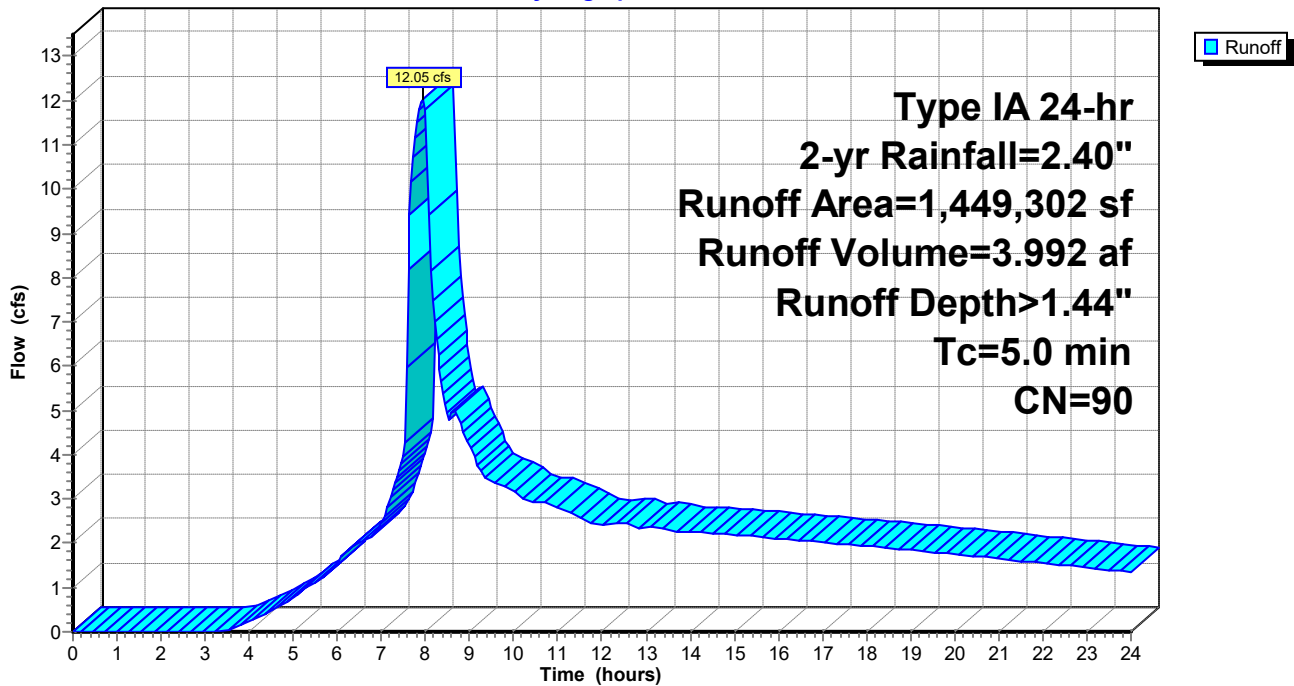
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (sf)	CN	Description
621,920	98	Paved roads w/curbs & sewers, HSG B
58,238	98	Water Surface, HSG B
466,903	98	Roofs, HSG B
302,241	61	>75% Grass cover, Good, HSG B
1,449,302	90	Weighted Average
302,241		20.85% Pervious Area
1,147,061		79.15% Impervious Area

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

Subcatchment Post1: Center Basin

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment Pre1: Total Pre Developed

Runoff = 3.64 cfs @ 9.64 hrs, Volume= 3.065 af, Depth> 0.68"

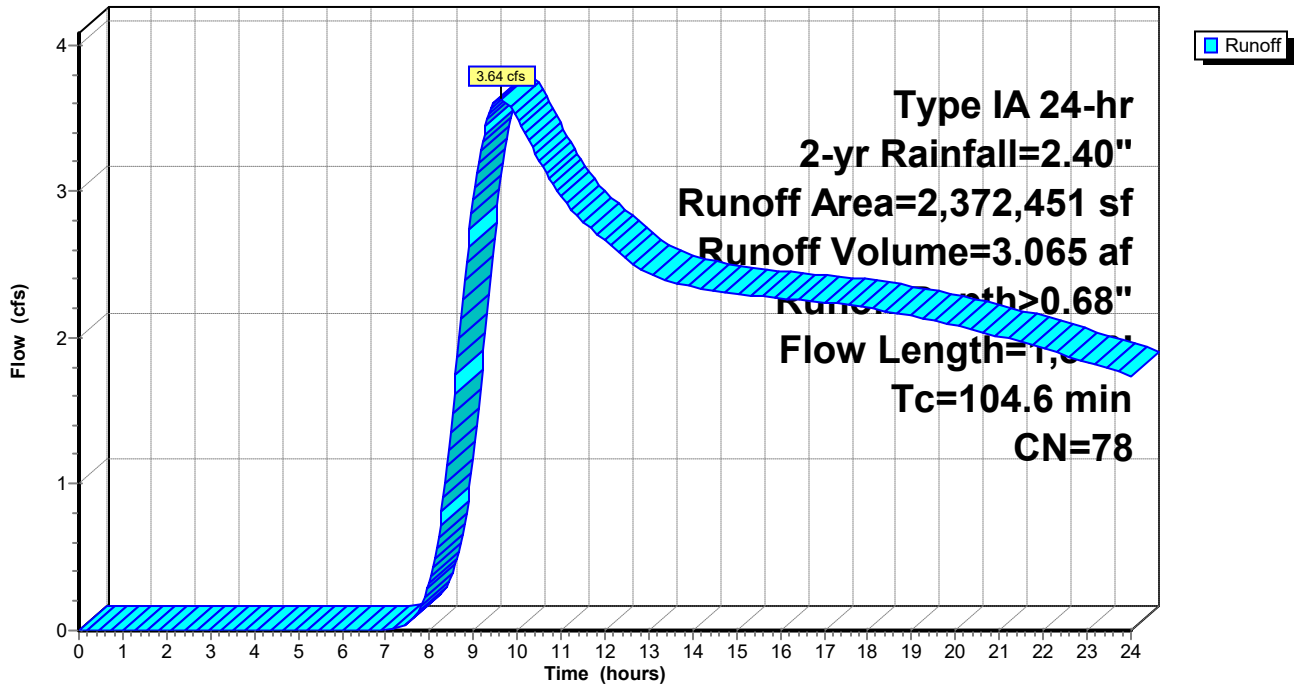
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (sf)	CN	Description
* 2,372,451	78	Meadow or pasture, HSG B
2,372,451		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
47.4	1,500	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns
					Kv= 11.0 fps
104.6	1,800	Total			

Subcatchment Pre1: Total Pre Developed

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment Pre1a: To Wetland A

Runoff = 2.15 cfs @ 9.33 hrs, Volume= 1.721 af, Depth> 0.68"

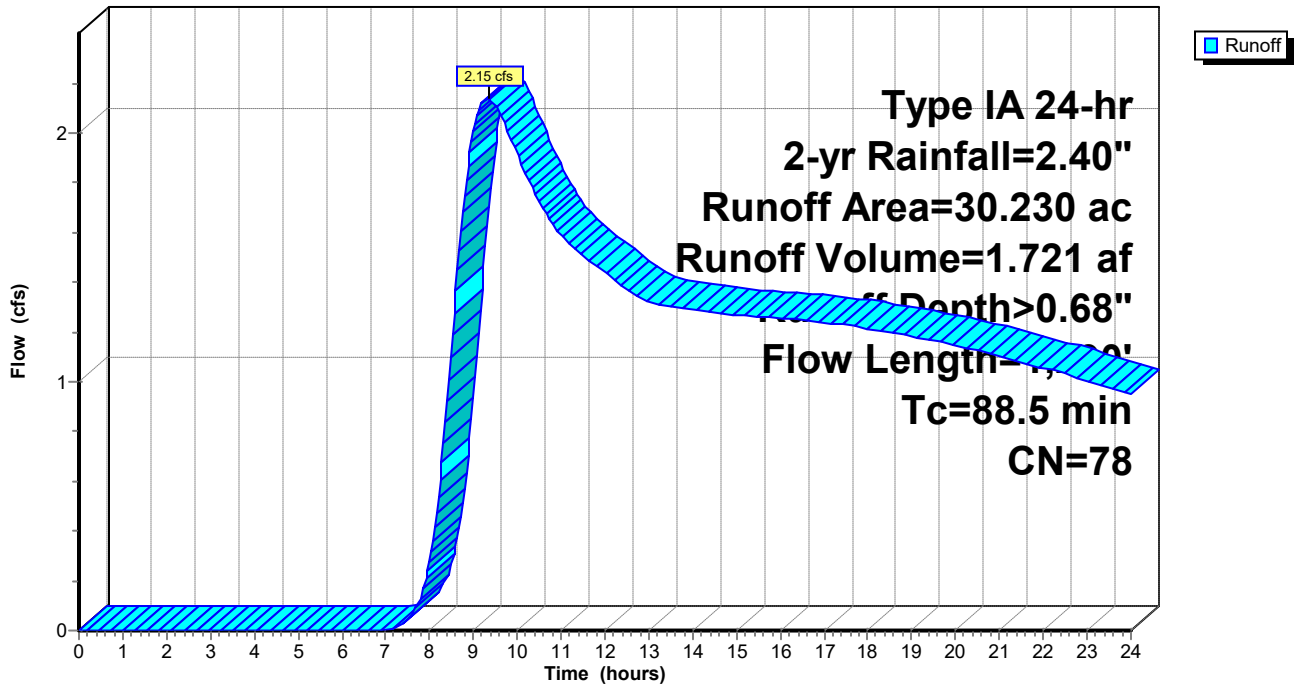
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (ac)	CN	Description
* 30.230	78	Meadow or pasture, HSG B
30.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.40"
31.3	990	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
88.5	1,290	Total			

Subcatchment Pre1a: To Wetland A

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Subcatchment Pre1b: Offsite

Runoff = 0.39 cfs @ 8.72 hrs, Volume= 0.270 af, Depth> 0.70"

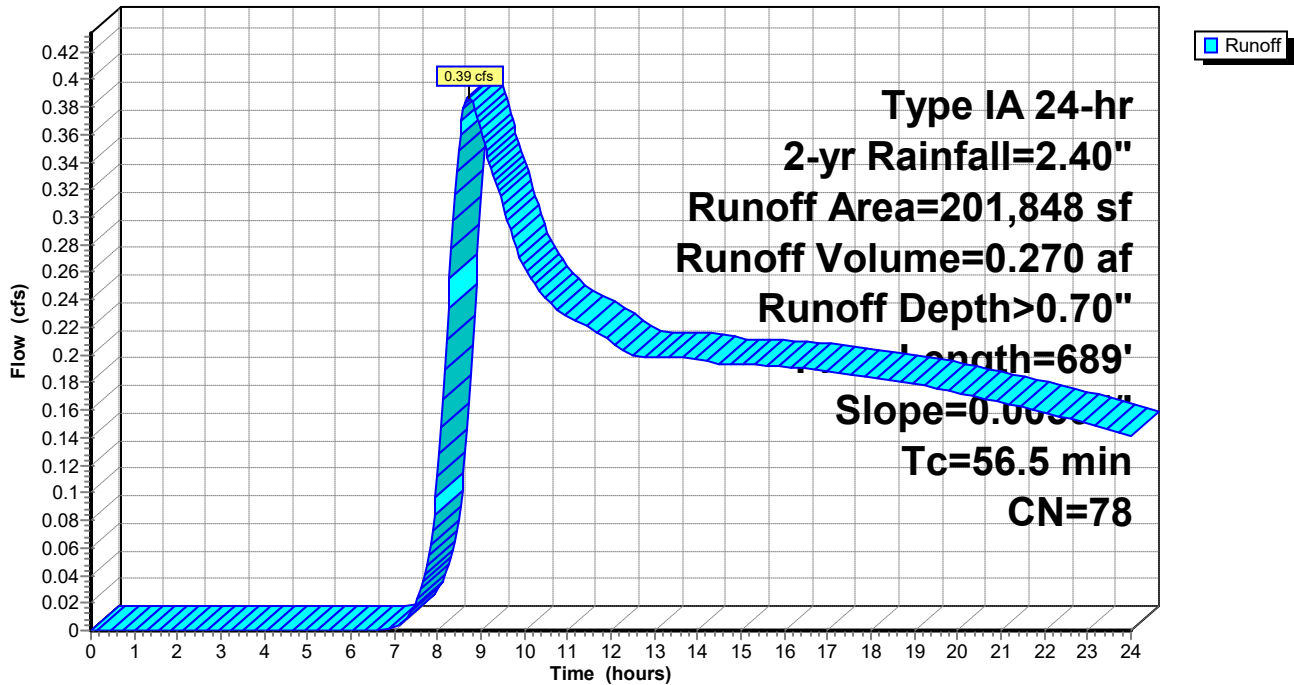
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 2-yr Rainfall=2.40"

Area (sf)	CN	Description
* 201,848	78	Meadow or pasture, HSG B
201,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
52.3	212	0.0050	0.07		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.40"
4.2	477	0.0050	1.91		Shallow Concentrated Flow, Gravel Roads Kv= 27.0 fps
56.5	689	Total			

Subcatchment Pre1b: Offsite

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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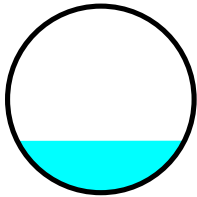
Summary for Reach 1R: 24-in CPEP Pipe

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 0.61" for 2-yr event
Inflow = 2.07 cfs @ 18.68 hrs, Volume= 1.574 af
Outflow = 2.07 cfs @ 18.69 hrs, Volume= 1.573 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.89 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.60 fps, Avg. Travel Time= 0.4 min

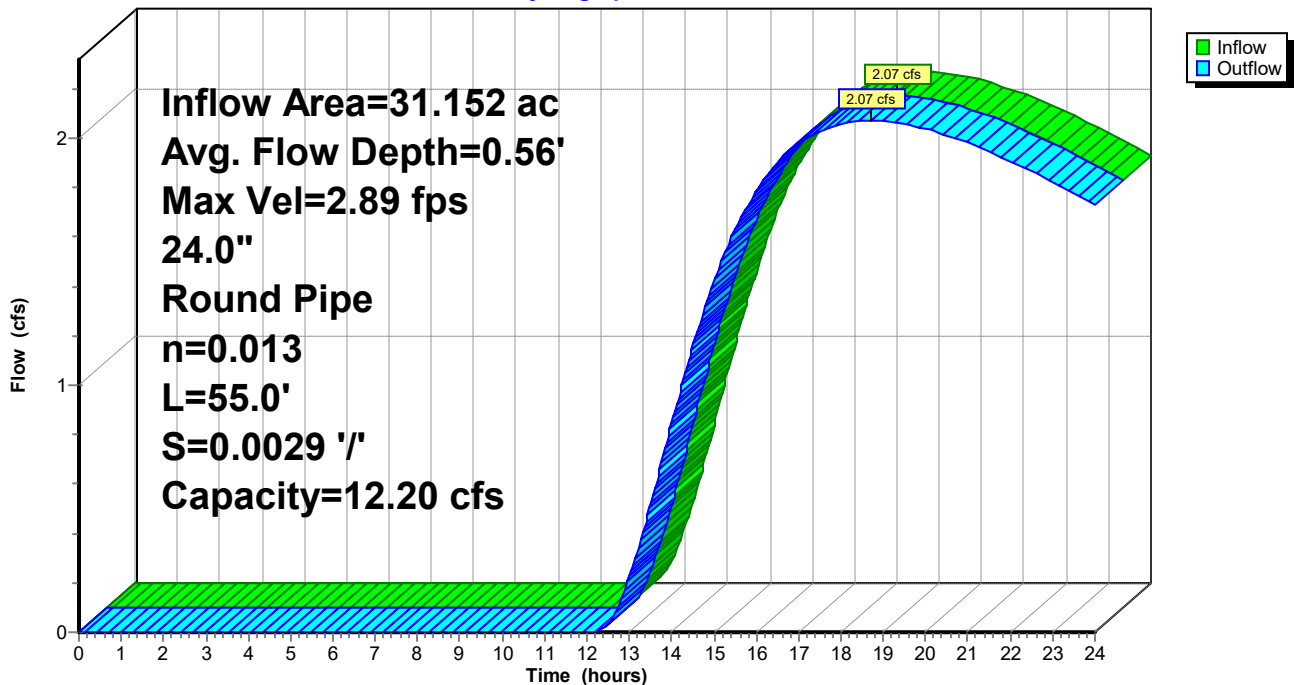
Peak Storage= 39 cf @ 18.68 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 12.20 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0029 '/'
Inlet Invert= 17.00', Outlet Invert= 16.84'



Reach 1R: 24-in CPEP Pipe

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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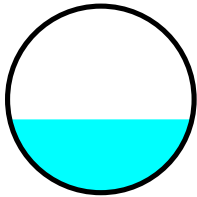
Summary for Reach 3R: 30-inch CPSSP

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 1.05" for 2-yr event
Inflow = 3.57 cfs @ 0.00 hrs, Volume= 5.617 af
Outflow = 3.57 cfs @ 21.42 hrs, Volume= 5.604 af, Atten= 0%, Lag= 1,285.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.56 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.20 fps, Avg. Travel Time= 0.8 min

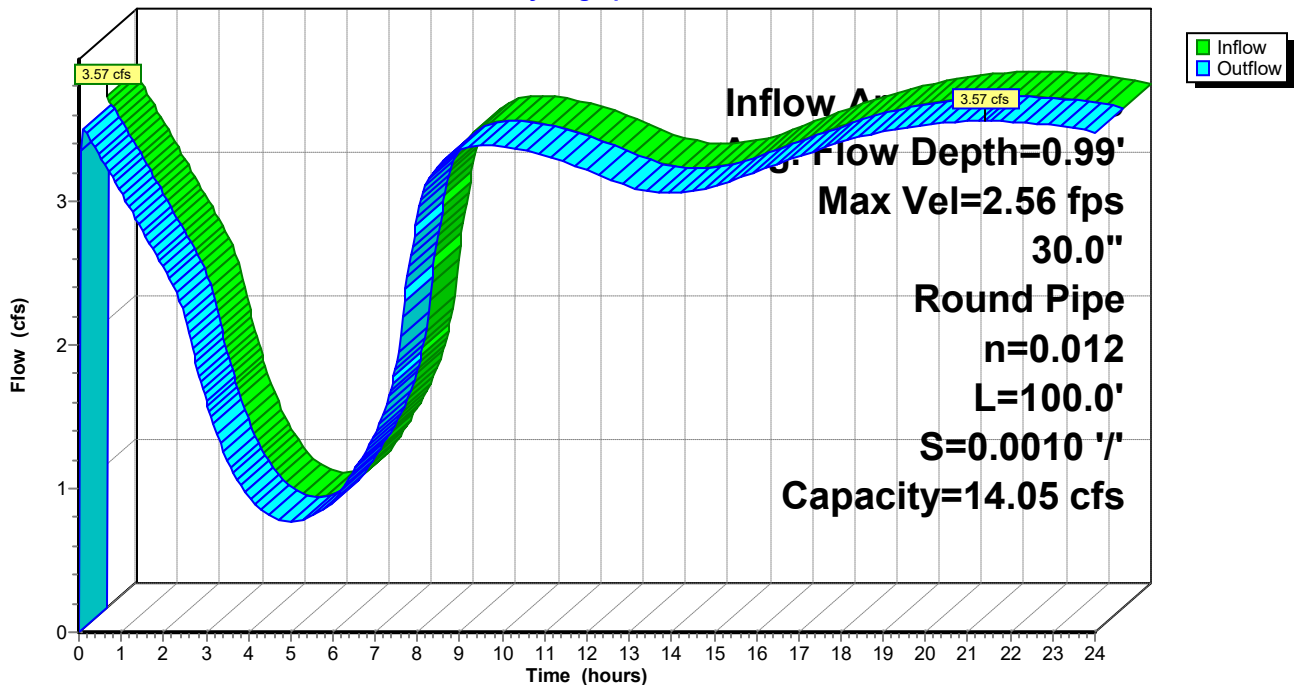
Peak Storage= 180 cf @ 0.04 hrs
Average Depth at Peak Storage= 0.99'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 14.05 cfs

30.0" Round Pipe
n= 0.012
Length= 100.0' Slope= 0.0010 '/'
Inlet Invert= 17.00', Outlet Invert= 16.90'



Reach 3R: 30-inch CPSSP

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Pond 8P: NE Pond

Inflow Area = 6.857 ac, 81.28% Impervious, Inflow Depth > 1.52" for 2-yr event
 Inflow = 2.65 cfs @ 7.92 hrs, Volume= 0.867 af
 Outflow = 0.91 cfs @ 8.99 hrs, Volume= 0.826 af, Atten= 66%, Lag= 64.1 min
 Primary = 0.91 cfs @ 8.99 hrs, Volume= 0.826 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.50' @ 8.99 hrs Surf.Area= 14,109 sf Storage= 6,751 cf

Plug-Flow detention time= 97.4 min calculated for 0.826 af (95% of inflow)
 Center-of-Mass det. time= 65.7 min (824.2 - 758.5)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	49,335 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	12,970	0	0
19.00	15,255	14,113	14,113
20.00	17,597	16,426	30,539
21.00	19,996	18,797	49,335

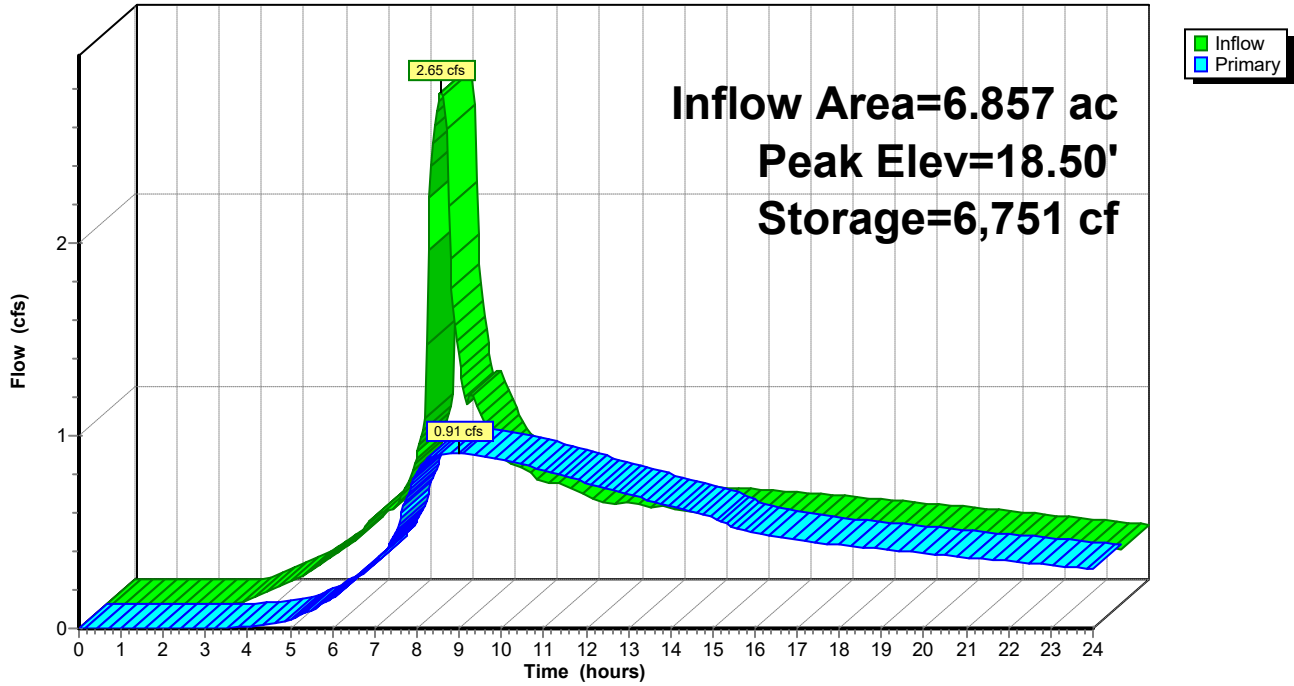
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	7.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.50'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.91 cfs @ 8.99 hrs HW=18.50' (Free Discharge)

- ↑ 1=Orifice/Grate (Orifice Controls 0.91 cfs @ 3.40 fps)
- └ 2=Orifice/Grate (Controls 0.00 cfs)

Pond 8P: NE Pond

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Pond A: Center Pond

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 1.04" for 2-yr event
 Inflow = 12.05 cfs @ 7.93 hrs, Volume= 5.564 af
 Outflow = 3.57 cfs @ 0.00 hrs, Volume= 5.617 af, Atten= 70%, Lag= 0.0 min
 Primary = 3.57 cfs @ 0.00 hrs, Volume= 5.617 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Starting Elev= 17.89' Surf.Area= 50,371 sf Storage= 43,385 cf
 Peak Elev= 17.89' @ 0.00 hrs Surf.Area= 50,371 sf Storage= 43,385 cf

Plug-Flow detention time= 169.2 min calculated for 4.613 af (83% of inflow)
 Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	218,077 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	47,123	0	0
18.00	50,772	48,948	48,948
19.00	54,477	52,625	101,572
20.00	58,238	56,358	157,930
21.00	62,056	60,147	218,077

Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.00'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.57 cfs @ 0.00 hrs HW=17.89' (Free Discharge)

1=Orifice/Grate (Orifice Controls 3.57 cfs @ 4.54 fps)

2=Orifice/Grate (Controls 0.00 cfs)

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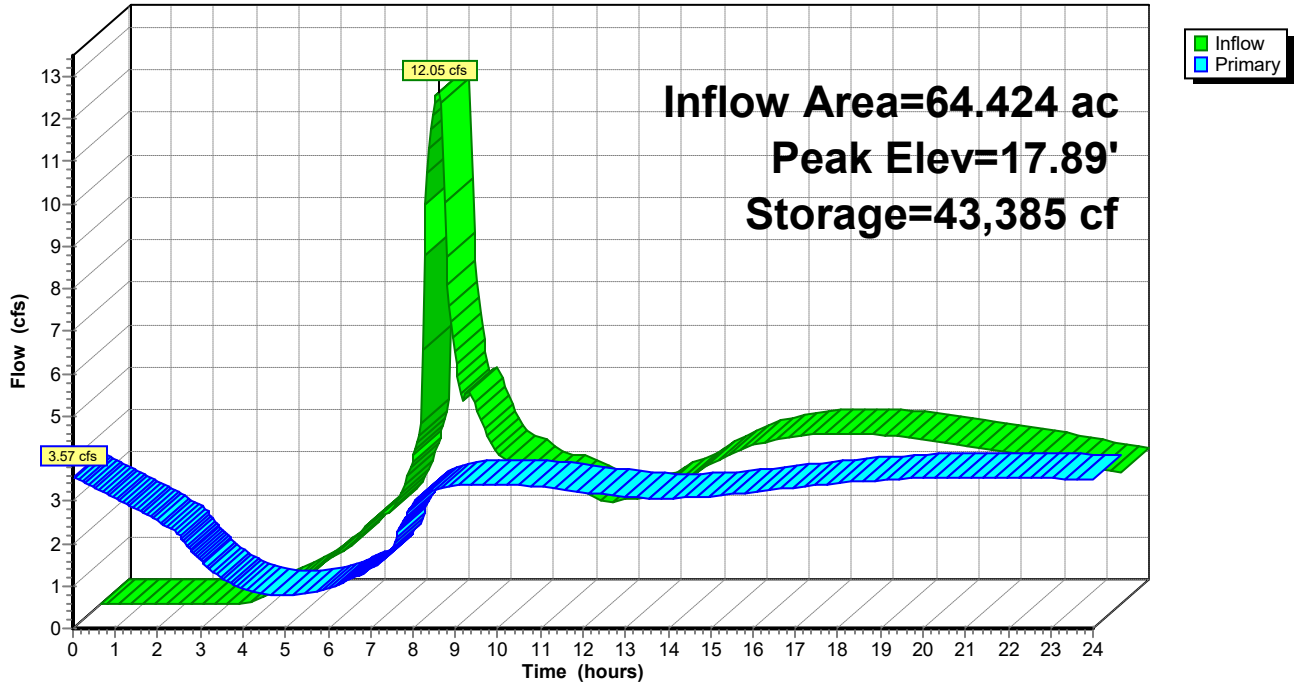
Type IA 24-hr 2-yr Rainfall=2.40"

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Pond A: Center Pond

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Pond B: NW Pond

Inflow Area = 14.337 ac, 92.61% Impervious, Inflow Depth > 1.86" for 2-yr event
 Inflow = 7.03 cfs @ 7.89 hrs, Volume= 2.227 af
 Outflow = 1.67 cfs @ 9.94 hrs, Volume= 2.055 af, Atten= 76%, Lag= 123.3 min
 Primary = 1.67 cfs @ 9.94 hrs, Volume= 2.055 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.98' @ 9.94 hrs Surf.Area= 26,944 sf Storage= 24,983 cf

Plug-Flow detention time= 194.8 min calculated for 2.055 af (92% of inflow)
 Center-of-Mass det. time= 141.8 min (856.9 - 715.1)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	86,200 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	23,810	0	0
19.00	26,993	25,402	25,402
20.00	30,355	28,674	54,076
21.00	33,894	32,125	86,200

Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.25'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.67 cfs @ 9.94 hrs HW=18.98' (Free Discharge)

↑ **1=Orifice/Grate** (Orifice Controls 1.67 cfs @ 4.78 fps)
 ↓ **2=Orifice/Grate** (Controls 0.00 cfs)

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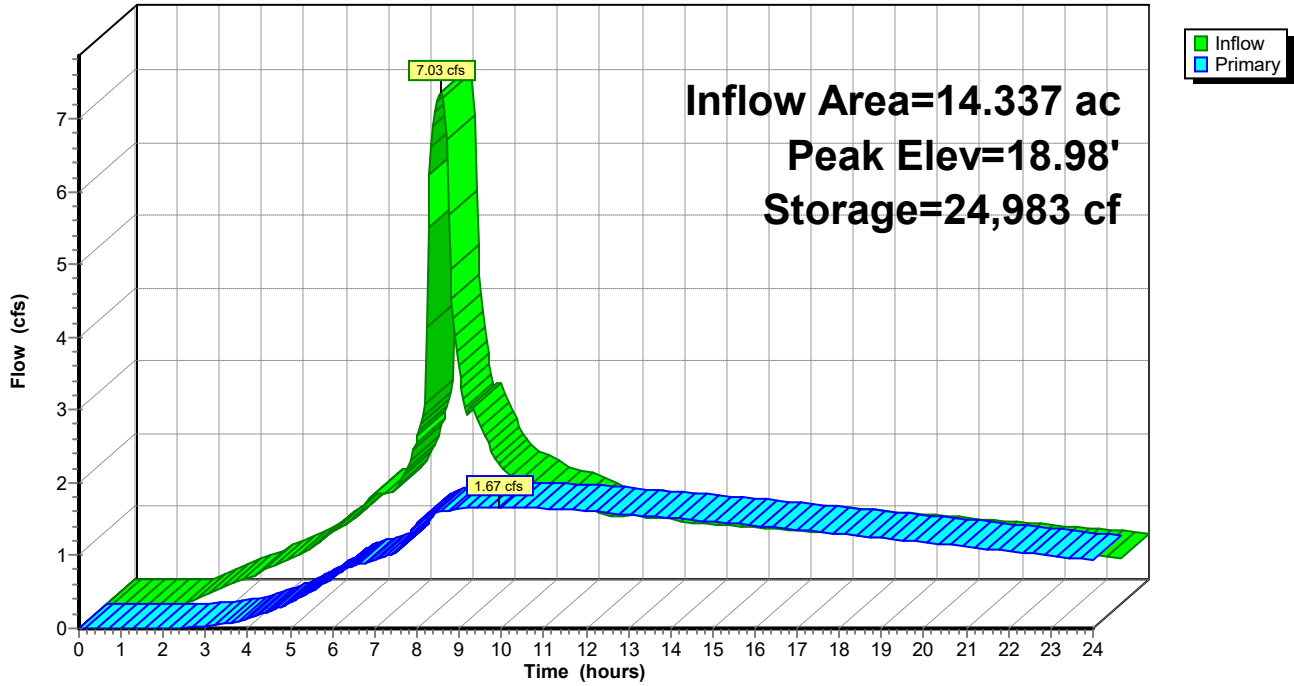
Type IA 24-hr 2-yr Rainfall=2.40"

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Pond B: NW Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Pond Post B: Wetland B

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 1.33" for 2-yr event
 Inflow = 3.32 cfs @ 8.98 hrs, Volume= 3.457 af
 Outflow = 2.07 cfs @ 18.68 hrs, Volume= 1.574 af, Atten= 38%, Lag= 582.2 min
 Primary = 2.07 cfs @ 18.68 hrs, Volume= 1.574 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.37' @ 18.68 hrs Surf.Area= 37,742 sf Storage= 84,362 cf

Plug-Flow detention time= 557.7 min calculated for 1.572 af (45% of inflow)
 Center-of-Mass det. time= 285.2 min (1,142.3 - 857.2)

Volume	Invert	Avail.Storage	Storage Description
#1	13.00'	271,767 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.00	33	0	0
14.00	587	310	310
15.00	6,414	3,501	3,811
16.00	18,334	12,374	16,185
17.00	27,808	23,071	39,256
18.00	35,098	31,453	70,709
19.00	42,150	38,624	109,333
20.00	49,398	45,774	155,107
21.00	57,993	53,696	208,802
22.00	67,936	62,965	271,767

Device	Routing	Invert	Outlet Devices
#1	Primary	17.68'	24.0" Round Culvert L= 87.0' Ke= 1.000 Inlet / Outlet Invert= 17.68' / 17.00' S= 0.0078 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=2.07 cfs @ 18.68 hrs HW=18.37' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 2.07 cfs @ 2.13 fps)

07880259 60% Stormwater Sizing

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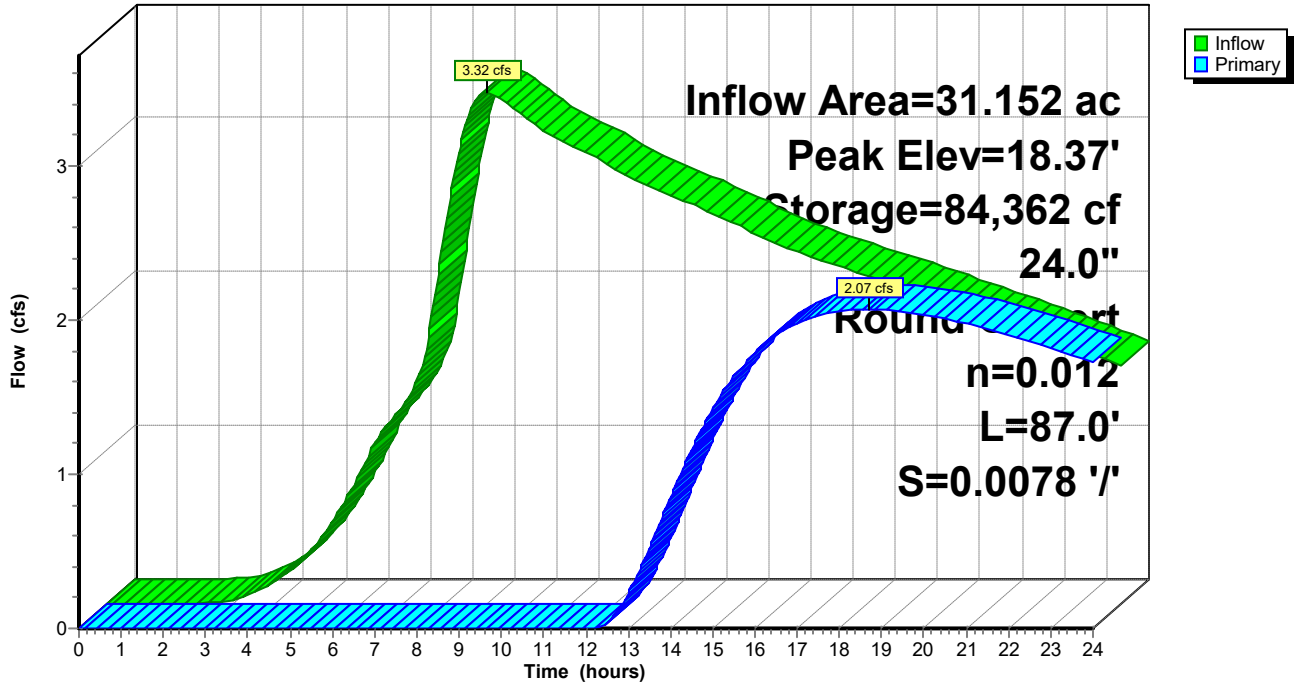
Type IA 24-hr 2-yr Rainfall=2.40"

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Pond Post B: Wetland B

Hydrograph



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Type IA 24-hr 2-yr Rainfall=2.40"

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Summary for Pond Pre-A: Wetland A

Inflow Area = 30.230 ac, 0.00% Impervious, Inflow Depth > 0.68" for 2-yr event
 Inflow = 2.15 cfs @ 9.33 hrs, Volume= 1.721 af
 Outflow = 2.13 cfs @ 9.44 hrs, Volume= 1.706 af, Atten= 1%, Lag= 6.2 min
 Primary = 2.13 cfs @ 9.44 hrs, Volume= 1.706 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 17.46' @ 9.44 hrs Surf.Area= 4,310 sf Storage= 1,115 cf

Plug-Flow detention time= 10.0 min calculated for 1.704 af (99% of inflow)
 Center-of-Mass det. time= 5.6 min (923.1 - 917.5)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	60,524 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	547	0	0
18.00	8,745	4,646	4,646
19.00	103,011	55,878	60,524

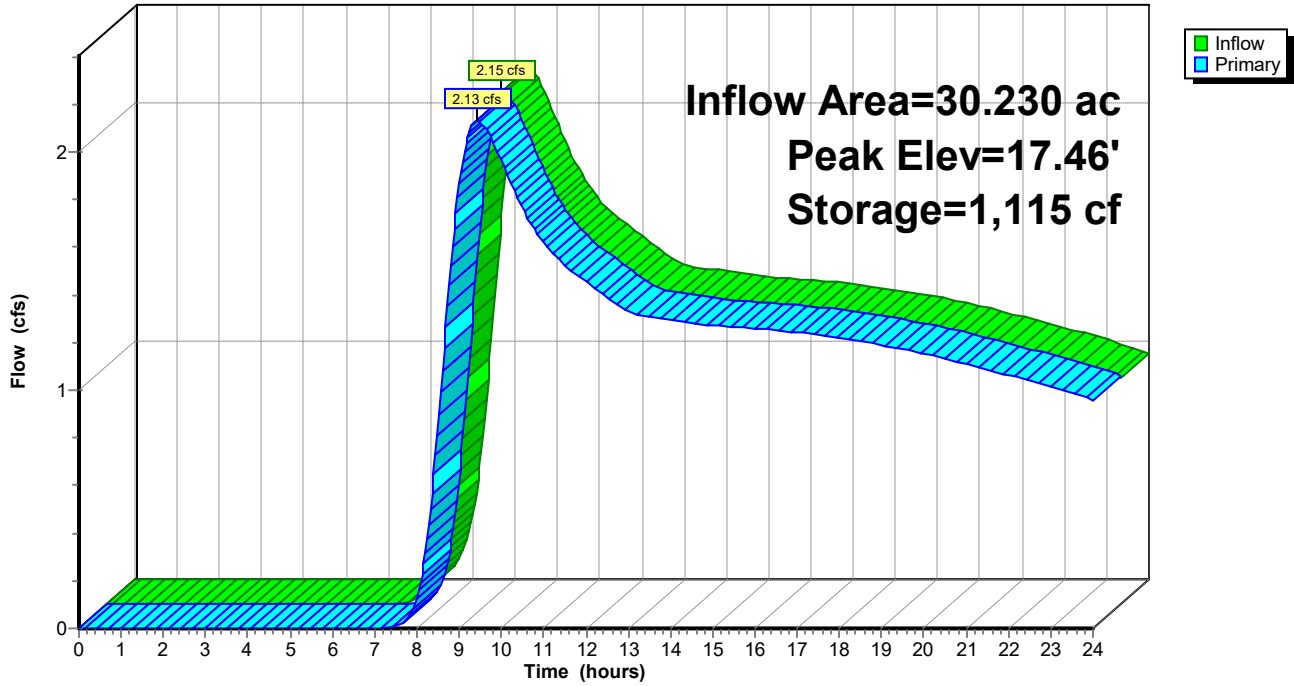
Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	161.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)
#2	Primary	17.71'	152.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)

Primary OutFlow Max=2.13 cfs @ 9.44 hrs HW=17.46' (Free Discharge)

- 1=Sharp-Crested Vee/Trap Weir (Weir Controls 2.13 cfs @ 1.67 fps)
- 2=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Pond Pre-A: Wetland A

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment 1S: CalPortland

Runoff = 0.99 cfs @ 8.91 hrs, Volume= 0.609 af, Depth> 1.37"

