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August 4, 2026

D. Petersburg Wetland Design Report
Site No. WOR982210D
Worth County, Iowa

Project Overview

This constructed wetland is planned to provide nutrient reduction benefits to a part of the watershed of Winans Creek in Worth County, Iowa. Nitrates will be converted to nitrogen gas through natural processes as the water passes through the wetland.

The project location is on the property of Doug Petersburg between Joice and Hanlontown, Iowa. Three separate wetland pools will be created through a combination of excavation and the construction of embankments around the pool. Water from Winans Creek will be pumped into the east wetland to fill the pool. The northwest and southwest pools will be filled by water being pumped out of the existing Drainage District 23 Lateral 9 Tile and adjacent relief tile. Diversion berms are proposed within each wetland pool to encourage mixing and reduce short-circuiting of water out of the wetland.

Water will be released from the pools through rectangular wetland outlet structures and be carried through reinforced concrete pipes, discharging into Winans Creek. During large storm events, the pool levels will rise, and water will flow over earthen auxiliary spillways that direct the outflow to the creek. Construction of the wetland will not have adverse effects on the hydrology of the neighboring properties.

Site Selection & Analysis

This site was deemed viable because of the size of the creek's watershed (9792 acres) and the area drained by DD 23 lateral 9 (2348 ac), along with the site's topography.

Bolton & Menk reviewed the soil survey data for the location and found the soils to be primarily loam. Multiple soil borings were conducted across the site, the results of which can be found in the attached geotechnical report. A slope stability analysis was completed by Chosen Valley Testing (CVT) since this project proposes to construct a wetland above ditch banks that are steep and high. The analysis shows that the banks will be stable under the proposed conditions, as the short-term and long-term factors of safety are greater than 1.2, the minimum safety factor desired for slopes not near structures or not where they may pose a threat to human life.

The surface watersheds of the pools were delineated and analyzed. The Winans Creek watershed was not analyzed because runoff from that watershed will not be routed through the wetlands or impacted by the wetlands. Watershed information, curve number calculations, and runoff analysis are provided in the attached hydrology outputs.

The site was surveyed with survey-grade GPS equipment, and additional topographic information was provided from a publicly available LiDAR database. LiDAR was verified with survey data. Elevations are

referenced to NAVD88, and the Iowa State Plane North (Survey Foot) coordinate system was used for horizontal coordinates. Survey data was collected electronically and is available in .csv files.

Design Standards

Iowa NRCS Conservation Practice Standard (CPS) 656, Constructed Wetland, dated December 2023, was used to develop this project. CPS 587 (Structure for Water Control) was used for the water control structure, and CPS 378 (Pond) was used to design the primary and auxiliary spillways and the embankment. The project is NRCS Job Class III under CPS 656 because the area of the direct watersheds total less than 300 acres.

Project Layout

Permanent pool elevations and embankment locations were selected based on the ability to maximize pool area while minimizing the deep (greater than three feet) pool area and embankment height. The watershed information and rainfall data were used to develop hydrographs in HydroCAD. The storm distribution used was MSE 3, with rainfall depths from the National Engineering Handbook. These hydrographs and the proposed stage-storage information were used to size primary outlet structures and auxiliary spillways for the wetland. Exceeding the minimum design standards of NRCS CPS 378, the auxiliary spillway is placed above the 25-year storm, and the spillways and embankments are designed to provide at least one foot of freeboard during the 100-year storm. HydroCAD outputs are provided in the appendix.

Existing Tiles

Two known tiles (DD Lateral 9 and the DD Lateral 9 relief line) are planned to be re-laid into a pump basin that will pump water to the northwest and southwest pools. From the pump basin, a new tile line will be constructed with a capacity greater than the capacity of the two tiles it is replacing. Pipe sizing calculations are provided for this pipe in the appendix.

Dam Regulation

A dam construction permit is required by the Iowa DNR if it (1) has a height of at least 25 feet and a storage of 15-acre feet at the top of the dam elevation; or (2) has a storage of at least 50 acre-feet at the top of dam and a height of at least 6 feet; or (3) is assigned a hazard potential of high hazard. The proposed dams of this project do not require a dam construction permit because the heights range from 4 to 4.5 feet, and the storage at the top of the dams range from 5.6 to 17.5 acre-feet. The hazard potential for the dams is low. The thresholds requiring a water storage permit are the same as those requiring a dam construction permit. Therefore, a water storage permit is not required.

The dam is classified as “low hazard” if failure of the dam would result in no probable loss of human life, low economic losses, and low public damages. The proposed dams meet the requirements of a low hazard dam.

Land Rights & Permits

The permanent easement for this project will be on the Petersburg property. IDALS-DSWQ is currently in the process of updating the abstracts and will have a signed easement recorded for the area as shown in the plans. No additional land rights are needed.

Name: D. Petersburg Wetland Design Report

Date: August 4, 2026

Page: 3

The Army Corps of Engineers has indicated that no permit will be required for this project. A floodplain permit will also be obtained by IDALS if necessary; there is no established floodway at this location.

This project is located in Drainage District 23 in Fertile Township. Plans for the project will be provided to the drainage district for review and approval prior to the bidding of the project.

Sincerely,

Bolton & Menk, Inc.

Brandon C. Short, PE

Water Resources Project Engineer

Appendices:

- A. Soil Survey Map
- B. Pump Basin Sizing Calculations
- C. Pipe Capacity Calculations
- D. Watershed Map
- E. Hydrology Report
- F. Geotechnical Report
- G. HydroCAD Output

Page: 4

Appendix B: Pump Basin Sizing Calculations

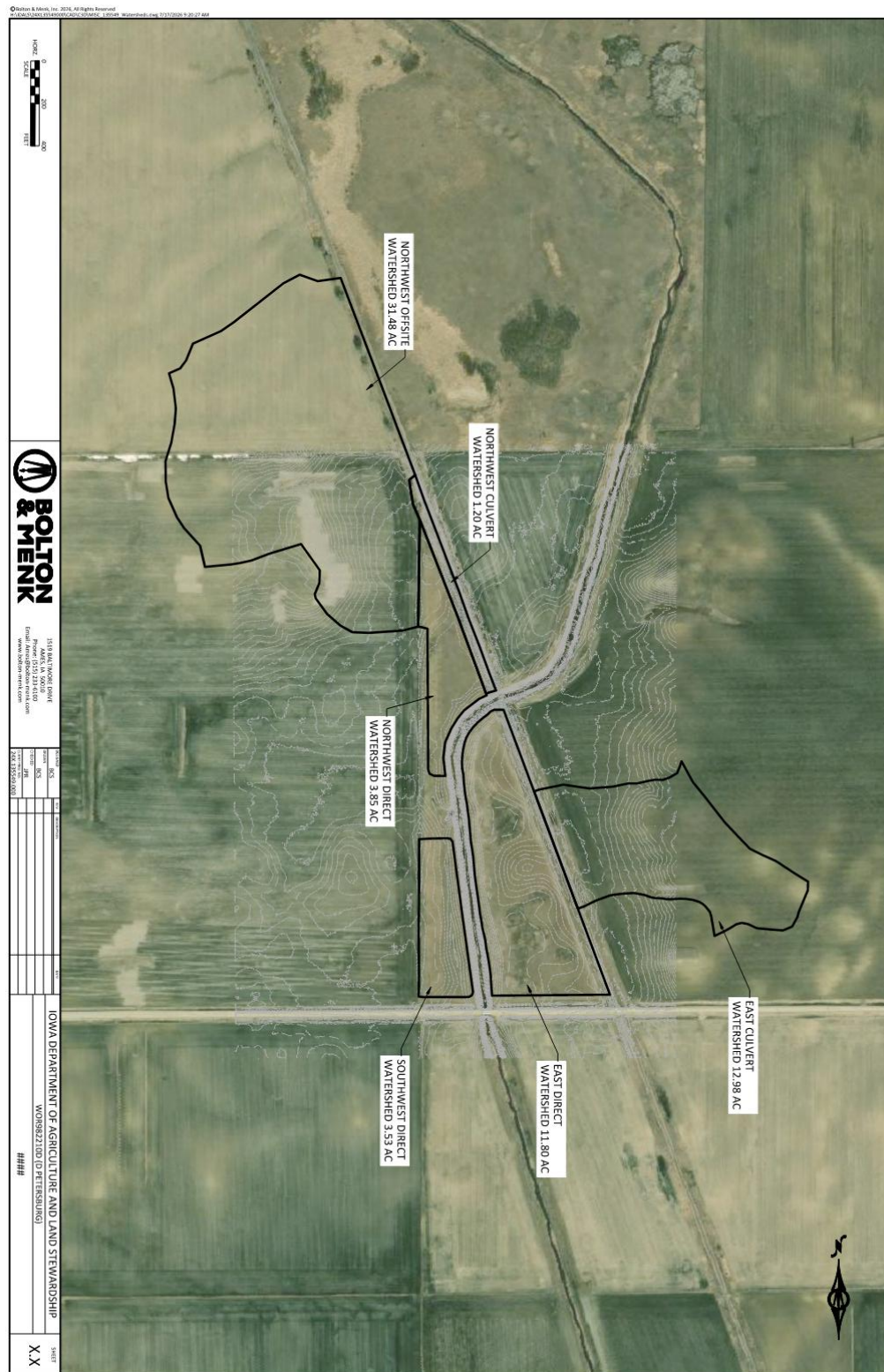
East Pump Basin Sizing Calculations		
Criteria	Provided	Requirement
Inlet Pipe Elev.	1183.00	
Pump Flow Rate	295 gpm	
Working Volume (Minimum)	306 gal	295 gal
Working Volume (Minimum)	40.8 cu. ft.	39.4 cu. ft.
Working Sump Depth (Minimum)	3.3 ft	3.1 ft
On Float Elev.	1183.5	
Off Float Elev.	1180.25	
Pump Submergence (Minimum)	31 in	30 in
Bottom of Sump Elev. (Max.)	1177.7	1177.75

West Pump Basin Sizing Calculations		
Criteria	Provided	Requirement
Inlet Pipe Elev.	1185.72	
Pump Flow Rate	380 gpm	
Working Volume (Minimum)	411 gal	380 gal
Working Volume (Minimum)	55.0 cu. ft.	50.8 cu. ft.
Working Sump Depth (Minimum)	2.8 ft	2.5 ft
On Float Elev.	1185.5	
Off Float Elev.	1182.75	
Pump Submergence (Minimum)	21.0 in	20.5 in
Bottom of Sump Elev. (Max.)	1181	1181.04

Appendix C: Pipe Capacity Calculations

Pipe Capacity Calculations							
Name	Dia (in)	A (sf)	P (ft)	R _h (ft)	s (%)	n	Q _{max} (cfs)
Existing DD 23 Lat. 9	24.00	3.142	6.283	0.500	2.14%	0.012	35.85
Proposed DD 23 Lat. 9 Re-lay	24.00	3.142	6.283	0.500	9.01%	0.013	67.90
Existing DD 23 Relief Tile	30.00	4.909	7.854	0.625	0.67%	0.013	33.57
Proposed DD 23 Relief Tile Re-lay	36.00	7.069	9.425	0.750	0.50%	0.013	47.16
Existing Culvert	18.00	1.767	4.712	0.375	7.87%	0.027	14.19
Proposed Culvert	18.00	1.767	4.712	0.375	7.87%	0.027	14.19
East Pool Outlet Pipe	18.00	1.767	4.712	0.375	2.00%	0.013	14.86
Northwest Pool Outlet Pipe	30.00	4.909	7.854	0.625	2.00%	0.013	58.01
Southwest Pool Outlet Pipe	12.00	0.785	3.142	0.250	2.00%	0.013	5.04

Appendix D: Watershed Map



Name: D. Petersburg Wetland Design Report

Date: August 4, 2026

Page: 8

Appendix E: Hydrology Report



Report Summary

Design Parameters and Procedures:

Design hydrology and hydraulic study of this site was completed. The drainage areas were determined and stage-area-storage curves were developed based on the topographic survey, LiDAR data, and grading design for the wetlands. Land use and treatment were determined through aerial photo review. Hydrologic data was compiled, the structures were flood routed using TR-55 in the HydroCAD Software, and all the output was reviewed.

Rainfall events used for this site were MSE 3 distribution, 24-hour, 5-, 10-, 25-, and 100-year events. The primary spillways are rectangular open-sided intake structures which discharge through a pipe to the ditch. The secondary spillways are earthen auxiliary spillways in the earthen berms.

Hydrology Analysis Summary

25-year Event: 5.80"

100-year Event: 7.80"

- * Hydrologic Soil Groups: B, C, D
- * Runoff Curve Number: 82.3 (based on Land use shown in this report)
- * Primary Spillway Weir Coefficient = 3.1
- * $T_c = 82.3$ as determined by the sum of sheet and shallow concentrated flow times.
- * Normal pool areas range from 1.66 to 4.51 acres.
- * Surface watershed area is approx. 64.83 acres or 0.1 square miles.

Summary Table: East Pool

Normal Pool Elevation: 1196.50

	$Q_{\max}$ In (cfs)	$Q_{\max}$ Out (cfs)	Max Elev (ft)
5-year	50.33	4.63	1197.01
10-year	61.33	6.19	1197.07
25-year	79.74	9.99	1197.19
100-year	109.86	18.35	1197.36

Summary Table: Northwest Pool

Normal Pool Elevation: 1196.50

	$Q_{\max}$ In (cfs)	$Q_{\max}$ Out (cfs)	Max Elev (ft)
5-year	68.40	44.91	1197.30
10-year	86.54	58.93	1197.47
25-year	118.00	71.62	1197.83
100-year	169.76	108.80	1198.42

Summary Table: Southwest Pool

Normal Pool Elevation: 1198

	$Q_{\max}$ In (cfs)	$Q_{\max}$ Out (cfs)	Max Elev (ft)
5-year	19.35	4.51	1198.24
10-year	23.37	5.86	1198.28
25-year	30.21	8.29	1198.36
100-year	41.50	10.09	1198.49



Rainfall Data

Surface-Drained DA = 65 ac
= .1 sq mi

The following rainfall data was used for the hydrology analysis of the site. Rainfall depths from three sources are shown, and the rainfall depths from the NEH Title 210 figure were used. MSE 3 was used for the rainfall distribution.

Frequency yr	24-hr Rainfall Depth		
	in ¹	in ²	in ³
2	3.06	3.06	3.10
5	3.86	3.83	3.90
10	4.61	4.55	4.60
25	5.78	5.67	5.80
50	6.80	6.63	6.80
100	7.90	7.68	7.80

References



Box indicates greater value and was selected.

- ¹ NOAA Atlas 14, Volume 8, Version 2
- ² SUDAS Design 2022 Edition
- ³ 24-hour rainfall depths by county from NEH Title 210 (Figure IA2-25)



Tributary Watershed Data

Watershed	Area (ac)	Area (sq. mi.)	Surface/Pump Flow
Direct - Northwest Pool	36.5	0.06	Surface
Direct - Southwest Pool	3.5	0.01	Surface
Direct - East Pool	24.8	0.04	Surface
¹ DD 23 Lat. 9	2349	3.67	Pump
² Winans Creek	9792	15.30	Pump

Surface Total	65	0.10
Pumped (Treated) Total	12141	18.97

Notes

¹ Tile pumped to Northwest and Southwest Pools.

² Drainage ditch pumped to East Pool.



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IDALS ID Number: WOR982210D
Job: D. Petersburg
BMI Project Number: 24X.135549.000
Designed By: BCS Date: 8/4/2026

Runoff Curve Number

Surface-Drained DA = 65 ac
= .1 sq mi

Typical Soil Name ¹	HSG ¹	Cover Type	Portion of W/S percent	CN ²	Product
Hawick Sandy Loam	A	Straight Row Crops, Good	3.3%	67	2.2
Clarion-Storden Complex et al.	B, B/D	Straight Row Crops, Good	30.0%	78	23.4
Clarion Loam, Marshan Clay Loam et al.	C, C/D	Straight Row Crops, Good	66.7%	85	56.7
Total			100.0%		82.3

Note: This soil information is a summary of the data for the surface watersheds of the three wetland pools, which watersheds were used to model the storm responses in the three pools. Representative soil types are shown. Actual curve number calculations used for the modeling is provided in the HydroCAD outputs.

References

¹ USDA - NRCS Soil Survey of Worth Co., Iowa.

² USDA - NRCS Technical Release 55, Chapter 2, June 1986.



Stage-Storage - East Pool

Surface-Drained DA = 65 ac
= .1 sq mi

Contour Elev.	Area (sq ft)	Area (Acres)	Average Area (Arces)	Incremental Volume (Ac-ft)	Cumulative Volume (Ac-ft)
1194.50	17700	0.41	0.41	0.00	0.00
1195.00	62200	1.43	0.92	0.46	0.46
1195.50	114900	2.64	2.03	1.02	1.47
1196.00	160400	3.68	3.16	1.58	3.05
1196.50	196500	4.51	4.10	2.05	5.10
1197.00	233000	5.35	4.93	2.46	7.57
1197.50	269400	6.18	5.77	2.88	10.45
1198.00	304700	6.99	6.59	3.29	13.75
1198.50	337700	7.75	7.37	3.69	17.43

Storage at Normal Pool	5.10 Acre-feet
Elevation of weir =	1196.50
Storage at Overflow	7.57 Acre-feet
Elevation =	1197.00

Average Depth =	storage at normal pool area at normal pool
Average Depth =	1.13 feet

Notes:

Storage areas include final earthwork borrow in pool area. Contour data is compiled from LiDAR, topographic survey, and proposed grading.



Stage-Storage - Northwest Pool

Surface-Drained DA = 65 ac
= .1 sq mi

Contour Elev.	Area (sq ft)	Area (Acres)	Average Area (Arces)	Incremental Volume (Ac-ft)	Cumulative Volume (Ac-ft)
1196.00	77100	1.77	1.77	0.00	0.00
1196.50	80400	1.85	1.81	0.90	0.90
1197.00	87700	2.01	1.93	0.96	1.87
1197.50	95850	2.20	2.11	1.05	2.92
1198.00	104000	2.39	2.29	1.15	4.07
1199.00	114600	2.63	2.51	2.51	6.58

Storage at Normal Pool	0.90 Acre-feet
Elevation of weir =	1196.50
Storage at Overflow	2.92 Acre-feet
Elevation =	1197.50

Average Depth =	$\frac{\text{storage at normal pool}}{\text{area at normal pool}}$
Average Depth =	0.49 feet

Notes:

Storage areas include final earthwork borrow in pool area. Contour data is compiled from LiDAR, topographic



Stage-Storage - Southwest Pool

Surface-Drained DA = 65 ac
= .1 sq mi

Contour Elev.	Area (sq ft)	Area (Acres)	Average Area (Arces)	Incremental Volume (Ac-ft)	Cumulative Volume (Ac-ft)
1195.00	500	0.01	0.01	0.00	0.00
1196.00	9600	0.22	0.12	0.12	0.12
1197.00	24600	0.56	0.39	0.39	0.51
1198.00	72500	1.66	1.11	1.11	1.62
1198.50	77700	1.78	1.72	0.86	2.49
1199.00	82900	1.90	1.84	0.92	3.41
1200.00	107900	2.48	2.19	2.19	5.60

Storage at Normal Pool	1.62 Acre-feet
Elevation of weir =	1198.00
Storage at Overflow	2.49 Acre-feet
Elevation =	1198.50

Average Depth =	$\frac{\text{storage at normal pool}}{\text{area at normal pool}}$
Average Depth =	0.98 feet

Notes:

Storage areas include final earthwork borrow in pool area. Contour data is compiled from LiDAR, topographic



Solar Pump Capture Calculations

Average Daylight Hours: 54.4%

Wetland Pool	Pump	Outlet Dia. (in)	TDH (ft)	Pump Summary			Watershed Area (ac) ²	Effective Pumped Watershed (ac)
				Peak Pumping Rate (gpm)	Peak Pumping Rate (cfs)	9-Month Percent Capture ¹		
East	3.0 HP	6	15.60	290	0.65	11.2%	9792	1097
Northwest	1.5 HP	6	13.65	200	0.45	21.0%	2349	493
Southwest	1.5 HP	6	15.65	180	0.40	21.2%	2349	498

Notes:

¹ Average capture was calculated for each month based on expected tile flow, daylight hours, and cloud cover. This percentage is the average of months March through November.

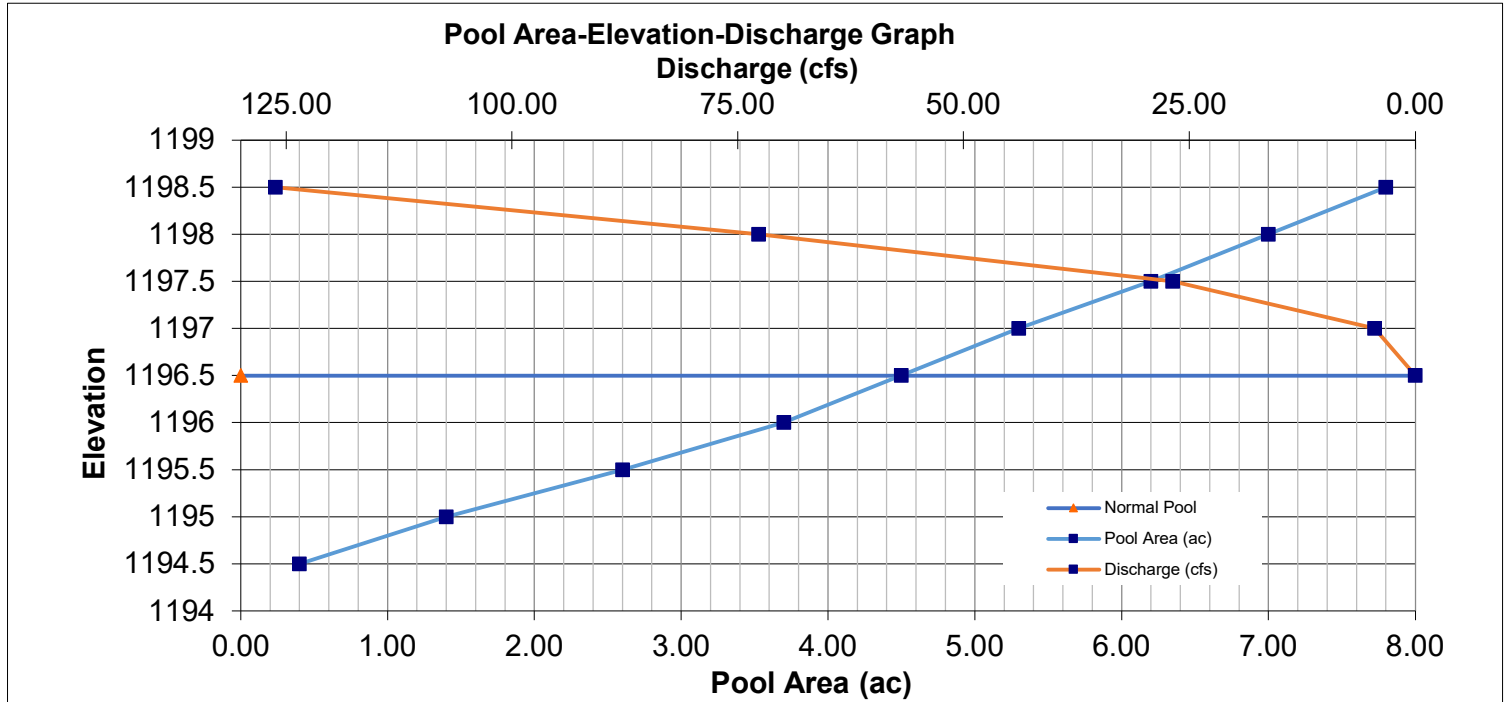
² Provided by StreamStats



Results - East Pool

Surface-Drained DA = 24.8 ac

= .04 sq mi



The Elevation-Discharge table below shows tile and surface outflows from the wetland for various elevations. The tile discharge is very small compared to the surface discharge at higher elevations.

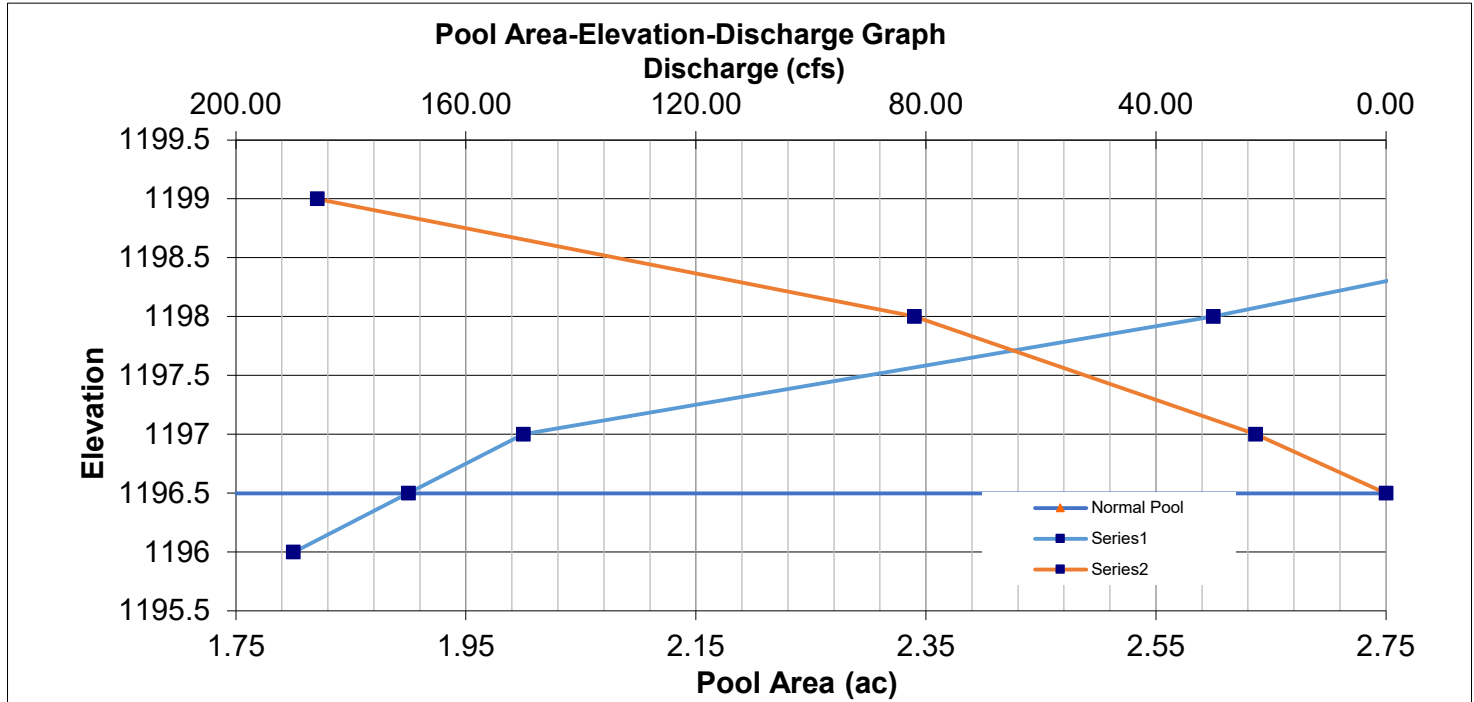
Elevation	Pool Area (ac)	Primary Outlet	Aux. Spillway	Total Discharge (cfs)
1194.50	0.40	0.00	0.00	0.00
1195.00	1.40	0.00	0.00	0.00
1195.50	2.60	0.00	0.00	0.00
1196.00	3.70	0.00	0.00	0.00
1196.50	4.50	0.00	0.00	0.00
1197.00	5.30	4.51	0.00	4.51
1197.50	6.20	12.43	14.42	26.85
1198.00	7.00	22.23	50.46	72.69
1198.50	7.80	23.69	102.47	126.16



Results - Northwest Pool

Surface-Drained DA = 36.5 ac

= .06 sq mi



The Elevation-Discharge table below shows tile and surface outflows from the wetland for various elevations. The tile discharge is very small compared to the surface discharge at higher elevations.

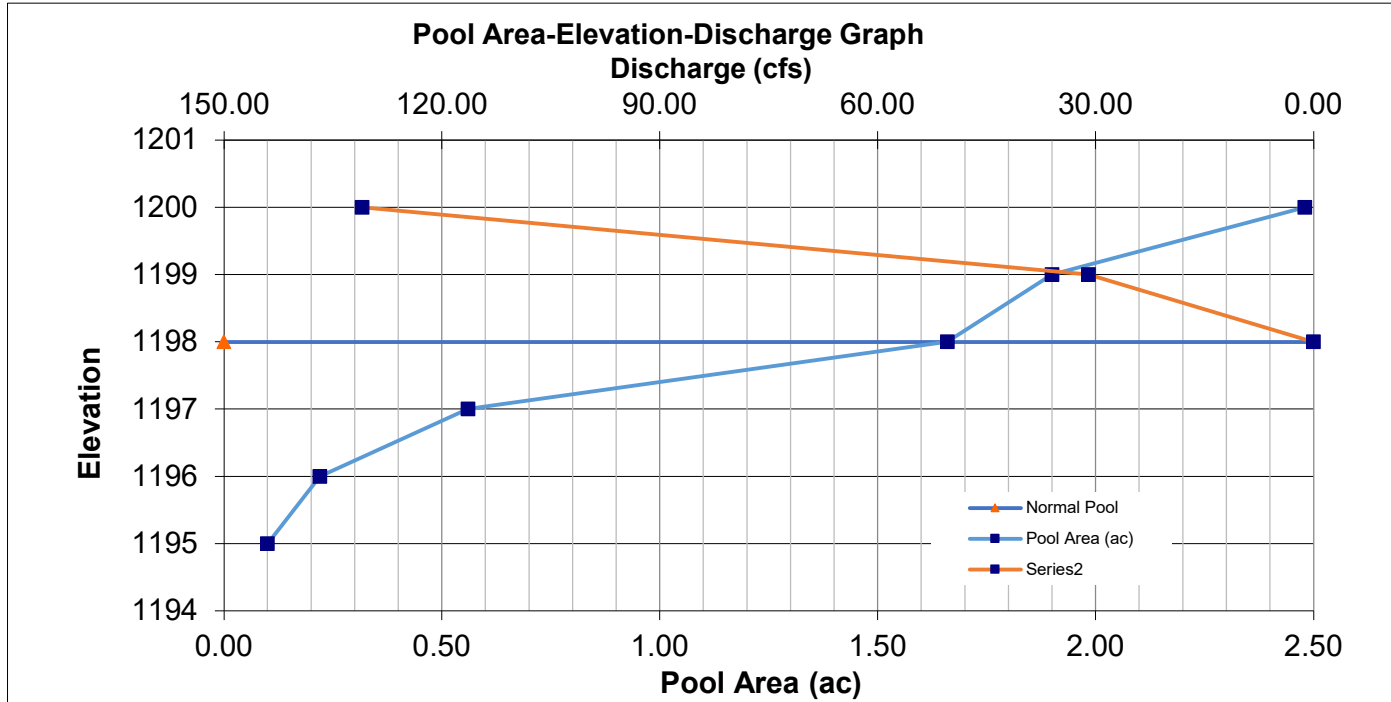
Elevation	Pool Area (ac)	Primary Outlet	Aux. Spillway	Total Discharge (cfs)
1196.00	1.80	0.00	0.00	0.00
1196.50	1.90	0.00	0.00	0.00
1197.00	2.00	22.66	0.00	22.66
1198.00	2.60	61.41	20.62	82.03
1199.00	3.10	65.80	120.05	185.85



Results - Southwest Pool

Surface-Drained DA = 3.5 ac

= .01 sq mi



The Elevation-Discharge table below shows tile and surface outflows from the wetland for various elevations. The tile discharge is very small compared to the surface discharge at higher elevations.

Elevation	Pool Area (ac)	Primary Outlet	Aux. Spillway	Total Discharge (cfs)
1195.00	0.10	0.00		0.00
1196.00	0.22	0.00		0.00
1197.00	0.56	0.00		0.00
1198.00	1.66	0.00		0.00
1199.00	1.90	10.38	20.62	31.00
1200.00	2.48	10.93	120.05	130.98

Name: D. Petersburg Wetland Design Report

Date: August 4, 2026

Page: 9

Appendix F: Geotechnical Report

Updated Factual Geotechnical Report:

Proposed Wetland
SE ¼ Sec. 10 – T98N – R22W
Fertile Township, Worth County, Iowa
CVT# 24387.24.IAM

Prepared for:

Mr. Brandon Short
Bolton & Menk, Inc.

Certification:

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.
	
	_____ (signature)
	_____ (date)
	Printed or typed name: <u>Matthew J. Reisdorfer, PE.</u> License number: <u>22234</u> My license renewal date is <u>December 31, 2025</u> Pages or sheets covered by this seal:

TABLE OF CONTENTS

A. Introduction	2
A.1. Purpose	2
A.2. Scope	2
A.3. Boring Locations and Elevation	3
A.4. Geologic Background	3
B. Subsurface Data	3
B.1. Stratification	3
B.2. Penetration Test Results	4
B.3. Groundwater Data	5
F. Slope Stability Analysis	5
C. Level of Care	5
Appendix	6

Soil Boring Location Sketch

Log of Boring # B1-B10 and HA1-HA4

Slope Stability Cross Sections

Legend to Soil Description

Chosen Valley Testing, Inc.

Geotechnical Engineering and Testing • 421 N Georgia Avenue • Mason City, IA 50401 • Telephone (641) 201-1050 • masoncity@cvtesting.com

Mr. Brandon Short
Design Engineer
Bolton & Menk, Inc.
1519 Baltimore Drive
Ames, Iowa 50010
Brandon.short@bolton-menk.com

April 21, 2025

**Re: Factual Geotechnical Evaluation
Proposed Wetland
SE ¼ Sec. 10 – T98N – R22W
Fertile Township, Worth County, Iowa
CVT Proposal Number: 24387.24.IAM**

Dear Mr. Short:

This factual report was prepared for the proposed wetland located in Fertile Township, Worth County, Iowa. Our services were authorized by Mr. Brandon Short, Design Engineer for Bolton & Menk, Inc.

A. Introduction

The intent of this report is to present our results to the client in the same logical sequence that led us to arrive at the opinions and recommendations expressed. Since our services must often be completed before the design, assumptions are sometimes needed to prepare a proper evaluation and to analyze the data. A complete and thorough review of this entire document, including the assumptions and the appendices, should be undertaken immediately upon receipt.

A.1. Purpose

This factual report was prepared for the proposed wetland located in Fertile Township, Worth County, Iowa. Our services were authorized by Mr. Brandon Short, Design Engineer for Bolton & Menk, Inc.

A.2. Scope

To obtain data for analysis, our services included ten penetration test borings. The borings were drilled to depths of about 15 feet below the surface. Additional services consisting of hand auger drilling and slope stability analysis were also authorized. Our engineering scope consisted of providing a factual discussion of the soils and materials encountered during our exploration.

A.3. Boring Locations and Elevation

The desired boring locations were indicated to Chosen Valley Testing based on on-site staking provided by the client. The Boring Location Sketch in the Appendix shows the approximate location drilled. Elevations at the borings were provided by the client.

A.4. Geologic Background

A geotechnical report is based on subsurface data collected for the specific structure or problem. Available geologic data from the region can help interpretation of the data and is briefly summarized in this section.

Area geologic maps indicate that the natural upper soils are primarily alluvium (water deposited) consisting of clay, silt, sand and gravel mixtures. Bedrock was expected to be within 50 to 100 feet below the surface and consists of limestone, dolomite, and shale of the Shell Rock Formation.

B. Subsurface Data

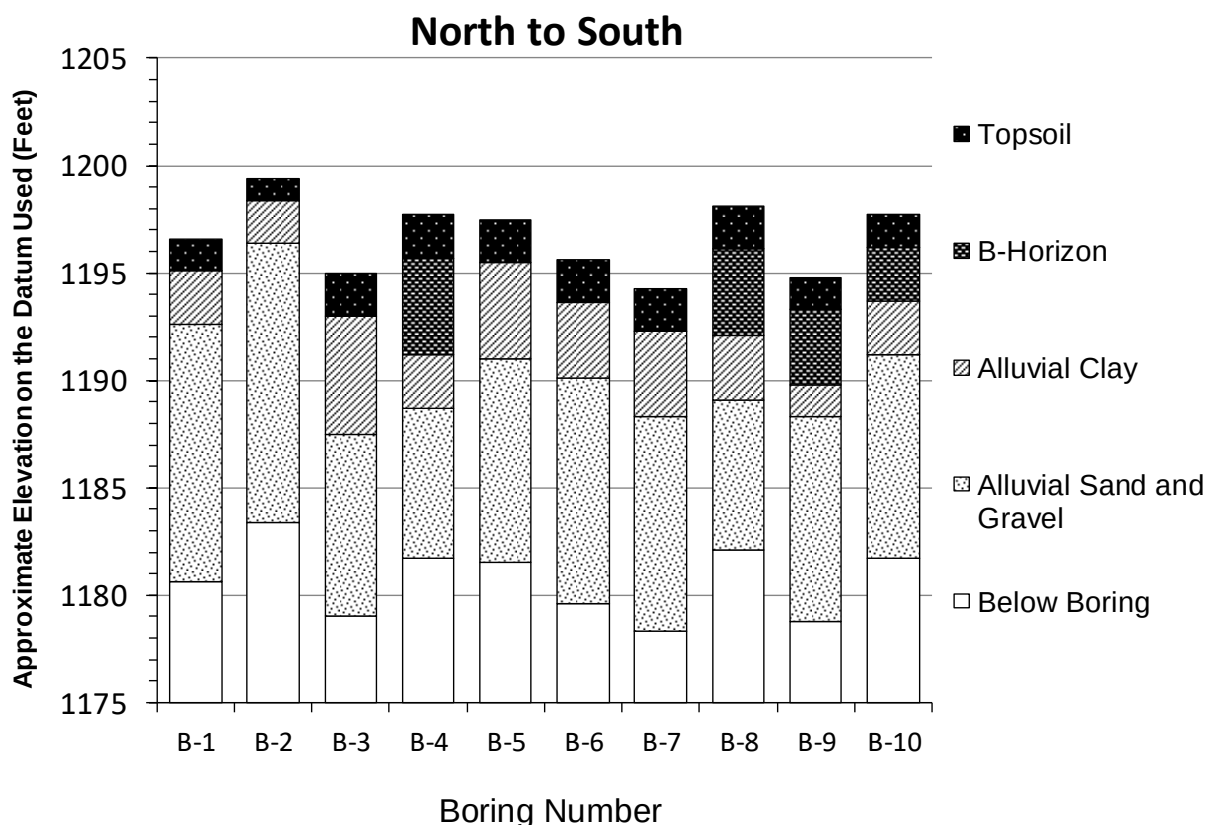
B.1. Stratification

At the surface, the borings met topsoil consisting mostly of slightly organic-to-organic lean clay to depths of about 1 to 2 feet below the surface. Below the topsoil, Borings B-4, B-8, B-9 and B-10 met B-Horizon consisting of mostly lean clay and sandy clay to depths of about 4 to 6 ½ feet below the surface. B-Horizon soils are similar in color and characteristics to that of topsoil but are less organic.

Alluvial clay was met below the B-Horizon and below the topsoil in Borings B-1, B-2, B-3, B-5, B-6 and B-7 to depths of about 3 to 9 feet below the surface.

Alluvial sand and gravel followed the alluvial clay in all borings. The borings terminated in alluvial sand and gravel at depths of about 16 feet below the surface.

The following simplified cross-section summarizes the boring data. For more detailed information, please refer to the Log of Boring sheets in the Appendix.



B.2. Penetration Test Results

The number of blows needed for the hammer to advance the penetration test sampler is an indicator of soil characteristics. The results tend to be more meaningful for natural mineral soils, than for fill soils. In fill soils, compaction tests are more meaningful.

Penetration resistance values ("N" Values) of 2 to 13 Blows per Foot (BPF) were recorded in the alluvial clays, indicating they were soft to stiff. The alluvial sands returned N-Values of 3 to 34 BPF, indicating they were very loose to dense. The B-Horizon clays returned N-Values of 2 to 7 BPF, indicating they were soft to medium.

A pocket penetrometer was used to provide additional data on the compressive strength of cohesive soils. The alluvial clays returned values of 1 ¼ to 3 ¾ tons per square foot (tsf). The B-Horizon clays returned values of 1 ¼ to 4 ¼ tsf.

A key to descriptors used to qualify the relative density of soil (such as *soft*, *stiff*, *loose*, and *dense*) can be found on the Legend to Soil Description in the Appendix.

B.3. Groundwater Data

During the drilling operation, the drillers may note the presence of moisture on the sampling instrument, in the cuttings, or within the borehole. These observations are recorded on the boring logs. The water level may vary with weather; time of year and other factors and the presence or absence of water during the drilling is subject to interpretation and is not always conclusive.

Water was encountered in most of the borings at depths of about 7 to 14 feet below the surface during drilling. The observed water levels correspond to an elevation of about 1180 ½ to 1188 feet on the datum used to locate the borings. Elevated moisture contents were recorded in the near surface clay samples as well. Groundwater levels at the site are expected to fluctuate seasonally with nearby creeks and rivers, as well as with local weather patterns.

F. Slope Stability Analysis

Slope stability analyses were performed along the drainage ditch embankment near STA 2+40, STA 9+10, STA 13+25 and STA 14+00 using the elevation data provided by Bolton & Menk, Inc. and the computer software Slide that employs both Janbu's and Bishops' Methods of Analysis. Data from our boring logs and hand auger exploration were used in our analysis. Design slopes ranging from 1.6:1 to 1.9:1 were provided by Bolton & Menk, Inc.

The following table provides further detail on the short term and long term stability safety factors at each of the four stations that were analyzed:

Station	Short Term Stability Safety Factor (West Bank/East Bank)	Long Term Stability Safety Factor (West Bank/East Bank)
STA 2+40	1.973 / 1.556	1.568 / 1.227
STA 9+10	2.393 / 1.925	1.793 / 1.496
STA 13+25	3.089 / 2.157	2.982 / 1.994
STA 14+00	1.850 / 1.419	1.496 / 1.244

A minimum safety factor of 1.2 is normally desired for slopes not near structures or not where they may pose a threat to human life. All safety factors from our analysis exceeded the minimum safety factor.

It should be noted that exposed slopes will be prone to surface erosion and shallow failures. Therefore, we recommend protecting surfaces with vegetation or other erosion control methods.

C. Level of Care

The services provided for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area, under similar budget and time constraints. This is our professional responsibility. No other warranty, expressed or implied, is made.

Appendix

Soil Boring Location Sketch

Log of Boring: B1-B10 and HA1-HA4

Slope Stability Cross Sections

Legend to Soil Description

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa					BORING: B-01	
					LOCATION: See attached sketch	
					DATE: 11/6/2024	SCALE: 1" = 2'
Elev. 1196.6	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		OL	ORGANIC CLAY trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc. MC = 38.1%
1195.1	1.5	CL	LEAN CLAY with SAND trace of gravel, trace of iron staining, light grey, wet, rather stiff. (Alluvium)	10		
1192.6	4.0	SP SC	POORLY-GRADED SAND to CLAYEY SAND mostly medium grained, trace of gravel, trace of iron staining, brown, moist, medium dense. (Alluvium)	18		PP = 2.75 tsf
1190.1	6.5	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, brown, moist, medium dense. (Alluvium)	20		
1187.6	9.0	GP	POORLY-GRADED GRAVEL with SAND mostly coarse grained, brown, moist, loose. (Alluvium)	10		Water encountered at about 12 feet during drilling.
1185.1	11.5	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, grey, moist to waterbearing, loose. (Alluvium)	7	▽	
1180.6	16.0		End of boring. Boring sealed upon completion.	8		

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND) GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: B-02		
				LOCATION: See attached sketch		
				DATE: 11/6/2024		SCALE: 1" = 2'
Elev. 1199.4	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
—	—	CL OL	Slightly Organic LEAN CLAY trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
-1198.4	1.0	CL	SANDY LEAN CLAY trace of gravel, trace of iron staining, light grey, wet, rather stiff. (Alluvium)			
—	—	SC SM	CLAYEY SAND to SILTY SAND mostly fine grained, trace of gravel, light brown, moist, loose to medium dense. (Alluvium)			
-1196.4	3.0					
—	—			17		Water encountered at about 12 feet during drilling.
—	—			19		
—	—			11		
-1192.9	6.5	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, light brown to grey, moist to waterbearing, loose to medium dense. (Alluvium)			
—	—		Trace of clay below about 9 feet to about 11.5 feet.			
—	—					
—	—					
—	—					
—	—					
—	—					
—	—					
—	—					
—	—					
—	—					
-1183.4	16.0					
—	—		End of boring. Boring sealed upon completion.			
—	—					

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: B-03		
				LOCATION: See attached sketch		
				DATE: 11/6/2024		SCALE: 1" = 2'
Elev. 1195.0	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
— — — 1193.0	— — — 2.0	CL OL	Slightly Organic LEAN CLAY trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
— — — — — — — 1187.5	— — — — — — — 7.5	CL	SANDY LEAN CLAY trace of gravel, trace of iron staining, dark grey, wet, soft to rather soft. (Alluvium)	2 5		PP = 1.75 tsf, MC = 29.9%
— — — 1186.0	— — — 9.0	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, grey, waterbearing, very loose to loose. (Alluvium)	3		Water encountered at about 7 feet during drilling.
— — — — — — 1183.5	— — — — — — 11.5	SP SC	POORLY-GRADED SAND to CLAYEY SAND mostly medium grained, trace of gravel, grey, waterbearing, loose. (Alluvium)	4	▽	
— — — — — — 1179.0	— — — — — — 16.0	SP	POORLY-GRADED SAND with GRAVEL mostly coarse grained, brown, moist, loose. (Alluvium)	5 5		
— 						

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND) GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: B-04		
				LOCATION: See attached sketch		
				DATE: 11/6/2024		SCALE: 1" = 2'
Elev. 1197.7	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		CL OL	<u>Slightly Organic LEAN CLAY</u> trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
1195.7	2.0	CL	<u>SANDY LEAN CLAY</u> trace of gravel, black, wet, soft to medium. (B-Horizon)	6		PP = 4.25 tsf, MC = 19.8%
				3		PP = 3.0 tsf, MC = 25.4%
1191.2	6.5	CL	<u>LEAN CLAY with SAND</u> trace of iron staining, dark brown, wet, rather soft. (Alluvium)	4		PP = 1.25 tsf
1188.7	9.0	SP SC	<u>POORLY-GRADED SAND to CLAYEY SAND</u> <u>with GRAVEL</u> mostly medium grained, grey, moist, loose. (Alluvium)	9		
1186.2	11.5	SP	<u>POORLY-GRADED SAND</u> mostly medium grained, trace of gravel, grey, moist, loose. (Alluvium)	10		
1181.7	16.0		End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: B-05		
				LOCATION: See attached sketch		
				DATE: 11/6/2024		SCALE: 1" = 2'
Elev. 1197.5	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
— — — 1195.5	— — — 2.0	CL OL	Slightly Organic LEAN CLAY trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
— — — — — — 1191.0	— — — — — — 6.5	CL	LEAN CLAY with SAND trace of gravel, trace of iron staining, dark brown to grey, wet, rather soft to medium. (Alluvium)	5		MC = 44.2%
— —						

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: B-06		
				LOCATION: See attached sketch		
				DATE: 11/4/2024		SCALE: 1" = 2'
Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1195.6	0.0	CL OL	<u>Slightly Organic LEAN CLAY</u> trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
1193.6	2.0	CL	<u>SANDY LEAN CLAY</u> trace of gravel, trace of iron staining, light grey, wet, rather stiff to stiff. (Alluvium)	13		MC = 14.5%
1190.1	5.5	SP	<u>POORLY-GRADED SAND</u> mostly medium to coarse grained, trace of gravel, light brown to grey, moist to waterbearing, loose to medium dense. (Alluvium)	12		
				6		
				6	▽	Water encountered at about 10 feet during drilling.
				17		
			Trace of silt below about 14 feet.	21		
1179.6	16.0		End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GPJ LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: B-07		
				LOCATION: See attached sketch		
				DATE: 11/4/2024	SCALE: 1" = 2'	
Elev. 1194.3	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		CL OL	Slightly Organic LEAN CLAY trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
-1192.3	2.0	CL	SANDY LEAN CLAY trace of gravel, grey, wet, rather stiff. (Alluvium)	12		MC = 16.3%
-1190.3	4.0	CL	LEAN CLAY with SAND trace of iron staining, light grey, wet, rather stiff. (Alluvium)	10		PP = 3.75 tsf
-1188.3	6.0	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, grey, moist to waterbearing, loose to medium dense. (Alluvium)	4		
				4		
				4	▽	Water encountered at about 10 feet during drilling.
				18		
			Trace of clay below about 14 feet.	20		
-1178.3	16.0		End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND) GPJ LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM
Factual Geotechnical Evaluation
Proposed Wetland
SE 1/4 Sec. 10 - T98N - R22W
Fertile Township, Worth County, Iowa

BORING: **B-08**

LOCATION:
See attached sketch

DATE: 11/4/2024

SCALE: 1" = 2'

Elev. 1198.1	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		CL OL	Slightly Organic LEAN CLAY trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
1196.1	2.0	CL	SANDY LEAN CLAY trace of gravel, black, wet, soft to medium. (B-Horizon)	7		PP = 2.5 tsf, MC = 25.7%
				2		PP = 1.5 tsf
1192.1	6.0					PP = 1.25 tsf
1191.6	6.5	CL	LEAN CLAY trace of iron staining, brown, wet, soft. (Alluvium)			
		SC CL	CLAYEY SAND to SANDY LEAN CLAY mostly medium grained, trace of gravel, trace of roots, trace of wood, grey, moist, loose. (Alluvium)	5		
1189.1	9.0	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, trace of clay, grey, moist, dense. (Alluvium)	34		
1186.6	11.5	SP SC	POORLY-GRADED SAND to CLAYEY SAND mostly medium grained, trace of gravel, brown, moist, medium dense. (Alluvium)	17		
1184.1	14.0	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, trace of clay, grey, moist, medium dense. (Alluvium)	17		
1182.1	16.0		End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: B-09		
				LOCATION: See attached sketch		
				DATE: 11/4/2024		SCALE: 1" = 2'
Elev. 1194.8	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
— 						

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND) GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM
Factual Geotechnical Evaluation
Proposed Wetland
SE 1/4 Sec. 10 - T98N - R22W
Fertile Township, Worth County, Iowa

BORING: **B-10**

LOCATION:
See attached sketch

DATE: 11/4/2024

SCALE: 1" = 2'

Elev. 1197.7	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		CL	Slightly Organic LEAN CLAY trace of roots, black, wet. (Topsoil)			Elevations provided by Bolton & Menk, Inc.
1196.2	1.5	CL	SANDY LEAN CLAY trace of gravel, black, wet, medium. (B-Horizon)	6		PP = 2.25 tsf, MC = 26.6%
1193.7	4.0	CL	LEAN CLAY trace of gravel, trace of iron staining, trace of sand, grey to dark grey, wet, rather soft. (Alluvium)	4		PP = 1.25 tsf, MC = 29.8%
1191.2	6.5	SC	CLAYEY SAND mostly medium grained, trace of gravel, brown, moist, loose. (Alluvium)	7		
1188.7	9.0	SP SC	POORLY-GRADED SAND to CLAYEY SAND mostly medium grained, trace of gravel, brown to grey, moist, medium dense to dense. (Alluvium)	30		
			With GRAVEL below about 11.5 feet.	17		
1183.7	14.0	SP	POORLY-GRADED SAND with GRAVEL mostly medium graiend, grey, moist to waterbearing, medium dense. (Alluvium)	16	▽	Water encountered at about 14 feet during drilling.
1181.7	16.0		End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GP3 LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: HA-1		
				LOCATION: See attached sketch		
				DATE: 3/21/2025		SCALE: 1" = 2'
Elev.	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	1.0	CL OL	<u>Slightly Organic SANDY LEAN CLAY</u> trace of gravel, black, wet.			Elevations estimated from Iowa DNR LiDAR.
	3.0	CL	<u>SANDY LEAN CLAY</u> trace of gravel, black, wet. (B-Horizon) Trace of roots below about 2 feet.			
	5.0	CL	<u>SANDY LEAN CLAY</u> trace of gravel, dark brown, wet. (Alluvium) Trace of iron staining below about 4 feet.			
	6.0	SC SM	<u>CLAYEY SAND to SILTY SAND</u> mostly fine grained, trace of gravel, light brown to light grey, moist. (Alluvium)			
			End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GPJ LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: HA-2	
				LOCATION: See attached sketch	
				DATE: 3/21/2025	SCALE: 1" = 2'

Elev.	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	1.0	CL OL	Slightly Organic SANDY LEAN CLAY trace of gravel, black, wet. (Topsoil)			Elevations estimated from Iowa DNR LiDAR.
	2.0	SC	CLAYEY SAND mostly medium grained, trace of gravel, brown to dark brown, moist. (Alluvium)			
	3.0	SP SC	POORLY-GRADED SAND to CLAYEY SAND mostly medium grained, trace of gravel, brown, moist. (Alluvium)			
	4.0	SP	POORLY-GRADED SAND mostly medium grained, trace of gravel, trace of clay, brown, moist. (Alluvium)			
			End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GPJ LOG A GNNIN06.GDT 3/28/25

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa	BORING: HA-3	
	LOCATION: See attached sketch	
	DATE: 3/21/2025	SCALE: 1" = 2'

Elev.	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	1.0	CL OL	<u>Slightly Organic LEAN CLAY</u> black, wet. (Topsoil)			Elevations estimated from Iowa DNR LiDAR.
	2.5	SC	<u>CLAYEY SAND</u> mostly medium grained, dark brown, moist. (Alluvium)			
	5.0	SP SC	<u>POORLY-GRADED SAND to CLAYEY SAND</u> mostly medium grained, dark brown, moist. (Alluvium)			
			End of boring. Boring sealed upon completion.			

LOG OF BORING

CHOSEN VALLEY TESTING

CVT

PROJECT: 24387.24.IAM Factual Geotechnical Evaluation Proposed Wetland SE 1/4 Sec. 10 - T98N - R22W Fertile Township, Worth County, Iowa				BORING: HA-4		
				LOCATION: See attached sketch		
				DATE: 3/21/2025	SCALE: 1" = 2'	
Elev.	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	1.0	CL OL	Slightly Organic LEAN CLAY black, wet to very wet. (Topsoil)			Elevations estimated from Iowa DNR LiDAR.
	2.0	CL	SANDY LEAN CLAY trace of roots, black, wet. (B-Horizon)			
	4.0	SC SM	CLAYEY SAND to SILTY SAND mostly fine grained, trace of gravel, brown to dark brown, moist. (Alluvium)			
	5.0	SC	CLAYEY SAND mostly fine grained, trace of gravel, brown, moist. (Alluvium)			
			End of boring. Boring sealed upon completion.			

