



PROJECT HICKORY
BLUEOVAL BATTERY PARK MICHIGAN
STORMWATER IMPACT ANALYSIS

November 13, 2023



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Acronyms	
CATL	Contemporary Amperex Technology Co., Limited
CFS	Cubic feet per second
CN	Curve number
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EV	Electric vehicle
FEMA	Federal Emergency Management Agency
MDOT	Michigan Department of Transportation
OCS	Outlet control structure
ROW	Right-of-way
SSA	Autodesk Storm and Sanitary Analysis 2020
T _c	Time of concentration
USDA	United States Department of Agriculture
USGS	United States Geological Survey

1.0 PROJECT NARRATIVE

The BlueOval Battery Park is a new greenfield site development project with the initial, primary space as the development area used for an Electric Vehicle Battery Manufacturing Facility by Ford Motor Company. A 731.40-acre parcel, as seen in Figure 1, has been identified on the Marshall Mega Site to develop the manufacturing facility.

Figure 1

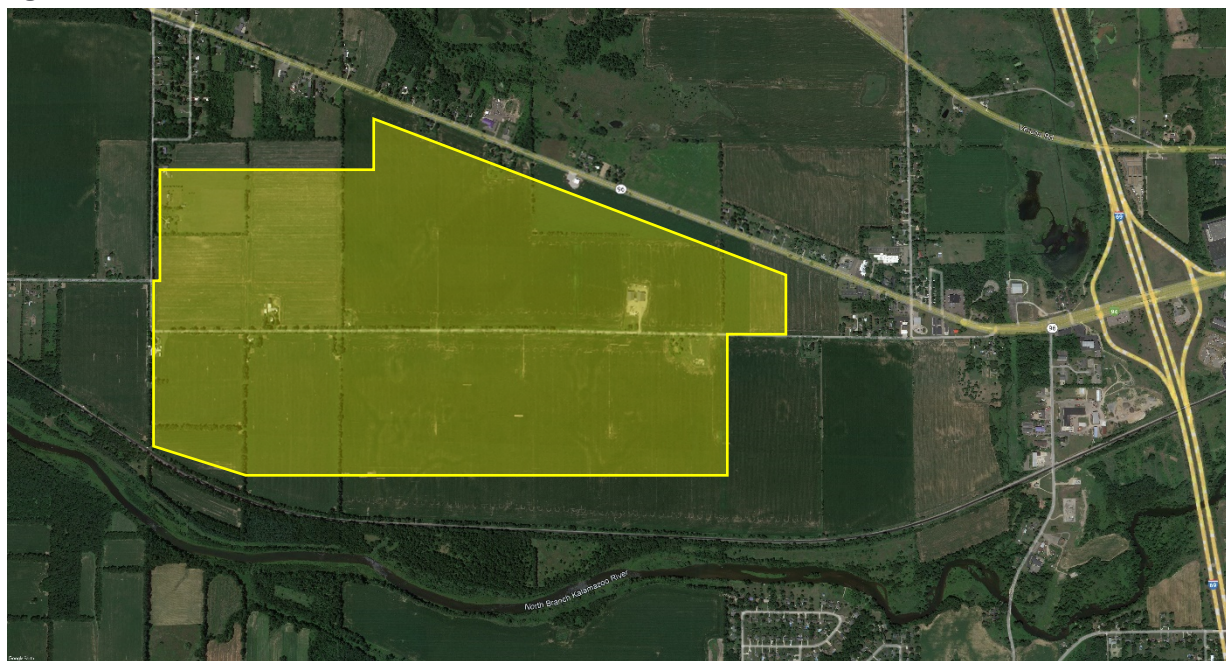


Figure 1: Approximate site area drawn and shaded in yellow.

This will include the main cell plant of approximately 2.3 million square feet, support utility buildings, internal roadways, truck access, parking lots, stormwater infiltration basins, and buffer zones.

1.1 Existing Conditions

The subject property is currently vacant, previously used for agriculture. Ground cover consists largely of tilled fields with minor impervious areas comprised of paving, houses, barns, sheds, and other auxiliary structures. There are no existing floodways or floodplains delineated on the property, and there are no wetlands present on the site.

The existing conditions drainage area map is provided in the site plan drawings on sheet C101.0. Existing topography divides the site into six sub-basins, with two major low points collecting runoff at the south of the site, along the northern edge of the railroad right-of-way. There are existing culverts at both locations. These existing drainage structures are in severe disrepair with highly compromised conveyance capacity. They are also outdated and undersized compared to the large amounts of

runoff directed to them. The other smaller sub-basins either drain towards the north or sheet flow south toward the river.

Existing soils classified using the United States Department of Agriculture (USDA) Web Soil Survey shows the site having a predominant hydrologic rating of Class C soils with smaller areas of Class A soils. For design purposes, a weighted curve number (CN) was calculated based on the hydrologic soil group and the existing agricultural land use. Infiltration rates were also studied at nine locations in the vicinity of the proposed infiltration basins, yielding a median infiltration rate of 0.50 inch/hour. Per the Michigan Department of Environment and Great Lakes and Energy (EGLE) stormwater requirements and the Calhoun County & Battle Creek Area Stormwater Management Program: Technical Reference Manual, an allowable infiltration rate of 0.25 inch/hour is being used for design calculations.

1.2 Proposed Conditions

This project proposes to remove the existing culverts and replacing with new and properly sized drainage culverts adjacent to them. These improvements are being submitted to the Michigan Department of Transportation (MDOT) and Amtrak for review and approval prior to construction.

The proposed conditions drainage area maps are provided in the site plan drawings on sheets C101.1 – C101.3. In post-development conditions, much of the runoff from sub-basins currently draining north will be redirected to flow south, towards the proposed infiltration basin. The remainder of these areas will be acquired by MDOT, and the associated runoff will be managed by the future roadway improvements to Michigan Avenue.

1.2.1 Temporary Stormwater

As stated, the two drainage culverts at the site's existing low points will need replacing. To temporarily manage stormwater during the construction phase while the new culverts are designed and installed, Infiltration Basin #1, an onsite permanent infiltration basin, will discharge into Infiltration Basin #2, an offsite temporary infiltration basin via a connecting drainage swale.

Infiltration Basin #2 is situated to the east of the project. All runoff up to and including the 100-year dearainfall event will be captured and managed using storage provided in both Infiltration Basin #1 and Infiltration Basin #2. Infiltration Basin #2 will have an emergency spillway that discharges towards Bear Creek should rainfall exceed the 100-year storm event. Otherwise, all stormwater runoff will be entirely captured and allowed to infiltrate back into the ground using the basins provided during the temporary condition.

1.2.2 Permanent Stormwater

Once the new culverts at the railroad are constructed and can serve as permanent discharge points to the river, the connecting channel between Infiltration Basin #1 and Infiltration Basin #2 will be

taken offline and a permanent emergency overflow spillway will be created at Infiltration Basin #1. The eastern portion of the temporary channel will be filled in, with any denuded areas being brought to finish grade and stabilized to establish vegetation. The western portion of the temporary channel will be connected to Infiltration Basin #1 and to Culvert 2 to create a permanent channel for the emergency overflow spillway.

Water Quantity

For all rainfall events up to and including the 100-year storm, runoff will be attenuated to be equal to or less than pre-development rates. The post-development condition accounts for runoff at the full buildout of the project, including any proposed impervious area that may be added in future development. Refer to the plan set for the limits of project area. Project area is considered fully developed in the current modeling calculations (CN number of 91 for urban industrial, 72% impervious with C soils).

Per EGLE requirements for point discharges into the Kalamazoo River, natural vegetative stabilization practices will be utilized to prevent erosion along the existing drainage course to the riverbank. This includes using stone, seeding, and stabilization matting downstream of the proposed stormwater conveyances.

The runoff analysis results for both analysis points are seen in Table 1. The analysis was performed for 2, 5, 10, 25, and 100-year storm events. Analysis point 1 includes both detained and un-detained runoff in the analysis. With the proposed basin, the post-development conditions have lower runoff peak discharge rates at analysis point 1. The results of the post-development modeling without the basin yield runoffs of 1,000 cfs and greater. These results illustrate the necessity of the proposed infiltration basin. Note, that because analysis point 2 is not subject to a permanent stormwater basin there is no difference in results for both post-development models. The full model results and hydrographs can be seen in Appendices A and B. Appendix B also includes separate weir calculations for the riser for each storm event that show the riser controlling the basin outflow for the 2-year, 5-year, 10-year and 25-year storm events. The 72-inch riser barrel controls flow for the 100-year storm event.

It is proposed that Infiltration Basin #2 will likely remain in place for future development, with the overflow spillway discharging to the east into Bear Creek. A significant portion of the existing drainage area to analysis point 2 is captured by Infiltration Basin #2. However, to more conservatively size the culvert at under the railroad at analysis point 2, it is assumed for the calculation that Infiltration Basin #2 will not remain in place, given the unknown nature of the future development.

Table 1 Stormwater Runoff Peak Flow Analysis (cfs)					
Development Stage	Storm Interval (year)				
Cumulative Rainfall (inches)	2.57	3.38	3.60	4.30	5.60
Pre-Development	2-year	5-year	10-year	25-year	100-year
Analysis Point 1 ^a	95.76	186.69	213.46	305.56	489.51
Analysis Point 2 ^b	60.38	116.52	133.03	189.46	301.63
Post-Development (no-Basin)	2-year	5-year	10-year	25-year	100-year
Analysis Point 1 ^c	1116.68	1632.58	1773.46	2228.55	3073.03
Analysis Point 2 ^d	58.23	110.00	125.36	177.33	280.24
Post-Development (With Basin)	2-year	5-year	10-year	25-year	100-year
Analysis Point 1 ^e	23.32	81.40	105.81	206.38	448.17
Analysis Point 2 ^d	58.23	110.00	125.36	177.33	280.24

Table 1: Comparison of stormwater runoff volumes (cfs) at each culvert analysis point. Analysis performed for pre-development, post-development (no basin), and post-development (with basin) conditions during the 2, 5, 10, 25, and 100-year storms.

a. From Subbasin Summary – Drainage_Area_3 in SSA report

b. From Subbasin Summary – Drainage_Area_4 in SSA report

c. From Node Summary – Infiltration_Basin_1 + Ditch_Start_East + Ditch_Start_West in SSA report

d. From Node Summary – Culvert_2_Inlet in SSA report

e. From Node Summary – 12'_DIA_MANHOLE in SSA report

Four of the six drainage areas included in the pre-development analysis have not been compared to post-development conditions. Those four areas were not analyzed because either there was no change in the post-development condition, or the drainage areas were greatly reduced by redirecting runoff to Infiltration Basin #1, eliminating the need for further analysis.

Water Quality

To meet the City of Marshall Stormwater Management Plan requirements for stormwater treatment, dated 3-31-2016, Infiltration Basin #1 is designed to capture and infiltrate the greater of the following:

- First flush volume; the runoff from one inch of rain over the entire developed site as determined using the composite runoff coefficient for developed conditions. This is calculated as follows:
 - $VWQ = 1/12 * Am * C$;

Where:

VWQ = Water Quality Volume (cubic feet)

A_m = Total Site Area (square feet)

C = Weighted Runoff Coefficient

$$\text{VWQ} = 1/12 * 33,182,265 * 0.9 = 2,488,670 \text{ cubic feet}$$

- Channel Protection Volume (CPV); The difference between the pre-development 2-year/24-hour and post development 2-year/24-hour runoff volumes. The pre-development CN is 73 and the post-development CN is 91. From TR-55:

$$V_r = 1/12 * A * [P - (0.2 * S)]^2 / [P + (0.8 * S)]$$

Where:

V_r = runoff (cf)

A = Area of land use (ft²)

P = rainfall (in.)

$S = (1000/CN) - 10$

CN = Curve number

$$\begin{aligned} V_e &= 1/12 * 33,182,265 * [2.57 - (0.2 * 3.7)]^2 / [2.57 + (0.8 * 3.7)] = 1,675,398 \text{ cf} \\ V_p &= 1/12 * 33,182,265 * [2.57 - (0.2 * 1.0)]^2 / [2.57 + (0.8 * 1.0)] = 4,629,468 \text{ cf} \\ \text{CPV} &= V_p - V_e = 2,954,070 \text{ cubic feet} \end{aligned}$$

The Infiltration Basin #1 outlet structure riser is designed to treat the CPV with an outlet elevation set at 900.80' with a cumulative storage volume of 3,671,540 cubic feet at that elevation.

Infiltration test results have been provided in a letter from SME dated August 9, 2023. Six test pits and four infiltration tests were taken at Infiltration Basin #1. Test results varied widely with some results less than ¼ inches/hour and others greater than 10 inches/hour. Given the widely varying test results and the very large basin size, the assumed infiltration is conservatively selected to be 0.25 inches/hour. This rate is consistent with the USGS hydrologic group C soils where the basin is constructed. The Calhoun County Stormwater Management Program: Technical Resource Manual (TRM), dated May 2020, allows for underdrains to be used when the infiltration rate is less than 0.4 inches/hour to dewater the basin within 48 hours. An underdrain dewatering calculation is provided in Appendix I. The underdrain design flow is controlled by a 6-inch sand layer above the underdrain. The permeability of the sand is assumed to be 40 ft/day. The resulting requirement for the surface area of the sand layer is 4,653 sf.

1.2.3 Stormwater Conveyance

Stormwater runoff from rooftops, roads, parking lots, and open spaces will be collected into a series of stormwater conveyance systems including open channels, curb-and-gutter, catch basins, pipe networks, and deep stormwater trunk lines, which ultimately discharge into Infiltration Basin 1. The stormwater pipe network is designed to convey the 10-year storm event within the of pipe. Channels and ditches are designed to contain the 25-year storm within the top of bank. The 25-year storm will also be retained within catch basin structures. The stormwater conveyance calculations include the

analysis of numerous catchment areas for each structure. A summary of the Autodesk Storm and Sanitary Analysis model results for stormwater conveyance are located in Appendix C.

The results for inflow into Infiltration Basin #1 from the stormwater conveyance calculations vary from the results of the permanent stormwater calculations. This result is expected, given the numerous catchment areas used for the stormwater conveyance analysis and the resulting differences in times to peak at the study point. The analysis method used for permanent stormwater results in higher peak flows and is appropriately conservative for sizing of the infiltration basin.

1.3 Hydraulic Analysis at Wetland W-4

Analysis Point 1 is located approximately 500 feet upslope from Wetland W4. Additional runoff accumulating between Analysis Point 1 and Wetland W4 was determined to be negligible. The post-development condition with the basin was used for the analysis. Cross sections were taken at 100-foot intervals in the natural channel between Analysis Point 1 and Wetland W4. Wetland W4 is located approximately at cross section 1+00, as shown in Appendix J.

Manning's Equation was used to determine the hydraulic condition at Wetland W4 for the 2-year, 10-year, 25-year and 100-year, 24-hour storm events as detailed in the attached Worksheets. Results are summarized in Table 2. It should be noted that Wetland W4 is in the Kalamazoo River FEMA 100-year floodplain and the hydraulic conditions at the wetland for the 100-year storm interval are controlled by the flood event, which is not included in this analysis. The allowable velocity in a grass lined channel is typically 5-8 ft/s depending on soil type and grass cover (Table 8-4 of USDA NRCS Part 654 Stream Restoration Design National Engineering Handbook). Based on the results provided in Table 2, the velocities at Wetland W4 are non-erosive for all analyzed storm events.

Table 2 Hydraulic Condition at Wetland W4			
Storm Interval (year)	Discharge (cfs)	Normal Depth (in)	Velocity (ft/s)
2-year	23.32	4.1	1.46
10-year	105.81	7.3	2.65
25-year	206.38	10.0	3.44
100-year	448.17	13.0	4.62

Table 2: Hydraulic condition at Wetland W4 for the 2-year, 10-year, 25-year, and 100-year using Manning's equation.

2.0 MODELING VARIABLES

The hydrologic and hydraulic analysis was performed in Autodesk Storm and Sanitary Analysis 2020 (SSA). The modeling considered the existing topography, land cover, soil conditions, and storm patterns for the project site.

Based on existing topography, the pre-development site was divided into six subbasins. The post-development site was divided into five subbasins based on preliminary grading and use. The proposed developed area, the proposed infiltration basin area, the offsite undeveloped area, and culvert 1 rail crossing were all assigned individual subbasins. These areas can be seen in the stormwater plan submittal set. These drawings were then imported into SSA for modeling.

2.1 Time of Concentration (Tc)

The time of concentration is the sum of travel time through the upstream reaches. For this modeling, TR-55 was used which utilizes the following formula: $T_c = \frac{[0.007(nL)^{0.8}]}{(P_2^{0.5}S^{0.4})}$

2.1.1 Permanent Stormwater Analysis Methodology

In Civil 3D, the Tc path was drawn according to the contours and longest path within the subbasin to its drain. This length was entered into the respective SSA subbasin properties. Slope of the line was determined by identifying the elevations at the beginning and end of the Tc path. To increase accuracy, subareas were created along this Tc path by providing different line lengths and slopes in areas of significant grade change.

TR-55 method contains different flow types for its Tc path: sheet flow, shallow concentrated flow, and channel flow. Per the USDA “TR 55 Worksheet 3: Time of Concentration (Tc) or Travel Time (Tt)” document, flow length for sheet flow can only be 100 feet maximum. After the first 100 feet, the path lengths and slope were calculated using the shallow concentrated flow tab.

Additionally, the Tc analysis requires a storm input. For this modeling, a 2-year, 24-hour storm was used. Based on the storm, slope, and length inputs, SSA uses the TR-55 Tc calculation to output a Tc time. For subbasins divided into Tc subareas, these times are summed to generate a Tc time for the entire subbasin. These inputs are represented in Figure 2 below:

Figure 2

Subbasins

General
Subbasin ID: Drainage_Area_2
Connectivity
Rain gage: 24hr2yr
Outlet node: DA_2
Peak rate factor: 484
Delete
Show
Report

Description:

Physical Properties SCS TR-55 TOC Curve Number

SCS TR-55 time of concentration
Methodology:
☐ Average
☐ Maximum
☐ Minimum
☒ Summation
☐ Weighted average

Sheet Flow
Manning's roughness: .06
Flow length: 100 ft
Slope: .05 %
2yr-24hr rainfall: 2.53 in
Computed flow time: 23.15 min

Shallow Concentrated Flow
Subarea A
Subarea B
Subarea C

Channel Flow
Subarea A
Subarea B
Subarea C

TOC Report
Subarea A
Subarea B
Subarea C

Total TOC: 37.83 min Percent area: % % %

Subbasin ID /	Area	Peak Rate Factor	Wt. CN	TOC	Rain Gage ID
1 Drainage_Area_1	48.760	484	73.00	23.62	24hr2yr
2 Drainage_Area_2	56.230	484	73.00	37.83	24hr2yr
3 Drainage_Area_3	452.080	484	74.08	98.88	24hr2yr
4 Drainage_Area_4	206.820	484	74.56	68.11	24hr2yr
5 Drainage_Area_5	63.550	484	73.00	41.93	24hr2yr
6 Drainage_Area_6	31.810	484	73.00	44.72	24hr2yr

Close Help

Figure 2: SSA subbasin Tc input menu. The input storm, lengths, and slopes yield a total Tc for the site. Flow is designated as sheet flow for the first 100 feet of the path and then shallow concentrated flow for the remainder.

All assigned Tc values can be seen in Appendices A and B.

2.1.2 Stormwater Conveyance Analysis Methodology

The TR-55 minimum Tc of 6 minutes is assumed for the smaller catchment areas within the project areas that have been graded, which are largely impervious. For larger areas of future development and for offsite areas, a Tc of 10 minutes or 20 minutes was assumed based on the size of the catchment.

2.2 Curve Number (CN)

The curve number is a dimensionless variable used in predicting stormwater runoff for a drainage basin. This number is dependent on hydrologic soil group, soil condition, and land use.

2.2.1 Permanent Stormwater Analysis Methodology

Each individual subbasin in SSA allow for multiple CN number inputs with a corresponding area input. SSA provides a curve number selection menu. The system provides CN numbers for all hydrologic soil groups for uses and conditions that includes developed, agricultural, and undeveloped land. The subbasin CN and CN selection menu screens can be seen in Figure 3 below:

Figure 3

Subbasins

General
Subbasin ID: Drainage_Area_5
Connectivity: 24hr2yr
Rain gage: DA_5
Outlet node: 484
Peak rate factor: 484

Description:

Physical Properties: SCS TR-55 TOC Curve Number

Composite curve number

	Area (ac)	Area (%)	Curve Number	Soil Group	Description
1	63.5500	100.00	73	B	Small grain, contoured, Good
2					
3					
4					
5					
6					

Total area: 63.550 ac Total area: 100.00 % Weighted CN: 73.00

Subbasin ID	Area	Peak Rate Factor	Wt. CN	TOC	Rain Gage ID
1 Drainage_Area_1	48.760	484	73.00	23.62	24hr2yr
2 Drainage_Area_2	56.230	484	73.00	37.83	24hr2yr
3 Drainage_Area_3	452.080	484	74.08	98.88	24hr2yr
4 Drainage_Area_4	206.820	484	74.56	68.11	24hr2yr
5 Drainage_Area_5	63.550	484	73.00	41.93	24hr2yr
6 Drainage_Area_6	31.810	484	73.00	44.72	24hr2yr

Select Curve Number

Select curve number from table

Description	Condition	A	B	C	D	Condensed Description
33 Crop residue (CR)	Good	74	83	88	90	Fallow, crop residue, Good
34 Row crops						
35 Straight row (SR)	Poor	72	81	88	91	Row crops, straight row, Poor
36 Straight row (SR)	Good	67	78	85	89	Row crops, straight row, Good
37 SR + Crop residue	Poor	71	80	87	90	Row crops, SR + CR, Poor
38 SR + Crop residue	Good	64	75	82	85	Row crops, SR + CR, Good
39 Contoured (C)	Poor	70	79	84	88	Row crops, contoured, Poor
40 Contoured (C)	Good	65	75	82	86	Row crops, contoured, Good
41 C + Crop residue	Poor	69	78	83	87	Row crops, C + CR, Poor
42 C + Crop residue	Good	64	74	81	85	Row crops, C + CR, Good
43 Contoured & terraced (C&T)	Poor	66	74	80	82	Row crops, C&T, Poor
44 Contoured & terraced (C&T)	Good	62	71	78	81	Row crops, C&T, Good
45 C&T + Crop residue	Poor	65	73	79	81	Row crops, C&T + CR, Poor
46 C&T + Crop residue	Good	61	70	77	80	Row crops, C&T + CR, Good
47 Small grain						
48 Straight row (SR)	Poor	65	76	84	88	Small grain, straight row, Poor
49 Straight row (SR)	Good	63	75	83	87	Small grain, straight row, Good
50 SR + Crop residue	Poor	64	75	83	86	Small grain, SR + CR, Poor
51 SR + Crop residue	Good	60	72	80	84	Small grain, SR + CR, Good
52 Contoured (C)	Poor	63	74	82	85	Small grain, contoured, Poor
53 Contoured (C)	Good	61	73	81	84	Small grain, contoured, Good
54 C + Crop residue	Poor	62	73	81	84	Small grain, C + CR, Poor
55 C + Crop residue	Good	60	72	80	83	Small grain, C + CR, Good
56 Contoured & terraced (C&T)	Poor	61	72	79	82	Small grain, C&T, Poor
57 Contoured & terraced (C&T)	Good	59	70	78	81	Small grain, C&T, Good
58 C&T + Crop residue	Poor	60	71	78	81	Small grain, C&T + CR, Poor
59 C&T + Crop residue	Good	58	69	77	80	Small grain, C&T + CR, Good
60 Close-seeded legumes/rotated meadow						
61 Straight row	Poor	66	77	85	89	Legumes, straight row, Poor
62 Straight row	Good	58	72	81	85	Legumes, straight row, Good
63 Contoured	Poor	64	75	83	85	Legumes, contoured, Poor
64 Contoured	Good	55	69	78	83	Legumes, contoured, Good

Figure 3: CN selection menus. Selection is based on the soil group, soil condition, and land use.

To determine the soil group for the pre-development conditions, the soil report for the site was consulted, as seen in Appendix E. Based on the report, 86.9% of the site is comprised of soil group C. Due to this majority, and to provide a more conservative estimate, all subbasins in the pre-development modeling were assigned a curve number based on soil group C. An investigation of the site determined that the soil condition is good and that the use falls under “Cultivated Agricultural Land”, specifically the “Row Crops - C + Crop residue” as seen in Figure 3. These factors yielded a CN value of 81 for all pre-development subbasins.

The post-development CN values do not have the same values for all subbasins as the pre-development conditions do. Due to the proposed work, developed portions of the site are assumed to be C soil group, urban industrial use. This results in a CN of 91, reflecting more runoff. Another subbasin represents the proposed infiltration pond. This area will have a significant water surface and infiltration properties. Therefore, this area has been assigned a soil group of A and a use of >75% grass cover, good condition. The infiltration pond subbasin has a CN of 39. Remaining portions of the site that will be undeveloped are assigned the same properties as the pre-development subbasins.

All assigned CN values can be seen in Appendices A and B.

2.2.2 Stormwater Conveyance Analysis Methodology

Stormwater conveyance drainage areas are based on the proposed developed condition and are typically smaller in area. The CN values for the proposed development are based on the known land

cover and soil type. Outlying areas where future development is proposed are assumed to be C soil group, urban industrial use, resulting in an assumed CN of 91.

2.3 Hydrographs

The hydrograph is a visual representation of cumulative rainfall over time for a storm event. This information is dependent on location and duration of the storm event. The rainfall designer is the SSA menu to compute the subbasin storm input for modeling. The rainfall designer utilizes hydrographs, location, and desired return period.

2.3.1 Permanent Stormwater Analysis Methodology

This analysis used the SCS Type II 24-hour hydrographs. The highest peak discharges are usually caused by intense, brief rainfalls. The National Resource Conservation Service (NRCS) developed four rainfall distributions from local storm data. Type II is the most intense, short duration rainfall. Therefore, for conservative modeling, Type II was chosen for this model.

Figure 4 shows the source of the rainfall inputs assigned to the subbasins for both pre- and post-development modeling:

Figure 4

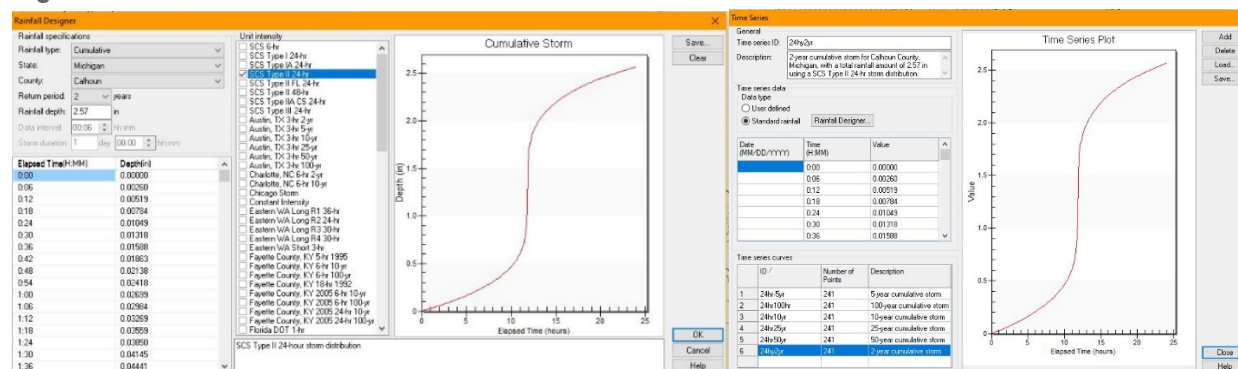


Figure 4: Rainfall designer menus. Output rainfall depth is assigned to all subbasins for both pre- and post-development conditions. SCS Type-II 24-hour selected for conservative modeling. Calhoun County, Michigan was set as the location, and 2-year was selected as the return period.

2.3.2 Stormwater Conveyance Analysis Methodology

The hydrograph methodology for the stormwater conveyance analysis is identical to the hydrograph methodology for the permanent stormwater analysis.

3.0 STORMWATER FACILITIES

3.1 Railroad Culvert Design

Culvert 1 and Culvert 2 will be replaced with new culverts. The proposed culverts were designed according to current Amtrak and MDOT design standards. The standards require pipes crossing under Amtrak tracks to carry the runoff from a 100-year storm. The Culvert 1 and Culvert 2 culvert replacements will be 72-inch inside diameter and made of CMP pipe, as specified by the Amtrak and MDOT design standards. This 72-inch diameter was sized to convey the 10-year storm event within the crown of the pipes, to convey the 25-year storm event below the rim elevation of the structures, and to maintain headwater for the 100-year storm below the railroad ties. HY-8 calculations for Culvert 1 and Culvert 2 are provided in Appendix F.

The length of pipes differs in Culverts 1 and 2. However, both will be installed by open-cut per Amtrak construction standards. The new culverts will be installed at the same location as the old culverts and the existing culverts will be removed.

Culvert 1 originates upstream at the proposed infiltration basin at an outlet control structure (OCS) that feeds into 201 feet of pipe sloped at 2.29% into a 12-foot diameter manhole. This manhole acts as inflow structure for the depressional area between the railroad tracks and infiltration basin 1 designated as Drainage Area 1-B (East & West). The culvert pipe then proceeds 117 feet at a slope of 2.06%. Culvert 1 ends at a headwall and transitions to the plunge pool. The culvert begins and terminates beyond the railway right-of-way (ROW) limits.

Culvert 2 begins and terminates ~5 feet outside of the railway ROW. This culvert is not connected to any permanent infiltration basin, therefore the structures starting and ending this culvert are headwalls. The culvert is 111 feet of pipe sloped at 1.45%.

3.2 Infiltration Basin Emergency Spillway

The TRM requires that all detention basins shall include an emergency overflow that can accommodate the 100-year peak detention basin inflow rate (i.e. 100-year peak flow calculated for developed conditions without detention). This analysis is provided for the City of Marshall and is not a requirement of MDOT or Amtrak. This requirement is equivalent to designing the spillway for a back-to-back 100-year storm event or a single storm that would be greater than the 1,000-year event. The analysis is for the purpose of sizing the spillway and protecting the basin embankment and the resulting flow rates are not appropriate for designing downstream culverts or other structures.

The emergency spillway for Infiltration Basin #1 is a 350-foot overflow weir on the east end of the basin connected to a channel that directs flow to Culvert 2. During the normal 100-year storm event, the maximum water surface elevation in the basin is below the spillway and no flow is directed to Culvert 2. The calculation for the emergency spillway is located in Appendix H. The spillway

receiving channel calculation is also provided in Appendix H, with capacity evaluated for the 100-year un-detained storm event and erosion evaluated for the 25-year storm event.

The HY-8 analysis of Culvert 2 in Appendix F includes an analysis of the 100-year peak flow for developed conditions without detention. This peak flow rate is identified as the 500-year storm in the HY-8 report; however, the flow rate used is the detention basin inflow for the 100-year storm event. The existing topography around the Culvert 2 inlet will direct floodwaters over the railroad prior to flowing to the east or west to other outlet locations. Additional grading was provided to the east of Culvert 2 to allow the overflow to reach Bear Creek. However, the slope to the east is essentially flat and the shallow cross-sectional areas available will only allow for a small fraction of the flow to reach Bear Creek (~50-100 cfs). The existing railroad profile was included in the HY-8 model for the roadway data. The resulting analysis shows that the 100-year peak flow for developed conditions without detention flows over the railroad at a depth of approximately 8-inches.

3.3 Plunge Pool Sizing

Headwalls and plunge pools have been added to the outfall structures at culverts 1 and 2. These devices will function to break up the flow regimes of the outfall pipes and their associated structures. This dispersion will more mimic the natural and historic flows through the existing channels to the Kalamazoo River channel. The minimum dimensions for each plunge pool were calculated following *USDOT FHA Hydraulic Engineering Circular No. 14, Third Edition Hydraulic Design of Energy Dissipators for Culverts and Channels* (HEC-14). The HEC-14 plunge pool calculations for both culverts are located in Appendix G.

3.4 Post Construction & Additional Stormwater Treatment Measures

In the permanent and final site condition, Infiltration Basin #1 will serve as the primary stormwater treatment and volume control measure. However, there are several additional stormwater control measures and practices that will be implemented throughout the site as the overall project design progresses. These additional measures will include infiltration ditches along roadways, landscape islands with bio-retention swales and sumps provided in catch basins throughout the stormwater pipe networks. These devices will provide measures of pre-treatment of the stormwater before it reaches the primary infiltration basin. They will also facilitate in an overall reduction of runoff by allowing stormwater to infiltrate into the ground.

Infiltration ditches will be constructed using grassy areas and shallow ditches that encourage stormwater infiltration. Where practical, they will be placed within the grass median of the ring-road and along the road shoulders. These infiltrating ditches will help to recharge groundwater and filter out sediment, reducing the volume and improving the quality of stormwater runoff.

Bio-retention swales will be provided throughout the parking lot landscaped islands and in some areas of the parking lot perimeter. Stormwater will be directed to sheet flow towards the bio-retention swales from the adjacent paved areas and evenly load runoff throughout the length of the device. As stormwater flows through the bio-retention swales, the soil and plants will help to remove sediments, improving the quality of the runoff before it enters the receiving groundwater. Excess flows from these areas will be captured using catch basins connected to the stormwater pipe drainage network, and ultimately conveyed to the primary infiltration basin. Bio-swales will be placed where practical in perimeter landscaped areas to aid in additional stormwater treatment, while conveying runoff to the stormwater network.

Catch basins used throughout the stormwater pipe network will have sumps provided at the base of each structure. Sumps help to provide additional storage capacity, allowing sediment to settle before the water is slowly released or directed to other treatment measures. This helps to prevent excessive stormwater runoff and minimize the transport of sediment downstream.

Collectively, these stormwater treatment measures will play a crucial role in improving the quality of stormwater runoff from the proposed buildings, parking lots, ring road, and other project areas. They aid in the removal of sediment and the recharge of groundwater. The specific design details for these measures will be developed as the project progresses and will be included in future construction drawing submittals to the City of Marshall for review and to ensure continued compliance with stormwater management regulations and standards.

Appendix A.
Autodesk Storm and Sanitary Analysis – Permanent Stormwater Existing
Condition

Project Description

File Name PreDevelopment Condition_9_22_2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 6
Subbasins..... 6
Nodes..... 6
 Junctions 0
 Outfalls 6
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	24hr100yr	Time Series	24hr100hr	Cumulative	inches					User Defined
2	24hr25yr	Time Series	24hr25yr	Cumulative	inches					User Defined
3	24hr2yr	Time Series	24hy2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
4	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
5	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches					User Defined
6	24hy10yr	Time Series	24hr10yr	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	48.76	484.00	73.00	2.57	0.61	29.55	25.92	0 00:23:37
2	Drainage_Area_2	56.23	484.00	73.00	2.57	0.61	34.08	21.85	0 00:37:49
3	Drainage_Area_3	452.08	484.00	74.08	2.57	0.65	294.30	95.76	0 01:38:52
4	Drainage_Area_4	206.82	484.00	74.56	2.57	0.67	138.98	60.38	0 01:08:06
5	Drainage_Area_5	63.55	484.00	73.00	2.57	0.61	38.51	22.95	0 00:41:55
6	Drainage_Area_6	31.81	484.00	73.00	2.57	0.61	19.28	10.94	0 00:44:43

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Peak Attained	Time of Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Analysis_Point_1	Outfall	884.00					0.00	0.00					
2	Analysis_Point_2	Outfall	900.00					0.00	0.00					
3	DA_1	Outfall	900.00					0.00	0.00					
4	DA_2	Outfall	900.00					0.00	0.00					
5	DA_5	Outfall	900.00					0.00	0.00					
6	DA_6	Outfall	900.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	48.76
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Legumes, C&T, Poor	48.76	B	73
Composite Area & Weighted CN	48.76		73

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{(2/3)}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

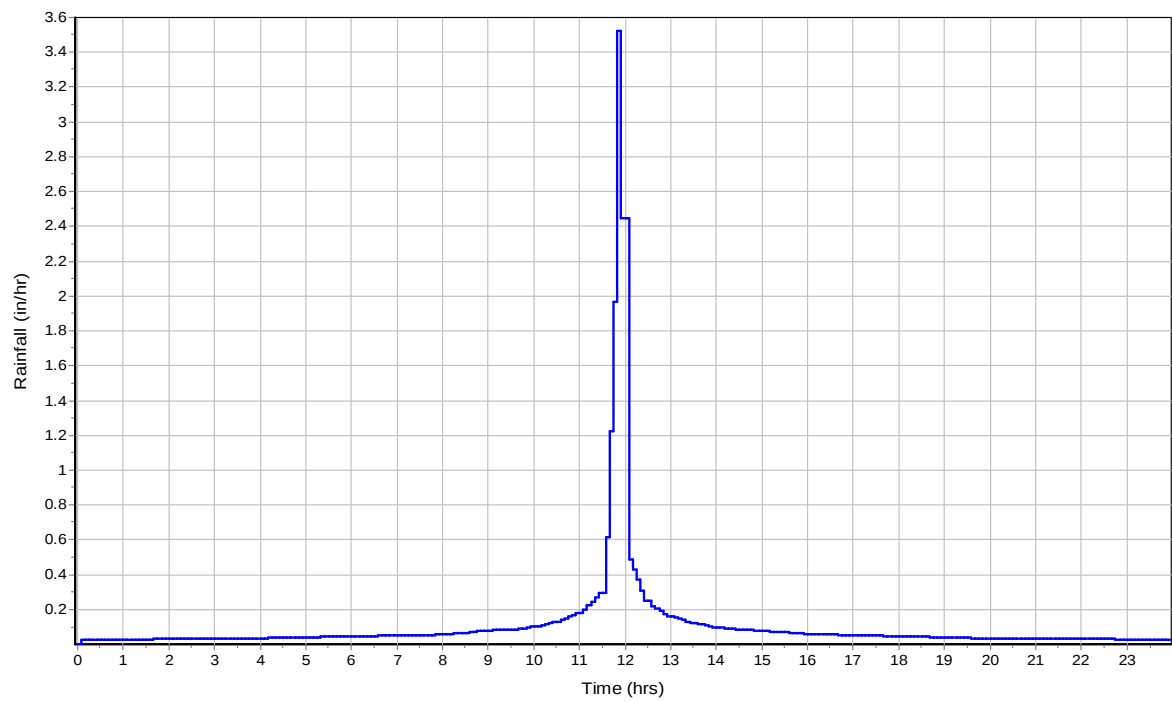
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.1	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	17.55	0	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	947	0	0
Slope (%) :	2.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.6	0	0
Computed Flow Time (min) :	6.07	0	0
Total TOC (min)	23.62		

Subbasin Runoff Results

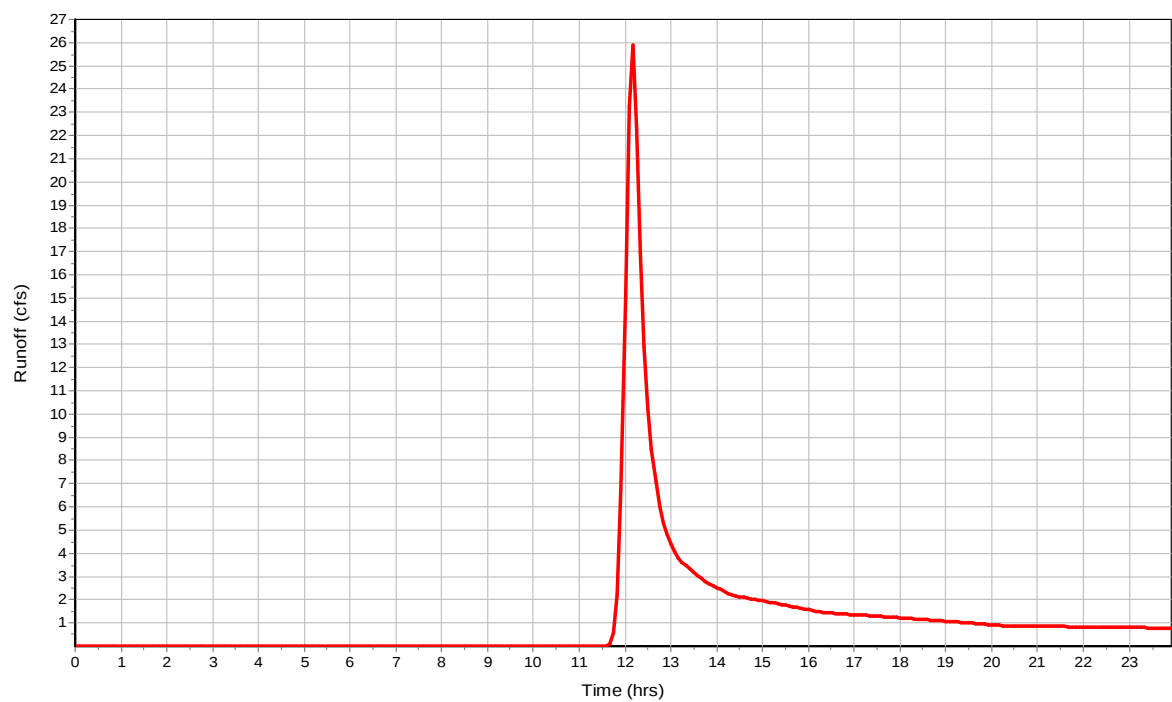
Total Rainfall (in)	2.57
Total Runoff (in)	0.61
Peak Runoff (cfs)	25.92
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:23:37

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 56.23
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hr2yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	56.23	B	73
Composite Area & Weighted CN	56.23		73

Time of Concentration

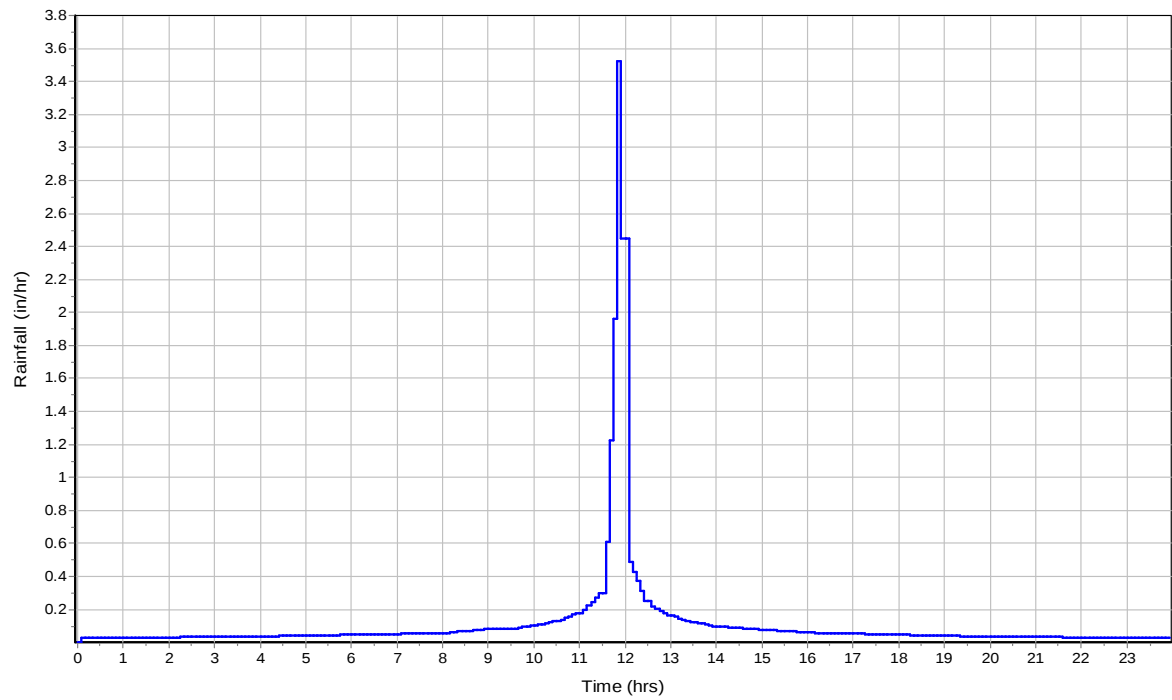
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.05	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.07	0	0
Computed Flow Time (min) :	23.15	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1198	245	0
Slope (%) :	0.83	5.4	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.47	3.75	0
Computed Flow Time (min) :	13.58	1.09	0
Total TOC (min)37.83			

Subbasin Runoff Results

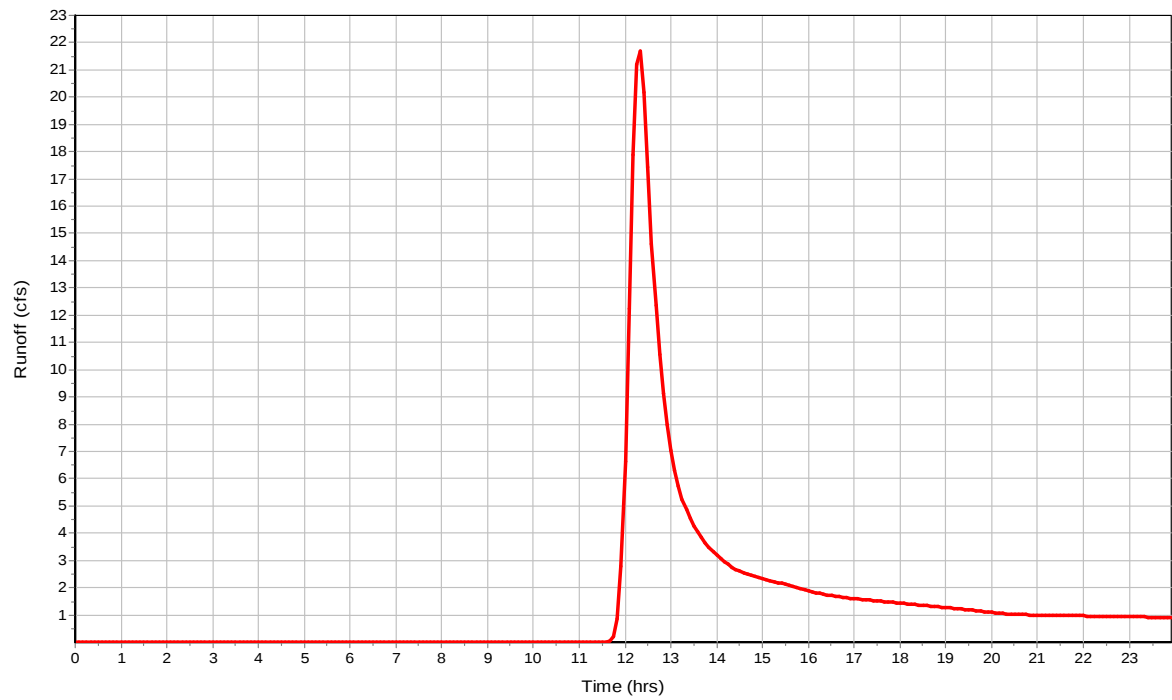
Total Rainfall (in) 2.57
Total Runoff (in) 0.61
Peak Runoff (cfs) 21.85
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:37:50

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_3

Input Data

Area (ac) 452.08
Peak Rate Factor 484
Weighted Curve Number 74.08
Rain Gage ID 24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Row crops, C&T + CR, Good	410.4	C	75
Row crops, contoured, Good	9.81	A	65
Row crops, contoured, Good	31.88	A	65
Composite Area & Weighted CN	452.09		74.08

Time of Concentration

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.08	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	19.19	0	0

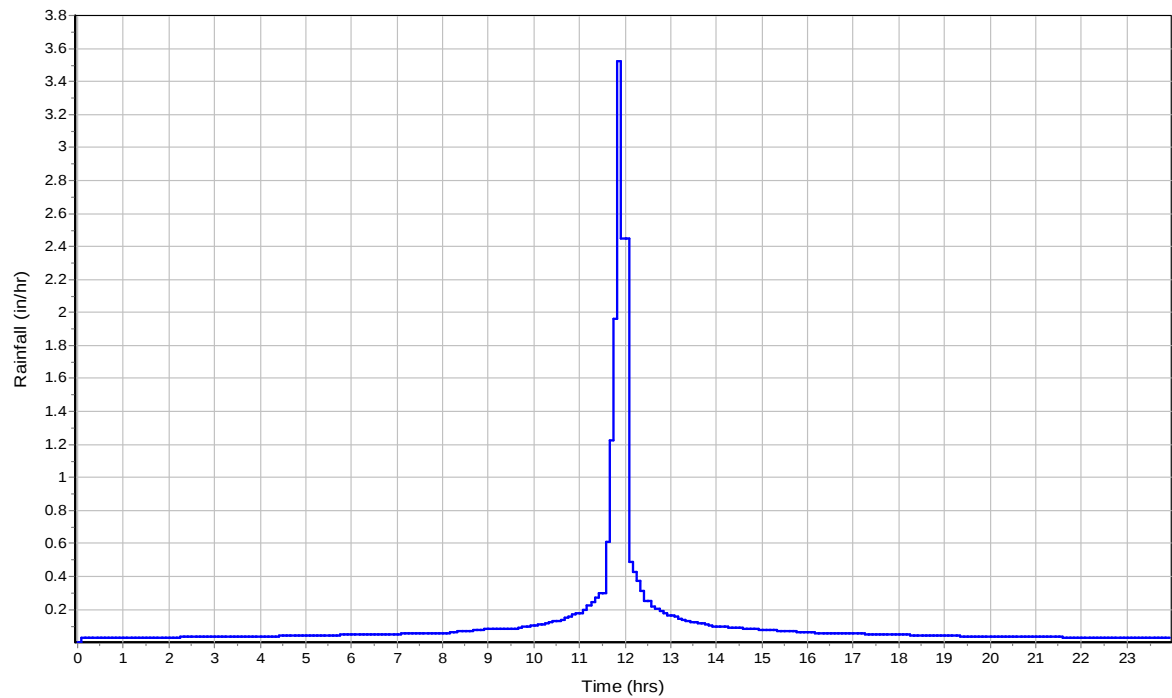
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	4320	1322	0
Slope (%) :	0.42	1.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.05	1.98	0
Computed Flow Time (min) :	68.57	11.13	0
Total TOC (min)98.88			

Subbasin Runoff Results

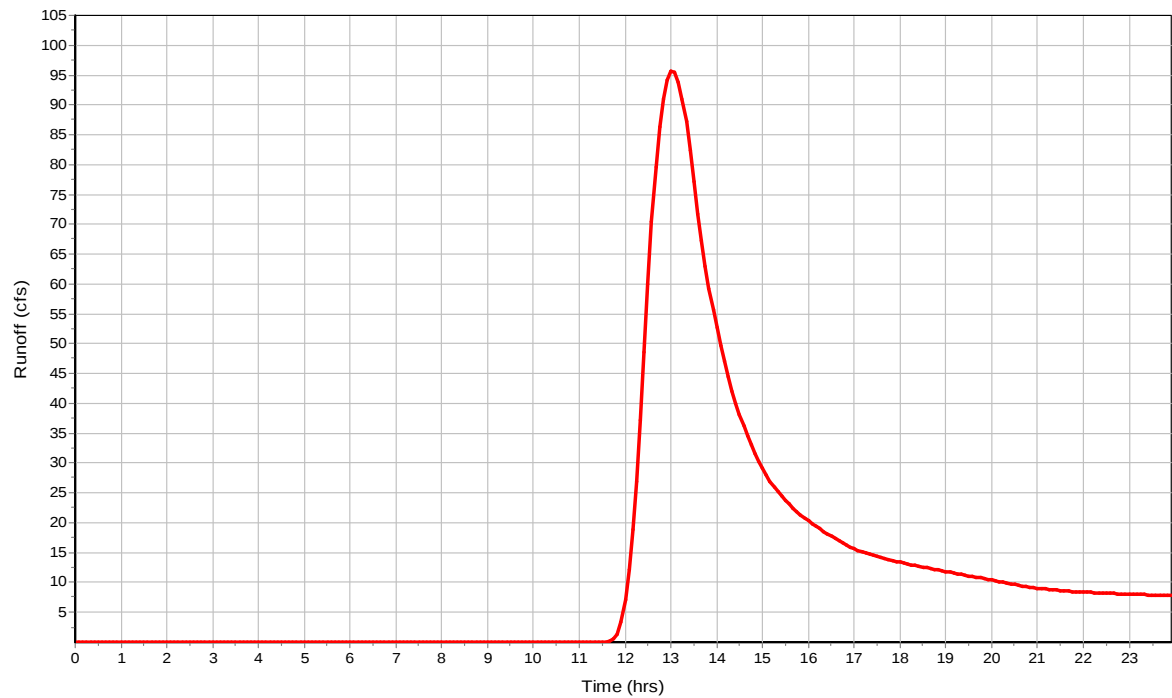
Total Rainfall (in) 2.57
Total Runoff (in) 0.65
Peak Runoff (cfs) 95.76
Weighted Curve Number 74.08
Time of Concentration (days hh:mm:ss) 0 01:38:53

Subbasin : Drainage_Area_3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_4

Input Data

Area (ac)	206.82
Peak Rate Factor	484
Weighted Curve Number	74.56
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C&T + CR, Good	197.77	C	75
Row crops, contoured, Good	9.05	A	65
Composite Area & Weighted CN	206.82		74.56

Time of Concentration

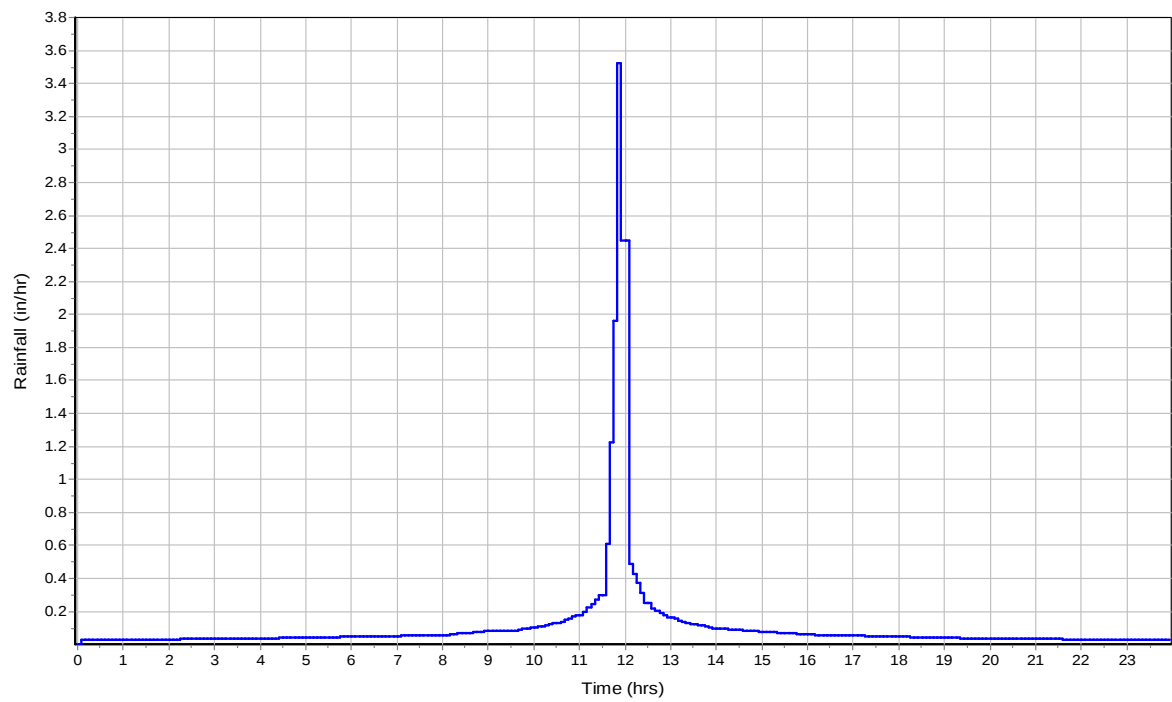
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.33	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.15	0	0
Computed Flow Time (min) :	10.88	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	3100	809	0
Slope (%) :	0.39	1.9	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	2.22	0
Computed Flow Time (min) :	51.16	6.07	0
Total TOC (min)	68.11		

Subbasin Runoff Results

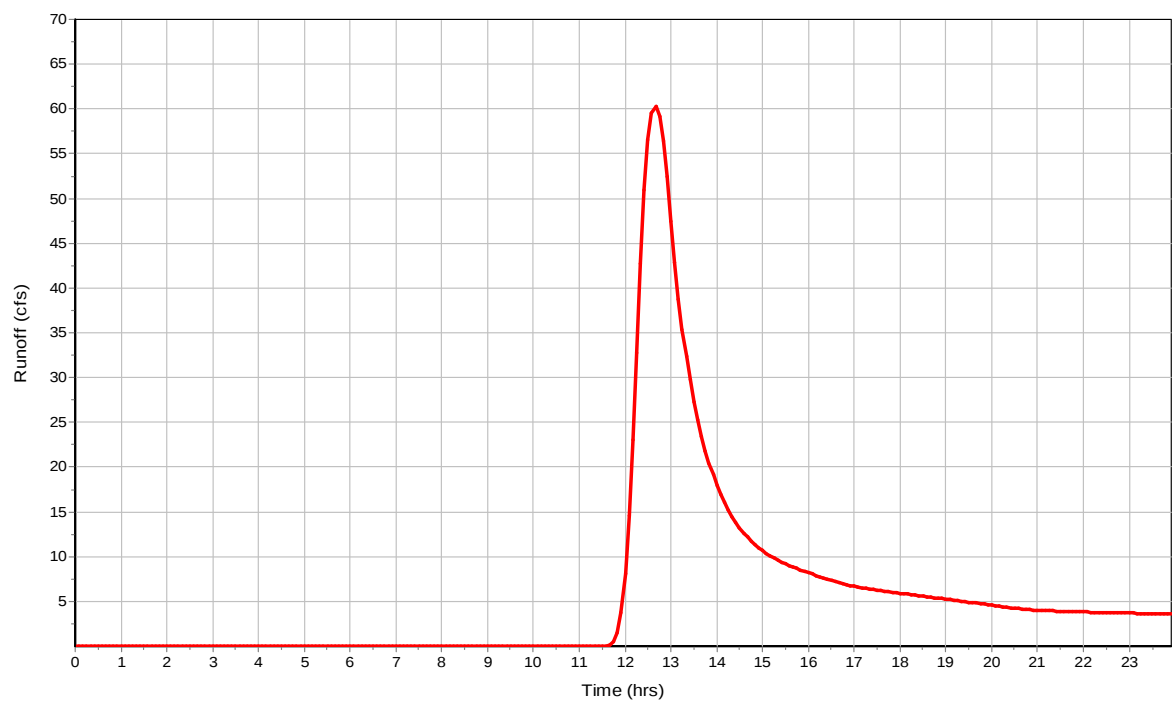
Total Rainfall (in)	2.57
Total Runoff (in)	0.67
Peak Runoff (cfs)	60.38
Weighted Curve Number	74.56
Time of Concentration (days hh:mm:ss)	0 01:08:07

Subbasin : Drainage_Area_4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_5

Input Data

Area (ac)	63.55
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, contoured, Good	63.55	B	73
Composite Area & Weighted CN	63.55		73

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.4	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.17	0	0
Computed Flow Time (min) :	10.08	0	0

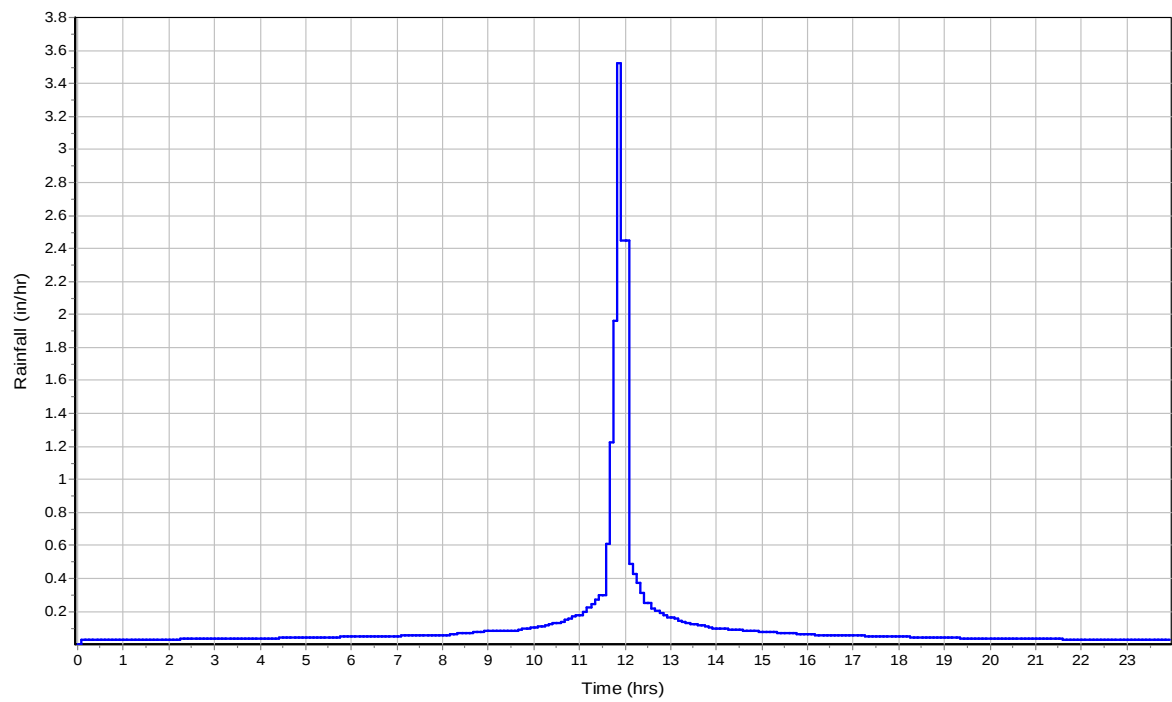
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1106	1008	0
Slope (%) :	0.38	0.62	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.99	1.27	0
Computed Flow Time (min) :	18.62	13.23	0
Total TOC (min)	41.93		

Subbasin Runoff Results

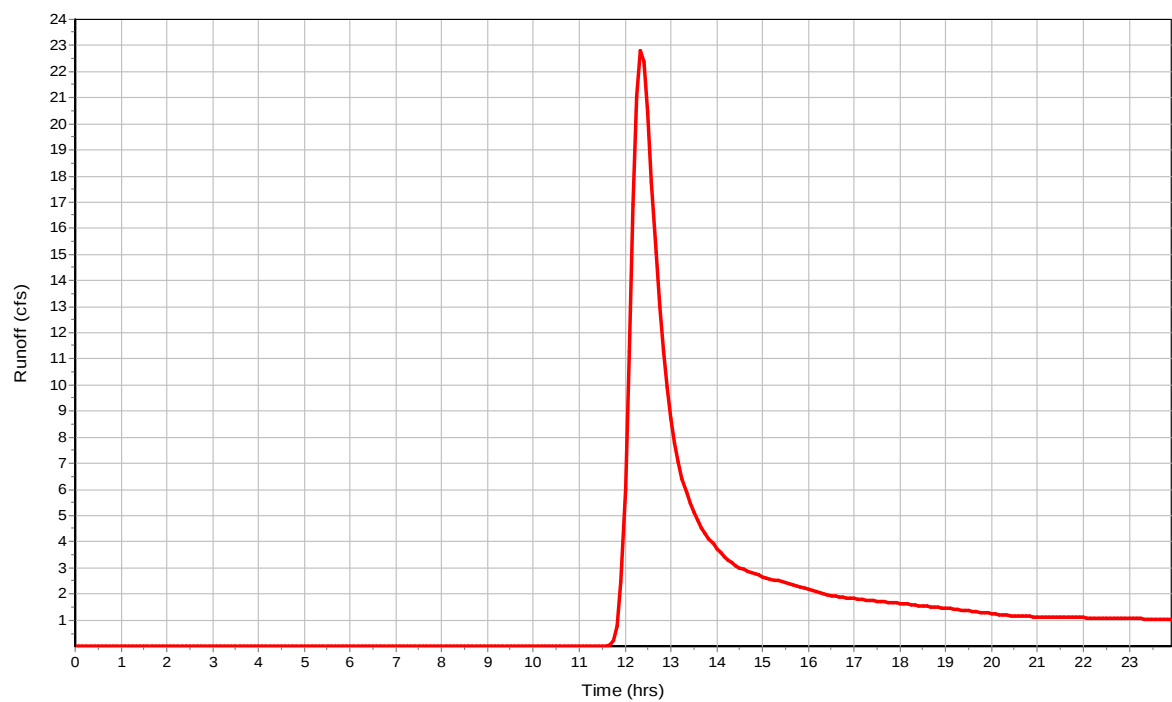
Total Rainfall (in)	2.57
Total Runoff (in)	0.61
Peak Runoff (cfs)	22.95
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:41:56

Subbasin : Drainage_Area_5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_6

Input Data

Area (ac)	31.81
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	31.81	B	73
Composite Area & Weighted CN	31.81		73

Time of Concentration

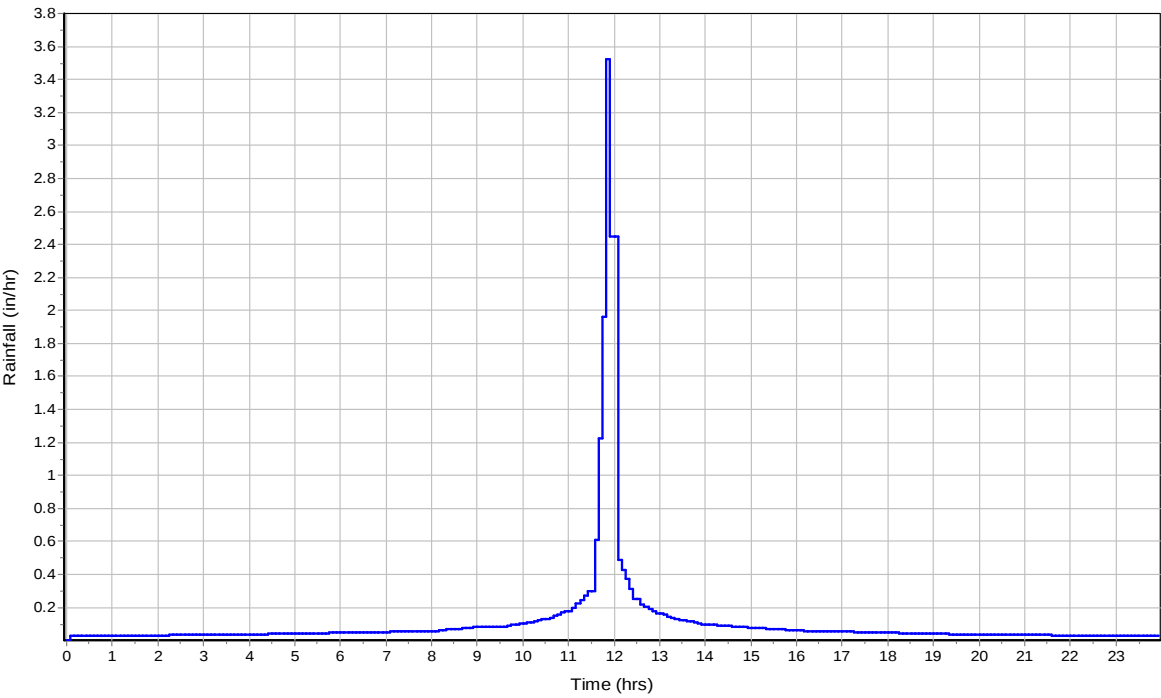
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.15	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.92	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1520	596	0
Slope (%) :	0.28	0.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.85	0	0
Computed Flow Time (min) :	29.8	0	0
Total TOC (min)	44.72		

Subbasin Runoff Results

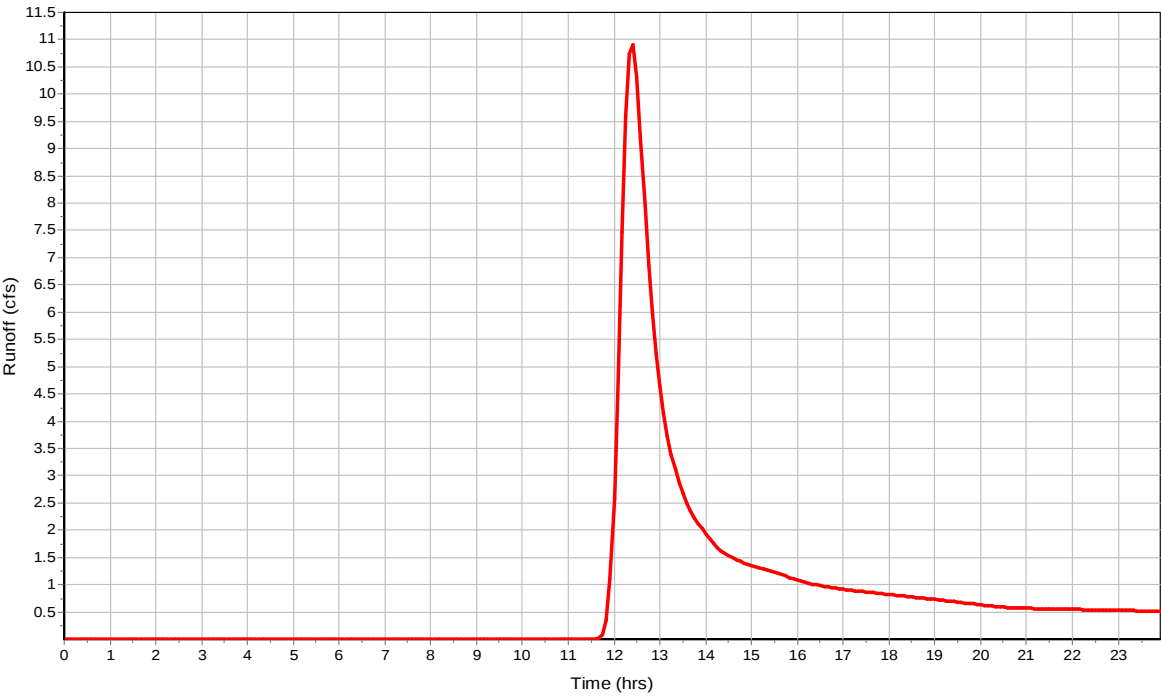
Total Rainfall (in)	2.57
Total Runoff (in)	0.61
Peak Runoff (cfs)	10.94
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:44:43

Subbasin : Drainage_Area_6

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name PreDevelopment Condition_9_22_2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 6
Subbasins..... 6
Nodes..... 6
 Junctions 0
 Outfalls 6
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	24hr100yr	Time Series	24hr100hr	Cumulative	inches					User Defined
2	24hr25yr	Time Series	24hr25yr	Cumulative	inches					User Defined
3	24hr2yr	Time Series	24hy2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
4	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
5	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches					User Defined
6	24hy10yr	Time Series	24hr10yr	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	48.76	484.00	73.00	3.38	1.10	53.64	51.37	0 00:23:37
2	Drainage_Area_2	56.23	484.00	73.00	3.38	1.10	61.85	43.79	0 00:37:49
3	Drainage_Area_3	452.08	484.00	74.08	3.38	1.16	525.77	186.69	0 01:38:52
4	Drainage_Area_4	206.82	484.00	74.56	3.38	1.19	246.32	116.52	0 01:08:06
5	Drainage_Area_5	63.55	484.00	73.00	3.38	1.10	69.91	46.04	0 00:41:55
6	Drainage_Area_6	31.81	484.00	73.00	3.38	1.10	34.99	22.06	0 00:44:43