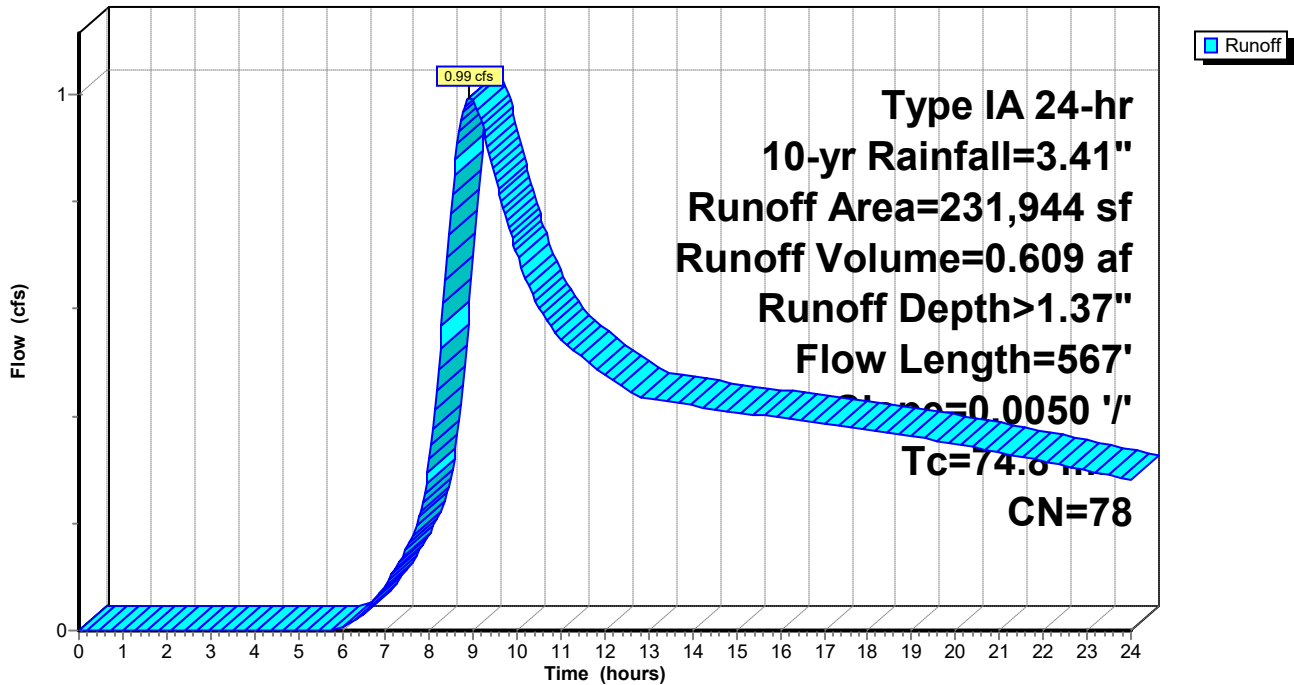
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 10-yr Rainfall=3.41"

Area (sf)	CN	Description
* 231,944	78	Meadow or Pasture, HSG B
231,944		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
69.1	300	0.0050	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 2.40"
5.7	267	0.0050	0.78		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
74.8	567	Total			

Subcatchment 1S: CalPortland

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment 2S: Pre West Basin

Runoff = 4.53 cfs @ 7.98 hrs, Volume= 1.696 af, Depth> 1.43"

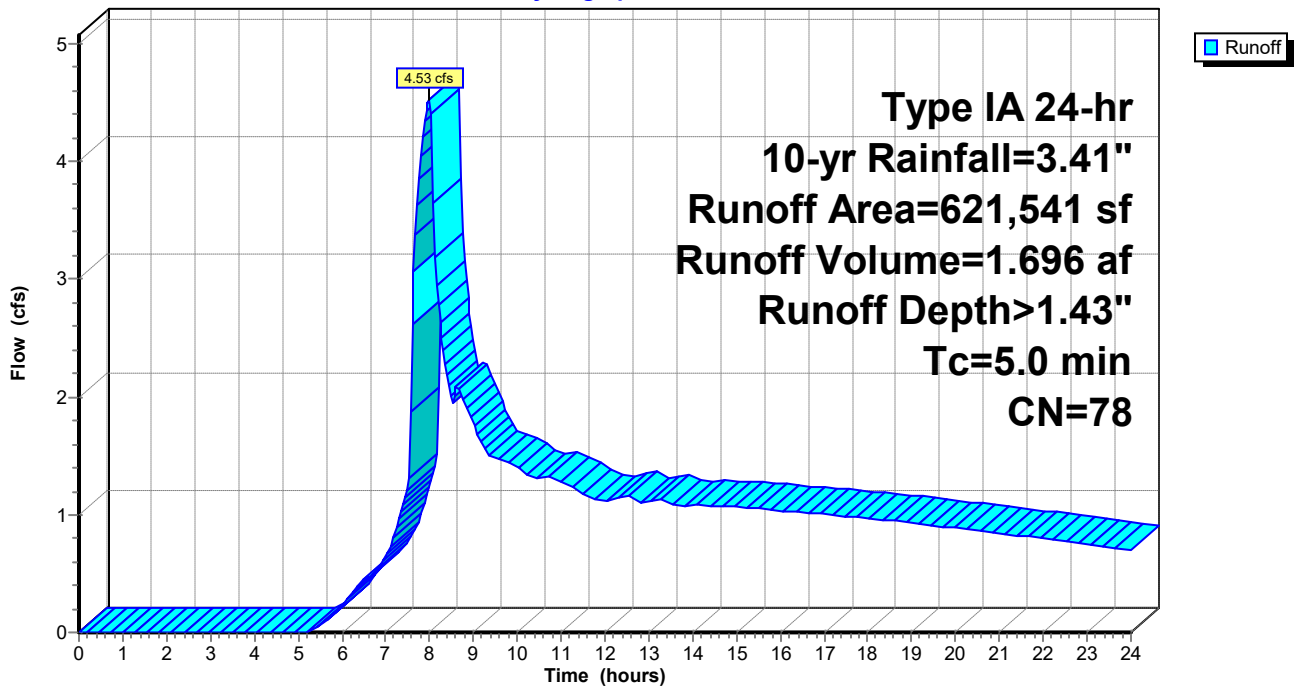
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (sf)	CN	Description
* 621,541	78	Meadow or Pasture, HSG B
621,541		100.00% Pervious Area

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

Subcatchment 2S: Pre West Basin

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment 3S: Pre East Basin

Runoff = 2.18 cfs @ 7.98 hrs, Volume= 0.815 af, Depth> 1.43"

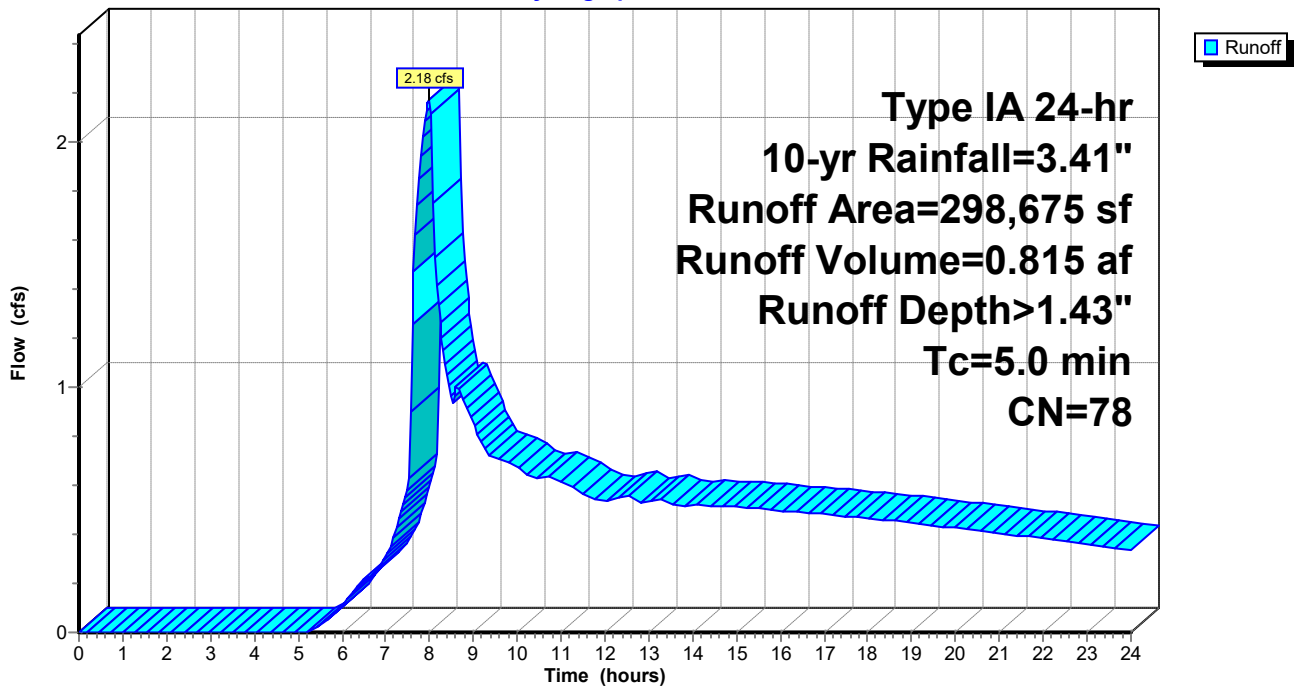
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (sf)	CN	Description
* 298,675	78	Meadow or Pasture, HSG B
298,675		100.00% Pervious Area

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

Subcatchment 3S: Pre East Basin

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment 4S: Post East Basin

Runoff = 2.51 cfs @ 7.86 hrs, Volume= 0.818 af, Depth> 3.17"

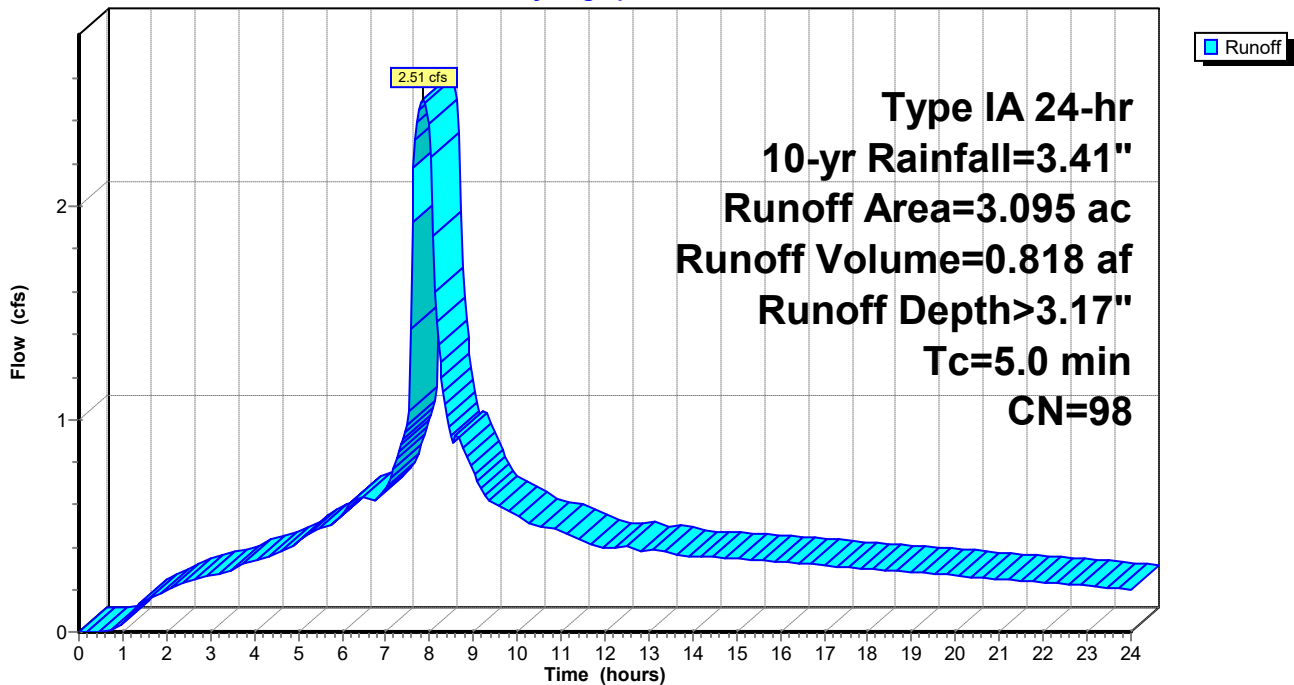
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (ac)	CN	Description
3.095	98	Unconnected roofs, HSG B
3.095		100.00% Impervious Area
3.095		100.00% Unconnected

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

Subcatchment 4S: Post East Basin

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment 6S: Post West Basin

Runoff = 10.72 cfs @ 7.87 hrs, Volume= 3.402 af, Depth> 2.85"

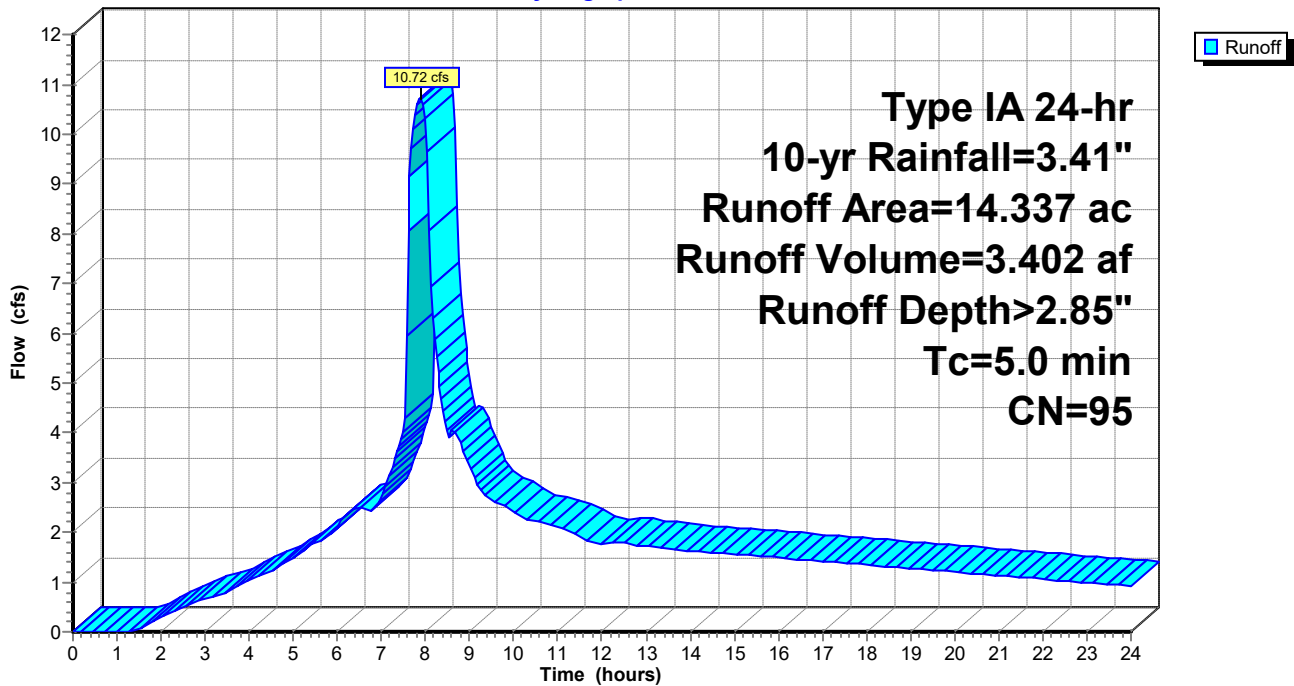
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (ac)	CN	Description
7.563	98	Roofs, HSG B
4.969	98	Paved parking, HSG B
1.059	61	>75% Grass cover, Good, HSG B
0.746	98	Water Surface, HSG B
14.337	95	Weighted Average
1.059		7.39% Pervious Area
13.278		92.61% Impervious Area

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

Subcatchment 6S: Post West Basin

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment 7S: Post East Basin

Runoff = 4.39 cfs @ 7.90 hrs, Volume= 1.401 af, Depth> 2.45"

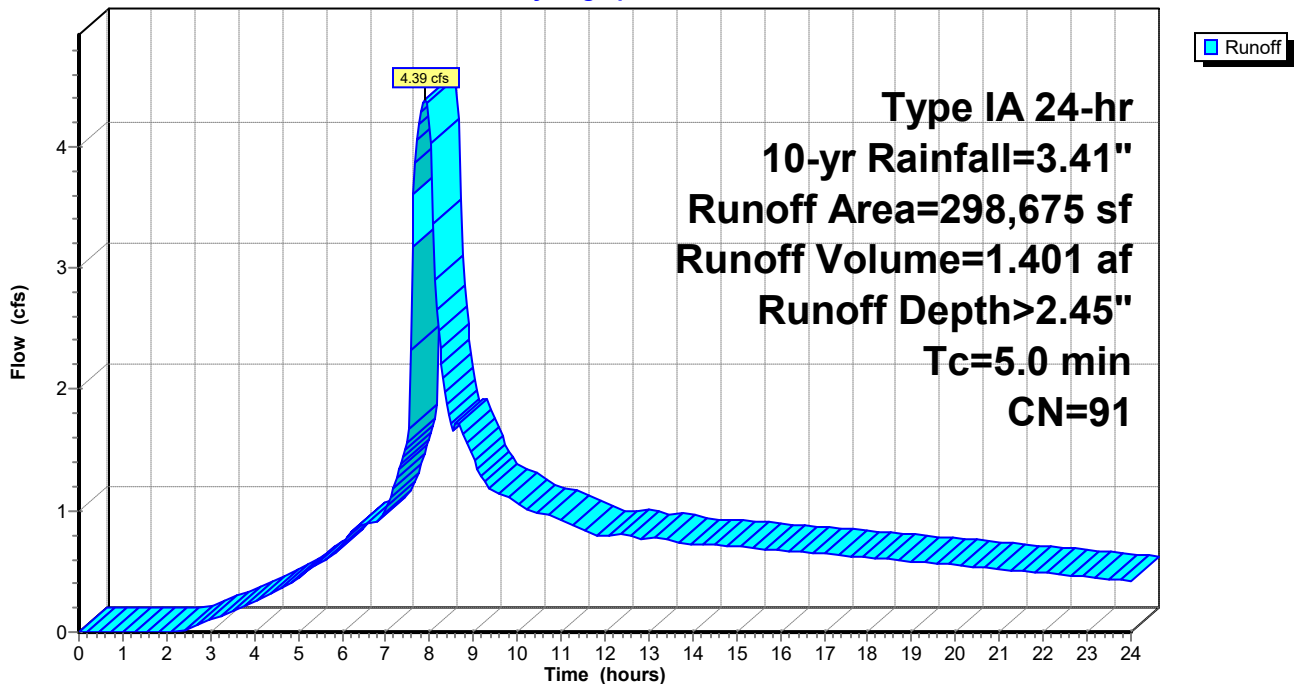
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (sf)	CN	Description
134,833	98	Unconnected roofs, HSG B
84,437	98	Paved parking, HSG B
55,925	61	>75% Grass cover, Good, HSG B
23,480	98	Water Surface, HSG B
298,675	91	Weighted Average
55,925		18.72% Pervious Area
242,750		81.28% Impervious Area
134,833		55.54% Unconnected

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

Subcatchment 7S: Post East Basin

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment Post1: Center Basin

Runoff = 20.39 cfs @ 7.91 hrs, Volume= 6.545 af, Depth> 2.36"

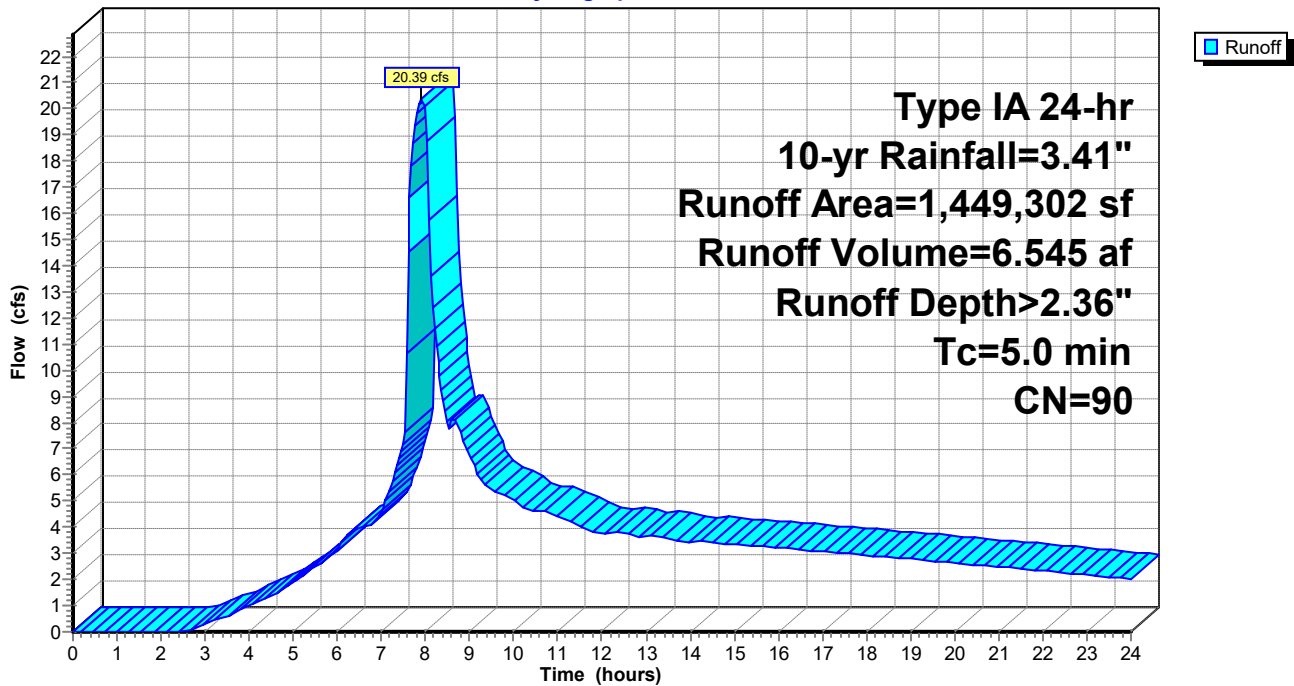
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (sf)	CN	Description
621,920	98	Paved roads w/curbs & sewers, HSG B
58,238	98	Water Surface, HSG B
466,903	98	Roofs, HSG B
302,241	61	>75% Grass cover, Good, HSG B
1,449,302	90	Weighted Average
302,241		20.85% Pervious Area
1,147,061		79.15% Impervious Area

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

Subcatchment Post1: Center Basin

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment Pre1: Total Pre Developed

Runoff = 8.87 cfs @ 9.42 hrs, Volume= 6.113 af, Depth> 1.35"

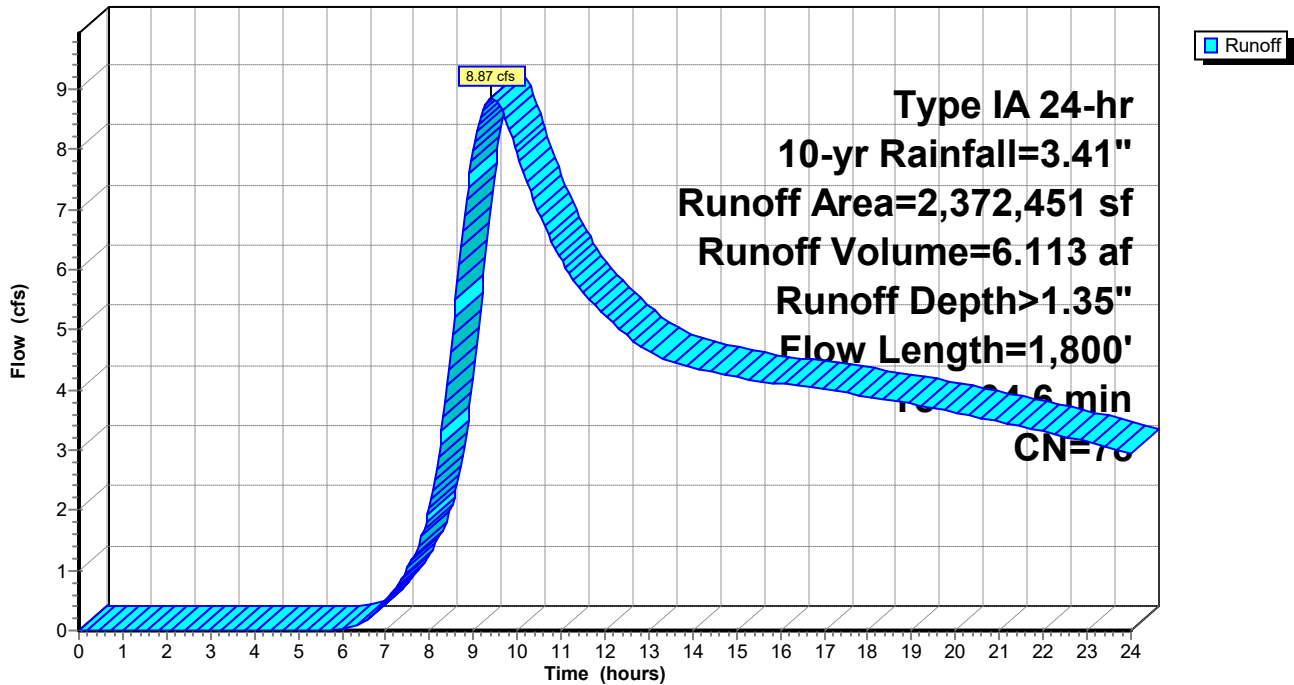
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 10-yr Rainfall=3.41"

Area (sf)	CN	Description
* 2,372,451	78	Meadow or pasture, HSG B
2,372,451		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.40"
47.4	1,500	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
104.6	1,800	Total			

Subcatchment Pre1: Total Pre Developed

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Subcatchment Pre1a: To Wetland A

Runoff = 5.28 cfs @ 9.15 hrs, Volume= 3.427 af, Depth> 1.36"

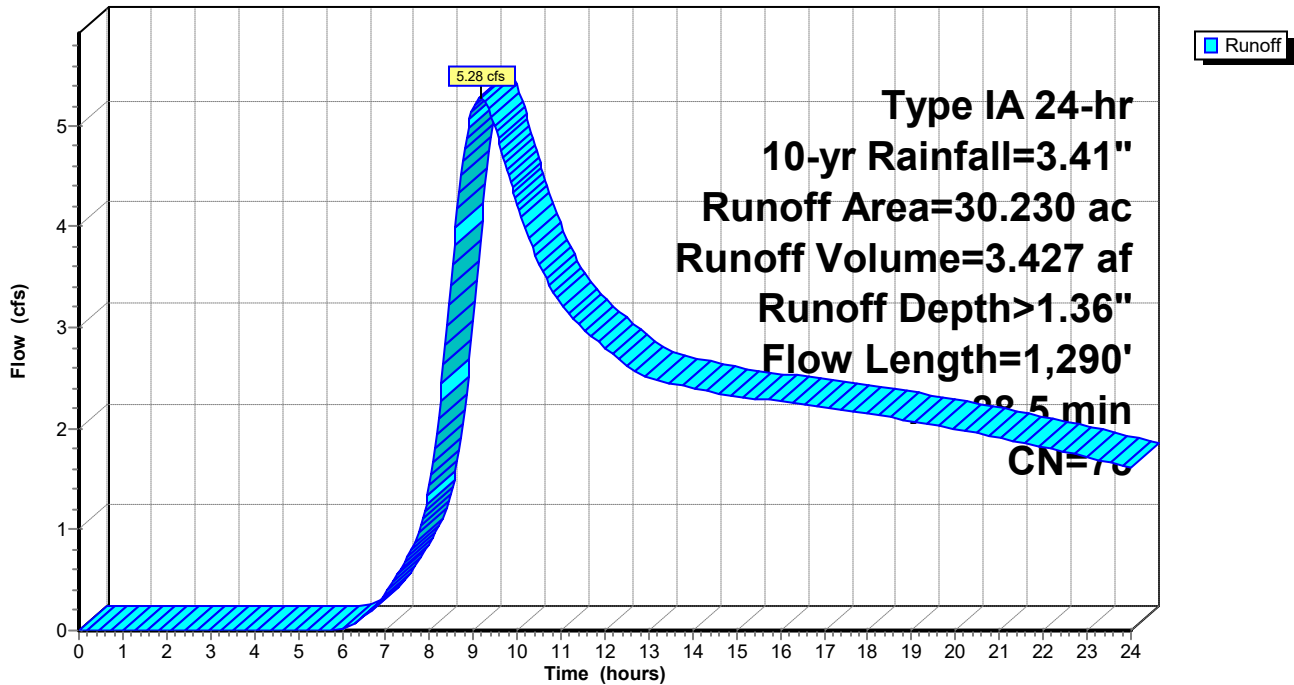
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (ac)	CN	Description
* 30.230	78	Meadow or pasture, HSG B
30.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.40"
31.3	990	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
88.5	1,290	Total			

Subcatchment Pre1a: To Wetland A

Hydrograph



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Summary for Subcatchment Pre1b: Offsite

Runoff = 0.97 cfs @ 8.62 hrs, Volume= 0.535 af, Depth> 1.39"

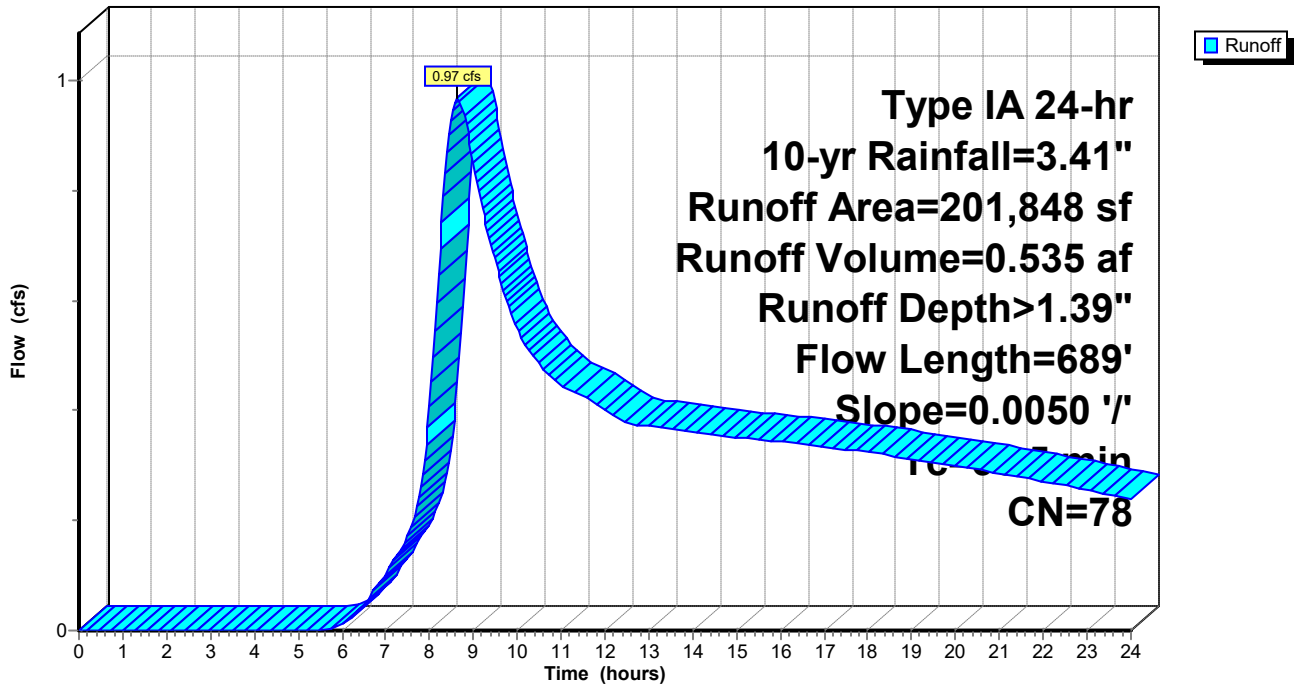
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 10-yr Rainfall=3.41"

Area (sf)	CN	Description
* 201,848	78	Meadow or pasture, HSG B
201,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
52.3	212	0.0050	0.07		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
4.2	477	0.0050	1.91		Shallow Concentrated Flow, Gravel Roads
					Kv= 27.0 fps
56.5	689	Total			

Subcatchment Pre1b: Offsite

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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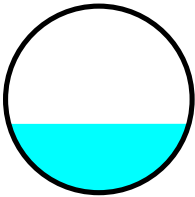
Summary for Reach 1R: 24-in CPEP Pipe

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 1.33" for 10-yr event
Inflow = 3.54 cfs @ 15.16 hrs, Volume= 3.466 af
Outflow = 3.54 cfs @ 15.17 hrs, Volume= 3.464 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.37 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.12 fps, Avg. Travel Time= 0.3 min

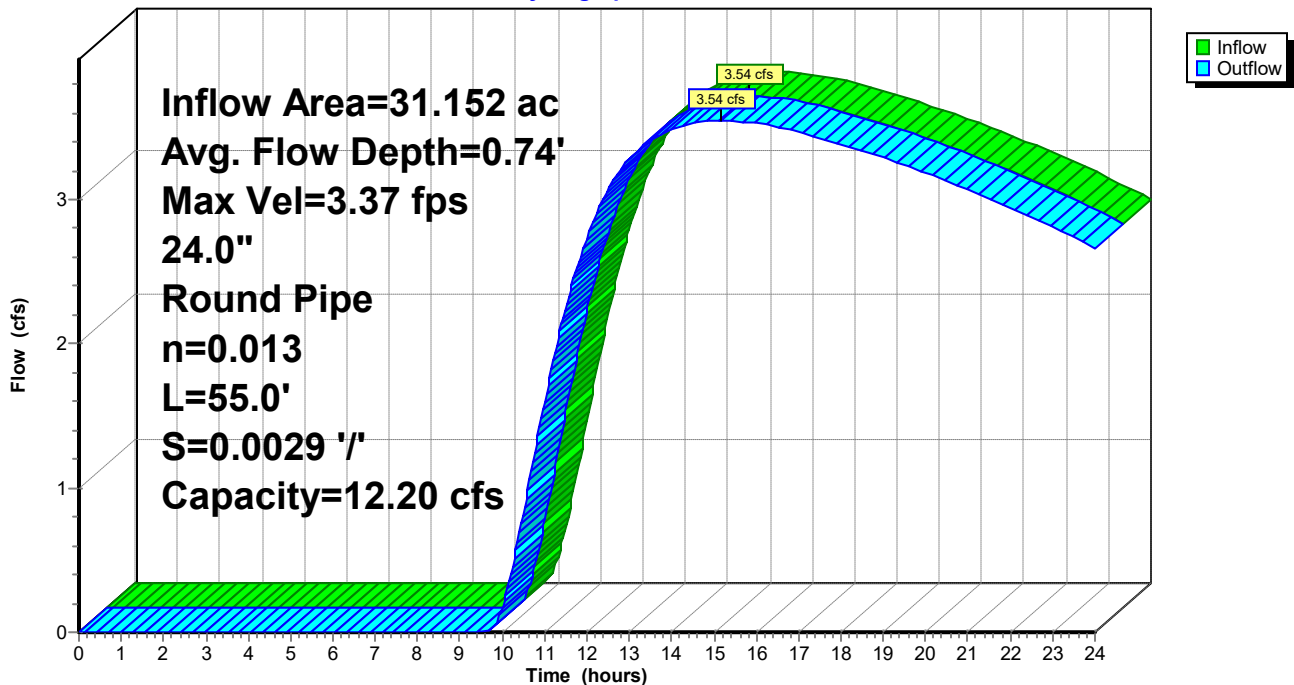
Peak Storage= 58 cf @ 15.16 hrs
Average Depth at Peak Storage= 0.74'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 12.20 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0029 '/'
Inlet Invert= 17.00', Outlet Invert= 16.84'



Reach 1R: 24-in CPEP Pipe

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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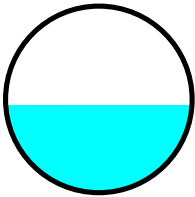
Summary for Reach 3R: 30-inch CPSSP

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 1.62" for 10-yr event
Inflow = 6.33 cfs @ 17.98 hrs, Volume= 8.683 af
Outflow = 6.33 cfs @ 17.99 hrs, Volume= 8.668 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.79 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.47 fps, Avg. Travel Time= 0.7 min

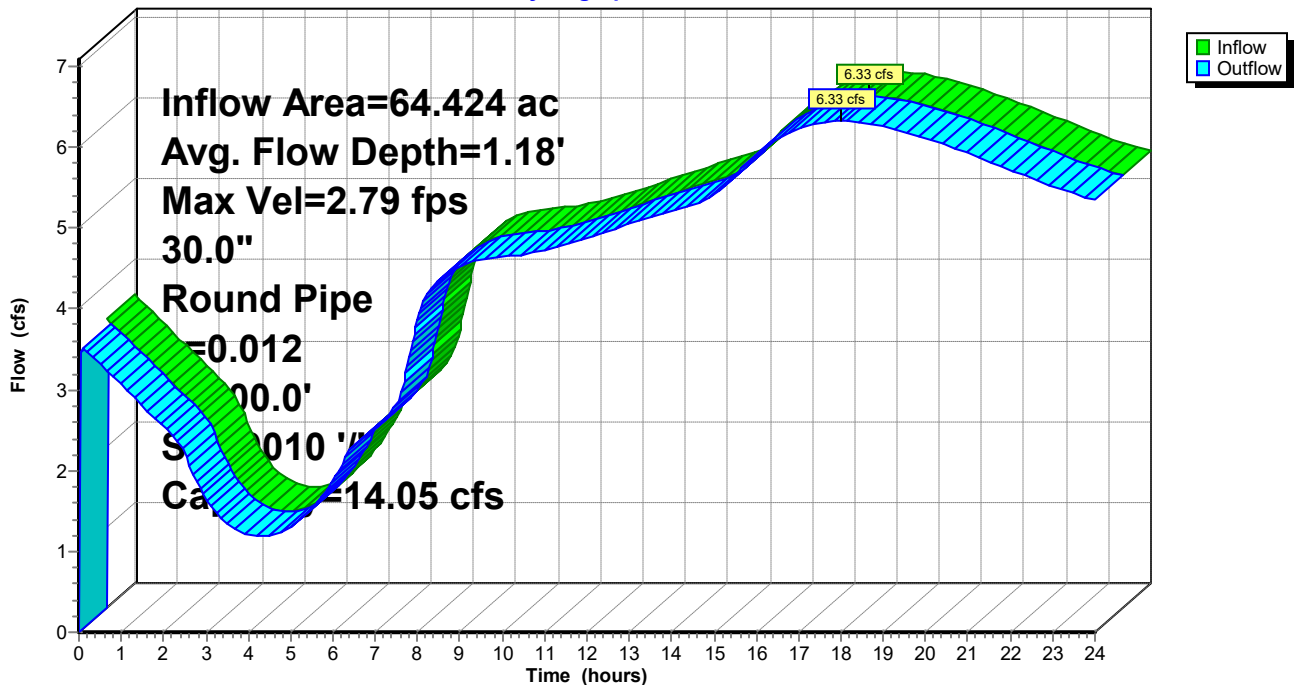
Peak Storage= 227 cf @ 17.98 hrs
Average Depth at Peak Storage= 1.18'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 14.05 cfs

30.0" Round Pipe
n= 0.012
Length= 100.0' Slope= 0.0010 '/'
Inlet Invert= 17.00', Outlet Invert= 16.90'



Reach 3R: 30-inch CPSSP

Hydrograph



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Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Pond 8P: NE Pond

Inflow Area = 6.857 ac, 81.28% Impervious, Inflow Depth > 2.45" for 10-yr event
 Inflow = 4.39 cfs @ 7.90 hrs, Volume= 1.401 af
 Outflow = 1.23 cfs @ 9.27 hrs, Volume= 1.346 af, Atten= 72%, Lag= 82.1 min
 Primary = 1.23 cfs @ 9.27 hrs, Volume= 1.346 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.92' @ 9.27 hrs Surf.Area= 15,068 sf Storage= 12,870 cf

Plug-Flow detention time= 128.1 min calculated for 1.346 af (96% of inflow)
 Center-of-Mass det. time= 100.9 min (833.6 - 732.7)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	49,335 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	12,970	0	0
19.00	15,255	14,113	14,113
20.00	17,597	16,426	30,539
21.00	19,996	18,797	49,335

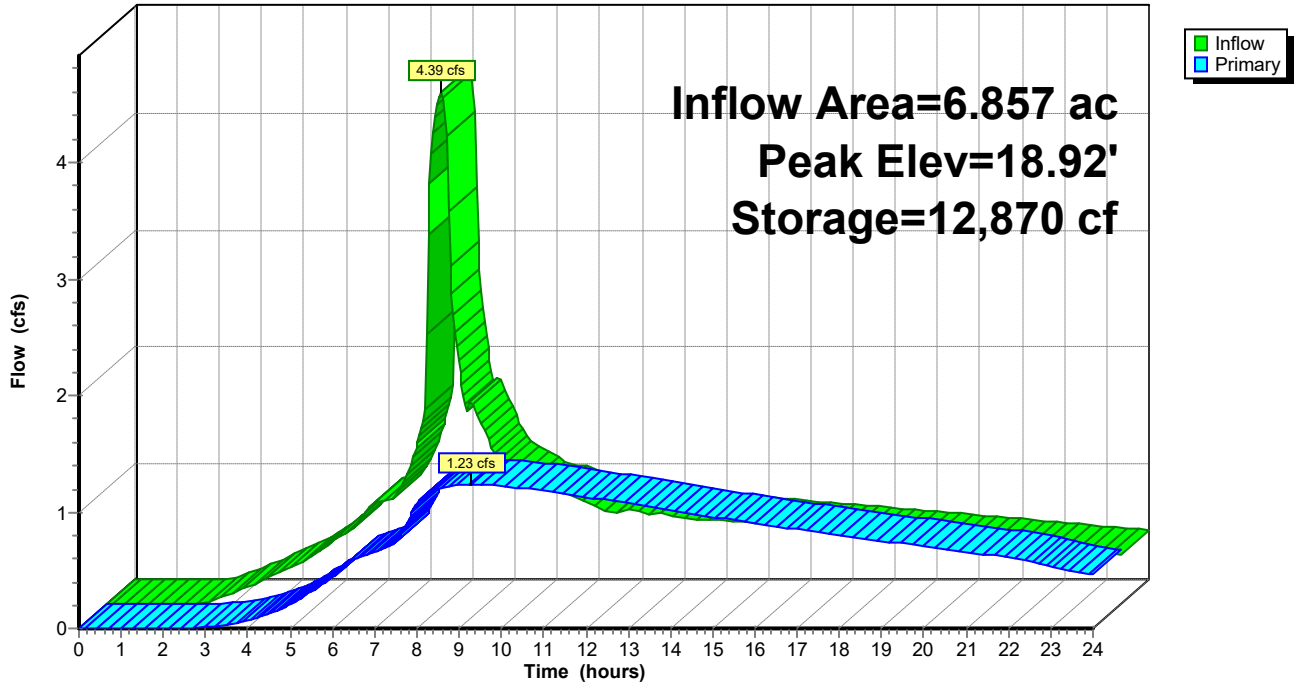
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	7.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.50'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.23 cfs @ 9.27 hrs HW=18.92' (Free Discharge)