CVT STANDARD 24387.24.IAM (WORTH COUNTY WETLAND).GPJ LOG A GNNIN06.GDT 3/28/25



Boring Location Sketch

Proposed Wetland

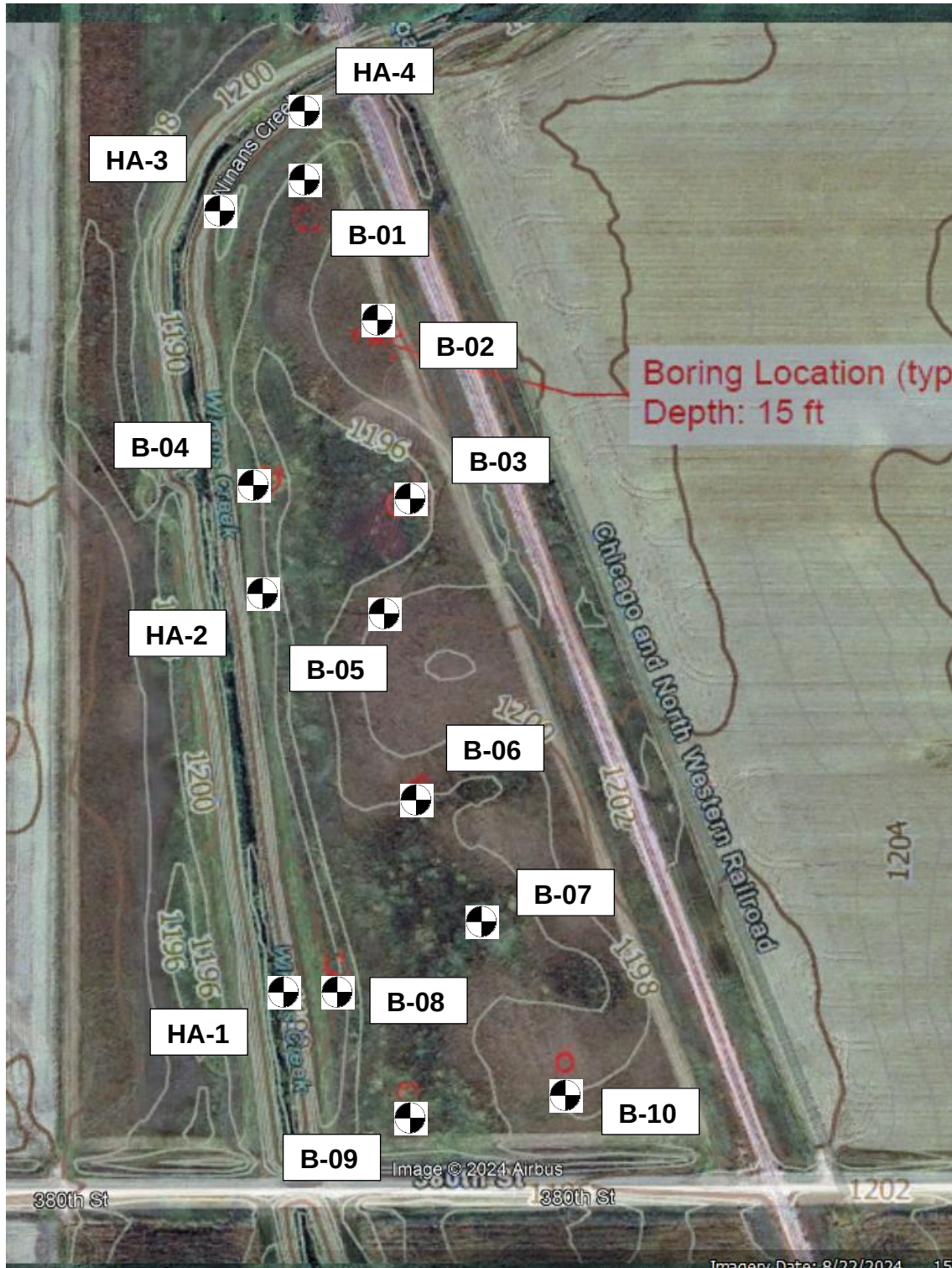
SE ¼ Sec. 10 – T98N – R22W

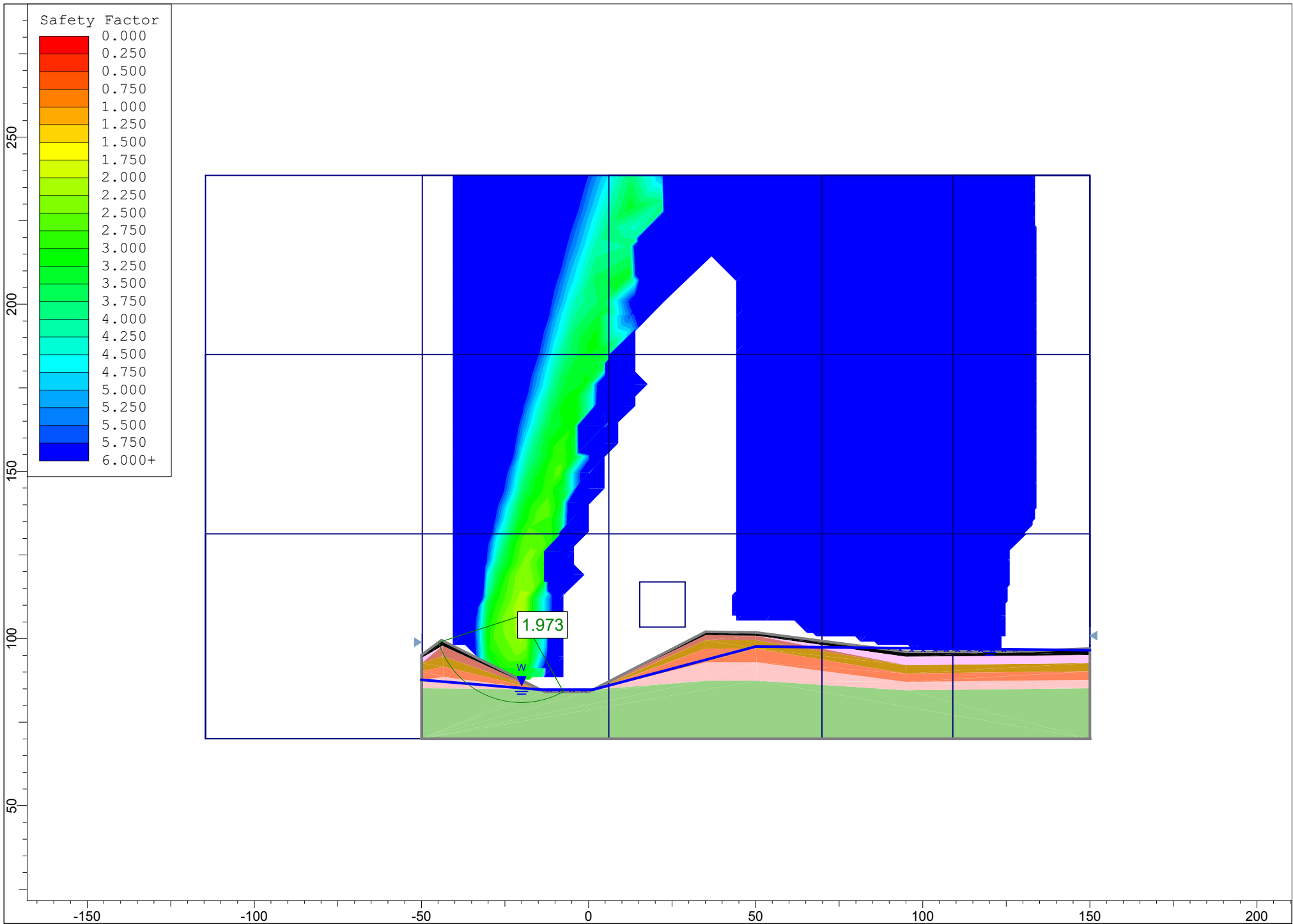
Fertile Township, Worth County, Iowa

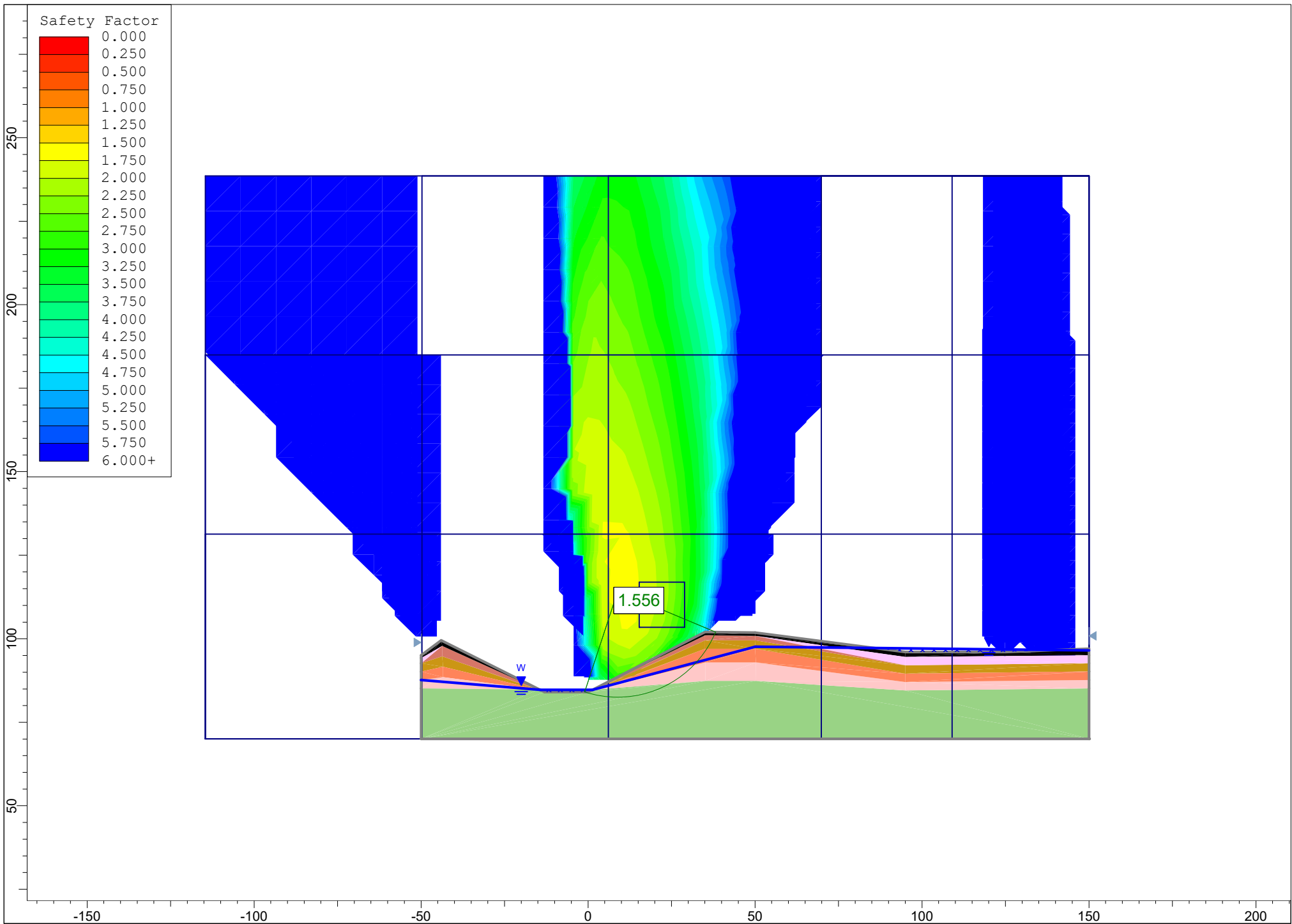
24387.24.IAM

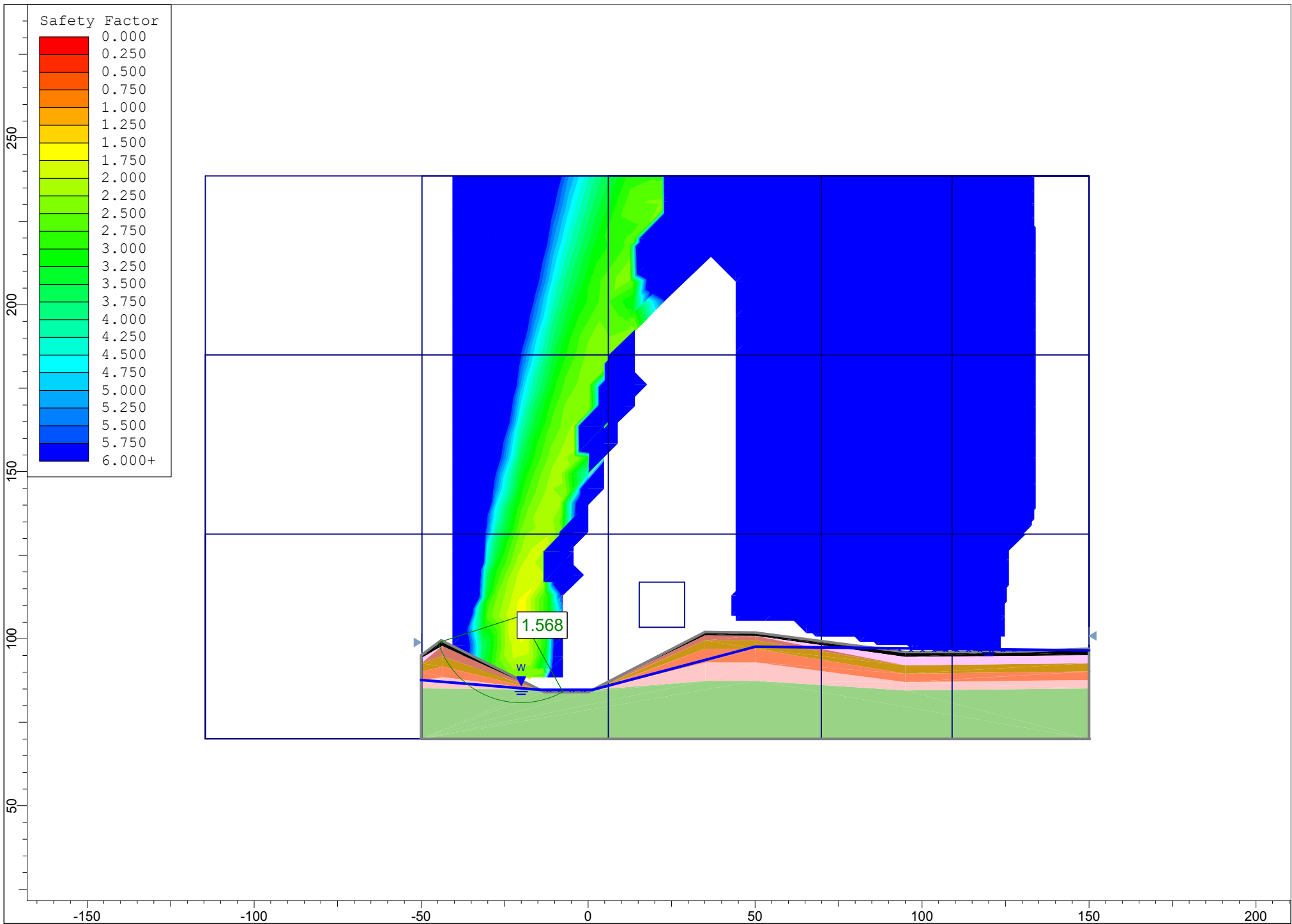
Legend

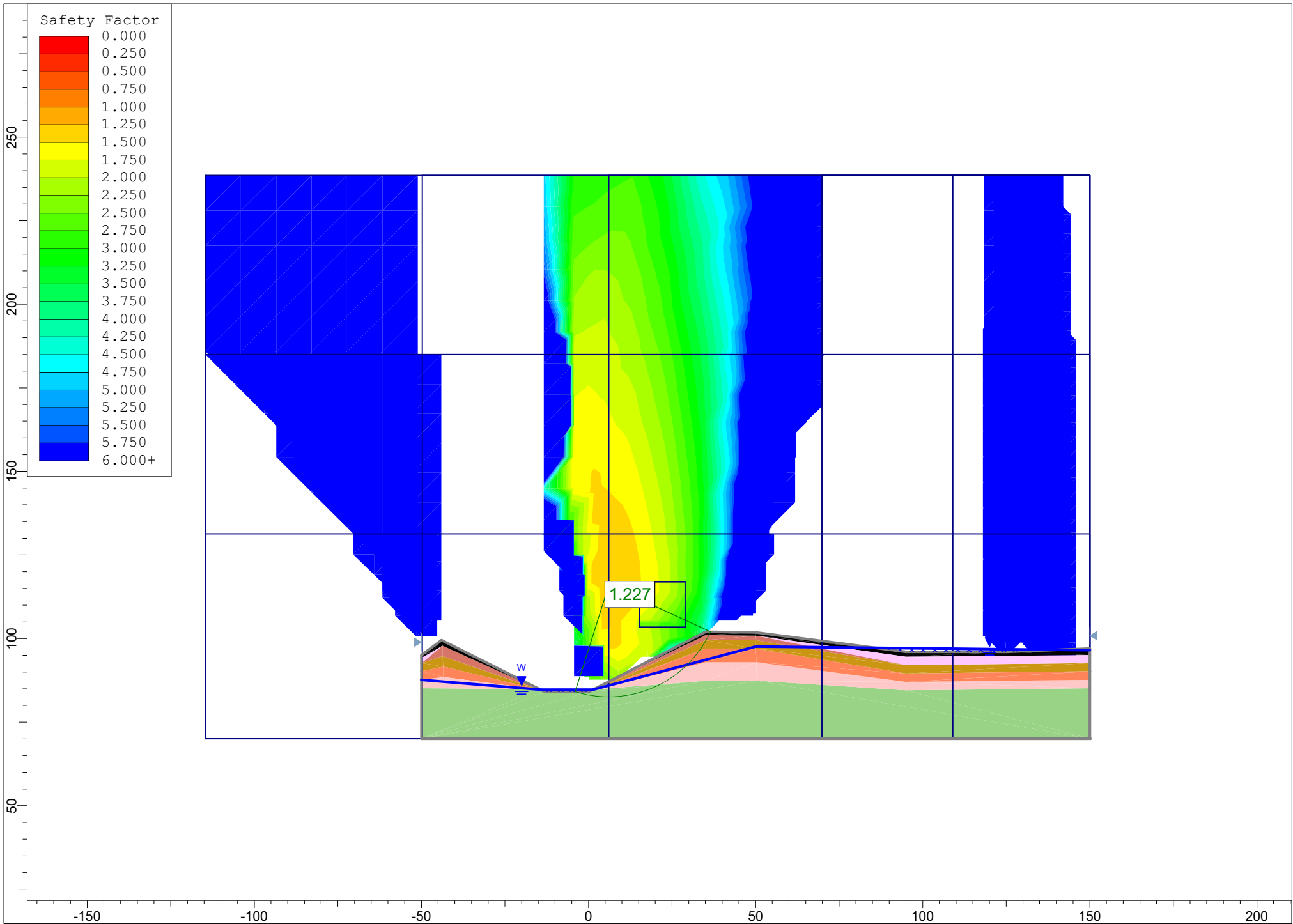
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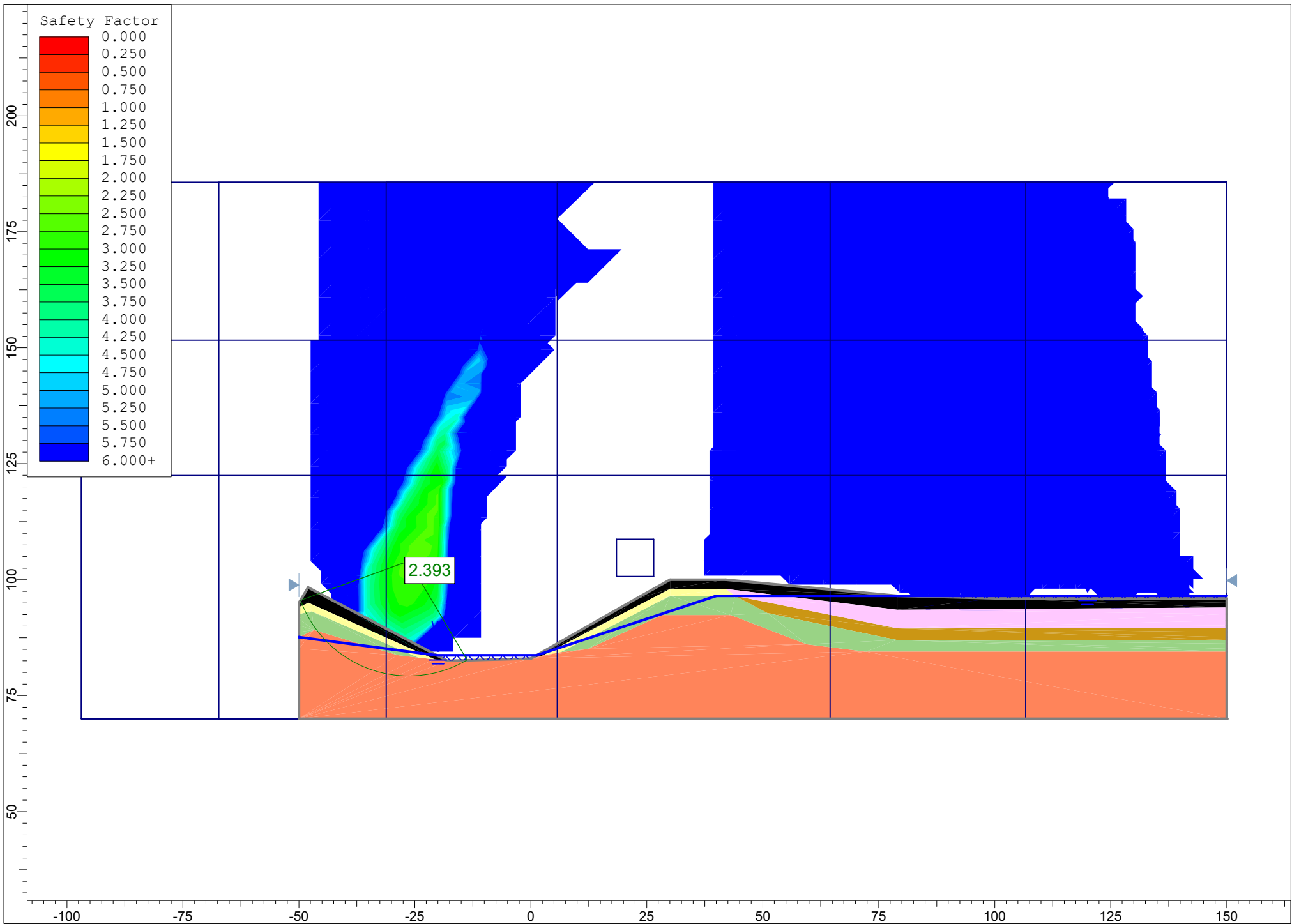


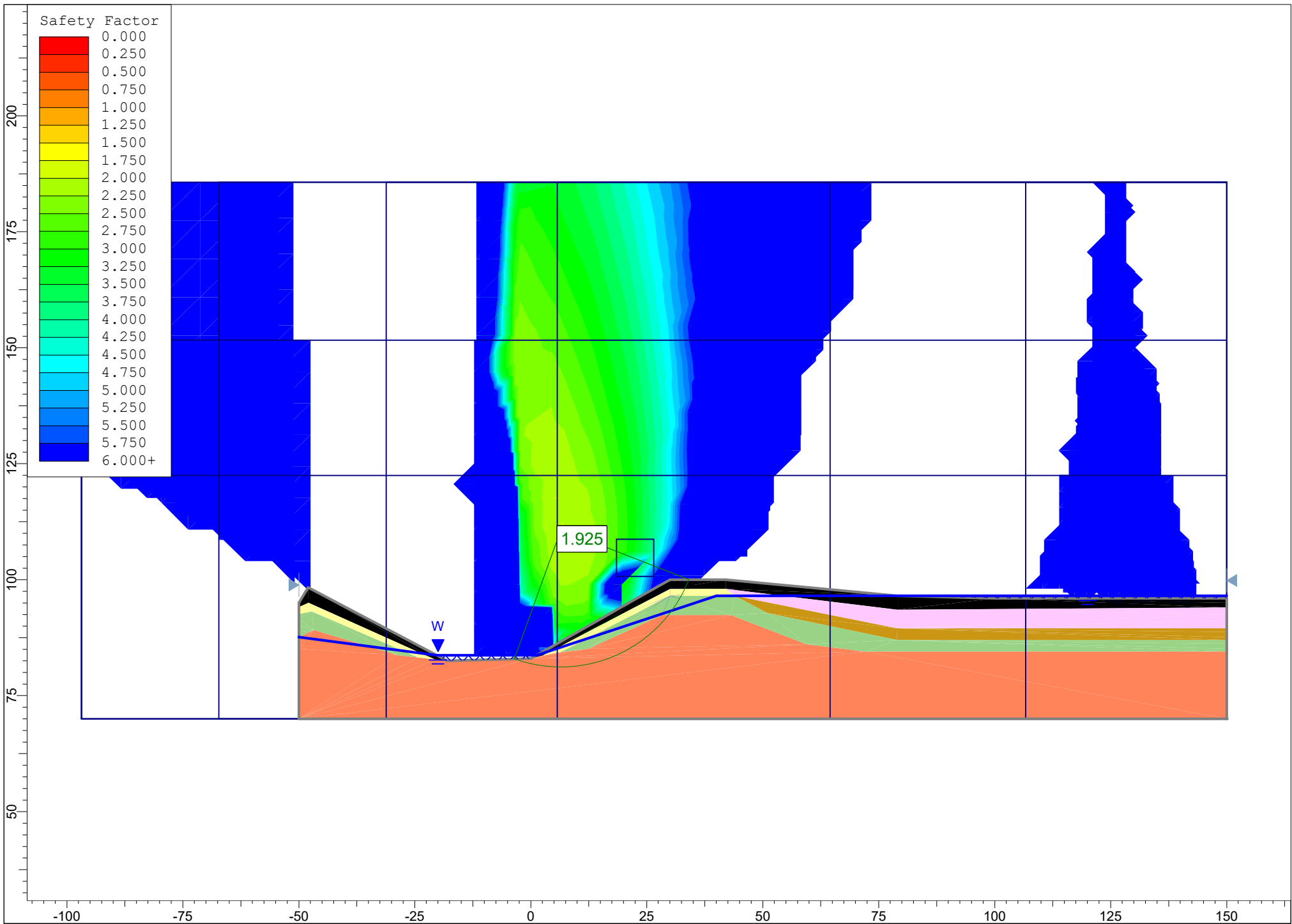


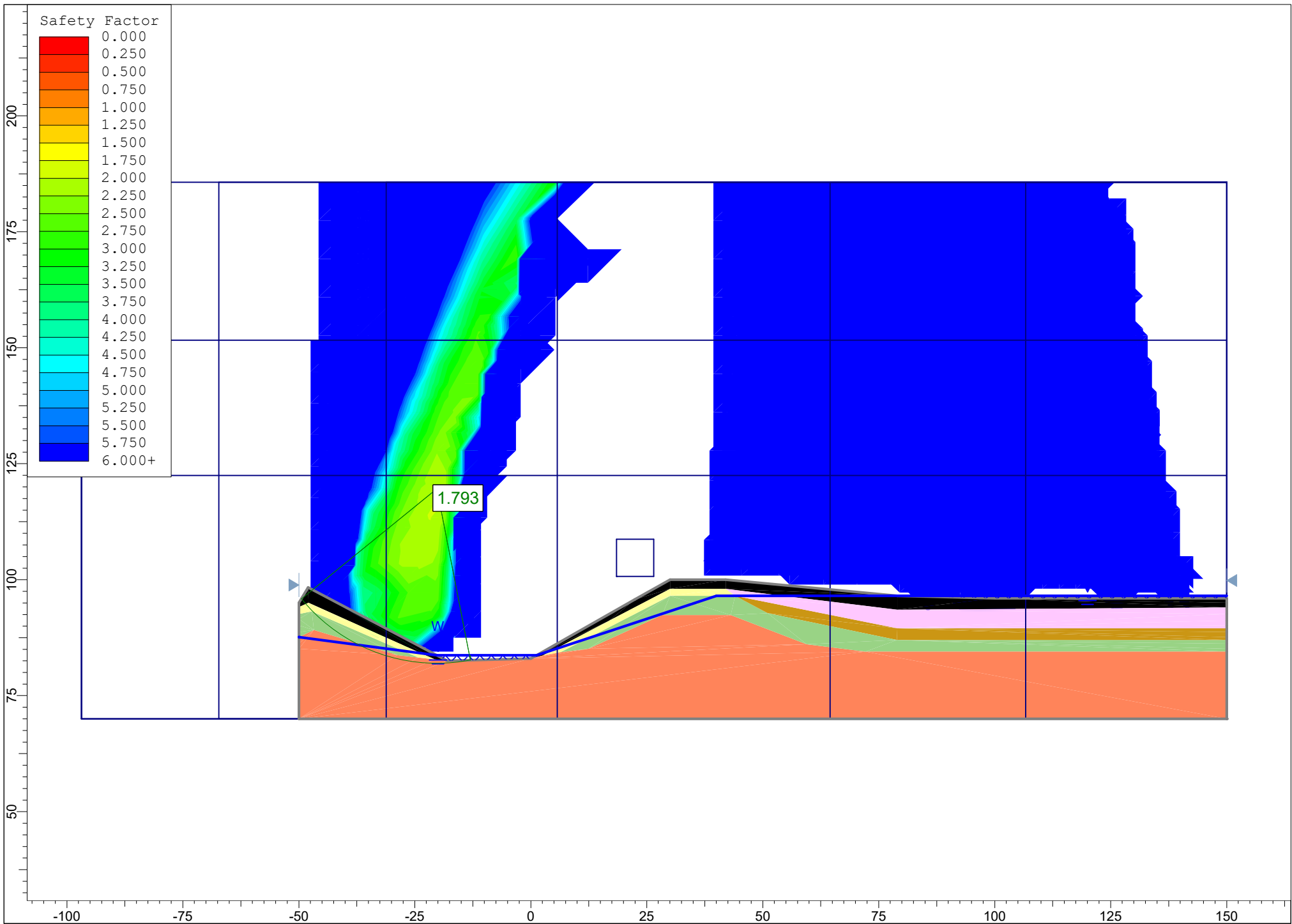


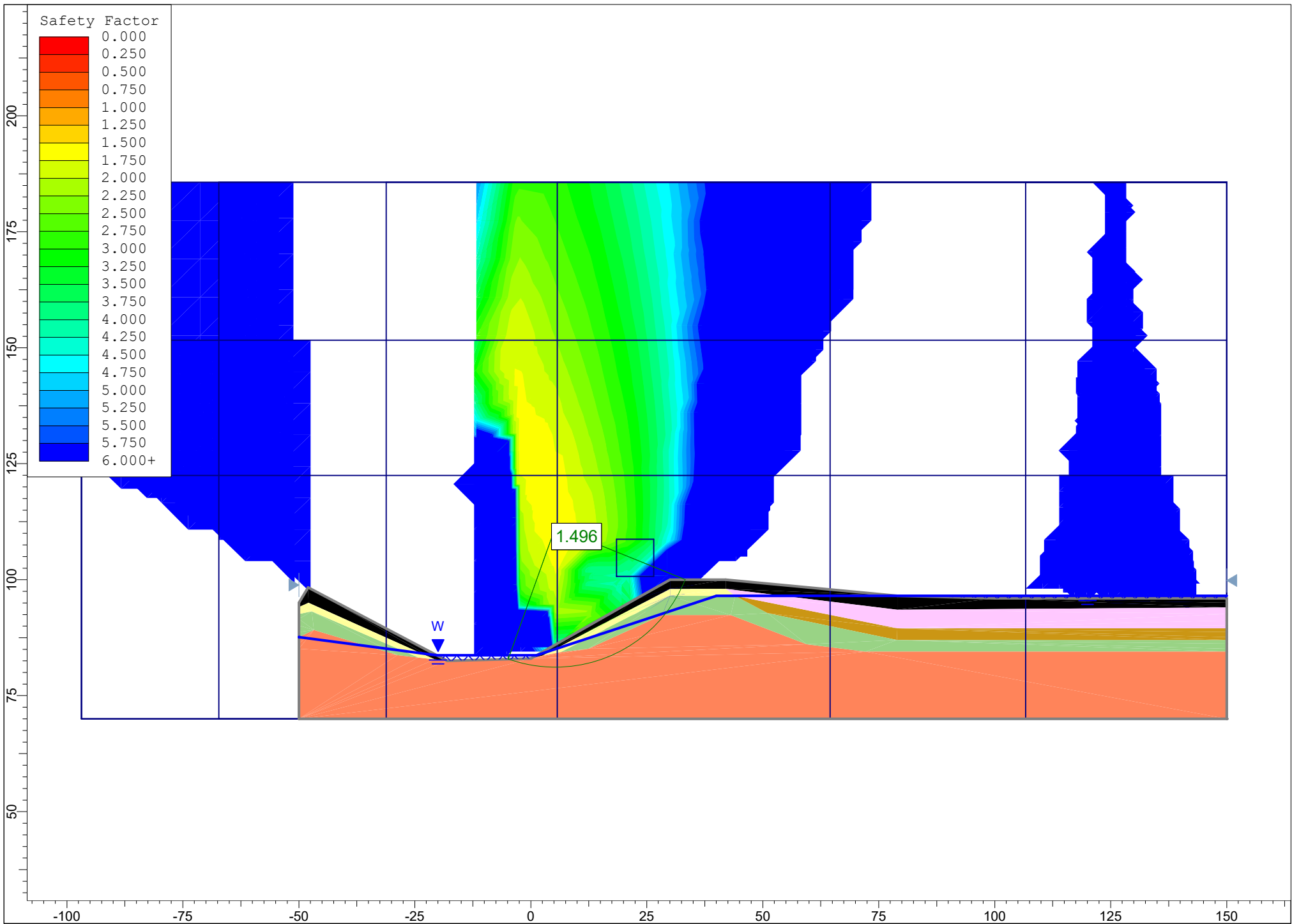


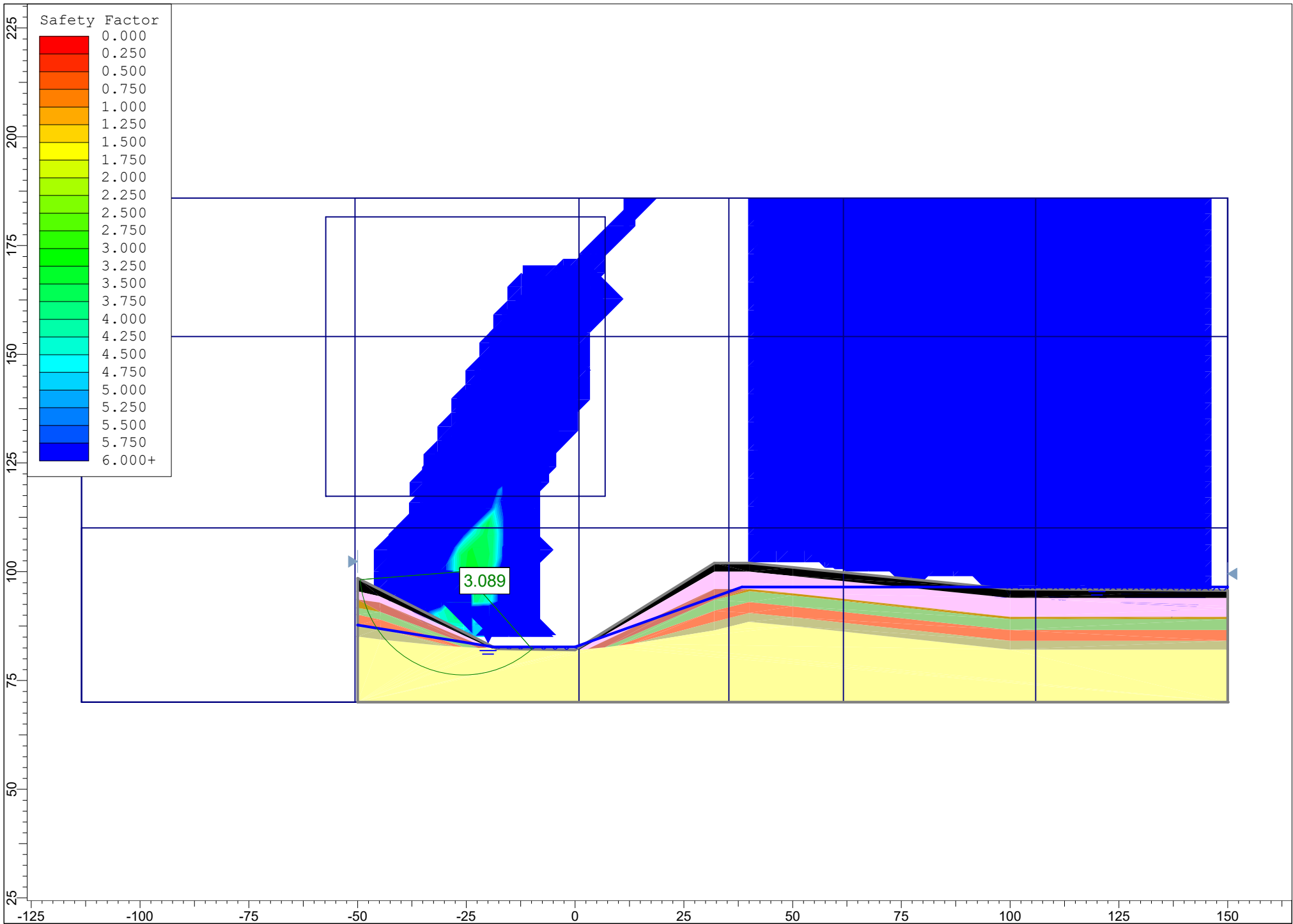


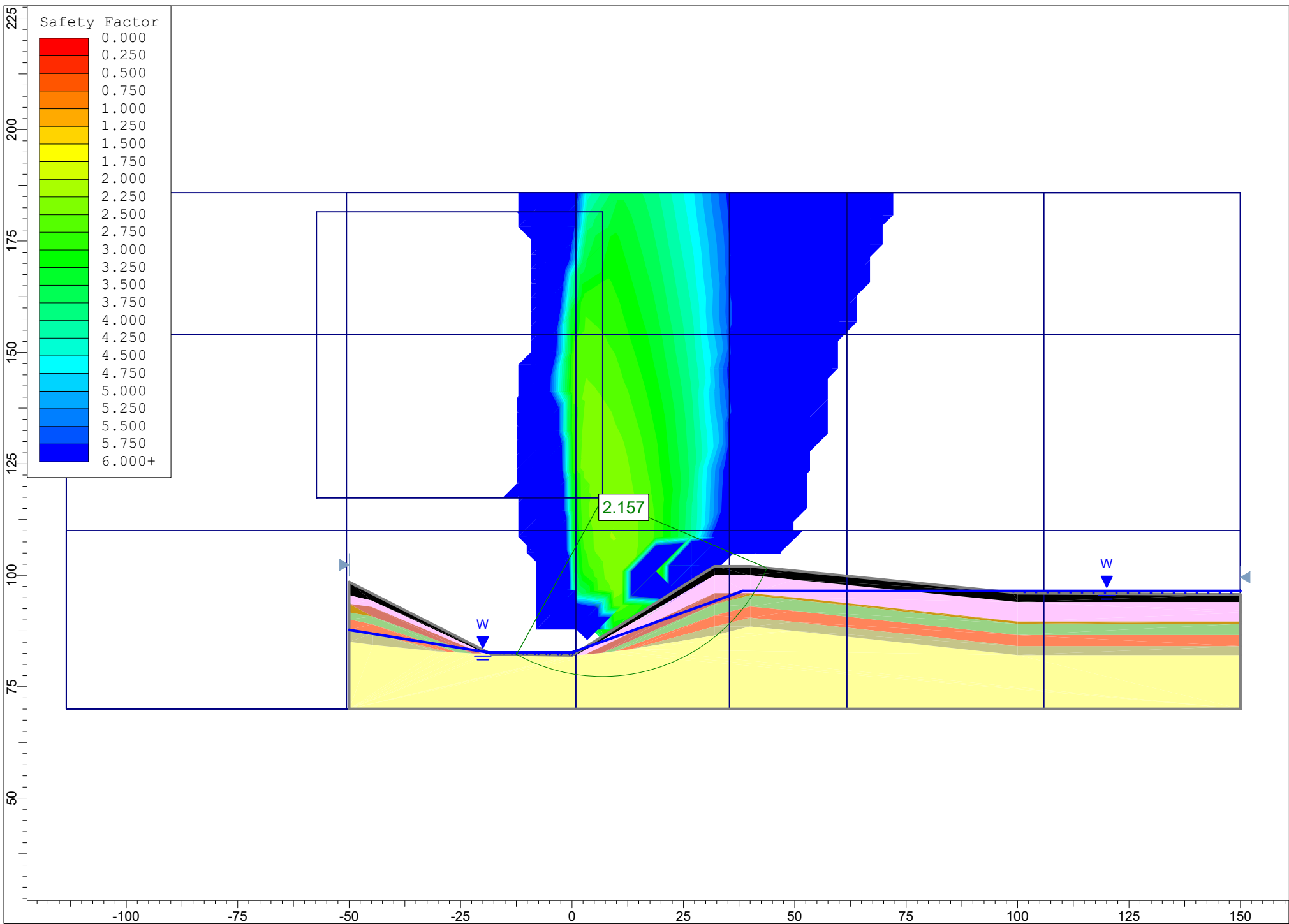


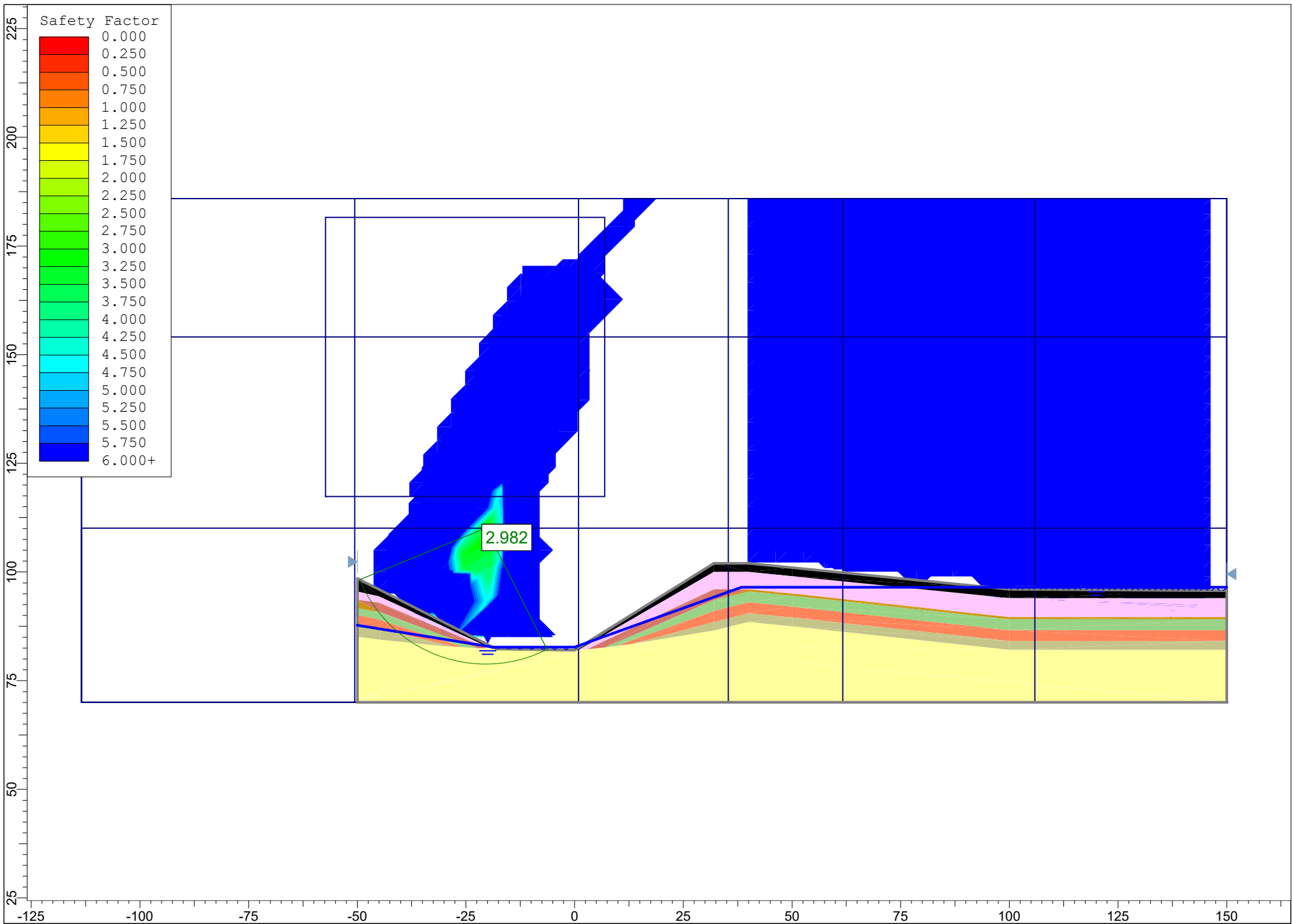


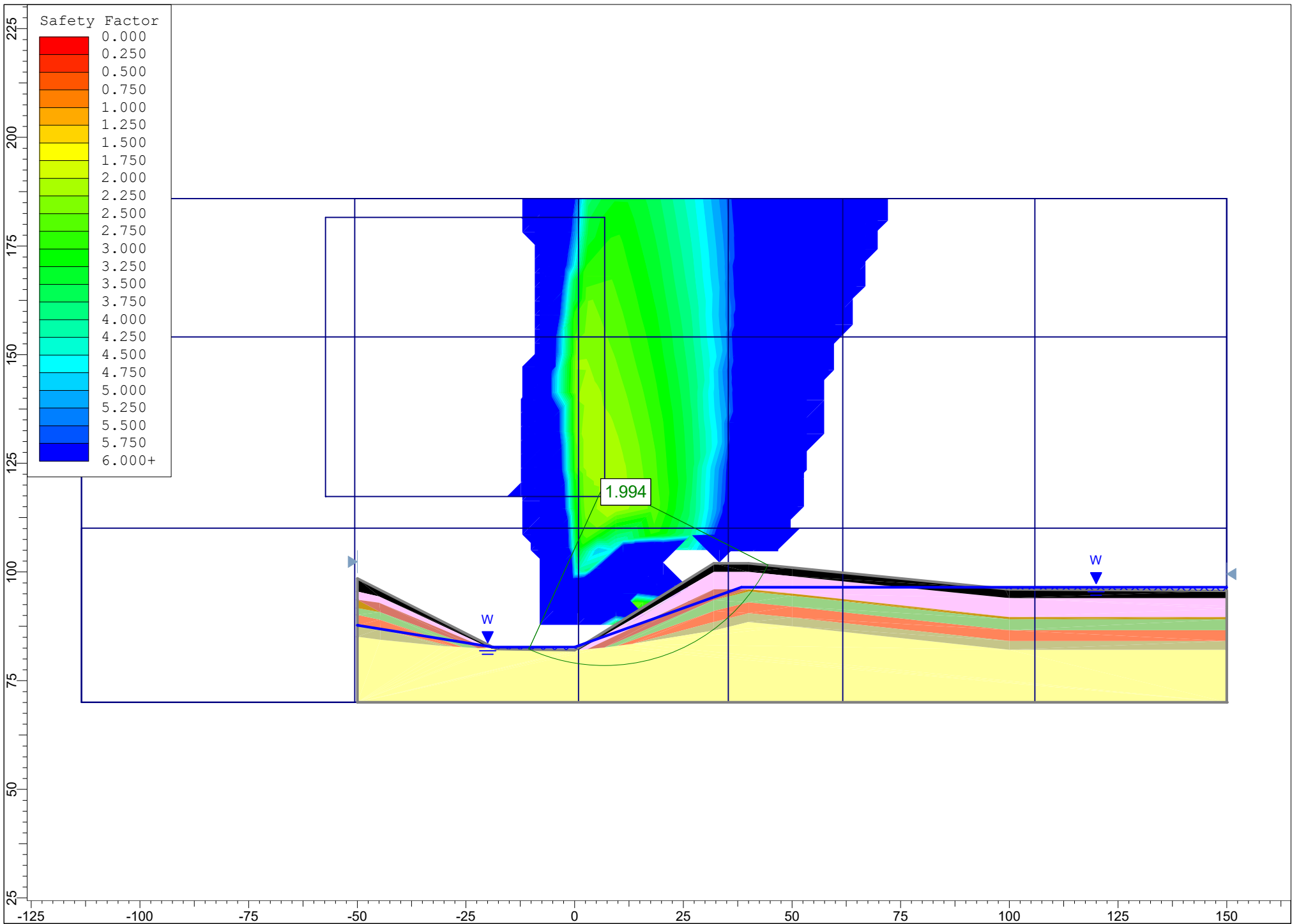


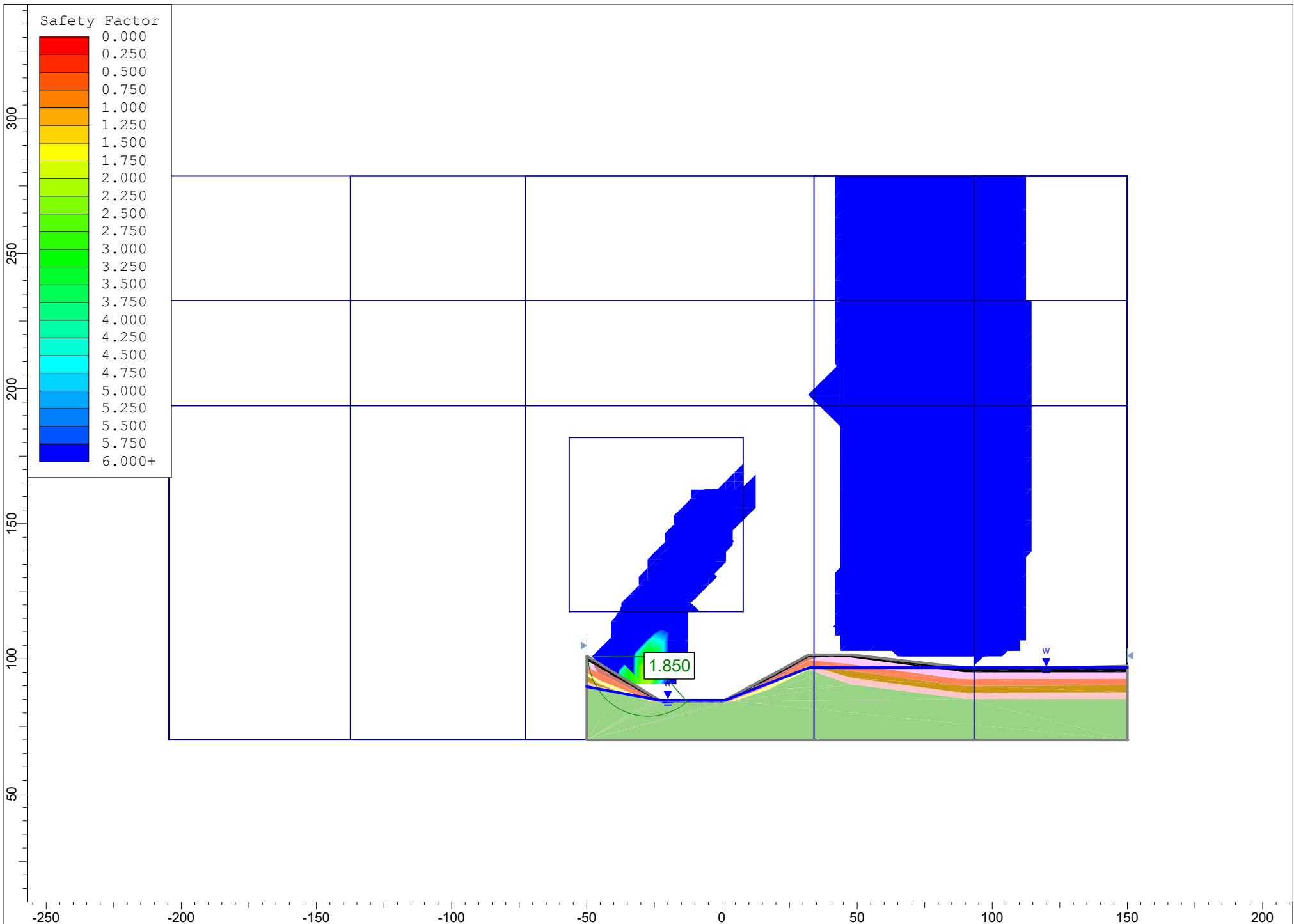


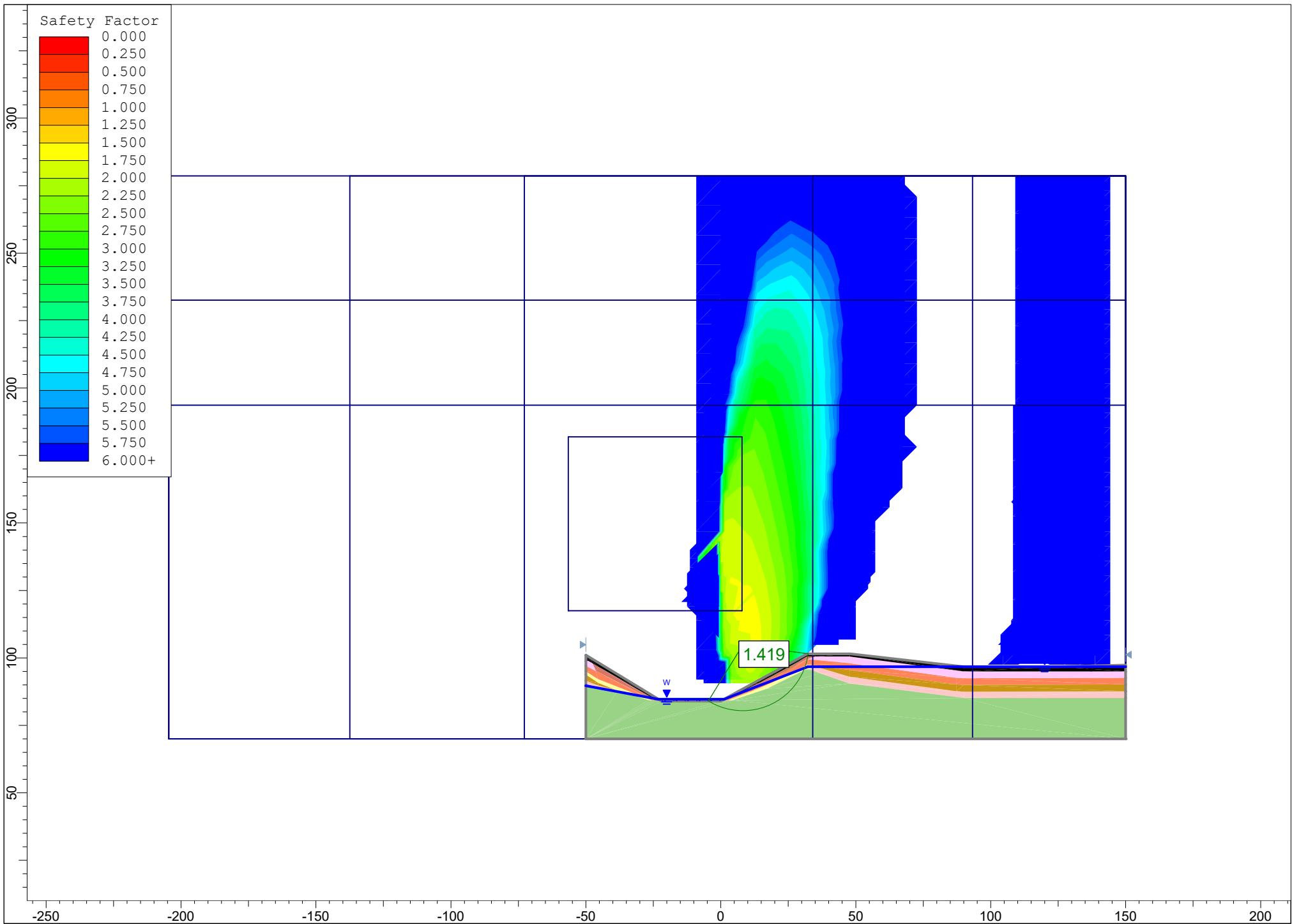


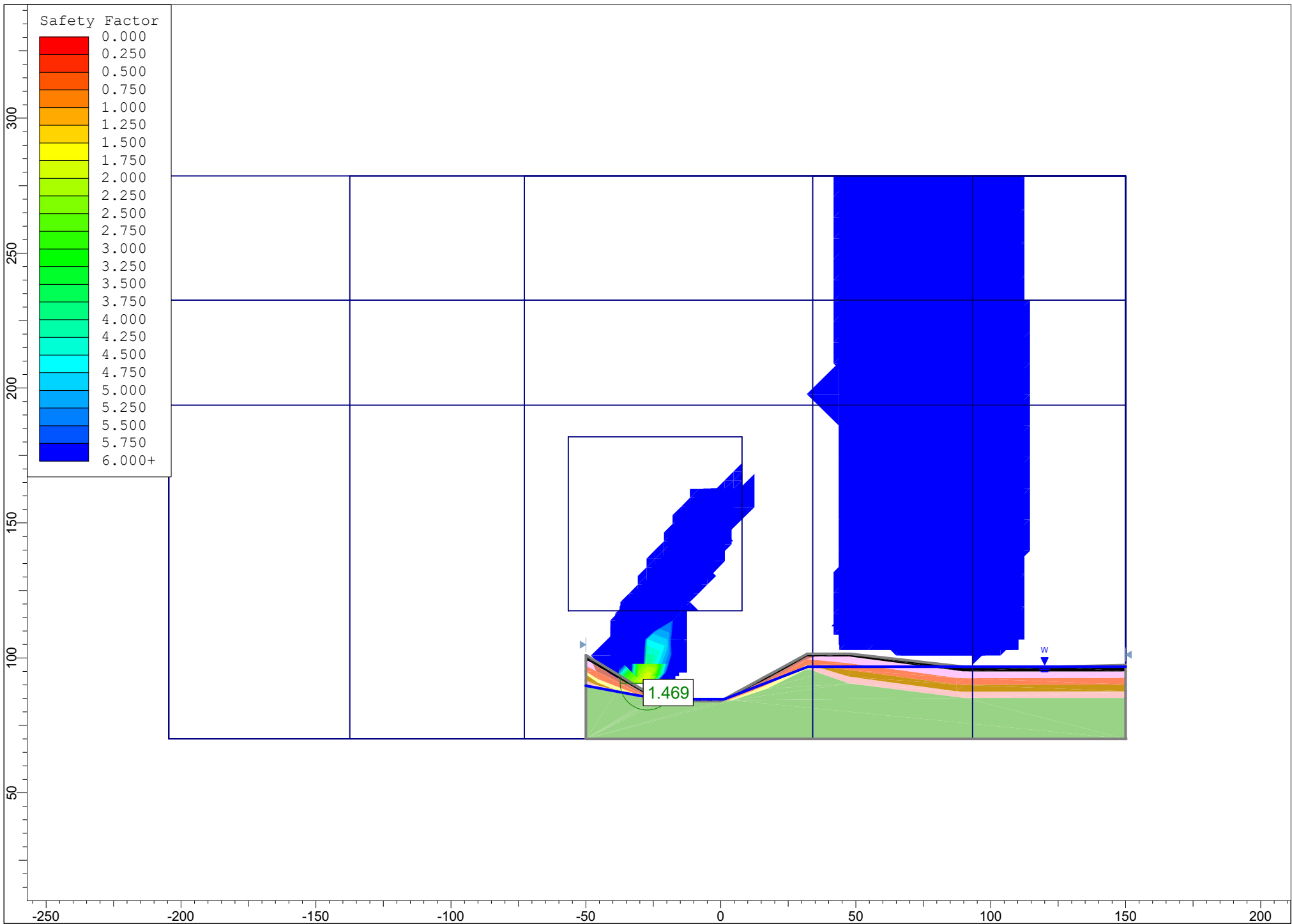


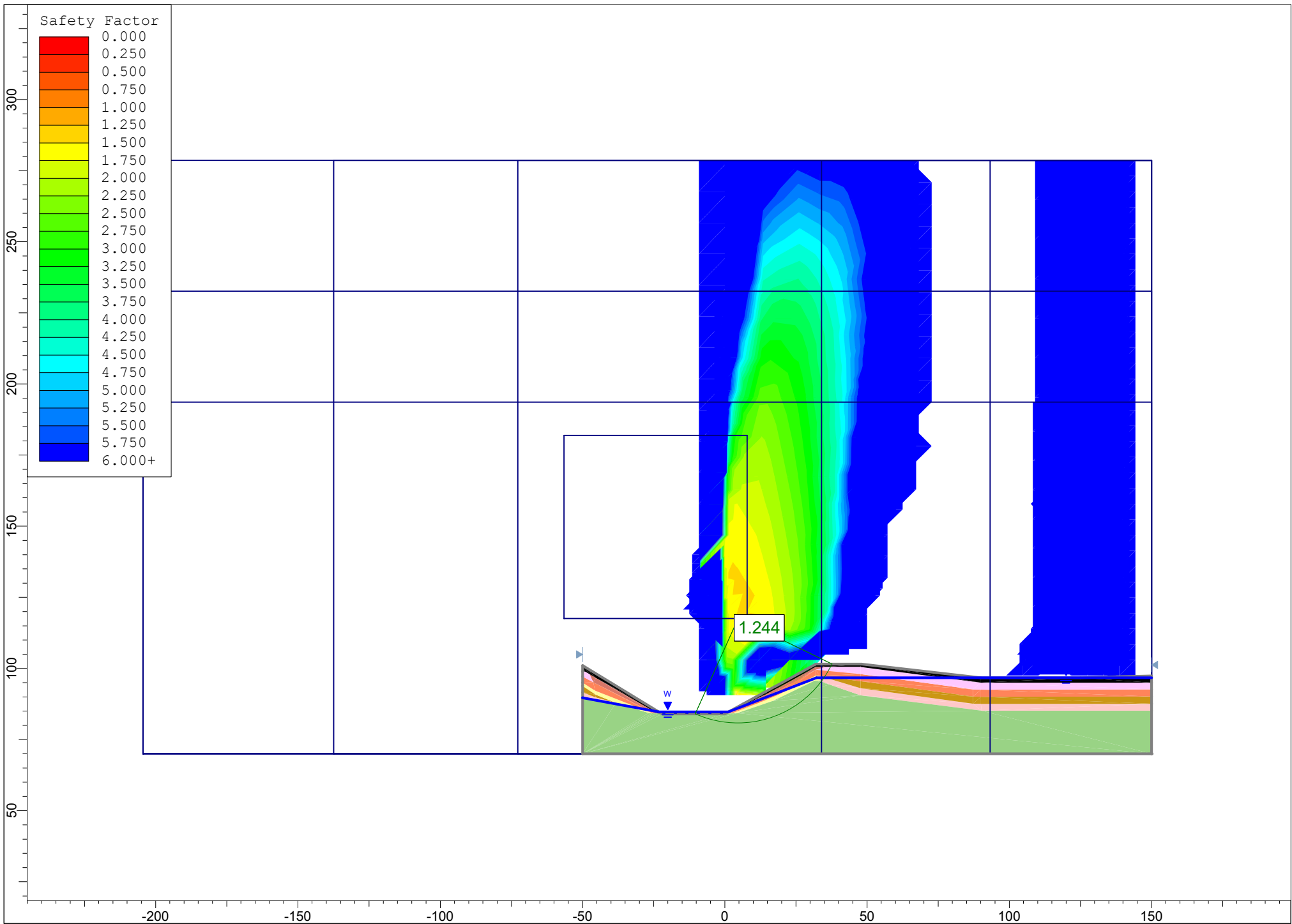












UNIFIED SOIL CLASSIFICATION (ASTM D-2487/2488)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND	
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL	
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL	
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL	
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL	
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND	
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND	
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND	
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY	
			PI>4 AND PLOTS<"A" LINE	ML	SILT	
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT	
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY	
			PI PLOTS <"A" LINE	MH	ELASTIC SILT	
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT	
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT	

Relative Proportions of Sand and Gravel	
TERM	PERCENT
Trace	< 15
With	15 - 29
Modifier	> 30
Relative Proportions of Fines	
TERM	PERCENT
Trace	< 5
With	5 - 12
Modifier	> 12
Grain Size Terminology	
TERM	SIZE
Boulder	< 12 in.
Cobble	3 in. - 12 in.
Gravel	#4 sieve to 3 in.
Sand	#200 sieve to #4 sieve
Silt or Clay	Passing #200 sieve

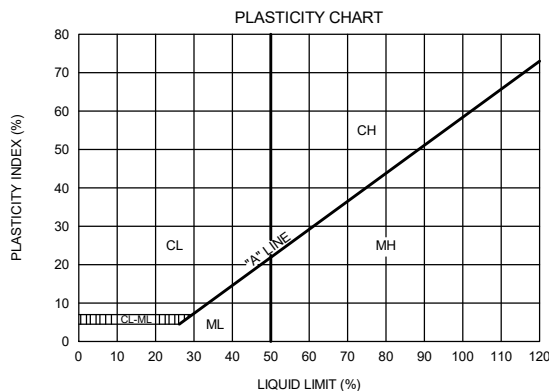
SAMPLE TYPES

- Hollow Stem
- Standard Penetration Test

TEST SYMBOLS

- | | |
|-----------------------------|--|
| MC - MOISTURE CONTENT | LL - LIQUID LIMIT |
| OC - ORGANIC CONTENT | PI - PLASTISITY INDEX |
| CN - CONSOLIDATION | SW - SWELL TEST |
| DD - DRY DENSITY | UU - Unconsolidated Undrained triaxial |
| PP - POCKET PENETROMETER | |
| RV - R-VALUE | |
| SA - SIEVE ANALYSIS | |
| P200 - % PASSING #200 SIEVE | |

- WATER LEVEL (WITH TIME OF MEASUREMENT)



PENETRATION RESISTANCE (RECORDED AS BLOWS / 0.5 FT)				
SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 1	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 3	0.25 - 0.50
MEDIUM DENSE	10 - 30	RATHER SOFT	4 - 5	0.50 - 1.0
DENSE	30 - 50	MEDIUM	6 - 8	
VERY DENSE	OVER 50	RATHER STIFF	9 - 12	1.0 - 2.0
		STIFF	13 - 16	2.0 - 4.0
		VERY STIFF	17 - 30	OVER 4.0
		HARD	OVER 30	

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

Chosen Valley Testing

Job No. 24387.24.IAM

**LEGEND TO SOIL
DESCRIPTIONS**

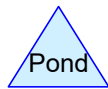
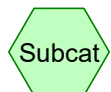
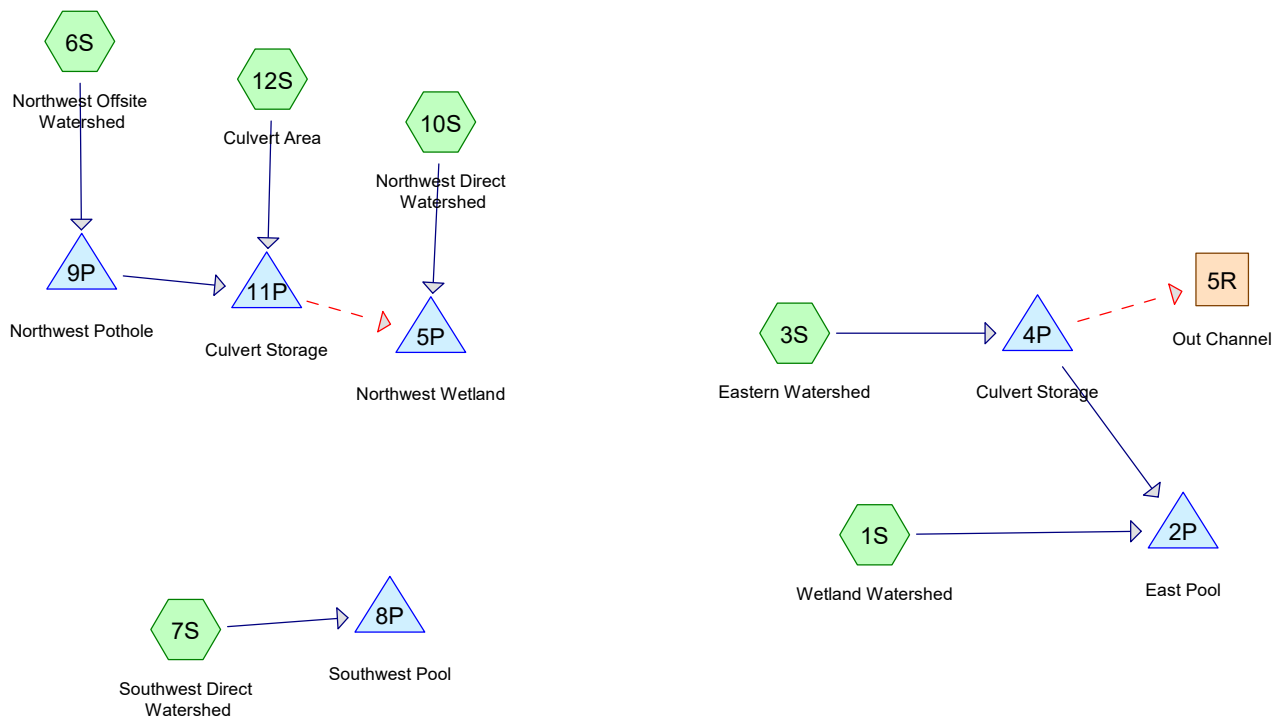


Name: D. Petersburg Wetland Design Report

Date: August 4, 2026

Page: 10

Appendix G: HydroCAD Output



D Petersburg HydroCAD

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Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	5 Yr	MSE 24-hr	3	Default	24.00	1	3.90	2
2	10 Yr	MSE 24-hr	3	Default	24.00	1	4.60	2
3	25 yr	MSE 24-hr	3	Default	24.00	1	5.80	2
4	100 yr	MSE 24-hr	3	Default	24.00	1	7.80	2

D Petersburg HydroCAD

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Page 3

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
19.300	83	(1S, 3S)
3.670	100	(7S, 10S)
3.710	85	(7S, 10S)
1.200	80	(12S)
5.500	100	Pool (1S)
31.480	85	Row crops, straight row, Good, HSG C (6S)
64.860	86	TOTAL AREA

D Petersburg HydroCAD

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MSE 24-hr 3 5 Yr Rainfall=3.90"

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Page 4

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Wetland Watershed Runoff Area=11.800 ac 46.61% Impervious Runoff Depth=2.92"
Flow Length=125' Tc=11.9 min CN=91 Runoff=47.87 cfs 2.873 af

Subcatchment 3S: Eastern Watershed Runoff Area=13.000 ac 0.00% Impervious Runoff Depth=2.20"
Flow Length=1,370' Tc=21.5 min CN=83 Runoff=30.84 cfs 2.383 af

Subcatchment 6S: Northwest Offsite Runoff Area=31.480 ac 0.00% Impervious Runoff Depth=2.37"
Flow Length=1,540' Tc=26.3 min CN=85 Runoff=72.11 cfs 6.214 af

Subcatchment 7S: Southwest Direct Runoff Area=3.530 ac 47.03% Impervious Runoff Depth=3.02"
Tc=5.0 min CN=92 Runoff=19.35 cfs 0.889 af

Subcatchment 10S: Northwest Direct Runoff Area=3.850 ac 52.21% Impervious Runoff Depth=3.12"
Tc=5.0 min CN=93 Runoff=21.55 cfs 1.002 af

Subcatchment 12S: Culvert Area Runoff Area=1.200 ac 0.00% Impervious Runoff Depth=1.96"
Tc=5.0 min CN=80 Runoff=4.60 cfs 0.196 af

Reach 5R: Out Channel Avg. Flow Depth=0.39' Max Vel=1.63 fps Inflow=4.89 cfs 0.385 af
n=0.025 L=80.0' S=0.0050 '/' Capacity=6,533.92 cfs Outflow=4.89 cfs 0.385 af

Pond 2P: East Pool Peak Elev=1,197.01' Storage=7.563 af Inflow=50.33 cfs 4.870 af
Primary=4.61 cfs 4.652 af Secondary=0.02 cfs 0.002 af Outflow=4.63 cfs 4.654 af

Pond 4P: Culvert Storage Peak Elev=1,199.79' Storage=1.066 af Inflow=30.84 cfs 2.383 af
Primary=4.52 cfs 1.997 af Secondary=4.89 cfs 0.385 af Outflow=9.41 cfs 2.383 af

Pond 5P: Northwest Wetland Peak Elev=1,197.30' Storage=2.517 af Inflow=68.40 cfs 4.367 af
Primary=44.91 cfs 4.366 af Secondary=0.00 cfs 0.000 af Outflow=44.91 cfs 4.366 af

Pond 8P: Southwest Pool Peak Elev=1,198.24' Storage=2.019 af Inflow=19.35 cfs 0.889 af
Primary=4.51 cfs 0.887 af Secondary=0.00 cfs 0.000 af Outflow=4.51 cfs 0.887 af

Pond 9P: Northwest Pothole Peak Elev=1,200.43' Storage=0.656 af Inflow=72.11 cfs 6.214 af
Primary=70.79 cfs 5.854 af Secondary=0.00 cfs 0.000 af Outflow=70.79 cfs 5.854 af

Pond 11P: Culvert Storage Peak Elev=1,197.32' Storage=0.098 af Inflow=71.68 cfs 6.050 af
Primary=6.95 cfs 2.685 af Secondary=64.63 cfs 3.365 af Outflow=71.45 cfs 6.050 af

Total Runoff Area = 64.860 ac Runoff Volume = 13.556 af Average Runoff Depth = 2.51"
85.86% Pervious = 55.690 ac 14.14% Impervious = 9.170 ac

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MSE 24-hr 3 5 Yr Rainfall=3.90"

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Page 5

Summary for Subcatchment 1S: Wetland Watershed

Runoff = 47.87 cfs @ 12.19 hrs, Volume= 2.873 af, Depth= 2.92"
Routed to Pond 2P : East Pool