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Peak Attained	Time of Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Analysis_Point_1	Outfall	884.00					0.00	0.00					
2	Analysis_Point_2	Outfall	900.00					0.00	0.00					
3	DA_1	Outfall	900.00					0.00	0.00					
4	DA_2	Outfall	900.00					0.00	0.00					
5	DA_5	Outfall	900.00					0.00	0.00					
6	DA_6	Outfall	900.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	48.76
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Legumes, C&T, Poor	48.76	B	73
Composite Area & Weighted CN	48.76		73

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n

R = Aq / Wp

Tc = (Lf / V) / (3600 sec/hr)

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

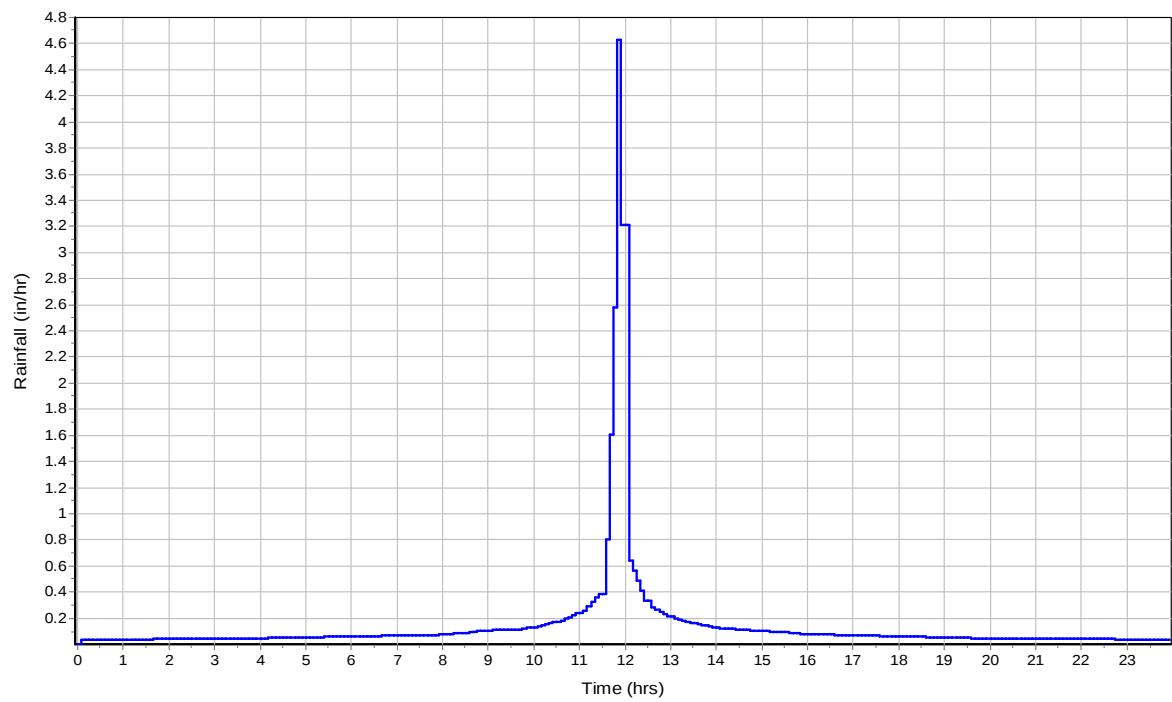
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.1	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	17.55	0	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	947	0	0
Slope (%) :	2.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.6	0	0
Computed Flow Time (min) :	6.07	0	0
Total TOC (min)	23.62		

Subbasin Runoff Results

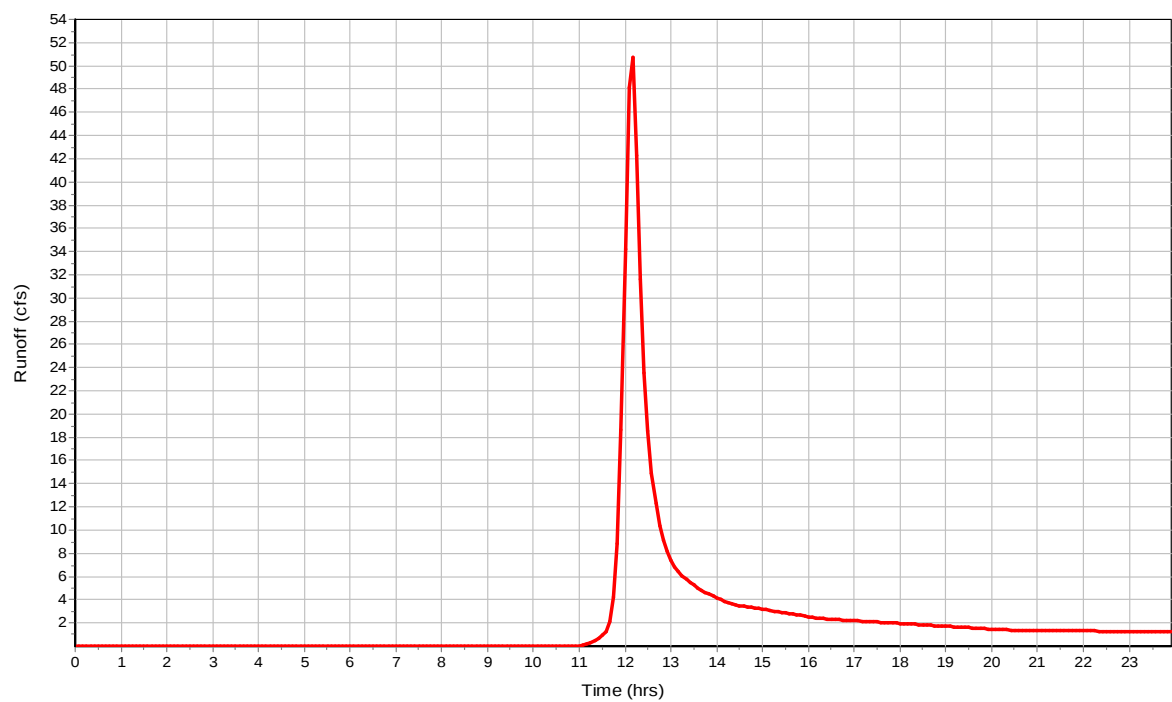
Total Rainfall (in)	3.38
Total Runoff (in)	1.1
Peak Runoff (cfs)	51.37
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:23:37

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac)	56.23
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, contoured, Good	56.23	B	73
Composite Area & Weighted CN	56.23		73

Time of Concentration

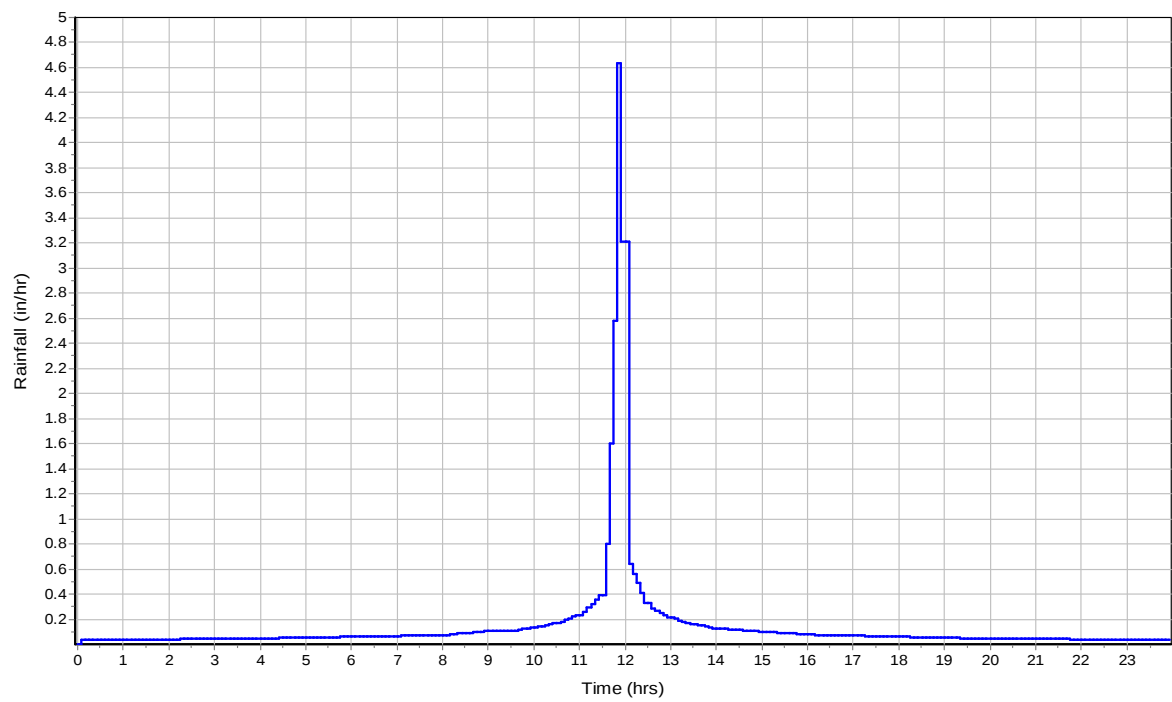
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.05	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.07	0	0
Computed Flow Time (min) :	23.15	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1198	245	0
Slope (%) :	0.83	5.4	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.47	3.75	0
Computed Flow Time (min) :	13.58	1.09	0
Total TOC (min)	37.83		

Subbasin Runoff Results

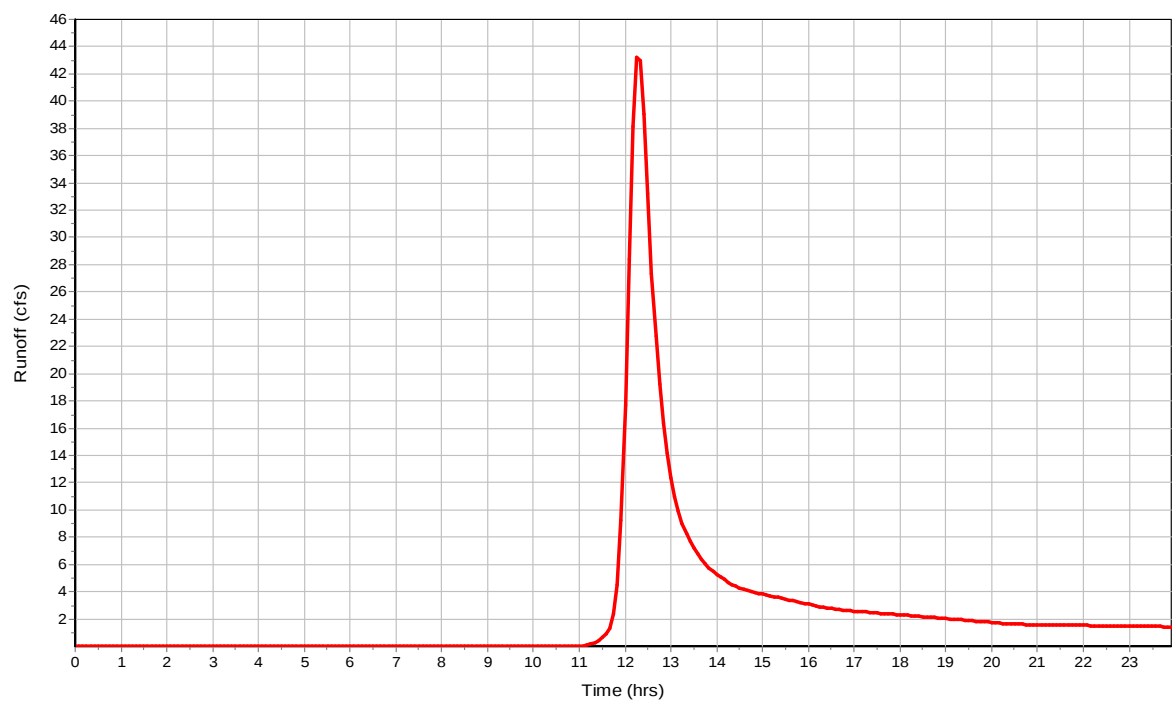
Total Rainfall (in)	3.38
Total Runoff (in)	1.1
Peak Runoff (cfs)	43.79
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:37:50

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_3

Input Data

Area (ac) 452.08
Peak Rate Factor 484
Weighted Curve Number 74.08
Rain Gage ID 24hr-5yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Row crops, C&T + CR, Good	410.4	C	75
Row crops, contoured, Good	9.81	A	65
Row crops, contoured, Good	31.88	A	65
Composite Area & Weighted CN	452.09		74.08

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.08	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	19.19	0	0

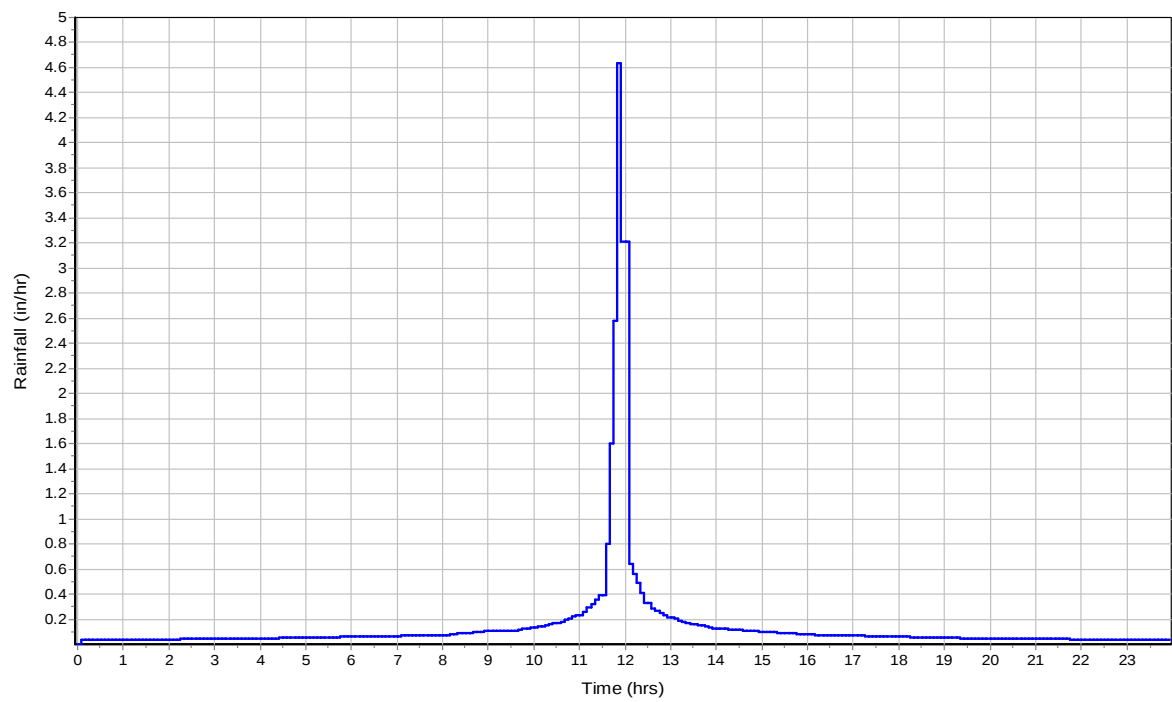
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	4320	1322	0
Slope (%) :	0.42	1.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.05	1.98	0
Computed Flow Time (min) :	68.57	11.13	0
Total TOC (min)98.88			

Subbasin Runoff Results

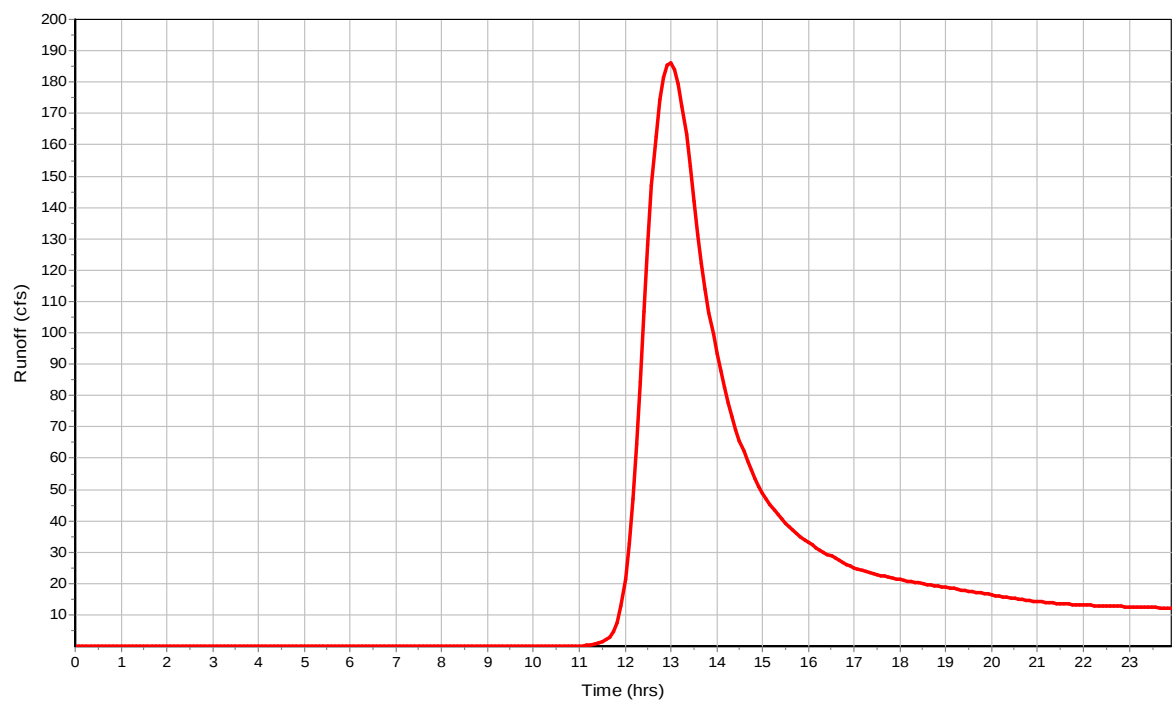
Total Rainfall (in) 3.38
Total Runoff (in) 1.16
Peak Runoff (cfs) 186.69
Weighted Curve Number 74.08
Time of Concentration (days hh:mm:ss) 0 01:38:53

Subbasin : Drainage_Area_3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_4

Input Data

Area (ac)	206.82
Peak Rate Factor	484
Weighted Curve Number	74.56
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C&T + CR, Good	197.77	C	75
Row crops, contoured, Good	9.05	A	65
Composite Area & Weighted CN	206.82		74.56

Time of Concentration

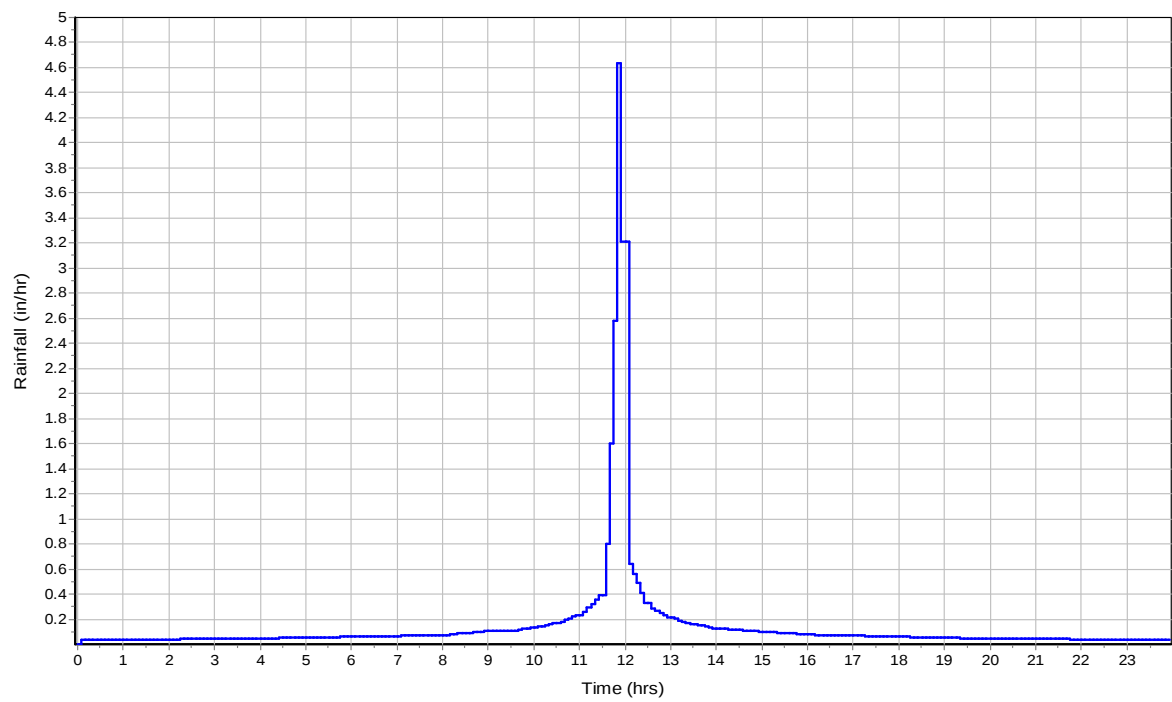
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.33	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.15	0	0
Computed Flow Time (min) :	10.88	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	3100	809	0
Slope (%) :	0.39	1.9	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	2.22	0
Computed Flow Time (min) :	51.16	6.07	0
Total TOC (min)	68.11		

Subbasin Runoff Results

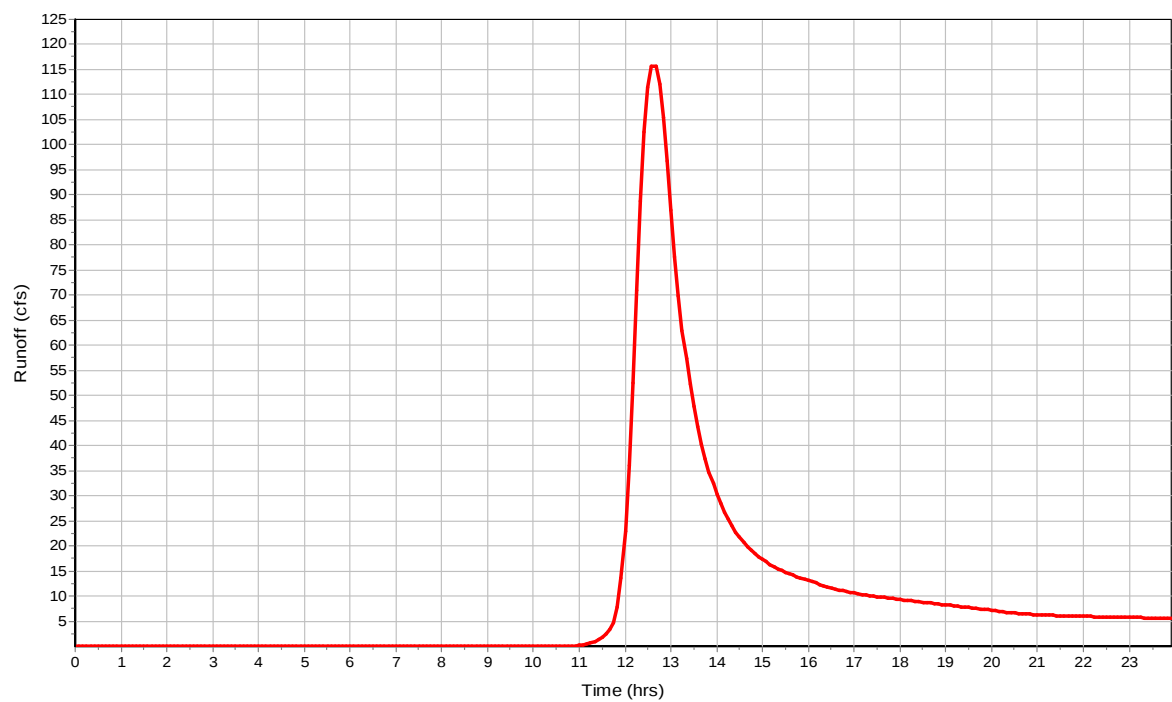
Total Rainfall (in)	3.38
Total Runoff (in)	1.19
Peak Runoff (cfs)	116.52
Weighted Curve Number	74.56
Time of Concentration (days hh:mm:ss)	0 01:08:07

Subbasin : Drainage_Area_4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_5

Input Data

Area (ac)	63.55
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, contoured, Good	63.55	B	73
Composite Area & Weighted CN	63.55		73

Time of Concentration

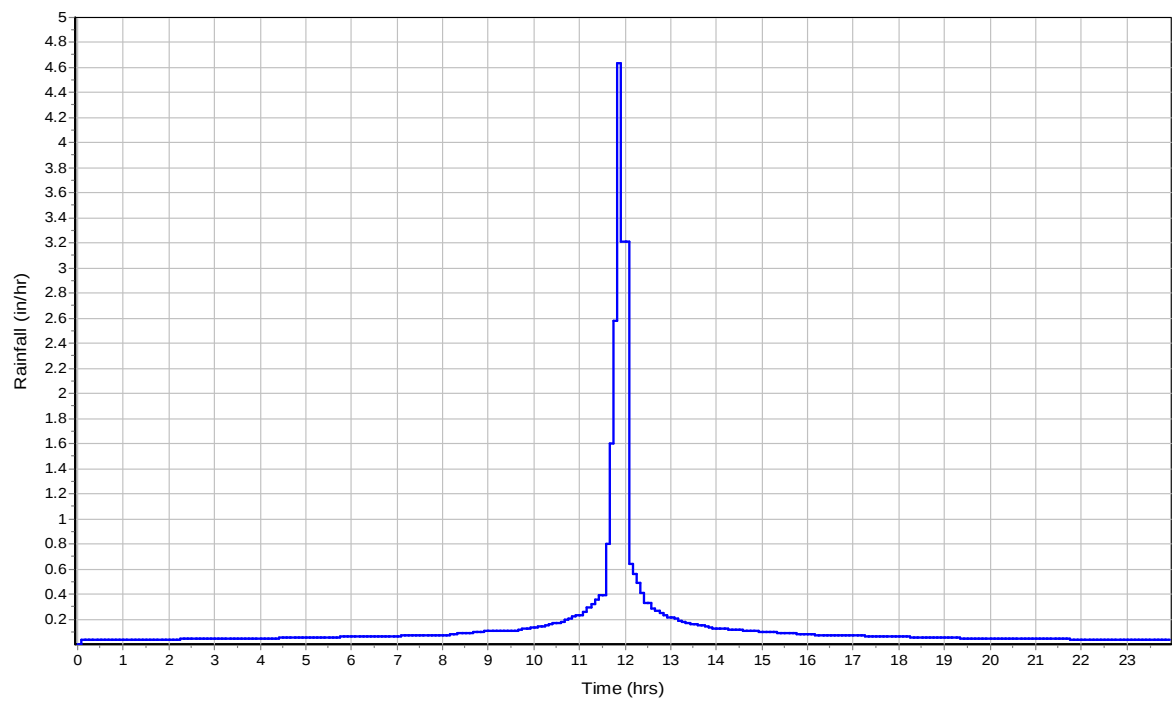
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.4	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.17	0	0
Computed Flow Time (min) :	10.08	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1106	1008	0
Slope (%) :	0.38	0.62	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.99	1.27	0
Computed Flow Time (min) :	18.62	13.23	0
Total TOC (min)	41.93		

Subbasin Runoff Results

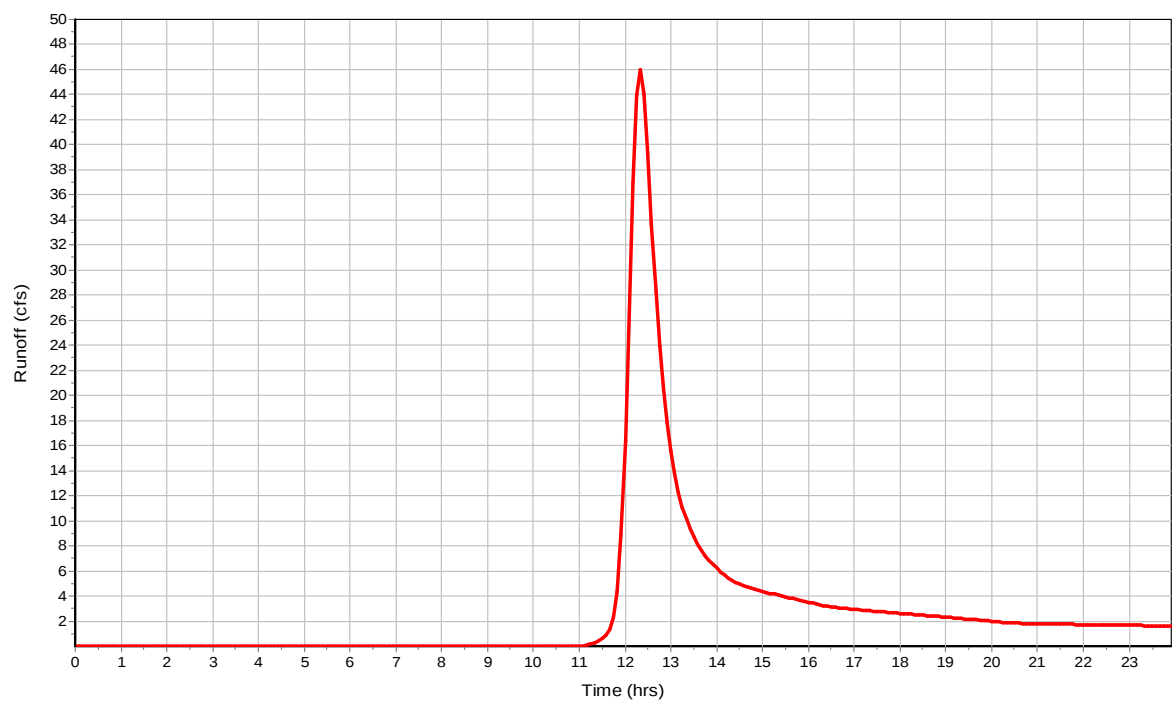
Total Rainfall (in)	3.38
Total Runoff (in)	1.1
Peak Runoff (cfs)	46.04
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:41:56

Subbasin : Drainage_Area_5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_6

Input Data

Area (ac)	31.81
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	31.81	B	73
Composite Area & Weighted CN	31.81		73

Time of Concentration

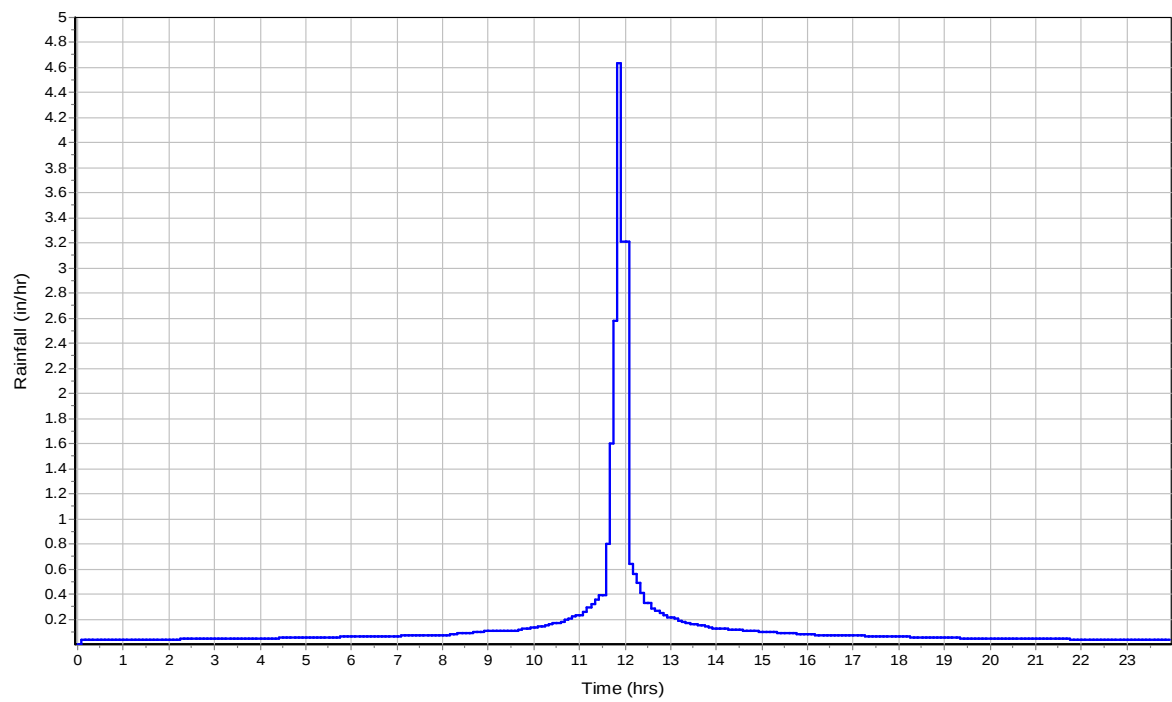
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.15	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.92	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1520	596	0
Slope (%) :	0.28	0.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.85	0	0
Computed Flow Time (min) :	29.8	0	0
Total TOC (min)	44.72		

Subbasin Runoff Results

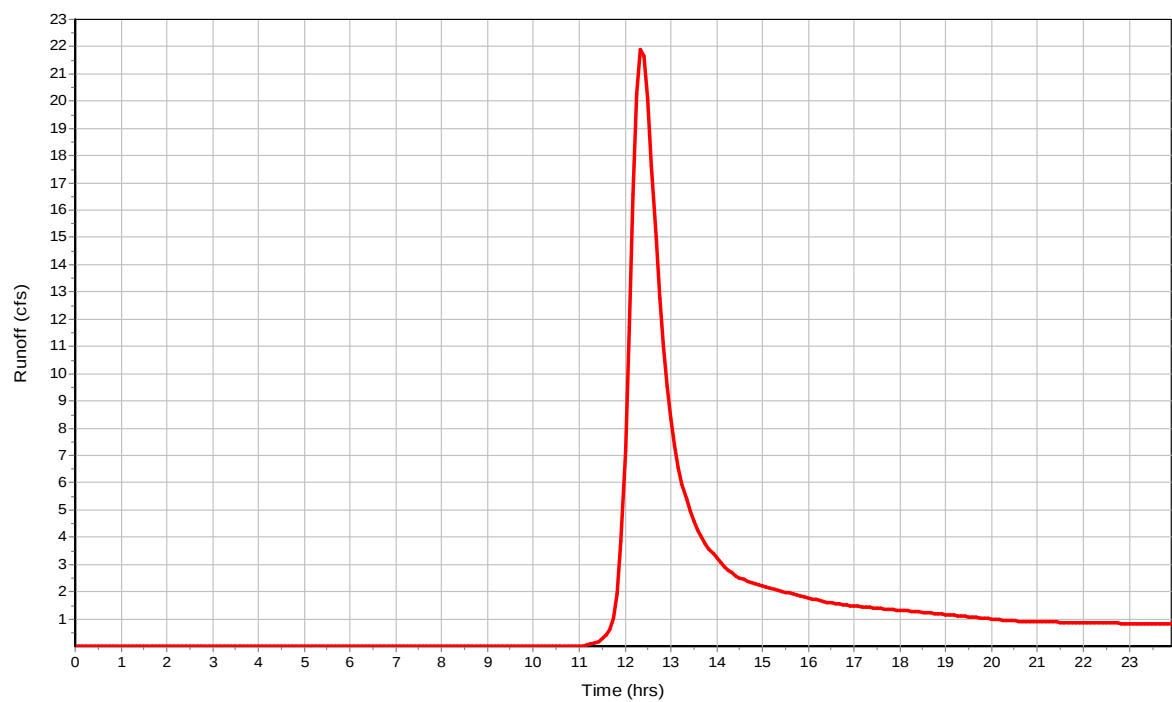
Total Rainfall (in)	3.38
Total Runoff (in)	1.1
Peak Runoff (cfs)	22.06
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:44:43

Subbasin : Drainage_Area_6

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name PreDevelopment Condition_9_22_2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 6
Subbasins..... 6
Nodes..... 6
 Junctions 0
 Outfalls 6
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	24hr100yr	Time Series	24hr100hr	Cumulative	inches					User Defined
2	24hr25yr	Time Series	24hr25yr	Cumulative	inches					User Defined
3	24hr2yr	Time Series	24hy2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
4	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
5	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches					User Defined
6	24hy10yr	Time Series	24hr10yr	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	48.76	484.00	73.00	3.60	1.25	60.80	59.01	0 00:23:37
2	Drainage_Area_2	56.23	484.00	73.00	3.60	1.25	70.12	50.51	0 00:37:49
3	Drainage_Area_3	452.08	484.00	74.08	3.60	1.31	594.03	213.46	0 01:38:52
4	Drainage_Area_4	206.82	484.00	74.56	3.60	1.35	278.17	133.03	0 01:08:06
5	Drainage_Area_5	63.55	484.00	73.00	3.60	1.25	79.25	53.03	0 00:41:55
6	Drainage_Area_6	31.81	484.00	73.00	3.60	1.25	39.67	25.40	0 00:44:43

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Peak Attained	Time of Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Analysis_Point_1	Outfall	884.00					0.00	0.00					
2	Analysis_Point_2	Outfall	900.00					0.00	0.00					
3	DA_1	Outfall	900.00					0.00	0.00					
4	DA_2	Outfall	900.00					0.00	0.00					
5	DA_5	Outfall	900.00					0.00	0.00					
6	DA_6	Outfall	900.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	48.76
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hy10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Legumes, C&T, Poor	48.76	B	73
Composite Area & Weighted CN	48.76		73

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n

R = Aq / Wp

Tc = (Lf / V) / (3600 sec/hr)

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

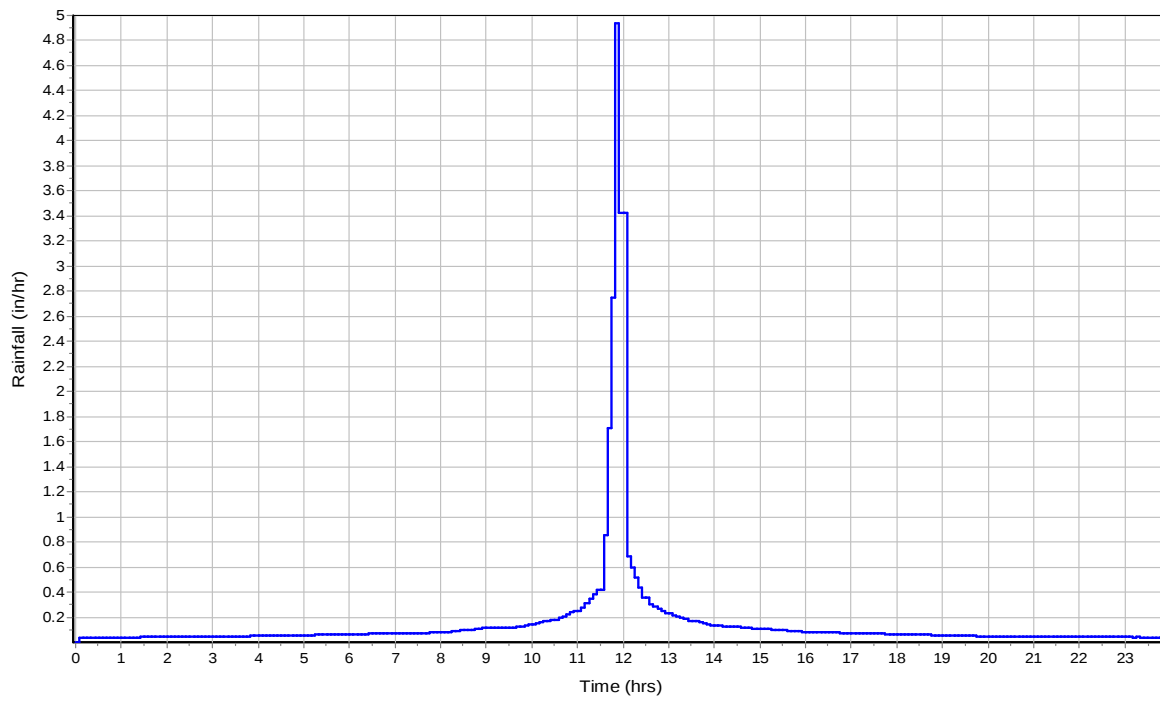
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.1	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	17.55	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	947	0	0
Slope (%) :	2.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.6	0	0
Computed Flow Time (min) :	6.07	0	0
Total TOC (min)23.62			

Subbasin Runoff Results

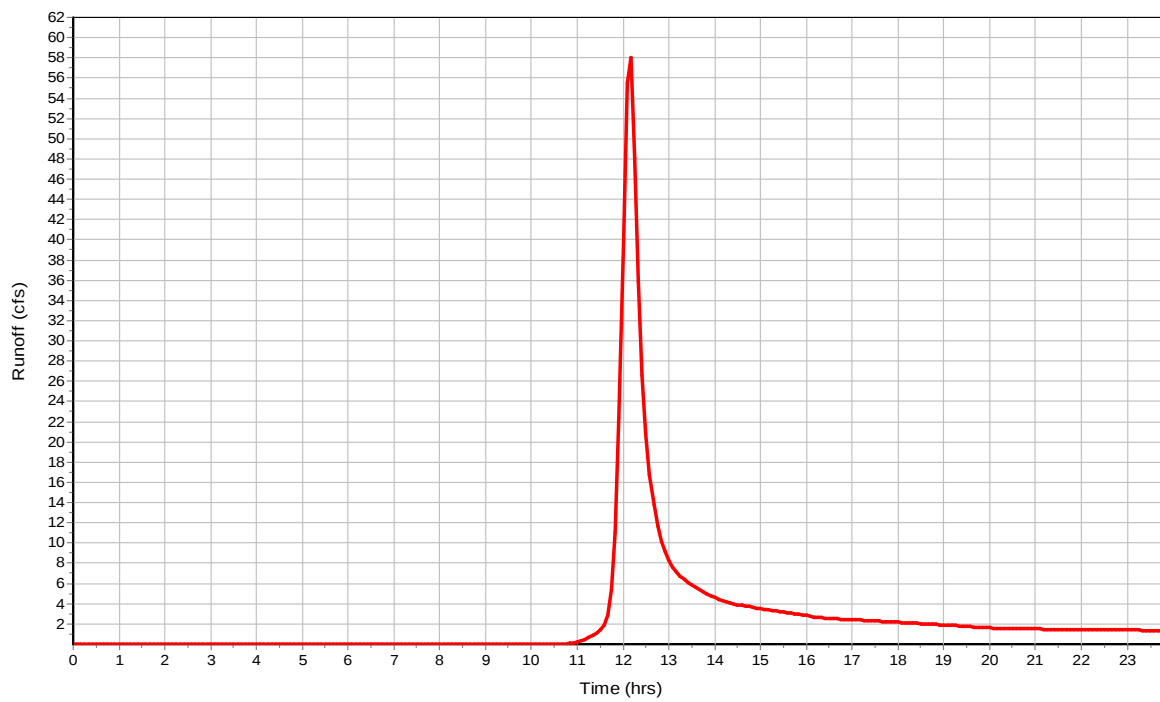
Total Rainfall (in)	3.6
Total Runoff (in)	1.25
Peak Runoff (cfs)	59.01
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:23:37

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 56.23
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hy10yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	56.23	B	73
Composite Area & Weighted CN	56.23		73

Time of Concentration

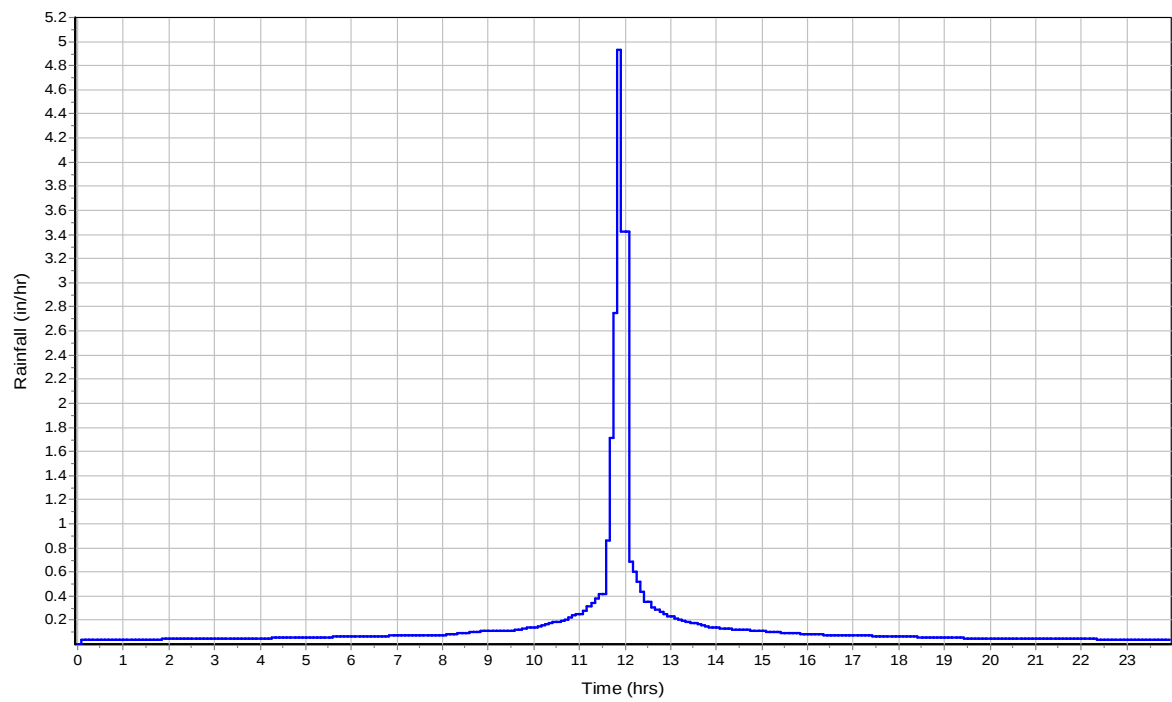
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.05	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.07	0	0
Computed Flow Time (min) :	23.15	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1198	245	0
Slope (%) :	0.83	5.4	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.47	3.75	0
Computed Flow Time (min) :	13.58	1.09	0
Total TOC (min)			37.83

Subbasin Runoff Results

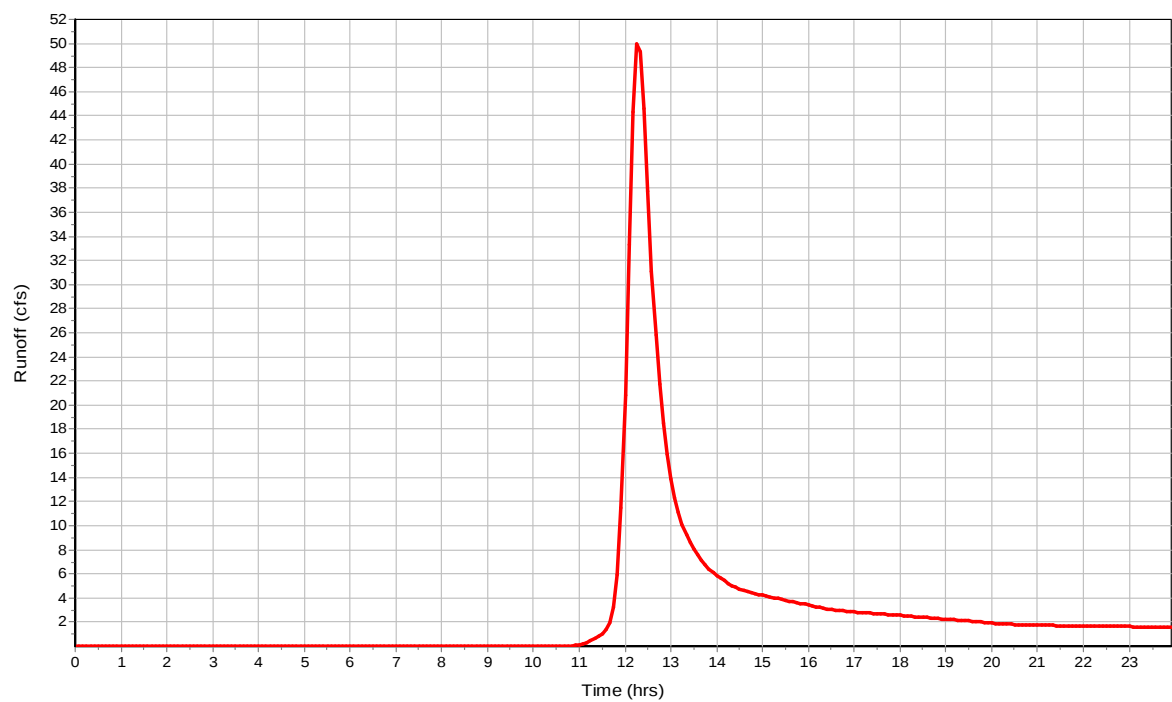
Total Rainfall (in) 3.6
Total Runoff (in) 1.25
Peak Runoff (cfs) 50.51
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:37:50

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_3

Input Data

Area (ac) 452.08
Peak Rate Factor 484
Weighted Curve Number 74.08
Rain Gage ID 24hy10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Row crops, C&T + CR, Good	410.4	C	75
Row crops, contoured, Good	9.81	A	65
Row crops, contoured, Good	31.88	A	65
Composite Area & Weighted CN	452.09		74.08

Time of Concentration

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.08	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	19.19	0	0

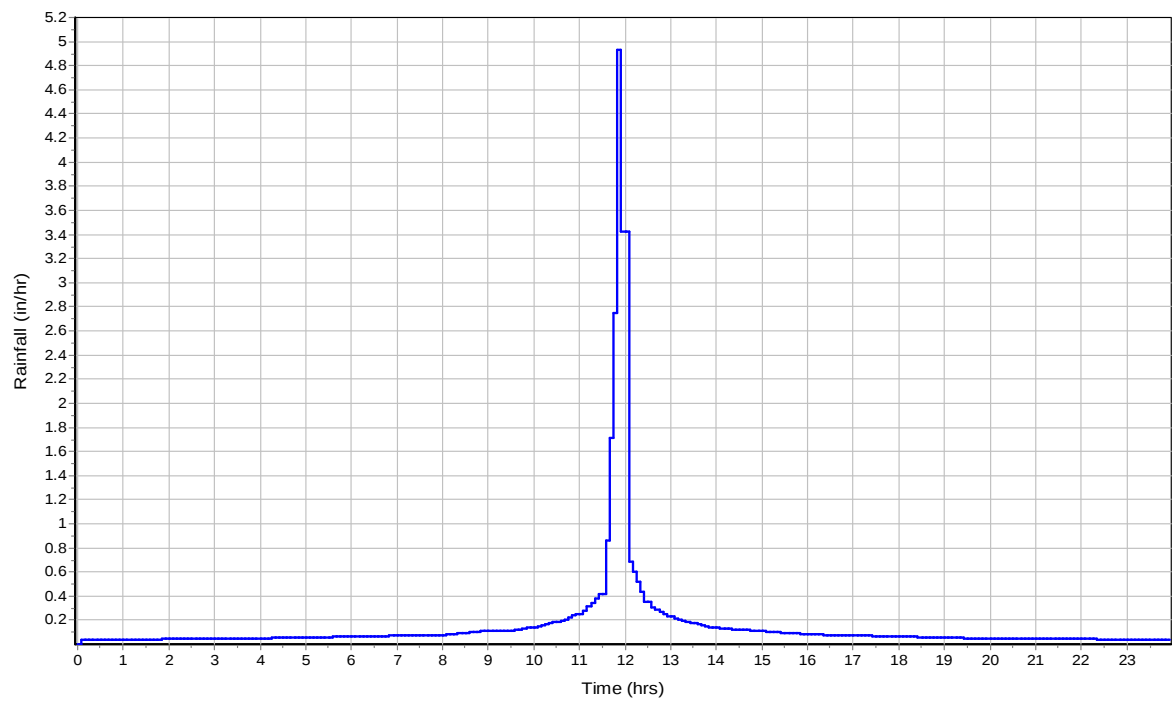
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	4320	1322	0
Slope (%) :	0.42	1.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.05	1.98	0
Computed Flow Time (min) :	68.57	11.13	0
Total TOC (min)98.88			

Subbasin Runoff Results

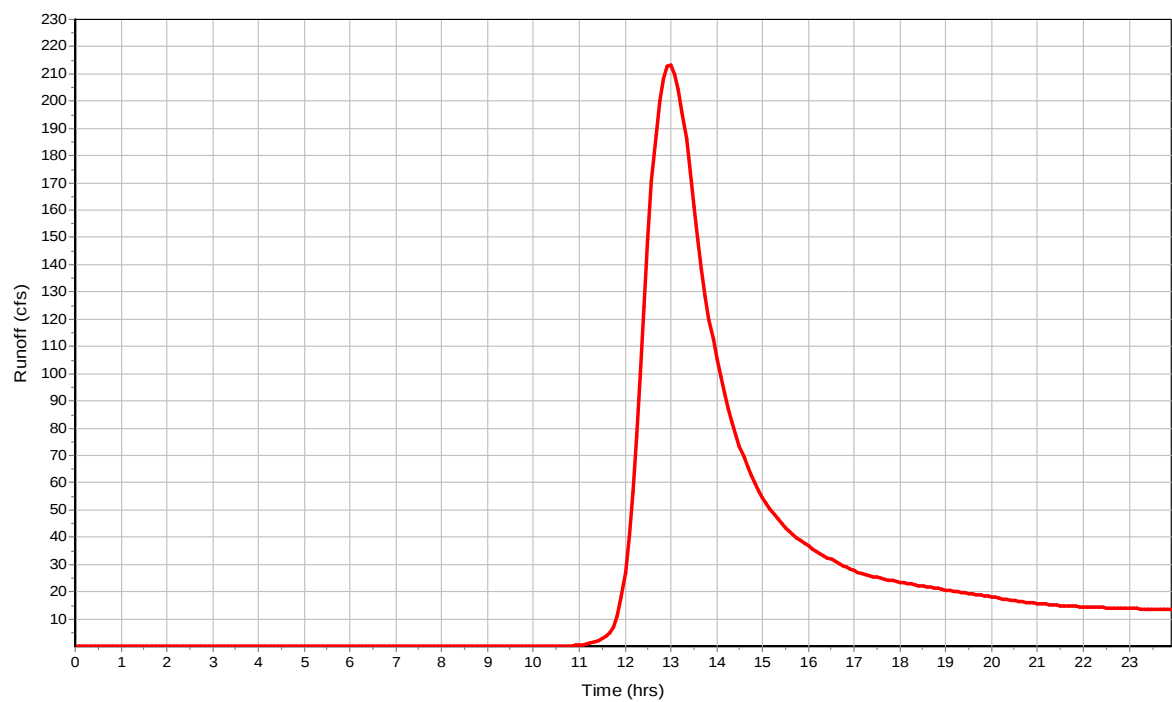
Total Rainfall (in) 3.6
Total Runoff (in) 1.31
Peak Runoff (cfs) 213.46
Weighted Curve Number 74.08
Time of Concentration (days hh:mm:ss) 0 01:38:53

Subbasin : Drainage_Area_3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_4

Input Data

Area (ac)	206.82
Peak Rate Factor	484
Weighted Curve Number	74.56
Rain Gage ID	24hy10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C&T + CR, Good	197.77	C	75
Row crops, contoured, Good	9.05	A	65
Composite Area & Weighted CN	206.82		74.56

Time of Concentration

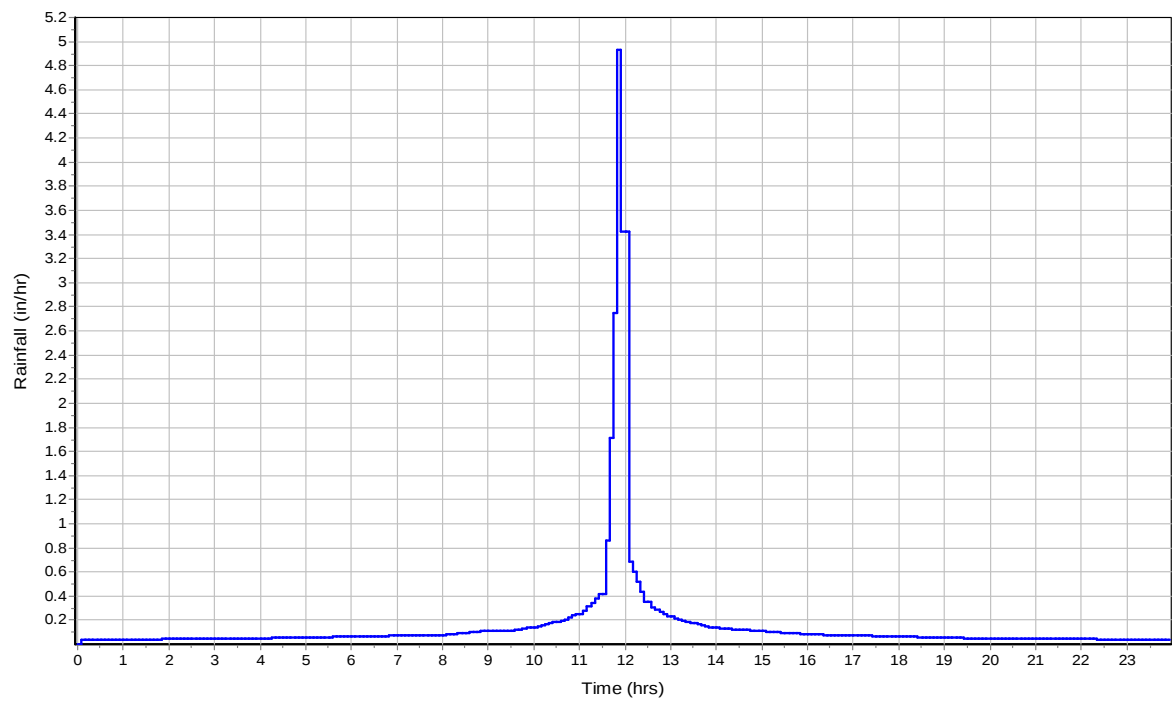
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.33	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.15	0	0
Computed Flow Time (min) :	10.88	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	3100	809	0
Slope (%) :	0.39	1.9	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	2.22	0
Computed Flow Time (min) :	51.16	6.07	0
Total TOC (min)	68.11		

Subbasin Runoff Results

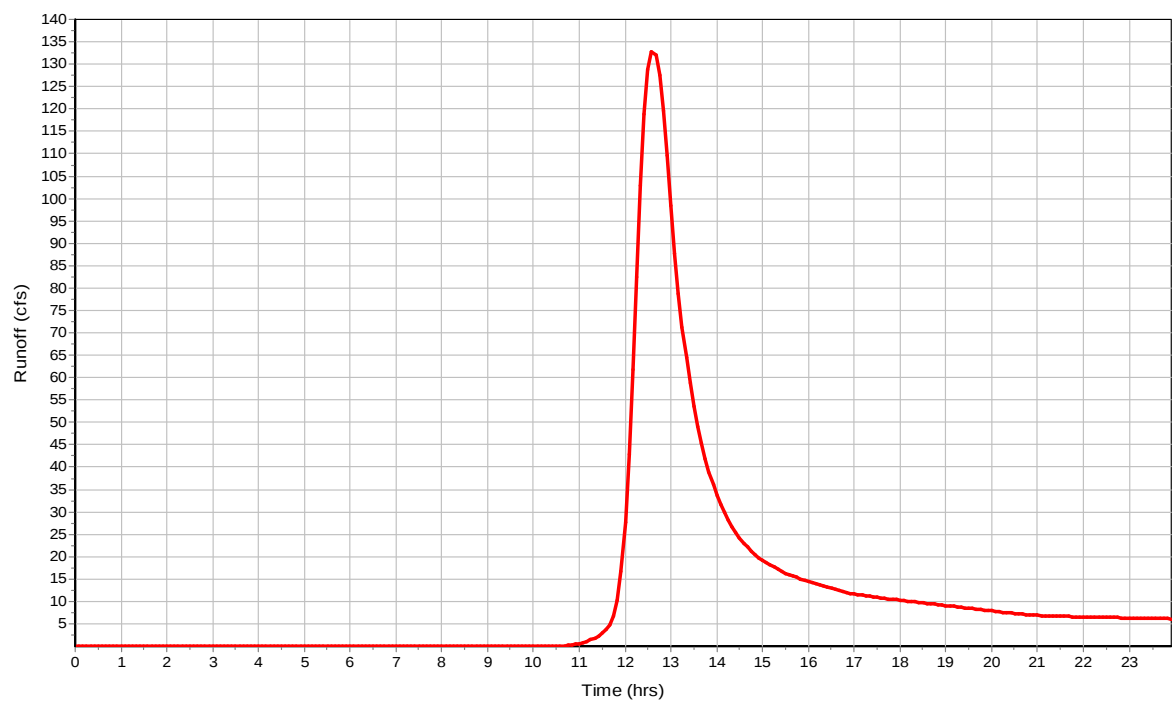
Total Rainfall (in)	3.6
Total Runoff (in)	1.35
Peak Runoff (cfs)	133.03
Weighted Curve Number	74.56
Time of Concentration (days hh:mm:ss)	0 01:08:07

Subbasin : Drainage_Area_4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_5

Input Data

Area (ac) 63.55
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hy10yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	63.55	B	73
Composite Area & Weighted CN	63.55		73

Time of Concentration

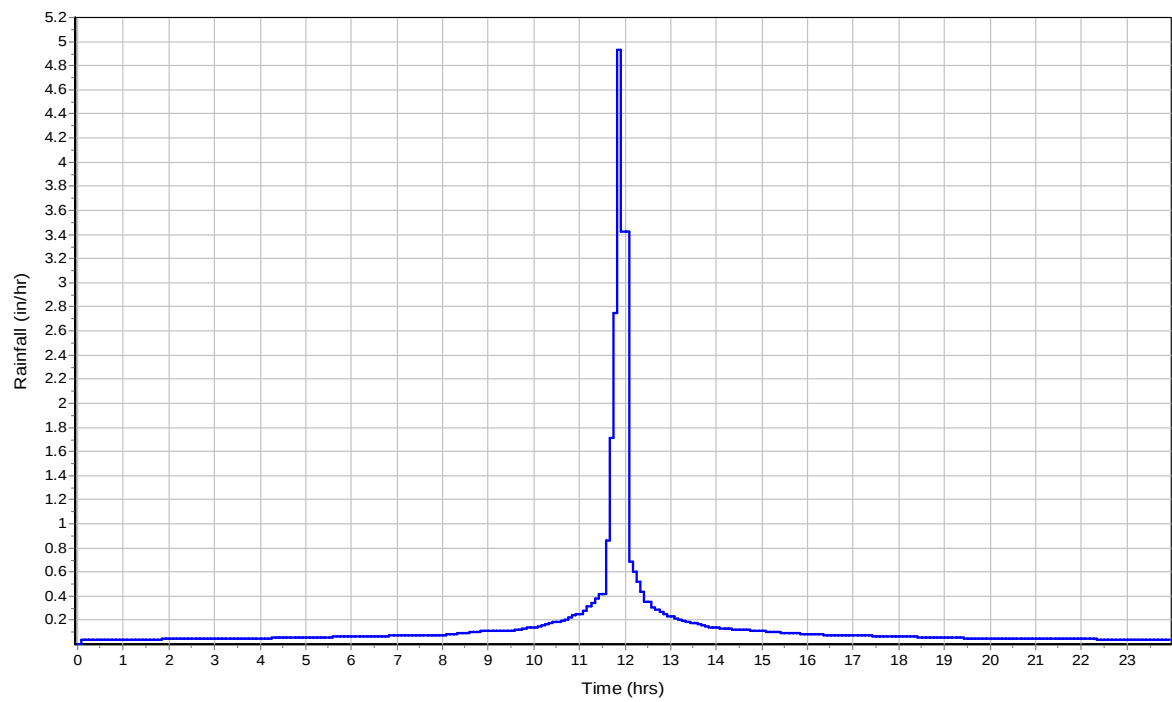
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.4	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.17	0	0
Computed Flow Time (min) :	10.08	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1106	1008	0
Slope (%) :	0.38	0.62	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.99	1.27	0
Computed Flow Time (min) :	18.62	13.23	0
Total TOC (min)			41.93

Subbasin Runoff Results

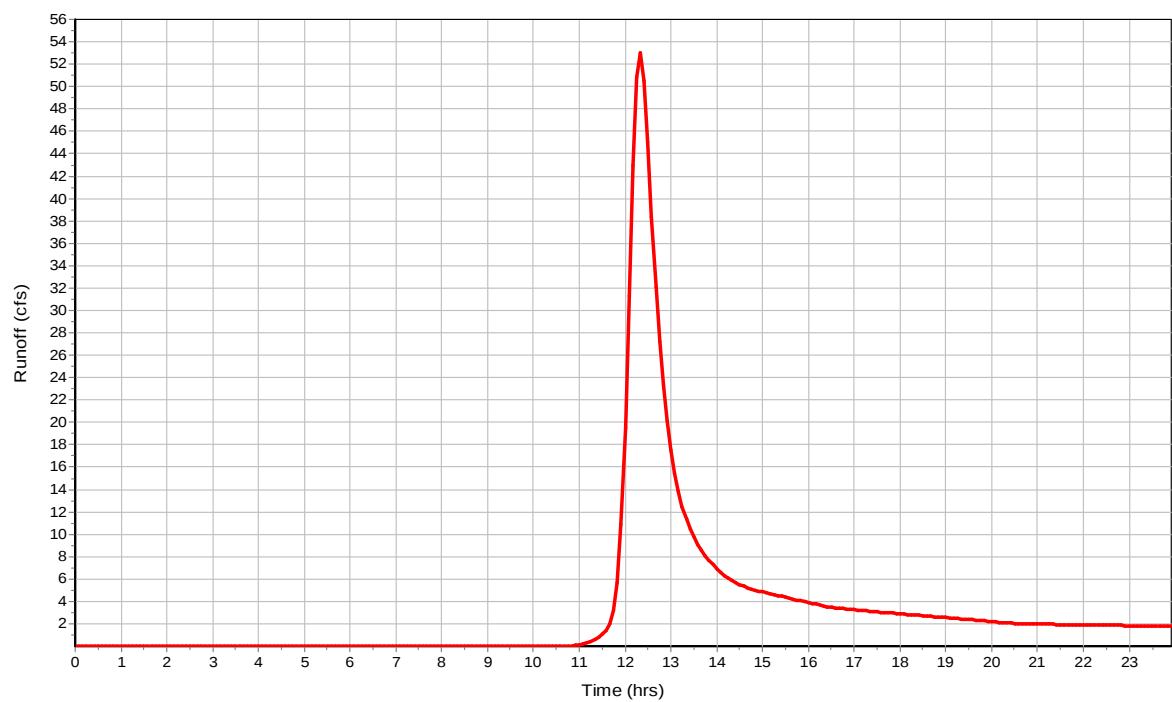
Total Rainfall (in) 3.6
Total Runoff (in) 1.25
Peak Runoff (cfs) 53.03
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:41:56

Subbasin : Drainage_Area_5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_6

Input Data

Area (ac)	31.81
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hy10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	31.81	B	73
Composite Area & Weighted CN	31.81		73

Time of Concentration

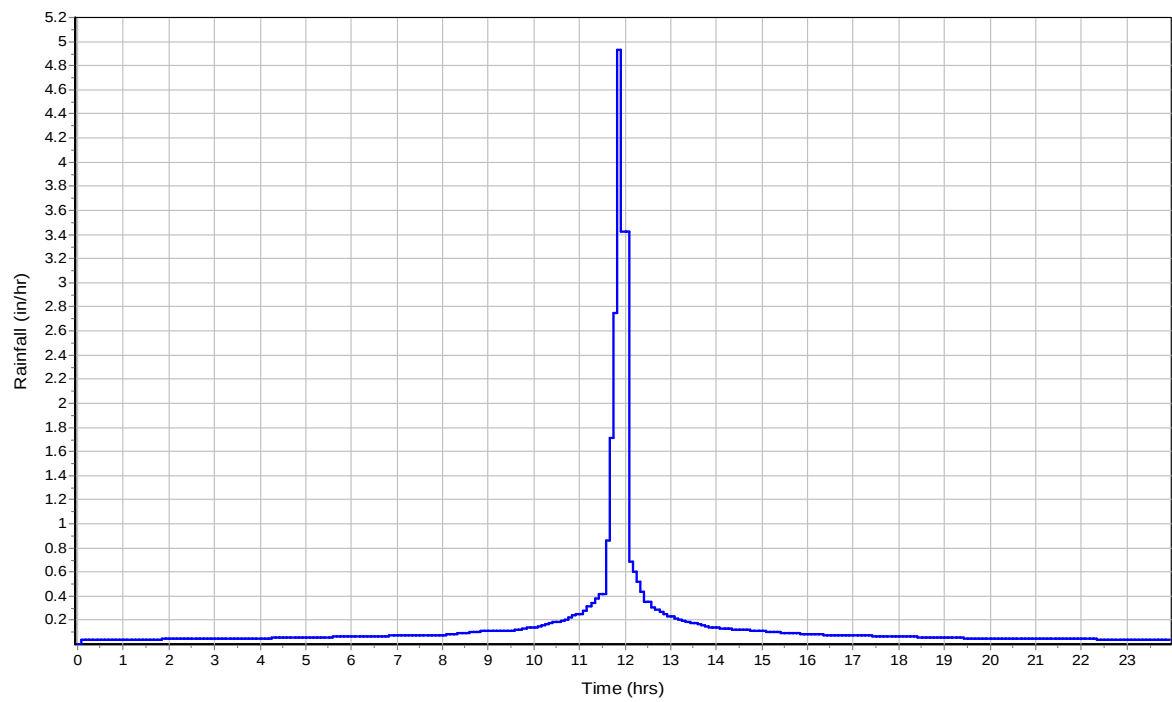
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.15	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.92	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1520	596	0
Slope (%) :	0.28	0.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.85	0	0
Computed Flow Time (min) :	29.8	0	0
Total TOC (min)	44.72		

Subbasin Runoff Results

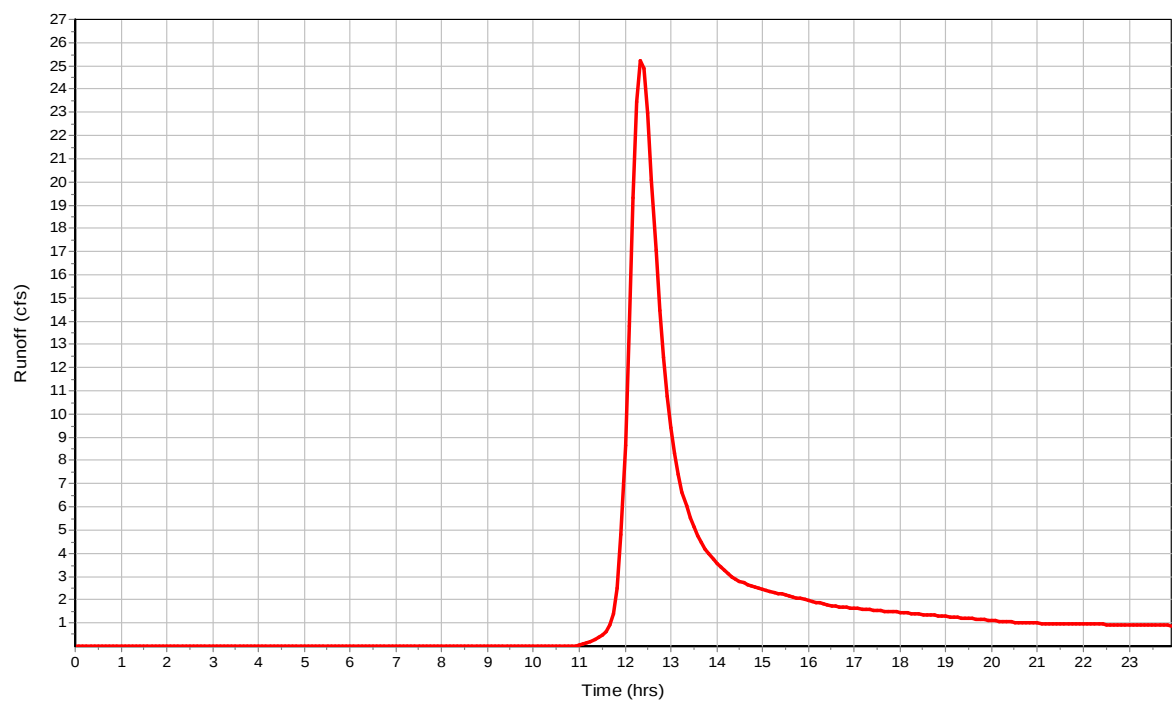
Total Rainfall (in)	3.6
Total Runoff (in)	1.25
Peak Runoff (cfs)	25.4
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:44:43