- ↑ 1=Orifice/Grate (Orifice Controls 1.23 cfs @ 4.61 fps)
- └ 2=Orifice/Grate (Controls 0.00 cfs)

Pond 8P: NE Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Pond A: Center Pond

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 1.86" for 10-yr event
 Inflow = 20.39 cfs @ 7.91 hrs, Volume= 10.008 af
 Outflow = 6.33 cfs @ 17.98 hrs, Volume= 8.683 af, Atten= 69%, Lag= 604.1 min
 Primary = 6.33 cfs @ 17.98 hrs, Volume= 8.683 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Starting Elev= 17.89' Surf.Area= 50,371 sf Storage= 43,385 cf
 Peak Elev= 19.14' @ 17.98 hrs Surf.Area= 54,996 sf Storage= 109,131 cf (65,746 cf above start)

Plug-Flow detention time= 237.6 min calculated for 7.687 af (77% of inflow)
 Center-of-Mass det. time= 12.9 min (857.3 - 844.4)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	218,077 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	47,123	0	0
18.00	50,772	48,948	48,948
19.00	54,477	52,625	101,572
20.00	58,238	56,358	157,930
21.00	62,056	60,147	218,077

Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.00'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

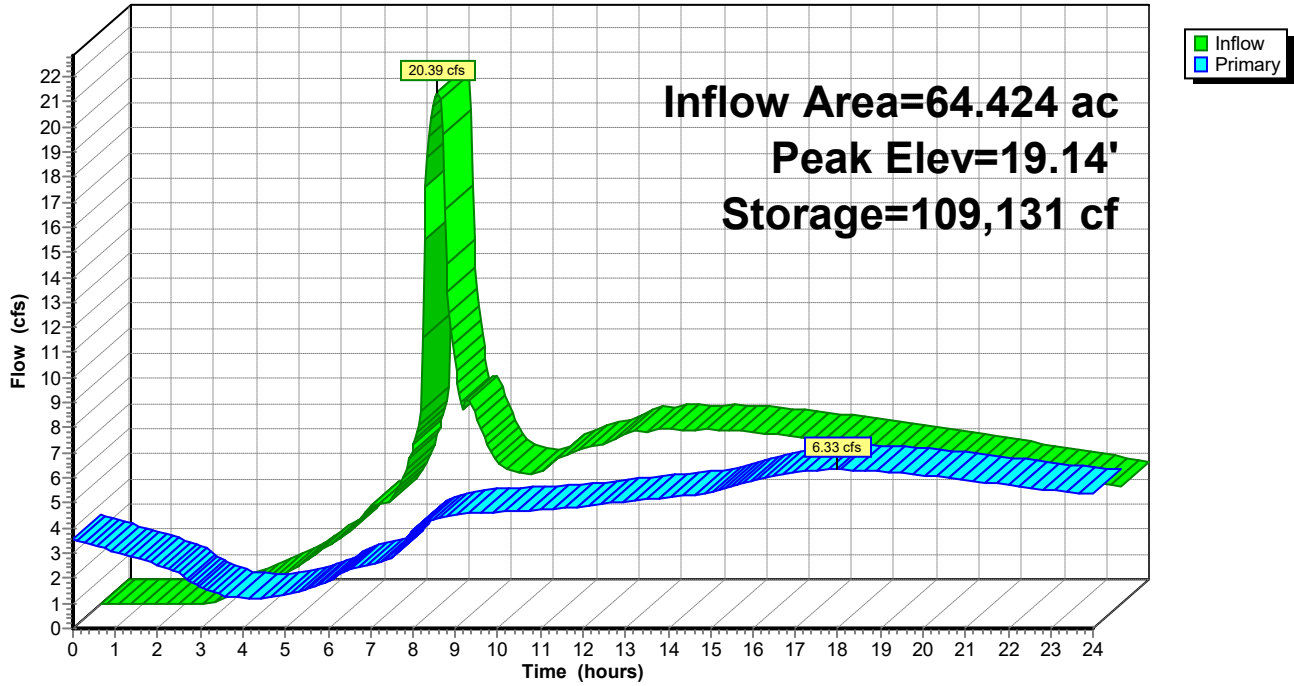
Primary OutFlow Max=6.32 cfs @ 17.98 hrs HW=19.14' (Free Discharge)

↑ **1=Orifice/Grate** (Orifice Controls 5.53 cfs @ 7.04 fps)

└ **2=Orifice/Grate** (Weir Controls 0.79 cfs @ 1.22 fps)

Pond A: Center Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 10-yr Rainfall=3.41"

Prepared by Gibbs & Olson

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Summary for Pond B: NW Pond

Inflow Area = 14.337 ac, 92.61% Impervious, Inflow Depth > 2.85" for 10-yr event
 Inflow = 10.72 cfs @ 7.87 hrs, Volume= 3.402 af
 Outflow = 3.47 cfs @ 8.93 hrs, Volume= 3.000 af, Atten= 68%, Lag= 63.1 min
 Primary = 3.47 cfs @ 8.93 hrs, Volume= 3.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 19.46' @ 8.93 hrs Surf.Area= 28,527 sf Storage= 38,067 cf

Plug-Flow detention time= 216.0 min calculated for 2.995 af (88% of inflow)
 Center-of-Mass det. time= 135.5 min (832.0 - 696.5)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	86,200 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	23,810	0	0
19.00	26,993	25,402	25,402
20.00	30,355	28,674	54,076
21.00	33,894	32,125	86,200

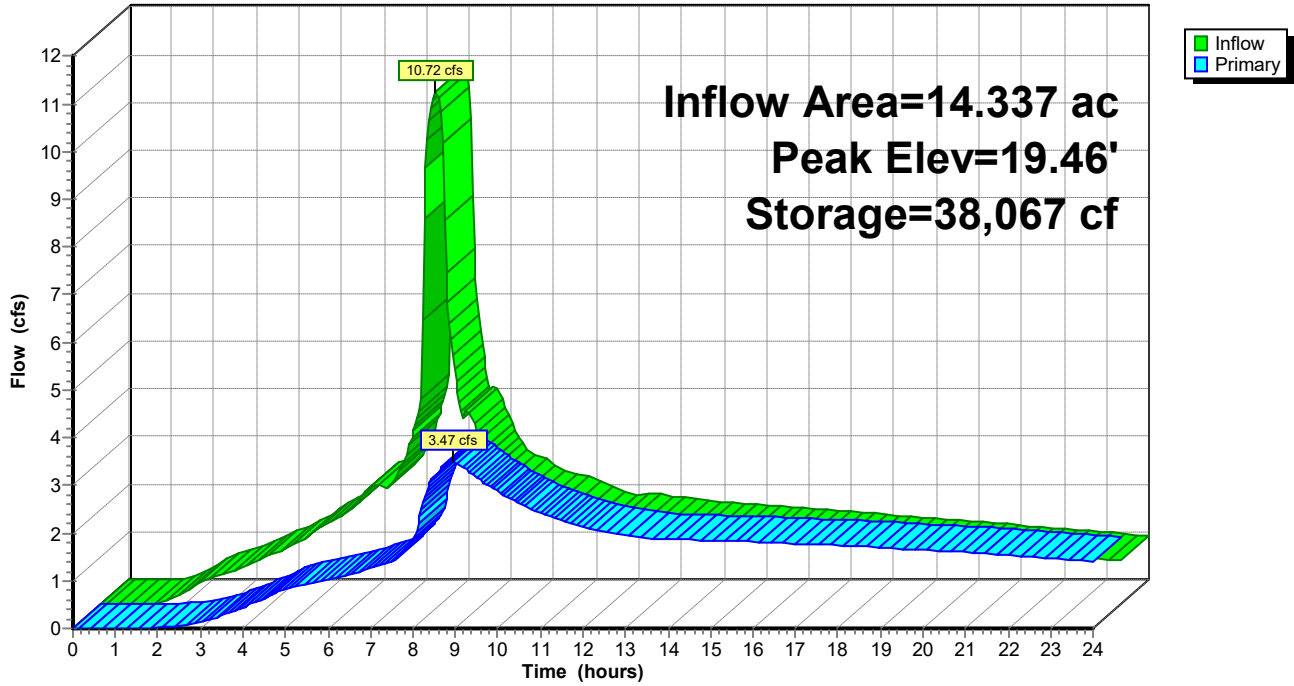
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.25'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.47 cfs @ 8.93 hrs HW=19.46' (Free Discharge)

- ↑ 1=Orifice/Grate (Orifice Controls 2.03 cfs @ 5.81 fps)
- └ 2=Orifice/Grate (Weir Controls 1.44 cfs @ 1.48 fps)

Pond B: NW Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Pond Post B: Wetland B

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 2.12" for 10-yr event
 Inflow = 6.59 cfs @ 8.86 hrs, Volume= 5.491 af
 Outflow = 3.54 cfs @ 15.16 hrs, Volume= 3.466 af, Atten= 46%, Lag= 378.1 min
 Primary = 3.54 cfs @ 15.16 hrs, Volume= 3.466 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.61' @ 15.16 hrs Surf.Area= 39,417 sf Storage= 93,526 cf

Plug-Flow detention time= 400.6 min calculated for 3.466 af (63% of inflow)
 Center-of-Mass det. time= 201.3 min (1,039.9 - 838.5)

Volume	Invert	Avail.Storage	Storage Description
#1	13.00'	271,767 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.00	33	0	0
14.00	587	310	310
15.00	6,414	3,501	3,811
16.00	18,334	12,374	16,185
17.00	27,808	23,071	39,256
18.00	35,098	31,453	70,709
19.00	42,150	38,624	109,333
20.00	49,398	45,774	155,107
21.00	57,993	53,696	208,802
22.00	67,936	62,965	271,767

Device	Routing	Invert	Outlet Devices
#1	Primary	17.68'	24.0" Round Culvert L= 87.0' Ke= 1.000 Inlet / Outlet Invert= 17.68' / 17.00' S= 0.0078 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=3.54 cfs @ 15.16 hrs HW=18.61' (Free Discharge)
 ↑1=Culvert (Inlet Controls 3.54 cfs @ 2.47 fps)

07880259 60% Stormwater Sizing

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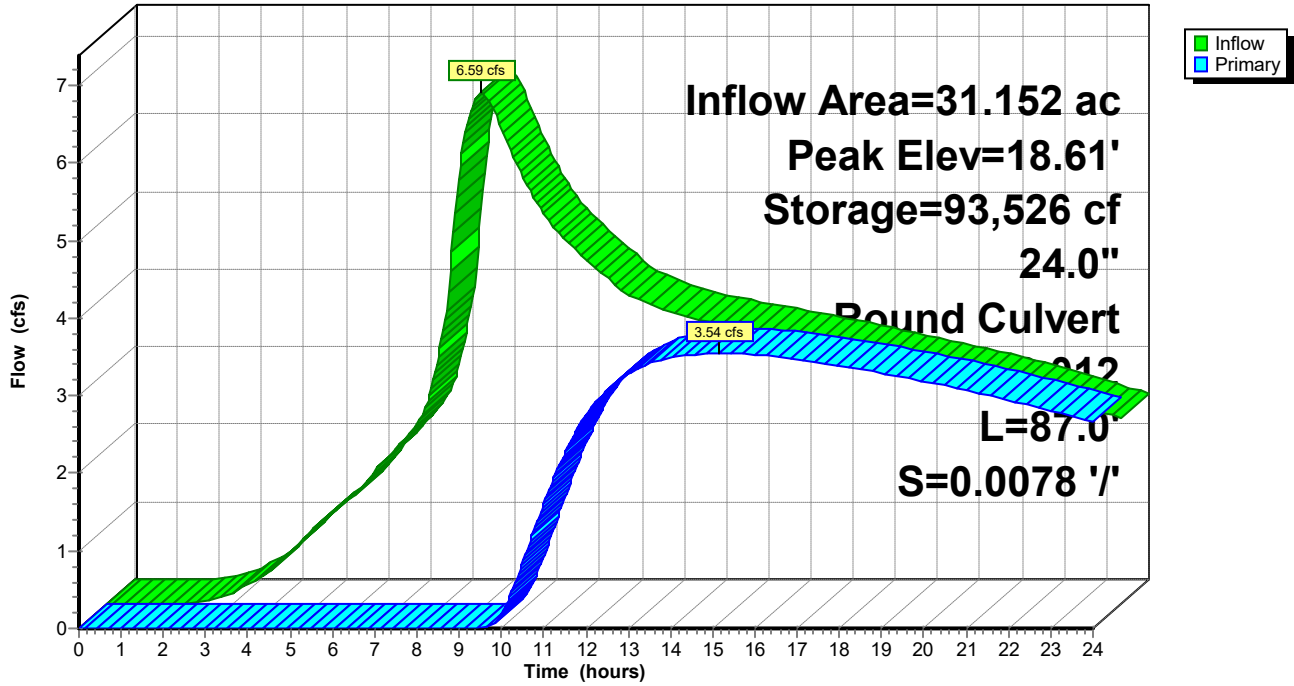
Type IA 24-hr 10-yr Rainfall=3.41"

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Pond Post B: Wetland B

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 10-yr Rainfall=3.41"

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Summary for Pond Pre-A: Wetland A

Inflow Area = 30.230 ac, 0.00% Impervious, Inflow Depth > 1.36" for 10-yr event
 Inflow = 5.28 cfs @ 9.15 hrs, Volume= 3.427 af
 Outflow = 5.24 cfs @ 9.24 hrs, Volume= 3.406 af, Atten= 1%, Lag= 5.2 min
 Primary = 5.24 cfs @ 9.24 hrs, Volume= 3.406 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 17.66' @ 9.24 hrs Surf.Area= 5,943 sf Storage= 2,136 cf

Plug-Flow detention time= 8.3 min calculated for 3.406 af (99% of inflow)
 Center-of-Mass det. time= 4.8 min (879.2 - 874.3)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	60,524 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	547	0	0
18.00	8,745	4,646	4,646
19.00	103,011	55,878	60,524

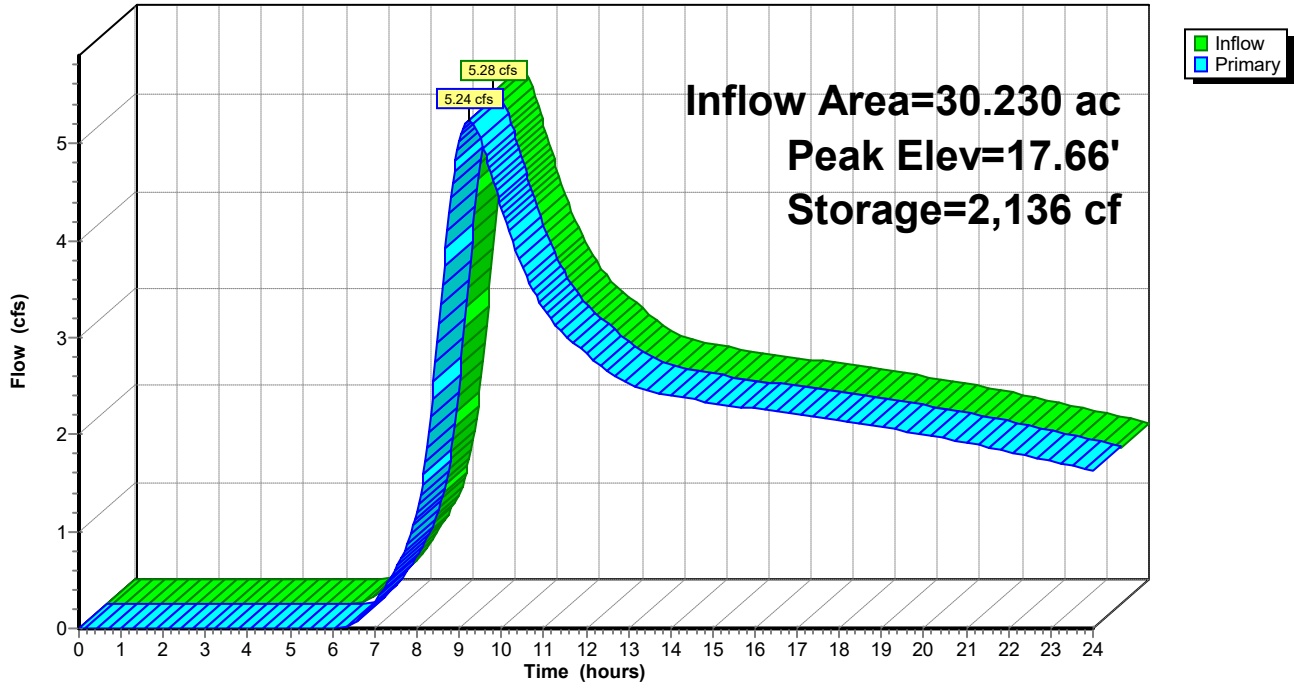
Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	161.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)
#2	Primary	17.71'	152.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)

Primary OutFlow Max=5.24 cfs @ 9.24 hrs HW=17.66' (Free Discharge)

- 1=Sharp-Crested Vee/Trap Weir (Weir Controls 5.24 cfs @ 2.00 fps)
- 2=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Pond Pre-A: Wetland A

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment 1S: CalPortland

Runoff = 1.25 cfs @ 8.90 hrs, Volume= 0.734 af, Depth> 1.65"

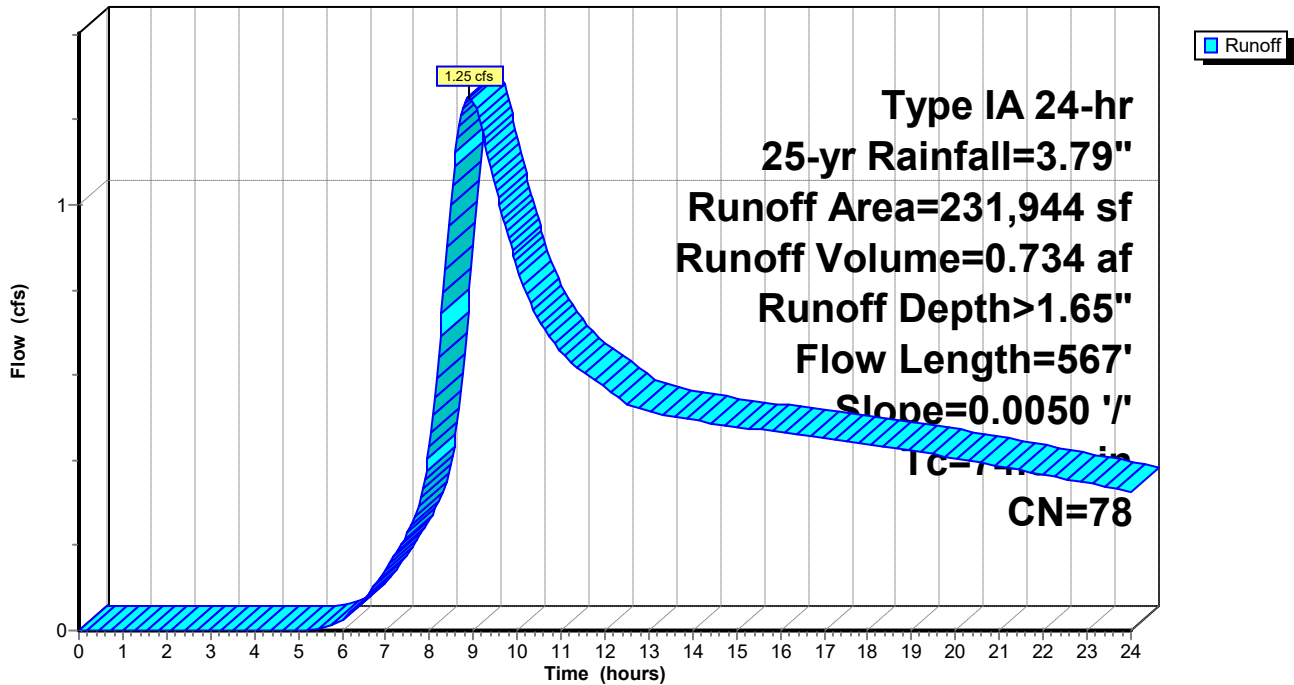
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 25-yr Rainfall=3.79"

Area (sf)	CN	Description
* 231,944	78	Meadow or Pasture, HSG B
231,944		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
69.1	300	0.0050	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 2.40"
5.7	267	0.0050	0.78		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
74.8	567	Total			

Subcatchment 1S: CalPortland

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment 2S: Pre West Basin

Runoff = 5.61 cfs @ 7.98 hrs, Volume= 2.043 af, Depth> 1.72"

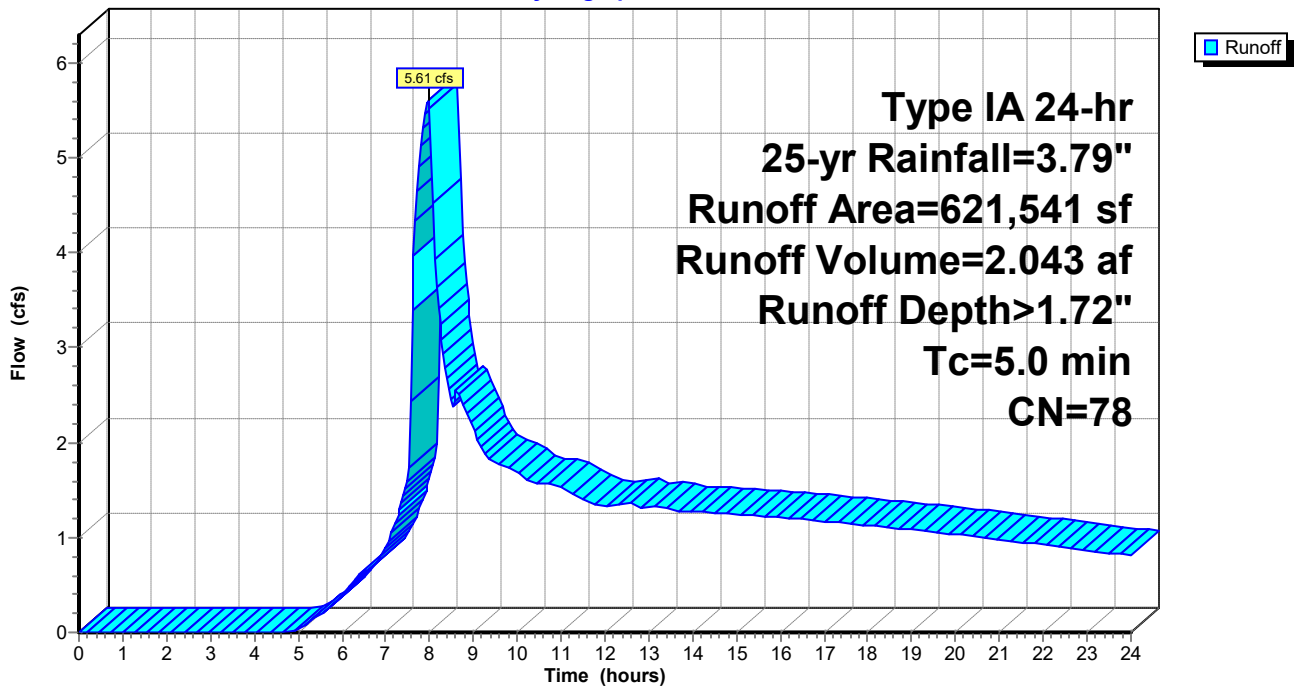
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (sf)	CN	Description
* 621,541	78	Meadow or Pasture, HSG B
621,541		100.00% Pervious Area

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

Subcatchment 2S: Pre West Basin

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment 3S: Pre East Basin

Runoff = 2.70 cfs @ 7.98 hrs, Volume= 0.982 af, Depth> 1.72"

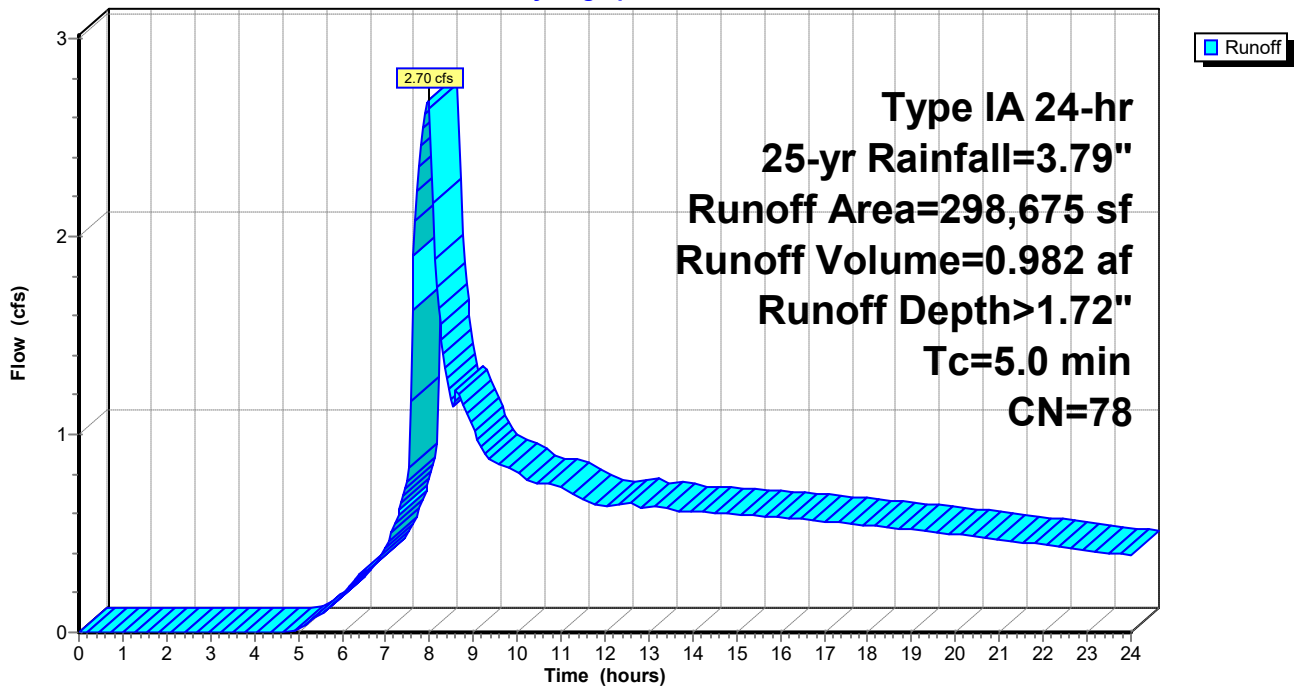
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (sf)	CN	Description
* 298,675	78	Meadow or Pasture, HSG B
298,675		100.00% Pervious Area

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

Subcatchment 3S: Pre East Basin

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment 4S: Post East Basin

Runoff = 2.80 cfs @ 7.86 hrs, Volume= 0.916 af, Depth> 3.55"

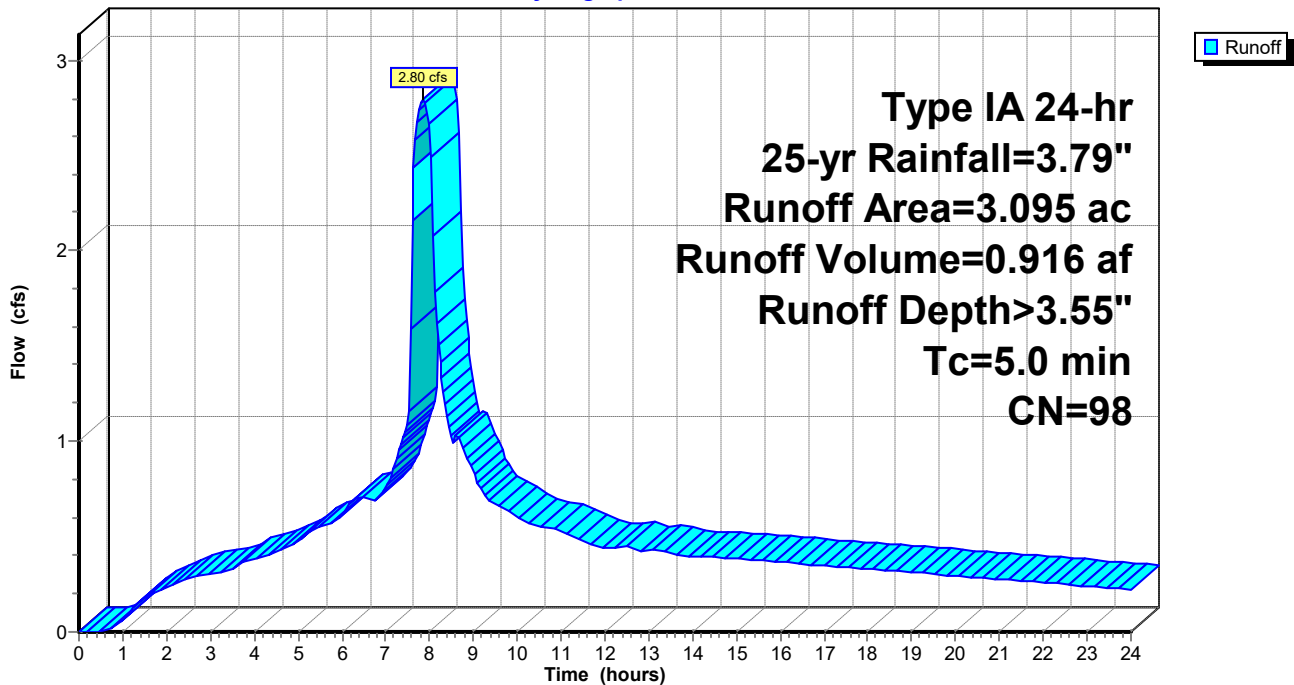
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (ac)	CN	Description
3.095	98	Unconnected roofs, HSG B
3.095		100.00% Impervious Area
3.095		100.00% Unconnected

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

Subcatchment 4S: Post East Basin

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment 6S: Post West Basin

Runoff = 12.11 cfs @ 7.87 hrs, Volume= 3.847 af, Depth> 3.22"

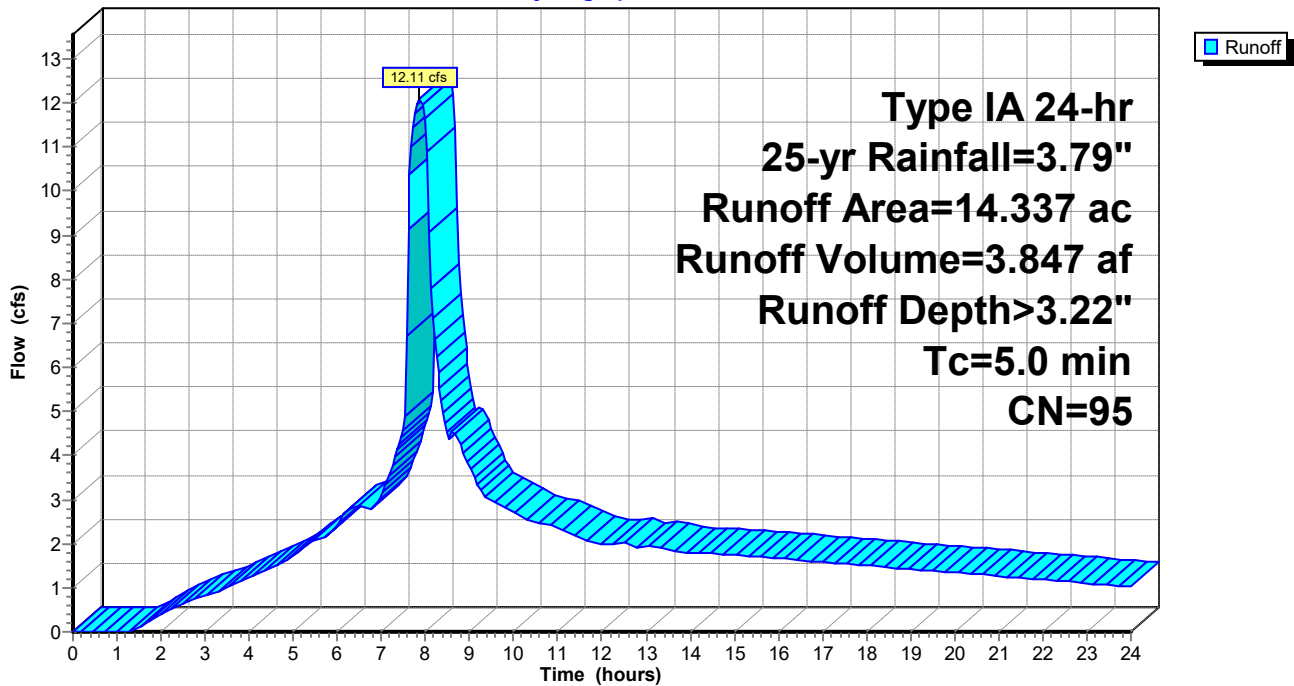
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (ac)	CN	Description
7.563	98	Roofs, HSG B
4.969	98	Paved parking, HSG B
1.059	61	>75% Grass cover, Good, HSG B
0.746	98	Water Surface, HSG B
14.337	95	Weighted Average
1.059		7.39% Pervious Area
13.278		92.61% Impervious Area

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

Subcatchment 6S: Post West Basin

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment 7S: Post East Basin

Runoff = 5.06 cfs @ 7.90 hrs, Volume= 1.607 af, Depth> 2.81"

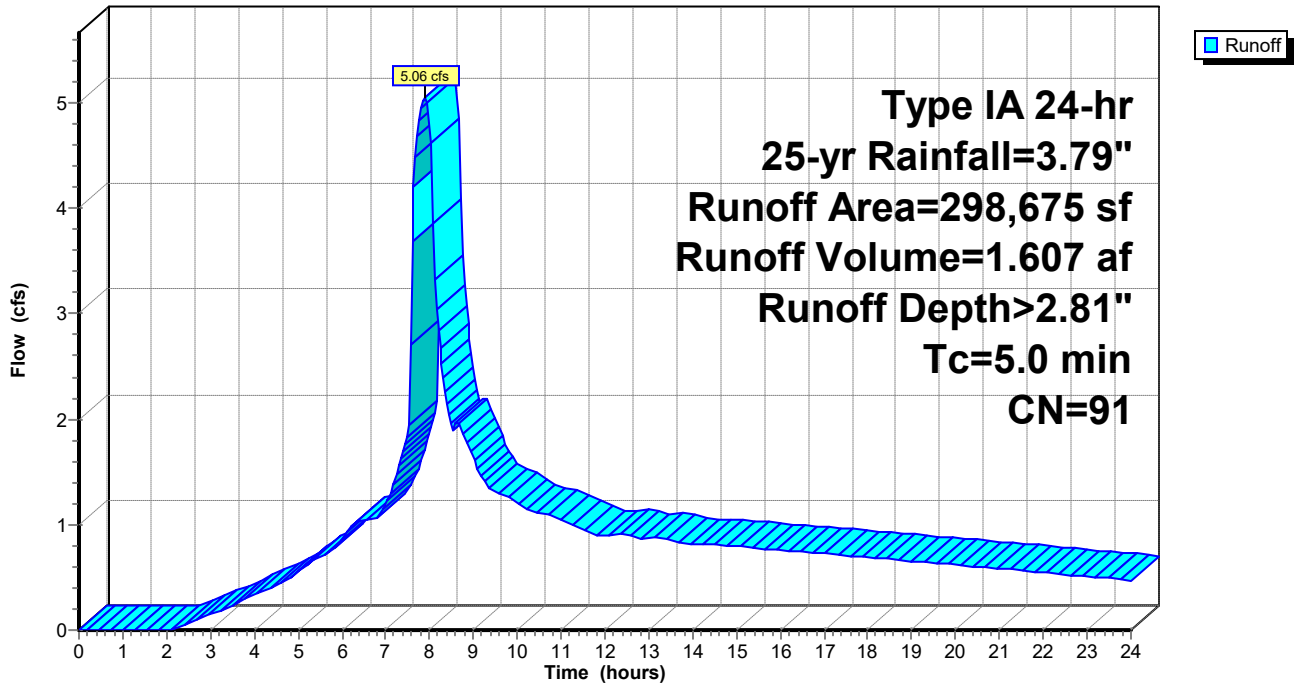
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (sf)	CN	Description
134,833	98	Unconnected roofs, HSG B
84,437	98	Paved parking, HSG B
55,925	61	>75% Grass cover, Good, HSG B
23,480	98	Water Surface, HSG B
298,675	91	Weighted Average
55,925		18.72% Pervious Area
242,750		81.28% Impervious Area
134,833		55.54% Unconnected

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

Subcatchment 7S: Post East Basin

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment Post1: Center Basin

Runoff = 23.60 cfs @ 7.90 hrs, Volume= 7.532 af, Depth> 2.72"

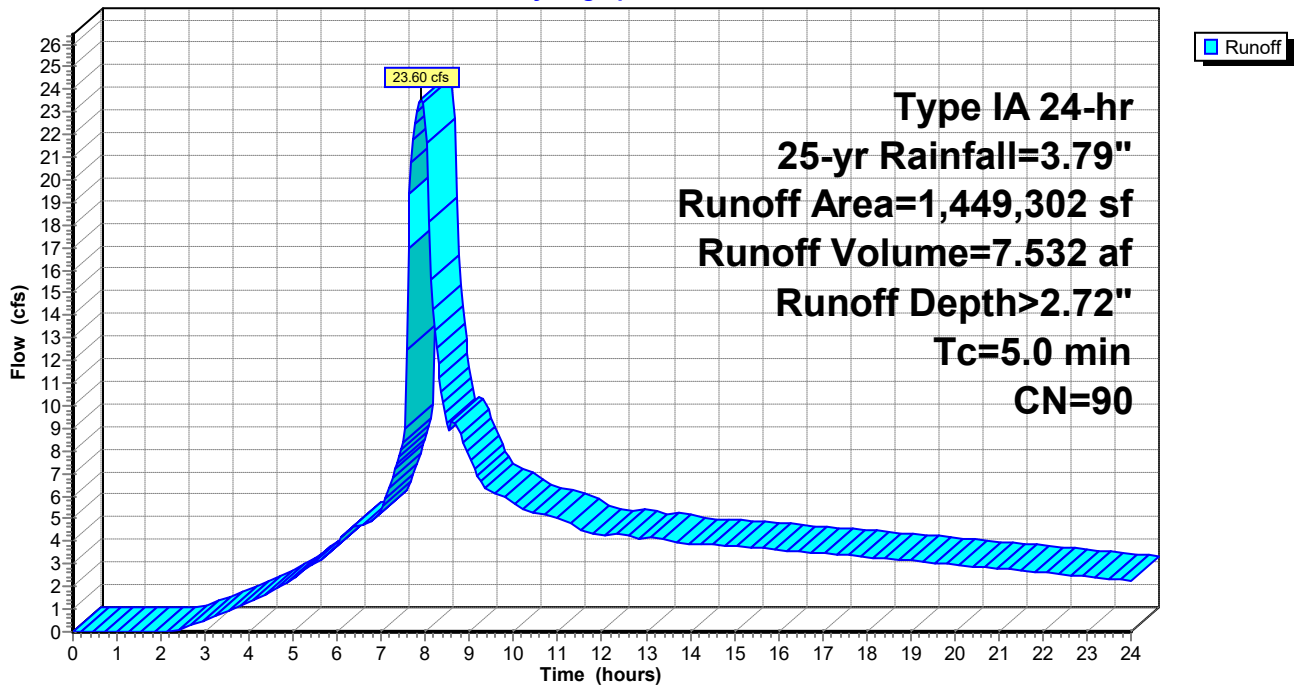
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (sf)	CN	Description
621,920	98	Paved roads w/curbs & sewers, HSG B
58,238	98	Water Surface, HSG B
466,903	98	Roofs, HSG B
302,241	61	>75% Grass cover, Good, HSG B
1,449,302	90	Weighted Average
302,241		20.85% Pervious Area
1,147,061		79.15% Impervious Area

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

Subcatchment Post1: Center Basin

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment Pre1: Total Pre Developed

Runoff = 11.12 cfs @ 9.40 hrs, Volume= 7.378 af, Depth> 1.63"