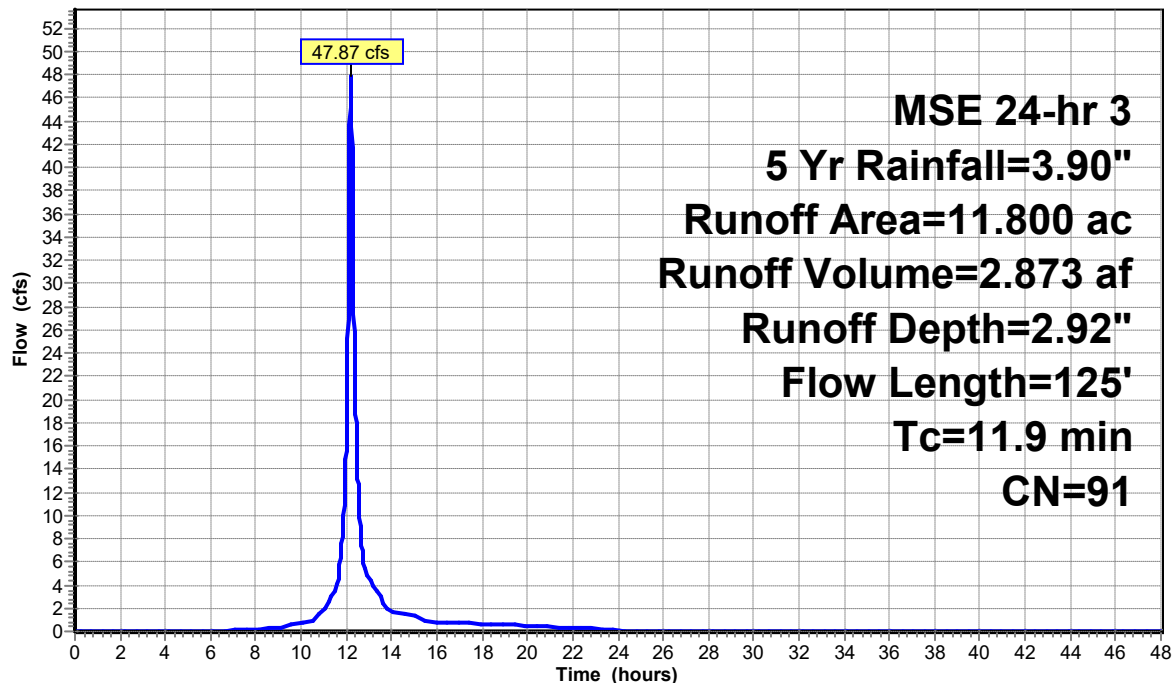
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 5 Yr Rainfall=3.90"

Area (ac)	CN	Description
* 5.500	100	Pool
* 6.300	83	
11.800	91	Weighted Average
6.300		53.39% Pervious Area
5.500		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0350	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 3.10"
0.3	25	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
11.9	125	Total			

Subcatchment 1S: Wetland Watershed

Hydrograph



Summary for Subcatchment 3S: Eastern Watershed

Runoff = 30.84 cfs @ 12.31 hrs, Volume= 2.383 af, Depth= 2.20"
Routed to Pond 4P : Culvert Storage

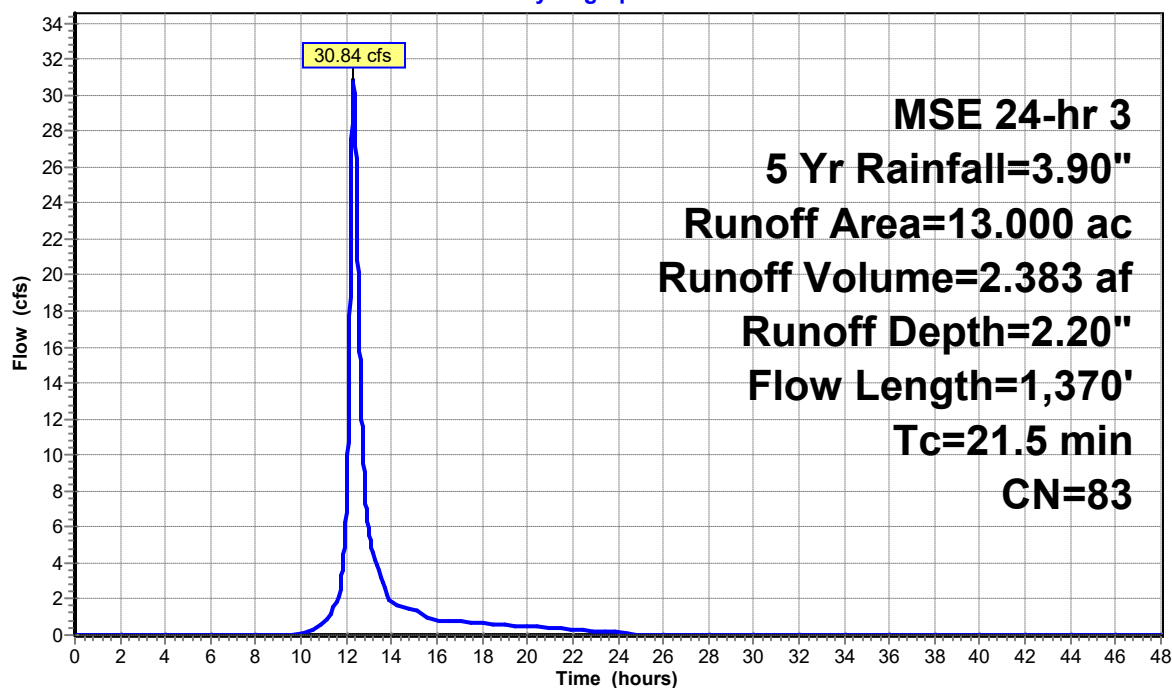
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 5 Yr Rainfall=3.90"

Area (ac)	CN	Description
* 13.000	83	
13.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0800	0.26		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
15.2	1,270	0.0240	1.39		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
21.5	1,370	Total			

Subcatchment 3S: Eastern Watershed

Hydrograph



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MSE 24-hr 3 5 Yr Rainfall=3.90"

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Page 7

Summary for Subcatchment 6S: Northwest Offsite Watershed

Runoff = 72.11 cfs @ 12.36 hrs, Volume= 6.214 af, Depth= 2.37"
Routed to Pond 9P : Northwest Pothole

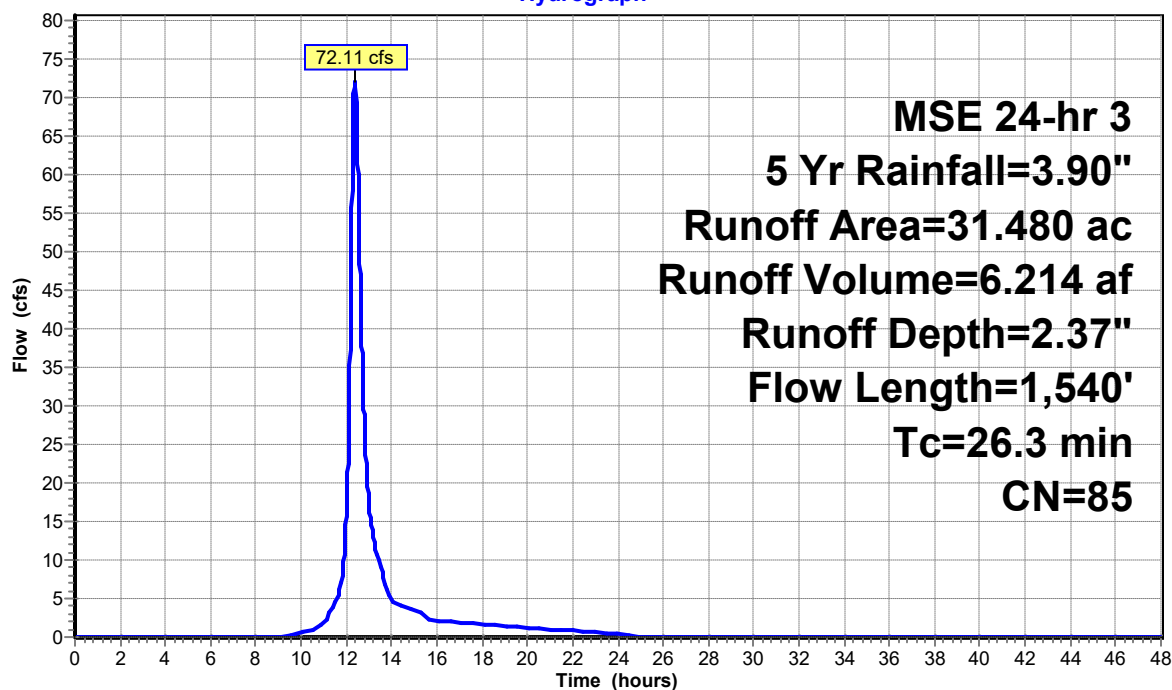
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 5 Yr Rainfall=3.90"

Area (ac)	CN	Description
31.480	85	Row crops, straight row, Good, HSG C
31.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	100	0.0300	0.18		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
16.9	1,440	0.0250	1.42		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
26.3	1,540	Total			

Subcatchment 6S: Northwest Offsite Watershed

Hydrograph



Summary for Subcatchment 7S: Southwest Direct Watershed

Runoff = 19.35 cfs @ 12.12 hrs, Volume= 0.889 af, Depth= 3.02"
Routed to Pond 8P : Southwest Pool

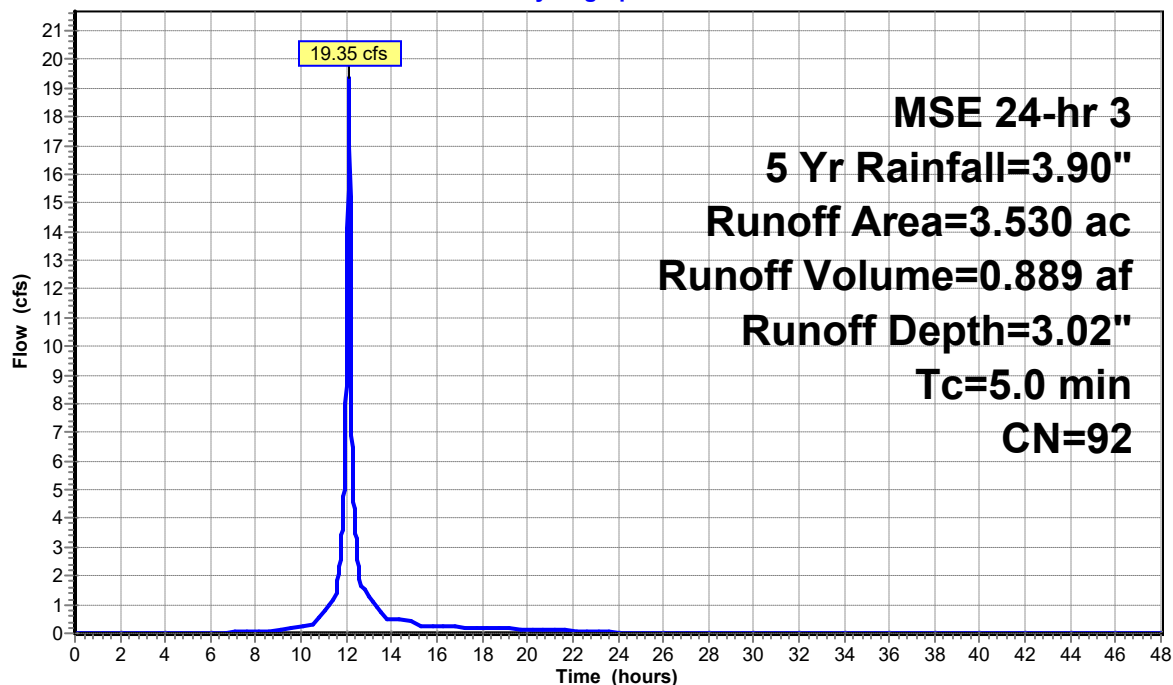
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 5 Yr Rainfall=3.90"

	Area (ac)	CN	Description
*	1.660	100	
*	1.870	85	
	3.530	92	Weighted Average
	1.870		52.97% Pervious Area
	1.660		47.03% Impervious Area

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

Subcatchment 7S: Southwest Direct Watershed

Hydrograph



Summary for Subcatchment 10S: Northwest Direct Watershed

Runoff = 21.55 cfs @ 12.12 hrs, Volume= 1.002 af, Depth= 3.12"
Routed to Pond 5P : Northwest Wetland

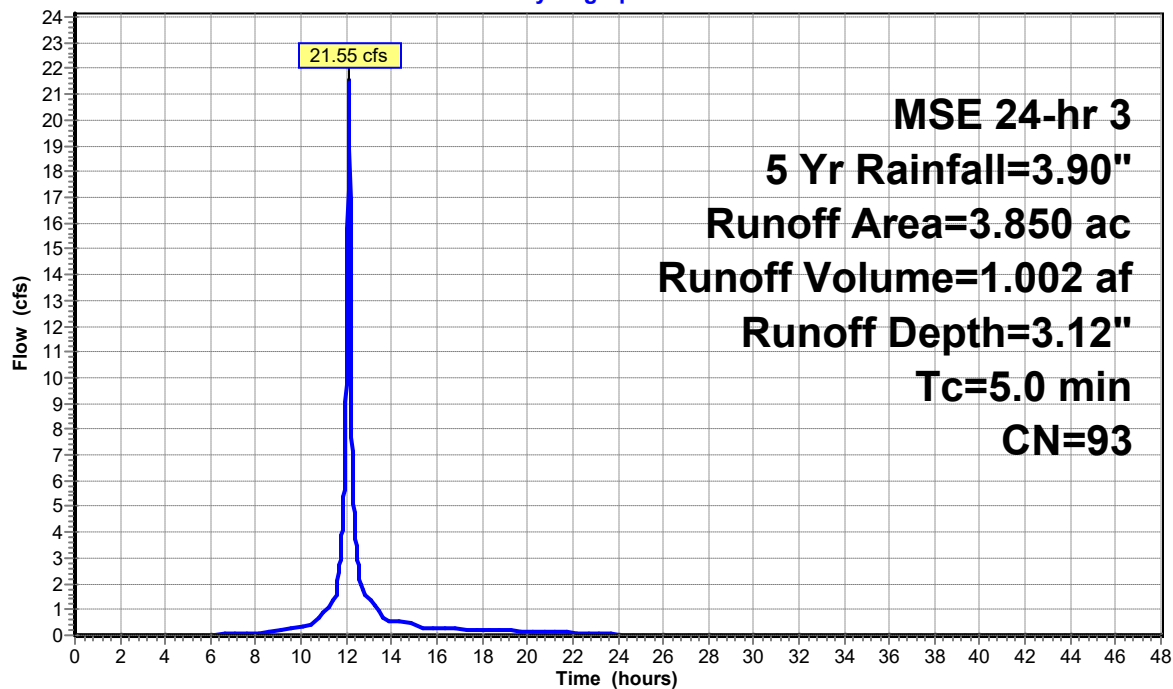
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 5 Yr Rainfall=3.90"

Area (ac)	CN	Description
* 1.840	85	
* 2.010	100	
3.850	93	Weighted Average
1.840		47.79% Pervious Area
2.010		52.21% Impervious Area

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

Subcatchment 10S: Northwest Direct Watershed

Hydrograph



Summary for Subcatchment 12S: Culvert Area

Runoff = 4.60 cfs @ 12.13 hrs, Volume= 0.196 af, Depth= 1.96"
Routed to Pond 11P : Culvert Storage

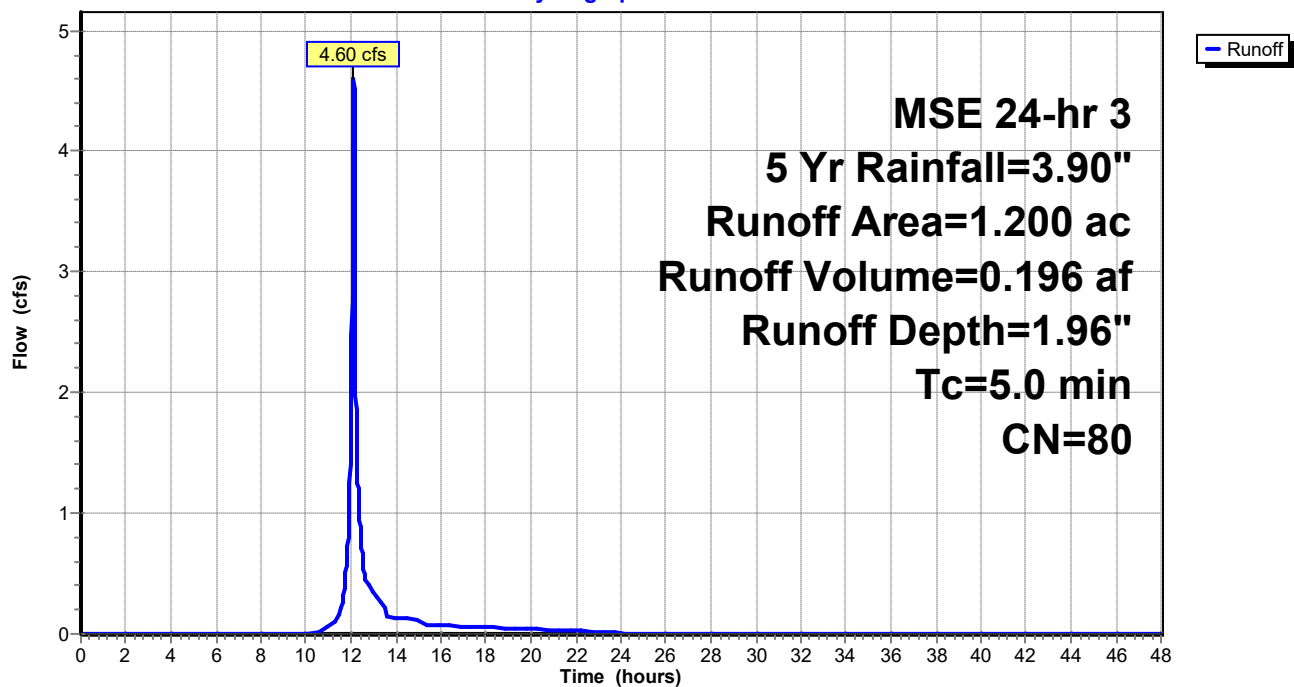
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 5 Yr Rainfall=3.90"

Area (ac)	CN	Description
* 1.200	80	
1.200		100.00% Pervious Area

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

Subcatchment 12S: Culvert Area

Hydrograph



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MSE 24-hr 3 5 Yr Rainfall=3.90"

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Page 11

Summary for Reach 5R: Out Channel

Inflow = 4.89 cfs @ 12.76 hrs, Volume= 0.385 af
 Outflow = 4.89 cfs @ 12.77 hrs, Volume= 0.385 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.63 fps, Min. Travel Time= 0.8 min

Avg. Velocity = 0.93 fps, Avg. Travel Time= 1.4 min

Peak Storage= 240 cf @ 12.77 hrs

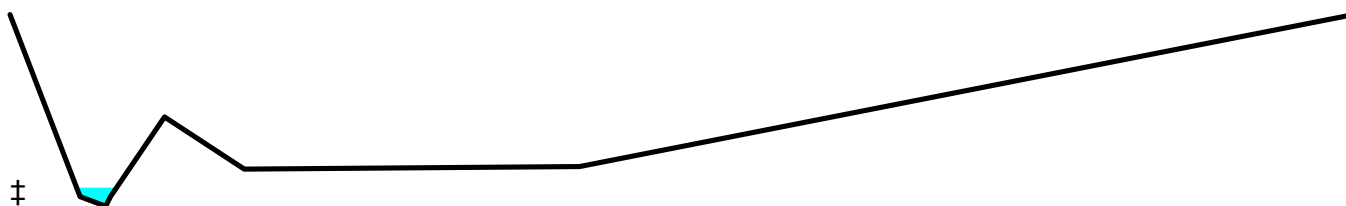
Average Depth at Peak Storage= 0.39' , Surface Width= 12.48'

Bank-Full Depth= 4.02' Flow Area= 922.7 sf, Capacity= 6,533.92 cfs

Custom cross-section, Length= 80.0' Slope= 0.0050 '/' (103 Elevation Intervals)

Constant n= 0.025 Earth, grassed & winding

Inlet Invert= 1,199.40', Outlet Invert= 1,199.00'

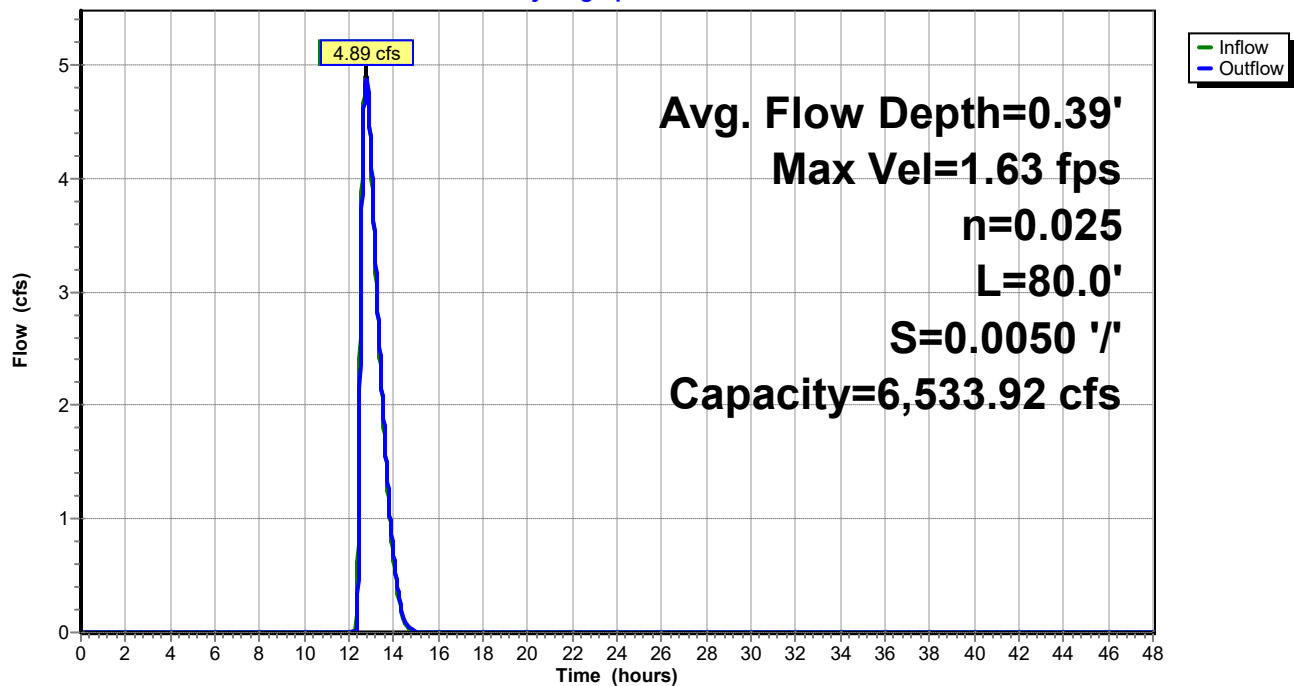


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,203.42	0.00
22.00	1,199.60	3.82
30.00	1,199.40	4.02
31.50	1,199.60	3.82
48.50	1,201.27	2.15
73.50	1,200.18	3.24
178.65	1,200.23	3.19
421.44	1,203.42	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.20	0.9	9.5	9.5	76	0.86
0.78	9.1	18.8	18.7	731	23.72
0.83	12.8	125.9	125.8	1,020	11.65
1.87	205.8	245.7	245.4	16,465	768.68
4.02	922.7	421.9	421.4	73,815	6,533.92

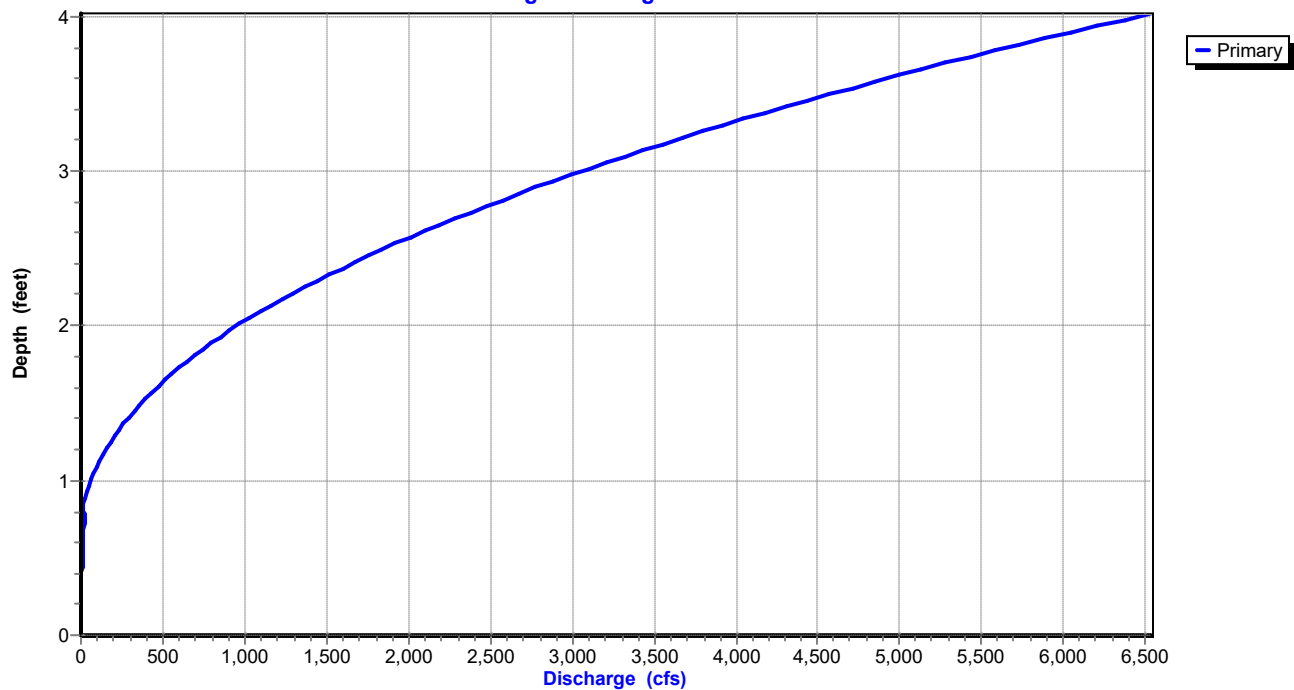
Reach 5R: Out Channel

Hydrograph

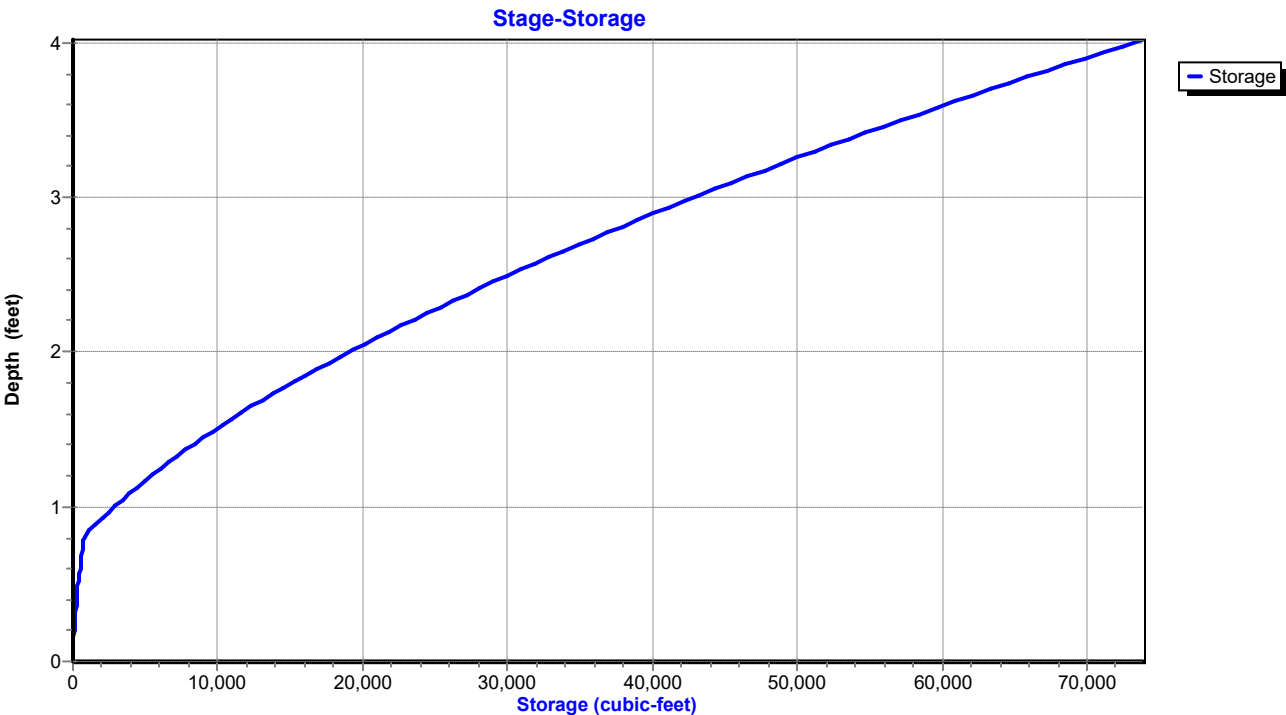


Reach 5R: Out Channel

Stage-Discharge



Reach 5R: Out Channel



Summary for Pond 2P: East Pool

Inflow Area = 24.800 ac, 22.18% Impervious, Inflow Depth = 2.36" for 5 Yr event
 Inflow = 50.33 cfs @ 12.20 hrs, Volume= 4.870 af
 Outflow = 4.63 cfs @ 15.14 hrs, Volume= 4.654 af, Atten= 91%, Lag= 176.5 min
 Primary = 4.61 cfs @ 15.14 hrs, Volume= 4.652 af
 Secondary = 0.02 cfs @ 15.14 hrs, Volume= 0.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,196.50' Surf.Area= 4.500 ac Storage= 5.075 af

Peak Elev= 1,197.01' @ 15.14 hrs Surf.Area= 5.313 ac Storage= 7.563 af (2.488 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 395.2 min (1,248.5 - 853.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,194.50'	17.400 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,194.50	0.400	0.000	0.000
1,195.00	1.400	0.450	0.450
1,195.50	2.600	1.000	1.450
1,196.00	3.700	1.575	3.025
1,196.50	4.500	2.050	5.075
1,197.00	5.300	2.450	7.525
1,197.50	6.200	2.875	10.400
1,198.00	7.000	3.300	13.700
1,198.50	7.800	3.700	17.400

Device	Routing	Invert	Outlet Devices
#1	Primary	1,190.00'	18.0" Round Culvert L= 80.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,190.00' / 1,188.39' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	1,196.50'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Secondary	1,197.00'	12.0' long + 4.0 ' /' SideZ x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.61 cfs @ 15.14 hrs HW=1,197.01' (Free Discharge)

↑ **1=Culvert** (Passes 4.61 cfs of 21.28 cfs potential flow)

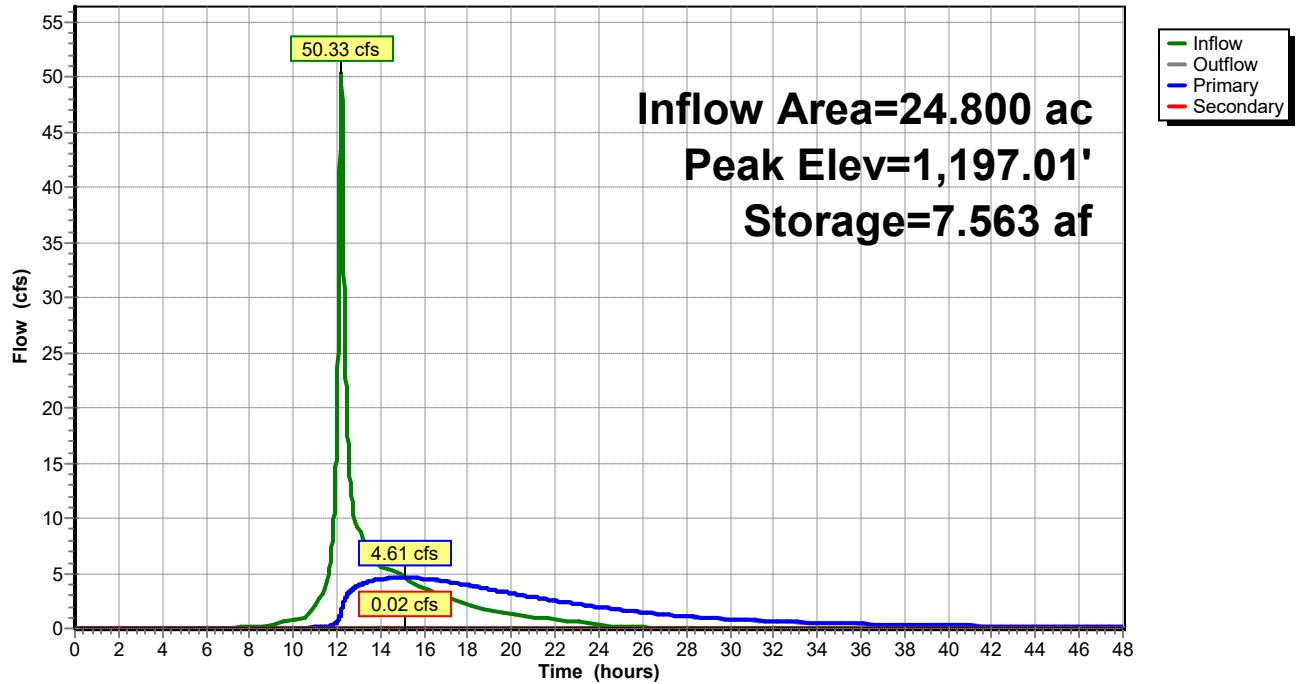
↑ **2=Sharp-Crested Rectangular Weir** (Weir Controls 4.61 cfs @ 2.33 fps)

Secondary OutFlow Max=0.02 cfs @ 15.14 hrs HW=1,197.01' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.24 fps)

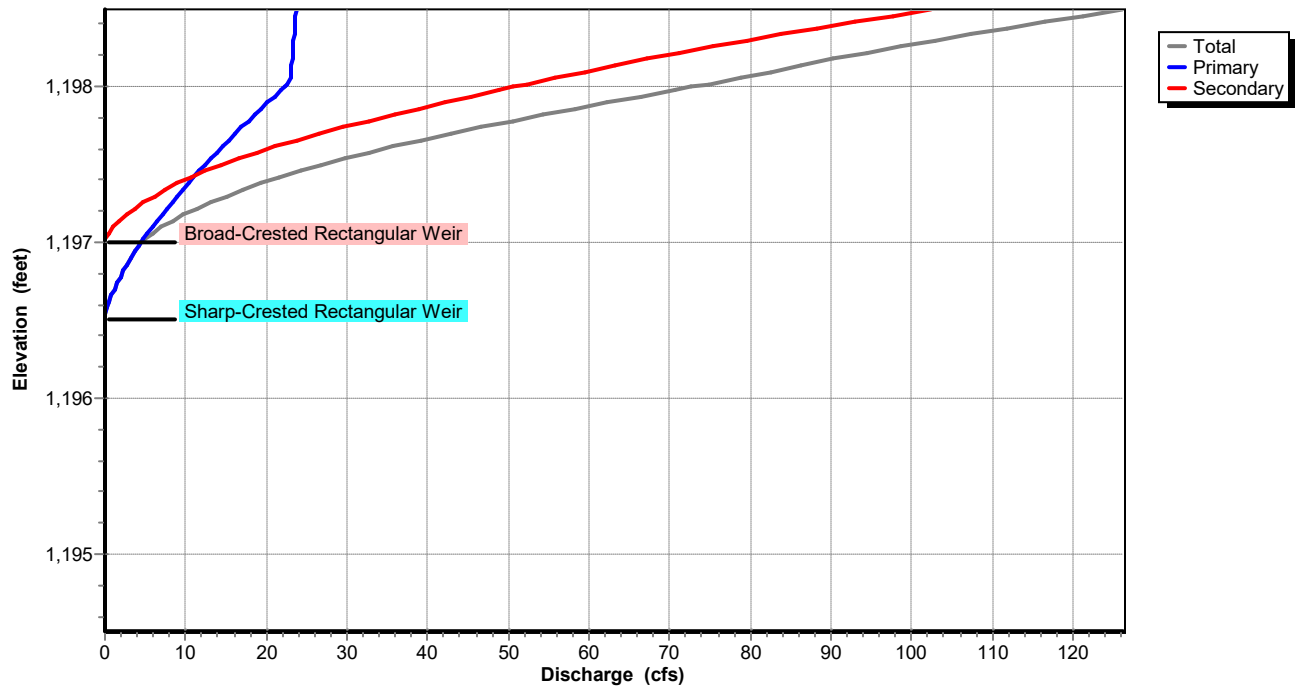
Pond 2P: East Pool

Hydrograph

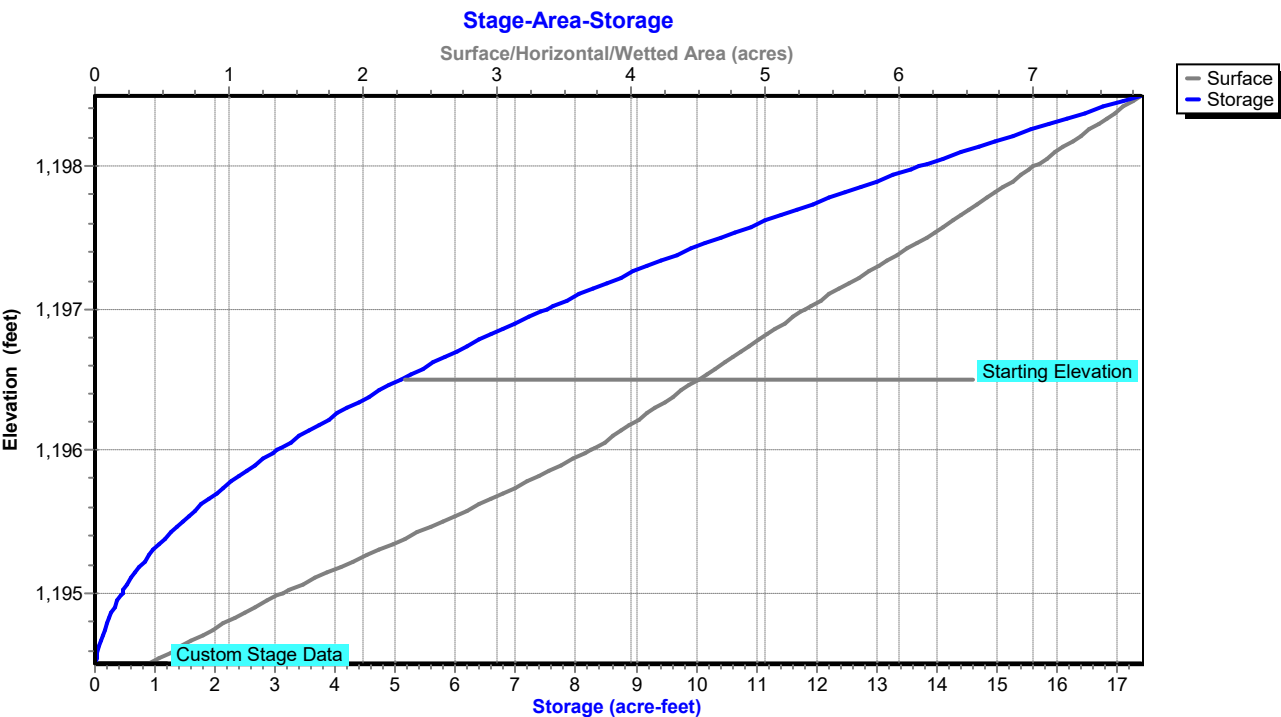


Pond 2P: East Pool

Stage-Discharge



Pond 2P: East Pool



Summary for Pond 4P: Culvert Storage

Inflow Area = 13.000 ac, 0.00% Impervious, Inflow Depth = 2.20" for 5 Yr event
 Inflow = 30.84 cfs @ 12.31 hrs, Volume= 2.383 af
 Outflow = 9.41 cfs @ 12.76 hrs, Volume= 2.383 af, Atten= 69%, Lag= 27.0 min
 Primary = 4.52 cfs @ 12.76 hrs, Volume= 1.997 af
 Routed to Pond 2P : East Pool
 Secondary = 4.89 cfs @ 12.76 hrs, Volume= 0.385 af
 Routed to Reach 5R : Out Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,199.79' @ 12.76 hrs Surf.Area= 1.434 ac Storage= 1.066 af

Plug-Flow detention time= 107.7 min calculated for 2.383 af (100% of inflow)
 Center-of-Mass det. time= 107.7 min (923.1 - 815.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	15.511 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,198.00	0.002	0.000	0.000
1,199.00	0.560	0.281	0.281
1,200.00	1.670	1.115	1.396
1,201.00	4.370	3.020	4.416
1,202.00	5.580	4.975	9.391
1,203.00	6.660	6.120	15.511

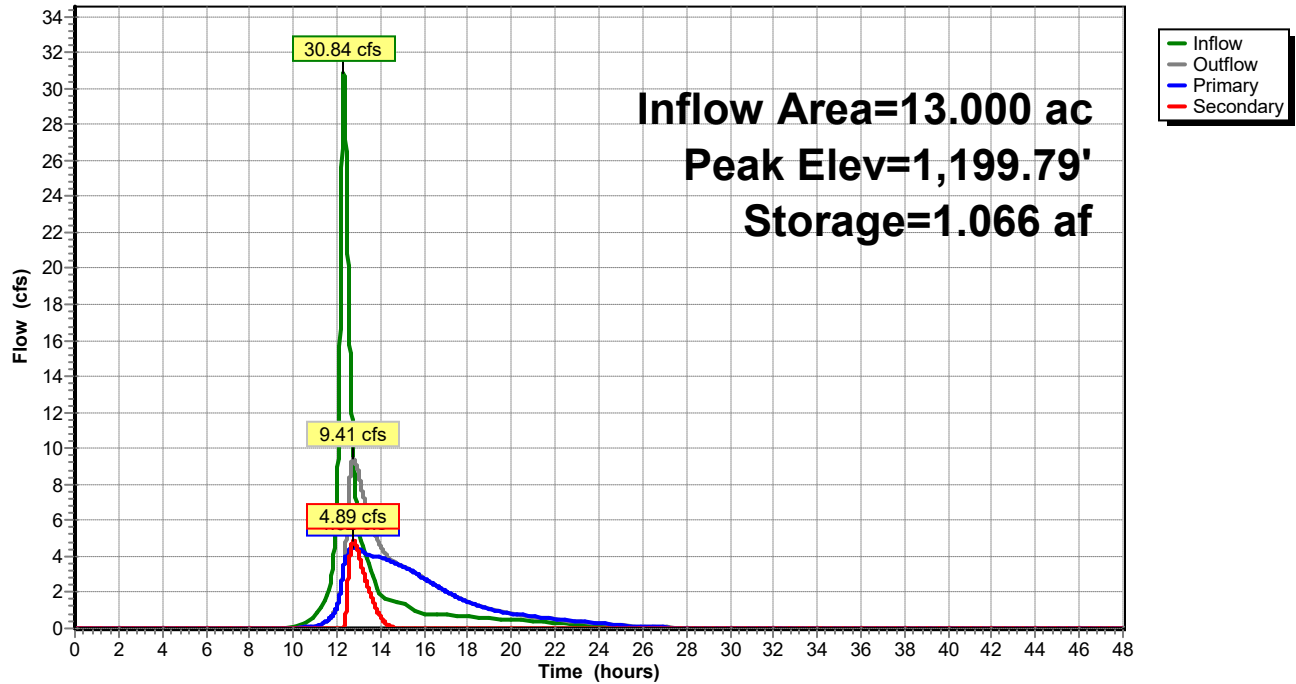
Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	15.0" Round Culvert L= 45.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,198.00' S= 0.0000 ' /' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Secondary	1,199.40'	Channel/Reach using Reach 5R: Out Channel

Primary OutFlow Max=4.52 cfs @ 12.76 hrs HW=1,199.79' TW=1,196.93' (Dynamic Tailwater)
 ↑ **1=Culvert** (Barrel Controls 4.52 cfs @ 3.68 fps)

Secondary OutFlow Max=4.89 cfs @ 12.76 hrs HW=1,199.79' TW=1,199.79' (Dynamic Tailwater)
 ↑ **2=Channel/Reach** (Channel Controls 4.89 cfs @ 1.62 fps)

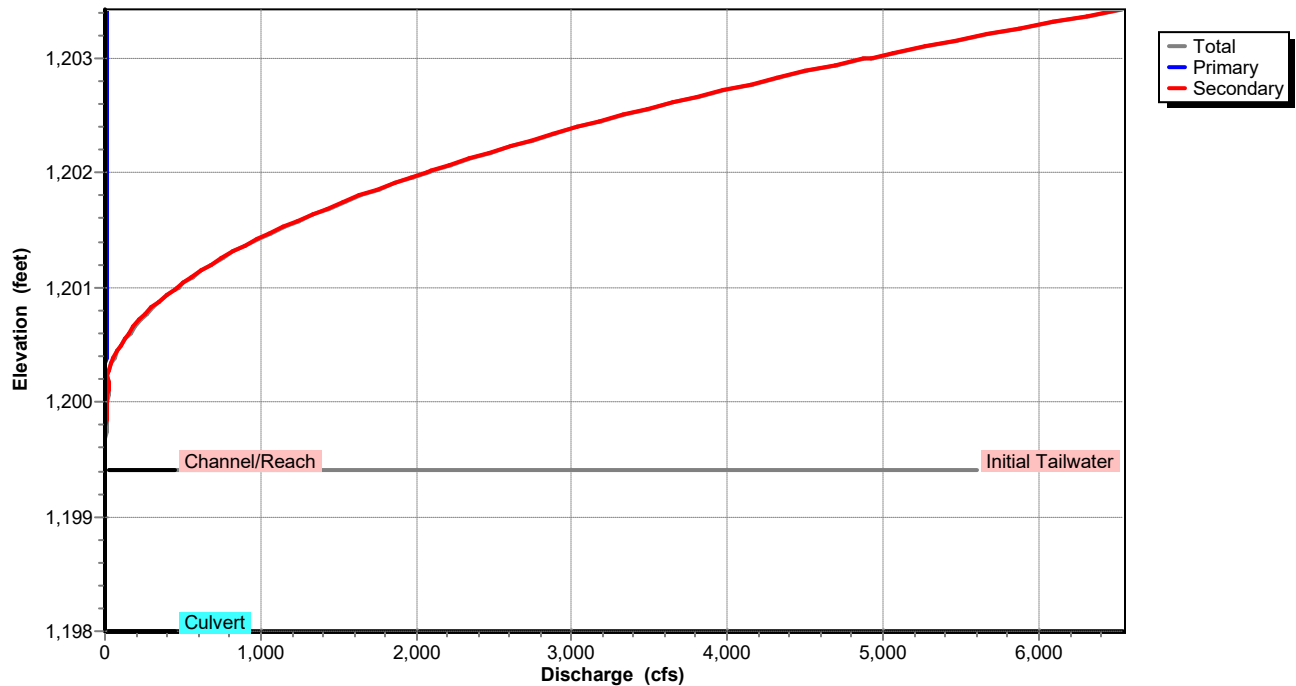
Pond 4P: Culvert Storage

Hydrograph

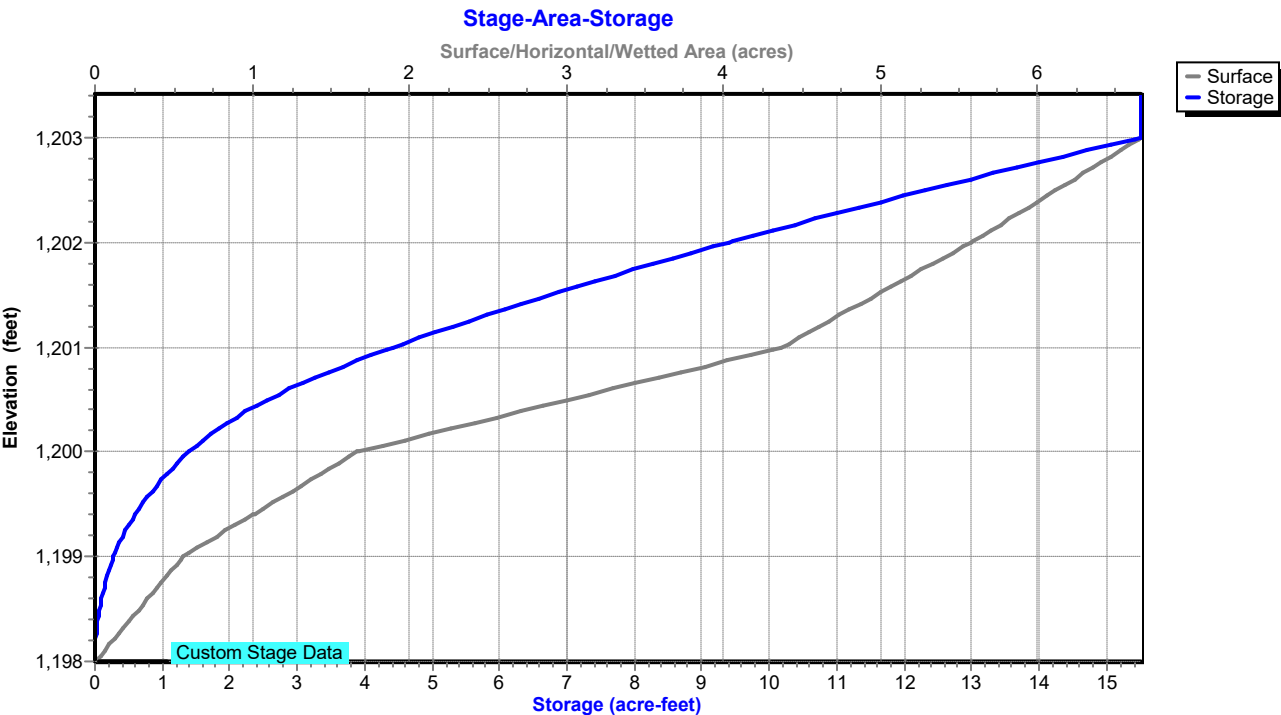


Pond 4P: Culvert Storage

Stage-Discharge



Pond 4P: Culvert Storage



Summary for Pond 5P: Northwest Wetland

Inflow Area = 3.850 ac, 52.21% Impervious, Inflow Depth = 13.61" for 5 Yr event
 Inflow = 68.40 cfs @ 12.40 hrs, Volume= 4.367 af
 Outflow = 44.91 cfs @ 12.62 hrs, Volume= 4.366 af, Atten= 34%, Lag= 13.4 min
 Primary = 44.91 cfs @ 12.62 hrs, Volume= 4.366 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,196.50' Surf.Area= 1.900 ac Storage= 0.925 af

Peak Elev= 1,197.30' @ 12.62 hrs Surf.Area= 2.177 ac Storage= 2.517 af (1.592 af above start)

Plug-Flow detention time= 77.5 min calculated for 3.441 af (79% of inflow)

Center-of-Mass det. time= 39.8 min (798.3 - 758.5)

Volume	Invert	Avail.Storage	Storage Description
--------	--------	---------------	---------------------

#1	1,196.00'	7.050 af	Custom Stage Data (Prismatic) Listed below (Recalc)
----	-----------	----------	--

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,196.00	1.800	0.000	0.000
1,197.00	2.000	1.900	1.900
1,198.00	2.600	2.300	4.200
1,199.00	3.100	2.850	7.050

Device	Routing	Invert	Outlet Devices
--------	---------	--------	----------------

#1	Primary	1,190.00'	30.0" Round Culvert
----	---------	-----------	----------------------------

L= 111.0' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 1,190.00' / 1,187.78' S= 0.0200 ' / ' Cc= 0.900

n= 0.013, Flow Area= 4.91 sf

#2	Secondary	1,197.50'	12.0' long + 4.0 ' / ' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
----	-----------	-----------	--

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

#3	Device 1	1,196.50'	5.0' long Sharp-Crested Rectangular Weir X 4.00
----	----------	-----------	--

2 End Contraction(s)

Primary OutFlow Max=44.91 cfs @ 12.62 hrs HW=1,197.30' (Free Discharge)

↑ **1=Culvert** (Passes 44.91 cfs of 58.11 cfs potential flow)

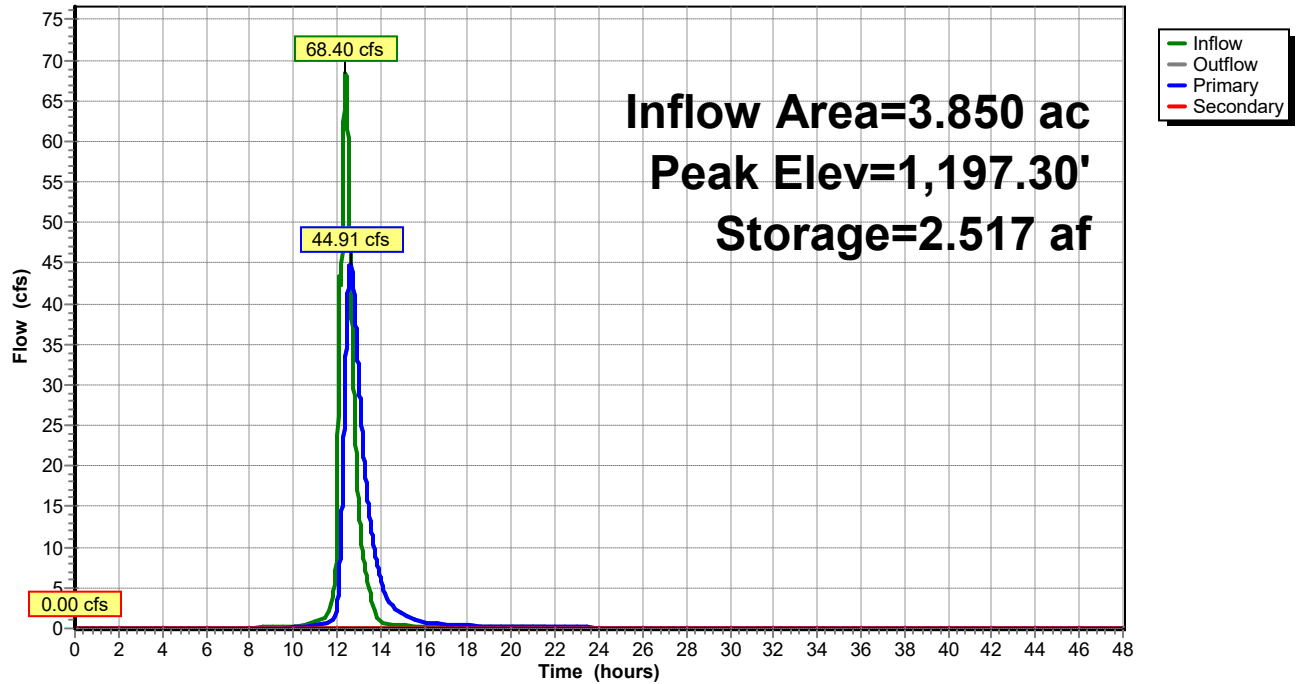
↑ **3=Sharp-Crested Rectangular Weir** (Weir Controls 44.91 cfs @ 2.92 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,196.50' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

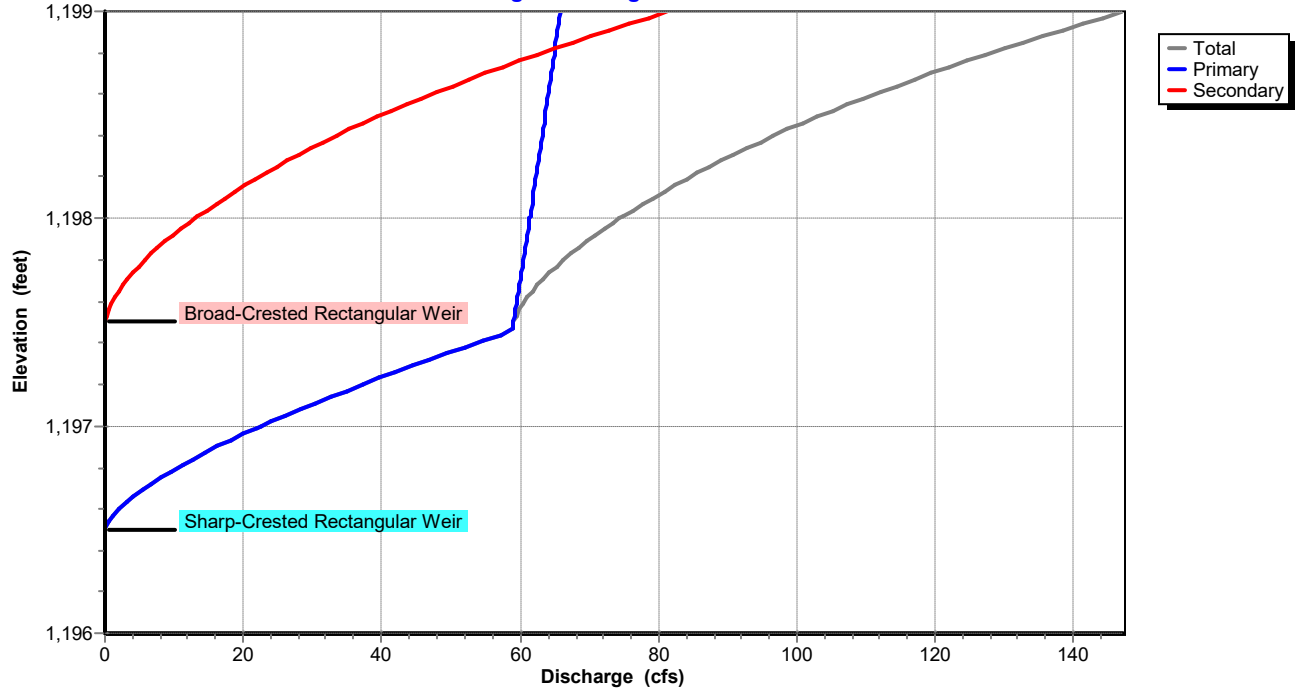
Pond 5P: Northwest Wetland

Hydrograph

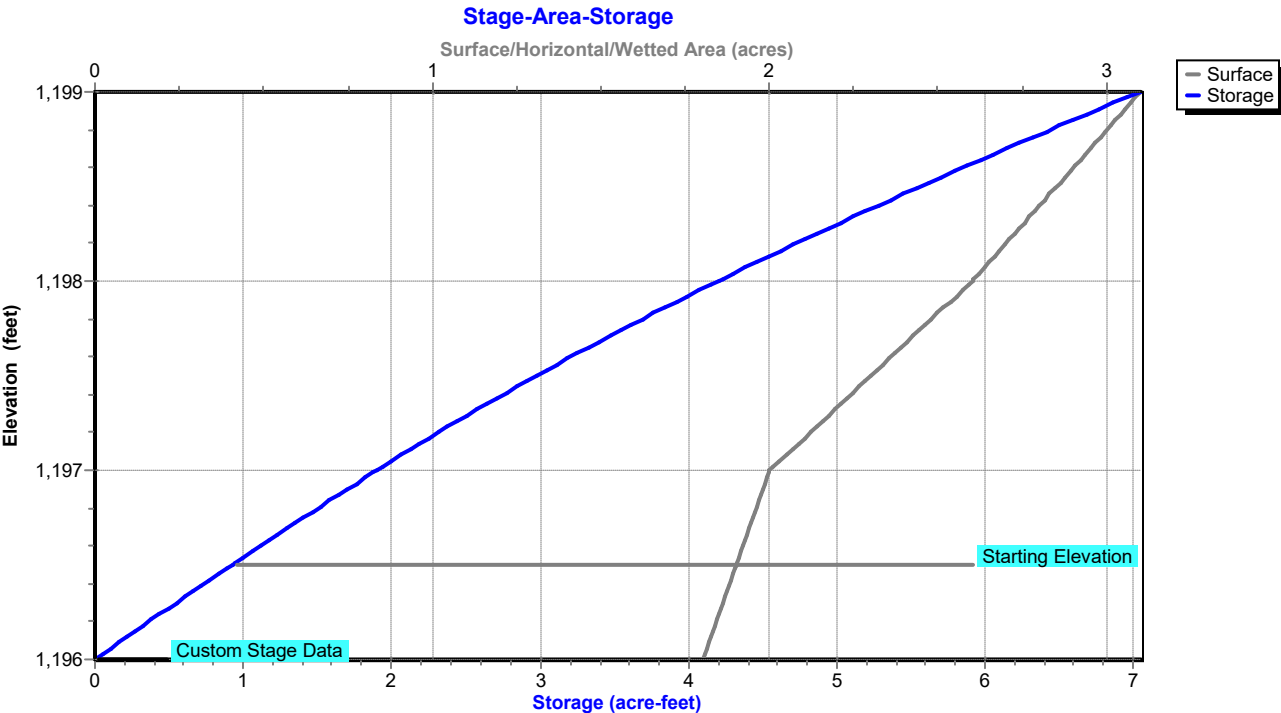


Pond 5P: Northwest Wetland

Stage-Discharge



Pond 5P: Northwest Wetland



Summary for Pond 8P: Southwest Pool

Inflow Area = 3.530 ac, 47.03% Impervious, Inflow Depth = 3.02" for 5 Yr event
 Inflow = 19.35 cfs @ 12.12 hrs, Volume= 0.889 af
 Outflow = 4.51 cfs @ 12.33 hrs, Volume= 0.887 af, Atten= 77%, Lag= 12.6 min
 Primary = 4.51 cfs @ 12.33 hrs, Volume= 0.887 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,198.00' Surf.Area= 1.660 ac Storage= 1.615 af

Peak Elev= 1,198.24' @ 12.33 hrs Surf.Area= 1.717 ac Storage= 2.019 af (0.404 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 107.7 min (884.4 - 776.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,195.00'	5.585 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.00	0.010	0.000	0.000
1,196.00	0.220	0.115	0.115
1,197.00	0.560	0.390	0.505
1,198.00	1.660	1.110	1.615
1,199.00	1.900	1.780	3.395
1,200.00	2.480	2.190	5.585

Device	Routing	Invert	Outlet Devices
#1	Primary	1,190.00'	12.0" Round Culvert L= 60.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,190.00' / 1,188.80' S= 0.0199 ' / ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,198.00'	48.0" W x 9.0" H Vert. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#3	Secondary	1,198.50'	20.0' long + 4.0 ' / ' SideZ x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.51 cfs @ 12.33 hrs HW=1,198.24' (Free Discharge)

↑ **1=Culvert** (Passes 4.51 cfs of 9.94 cfs potential flow)

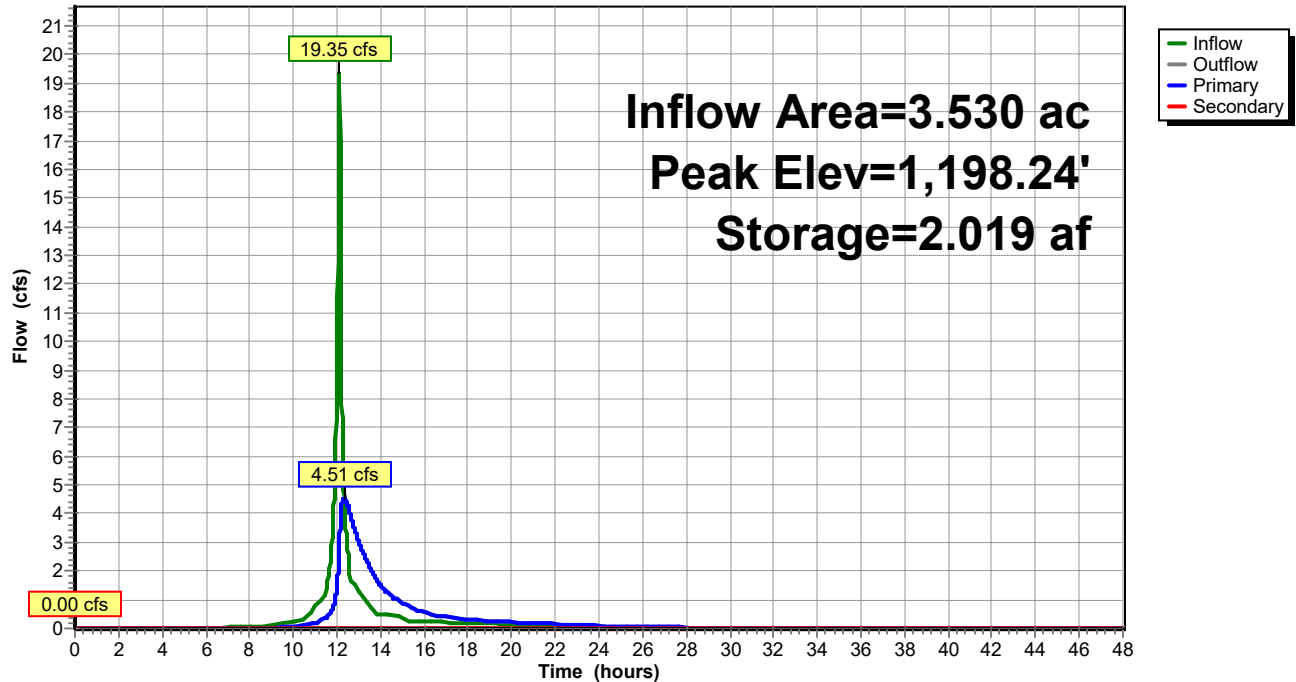
↑ **2=Orifice/Grate** (Orifice Controls 4.51 cfs @ 1.57 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,198.00' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