Subbasin : Drainage_Area_6

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name PreDevelopment Condition_9_22_2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 6
Subbasins..... 6
Nodes..... 6
 Junctions 0
 Outfalls 6
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	24hr100yr	Time Series	24hr100hr	Cumulative	inches					User Defined
2	24hr25yr	Time Series	24hr25yr	Cumulative	inches					User Defined
3	24hr2yr	Time Series	24hy2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
4	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
5	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches					User Defined
6	24hy10yr	Time Series	24hr10yr	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	48.76	484.00	73.00	4.30	1.75	85.13	84.59	0 00:23:37
2	Drainage_Area_2	56.23	484.00	73.00	4.30	1.75	98.18	72.70	0 00:37:49
3	Drainage_Area_3	452.08	484.00	74.08	4.30	1.83	825.50	305.56	0 01:38:52
4	Drainage_Area_4	206.82	484.00	74.56	4.30	1.86	385.10	189.46	0 01:08:06
5	Drainage_Area_5	63.55	484.00	73.00	4.30	1.75	110.96	76.55	0 00:41:55
6	Drainage_Area_6	31.81	484.00	73.00	4.30	1.75	55.54	36.63	0 00:44:43

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Peak Attained	Time of Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Analysis_Point_1	Outfall	884.00					0.00	0.00					
2	Analysis_Point_2	Outfall	900.00					0.00	0.00					
3	DA_1	Outfall	900.00					0.00	0.00					
4	DA_2	Outfall	900.00					0.00	0.00					
5	DA_5	Outfall	900.00					0.00	0.00					
6	DA_6	Outfall	900.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	48.76
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Legumes, C&T, Poor	48.76	B	73
Composite Area & Weighted CN	48.76		73

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n

R = Aq / Wp

Tc = (Lf / V) / (3600 sec/hr)

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

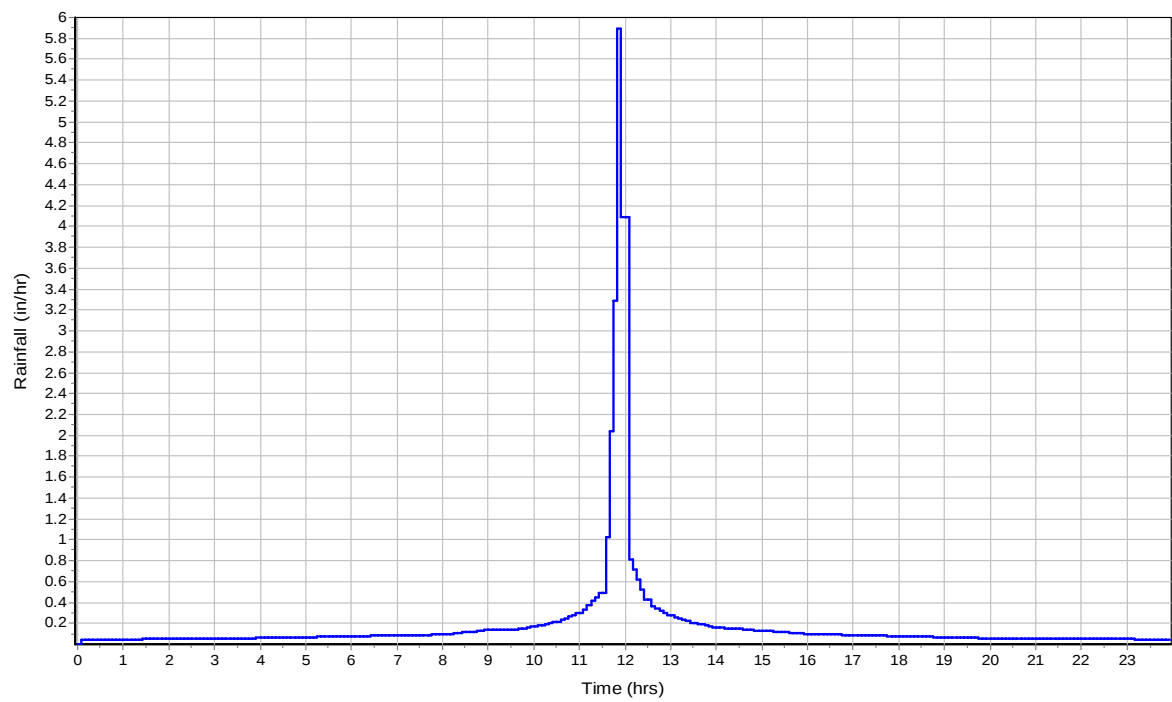
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.1	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	17.55	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	947	0	0
Slope (%) :	2.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.6	0	0
Computed Flow Time (min) :	6.07	0	0
Total TOC (min)23.62			

Subbasin Runoff Results

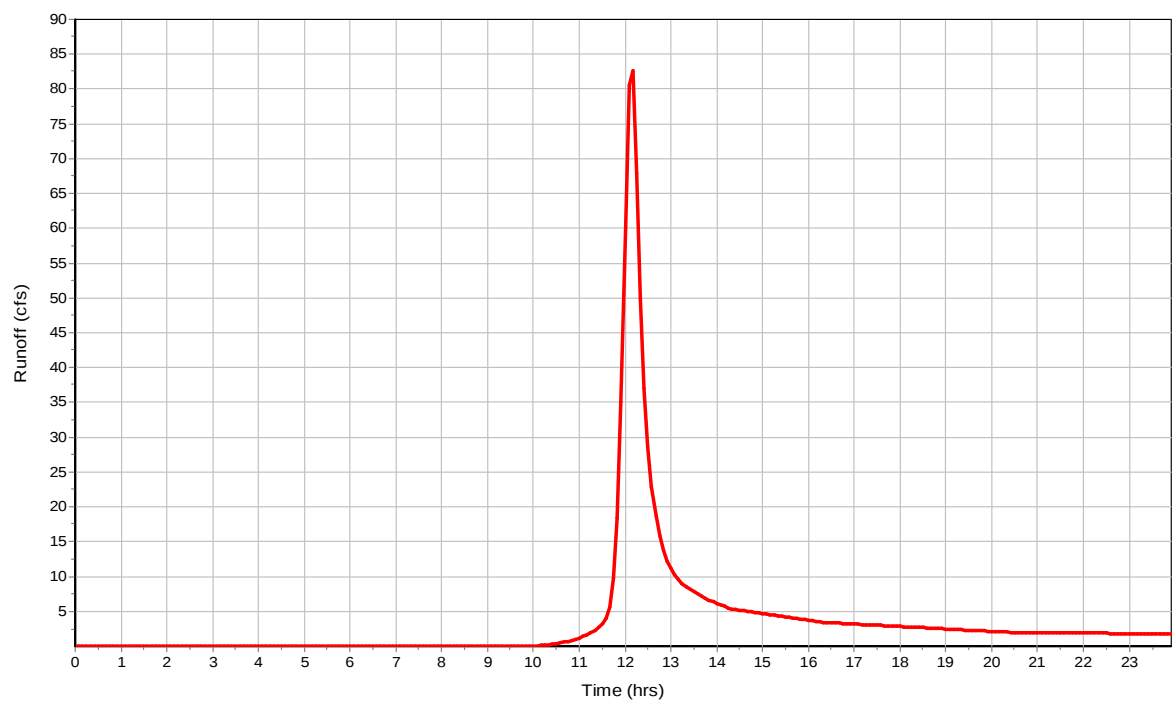
Total Rainfall (in)	4.3
Total Runoff (in)	1.75
Peak Runoff (cfs)	84.59
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:23:37

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac)	56.23
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, contoured, Good	56.23	B	73
Composite Area & Weighted CN	56.23		73

Time of Concentration

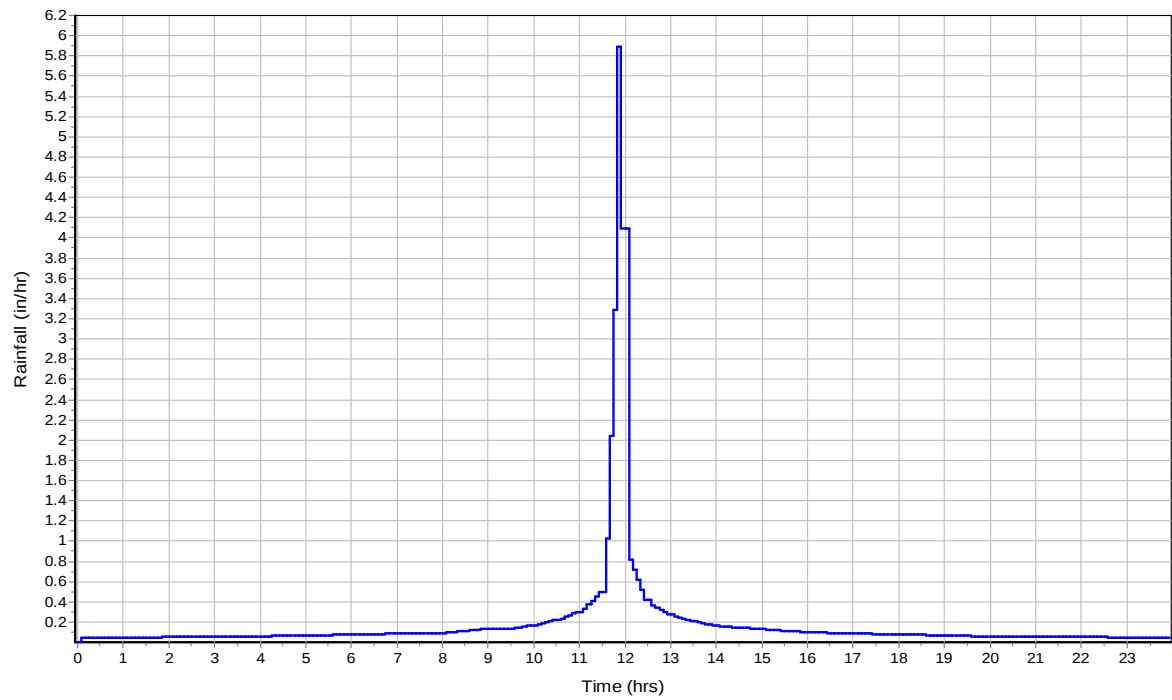
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.05	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.07	0	0
Computed Flow Time (min) :	23.15	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1198	245	0
Slope (%) :	0.83	5.4	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.47	3.75	0
Computed Flow Time (min) :	13.58	1.09	0
Total TOC (min)	37.83		

Subbasin Runoff Results

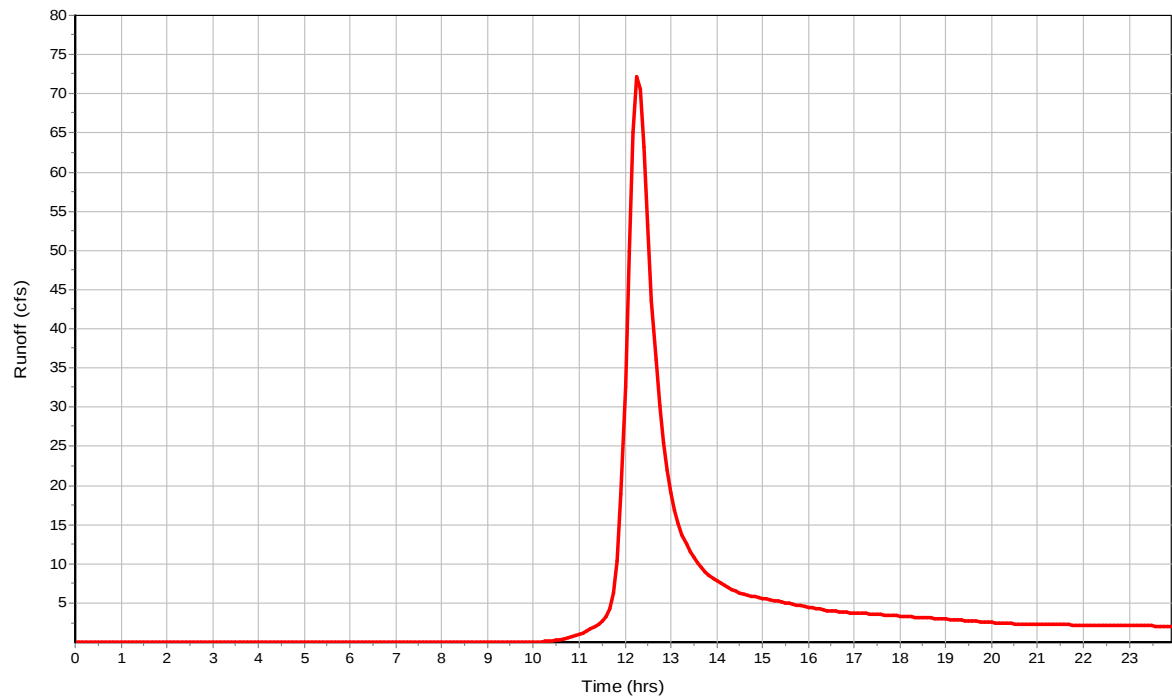
Total Rainfall (in)	4.3
Total Runoff (in)	1.75
Peak Runoff (cfs)	72.7
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:37:50

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_3

Input Data

Area (ac) 452.08
Peak Rate Factor 484
Weighted Curve Number 74.08
Rain Gage ID 24hr25yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Row crops, C&T + CR, Good	410.4	C	75
Row crops, contoured, Good	9.81	A	65
Row crops, contoured, Good	31.88	A	65
Composite Area & Weighted CN	452.09		74.08

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.08	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	19.19	0	0

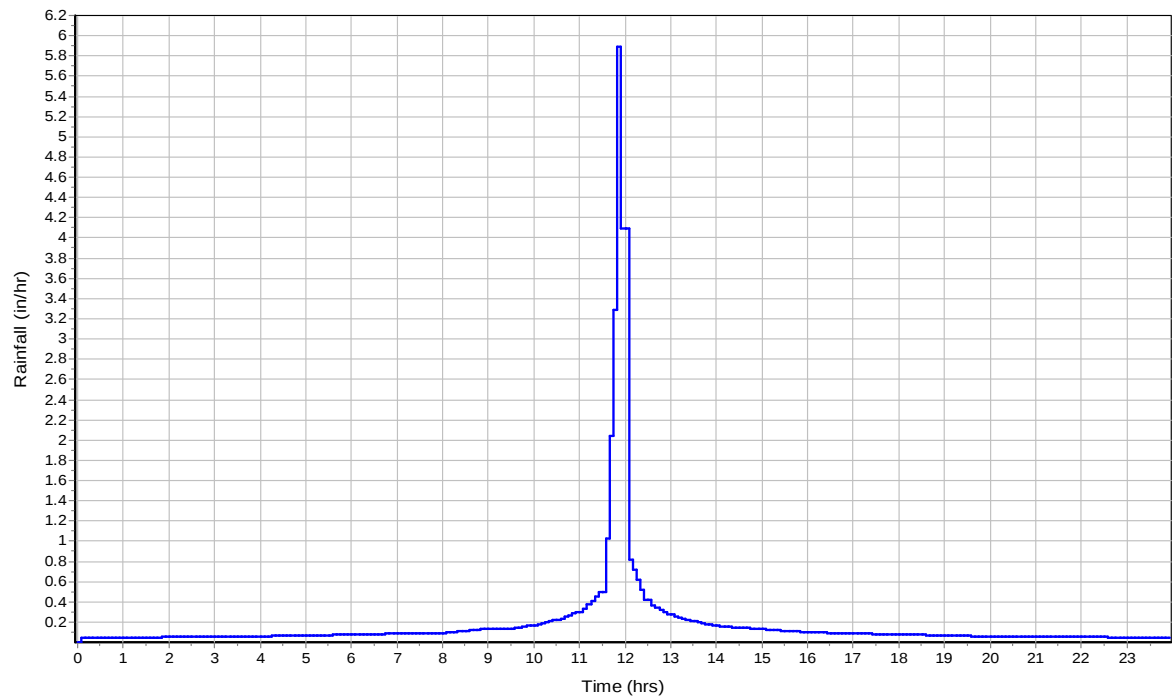
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	4320	1322	0
Slope (%) :	0.42	1.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.05	1.98	0
Computed Flow Time (min) :	68.57	11.13	0
Total TOC (min)98.88			

Subbasin Runoff Results

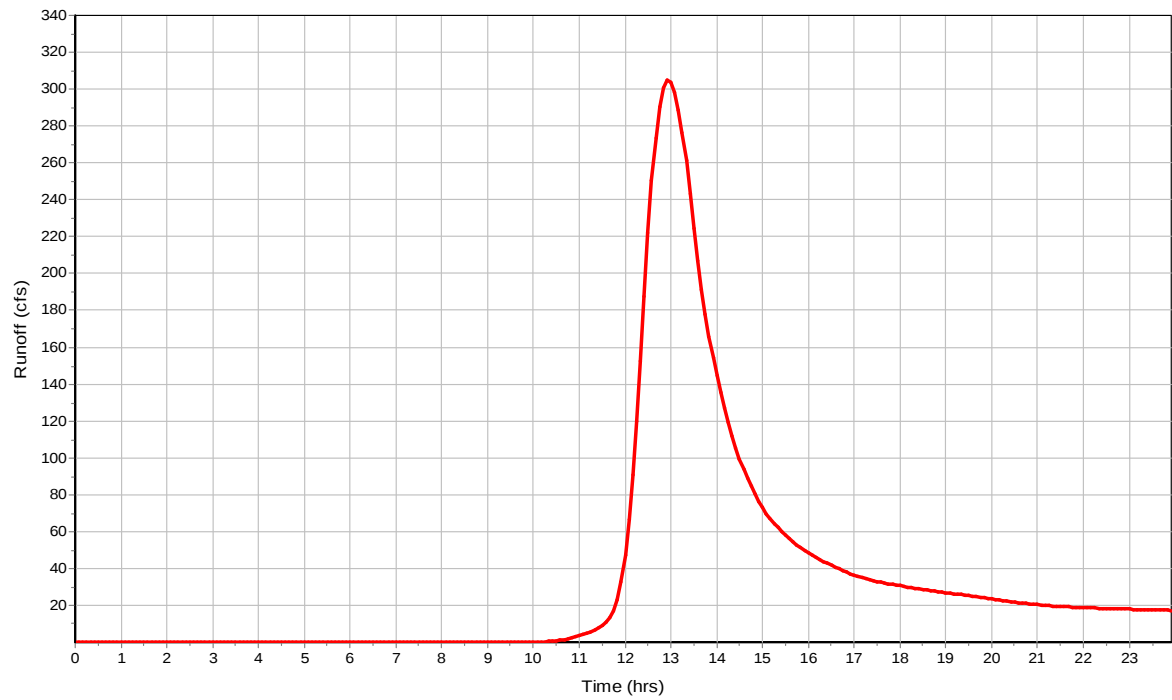
Total Rainfall (in) 4.3
Total Runoff (in) 1.83
Peak Runoff (cfs) 305.56
Weighted Curve Number 74.08
Time of Concentration (days hh:mm:ss) 0 01:38:53

Subbasin : Drainage_Area_3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_4

Input Data

Area (ac)	206.82
Peak Rate Factor	484
Weighted Curve Number	74.56
Rain Gage ID	24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C&T + CR, Good	197.77	C	75
Row crops, contoured, Good	9.05	A	65
Composite Area & Weighted CN	206.82		74.56

Time of Concentration

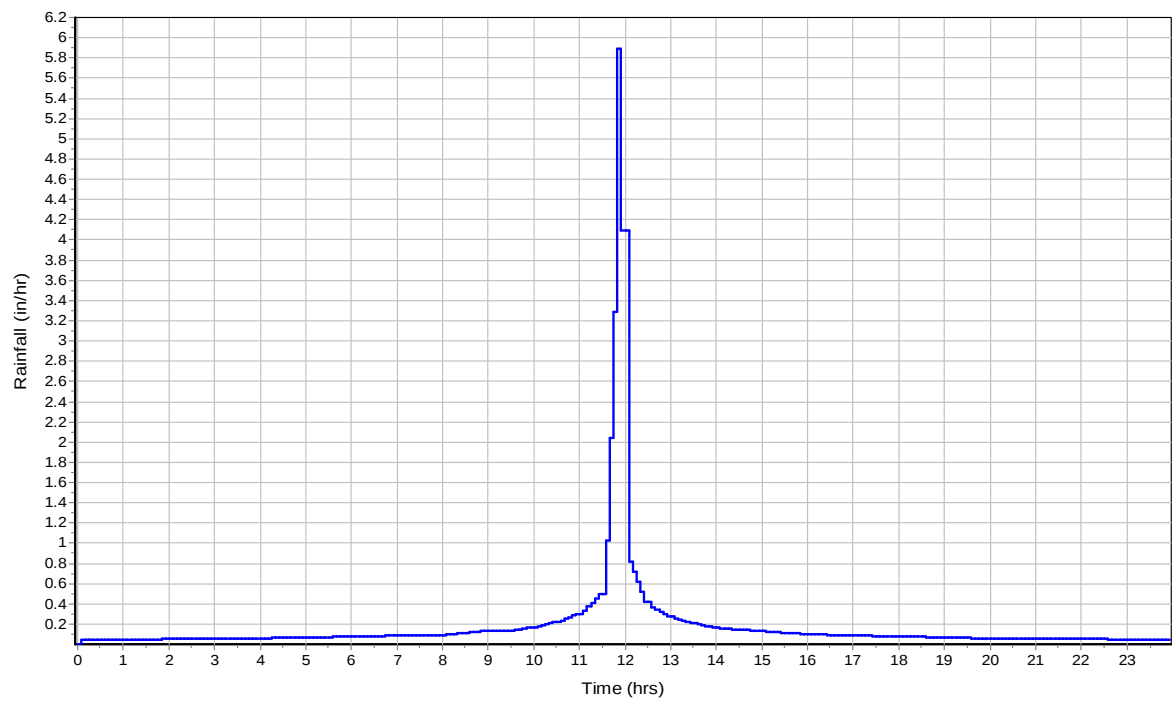
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.33	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.15	0	0
Computed Flow Time (min) :	10.88	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	3100	809	0
Slope (%) :	0.39	1.9	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	2.22	0
Computed Flow Time (min) :	51.16	6.07	0
Total TOC (min)	68.11		

Subbasin Runoff Results

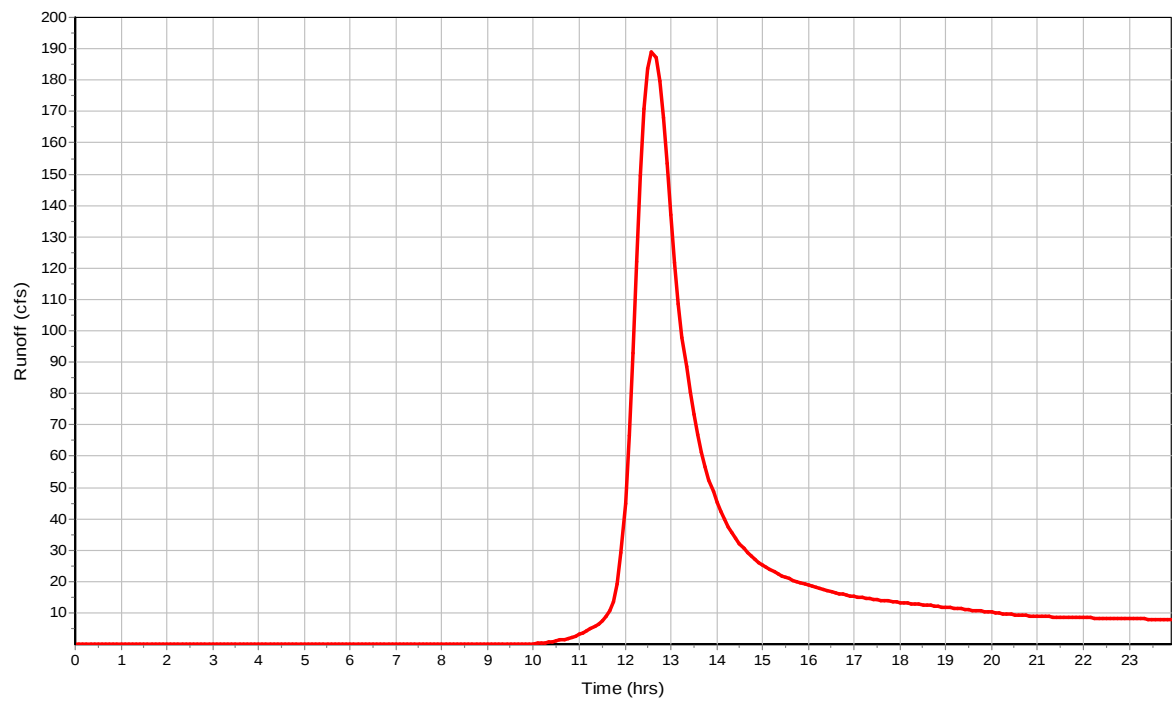
Total Rainfall (in)	4.3
Total Runoff (in)	1.86
Peak Runoff (cfs)	189.46
Weighted Curve Number	74.56
Time of Concentration (days hh:mm:ss)	0 01:08:07

Subbasin : Drainage_Area_4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_5

Input Data

Area (ac) 63.55
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hr25yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	63.55	B	73
Composite Area & Weighted CN	63.55		73

Time of Concentration

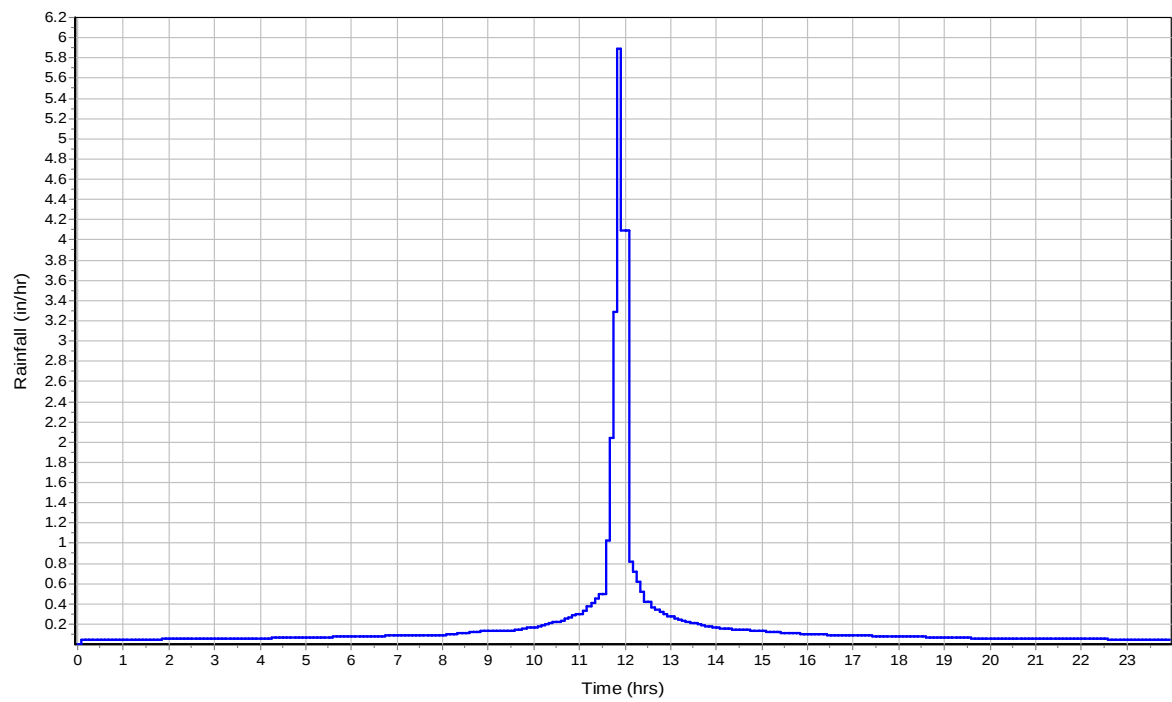
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.4	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.17	0	0
Computed Flow Time (min) :	10.08	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1106	1008	0
Slope (%) :	0.38	0.62	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.99	1.27	0
Computed Flow Time (min) :	18.62	13.23	0
Total TOC (min)	41.93		

Subbasin Runoff Results

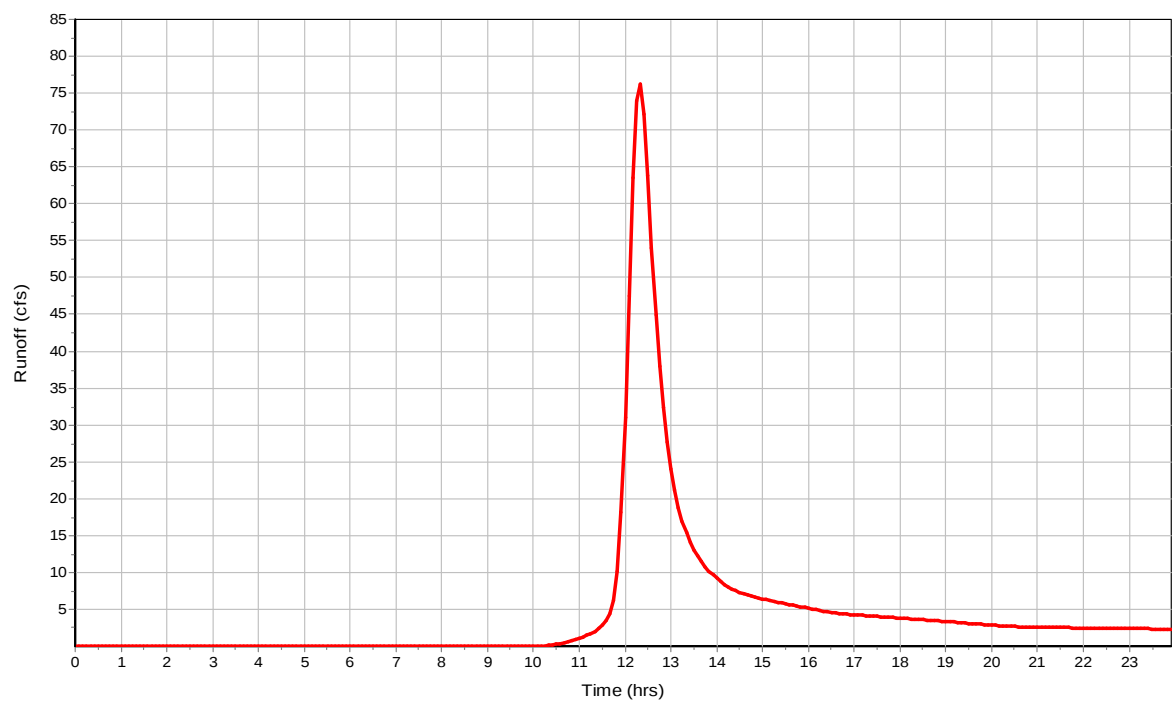
Total Rainfall (in) 4.3
Total Runoff (in) 1.75
Peak Runoff (cfs) 76.55
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:41:56

Subbasin : Drainage_Area_5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_6

Input Data

Area (ac)	31.81
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	31.81	B	73
Composite Area & Weighted CN	31.81		73

Time of Concentration

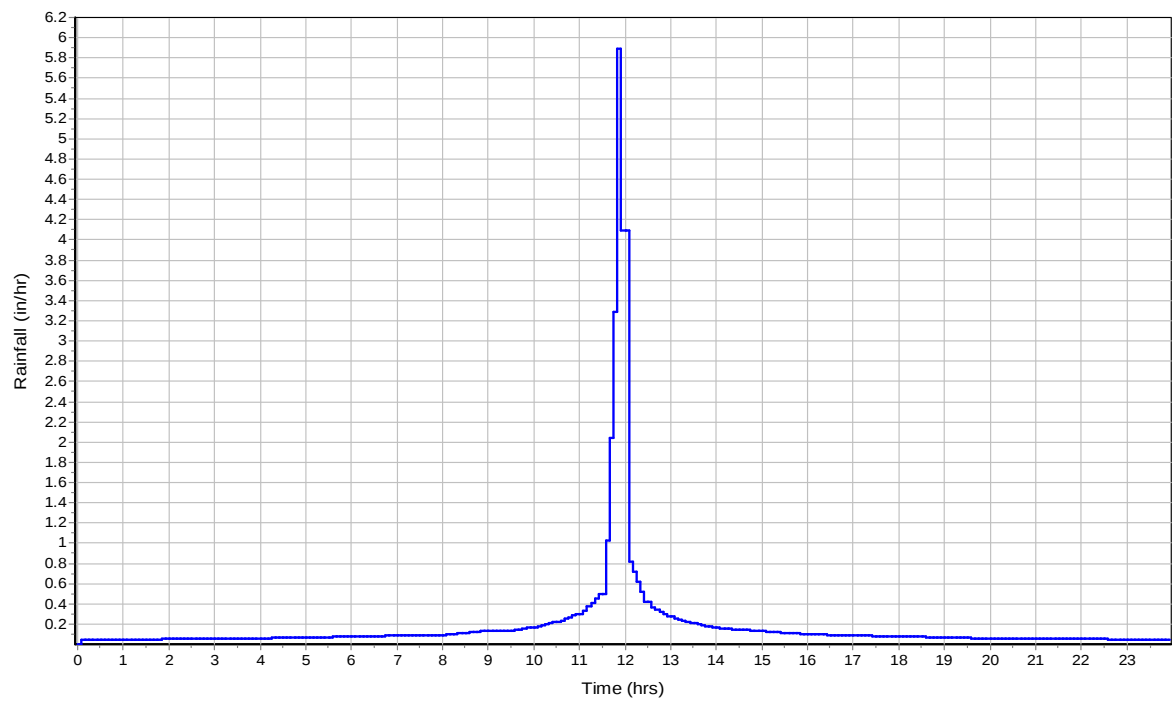
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.15	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.92	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1520	596	0
Slope (%) :	0.28	0.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.85	0	0
Computed Flow Time (min) :	29.8	0	0
Total TOC (min)	44.72		

Subbasin Runoff Results

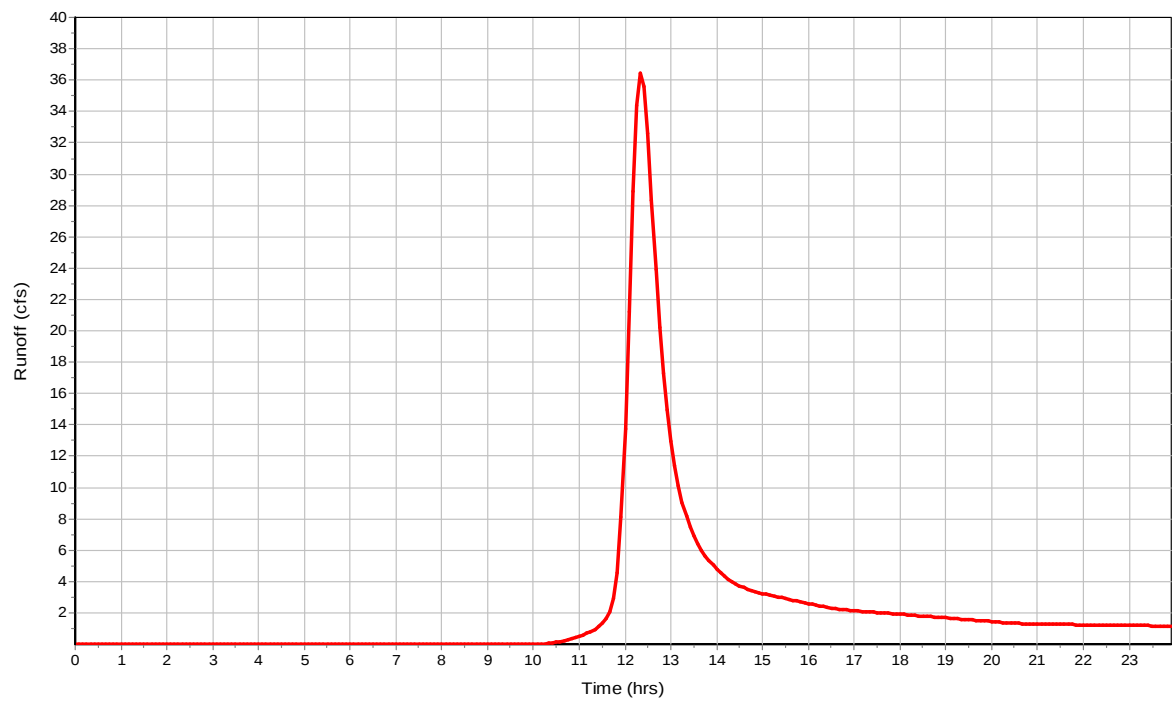
Total Rainfall (in)	4.3
Total Runoff (in)	1.75
Peak Runoff (cfs)	36.63
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:44:43

Subbasin : Drainage_Area_6

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name PreDevelopment Condition_9_22_2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 6
Subbasins..... 6
Nodes..... 6
 Junctions 0
 Outfalls 6
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	24hr100yr	Time Series	24hr100hr	Cumulative	inches					User Defined
2	24hr25yr	Time Series	24hr25yr	Cumulative	inches					User Defined
3	24hr2yr	Time Series	24hy2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
4	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
5	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches					User Defined
6	24hy10yr	Time Series	24hr10yr	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	48.76	484.00	73.00	4.91	2.21	107.76	108.21	0 00:23:37
2	Drainage_Area_2	56.23	484.00	73.00	4.91	2.21	124.27	93.17	0 00:37:49
3	Drainage_Area_3	452.08	484.00	74.08	4.91	2.30	1039.33	390.19	0 01:38:52
4	Drainage_Area_4	206.82	484.00	74.56	4.91	2.34	483.75	240.79	0 01:08:06
5	Drainage_Area_5	63.55	484.00	73.00	4.91	2.21	140.45	98.02	0 00:41:55
6	Drainage_Area_6	31.81	484.00	73.00	4.91	2.21	70.30	46.95	0 00:44:43

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Peak Attained	Time of Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Analysis_Point_1	Outfall	884.00					0.00	0.00					
2	Analysis_Point_2	Outfall	900.00					0.00	0.00					
3	DA_1	Outfall	900.00					0.00	0.00					
4	DA_2	Outfall	900.00					0.00	0.00					
5	DA_5	Outfall	900.00					0.00	0.00					
6	DA_6	Outfall	900.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	48.76
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Legumes, C&T, Poor	48.76	B	73
Composite Area & Weighted CN	48.76		73

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{(2/3)})) * (S_f^{0.5}) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

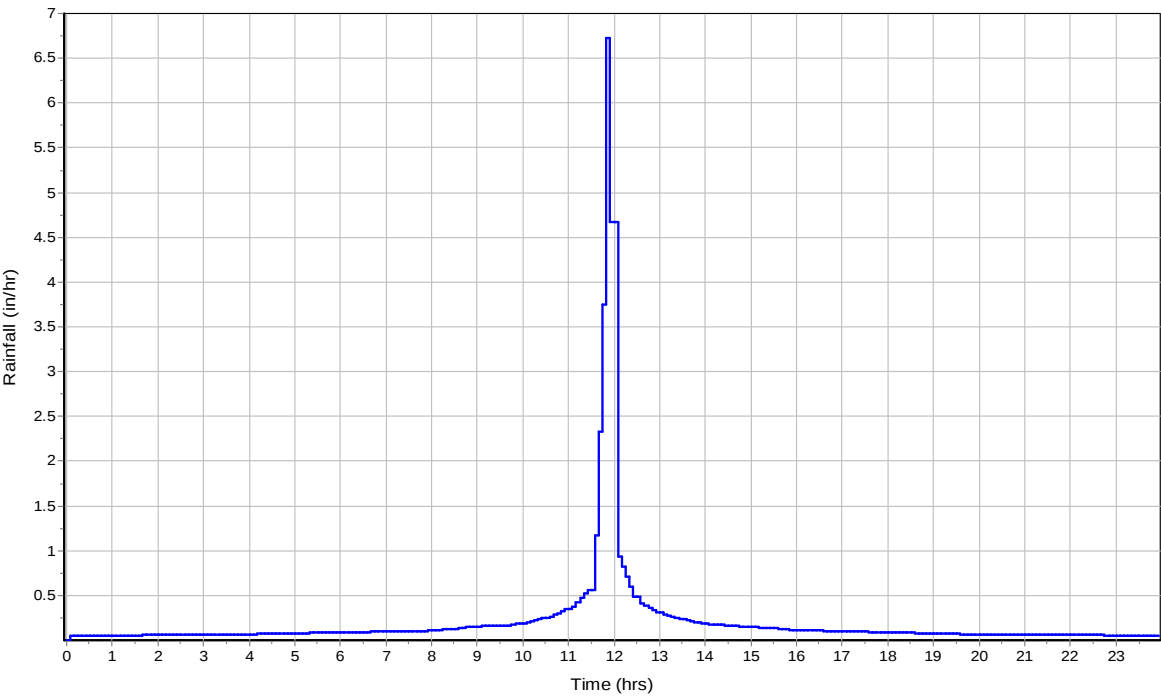
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.1	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	17.55	0	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	947	0	0
Slope (%) :	2.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.6	0	0
Computed Flow Time (min) :	6.07	0	0
Total TOC (min)	23.62		

Subbasin Runoff Results

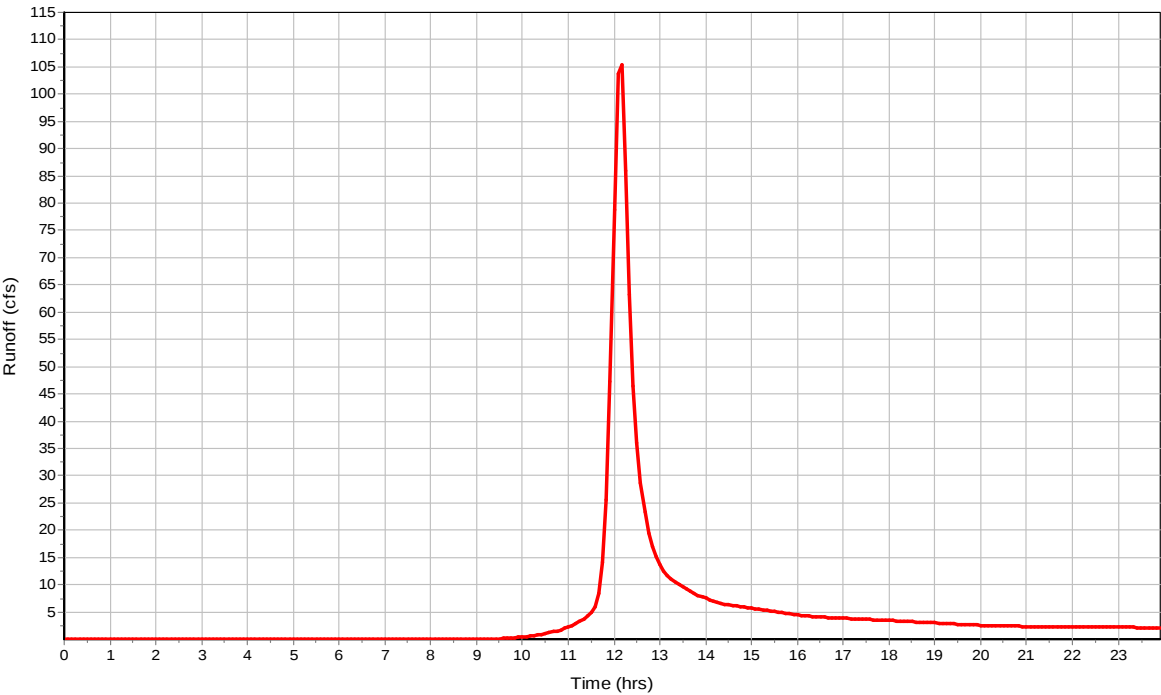
Total Rainfall (in)	4.91
Total Runoff (in)	2.21
Peak Runoff (cfs)	108.21
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:23:37

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 56.23
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	56.23	B	73
Composite Area & Weighted CN	56.23		73

Time of Concentration

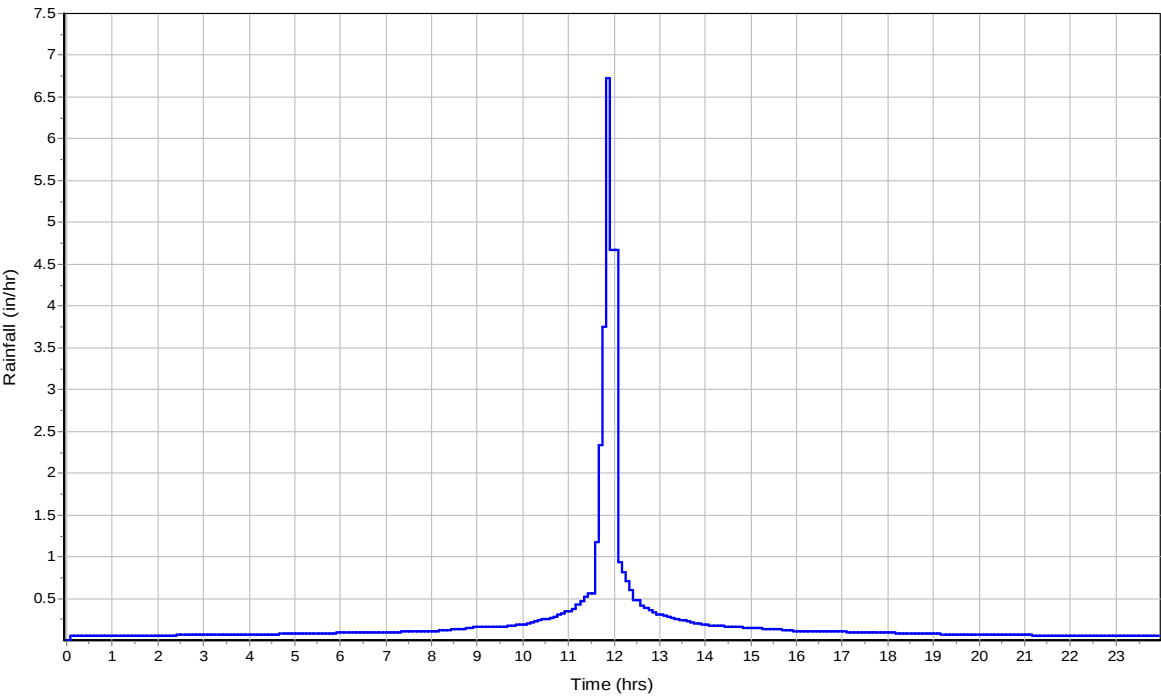
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.05	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.07	0	0
Computed Flow Time (min) :	23.15	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1198	245	0
Slope (%) :	0.83	5.4	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.47	3.75	0
Computed Flow Time (min) :	13.58	1.09	0
Total TOC (min)			37.83

Subbasin Runoff Results

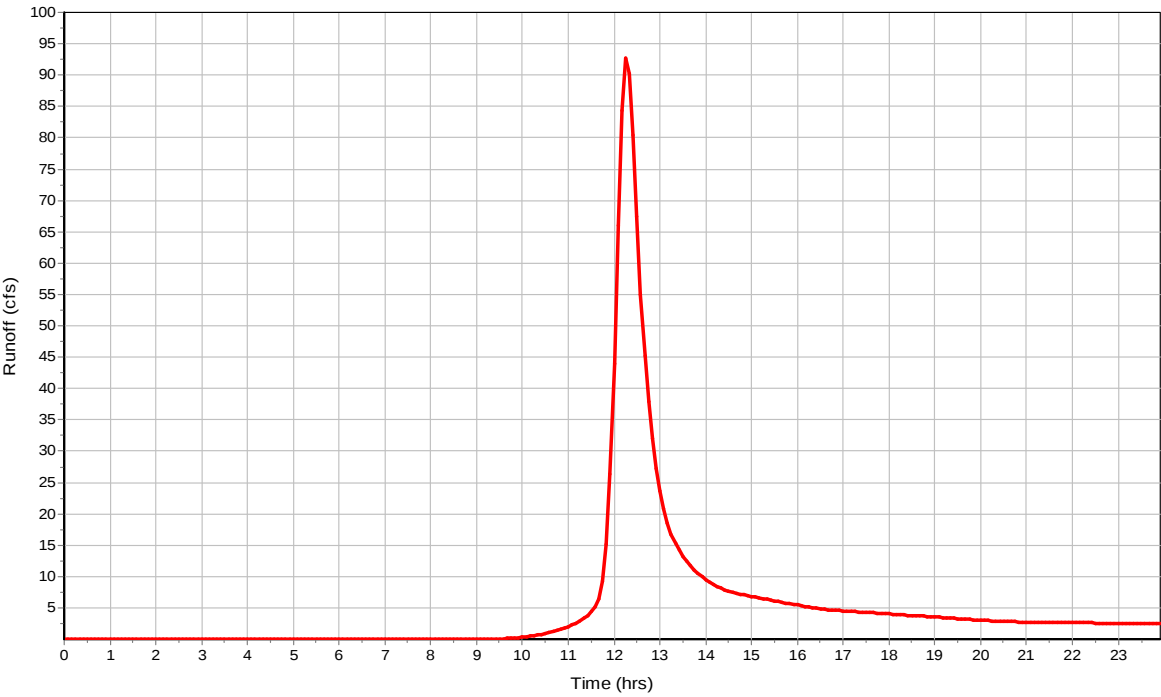
Total Rainfall (in) 4.91
Total Runoff (in) 2.21
Peak Runoff (cfs) 93.17
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:37:50

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_3

Input Data

Area (ac) 452.08
Peak Rate Factor 484
Weighted Curve Number 74.08
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Row crops, C&T + CR, Good	410.4	C	75
Row crops, contoured, Good	9.81	A	65
Row crops, contoured, Good	31.88	A	65
Composite Area & Weighted CN	452.09		74.08

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.08	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	19.19	0	0

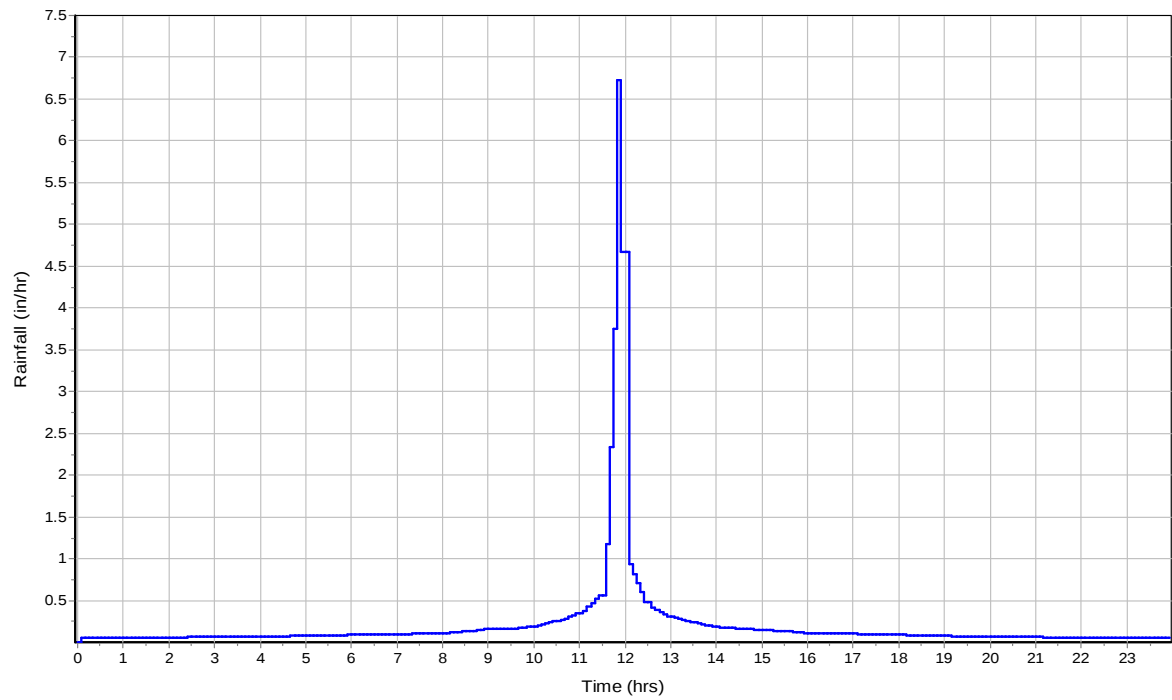
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	4320	1322	0
Slope (%) :	0.42	1.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.05	1.98	0
Computed Flow Time (min) :	68.57	11.13	0
Total TOC (min)98.88			

Subbasin Runoff Results

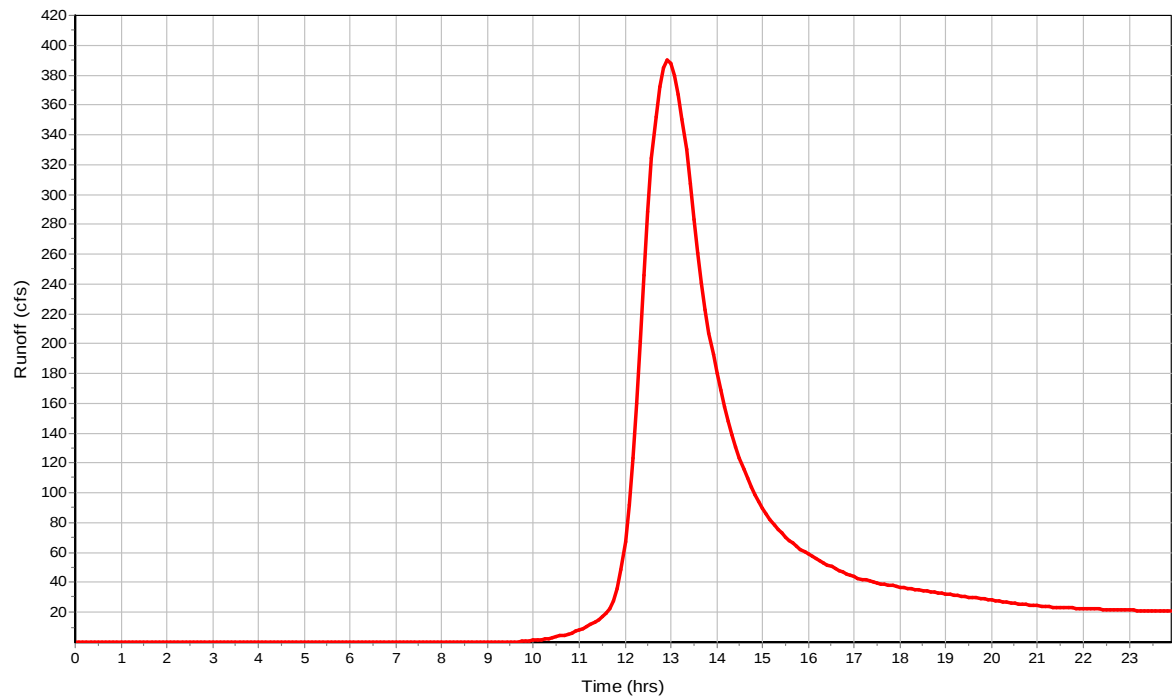
Total Rainfall (in) 4.91
Total Runoff (in) 2.3
Peak Runoff (cfs) 390.19
Weighted Curve Number 74.08
Time of Concentration (days hh:mm:ss) 0 01:38:53

Subbasin : Drainage_Area_3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_4

Input Data

Area (ac) 206.82
Peak Rate Factor 484
Weighted Curve Number 74.56
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, C&T + CR, Good	197.77	C	75
Row crops, contoured, Good	9.05	A	65
Composite Area & Weighted CN	206.82		74.56

Time of Concentration

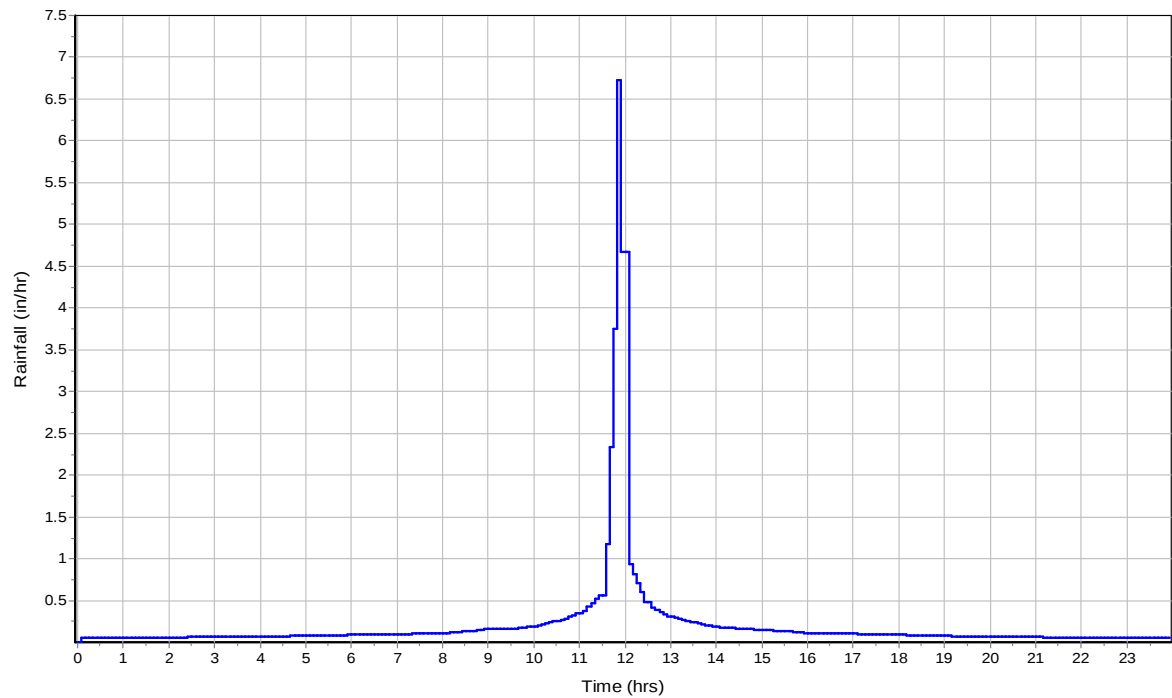
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.33	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.15	0	0
Computed Flow Time (min) :	10.88	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	3100	809	0
Slope (%) :	0.39	1.9	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	2.22	0
Computed Flow Time (min) :	51.16	6.07	0
Total TOC (min)	68.11		

Subbasin Runoff Results

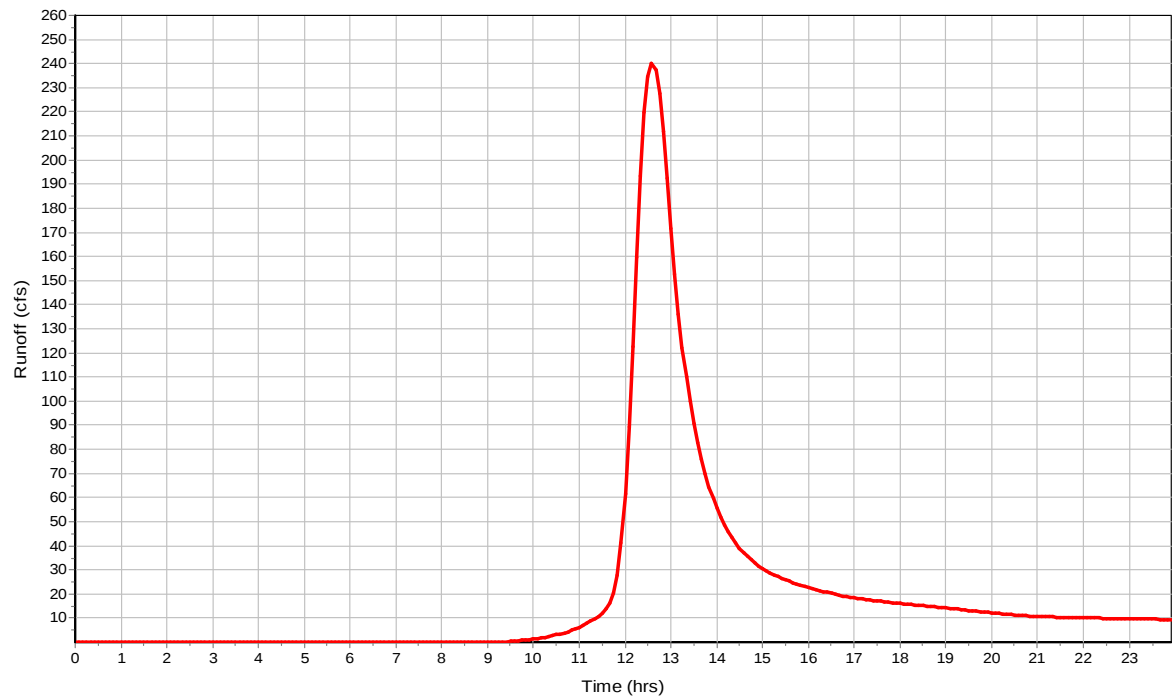
Total Rainfall (in) 4.91
Total Runoff (in) 2.34
Peak Runoff (cfs) 240.79
Weighted Curve Number 74.56
Time of Concentration (days hh:mm:ss) 0 01:08:07

Subbasin : Drainage_Area_4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_5

Input Data

Area (ac) 63.55
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	63.55	B	73
Composite Area & Weighted CN	63.55		73

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.4	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.17	0	0
Computed Flow Time (min) :	10.08	0	0

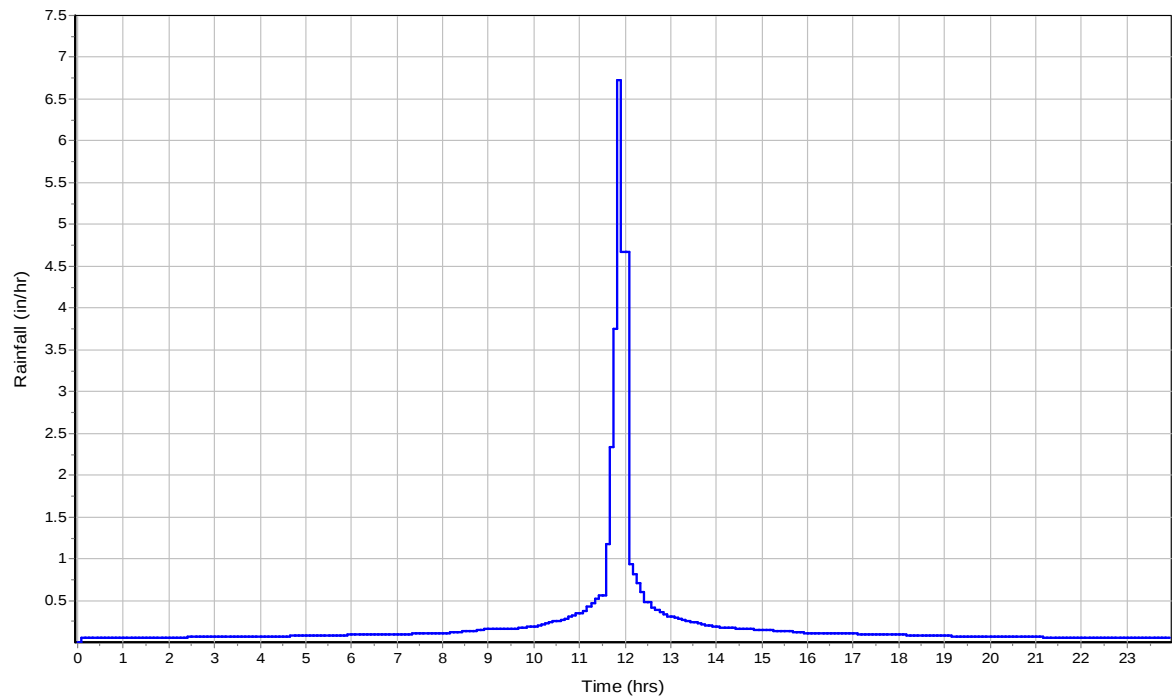
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1106	1008	0
Slope (%) :	0.38	0.62	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.99	1.27	0
Computed Flow Time (min) :	18.62	13.23	0
Total TOC (min)	41.93		

Subbasin Runoff Results

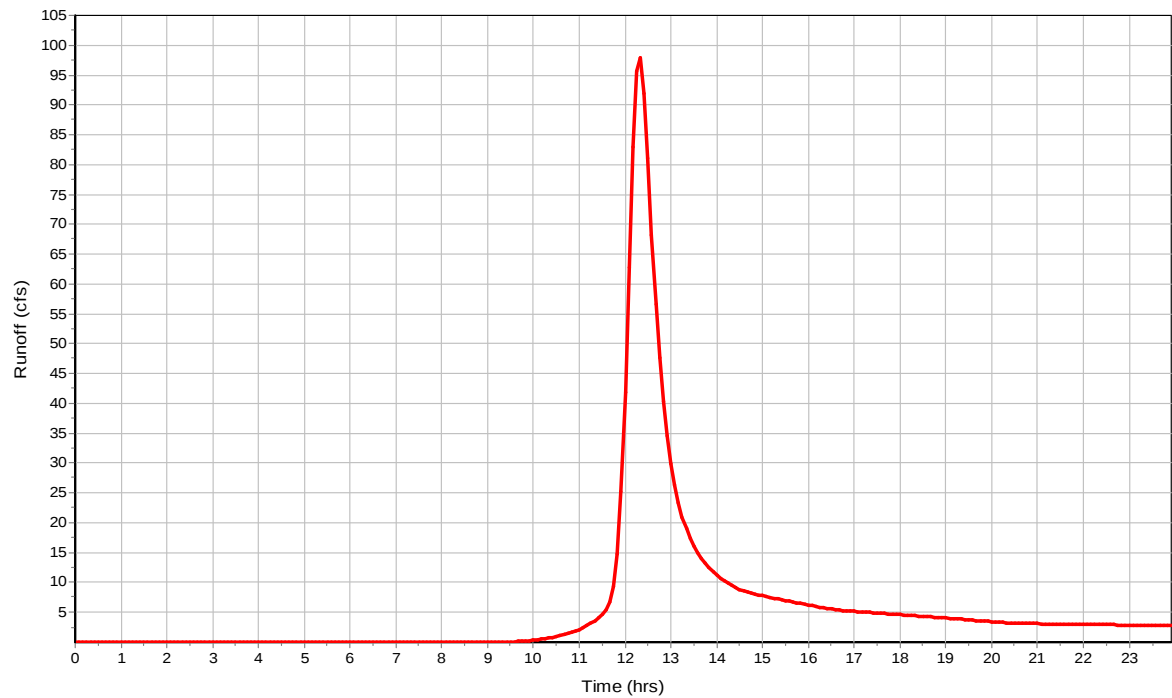
Total Rainfall (in) 4.91
Total Runoff (in) 2.21
Peak Runoff (cfs) 98.02
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:41:56

Subbasin : Drainage_Area_5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_6

Input Data

Area (ac)	31.81
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	31.81	B	73
Composite Area & Weighted CN	31.81		73

Time of Concentration

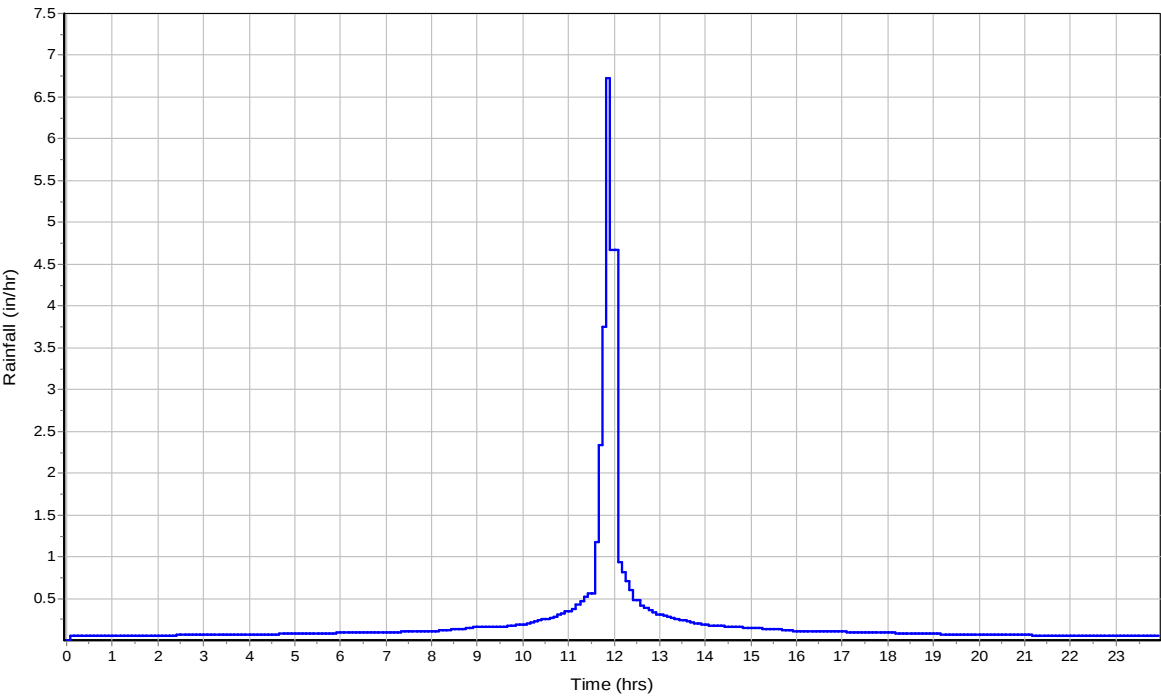
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.15	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.92	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1520	596	0
Slope (%) :	0.28	0.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.85	0	0
Computed Flow Time (min) :	29.8	0	0
Total TOC (min)	44.72		