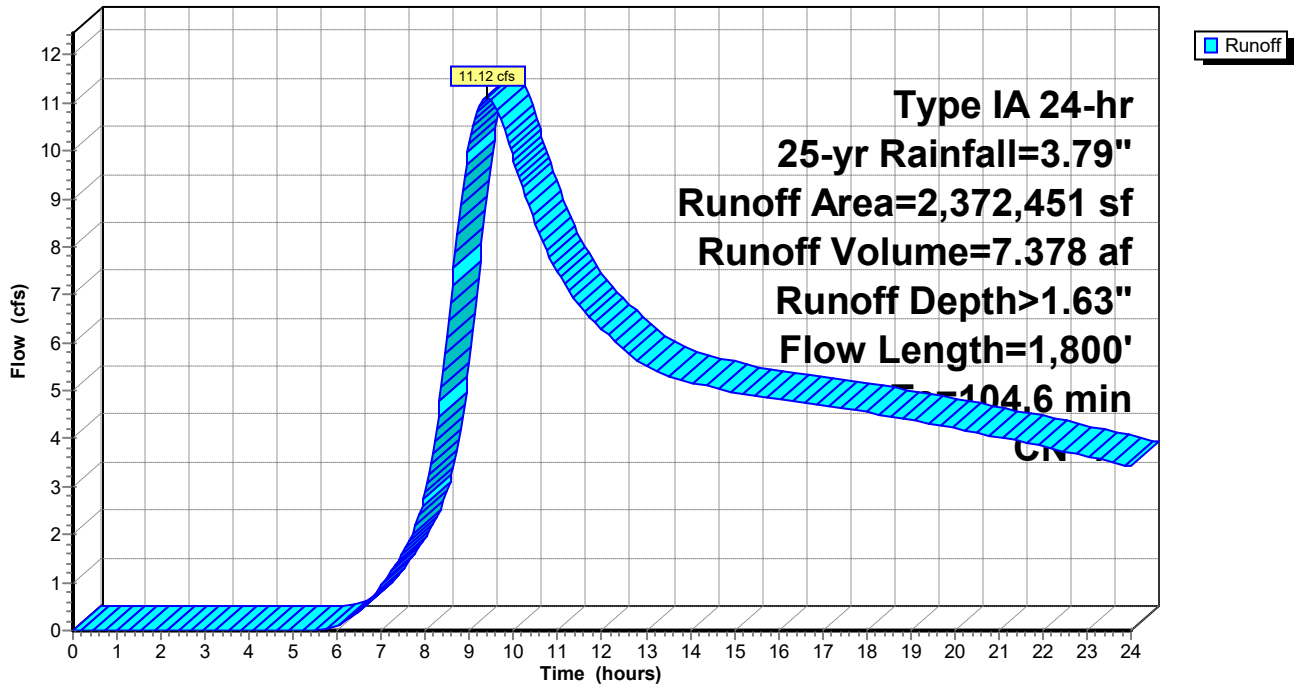
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (sf)	CN	Description
* 2,372,451	78	Meadow or pasture, HSG B
2,372,451		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
47.4	1,500	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns
					Kv= 11.0 fps
104.6	1,800	Total			

Subcatchment Pre1: Total Pre Developed

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment Pre1a: To Wetland A

Runoff = 6.62 cfs @ 9.14 hrs, Volume= 4.135 af, Depth> 1.64"

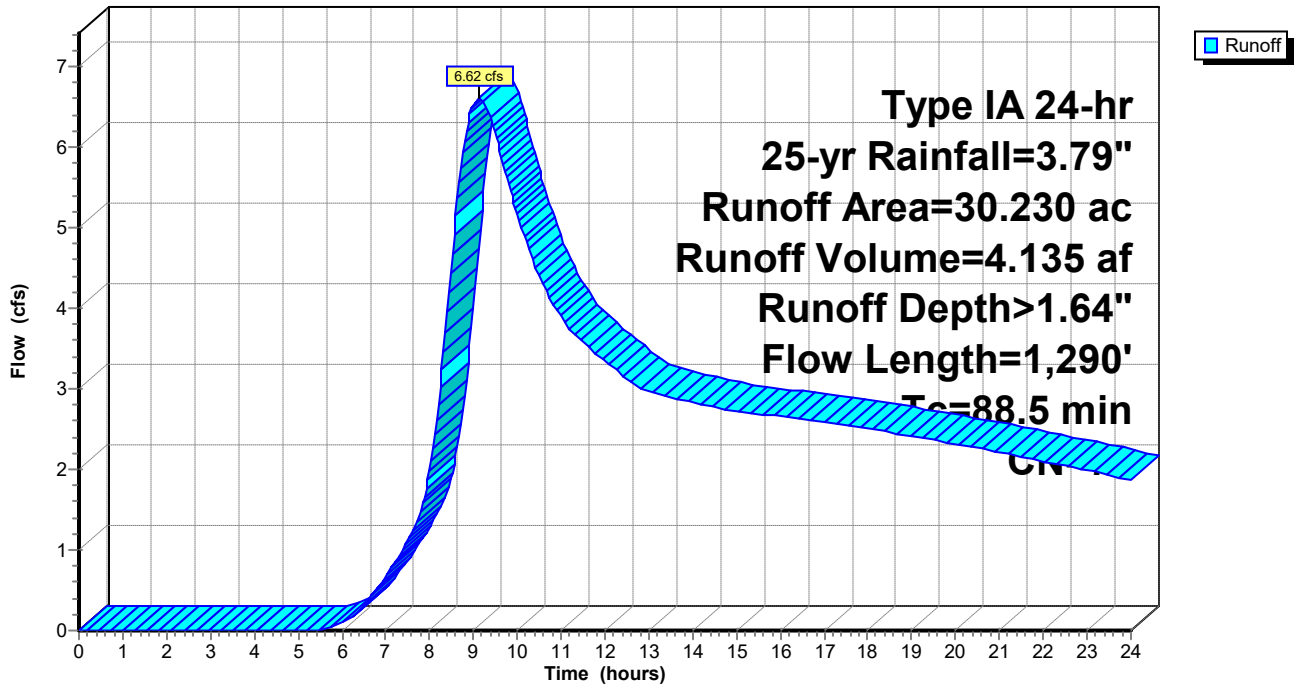
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (ac)	CN	Description
* 30.230	78	Meadow or pasture, HSG B
30.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.40"
31.3	990	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
88.5	1,290	Total			

Subcatchment Pre1a: To Wetland A

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Subcatchment Pre1b: Offsite

Runoff = 1.22 cfs @ 8.61 hrs, Volume= 0.646 af, Depth> 1.67"

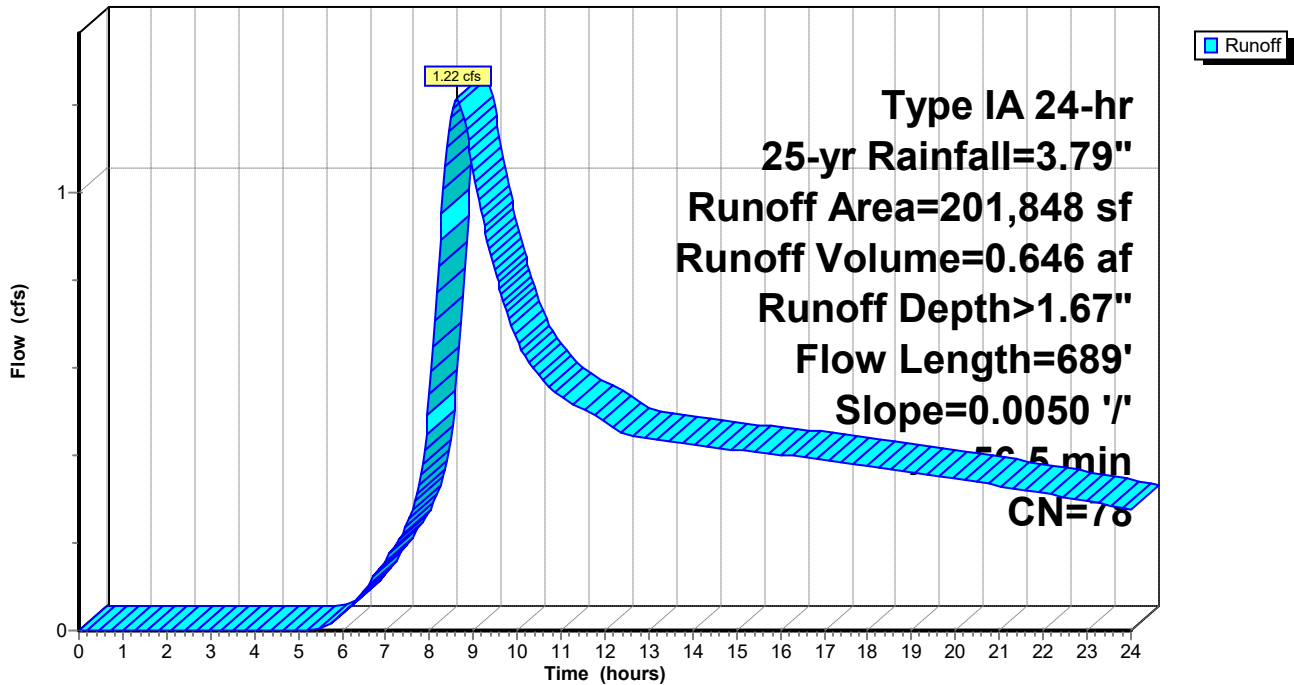
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 25-yr Rainfall=3.79"

Area (sf)	CN	Description
* 201,848	78	Meadow or pasture, HSG B
201,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
52.3	212	0.0050	0.07		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
4.2	477	0.0050	1.91		Shallow Concentrated Flow, Gravel Roads
					Kv= 27.0 fps
56.5	689	Total			

Subcatchment Pre1b: Offsite

Hydrograph



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Type IA 24-hr 25-yr Rainfall=3.79"

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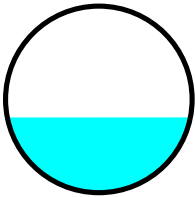
Summary for Reach 1R: 24-in CPEP Pipe

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 1.62" for 25-yr event
Inflow = 4.20 cfs @ 13.36 hrs, Volume= 4.218 af
Outflow = 4.20 cfs @ 13.37 hrs, Volume= 4.216 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.52 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.27 fps, Avg. Travel Time= 0.3 min

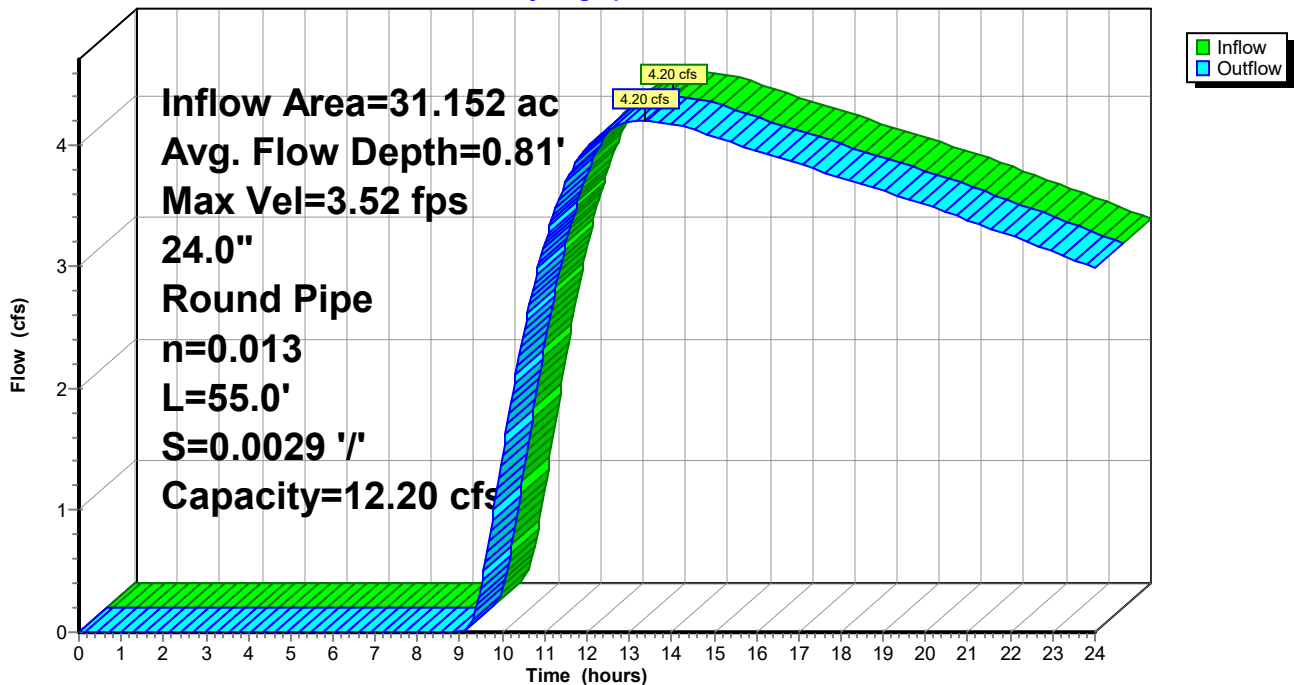
Peak Storage= 66 cf @ 13.37 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 12.20 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0029 '/'
Inlet Invert= 17.00', Outlet Invert= 16.84'



Reach 1R: 24-in CPEP Pipe

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr 25-yr Rainfall=3.79"

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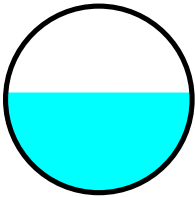
Summary for Reach 3R: 30-inch CPSSP

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 1.92" for 25-yr event
Inflow = 7.94 cfs @ 14.70 hrs, Volume= 10.325 af
Outflow = 7.94 cfs @ 14.72 hrs, Volume= 10.309 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.95 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.58 fps, Avg. Travel Time= 0.6 min

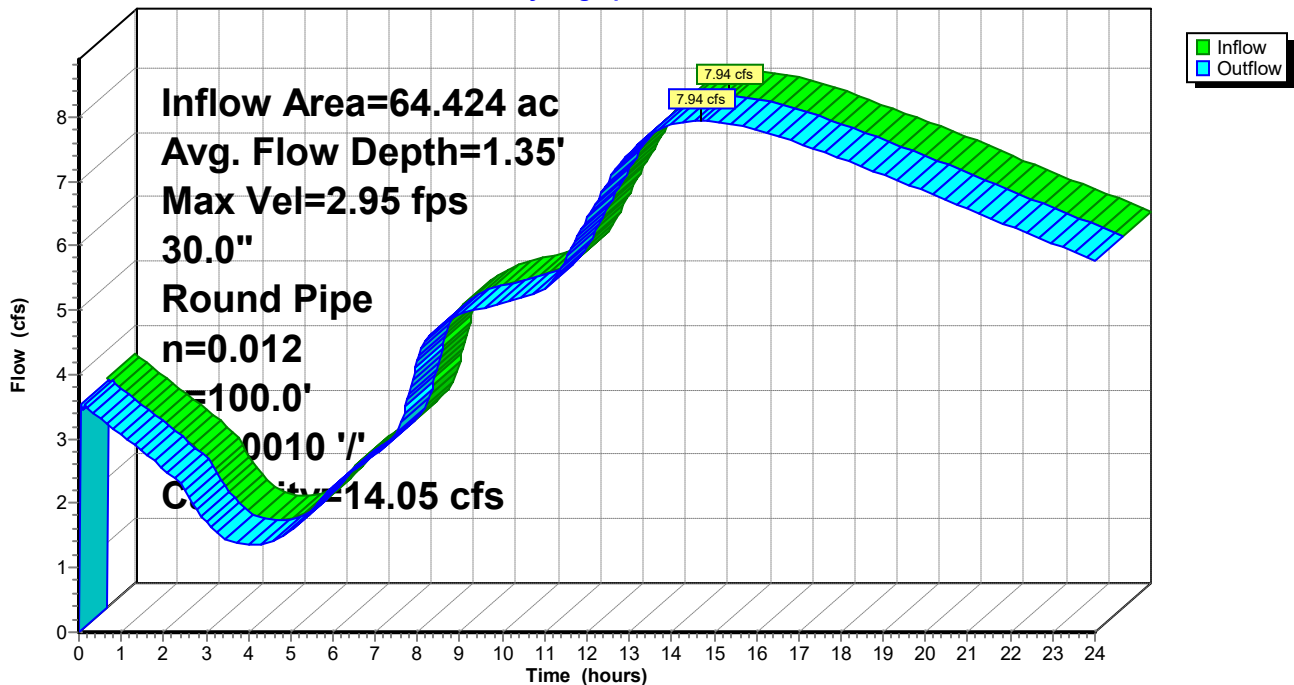
Peak Storage= 269 cf @ 14.71 hrs
Average Depth at Peak Storage= 1.35'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 14.05 cfs

30.0" Round Pipe
n= 0.012
Length= 100.0' Slope= 0.0010 '/'
Inlet Invert= 17.00', Outlet Invert= 16.90'



Reach 3R: 30-inch CPSSP

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Pond 8P: NE Pond

Inflow Area = 6.857 ac, 81.28% Impervious, Inflow Depth > 2.81" for 25-yr event
 Inflow = 5.06 cfs @ 7.90 hrs, Volume= 1.607 af
 Outflow = 1.34 cfs @ 9.37 hrs, Volume= 1.538 af, Atten= 73%, Lag= 88.4 min
 Primary = 1.34 cfs @ 9.37 hrs, Volume= 1.538 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 19.09' @ 9.37 hrs Surf.Area= 15,471 sf Storage= 15,529 cf

Plug-Flow detention time= 142.9 min calculated for 1.536 af (96% of inflow)
 Center-of-Mass det. time= 113.1 min (838.8 - 725.8)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	49,335 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	12,970	0	0
19.00	15,255	14,113	14,113
20.00	17,597	16,426	30,539
21.00	19,996	18,797	49,335

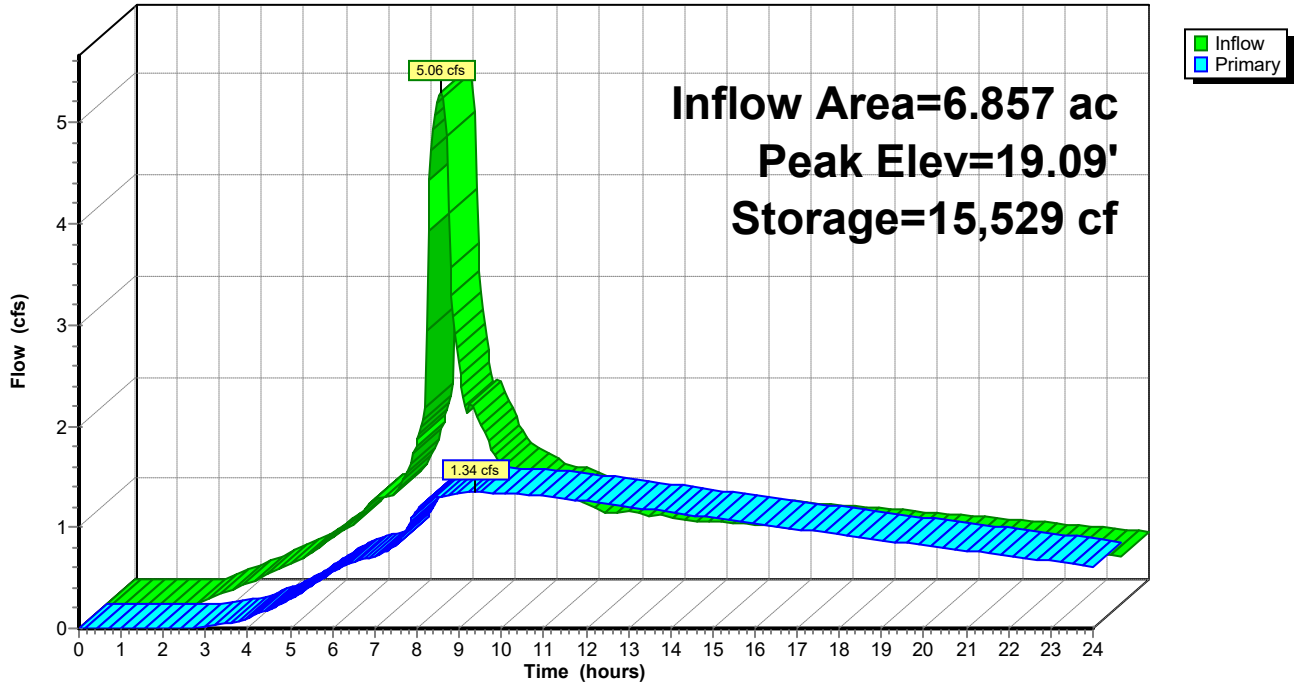
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	7.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.50'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.34 cfs @ 9.37 hrs HW=19.09' (Free Discharge)

- ↑ 1=Orifice/Grate (Orifice Controls 1.34 cfs @ 5.03 fps)
- └ 2=Orifice/Grate (Controls 0.00 cfs)

Pond 8P: NE Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Pond A: Center Pond

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 2.19" for 25-yr event
 Inflow = 23.60 cfs @ 7.90 hrs, Volume= 11.748 af
 Outflow = 7.94 cfs @ 14.70 hrs, Volume= 10.325 af, Atten= 66%, Lag= 407.8 min
 Primary = 7.94 cfs @ 14.70 hrs, Volume= 10.325 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Starting Elev= 17.89' Surf.Area= 50,371 sf Storage= 43,385 cf
 Peak Elev= 19.28' @ 14.70 hrs Surf.Area= 55,515 sf Storage= 116,752 cf (73,367 cf above start)

Plug-Flow detention time= 226.6 min calculated for 9.313 af (79% of inflow)
 Center-of-Mass det. time= 30.4 min (862.6 - 832.2)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	218,077 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	47,123	0	0
18.00	50,772	48,948	48,948
19.00	54,477	52,625	101,572
20.00	58,238	56,358	157,930
21.00	62,056	60,147	218,077

Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.00'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

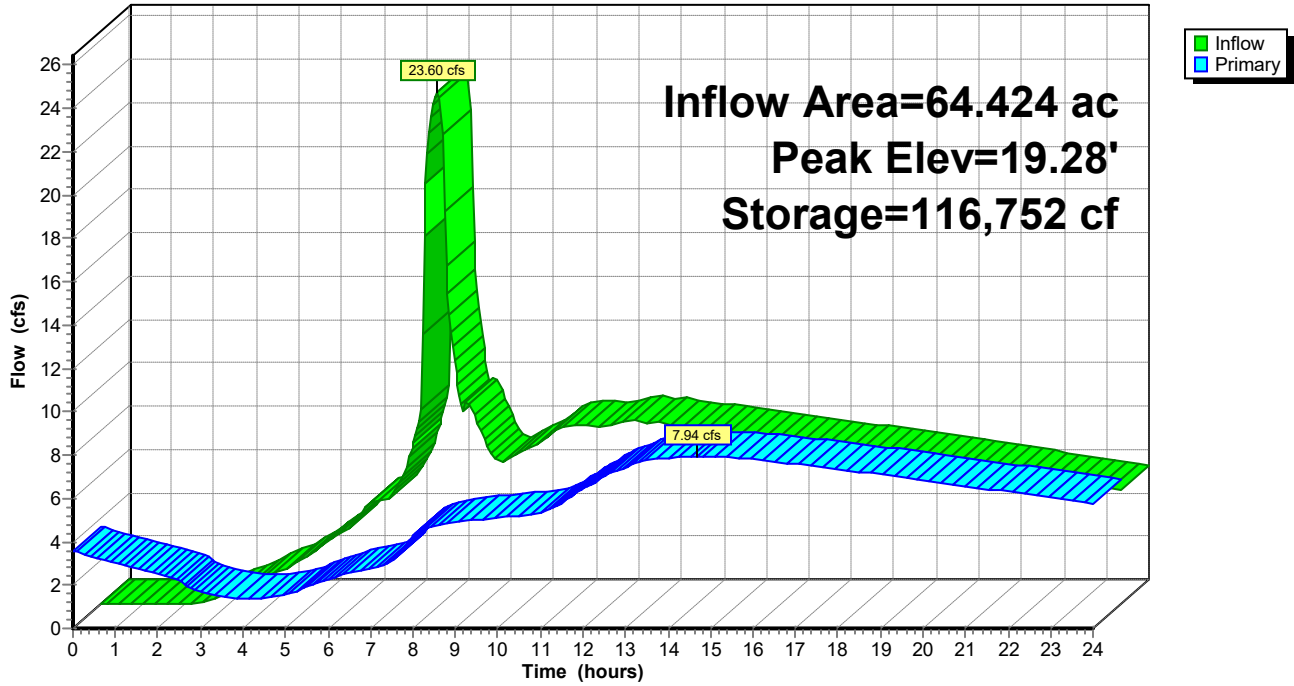
Primary OutFlow Max=7.94 cfs @ 14.70 hrs HW=19.28' (Free Discharge)

↑ **1=Orifice/Grate** (Orifice Controls 5.71 cfs @ 7.26 fps)

└ **2=Orifice/Grate** (Weir Controls 2.23 cfs @ 1.72 fps)

Pond A: Center Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Pond B: NW Pond

Inflow Area = 14.337 ac, 92.61% Impervious, Inflow Depth > 3.22" for 25-yr event
 Inflow = 12.11 cfs @ 7.87 hrs, Volume= 3.847 af
 Outflow = 4.69 cfs @ 8.45 hrs, Volume= 3.371 af, Atten= 61%, Lag= 34.9 min
 Primary = 4.69 cfs @ 8.45 hrs, Volume= 3.371 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 19.55' @ 8.45 hrs Surf.Area= 28,858 sf Storage= 40,889 cf

Plug-Flow detention time= 206.3 min calculated for 3.371 af (88% of inflow)
 Center-of-Mass det. time= 121.6 min (813.1 - 691.5)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	86,200 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	23,810	0	0
19.00	26,993	25,402	25,402
20.00	30,355	28,674	54,076
21.00	33,894	32,125	86,200

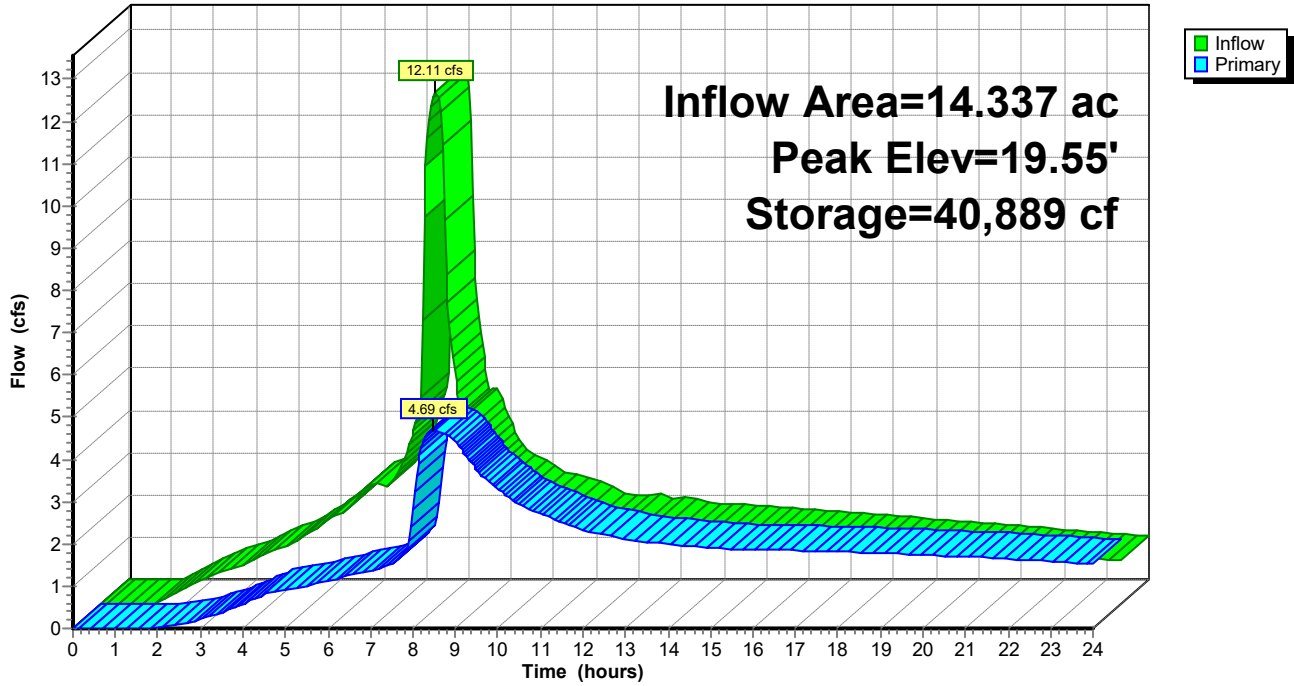
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.25'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.68 cfs @ 8.45 hrs HW=19.55' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 2.10 cfs @ 6.00 fps)
- 2=Orifice/Grate (Weir Controls 2.59 cfs @ 1.80 fps)

Pond B: NW Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Pond Post B: Wetland B

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 2.42" for 25-yr event
 Inflow = 8.36 cfs @ 8.72 hrs, Volume= 6.288 af
 Outflow = 4.20 cfs @ 13.36 hrs, Volume= 4.218 af, Atten= 50%, Lag= 278.8 min
 Primary = 4.20 cfs @ 13.36 hrs, Volume= 4.218 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.71' @ 13.36 hrs Surf.Area= 40,073 sf Storage= 97,224 cf

Plug-Flow detention time= 363.2 min calculated for 4.211 af (67% of inflow)
 Center-of-Mass det. time= 180.9 min (1,008.5 - 827.5)

Volume	Invert	Avail.Storage	Storage Description
#1	13.00'	271,767 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.00	33	0	0
14.00	587	310	310
15.00	6,414	3,501	3,811
16.00	18,334	12,374	16,185
17.00	27,808	23,071	39,256
18.00	35,098	31,453	70,709
19.00	42,150	38,624	109,333
20.00	49,398	45,774	155,107
21.00	57,993	53,696	208,802
22.00	67,936	62,965	271,767

Device	Routing	Invert	Outlet Devices
#1	Primary	17.68'	24.0" Round Culvert L= 87.0' Ke= 1.000 Inlet / Outlet Invert= 17.68' / 17.00' S= 0.0078 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=4.19 cfs @ 13.36 hrs HW=18.71' (Free Discharge)
 ↑1=Culvert (Inlet Controls 4.19 cfs @ 2.59 fps)

07880259 60% Stormwater Sizing

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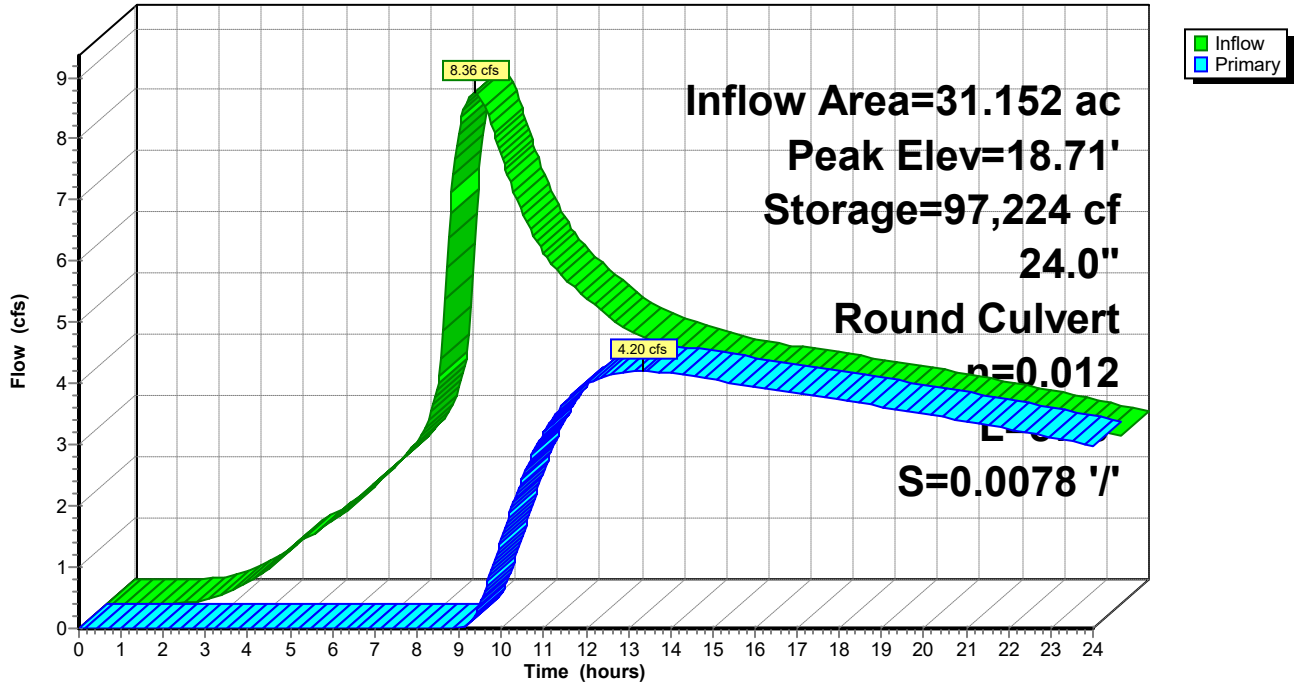
Type IA 24-hr 25-yr Rainfall=3.79"

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Pond Post B: Wetland B

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 25-yr Rainfall=3.79"

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Summary for Pond Pre-A: Wetland A

Inflow Area = 30.230 ac, 0.00% Impervious, Inflow Depth > 1.64" for 25-yr event
 Inflow = 6.62 cfs @ 9.14 hrs, Volume= 4.135 af
 Outflow = 6.59 cfs @ 9.21 hrs, Volume= 4.112 af, Atten= 1%, Lag= 4.0 min
 Primary = 6.59 cfs @ 9.21 hrs, Volume= 4.112 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 17.72' @ 9.21 hrs Surf.Area= 6,459 sf Storage= 2,526 cf

Plug-Flow detention time= 7.9 min calculated for 4.112 af (99% of inflow)
 Center-of-Mass det. time= 4.6 min (867.8 - 863.2)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	60,524 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	547	0	0
18.00	8,745	4,646	4,646
19.00	103,011	55,878	60,524

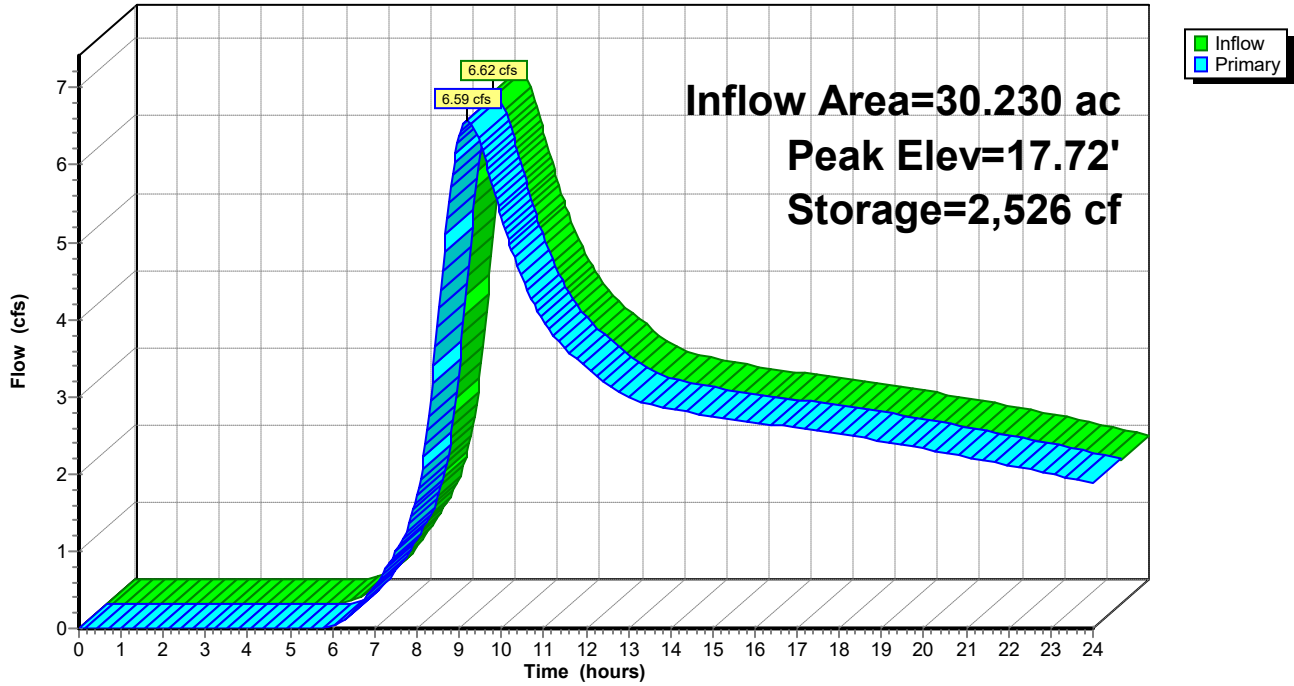
Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	161.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)
#2	Primary	17.71'	152.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)

Primary OutFlow Max=6.59 cfs @ 9.21 hrs HW=17.72' (Free Discharge)

- 1=Sharp-Crested Vee/Trap Weir (Weir Controls 6.59 cfs @ 2.10 fps)
- 2=Sharp-Crested Vee/Trap Weir (Weir Controls 0.00 cfs @ 0.26 fps)

Pond Pre-A: Wetland A

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment 1S: CalPortland

Runoff = 1.80 cfs @ 8.88 hrs, Volume= 0.998 af, Depth> 2.25"

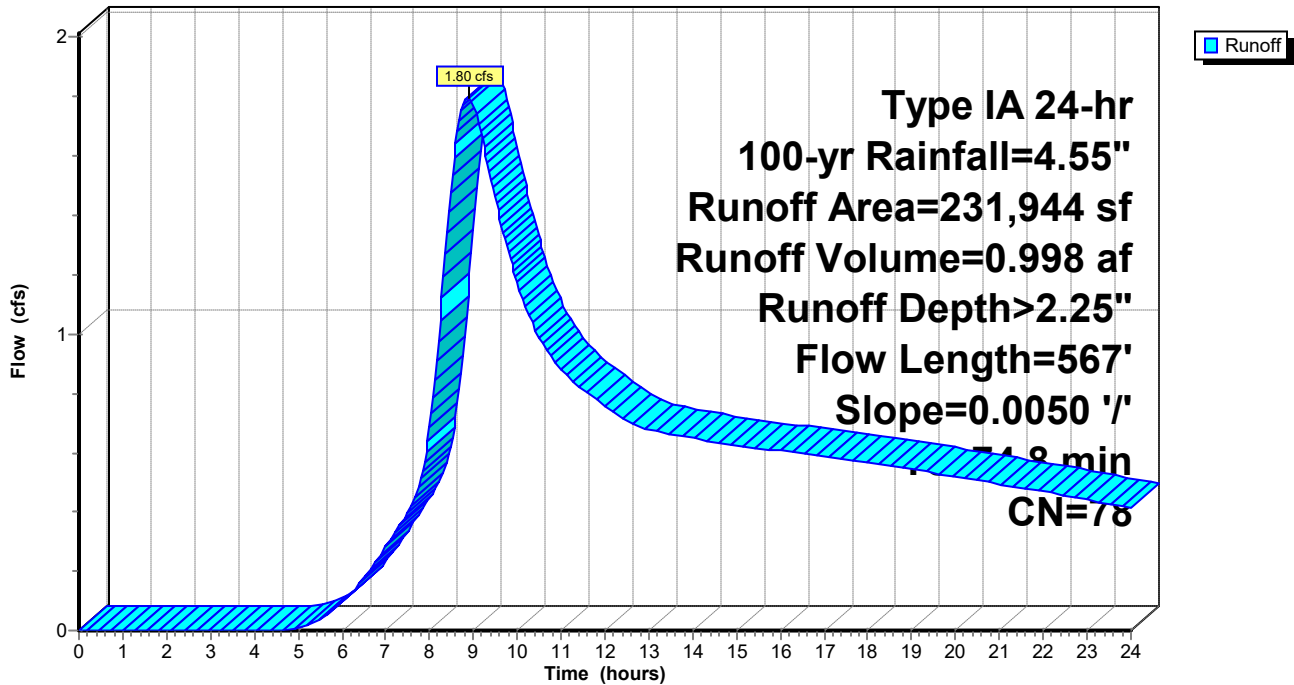
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 100-yr Rainfall=4.55"

Area (sf)	CN	Description
* 231,944	78	Meadow or Pasture, HSG B
231,944		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
69.1	300	0.0050	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 2.40"
5.7	267	0.0050	0.78		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
74.8	567	Total			

Subcatchment 1S: CalPortland

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment 2S: Pre West Basin

Runoff = 7.97 cfs @ 7.96 hrs, Volume= 2.771 af, Depth> 2.33"