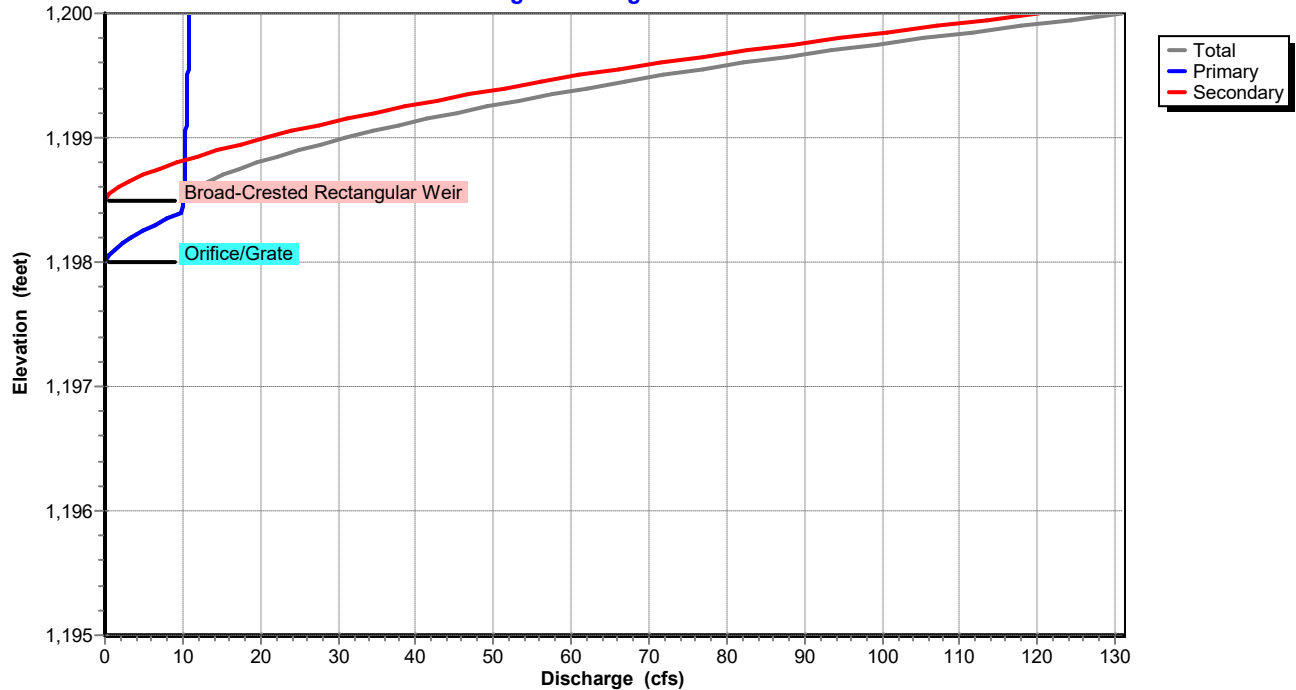
Pond 8P: Southwest Pool

Hydrograph



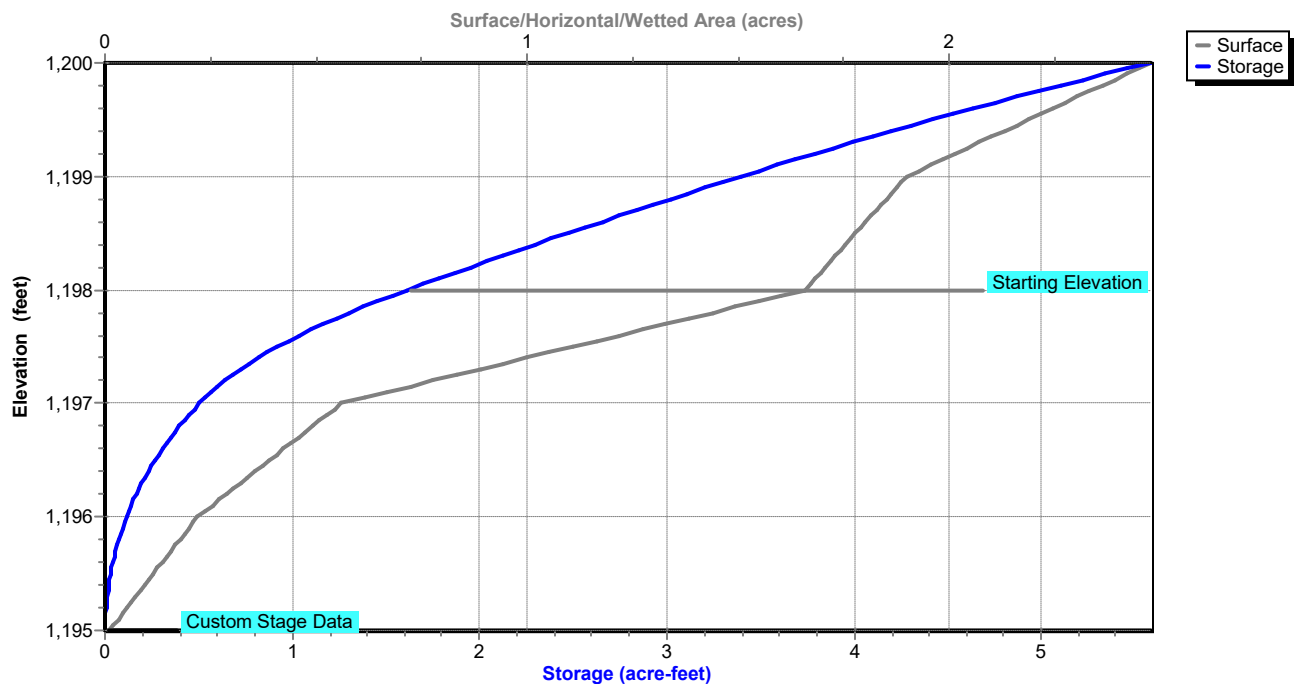
Pond 8P: Southwest Pool

Stage-Discharge



Pond 8P: Southwest Pool

Stage-Area-Storage



Summary for Pond 9P: Northwest Pothole

Inflow Area = 31.480 ac, 0.00% Impervious, Inflow Depth = 2.37" for 5 Yr event
 Inflow = 72.11 cfs @ 12.36 hrs, Volume= 6.214 af
 Outflow = 70.79 cfs @ 12.41 hrs, Volume= 5.854 af, Atten= 2%, Lag= 2.9 min
 Primary = 70.79 cfs @ 12.41 hrs, Volume= 5.854 af
 Routed to Pond 11P : Culvert Storage
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,200.43' @ 12.41 hrs Surf.Area= 1.465 ac Storage= 0.656 af

Plug-Flow detention time= 42.6 min calculated for 5.854 af (94% of inflow)
 Center-of-Mass det. time= 14.3 min (829.6 - 815.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,199.50'	8.578 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,199.50	0.000	0.000	0.000
1,200.00	0.724	0.181	0.181
1,201.00	2.430	1.577	1.758
1,202.00	3.650	3.040	4.798
1,203.00	3.910	3.780	8.578

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,200.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.50 1.50 2.50 3.50 Width (feet) 0.00 65.00 230.00 300.00 350.00
#2	Primary	1,200.20'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.80 1.80 Width (feet) 168.00 363.00 650.00

Primary OutFlow Max=70.78 cfs @ 12.41 hrs HW=1,200.43' TW=1,197.28' (Dynamic Tailwater)

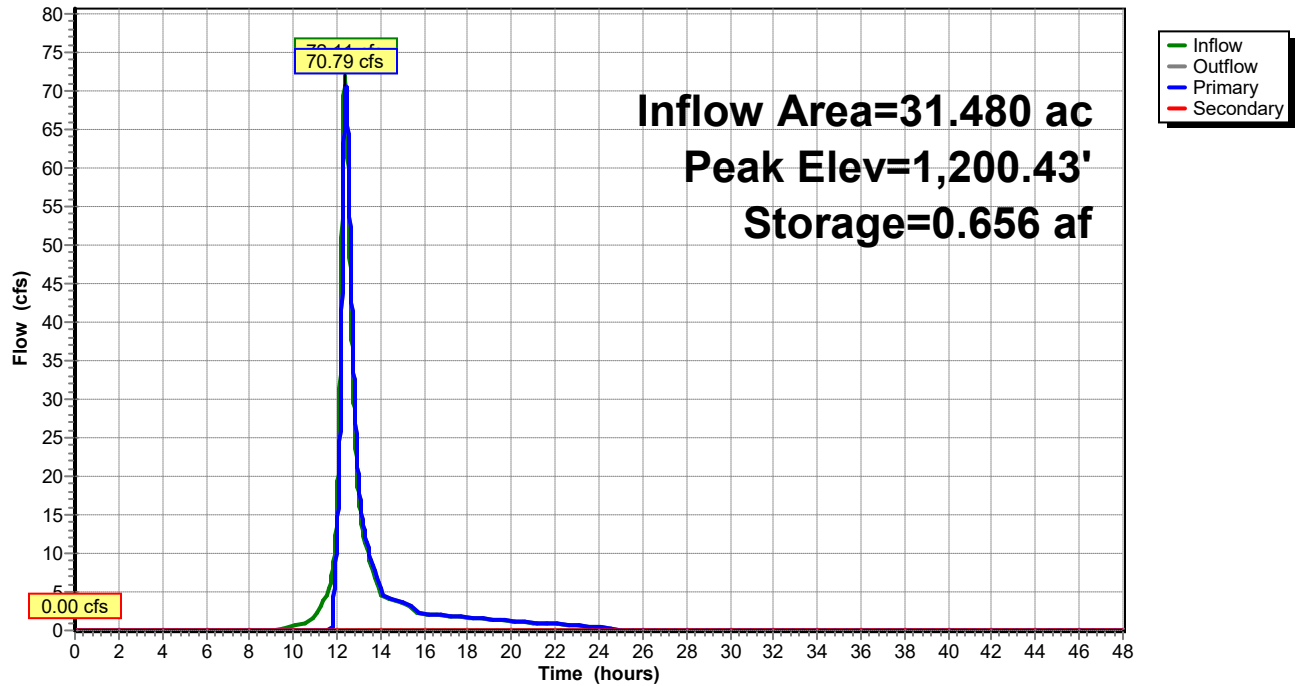
↑ **2=Custom Weir/Orifice** (Weir Controls 70.78 cfs @ 1.54 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,199.50' (Free Discharge)

↑ **1=Custom Weir/Orifice** (Controls 0.00 cfs)

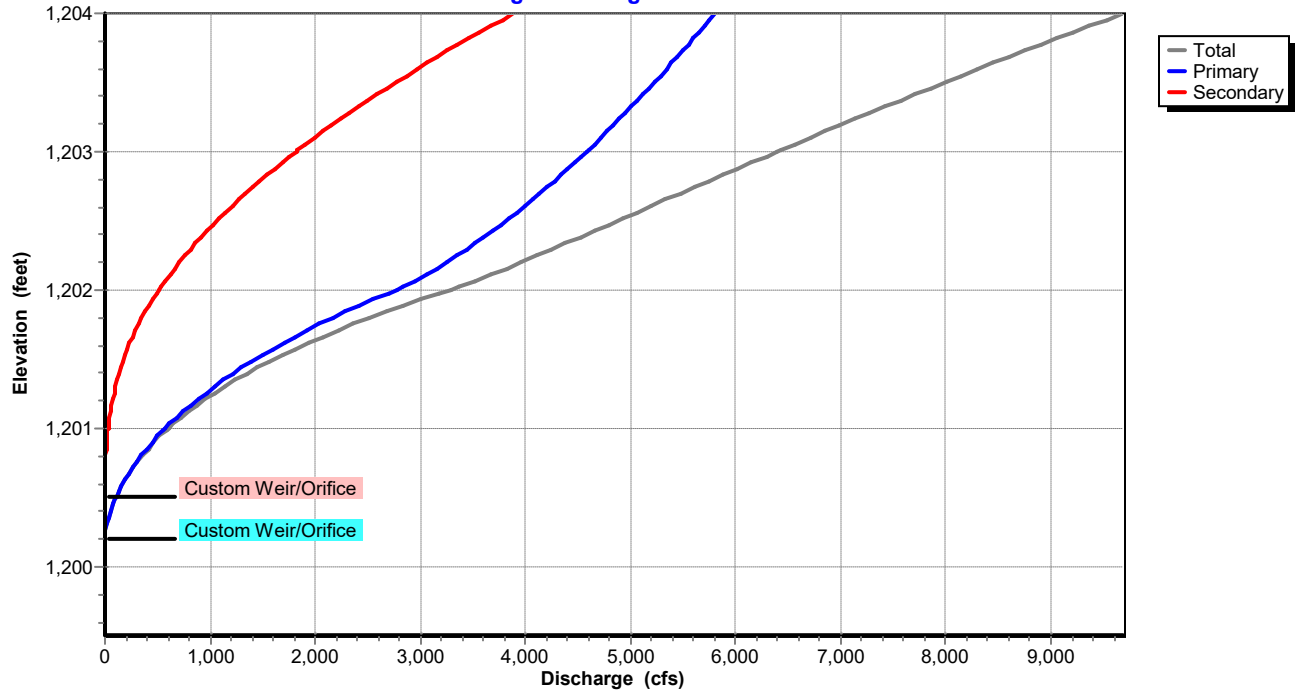
Pond 9P: Northwest Pothole

Hydrograph

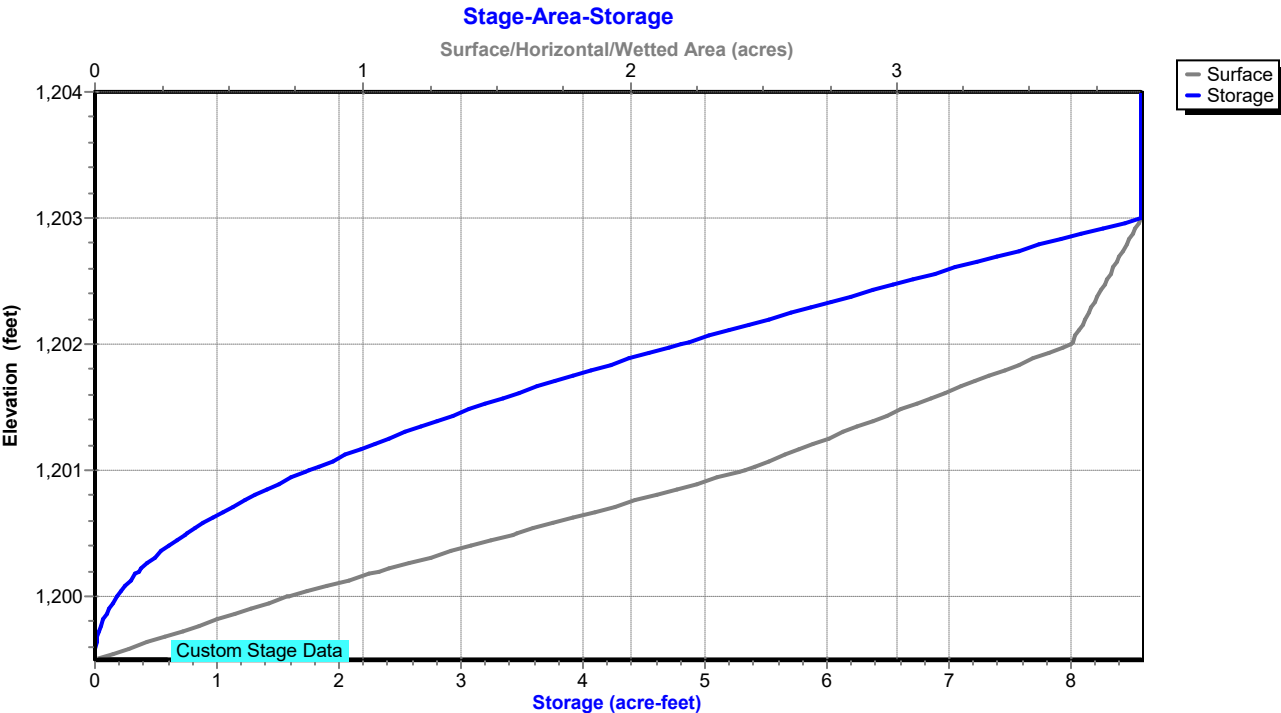


Pond 9P: Northwest Pothole

Stage-Discharge



Pond 9P: Northwest Pothole



Summary for Pond 11P: Culvert Storage

Inflow Area = 32.680 ac, 0.00% Impervious, Inflow Depth = 2.22" for 5 Yr event
 Inflow = 71.68 cfs @ 12.41 hrs, Volume= 6.050 af
 Outflow = 71.45 cfs @ 12.41 hrs, Volume= 6.050 af, Atten= 0%, Lag= 0.0 min
 Primary = 6.95 cfs @ 12.60 hrs, Volume= 2.685 af
 Secondary = 64.63 cfs @ 12.41 hrs, Volume= 3.365 af
 Routed to Pond 5P : Northwest Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,197.32' @ 12.60 hrs Surf.Area= 0.139 ac Storage= 0.098 af

Plug-Flow detention time= 2.7 min calculated for 6.048 af (100% of inflow)
 Center-of-Mass det. time= 2.7 min (831.6 - 828.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,195.50'	0.555 af	Custom Stage Data (Prismatic) Listed below (Recalc)

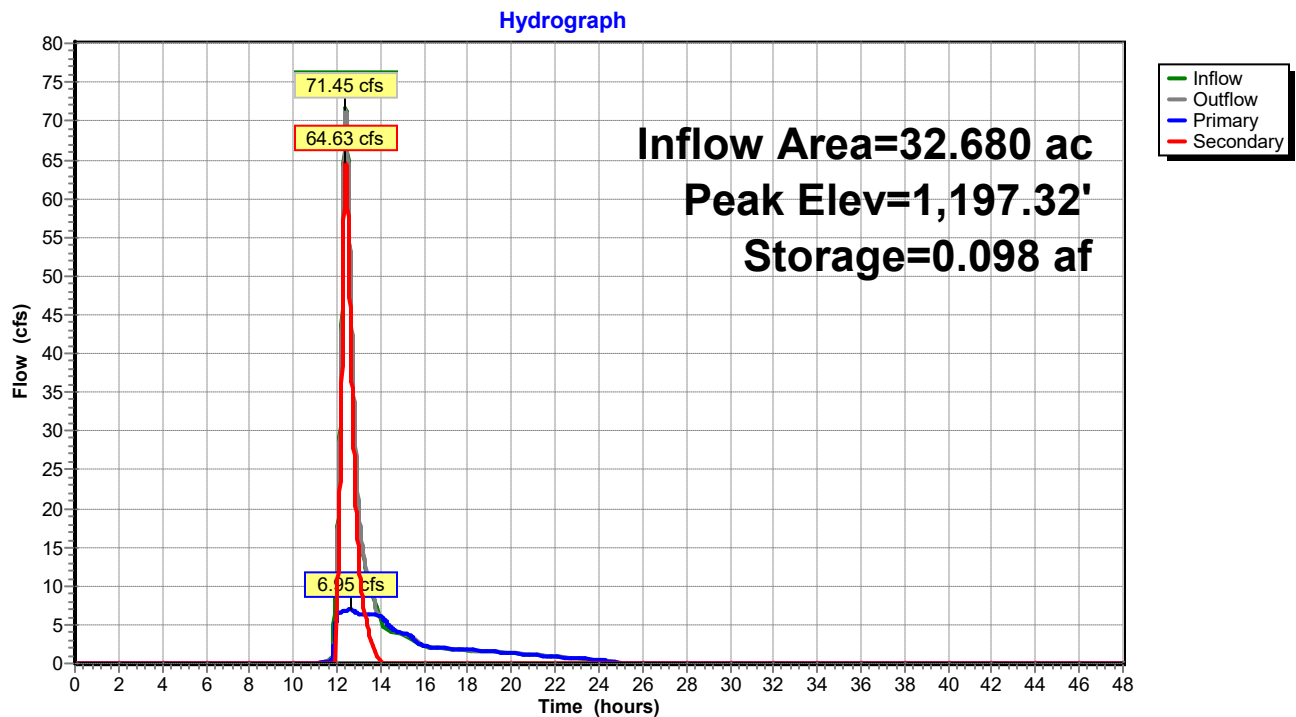
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.50	0.000	0.000	0.000
1,196.00	0.016	0.004	0.004
1,197.00	0.096	0.056	0.060
1,198.00	0.230	0.163	0.223
1,199.00	0.434	0.332	0.555

Device	Routing	Invert	Outlet Devices
#1	Primary	1,195.50'	18.0" Round Culvert L= 70.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,195.50' / 1,190.00' S= 0.0786 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf
#2	Secondary	1,197.10'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.90 1.90 2.90 Width (feet) 250.00 350.00 450.00 522.00

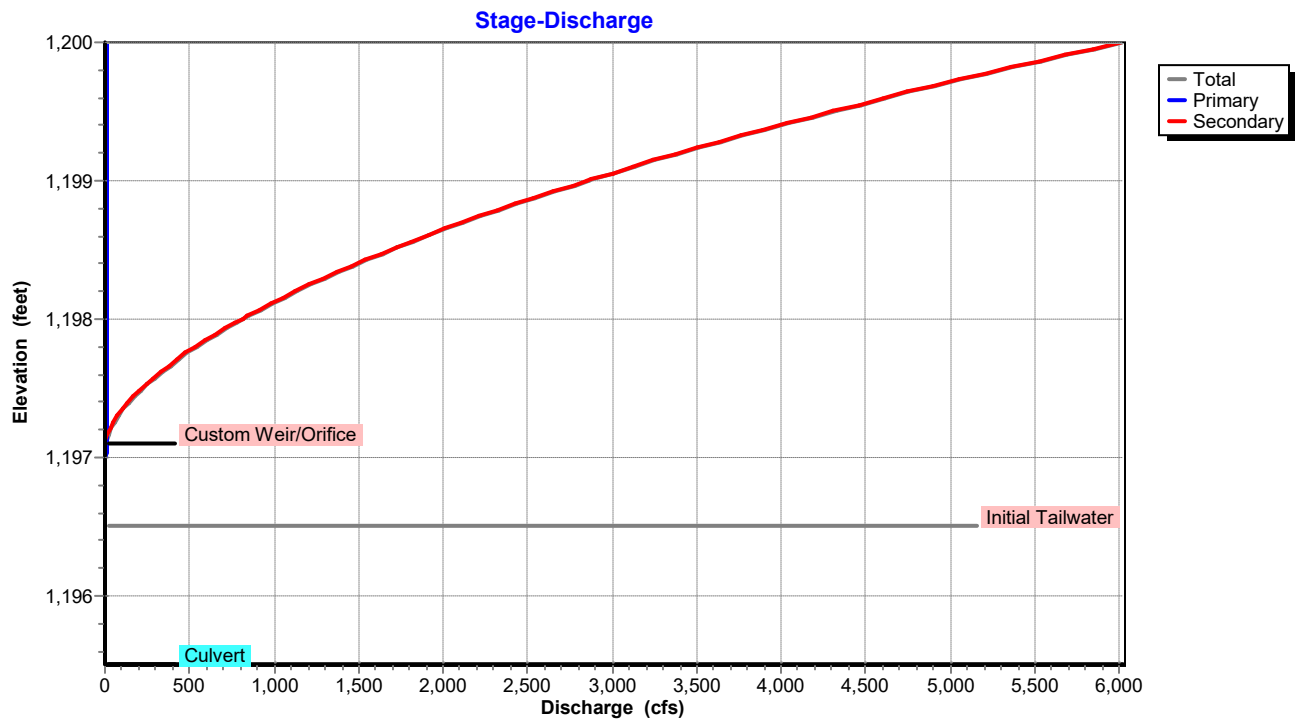
Primary OutFlow Max=6.95 cfs @ 12.60 hrs HW=1,197.32' (Free Discharge)
 ↑1=Culvert (Inlet Controls 6.95 cfs @ 3.93 fps)

Secondary OutFlow Max=63.73 cfs @ 12.41 hrs HW=1,197.28' TW=1,197.15' (Dynamic Tailwater)
 ↑2=Custom Weir/Orifice (Weir Controls 63.73 cfs @ 1.35 fps)

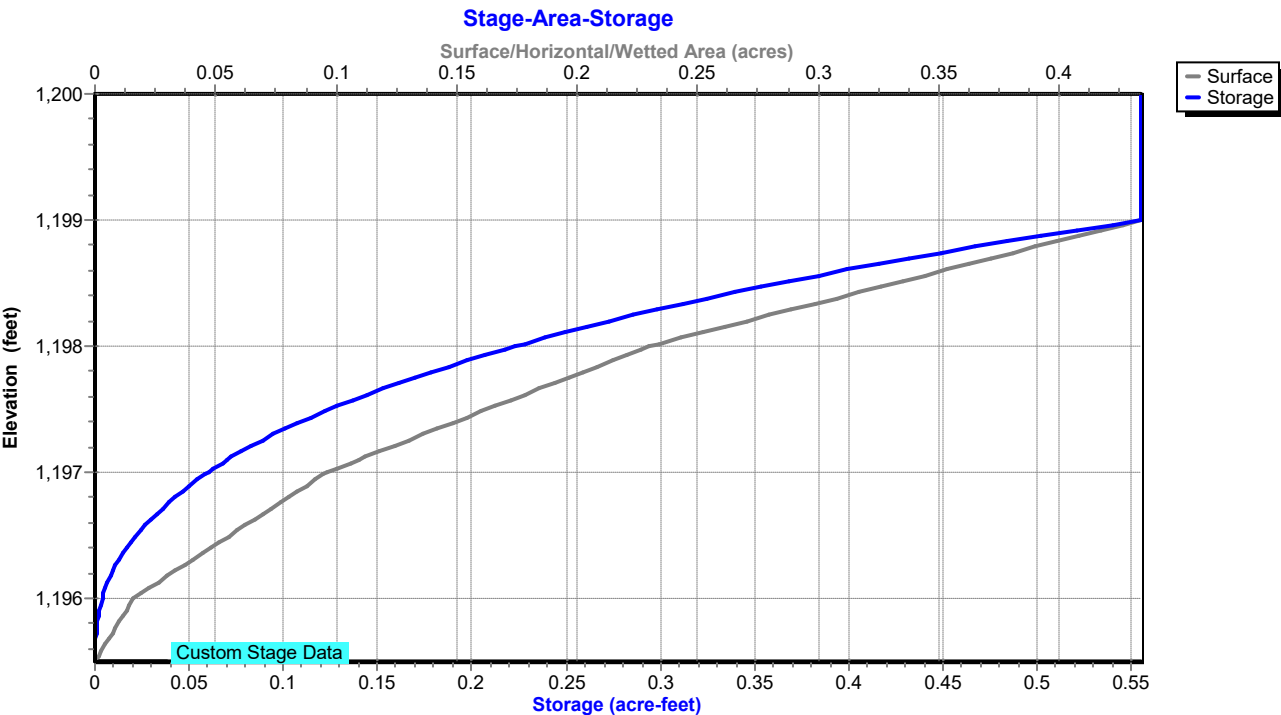
Pond 11P: Culvert Storage



Pond 11P: Culvert Storage



Pond 11P: Culvert Storage



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MSE 24-hr 3 10 Yr Rainfall=4.60"

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Page 32

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Wetland Watershed Runoff Area=11.800 ac 46.61% Impervious Runoff Depth=3.59"
Flow Length=125' Tc=11.9 min CN=91 Runoff=58.24 cfs 3.535 af

Subcatchment 3S: Eastern Watershed Runoff Area=13.000 ac 0.00% Impervious Runoff Depth=2.81"
Flow Length=1,370' Tc=21.5 min CN=83 Runoff=39.39 cfs 3.049 af

Subcatchment 6S: Northwest Offsite Runoff Area=31.480 ac 0.00% Impervious Runoff Depth=3.00"
Flow Length=1,540' Tc=26.3 min CN=85 Runoff=91.04 cfs 7.871 af

Subcatchment 7S: Southwest Direct Runoff Area=3.530 ac 47.03% Impervious Runoff Depth=3.70"
Tc=5.0 min CN=92 Runoff=23.37 cfs 1.088 af

Subcatchment 10S: Northwest Direct Runoff Area=3.850 ac 52.21% Impervious Runoff Depth=3.81"
Tc=5.0 min CN=93 Runoff=25.92 cfs 1.221 af

Subcatchment 12S: Culvert Area Runoff Area=1.200 ac 0.00% Impervious Runoff Depth=2.55"
Tc=5.0 min CN=80 Runoff=5.94 cfs 0.255 af

Reach 5R: Out Channel Avg. Flow Depth=0.53' Max Vel=2.02 fps Inflow=10.03 cfs 0.790 af
n=0.025 L=80.0' S=0.0050 '/' Capacity=6,533.92 cfs Outflow=10.03 cfs 0.790 af

Pond 2P: East Pool Peak Elev=1,197.07' Storage=7.917 af Inflow=61.33 cfs 5.793 af
Primary=5.51 cfs 5.401 af Secondary=0.68 cfs 0.167 af Outflow=6.19 cfs 5.568 af

Pond 4P: Culvert Storage Peak Elev=1,199.93' Storage=1.282 af Inflow=39.39 cfs 3.049 af
Primary=5.09 cfs 2.259 af Secondary=10.03 cfs 0.790 af Outflow=15.11 cfs 3.049 af

Pond 5P: Northwest Wetland Peak Elev=1,197.47' Storage=2.901 af Inflow=86.54 cfs 5.817 af
Primary=58.93 cfs 5.816 af Secondary=0.00 cfs 0.000 af Outflow=58.93 cfs 5.816 af

Pond 8P: Southwest Pool Peak Elev=1,198.28' Storage=2.098 af Inflow=23.37 cfs 1.088 af
Primary=5.86 cfs 1.086 af Secondary=0.00 cfs 0.000 af Outflow=5.86 cfs 1.086 af

Pond 9P: Northwest Pothole Peak Elev=1,200.47' Storage=0.710 af Inflow=91.04 cfs 7.871 af
Primary=89.51 cfs 7.511 af Secondary=0.00 cfs 0.000 af Outflow=89.51 cfs 7.511 af

Pond 11P: Culvert Storage Peak Elev=1,197.48' Storage=0.122 af Inflow=90.64 cfs 7.766 af
Primary=7.45 cfs 3.170 af Secondary=81.96 cfs 4.596 af Outflow=89.05 cfs 7.766 af

Total Runoff Area = 64.860 ac Runoff Volume = 17.019 af Average Runoff Depth = 3.15"
85.86% Pervious = 55.690 ac 14.14% Impervious = 9.170 ac

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MSE 24-hr 3 10 Yr Rainfall=4.60"

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Page 33

Summary for Subcatchment 1S: Wetland Watershed

Runoff = 58.24 cfs @ 12.19 hrs, Volume= 3.535 af, Depth= 3.59"
Routed to Pond 2P : East Pool

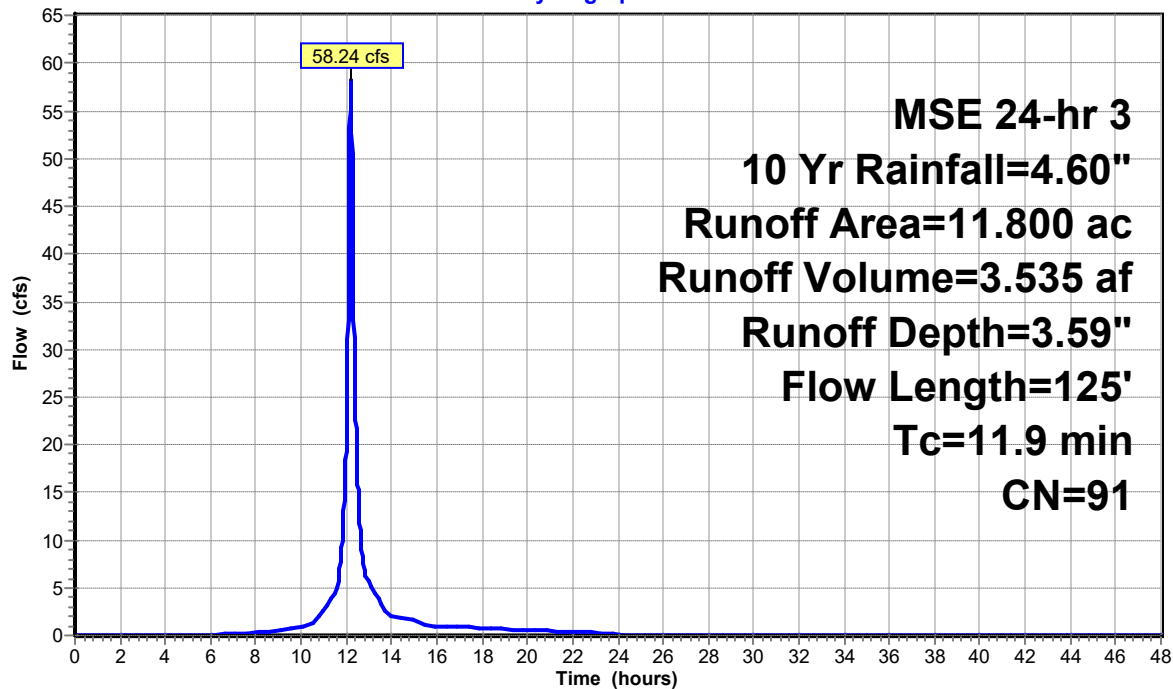
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10 Yr Rainfall=4.60"

Area (ac)	CN	Description
* 5.500	100	Pool
* 6.300	83	
11.800	91	Weighted Average
6.300		53.39% Pervious Area
5.500		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0350	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 3.10"
0.3	25	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
11.9	125	Total			

Subcatchment 1S: Wetland Watershed

Hydrograph



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MSE 24-hr 3 10 Yr Rainfall=4.60"

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Page 34

Summary for Subcatchment 3S: Eastern Watershed

Runoff = 39.39 cfs @ 12.31 hrs, Volume= 3.049 af, Depth= 2.81"
Routed to Pond 4P : Culvert Storage

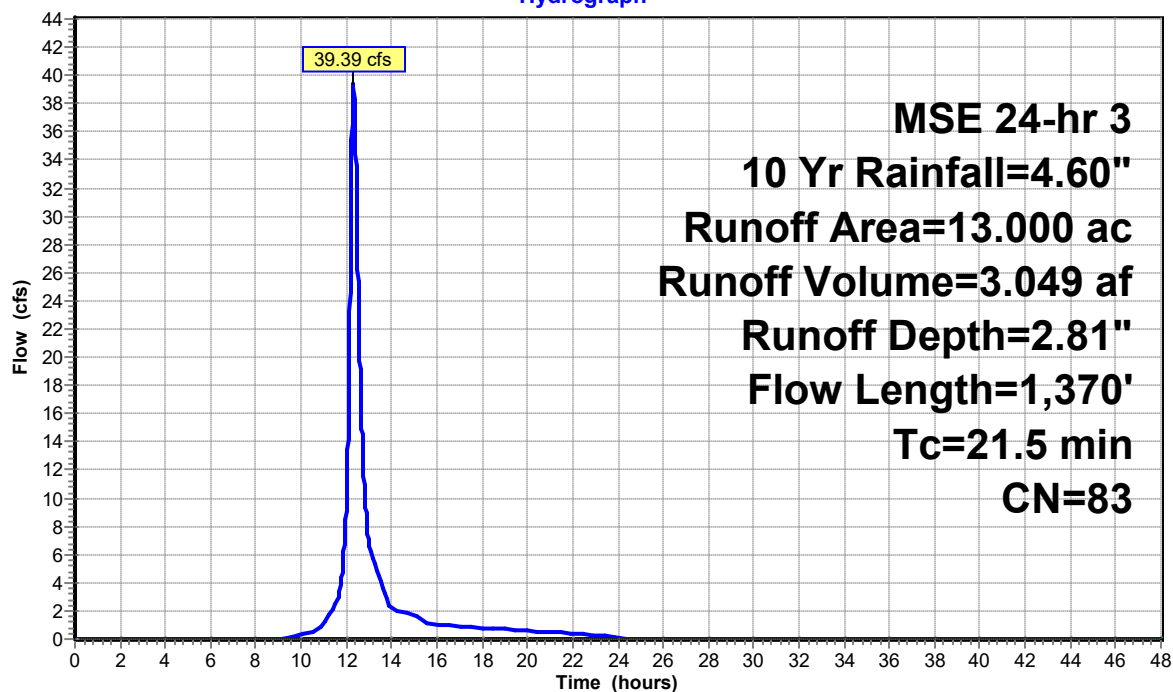
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10 Yr Rainfall=4.60"

Area (ac)	CN	Description
* 13.000	83	
13.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0800	0.26		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
15.2	1,270	0.0240	1.39		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
21.5	1,370	Total			

Subcatchment 3S: Eastern Watershed

Hydrograph



Summary for Subcatchment 6S: Northwest Offsite Watershed

Runoff = 91.04 cfs @ 12.36 hrs, Volume= 7.871 af, Depth= 3.00"
 Routed to Pond 9P : Northwest Pothole

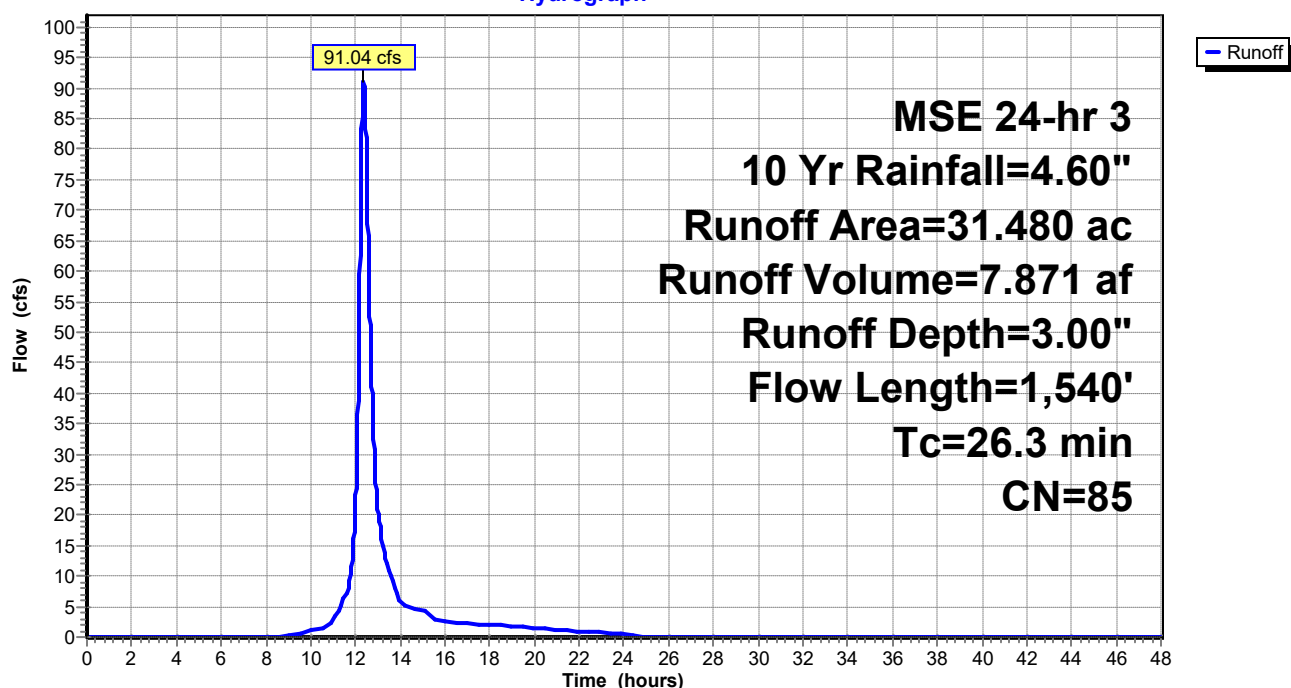
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 MSE 24-hr 3 10 Yr Rainfall=4.60"

Area (ac)	CN	Description
31.480	85	Row crops, straight row, Good, HSG C
31.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	100	0.0300	0.18		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
16.9	1,440	0.0250	1.42		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
26.3	1,540	Total			

Subcatchment 6S: Northwest Offsite Watershed

Hydrograph



Summary for Subcatchment 7S: Southwest Direct Watershed

Runoff = 23.37 cfs @ 12.12 hrs, Volume= 1.088 af, Depth= 3.70"
Routed to Pond 8P : Southwest Pool

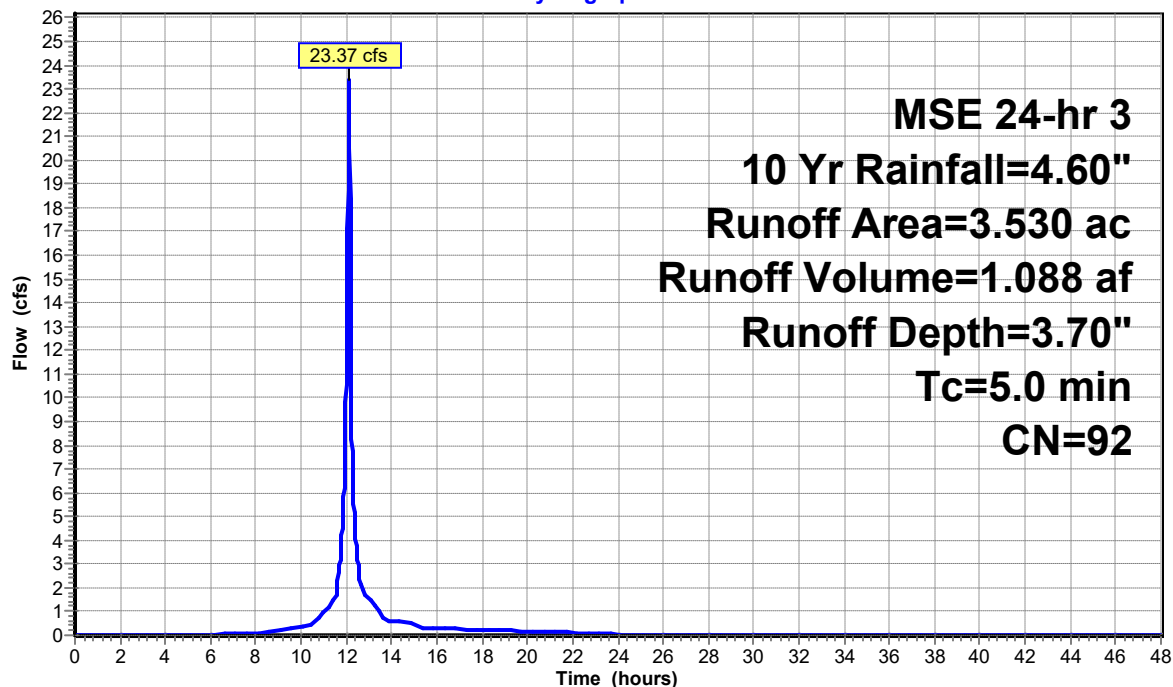
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10 Yr Rainfall=4.60"

	Area (ac)	CN	Description
*	1.660	100	
*	1.870	85	
	3.530	92	Weighted Average
	1.870		52.97% Pervious Area
	1.660		47.03% Impervious Area

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

Subcatchment 7S: Southwest Direct Watershed

Hydrograph



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MSE 24-hr 3 10 Yr Rainfall=4.60"

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Page 37

Summary for Subcatchment 10S: Northwest Direct Watershed

Runoff = 25.92 cfs @ 12.12 hrs, Volume= 1.221 af, Depth= 3.81"
Routed to Pond 5P : Northwest Wetland

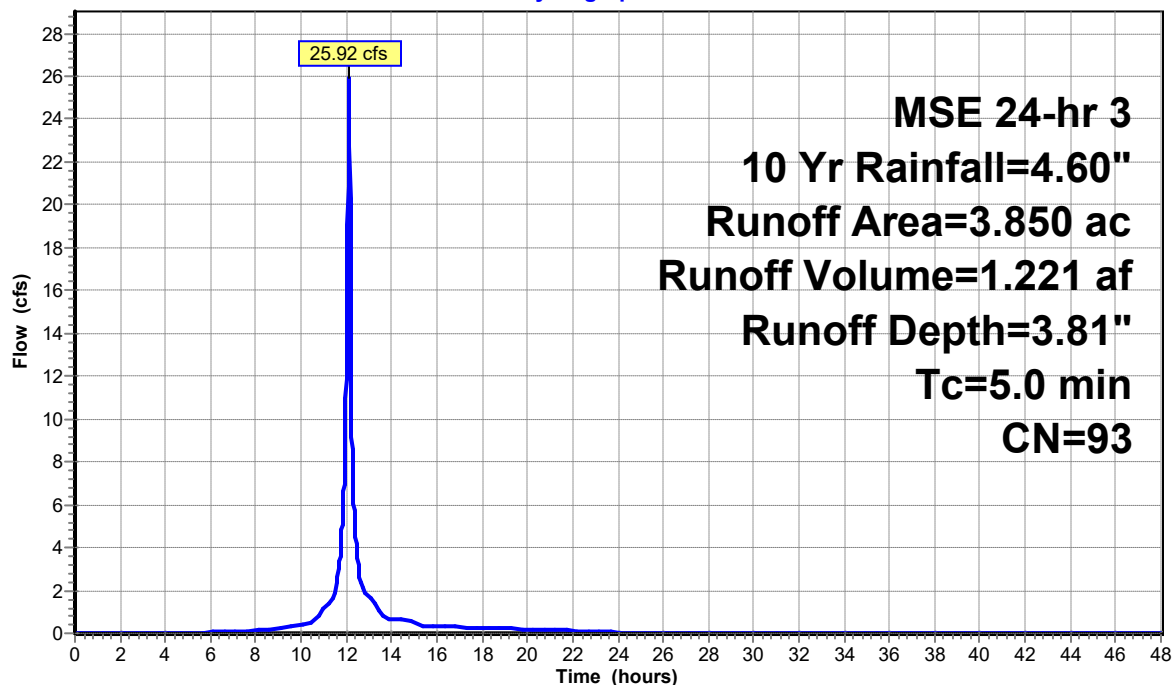
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10 Yr Rainfall=4.60"

	Area (ac)	CN	Description
*	1.840	85	
*	2.010	100	
	3.850	93	Weighted Average
	1.840		47.79% Pervious Area
	2.010		52.21% Impervious Area

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

Subcatchment 10S: Northwest Direct Watershed

Hydrograph



Summary for Subcatchment 12S: Culvert Area

Runoff = 5.94 cfs @ 12.13 hrs, Volume= 0.255 af, Depth= 2.55"
Routed to Pond 11P : Culvert Storage

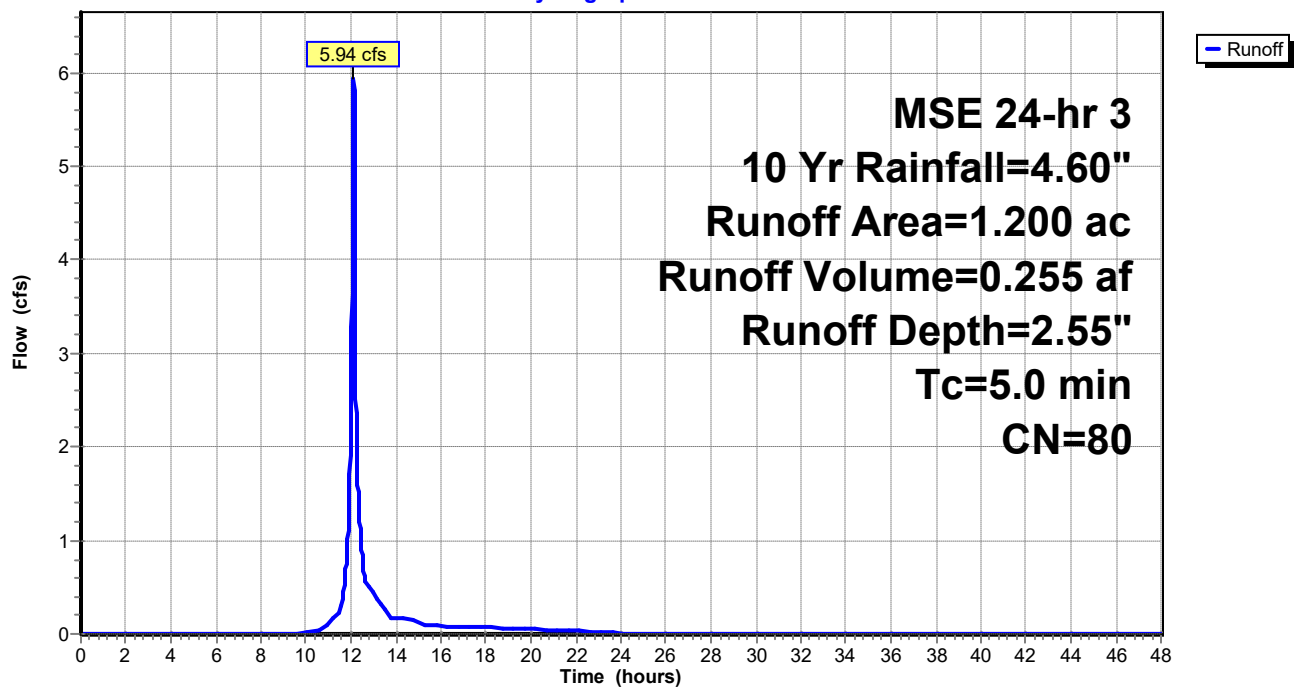
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10 Yr Rainfall=4.60"

Area (ac)	CN	Description
* 1.200	80	
1.200		100.00% Pervious Area

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

Subcatchment 12S: Culvert Area

Hydrograph



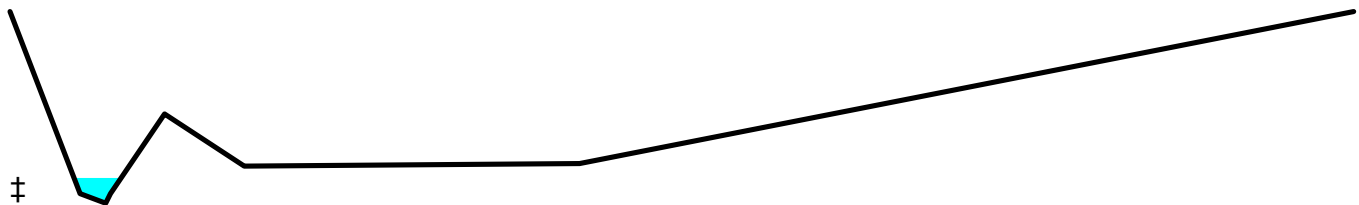
Summary for Reach 5R: Out Channel

Inflow = 10.03 cfs @ 12.68 hrs, Volume= 0.790 af
 Outflow = 10.03 cfs @ 12.68 hrs, Volume= 0.790 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Max. Velocity= 2.02 fps, Min. Travel Time= 0.7 min
 Avg. Velocity= 1.08 fps, Avg. Travel Time= 1.2 min

Peak Storage= 396 cf @ 12.68 hrs
 Average Depth at Peak Storage= 0.53' , Surface Width= 14.76'
 Bank-Full Depth= 4.02' Flow Area= 922.7 sf, Capacity= 6,533.92 cfs

Custom cross-section, Length= 80.0' Slope= 0.0050 '/' (103 Elevation Intervals)
 Constant n= 0.025 Earth, grassed & winding
 Inlet Invert= 1,199.40', Outlet Invert= 1,199.00'

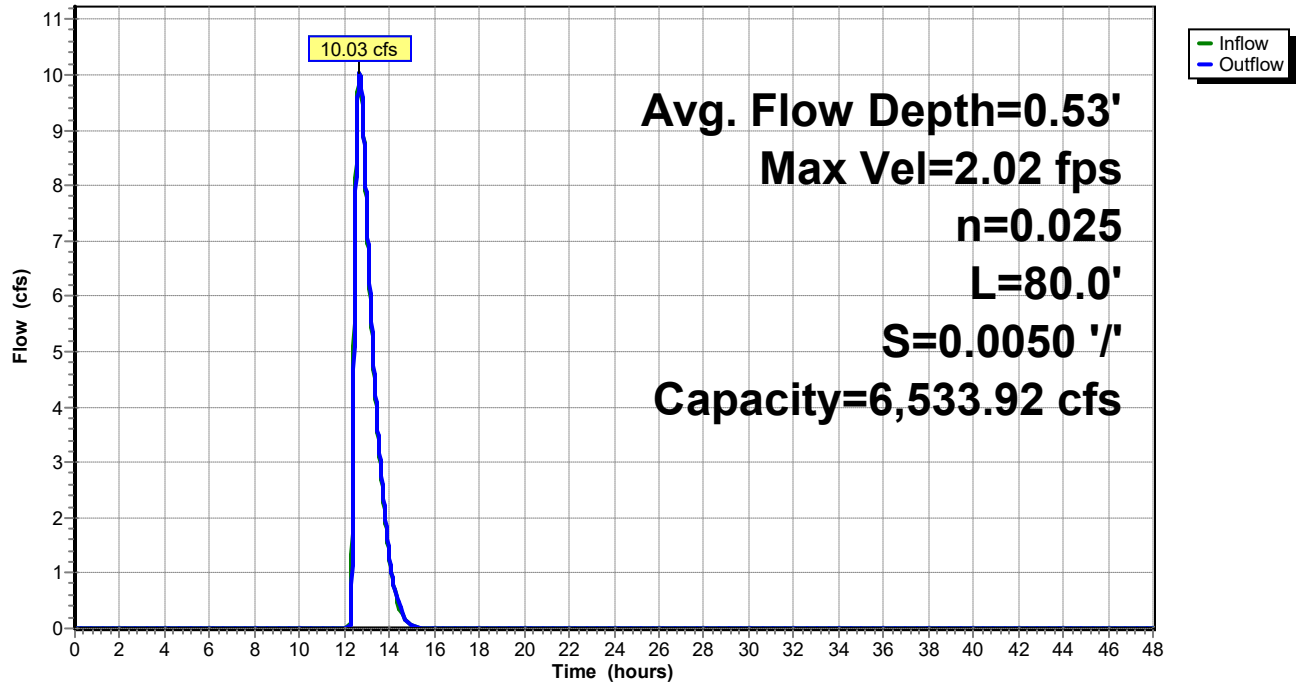


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,203.42	0.00
22.00	1,199.60	3.82
30.00	1,199.40	4.02
31.50	1,199.60	3.82
48.50	1,201.27	2.15
73.50	1,200.18	3.24
178.65	1,200.23	3.19
421.44	1,203.42	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.20	0.9	9.5	9.5	76	0.86
0.78	9.1	18.8	18.7	731	23.72
0.83	12.8	125.9	125.8	1,020	11.65
1.87	205.8	245.7	245.4	16,465	768.68
4.02	922.7	421.9	421.4	73,815	6,533.92

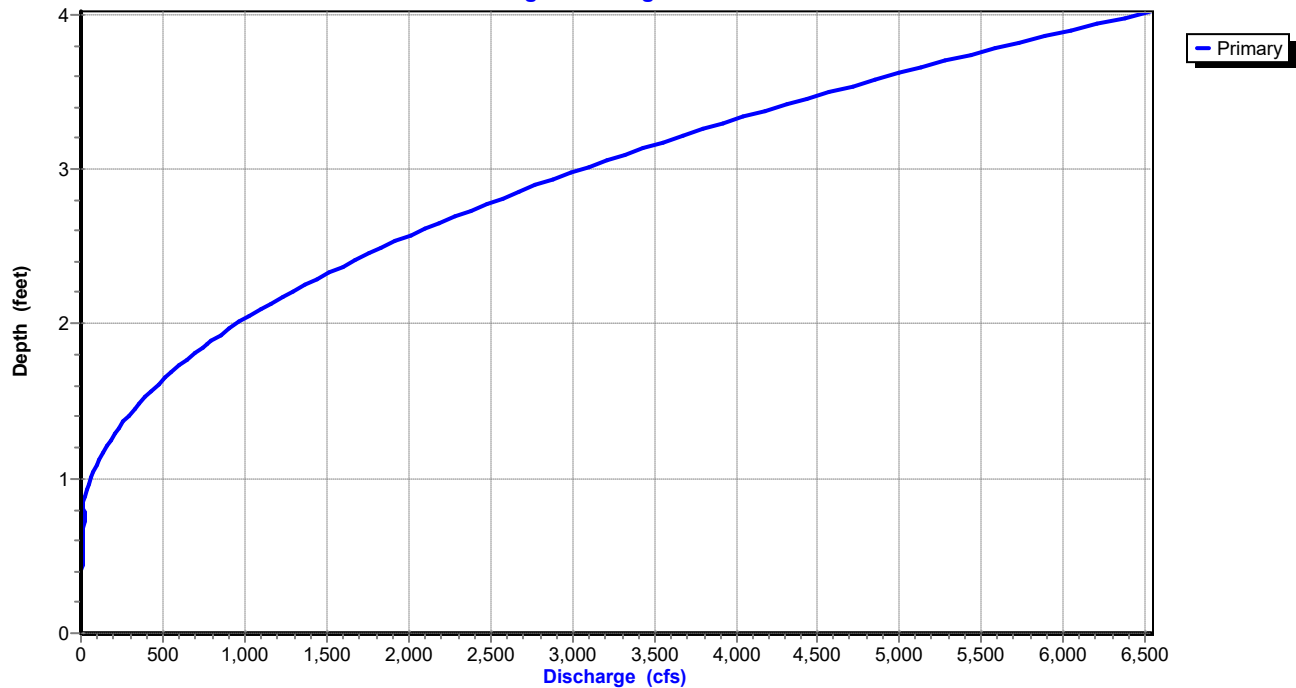
Reach 5R: Out Channel

Hydrograph

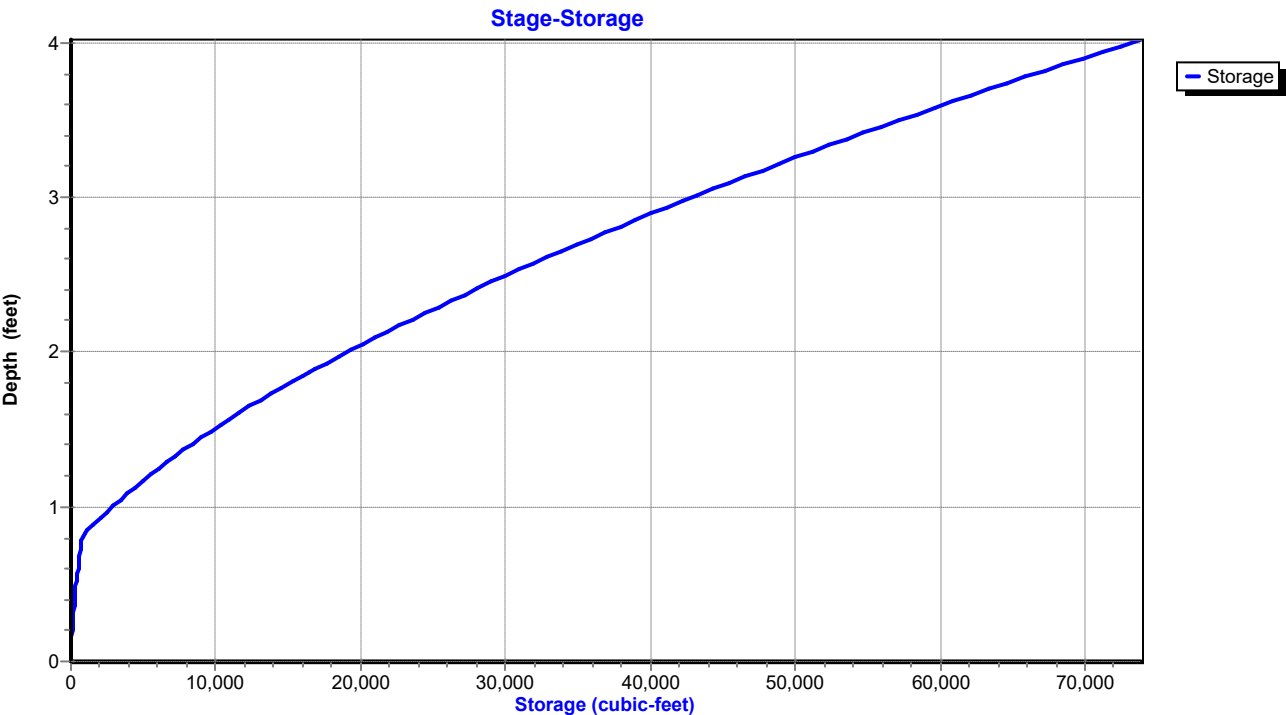


Reach 5R: Out Channel

Stage-Discharge



Reach 5R: Out Channel



Summary for Pond 2P: East Pool

Inflow Area = 24.800 ac, 22.18% Impervious, Inflow Depth = 2.80" for 10 Yr event
 Inflow = 61.33 cfs @ 12.20 hrs, Volume= 5.793 af
 Outflow = 6.19 cfs @ 13.78 hrs, Volume= 5.568 af, Atten= 90%, Lag= 94.8 min
 Primary = 5.51 cfs @ 13.78 hrs, Volume= 5.401 af
 Secondary = 0.68 cfs @ 13.78 hrs, Volume= 0.167 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,196.50' Surf.Area= 4.500 ac Storage= 5.075 af

Peak Elev= 1,197.07' @ 13.78 hrs Surf.Area= 5.432 ac Storage= 7.917 af (2.842 af above start)

Plug-Flow detention time= 1,602.2 min calculated for 0.493 af (9% of inflow)

Center-of-Mass det. time= 371.9 min (1,220.6 - 848.7)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,194.50'	17.400 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,194.50	0.400	0.000	0.000
1,195.00	1.400	0.450	0.450
1,195.50	2.600	1.000	1.450
1,196.00	3.700	1.575	3.025
1,196.50	4.500	2.050	5.075
1,197.00	5.300	2.450	7.525
1,197.50	6.200	2.875	10.400
1,198.00	7.000	3.300	13.700
1,198.50	7.800	3.700	17.400

Device	Routing	Invert	Outlet Devices
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#1	Primary	1,190.00'	18.0" Round Culvert
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L= 80.5' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 1,190.00' / 1,188.39' S= 0.0200 '/' Cc= 0.900

n= 0.013, Flow Area= 1.77 sf

#2	Device 1	1,196.50'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
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#3	Secondary	1,197.00'	12.0' long + 4.0 ' SideZ x 0.5' breadth Broad-Crested Rectangular Weir
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Head (feet) 0.20 0.40 0.60 0.80 1.00

Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=5.51 cfs @ 13.78 hrs HW=1,197.07' (Free Discharge)

↑ **1=Culvert** (Passes 5.51 cfs of 21.40 cfs potential flow)

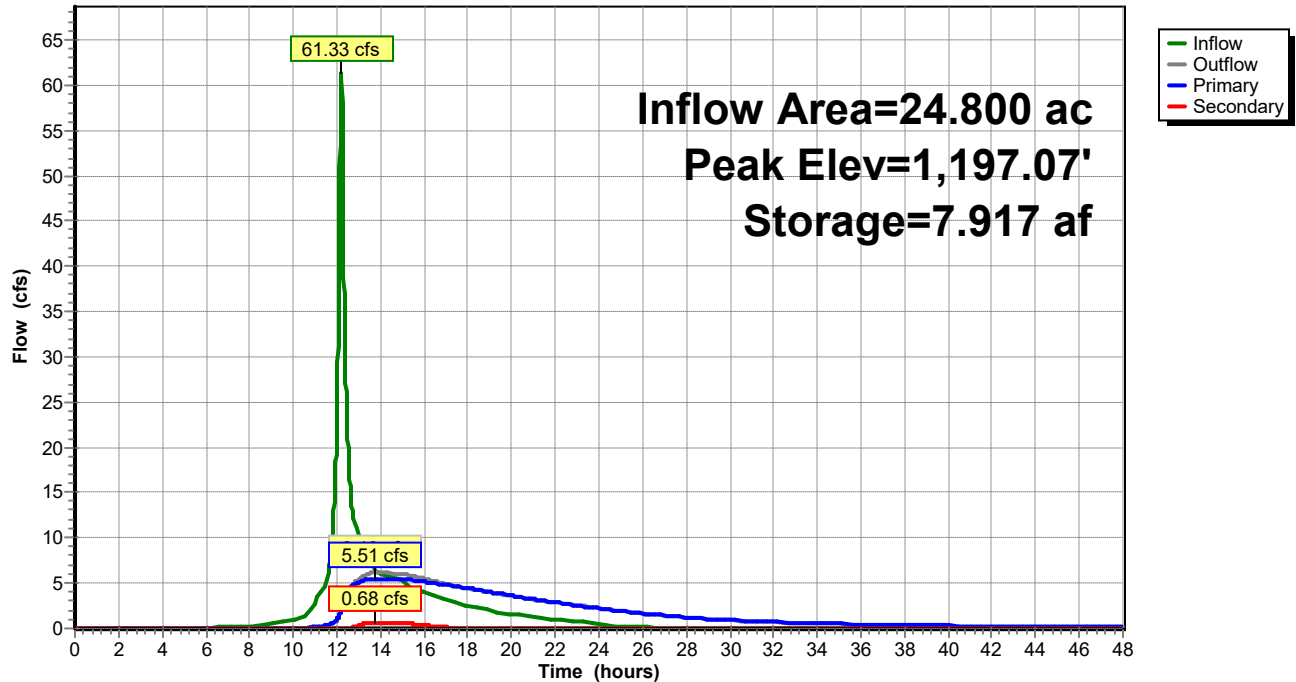
↑ **2=Sharp-Crested Rectangular Weir** (Weir Controls 5.51 cfs @ 2.48 fps)