Subbasin Runoff Results

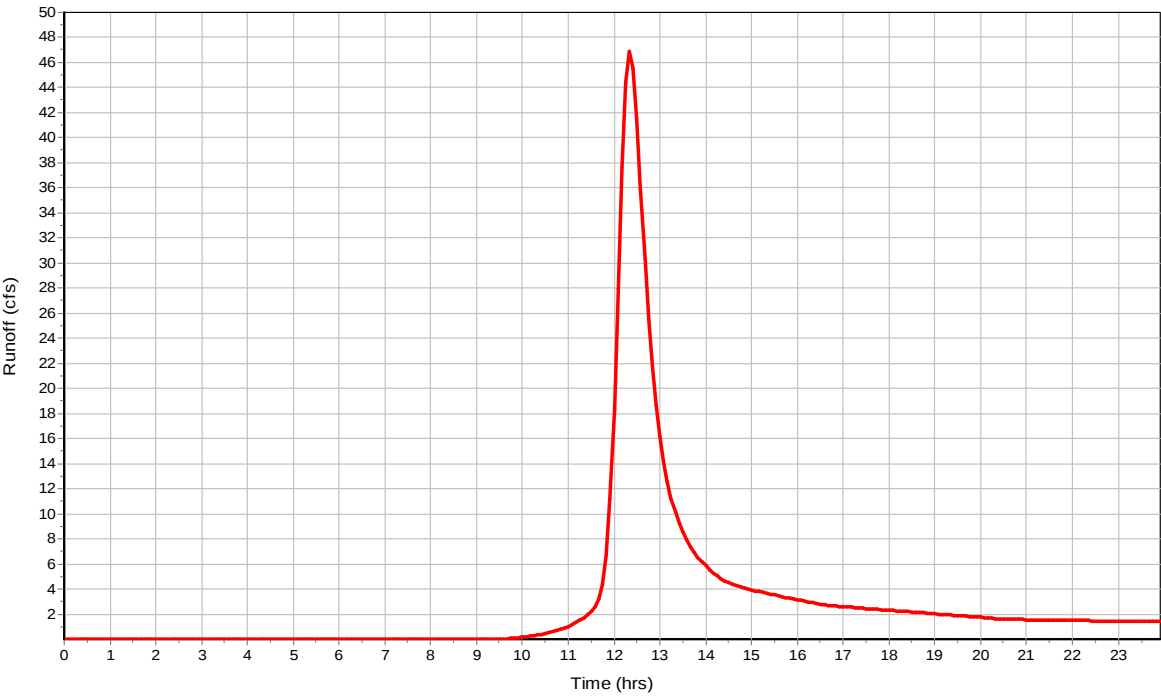
Total Rainfall (in)	4.91
Total Runoff (in)	2.21
Peak Runoff (cfs)	46.95
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:44:43

Subbasin : Drainage_Area_6

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name PreDevelopment Condition_9_22_2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 6
Subbasins..... 6
Nodes..... 6
 Junctions 0
 Outfalls 6
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 0
 Channels 0
 Pipes 0
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	24hr100yr	Time Series	24hr100hr	Cumulative	inches					User Defined
2	24hr25yr	Time Series	24hr25yr	Cumulative	inches					User Defined
3	24hr2yr	Time Series	24hy2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
4	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
5	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches					User Defined
6	24hy10yr	Time Series	24hr10yr	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	48.76	484.00	73.00	5.60	2.76	134.58	136.08	0 00:23:37
2	Drainage_Area_2	56.23	484.00	73.00	5.60	2.76	155.19	117.52	0 00:37:49
3	Drainage_Area_3	452.08	484.00	74.08	5.60	2.86	1292.50	489.51	0 01:38:52
4	Drainage_Area_4	206.82	484.00	74.56	5.60	2.90	600.40	301.63	0 01:08:06
5	Drainage_Area_5	63.55	484.00	73.00	5.60	2.76	175.40	123.67	0 00:41:55
6	Drainage_Area_6	31.81	484.00	73.00	5.60	2.76	87.80	59.24	0 00:44:43

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Peak Attained	Time of Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Analysis_Point_1	Outfall	884.00					0.00	0.00					
2	Analysis_Point_2	Outfall	900.00					0.00	0.00					
3	DA_1	Outfall	900.00					0.00	0.00					
4	DA_2	Outfall	900.00					0.00	0.00					
5	DA_5	Outfall	900.00					0.00	0.00					
6	DA_6	Outfall	900.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	48.76
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Legumes, C&T, Poor	48.76	B	73
Composite Area & Weighted CN	48.76		73

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{(2/3)}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

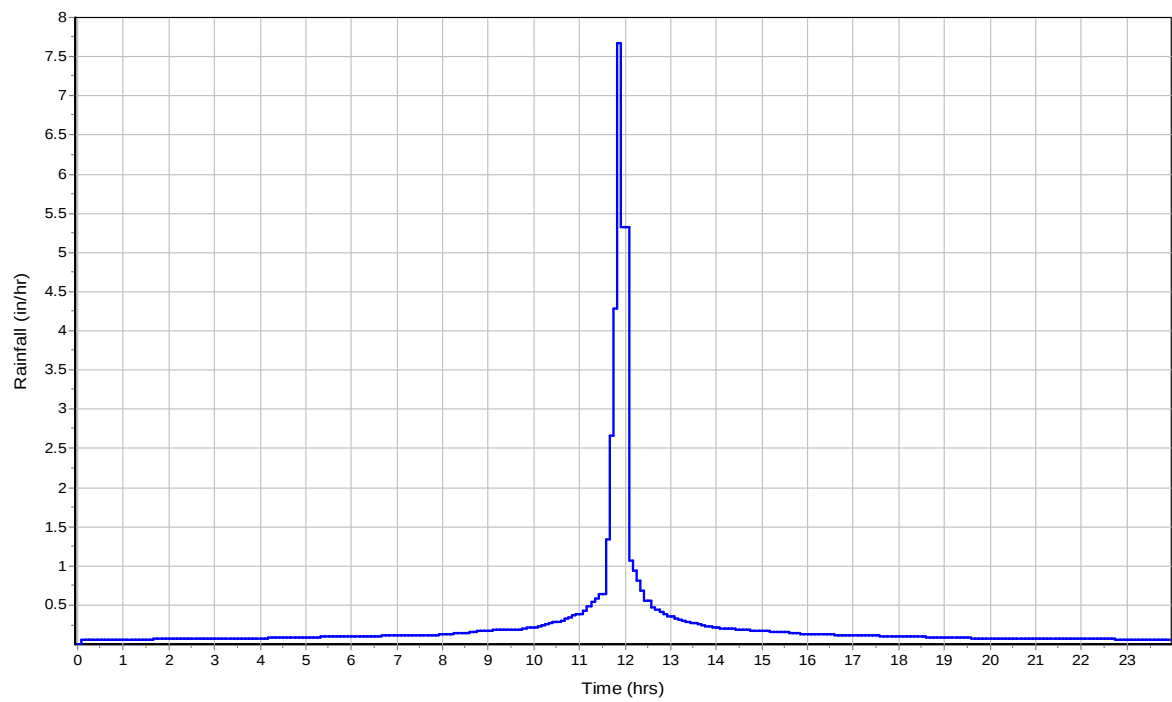
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.1	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	17.55	0	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	947	0	0
Slope (%) :	2.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.6	0	0
Computed Flow Time (min) :	6.07	0	0
Total TOC (min)	23.62		

Subbasin Runoff Results

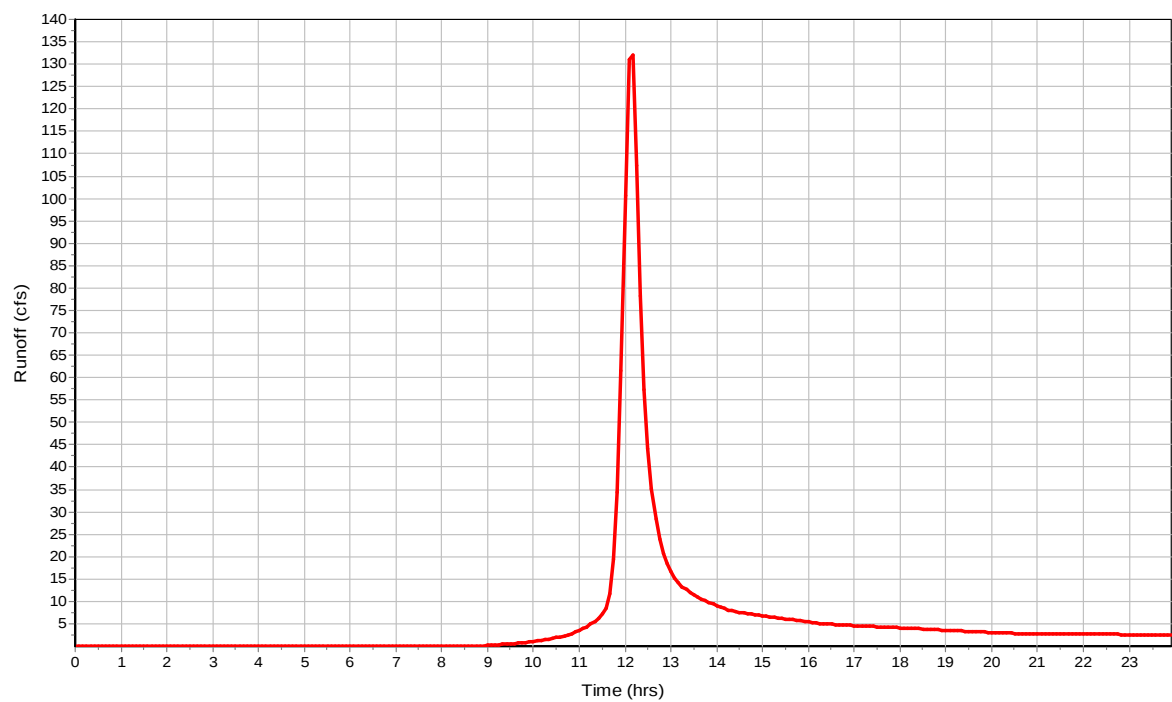
Total Rainfall (in)	5.6
Total Runoff (in)	2.76
Peak Runoff (cfs)	136.08
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:23:37

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 56.23
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hr100yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	56.23	B	73
Composite Area & Weighted CN	56.23		73

Time of Concentration

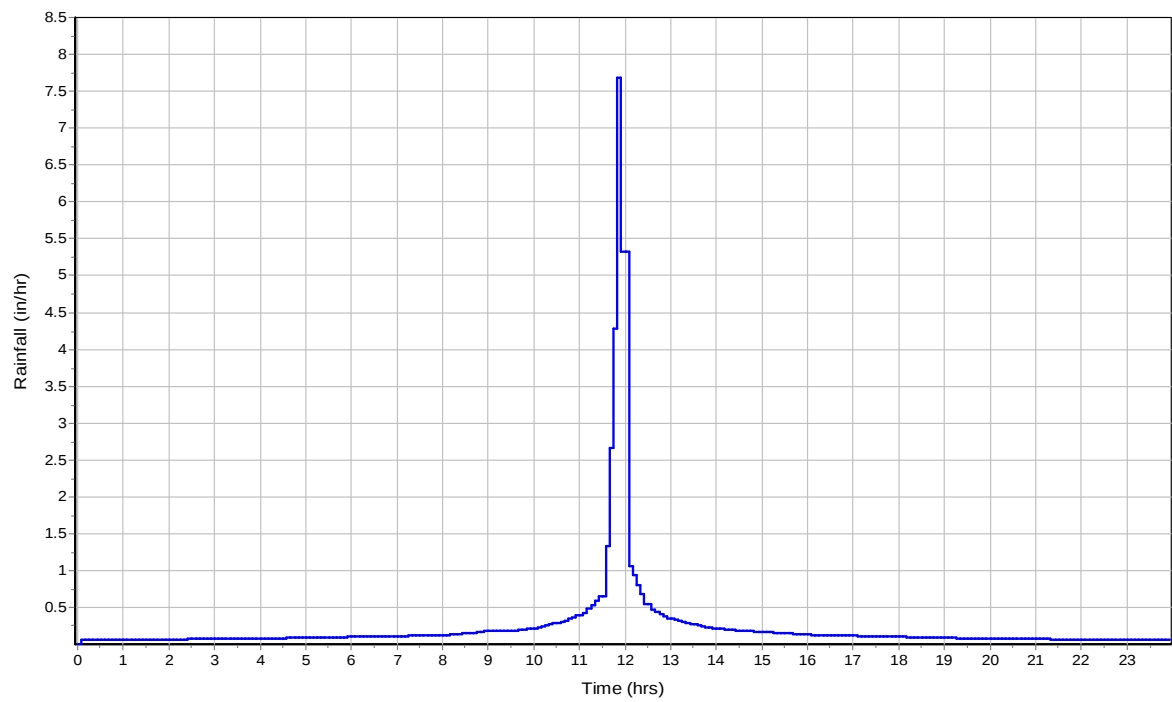
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.05	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.07	0	0
Computed Flow Time (min) :	23.15	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1198	245	0
Slope (%) :	0.83	5.4	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.47	3.75	0
Computed Flow Time (min) :	13.58	1.09	0
Total TOC (min)37.83			

Subbasin Runoff Results

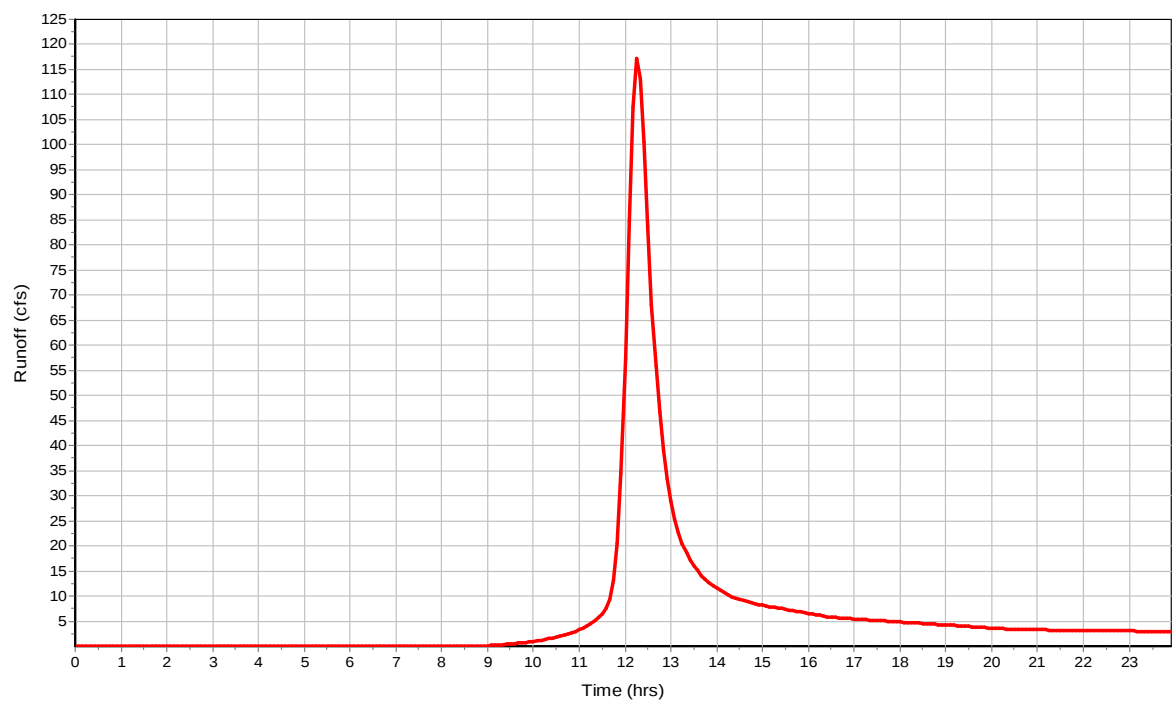
Total Rainfall (in) 5.6
Total Runoff (in) 2.76
Peak Runoff (cfs) 117.52
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:37:50

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_3

Input Data

Area (ac)	452.08
Peak Rate Factor	484
Weighted Curve Number	74.08
Rain Gage ID	24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Row crops, C&T + CR, Good	410.4	C	75
Row crops, contoured, Good	9.81	A	65
Row crops, contoured, Good	31.88	A	65
Composite Area & Weighted CN	452.09		74.08

Time of Concentration

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.08	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.09	0	0
Computed Flow Time (min) :	19.19	0	0

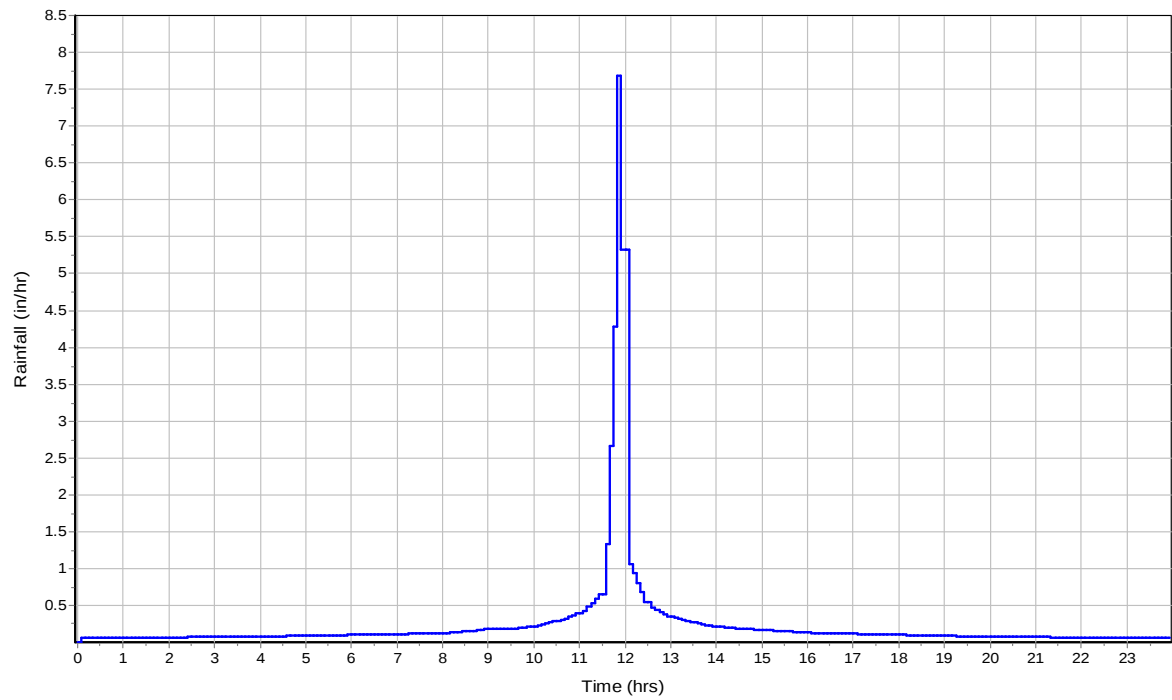
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	4320	1322	0
Slope (%) :	0.42	1.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.05	1.98	0
Computed Flow Time (min) :	68.57	11.13	0
Total TOC (min)	98.88		

Subbasin Runoff Results

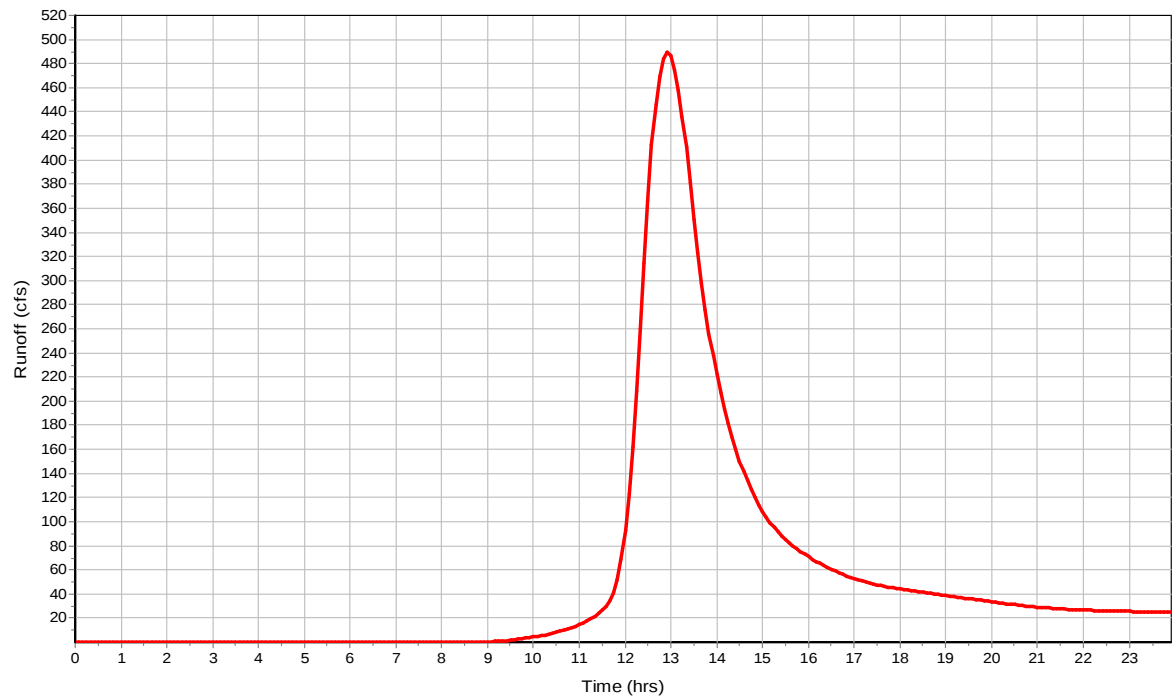
Total Rainfall (in)	5.6
Total Runoff (in)	2.86
Peak Runoff (cfs)	489.51
Weighted Curve Number	74.08
Time of Concentration (days hh:mm:ss)	0 01:38:53

Subbasin : Drainage_Area_3

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_4

Input Data

Area (ac)	206.82
Peak Rate Factor	484
Weighted Curve Number	74.56
Rain Gage ID	24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C&T + CR, Good	197.77	C	75
Row crops, contoured, Good	9.05	A	65
Composite Area & Weighted CN	206.82		74.56

Time of Concentration

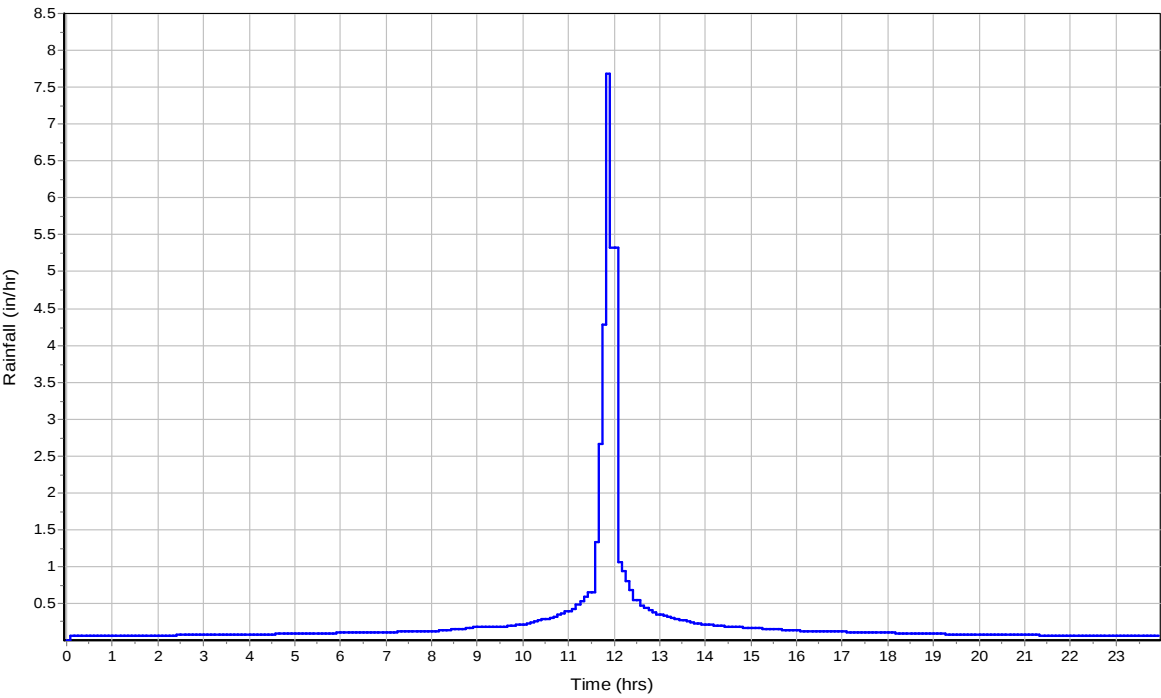
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.33	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.15	0	0
Computed Flow Time (min) :	10.88	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	3100	809	0
Slope (%) :	0.39	1.9	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	2.22	0
Computed Flow Time (min) :	51.16	6.07	0
Total TOC (min)	68.11		

Subbasin Runoff Results

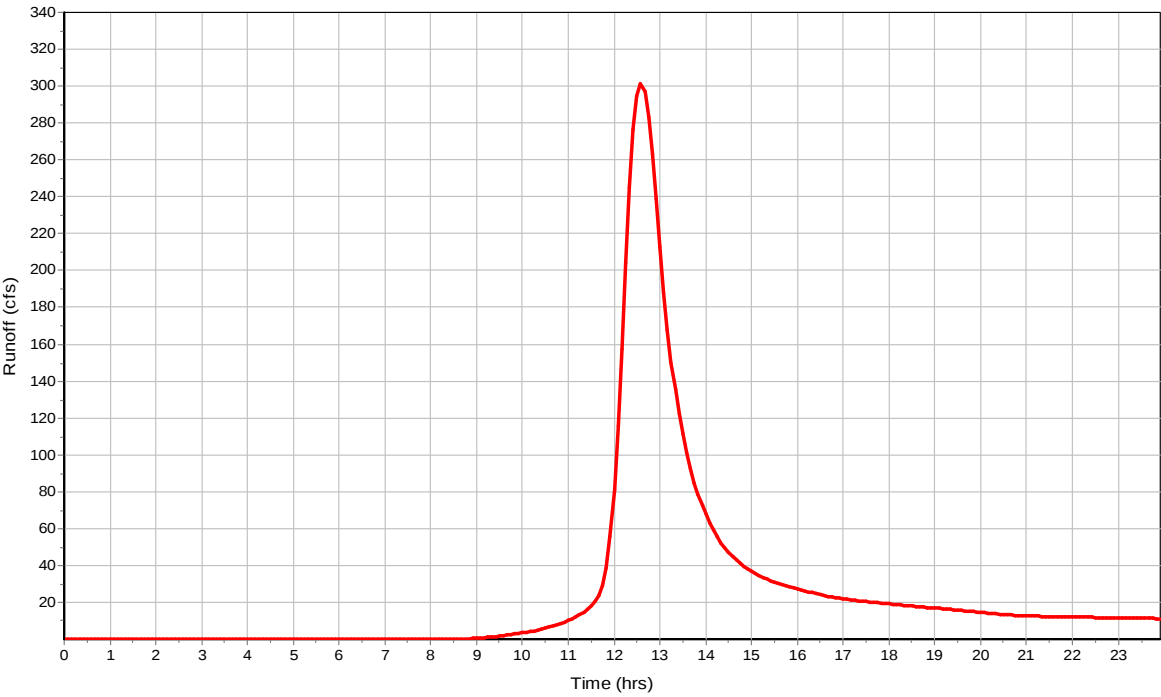
Total Rainfall (in)	5.6
Total Runoff (in)	2.9
Peak Runoff (cfs)	301.63
Weighted Curve Number	74.56
Time of Concentration (days hh:mm:ss)	0 01:08:07

Subbasin : Drainage_Area_4

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_5

Input Data

Area (ac) 63.55
Peak Rate Factor 484
Weighted Curve Number 73
Rain Gage ID 24hr100yr

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Small grain, contoured, Good	63.55	B	73
Composite Area & Weighted CN	63.55		73

Time of Concentration

	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.4	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.17	0	0
Computed Flow Time (min) :	10.08	0	0

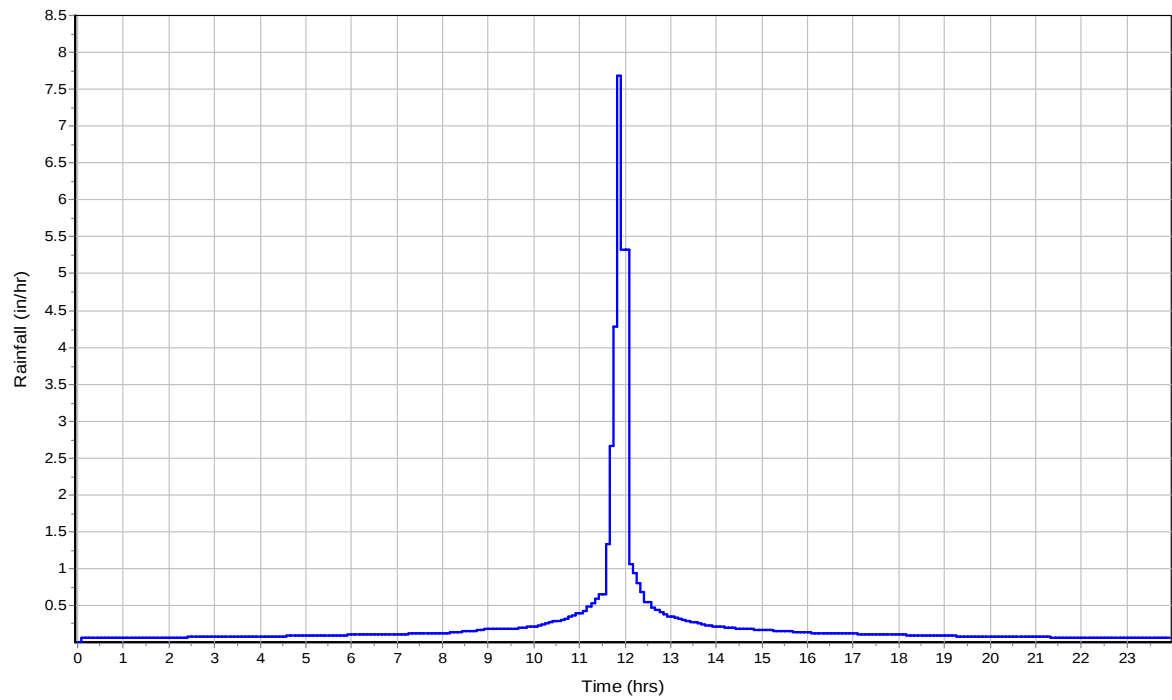
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1106	1008	0
Slope (%) :	0.38	0.62	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.99	1.27	0
Computed Flow Time (min) :	18.62	13.23	0
Total TOC (min)	41.93		

Subbasin Runoff Results

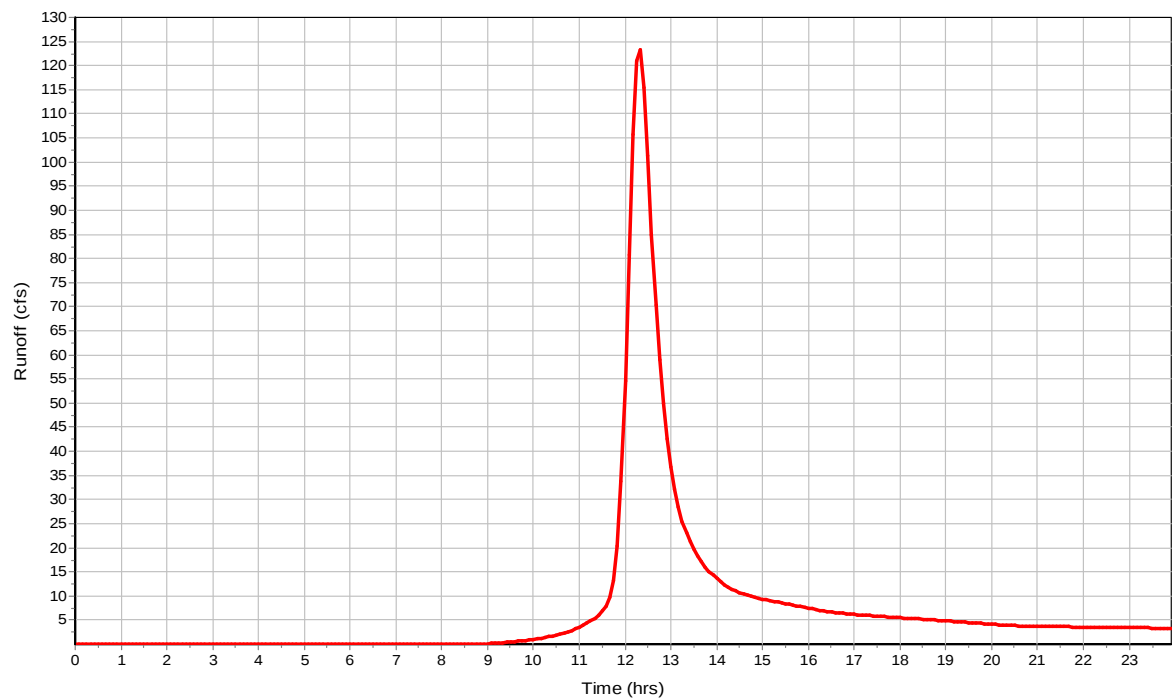
Total Rainfall (in) 5.6
Total Runoff (in) 2.76
Peak Runoff (cfs) 123.67
Weighted Curve Number 73
Time of Concentration (days hh:mm:ss) 0 00:41:56

Subbasin : Drainage_Area_5

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_6

Input Data

Area (ac)	31.81
Peak Rate Factor	484
Weighted Curve Number	73
Rain Gage ID	24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	31.81	B	73
Composite Area & Weighted CN	31.81		73

Time of Concentration

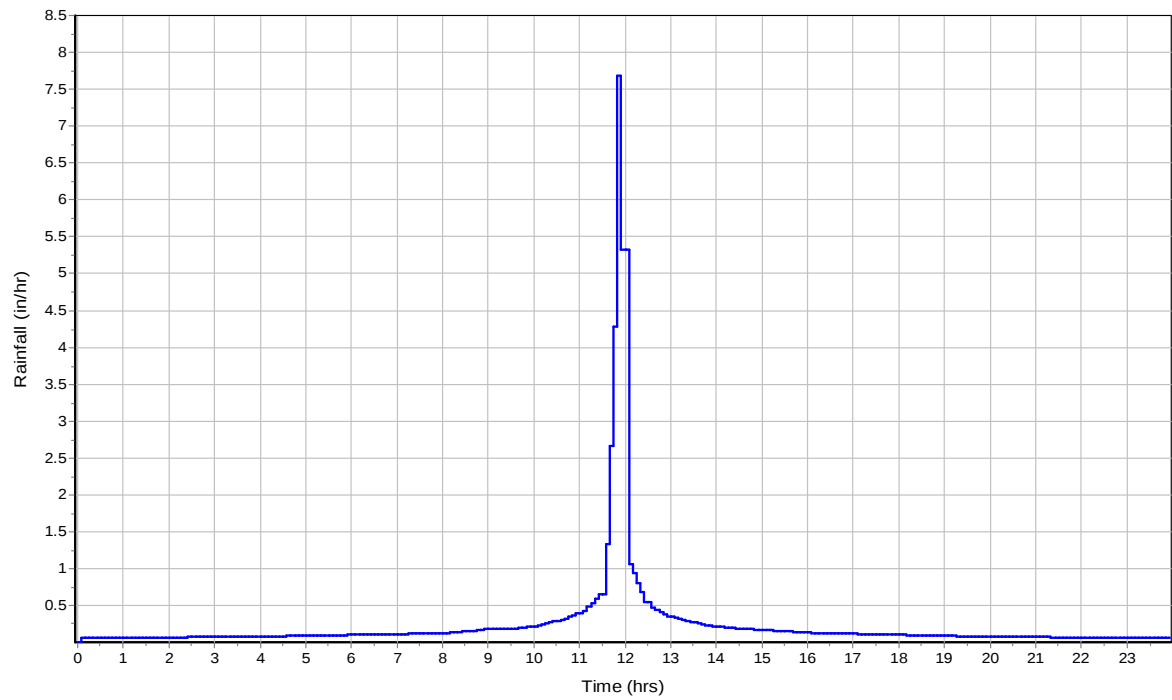
	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.06	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	0.15	0	0
2 yr, 24 hr Rainfall (in) :	2.53	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.92	0	0
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	1520	596	0
Slope (%) :	0.28	0.5	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	0.85	0	0
Computed Flow Time (min) :	29.8	0	0
Total TOC (min)	44.72		

Subbasin Runoff Results

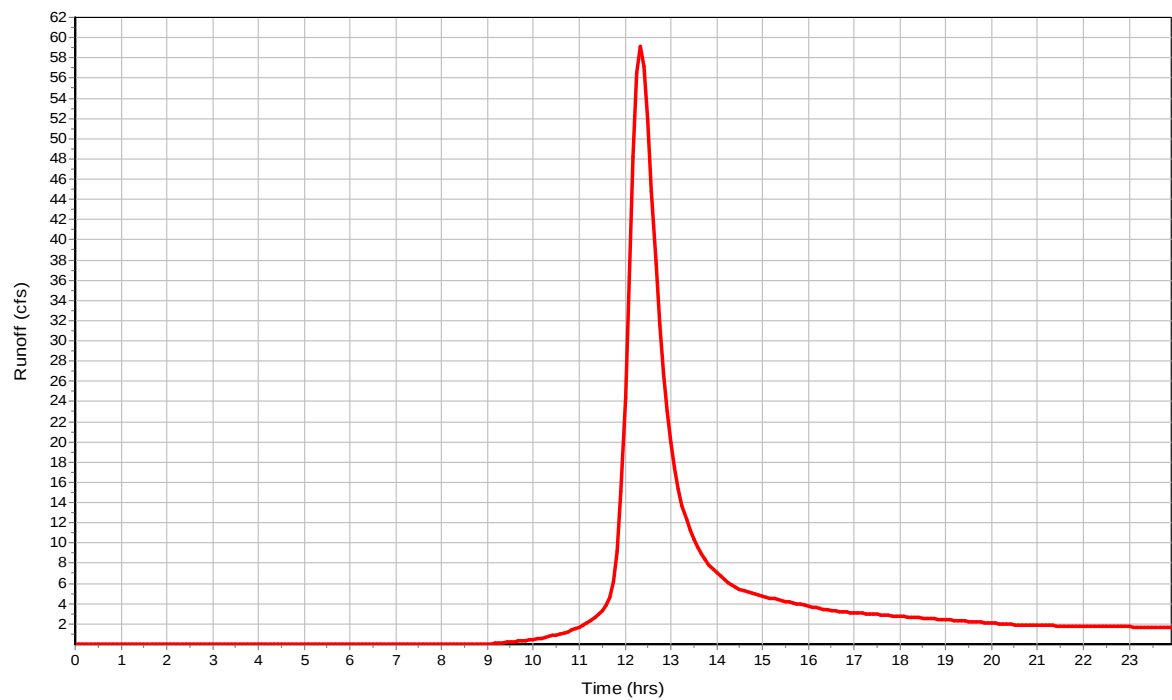
Total Rainfall (in)	5.6
Total Runoff (in)	2.76
Peak Runoff (cfs)	59.24
Weighted Curve Number	73
Time of Concentration (days hh:mm:ss)	0 00:44:43

Subbasin : Drainage_Area_6

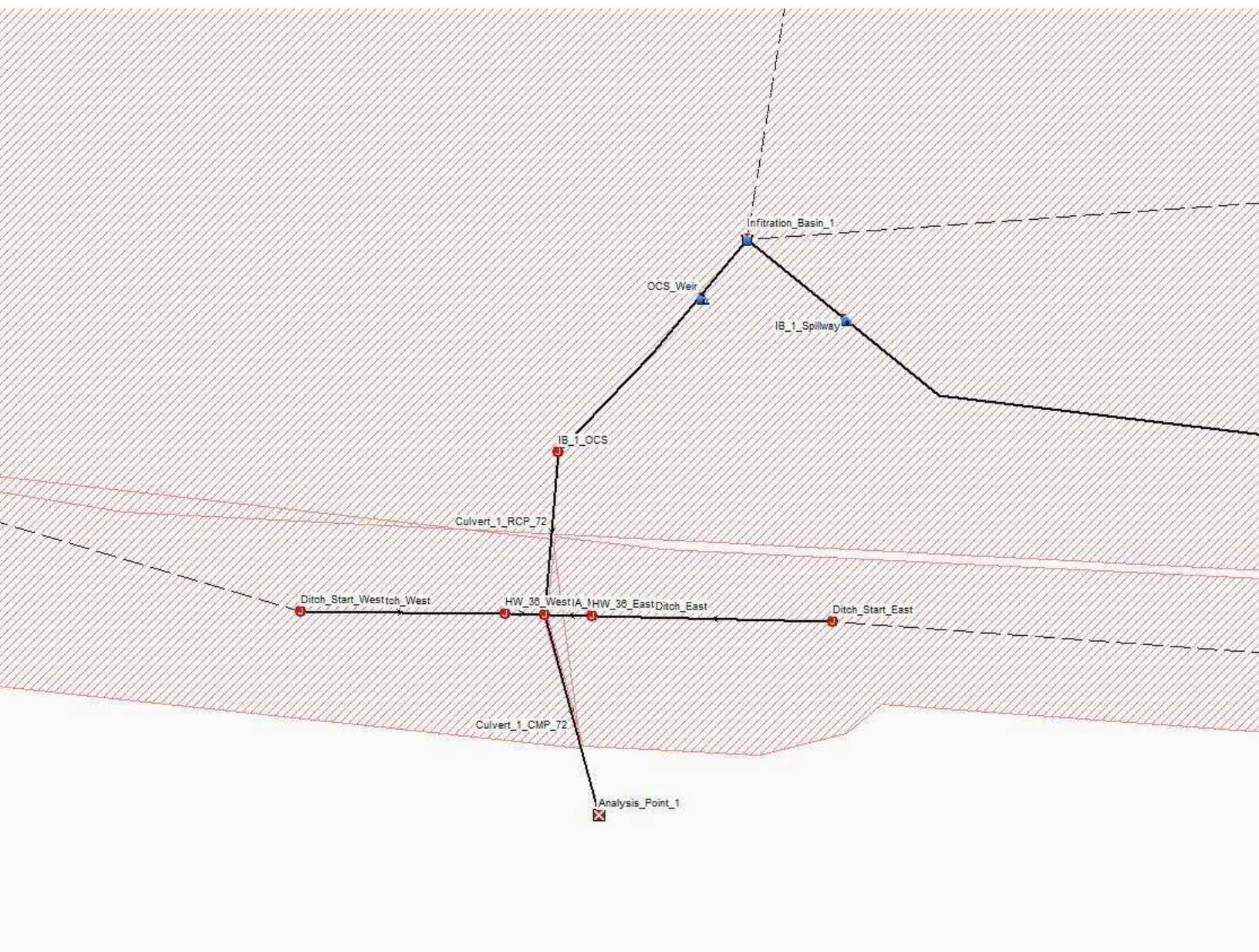
Rainfall Intensity Graph



Runoff Hydrograph



Appendix B.
Autodesk Storm and Sanitary Analysis – Permanent Stormwater Proposed Condition

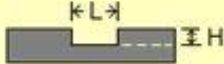


Top of Riser Elevation = 900.80'
 2-year storm elevation = 901.16'
 H = 0.36'
 Q ~ 22 cfs

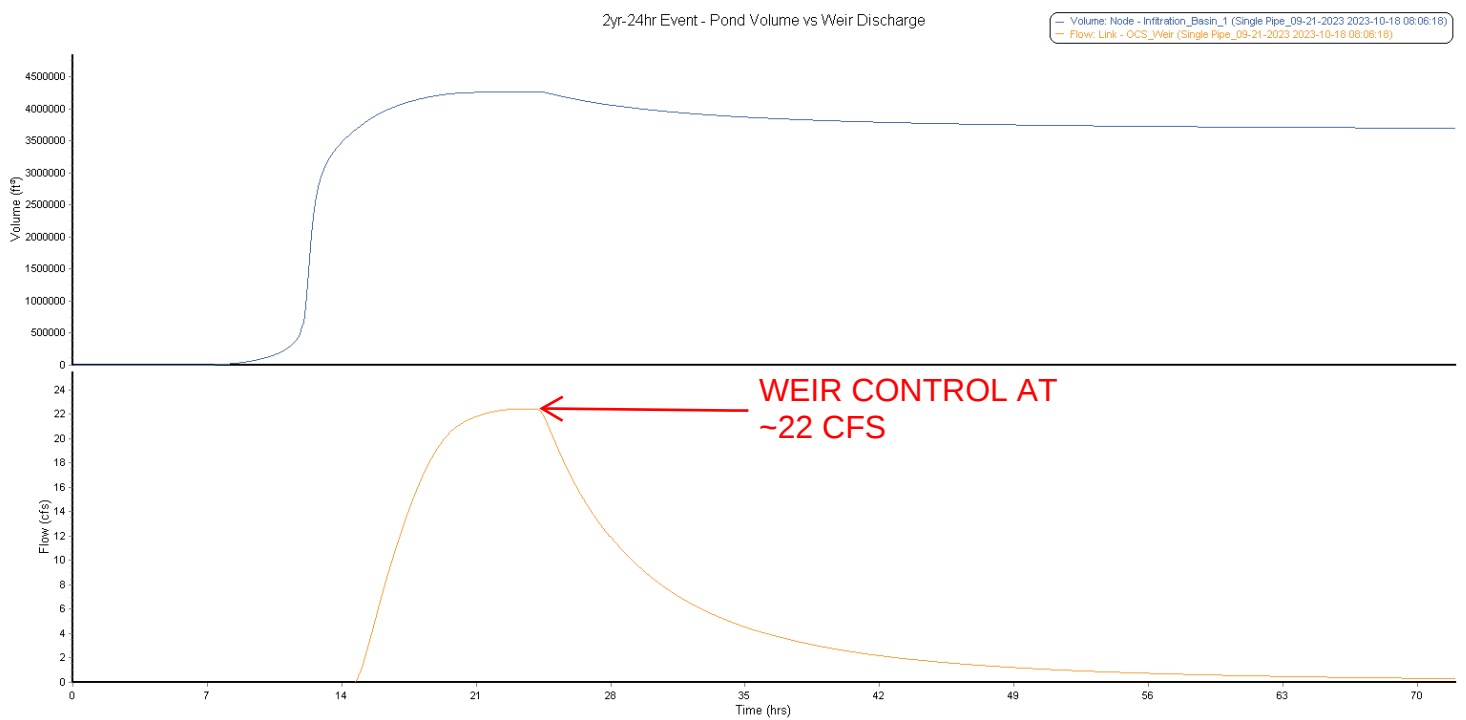
Thin Blue Numbers = Input data
 Bold Red Numbers = Answers

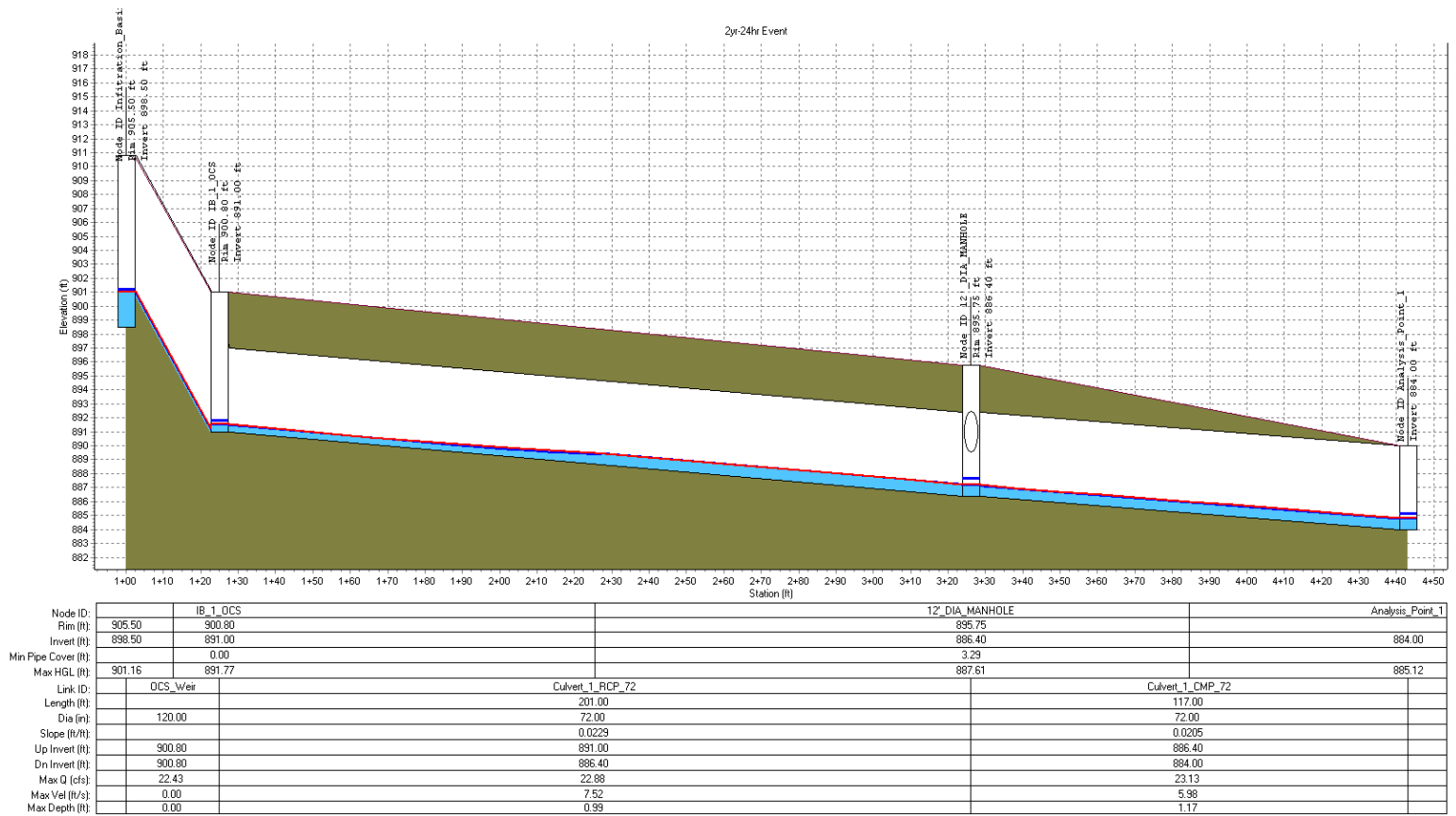
Weir Notch Bleed Down Calculations

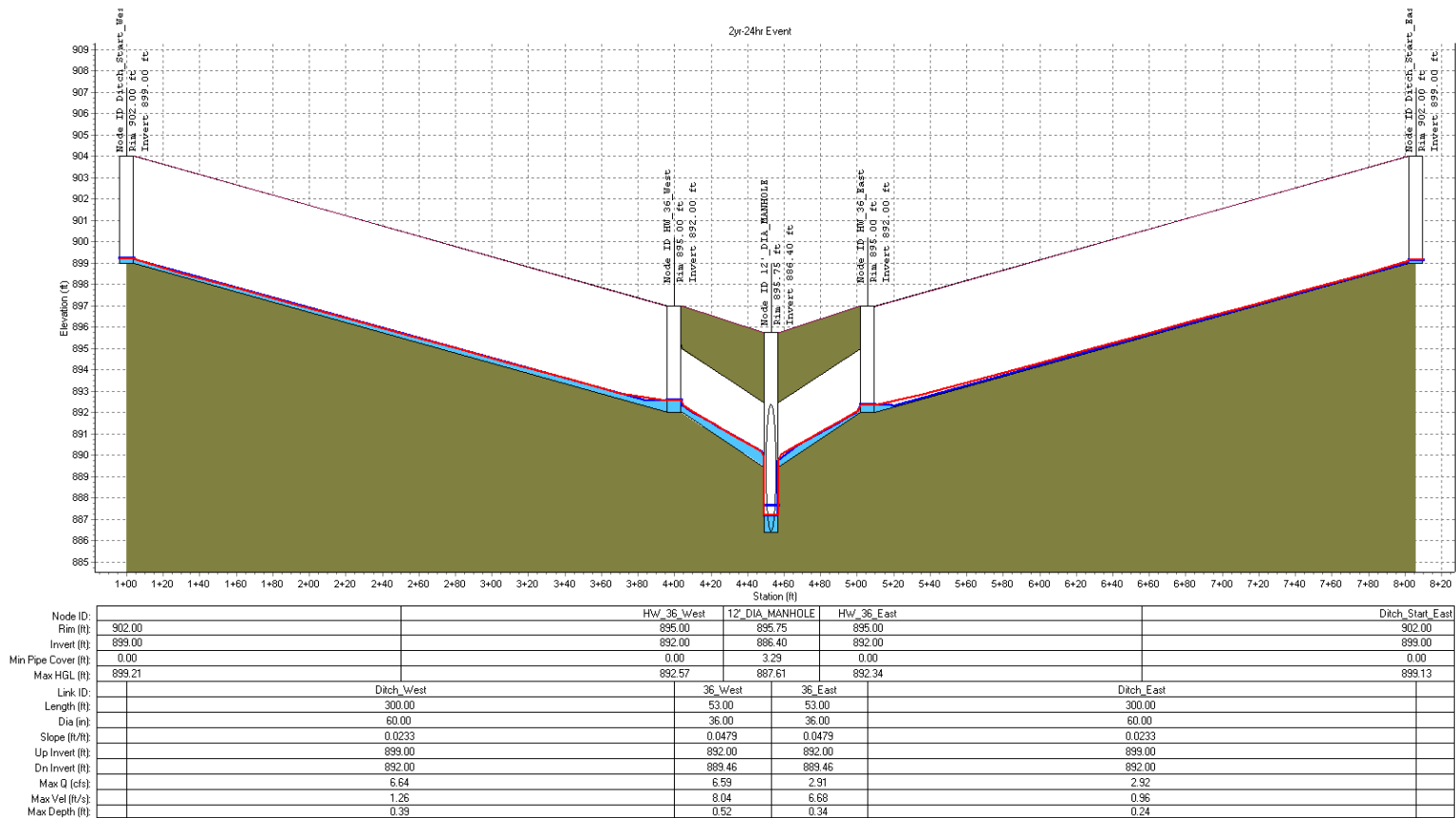
Pond Surface Area at SHW = 0 Sq. Ft.
 Pond Surface Area at NWL = 0 Sq. Ft.
 Notch Height (H) = 0.36 Feet
 Notch Width (L) = 31.40 Feet
 C = 3.25 Coefficient of discharge
 1/2 Volume Time = 0.00 Hours
 Total Time = 0.00 Hours


 Horizontal Broad Crested W
 $Q = C L H^{3/2}$

Total H (Ft)	Increm. H (Ft)	Flow Q (cfs)	Q Avg.	Delta Volume	Cum. Volume	Delta Hours	Cum. Hours
0.36		22.02					
	0.01		21.694	0	0	0.0	
0.35		21.37					0.0
	0.01		21.040	0	0	0.0	
0.35		20.71					0.0
	0.01		20.392	0	0	0.0	
0.34		20.07					0.0
	0.01		19.752	0	0	0.0	
0.33		19.43					0.0
	0.01		19.118	0	0	0.0	
0.32		18.80					0.0
	0.01		18.491	0	0	0.0	
0.32		18.18					0.0
	0.01		17.872	0	0	0.0	
0.31		17.56					0.0
	0.01		17.259	0	0	0.0	
0.30		16.95					0.0
	0.01		16.654	0	0	0.0	
0.30		16.35					0.0
	0.01		16.055	0	0	0.0	
0.29		15.76					0.0
	0.01		15.464	0	0	0.0	
0.28		15.17					0.0
	0.01		14.881	0	0	0.0	
0.27		14.59					0.0
	0.01		14.305	0	0	0.0	
0.27		14.02					0.0
	0.01		13.737	0	0	0.0	
0.26		13.45					0.0
	0.01		13.176	0	0	0.0	
0.25		12.90					0.0
	0.01		12.623	0	0	0.0	
0.24		12.35					0.0







Project Description

File Name Single Pipe_09-21-2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:03:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 7
Subbasins..... 6
Nodes..... 10
 Junctions 6
 Outfalls 2
 Flow Diversions 0
 Inlets 0
 Storage Nodes 2
Links..... 9
 Channels 2
 Pipes 5
 Pumps 0
 Orifices 1
 Weirs 1
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	1yr24hr	Time Series	1-inch	Cumulative	inches	Michigan	Calhoun	1.00	1.00	SCS Type II 24-hr
2	24hr100yr	Time Series	24hr100yr	Cumulative	inches	Michigan	Calhoun	100.00	5.60	SCS Type II 24-hr
3	24hr10yr	Time Series	24hr10yr	Cumulative	inches	Michigan	Calhoun	10.00	3.60	SCS Type II 24-hr
4	24hr25yr	Time Series	24hr25yr	Cumulative	inches	Michigan	Calhoun	25.00	4.30	SCS Type II 24-hr
5	24hr2yr	Time Series	24hr2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
6	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
7	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches	Michigan	Calhoun	5.00	3.38	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	761.76	484.00	91.00	2.57	1.67	1275.19	1056.44	0 00:33:17
2	Drainage_Area_1b_East	7.81	484.00	74.00	2.57	0.65	5.06	2.93	0 00:45:00
3	Drainage_Area_1b_West	17.73	484.00	74.00	2.57	0.65	11.49	6.66	0 00:45:00
4	Drainage_Area_2	113.11	484.00	75.00	2.57	0.69	78.27	53.38	0 00:37:00
5	Drainage_Area_2b	12.47	484.00	75.00	2.57	0.69	8.63	5.13	0 00:45:00
6	Sub_Infiltration_Basin_1	98.48	484.00	74.00	2.57	0.65	63.82	63.31	0 00:20:00

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	Junction	886.40	895.75	886.40	895.75	0.00	23.32	887.61	0.00	8.14	0 00:00	0.00	0.00
2	Ditch_Start_East	Junction	899.00	902.00	899.00	902.00	0.00	2.93	899.13	0.00	4.87	0 00:00	0.00	0.00
3	Ditch_Start_West	Junction	899.00	902.00	899.00	902.00	0.00	6.65	899.21	0.00	4.79	0 00:00	0.00	0.00
4	HW_36_East	Junction	892.00	895.00	0.00	0.00	0.00	2.92	892.34	0.00	4.66	0 00:00	0.00	0.00
5	HW_36_West	Junction	892.00	895.00	892.00	899.00	0.00	6.64	892.57	0.00	4.43	0 00:00	0.00	0.00
6	IB_1_OCS	Junction	891.00	903.00	891.00	903.00	0.00	22.43	891.77	0.00	11.23	0 00:00	0.00	0.00
7	Analysis_Point_1	Outfall	884.00					23.13	885.12					
8	Analysis_Point_2	Outfall	890.65					55.21	891.99					
9	Culvert_2_Inlet	Storage Node	892.00	900.00	892.00		8168.00	58.23	894.29				0.00	0.00
10	Infiltration_Basin_1	Storage Node	898.50	905.50	898.50		1512370.00	1107.10	901.16				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	36_East	Pipe	HW_36_East	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	2.91	126.55	0.02	6.68	0.34	0.11	0.00	Calculated
2	36_West	Pipe	HW_36_West	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	6.59	126.55	0.05	8.04	0.52	0.17	0.00	Calculated
3	Culvert_1_CMP_72	Pipe	12'_DIA_MANHOLE	Analysis_Point_1	117.00	886.40	884.00	2.0500	72.000	0.0260	23.13	303.28	0.08	5.98	1.17	0.19	0.00	Calculated
4	Culvert_1_RCP_72	Pipe	IB_1_OCS	12'_DIA_MANHOLE	201.00	891.00	886.40	2.2900	72.000	0.0130	22.88	640.68	0.04	7.52	0.99	0.16	0.00	Calculated
5	Culvert_2	Pipe	Culvert_2_Inlet	Analysis_Point_2	111.00	892.25	890.65	1.4400	72.000	0.0130	55.21	508.46	0.11	8.46	1.69	0.28	0.00	Calculated
6	Ditch_East	Channel	Ditch_Start_East	HW_36_East	300.00	899.00	892.00	2.3300	60.000	0.0320	2.92	2363.82	0.00	0.96	0.24	0.05	0.00	
7	Ditch_West	Channel	Ditch_Start_West	HW_36_West	300.00	899.00	892.00	2.3300	60.000	0.0320	6.64	2363.82	0.00	1.26	0.39	0.08	0.00	
8	OCS_Weir	Orifice	Infiltration_Basin_1	IB_1_OCS		898.50	891.00		120.000		22.43							
9	IB_1_Spillway	Weir	Infiltration_Basin_1	Culvert_2_Inlet		898.50	892.00				0.00							

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	761.76
Peak Rate Factor	484
Weighted Curve Number	91
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Urban industrial, 72% imp	761.76	C	91
Composite Area & Weighted CN	761.76		91

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{(2/3)}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

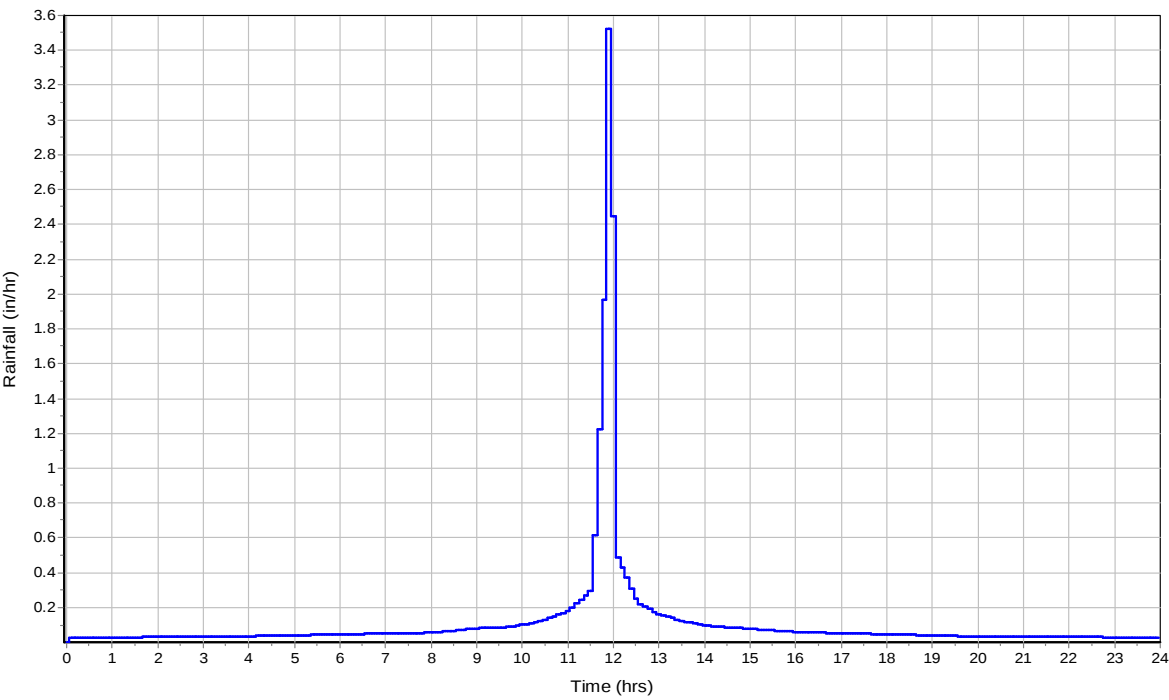
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.011	0
Flow Length (ft) :	150	150	0
Slope (%) :	0.5	0.5	0
2 yr, 24 hr Rainfall (in) :	2.53	2.53	0
Velocity (ft/sec) :	0.09	0.76	0
Computed Flow Time (min) :	26.54	3.28	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	300	0	0
Slope (%) :	0.5	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0	0
Computed Flow Time (min) :	3.47	0	0
Total TOC (min)	33.29		

Subbasin Runoff Results

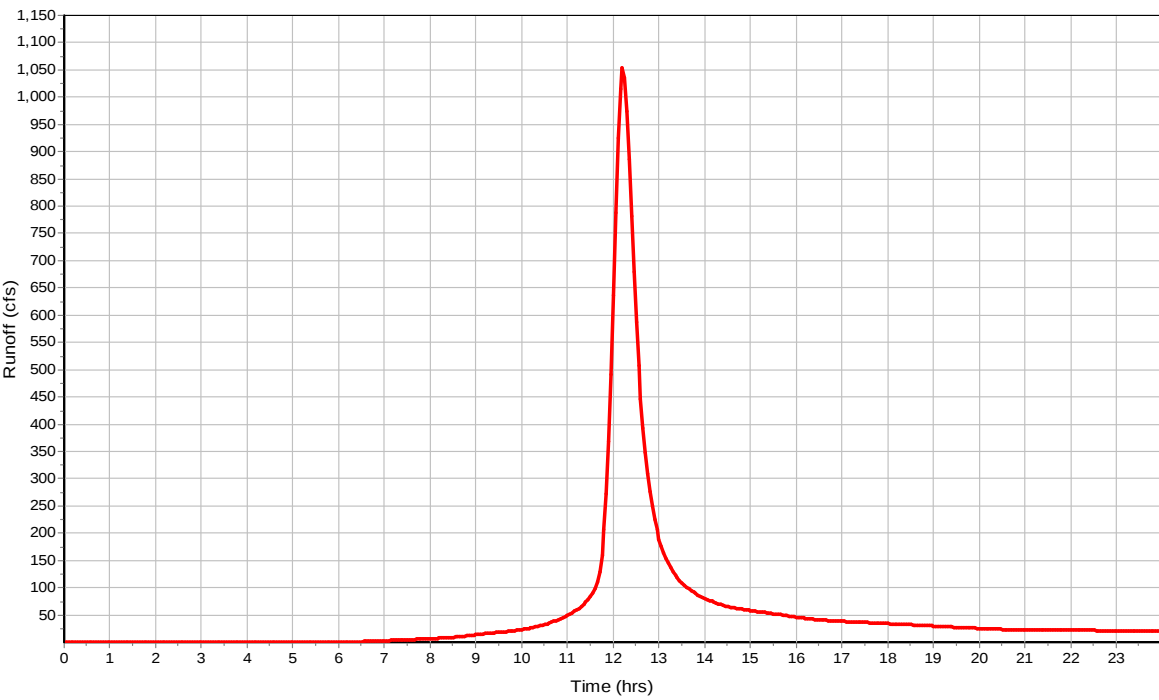
Total Rainfall (in)	2.57
Total Runoff (in)	1.67
Peak Runoff (cfs)	1056.44
Weighted Curve Number	91
Time of Concentration (days hh:mm:ss)	0 00:33:17

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_East

Input Data

Area (ac)	7.81
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	7.81	C	74
Composite Area & Weighted CN	7.81		74

Time of Concentration

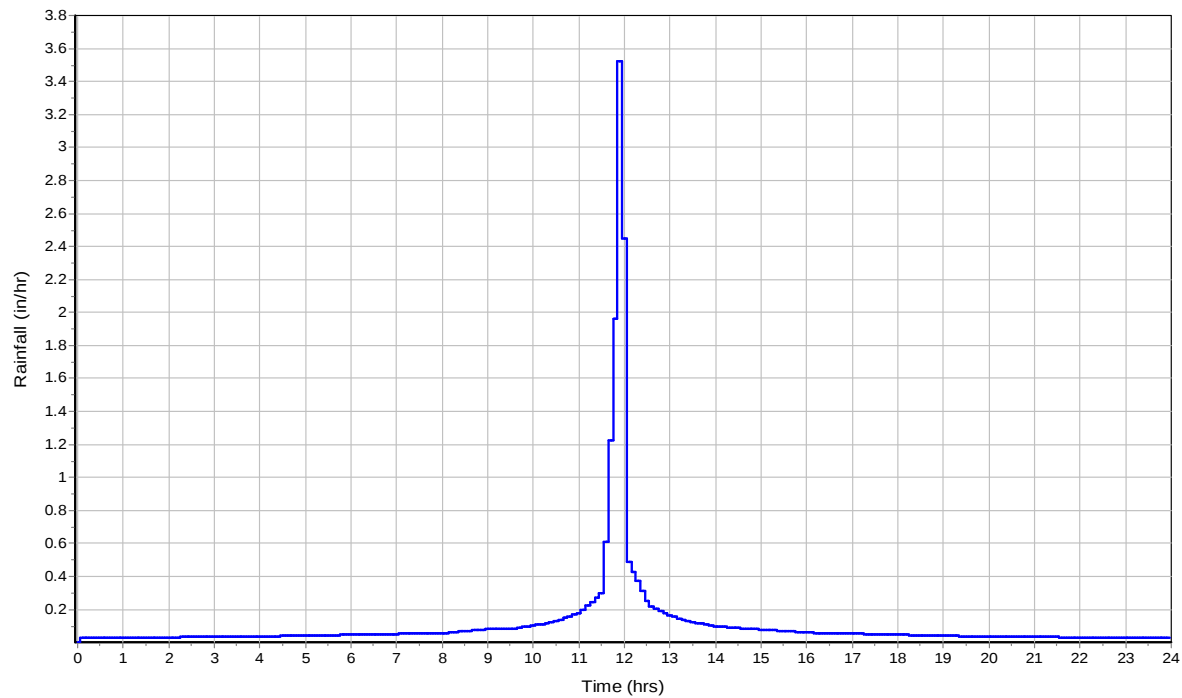
User-Defined TOC override (minutes): 45

Subbasin Runoff Results

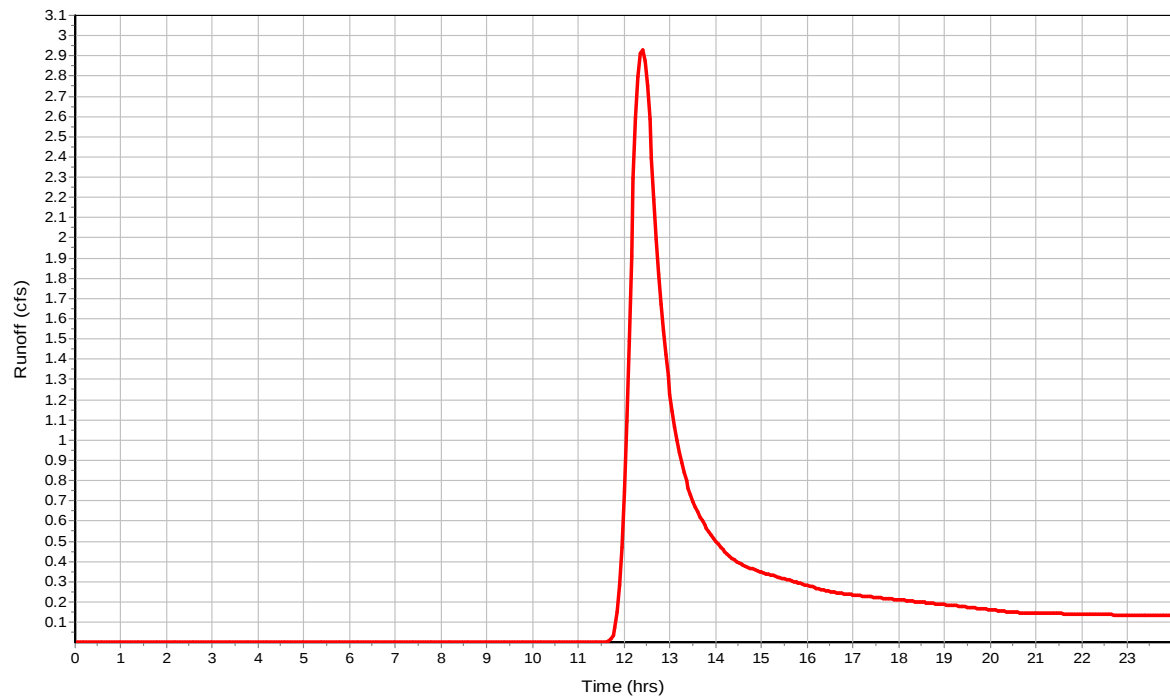
Total Rainfall (in)	2.57
Total Runoff (in)	0.65
Peak Runoff (cfs)	2.93
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:45:00