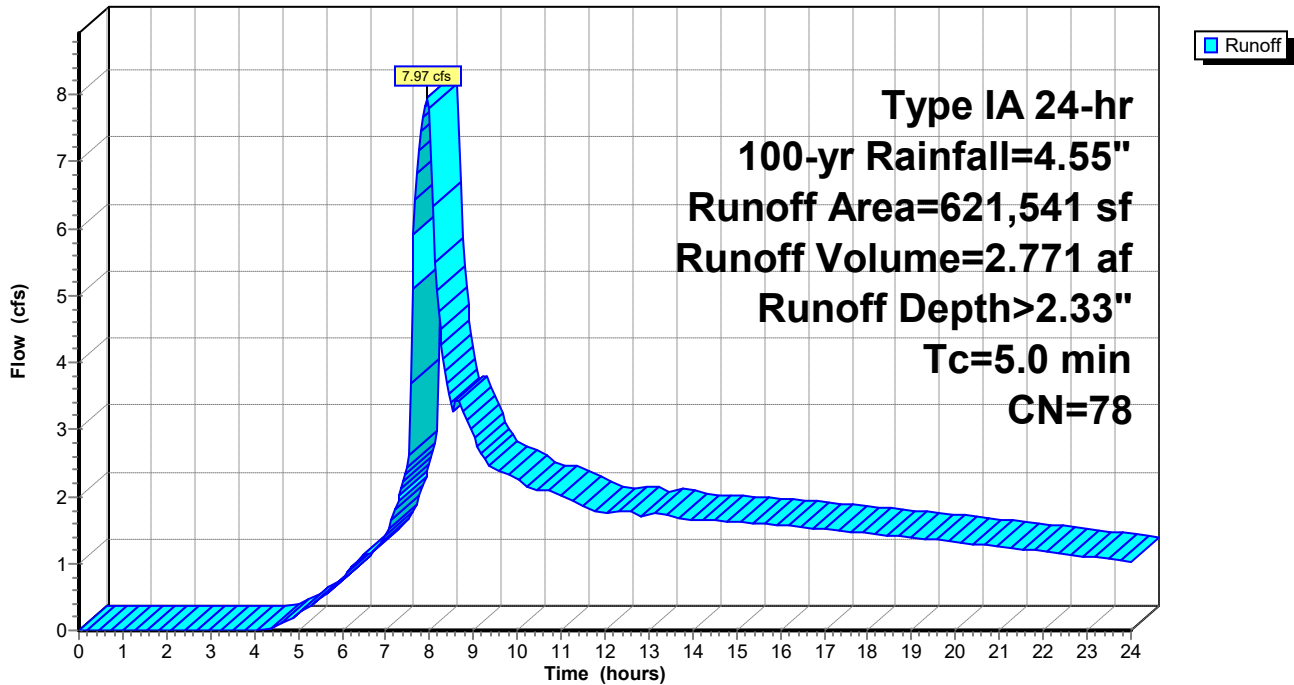
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 100-yr Rainfall=4.55"

Area (sf)	CN	Description
* 621,541	78	Meadow or Pasture, HSG B
621,541		100.00% Pervious Area

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

Subcatchment 2S: Pre West Basin

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment 3S: Pre East Basin

Runoff = 3.83 cfs @ 7.96 hrs, Volume= 1.331 af, Depth> 2.33"

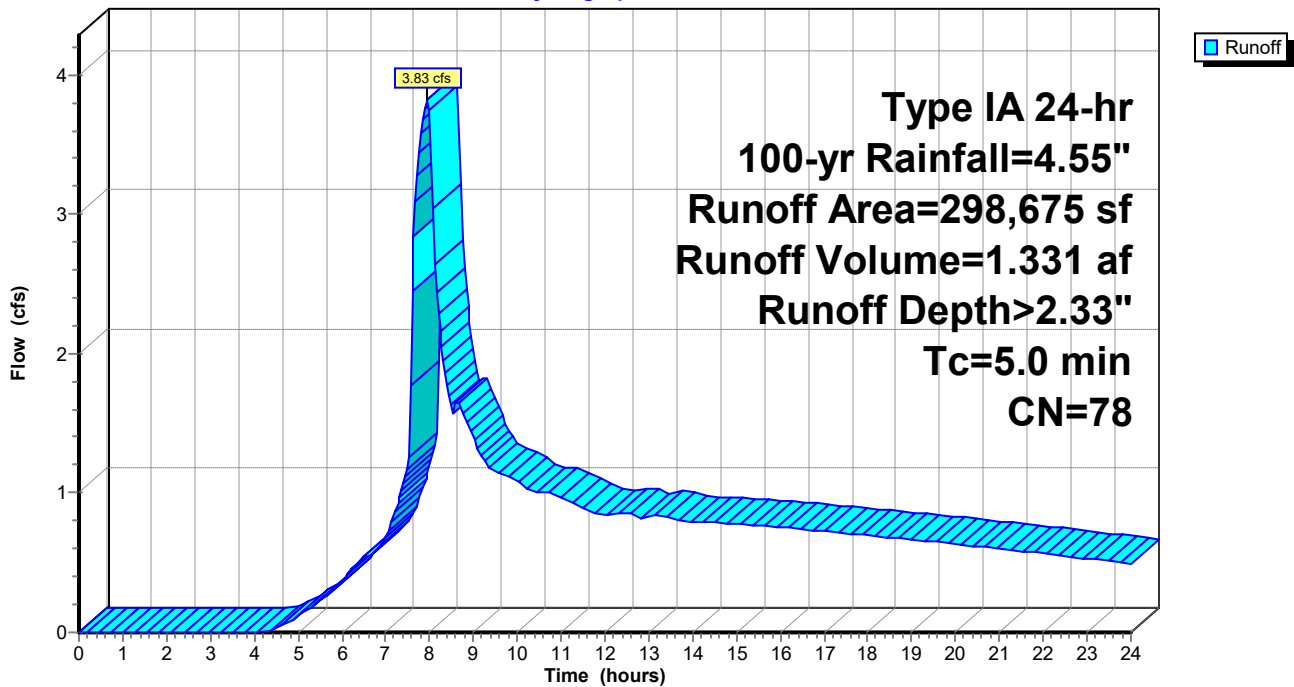
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 100-yr Rainfall=4.55"

Area (sf)	CN	Description
* 298,675	78	Meadow or Pasture, HSG B
298,675		100.00% Pervious Area

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

Subcatchment 3S: Pre East Basin

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment 4S: Post East Basin

Runoff = 3.38 cfs @ 7.86 hrs, Volume= 1.111 af, Depth> 4.31"

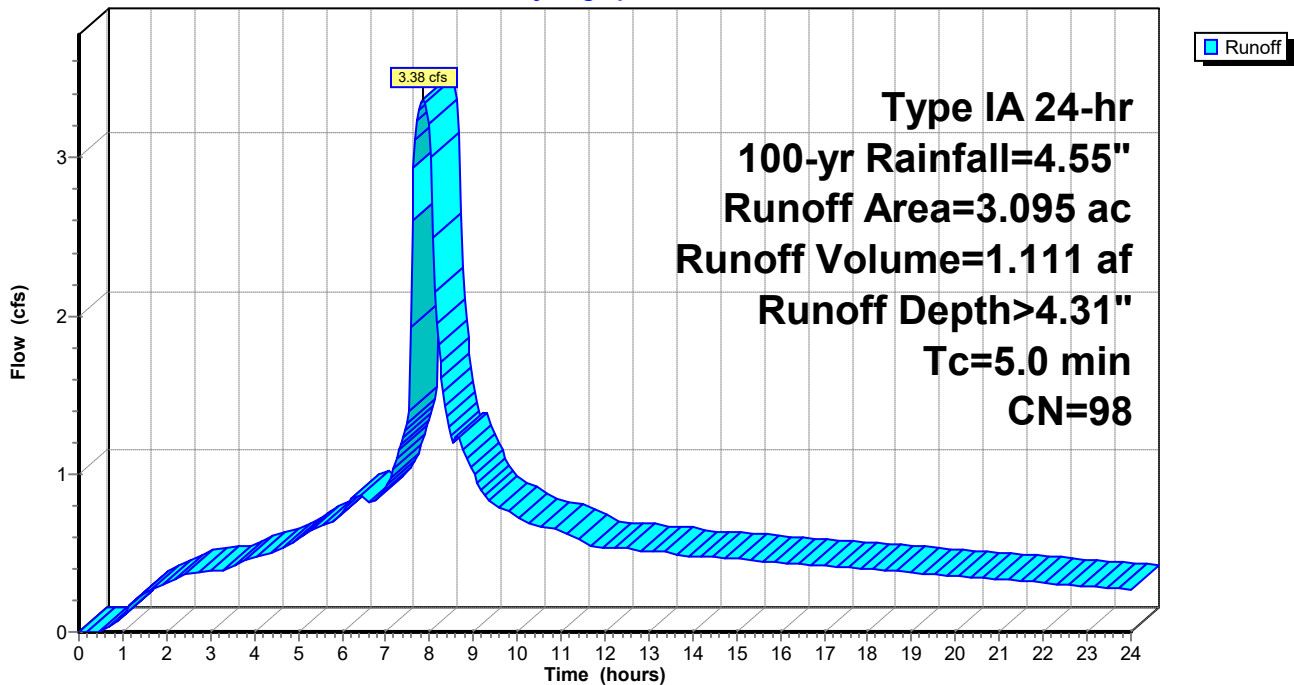
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 100-yr Rainfall=4.55"

Area (ac)	CN	Description
3.095	98	Unconnected roofs, HSG B
3.095		100.00% Impervious Area
3.095		100.00% Unconnected

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

Subcatchment 4S: Post East Basin

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment 6S: Post West Basin

Runoff = 14.85 cfs @ 7.87 hrs, Volume= 4.742 af, Depth> 3.97"

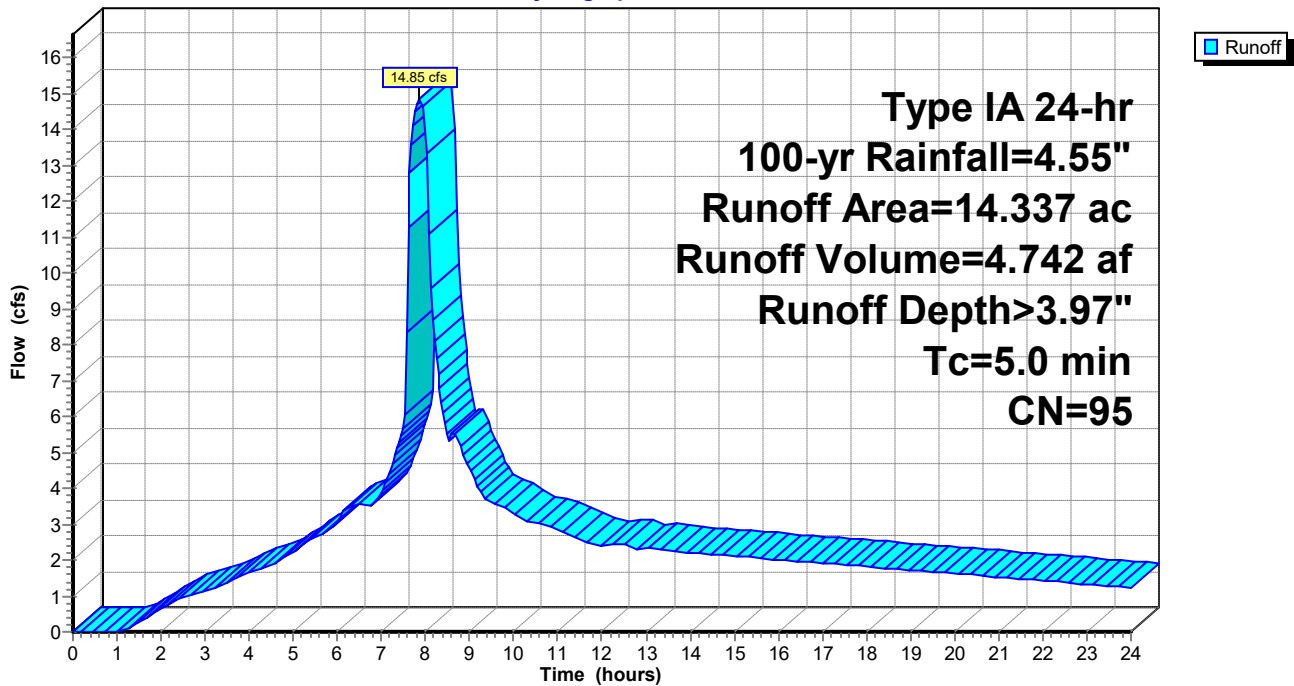
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 100-yr Rainfall=4.55"

Area (ac)	CN	Description
7.563	98	Roofs, HSG B
4.969	98	Paved parking, HSG B
1.059	61	>75% Grass cover, Good, HSG B
0.746	98	Water Surface, HSG B
14.337	95	Weighted Average
1.059		7.39% Pervious Area
13.278		92.61% Impervious Area

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

Subcatchment 6S: Post West Basin

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment 7S: Post East Basin

Runoff = 6.39 cfs @ 7.89 hrs, Volume= 2.024 af, Depth> 3.54"

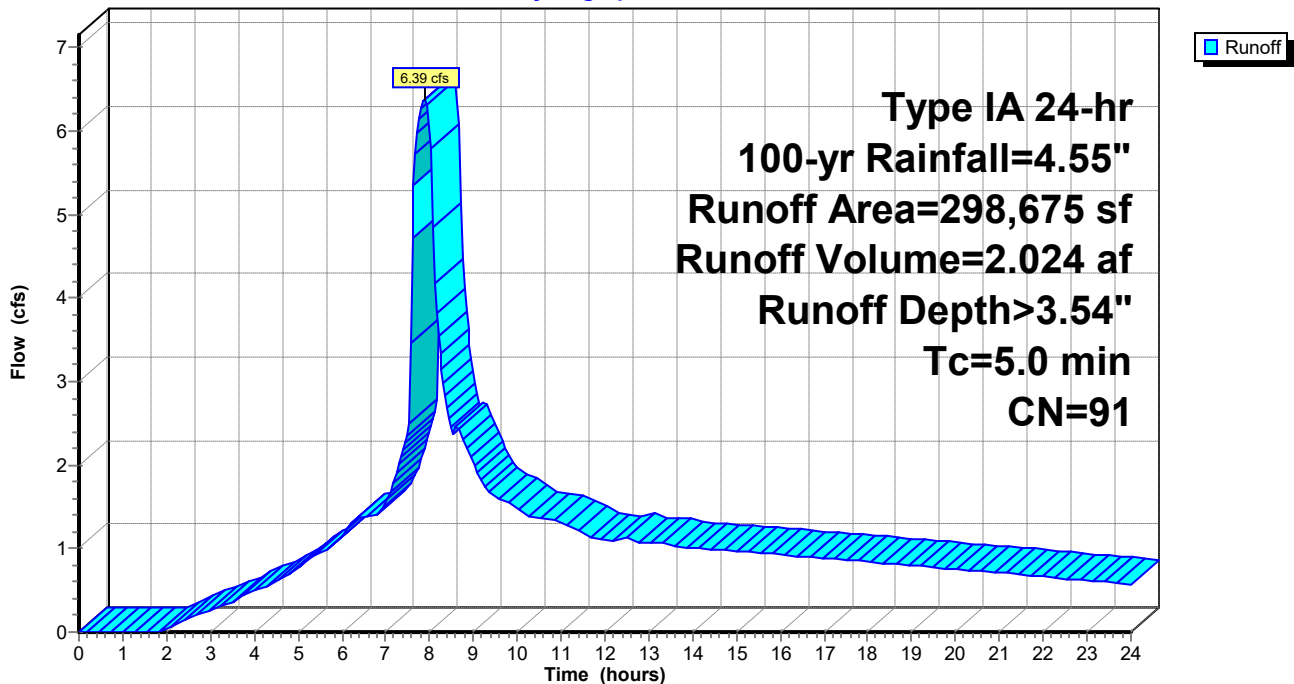
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 100-yr Rainfall=4.55"

Area (sf)	CN	Description
134,833	98	Unconnected roofs, HSG B
84,437	98	Paved parking, HSG B
55,925	61	>75% Grass cover, Good, HSG B
23,480	98	Water Surface, HSG B
298,675	91	Weighted Average
55,925		18.72% Pervious Area
242,750		81.28% Impervious Area
134,833		55.54% Unconnected

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

Subcatchment 7S: Post East Basin

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment Post1: Center Basin

Runoff = 30.05 cfs @ 7.89 hrs, Volume= 9.535 af, Depth> 3.44"

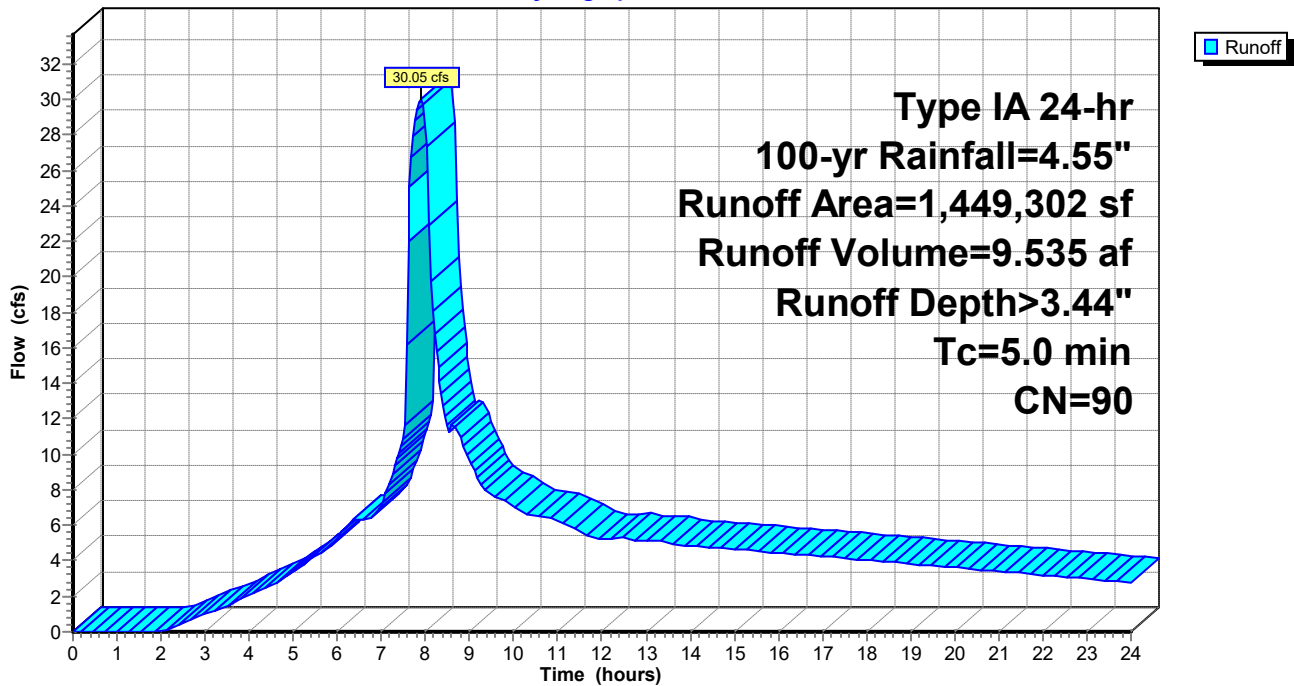
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr 100-yr Rainfall=4.55"

Area (sf)	CN	Description
621,920	98	Paved roads w/curbs & sewers, HSG B
58,238	98	Water Surface, HSG B
466,903	98	Roofs, HSG B
302,241	61	>75% Grass cover, Good, HSG B
1,449,302	90	Weighted Average
302,241		20.85% Pervious Area
1,147,061		79.15% Impervious Area

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

Subcatchment Post1: Center Basin

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment Pre1: Total Pre Developed

Runoff = 15.92 cfs @ 9.38 hrs, Volume= 10.043 af, Depth> 2.21"

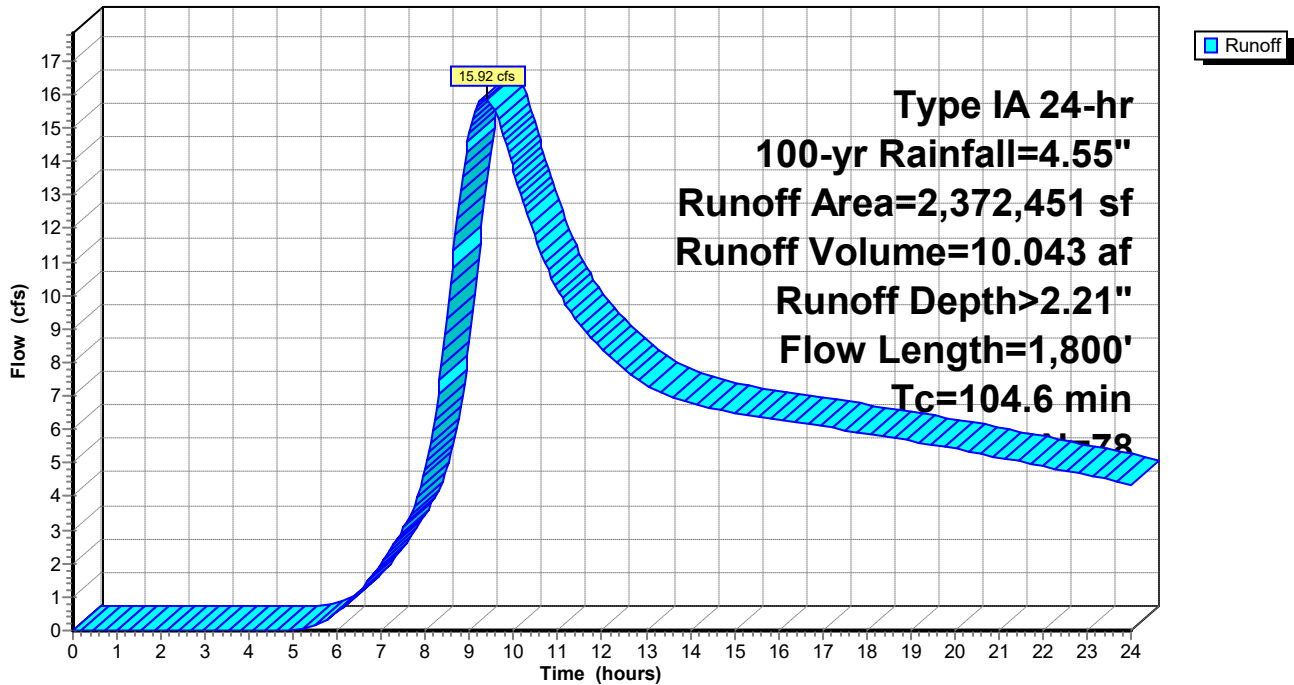
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 100-yr Rainfall=4.55"

Area (sf)	CN	Description
* 2,372,451	78	Meadow or pasture, HSG B
2,372,451		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
47.4	1,500	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns
					Kv= 11.0 fps
104.6	1,800	Total			

Subcatchment Pre1: Total Pre Developed

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment Pre1a: To Wetland A

Runoff = 9.50 cfs @ 9.11 hrs, Volume= 5.625 af, Depth> 2.23"

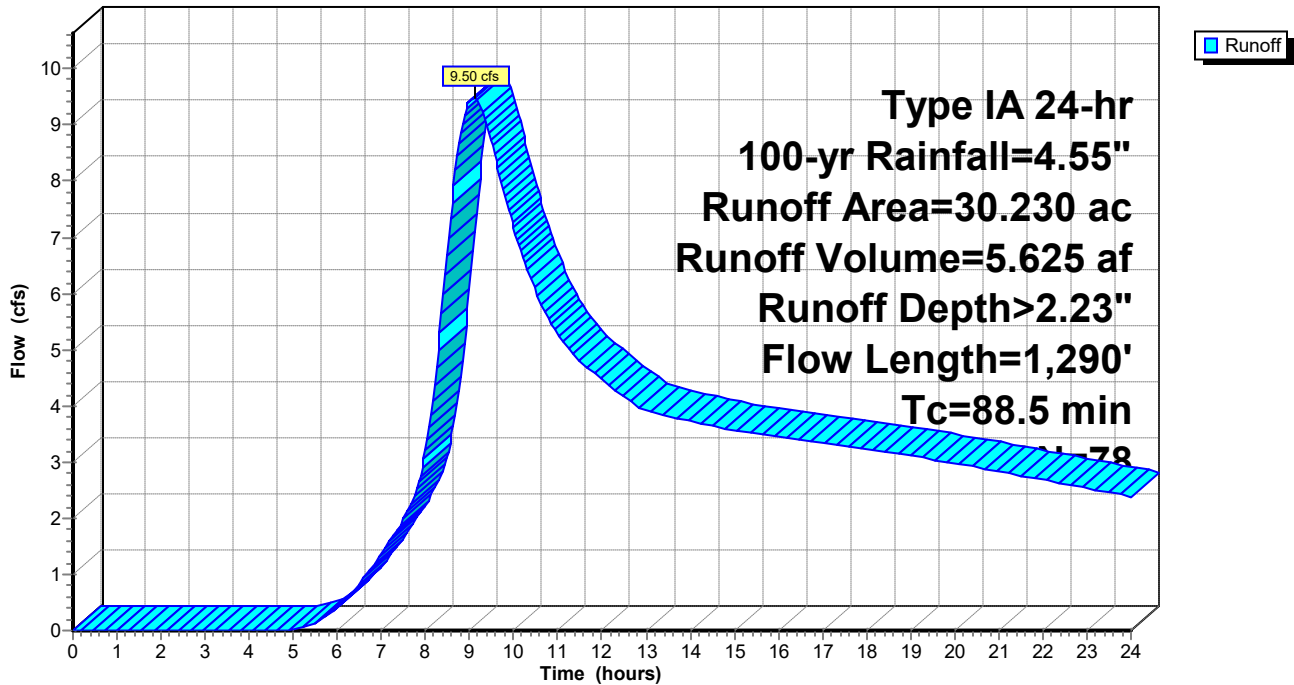
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 100-yr Rainfall=4.55"

Area (ac)	CN	Description
* 30.230	78	Meadow or pasture, HSG B
30.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.40"
31.3	990	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
88.5	1,290	Total			

Subcatchment Pre1a: To Wetland A

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Subcatchment Pre1b: Offsite

Runoff = 1.75 cfs @ 8.60 hrs, Volume= 0.877 af, Depth> 2.27"

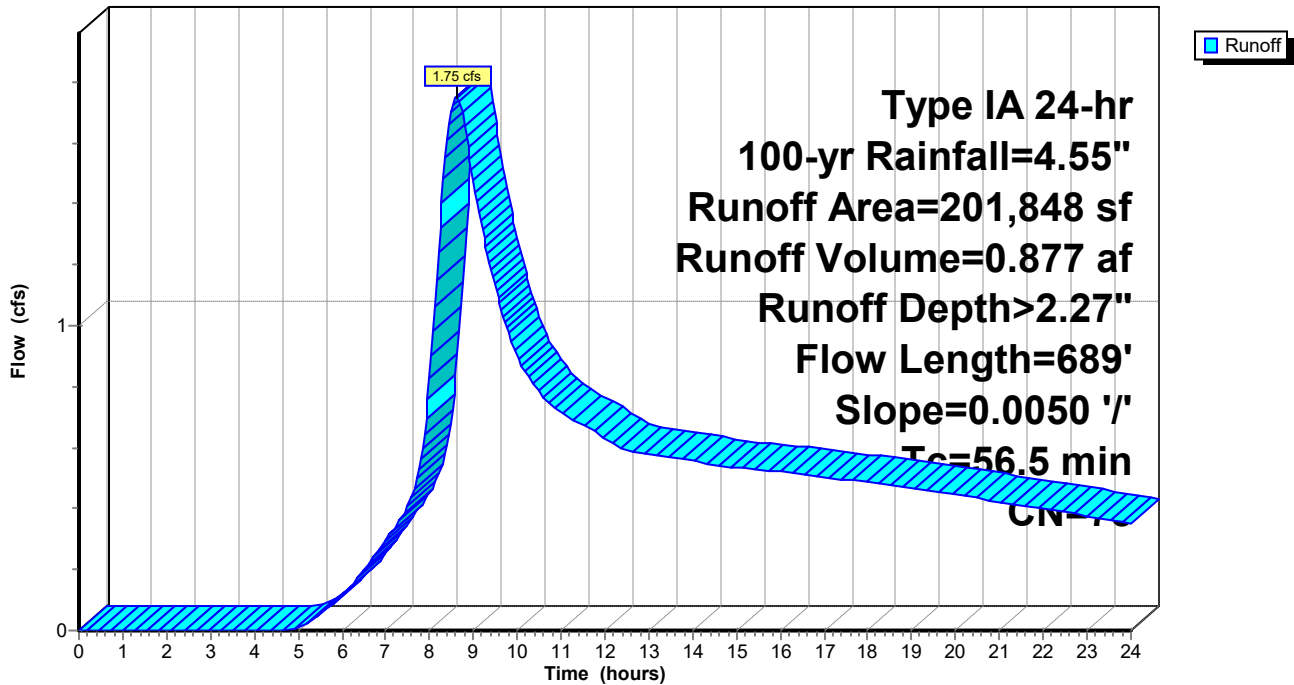
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Type IA 24-hr 100-yr Rainfall=4.55"

Area (sf)	CN	Description
* 201,848	78	Meadow or pasture, HSG B
201,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
52.3	212	0.0050	0.07		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
4.2	477	0.0050	1.91		Shallow Concentrated Flow, Gravel Roads
					Kv= 27.0 fps
56.5	689	Total			

Subcatchment Pre1b: Offsite

Hydrograph



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Type IA 24-hr 100-yr Rainfall=4.55"

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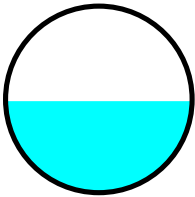
Summary for Reach 1R: 24-in CPEP Pipe

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 2.22" for 100-yr event
Inflow = 5.92 cfs @ 11.61 hrs, Volume= 5.768 af
Outflow = 5.92 cfs @ 11.61 hrs, Volume= 5.766 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.85 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.54 fps, Avg. Travel Time= 0.3 min

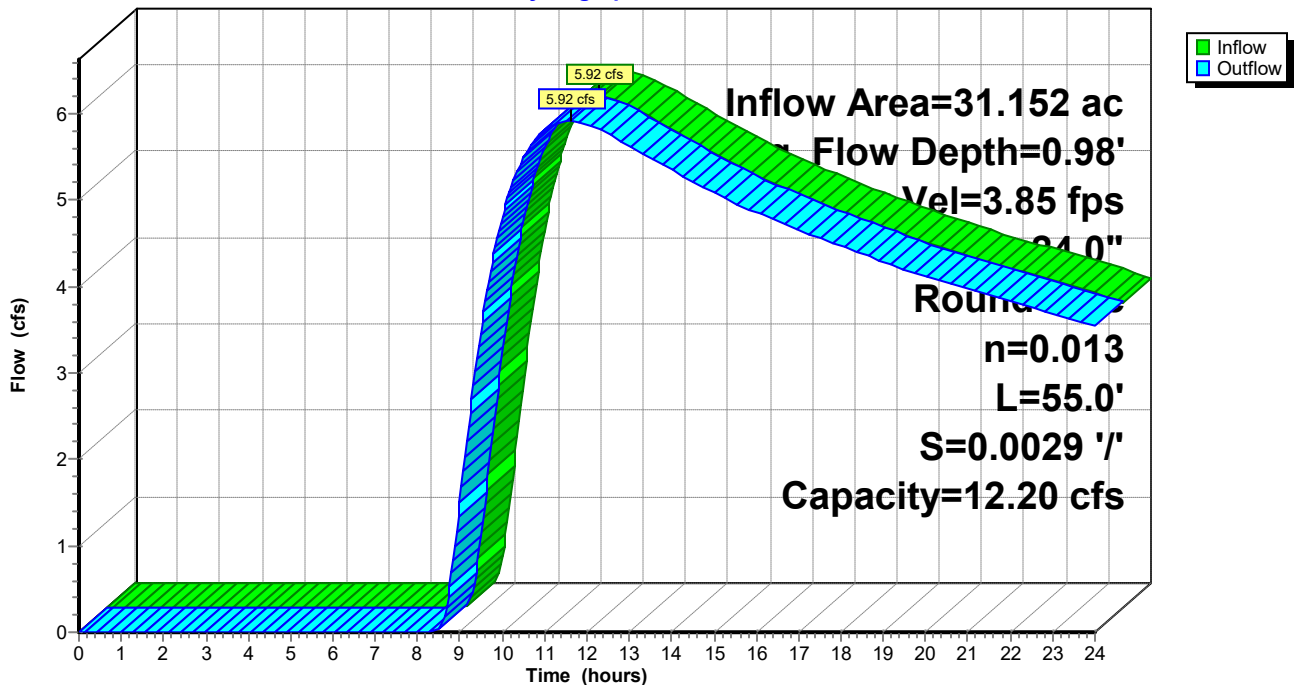
Peak Storage= 84 cf @ 11.61 hrs
Average Depth at Peak Storage= 0.98'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 12.20 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0029 '/'
Inlet Invert= 17.00', Outlet Invert= 16.84'



Reach 1R: 24-in CPEP Pipe

Hydrograph



07880259 60% Stormwater Sizing

Prepared by Gibbs & Olson

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Type IA 24-hr 100-yr Rainfall=4.55"

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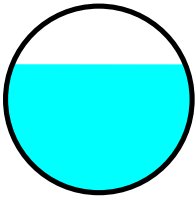
Summary for Reach 3R: 30-inch CPSSP

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 2.56" for 100-yr event
Inflow = 11.51 cfs @ 11.55 hrs, Volume= 13.744 af
Outflow = 11.51 cfs @ 11.56 hrs, Volume= 13.728 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 3.19 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.75 fps, Avg. Travel Time= 0.6 min

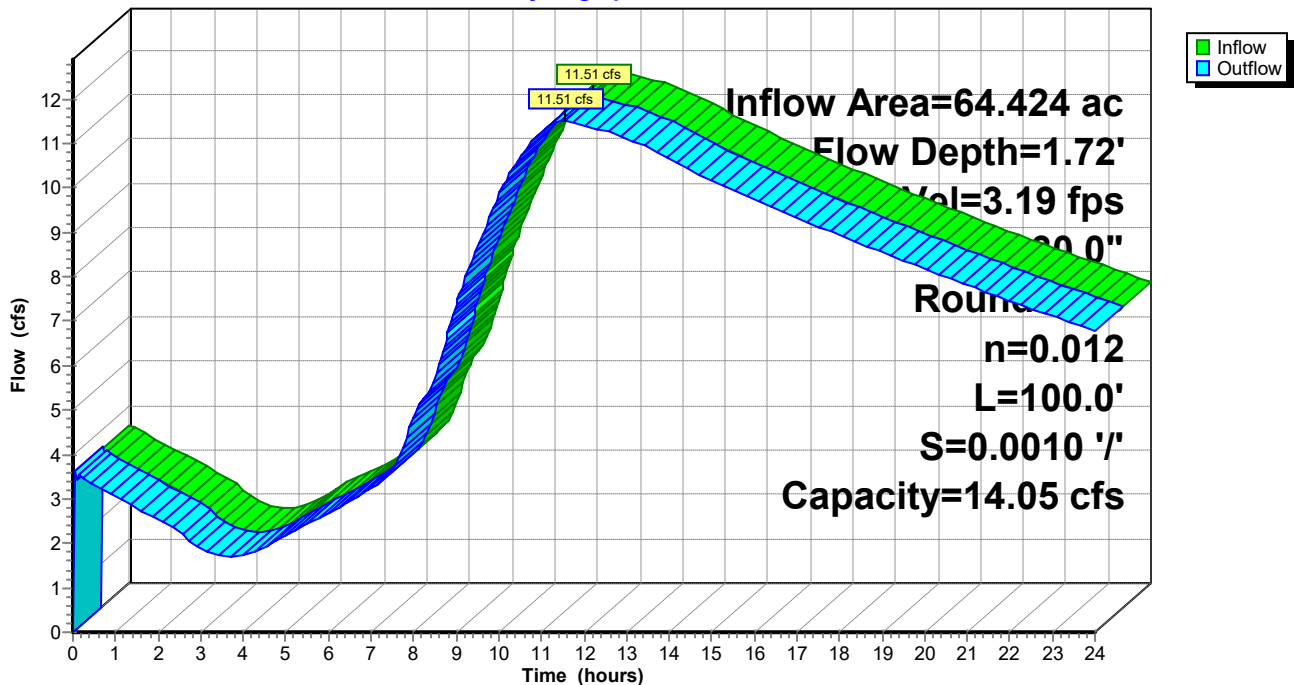
Peak Storage= 360 cf @ 11.56 hrs
Average Depth at Peak Storage= 1.72'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 14.05 cfs

30.0" Round Pipe
n= 0.012
Length= 100.0' Slope= 0.0010 '/'
Inlet Invert= 17.00', Outlet Invert= 16.90'



Reach 3R: 30-inch CPSSP

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Pond 8P: NE Pond

Inflow Area = 6.857 ac, 81.28% Impervious, Inflow Depth > 3.54" for 100-yr event
 Inflow = 6.39 cfs @ 7.89 hrs, Volume= 2.024 af
 Outflow = 1.55 cfs @ 9.82 hrs, Volume= 1.900 af, Atten= 76%, Lag= 116.0 min
 Primary = 1.55 cfs @ 9.82 hrs, Volume= 1.900 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 19.46' @ 9.82 hrs Surf.Area= 16,326 sf Storage= 21,333 cf

Plug-Flow detention time= 172.5 min calculated for 1.897 af (94% of inflow)
 Center-of-Mass det. time= 130.1 min (844.7 - 714.6)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	49,335 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	12,970	0	0
19.00	15,255	14,113	14,113
20.00	17,597	16,426	30,539
21.00	19,996	18,797	49,335

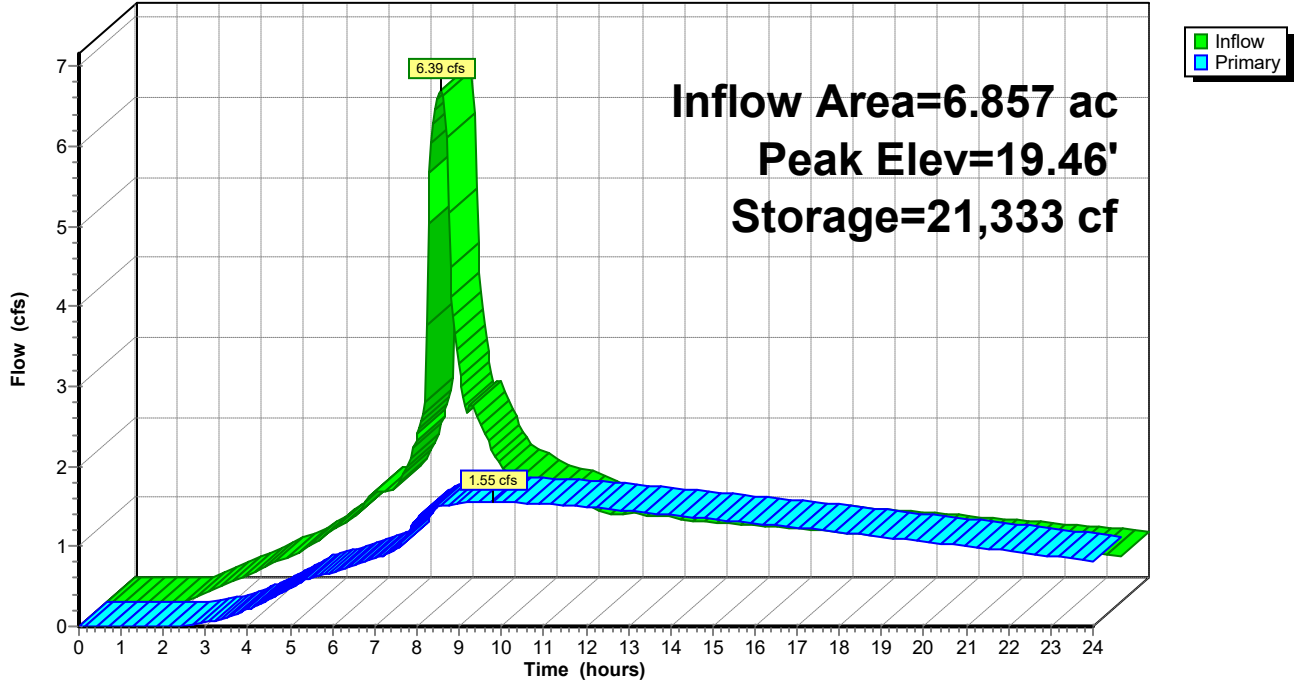
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	7.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.50'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.55 cfs @ 9.82 hrs HW=19.46' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 1.55 cfs @ 5.81 fps)
- 2=Orifice/Grate (Controls 0.00 cfs)

Pond 8P: NE Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Pond A: Center Pond

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 2.85" for 100-yr event
 Inflow = 30.05 cfs @ 7.89 hrs, Volume= 15.301 af
 Outflow = 11.51 cfs @ 11.55 hrs, Volume= 13.744 af, Atten= 62%, Lag= 219.4 min
 Primary = 11.51 cfs @ 11.55 hrs, Volume= 13.744 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Starting Elev= 17.89' Surf.Area= 50,371 sf Storage= 43,385 cf
 Peak Elev= 19.50' @ 11.55 hrs Surf.Area= 56,375 sf Storage= 129,543 cf (86,158 cf above start)

Plug-Flow detention time= 193.7 min calculated for 12.748 af (83% of inflow)
 Center-of-Mass det. time= 38.4 min (850.5 - 812.1)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	218,077 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	47,123	0	0
18.00	50,772	48,948	48,948
19.00	54,477	52,625	101,572
20.00	58,238	56,358	157,930
21.00	62,056	60,147	218,077

Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.00'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