Secondary OutFlow Max=0.68 cfs @ 13.78 hrs HW=1,197.07' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 0.68 cfs @ 0.75 fps)

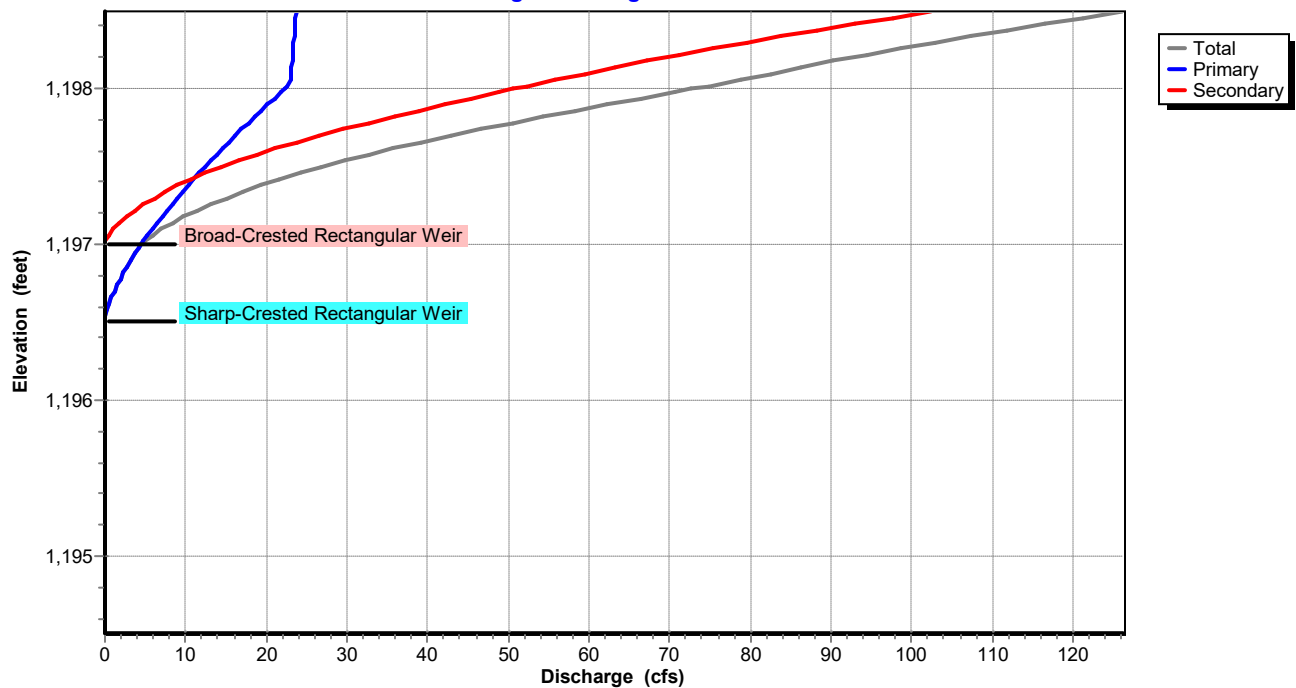
Pond 2P: East Pool

Hydrograph



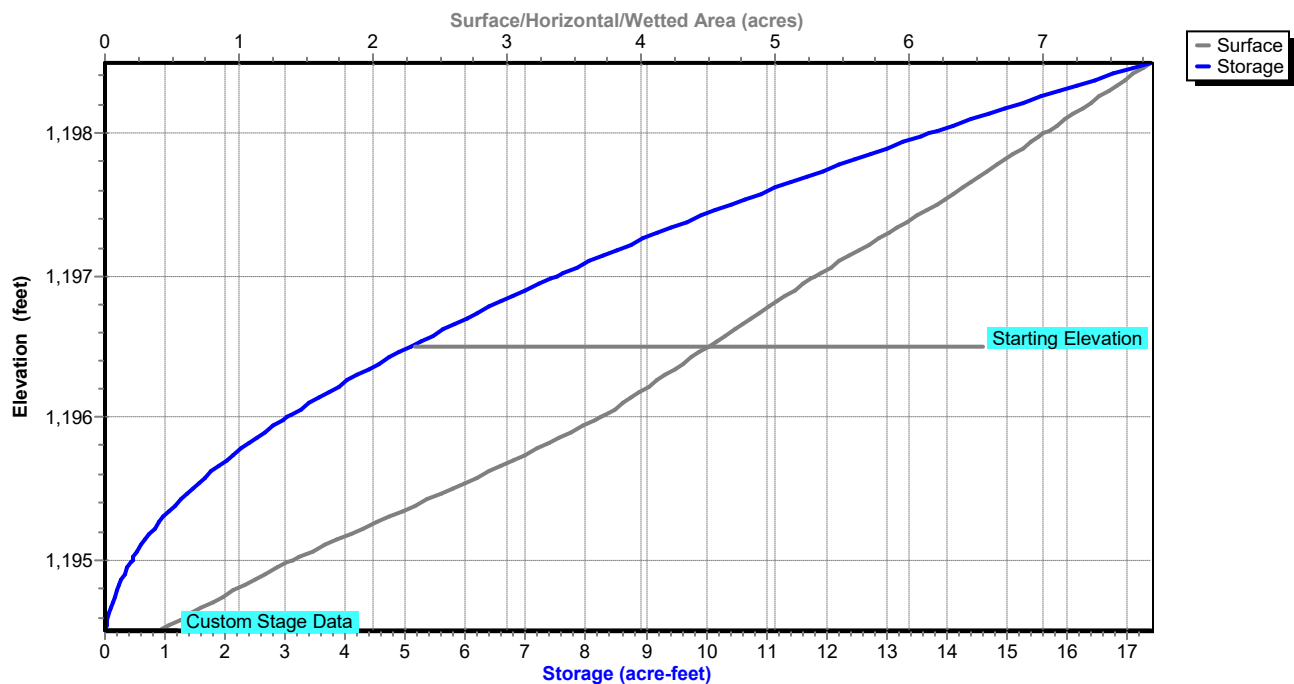
Pond 2P: East Pool

Stage-Discharge



Pond 2P: East Pool

Stage-Area-Storage



Summary for Pond 4P: Culvert Storage

Inflow Area = 13.000 ac, 0.00% Impervious, Inflow Depth = 2.81" for 10 Yr event
 Inflow = 39.39 cfs @ 12.31 hrs, Volume= 3.049 af
 Outflow = 15.11 cfs @ 12.68 hrs, Volume= 3.049 af, Atten= 62%, Lag= 22.1 min
 Primary = 5.09 cfs @ 12.68 hrs, Volume= 2.259 af
 Routed to Pond 2P : East Pool
 Secondary = 10.03 cfs @ 12.68 hrs, Volume= 0.790 af
 Routed to Reach 5R : Out Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,199.93' @ 12.68 hrs Surf.Area= 1.592 ac Storage= 1.282 af

Plug-Flow detention time= 98.0 min calculated for 3.049 af (100% of inflow)
 Center-of-Mass det. time= 97.9 min (908.4 - 810.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	15.511 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,198.00	0.002	0.000	0.000
1,199.00	0.560	0.281	0.281
1,200.00	1.670	1.115	1.396
1,201.00	4.370	3.020	4.416
1,202.00	5.580	4.975	9.391
1,203.00	6.660	6.120	15.511

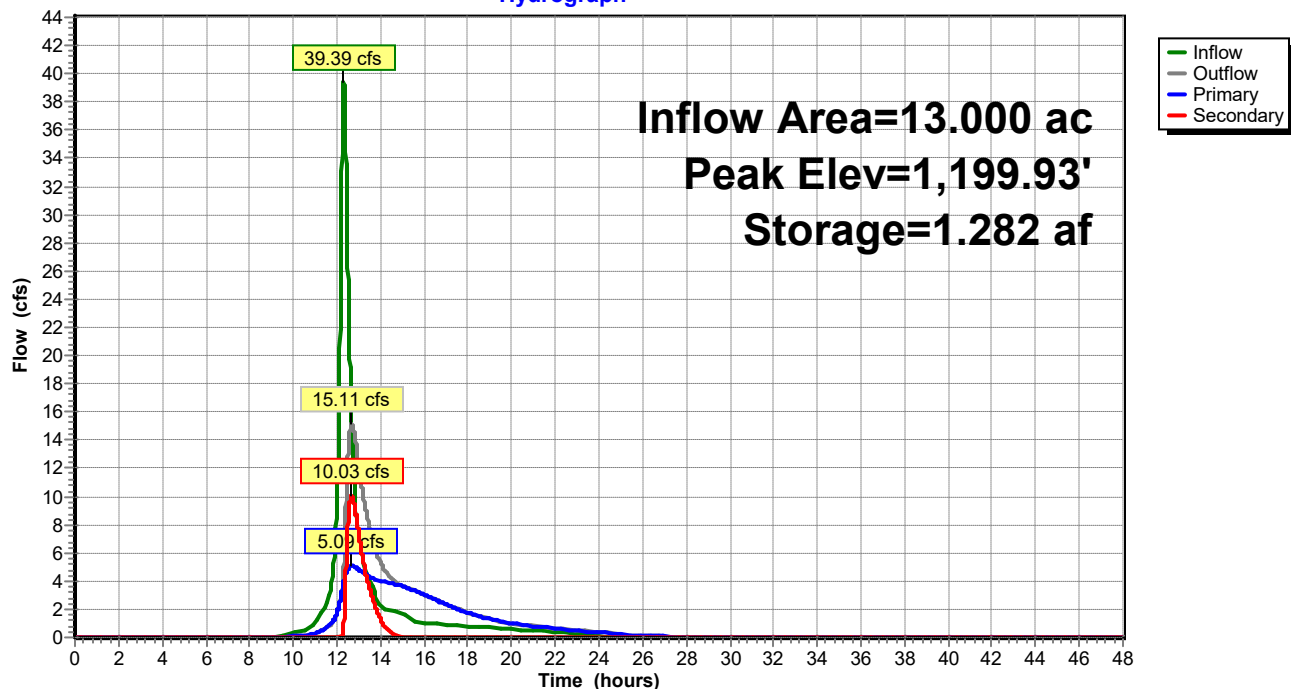
Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	15.0" Round Culvert L= 45.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,198.00' S= 0.0000 ' /' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Secondary	1,199.40'	Channel/Reach using Reach 5R: Out Channel

Primary OutFlow Max=5.09 cfs @ 12.68 hrs HW=1,199.93' TW=1,197.01' (Dynamic Tailwater)
 ↑ **1=Culvert** (Barrel Controls 5.09 cfs @ 4.14 fps)

Secondary OutFlow Max=10.03 cfs @ 12.68 hrs HW=1,199.93' TW=1,199.93' (Dynamic Tailwater)
 ↑ **2=Channel/Reach** (Channel Controls 10.03 cfs @ 2.02 fps)

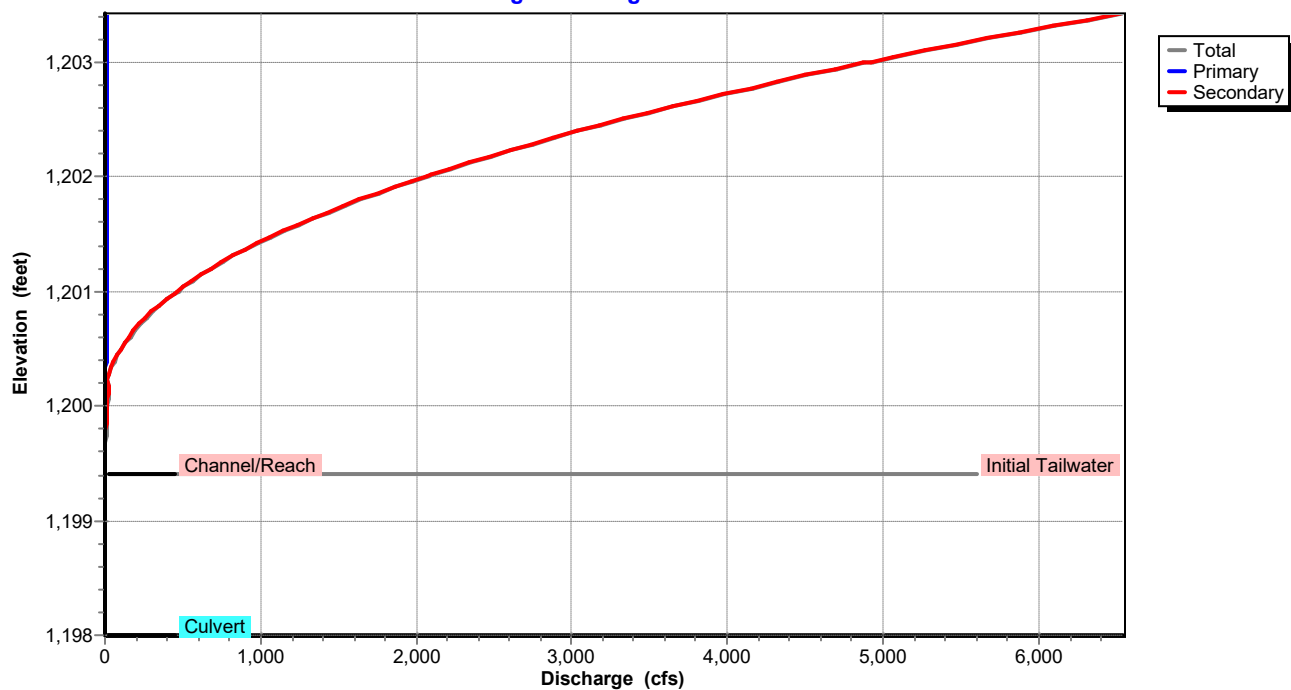
Pond 4P: Culvert Storage

Hydrograph

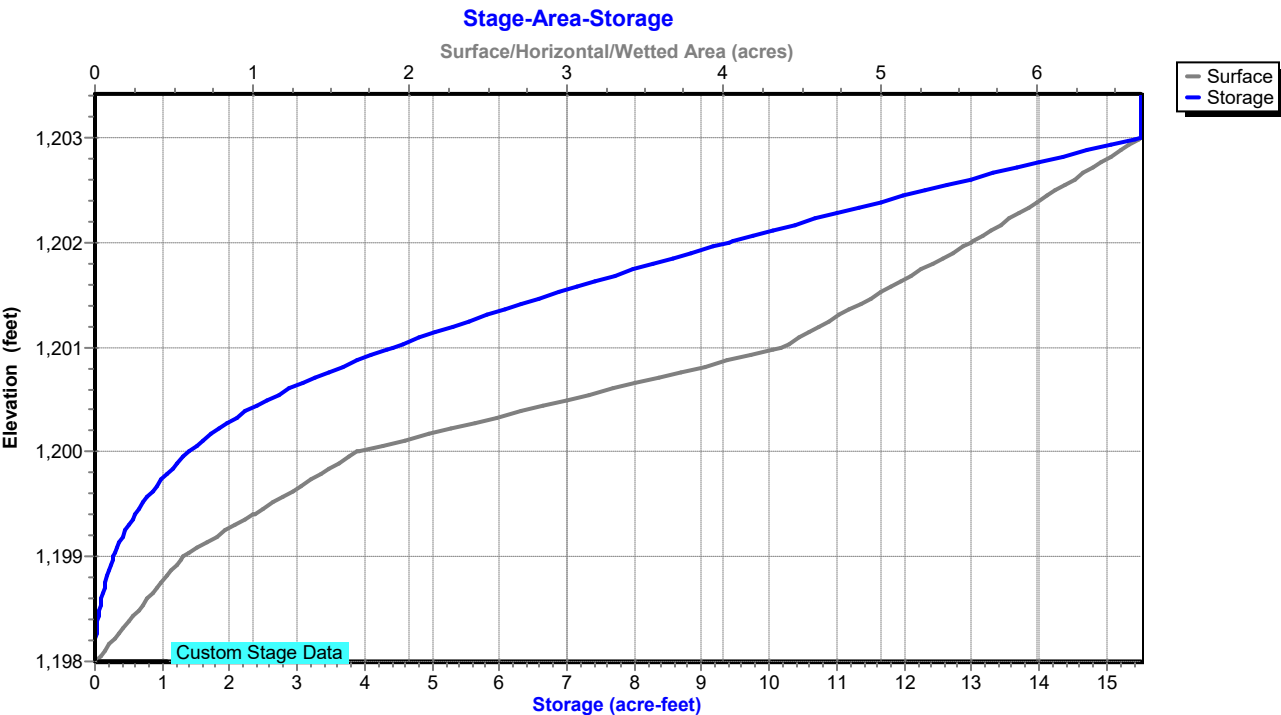


Pond 4P: Culvert Storage

Stage-Discharge



Pond 4P: Culvert Storage



Summary for Pond 5P: Northwest Wetland

Inflow Area = 3.850 ac, 52.21% Impervious, Inflow Depth = 18.13" for 10 Yr event
 Inflow = 86.54 cfs @ 12.39 hrs, Volume= 5.817 af
 Outflow = 58.93 cfs @ 12.61 hrs, Volume= 5.816 af, Atten= 32%, Lag= 13.0 min
 Primary = 58.93 cfs @ 12.61 hrs, Volume= 5.816 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,196.50' Surf.Area= 1.900 ac Storage= 0.925 af

Peak Elev= 1,197.47' @ 12.61 hrs Surf.Area= 2.281 ac Storage= 2.901 af (1.976 af above start)

Plug-Flow detention time= 66.4 min calculated for 4.890 af (84% of inflow)

Center-of-Mass det. time= 36.2 min (793.4 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,196.00'	7.050 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,196.00	1.800	0.000	0.000
1,197.00	2.000	1.900	1.900
1,198.00	2.600	2.300	4.200
1,199.00	3.100	2.850	7.050

Device	Routing	Invert	Outlet Devices
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#1	Primary	1,190.00'	30.0" Round Culvert
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L= 111.0' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 1,190.00' / 1,187.78' S= 0.0200 ' / ' Cc= 0.900

n= 0.013, Flow Area= 4.91 sf

#2	Secondary	1,197.50'	12.0' long + 4.0 ' / ' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
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Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

#3	Device 1	1,196.50'	5.0' long Sharp-Crested Rectangular Weir X 4.00
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2 End Contraction(s)

Primary OutFlow Max=58.94 cfs @ 12.61 hrs HW=1,197.47' (Free Discharge)

↑ **1=Culvert** (Inlet Controls 58.94 cfs @ 12.01 fps)

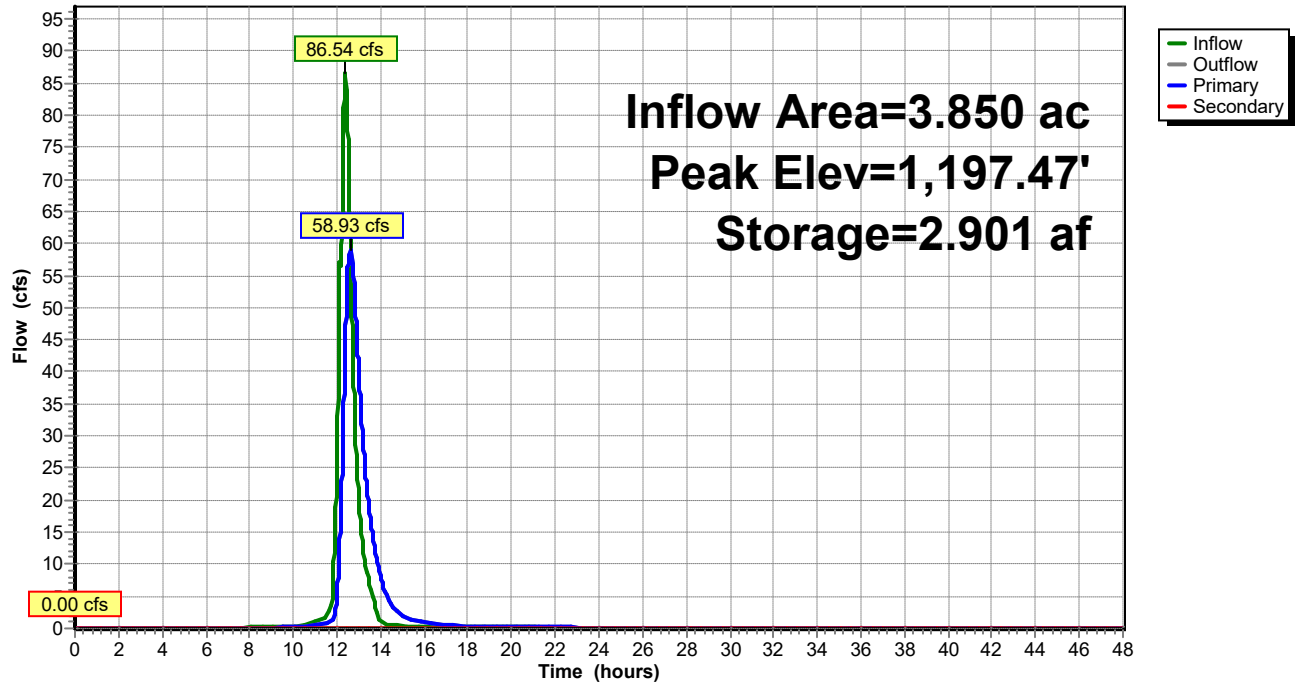
↑ **3=Sharp-Crested Rectangular Weir** (Passes 58.94 cfs of 59.83 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,196.50' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

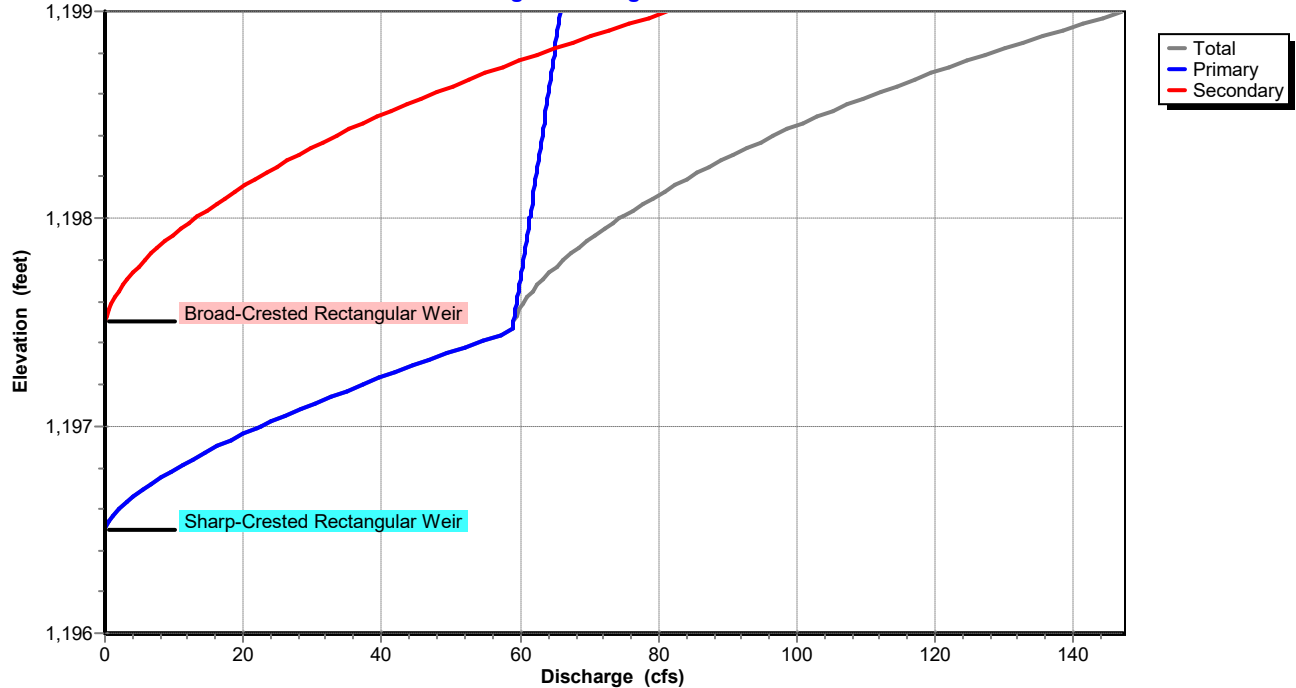
Pond 5P: Northwest Wetland

Hydrograph

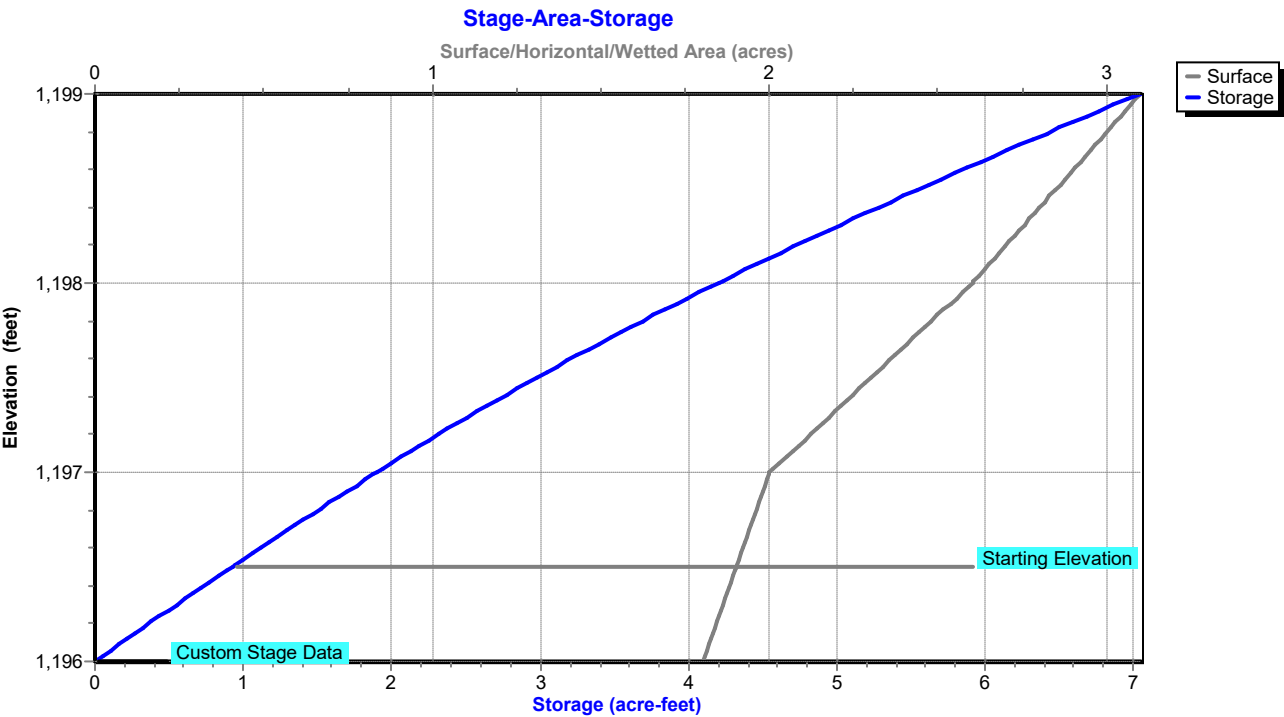


Pond 5P: Northwest Wetland

Stage-Discharge



Pond 5P: Northwest Wetland



Summary for Pond 8P: Southwest Pool

Inflow Area = 3.530 ac, 47.03% Impervious, Inflow Depth = 3.70" for 10 Yr event
 Inflow = 23.37 cfs @ 12.12 hrs, Volume= 1.088 af
 Outflow = 5.86 cfs @ 12.30 hrs, Volume= 1.086 af, Atten= 75%, Lag= 10.9 min
 Primary = 5.86 cfs @ 12.30 hrs, Volume= 1.086 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,198.00' Surf.Area= 1.660 ac Storage= 1.615 af

Peak Elev= 1,198.28' @ 12.30 hrs Surf.Area= 1.728 ac Storage= 2.098 af (0.483 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 100.7 min (873.5 - 772.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,195.00'	5.585 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.00	0.010	0.000	0.000
1,196.00	0.220	0.115	0.115
1,197.00	0.560	0.390	0.505
1,198.00	1.660	1.110	1.615
1,199.00	1.900	1.780	3.395
1,200.00	2.480	2.190	5.585

Device	Routing	Invert	Outlet Devices
#1	Primary	1,190.00'	12.0" Round Culvert L= 60.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,190.00' / 1,188.80' S= 0.0199 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,198.00'	48.0" W x 9.0" H Vert. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#3	Secondary	1,198.50'	20.0' long + 4.0 ' SideZ x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.86 cfs @ 12.30 hrs HW=1,198.28' (Free Discharge)

↑ **1=Culvert** (Passes 5.86 cfs of 9.97 cfs potential flow)

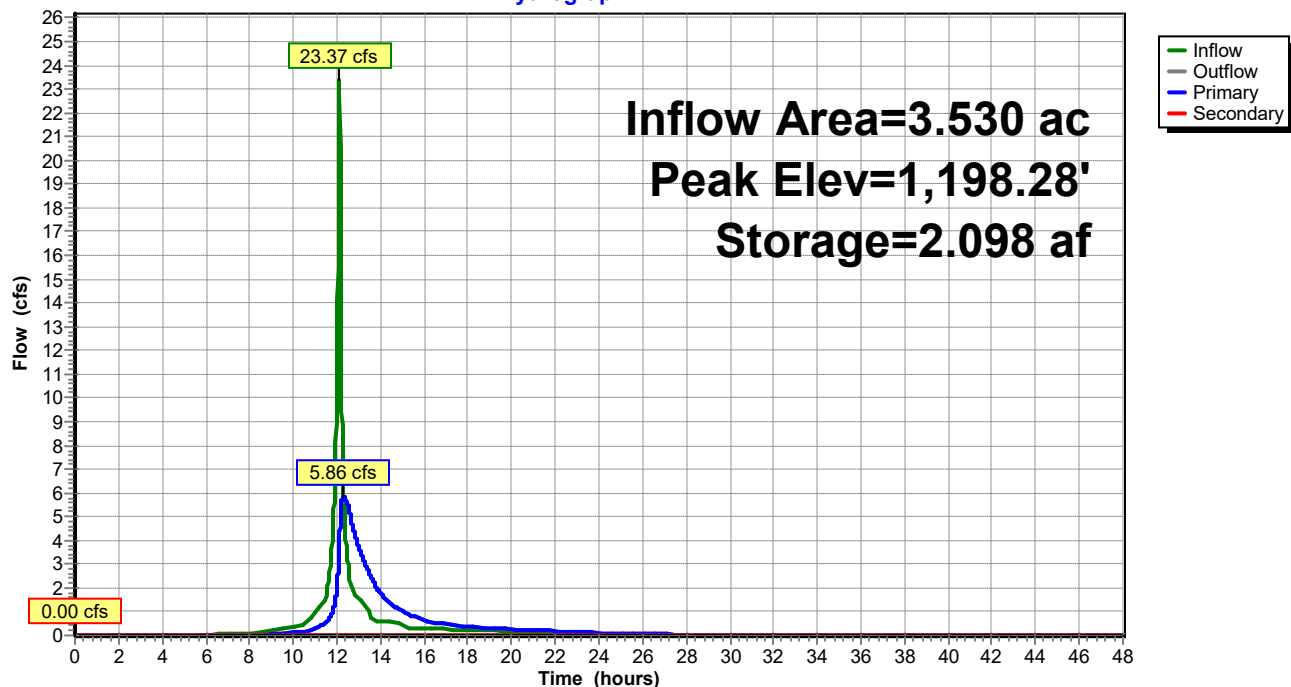
↑ **2=Orifice/Grate** (Orifice Controls 5.86 cfs @ 1.71 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,198.00' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

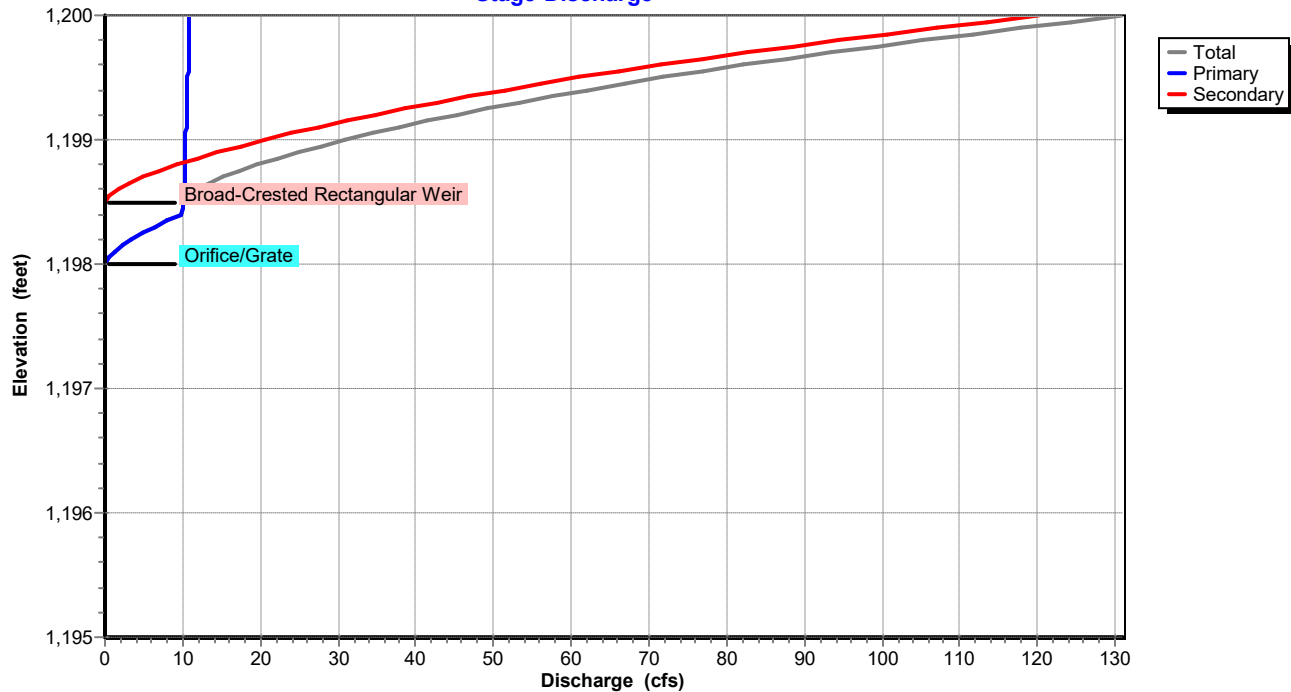
Pond 8P: Southwest Pool

Hydrograph

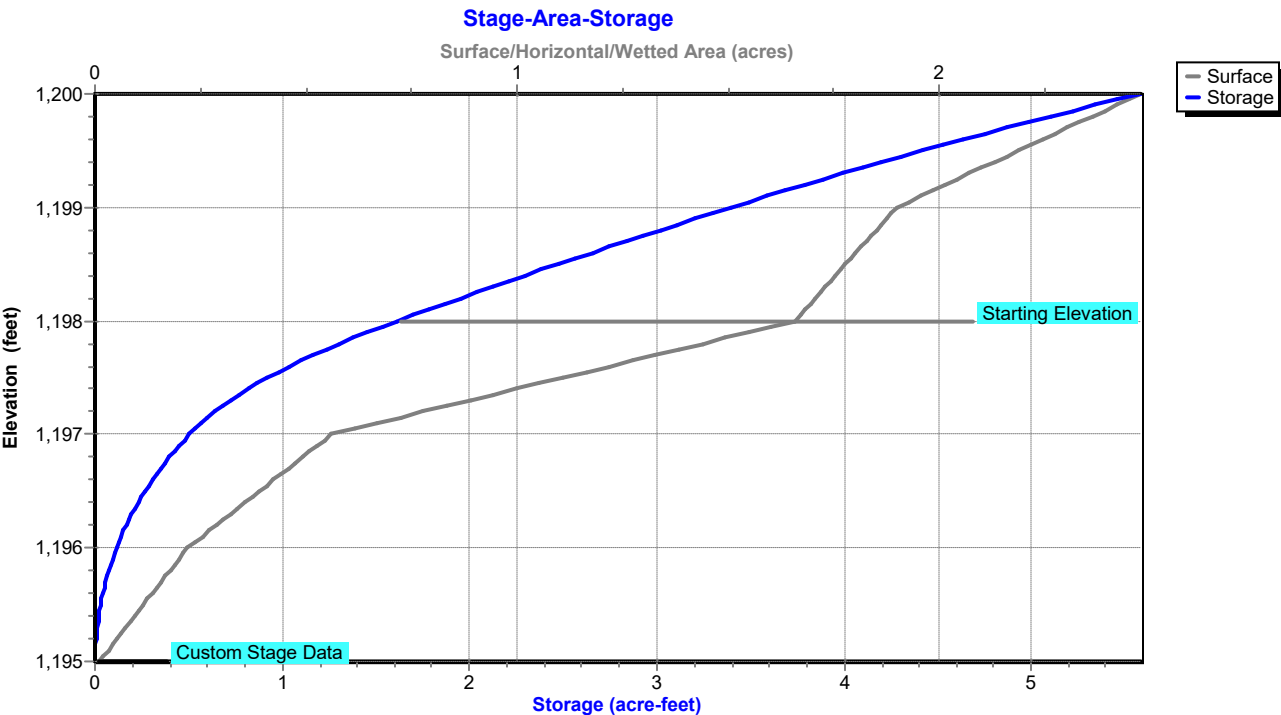


Pond 8P: Southwest Pool

Stage-Discharge



Pond 8P: Southwest Pool



Summary for Pond 9P: Northwest Pothole

Inflow Area = 31.480 ac, 0.00% Impervious, Inflow Depth = 3.00" for 10 Yr event
 Inflow = 91.04 cfs @ 12.36 hrs, Volume= 7.871 af
 Outflow = 89.51 cfs @ 12.41 hrs, Volume= 7.511 af, Atten= 2%, Lag= 2.5 min
 Primary = 89.51 cfs @ 12.41 hrs, Volume= 7.511 af
 Routed to Pond 11P : Culvert Storage
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,200.47' @ 12.41 hrs Surf.Area= 1.527 ac Storage= 0.710 af

Plug-Flow detention time= 36.4 min calculated for 7.511 af (95% of inflow)
 Center-of-Mass det. time= 13.0 min (823.6 - 810.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,199.50'	8.578 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,199.50	0.000	0.000	0.000
1,200.00	0.724	0.181	0.181
1,201.00	2.430	1.577	1.758
1,202.00	3.650	3.040	4.798
1,203.00	3.910	3.780	8.578

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,200.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.50 1.50 2.50 3.50 Width (feet) 0.00 65.00 230.00 300.00 350.00
#2	Primary	1,200.20'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.80 1.80 Width (feet) 168.00 363.00 650.00

Primary OutFlow Max=89.49 cfs @ 12.41 hrs HW=1,200.47' TW=1,197.37' (Dynamic Tailwater)

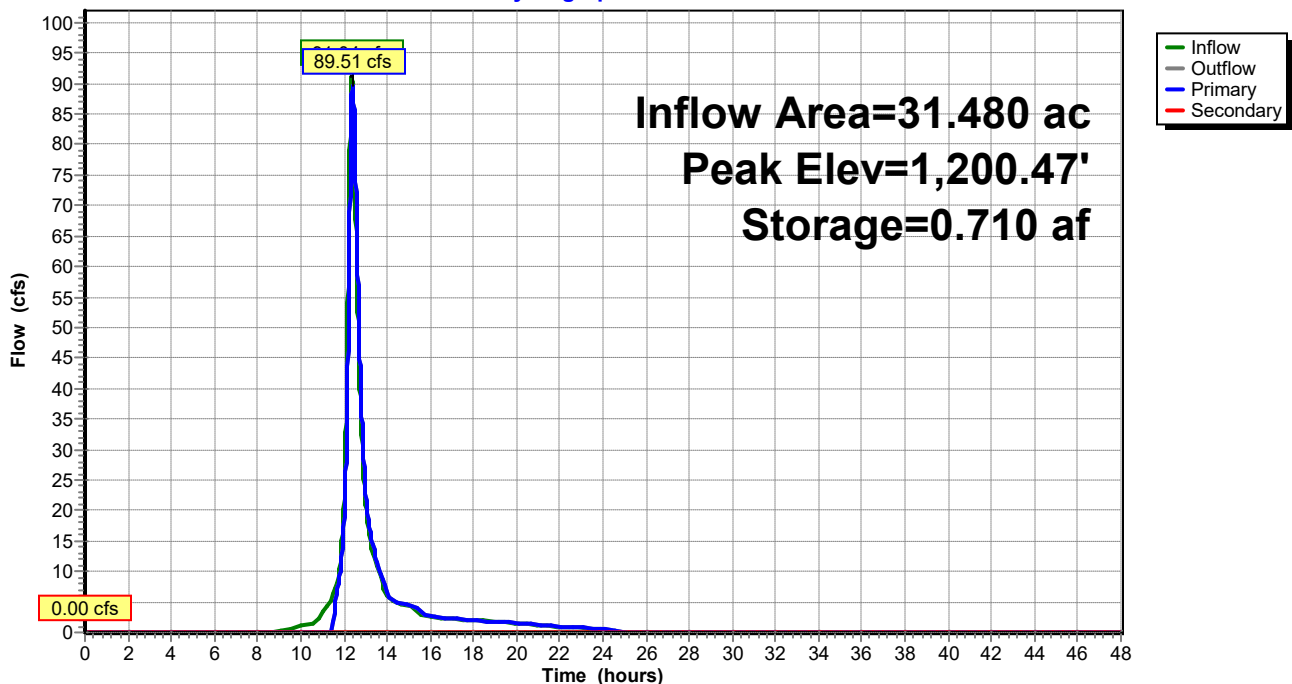
↑ **2=Custom Weir/Orifice** (Weir Controls 89.49 cfs @ 1.65 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,199.50' (Free Discharge)

↑ **1=Custom Weir/Orifice** (Controls 0.00 cfs)

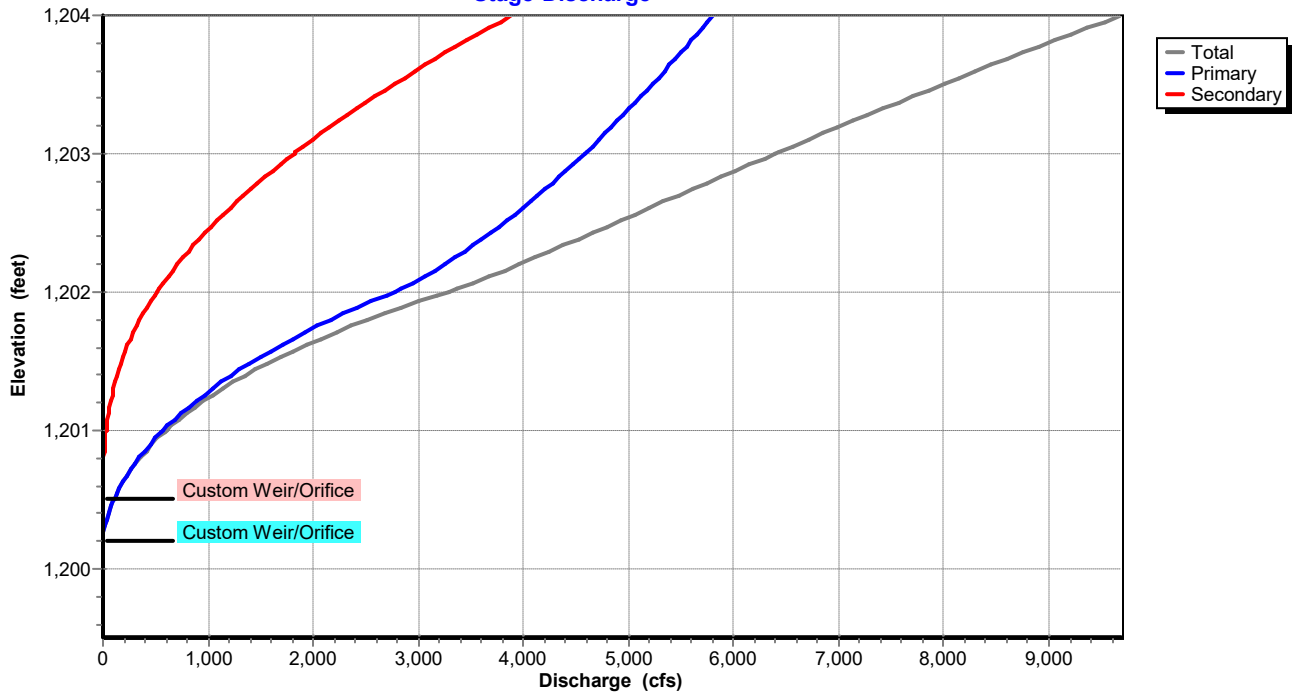
Pond 9P: Northwest Pothole

Hydrograph

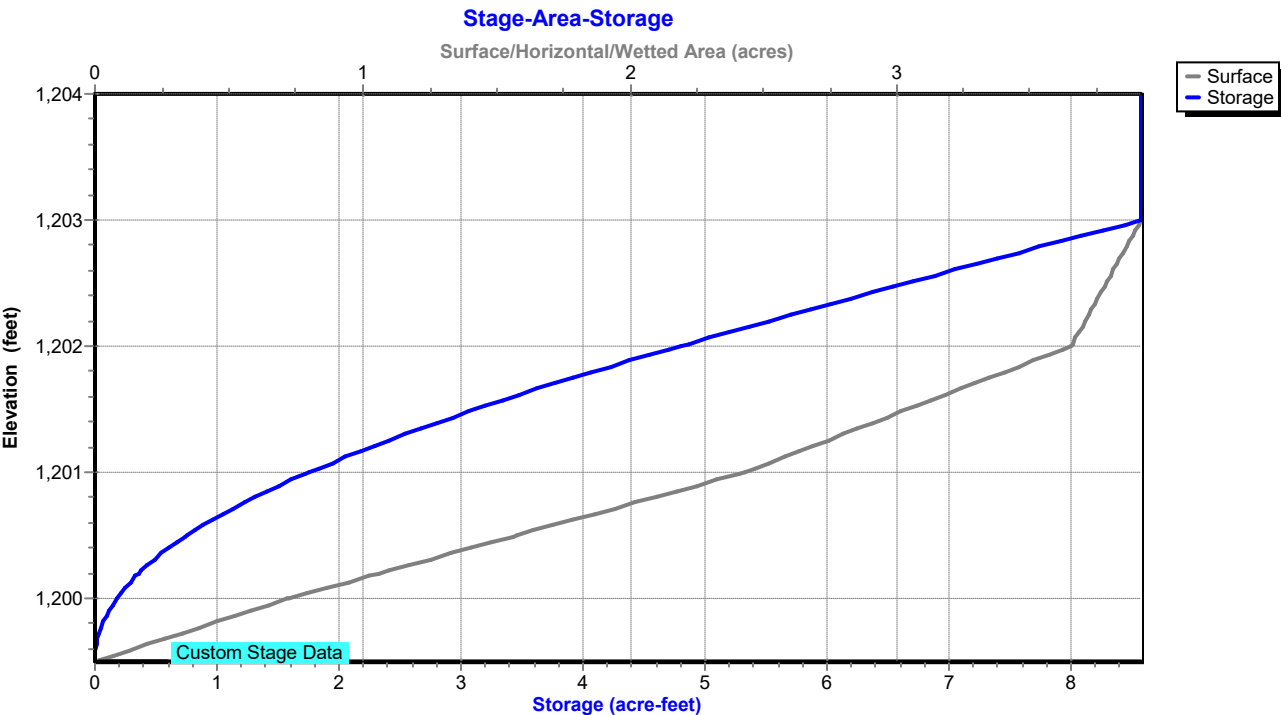


Pond 9P: Northwest Pothole

Stage-Discharge



Pond 9P: Northwest Pothole



Summary for Pond 11P: Culvert Storage

Inflow Area = 32.680 ac, 0.00% Impervious, Inflow Depth = 2.85" for 10 Yr event
 Inflow = 90.64 cfs @ 12.40 hrs, Volume= 7.766 af
 Outflow = 89.05 cfs @ 12.40 hrs, Volume= 7.766 af, Atten= 2%, Lag= 0.0 min
 Primary = 7.45 cfs @ 12.61 hrs, Volume= 3.170 af
 Secondary = 81.96 cfs @ 12.40 hrs, Volume= 4.596 af
 Routed to Pond 5P : Northwest Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,197.48' @ 12.61 hrs Surf.Area= 0.160 ac Storage= 0.122 af

Plug-Flow detention time= 2.7 min calculated for 7.764 af (100% of inflow)
 Center-of-Mass det. time= 2.7 min (825.6 - 822.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,195.50'	0.555 af	Custom Stage Data (Prismatic) Listed below (Recalc)

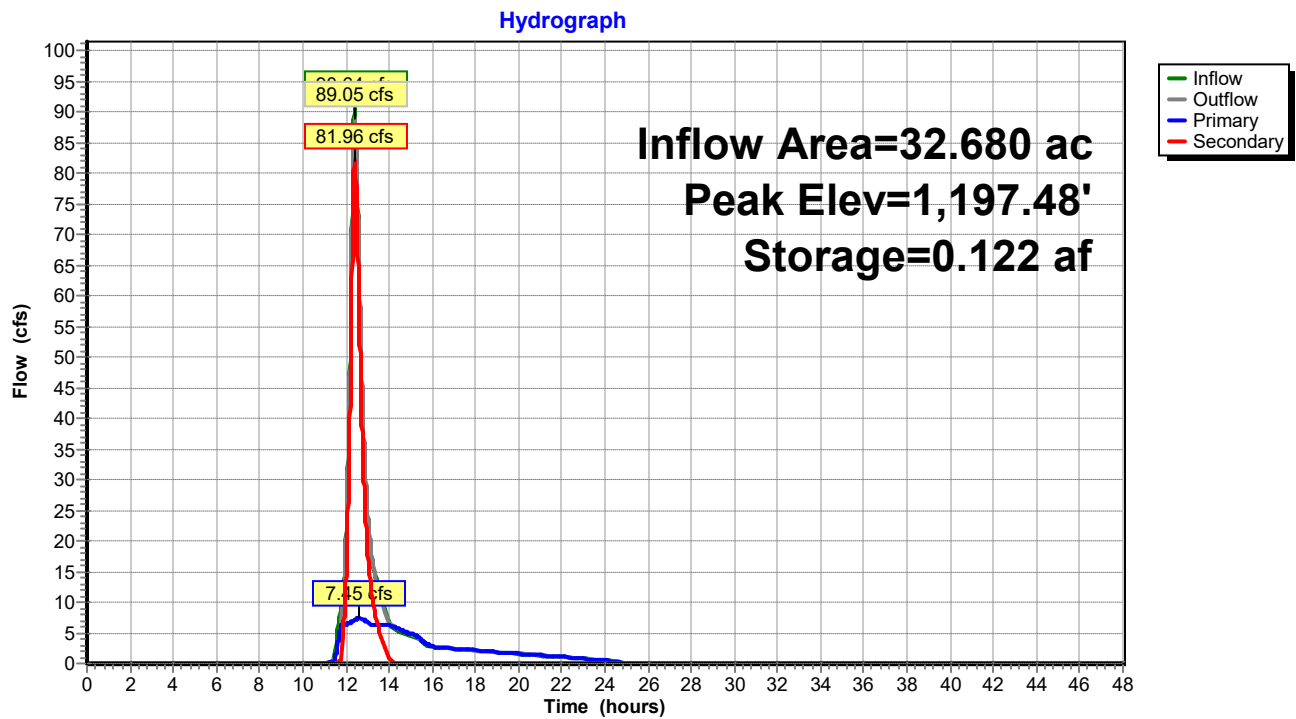
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.50	0.000	0.000	0.000
1,196.00	0.016	0.004	0.004
1,197.00	0.096	0.056	0.060
1,198.00	0.230	0.163	0.223
1,199.00	0.434	0.332	0.555

Device	Routing	Invert	Outlet Devices
#1	Primary	1,195.50'	18.0" Round Culvert L= 70.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,195.50' / 1,190.00' S= 0.0786 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf
#2	Secondary	1,197.10'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.90 1.90 2.90 Width (feet) 250.00 350.00 450.00 522.00

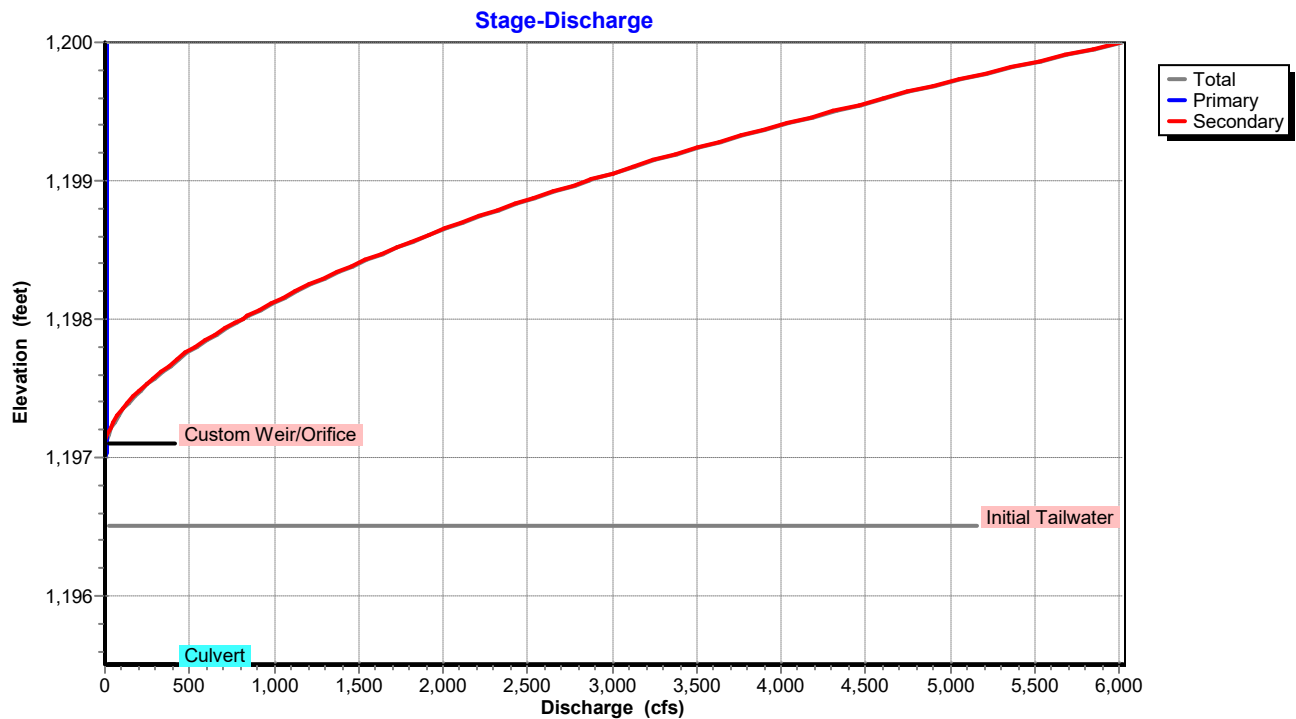
Primary OutFlow Max=7.45 cfs @ 12.61 hrs HW=1,197.48' (Free Discharge)
 ↑1=Culvert (Inlet Controls 7.45 cfs @ 4.22 fps)

Secondary OutFlow Max=73.81 cfs @ 12.40 hrs HW=1,197.36' TW=1,197.31' (Dynamic Tailwater)
 ↑2=Custom Weir/Orifice (Weir Controls 73.81 cfs @ 1.06 fps)

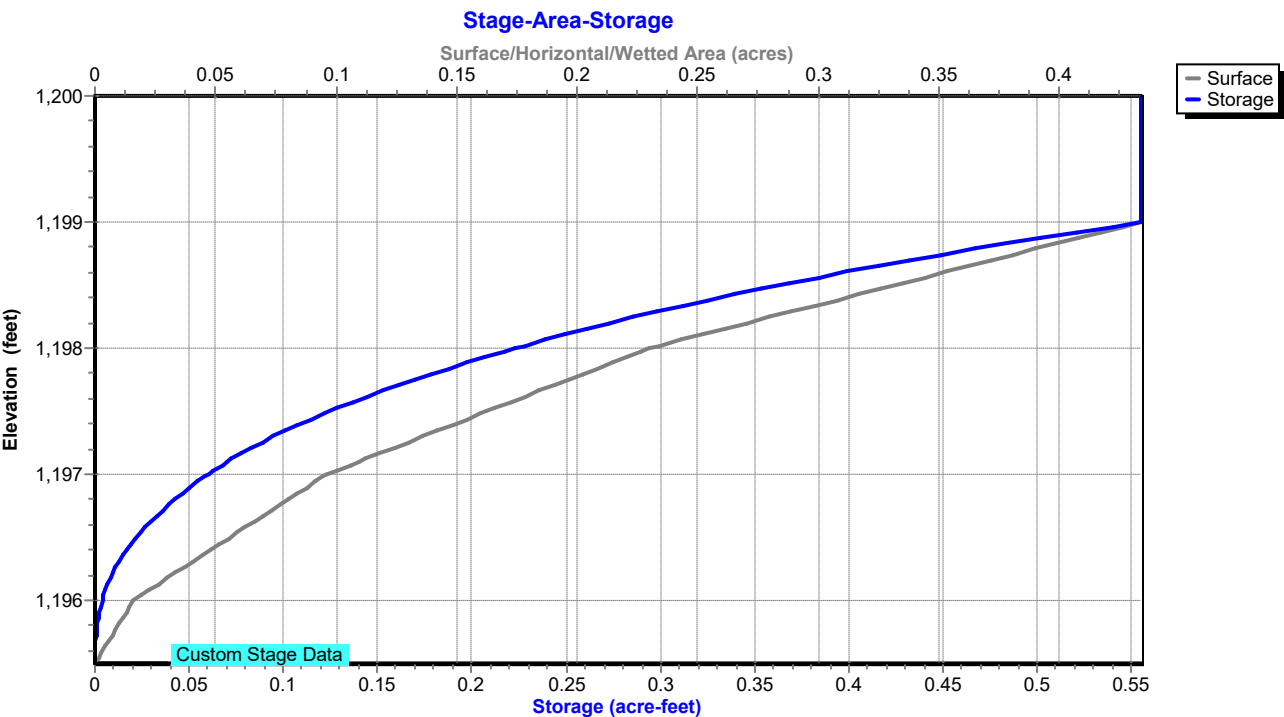
Pond 11P: Culvert Storage



Pond 11P: Culvert Storage



Pond 11P: Culvert Storage



D Petersburg HydroCAD

Prepared by Bolton & Menk, Inc

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MSE 24-hr 3 25 yr Rainfall=5.80"

Printed 4/10/2026

Page 60

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Wetland Watershed Runoff Area=11.800 ac 46.61% Impervious Runoff Depth=4.76"
Flow Length=125' Tc=11.9 min CN=91 Runoff=75.89 cfs 4.682 af

Subcatchment 3S: Eastern Watershed Runoff Area=13.000 ac 0.00% Impervious Runoff Depth=3.91"
Flow Length=1,370' Tc=21.5 min CN=83 Runoff=54.31 cfs 4.232 af

Subcatchment 6S: Northwest Offsite Runoff Area=31.480 ac 0.00% Impervious Runoff Depth=4.11"
Flow Length=1,540' Tc=26.3 min CN=85 Runoff=123.83 cfs 10.793 af

Subcatchment 7S: Southwest Direct Runoff Area=3.530 ac 47.03% Impervious Runoff Depth=4.87"
Tc=5.0 min CN=92 Runoff=30.21 cfs 1.433 af

Subcatchment 10S: Northwest Direct Runoff Area=3.850 ac 52.21% Impervious Runoff Depth=4.99"
Tc=5.0 min CN=93 Runoff=33.33 cfs 1.599 af

Subcatchment 12S: Culvert Area Runoff Area=1.200 ac 0.00% Impervious Runoff Depth=3.60"
Tc=5.0 min CN=80 Runoff=8.26 cfs 0.360 af

Reach 5R: Out Channel Avg. Flow Depth=0.72' Max Vel=2.48 fps Inflow=20.16 cfs 1.580 af
n=0.025 L=80.0' S=0.0050 '/' Capacity=6,533.92 cfs Outflow=20.16 cfs 1.580 af

Pond 2P: East Pool Peak Elev=1,197.19' Storage=8.540 af Inflow=79.74 cfs 7.334 af
Primary=7.17 cfs 6.381 af Secondary=2.82 cfs 0.717 af Outflow=9.99 cfs 7.098 af

Pond 4P: Culvert Storage Peak Elev=1,200.12' Storage=1.626 af Inflow=54.31 cfs 4.232 af
Primary=5.77 cfs 2.652 af Secondary=20.16 cfs 1.580 af Outflow=25.93 cfs 4.231 af

Pond 5P: Northwest Wetland Peak Elev=1,197.85' Storage=3.827 af Inflow=117.99 cfs 8.391 af
Primary=60.74 cfs 8.139 af Secondary=7.46 cfs 0.251 af Outflow=68.20 cfs 8.390 af

Pond 8P: Southwest Pool Peak Elev=1,198.36' Storage=2.227 af Inflow=30.21 cfs 1.433 af
Primary=8.29 cfs 1.432 af Secondary=0.00 cfs 0.000 af Outflow=8.29 cfs 1.432 af

Pond 9P: Northwest Pothole Peak Elev=1,200.53' Storage=0.798 af Inflow=123.83 cfs 10.793 af
Primary=121.94 cfs 10.433 af Secondary=0.02 cfs 0.000 af Outflow=121.96 cfs 10.433 af

Pond 11P: Culvert Storage Peak Elev=1,197.86' Storage=0.192 af Inflow=123.50 cfs 10.793 af
Primary=8.52 cfs 4.002 af Secondary=111.98 cfs 6.791 af Outflow=119.72 cfs 10.793 af

Total Runoff Area = 64.860 ac Runoff Volume = 23.100 af Average Runoff Depth = 4.27"
85.86% Pervious = 55.690 ac 14.14% Impervious = 9.170 ac

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MSE 24-hr 3 25 yr Rainfall=5.80"

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Page 61

Summary for Subcatchment 1S: Wetland Watershed

Runoff = 75.89 cfs @ 12.19 hrs, Volume= 4.682 af, Depth= 4.76"
Routed to Pond 2P : East Pool

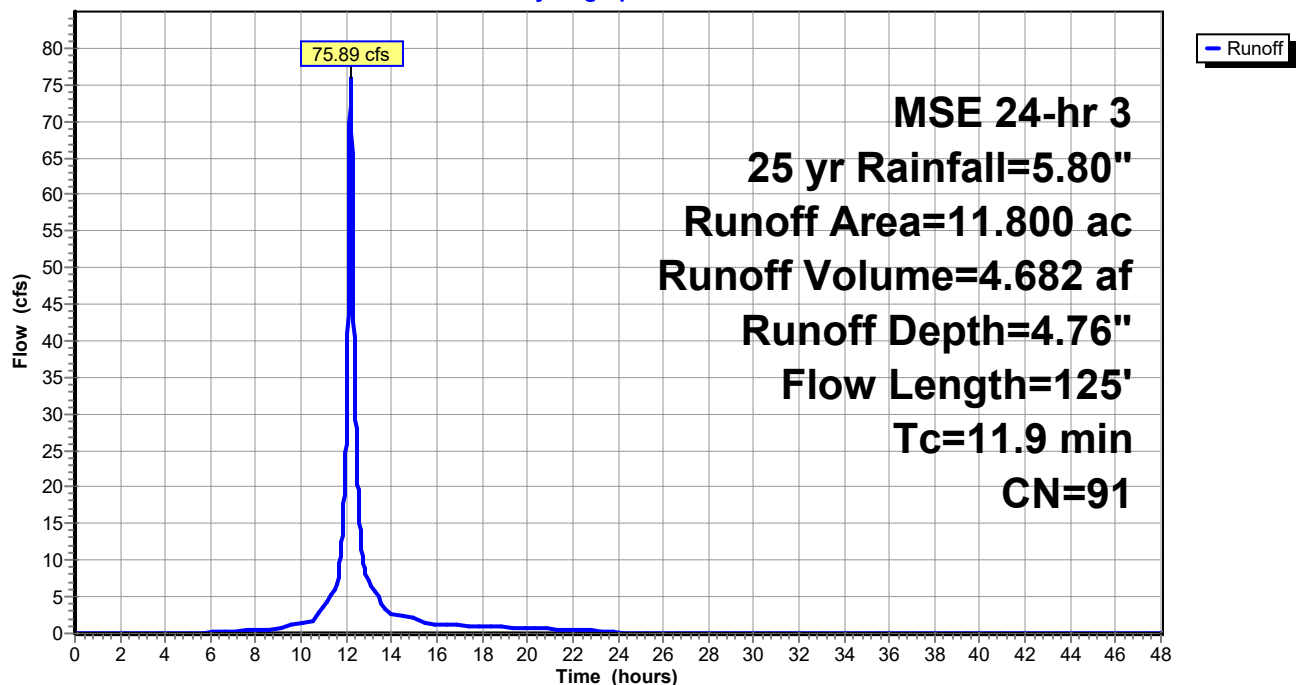
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 25 yr Rainfall=5.80"