Subbasin : Drainage_Area_1b_East

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_West

Input Data

Area (ac) 17.73
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	17.73	C	74
Composite Area & Weighted CN	17.73		74

Time of Concentration

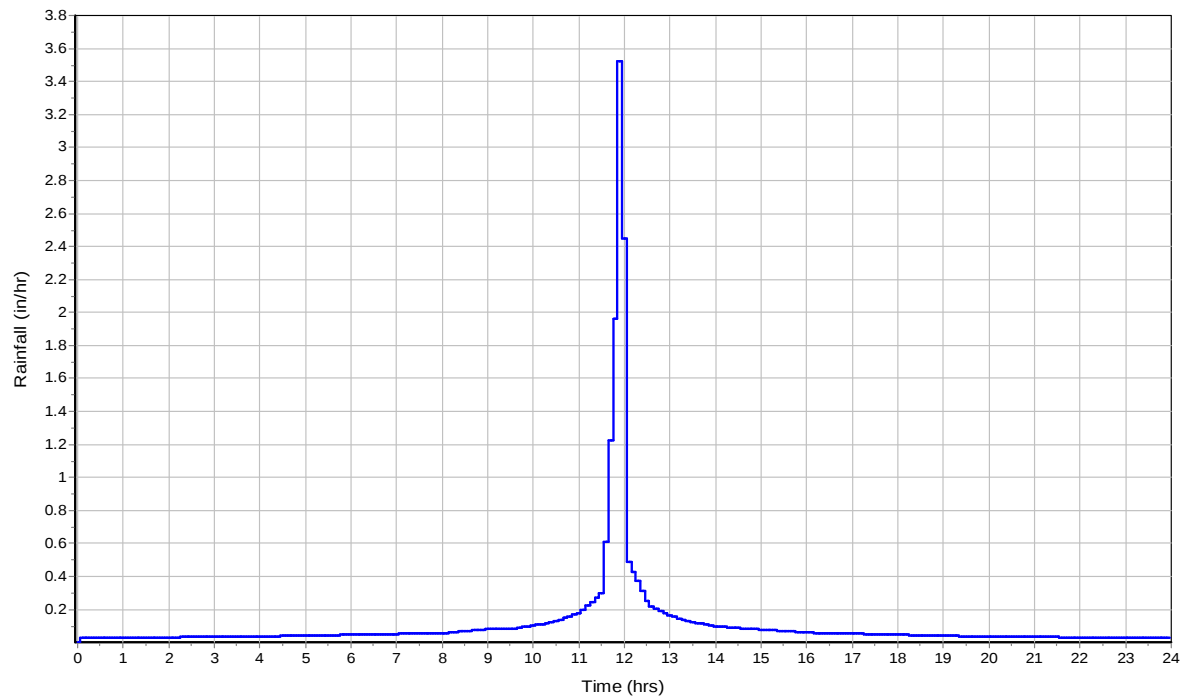
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

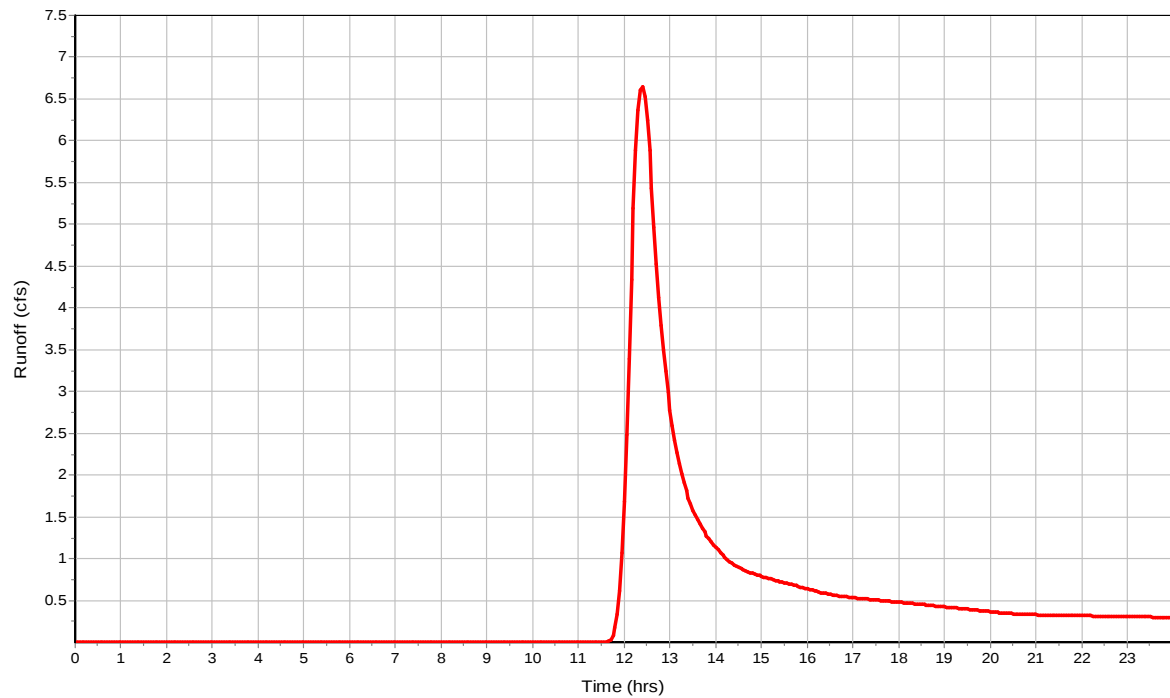
Total Rainfall (in) 2.57
Total Runoff (in) 0.65
Peak Runoff (cfs) 6.66
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_West

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac)	113.11
Peak Rate Factor	484
Weighted Curve Number	75
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	113.11	C	75
Composite Area & Weighted CN	113.11		75

Time of Concentration

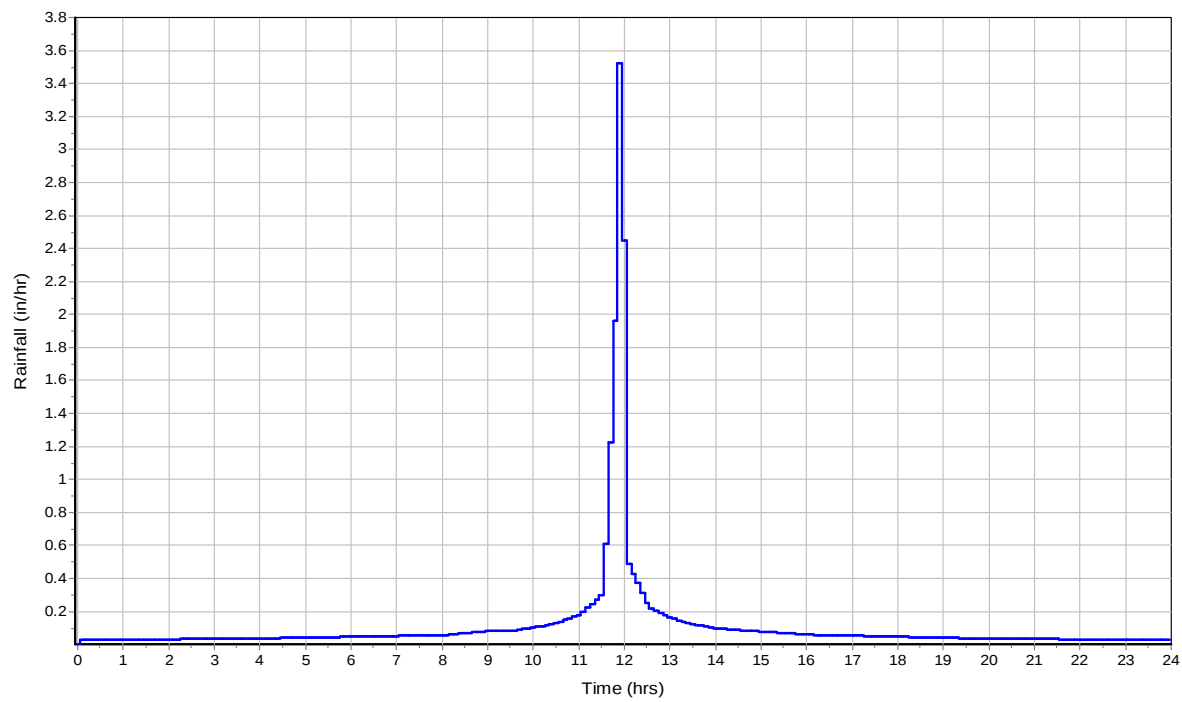
User-Defined TOC override (minutes): 37

Subbasin Runoff Results

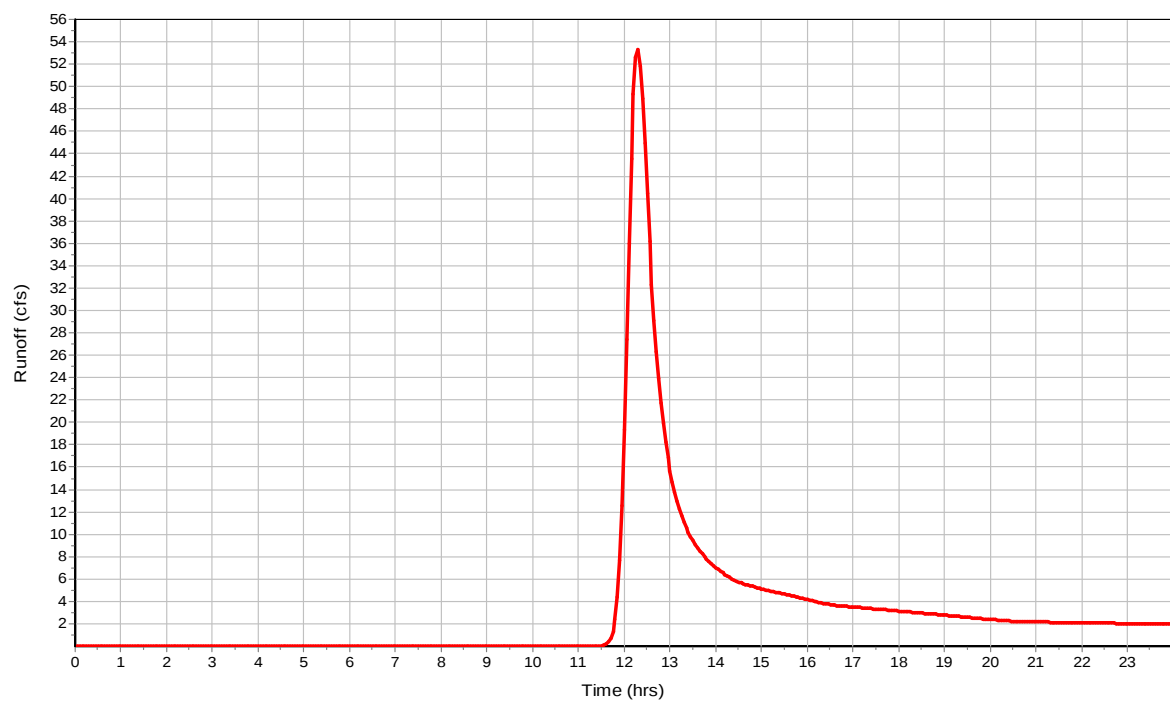
Total Rainfall (in)	2.57
Total Runoff (in)	0.69
Peak Runoff (cfs)	53.38
Weighted Curve Number	75
Time of Concentration (days hh:mm:ss)	0 00:37:00

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2b

Input Data

Area (ac) 12.47
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
-	12.47	-	75
Composite Area & Weighted CN	12.47		75

Time of Concentration

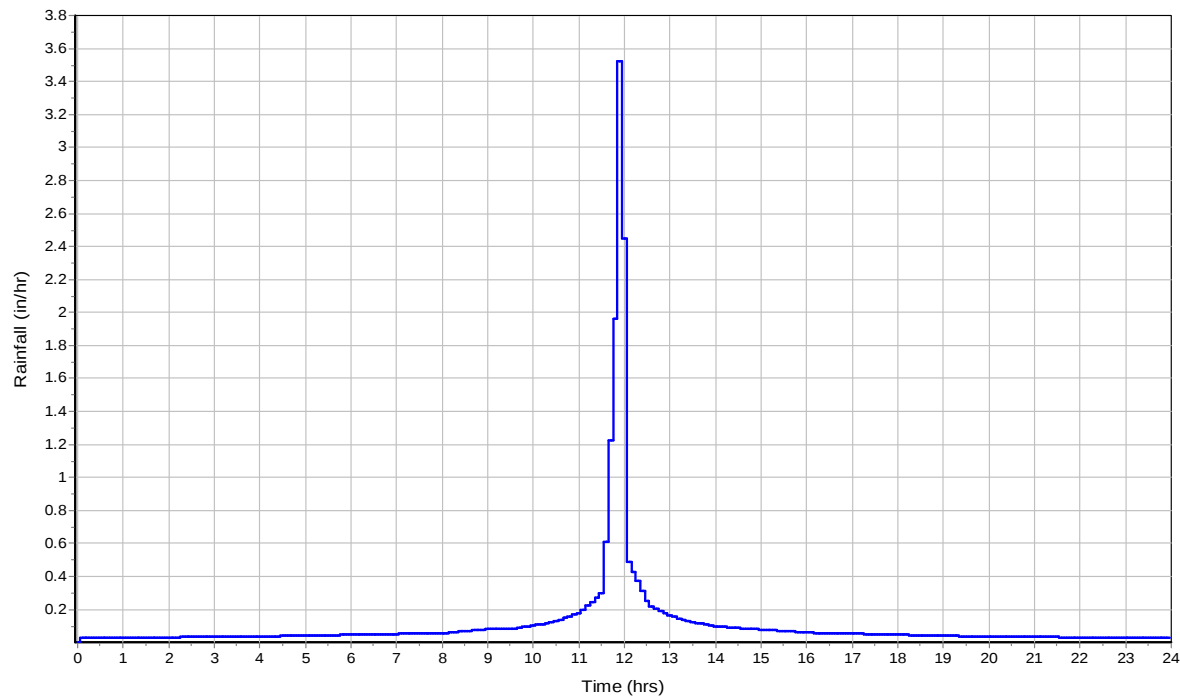
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

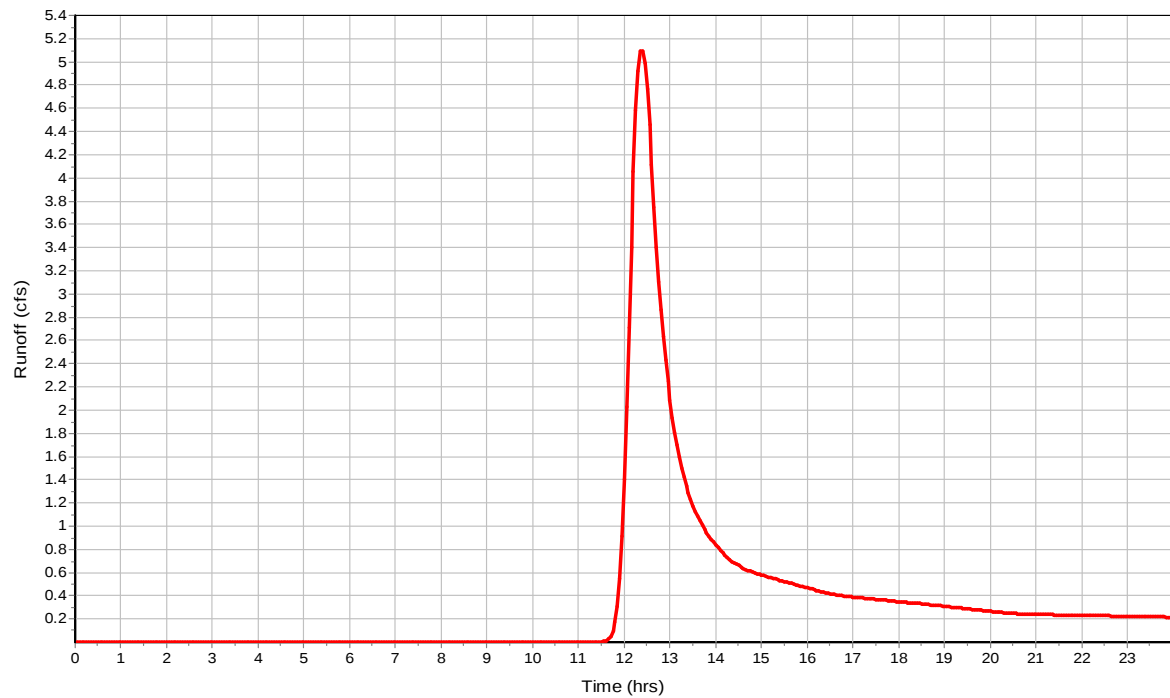
Total Rainfall (in) 2.57
Total Runoff (in) 0.69
Peak Runoff (cfs) 5.13
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub_Infiltration_Basin_1

Input Data

Area (ac)	98.48
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr2yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	98.48	C	74
Composite Area & Weighted CN	98.48		74

Time of Concentration

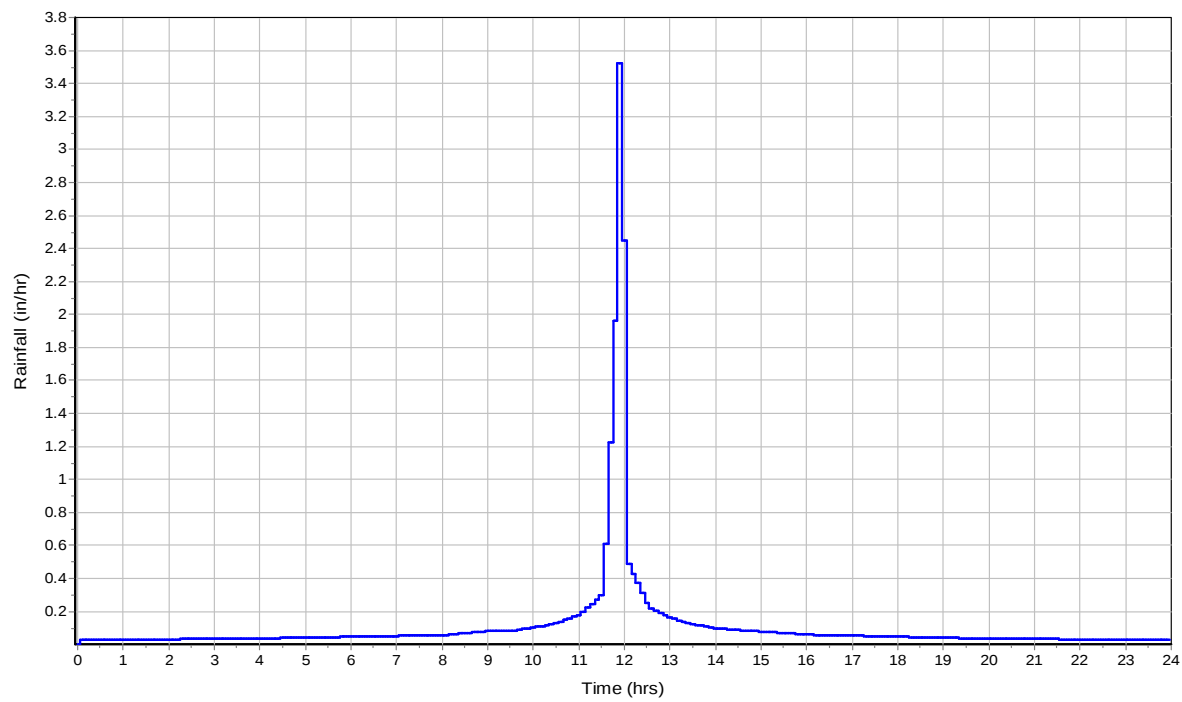
User-Defined TOC override (minutes): 20.00

Subbasin Runoff Results

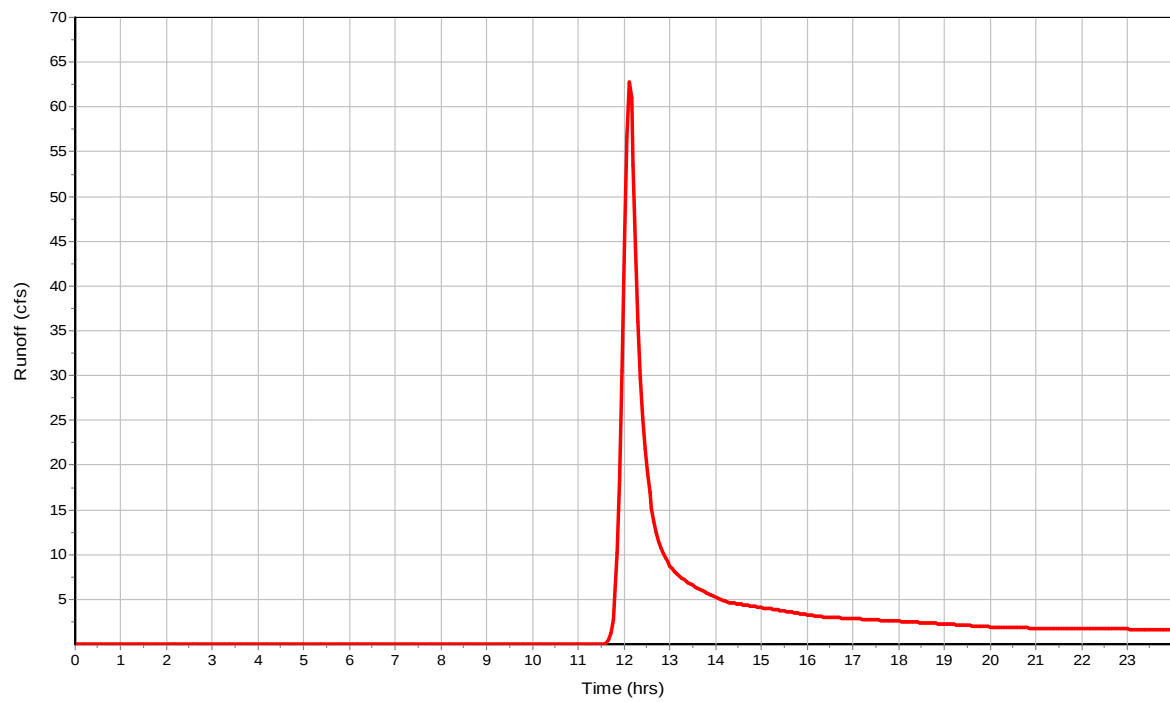
Total Rainfall (in)	2.57
Total Runoff (in)	0.65
Peak Runoff (cfs)	63.31
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:20:00

Subbasin : Sub_Infiltration_Basin_1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	12" DIA MANHOLE	886.40	895.75	9.35	886.40	0.00	895.75	0.00	0.00	0.00
2	Ditch_Start_East	899.00	902.00	3.00	899.00	0.00	9020.00	8118.00	0.00	0.00
3	Ditch_Start_West	899.00	902.00	3.00	899.00	0.00	902.00	0.00	0.00	0.00
4	HW_36_East	892.00	895.00	3.00	0.00	-892.00	0.00	-895.00	0.00	0.00
5	HW_36_West	892.00	895.00	3.00	892.00	0.00	899.00	4.00	0.00	0.00
6	IB_1_OCS	891.00	903.00	12.00	891.00	0.00	903.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	23.32	0.00	887.61	1.21	0.00	8.14	886.84	0.44	0 23:28	0 00:00	0.00	0.00
2	Ditch_Start_East	2.93	2.93	899.13	0.13	0.00	4.87	899.02	0.02	0 12:27	0 00:00	0.00	0.00
3	Ditch_Start_West	6.65	6.65	899.21	0.21	0.00	4.79	899.03	0.03	0 12:27	0 00:00	0.00	0.00
4	HW_36_East	2.92	0.00	892.34	0.34	0.00	4.66	892.06	0.06	0 12:29	0 00:00	0.00	0.00
5	HW_36_West	6.64	0.00	892.57	0.57	0.00	4.43	892.09	0.09	0 12:29	0 00:00	0.00	0.00
6	IB_1_OCS	22.43	0.00	891.77	0.77	0.00	11.23	891.25	0.25	0 23:19	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch_East	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch_West	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch_East	2.92	0 12:27	2363.82	0.00	0.96	5.21	0.24	0.05	0.00		
2	Ditch_West	6.64	0 12:27	2363.82	0.00	1.26	3.97	0.39	0.08	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Offset	Outlet Invert	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	36_East	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	36_West	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	Culvert_1_CMP_72	117.00	886.40	0.00	884.00	0.00	2.40	2.0500	CIRCULAR	72.000	72.000	0.0260	0.5000	0.5000	0.0000	0.00	No
4	Culvert_1_RCP_72	201.00	891.00	0.00	886.40	0.00	4.60	2.2900	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No
5	Culvert_2	111.00	892.25	0.25	890.65	0.00	1.60	1.4400	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

	1
	1
	1
	1
	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	36_East	2.91	0 12:29	126.55	0.02	6.68	0.13	0.34	0.11	0.00		Calculated
2	36_West	6.59	0 12:29	126.55	0.05	8.04	0.11	0.52	0.17	0.00		Calculated
3	Culvert_1_CMP_72	23.13	0 23:19	303.28	0.08	5.98	0.33	1.17	0.19	0.00		Calculated
4	Culvert_1_RCP_72	22.88	0 23:27	640.68	0.04	7.52	0.45	0.99	0.16	0.00		Calculated
5	Culvert_2	55.21	0 12:25	508.46	0.11	8.46	0.22	1.69	0.28	0.00		Calculated

Storage Nodes

Storage Node : Culvert_2_Inlet

Input Data

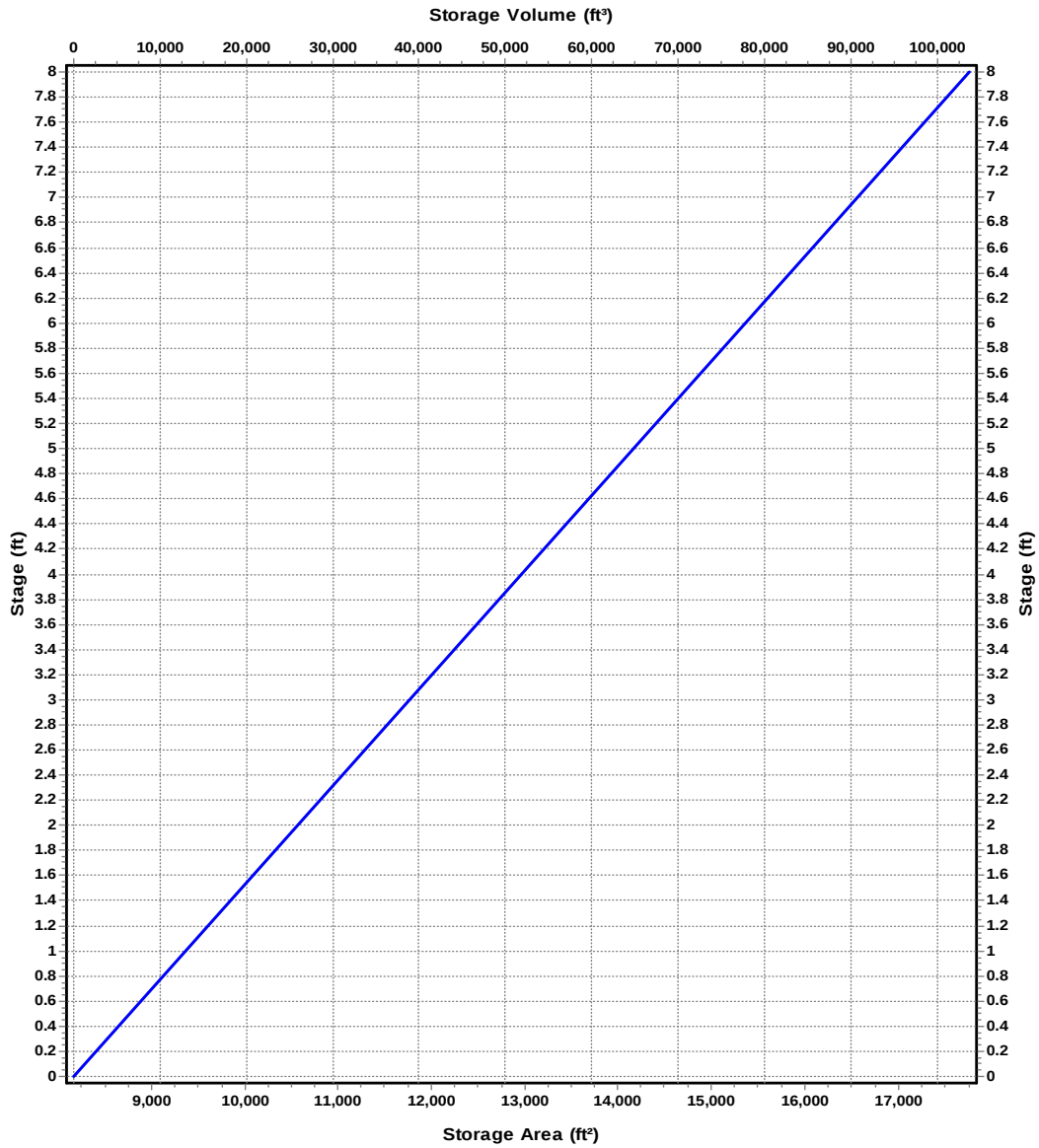
Invert Elevation (ft)	892.00
Max (Rim) Elevation (ft)	900.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	892.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	8168.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Offsite_2

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	8168	0
8	17763	103724

Storage Area Volume Curves



Storage Area Storage Volume

Storage Node : Culvert_2_Inlet (continued)

Output Summary Results

Peak Inflow (cfs)	58.23
Peak Lateral Inflow (cfs)	58.23
Peak Outflow (cfs)	55.21
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	894.29
Max HGL Depth Attained (ft)	2.29
Average HGL Elevation Attained (ft)	892.38
Average HGL Depth Attained (ft)	0.38
Time of Max HGL Occurrence (days hh:mm)	0 12:25
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Infiltration_Basin_1

Input Data

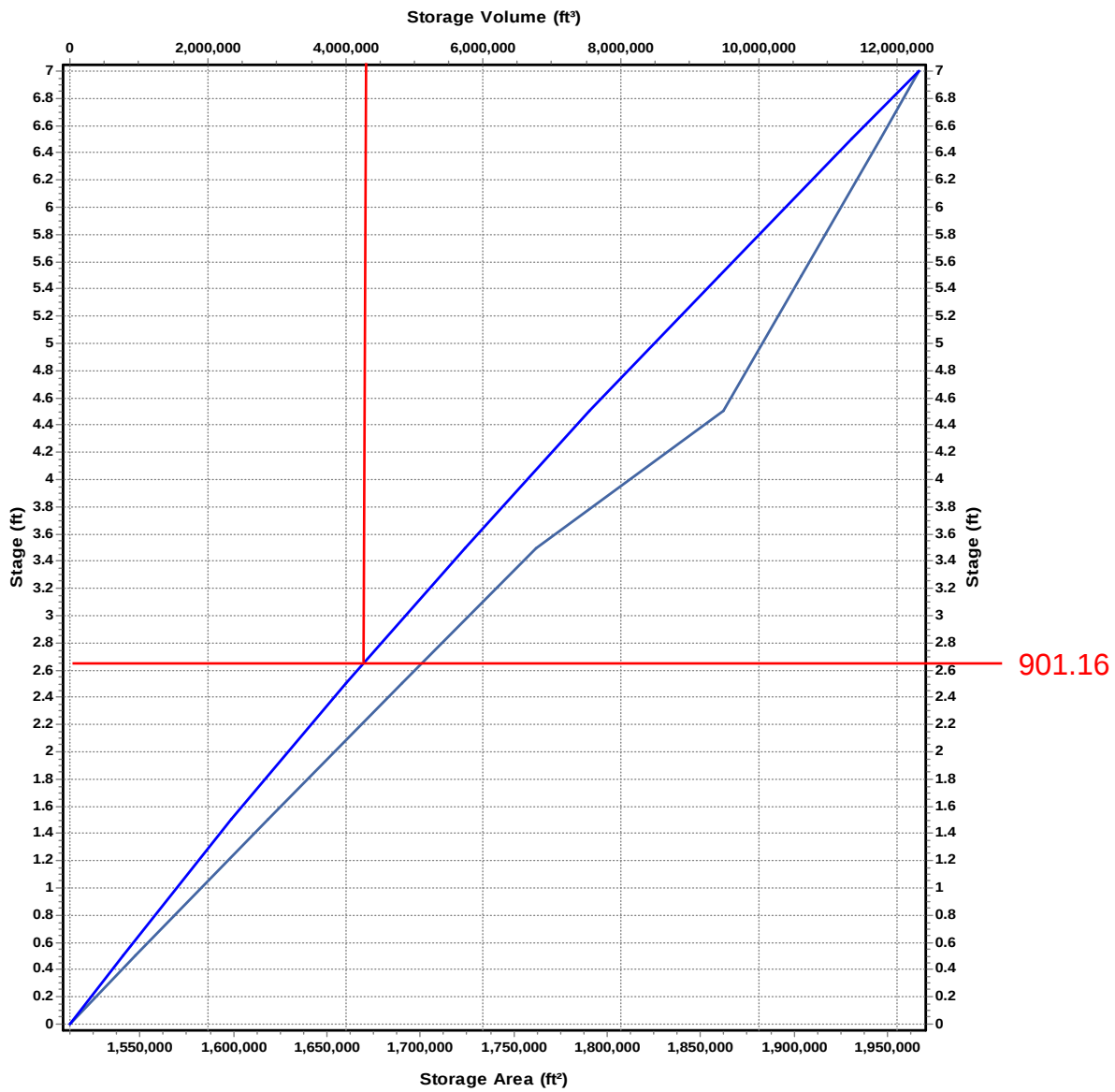
Invert Elevation (ft)	898.50
Max (Rim) Elevation (ft)	905.50
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	898.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	1512370.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : SME Pond

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	1512370	0
0.5	1547431	764950.25
1.5	1618709	2348020.25
2.5	1690091	4002420.25
3.5	1761575	5728253.25
4.5	1862035	7540058.25
5.5	1904021	9423086.25
6.5	1946087	11348140.25
7	1966758	12326351.5

Storage Area Volume Curves



— Storage Area — Storage Volume

Storage Node : Infiltration_Basin_1 (continued)

Outflow Weirs

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 IB_1_Spillway	Trapezoidal	No	903.50	5.00	350.00	2.20	3.40

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 OCS_Weir	Bottom	CIRCULAR	No	120.00			900.80	0.61

Output Summary Results

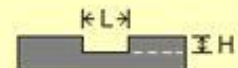
Peak Inflow (cfs)	1107.1
Peak Lateral Inflow (cfs)	1107.1
Peak Outflow (cfs)	22.43
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	901.16
Max HGL Depth Attained (ft)	2.66
Average HGL Elevation Attained (ft)	899.73
Average HGL Depth Attained (ft)	1.23
Time of Max HGL Occurrence (days hh:mm)	0 23:24
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Top of Riser Elevation = 900.80'
 5-year storm elevation = 901.63'
 H = 0.83'
 Q ~ 77 cfs

Thin Blue Numbers = Input data
 Bold Red Numbers = Answers

Weir Notch Bleed Down Calculations

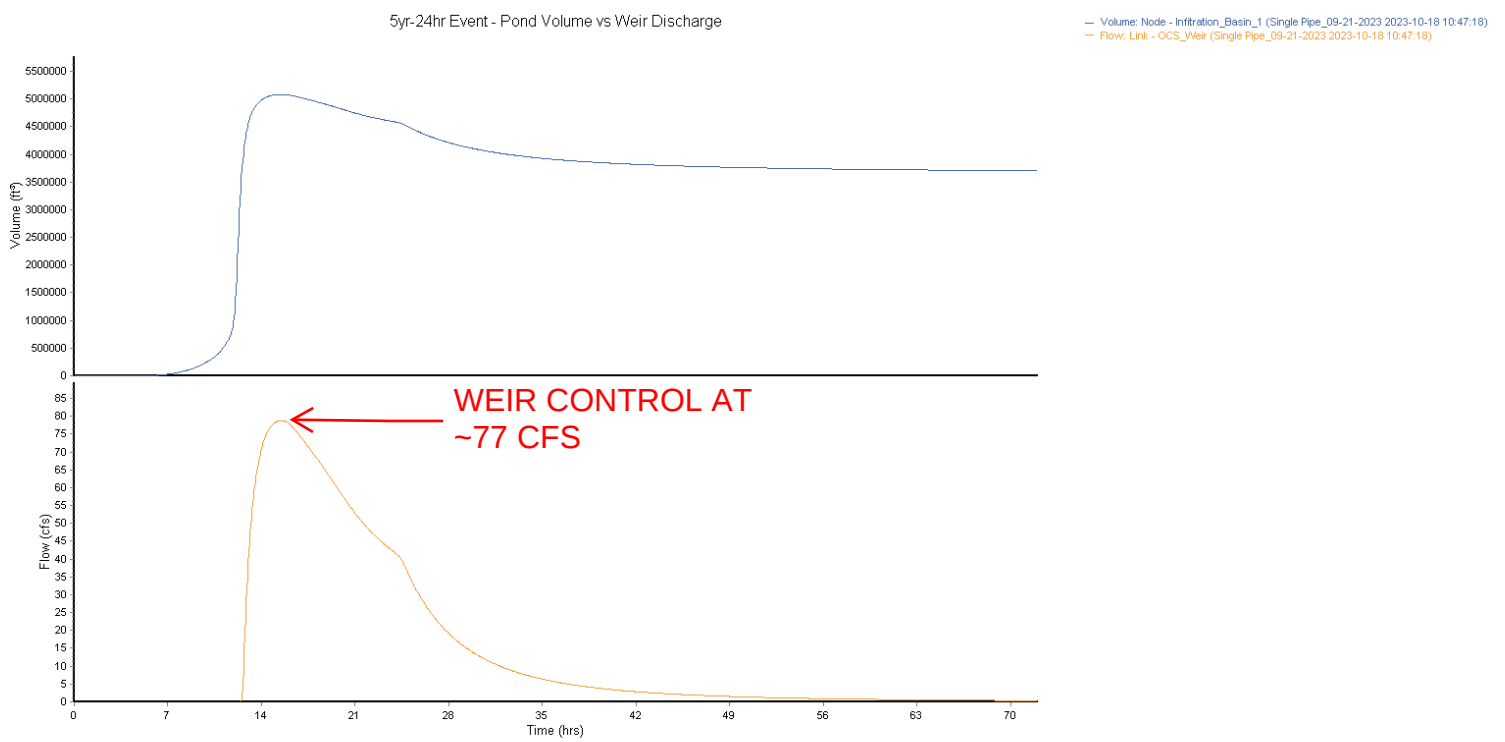
Pond Surface Area at SHW = 0 Sq. Ft.
 Pond Surface Area at NWL = 0 Sq. Ft.
 Notch Height (H) = 0.83 Feet
 Notch Width (L) = 31.40 Feet
 C = 3.25 Coefficient of discharge

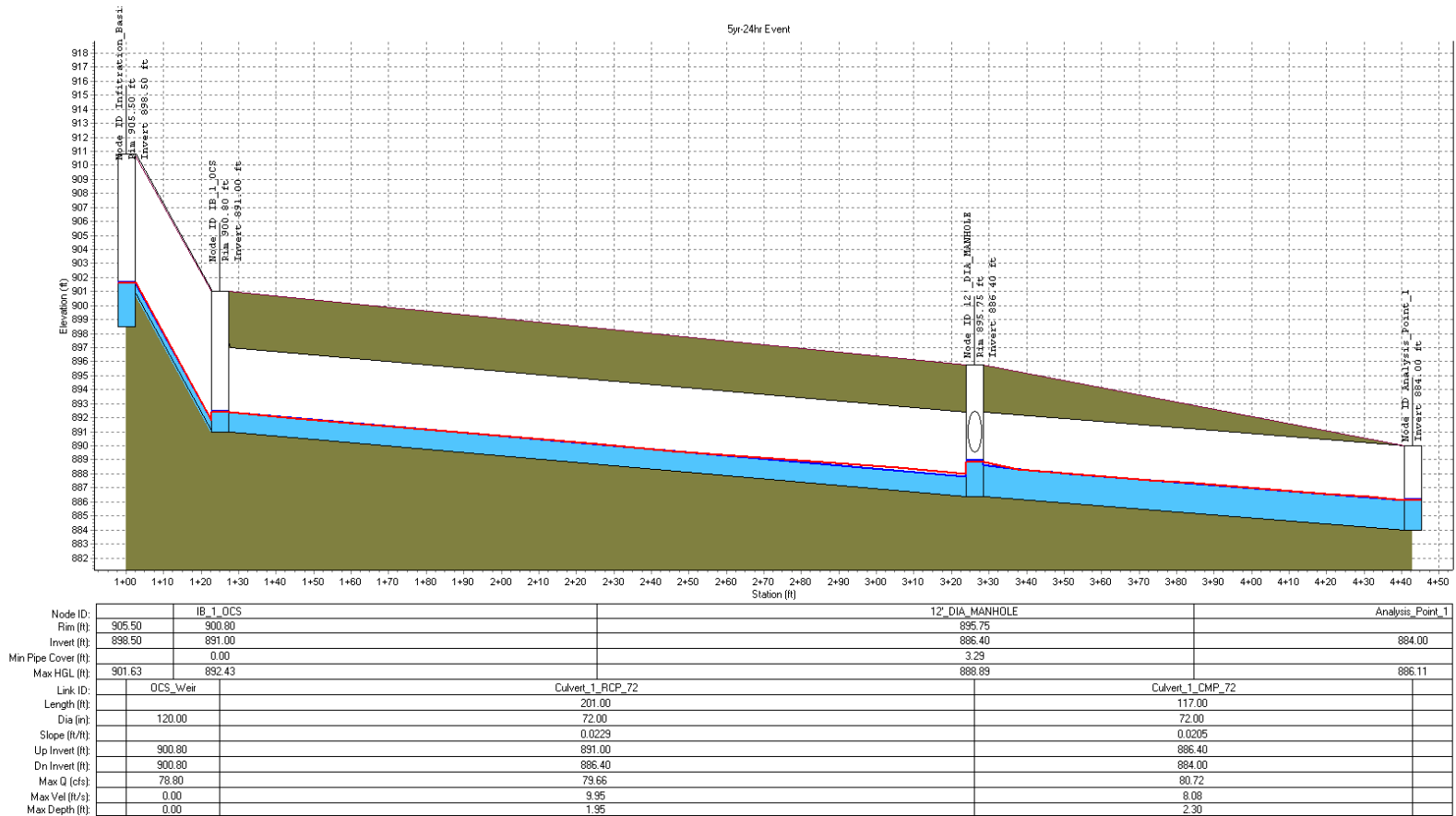


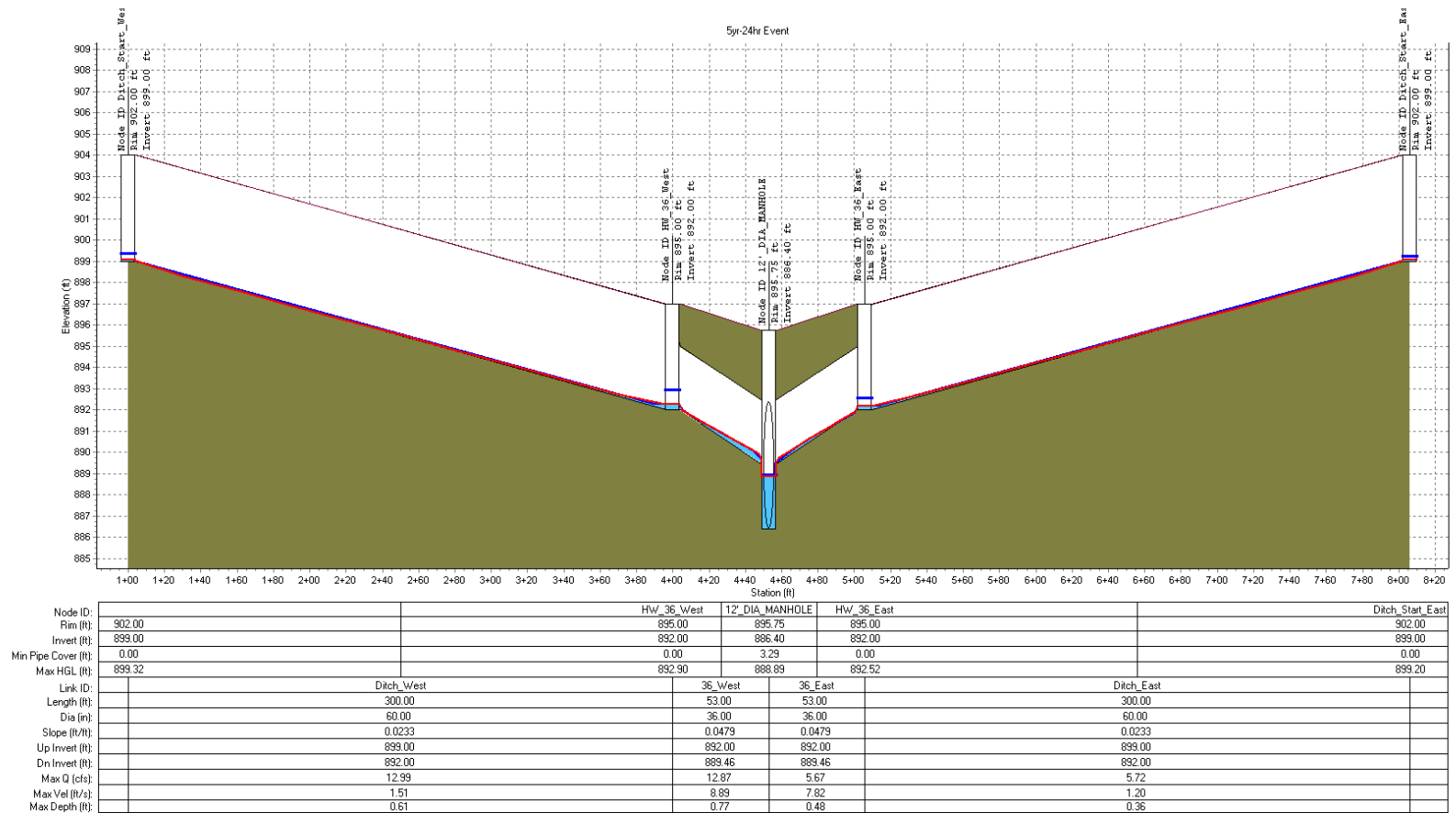
Horizontal Broad Crested W
 $Q = C L H^{3/2}$

1/2 Volume Time = 0.00 Hours
 Total Time = 0.00 Hours

Total H (Ft)	Increm. H (Ft)	Flow Q (cfs)	Q Avg.	Delta Volume	Cum. Volume	Delta Hours	Cum. Hours
0.83		77.10					
	0.02		75.945	0	0	0.0	
0.81		74.79					0.0
	0.02		73.655	0	0	0.0	
0.80		72.52					0.0
	0.02		71.389	0	0	0.0	
0.78		70.26					0.0
	0.02		69.147	0	0	0.0	
0.76		68.03					0.0
	0.02		66.928	0	0	0.0	
0.75		65.83					0.0
	0.02		64.734	0	0	0.0	
0.73		63.64					0.0
	0.02		62.565	0	0	0.0	
0.71		61.49					0.0
	0.02		60.420	0	0	0.0	
0.70		59.35					0.0
	0.02		58.300	0	0	0.0	
0.68		57.25					0.0
	0.02		56.206	0	0	0.0	
0.66		55.17					0.0
	0.02		54.137	0	0	0.0	
0.65		53.11					0.0
	0.02		52.095	0	0	0.0	
0.63		51.08					0.0
	0.02		50.078	0	0	0.0	
0.61		49.08					0.0
	0.02		48.089	0	0	0.0	
0.60		47.10					0.0
	0.02		46.126	0	0	0.0	
0.58		45.15					0.0
	0.02		44.191	0	0	0.0	
0.56		43.23					0.0







Project Description

File Name Single Pipe_09-21-2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:03:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 7
Subbasins..... 6
Nodes..... 10
 Junctions 6
 Outfalls 2
 Flow Diversions 0
 Inlets 0
 Storage Nodes 2
Links..... 9
 Channels 2
 Pipes 5
 Pumps 0
 Orifices 1
 Weirs 1
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	1yr24hr	Time Series	1-inch	Cumulative	inches	Michigan	Calhoun	1.00	1.00	SCS Type II 24-hr
2	24hr100yr	Time Series	24hr100yr	Cumulative	inches	Michigan	Calhoun	100.00	5.60	SCS Type II 24-hr
3	24hr10yr	Time Series	24hr10yr	Cumulative	inches	Michigan	Calhoun	10.00	3.60	SCS Type II 24-hr
4	24hr25yr	Time Series	24hr25yr	Cumulative	inches	Michigan	Calhoun	25.00	4.30	SCS Type II 24-hr
5	24hr2yr	Time Series	24hr2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
6	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
7	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches	Michigan	Calhoun	5.00	3.38	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	761.76	484.00	91.00	3.38	2.43	1849.55	1518.05	0 00:33:17
2	Drainage_Area_1b_East	7.81	484.00	74.00	3.38	1.16	9.04	5.74	0 00:45:00
3	Drainage_Area_1b_West	17.73	484.00	74.00	3.38	1.16	20.53	13.04	0 00:45:00
4	Drainage_Area_2	113.11	484.00	75.00	3.38	1.22	137.77	101.45	0 00:37:00
5	Drainage_Area_2b	12.47	484.00	75.00	3.38	1.22	15.18	9.75	0 00:45:00
6	Sub_Infiltration_Basin_1	98.48	484.00	74.00	3.38	1.16	114.04	121.03	0 00:20:00

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	Junction	886.40	895.75	886.40	895.75	0.00	81.40	888.89	0.00	6.86	0 00:00	0.00	0.00
2	Ditch_Start_East	Junction	899.00	902.00	899.00	902.00	0.00	5.73	899.20	0.00	4.80	0 00:00	0.00	0.00
3	Ditch_Start_West	Junction	899.00	902.00	899.00	902.00	0.00	13.01	899.32	0.00	4.68	0 00:00	0.00	0.00
4	HW_36_East	Junction	892.00	895.00	0.00	0.00	0.00	5.72	892.52	0.00	4.48	0 00:00	0.00	0.00
5	HW_36_West	Junction	892.00	895.00	892.00	899.00	0.00	12.99	892.90	0.00	4.10	0 00:00	0.00	0.00
6	IB_1_OCS	Junction	891.00	903.00	891.00	903.00	0.00	78.80	892.43	0.00	10.57	0 00:00	0.00	0.00
7	Analysis_Point_1	Outfall	884.00					80.72	886.11					
8	Analysis_Point_2	Outfall	890.65					105.95	892.51					
9	Culvert_2_Inlet	Storage Node	892.00	900.00	892.00		8168.00	110.00	895.40				0.00	0.00
10	Infiltration_Basin_1	Storage Node	898.50	905.50	898.50		1512370.00	1613.84	901.63				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	36_East	Pipe	HW_36_East	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	5.67	126.55	0.04	7.82	0.48	0.16	0.00 Calculated
2	36_West	Pipe	HW_36_West	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	12.87	126.55	0.10	8.89	0.77	0.26	0.00 Calculated
3	Culvert_1_CMP_72	Pipe	12'_DIA_MANHOLE	Analysis_Point_1	117.00	886.40	884.00	2.0500	72.000	0.0260	80.72	303.28	0.27	8.08	2.30	0.38	0.00 Calculated
4	Culvert_1_RCP_72	Pipe	IB_1_OCS	12'_DIA_MANHOLE	201.00	891.00	886.40	2.2900	72.000	0.0130	79.66	640.68	0.12	9.95	1.95	0.33	0.00 Calculated
5	Culvert_2	Pipe	Culvert_2_Inlet	Analysis_Point_2	111.00	892.25	890.65	1.4400	72.000	0.0130	105.95	508.46	0.21	9.50	2.50	0.42	0.00 Calculated
6	Ditch_East	Channel	Ditch_Start_East	HW_36_East	300.00	899.00	892.00	2.3300	60.000	0.0320	5.72	2363.82	0.00	1.20	0.36	0.07	0.00
7	Ditch_West	Channel	Ditch_Start_West	HW_36_West	300.00	899.00	892.00	2.3300	60.000	0.0320	12.99	2363.82	0.01	1.51	0.61	0.12	0.00
8	OCS_Weir	Orifice	Infiltration_Basin_1	IB_1_OCS		898.50	891.00		120.000		78.80						
9	IB_1_Spillway	Weir	Infiltration_Basin_1	Culvert_2_Inlet		898.50	892.00				0.00						

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	761.76
Peak Rate Factor	484
Weighted Curve Number	91
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Urban industrial, 72% imp	761.76	C	91
Composite Area & Weighted CN	761.76		91

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n

R = Aq / Wp

Tc = (Lf / V) / (3600 sec/hr)

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

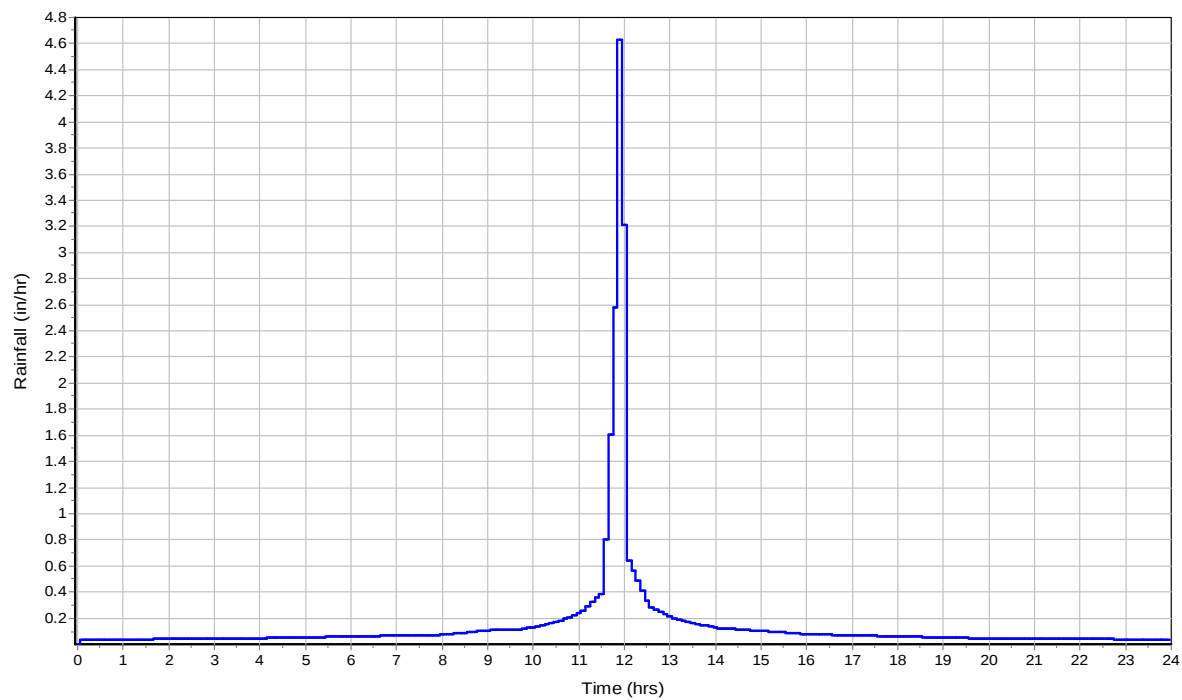
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.011	0
Flow Length (ft) :	150	150	0
Slope (%) :	0.5	0.5	0
2 yr, 24 hr Rainfall (in) :	2.53	2.53	0
Velocity (ft/sec) :	0.09	0.76	0
Computed Flow Time (min) :	26.54	3.28	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	300	0	0
Slope (%) :	0.5	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0	0
Computed Flow Time (min) :	3.47	0	0
Total TOC (min)	33.29		

Subbasin Runoff Results

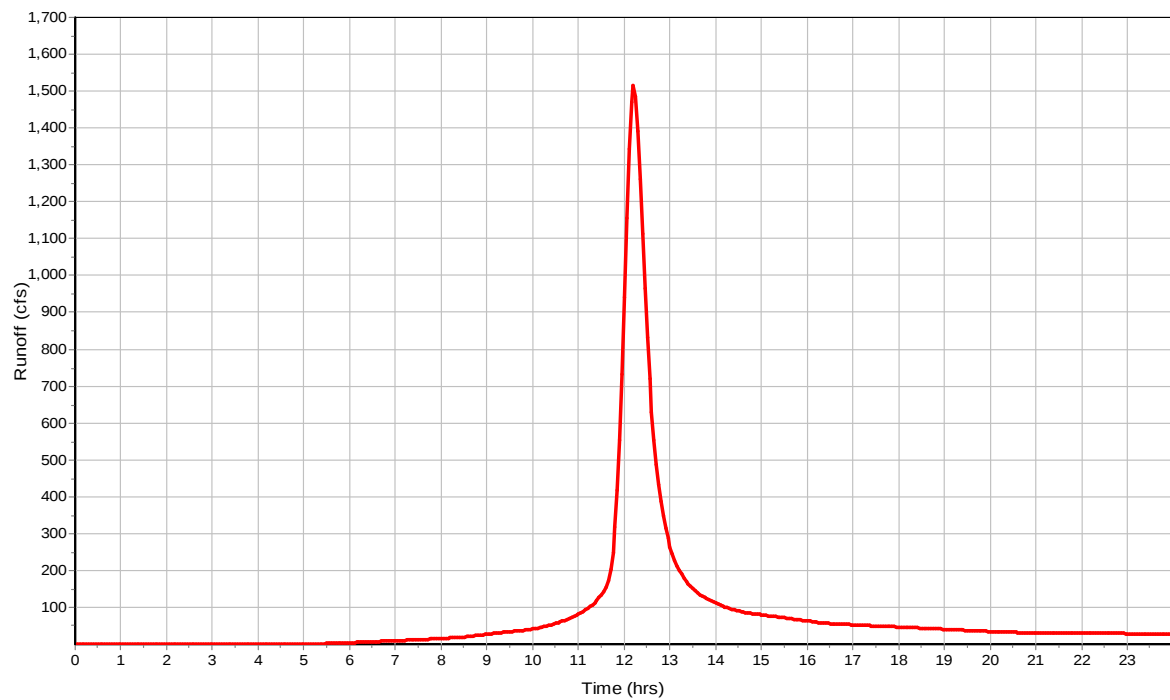
Total Rainfall (in)	3.38
Total Runoff (in)	2.43
Peak Runoff (cfs)	1518.05
Weighted Curve Number	91
Time of Concentration (days hh:mm:ss)	0 00:33:17

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_East

Input Data

Area (ac)	7.81
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	7.81	C	74
Composite Area & Weighted CN	7.81		74

Time of Concentration

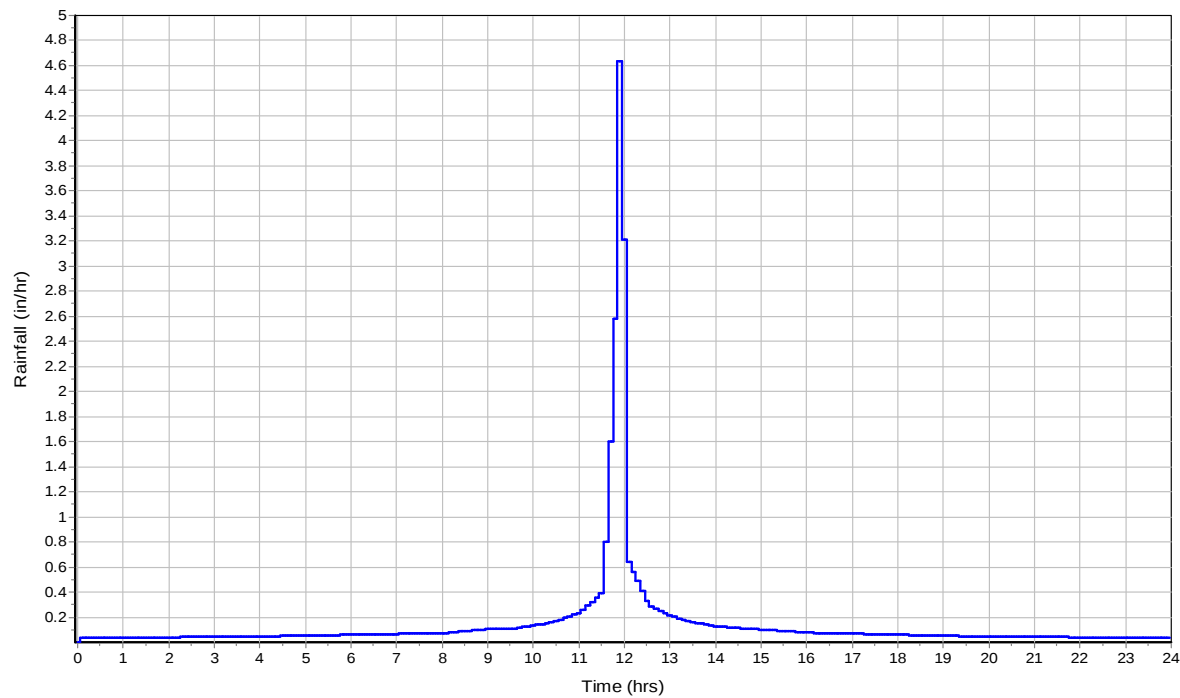
User-Defined TOC override (minutes): 45

Subbasin Runoff Results

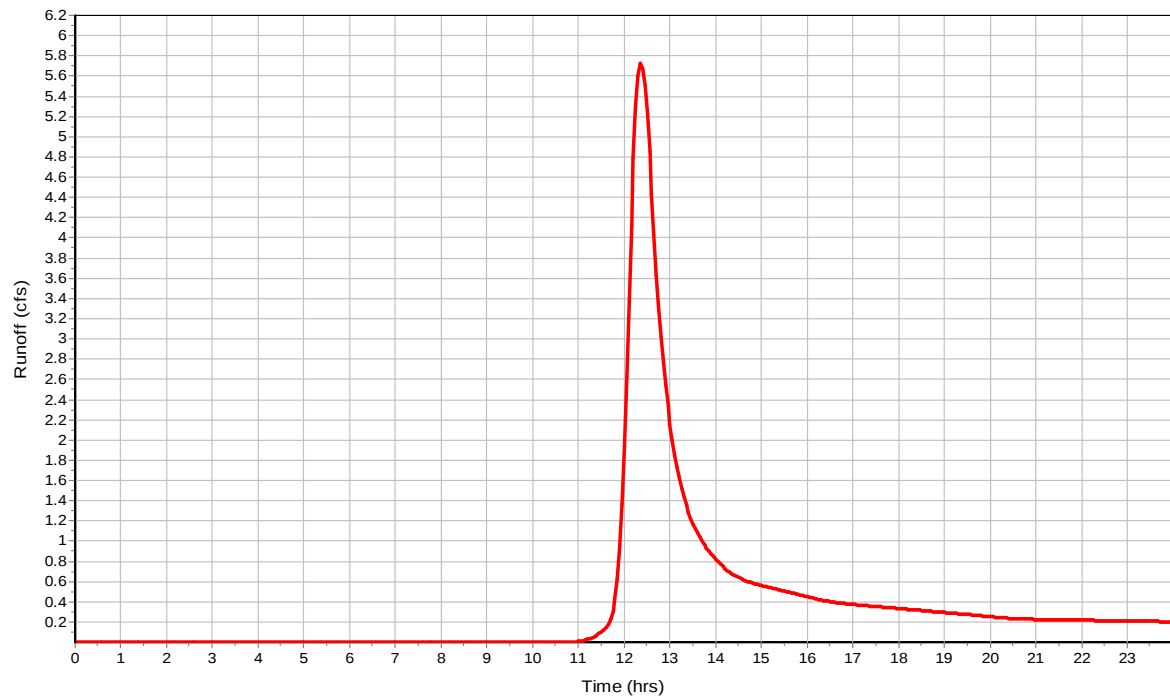
Total Rainfall (in)	3.38
Total Runoff (in)	1.16
Peak Runoff (cfs)	5.74
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:45:00

Subbasin : Drainage_Area_1b_East

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_West

Input Data

Area (ac) 17.73
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	17.73	C	74
Composite Area & Weighted CN	17.73		74

Time of Concentration

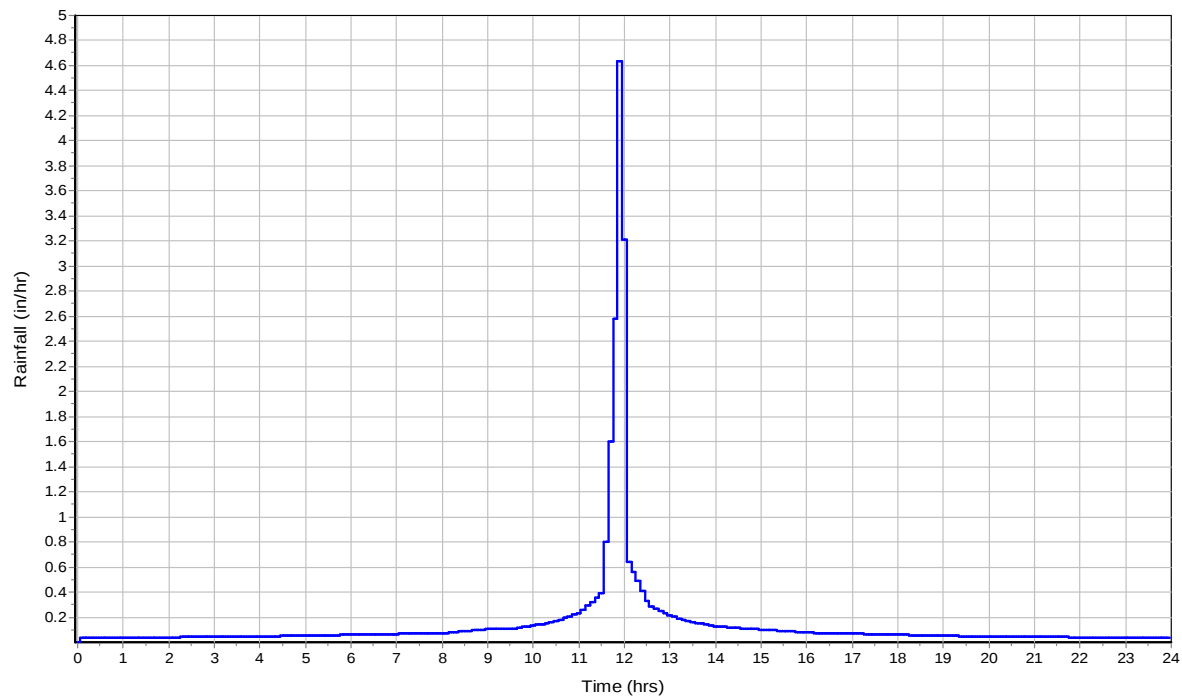
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

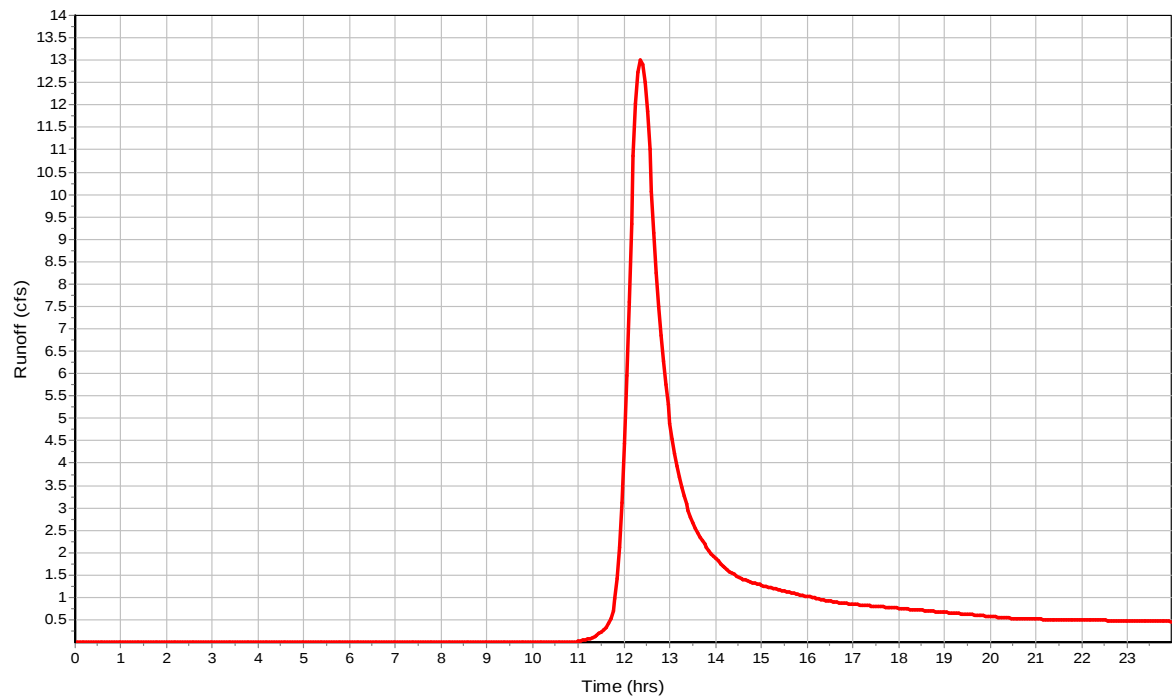
Total Rainfall (in) 3.38
Total Runoff (in) 1.16
Peak Runoff (cfs) 13.04
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_West

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 113.11
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	113.11	C	75
Composite Area & Weighted CN	113.11		75