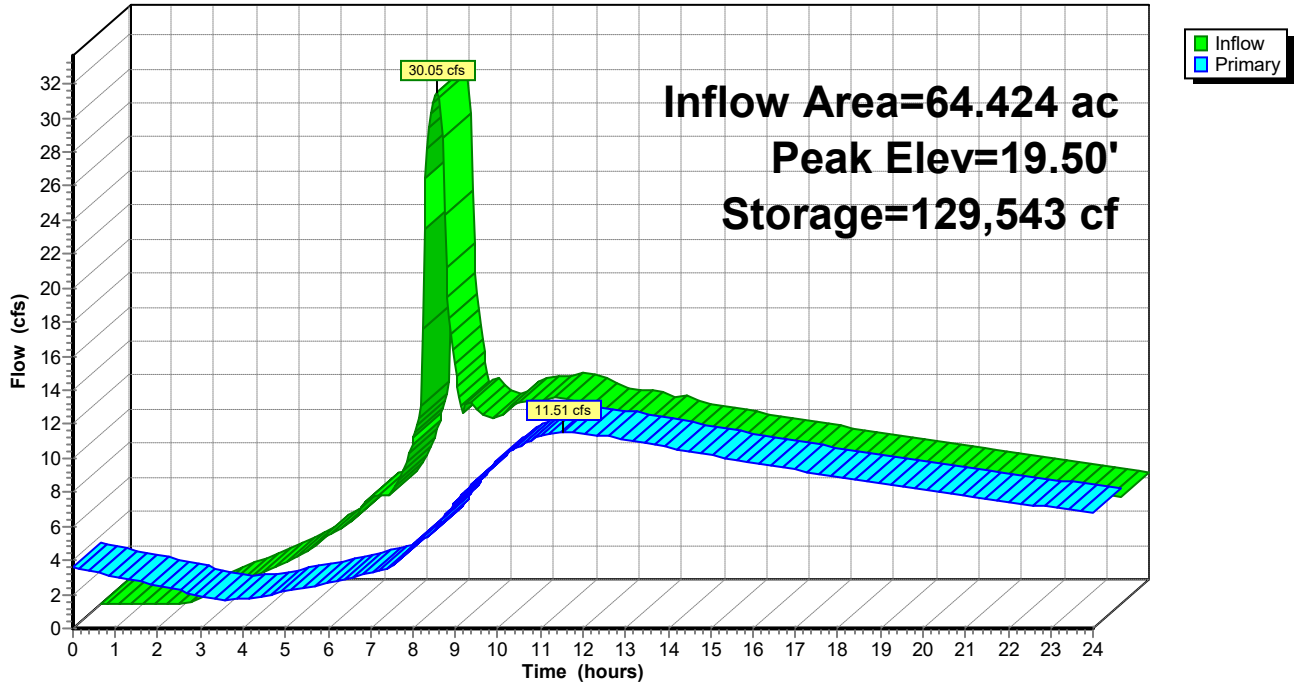
Primary OutFlow Max=11.51 cfs @ 11.55 hrs HW=19.50' (Free Discharge)

↑ **1=Orifice/Grate** (Orifice Controls 5.98 cfs @ 7.62 fps)

└ **2=Orifice/Grate** (Weir Controls 5.52 cfs @ 2.32 fps)

Pond A: Center Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Pond B: NW Pond

Inflow Area = 14.337 ac, 92.61% Impervious, Inflow Depth > 3.97" for 100-yr event
 Inflow = 14.85 cfs @ 7.87 hrs, Volume= 4.742 af
 Outflow = 8.04 cfs @ 8.21 hrs, Volume= 4.139 af, Atten= 46%, Lag= 20.4 min
 Primary = 8.04 cfs @ 8.21 hrs, Volume= 4.139 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 19.77' @ 8.21 hrs Surf.Area= 29,587 sf Storage= 47,232 cf

Plug-Flow detention time= 185.4 min calculated for 4.132 af (87% of inflow)
 Center-of-Mass det. time= 98.0 min (781.8 - 683.7)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	86,200 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	23,810	0	0
19.00	26,993	25,402	25,402
20.00	30,355	28,674	54,076
21.00	33,894	32,125	86,200

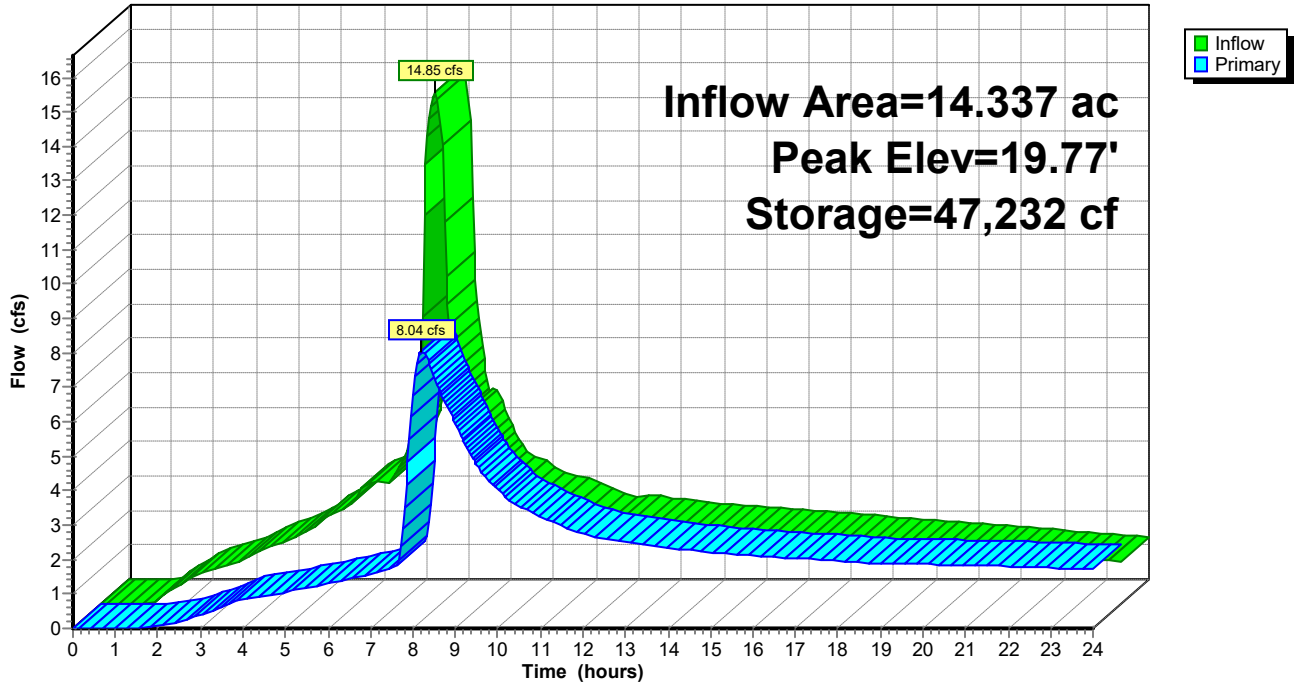
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.25'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=8.04 cfs @ 8.21 hrs HW=19.77' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 2.24 cfs @ 6.41 fps)
- 2=Orifice/Grate (Weir Controls 5.80 cfs @ 2.36 fps)

Pond B: NW Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Pond Post B: Wetland B

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 3.05" for 100-yr event
 Inflow = 12.10 cfs @ 8.40 hrs, Volume= 7.914 af
 Outflow = 5.92 cfs @ 11.61 hrs, Volume= 5.768 af, Atten= 51%, Lag= 192.4 min
 Primary = 5.92 cfs @ 11.61 hrs, Volume= 5.768 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.93' @ 11.61 hrs Surf.Area= 41,677 sf Storage= 106,522 cf

Plug-Flow detention time= 308.0 min calculated for 5.759 af (73% of inflow)
 Center-of-Mass det. time= 152.8 min (961.6 - 808.8)

Volume	Invert	Avail.Storage	Storage Description
#1	13.00'	271,767 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

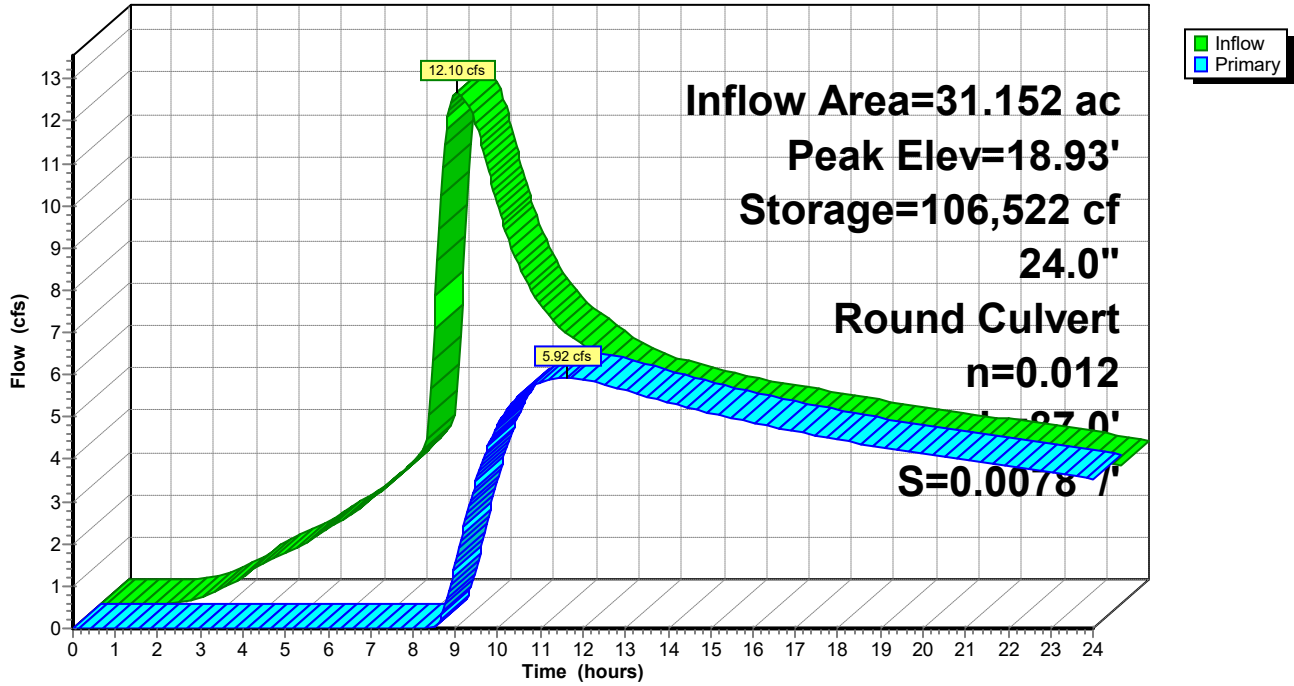
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.00	33	0	0
14.00	587	310	310
15.00	6,414	3,501	3,811
16.00	18,334	12,374	16,185
17.00	27,808	23,071	39,256
18.00	35,098	31,453	70,709
19.00	42,150	38,624	109,333
20.00	49,398	45,774	155,107
21.00	57,993	53,696	208,802
22.00	67,936	62,965	271,767

Device	Routing	Invert	Outlet Devices
#1	Primary	17.68'	24.0" Round Culvert L= 87.0' Ke= 1.000 Inlet / Outlet Invert= 17.68' / 17.00' S= 0.0078 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=5.92 cfs @ 11.61 hrs HW=18.93' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 5.92 cfs @ 2.86 fps)

Pond Post B: Wetland B

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr 100-yr Rainfall=4.55"

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Summary for Pond Pre-A: Wetland A

Inflow Area = 30.230 ac, 0.00% Impervious, Inflow Depth > 2.23" for 100-yr event
 Inflow = 9.50 cfs @ 9.11 hrs, Volume= 5.625 af
 Outflow = 9.46 cfs @ 9.17 hrs, Volume= 5.597 af, Atten= 0%, Lag= 3.4 min
 Primary = 9.46 cfs @ 9.17 hrs, Volume= 5.597 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 17.83' @ 9.17 hrs Surf.Area= 7,364 sf Storage= 3,290 cf

Plug-Flow detention time= 7.3 min calculated for 5.597 af (100% of inflow)
 Center-of-Mass det. time= 4.3 min (849.6 - 845.3)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	60,524 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	547	0	0
18.00	8,745	4,646	4,646
19.00	103,011	55,878	60,524

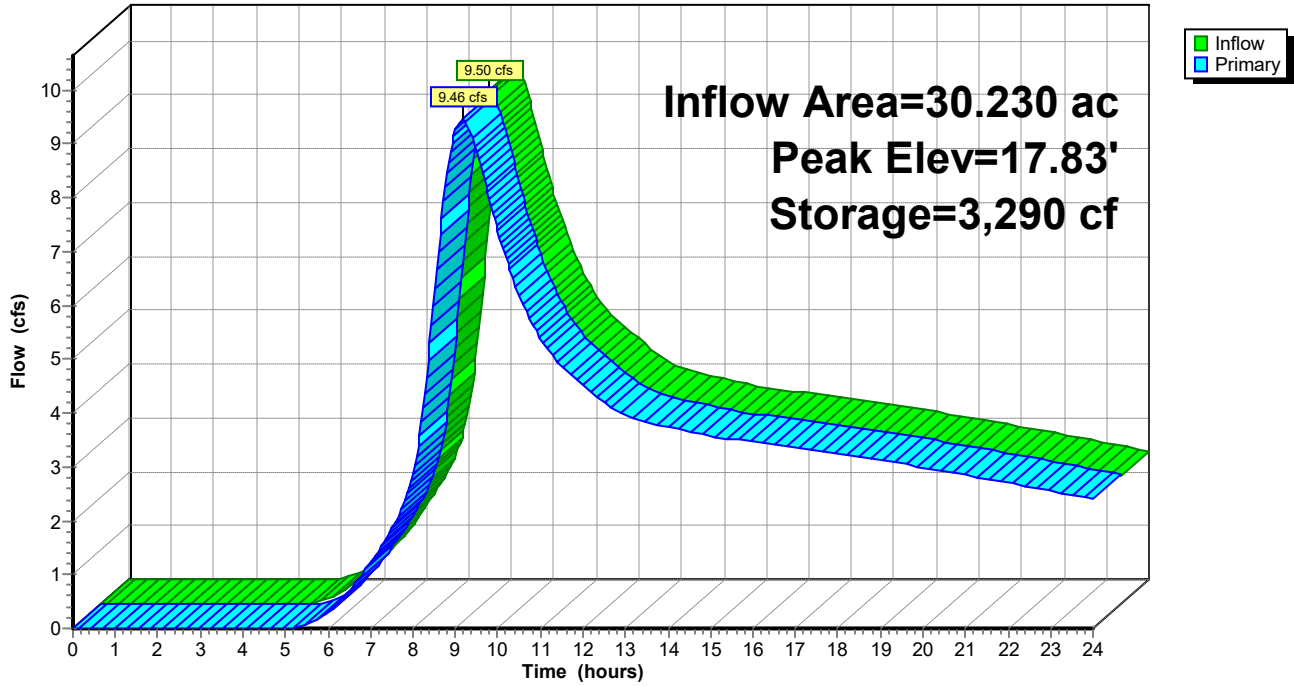
Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	161.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)
#2	Primary	17.71'	152.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)

Primary OutFlow Max=9.46 cfs @ 9.17 hrs HW=17.83' (Free Discharge)

1=Sharp-Crested Vee/Trap Weir (Weir Controls 9.41 cfs @ 2.25 fps)
 2=Sharp-Crested Vee/Trap Weir (Weir Controls 0.05 cfs @ 0.86 fps)

Pond Pre-A: Wetland A

Hydrograph



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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment 1S: CalPortland

Runoff = 0.09 cfs @ 17.37 hrs, Volume= 0.105 af, Depth> 0.24"

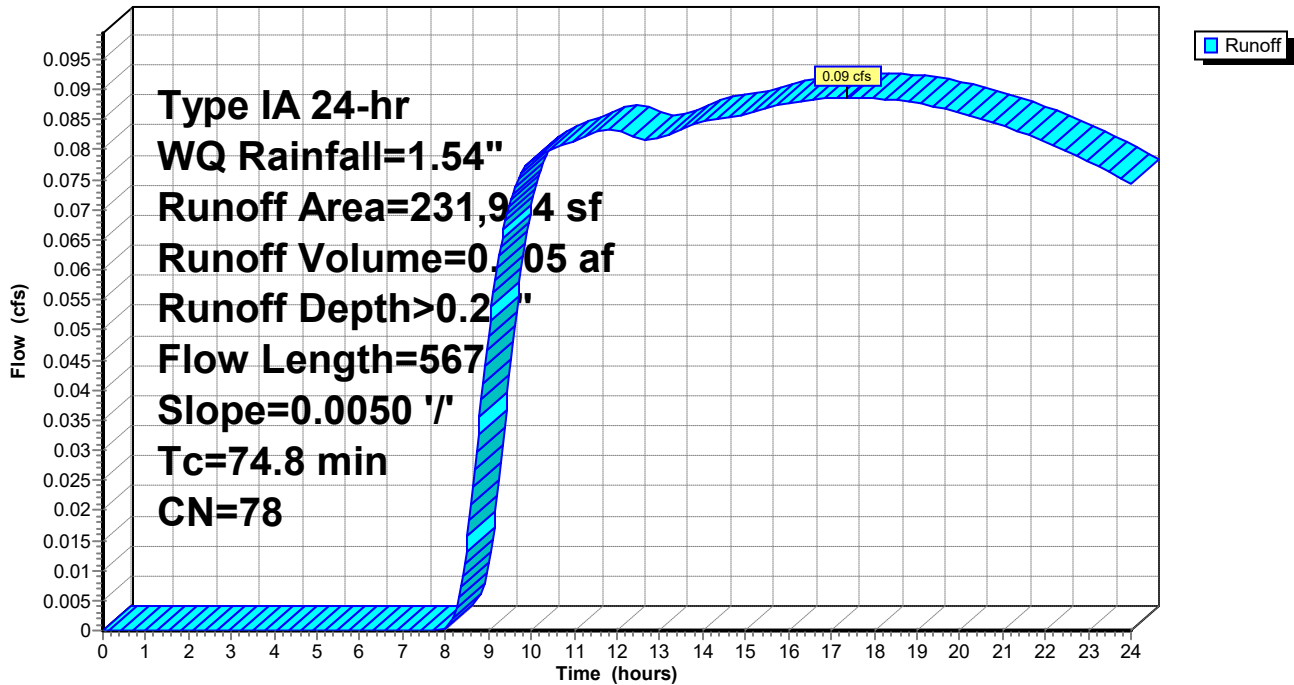
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (sf)	CN	Description
* 231,944	78	Meadow or Pasture, HSG B
231,944		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
69.1	300	0.0050	0.07		Sheet Flow, Grass: Dense n= 0.240 P2= 2.40"
5.7	267	0.0050	0.78		Shallow Concentrated Flow, Short grass, pasture, and lawns Kv= 11.0 fps
74.8	567	Total			

Subcatchment 1S: CalPortland

Hydrograph



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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment 2S: Pre West Basin

Runoff = 0.25 cfs @ 8.05 hrs, Volume= 0.297 af, Depth> 0.25"

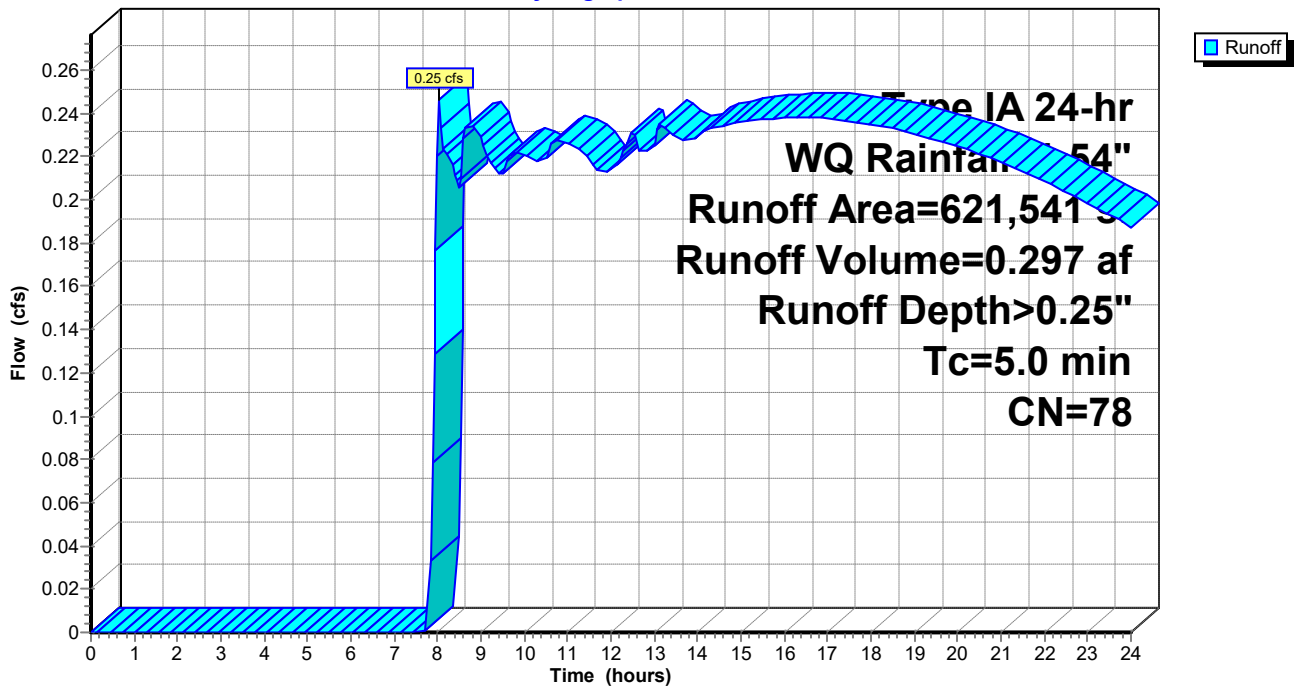
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (sf)	CN	Description
* 621,541	78	Meadow or Pasture, HSG B
621,541		100.00% Pervious Area

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

Subcatchment 2S: Pre West Basin

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment 3S: Pre East Basin

Runoff = 0.12 cfs @ 8.05 hrs, Volume= 0.143 af, Depth> 0.25"

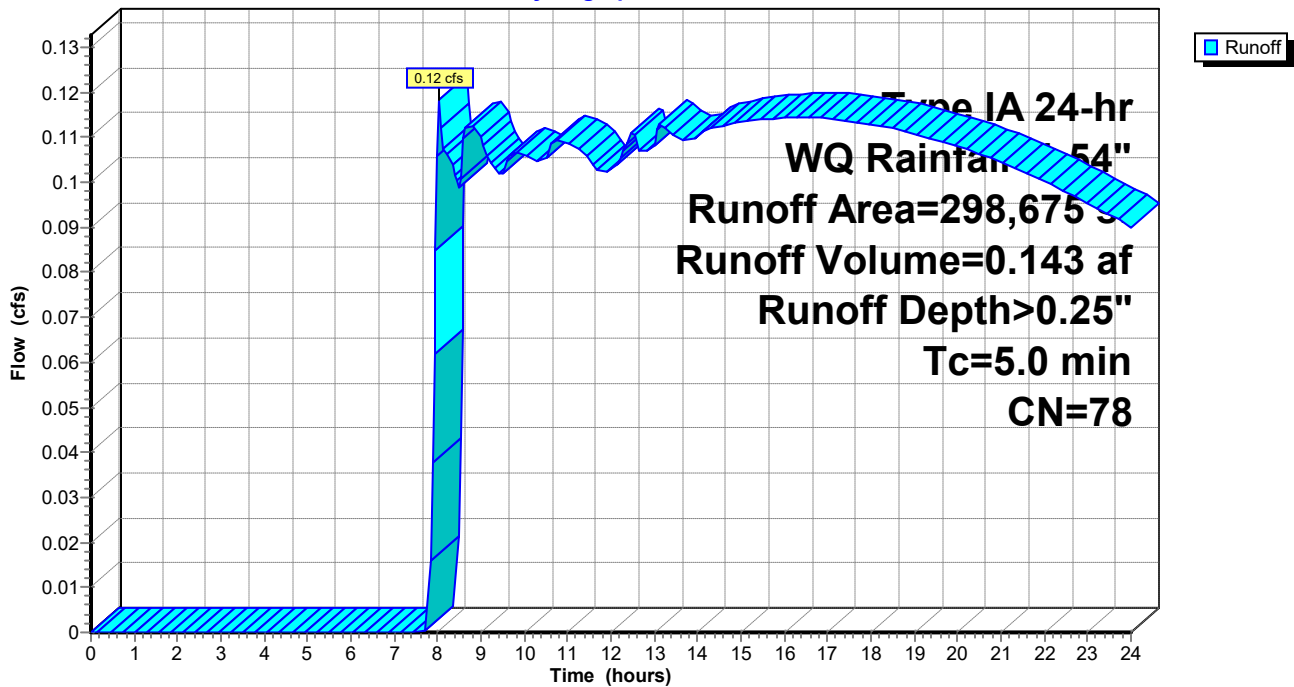
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (sf)	CN	Description
* 298,675	78	Meadow or Pasture, HSG B
298,675		100.00% Pervious Area

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

Subcatchment 3S: Pre East Basin

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment 4S: Post East Basin

Runoff = 1.07 cfs @ 7.87 hrs, Volume= 0.340 af, Depth> 1.32"

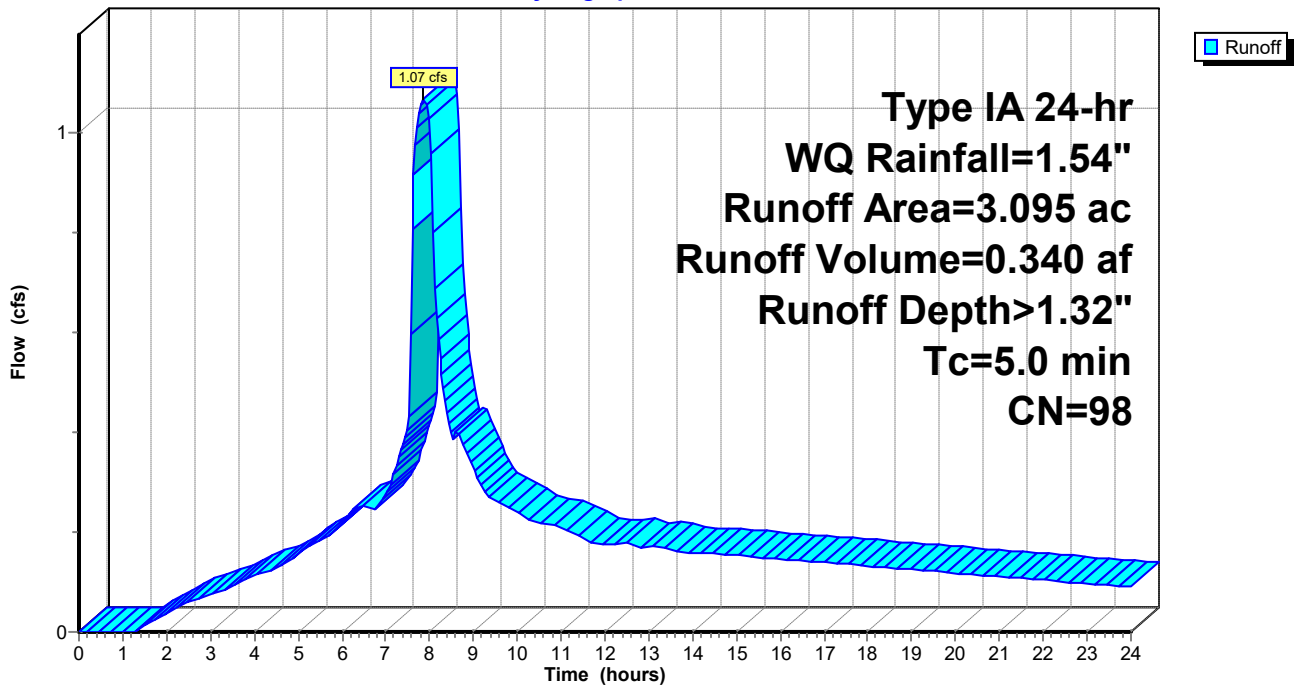
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (ac)	CN	Description
3.095	98	Unconnected roofs, HSG B
3.095		100.00% Impervious Area
3.095		100.00% Unconnected

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

Subcatchment 4S: Post East Basin

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment 6S: Post West Basin

Runoff = 3.89 cfs @ 7.91 hrs, Volume= 1.252 af, Depth> 1.05"

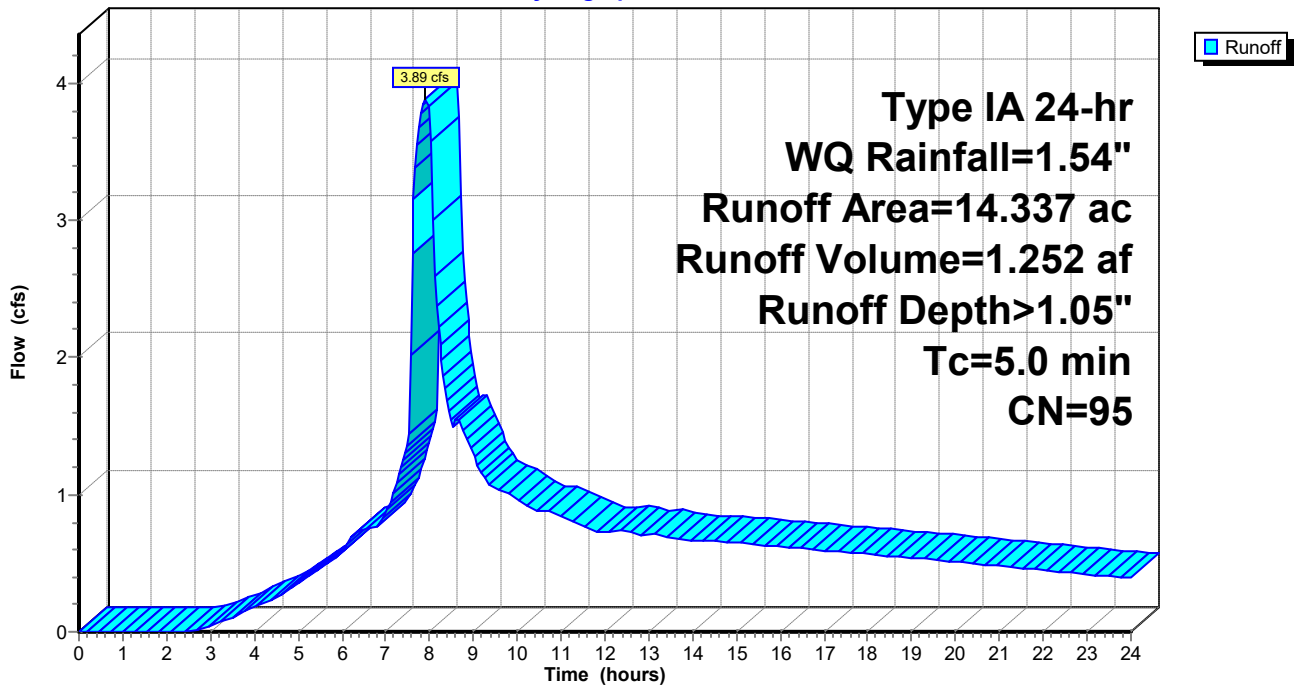
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (ac)	CN	Description
7.563	98	Roofs, HSG B
4.969	98	Paved parking, HSG B
1.059	61	>75% Grass cover, Good, HSG B
0.746	98	Water Surface, HSG B
14.337	95	Weighted Average
1.059		7.39% Pervious Area
13.278		92.61% Impervious Area

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

Subcatchment 6S: Post West Basin

Hydrograph



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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment 7S: Post East Basin

Runoff = 1.26 cfs @ 7.96 hrs, Volume= 0.441 af, Depth> 0.77"

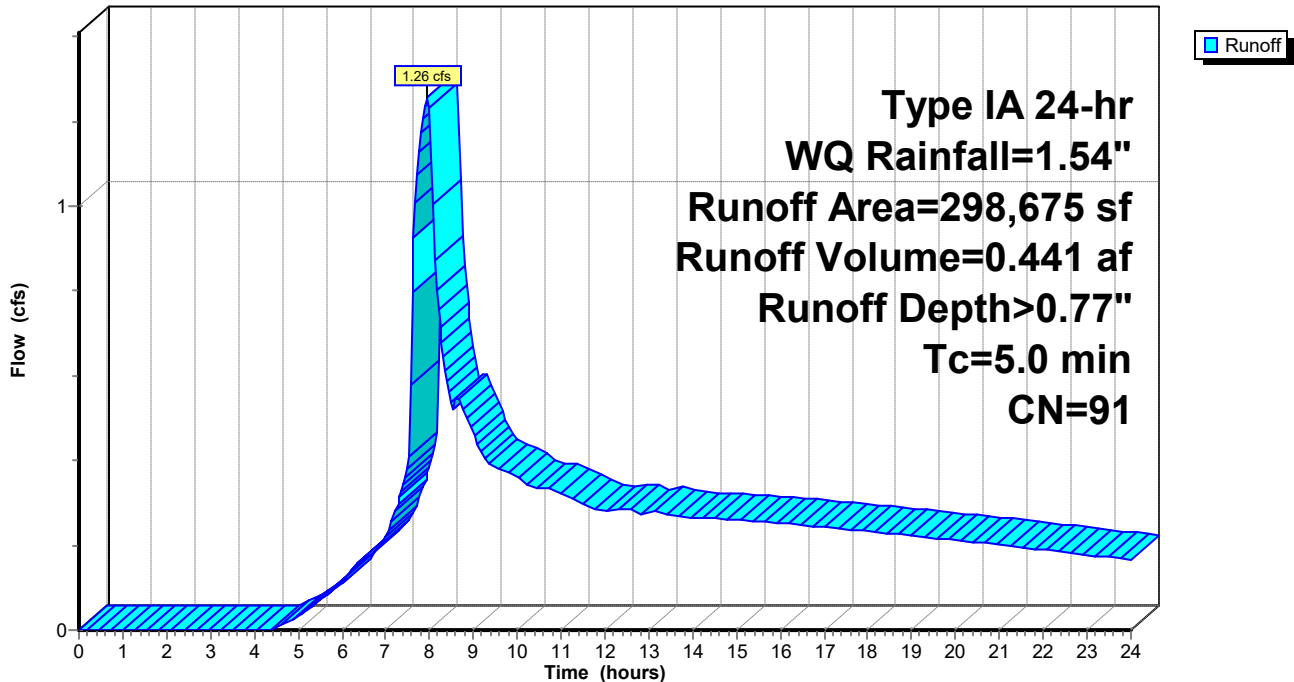
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (sf)	CN	Description
134,833	98	Unconnected roofs, HSG B
84,437	98	Paved parking, HSG B
55,925	61	>75% Grass cover, Good, HSG B
23,480	98	Water Surface, HSG B
298,675	91	Weighted Average
55,925		18.72% Pervious Area
242,750		81.28% Impervious Area
134,833		55.54% Unconnected

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

Subcatchment 7S: Post East Basin

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment Post1: Center Basin

Runoff = 5.49 cfs @ 7.97 hrs, Volume= 1.979 af, Depth> 0.71"

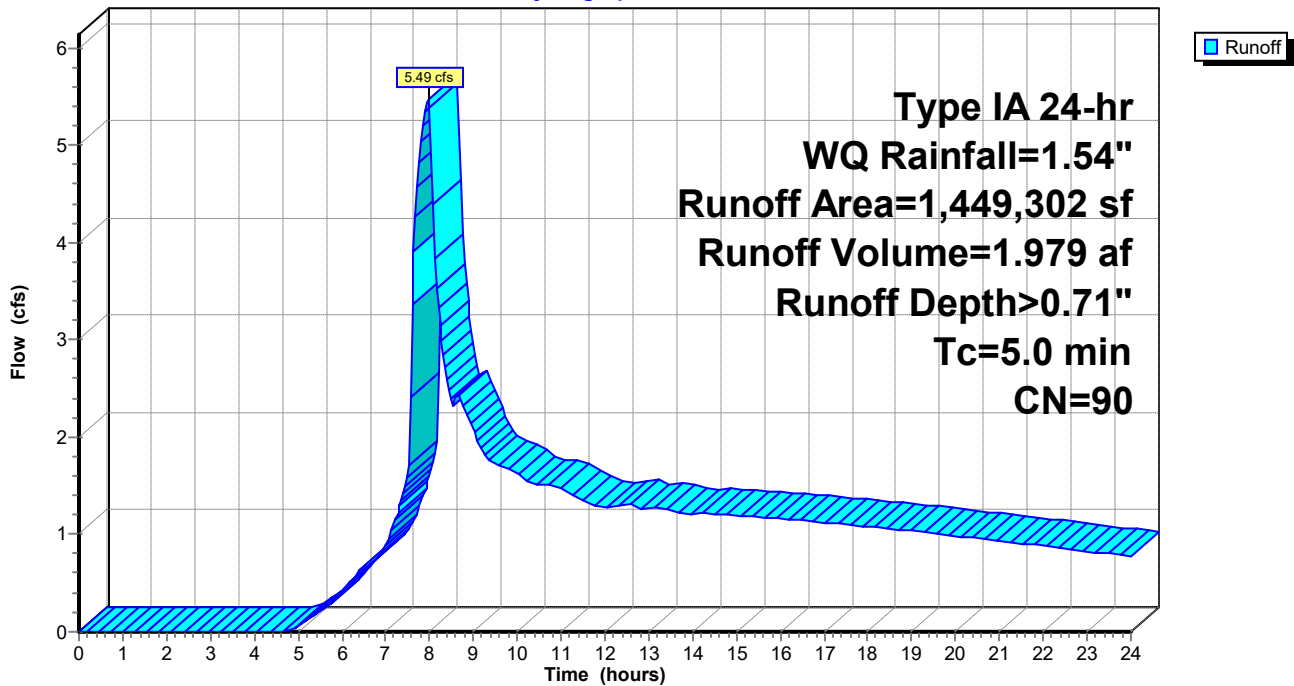
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (sf)	CN	Description
621,920	98	Paved roads w/curbs & sewers, HSG B
58,238	98	Water Surface, HSG B
466,903	98	Roofs, HSG B
302,241	61	>75% Grass cover, Good, HSG B
1,449,302	90	Weighted Average
302,241		20.85% Pervious Area
1,147,061		79.15% Impervious Area

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

Subcatchment Post1: Center Basin

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment Pre1: Total Pre Developed

Runoff = 0.91 cfs @ 18.01 hrs, Volume= 1.039 af, Depth> 0.23"

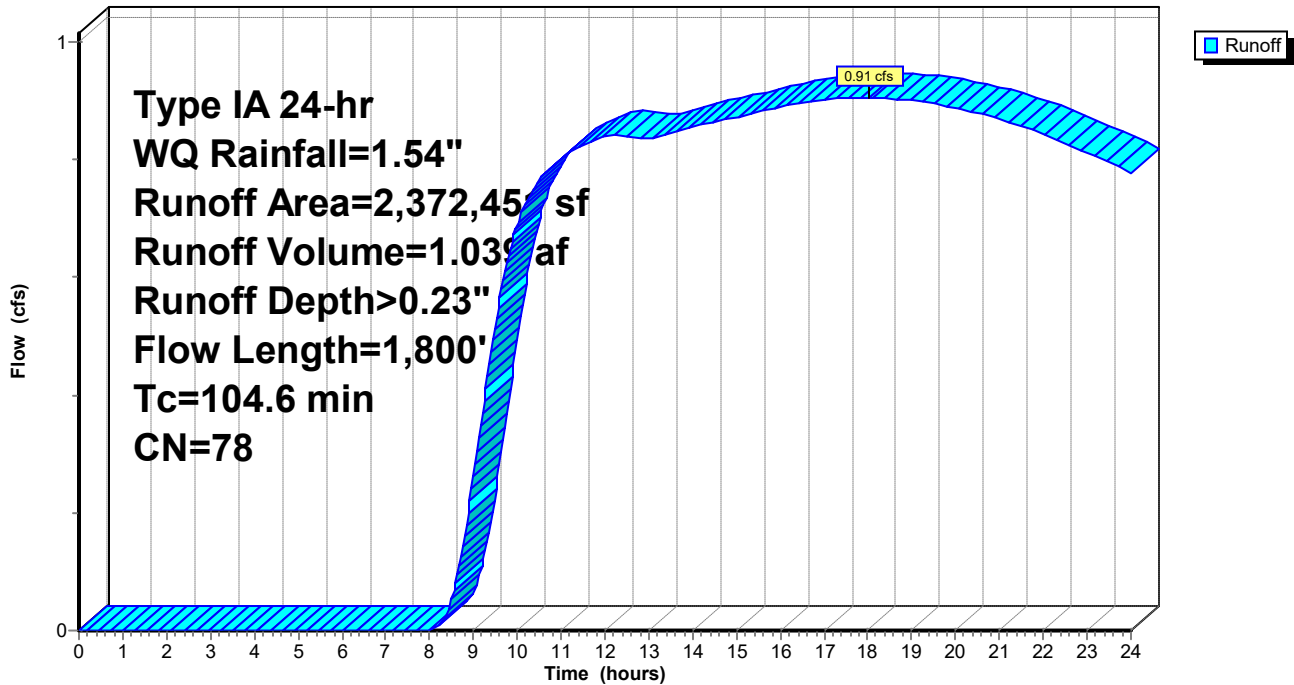
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (sf)	CN	Description
* 2,372,451	78	Meadow or pasture, HSG B
2,372,451		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
47.4	1,500	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns
					Kv= 11.0 fps
104.6	1,800	Total			

Subcatchment Pre1: Total Pre Developed

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment Pre1a: To Wetland A

Runoff = 0.50 cfs @ 17.60 hrs, Volume= 0.586 af, Depth> 0.23"