Area (ac)	CN	Description
* 5.500	100	Pool
* 6.300	83	
11.800	91	Weighted Average
6.300		53.39% Pervious Area
5.500		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0350	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 3.10"
0.3	25	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
11.9	125	Total			

Subcatchment 1S: Wetland Watershed

Hydrograph



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MSE 24-hr 3 25 yr Rainfall=5.80"

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Page 62

Summary for Subcatchment 3S: Eastern Watershed

Runoff = 54.31 cfs @ 12.31 hrs, Volume= 4.232 af, Depth= 3.91"
Routed to Pond 4P : Culvert Storage

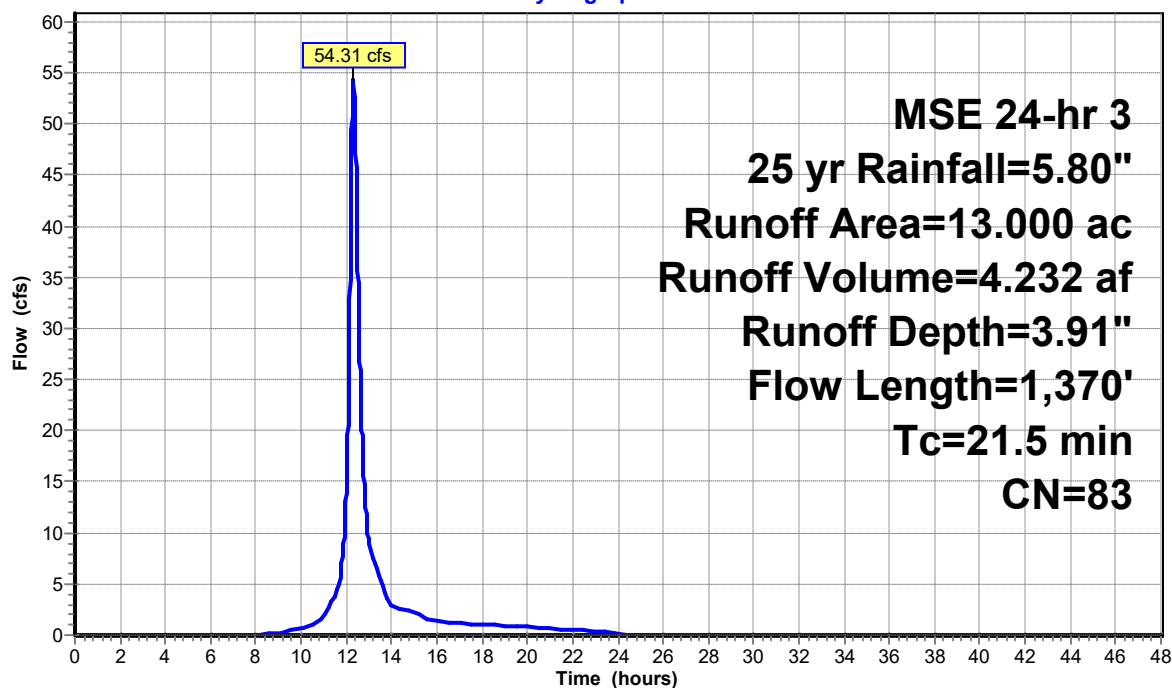
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 25 yr Rainfall=5.80"

Area (ac)	CN	Description
* 13.000	83	
13.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0800	0.26		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
15.2	1,270	0.0240	1.39		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
21.5	1,370	Total			

Subcatchment 3S: Eastern Watershed

Hydrograph



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MSE 24-hr 3 25 yr Rainfall=5.80"

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Page 63

Summary for Subcatchment 6S: Northwest Offsite Watershed

Runoff = 123.83 cfs @ 12.36 hrs, Volume= 10.793 af, Depth= 4.11"
Routed to Pond 9P : Northwest Pothole

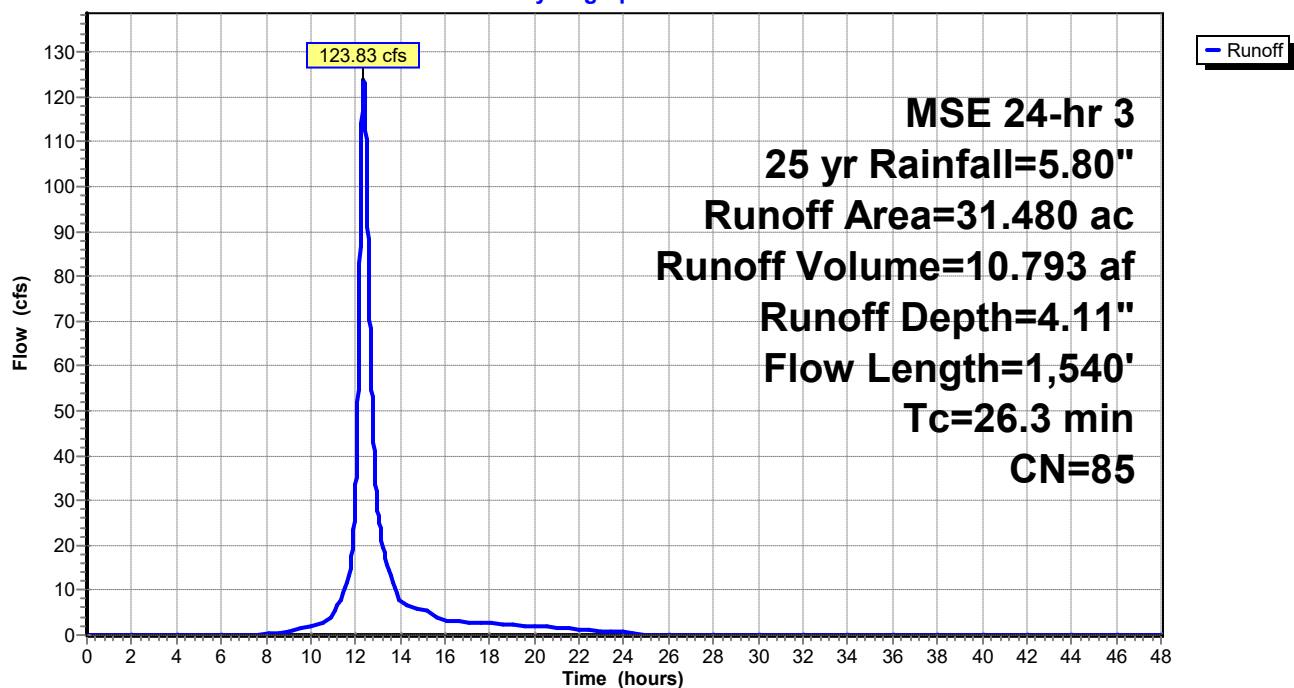
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 25 yr Rainfall=5.80"

Area (ac)	CN	Description
31.480	85	Row crops, straight row, Good, HSG C
31.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	100	0.0300	0.18		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
16.9	1,440	0.0250	1.42		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
26.3	1,540	Total			

Subcatchment 6S: Northwest Offsite Watershed

Hydrograph



Summary for Subcatchment 7S: Southwest Direct Watershed

Runoff = 30.21 cfs @ 12.12 hrs, Volume= 1.433 af, Depth= 4.87"
Routed to Pond 8P : Southwest Pool

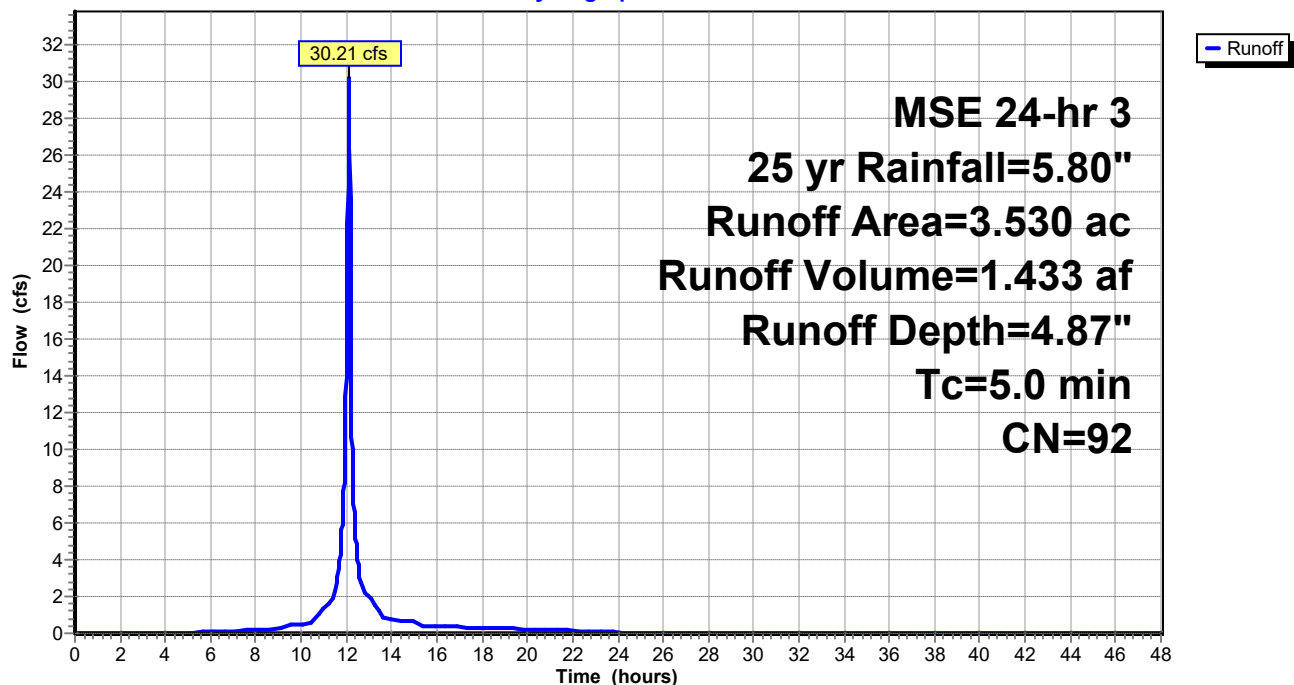
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 25 yr Rainfall=5.80"

	Area (ac)	CN	Description
*	1.660	100	
*	1.870	85	
	3.530	92	Weighted Average
	1.870		52.97% Pervious Area
	1.660		47.03% Impervious Area

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

Subcatchment 7S: Southwest Direct Watershed

Hydrograph



Summary for Subcatchment 10S: Northwest Direct Watershed

Runoff = 33.33 cfs @ 12.12 hrs, Volume= 1.599 af, Depth= 4.99"
Routed to Pond 5P : Northwest Wetland

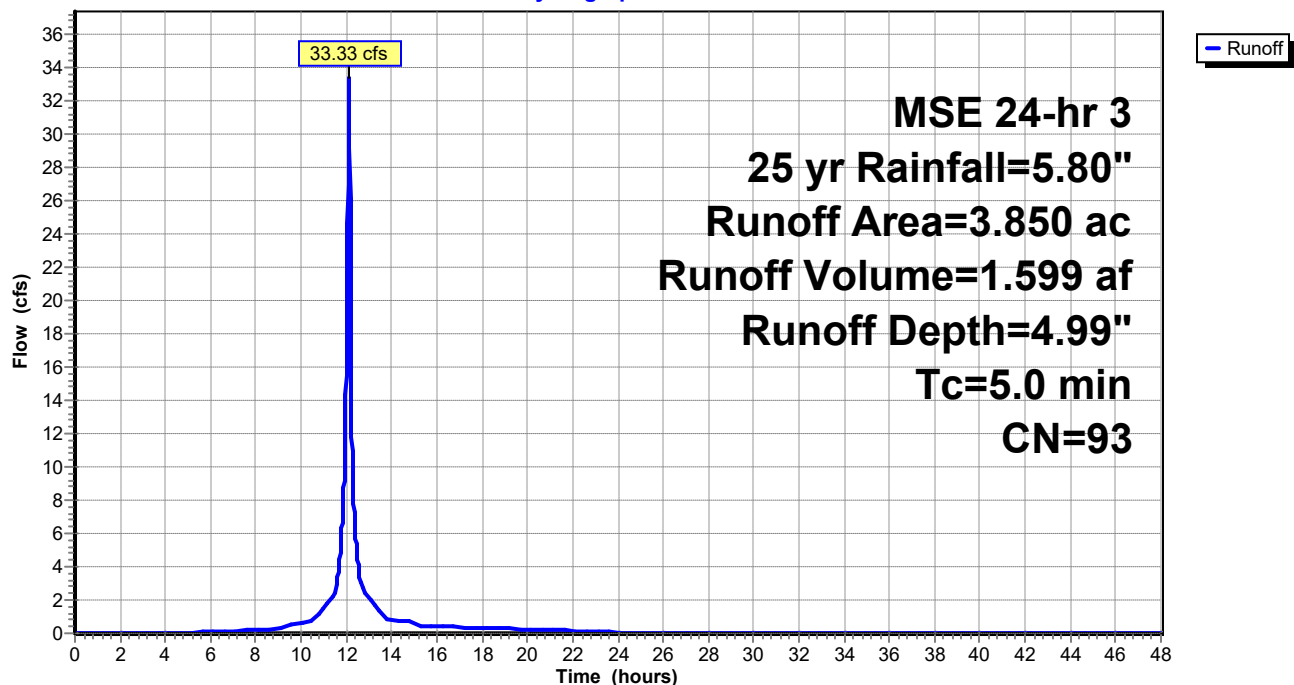
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 25 yr Rainfall=5.80"

Area (ac)	CN	Description
* 1.840	85	
* 2.010	100	
3.850	93	Weighted Average
1.840		47.79% Pervious Area
2.010		52.21% Impervious Area

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

Subcatchment 10S: Northwest Direct Watershed

Hydrograph



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MSE 24-hr 3 25 yr Rainfall=5.80"

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Page 66

Summary for Subcatchment 12S: Culvert Area

Runoff = 8.26 cfs @ 12.12 hrs, Volume= 0.360 af, Depth= 3.60"
Routed to Pond 11P : Culvert Storage

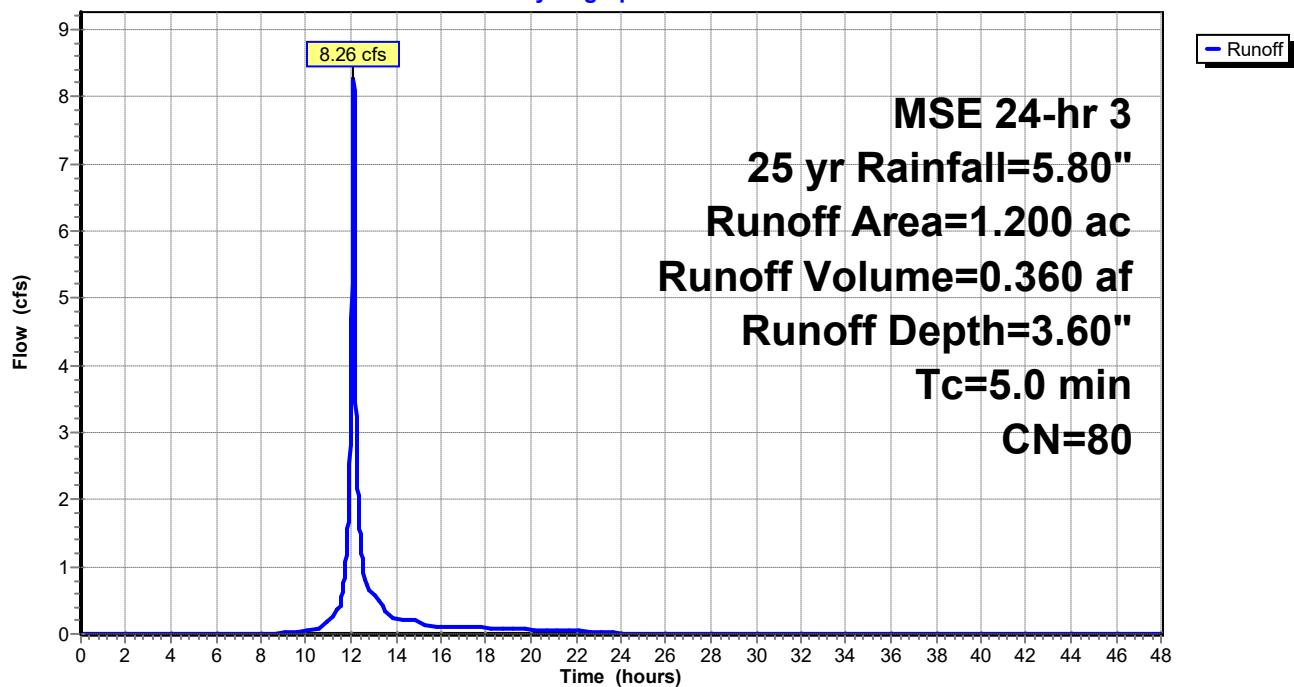
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 25 yr Rainfall=5.80"

Area (ac)	CN	Description
* 1.200	80	
1.200		100.00% Pervious Area

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

Subcatchment 12S: Culvert Area

Hydrograph



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MSE 24-hr 3 25 yr Rainfall=5.80"

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Page 67

Summary for Reach 5R: Out Channel

Inflow = 20.16 cfs @ 12.60 hrs, Volume= 1.580 af
Outflow = 20.16 cfs @ 12.61 hrs, Volume= 1.580 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Max. Velocity= 2.48 fps, Min. Travel Time= 0.5 min

Avg. Velocity= 1.24 fps, Avg. Travel Time= 1.1 min

Peak Storage= 651 cf @ 12.61 hrs

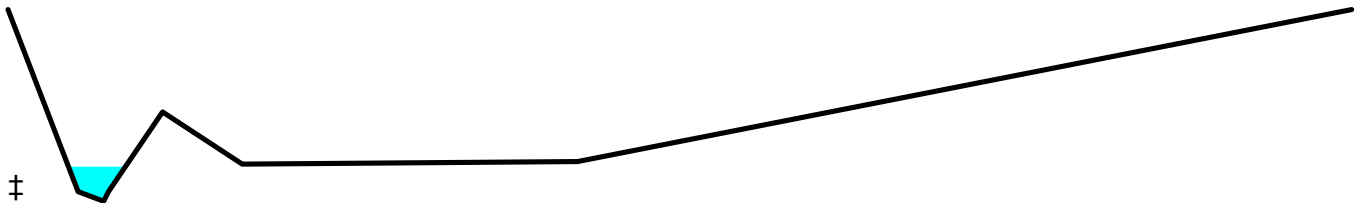
Average Depth at Peak Storage= 0.72' , Surface Width= 17.87'

Bank-Full Depth= 4.02' Flow Area= 922.7 sf, Capacity= 6,533.92 cfs

Custom cross-section, Length= 80.0' Slope= 0.0050 '/' (103 Elevation Intervals)

Constant n= 0.025 Earth, grassed & winding

Inlet Invert= 1,199.40', Outlet Invert= 1,199.00'

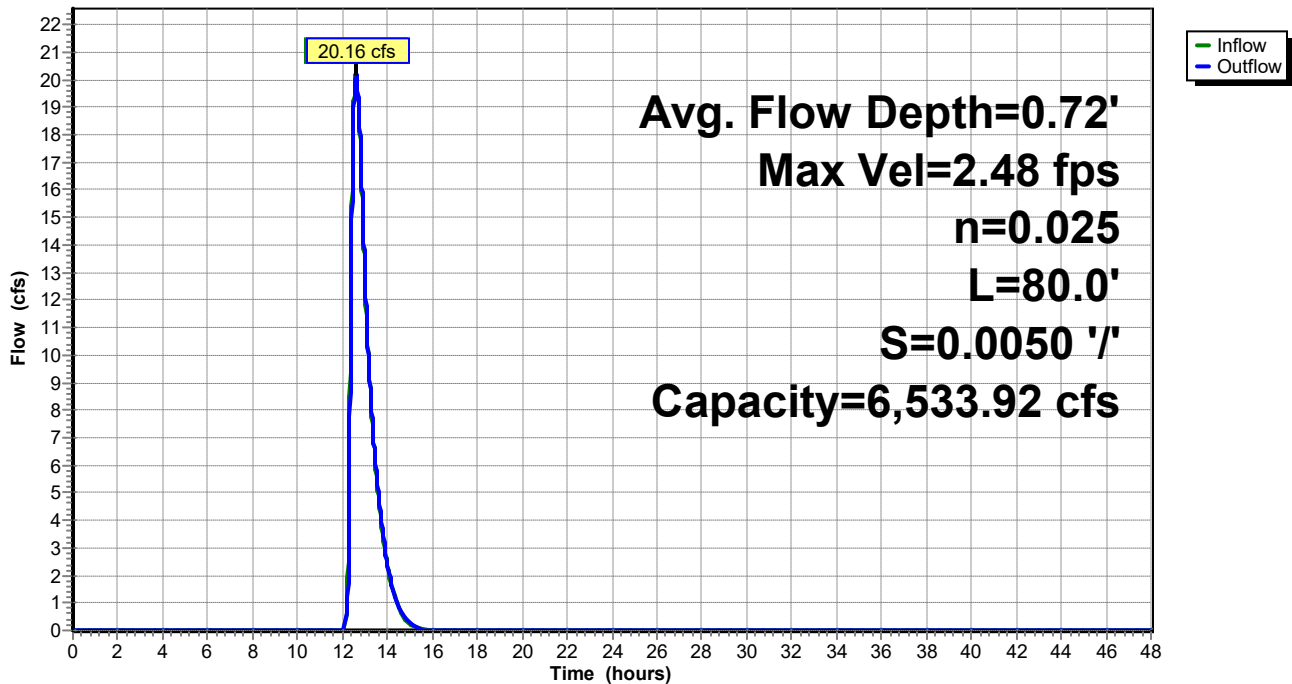


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,203.42	0.00
22.00	1,199.60	3.82
30.00	1,199.40	4.02
31.50	1,199.60	3.82
48.50	1,201.27	2.15
73.50	1,200.18	3.24
178.65	1,200.23	3.19
421.44	1,203.42	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.20	0.9	9.5	9.5	76	0.86
0.78	9.1	18.8	18.7	731	23.72
0.83	12.8	125.9	125.8	1,020	11.65
1.87	205.8	245.7	245.4	16,465	768.68
4.02	922.7	421.9	421.4	73,815	6,533.92

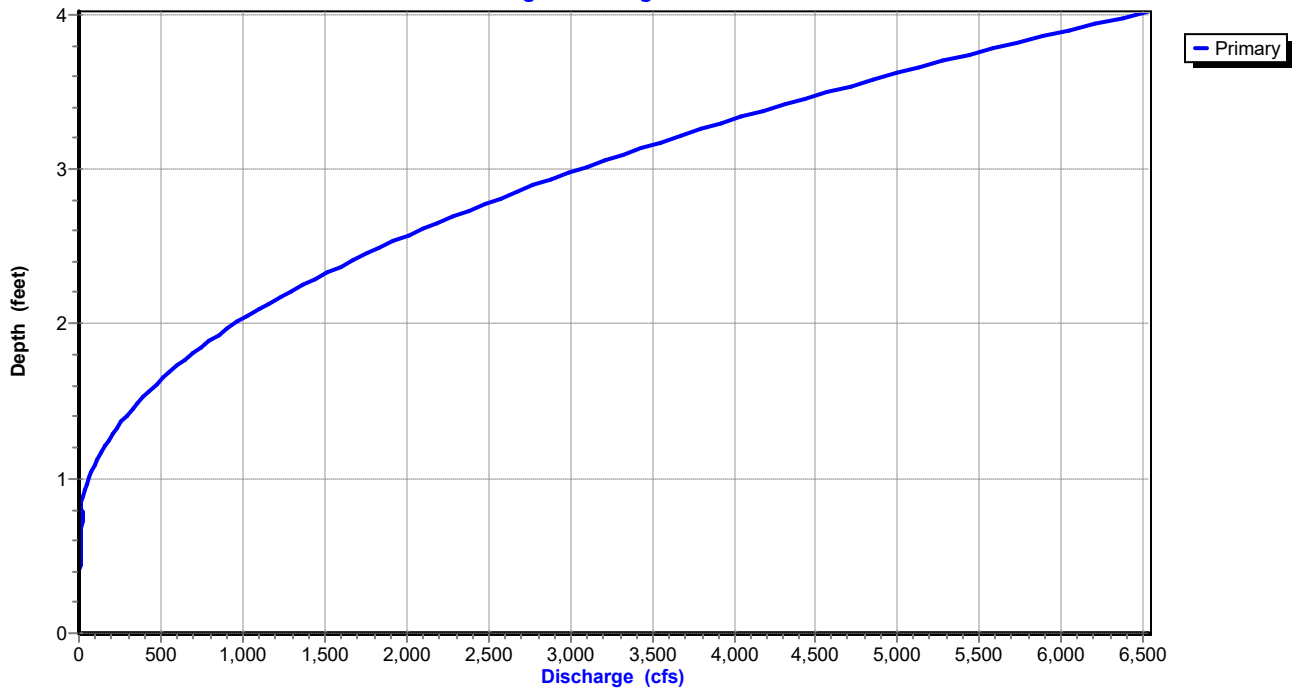
Reach 5R: Out Channel

Hydrograph

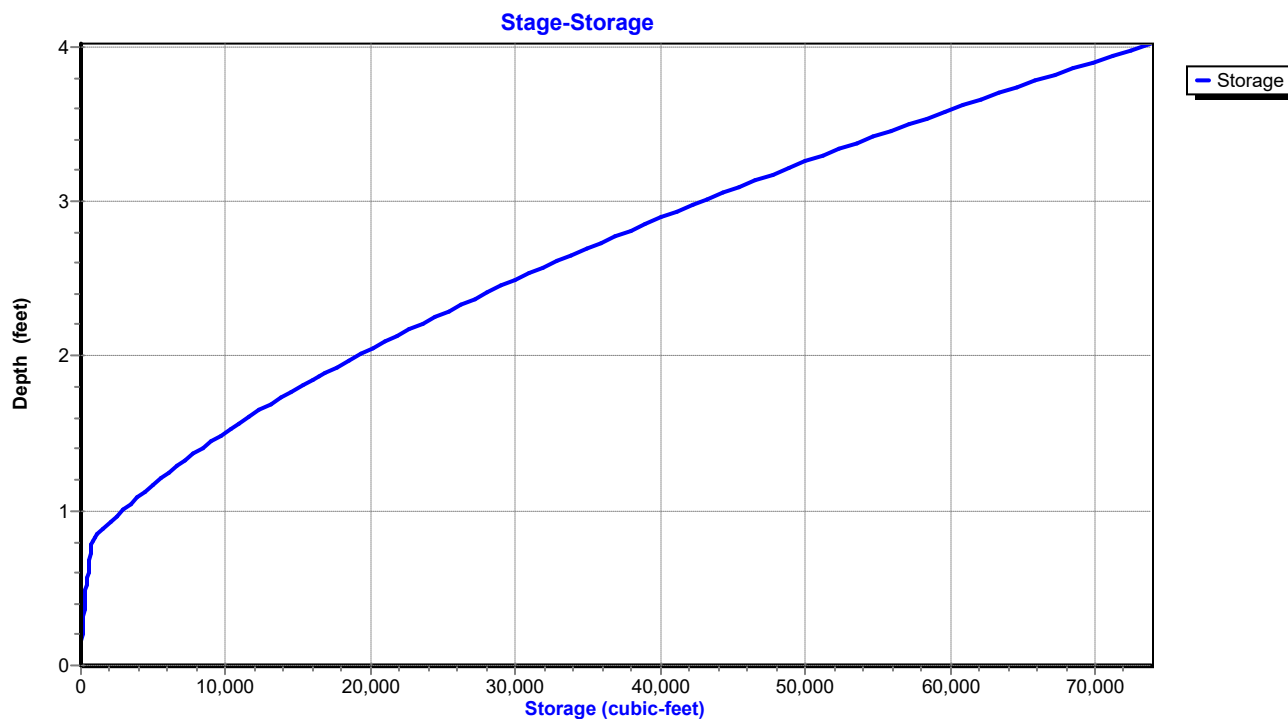


Reach 5R: Out Channel

Stage-Discharge



Reach 5R: Out Channel



Summary for Pond 2P: East Pool

Inflow Area = 24.800 ac, 22.18% Impervious, Inflow Depth = 3.55" for 25 yr event
 Inflow = 79.74 cfs @ 12.19 hrs, Volume= 7.334 af
 Outflow = 9.99 cfs @ 13.37 hrs, Volume= 7.098 af, Atten= 87%, Lag= 70.4 min
 Primary = 7.17 cfs @ 13.37 hrs, Volume= 6.381 af
 Secondary = 2.82 cfs @ 13.37 hrs, Volume= 0.717 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Starting Elev= 1,196.50' Surf.Area= 4.500 ac Storage= 5.075 af
 Peak Elev= 1,197.19' @ 13.37 hrs Surf.Area= 5.634 ac Storage= 8.540 af (3.465 af above start)

Plug-Flow detention time= 1,029.9 min calculated for 2.023 af (28% of inflow)
 Center-of-Mass det. time= 333.8 min (1,175.2 - 841.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,194.50'	17.400 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,194.50	0.400	0.000	0.000
1,195.00	1.400	0.450	0.450
1,195.50	2.600	1.000	1.450
1,196.00	3.700	1.575	3.025
1,196.50	4.500	2.050	5.075
1,197.00	5.300	2.450	7.525
1,197.50	6.200	2.875	10.400
1,198.00	7.000	3.300	13.700
1,198.50	7.800	3.700	17.400

Device	Routing	Invert	Outlet Devices
#1	Primary	1,190.00'	18.0" Round Culvert L= 80.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,190.00' / 1,188.39' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	1,196.50'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Secondary	1,197.00'	12.0' long + 4.0 ' /' SideZ x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=7.17 cfs @ 13.37 hrs HW=1,197.19' (Free Discharge)

↑ **1=Culvert** (Passes 7.17 cfs of 21.59 cfs potential flow)

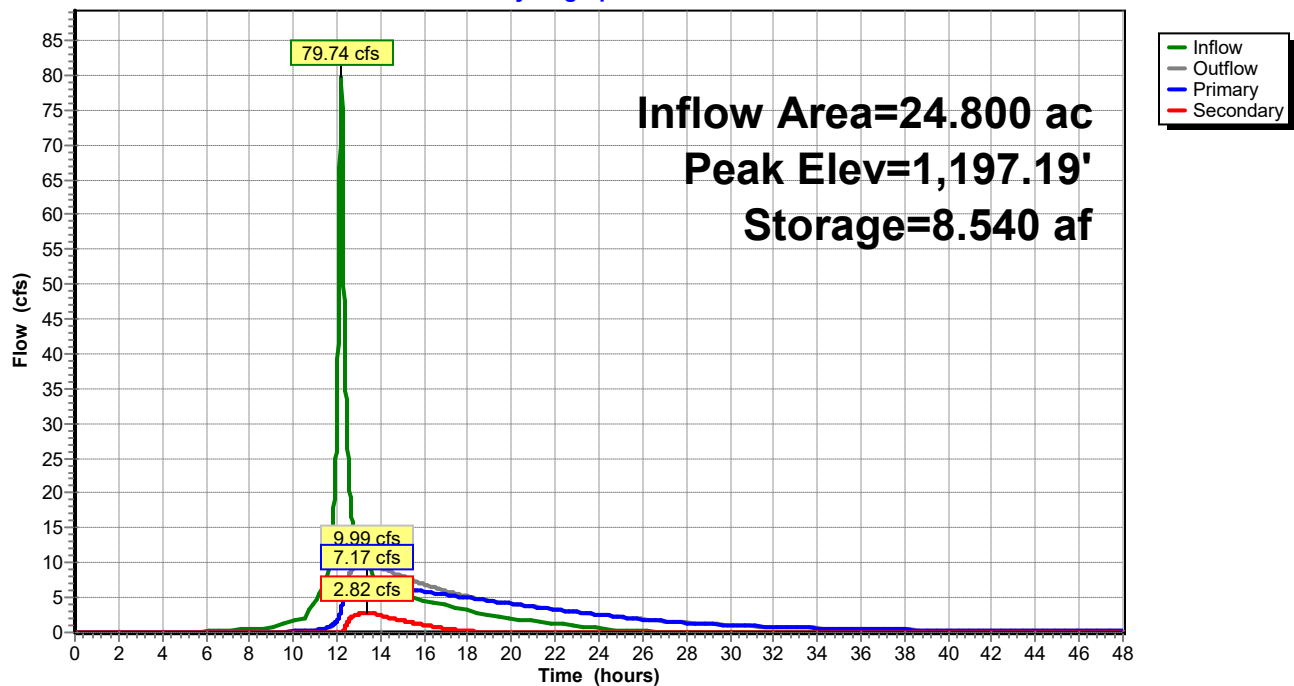
↑ **2=Sharp-Crested Rectangular Weir** (Weir Controls 7.17 cfs @ 2.71 fps)

Secondary OutFlow Max=2.82 cfs @ 13.37 hrs HW=1,197.19' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 2.82 cfs @ 1.19 fps)

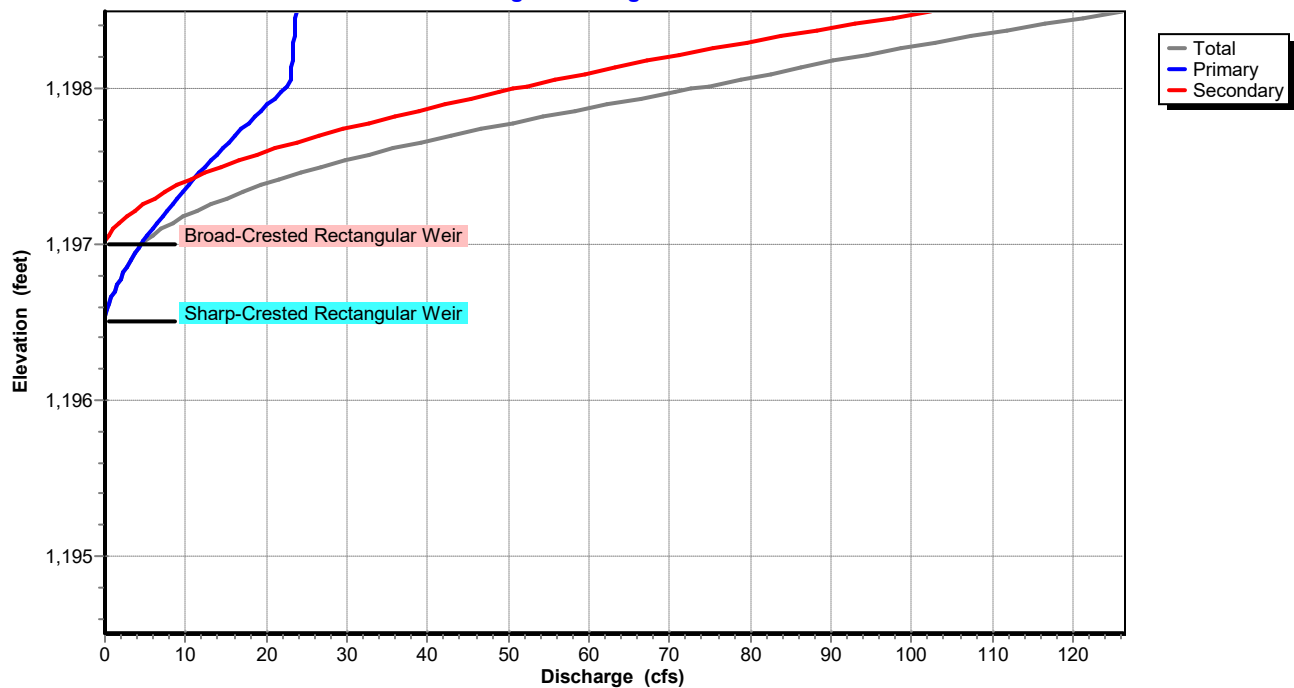
Pond 2P: East Pool

Hydrograph

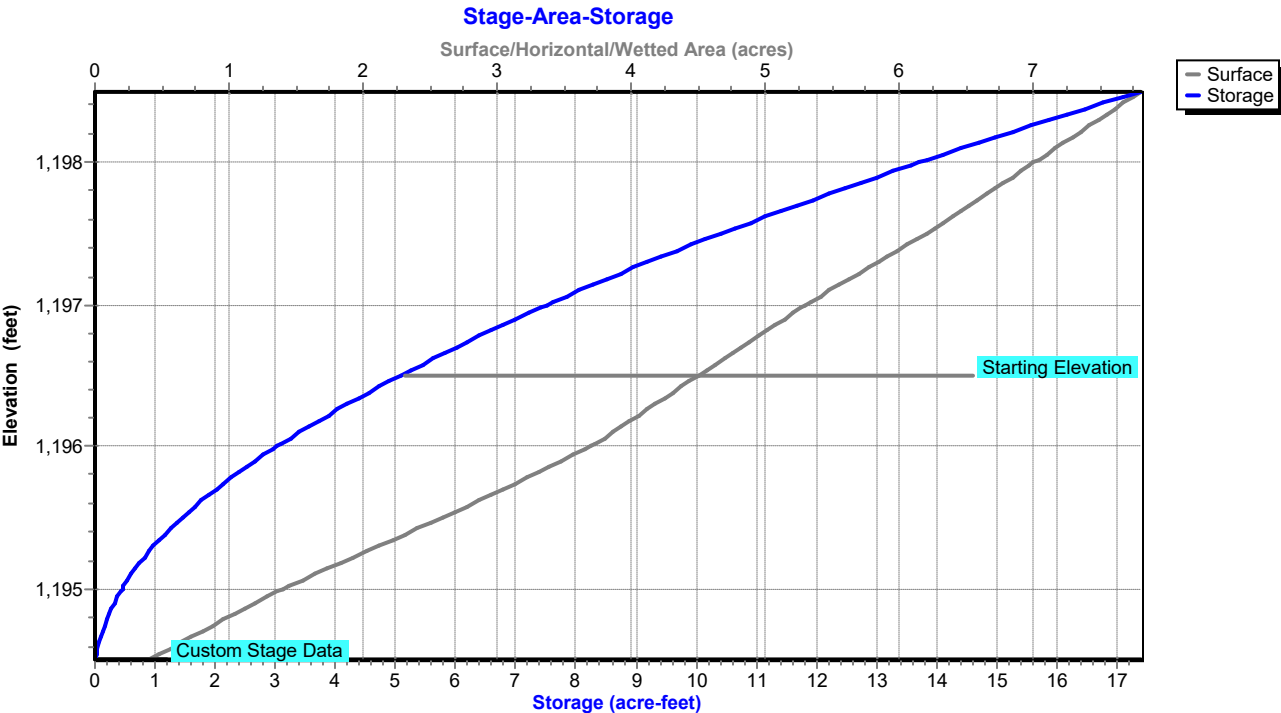


Pond 2P: East Pool

Stage-Discharge



Pond 2P: East Pool



Summary for Pond 4P: Culvert Storage

Inflow Area = 13.000 ac, 0.00% Impervious, Inflow Depth = 3.91" for 25 yr event
 Inflow = 54.31 cfs @ 12.31 hrs, Volume= 4.232 af
 Outflow = 25.93 cfs @ 12.60 hrs, Volume= 4.231 af, Atten= 52%, Lag= 17.7 min
 Primary = 5.77 cfs @ 12.60 hrs, Volume= 2.652 af
 Routed to Pond 2P : East Pool
 Secondary = 20.16 cfs @ 12.60 hrs, Volume= 1.580 af
 Routed to Reach 5R : Out Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,200.12' @ 12.60 hrs Surf.Area= 2.007 ac Storage= 1.626 af

Plug-Flow detention time= 85.6 min calculated for 4.231 af (100% of inflow)
 Center-of-Mass det. time= 85.7 min (889.7 - 803.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	15.511 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,198.00	0.002	0.000	0.000
1,199.00	0.560	0.281	0.281
1,200.00	1.670	1.115	1.396
1,201.00	4.370	3.020	4.416
1,202.00	5.580	4.975	9.391
1,203.00	6.660	6.120	15.511

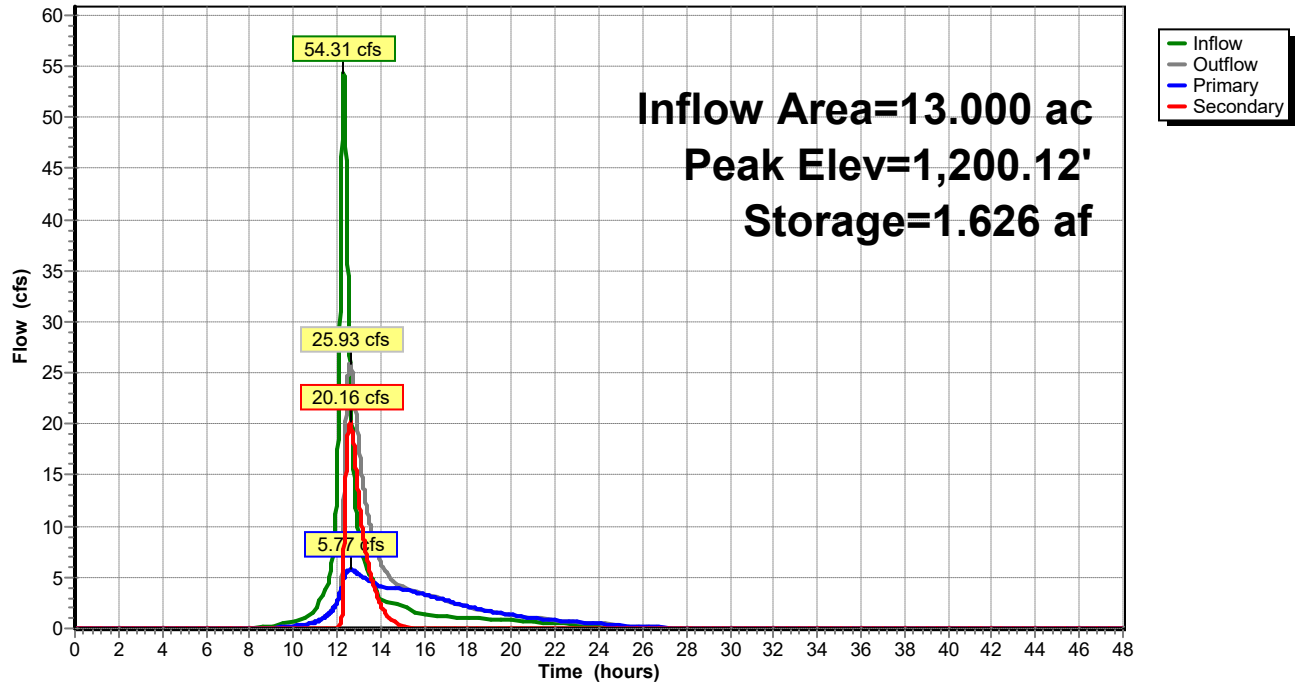
Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	15.0" Round Culvert L= 45.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,198.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Secondary	1,199.40'	Channel/Reach using Reach 5R: Out Channel

Primary OutFlow Max=5.77 cfs @ 12.60 hrs HW=1,200.12' TW=1,197.15' (Dynamic Tailwater)
 ↑ **1=Culvert** (Barrel Controls 5.77 cfs @ 4.70 fps)

Secondary OutFlow Max=20.16 cfs @ 12.60 hrs HW=1,200.12' TW=1,200.12' (Dynamic Tailwater)
 ↑ **2=Channel/Reach** (Channel Controls 20.16 cfs @ 2.48 fps)

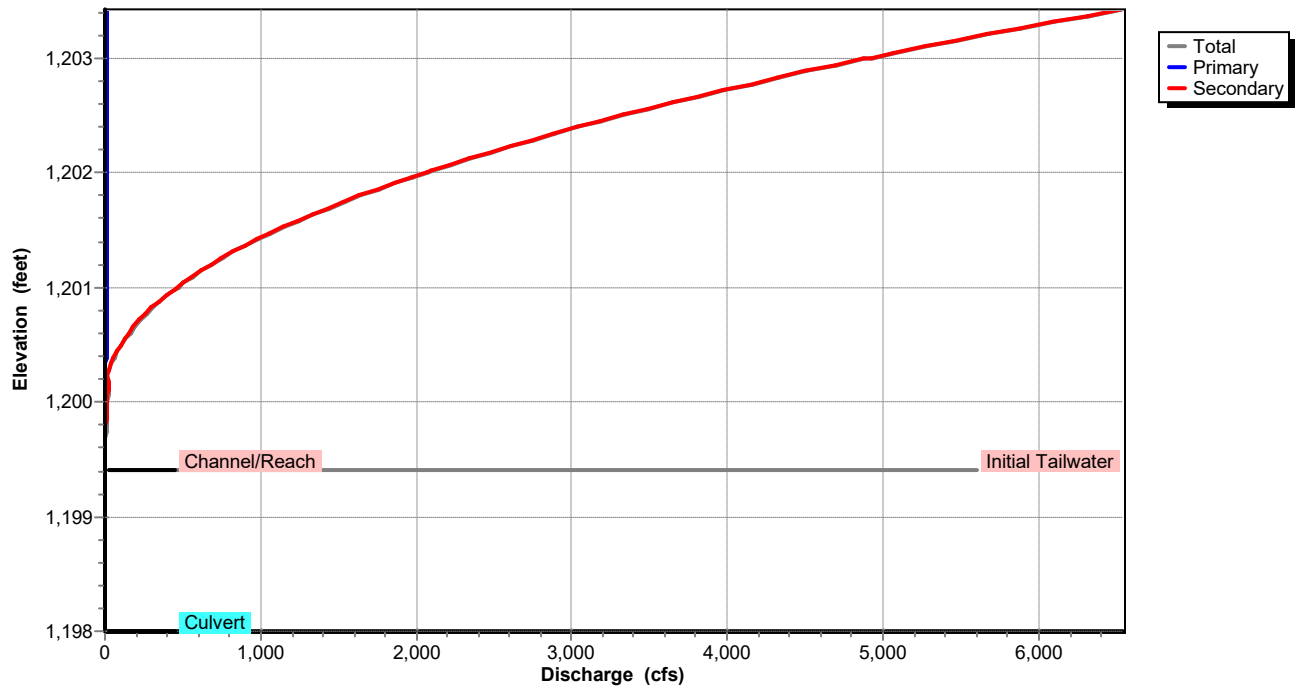
Pond 4P: Culvert Storage

Hydrograph

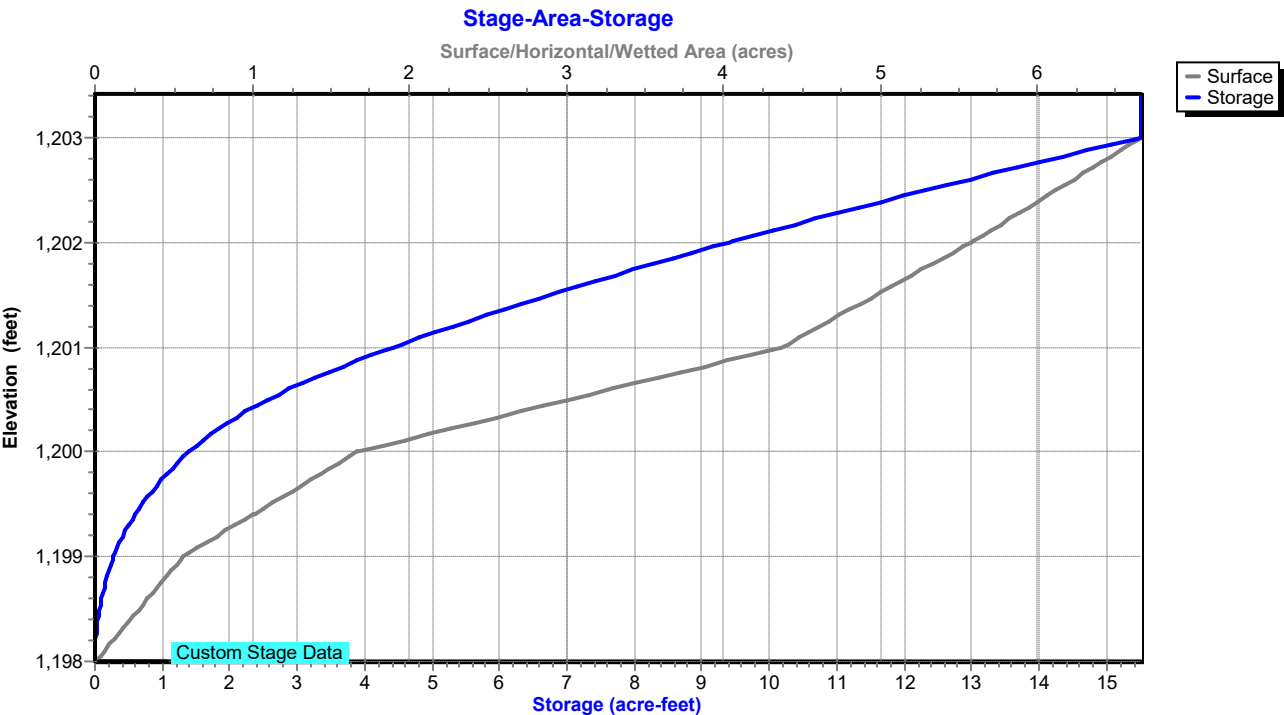


Pond 4P: Culvert Storage

Stage-Discharge



Pond 4P: Culvert Storage



Summary for Pond 5P: Northwest Wetland

Inflow Area = 3.850 ac, 52.21% Impervious, Inflow Depth = 26.15" for 25 yr event
 Inflow = 117.99 cfs @ 12.38 hrs, Volume= 8.391 af
 Outflow = 68.20 cfs @ 12.66 hrs, Volume= 8.390 af, Atten= 42%, Lag= 16.7 min
 Primary = 60.74 cfs @ 12.66 hrs, Volume= 8.139 af
 Secondary = 7.46 cfs @ 12.66 hrs, Volume= 0.251 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,196.50' Surf.Area= 1.900 ac Storage= 0.925 af

Peak Elev= 1,197.85' @ 12.66 hrs Surf.Area= 2.513 ac Storage= 3.827 af (2.902 af above start)

Plug-Flow detention time= 60.0 min calculated for 7.463 af (89% of inflow)

Center-of-Mass det. time= 35.4 min (791.2 - 755.7)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,196.00'	7.050 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,196.00	1.800	0.000	0.000
1,197.00	2.000	1.900	1.900
1,198.00	2.600	2.300	4.200
1,199.00	3.100	2.850	7.050

Device	Routing	Invert	Outlet Devices
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#1	Primary	1,190.00'	30.0" Round Culvert
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L= 111.0' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 1,190.00' / 1,187.78' S= 0.0200 ' / ' Cc= 0.900

n= 0.013, Flow Area= 4.91 sf

#2	Secondary	1,197.50'	12.0' long + 4.0 ' / ' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
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Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

#3	Device 1	1,196.50'	5.0' long Sharp-Crested Rectangular Weir X 4.00
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2 End Contraction(s)

Primary OutFlow Max=60.74 cfs @ 12.66 hrs HW=1,197.85' (Free Discharge)

↑ **1=Culvert** (Inlet Controls 60.74 cfs @ 12.37 fps)

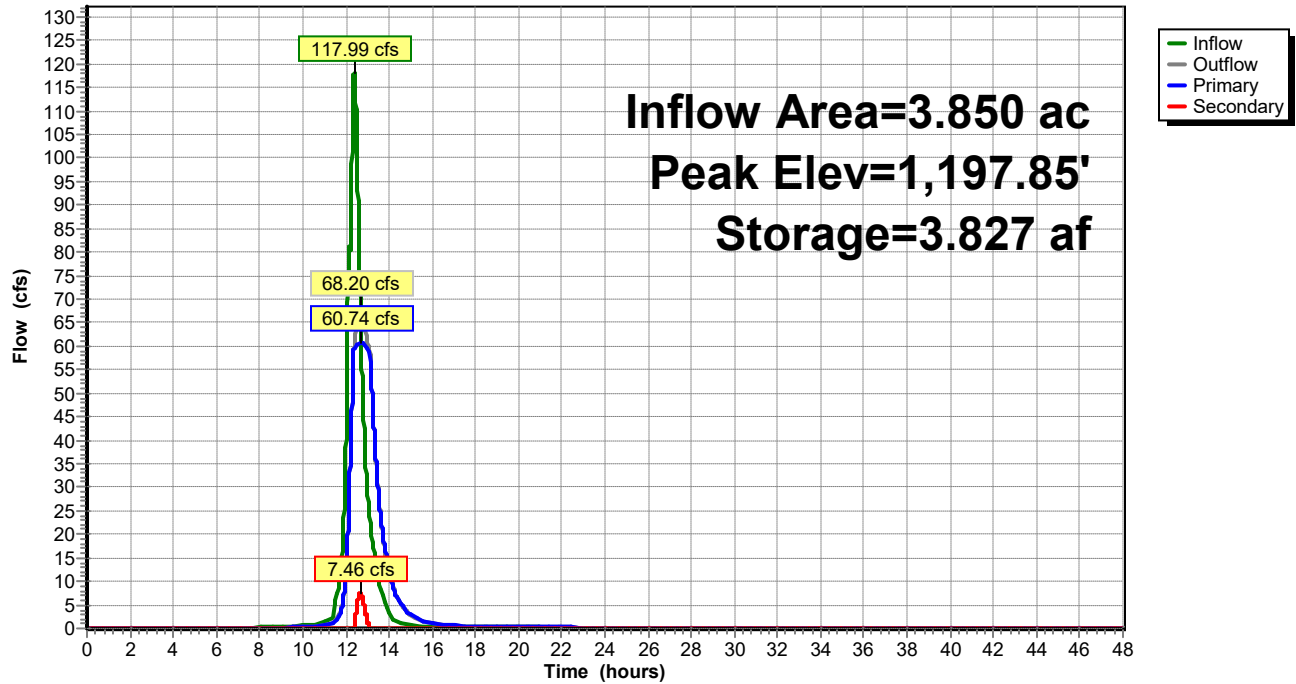
↑ **3=Sharp-Crested Rectangular Weir** (Passes 60.74 cfs of 97.48 cfs potential flow)

Secondary OutFlow Max=7.46 cfs @ 12.66 hrs HW=1,197.85' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 7.46 cfs @ 1.57 fps)

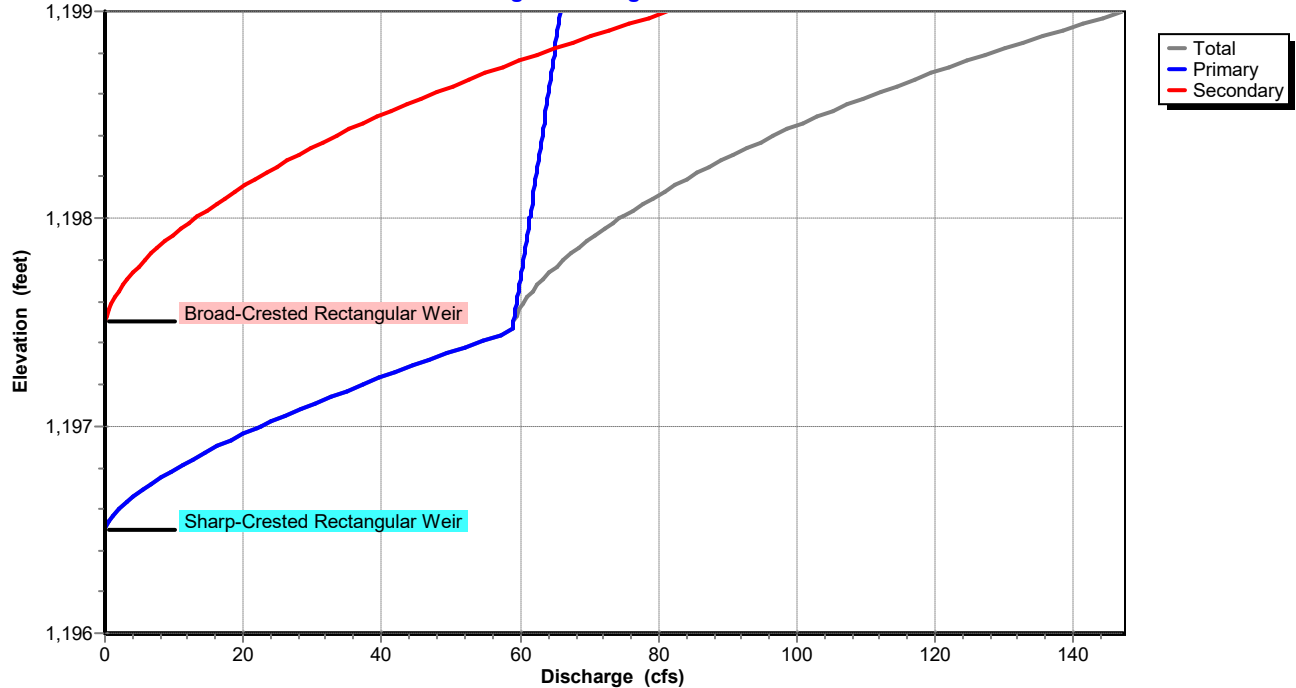
Pond 5P: Northwest Wetland

Hydrograph

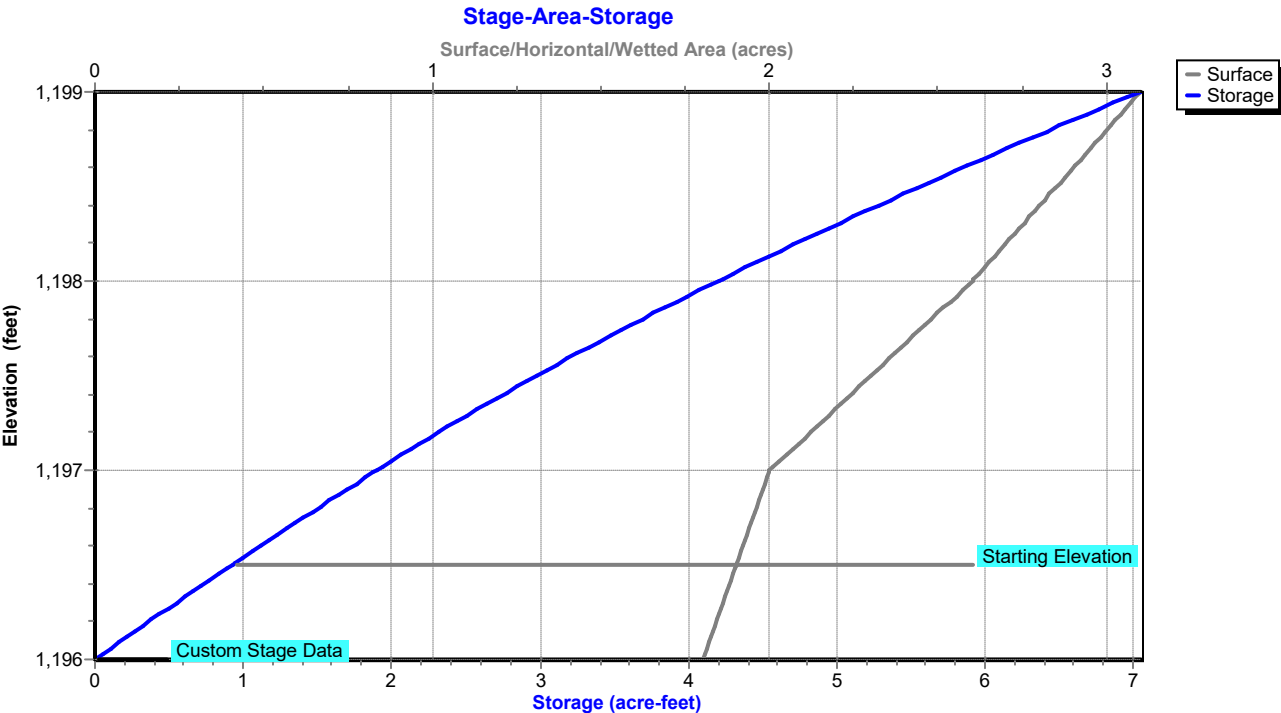


Pond 5P: Northwest Wetland

Stage-Discharge



Pond 5P: Northwest Wetland



Summary for Pond 8P: Southwest Pool

Inflow Area = 3.530 ac, 47.03% Impervious, Inflow Depth = 4.87" for 25 yr event
 Inflow = 30.21 cfs @ 12.12 hrs, Volume= 1.433 af
 Outflow = 8.29 cfs @ 12.28 hrs, Volume= 1.432 af, Atten= 73%, Lag= 9.5 min
 Primary = 8.29 cfs @ 12.28 hrs, Volume= 1.432 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,198.00' Surf.Area= 1.660 ac Storage= 1.615 af

Peak Elev= 1,198.36' @ 12.28 hrs Surf.Area= 1.746 ac Storage= 2.227 af (0.612 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 92.1 min (859.5 - 767.5)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,195.00'	5.585 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.00	0.010	0.000	0.000
1,196.00	0.220	0.115	0.115
1,197.00	0.560	0.390	0.505
1,198.00	1.660	1.110	1.615
1,199.00	1.900	1.780	3.395
1,200.00	2.480	2.190	5.585

Device	Routing	Invert	Outlet Devices
--------	---------	--------	----------------

#1	Primary	1,190.00'	12.0" Round Culvert
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L= 60.2' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 1,190.00' / 1,188.80' S= 0.0199 ' /' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

#2	Device 1	1,198.00'	48.0" W x 9.0" H Vert. Orifice/Grate X 3.00 C= 0.600
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Limited to weir flow at low heads

#3	Secondary	1,198.50'	20.0' long + 4.0 ' /' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
----	-----------	-----------	---

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.29 cfs @ 12.28 hrs HW=1,198.36' (Free Discharge)

↑ **1=Culvert** (Passes 8.29 cfs of 10.01 cfs potential flow)

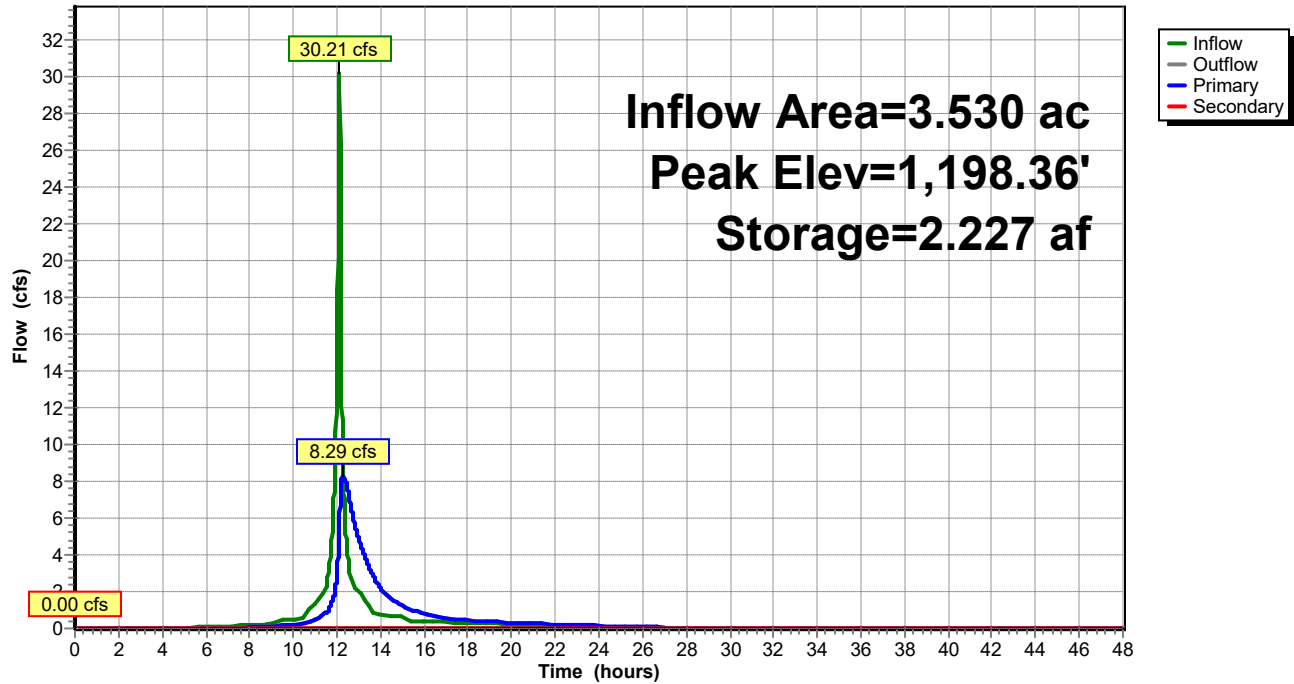
↑ **2=Orifice/Grate** (Orifice Controls 8.29 cfs @ 1.92 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,198.00' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