Time of Concentration

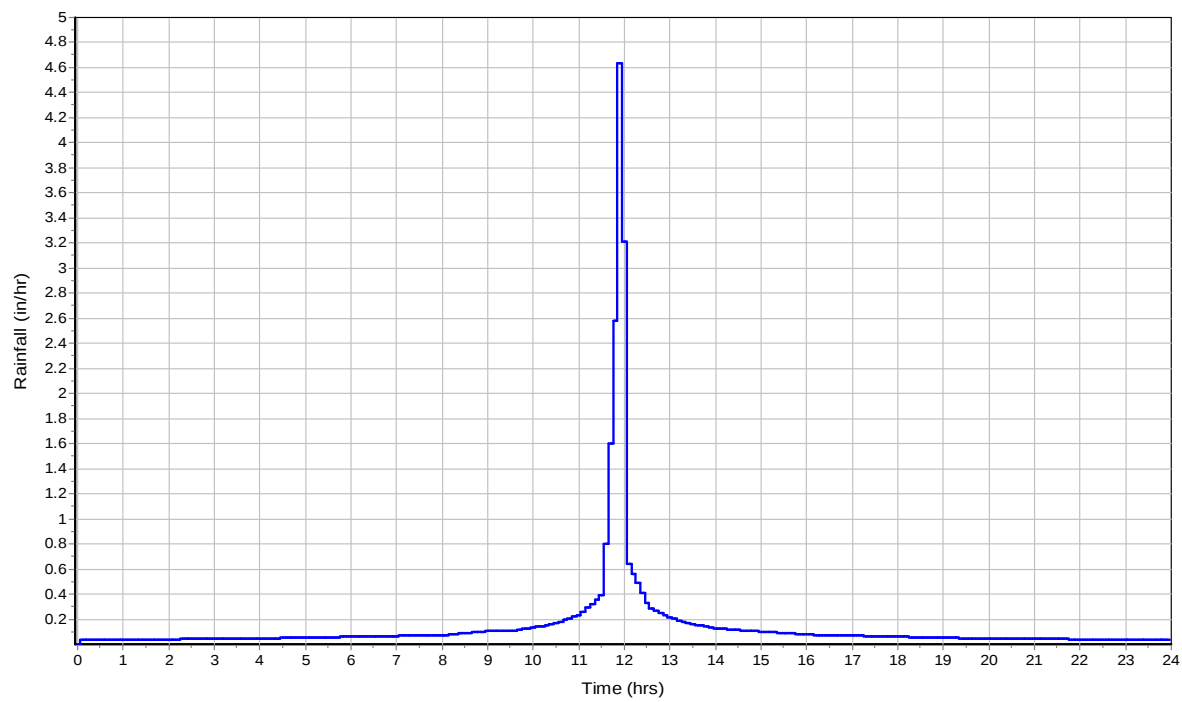
User-Defined TOC override (minutes): 37

Subbasin Runoff Results

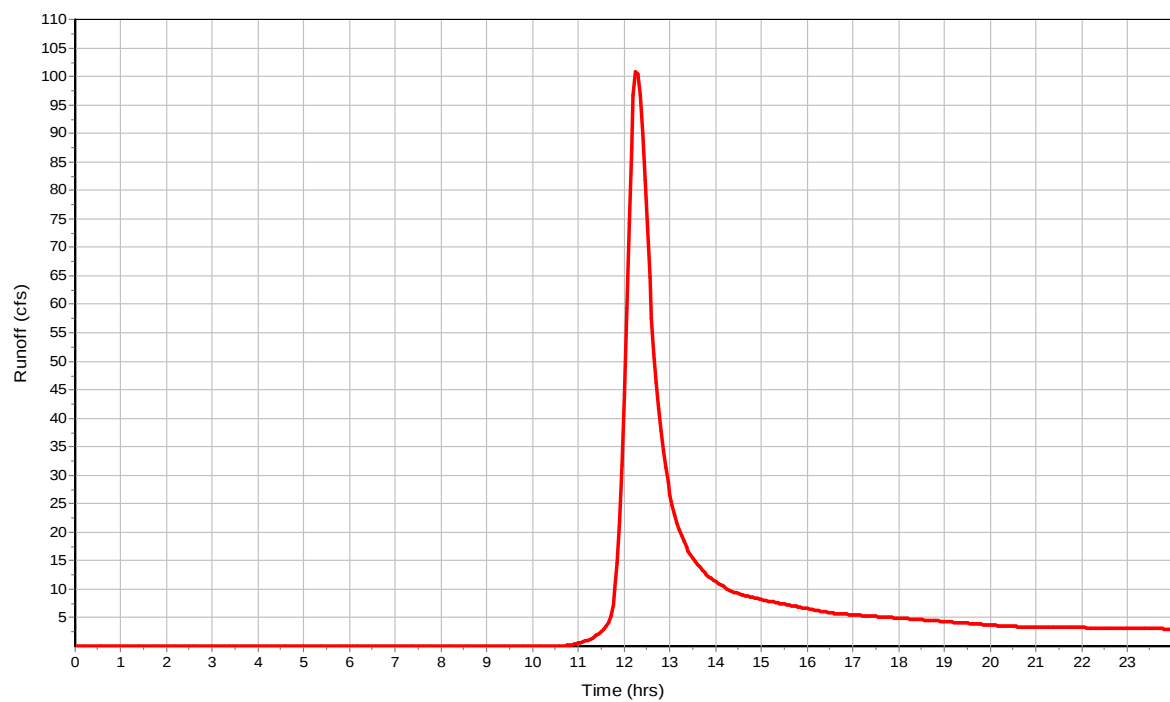
Total Rainfall (in) 3.38
Total Runoff (in) 1.22
Peak Runoff (cfs) 101.45
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:37:00

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2b

Input Data

Area (ac) 12.47
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
-	12.47	-	75
Composite Area & Weighted CN	12.47		75

Time of Concentration

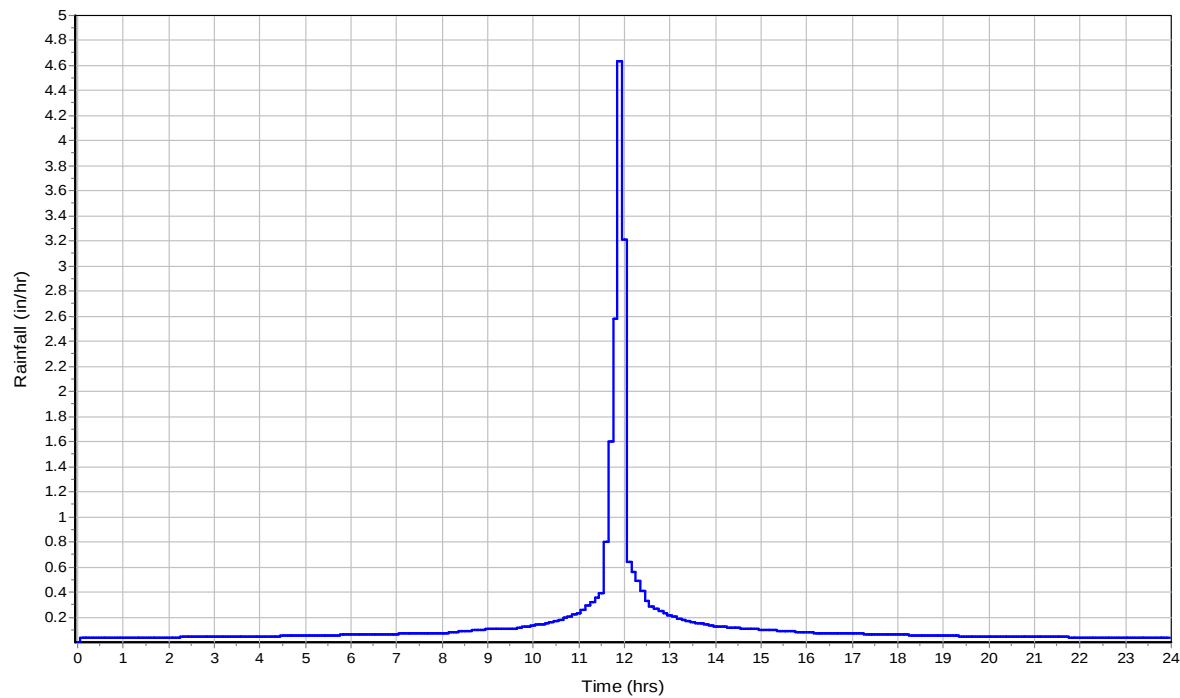
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

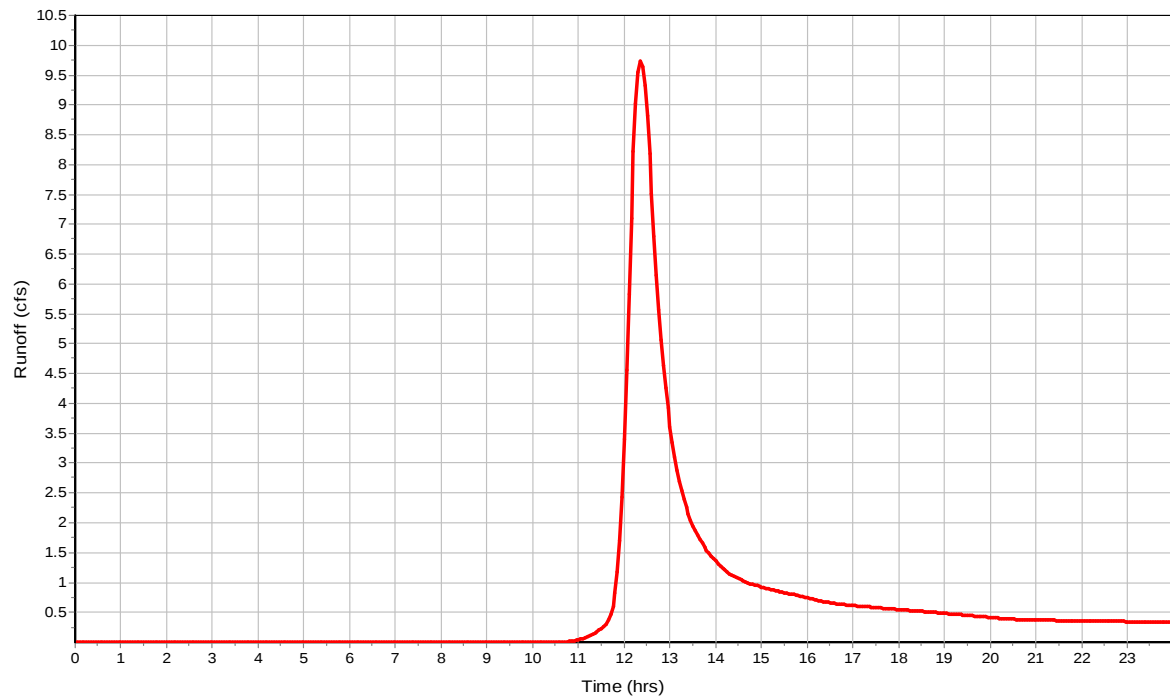
Total Rainfall (in) 3.38
Total Runoff (in) 1.22
Peak Runoff (cfs) 9.75
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub_Infiltration_Basin_1

Input Data

Area (ac)	98.48
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr-5yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	98.48	C	74
Composite Area & Weighted CN	98.48		74

Time of Concentration

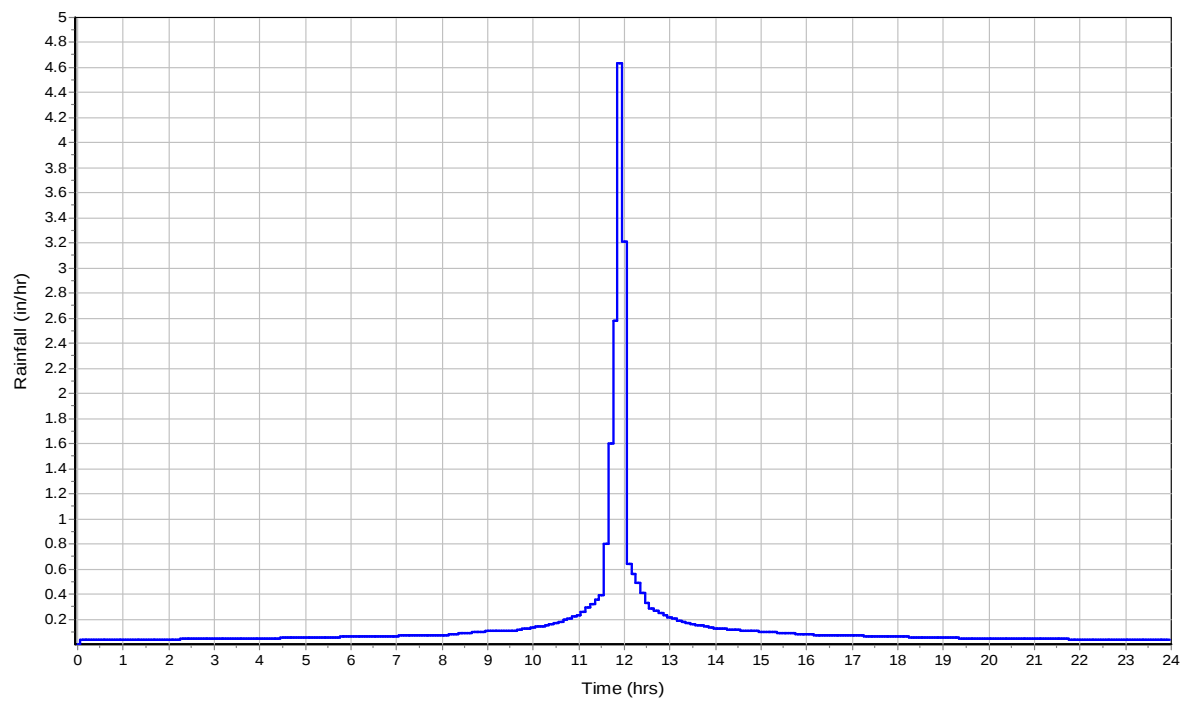
User-Defined TOC override (minutes): 20.00

Subbasin Runoff Results

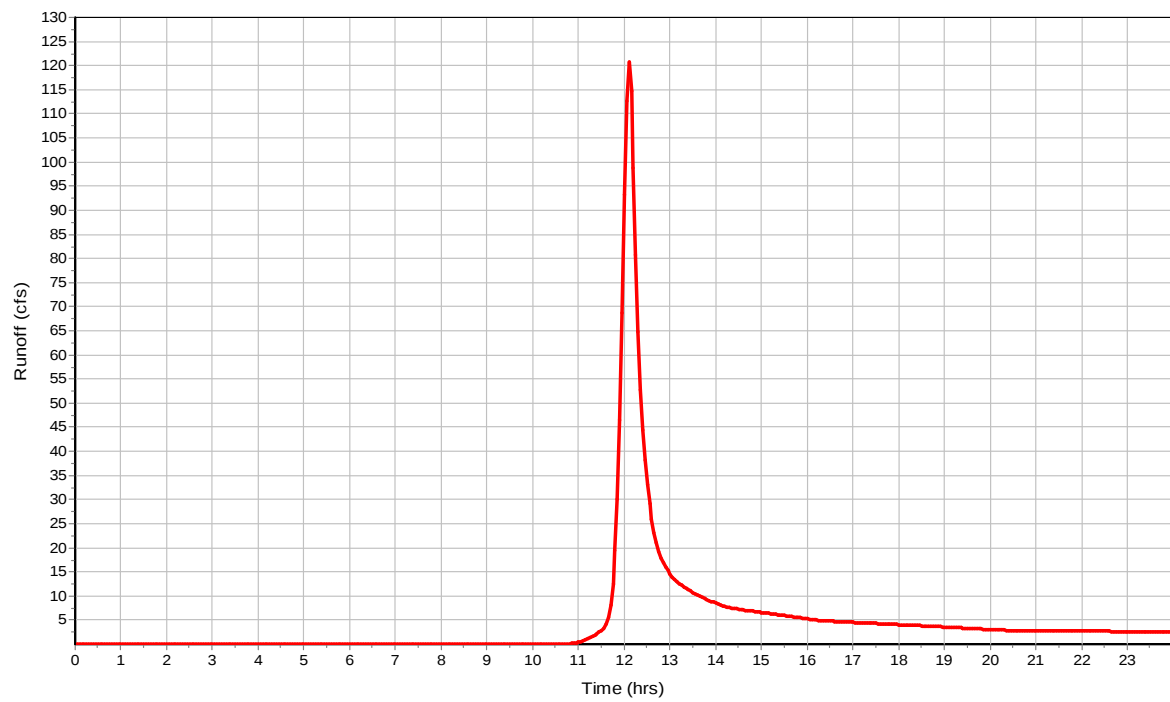
Total Rainfall (in)	3.38
Total Runoff (in)	1.16
Peak Runoff (cfs)	121.03
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:20:00

Subbasin : Sub_Infiltration_Basin_1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	12" DIA MANHOLE	886.40	895.75	9.35	886.40	0.00	895.75	0.00	0.00	0.00
2	Ditch_Start_East	899.00	902.00	3.00	899.00	0.00	9020.00	8118.00	0.00	0.00
3	Ditch_Start_West	899.00	902.00	3.00	899.00	0.00	902.00	0.00	0.00	0.00
4	HW_36_East	892.00	895.00	3.00	0.00	-892.00	0.00	-895.00	0.00	0.00
5	HW_36_West	892.00	895.00	3.00	892.00	0.00	899.00	4.00	0.00	0.00
6	IB_1_OCS	891.00	903.00	12.00	891.00	0.00	903.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	81.40	0.00	888.89	2.49	0.00	6.86	887.43	1.03	0 15:22	0 00:00	0.00	0.00
2	Ditch_Start_East	5.73	5.73	899.20	0.20	0.00	4.80	899.03	0.03	0 12:24	0 00:00	0.00	0.00
3	Ditch_Start_West	13.01	13.01	899.32	0.32	0.00	4.68	899.04	0.04	0 12:24	0 00:00	0.00	0.00
4	HW_36_East	5.72	0.00	892.52	0.52	0.00	4.48	892.08	0.08	0 12:28	0 00:00	0.00	0.00
5	HW_36_West	12.99	0.00	892.90	0.90	0.00	4.10	892.12	0.12	0 12:27	0 00:00	0.00	0.00
6	IB_1_OCS	78.80	0.00	892.43	1.43	0.00	10.57	891.59	0.59	0 15:34	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch_East	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch_West	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch_East	5.72	0 12:25	2363.82	0.00	1.20	4.17	0.36	0.07	0.00		
2	Ditch_West	12.99	0 12:25	2363.82	0.01	1.51	3.31	0.61	0.12	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Offset	Outlet Invert	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	36_East	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	36_West	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	Culvert_1_CMP_72	117.00	886.40	0.00	884.00	0.00	2.40	2.0500	CIRCULAR	72.000	72.000	0.0260	0.5000	0.5000	0.0000	0.00	No
4	Culvert_1_RCP_72	201.00	891.00	0.00	886.40	0.00	4.60	2.2900	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No
5	Culvert_2	111.00	892.25	0.25	890.65	0.00	1.60	1.4400	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

	1
	1
	1
	1
	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	36_East	5.67	0 12:28	126.55	0.04	7.82	0.11	0.48	0.16	0.00		Calculated
2	36_West	12.87	0 12:27	126.55	0.10	8.89	0.10	0.77	0.26	0.00		Calculated
3	Culvert_1_CMP_72	80.72	0 15:21	303.28	0.27	8.08	0.24	2.30	0.38	0.00		Calculated
4	Culvert_1_RCP_72	79.66	0 15:27	640.68	0.12	9.95	0.34	1.95	0.33	0.00		Calculated
5	Culvert_2	105.95	0 12:24	508.46	0.21	9.50	0.19	2.50	0.42	0.00		Calculated

Storage Nodes

Storage Node : Culvert_2_Inlet

Input Data

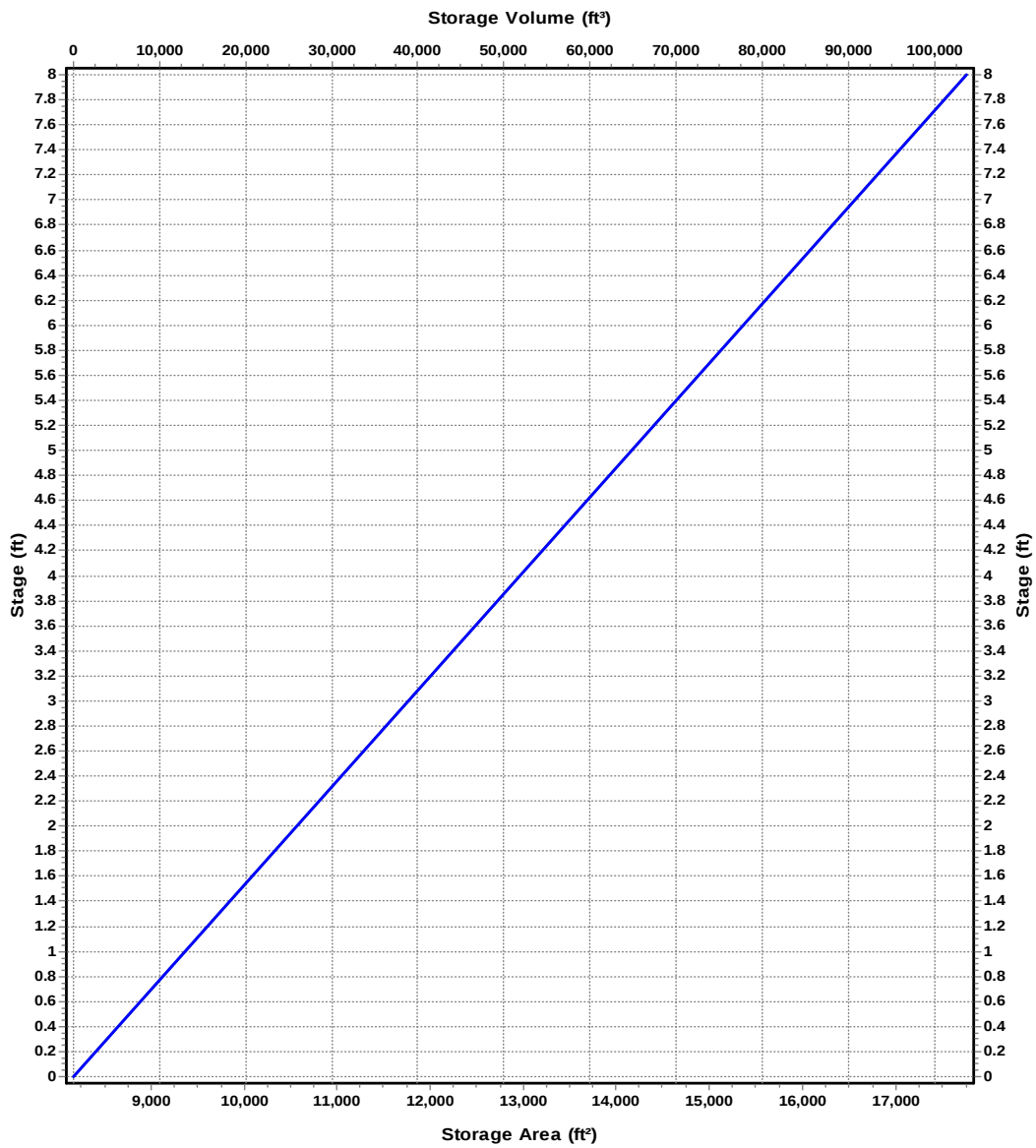
Invert Elevation (ft)	892.00
Max (Rim) Elevation (ft)	900.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	892.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	8168.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Offsite_2

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	8168	0
8	17763	103724

Storage Area Volume Curves



Storage Area Storage Volume

Storage Node : Culvert_2_Inlet (continued)

Output Summary Results

Peak Inflow (cfs)	110
Peak Lateral Inflow (cfs)	110
Peak Outflow (cfs)	105.95
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	895.4
Max HGL Depth Attained (ft)	3.4
Average HGL Elevation Attained (ft)	892.49
Average HGL Depth Attained (ft)	0.49
Time of Max HGL Occurrence (days hh:mm)	0 12:24
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Infiltration_Basin_1

Input Data

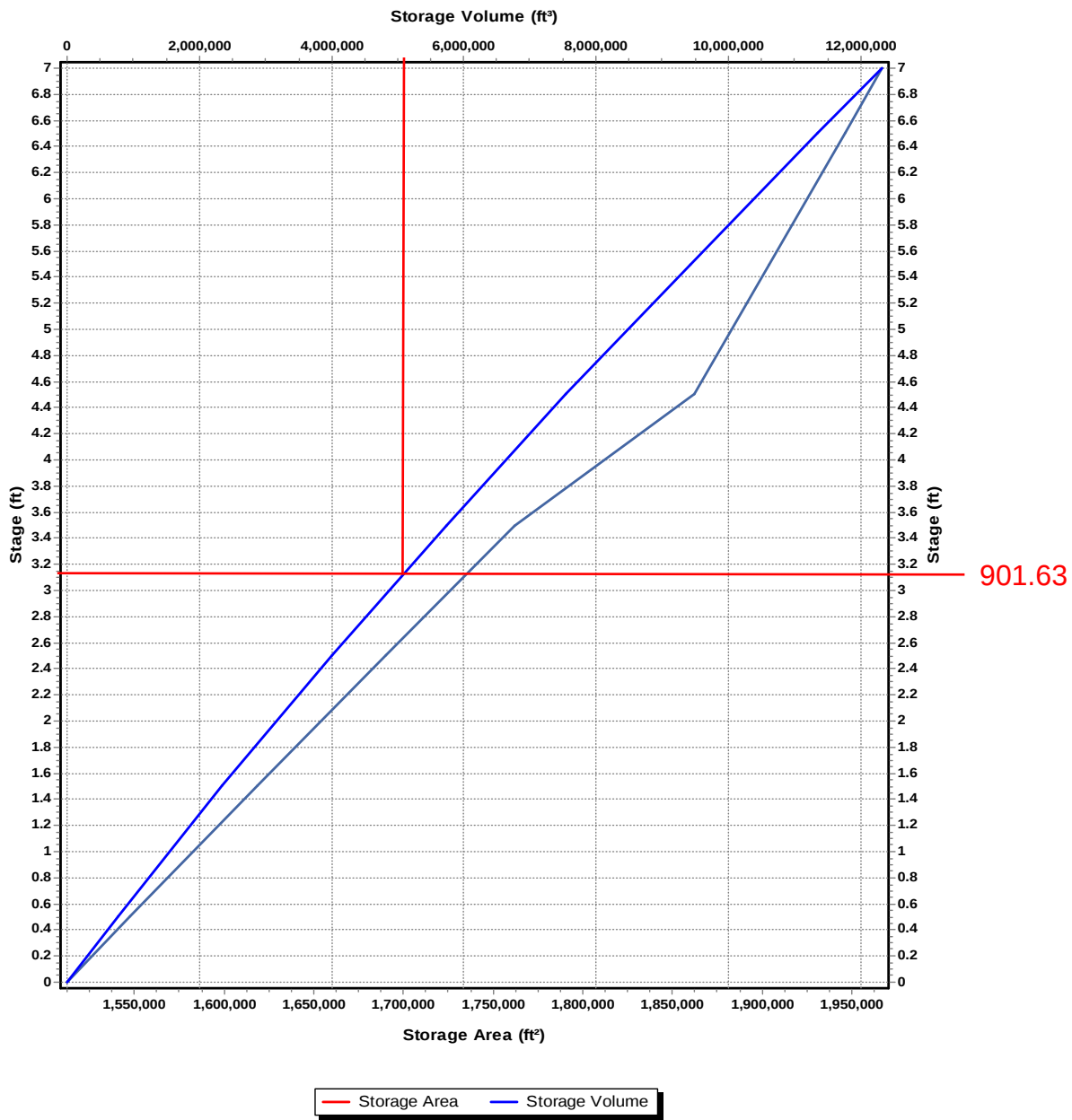
Invert Elevation (ft)	898.50
Max (Rim) Elevation (ft)	905.50
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	898.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	1512370.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : SME Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	1512370	0
0.5	1547431	764950.25
1.5	1618709	2348020.25
2.5	1690091	4002420.25
3.5	1761575	5728253.25
4.5	1862035	7540058.25
5.5	1904021	9423086.25
6.5	1946087	11348140.25
7	1966758	12326351.5

Storage Area Volume Curves



Storage Node : Infiltration_Basin_1 (continued)

Outflow Weirs

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 IB_1_Spillway	Trapezoidal	No	903.50	5.00	350.00	2.20	3.40

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 OCS_Weir	Bottom	CIRCULAR	No	120.00			900.80	0.61

Output Summary Results

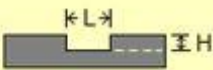
Peak Inflow (cfs)	1613.84
Peak Lateral Inflow (cfs)	1613.84
Peak Outflow (cfs)	78.8
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	901.63
Max HGL Depth Attained (ft)	3.13
Average HGL Elevation Attained (ft)	900
Average HGL Depth Attained (ft)	1.5
Time of Max HGL Occurrence (days hh:mm)	0 15:27
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Top of Riser Elevation = 900.80'
 10-year storm elevation = 901.79'
 H = 0.99'
 Q ~ 100 cfs

Thin Blue Numbers = Input data
 Bold Red Numbers = Answers

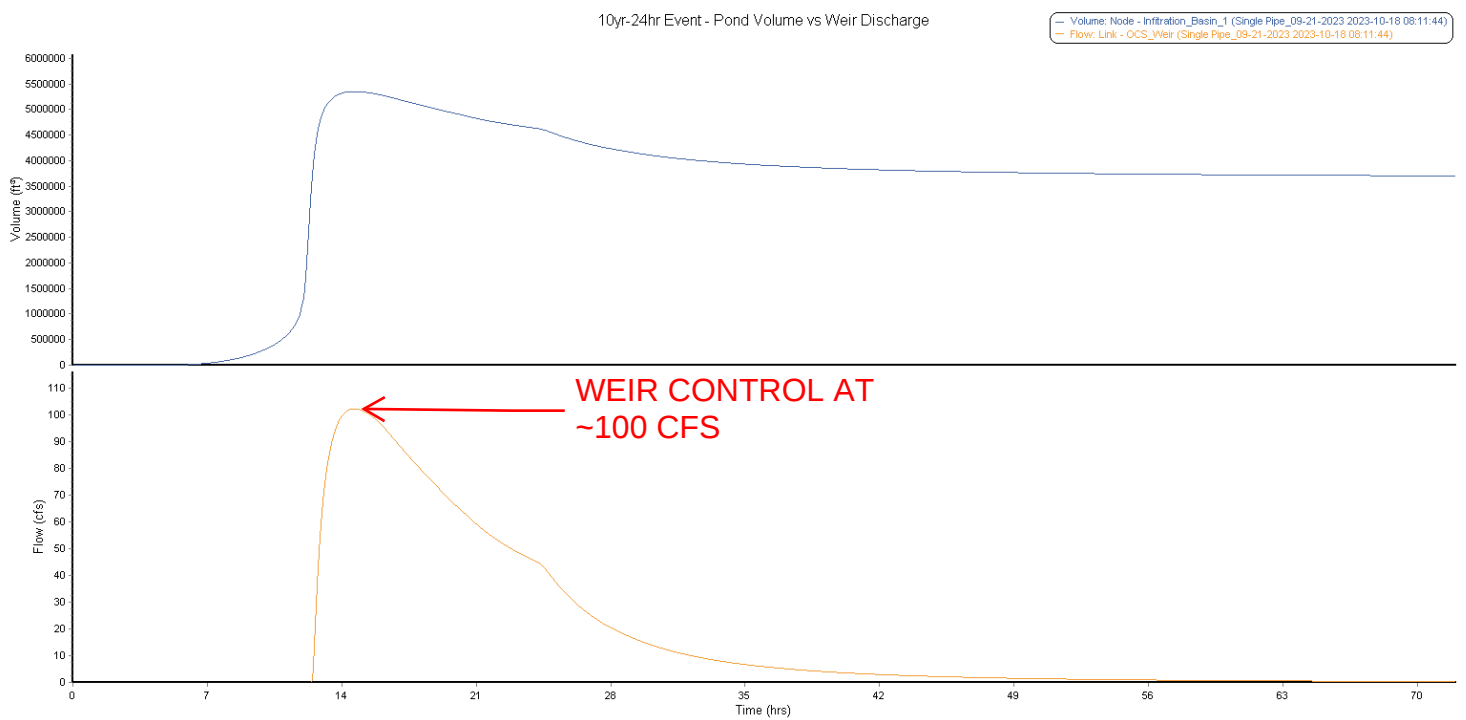
Weir Notch Bleed Down Calculations

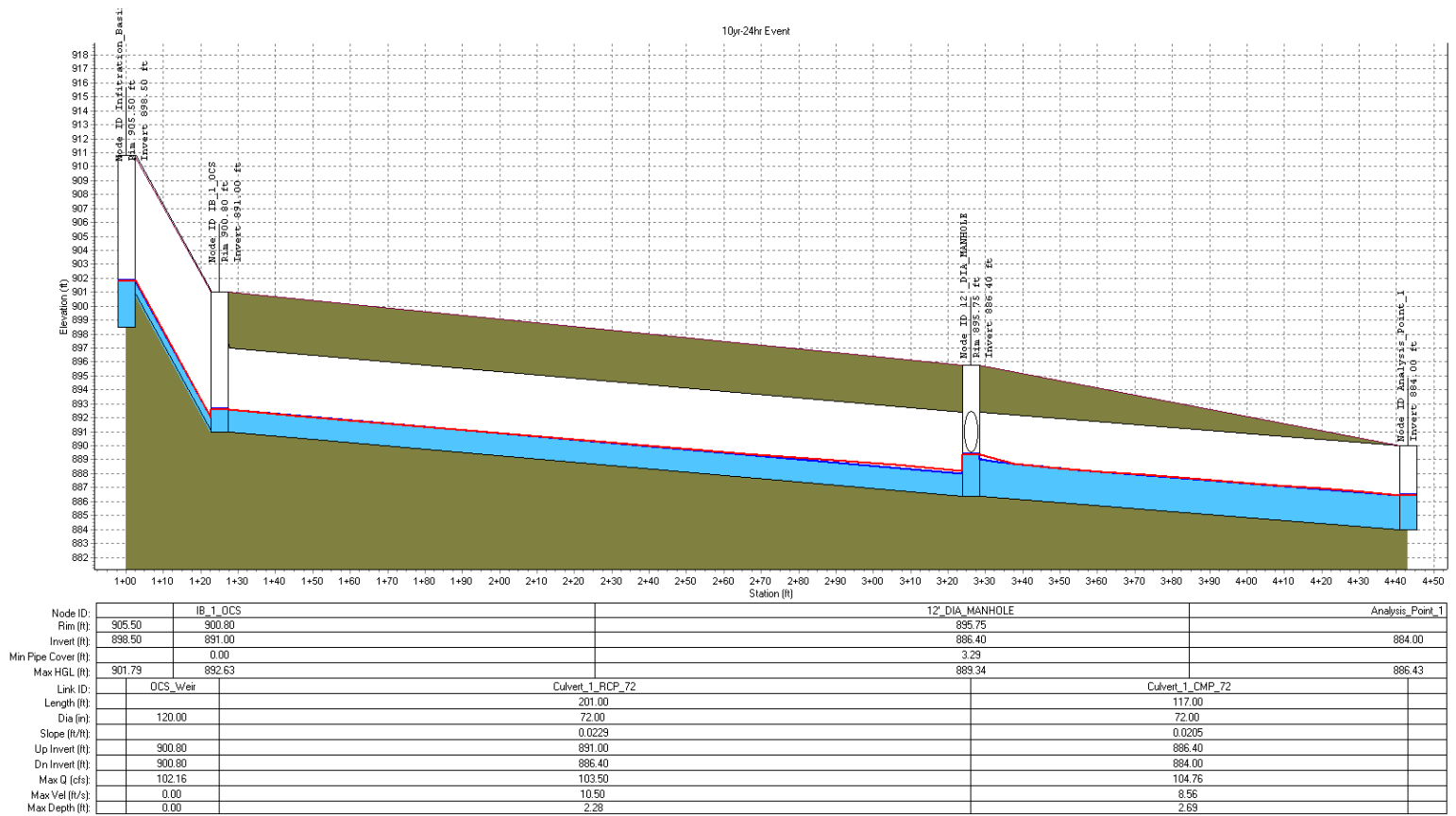
Pond Surface Area at SHW = 0 Sq. Ft.
 Pond Surface Area at NWL = 0 Sq. Ft.
 Notch Height (H) = 0.99 Feet
 Notch Width (L) = 31.40 Feet
 C = 3.25 Coefficient of discharge

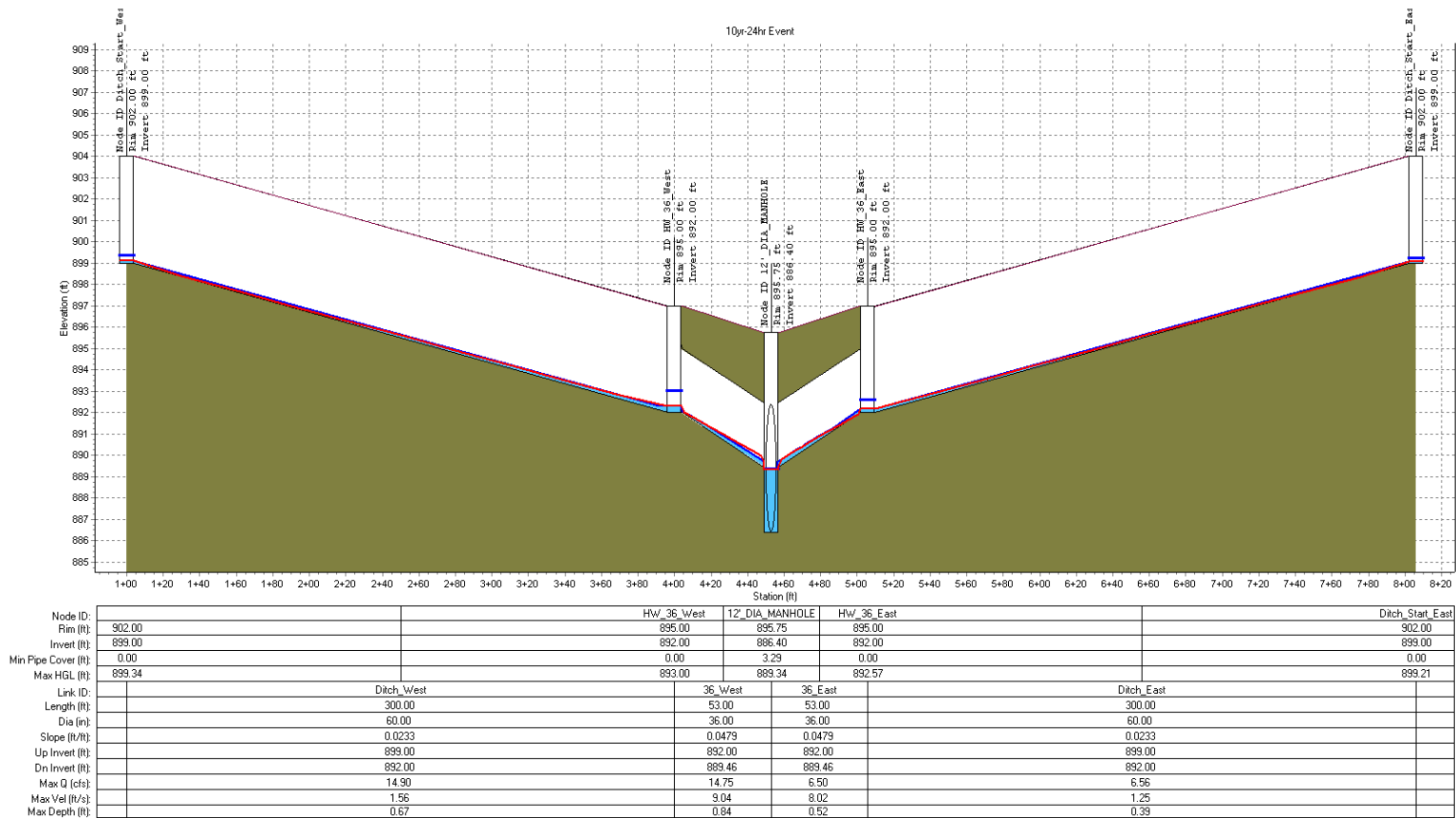

 Horizontal Broad Crested W
 $Q = C L H^{3/2}$

1/2 Volume Time = 0.00 Hours
 Total Time = 0.00 Hours

Total H (Ft)	Increm. H (Ft)	Flow Q (cfs)	Q Avg.	Delta Volume	Cum. Volume	Delta Hours	Cum. Hours
0.99		100.43					
	0.02		98.931	0	0	0.0	
0.97		97.43					0.0
	0.02		95.949	0	0	0.0	
0.95		94.47					0.0
	0.02		92.997	0	0	0.0	
0.93		91.53					0.0
	0.02		90.076	0	0	0.0	
0.91		88.62					0.0
	0.02		87.186	0	0	0.0	
0.89		85.75					0.0
	0.02		84.328	0	0	0.0	
0.87		82.91					0.0
	0.02		81.501	0	0	0.0	
0.85		80.10					0.0
	0.02		78.707	0	0	0.0	
0.83		77.32					0.0
	0.02		75.946	0	0	0.0	
0.81		74.57					0.0
	0.02		73.218	0	0	0.0	
0.79		71.86					0.0
	0.02		70.523	0	0	0.0	
0.77		69.18					0.0
	0.02		67.862	0	0	0.0	
0.75		66.54					0.0
	0.02		65.236	0	0	0.0	
0.73		63.93					0.0
	0.02		62.644	0	0	0.0	
0.71		61.36					0.0
	0.02		60.088	0	0	0.0	
0.69		58.82					0.0
	0.02		57.567	0	0	0.0	
0.67		56.32					0.0







Project Description

File Name Single Pipe_09-21-2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:03:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 7
Subbasins..... 6
Nodes..... 10
 Junctions 6
 Outfalls 2
 Flow Diversions 0
 Inlets 0
 Storage Nodes 2
Links..... 9
 Channels 2
 Pipes 5
 Pumps 0
 Orifices 1
 Weirs 1
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	1yr24hr	Time Series	1-inch	Cumulative	inches	Michigan	Calhoun	1.00	1.00	SCS Type II 24-hr
2	24hr100yr	Time Series	24hr100yr	Cumulative	inches	Michigan	Calhoun	100.00	5.60	SCS Type II 24-hr
3	24hr10yr	Time Series	24hr10yr	Cumulative	inches	Michigan	Calhoun	10.00	3.60	SCS Type II 24-hr
4	24hr25yr	Time Series	24hr25yr	Cumulative	inches	Michigan	Calhoun	25.00	4.30	SCS Type II 24-hr
5	24hr2yr	Time Series	24hr2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
6	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
7	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches	Michigan	Calhoun	5.00	3.38	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	761.76	484.00	91.00	3.60	2.64	2008.00	1641.14	0 00:33:17
2	Drainage_Area_1b_East	7.81	484.00	74.00	3.60	1.31	10.22	6.58	0 00:45:00
3	Drainage_Area_1b_West	17.73	484.00	74.00	3.60	1.31	23.21	14.94	0 00:45:00
4	Drainage_Area_2	113.11	484.00	75.00	3.60	1.37	155.30	115.31	0 00:37:00
5	Drainage_Area_2b	12.47	484.00	75.00	3.60	1.37	17.12	11.10	0 00:45:00
6	Sub_Infiltration_Basin_1	98.48	484.00	74.00	3.60	1.31	128.91	137.77	0 00:20:00

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	Junction	886.40	895.75	886.40	895.75	0.00	105.81	889.34	0.00	6.41	0 00:00	0.00	0.00
2	Ditch_Start_East	Junction	899.00	902.00	899.00	902.00	0.00	6.57	899.21	0.00	4.79	0 00:00	0.00	0.00
3	Ditch_Start_West	Junction	899.00	902.00	899.00	902.00	0.00	14.91	899.34	0.00	4.66	0 00:00	0.00	0.00
4	HW_36_East	Junction	892.00	895.00	0.00	0.00	0.00	6.56	892.57	0.00	4.43	0 00:00	0.00	0.00
5	HW_36_West	Junction	892.00	895.00	892.00	899.00	0.00	14.90	893.00	0.00	4.00	0 00:00	0.00	0.00
6	IB_1_OCS	Junction	891.00	903.00	891.00	903.00	0.00	102.16	892.63	0.00	10.37	0 00:00	0.00	0.00
7	Analysis_Point_1	Outfall	884.00					104.76	886.43					
8	Analysis_Point_2	Outfall	890.65					120.79	892.64					
9	Culvert_2_Inlet	Storage Node	892.00	900.00	892.00		8168.00	125.36	895.68				0.00	0.00
10	Infiltration_Basin_1	Storage Node	898.50	905.50	898.50		1512370.00	1751.98	901.79				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	36_East	Pipe	HW_36_East	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	6.50	126.55	0.05	8.02	0.52	0.17	0.00 Calculated
2	36_West	Pipe	HW_36_West	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	14.75	126.55	0.12	9.04	0.84	0.28	0.00 Calculated
3	Culvert_1_CMP_72	Pipe	12'_DIA_MANHOLE	Analysis_Point_1	117.00	886.40	884.00	2.0500	72.000	0.0260	104.76	303.28	0.35	8.56	2.69	0.45	0.00 Calculated
4	Culvert_1_RCP_72	Pipe	IB_1_OCS	12'_DIA_MANHOLE	201.00	891.00	886.40	2.2900	72.000	0.0130	103.50	640.68	0.16	10.50	2.28	0.38	0.00 Calculated
5	Culvert_2	Pipe	Culvert_2_Inlet	Analysis_Point_2	111.00	892.25	890.65	1.4400	72.000	0.0130	120.79	508.46	0.24	9.75	2.71	0.45	0.00 Calculated
6	Ditch_East	Channel	Ditch_Start_East	HW_36_East	300.00	899.00	892.00	2.3300	60.000	0.0320	6.56	2363.82	0.00	1.25	0.39	0.08	0.00
7	Ditch_West	Channel	Ditch_Start_West	HW_36_West	300.00	899.00	892.00	2.3300	60.000	0.0320	14.90	2363.82	0.01	1.56	0.67	0.13	0.00
8	OCS_Weir	Orifice	Infiltration_Basin_1	IB_1_OCS		898.50	891.00		120.000		102.16						
9	IB_1_Spillway	Weir	Infiltration_Basin_1	Culvert_2_Inlet		898.50	892.00				0.00						

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	761.76
Peak Rate Factor	484
Weighted Curve Number	91
Rain Gage ID	24hr10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Urban industrial, 72% imp	761.76	C	91
Composite Area & Weighted CN	761.76		91

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{(2/3)}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

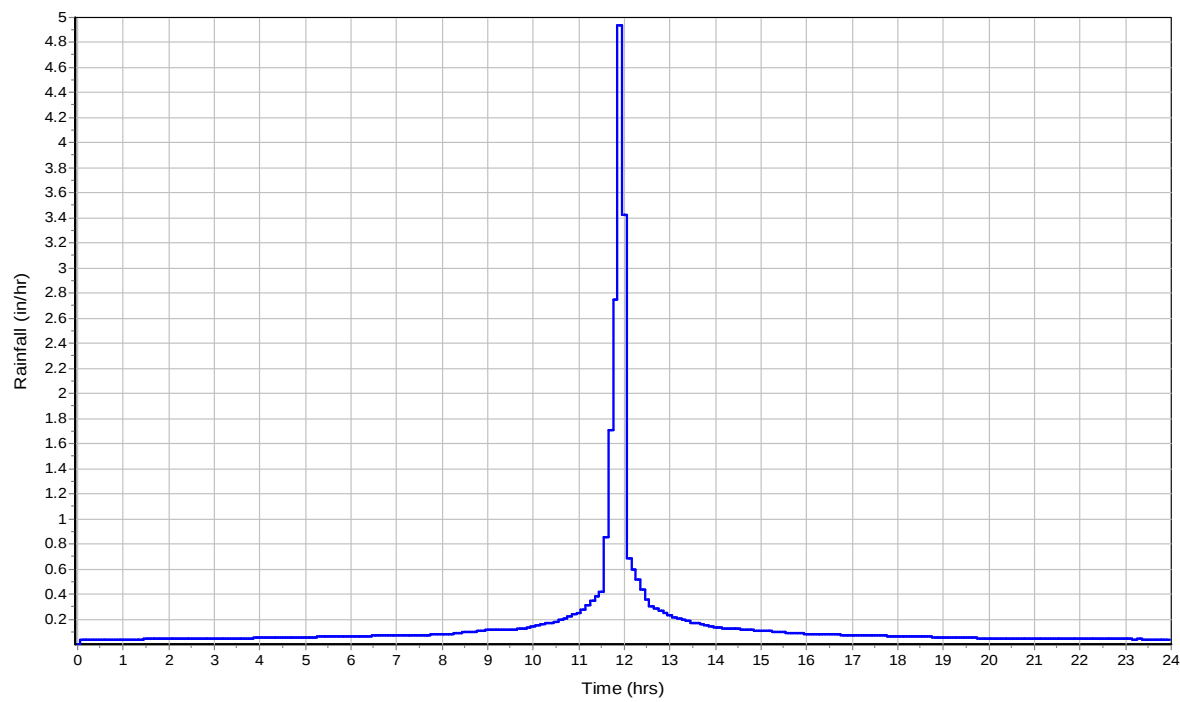
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.011	0
Flow Length (ft) :	150	150	0
Slope (%) :	0.5	0.5	0
2 yr, 24 hr Rainfall (in) :	2.53	2.53	0
Velocity (ft/sec) :	0.09	0.76	0
Computed Flow Time (min) :	26.54	3.28	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	300	0	0
Slope (%) :	0.5	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0	0
Computed Flow Time (min) :	3.47	0	0
Total TOC (min)	33.29		

Subbasin Runoff Results

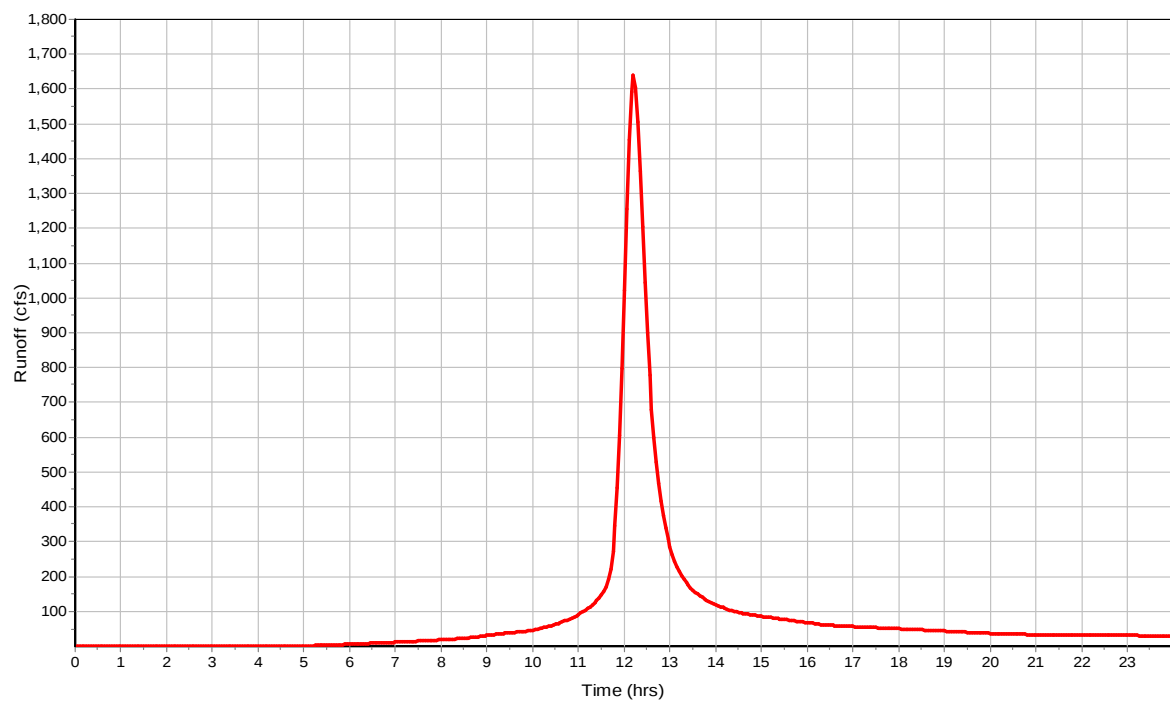
Total Rainfall (in)	3.6
Total Runoff (in)	2.64
Peak Runoff (cfs)	1641.14
Weighted Curve Number	91
Time of Concentration (days hh:mm:ss)	0 00:33:17

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_East

Input Data

Area (ac)	7.81
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	7.81	C	74
Composite Area & Weighted CN	7.81		74

Time of Concentration

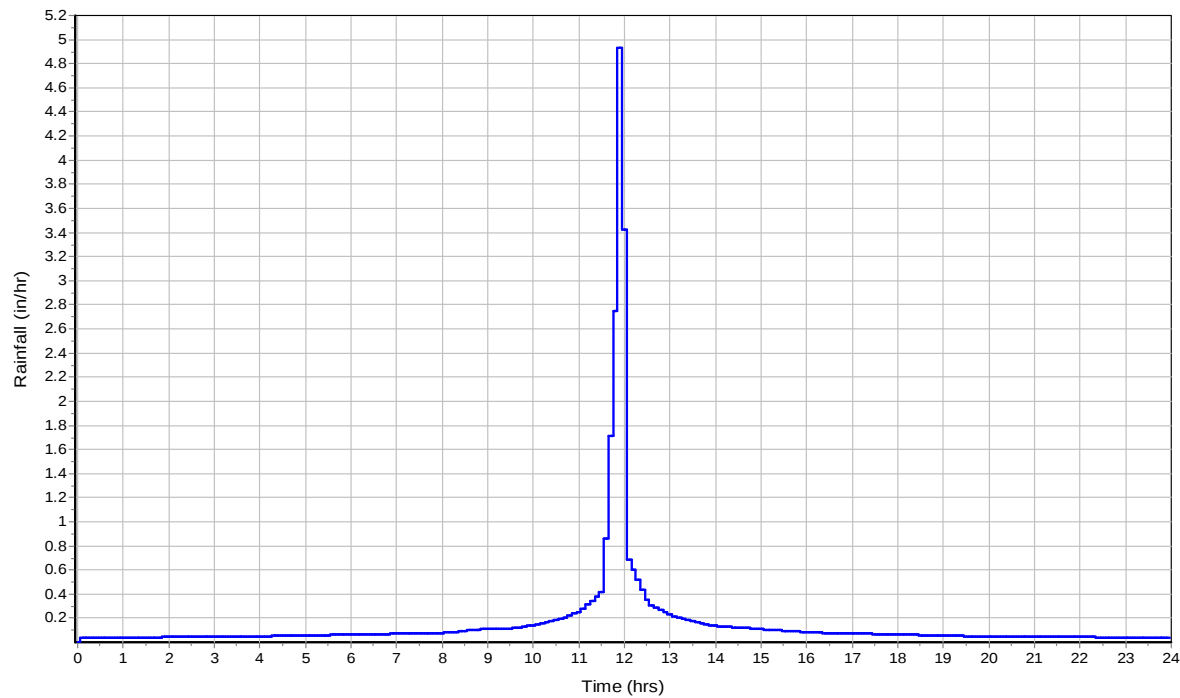
User-Defined TOC override (minutes): 45

Subbasin Runoff Results

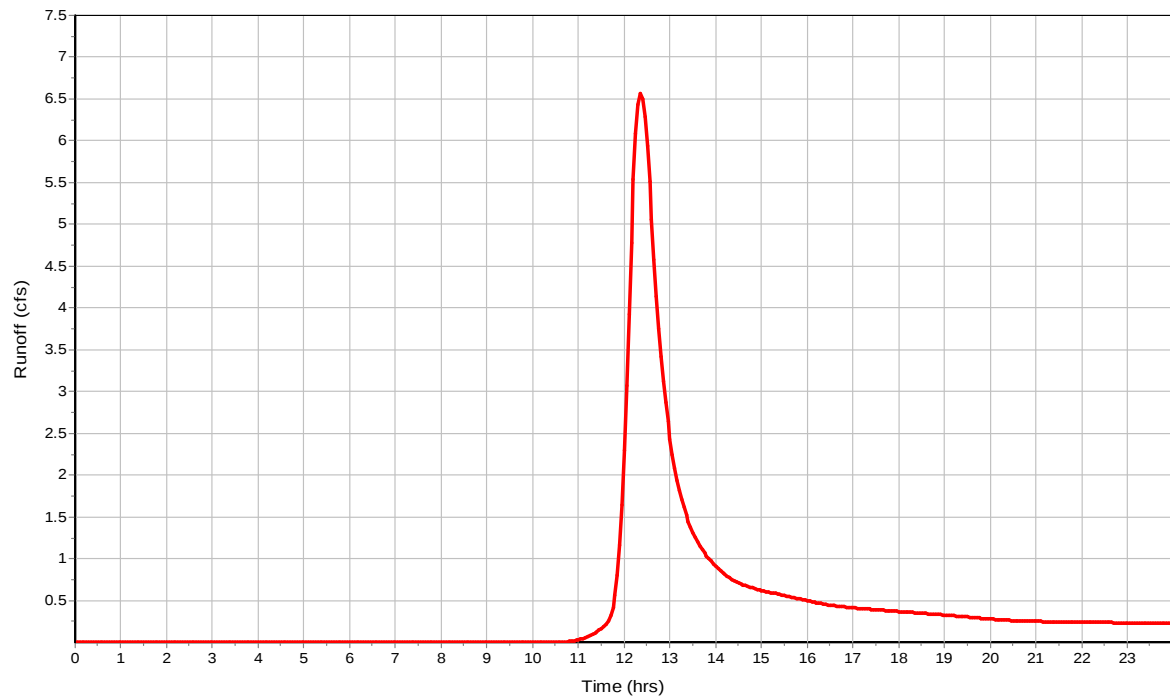
Total Rainfall (in)	3.6
Total Runoff (in)	1.31
Peak Runoff (cfs)	6.58
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:45:00

Subbasin : Drainage_Area_1b_East

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_West

Input Data

Area (ac) 17.73
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	17.73	C	74
Composite Area & Weighted CN	17.73		74

Time of Concentration

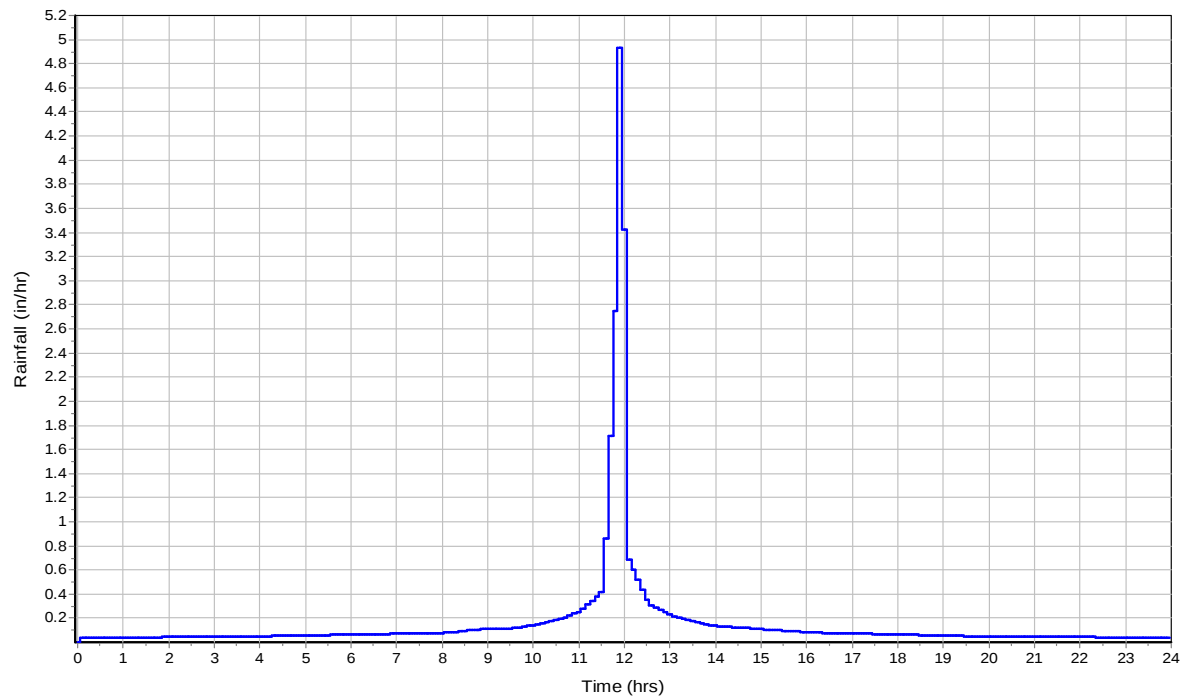
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

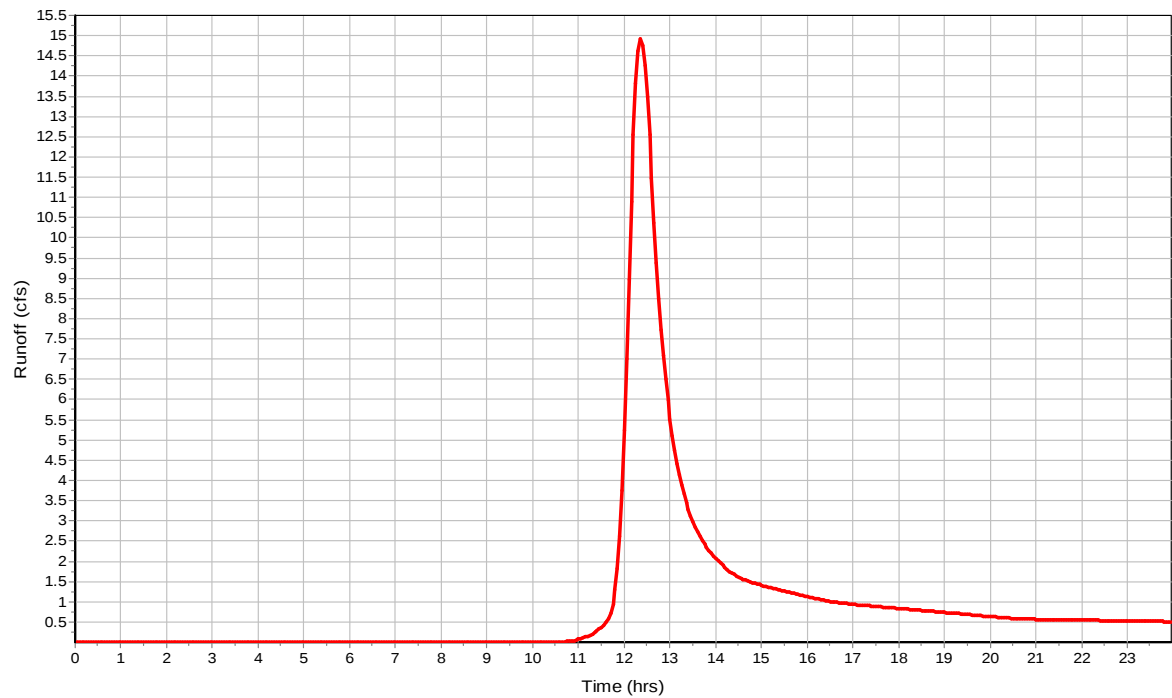
Total Rainfall (in) 3.6
Total Runoff (in) 1.31
Peak Runoff (cfs) 14.94
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_West

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 113.11
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	113.11	C	75
Composite Area & Weighted CN	113.11		75

Time of Concentration

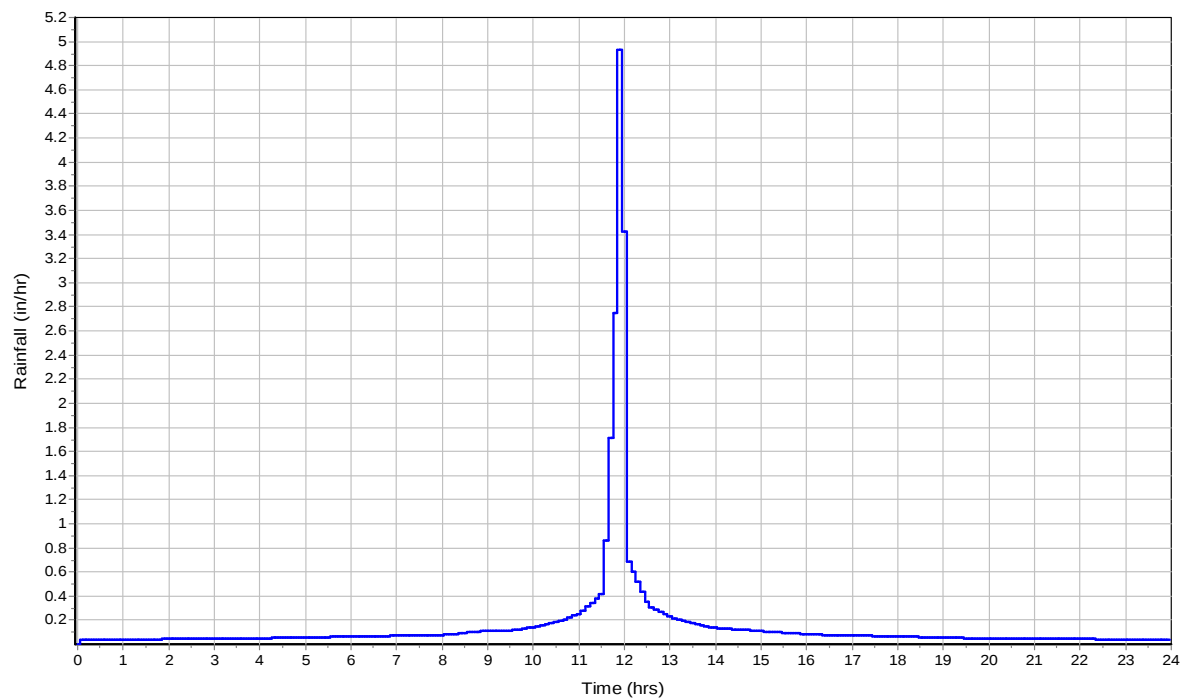
User-Defined TOC override (minutes): 37

Subbasin Runoff Results

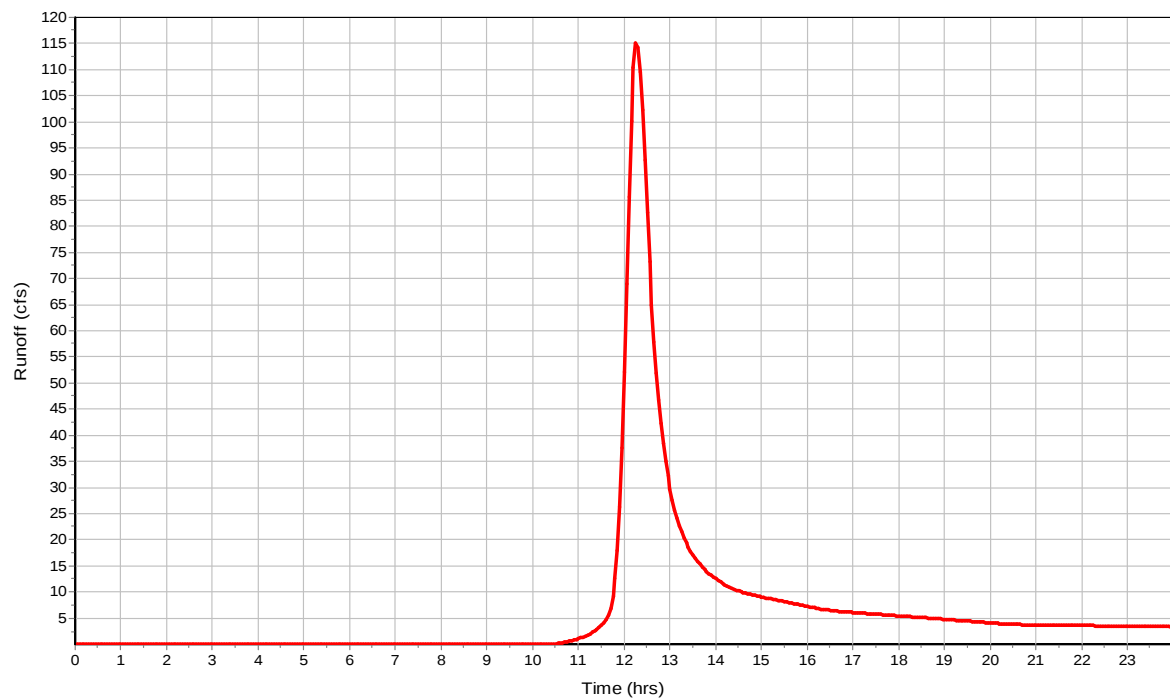
Total Rainfall (in) 3.6
Total Runoff (in) 1.37
Peak Runoff (cfs) 115.31
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:37:00

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2b

Input Data

Area (ac) 12.47
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
-	12.47	-	75
Composite Area & Weighted CN	12.47		75

Time of Concentration

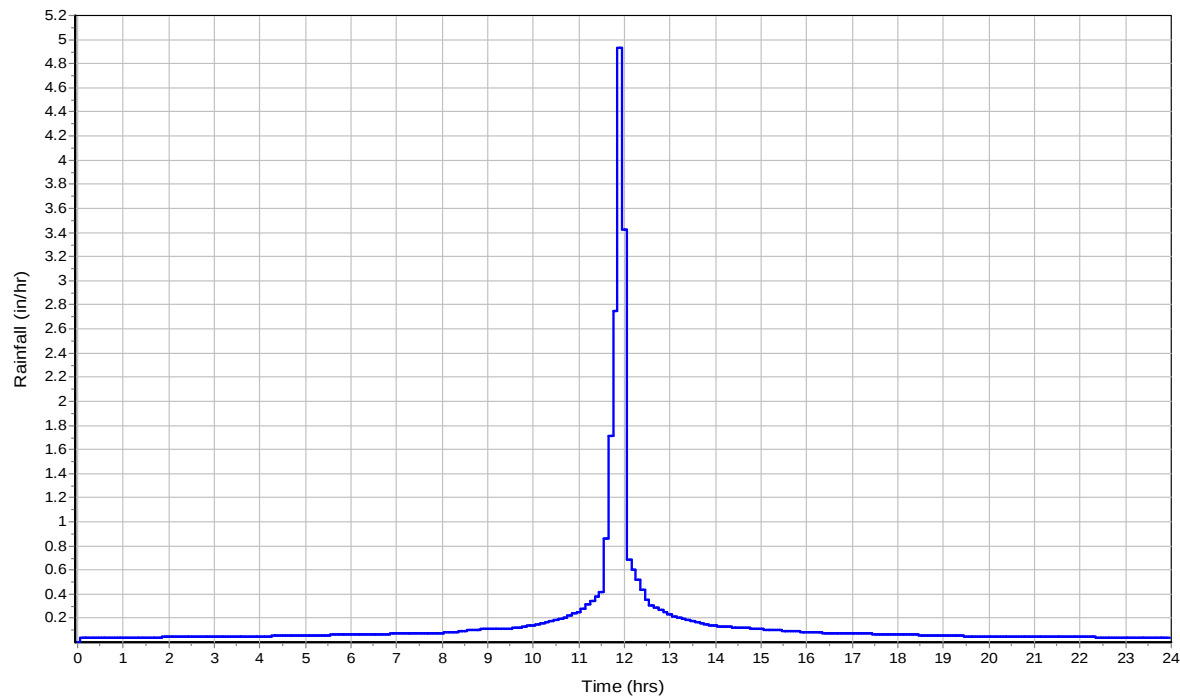
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

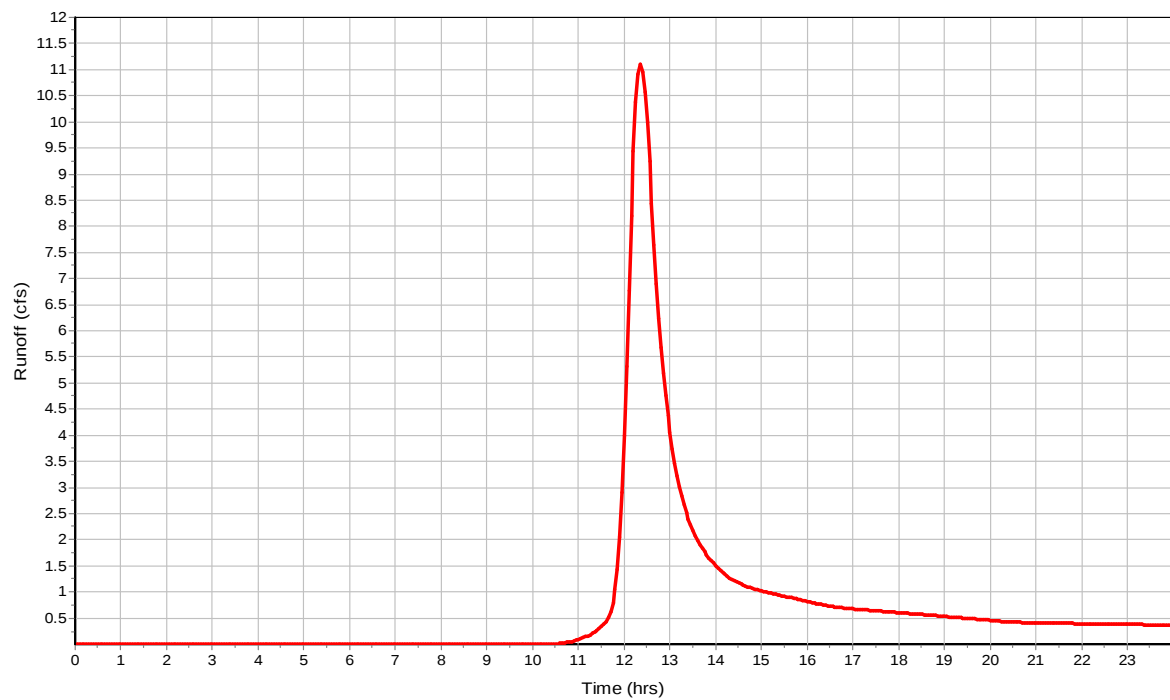
Total Rainfall (in) 3.6
Total Runoff (in) 1.37
Peak Runoff (cfs) 11.1
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub_Infiltration_Basin_1