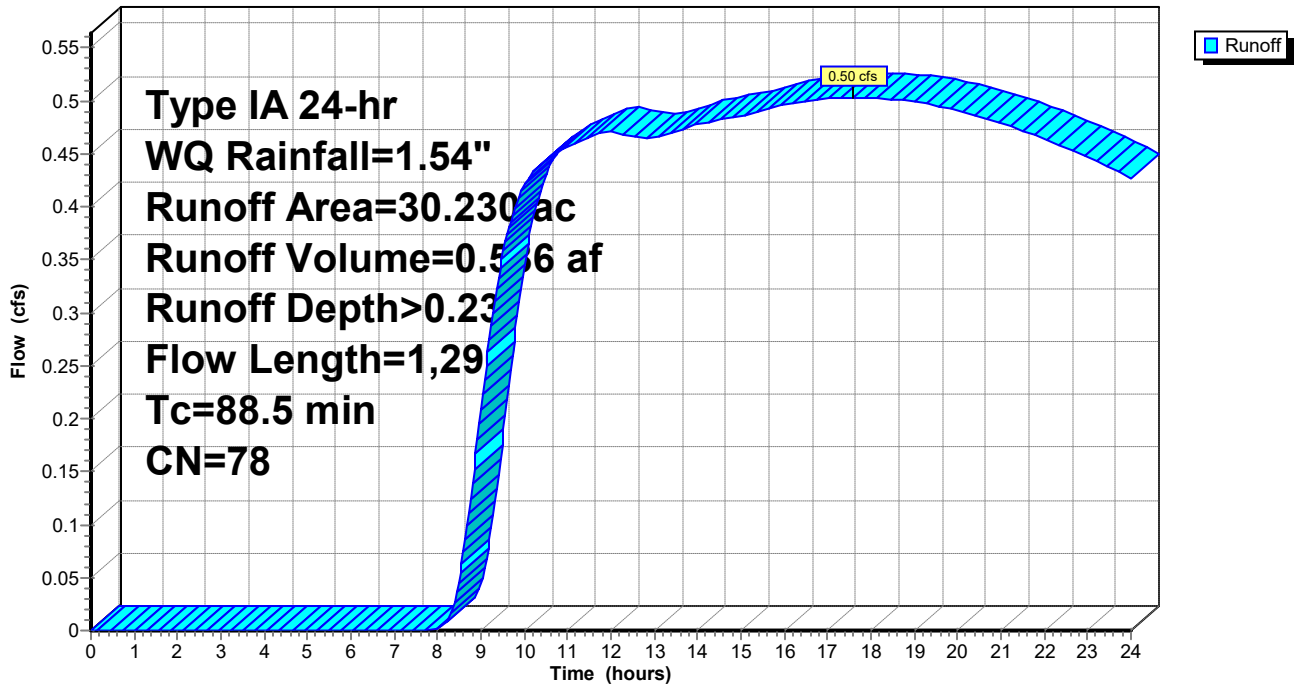
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (ac)	CN	Description
* 30.230	78	Meadow or pasture, HSG B
30.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
57.2	300	0.0080	0.09		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
31.3	990	0.0023	0.53		Shallow Concentrated Flow, Short grass, pasture, and lawns
					Kv= 11.0 fps
88.5	1,290	Total			

Subcatchment Pre1a: To Wetland A

Hydrograph



07880259 60% Stormwater Sizing

Prepared by Gibbs & Olson

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Type IA 24-hr WQ Rainfall=1.54"

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Summary for Subcatchment Pre1b: Offsite

Runoff = 0.08 cfs @ 17.01 hrs, Volume= 0.092 af, Depth> 0.24"

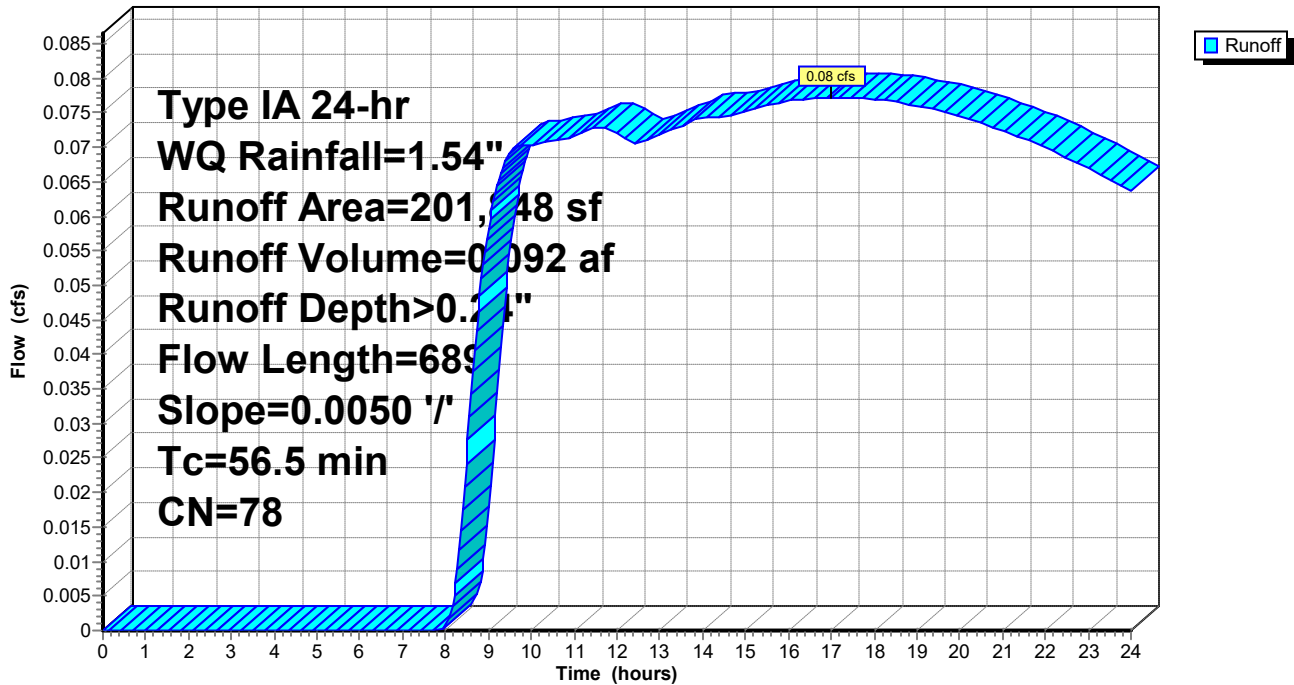
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Type IA 24-hr WQ Rainfall=1.54"

Area (sf)	CN	Description
* 201,848	78	Meadow or pasture, HSG B
201,848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
52.3	212	0.0050	0.07		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 2.40"
4.2	477	0.0050	1.91		Shallow Concentrated Flow, Gravel Roads
					Kv= 27.0 fps
56.5	689	Total			

Subcatchment Pre1b: Offsite

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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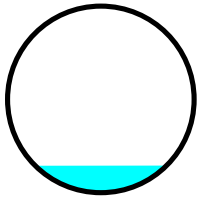
Summary for Reach 1R: 24-in CPEP Pipe

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 0.05" for WQ event
Inflow = 0.56 cfs @ 24.00 hrs, Volume= 0.124 af
Outflow = 0.56 cfs @ 24.00 hrs, Volume= 0.124 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 1.98 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.47 fps, Avg. Travel Time= 0.6 min

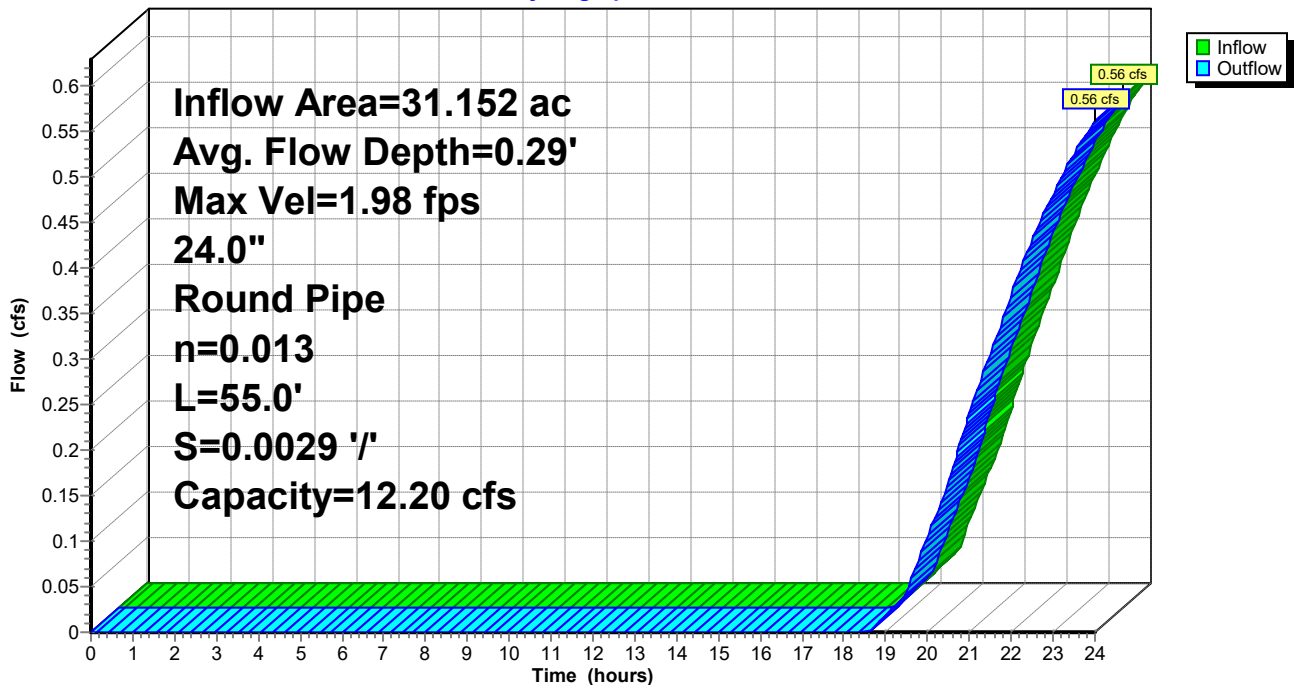
Peak Storage= 16 cf @ 24.00 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 12.20 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 55.0' Slope= 0.0029 '/'
Inlet Invert= 17.00', Outlet Invert= 16.84'



Reach 1R: 24-in CPEP Pipe

Hydrograph



07880259 60% Stormwater Sizing

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Type IA 24-hr WQ Rainfall=1.54"

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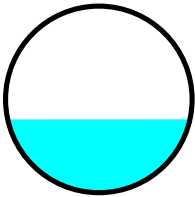
Summary for Reach 3R: 30-inch CPSSP

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 0.53" for WQ event
Inflow = 3.57 cfs @ 0.00 hrs, Volume= 2.834 af
Outflow = 3.53 cfs @ 0.12 hrs, Volume= 2.825 af, Atten= 1%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Max. Velocity= 2.56 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 0.9 min

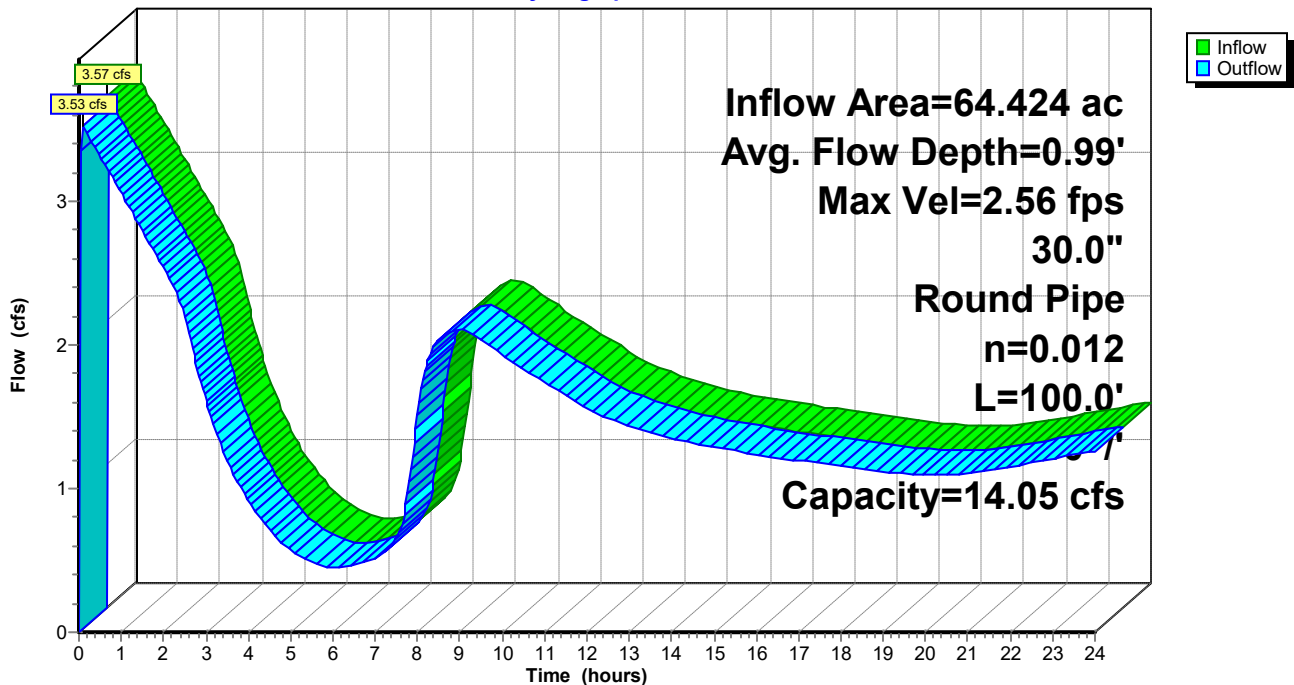
Peak Storage= 180 cf @ 0.04 hrs
Average Depth at Peak Storage= 0.99'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 14.05 cfs

30.0" Round Pipe
n= 0.012
Length= 100.0' Slope= 0.0010 '/'
Inlet Invert= 17.00', Outlet Invert= 16.90'



Reach 3R: 30-inch CPSSP

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr WQ Rainfall=1.54"

Prepared by Gibbs & Olson

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Summary for Pond 8P: NE Pond

Inflow Area = 6.857 ac, 81.28% Impervious, Inflow Depth > 0.77" for WQ event
 Inflow = 1.26 cfs @ 7.96 hrs, Volume= 0.441 af
 Outflow = 0.58 cfs @ 8.41 hrs, Volume= 0.412 af, Atten= 54%, Lag= 27.2 min
 Primary = 0.58 cfs @ 8.41 hrs, Volume= 0.412 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.21' @ 8.41 hrs Surf.Area= 13,450 sf Storage= 2,773 cf

Plug-Flow detention time= 95.2 min calculated for 0.411 af (93% of inflow)
 Center-of-Mass det. time= 54.4 min (852.7 - 798.3)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	49,335 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	12,970	0	0
19.00	15,255	14,113	14,113
20.00	17,597	16,426	30,539
21.00	19,996	18,797	49,335

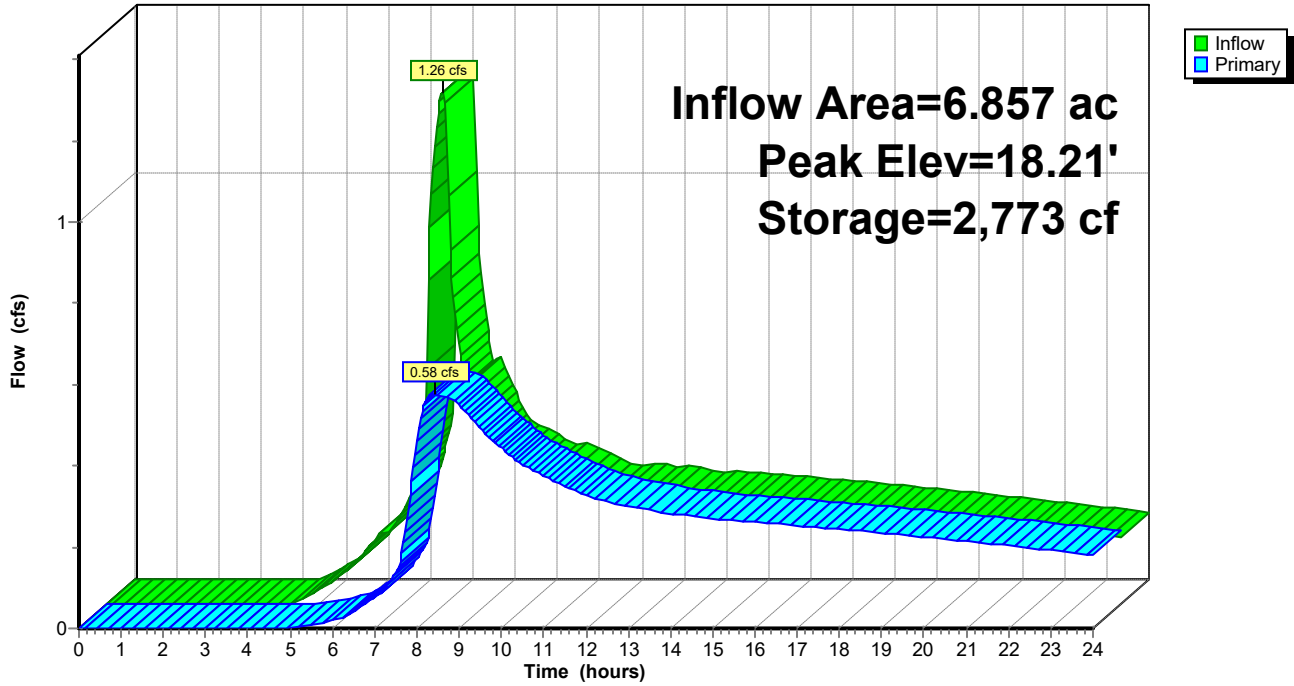
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	7.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.50'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.58 cfs @ 8.41 hrs HW=18.21' (Free Discharge)

- 1=Orifice/Grate (Weir Controls 0.58 cfs @ 1.50 fps)
- 2=Orifice/Grate (Controls 0.00 cfs)

Pond 8P: NE Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr WQ Rainfall=1.54"

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Summary for Pond A: Center Pond

Inflow Area = 64.424 ac, 70.14% Impervious, Inflow Depth > 0.39" for WQ event
 Inflow = 5.49 cfs @ 7.97 hrs, Volume= 2.102 af
 Outflow = 3.57 cfs @ 0.00 hrs, Volume= 2.834 af, Atten= 35%, Lag= 0.0 min
 Primary = 3.57 cfs @ 0.00 hrs, Volume= 2.834 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Starting Elev= 17.89' Surf.Area= 50,371 sf Storage= 43,385 cf
 Peak Elev= 17.89' @ 0.00 hrs Surf.Area= 50,371 sf Storage= 43,385 cf

Plug-Flow detention time= 142.9 min calculated for 1.838 af (87% of inflow)
 Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	218,077 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	47,123	0	0
18.00	50,772	48,948	48,948
19.00	54,477	52,625	101,572
20.00	58,238	56,358	157,930
21.00	62,056	60,147	218,077

Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	12.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.00'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.57 cfs @ 0.00 hrs HW=17.89' (Free Discharge)

1=Orifice/Grate (Orifice Controls 3.57 cfs @ 4.54 fps)

2=Orifice/Grate (Controls 0.00 cfs)

07880259 60% Stormwater Sizing

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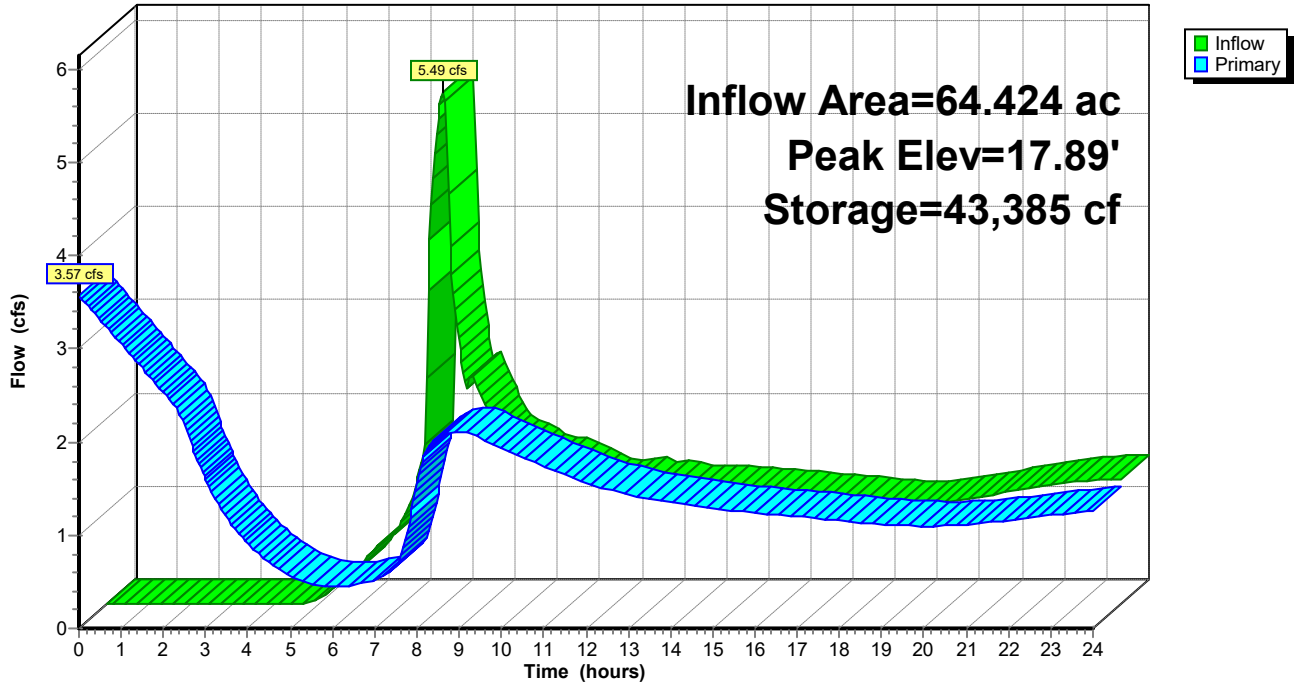
Type IA 24-hr WQ Rainfall=1.54"

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Pond A: Center Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr WQ Rainfall=1.54"

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Summary for Pond B: NW Pond

Inflow Area = 14.337 ac, 92.61% Impervious, Inflow Depth > 1.05" for WQ event
 Inflow = 3.89 cfs @ 7.91 hrs, Volume= 1.252 af
 Outflow = 1.17 cfs @ 9.17 hrs, Volume= 1.164 af, Atten= 70%, Lag= 75.5 min
 Primary = 1.17 cfs @ 9.17 hrs, Volume= 1.164 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.48' @ 9.17 hrs Surf.Area= 25,354 sf Storage= 11,920 cf

Plug-Flow detention time= 139.7 min calculated for 1.164 af (93% of inflow)
 Center-of-Mass det. time= 92.7 min (836.9 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1	18.00'	86,200 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.00	23,810	0	0
19.00	26,993	25,402	25,402
20.00	30,355	28,674	54,076
21.00	33,894	32,125	86,200

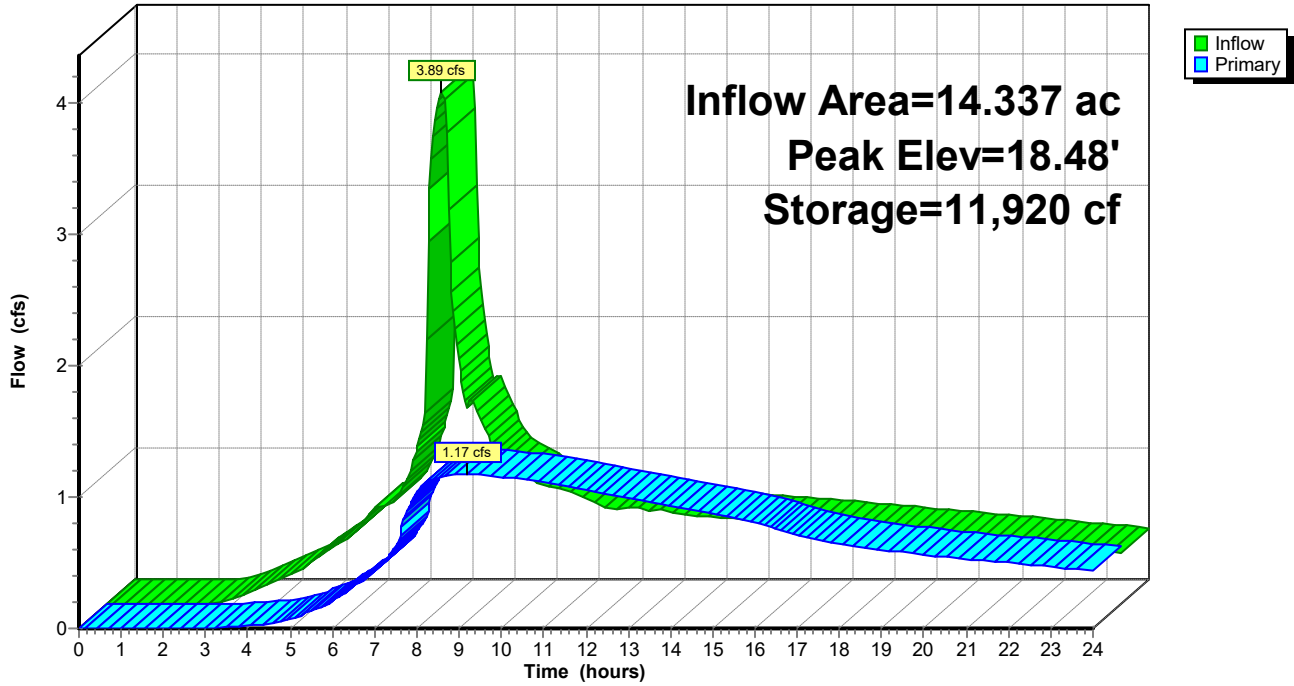
Device	Routing	Invert	Outlet Devices
#1	Primary	18.00'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#2	Primary	19.25'	18.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.17 cfs @ 9.17 hrs HW=18.48' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 1.17 cfs @ 3.35 fps)
- 2=Orifice/Grate (Controls 0.00 cfs)

Pond B: NW Pond

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr WQ Rainfall=1.54"

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Summary for Pond Post B: Wetland B

Inflow Area = 31.152 ac, 60.51% Impervious, Inflow Depth > 0.68" for WQ event
 Inflow = 1.83 cfs @ 9.07 hrs, Volume= 1.773 af
 Outflow = 0.56 cfs @ 24.00 hrs, Volume= 0.124 af, Atten= 69%, Lag= 895.7 min
 Primary = 0.56 cfs @ 24.00 hrs, Volume= 0.124 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 18.03' @ 24.00 hrs Surf.Area= 35,316 sf Storage= 71,796 cf

Plug-Flow detention time= 915.6 min calculated for 0.124 af (7% of inflow)
 Center-of-Mass det. time= 483.6 min (1,340.5 - 856.8)

Volume	Invert	Avail.Storage	Storage Description
#1	13.00'	271,767 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
13.00	33	0	0
14.00	587	310	310
15.00	6,414	3,501	3,811
16.00	18,334	12,374	16,185
17.00	27,808	23,071	39,256
18.00	35,098	31,453	70,709
19.00	42,150	38,624	109,333
20.00	49,398	45,774	155,107
21.00	57,993	53,696	208,802
22.00	67,936	62,965	271,767

Device	Routing	Invert	Outlet Devices
#1	Primary	17.68'	24.0" Round Culvert L= 87.0' Ke= 1.000 Inlet / Outlet Invert= 17.68' / 17.00' S= 0.0078 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=0.56 cfs @ 24.00 hrs HW=18.03' (Free Discharge)

↑**1=Culvert** (Inlet Controls 0.56 cfs @ 1.51 fps)

07880259 60% Stormwater Sizing

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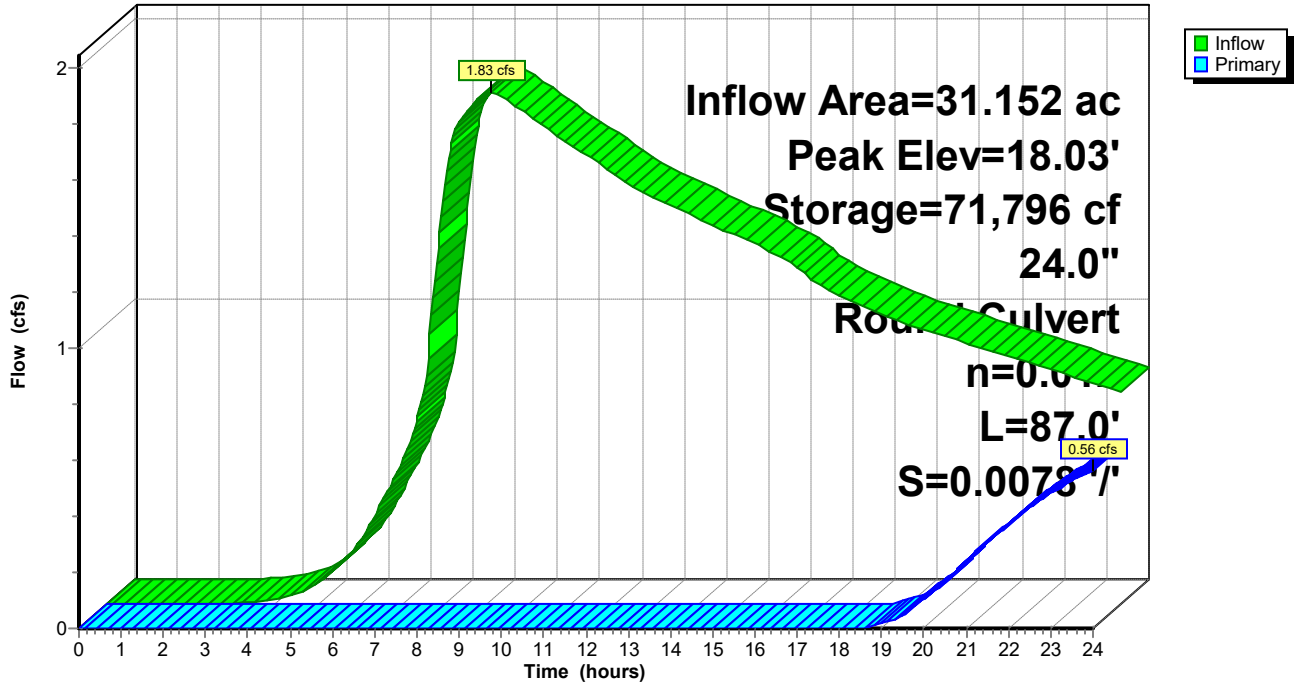
Type IA 24-hr WQ Rainfall=1.54"

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Pond Post B: Wetland B

Hydrograph



07880259 60% Stormwater Sizing

Type IA 24-hr WQ Rainfall=1.54"

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Summary for Pond Pre-A: Wetland A

Inflow Area = 30.230 ac, 0.00% Impervious, Inflow Depth > 0.23" for WQ event
 Inflow = 0.50 cfs @ 17.60 hrs, Volume= 0.586 af
 Outflow = 0.50 cfs @ 17.84 hrs, Volume= 0.577 af, Atten= 0%, Lag= 14.1 min
 Primary = 0.50 cfs @ 17.84 hrs, Volume= 0.577 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
 Peak Elev= 17.26' @ 17.84 hrs Surf.Area= 2,659 sf Storage= 413 cf

Plug-Flow detention time= 14.0 min calculated for 0.577 af (99% of inflow)
 Center-of-Mass det. time= 7.5 min (1,002.0 - 994.5)

Volume	Invert	Avail.Storage	Storage Description
#1	17.00'	60,524 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
17.00	547	0	0
18.00	8,745	4,646	4,646
19.00	103,011	55,878	60,524

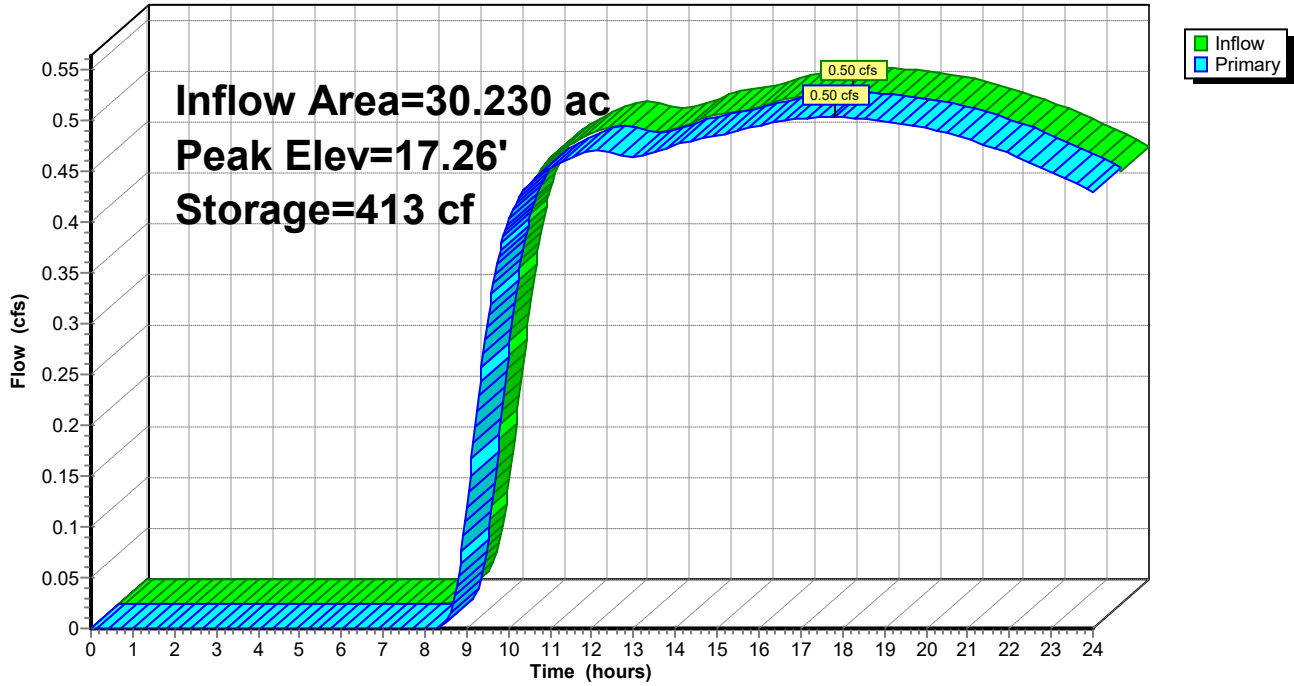
Device	Routing	Invert	Outlet Devices
#1	Primary	17.00'	161.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)
#2	Primary	17.71'	152.2 deg Sharp-Crested Vee/Trap Weir Cv= 2.47 (C= 3.09)

Primary OutFlow Max=0.50 cfs @ 17.84 hrs HW=17.26' (Free Discharge)

- 1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.50 cfs @ 1.25 fps)
- 2=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Pond Pre-A: Wetland A

Hydrograph



WWHM2012
PROJECT REPORT

General Model Information

Project Name: 07880259 Rose Way Extension
Site Name: Bozorth
Site Address: N Pekin Road
City: Woodland, WA
Report Date: 11/14/2023
Gage: Longview
Data Start: 1955/10/01
Data End: 2009/09/30
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2021/08/18
Version: 4.2.18

POC Thresholds

Low Flow Threshold for POC1: 50 Percent of the 2 Year
High Flow Threshold for POC1: 50 Year

Landuse Basin Data

Predeveloped Land Use

Rose Way Extension (Full Width)

Bypass: No

GroundWater: No

Pervious Land Use acre
A B, Pasture, Flat 1.5543

Pervious Total 1.5543

Impervious Land Use acre

Impervious Total 0

Basin Total 1.5543

Element Flows To:
Surface Interflow Groundwater

DRAFT

Mitigated Land Use

Rose Way Extension (Full Width)

Bypass:	No
GroundWater:	No
Pervious Land Use A B, Lawn, Flat	acre 0.2062
Pervious Total	0.2062
Impervious Land Use ROADS FLAT	acre 1.3481
Impervious Total	1.3481
Basin Total	1.5543

Element Flows To:
Surface Interflow Groundwater
Surface Bioretention Surface Bioretention

DRAFT

Routing Elements
Predeveloped Routing

DRAFT

Mitigated Routing

Rose Way Bioretention

Bottom Length:	1410.00 ft.
Bottom Width:	2.00 ft.
Material thickness of first layer:	0.25
Material type for first layer:	ASTM 100
Material thickness of second layer:	1.5
Material type for second layer:	SMMWW
Material thickness of third layer:	2
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	2.46
Infiltration safety factor:	0.4
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	250.869
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	250.869
Percent Infiltrated:	100
Total Precip Applied to Facility:	65.029
Total Evap From Facility:	26.634
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	0.5
Offset (in.):	6
Flow Through Underdrain (ac-ft.):	0
Total Outflow (ac-ft.):	250.869
Percent Through Underdrain:	0
Discharge Structure	
Riser Height:	1 ft.
Riser Diameter:	6 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.8057	0.0000	0.0000	0.0000
0.0577	0.8057	0.0020	0.0000	0.0000
0.1154	0.7941	0.0044	0.0000	0.0000
0.1731	0.7826	0.0071	0.0000	0.0000
0.2308	0.7710	0.0102	0.0000	0.0000
0.2885	0.7594	0.0128	0.0000	0.0000
0.3462	0.7479	0.0158	0.0000	0.0014
0.4038	0.7363	0.0190	0.0000	0.0027
0.4615	0.7248	0.0224	0.0000	0.0038
0.5192	0.7132	0.0261	0.0000	0.0063
0.5769	0.7017	0.0301	0.0000	0.0082
0.6346	0.6902	0.0343	0.0000	0.0123
0.6923	0.6787	0.0388	0.0000	0.0153
0.7500	0.6672	0.0436	0.0000	0.0216
0.8077	0.6556	0.0486	0.0000	0.0261
0.8654	0.6441	0.0539	0.0000	0.0351
0.9231	0.6326	0.0594	0.0000	0.0414
0.9808	0.6212	0.0652	0.0000	0.0538
1.0385	0.6097	0.0713	0.0000	0.0622

1.0962	0.5982	0.0776	0.0000	0.0786
1.1538	0.5867	0.0842	0.0000	0.0895
1.2115	0.5752	0.0911	0.0000	0.1106
1.2692	0.5638	0.0982	0.0000	0.1246
1.3269	0.5523	0.1056	0.0000	0.1510
1.3846	0.5409	0.1132	0.0000	0.1684
1.4423	0.5294	0.1211	0.0000	0.2010
1.5000	0.5180	0.1293	0.0000	0.2223
1.5577	0.5065	0.1377	0.0000	0.2617
1.6154	0.4951	0.1464	0.0000	0.2874
1.6731	0.4837	0.1554	0.0000	0.3345
1.7308	0.4722	0.1646	0.0000	0.3651
1.7885	0.4608	0.1744	0.0000	0.4120
1.8462	0.4494	0.1845	0.0000	0.4233
1.9038	0.4380	0.1948	0.0000	0.4346
1.9615	0.4266	0.2055	0.0000	0.4459
2.0192	0.4152	0.2164	0.0000	0.4572
2.0769	0.4038	0.2275	0.0000	0.4686
2.1346	0.3924	0.2390	0.0000	0.4799
2.1923	0.3811	0.2507	0.0007	0.4912
2.2500	0.3697	0.2627	0.0010	0.5026
2.3077	0.3583	0.2749	0.0016	0.5139
2.3654	0.3470	0.2875	0.0021	0.5253
2.4231	0.3356	0.3003	0.0026	0.5366
2.4808	0.3243	0.3134	0.0031	0.5480
2.5385	0.3129	0.3267	0.0033	0.5594
2.5962	0.3016	0.3404	0.0036	0.5707
2.6538	0.2903	0.3543	0.0039	0.5821
2.7115	0.2789	0.3685	0.0042	0.5935
2.7692	0.2676	0.3829	0.0045	0.6049
2.8269	0.2563	0.3977	0.0048	0.6163
2.8846	0.2450	0.4127	0.0050	0.6277
2.9423	0.2337	0.4280	0.0053	0.6391
3.0000	0.2224	0.4435	0.0055	0.6505
3.0577	0.2111	0.4594	0.0057	0.6620
3.1154	0.1998	0.4755	0.0060	0.6734
3.1731	0.1885	0.4918	0.0062	0.6848
3.2308	0.1772	0.5085	0.0064	0.6962
3.2885	0.1659	0.5255	0.0066	0.7077
3.3462	0.1547	0.5427	0.0068	0.7191
3.4038	0.1434	0.5602	0.0070	0.7306
3.4615	0.1322	0.5779	0.0072	0.7420
3.5192	0.1209	0.5960	0.0074	0.7535
3.5769	0.1097	0.6143	0.0076	0.7650
3.6346	0.0984	0.6329	0.0077	0.7764
3.6923	0.0872	0.6518	0.0079	0.7879
3.7500	0.0760	0.6709	0.0081	0.7994
3.7500	0.0647	0.6709	0.0122	0.7994

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infil(cfs)
3.7500	0.8057	0.6709	0.0000	0.1180	0.0115
3.8077	0.8173	0.7177	0.0000	0.1180	0.0230
3.8654	0.8289	0.7652	0.0000	0.1218	0.0345
3.9231	0.8405	0.8134	0.0000	0.1255	0.0460
3.9808	0.8521	0.8622	0.0000	0.1293	0.0575
4.0385	0.8637	0.9117	0.0000	0.1331	0.0690
4.0962	0.8753	0.9618	0.0000	0.1368	0.0805