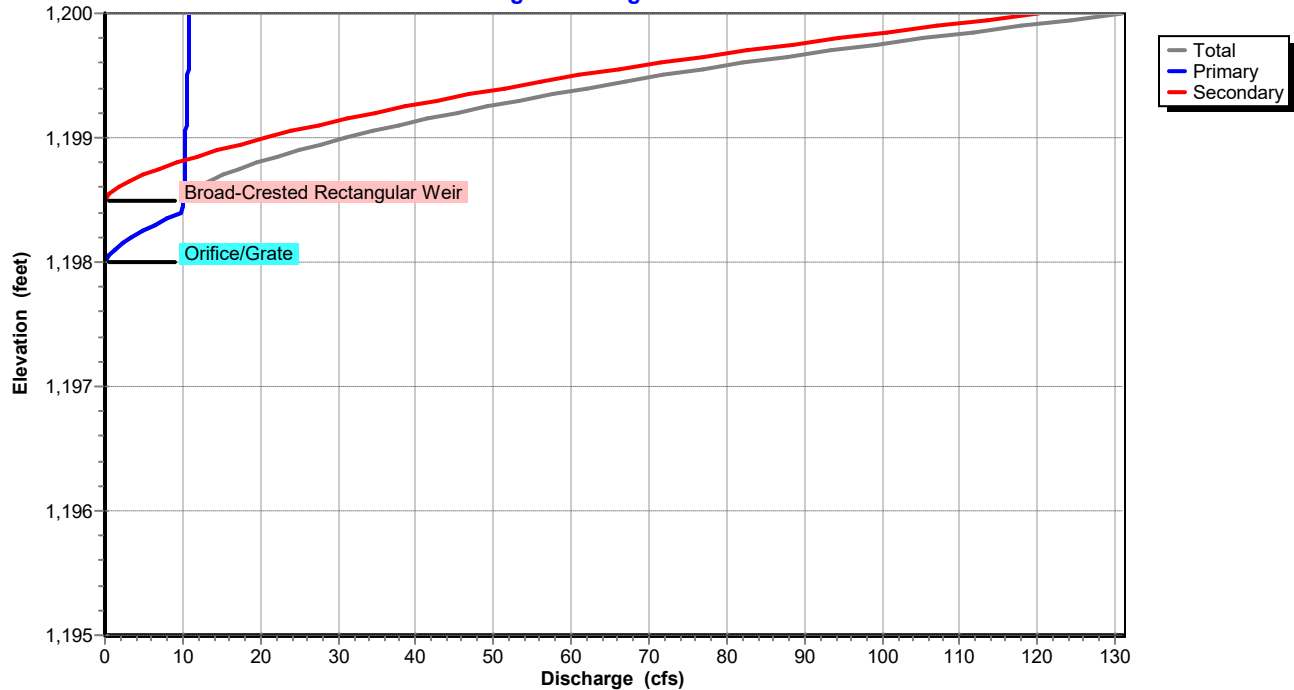
Pond 8P: Southwest Pool

Hydrograph

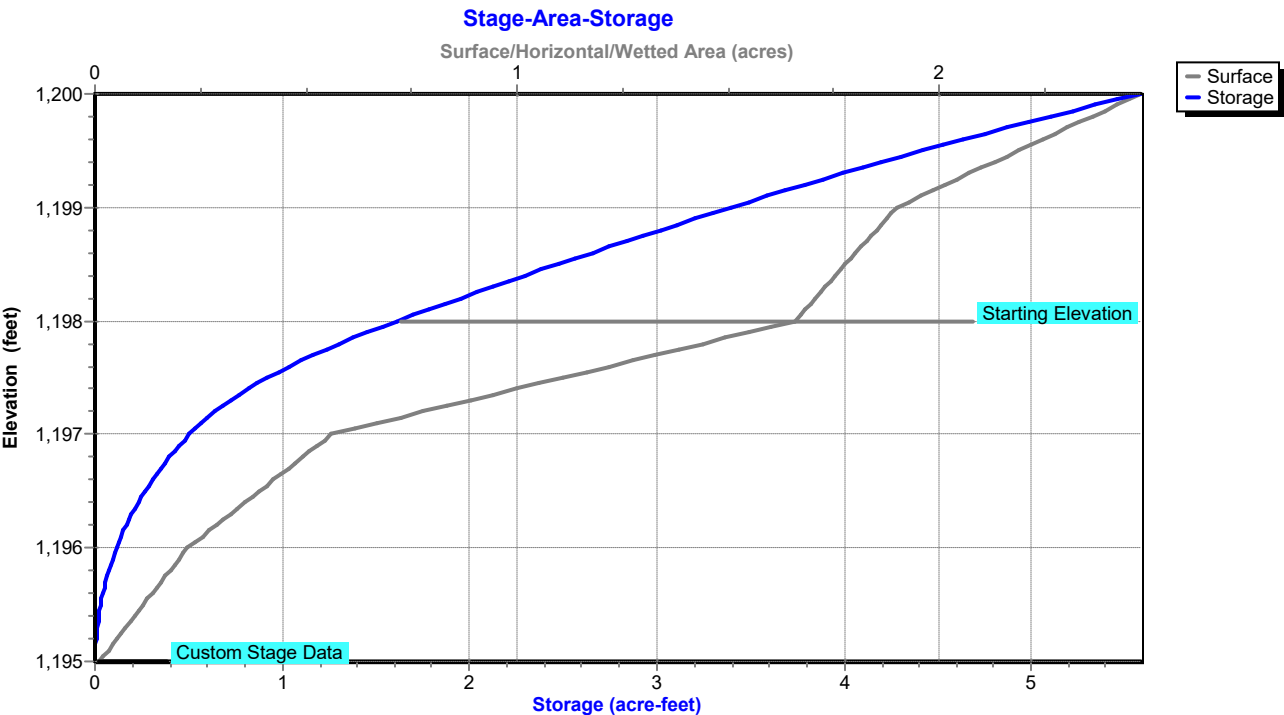


Pond 8P: Southwest Pool

Stage-Discharge



Pond 8P: Southwest Pool



Summary for Pond 9P: Northwest Pothole

Inflow Area = 31.480 ac, 0.00% Impervious, Inflow Depth = 4.11" for 25 yr event
 Inflow = 123.83 cfs @ 12.36 hrs, Volume= 10.793 af
 Outflow = 121.96 cfs @ 12.40 hrs, Volume= 10.433 af, Atten= 2%, Lag= 2.2 min
 Primary = 121.94 cfs @ 12.40 hrs, Volume= 10.433 af
 Routed to Pond 11P : Culvert Storage
 Secondary = 0.02 cfs @ 12.40 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,200.53' @ 12.40 hrs Surf.Area= 1.622 ac Storage= 0.798 af

Plug-Flow detention time= 29.7 min calculated for 10.433 af (97% of inflow)
 Center-of-Mass det. time= 11.7 min (816.1 - 804.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,199.50'	8.578 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,199.50	0.000	0.000	0.000
1,200.00	0.724	0.181	0.181
1,201.00	2.430	1.577	1.758
1,202.00	3.650	3.040	4.798
1,203.00	3.910	3.780	8.578

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,200.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.50 1.50 2.50 3.50 Width (feet) 0.00 65.00 230.00 300.00 350.00
#2	Primary	1,200.20'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.80 1.80 Width (feet) 168.00 363.00 650.00

Primary OutFlow Max=121.93 cfs @ 12.40 hrs HW=1,200.53' TW=1,197.59' (Dynamic Tailwater)

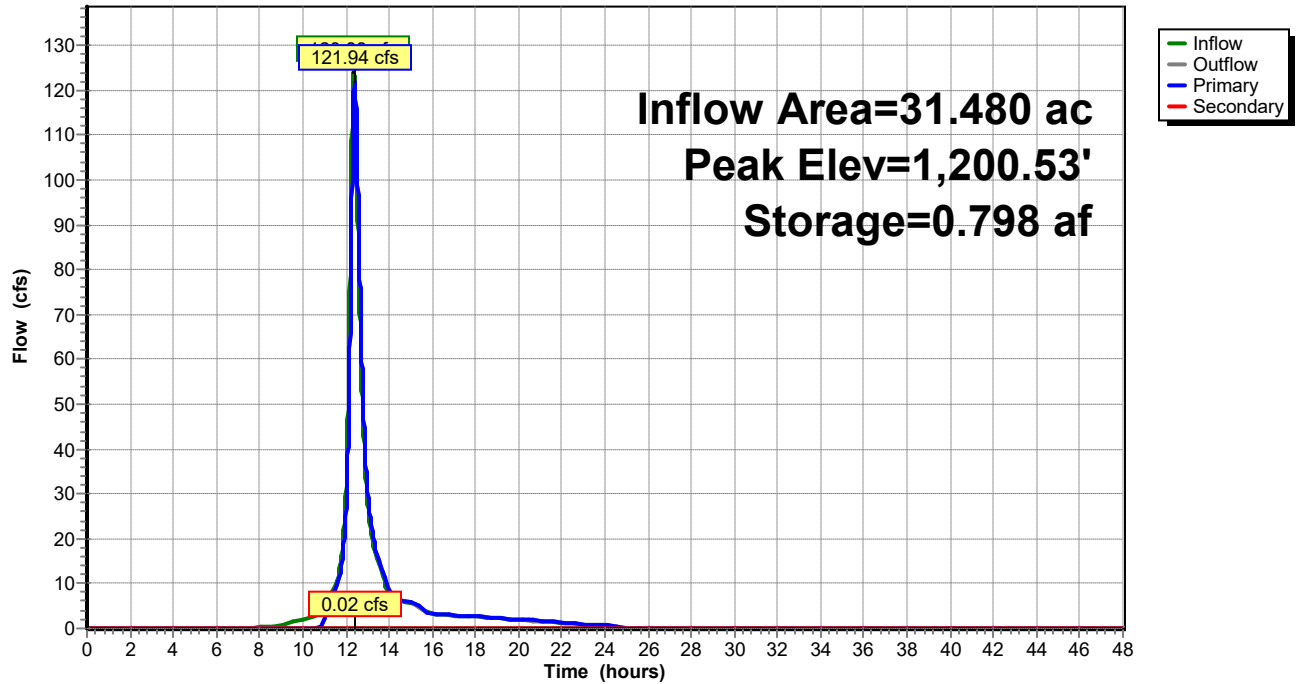
↑ **2=Custom Weir/Orifice** (Weir Controls 121.93 cfs @ 1.80 fps)

Secondary OutFlow Max=0.02 cfs @ 12.40 hrs HW=1,200.53' (Free Discharge)

↑ **1=Custom Weir/Orifice** (Weir Controls 0.02 cfs @ 0.42 fps)

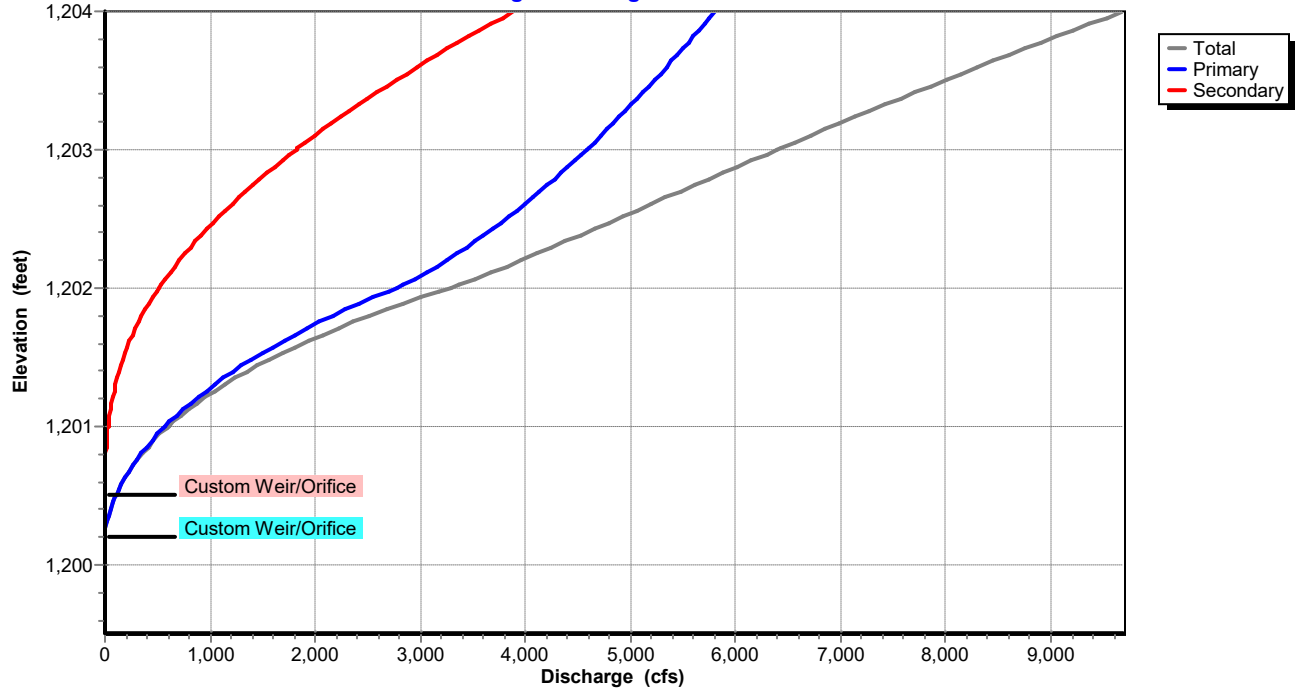
Pond 9P: Northwest Pothole

Hydrograph

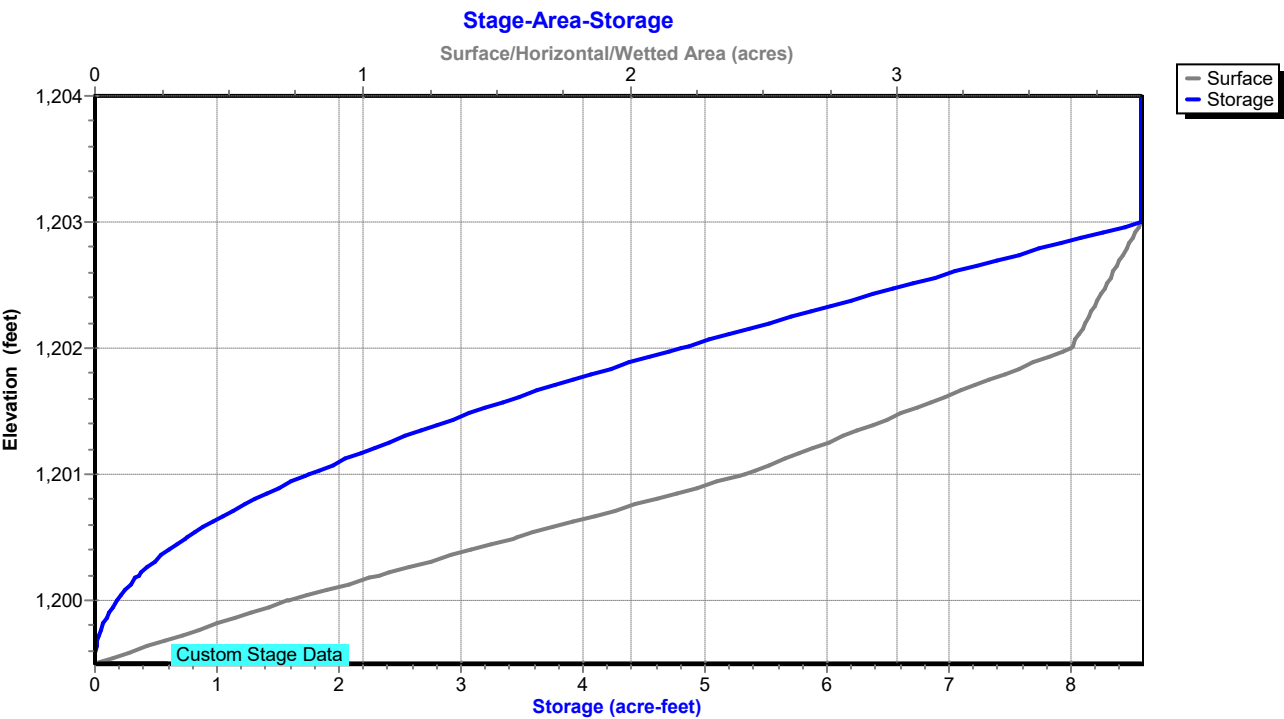


Pond 9P: Northwest Pothole

Stage-Discharge



Pond 9P: Northwest Pothole



Summary for Pond 11P: Culvert Storage

Inflow Area = 32.680 ac, 0.00% Impervious, Inflow Depth = 3.96" for 25 yr event
 Inflow = 123.50 cfs @ 12.40 hrs, Volume= 10.793 af
 Outflow = 119.72 cfs @ 12.40 hrs, Volume= 10.793 af, Atten= 3%, Lag= 0.0 min
 Primary = 8.52 cfs @ 12.67 hrs, Volume= 4.002 af
 Secondary = 111.98 cfs @ 12.39 hrs, Volume= 6.791 af
 Routed to Pond 5P : Northwest Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,197.86' @ 12.67 hrs Surf.Area= 0.211 ac Storage= 0.192 af

Plug-Flow detention time= 2.8 min calculated for 10.791 af (100% of inflow)
 Center-of-Mass det. time= 2.8 min (818.1 - 815.3)

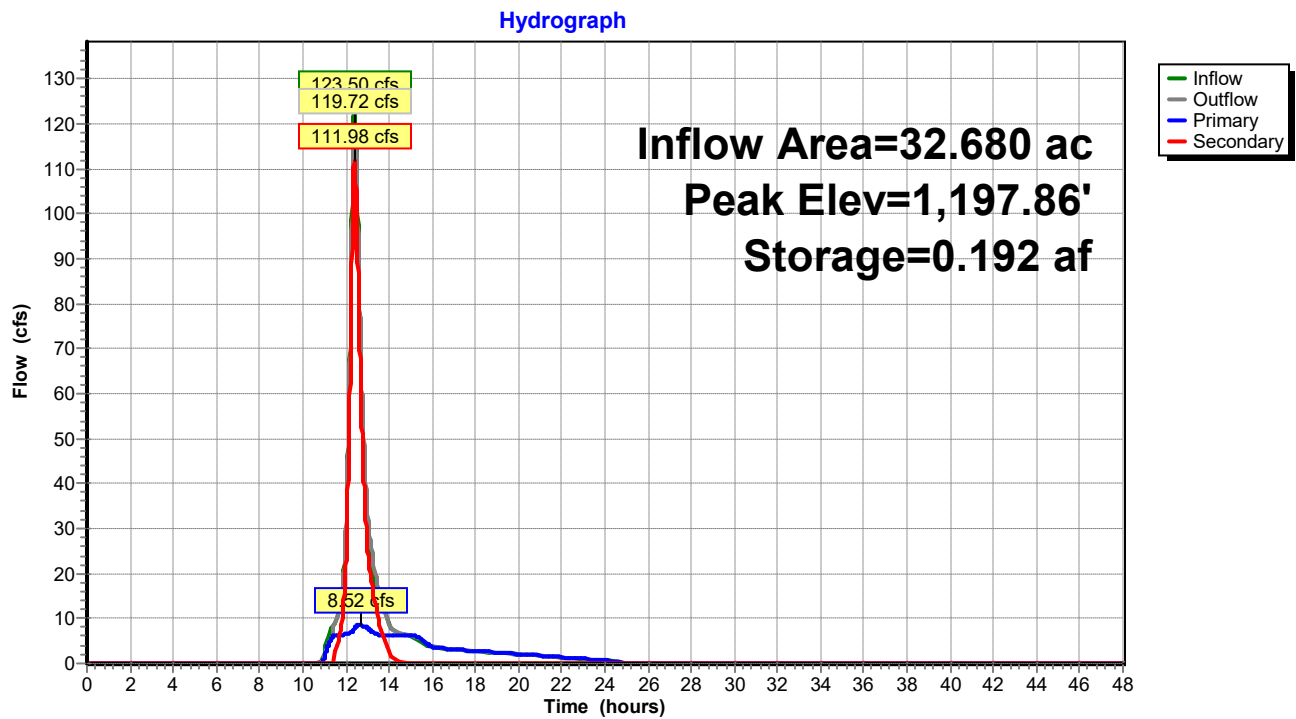
Volume	Invert	Avail.Storage	Storage Description
#1	1,195.50'	0.555 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.50	0.000	0.000	0.000
1,196.00	0.016	0.004	0.004
1,197.00	0.096	0.056	0.060
1,198.00	0.230	0.163	0.223
1,199.00	0.434	0.332	0.555

Device	Routing	Invert	Outlet Devices
#1	Primary	1,195.50'	18.0" Round Culvert L= 70.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,195.50' / 1,190.00' S= 0.0786 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf
#2	Secondary	1,197.10'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.90 1.90 2.90 Width (feet) 250.00 350.00 450.00 522.00

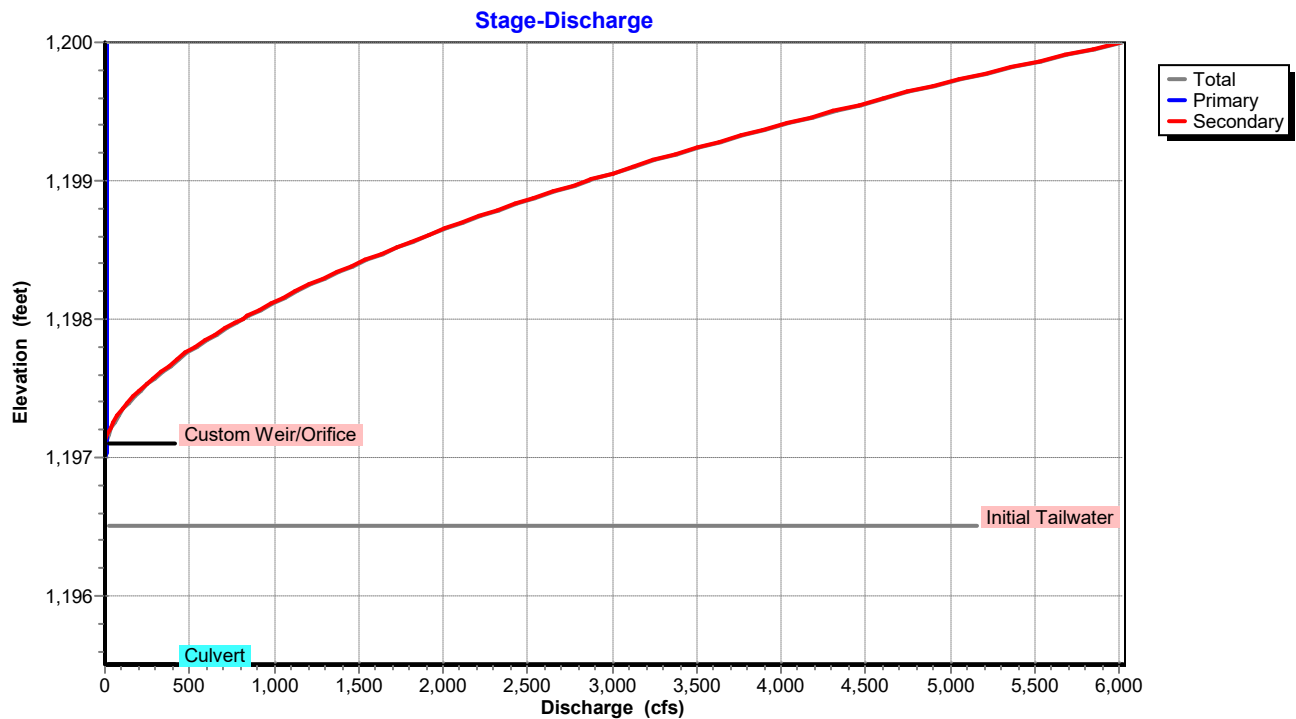
Primary OutFlow Max=8.52 cfs @ 12.67 hrs HW=1,197.86' (Free Discharge)
 ↑1=Culvert (Inlet Controls 8.52 cfs @ 4.82 fps)

Secondary OutFlow Max=66.83 cfs @ 12.39 hrs HW=1,197.58' TW=1,197.57' (Dynamic Tailwater)
 ↑2=Custom Weir/Orifice (Weir Controls 66.83 cfs @ 0.51 fps)

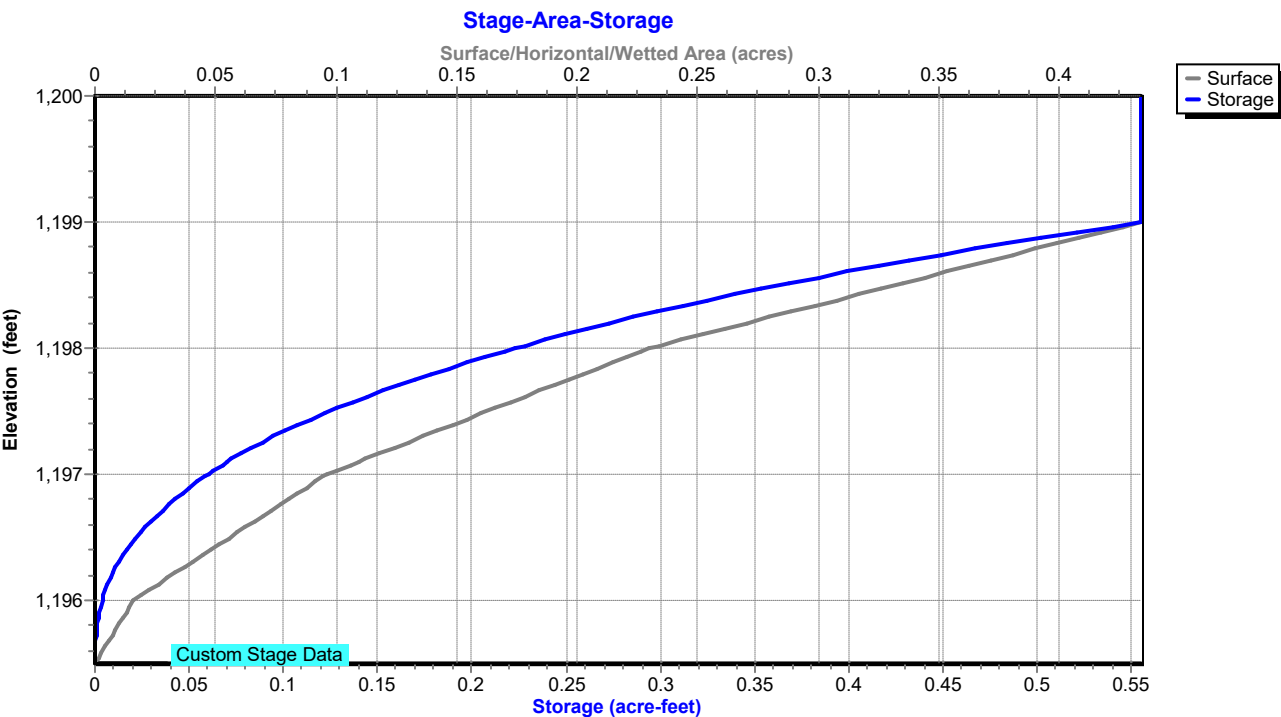
Pond 11P: Culvert Storage



Pond 11P: Culvert Storage



Pond 11P: Culvert Storage



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MSE 24-hr 3 100 yr Rainfall=7.80"

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Page 88

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Wetland Watershed Runoff Area=11.800 ac 46.61% Impervious Runoff Depth=6.73"
Flow Length=125' Tc=11.9 min CN=91 Runoff=105.04 cfs 6.615 af

Subcatchment 3S: Eastern Watershed Runoff Area=13.000 ac 0.00% Impervious Runoff Depth=5.79"
Flow Length=1,370' Tc=21.5 min CN=83 Runoff=79.42 cfs 6.269 af

Subcatchment 6S: Northwest Offsite Runoff Area=31.480 ac 0.00% Impervious Runoff Depth=6.02"
Flow Length=1,540' Tc=26.3 min CN=85 Runoff=178.58 cfs 15.794 af

Subcatchment 7S: Southwest Direct Runoff Area=3.530 ac 47.03% Impervious Runoff Depth=6.85"
Tc=5.0 min CN=92 Runoff=41.50 cfs 2.014 af

Subcatchment 10S: Northwest Direct Runoff Area=3.850 ac 52.21% Impervious Runoff Depth=6.96"
Tc=5.0 min CN=93 Runoff=45.59 cfs 2.234 af

Subcatchment 12S: Culvert Area Runoff Area=1.200 ac 0.00% Impervious Runoff Depth=5.44"
Tc=5.0 min CN=80 Runoff=12.20 cfs 0.544 af

Reach 5R: Out Channel Avg. Flow Depth=0.96' Max Vel=2.57 fps Inflow=44.78 cfs 2.999 af
n=0.025 L=80.0' S=0.0050 '/' Capacity=6,533.92 cfs Outflow=44.69 cfs 2.999 af

Pond 2P: East Pool Peak Elev=1,197.36' Storage=9.564 af Inflow=109.86 cfs 9.884 af
Primary=10.03 cfs 7.728 af Secondary=8.32 cfs 1.907 af Outflow=18.35 cfs 9.635 af

Pond 4P: Culvert Storage Peak Elev=1,200.36' Storage=2.169 af Inflow=79.42 cfs 6.269 af
Primary=6.49 cfs 3.269 af Secondary=44.78 cfs 2.999 af Outflow=51.28 cfs 6.269 af

Pond 5P: Northwest Wetland Peak Elev=1,198.42' Storage=5.344 af Inflow=169.22 cfs 12.984 af
Primary=63.30 cfs 11.163 af Secondary=34.92 cfs 1.820 af Outflow=98.22 cfs 12.983 af

Pond 8P: Southwest Pool Peak Elev=1,198.49' Storage=2.453 af Inflow=41.50 cfs 2.014 af
Primary=10.09 cfs 2.012 af Secondary=0.00 cfs 0.000 af Outflow=10.09 cfs 2.012 af

Pond 9P: Northwest Pothole Peak Elev=1,200.61' Storage=0.933 af Inflow=178.58 cfs 15.794 af
Primary=175.67 cfs 15.423 af Secondary=0.62 cfs 0.010 af Outflow=176.29 cfs 15.434 af

Pond 11P: Culvert Storage Peak Elev=1,198.42' Storage=0.339 af Inflow=177.96 cfs 15.967 af
Primary=9.91 cfs 5.218 af Secondary=160.89 cfs 10.750 af Outflow=169.79 cfs 15.967 af

Total Runoff Area = 64.860 ac Runoff Volume = 33.469 af Average Runoff Depth = 6.19"
85.86% Pervious = 55.690 ac 14.14% Impervious = 9.170 ac

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MSE 24-hr 3 100 yr Rainfall=7.80"

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Page 89

Summary for Subcatchment 1S: Wetland Watershed

Runoff = 105.04 cfs @ 12.19 hrs, Volume= 6.615 af, Depth= 6.73"
Routed to Pond 2P : East Pool

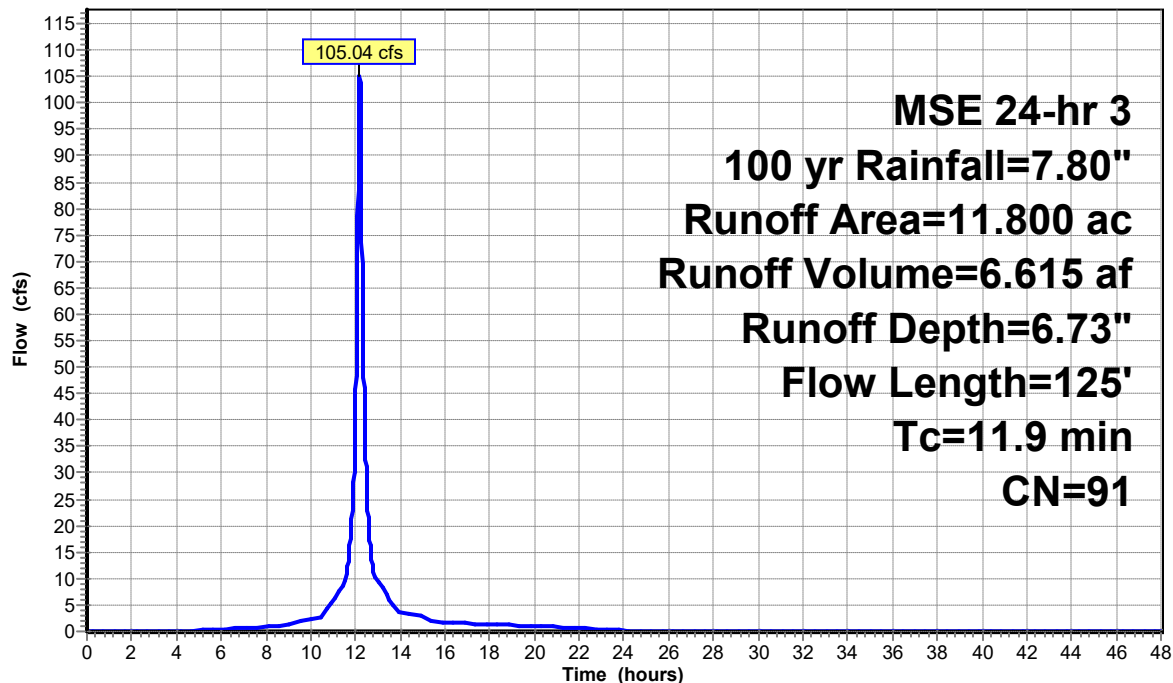
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100 yr Rainfall=7.80"

Area (ac)	CN	Description
* 5.500	100	Pool
* 6.300	83	
11.800	91	Weighted Average
6.300		53.39% Pervious Area
5.500		46.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	100	0.0350	0.14		Sheet Flow, Grass: Dense n= 0.240 P2= 3.10"
0.3	25	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
11.9	125	Total			

Subcatchment 1S: Wetland Watershed

Hydrograph



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Page 90

Summary for Subcatchment 3S: Eastern Watershed

Runoff = 79.42 cfs @ 12.30 hrs, Volume= 6.269 af, Depth= 5.79"
Routed to Pond 4P : Culvert Storage

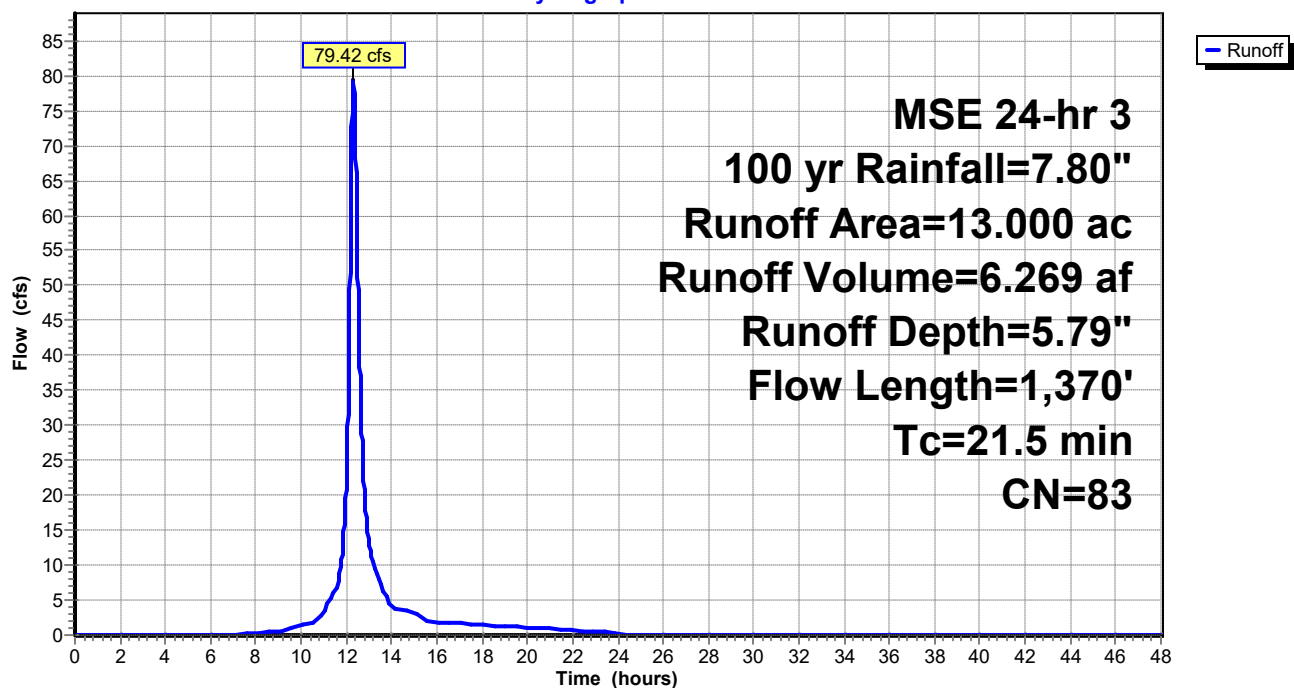
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100 yr Rainfall=7.80"

Area (ac)	CN	Description
* 13.000	83	
13.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0800	0.26		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
15.2	1,270	0.0240	1.39		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
21.5	1,370	Total			

Subcatchment 3S: Eastern Watershed

Hydrograph



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Page 91

Summary for Subcatchment 6S: Northwest Offsite Watershed

Runoff = 178.58 cfs @ 12.36 hrs, Volume= 15.794 af, Depth= 6.02"
Routed to Pond 9P : Northwest Pothole

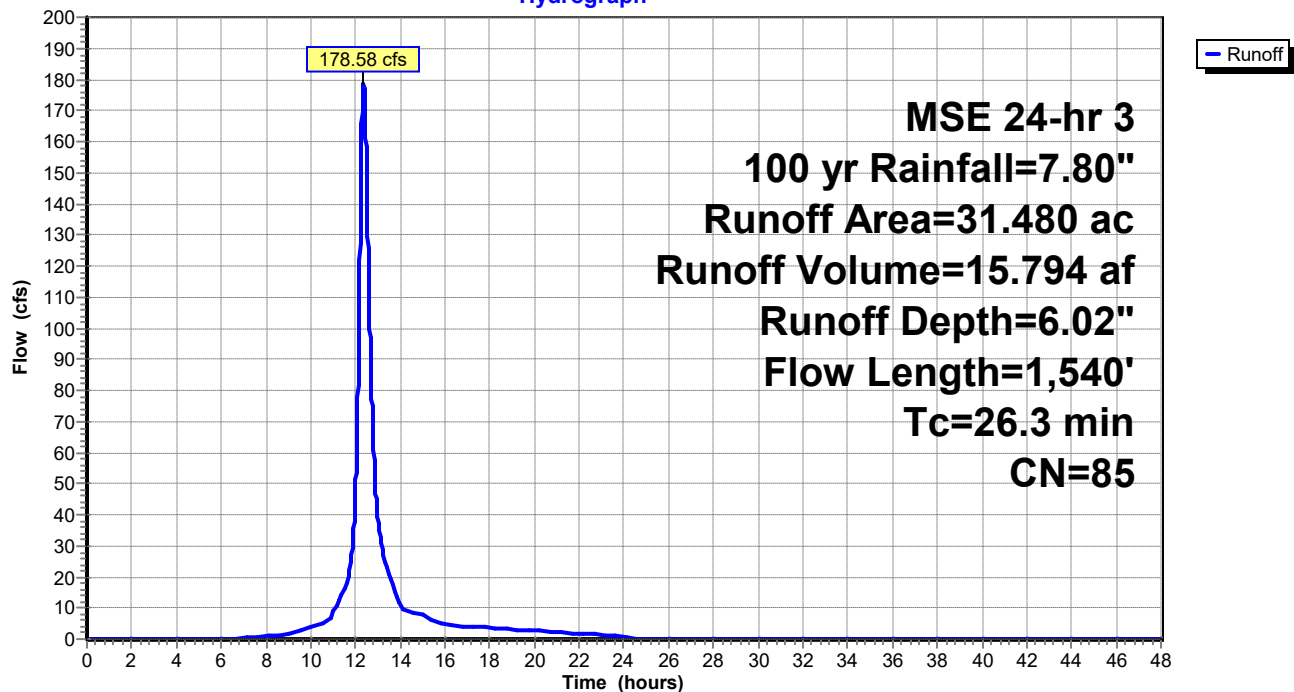
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100 yr Rainfall=7.80"

Area (ac)	CN	Description
31.480	85	Row crops, straight row, Good, HSG C
31.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	100	0.0300	0.18		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 3.10"
16.9	1,440	0.0250	1.42		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
26.3	1,540	Total			

Subcatchment 6S: Northwest Offsite Watershed

Hydrograph



Summary for Subcatchment 7S: Southwest Direct Watershed

Runoff = 41.50 cfs @ 12.12 hrs, Volume= 2.014 af, Depth= 6.85"
Routed to Pond 8P : Southwest Pool

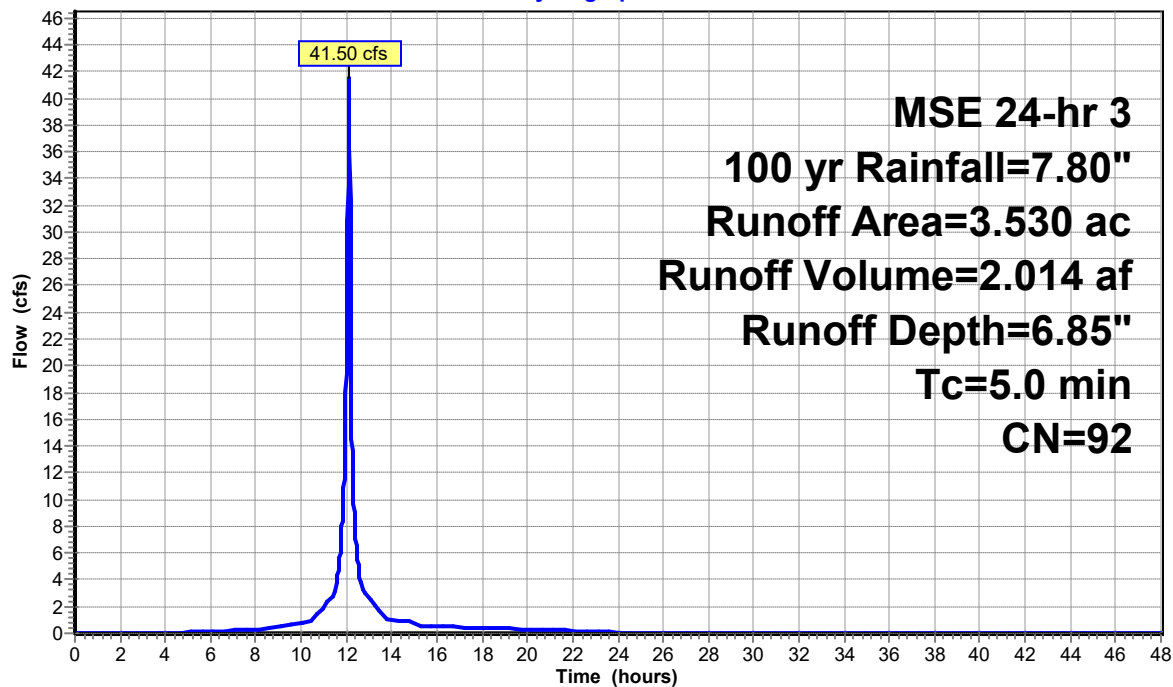
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100 yr Rainfall=7.80"

Area (ac)	CN	Description
* 1.660	100	
* 1.870	85	
3.530	92	Weighted Average
1.870		52.97% Pervious Area
1.660		47.03% Impervious Area

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

Subcatchment 7S: Southwest Direct Watershed

Hydrograph



Summary for Subcatchment 10S: Northwest Direct Watershed

Runoff = 45.59 cfs @ 12.12 hrs, Volume= 2.234 af, Depth= 6.96"
Routed to Pond 5P : Northwest Wetland

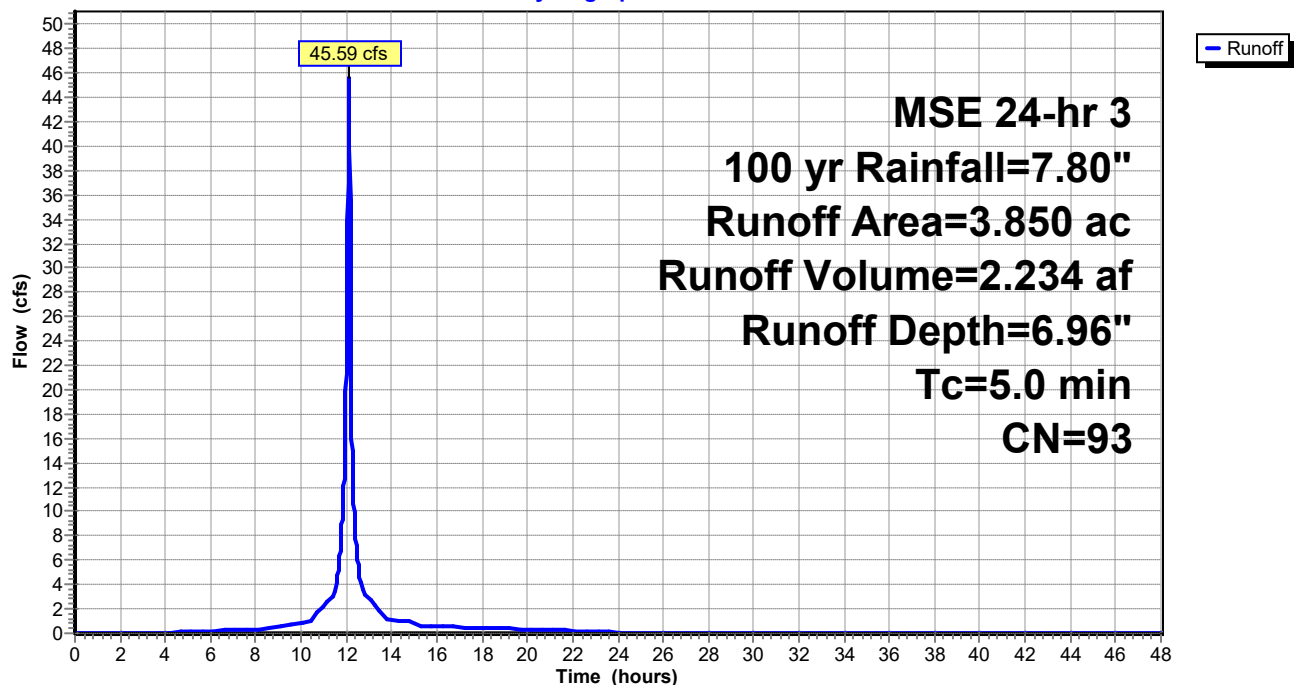
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100 yr Rainfall=7.80"

Area (ac)	CN	Description
* 1.840	85	
* 2.010	100	
3.850	93	Weighted Average
1.840		47.79% Pervious Area
2.010		52.21% Impervious Area

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

Subcatchment 10S: Northwest Direct Watershed

Hydrograph



Summary for Subcatchment 12S: Culvert Area

Runoff = 12.20 cfs @ 12.12 hrs, Volume= 0.544 af, Depth= 5.44"
Routed to Pond 11P : Culvert Storage

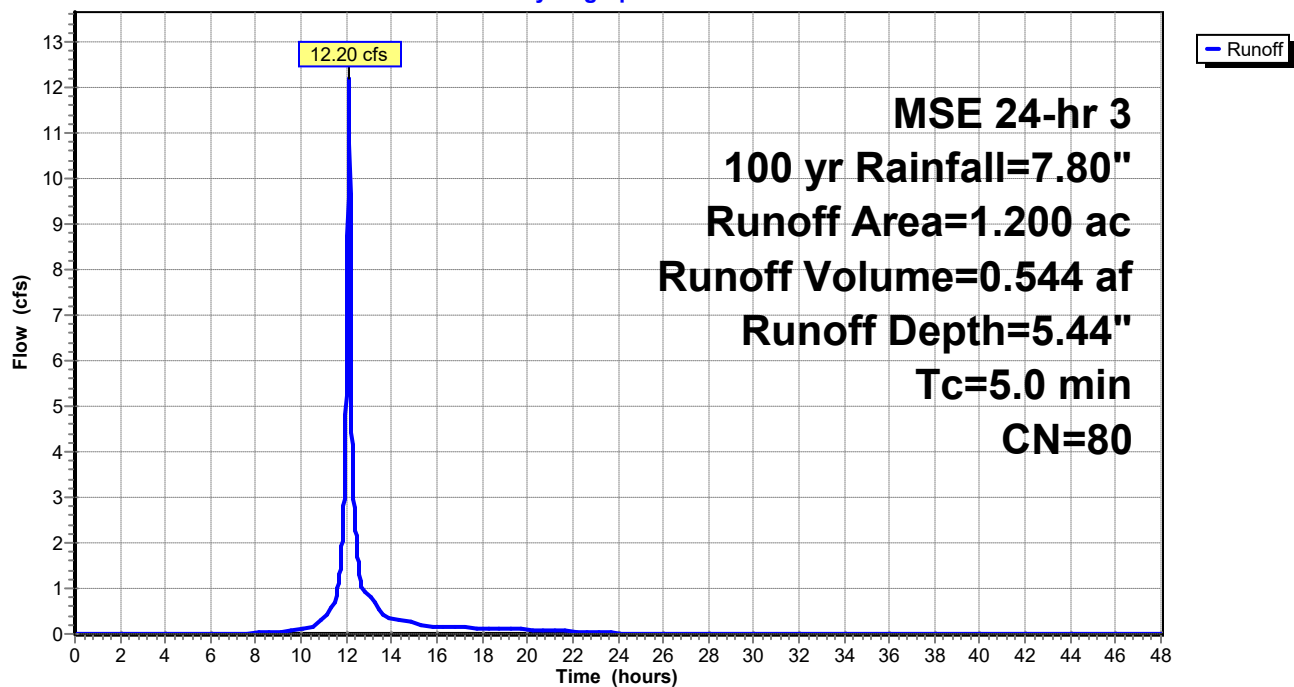
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100 yr Rainfall=7.80"

Area (ac)	CN	Description
* 1.200	80	
1.200		100.00% Pervious Area

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

Subcatchment 12S: Culvert Area

Hydrograph



Summary for Reach 5R: Out Channel

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow = 44.78 cfs @ 12.50 hrs, Volume= 2.999 af
 Outflow = 44.69 cfs @ 12.51 hrs, Volume= 2.999 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Max. Velocity= 2.57 fps, Min. Travel Time= 0.5 min

Avg. Velocity= 1.05 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,387 cf @ 12.51 hrs

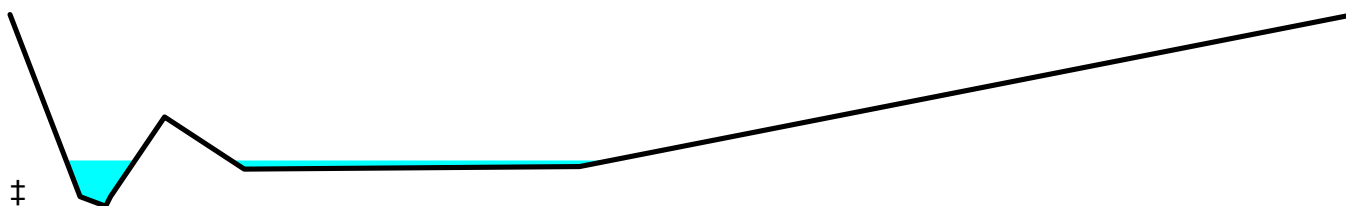
Average Depth at Peak Storage= 0.96', Surface Width= 140.58'

Bank-Full Depth= 4.02' Flow Area= 922.7 sf, Capacity= 6,533.92 cfs

Custom cross-section, Length= 80.0' Slope= 0.0050 '/' (103 Elevation Intervals)

Constant n= 0.025 Earth, grassed & winding

Inlet Invert= 1,199.40', Outlet Invert= 1,199.00'

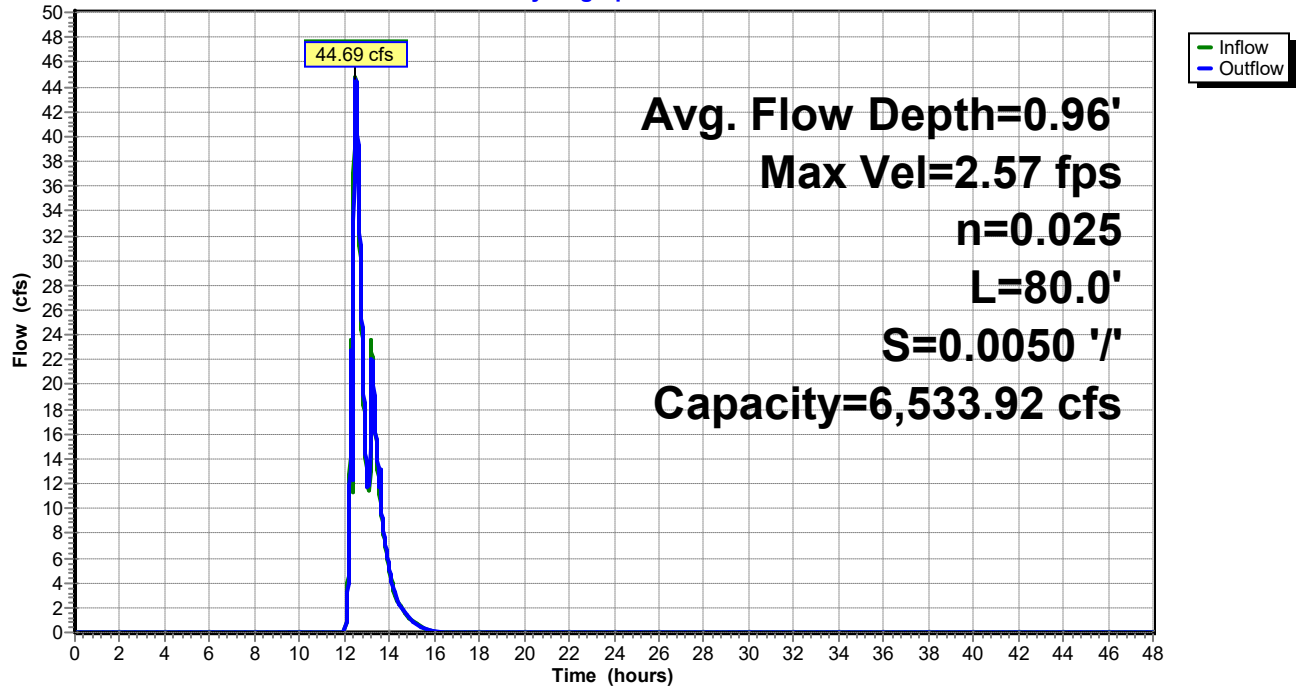


Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1,203.42	0.00
22.00	1,199.60	3.82
30.00	1,199.40	4.02
31.50	1,199.60	3.82
48.50	1,201.27	2.15
73.50	1,200.18	3.24
178.65	1,200.23	3.19
421.44	1,203.42	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0.0	0	0.00
0.20	0.9	9.5	9.5	76	0.86
0.78	9.1	18.8	18.7	731	23.72
0.83	12.8	125.9	125.8	1,020	11.65
1.87	205.8	245.7	245.4	16,465	768.68
4.02	922.7	421.9	421.4	73,815	6,533.92

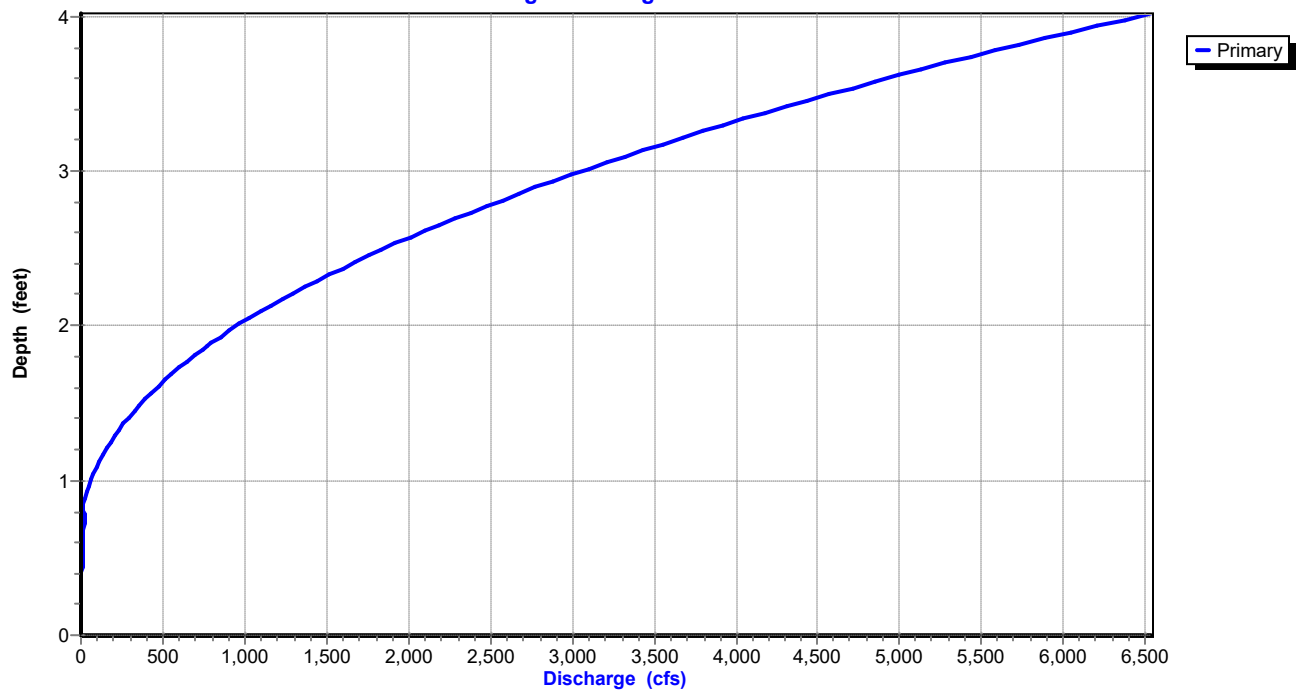
Reach 5R: Out Channel

Hydrograph

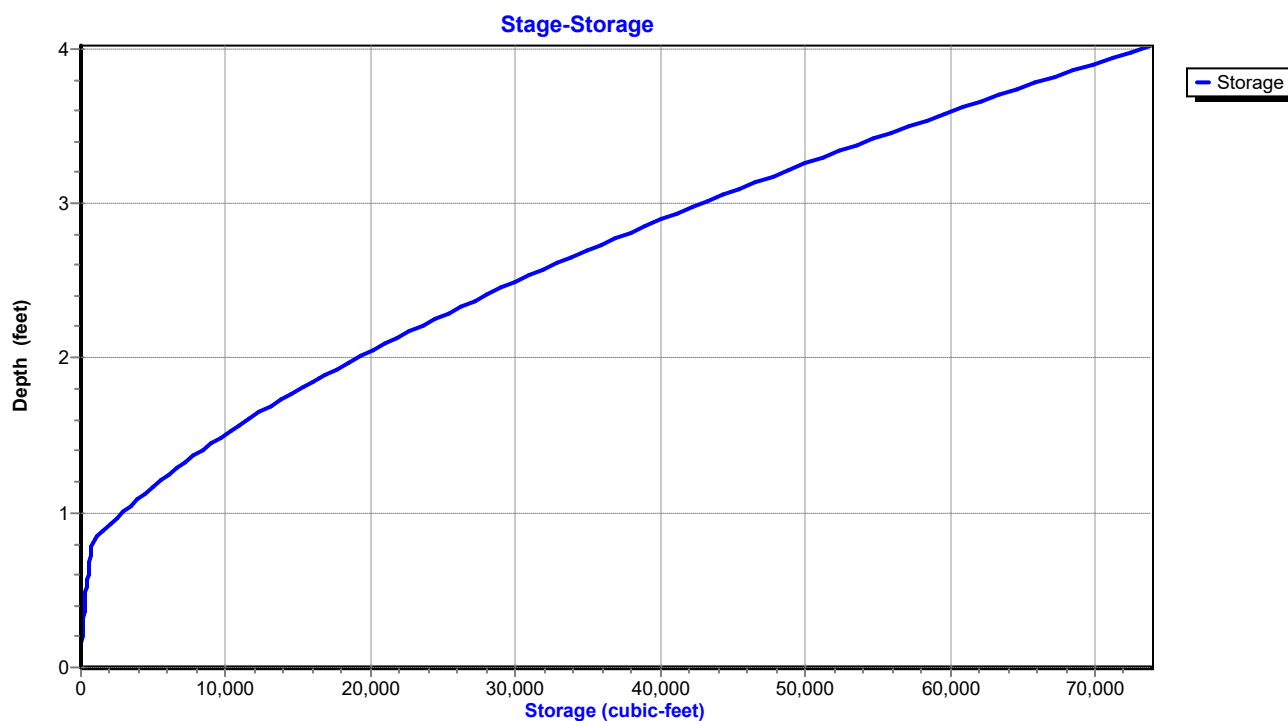


Reach 5R: Out Channel

Stage-Discharge



Reach 5R: Out Channel



Summary for Pond 2P: East Pool

Inflow Area = 24.800 ac, 22.18% Impervious, Inflow Depth = 4.78" for 100 yr event
 Inflow = 109.86 cfs @ 12.19 hrs, Volume= 9.884 af
 Outflow = 18.35 cfs @ 12.77 hrs, Volume= 9.635 af, Atten= 83%, Lag= 34.8 min
 Primary = 10.03 cfs @ 12.77 hrs, Volume= 7.728 af
 Secondary = 8.32 cfs @ 12.77 hrs, Volume= 1.907 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,196.50' Surf.Area= 4.500 ac Storage= 5.075 af

Peak Elev= 1,197.36' @ 12.77 hrs Surf.Area= 5.952 ac Storage= 9.564 af (4.489 af above start)

Plug-Flow detention time= 735.6 min calculated for 4.560 af (46% of inflow)

Center-of-Mass det. time= 287.7 min (1,119.6 - 831.9)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,194.50'	17.400 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,194.50	0.400	0.000	0.000
1,195.00	1.400	0.450	0.450
1,195.50	2.600	1.000	1.450
1,196.00	3.700	1.575	3.025
1,196.50	4.500	2.050	5.075
1,197.00	5.300	2.450	7.525
1,197.50	6.200	2.875	10.400
1,198.00	7.000	3.300	13.700
1,198.50	7.800	3.700	17.400

Device	Routing	Invert	Outlet Devices
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#1	Primary	1,190.00'	18.0" Round Culvert
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L= 80.5' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 1,190.00' / 1,188.39' S= 0.0200 '/' Cc= 0.900

n= 0.013, Flow Area= 1.77 sf

#2	Device 1	1,196.50'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
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#3	Secondary	1,197.00'	12.0' long + 4.0 ' /' SideZ x 0.5' breadth Broad-Crested Rectangular Weir
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Head (feet) 0.20 0.40 0.60 0.80 1.00

Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=10.03 cfs @ 12.77 hrs HW=1,197.36' (Free Discharge)

↑ **1=Culvert** (Passes 10.03 cfs of 21.88 cfs potential flow)