Input Data

Area (ac)	98.48
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr10yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	98.48	C	74
Composite Area & Weighted CN	98.48		74

Time of Concentration

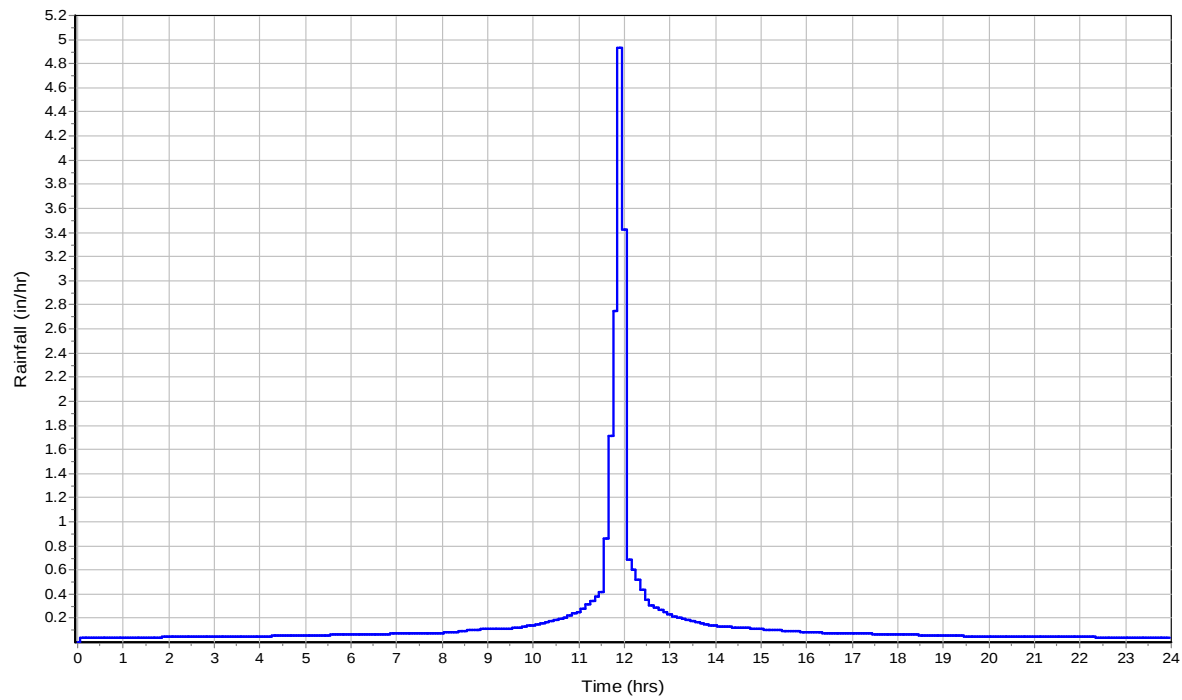
User-Defined TOC override (minutes): 20.00

Subbasin Runoff Results

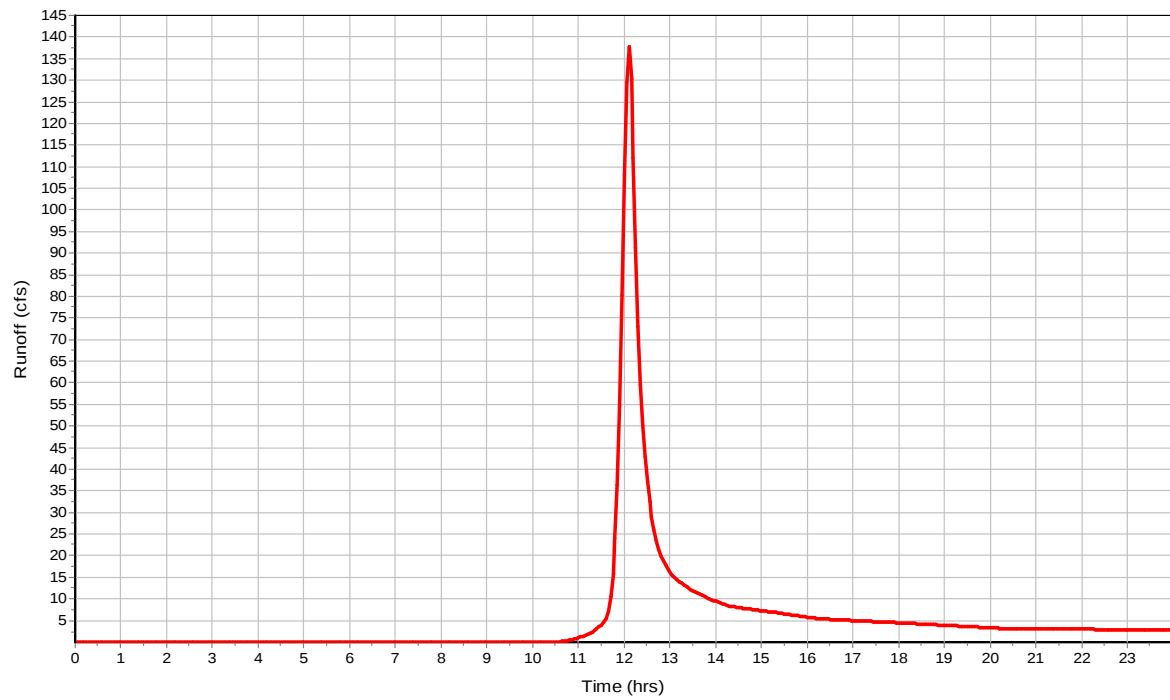
Total Rainfall (in)	3.6
Total Runoff (in)	1.31
Peak Runoff (cfs)	137.77
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:20:00

Subbasin : Sub_Infiltration_Basin_1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	12" DIA_MANHOLE	886.40	895.75	9.35	886.40	0.00	895.75	0.00	0.00	0.00
2	Ditch_Start_East	899.00	902.00	3.00	899.00	0.00	9020.00	8118.00	0.00	0.00
3	Ditch_Start_West	899.00	902.00	3.00	899.00	0.00	902.00	0.00	0.00	0.00
4	HW_36_East	892.00	895.00	3.00	0.00	-892.00	0.00	-895.00	0.00	0.00
5	HW_36_West	892.00	895.00	3.00	892.00	0.00	899.00	4.00	0.00	0.00
6	IB_1_OCS	891.00	903.00	12.00	891.00	0.00	903.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	105.81	0.00	889.34	2.94	0.00	6.41	887.57	1.17	0 14:39	0 00:00	0.00	0.00
2	Ditch_Start_East	6.57	6.57	899.21	0.21	0.00	4.79	899.03	0.03	0 12:24	0 00:00	0.00	0.00
3	Ditch_Start_West	14.91	14.91	899.34	0.34	0.00	4.66	899.05	0.05	0 12:24	0 00:00	0.00	0.00
4	HW_36_East	6.56	0.00	892.57	0.57	0.00	4.43	892.08	0.08	0 12:27	0 00:00	0.00	0.00
5	HW_36_West	14.90	0.00	893.00	1.00	0.00	4.00	892.13	0.13	0 12:27	0 00:00	0.00	0.00
6	IB_1_OCS	102.16	0.00	892.63	1.63	0.00	10.37	891.65	0.65	0 14:39	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch_East	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch_West	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch_East	6.56	0 12:25	2363.82	0.00	1.25	4.00	0.39	0.08	0.00		
2	Ditch_West	14.90	0 12:24	2363.82	0.01	1.56	3.21	0.67	0.13	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Offset	Outlet Invert	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	36_East	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	36_West	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	Culvert_1_CMP_72	117.00	886.40	0.00	884.00	0.00	2.40	2.0500	CIRCULAR	72.000	72.000	0.0260	0.5000	0.5000	0.0000	0.00	No
4	Culvert_1_RCP_72	201.00	891.00	0.00	886.40	0.00	4.60	2.2900	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No
5	Culvert_2	111.00	892.25	0.25	890.65	0.00	1.60	1.4400	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

	1
	1
	1
	1
	1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 36_East	6.50	0 12:27	126.55	0.05	8.02	0.11	0.52	0.17	0.00		Calculated
2 36_West	14.75	0 12:27	126.55	0.12	9.04	0.10	0.84	0.28	0.00		Calculated
3 Culvert_1_CMP_72	104.76	0 14:39	303.28	0.35	8.56	0.23	2.69	0.45	0.00		Calculated
4 Culvert_1_RCP_72	103.50	0 14:38	640.68	0.16	10.50	0.32	2.28	0.38	0.00		Calculated
5 Culvert_2	120.79	0 12:23	508.46	0.24	9.75	0.19	2.71	0.45	0.00		Calculated

Storage Nodes

Storage Node : Culvert_2_Inlet

Input Data

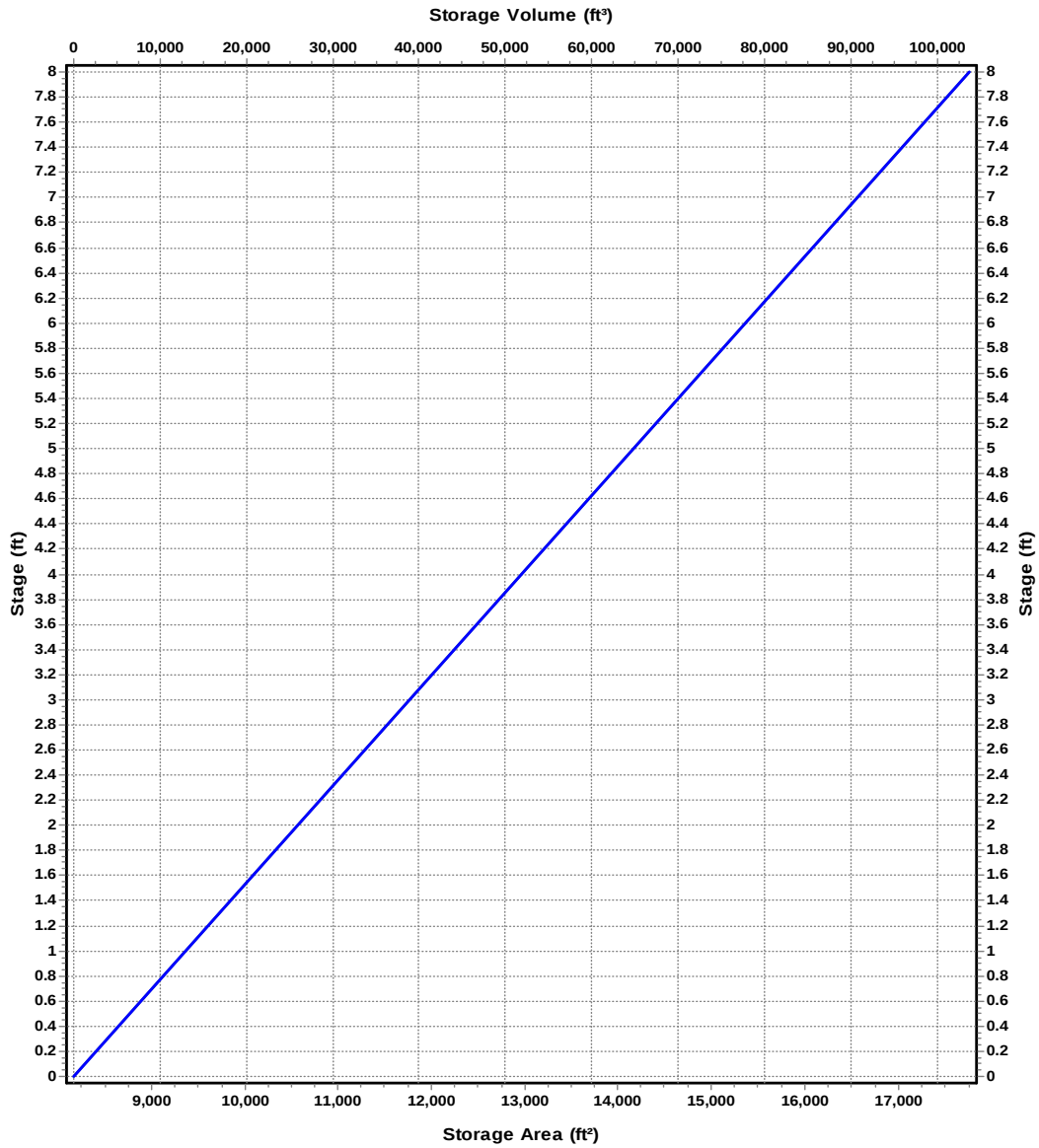
Invert Elevation (ft)	892.00
Max (Rim) Elevation (ft)	900.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	892.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	8168.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Offsite_2

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	8168	0
8	17763	103724

Storage Area Volume Curves



Storage Area Storage Volume

Storage Node : Culvert_2_Inlet (continued)

Output Summary Results

Peak Inflow (cfs)	125.36
Peak Lateral Inflow (cfs)	125.36
Peak Outflow (cfs)	120.79
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	895.68
Max HGL Depth Attained (ft)	3.68
Average HGL Elevation Attained (ft)	892.52
Average HGL Depth Attained (ft)	0.52
Time of Max HGL Occurrence (days hh:mm)	0 12:24
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Infiltration_Basin_1

Input Data

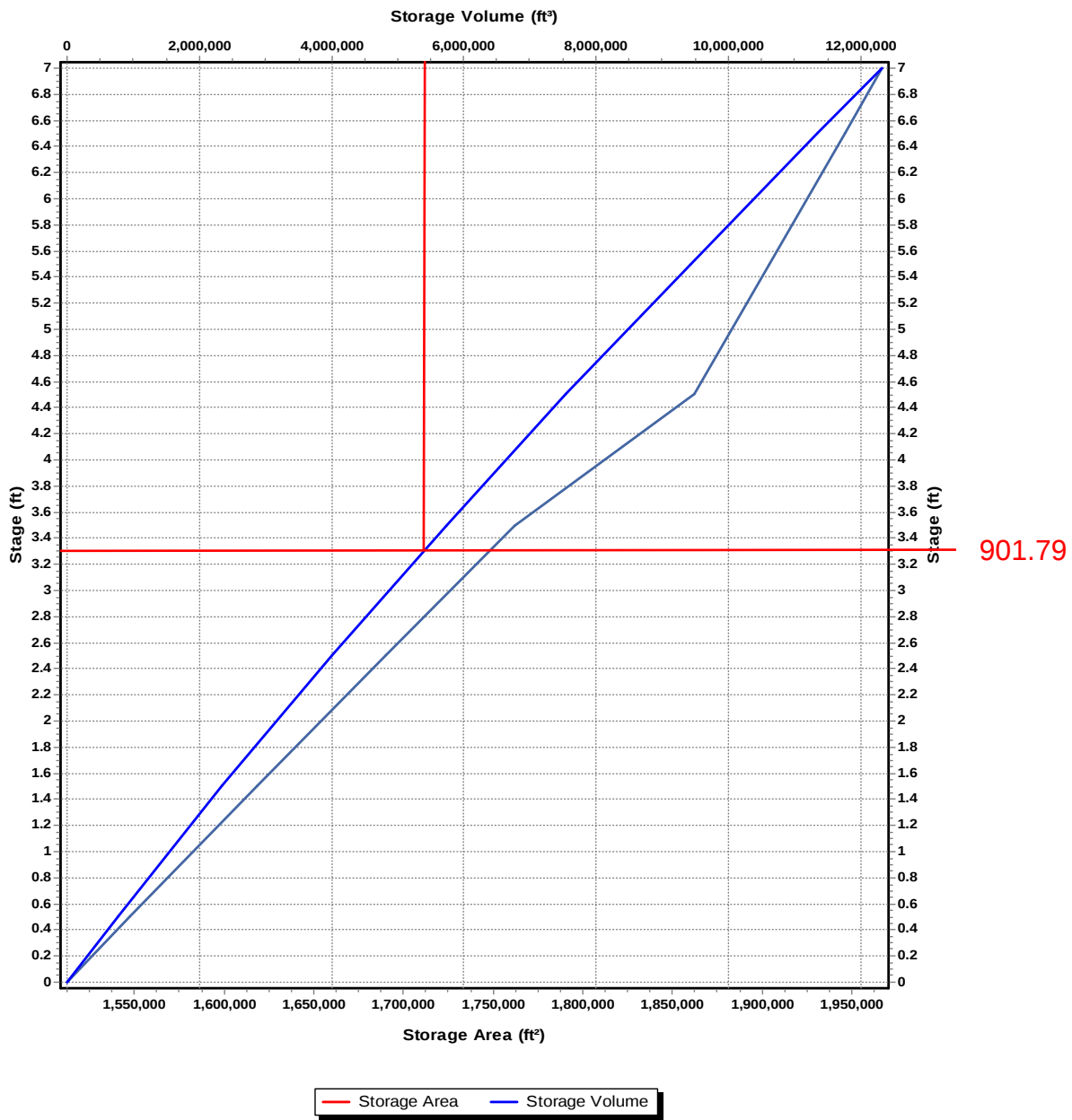
Invert Elevation (ft)	898.50
Max (Rim) Elevation (ft)	905.50
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	898.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	1512370.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : SME Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	1512370	0
0.5	1547431	764950.25
1.5	1618709	2348020.25
2.5	1690091	4002420.25
3.5	1761575	5728253.25
4.5	1862035	7540058.25
5.5	1904021	9423086.25
6.5	1946087	11348140.25
7	1966758	12326351.5

Storage Area Volume Curves



Storage Node : Infiltration_Basin_1 (continued)

Outflow Weirs

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 IB_1_Spillway	Trapezoidal	No	903.50	5.00	350.00	2.20	3.40

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 OCS_Weir	Bottom	CIRCULAR	No	120.00			900.80	0.61

Output Summary Results

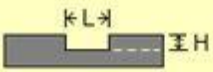
Peak Inflow (cfs)	1751.98
Peak Lateral Inflow (cfs)	1751.98
Peak Outflow (cfs)	102.16
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	901.79
Max HGL Depth Attained (ft)	3.29
Average HGL Elevation Attained (ft)	900.06
Average HGL Depth Attained (ft)	1.56
Time of Max HGL Occurrence (days hh:mm)	0 14:37
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Top of Riser Elevation = 900.80'
 25-year storm elevation = 902.34'
 H = 1.54'
 Q ~ 195 cfs

Thin Blue Numbers = Input data
 Bold Red Numbers = Answers

Weir Notch Bleed Down Calculations

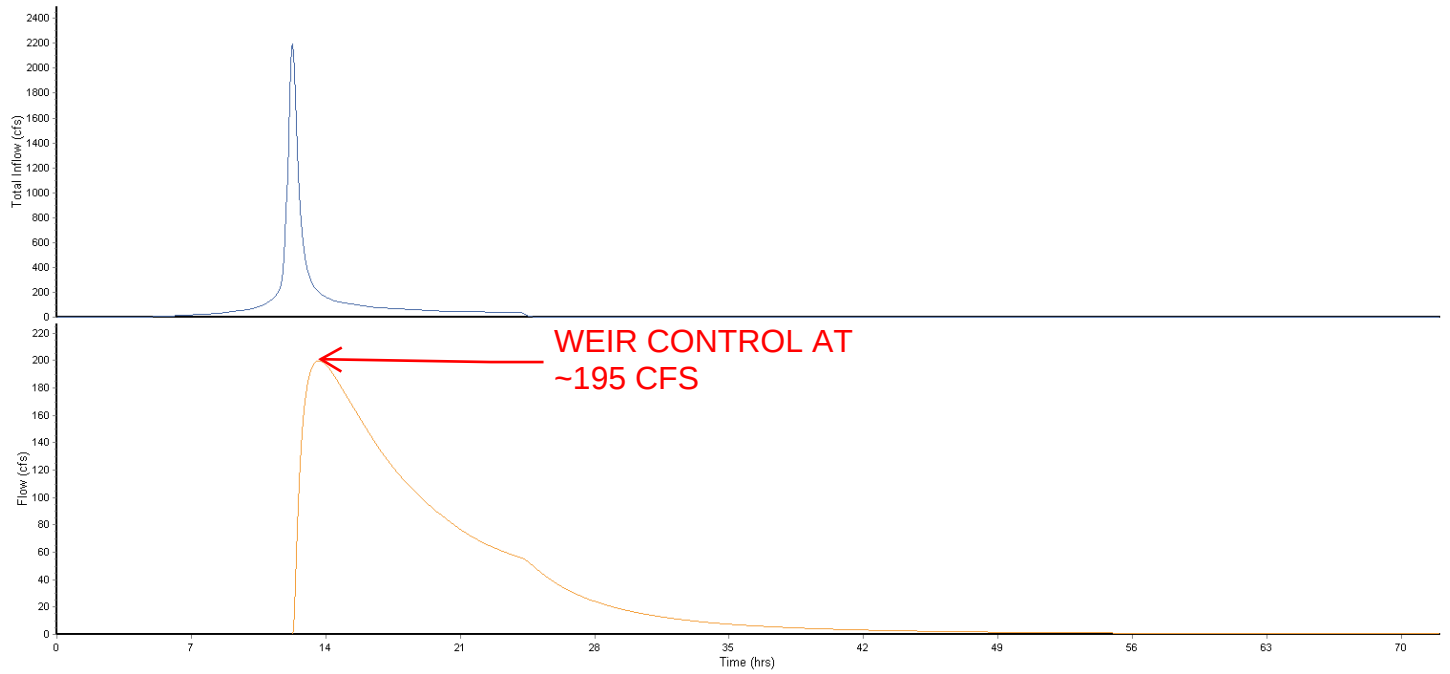
Pond Surface Area at SHW = 0 Sq. Ft.
 Pond Surface Area at NWL = 0 Sq. Ft.
 Notch Height (H) = 1.54 Feet
 Notch Width (L) = 31.40 Feet
 C = 3.25 Coefficient of discharge
 1/2 Volume Time = 0.00 Hours
 Total Time = 0.00 Hours

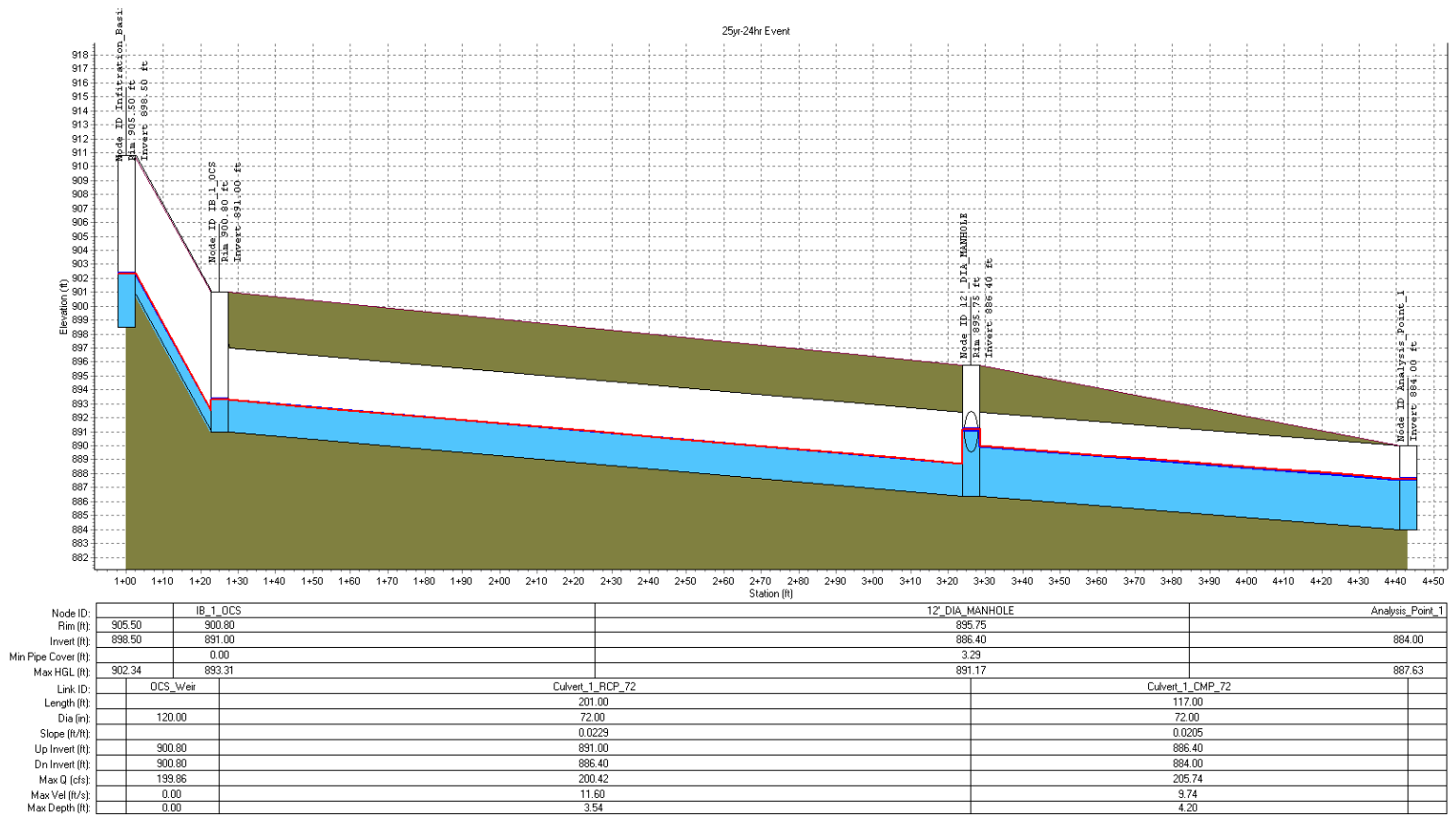

 Horizontal Broad Crested W
 $Q = C L H^{3/2}$

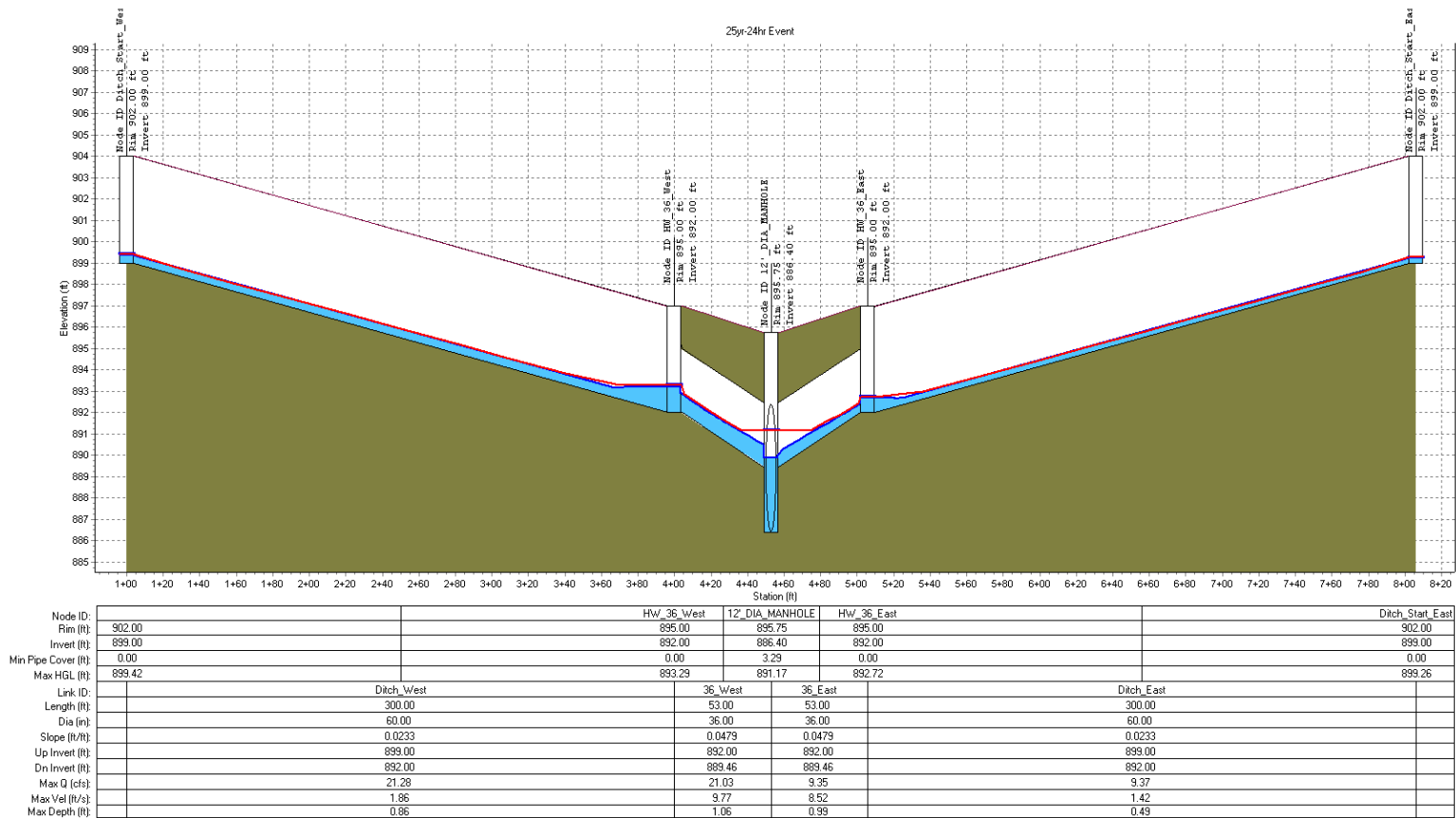
Total H (Ft)	Increm. H (Ft)	Flow Q (cfs)	Q Avg.	Delta Volume	Cum. Volume	Delta Hours	Cum. Hours
1.54		194.85					
	0.03		191.939	0	0	0.0	
1.51		189.03					0.0
	0.03		186.152	0	0	0.0	
1.48		183.27					0.0
	0.03		180.425	0	0	0.0	
1.45		177.58					0.0
	0.03		174.758	0	0	0.0	
1.42		171.94					0.0
	0.03		169.151	0	0	0.0	
1.39		166.36					0.0
	0.03		163.606	0	0	0.0	
1.36		160.85					0.0
	0.03		158.122	0	0	0.0	
1.32		155.40					0.0
	0.03		152.702	0	0	0.0	
1.29		150.01					0.0
	0.03		147.344	0	0	0.0	
1.26		144.68					0.0
	0.03		142.051	0	0	0.0	
1.23		139.42					0.0
	0.03		136.823	0	0	0.0	
1.20		134.23					0.0
	0.03		131.661	0	0	0.0	
1.17		129.10					0.0
	0.03		126.565	0	0	0.0	
1.14		124.03					0.0
	0.03		121.537	0	0	0.0	
1.11		119.04					0.0
	0.03		116.577	0	0	0.0	
1.08		114.11					0.0
	0.03		111.687	0	0	0.0	
1.05		109.26					0.0

25yr-24hr Event - Pond Volume vs Weir Discharge

— Total Inflow: Node - Infiltration_Basin_1 (Single Pipe_09-21-2023 2023-10-18 07:59:50)
— Flow: Link - OCS_Weir (Single Pipe_09-21-2023 2023-10-18 07:59:50)







Project Description

File Name Single Pipe_09-21-2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:03:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 7
Subbasins..... 6
Nodes..... 10
 Junctions 6
 Outfalls 2
 Flow Diversions 0
 Inlets 0
 Storage Nodes 2
Links..... 9
 Channels 2
 Pipes 5
 Pumps 0
 Orifices 1
 Weirs 1
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	1yr24hr	Time Series	1-inch	Cumulative	inches	Michigan	Calhoun	1.00	1.00	SCS Type II 24-hr
2	24hr100yr	Time Series	24hr100yr	Cumulative	inches	Michigan	Calhoun	100.00	5.60	SCS Type II 24-hr
3	24hr10yr	Time Series	24hr10yr	Cumulative	inches	Michigan	Calhoun	10.00	3.60	SCS Type II 24-hr
4	24hr25yr	Time Series	24hr25yr	Cumulative	inches	Michigan	Calhoun	25.00	4.30	SCS Type II 24-hr
5	24hr2yr	Time Series	24hr2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
6	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
7	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches	Michigan	Calhoun	5.00	3.38	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	761.76	484.00	91.00	4.30	3.31	2517.62	2044.29	0 00:33:17
2	Drainage_Area_1b_East	7.81	484.00	74.00	4.30	1.82	14.21	9.39	0 00:45:00
3	Drainage_Area_1b_West	17.73	484.00	74.00	4.30	1.82	32.27	21.31	0 00:45:00
4	Drainage_Area_2	113.11	484.00	75.00	4.30	1.90	214.35	162.61	0 00:37:00
5	Drainage_Area_2b	12.47	484.00	75.00	4.30	1.90	23.62	15.70	0 00:45:00
6	Sub_Infiltration_Basin_1	98.48	484.00	74.00	4.30	1.82	179.23	195.26	0 00:20:00

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	Junction	886.40	895.75	886.40	895.75	0.00	206.38	891.17	0.00	4.58	0 00:00	0.00	0.00
2	Ditch_Start_East	Junction	899.00	902.00	899.00	902.00	0.00	9.38	899.26	0.00	4.74	0 00:00	0.00	0.00
3	Ditch_Start_West	Junction	899.00	902.00	899.00	902.00	0.00	21.30	899.42	0.00	4.58	0 00:00	0.00	0.00
4	HW_36_East	Junction	892.00	895.00	0.00	0.00	0.00	9.37	892.72	0.00	4.28	0 00:00	0.00	0.00
5	HW_36_West	Junction	892.00	895.00	892.00	899.00	0.00	21.28	893.29	0.00	3.71	0 00:00	0.00	0.00
6	IB_1_OCS	Junction	891.00	903.00	891.00	903.00	0.00	199.86	893.31	0.00	9.69	0 00:00	0.00	0.00
7	Analysis_Point_1	Outfall	884.00					205.74	887.63					
8	Analysis_Point_2	Outfall	890.65					170.58	893.04					
9	Culvert_2_Inlet	Storage Node	892.00	900.00	892.00		8168.00	177.33	896.58				0.00	0.00
10	Infiltration_Basin_1	Storage Node	898.50	905.50	898.50		1512370.00	2197.87	902.34				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	36_East	Pipe	HW_36_East	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	9.35	126.55	0.07	8.52	0.99	0.33	0.00 Calculated
2	36_West	Pipe	HW_36_West	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	21.03	126.55	0.17	9.77	1.06	0.35	0.00 Calculated
3	Culvert_1_CMP_72	Pipe	12'_DIA_MANHOLE	Analysis_Point_1	117.00	886.40	884.00	2.0500	72.000	0.0260	205.74	303.28	0.68	9.74	4.20	0.70	0.00 Calculated
4	Culvert_1_RCP_72	Pipe	IB_1_OCS	12'_DIA_MANHOLE	201.00	891.00	886.40	2.2900	72.000	0.0130	200.42	640.68	0.31	11.60	3.54	0.59	0.00 Calculated
5	Culvert_2	Pipe	Culvert_2_Inlet	Analysis_Point_2	111.00	892.25	890.65	1.4400	72.000	0.0130	170.58	508.46	0.34	10.46	3.36	0.56	0.00 Calculated
6	Ditch_East	Channel	Ditch_Start_East	HW_36_East	300.00	899.00	892.00	2.3300	60.000	0.0320	9.37	2363.82	0.00	1.42	0.49	0.10	0.00
7	Ditch_West	Channel	Ditch_Start_West	HW_36_West	300.00	899.00	892.00	2.3300	60.000	0.0320	21.28	2363.82	0.01	1.86	0.86	0.17	0.00
8	OCS_Weir	Orifice	Infiltration_Basin_1	IB_1_OCS		898.50	891.00		120.000		199.86						
9	IB_1_Spillway	Weir	Infiltration_Basin_1	Culvert_2_Inlet		898.50	892.00				0.00						

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	761.76
Peak Rate Factor	484
Weighted Curve Number	91
Rain Gage ID	24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Urban industrial, 72% imp	761.76	C	91
Composite Area & Weighted CN	761.76		91

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{(2/3)}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

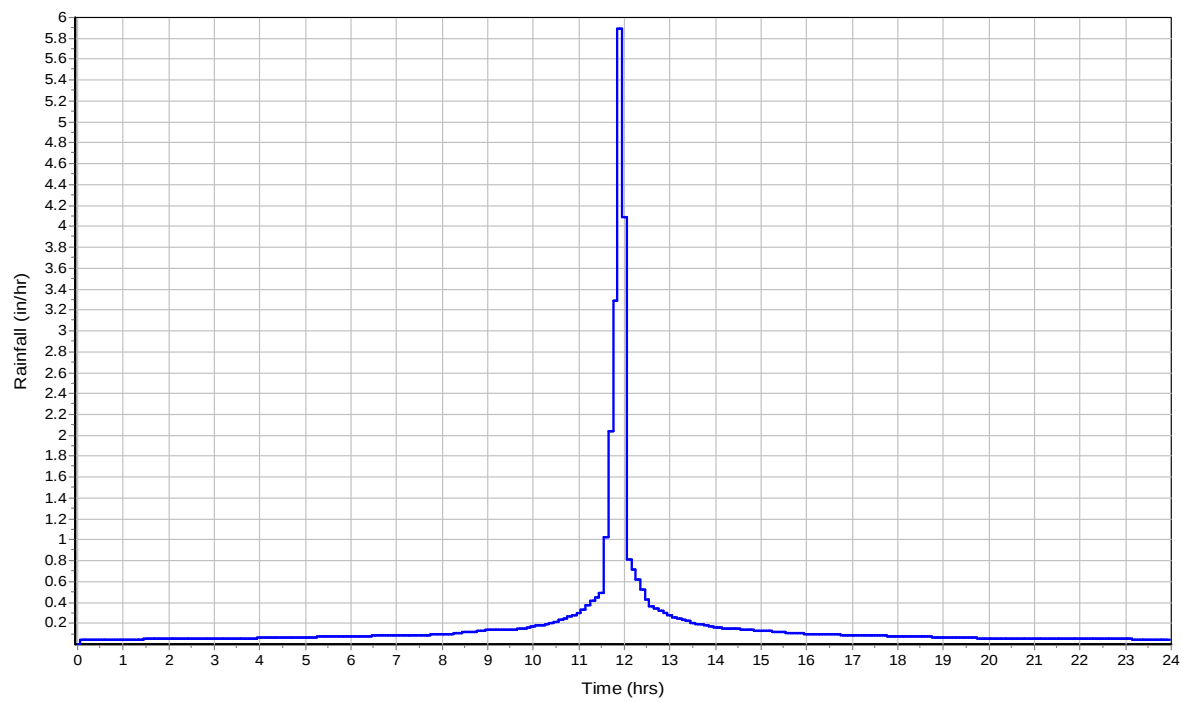
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.011	0
Flow Length (ft) :	150	150	0
Slope (%) :	0.5	0.5	0
2 yr, 24 hr Rainfall (in) :	2.53	2.53	0
Velocity (ft/sec) :	0.09	0.76	0
Computed Flow Time (min) :	26.54	3.28	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	300	0	0
Slope (%) :	0.5	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0	0
Computed Flow Time (min) :	3.47	0	0
Total TOC (min)	33.29		

Subbasin Runoff Results

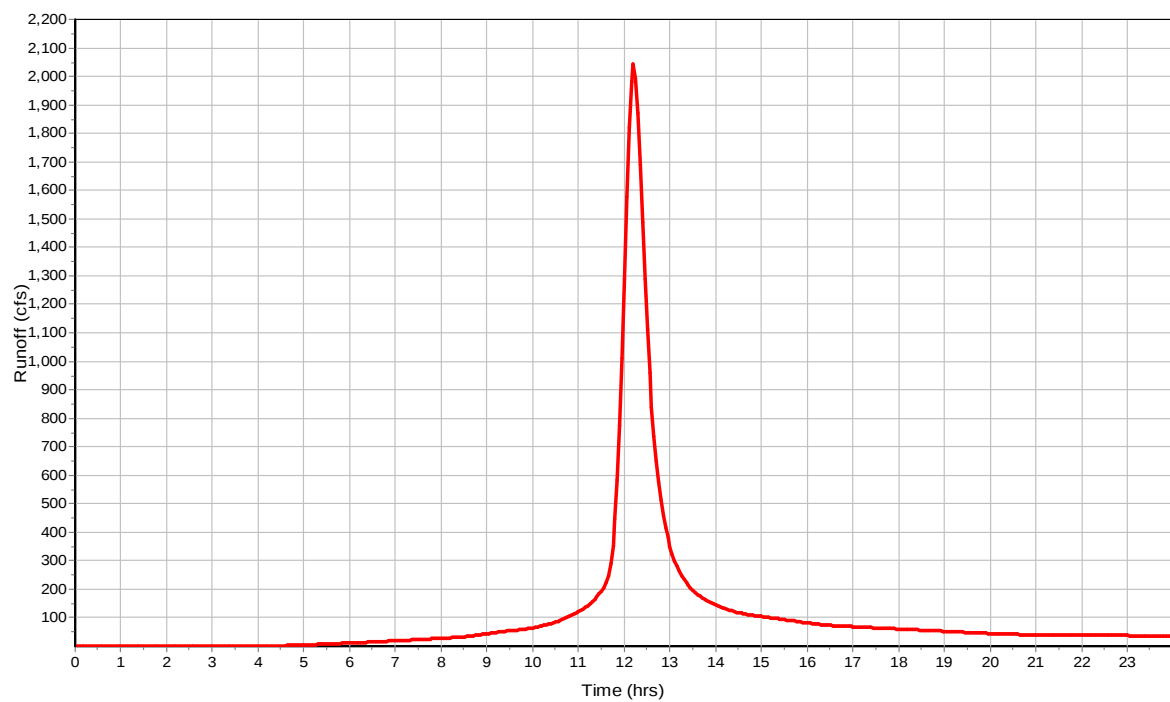
Total Rainfall (in)	4.3
Total Runoff (in)	3.31
Peak Runoff (cfs)	2044.29
Weighted Curve Number	91
Time of Concentration (days hh:mm:ss)	0 00:33:17

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_East

Input Data

Area (ac) 7.81
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	7.81	C	74
Composite Area & Weighted CN	7.81		74

Time of Concentration

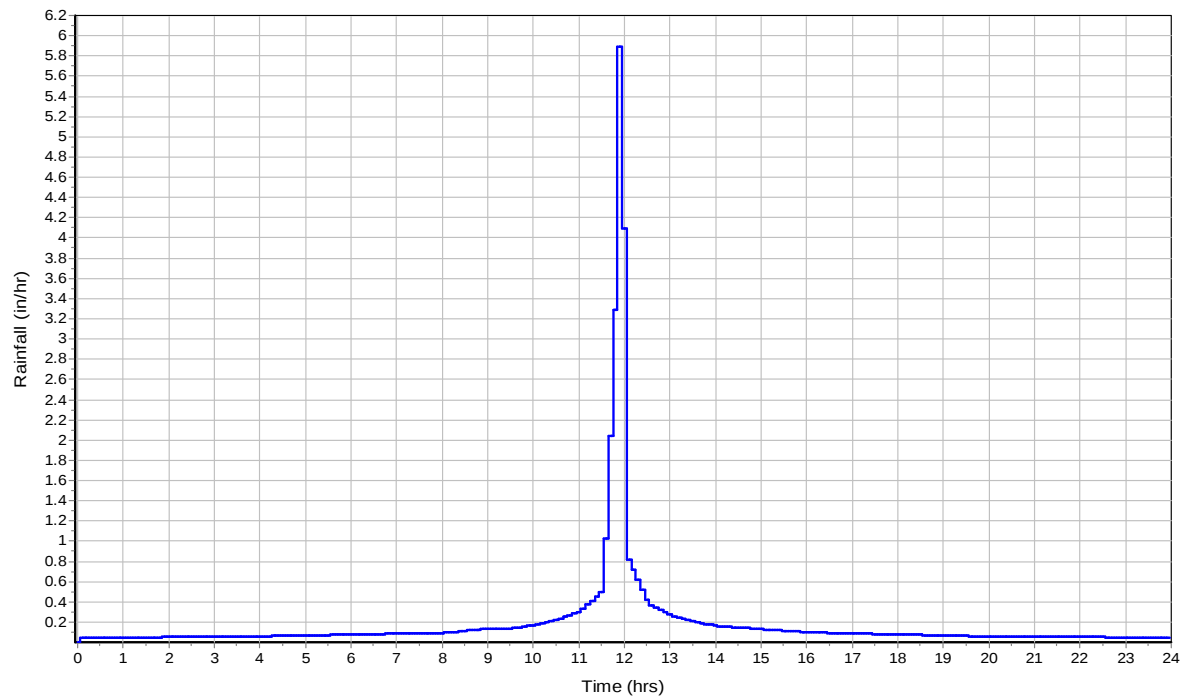
User-Defined TOC override (minutes): 45

Subbasin Runoff Results

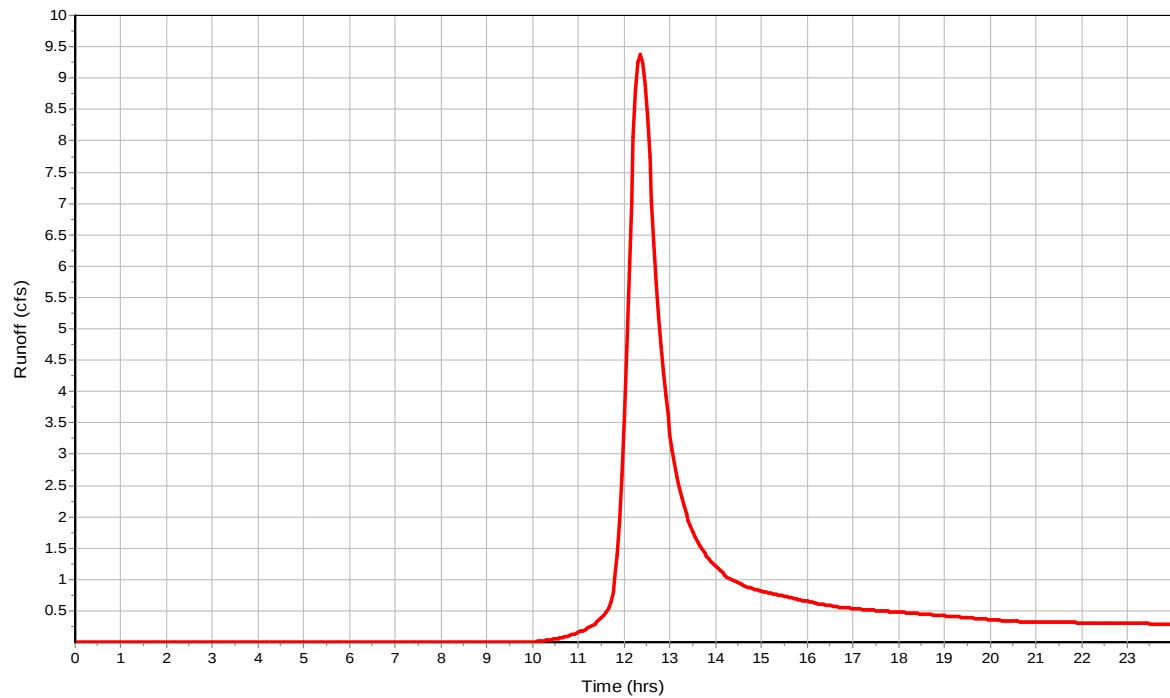
Total Rainfall (in) 4.3
Total Runoff (in) 1.82
Peak Runoff (cfs) 9.39
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_East

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_West

Input Data

Area (ac) 17.73
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	17.73	C	74
Composite Area & Weighted CN	17.73		74

Time of Concentration

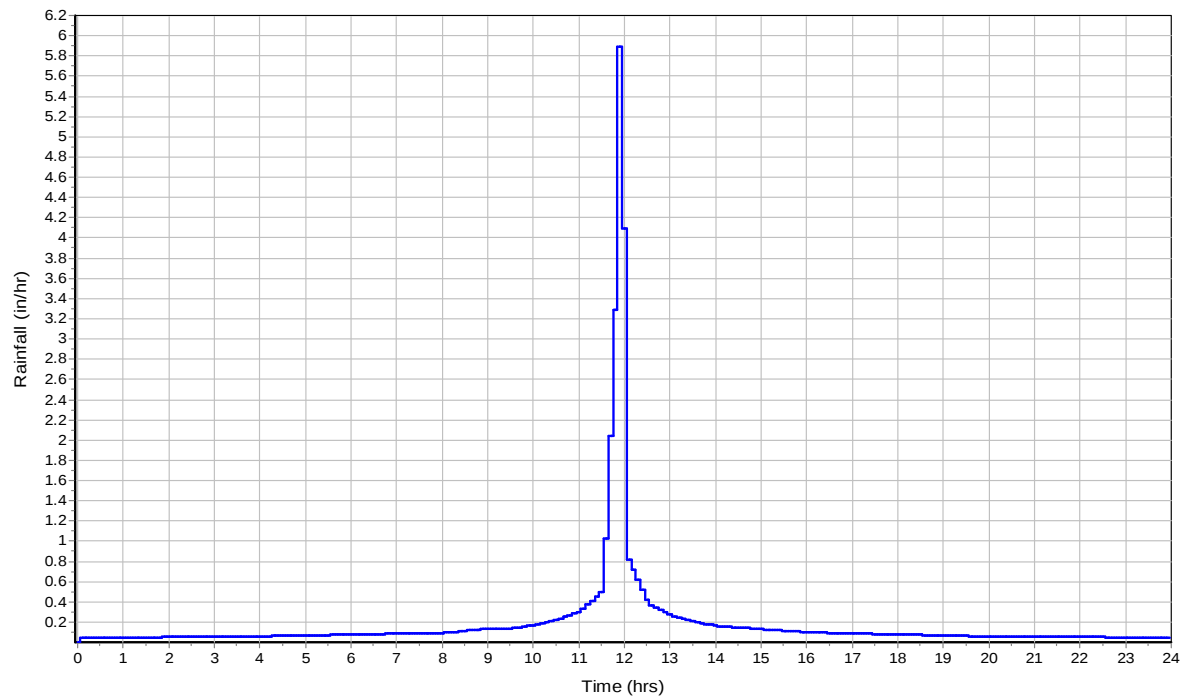
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

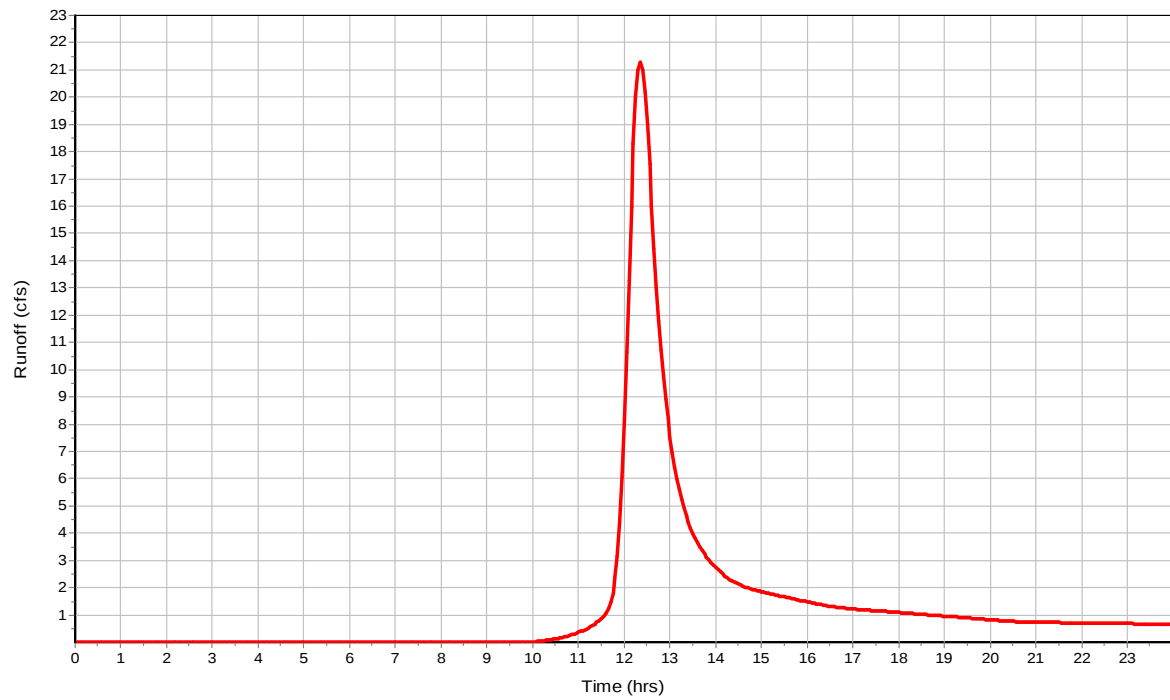
Total Rainfall (in) 4.3
Total Runoff (in) 1.82
Peak Runoff (cfs) 21.31
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_West

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 113.11
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	113.11	C	75
Composite Area & Weighted CN	113.11		75

Time of Concentration

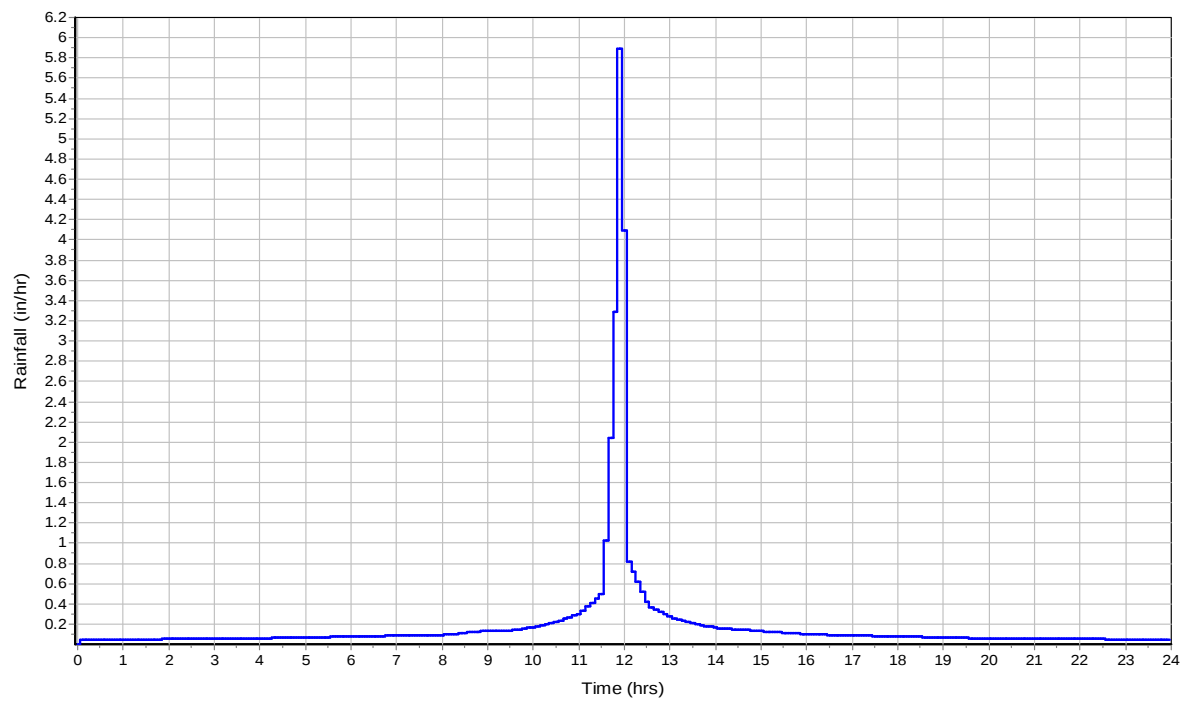
User-Defined TOC override (minutes): 37

Subbasin Runoff Results

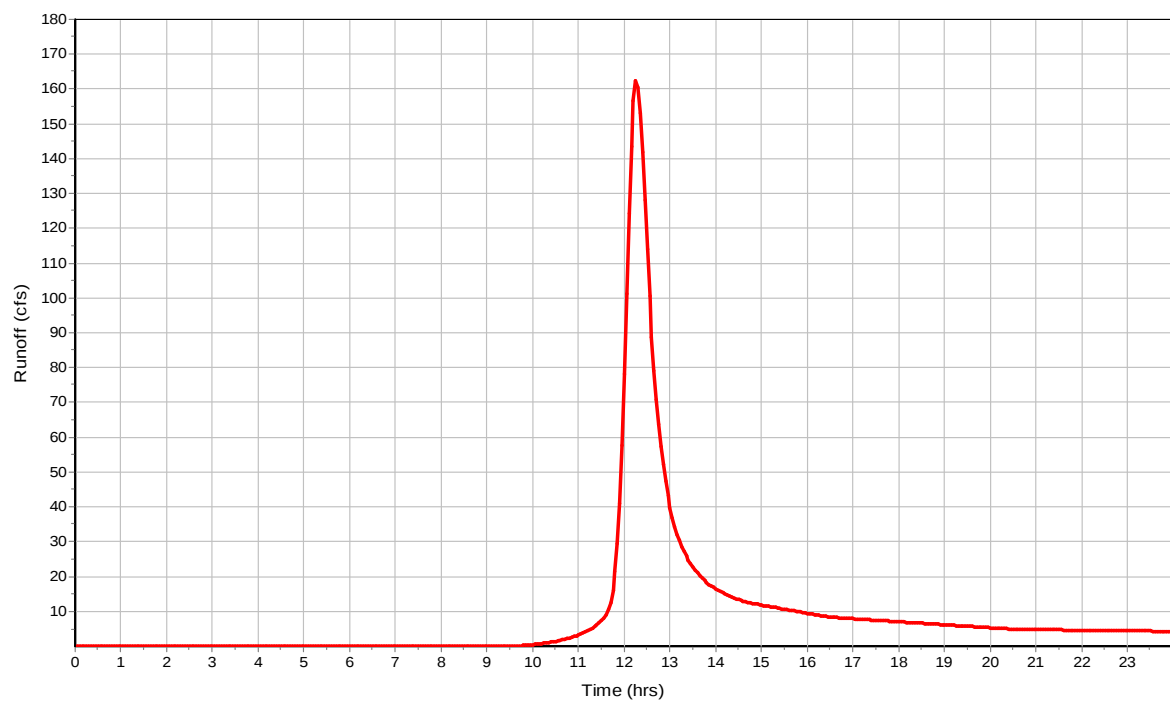
Total Rainfall (in) 4.3
Total Runoff (in) 1.9
Peak Runoff (cfs) 162.61
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:37:00

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2b

Input Data

Area (ac) 12.47
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
-	12.47	-	75
Composite Area & Weighted CN	12.47		75

Time of Concentration

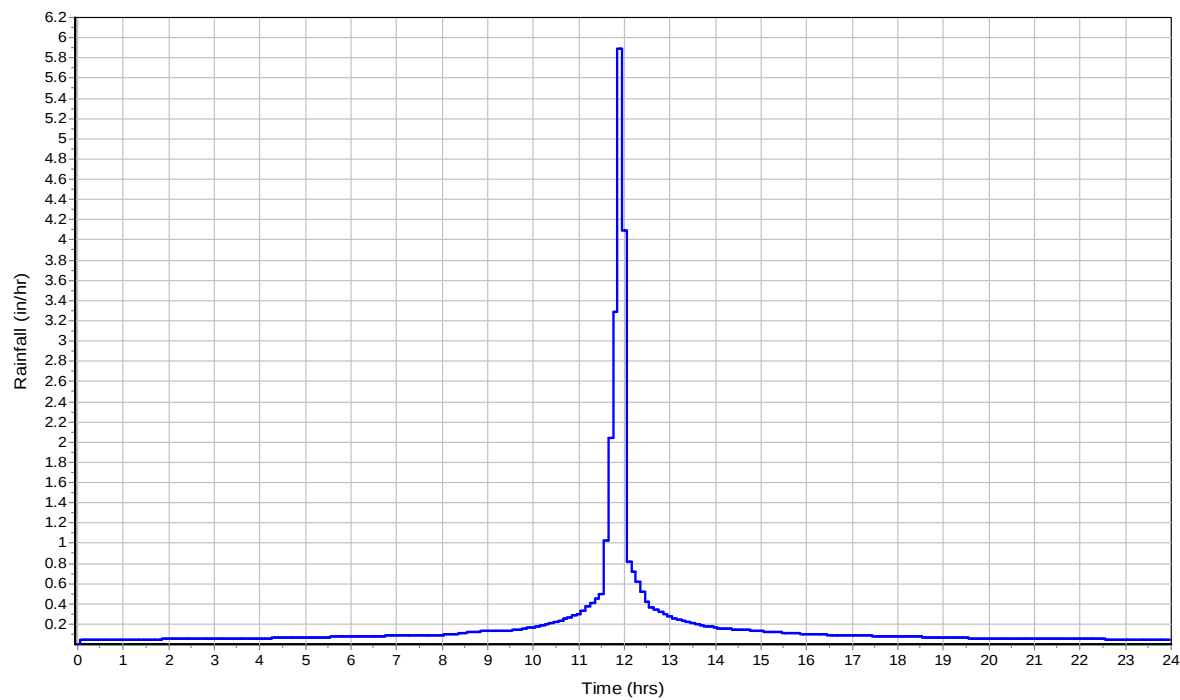
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

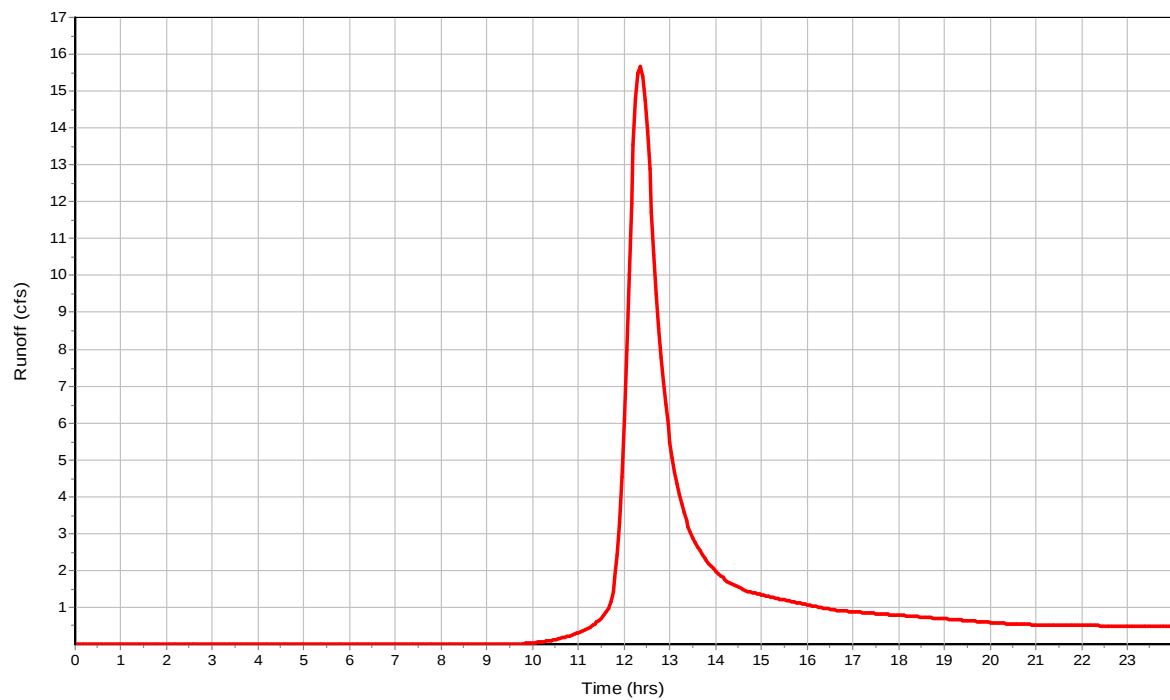
Total Rainfall (in) 4.3
Total Runoff (in) 1.9
Peak Runoff (cfs) 15.7
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub_Infiltration_Basin_1

Input Data

Area (ac)	98.48
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr25yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	98.48	C	74
Composite Area & Weighted CN	98.48		74

Time of Concentration

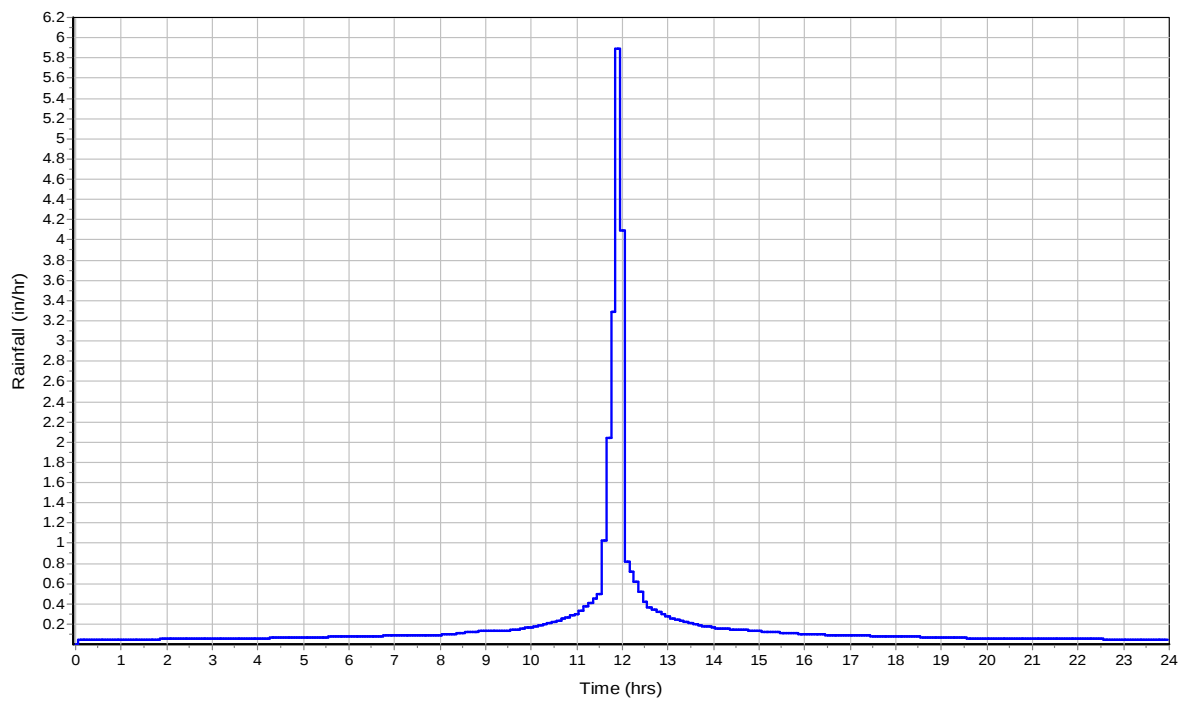
User-Defined TOC override (minutes): 20.00

Subbasin Runoff Results

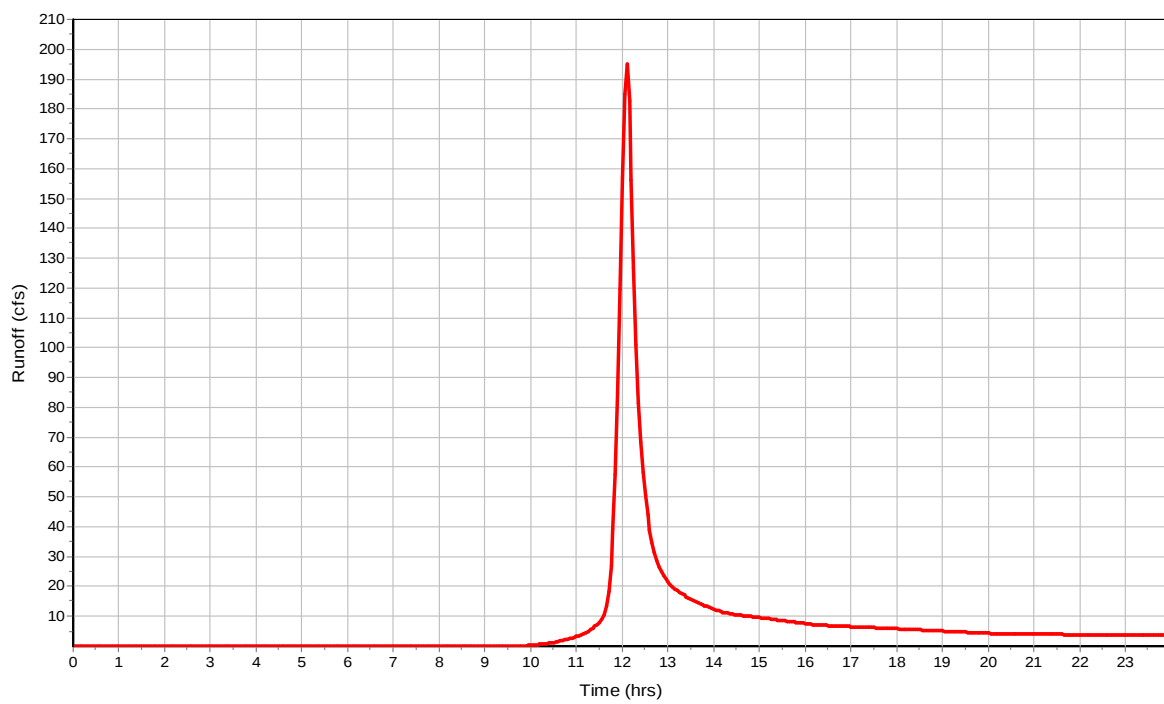
Total Rainfall (in)	4.3
Total Runoff (in)	1.82
Peak Runoff (cfs)	195.26
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:20:00