4.1538	0.8869	1.0127	0.0000	0.1406	0.0921
4.2115	0.8985	1.0642	0.0000	0.1444	0.1036
4.2692	0.9101	1.1163	0.0000	0.1481	0.1152
4.3269	0.9218	1.1692	0.0000	0.1519	0.1267
4.3846	0.9334	1.2227	0.0000	0.1557	0.1382
4.4423	0.9450	1.2769	0.0000	0.1594	0.1498
4.5000	0.9567	1.3317	0.0000	0.1632	0.1614
4.5577	0.9683	1.3873	0.0000	0.1670	0.1729
4.6154	0.9800	1.4435	0.0000	0.1707	0.1845
4.6731	0.9917	1.5004	0.0000	0.1745	0.1961
4.7308	1.0033	1.5579	0.0000	0.1783	0.2077
4.7885	1.0150	1.6161	0.0399	0.1820	0.2193
4.8462	1.0267	1.6750	0.1520	0.1858	0.2308
4.9038	1.0384	1.7346	0.2743	0.1896	0.2424
4.9615	1.0501	1.7948	0.3592	0.1933	0.2541
5.0192	1.0618	1.8557	0.4086	0.1971	0.2657
5.0769	1.0735	1.9173	0.4502	0.2009	0.2773
5.1346	1.0852	1.9796	0.4883	0.2046	0.2889
5.1923	1.0969	2.0425	0.5237	0.2084	0.3005
5.2500	1.1086	2.1062	0.5568	0.2122	0.3005

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Surface Bioretention

Element Flows To:

Outlet 1

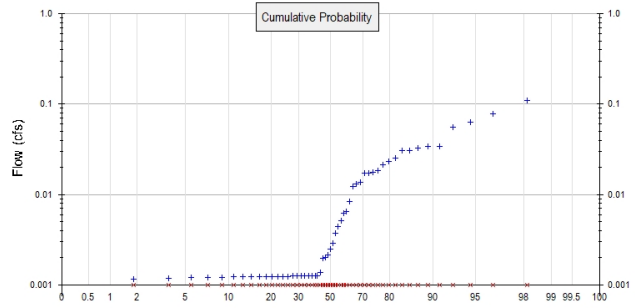
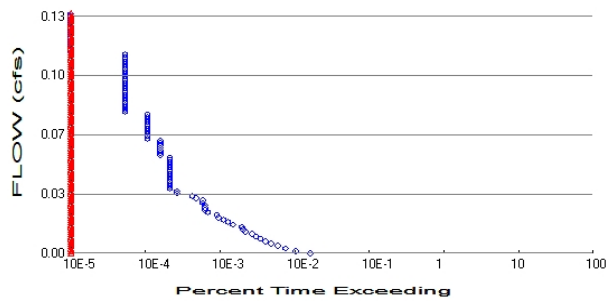
Outlet 2

Rose Way Bioretention

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Analysis Results

POC 1



+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area: 1.5543
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1

Total Pervious Area: 0.2062
Total Impervious Area: 1.3481

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.004117
5 year	0.015302
10 year	0.032197
25 year	0.07444
50 year	0.131157
100 year	0.222033

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.064	0.000
1957	0.002	0.000
1958	0.017	0.000
1959	0.018	0.000
1960	0.034	0.000
1961	0.055	0.000
1962	0.111	0.000
1963	0.023	0.000
1964	0.018	0.000
1965	0.002	0.000

1966	0.001	0.000
1967	0.001	0.000
1968	0.001	0.000
1969	0.002	0.000
1970	0.001	0.000
1971	0.006	0.000
1972	0.014	0.000
1973	0.001	0.000
1974	0.025	0.000
1975	0.034	0.000
1976	0.001	0.000
1977	0.001	0.000
1978	0.021	0.000
1979	0.001	0.000
1980	0.001	0.000
1981	0.001	0.000
1982	0.033	0.000
1983	0.004	0.000
1984	0.017	0.000
1985	0.001	0.000
1986	0.031	0.000
1987	0.001	0.000
1988	0.001	0.000
1989	0.001	0.000
1990	0.013	0.000
1991	0.008	0.000
1992	0.001	0.000
1993	0.004	0.000
1994	0.001	0.000
1995	0.001	0.000
1996	0.079	0.000
1997	0.012	0.000
1998	0.001	0.000
1999	0.001	0.000
2000	0.001	0.000
2001	0.000	0.000
2002	0.001	0.000
2003	0.001	0.000
2004	0.001	0.000
2005	0.002	0.000
2006	0.006	0.000
2007	0.031	0.000
2008	0.005	0.000
2009	0.003	0.000

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Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1105	0.0000
2	0.0788	0.0000
3	0.0635	0.0000
4	0.0554	0.0000
5	0.0345	0.0000
6	0.0343	0.0000
7	0.0328	0.0000
8	0.0309	0.0000
9	0.0309	0.0000
10	0.0254	0.0000

11	0.0234	0.0000
12	0.0213	0.0000
13	0.0184	0.0000
14	0.0176	0.0000
15	0.0173	0.0000
16	0.0172	0.0000
17	0.0137	0.0000
18	0.0130	0.0000
19	0.0122	0.0000
20	0.0084	0.0000
21	0.0065	0.0000
22	0.0062	0.0000
23	0.0051	0.0000
24	0.0044	0.0000
25	0.0038	0.0000
26	0.0029	0.0000
27	0.0025	0.0000
28	0.0022	0.0000
29	0.0020	0.0000
30	0.0020	0.0000
31	0.0014	0.0000
32	0.0013	0.0000
33	0.0013	0.0000
34	0.0013	0.0000
35	0.0013	0.0000
36	0.0013	0.0000
37	0.0012	0.0000
38	0.0012	0.0000
39	0.0012	0.0000
40	0.0012	0.0000
41	0.0012	0.0000
42	0.0012	0.0000
43	0.0012	0.0000
44	0.0012	0.0000
45	0.0012	0.0000
46	0.0012	0.0000
47	0.0012	0.0000
48	0.0012	0.0000
49	0.0012	0.0000
50	0.0012	0.0000
51	0.0012	0.0000
52	0.0012	0.0000
53	0.0012	0.0000
54	0.0004	0.0000

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Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0021	308	0	0	Pass
0.0034	196	0	0	Pass
0.0047	144	0	0	Pass
0.0060	112	0	0	Pass
0.0073	92	0	0	Pass
0.0086	77	0	0	Pass
0.0099	66	0	0	Pass
0.0112	57	0	0	Pass
0.0125	51	0	0	Pass
0.0138	41	0	0	Pass
0.0151	38	0	0	Pass
0.0164	37	0	0	Pass
0.0177	28	0	0	Pass
0.0190	24	0	0	Pass
0.0203	21	0	0	Pass
0.0216	18	0	0	Pass
0.0229	17	0	0	Pass
0.0242	13	0	0	Pass
0.0255	12	0	0	Pass
0.0268	12	0	0	Pass
0.0281	12	0	0	Pass
0.0294	11	0	0	Pass
0.0307	11	0	0	Pass
0.0321	9	0	0	Pass
0.0334	8	0	0	Pass
0.0347	5	0	0	Pass
0.0360	5	0	0	Pass
0.0373	4	0	0	Pass
0.0386	4	0	0	Pass
0.0399	4	0	0	Pass
0.0412	4	0	0	Pass
0.0425	4	0	0	Pass
0.0438	4	0	0	Pass
0.0451	4	0	0	Pass
0.0464	4	0	0	Pass
0.0477	4	0	0	Pass
0.0490	4	0	0	Pass
0.0503	4	0	0	Pass
0.0516	4	0	0	Pass
0.0529	4	0	0	Pass
0.0542	4	0	0	Pass
0.0555	3	0	0	Pass
0.0568	3	0	0	Pass
0.0581	3	0	0	Pass
0.0594	3	0	0	Pass
0.0607	3	0	0	Pass
0.0620	3	0	0	Pass
0.0633	3	0	0	Pass
0.0647	2	0	0	Pass
0.0660	2	0	0	Pass
0.0673	2	0	0	Pass
0.0686	2	0	0	Pass
0.0699	2	0	0	Pass

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0.0712	2	0	0	Pass
0.0725	2	0	0	Pass
0.0738	2	0	0	Pass
0.0751	2	0	0	Pass
0.0764	2	0	0	Pass
0.0777	2	0	0	Pass
0.0790	1	0	0	Pass
0.0803	1	0	0	Pass
0.0816	1	0	0	Pass
0.0829	1	0	0	Pass
0.0842	1	0	0	Pass
0.0855	1	0	0	Pass
0.0868	1	0	0	Pass
0.0881	1	0	0	Pass
0.0894	1	0	0	Pass
0.0907	1	0	0	Pass
0.0920	1	0	0	Pass
0.0933	1	0	0	Pass
0.0946	1	0	0	Pass
0.0959	1	0	0	Pass
0.0973	1	0	0	Pass
0.0986	1	0	0	Pass
0.0999	1	0	0	Pass
0.1012	1	0	0	Pass
0.1025	1	0	0	Pass
0.1038	1	0	0	Pass
0.1051	1	0	0	Pass
0.1064	1	0	0	Pass
0.1077	1	0	0	Pass
0.1090	1	0	0	Pass
0.1103	1	0	0	Pass
0.1116	0	0	0	Pass
0.1129	0	0	0	Pass
0.1142	0	0	0	Pass
0.1155	0	0	0	Pass
0.1168	0	0	0	Pass
0.1181	0	0	0	Pass
0.1194	0	0	0	Pass
0.1207	0	0	0	Pass
0.1220	0	0	0	Pass
0.1233	0	0	0	Pass
0.1246	0	0	0	Pass
0.1259	0	0	0	Pass
0.1272	0	0	0	Pass
0.1285	0	0	0	Pass
0.1299	0	0	0	Pass
0.1312	0	0	0	Pass

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Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 0 acre-feet

On-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

Off-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

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LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Bioretention POC	<input type="checkbox"/>	228.29			<input type="checkbox"/>	100.00			
Total Volume Infiltrated		228.29	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

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Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

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Appendix
Predeveloped Schematic



Rose Way
Extension
(Full Width)
1.55ac

Mitigated Schematic



SI



Predeveloped UCI File

RUN

GLOBAL

wWHM4 model simulation
START 1955 10 01 END 2009 09 30
RUN INTERP OUTPUT LEVEL 3 0
RESUME 0 RUN 1 UNIT SYSTEM 1
END GLOBAL

FILES

<File> <Un#> <-----File Name----->***
<-ID-> ***
WDM 26 07880259 Rose Way Extension.wdm
MESSU 25 Pre07880259 Rose Way Extension.MES
27 Pre07880259 Rose Way Extension.L61
28 Pre07880259 Rose Way Extension.L62
30 POC07880259 Rose Way Extension1.dat

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

PERLND 4
COPY 501
DISPLY 1

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

- #<-----Title----->***TRAN PIVL DIG1 FIL1 PYR DIG2 FIL2 YRND
1 Rose Way Extension (Full MAX 1 2 30 9

END DISPLY-INF01

END DISPLY

COPY

TIMESERIES

- # NPT NMN ***
1 1 1
501 1 1

END TIMESERIES

END COPY

GENER

OPCODE

OPCD ***

END OPCODE

PARM

K ***

END PARM

END GENER

PERLND

GEN-INFO

<PLS ><-----Name----->NBLKS Unit-systems Printer ***
- # User t-series Engl Metr ***
in out ***

4 A/B, Pasture, Flat 1 1 1 1 27 0

END GEN-INFO

*** Section PWATER***

ACTIVITY

<PLS > ***** Active Sections *****
- # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC ***
4 0 0 1 0 0 0 0 0 0 0 0 0 0

END ACTIVITY

PRINT-INFO

<PLS > ***** Print-flags ***** PIVL PYR
- # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC *****
4 0 0 4 0 0 0 0 0 0 0 0 0 0 1 9

END PRINT-INFO


```

PWAT-PARM1
<PLS > PWATER variable monthly parameter value flags ***
# - # CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE INFC HWT ***
4 0 0 0 0 0 0 0 0 0 0 0
END PWAT-PARM1

PWAT-PARM2
<PLS > PWATER input info: Part 2 ***
# - # ***FOREST LZSN INFILT LSUR SLSUR KVARY AGWRC
4 0 5 1.5 400 0.05 0.3 0.996
END PWAT-PARM2

PWAT-PARM3
<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
4 0 0 2 2 0 0 0
END PWAT-PARM3

PWAT-PARM4
<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
4 0.15 0.5 0.3 0 0.7 0.4
END PWAT-PARM4

PWAT-STATE1
<PLS > *** Initial conditions at start of simulation
ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS SURS UZS IFWS LZS AGWS GWVS
4 0 0 0 0 3 1 0
END PWAT-STATE1

END PERLND

IMPLND
GEN-INFO
<PLS ><-----Name-----> Unit-systems Printer ***
# - # User t-series Engl Metr ***
in out ***

END GEN-INFO
*** Section IWATER***

ACTIVITY
<PLS > ***** Active Sections *****
# - # ATMP SNOW IWAT SLD IWG IQAL ***
END ACTIVITY

PRINT-INFO
<ILS > ***** Print-flags ***** PIVL PYR
# - # ATMP SNOW IWAT SLD IWG IQAL *****
END PRINT-INFO

IWAT-PARM1
<PLS > IWATER variable monthly parameter value flags ***
# - # CSNO RTOP VRS VNN RTLI ***
END IWAT-PARM1

IWAT-PARM2
<PLS > IWATER input info: Part 2 ***
# - # *** LSUR SLSUR NSUR RETSC
END IWAT-PARM2

IWAT-PARM3
<PLS > IWATER input info: Part 3 ***
# - # ***PETMAX PETMIN
END IWAT-PARM3

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
# - # *** RETS SURS
END IWAT-STATE1

```

END IMPLND

SCHEMATIC

<-Source->	<-Area-->	<-Target->	MBLK	***
<Name> #	<-factor->	<Name> #	Tbl#	***
Rose Way Extension (Full Width)***				
PERLND 4	1.5543	COPY 501	12	
PERLND 4	1.5543	COPY 501	13	

*****Routing*****
END SCHEMATIC

NETWORK

<-Volume->	<-Grp>	<-Member->	<-Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name> #		<Name> #	#	<-factor->strg	<Name> #	#	<Name> #	***
COPY	501	OUTPUT	MEAN	1 1	48.4	DISPLY	1	INPUT TIMSER 1

<-Volume->	<-Grp>	<-Member->	<-Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name> #		<Name> #	#	<-factor->strg	<Name> #	#	<Name> #	***
END NETWORK								

RCHRES

GEN-INFO

RCHRES	Name	Nexits	Unit	Systems	Printer	***
# - #	<----->	<---->	User	T-series	Engl Metr	LKFG
			in	out		***

END GEN-INFO
*** Section RCHRES***

ACTIVITY

<PLS >	***** Active Sections *****										
# - #	HYFG	ADFG	CNFG	HTFG	SDFG	GQFG	OXFG	NUFG	PKFG	PHFG	***
END ACTIVITY											

PRINT-INFO

<PLS >	***** Print-flags *****										PIVL	PYR	
# - #	HYDR	ADCA	CONS	HEAT	SED	GQL	OXRX	NUTR	PLNK	PHCB	PIVL	PYR	*****
END PRINT-INFO													

HYDR-PARM1

RCHRES	Flags for each HYDR Section										***	
# - #	VC	A1	A2	A3	ODFVFG for each			***	ODGTFG for each	FUNCT for each		
	FG	FG	FG	FG	possible exit			***	possible exit	possible exit		
	*	*	*	*	*	*	*	*	*	*	*	
END HYDR-PARM1												

HYDR-PARM2

# - #	FTABNO	LEN	DELTH	STCOR	KS	DB50	***
<----->	<----->	<----->	<----->	<----->	<----->	<----->	***
END HYDR-PARM2							

HYDR-INIT

RCHRES	Initial conditions for each HYDR section										***
# - #	***	VOL	Initial value of COLIND				Initial value of OUTDGT				
	***	ac-ft	for each possible exit				for each possible exit				
<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->
END HYDR-INIT											

END RCHRES

SPEC-ACTIONS

END SPEC-ACTIONS

FTABLES

END FTABLES

EXT SOURCES

<-Volume->	<Member>	SsysSgap	<-Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name> #	<Name> #	tem	strg	<-factor->strg	<Name> #	#	<Name> #	***
WDM	2	PREC	ENGL	1	PERLND	1 999	EXTNL	PREC
WDM	2	PREC	ENGL	1	IMPLND	1 999	EXTNL	PREC

```

WDM      1 EVAP      ENGL      0.76          PERLND  1 999 EXTNL  PETINP
WDM      1 EVAP      ENGL      0.76          IMPLND  1 999 EXTNL  PETINP

```

END EXT SOURCES

EXT TARGETS

```

<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name> # <Name> # #<-factor->strg <Name> # <Name> tem strg strg***
COPY 501 OUTPUT MEAN 1 1 48.4 WDM 501 FLOW ENGL REPL
END EXT TARGETS

```

MASS-LINK

```

<Volume> <-Grp> <-Member-><--Mult--> <Target> <-Grp> <-Member->***
<Name> # <Name> # #<-factor-> <Name> # <Name> # #***
MASS-LINK 12
PERLND PWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 12

```

```

MASS-LINK 13
PERLND PWATER IFWO 0.083333 COPY INPUT MEAN
END MASS-LINK 13

```

END MASS-LINK

END RUN

DRAFT

Mitigated UCI File

RUN

GLOBAL

wWHM4 model simulation
START 1955 10 01 END 2009 09 30
RUN INTERP OUTPUT LEVEL 3 0
RESUME 0 RUN 1 UNIT SYSTEM 1
END GLOBAL

FILES

<File>	<Un#>	<-----File Name----->	***
<-ID->			***
WDM	26	07880259 Rose Way Extension.wdm	
MESSU	25	Mit07880259 Rose Way Extension.MES	
	27	Mit07880259 Rose Way Extension.L61	
	28	Mit07880259 Rose Way Extension.L62	
	30	POC07880259 Rose Way Extension1.dat	

END FILES

OPN SEQUENCE

INGRP INDELT 00:15
PERLND 7
IMPLND 1
GENER 2
RCHRES 1
RCHRES 2
COPY 1
COPY 501
DISPLY 1

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01
- #<-----Title----->***TRAN PIVL DIG1 FIL1 PYR DIG2 FIL2 YRND
1 Surface Bioretention MAX 1 2 30 9

END DISPLY-INF01

END DISPLY

COPY

TIMESERIES
- # NPT NMN ***
1 1 1
501 1 1

END TIMESERIES

END COPY

GENER

OPCODE
OPCD ***
2 24

END OPCODE

PARM

K ***
2 0.

END PARM

END GENER

PERLND

GEN-INFO

<PLS ><-----Name----->	NBLKS	Unit-systems	Printer	***
# - #	User	t-series	Engl Metr	***
	in	out		***
7 A/B, Lawn, Flat	1	1	1 1	27 0

END GEN-INFO

*** Section PWATER***

ACTIVITY

<PLS >	*****	Active	Sections	*****									
# - #	ATMP	SNOW	PWAT	SED	PST	PWG	PQAL	MSTL	PEST	NITR	PHOS	TRAC	***
7	0	0	1	0	0	0	0	0	0	0	0	0	

END ACTIVITY

```

PRINT-INFO
<PLS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST NITR PHOS TRAC  *****
7   0   0   4   0   0   0   0   0   0   0   0   0   0   1   9
END PRINT-INFO

```

```

PWAT-PARM1
<PLS >  PWATER variable monthly parameter value flags  ***
# - # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT  ***
7   0   0   0   0   0   0   0   0   0   0   0
END PWAT-PARM1

```

```

PWAT-PARM2
<PLS >  PWATER input info: Part 2          ***
# - # ***FOREST  LZSN  INFILT  LSUR  SLSUR  KVARY  AGWRC
7   0   5   0.8  400  0.05  0.3  0.996
END PWAT-PARM2

```

```

PWAT-PARM3
<PLS >  PWATER input info: Part 3          ***
# - # ***PETMAX  PETMIN  INFEXP  INFILD  DEEPFR  BASETP  AGWETP
7   0   0   2   2   0   0   0
END PWAT-PARM3

```

```

PWAT-PARM4
<PLS >  PWATER input info: Part 4          ***
# - #  CEpsc  UZSN  NSUR  INTFW  IRC  LZETP  ***
7   0.1  0.5  0.25  0   0.7  0.25  ***
END PWAT-PARM4

```

```

PWAT-STATE1
<PLS >  *** Initial conditions at start of simulation
ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS  SURS  UZS  IFWS  LZS  AGWS  GWVS
7   0   0   0   0   3   1   0
END PWAT-STATE1

```

END PERLND

IMPLND

```

GEN-INFO
<PLS ><-----Name----->  Unit-systems  Printer  ***
# - #  User  t-series  Engl Metr  ***
              in  out
1   ROADS/FLAT  1  1  1  27  0
END GEN-INFO
*** Section IWATER***

```

```

ACTIVITY
<PLS >  ***** Active Sections *****
# - # ATMP SNOW IWAT  SLD  IWG IQAL  ***
1   0   0   1   0   0   0
END ACTIVITY

```

```

PRINT-INFO
<ILS >  ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW IWAT  SLD  IWG IQAL  *****
1   0   0   4   0   0   0   1   9
END PRINT-INFO

```

```

IWAT-PARM1
<PLS >  IWATER variable monthly parameter value flags  ***
# - # CSNO RTOP  VRS  VNN RTLI  ***
1   0   0   0   0   0
END IWAT-PARM1

```

```

IWAT-PARM2
<PLS >  IWATER input info: Part 2          ***
# - # ***  LSUR  SLSUR  NSUR  RETSC
1   400  0.01  0.1  0.1

```

END IWAT-PARM2

IWAT-PARM3
<PLS > IWATER input info: Part 3 ***
- # ***PETMAX PETMIN
1 0 0
END IWAT-PARM3

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
- # *** RETS SURS
1 0 0
END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source-> <-Area--> <-Target-> MBLK ***
<Name> # <-factor-> <Name> # Tbl# ***
Rose Way Extension (Full Width)***
PERLND 7 0.2062 RCHRES 1 2
PERLND 7 0.2062 RCHRES 1 3
IMPLND 1 1.3481 RCHRES 1 5

*****Routing*****
PERLND 7 0.2062 COPY 1 12
IMPLND 1 1.3481 COPY 1 15
PERLND 7 0.2062 COPY 1 13
RCHRES 1 1 RCHRES 2 8
RCHRES 2 1 COPY 501 17
RCHRES 1 1 COPY 501 17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><-Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name> # <Name> # #<-factor->strg <Name> # # <Name> # # ***
COPY 501 OUTPUT MEAN 1 1 48.4 DISPLY 1 INPUT TIMSER 1
GENER 2 OUTPUT TIMSER .00111111 RCHRES 1 EXTNL OUTDGT 1

<-Volume-> <-Grp> <-Member-><-Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name> # <Name> # #<-factor->strg <Name> # # <Name> # # ***
END NETWORK

RCHRES
GEN-INFO
RCHRES Name Nexits Unit Systems Printer ***
- #<-----><----> User T-series Engl Metr LKFG ***
in out ***
1 Surface Bioreten-010 3 1 1 1 28 0 1
2 Rose Way Biorete-009 2 1 1 1 28 0 1
END GEN-INFO
*** Section RCHRES***

ACTIVITY
<PLS > ***** Active Sections *****
- # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
1 1 0 0 0 0 0 0 0 0 0
2 1 0 0 0 0 0 0 0 0 0
END ACTIVITY

PRINT-INFO
<PLS > ***** Print-flags ***** PIVL PYR
- # HYDR ADCA CONS HEAT SED GQL OXRX NUTR PLNK PHCB PIVL PYR *****
1 4 0 0 0 0 0 0 0 0 0 1 9
2 4 0 0 0 0 0 0 0 0 0 1 9
END PRINT-INFO

HYDR-PARM1

```

RCHRES  Flags for each HYDR Section
# - # VC A1 A2 A3 ODFVFG for each *** ODCGTFG for each FUNCT for each
      FG FG FG FG possible exit *** possible exit possible exit
      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
1      0 1 0 0 4 5 6 0 0 0 0 1 0 0 0 2 1 2 2 2
2      0 1 0 0 4 5 0 0 0 0 0 0 0 0 0 2 2 2 2 2
END HYDR-PARM1

```

```

HYDR-PARM2
# - # FTABNO LEN DELTH STCOR KS DB50 ***
<-----><-----><-----><-----><-----><-----><----->
1      1 0.01 0.0 0.0 0.0 0.0
2      2 0.27 0.0 0.0 0.0 0.0
END HYDR-PARM2

```

```

HYDR-INIT
RCHRES  Initial conditions for each HYDR section ***
# - # *** VOL Initial value of COLIND Initial value of OUTDGT
      *** ac-ft for each possible exit for each possible exit
<-----><-----><-----><-----><-----><-----><-----><-----><----->
1      0 4.0 5.0 6.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2      0 4.0 5.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
END HYDR-INIT
END RCHRES

```

SPEC-ACTIONS

```

*** User-Defined Variable Quantity Lines
***
***
*** kwd varnam optyp opn vari s1 s2 s3 tp multiply lc ls ac as agfn ***
<****> <-----> <-----> <-> <-----><-----><-----><-----> <-----> <-----> <-----> <----->
UVQUAN vol2 RCHRES 2 VOL 4
UVQUAN v2m2 GLOBAL WORKSP 1 3
UVQUAN vpo2 GLOBAL WORKSP 2 3
UVQUAN v2d2 GENER 2 K 1 3
*** User-Defined Target Variable Names
***
***
*** kwd varnam ct vari s1 s2 s3 frac oper vari s1 s2 s3 frac oper
<****> <-----><-----> <-----><-----><-----> <-----> <-----> <-----><-----><-----><-----> <-----> <----->
UVNAME v2m2 1 WORKSP 1 1.0 QUAN
UVNAME vpo2 1 WORKSP 2 1.0 QUAN
UVNAME v2d2 1 K 1 1.0 QUAN
*** opt foplop dcdts yr mo dy hr mn d t vnam s1 s2 s3 ac quantity tc ts rp
<****><-----><-----><-----><-----> <-----><-----><-----><-----><-----> <-----> <----->
GENER 2 v2m2 = 29955.47
*** Compute remaining available pore space
GENER 2 vpo2 = v2m2
GENER 2 vpo2 -= vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
GENER 2 vpo2 = 0.0
END IF
*** Infiltration volume
GENER 2 v2d2 = vpo2
END SPEC-ACTIONS

```

FTABLES

```

FTABLE 2
67 5
Depth Area Volume Outflow1 Outflow2 Velocity Travel Time***
(ft) (acres) (acre-ft) (cfs) (cfs) (ft/sec) (Minutes)***
0.000000 0.805699 0.000000 0.000000 0.000000
0.057692 0.805699 0.002050 0.000000 0.000000
0.115385 0.794124 0.004426 0.000000 0.000000
0.173077 0.782554 0.007130 0.000000 0.000000
0.230769 0.770989 0.010162 0.000000 0.000000
0.288462 0.759430 0.012832 0.000000 0.000000
0.346154 0.747877 0.015763 0.000000 0.001402
0.403846 0.736329 0.018955 0.000000 0.002729
0.461538 0.724786 0.022407 0.000000 0.003779
0.519231 0.713250 0.026121 0.000000 0.006288

```

0.576923	0.701718	0.030095	0.000000	0.008158
0.634615	0.690192	0.034331	0.000000	0.012320
0.692308	0.678672	0.038828	0.000000	0.015307
0.750000	0.667157	0.043586	0.000000	0.021640
0.807692	0.655647	0.048606	0.000000	0.026071
0.865385	0.644143	0.053888	0.000000	0.035138
0.923077	0.632645	0.059431	0.000000	0.041367
0.980769	0.621152	0.065236	0.000000	0.053773
1.038462	0.609665	0.071304	0.000000	0.062178
1.096154	0.598183	0.077634	0.000000	0.078566
1.153846	0.586706	0.084226	0.000000	0.089549
1.211538	0.575235	0.091080	0.000000	0.110597
1.269231	0.563770	0.098197	0.000000	0.124582
1.326923	0.552310	0.105577	0.000000	0.151001
1.384615	0.540856	0.113219	0.000000	0.168432
1.442308	0.529407	0.121125	0.000000	0.200964
1.500000	0.517963	0.129294	0.000000	0.222303
1.557692	0.506525	0.137726	0.000000	0.261714
1.615385	0.495093	0.146421	0.000000	0.287439
1.673077	0.483666	0.155380	0.000000	0.334517
1.730769	0.472245	0.164602	0.000000	0.365115
1.788462	0.460829	0.174407	0.000000	0.411982
1.846154	0.449418	0.184485	0.000000	0.423287
1.903846	0.438014	0.194835	0.000000	0.434597
1.961538	0.426614	0.205459	0.000000	0.445913
2.019231	0.415220	0.216355	0.000000	0.457234
2.076923	0.403832	0.227525	0.000000	0.468561
2.134615	0.392449	0.238969	0.000000	0.479894
2.192308	0.381072	0.250686	0.000681	0.491231
2.250000	0.369700	0.262676	0.001022	0.502575
2.307692	0.358333	0.274940	0.001576	0.513923
2.365385	0.346972	0.287479	0.002131	0.525277
2.423077	0.335617	0.300291	0.002638	0.536637
2.480769	0.324267	0.313377	0.003091	0.548002
2.538462	0.312923	0.326738	0.003318	0.559373
2.596154	0.301584	0.340373	0.003611	0.570749
2.653846	0.290251	0.354283	0.003922	0.582130
2.711538	0.278923	0.368468	0.004230	0.593517
2.769231	0.267600	0.382927	0.004526	0.604909
2.826923	0.256283	0.397661	0.004765	0.616307
2.884615	0.244972	0.412671	0.005015	0.627710
2.942308	0.233666	0.427955	0.005264	0.639119
3.000000	0.222366	0.443515	0.005507	0.650533
3.057692	0.211071	0.459351	0.005743	0.661953
3.115385	0.199782	0.475462	0.005970	0.673378
3.173077	0.188498	0.491849	0.006190	0.684809
3.230769	0.177219	0.508512	0.006403	0.696245
3.288462	0.165946	0.525450	0.006609	0.707686
3.346154	0.154679	0.542665	0.006809	0.719133
3.403846	0.143417	0.560157	0.007003	0.730586
3.461538	0.132161	0.577924	0.007192	0.742043
3.519231	0.120910	0.595968	0.007377	0.753507
3.576923	0.109665	0.614289	0.007557	0.764975
3.634615	0.098425	0.632887	0.007734	0.776450
3.692308	0.087190	0.651762	0.007908	0.787929
3.750000	0.075962	0.670913	0.008107	0.799415
3.750000	0.064738	0.687683	0.012230	0.799415

END FTABLE 2
 FTABLE 1

Time*** (Minutes)***	Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Outflow3 (cfs)	Velocity (ft/sec)	Travel
0.000000	0.064738	0.000000	0.000000	0.000000	0.000000	0.011491		
0.057692	0.817280	0.046817	0.000000	0.118002	0.011491			
0.115385	0.828866	0.094302	0.000000	0.121768	0.022987			
0.173077	0.840458	0.142455	0.000000	0.125534	0.034488			
0.230769	0.852056	0.191278	0.000000	0.129300	0.045995			
0.288462	0.863659	0.240770	0.000000	0.133066	0.057508			

0.346154	0.875267	0.290931	0.000000	0.136832	0.069026
0.403846	0.886881	0.341762	0.000000	0.140598	0.080549
0.461538	0.898501	0.393264	0.000000	0.144364	0.092078
0.519231	0.910126	0.445435	0.000000	0.148130	0.103612
0.576923	0.921756	0.498278	0.000000	0.151896	0.115152
0.634615	0.933392	0.551792	0.000000	0.155663	0.126697
0.692308	0.945033	0.605977	0.000000	0.159429	0.138248
0.750000	0.956680	0.660835	0.000000	0.163195	0.149804
0.807692	0.968333	0.716364	0.000000	0.166961	0.161365
0.865385	0.979991	0.772565	0.000000	0.170727	0.172932
0.923077	0.991654	0.829440	0.000000	0.174493	0.184505
0.980769	1.003323	0.886987	0.000000	0.178259	0.196083
1.038462	1.014998	0.945208	0.039893	0.182025	0.207666
1.096154	1.026678	1.004103	0.152027	0.185791	0.219255
1.153846	1.038363	1.063671	0.274281	0.189557	0.230849
1.211538	1.050054	1.123914	0.359182	0.193323	0.242449
1.269231	1.061751	1.184831	0.408566	0.197089	0.254054
1.326923	1.073453	1.246424	0.450217	0.200855	0.265665
1.384615	1.085160	1.308691	0.488329	0.204621	0.277281
1.442308	1.096873	1.371635	0.523675	0.208387	0.288903
1.500000	1.108592	1.435254	0.556781	0.212153	0.300530

END FTABLE 1

END FTABLES

EXT SOURCES

<-Volume->	<Member>	SsysSgap	<-Mult-->	Tran	<-Target	vols>	<-Grp>	<-Member-->	***				
<Name>	#	<Name>	#	tem	strg	<-factor-->	strg	<Name>	#	#	***		
WDM	2	PREC		ENGL	1			PERLND	1	999	EXTNL	PREC	***
WDM	2	PREC		ENGL	1			IMPLND	1	999	EXTNL	PREC	***
WDM	1	EVAP		ENGL	0.76			PERLND	1	999	EXTNL	PETINP	***
WDM	1	EVAP		ENGL	0.76			IMPLND	1	999	EXTNL	PETINP	***
WDM	2	PREC		ENGL	1			RCHRES	1		EXTNL	PREC	***
WDM	1	EVAP		ENGL	0.5			RCHRES	1		EXTNL	POTEV	***
WDM	1	EVAP		ENGL	0.76			RCHRES	2		EXTNL	POTEV	***

END EXT SOURCES

EXT TARGETS

<-Volume->	<-Grp>	<-Member-->	<-Mult-->	Tran	<-Volume->	<Member>	Tsys	Tgap	Amd	***		
<Name>	#	<Name>	#	#	<-factor-->	strg	tem	strg	strg	***		
RCHRES	2	HYDR	RO	1	1	1	WDM	1002	FLOW	ENGL	REPL	***
RCHRES	2	HYDR	0	1	1	1	WDM	1003	FLOW	ENGL	REPL	***
RCHRES	2	HYDR	0	2	1	1	WDM	1004	FLOW	ENGL	REPL	***
RCHRES	2	HYDR	STAGE	1	1	1	WDM	1005	STAG	ENGL	REPL	***
RCHRES	1	HYDR	STAGE	1	1	1	WDM	1006	STAG	ENGL	REPL	***
RCHRES	1	HYDR	0	1	1	1	WDM	1007	FLOW	ENGL	REPL	***
COPY	1	OUTPUT	MEAN	1	1	48.4	WDM	701	FLOW	ENGL	REPL	***
COPY	501	OUTPUT	MEAN	1	1	48.4	WDM	801	FLOW	ENGL	REPL	***

END EXT TARGETS

MASS-LINK

<Volume>	<-Grp>	<-Member-->	<-Mult-->	<Target>	<-Grp>	<-Member-->	***
<Name>	#	<Name>	#	<-factor-->	<Name>	#	***
MASS-LINK			2				
PERLND	PWATER	SURO		0.083333	RCHRES	INFLOW	IVOL
END MASS-LINK			2				
MASS-LINK			3				
PERLND	PWATER	IFWO		0.083333	RCHRES	INFLOW	IVOL
END MASS-LINK			3				
MASS-LINK			5				
IMPLND	IWATER	SURO		0.083333	RCHRES	INFLOW	IVOL
END MASS-LINK			5				
MASS-LINK			8				
RCHRES	OFLOW	OVOL	2		RCHRES	INFLOW	IVOL
END MASS-LINK			8				
MASS-LINK			12				

PERLND	PWATER	SURO	0.083333	COPY	INPUT	MEAN
END	MASS-LINK	12				
	MASS-LINK	13				
PERLND	PWATER	IFW0	0.083333	COPY	INPUT	MEAN
END	MASS-LINK	13				
	MASS-LINK	15				
IMPLND	IWATER	SURO	0.083333	COPY	INPUT	MEAN
END	MASS-LINK	15				
	MASS-LINK	17				
RCHRES	OFLOW	OVOL	1	COPY	INPUT	MEAN
END	MASS-LINK	17				

END MASS-LINK

END RUN

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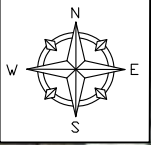
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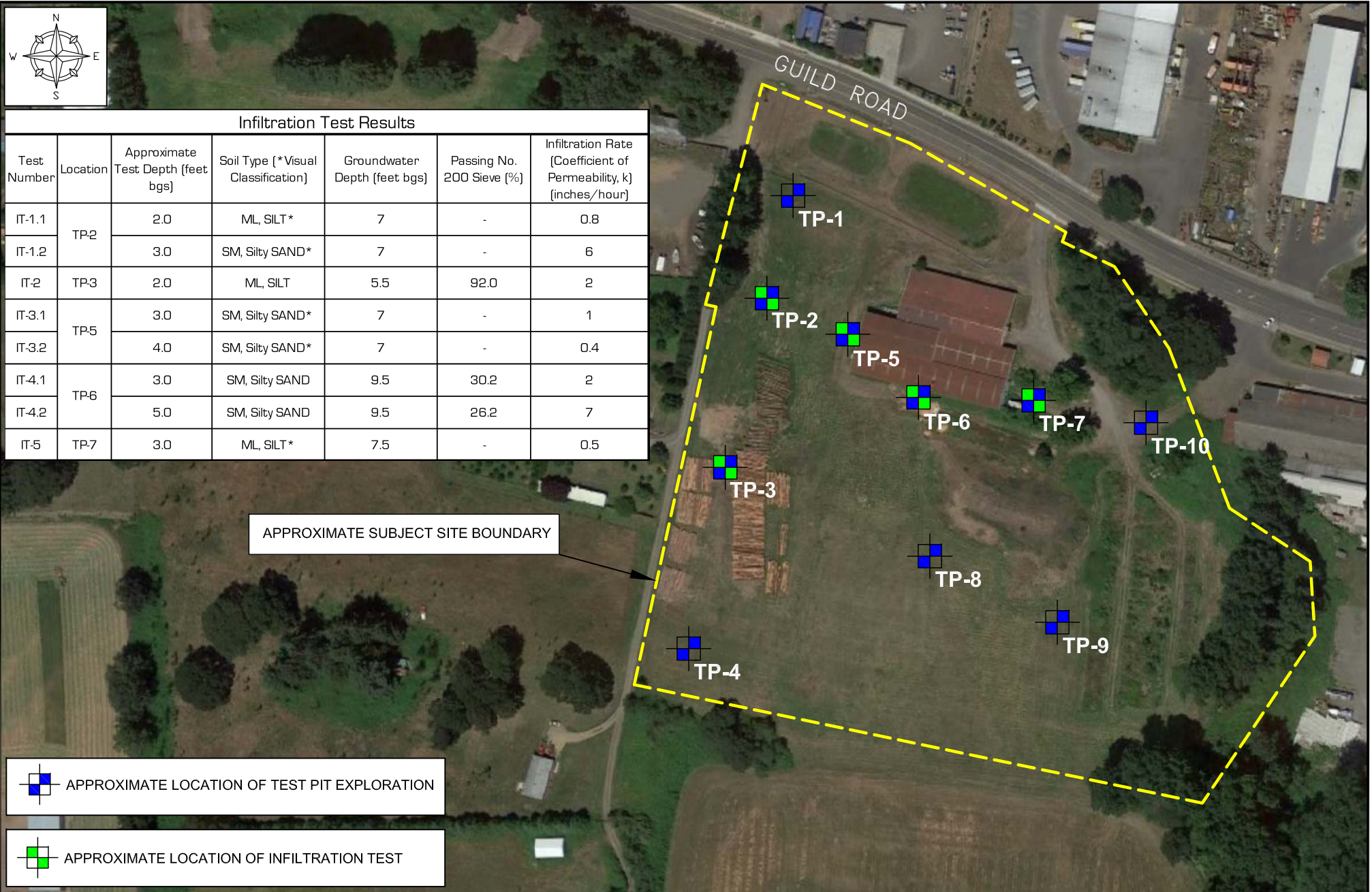
Appendix C

Geotechnical Investigations and Reports




Infiltration Test Results

Test Number	Location	Approximate Test Depth (feet bgs)	Soil Type [* Visual Classification]	Groundwater Depth (feet bgs)	Passing No. 200 Sieve (%)	Infiltration Rate [Coefficient of Permeability, k] (inches/hour)
IT-1.1	TP-2	2.0	ML, SILT*	7	-	0.8
IT-1.2		3.0	SM, Silty SAND*	7	-	6
IT-2	TP-3	2.0	ML, SILT	5.5	92.0	2
IT-3.1	TP-5	3.0	SM, Silty SAND*	7	-	1
IT-3.2		4.0	SM, Silty SAND*	7	-	0.4
IT-4.1	TP-6	3.0	SM, Silty SAND	9.5	30.2	2
IT-4.2		5.0	SM, Silty SAND	9.5	26.2	7
IT-5	TP-7	3.0	ML, SILT*	7.5	-	0.5



APPROXIMATE SUBJECT SITE BOUNDARY

 APPROXIMATE LOCATION OF TEST PIT EXPLORATION

 APPROXIMATE LOCATION OF INFILTRATION TEST

- NOTES:
1. SITE LOCATION: 1435 GUILD ROAD, WOODLAND, WASHINGTON.
 2. SITE CONSISTS OF PARCEL 508310100 TOTALING APPROXIMATELY 12.16 ACRES.
 3. DRAWING IS NOT TO SCALE.
 4. AERIAL PHOTO SOURCED FROM GOOGLE EARTH.
 5. GROUNDWATER ENCOUNTERED BETWEEN 5 AND 9.5 FEET BGS.
 6. SOIL EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
 7. TEST PITS BACKFILLED LOOSELY WITH ONSITE SOIL ON MAY 10, 2017.

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 www.columbiawestengineering.com

Design:	Drawn: HDG
Checked: GLW	Date: 5/11/17
Client: HHRP	Rev By Date
Job No: 17103	
CAD File: FIGURE 2	
Scale: NONE	

EXPLORATION LOCATION MAP
 GUILD ROAD INDUSTRIAL PARK
 WOODLAND, WASHINGTON

FIGURE
 2