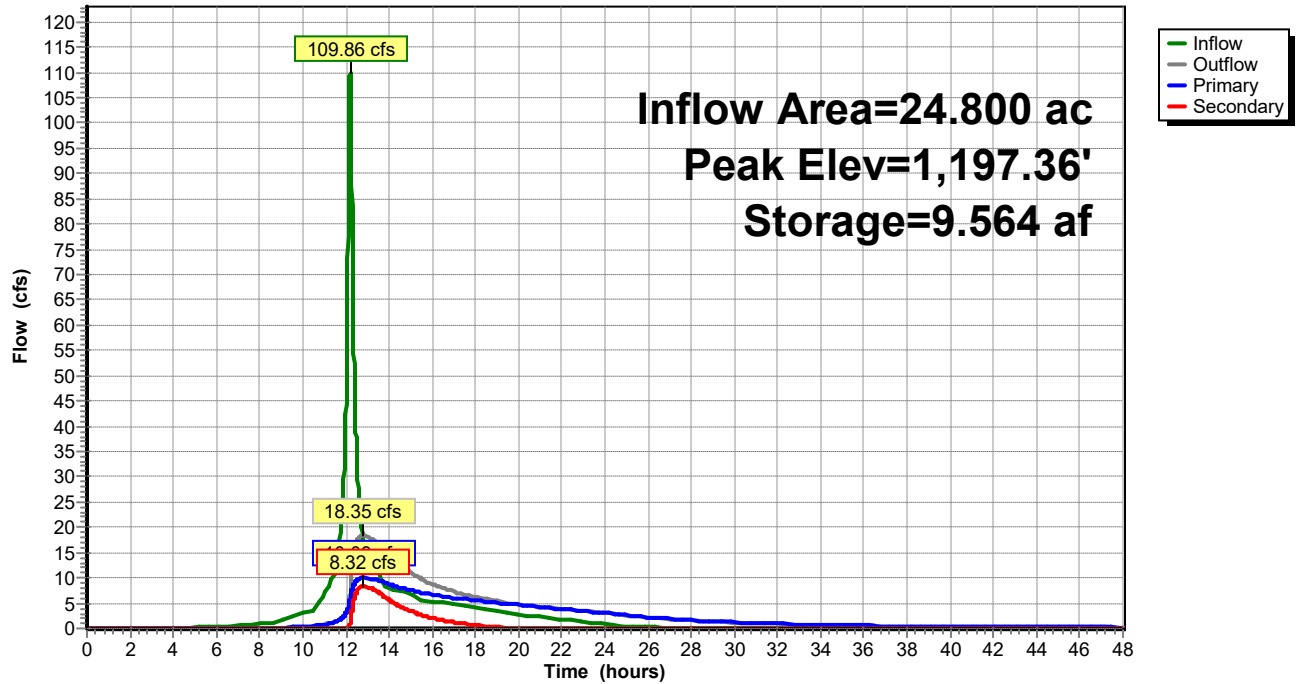
↑ **2=Sharp-Crested Rectangular Weir** (Weir Controls 10.03 cfs @ 3.04 fps)

Secondary OutFlow Max=8.32 cfs @ 12.77 hrs HW=1,197.36' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 8.32 cfs @ 1.71 fps)

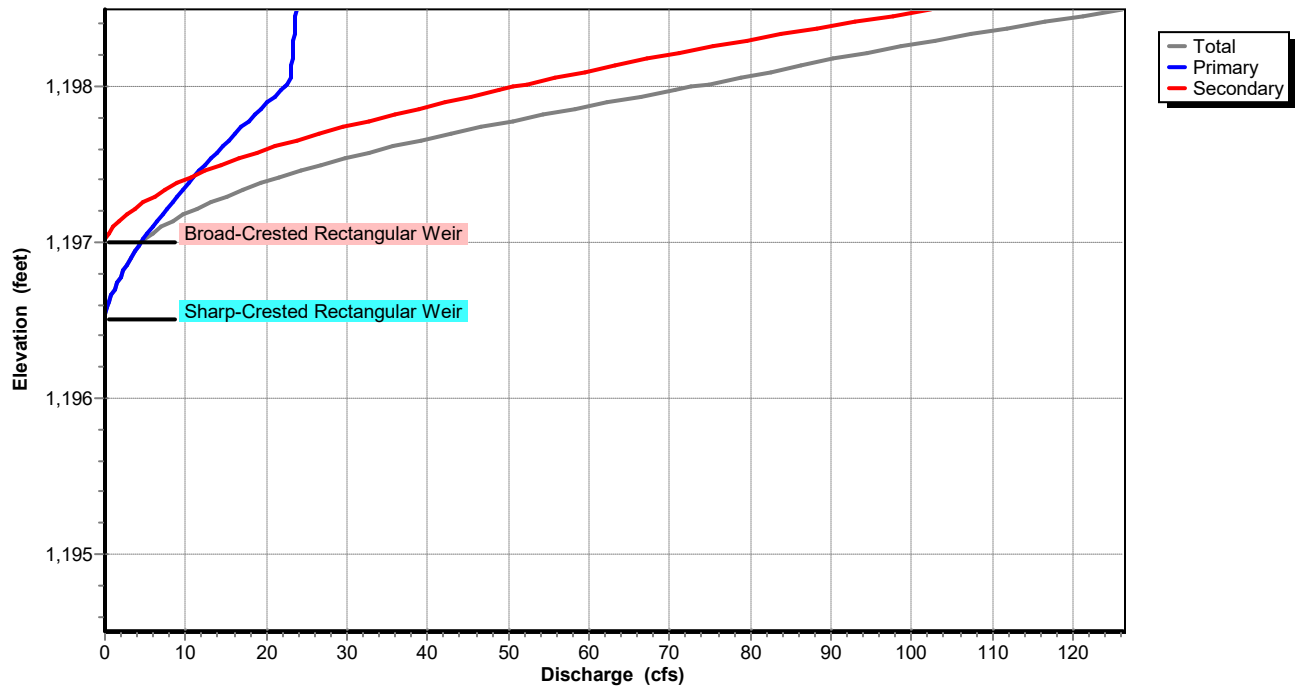
Pond 2P: East Pool

Hydrograph



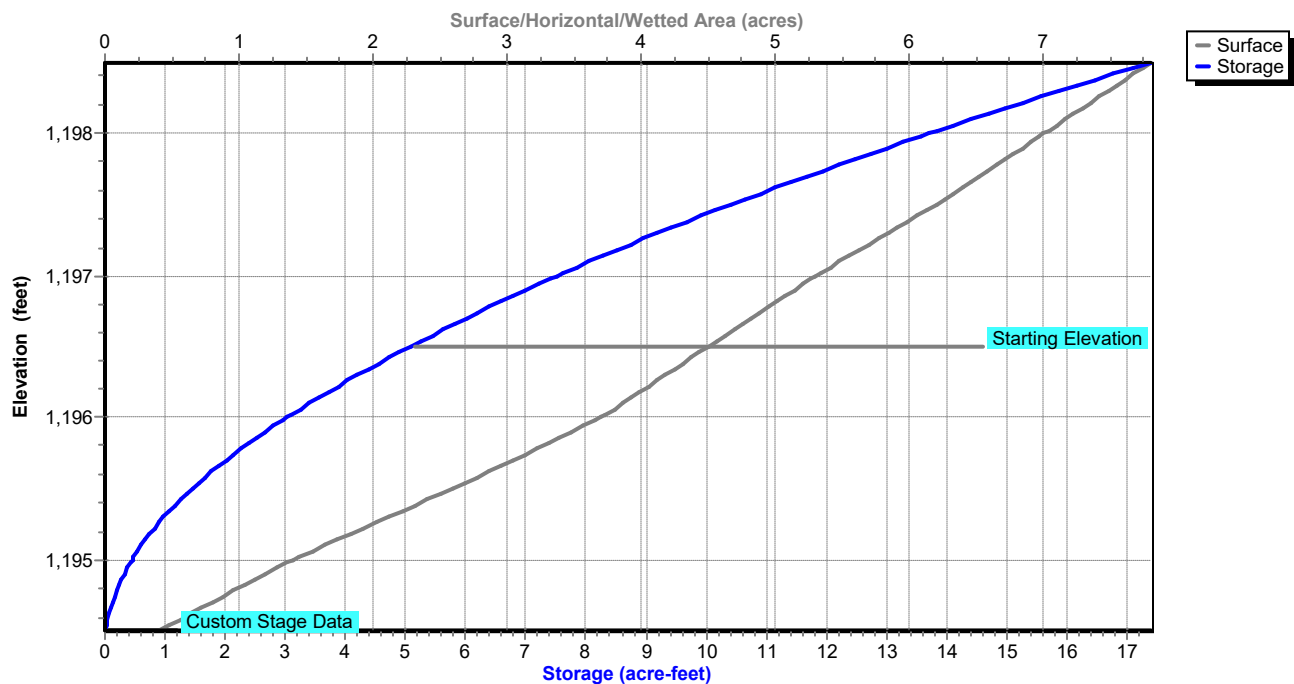
Pond 2P: East Pool

Stage-Discharge



Pond 2P: East Pool

Stage-Area-Storage



D Petersburg HydroCAD

Prepared by Bolton & Menk, Inc

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MSE 24-hr 3 100 yr Rainfall=7.80"

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Page 101

Summary for Pond 4P: Culvert Storage

Inflow Area = 13.000 ac, 0.00% Impervious, Inflow Depth = 5.79" for 100 yr event
 Inflow = 79.42 cfs @ 12.30 hrs, Volume= 6.269 af
 Outflow = 51.28 cfs @ 12.50 hrs, Volume= 6.269 af, Atten= 35%, Lag= 11.8 min
 Primary = 6.49 cfs @ 12.50 hrs, Volume= 3.269 af
 Routed to Pond 2P : East Pool
 Secondary = 44.78 cfs @ 12.50 hrs, Volume= 2.999 af
 Routed to Reach 5R : Out Channel

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,200.36' @ 12.50 hrs Surf.Area= 2.639 ac Storage= 2.169 af

Plug-Flow detention time= 75.8 min calculated for 6.267 af (100% of inflow)
 Center-of-Mass det. time= 75.9 min (872.0 - 796.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	15.511 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,198.00	0.002	0.000	0.000
1,199.00	0.560	0.281	0.281
1,200.00	1.670	1.115	1.396
1,201.00	4.370	3.020	4.416
1,202.00	5.580	4.975	9.391
1,203.00	6.660	6.120	15.511

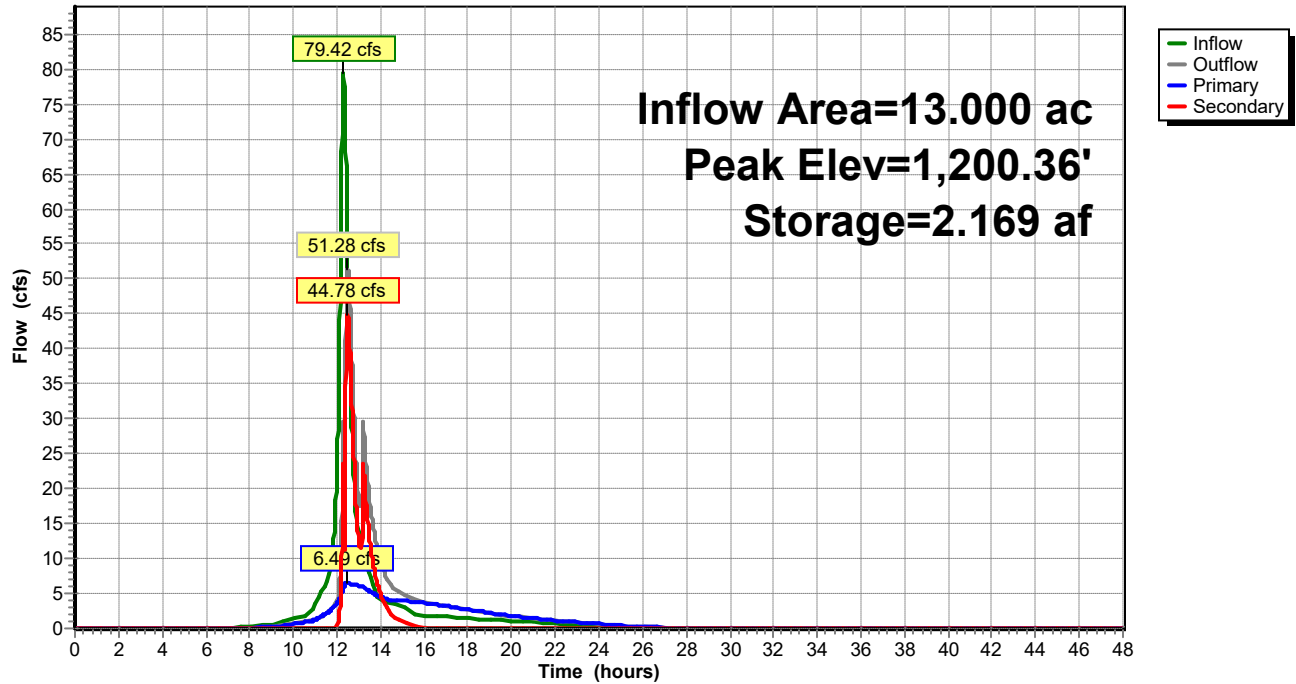
Device	Routing	Invert	Outlet Devices
#1	Primary	1,198.00'	15.0" Round Culvert L= 45.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 1,198.00' / 1,198.00' S= 0.0000 '/ Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Secondary	1,199.40'	Channel/Reach using Reach 5R: Out Channel

Primary OutFlow Max=6.49 cfs @ 12.50 hrs HW=1,200.36' TW=1,197.34' (Dynamic Tailwater)
 ↑ **1=Culvert** (Barrel Controls 6.49 cfs @ 5.29 fps)

Secondary OutFlow Max=44.78 cfs @ 12.50 hrs HW=1,200.36' TW=1,200.36' (Dynamic Tailwater)
 ↑ **2=Channel/Reach** (Channel Controls 44.78 cfs @ 1.50 fps)

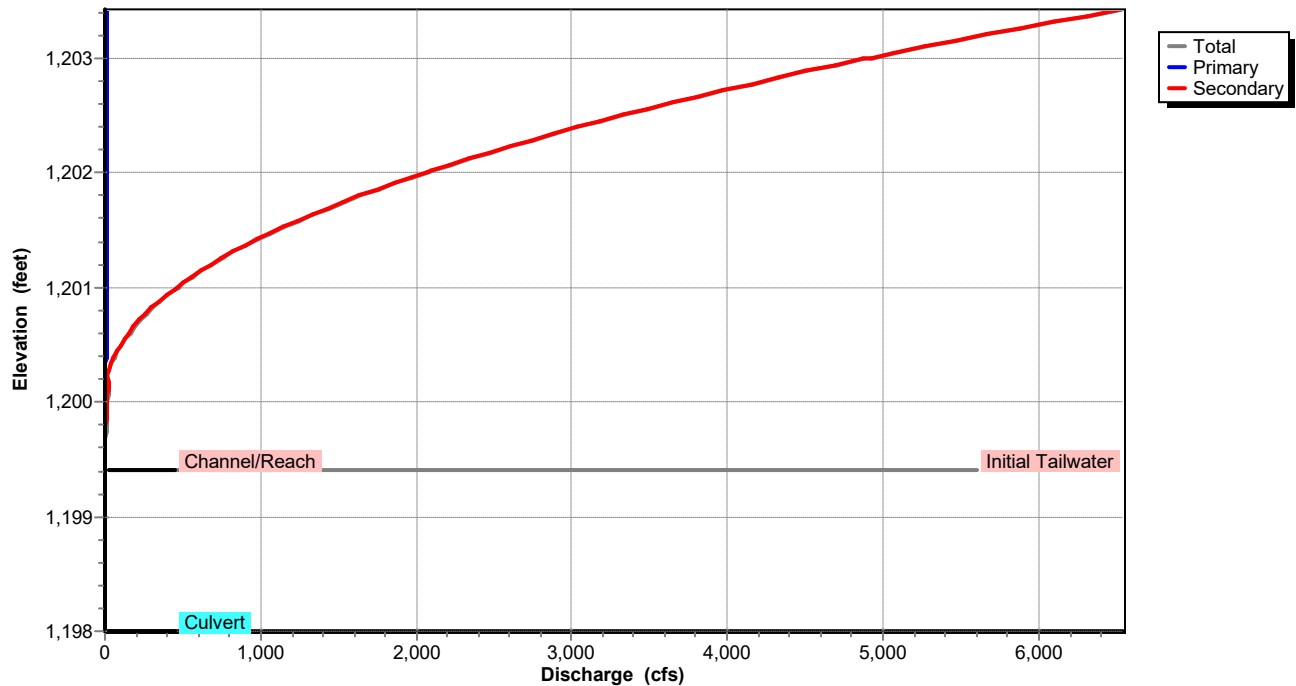
Pond 4P: Culvert Storage

Hydrograph

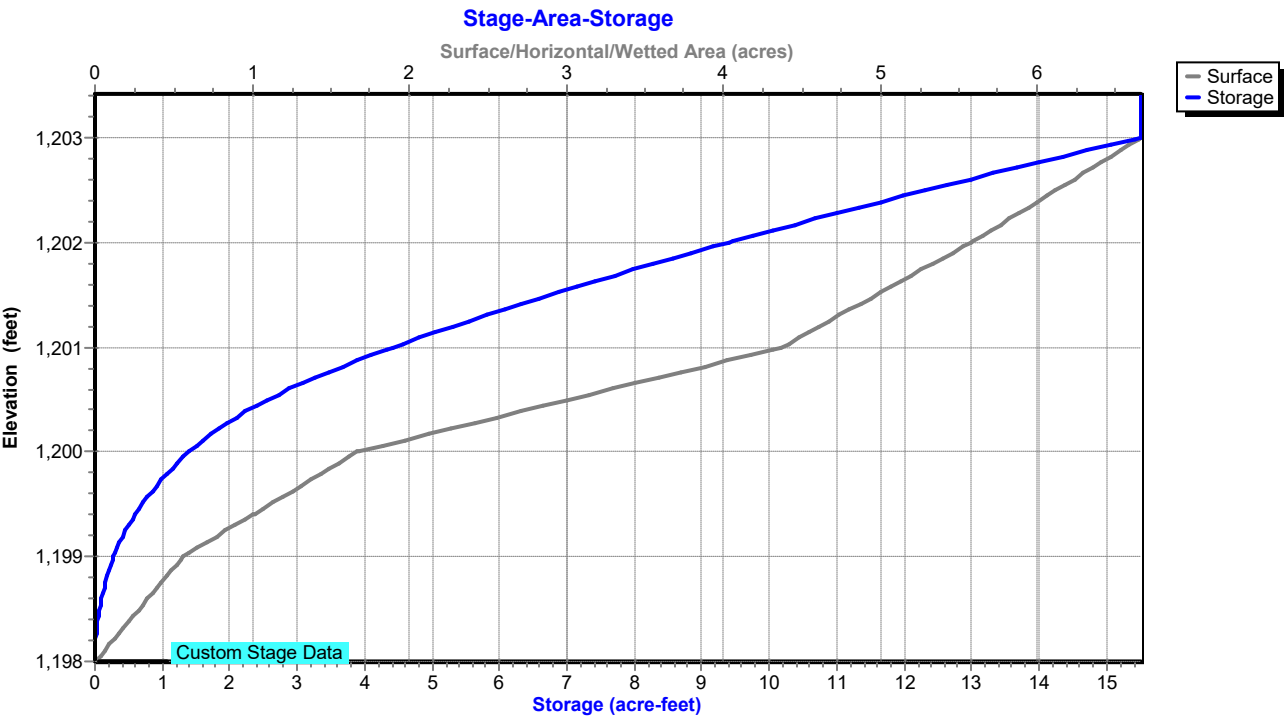


Pond 4P: Culvert Storage

Stage-Discharge



Pond 4P: Culvert Storage



Summary for Pond 5P: Northwest Wetland

[80] Warning: Exceeded Pond 11P by 0.02' @ 12.42 hrs (191.56 cfs 4.380 af)

Inflow Area = 3.850 ac, 52.21% Impervious, Inflow Depth = 40.47" for 100 yr event
 Inflow = 169.22 cfs @ 12.38 hrs, Volume= 12.984 af
 Outflow = 98.22 cfs @ 12.66 hrs, Volume= 12.983 af, Atten= 42%, Lag= 17.0 min
 Primary = 63.30 cfs @ 12.66 hrs, Volume= 11.163 af
 Secondary = 34.92 cfs @ 12.66 hrs, Volume= 1.820 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,196.50' Surf.Area= 1.900 ac Storage= 0.925 af

Peak Elev= 1,198.42' @ 12.66 hrs Surf.Area= 2.811 ac Storage= 5.344 af (4.419 af above start)

Plug-Flow detention time= 56.1 min calculated for 12.055 af (93% of inflow)

Center-of-Mass det. time= 35.4 min (790.9 - 755.5)

Volume	Invert	Avail.Storage	Storage Description
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#1	1,196.00'	7.050 af	Custom Stage Data (Prismatic) Listed below (Recalc)
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Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,196.00	1.800	0.000	0.000
1,197.00	2.000	1.900	1.900
1,198.00	2.600	2.300	4.200
1,199.00	3.100	2.850	7.050

Device	Routing	Invert	Outlet Devices
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#1	Primary	1,190.00'	30.0" Round Culvert
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L= 111.0' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 1,190.00' / 1,187.78' S= 0.0200 ' / ' Cc= 0.900

n= 0.013, Flow Area= 4.91 sf

#2	Secondary	1,197.50'	12.0' long + 4.0 ' / ' SideZ x 15.0' breadth Broad-Crested Rectangular Weir
----	-----------	-----------	--

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

#3	Device 1	1,196.50'	5.0' long Sharp-Crested Rectangular Weir X 4.00
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2 End Contraction(s)

Primary OutFlow Max=63.30 cfs @ 12.66 hrs HW=1,198.42' (Free Discharge)

↑ **1=Culvert** (Inlet Controls 63.30 cfs @ 12.90 fps)

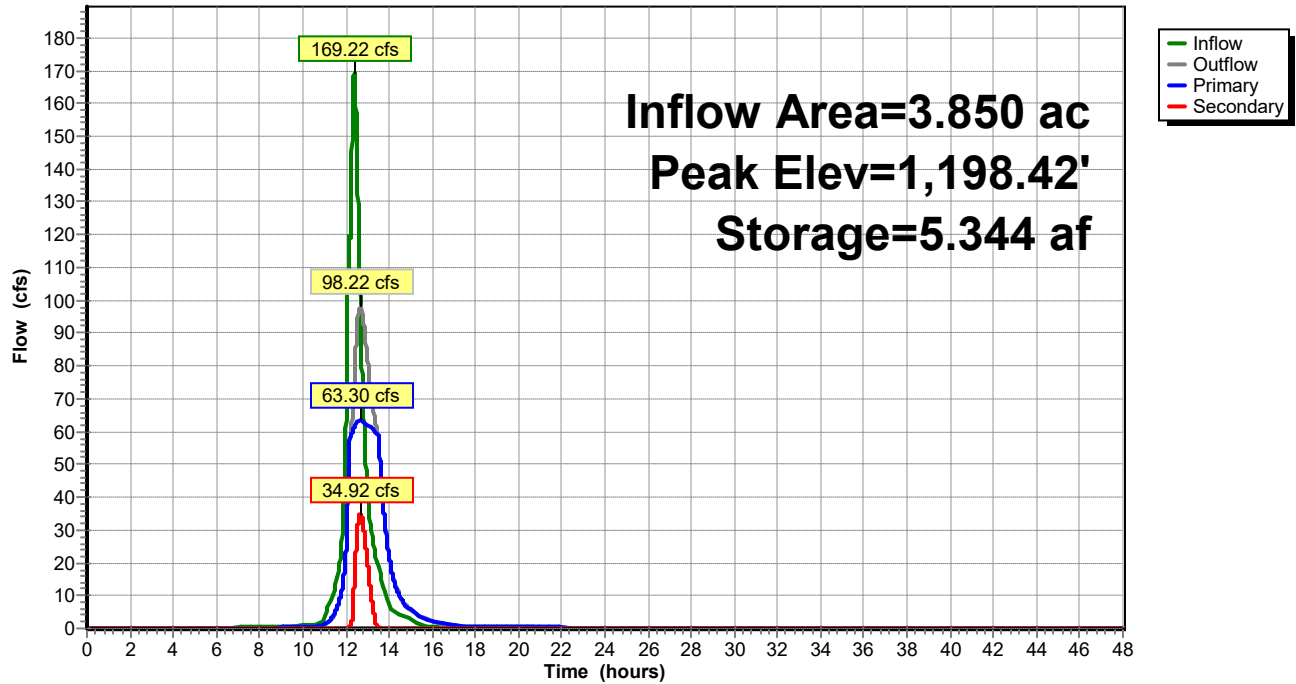
↑ **3=Sharp-Crested Rectangular Weir** (Passes 63.30 cfs of 160.97 cfs potential flow)

Secondary OutFlow Max=34.92 cfs @ 12.66 hrs HW=1,198.42' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 34.92 cfs @ 2.41 fps)

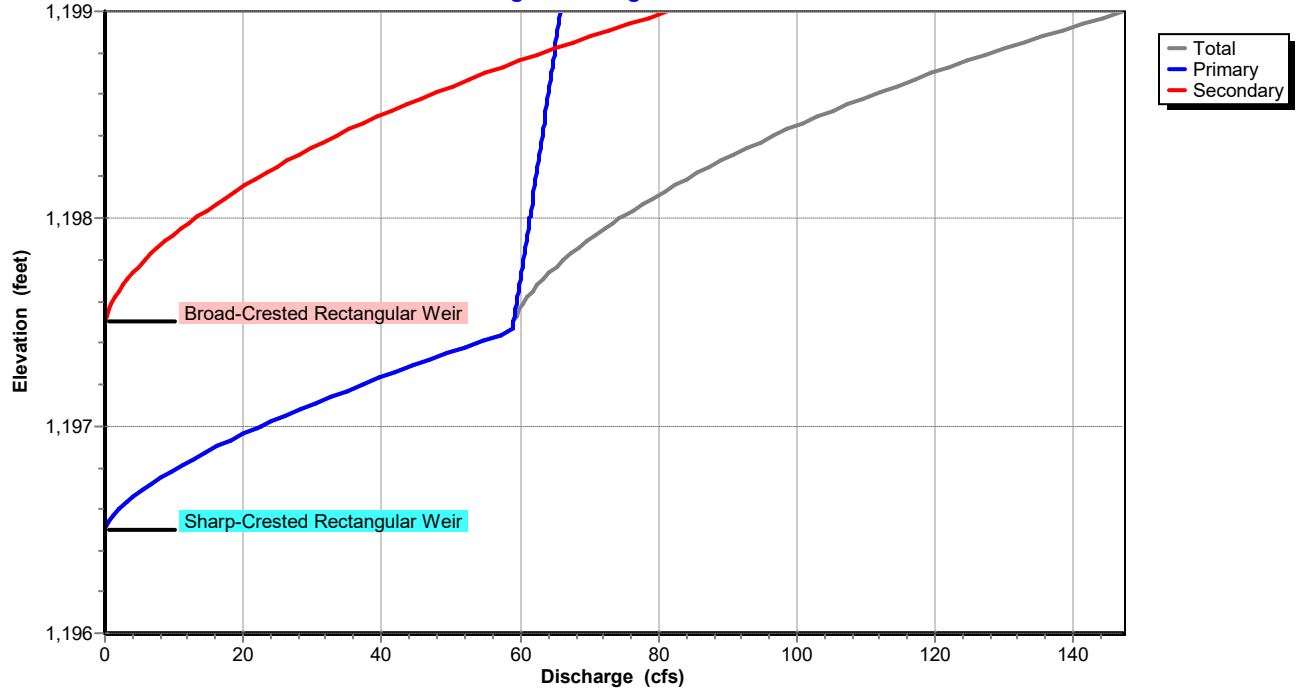
Pond 5P: Northwest Wetland

Hydrograph

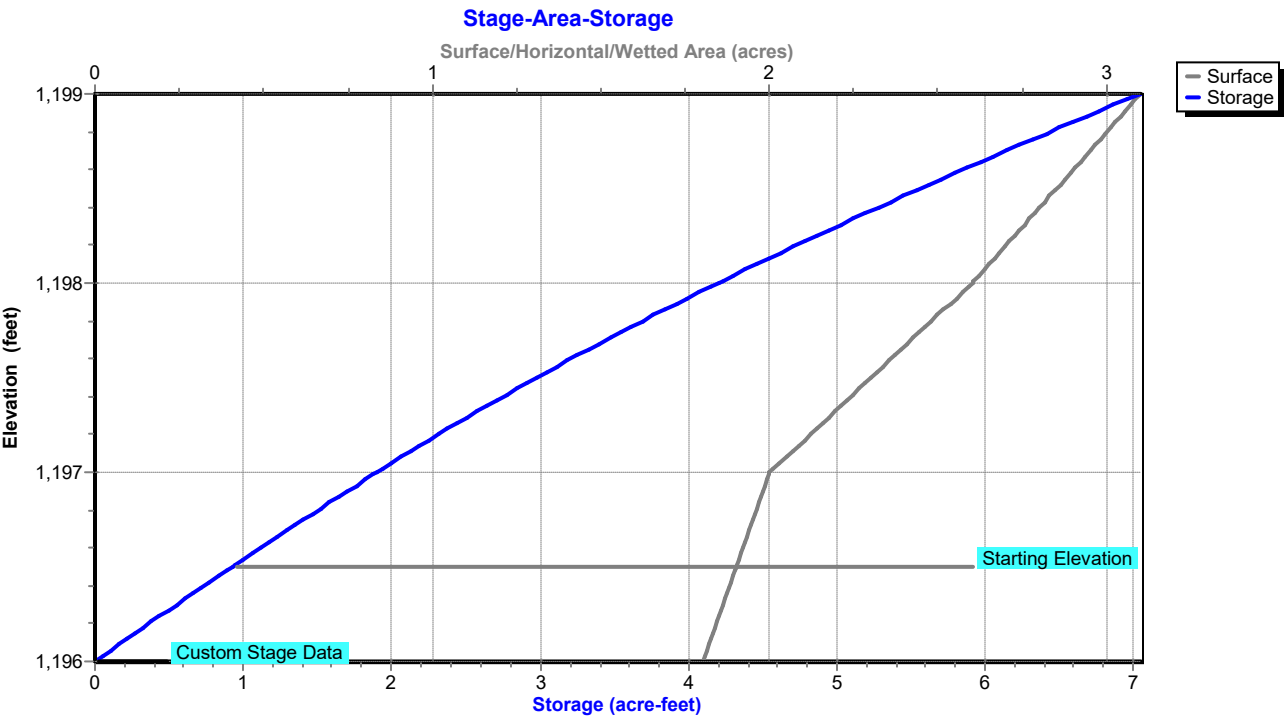


Pond 5P: Northwest Wetland

Stage-Discharge



Pond 5P: Northwest Wetland



Summary for Pond 8P: Southwest Pool

Inflow Area = 3.530 ac, 47.03% Impervious, Inflow Depth = 6.85" for 100 yr event
 Inflow = 41.50 cfs @ 12.12 hrs, Volume= 2.014 af
 Outflow = 10.09 cfs @ 12.31 hrs, Volume= 2.012 af, Atten= 76%, Lag= 11.2 min
 Primary = 10.09 cfs @ 12.31 hrs, Volume= 2.012 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Starting Elev= 1,198.00' Surf.Area= 1.660 ac Storage= 1.615 af

Peak Elev= 1,198.49' @ 12.31 hrs Surf.Area= 1.777 ac Storage= 2.453 af (0.838 af above start)

Plug-Flow detention time= 559.5 min calculated for 0.397 af (20% of inflow)

Center-of-Mass det. time= 84.4 min (845.6 - 761.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,195.00'	5.585 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.00	0.010	0.000	0.000
1,196.00	0.220	0.115	0.115
1,197.00	0.560	0.390	0.505
1,198.00	1.660	1.110	1.615
1,199.00	1.900	1.780	3.395
1,200.00	2.480	2.190	5.585

Device	Routing	Invert	Outlet Devices
#1	Primary	1,190.00'	12.0" Round Culvert L= 60.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,190.00' / 1,188.80' S= 0.0199 ' /' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	1,198.00'	48.0" W x 9.0" H Vert. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#3	Secondary	1,198.50'	20.0' long + 4.0 ' /' SideZ x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=10.09 cfs @ 12.31 hrs HW=1,198.49' (Free Discharge)

↑ **1=Culvert** (Barrel Controls 10.09 cfs @ 12.85 fps)

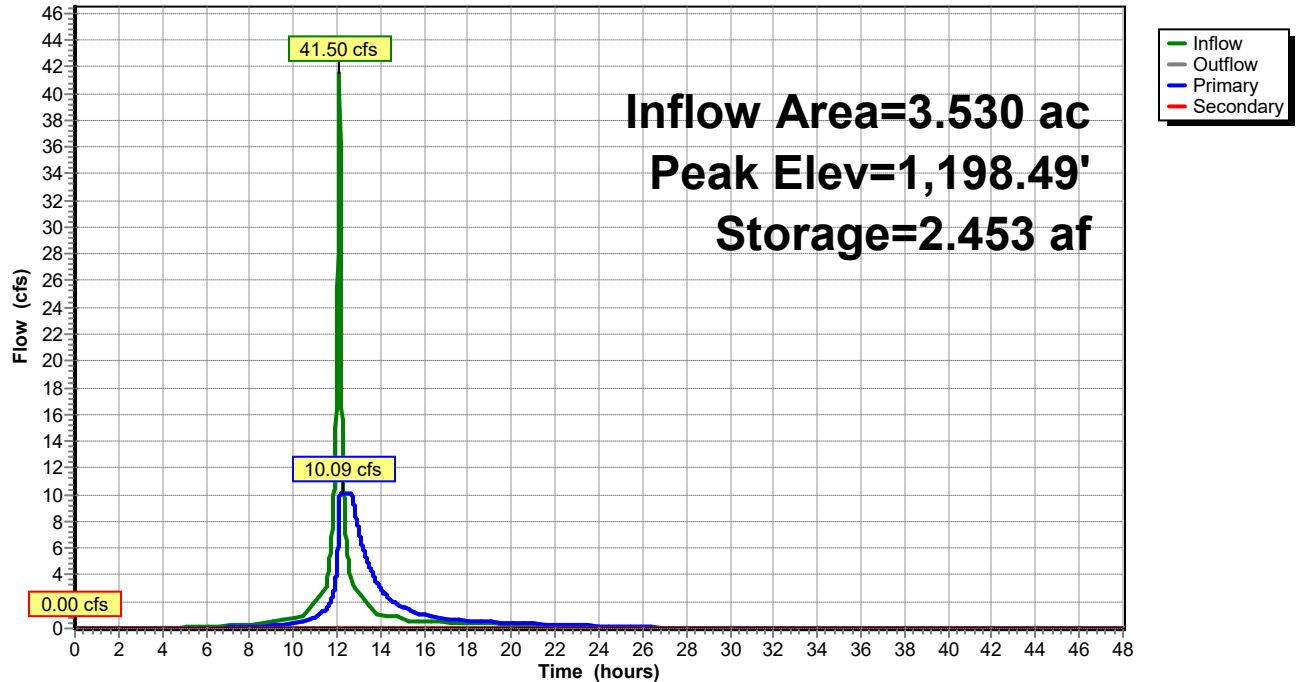
↑ **2=Orifice/Grate** (Passes 10.09 cfs of 13.12 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,198.00' (Free Discharge)

↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

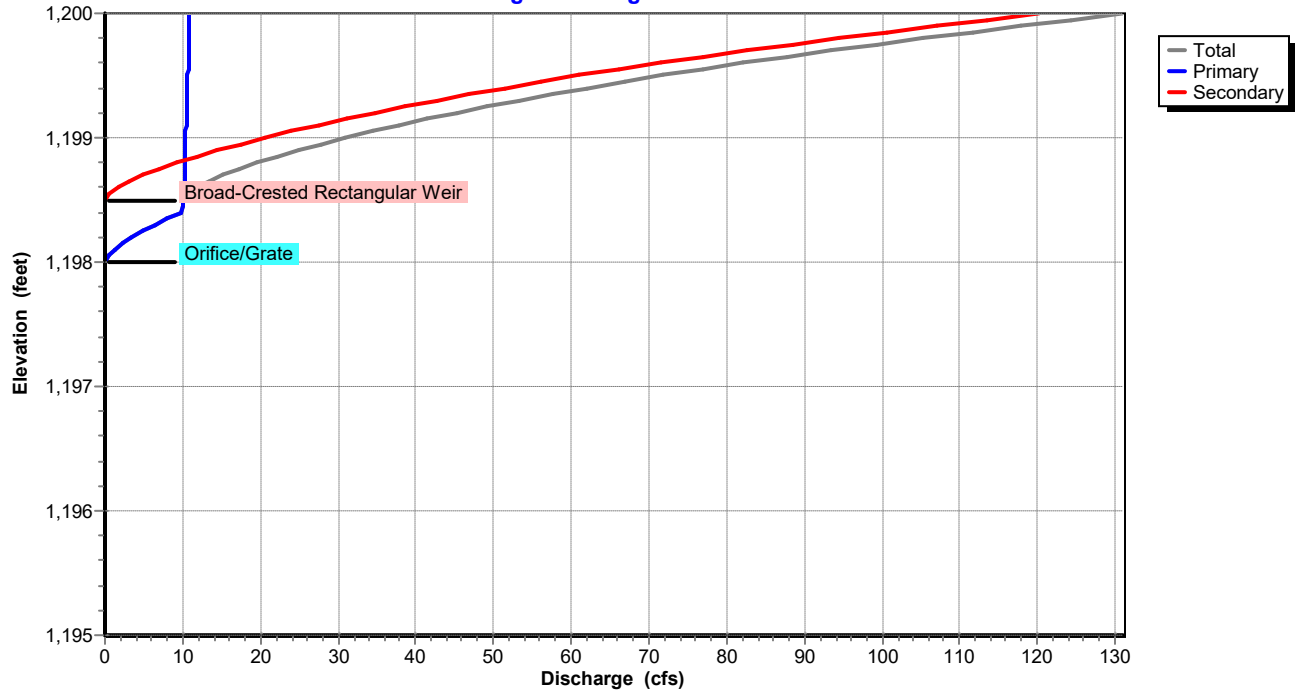
Pond 8P: Southwest Pool

Hydrograph



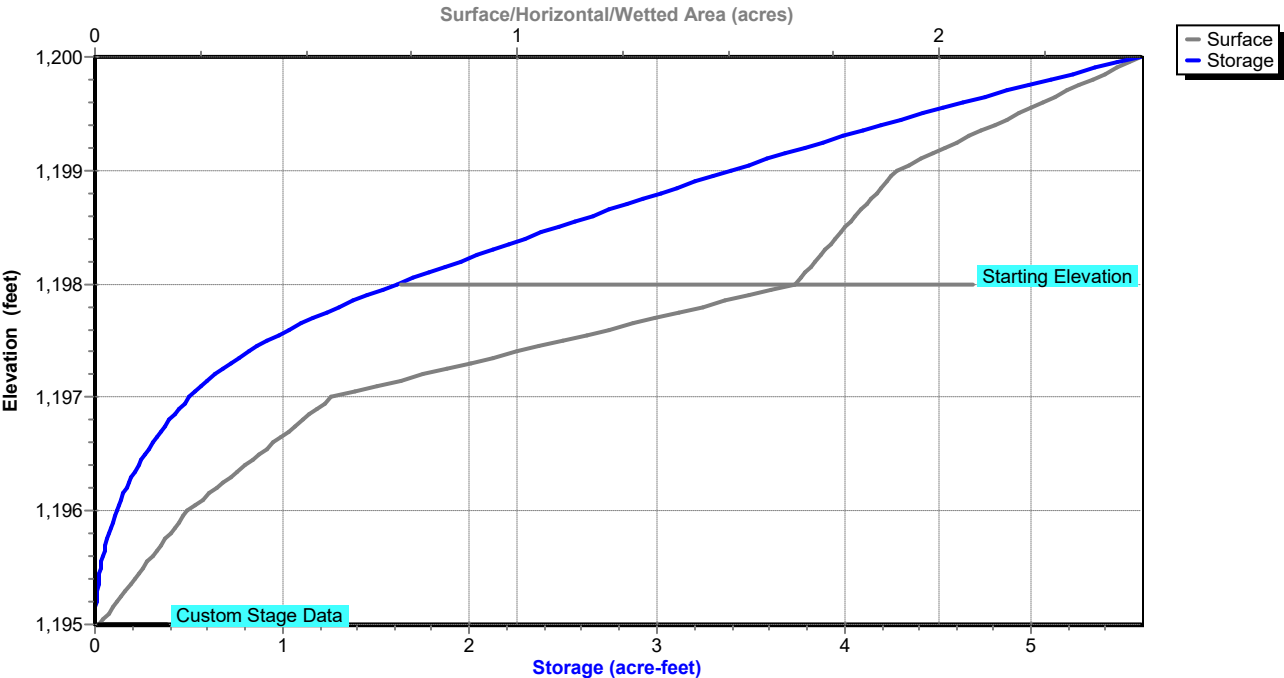
Pond 8P: Southwest Pool

Stage-Discharge



Pond 8P: Southwest Pool

Stage-Area-Storage



Summary for Pond 9P: Northwest Pothole

Inflow Area = 31.480 ac, 0.00% Impervious, Inflow Depth = 6.02" for 100 yr event
 Inflow = 178.58 cfs @ 12.36 hrs, Volume= 15.794 af
 Outflow = 176.29 cfs @ 12.39 hrs, Volume= 15.434 af, Atten= 1%, Lag= 1.8 min
 Primary = 175.67 cfs @ 12.39 hrs, Volume= 15.423 af
 Routed to Pond 11P : Culvert Storage
 Secondary = 0.62 cfs @ 12.39 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,200.61' @ 12.39 hrs Surf.Area= 1.757 ac Storage= 0.933 af

Plug-Flow detention time= 23.3 min calculated for 15.430 af (98% of inflow)
 Center-of-Mass det. time= 10.5 min (807.2 - 796.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,199.50'	8.578 af	Custom Stage Data (Prismatic) Listed below (Recalc)

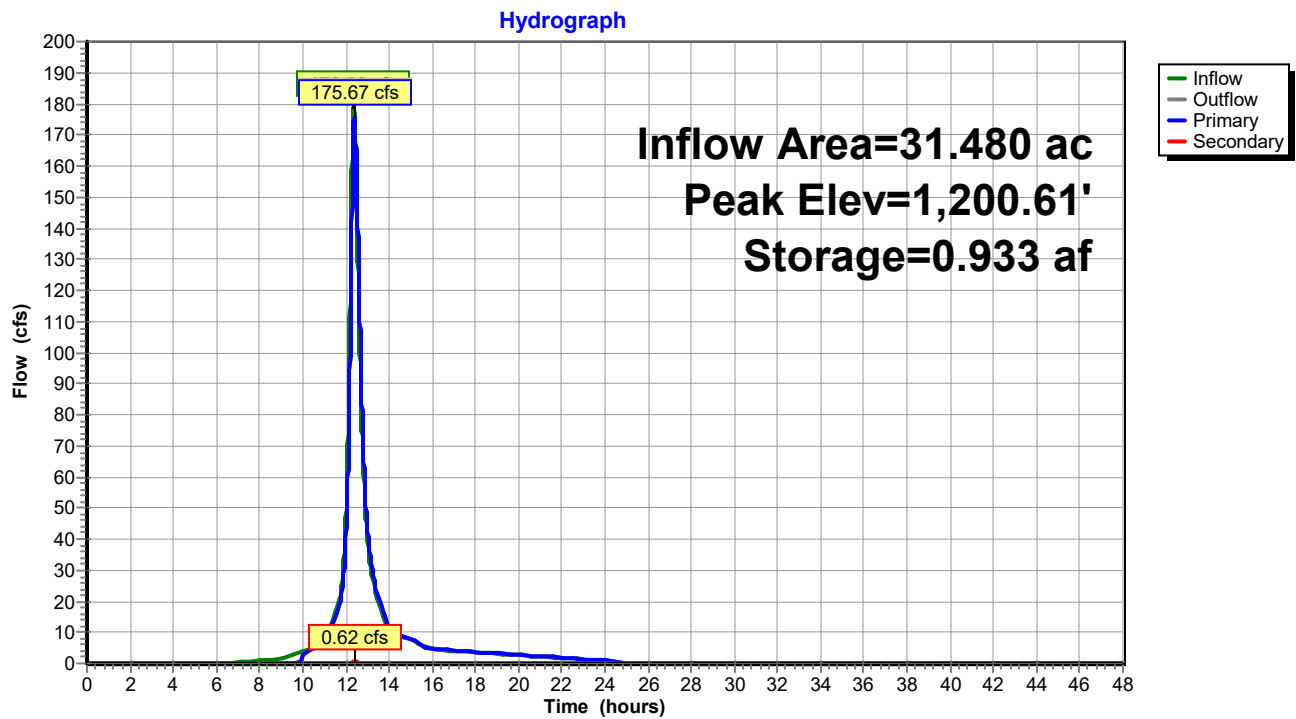
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,199.50	0.000	0.000	0.000
1,200.00	0.724	0.181	0.181
1,201.00	2.430	1.577	1.758
1,202.00	3.650	3.040	4.798
1,203.00	3.910	3.780	8.578

Device	Routing	Invert	Outlet Devices
#1	Secondary	1,200.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.50 1.50 2.50 3.50 Width (feet) 0.00 65.00 230.00 300.00 350.00
#2	Primary	1,200.20'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.80 1.80 Width (feet) 168.00 363.00 650.00

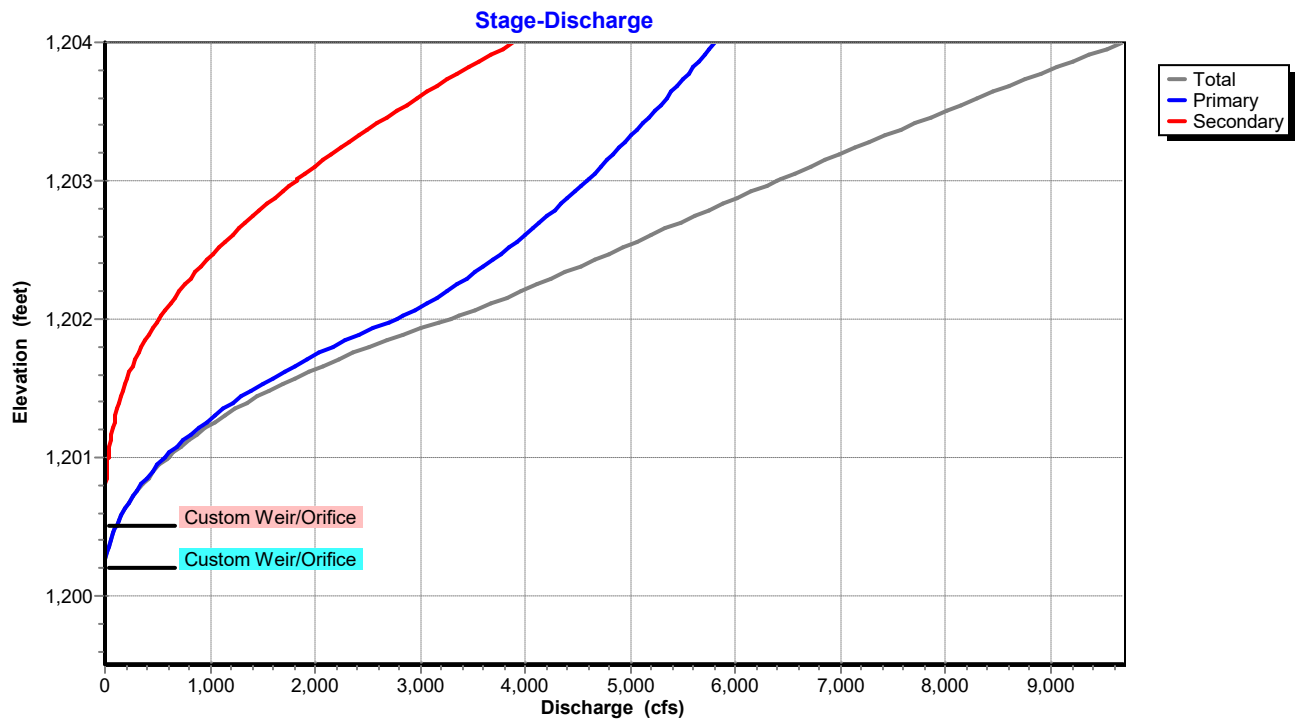
Primary OutFlow Max=175.65 cfs @ 12.39 hrs HW=1,200.61' TW=1,198.02' (Dynamic Tailwater)
 ↑ **2=Custom Weir/Orifice** (Weir Controls 175.65 cfs @ 1.99 fps)

Secondary OutFlow Max=0.62 cfs @ 12.39 hrs HW=1,200.61' (Free Discharge)
 ↑ **1=Custom Weir/Orifice** (Weir Controls 0.62 cfs @ 0.85 fps)

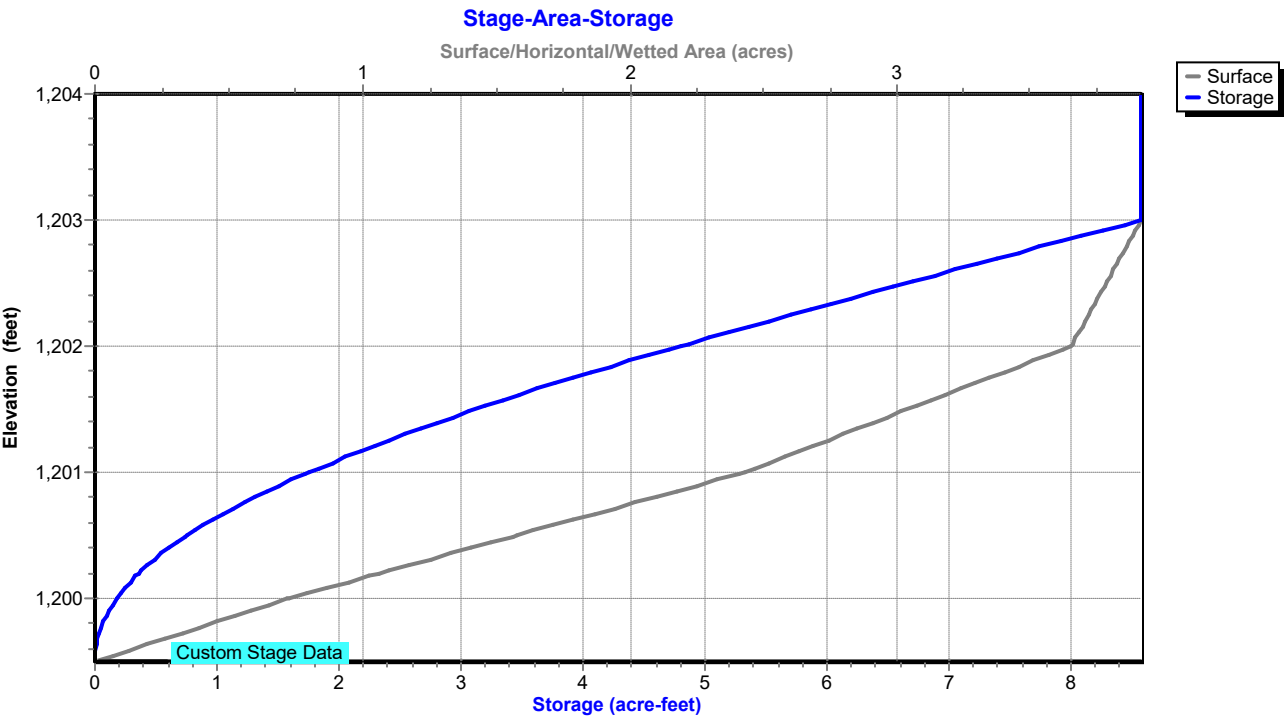
Pond 9P: Northwest Pothole



Pond 9P: Northwest Pothole



Pond 9P: Northwest Pothole



Summary for Pond 11P: Culvert Storage

Inflow Area = 32.680 ac, 0.00% Impervious, Inflow Depth = 5.86" for 100 yr event
 Inflow = 177.96 cfs @ 12.39 hrs, Volume= 15.967 af
 Outflow = 169.79 cfs @ 12.39 hrs, Volume= 15.967 af, Atten= 5%, Lag= 0.0 min
 Primary = 9.91 cfs @ 12.67 hrs, Volume= 5.218 af
 Secondary = 160.89 cfs @ 12.39 hrs, Volume= 10.750 af
 Routed to Pond 5P : Northwest Wetland

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,198.42' @ 12.67 hrs Surf.Area= 0.317 ac Storage= 0.339 af

Plug-Flow detention time= 2.9 min calculated for 15.964 af (100% of inflow)
 Center-of-Mass det. time= 2.9 min (809.5 - 806.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,195.50'	0.555 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
1,195.50	0.000	0.000	0.000
1,196.00	0.016	0.004	0.004
1,197.00	0.096	0.056	0.060
1,198.00	0.230	0.163	0.223
1,199.00	0.434	0.332	0.555

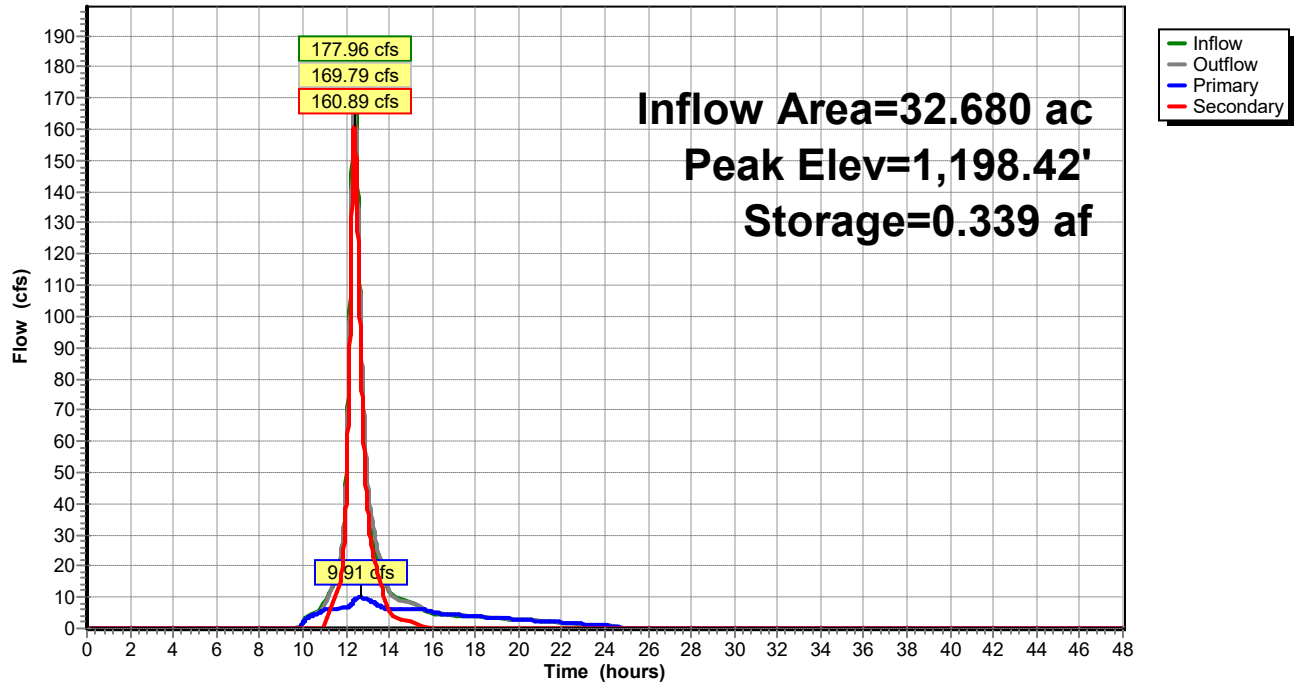
Device	Routing	Invert	Outlet Devices
#1	Primary	1,195.50'	18.0" Round Culvert L= 70.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,195.50' / 1,190.00' S= 0.0786 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.77 sf
#2	Secondary	1,197.10'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.90 1.90 2.90 Width (feet) 250.00 350.00 450.00 522.00

Primary OutFlow Max=9.91 cfs @ 12.67 hrs HW=1,198.42' (Free Discharge)
 ↑1=Culvert (Inlet Controls 9.91 cfs @ 5.61 fps)

Secondary OutFlow Max=0.00 cfs @ 12.39 hrs HW=1,198.00' TW=1,198.02' (Dynamic Tailwater)
 ↑2=Custom Weir/Orifice (Controls 0.00 cfs)

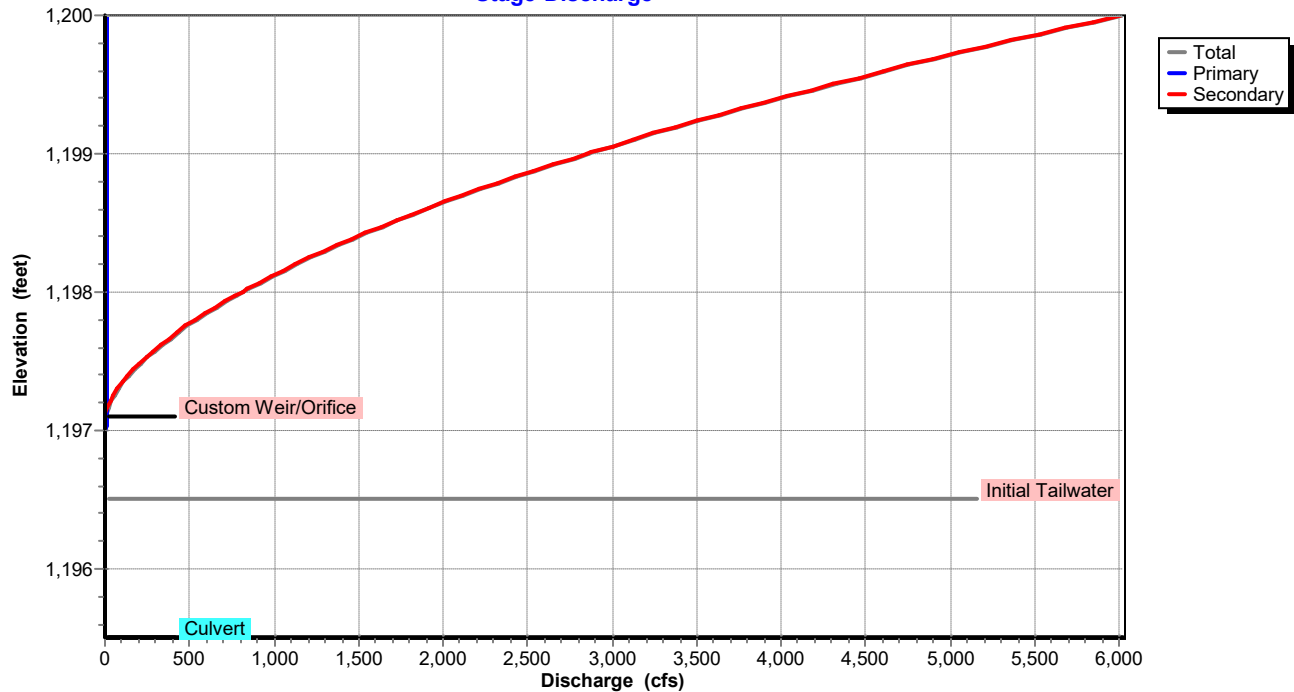
Pond 11P: Culvert Storage

Hydrograph



Pond 11P: Culvert Storage

Stage-Discharge



Pond 11P: Culvert Storage

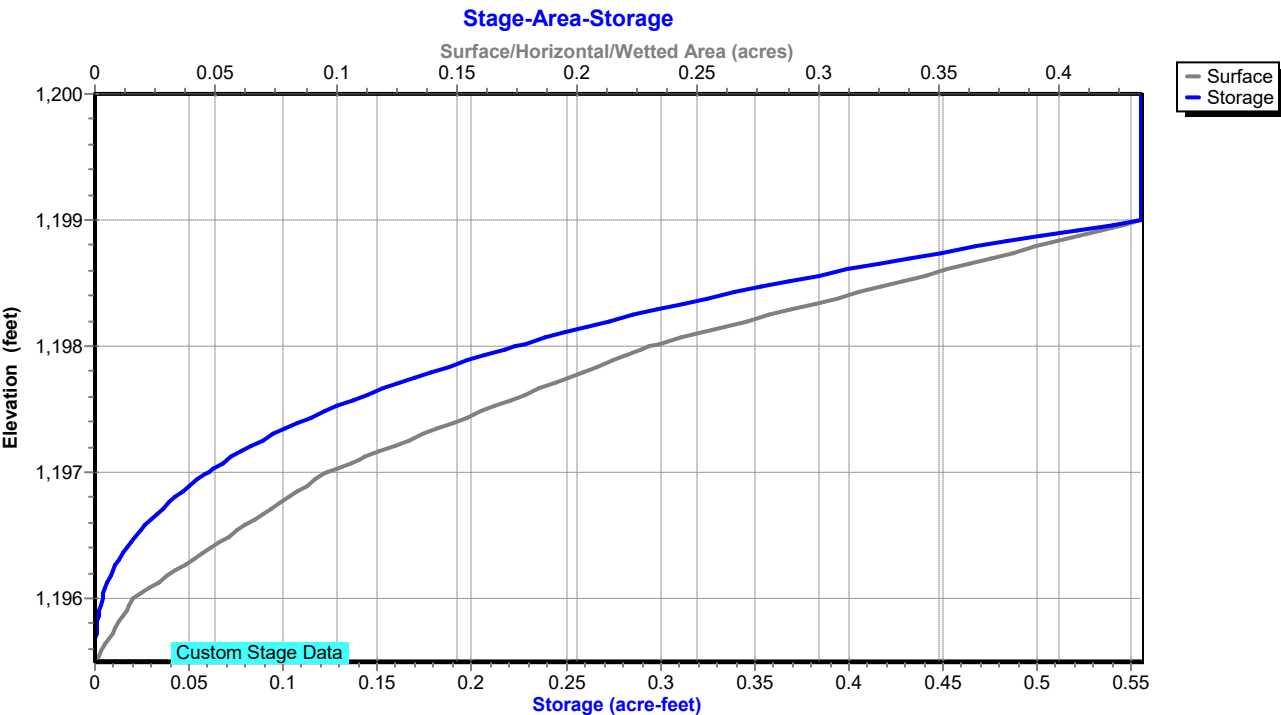


TABLE OF CONTENTS**Project Reports**

- 1 Routing Diagram
- 2 Rainfall Events Listing
- 3 Area Listing (all nodes)

5 Yr Event

- 4 Node Listing
- 5 Subcat 1S: Wetland Watershed
- 6 Subcat 3S: Eastern Watershed
- 7 Subcat 6S: Northwest Offsite Watershed
- 8 Subcat 7S: Southwest Direct Watershed
- 9 Subcat 10S: Northwest Direct Watershed
- 10 Subcat 12S: Culvert Area
- 11 Reach 5R: Out Channel
- 14 Pond 2P: East Pool
- 17 Pond 4P: Culvert Storage
- 20 Pond 5P: Northwest Wetland
- 23 Pond 8P: Southwest Pool
- 26 Pond 9P: Northwest Pothole
- 29 Pond 11P: Culvert Storage

10 Yr Event

- 32 Node Listing
- 33 Subcat 1S: Wetland Watershed
- 34 Subcat 3S: Eastern Watershed
- 35 Subcat 6S: Northwest Offsite Watershed
- 36 Subcat 7S: Southwest Direct Watershed
- 37 Subcat 10S: Northwest Direct Watershed
- 38 Subcat 12S: Culvert Area
- 39 Reach 5R: Out Channel
- 42 Pond 2P: East Pool
- 45 Pond 4P: Culvert Storage
- 48 Pond 5P: Northwest Wetland
- 51 Pond 8P: Southwest Pool
- 54 Pond 9P: Northwest Pothole
- 57 Pond 11P: Culvert Storage

25 yr Event

- 60 Node Listing
- 61 Subcat 1S: Wetland Watershed
- 62 Subcat 3S: Eastern Watershed
- 63 Subcat 6S: Northwest Offsite Watershed
- 64 Subcat 7S: Southwest Direct Watershed
- 65 Subcat 10S: Northwest Direct Watershed
- 66 Subcat 12S: Culvert Area
- 67 Reach 5R: Out Channel

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Table of Contents

Printed 4/10/2026

- 70 Pond 2P: East Pool
- 73 Pond 4P: Culvert Storage
- 76 Pond 5P: Northwest Wetland
- 79 Pond 8P: Southwest Pool
- 82 Pond 9P: Northwest Pothole
- 85 Pond 11P: Culvert Storage

100 yr Event

- 88 Node Listing
- 89 Subcat 1S: Wetland Watershed
- 90 Subcat 3S: Eastern Watershed
- 91 Subcat 6S: Northwest Offsite Watershed
- 92 Subcat 7S: Southwest Direct Watershed
- 93 Subcat 10S: Northwest Direct Watershed
- 94 Subcat 12S: Culvert Area
- 95 Reach 5R: Out Channel
- 98 Pond 2P: East Pool
- 101 Pond 4P: Culvert Storage
- 104 Pond 5P: Northwest Wetland
- 107 Pond 8P: Southwest Pool
- 110 Pond 9P: Northwest Pothole
- 113 Pond 11P: Culvert Storage