Subbasin : Sub_Infiltration_Basin_1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	12" DIA MANHOLE	886.40	895.75	9.35	886.40	0.00	895.75	0.00	0.00	0.00
2	Ditch_Start_East	899.00	902.00	3.00	899.00	0.00	9020.00	8118.00	0.00	0.00
3	Ditch_Start_West	899.00	902.00	3.00	899.00	0.00	902.00	0.00	0.00	0.00
4	HW_36_East	892.00	895.00	3.00	0.00	-892.00	0.00	-895.00	0.00	0.00
5	HW_36_West	892.00	895.00	3.00	892.00	0.00	899.00	4.00	0.00	0.00
6	IB_1_OCS	891.00	903.00	12.00	891.00	0.00	903.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	206.38	0.00	891.17	4.77	0.00	4.58	887.99	1.59	0 13:32	0 00:00	0.00	0.00
2	Ditch_Start_East	9.38	9.38	899.26	0.26	0.00	4.74	899.03	0.03	0 12:24	0 00:00	0.00	0.00
3	Ditch_Start_West	21.30	21.30	899.42	0.42	0.00	4.58	899.06	0.06	0 12:24	0 00:00	0.00	0.00
4	HW_36_East	9.37	0.00	892.72	0.72	0.00	4.28	892.10	0.10	0 12:27	0 00:00	0.00	0.00
5	HW_36_West	21.28	0.00	893.29	1.29	0.00	3.71	892.15	0.15	0 12:27	0 00:00	0.00	0.00
6	IB_1_OCS	199.86	0.00	893.31	2.31	0.00	9.69	891.83	0.83	0 13:37	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch_East	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch_West	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch_East	9.37	0 12:24	2363.82	0.00	1.42	3.52	0.49	0.10	0.00		
2	Ditch_West	21.28	0 12:24	2363.82	0.01	1.86	2.69	0.86	0.17	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Offset	Outlet Invert	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	36_East	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	36_West	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	Culvert_1_CMP_72	117.00	886.40	0.00	884.00	0.00	2.40	2.0500	CIRCULAR	72.000	72.000	0.0260	0.5000	0.5000	0.0000	0.00	No
4	Culvert_1_RCP_72	201.00	891.00	0.00	886.40	0.00	4.60	2.2900	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No
5	Culvert_2	111.00	892.25	0.25	890.65	0.00	1.60	1.4400	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

	1
	1
	1
	1
	1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 36_East	9.35	0 12:39	126.55	0.07	8.52	0.10	0.99	0.33	0.00		Calculated
2 36_West	21.03	0 12:27	126.55	0.17	9.77	0.09	1.06	0.35	0.00		Calculated
3 Culvert_1_CMP_72	205.74	0 13:34	303.28	0.68	9.74	0.20	4.20	0.70	0.00		Calculated
4 Culvert_1_RCP_72	200.42	0 13:38	640.68	0.31	11.60	0.29	3.54	0.59	0.00		Calculated
5 Culvert_2	170.58	0 12:23	508.46	0.34	10.46	0.18	3.36	0.56	0.00		Calculated

Storage Nodes

Storage Node : Culvert_2_Inlet

Input Data

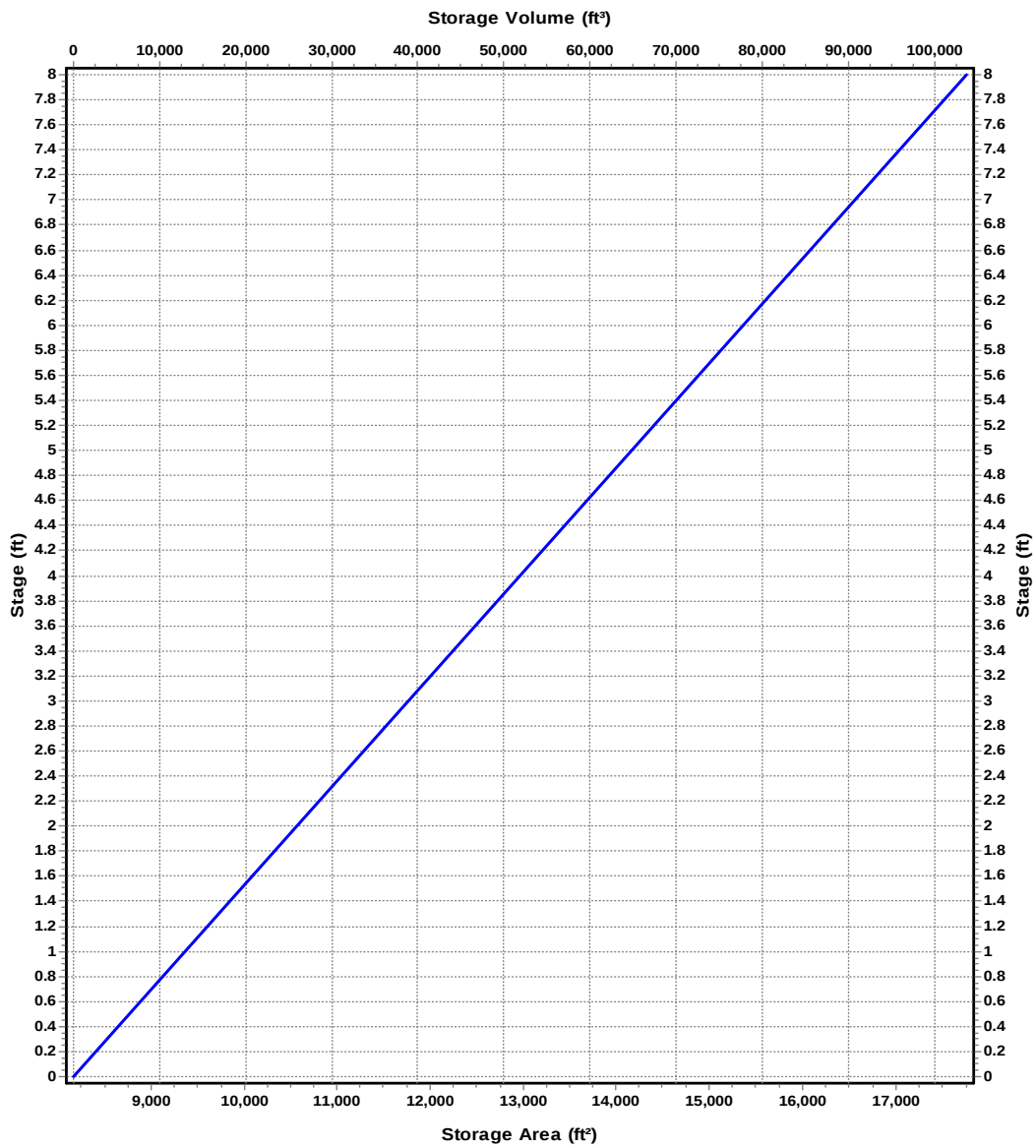
Invert Elevation (ft)	892.00
Max (Rim) Elevation (ft)	900.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	892.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	8168.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Offsite_2

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	8168	0
8	17763	103724

Storage Area Volume Curves



Storage Area Storage Volume

Storage Node : Culvert_2_Inlet (continued)

Output Summary Results

Peak Inflow (cfs)	177.33
Peak Lateral Inflow (cfs)	177.33
Peak Outflow (cfs)	170.58
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	896.58
Max HGL Depth Attained (ft)	4.58
Average HGL Elevation Attained (ft)	892.61
Average HGL Depth Attained (ft)	0.61
Time of Max HGL Occurrence (days hh:mm)	0 12:23
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Infiltration_Basin_1

Input Data

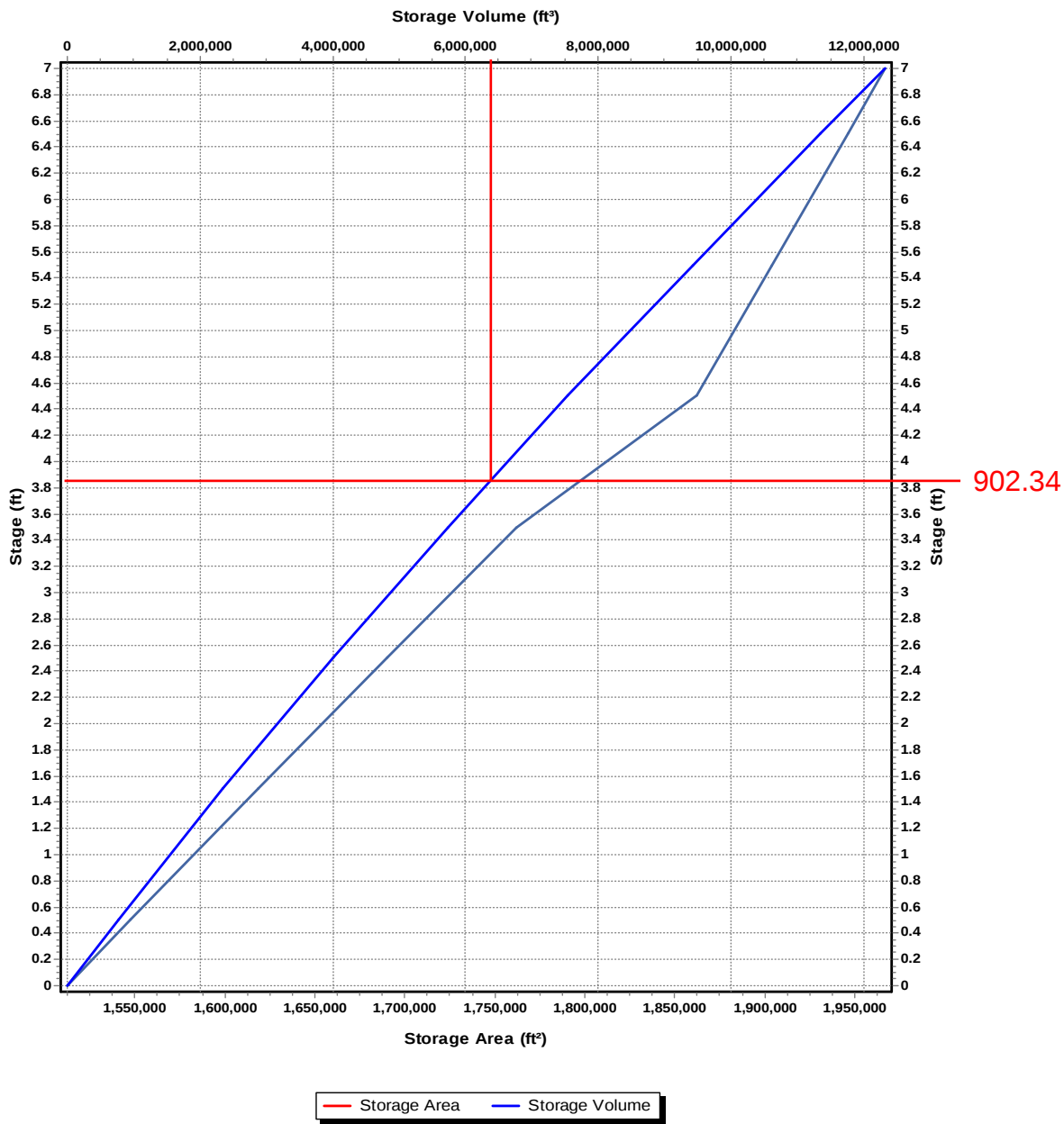
Invert Elevation (ft)	898.50
Max (Rim) Elevation (ft)	905.50
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	898.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	1512370.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : SME Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	1512370	0
0.5	1547431	764950.25
1.5	1618709	2348020.25
2.5	1690091	4002420.25
3.5	1761575	5728253.25
4.5	1862035	7540058.25
5.5	1904021	9423086.25
6.5	1946087	11348140.25
7	1966758	12326351.5

Storage Area Volume Curves



Storage Node : Infiltration_Basin_1 (continued)

Outflow Weirs

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 IB_1_Spillway	Trapezoidal	No	903.50	5.00	350.00	2.20	3.40

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 OCS_Weir	Bottom	CIRCULAR	No	120.00			900.80	0.61

Output Summary Results

Peak Inflow (cfs)	2197.87
Peak Lateral Inflow (cfs)	2197.87
Peak Outflow (cfs)	199.86
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	902.34
Max HGL Depth Attained (ft)	3.84
Average HGL Elevation Attained (ft)	900.23
Average HGL Depth Attained (ft)	1.73
Time of Max HGL Occurrence (days hh:mm)	0 13:37
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Project Description

File Name Single Pipe_09-21-2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:03:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 7
Subbasins..... 6
Nodes..... 11
 Junctions 6
 Outfalls 3
 Flow Diversions 0
 Inlets 0
 Storage Nodes 2
Links..... 9
 Channels 2
 Pipes 5
 Pumps 0
 Orifices 1
 Weirs 1
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	1yr24hr	Time Series	1-inch	Cumulative	inches	Michigan	Calhoun	1.00	1.00	SCS Type II 24-hr
2	24hr100yr	Time Series	24hr100yr	Cumulative	inches	Michigan	Calhoun	100.00	5.60	SCS Type II 24-hr
3	24hr10yr	Time Series	24hr10yr	Cumulative	inches	Michigan	Calhoun	10.00	3.60	SCS Type II 24-hr
4	24hr25yr	Time Series	24hr25yr	Cumulative	inches	Michigan	Calhoun	25.00	4.30	SCS Type II 24-hr
5	24hr2yr	Time Series	24hr2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
6	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
7	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches	Michigan	Calhoun	5.00	3.38	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	761.76	484.00	91.00	4.91	3.90	2967.06	2392.89	0 00:33:17
2	Drainage_Area_1b_East	7.81	484.00	74.00	4.91	2.29	17.91	11.99	0 00:45:00
3	Drainage_Area_1b_West	17.73	484.00	74.00	4.91	2.29	40.65	27.22	0 00:45:00
4	Drainage_Area_2	113.11	484.00	75.00	4.91	2.38	268.76	206.11	0 00:37:00
5	Drainage_Area_2b	12.47	484.00	75.00	4.91	2.38	29.62	19.88	0 00:45:00
6	Sub_Infiltration_Basin_1	98.48	484.00	74.00	4.91	2.29	225.81	247.67	0 00:20:00

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	Junction	886.40	895.75	886.40	895.75	0.00	313.79	894.00	0.00	1.75	0 00:00	0.00	0.00
2	Ditch_Start_East	Junction	899.00	902.00	899.00	902.00	0.00	11.95	899.30	0.00	4.70	0 00:00	0.00	0.00
3	Ditch_Start_West	Junction	899.00	902.00	899.00	902.00	0.00	27.13	899.49	0.00	4.51	0 00:00	0.00	0.00
4	HW_36_East	Junction	892.00	895.00	892.00	895.00	0.00	11.93	894.00	0.00	3.00	0 00:00	0.00	0.00
5	HW_36_West	Junction	892.00	895.00	892.00	899.00	0.00	27.10	894.01	0.00	2.99	0 00:00	0.00	0.00
6	IB_1_OCS	Junction	891.00	903.00	891.00	903.00	0.00	304.57	896.68	0.00	6.32	0 00:00	0.00	0.00
7	Analysis_Point_1	Outfall	884.00					313.65	888.83					
8	Analysis_Point_2	Outfall	890.65					216.01	893.38					
9	Out-16	Outfall	900.00					0.00	900.00					
10	Culvert_2_Inlet	Storage Node	892.00	900.00	892.00		8168.00	224.95	897.35				0.00	0.00
11	Infiltration_Basin_1	Storage Node	898.50	905.50	898.50		1512370.00	2587.08	902.84				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	36_East	Pipe	HW_36_East	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	17.10	126.55	0.14	9.64	2.50	0.83	0.00 Calculated
2	36_West	Pipe	HW_36_West	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	37.25	126.55	0.29	11.14	2.51	0.84	0.00 Calculated
3	Culvert_1_CMP_72	Pipe	12'_DIA_MANHOLE	Analysis_Point_1	117.00	886.40	884.00	2.0500	72.000	0.0260	313.65	303.28	1.03	11.68	5.41	0.90	0.00 > CAPACITY
4	Culvert_1_RCP_72	Pipe	IB_1_OCS	12'_DIA_MANHOLE	201.00	891.00	886.40	2.2900	72.000	0.0130	304.66	640.68	0.48	11.83	5.84	0.97	0.00 Calculated
5	Culvert_2	Pipe	Culvert_2_Inlet	Analysis_Point_2	111.00	892.25	890.65	1.4400	72.000	0.0130	216.01	508.46	0.42	11.05	3.91	0.65	0.00 Calculated
6	Ditch_East	Channel	Ditch_Start_East	HW_36_East	300.00	899.00	892.00	2.3300	60.000	0.0320	11.93	2363.82	0.01	1.82	1.07	0.21	0.00
7	Ditch_West	Channel	Ditch_Start_West	HW_36_West	300.00	899.00	892.00	2.3300	60.000	0.0320	27.10	2363.82	0.01	2.45	1.11	0.22	0.00
8	OCS_Weir	Orifice	Infiltration_Basin_1	IB_1_OCS		898.50	891.00		120.000		304.57						
9	IB_1_Spillway	Weir	Infiltration_Basin_1	Culvert_2_Inlet		898.50	892.00				0.00						

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	761.76
Peak Rate Factor	484
Weighted Curve Number	91
Rain Gage ID	24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Urban industrial, 72% imp	761.76	C	91
Composite Area & Weighted CN	761.76		91

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n

R = Aq / Wp

Tc = (Lf / V) / (3600 sec/hr)

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

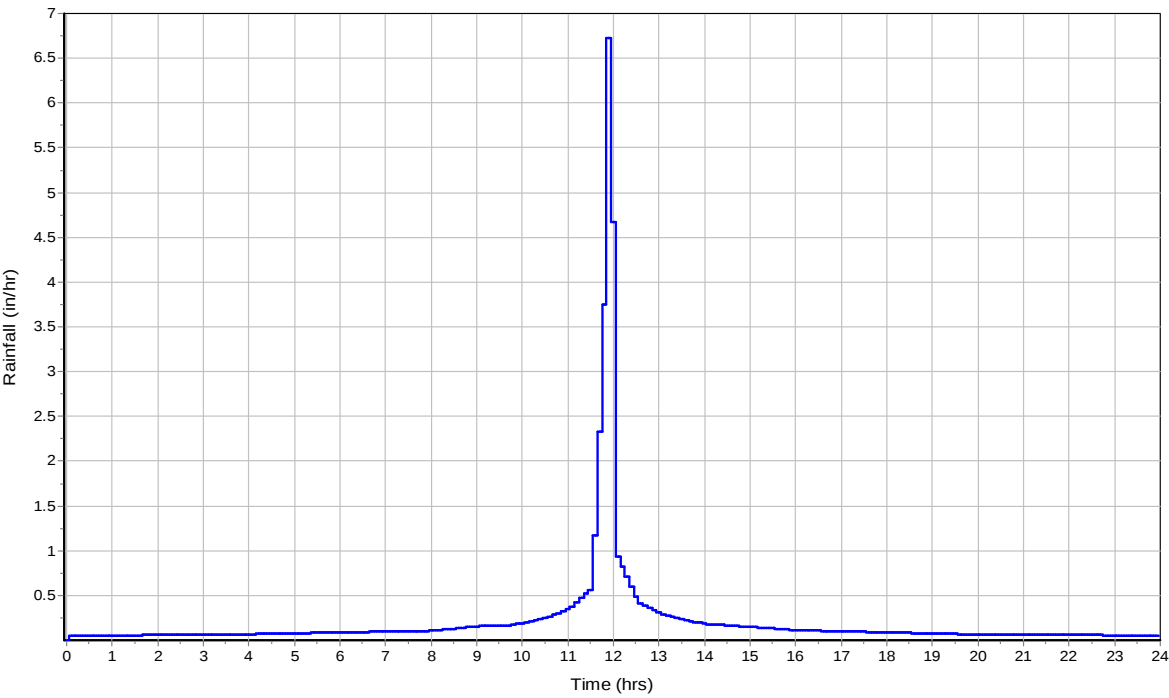
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.011	0
Flow Length (ft) :	150	150	0
Slope (%) :	0.5	0.5	0
2 yr, 24 hr Rainfall (in) :	2.53	2.53	0
Velocity (ft/sec) :	0.09	0.76	0
Computed Flow Time (min) :	26.54	3.28	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	300	0	0
Slope (%) :	0.5	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0	0
Computed Flow Time (min) :	3.47	0	0
Total TOC (min)	33.29		

Subbasin Runoff Results

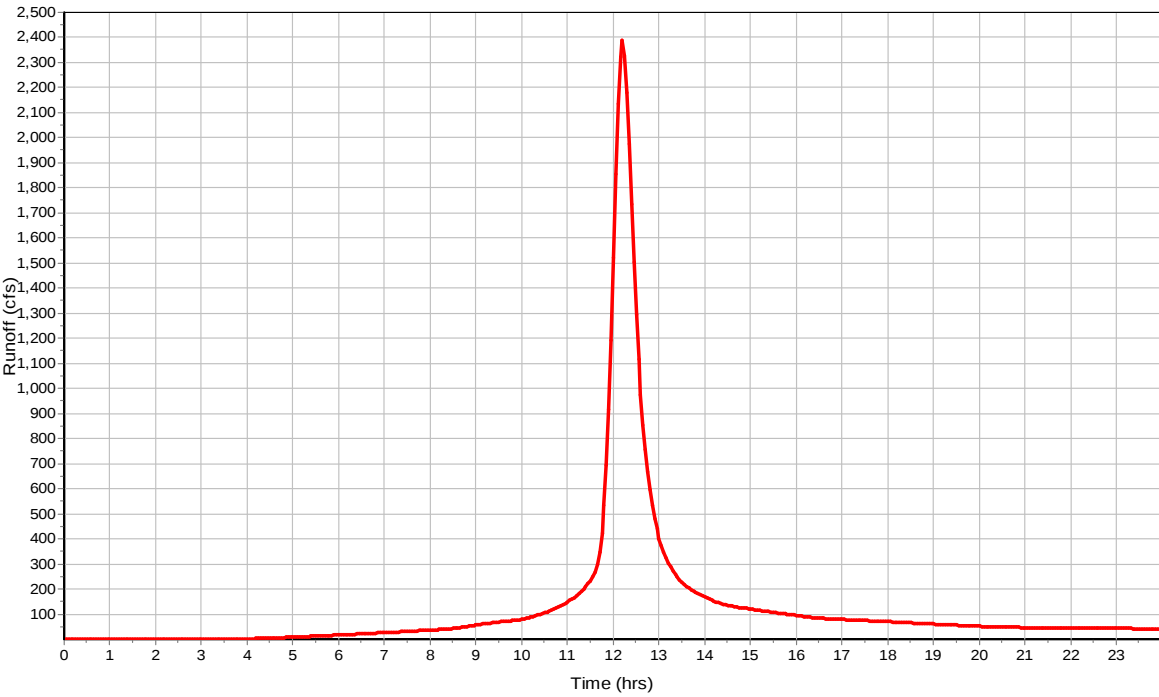
Total Rainfall (in)	4.91
Total Runoff (in)	3.9
Peak Runoff (cfs)	2392.89
Weighted Curve Number	91
Time of Concentration (days hh:mm:ss)	0 00:33:17

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_East

Input Data

Area (ac) 7.81
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	7.81	C	74
Composite Area & Weighted CN	7.81		74

Time of Concentration

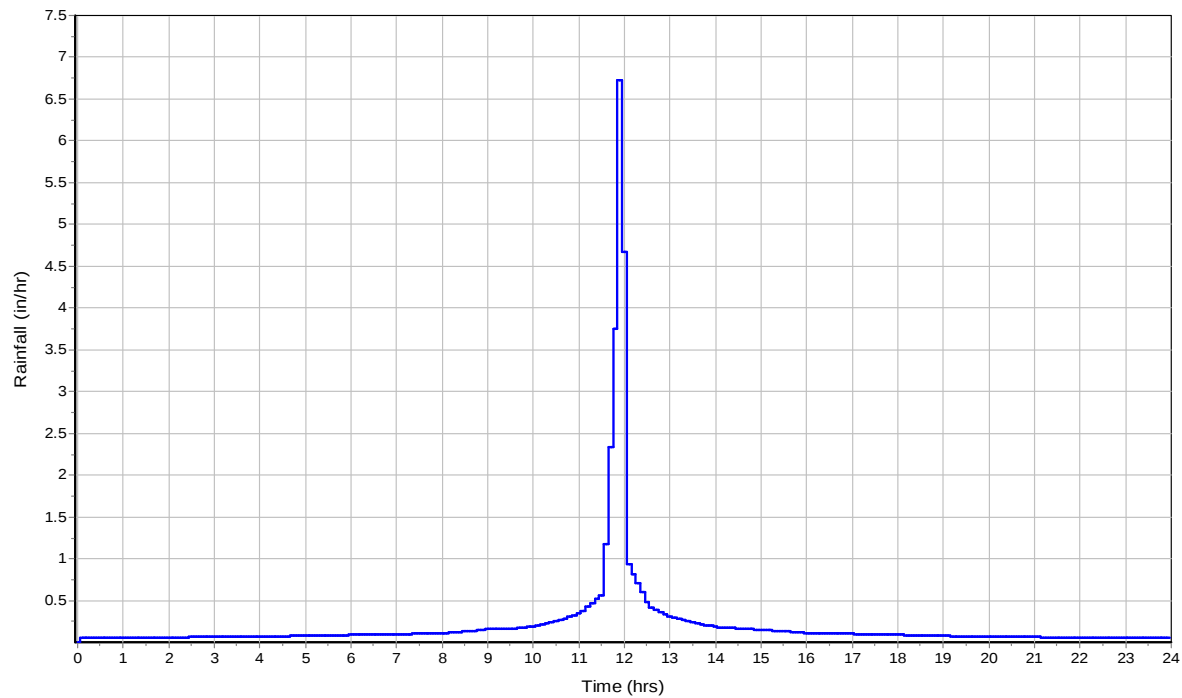
User-Defined TOC override (minutes): 45

Subbasin Runoff Results

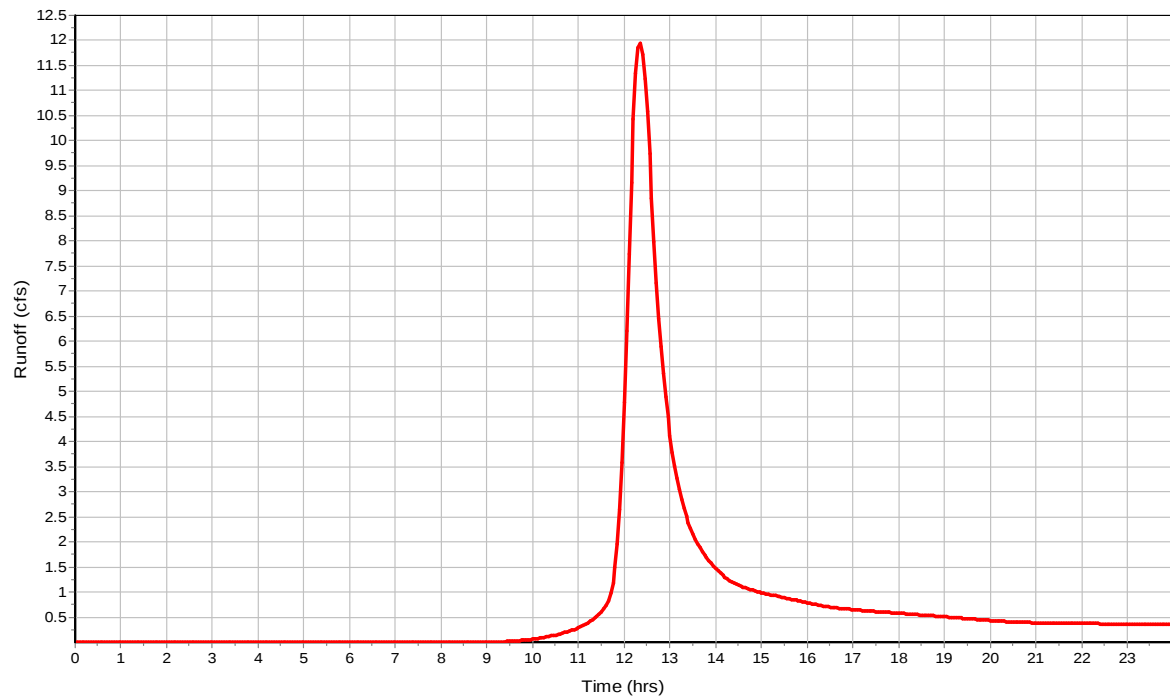
Total Rainfall (in) 4.91
Total Runoff (in) 2.29
Peak Runoff (cfs) 11.99
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_East

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_West

Input Data

Area (ac) 17.73
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	17.73	C	74
Composite Area & Weighted CN	17.73		74

Time of Concentration

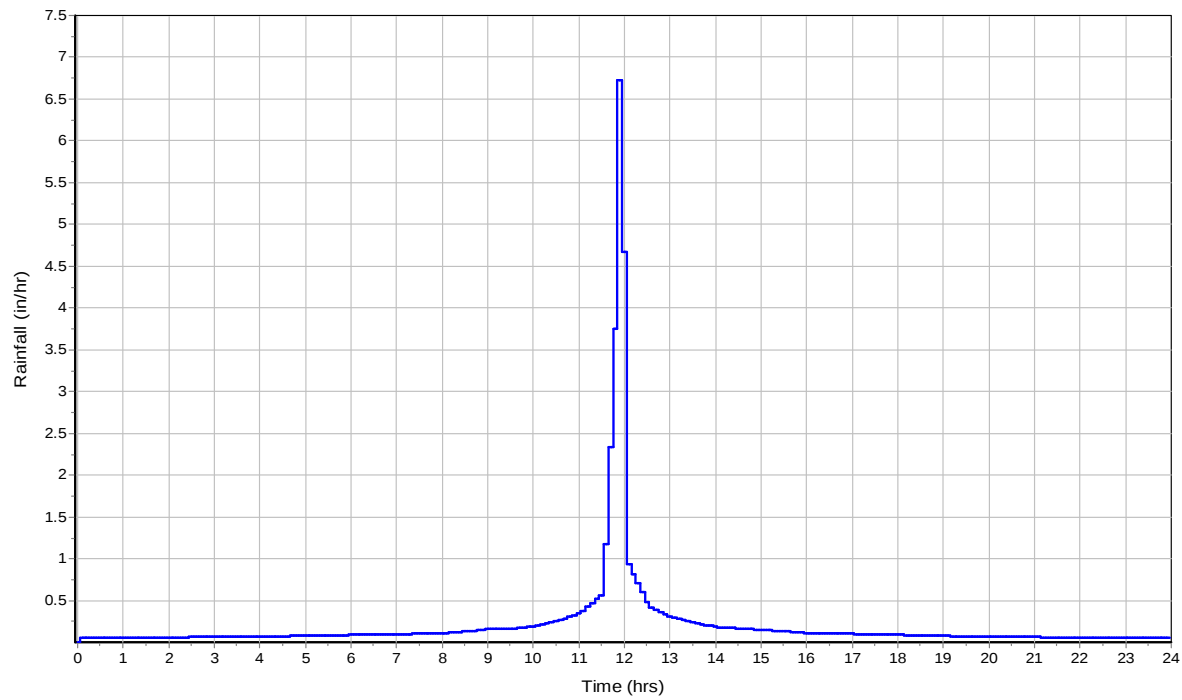
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

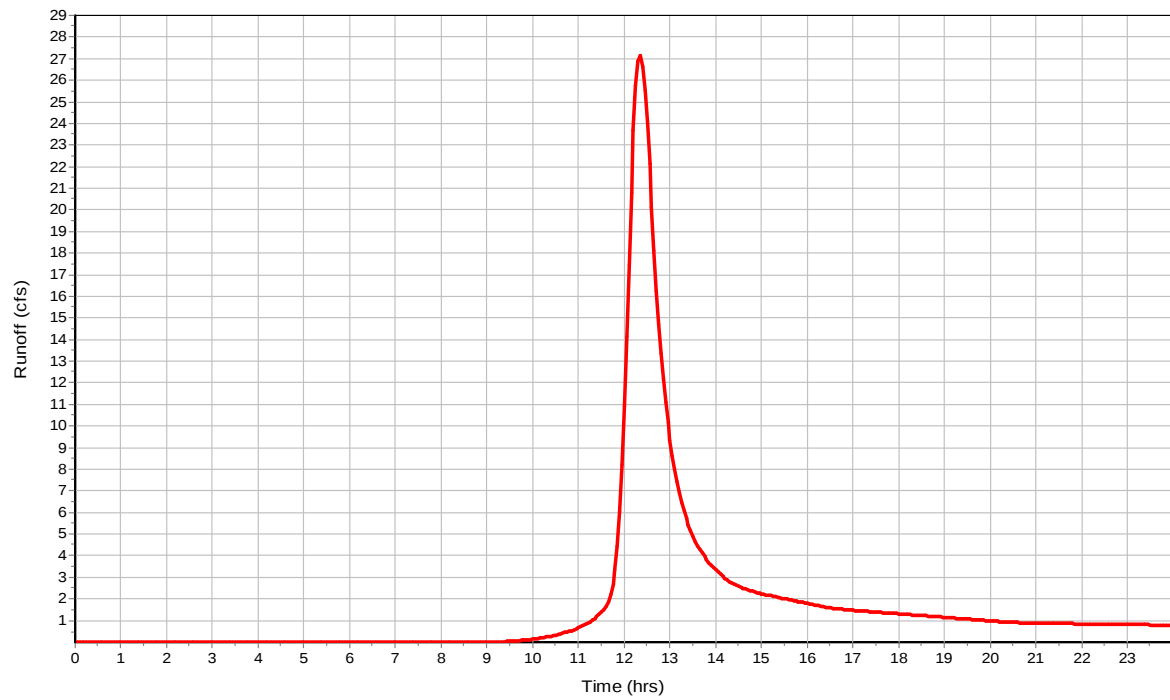
Total Rainfall (in) 4.91
Total Runoff (in) 2.29
Peak Runoff (cfs) 27.22
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_West

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 113.11
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	113.11	C	75
Composite Area & Weighted CN	113.11		75

Time of Concentration

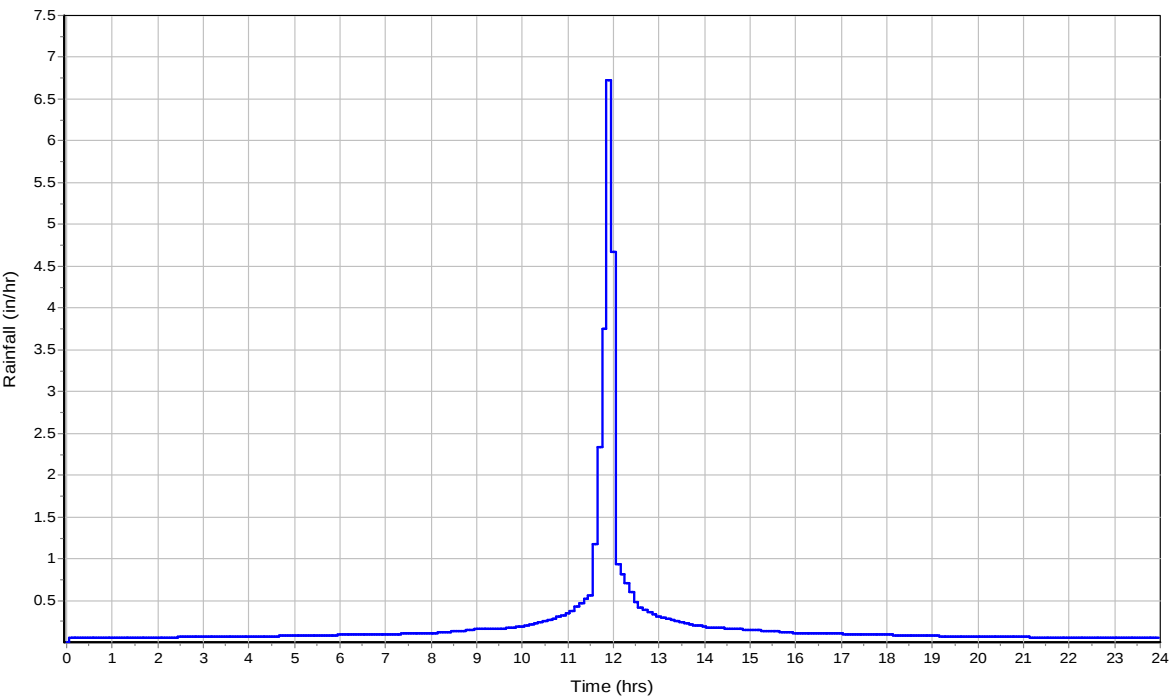
User-Defined TOC override (minutes): 37

Subbasin Runoff Results

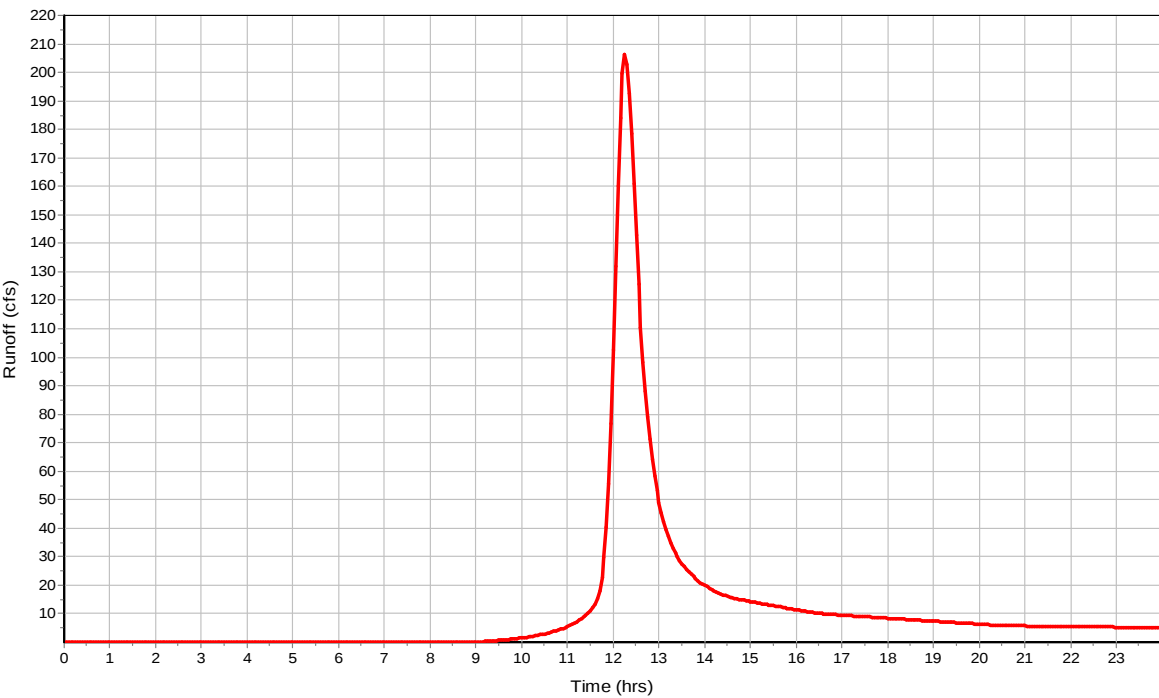
Total Rainfall (in) 4.91
Total Runoff (in) 2.38
Peak Runoff (cfs) 206.11
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:37:00

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2b

Input Data

Area (ac) 12.47
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
-	12.47	-	75
Composite Area & Weighted CN	12.47		75

Time of Concentration

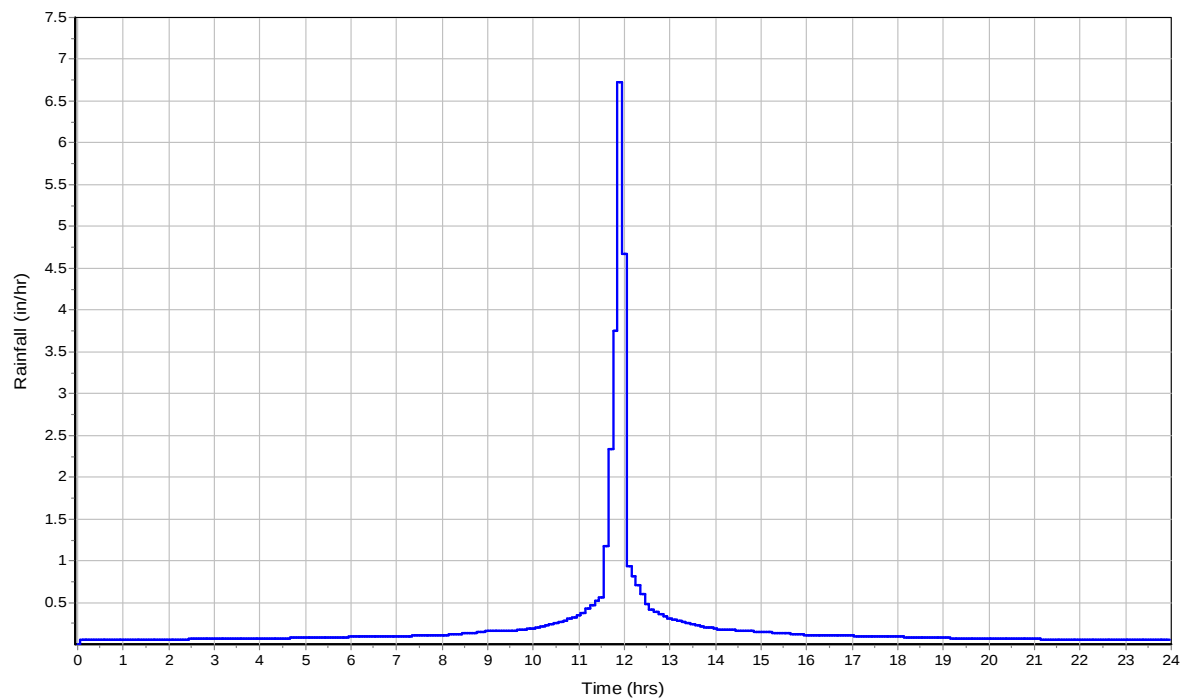
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

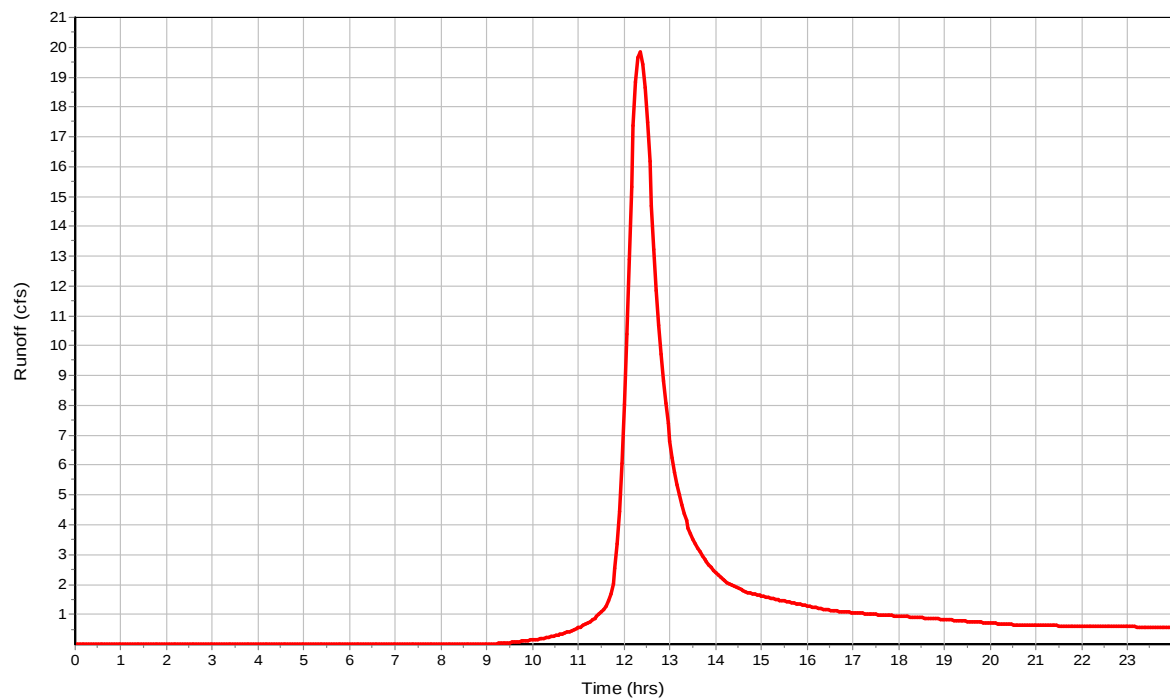
Total Rainfall (in) 4.91
Total Runoff (in) 2.38
Peak Runoff (cfs) 19.88
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub_Infiltration_Basin_1

Input Data

Area (ac)	98.48
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr50yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	98.48	C	74
Composite Area & Weighted CN	98.48		74

Time of Concentration

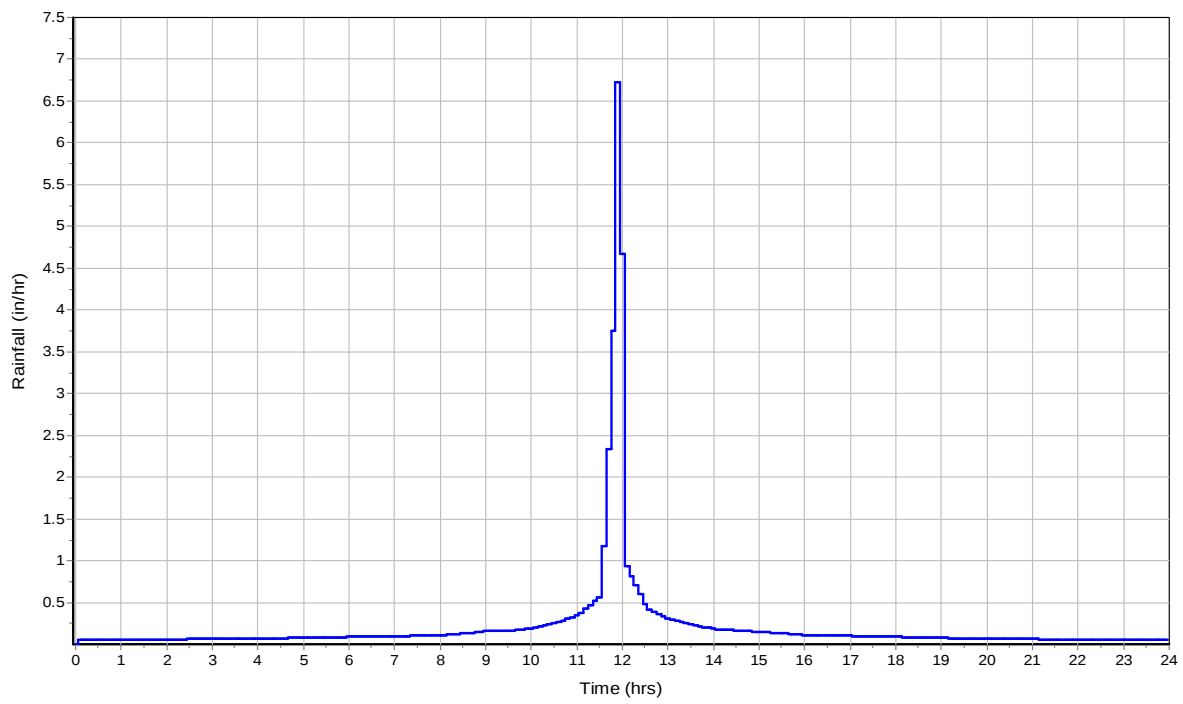
User-Defined TOC override (minutes): 20.00

Subbasin Runoff Results

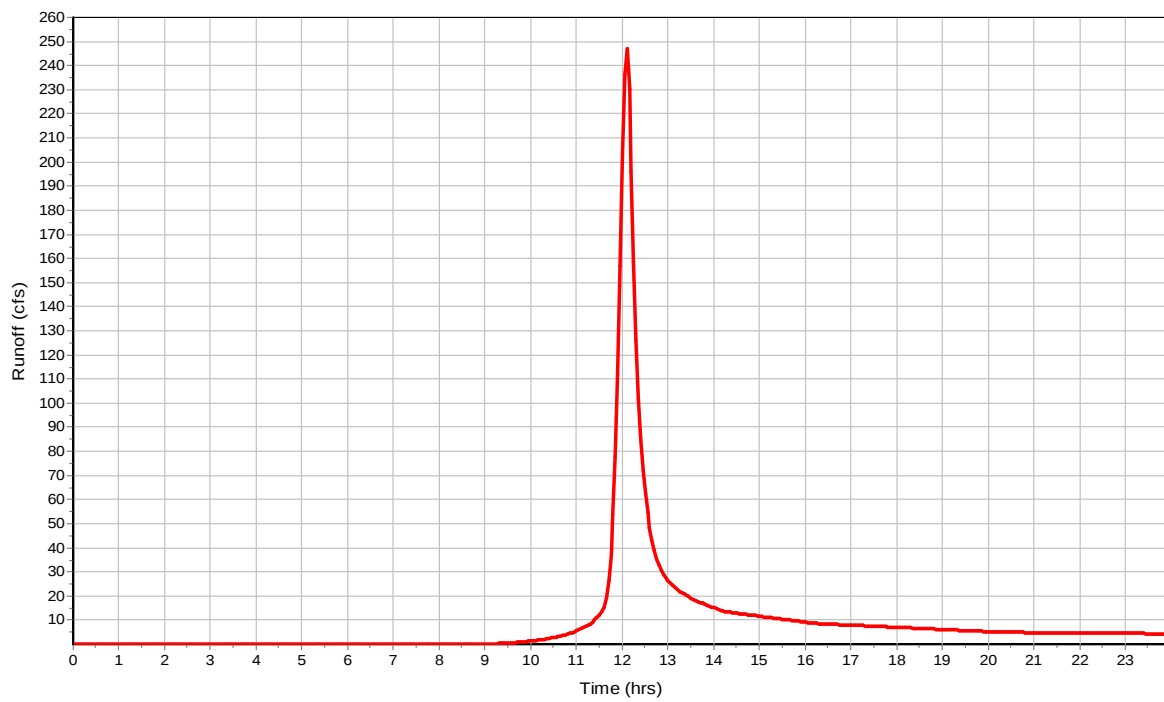
Total Rainfall (in)	4.91
Total Runoff (in)	2.29
Peak Runoff (cfs)	247.67
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:20:00

Subbasin : Sub_Infiltration_Basin_1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	12" DIA MANHOLE	886.40	895.75	9.35	886.40	0.00	895.75	0.00	0.00	0.00
2	Ditch_Start_East	899.00	902.00	3.00	899.00	0.00	902.00	0.00	0.00	0.00
3	Ditch_Start_West	899.00	902.00	3.00	899.00	0.00	902.00	0.00	0.00	0.00
4	HW_36_East	892.00	895.00	3.00	892.00	0.00	895.00	0.00	0.00	0.00
5	HW_36_West	892.00	895.00	3.00	892.00	0.00	899.00	4.00	0.00	0.00
6	IB_1_OCS	891.00	903.00	12.00	891.00	0.00	903.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	313.79	0.00	894.00	7.60	0.00	1.75	888.42	2.02	0 13:20	0 00:00	0.00	0.00
2	Ditch_Start_East	11.95	11.95	899.30	0.30	0.00	4.70	899.04	0.04	0 12:24	0 00:00	0.00	0.00
3	Ditch_Start_West	27.13	27.13	899.49	0.49	0.00	4.51	899.06	0.06	0 12:24	0 00:00	0.00	0.00
4	HW_36_East	11.93	0.00	894.00	2.00	0.00	3.00	892.20	0.20	0 13:20	0 00:00	0.00	0.00
5	HW_36_West	27.10	0.00	894.01	2.01	0.00	2.99	892.25	0.25	0 13:20	0 00:00	0.00	0.00
6	IB_1_OCS	304.57	0.00	896.68	5.68	0.00	6.32	892.11	1.11	0 13:19	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch_East	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch_West	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch_East	11.93	0 12:24	2363.82	0.01	1.82	2.75	1.07	0.21	0.00		
2	Ditch_West	27.10	0 12:24	2363.82	0.01	2.45	2.04	1.11	0.22	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Offset	Outlet Invert	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	36_East	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	36_West	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	Culvert_1_CMP_72	117.00	886.40	0.00	884.00	0.00	2.40	2.0500	CIRCULAR	72.000	72.000	0.0260	0.5000	0.5000	0.0000	0.00	No
4	Culvert_1_RCP_72	201.00	891.00	0.00	886.40	0.00	4.60	2.2900	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No
5	Culvert_2	111.00	892.25	0.25	890.65	0.00	1.60	1.4400	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

	1
	1
	1
	1
	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	36_East	17.10	0 12:26	126.55	0.14	9.64	0.09	2.50	0.83	0.00		Calculated
2	36_West	37.25	0 12:29	126.55	0.29	11.14	0.08	2.51	0.84	0.00		Calculated
3	Culvert_1_CMP_72	313.65	0 13:20	303.28	1.03	11.68	0.17	5.41	0.90	0.00		> CAPACITY
4	Culvert_1_RCP_72	304.66	0 13:19	640.68	0.48	11.83	0.28	5.84	0.97	0.00		Calculated
5	Culvert_2	216.01	0 12:23	508.46	0.42	11.05	0.17	3.91	0.65	0.00		Calculated

Storage Nodes

Storage Node : Culvert_2_Inlet

Input Data

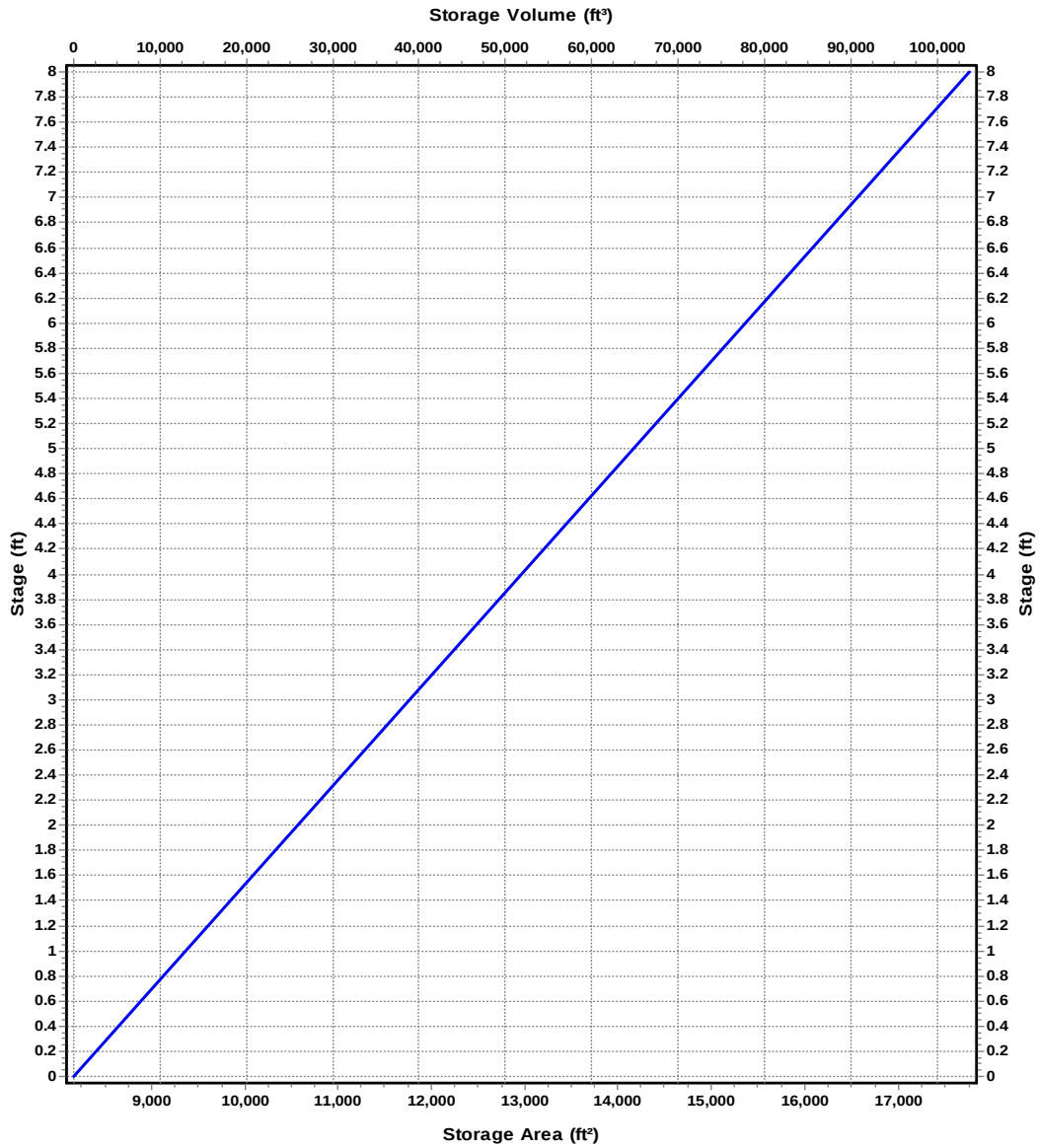
Invert Elevation (ft)	892.00
Max (Rim) Elevation (ft)	900.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	892.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	8168.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Offsite_2

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	8168	0
8	17763	103724

Storage Area Volume Curves



Storage Area Storage Volume

Storage Node : Culvert_2_Inlet (continued)

Output Summary Results

Peak Inflow (cfs)	224.95
Peak Lateral Inflow (cfs)	224.95
Peak Outflow (cfs)	216.01
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	897.35
Max HGL Depth Attained (ft)	5.35
Average HGL Elevation Attained (ft)	892.7
Average HGL Depth Attained (ft)	0.7
Time of Max HGL Occurrence (days hh:mm)	0 12:23
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Infiltration_Basin_1

Input Data

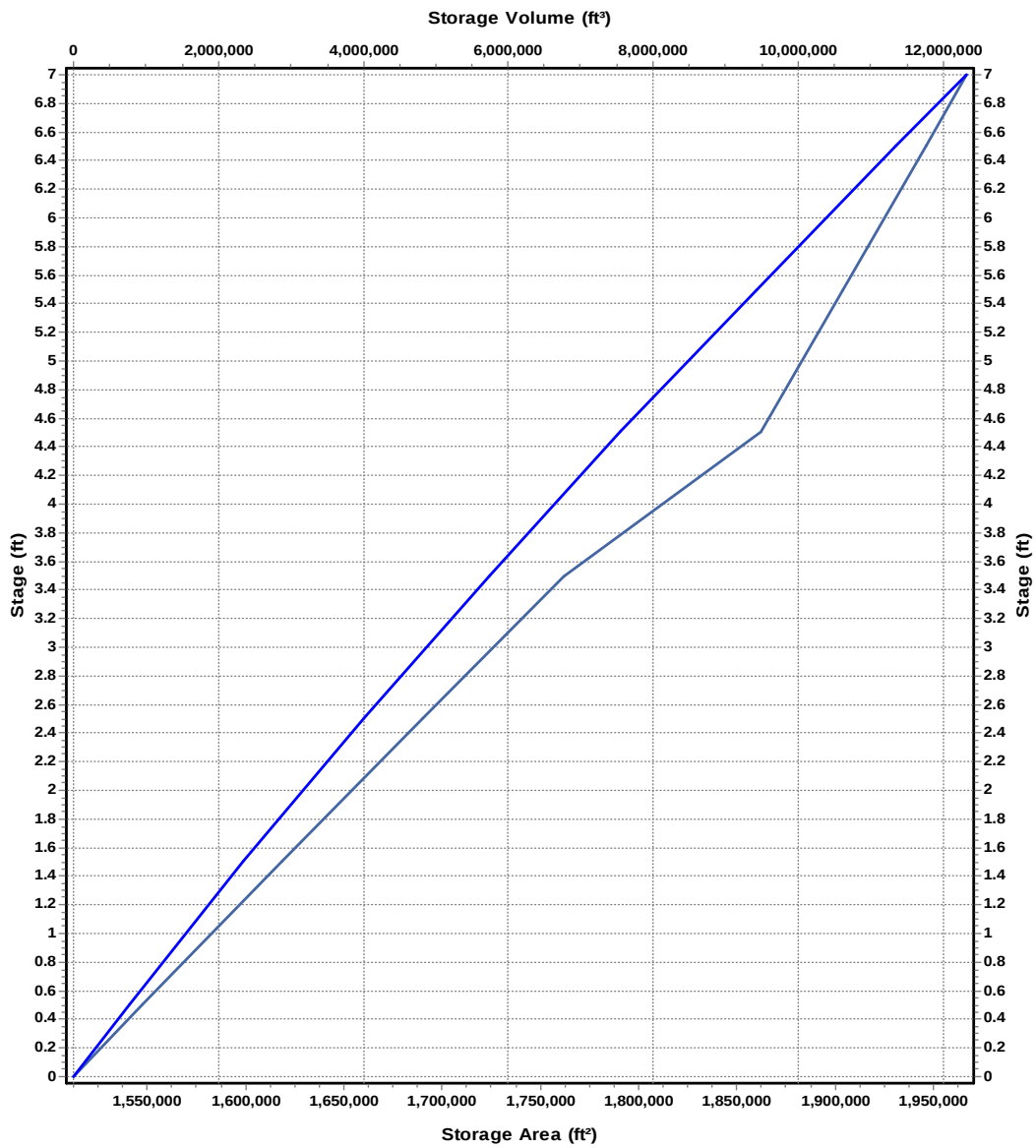
Invert Elevation (ft)	898.50
Max (Rim) Elevation (ft)	905.50
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	898.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	1512370.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : SME Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	1512370	0
0.5	1547431	764950.25
1.5	1618709	2348020.25
2.5	1690091	4002420.25
3.5	1761575	5728253.25
4.5	1862035	7540058.25
5.5	1904021	9423086.25
6.5	1946087	11348140.25
7	1966758	12326351.5

Storage Area Volume Curves



Storage Area Storage Volume

Storage Node : Infiltration_Basin_1 (continued)

Outflow Weirs

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 IB_1_Spillway	Trapezoidal	No	903.50	5.00	350.00	2.20	3.40

Outflow Orifices

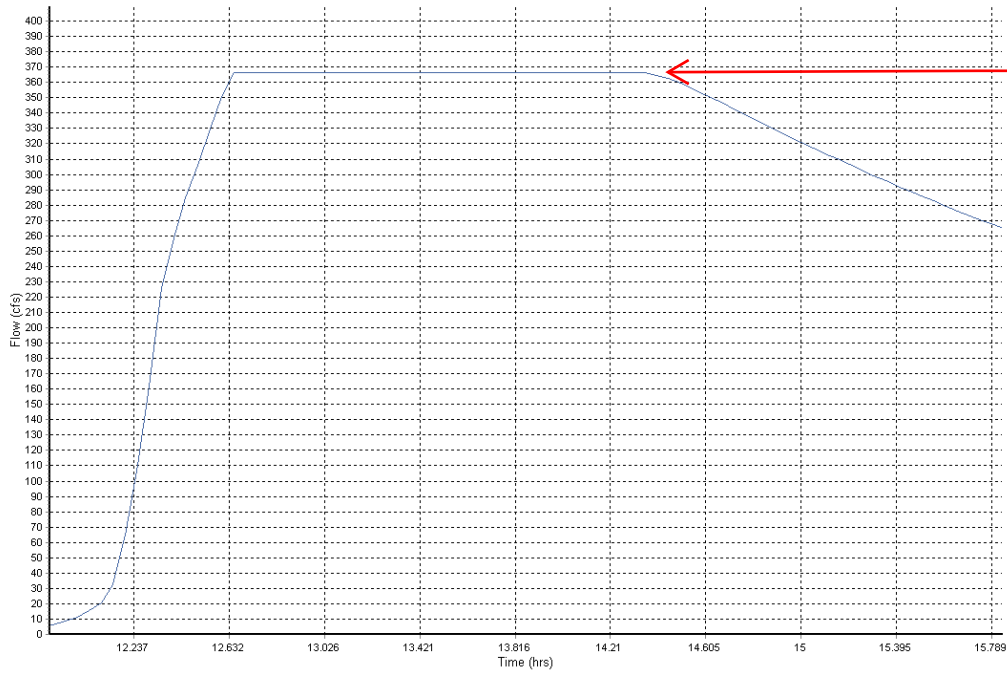
SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 OCS_Weir	Bottom	CIRCULAR	No	120.00			900.80	0.61

Output Summary Results

Peak Inflow (cfs)	2587.08
Peak Lateral Inflow (cfs)	2587.08
Peak Outflow (cfs)	304.57
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	902.84
Max HGL Depth Attained (ft)	4.34
Average HGL Elevation Attained (ft)	900.36
Average HGL Depth Attained (ft)	1.86
Time of Max HGL Occurrence (days hh:mm)	0 13:19
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

100yr 72" CMP FLOW VS TIME

— Flow: Link - Culvert_1_CMP_72 (Single Pipe_09-21-2023 2023-10-18 09:54:46)



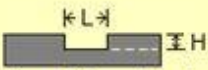
PIPE BARREL CONTROLS
FLOW AT ~366 CFS

Top of Riser Elevation = 900.80'
 100-year storm elevation = 903.46'
 H = 2.66'
 Q ~ 430 cfs

Thin Blue Numbers = Input data
 Bold Red Numbers = Answers

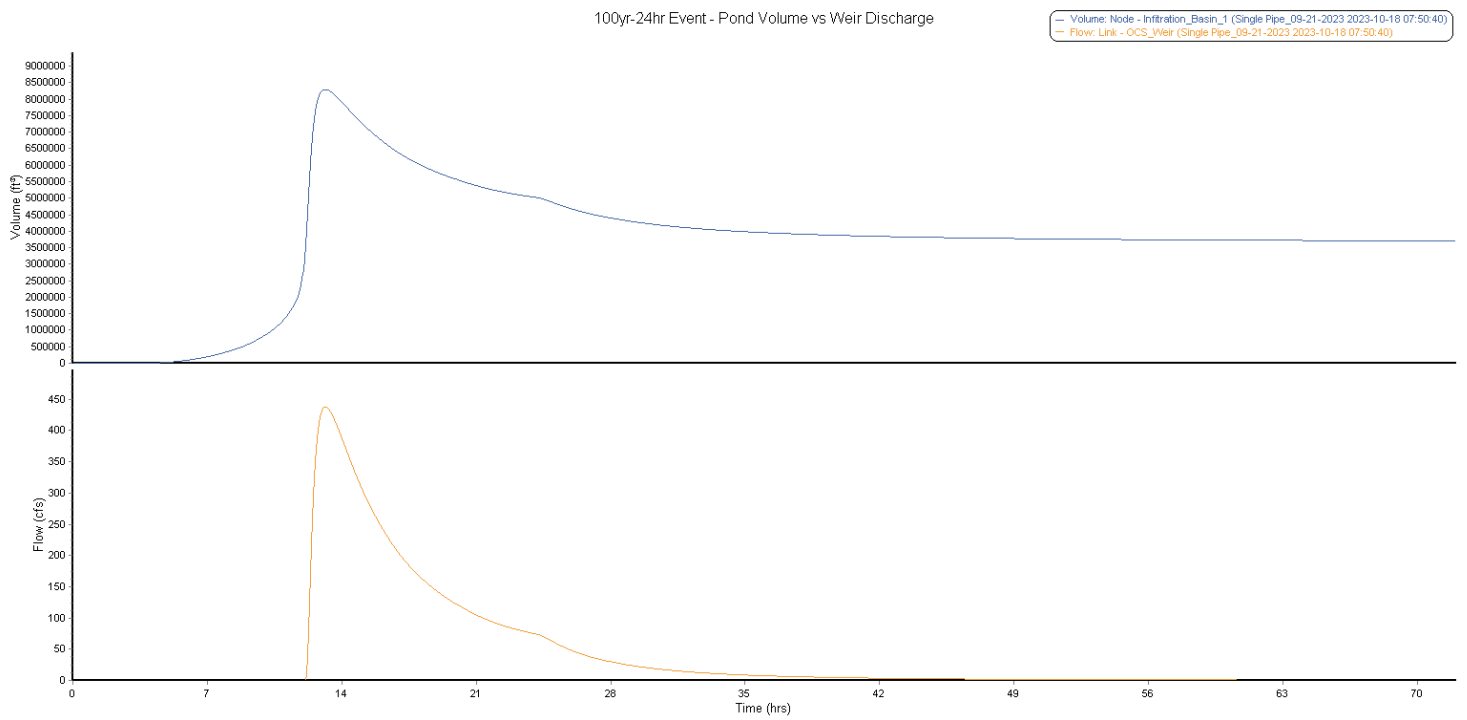
Weir Notch Bleed Down Calculations

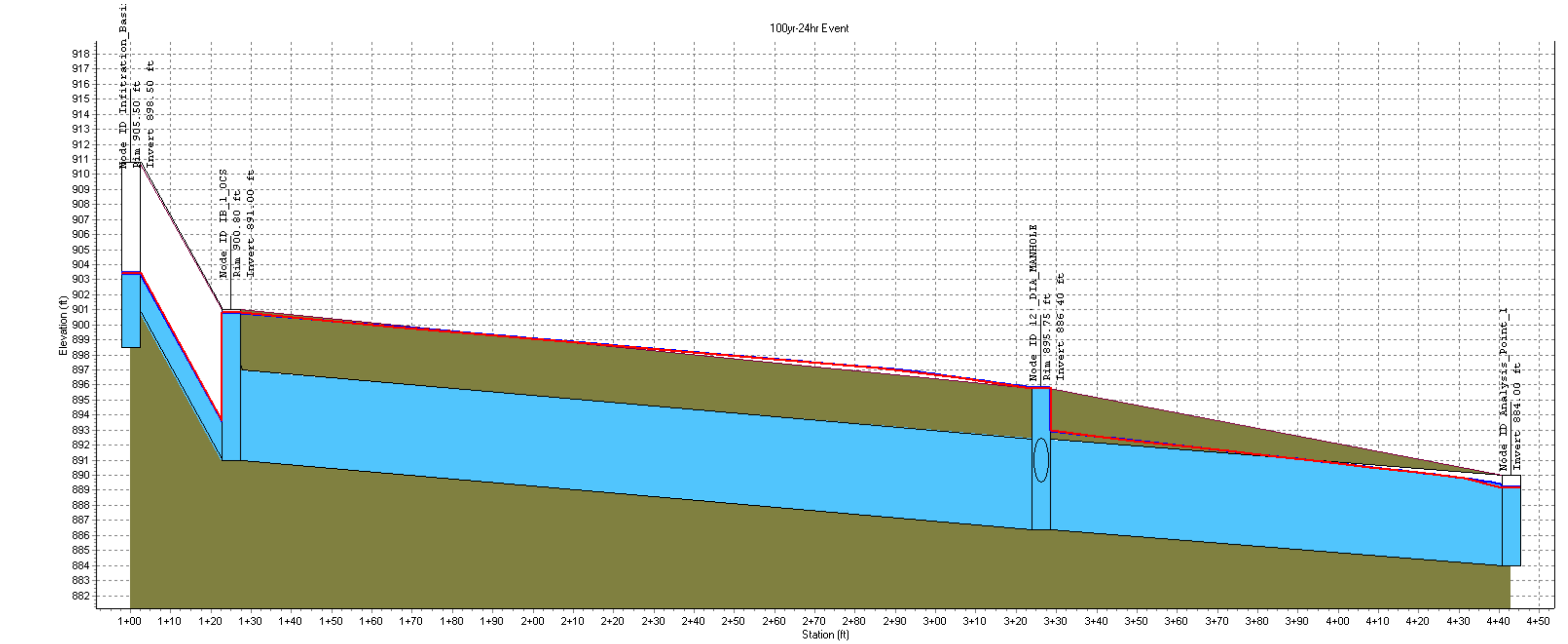
Pond Surface Area at SHW = 0 Sq. Ft.
 Pond Surface Area at NWL = 0 Sq. Ft.
 Notch Height (H) = 2.60 Feet
 Notch Width (L) = 31.40 Feet
 C = 3.25 Coefficient of discharge
 1/2 Volume Time = 0.00 Hours
 Total Time = 0.00 Hours


 Horizontal Broad Crested W
 $Q = C L H^{3/2}$

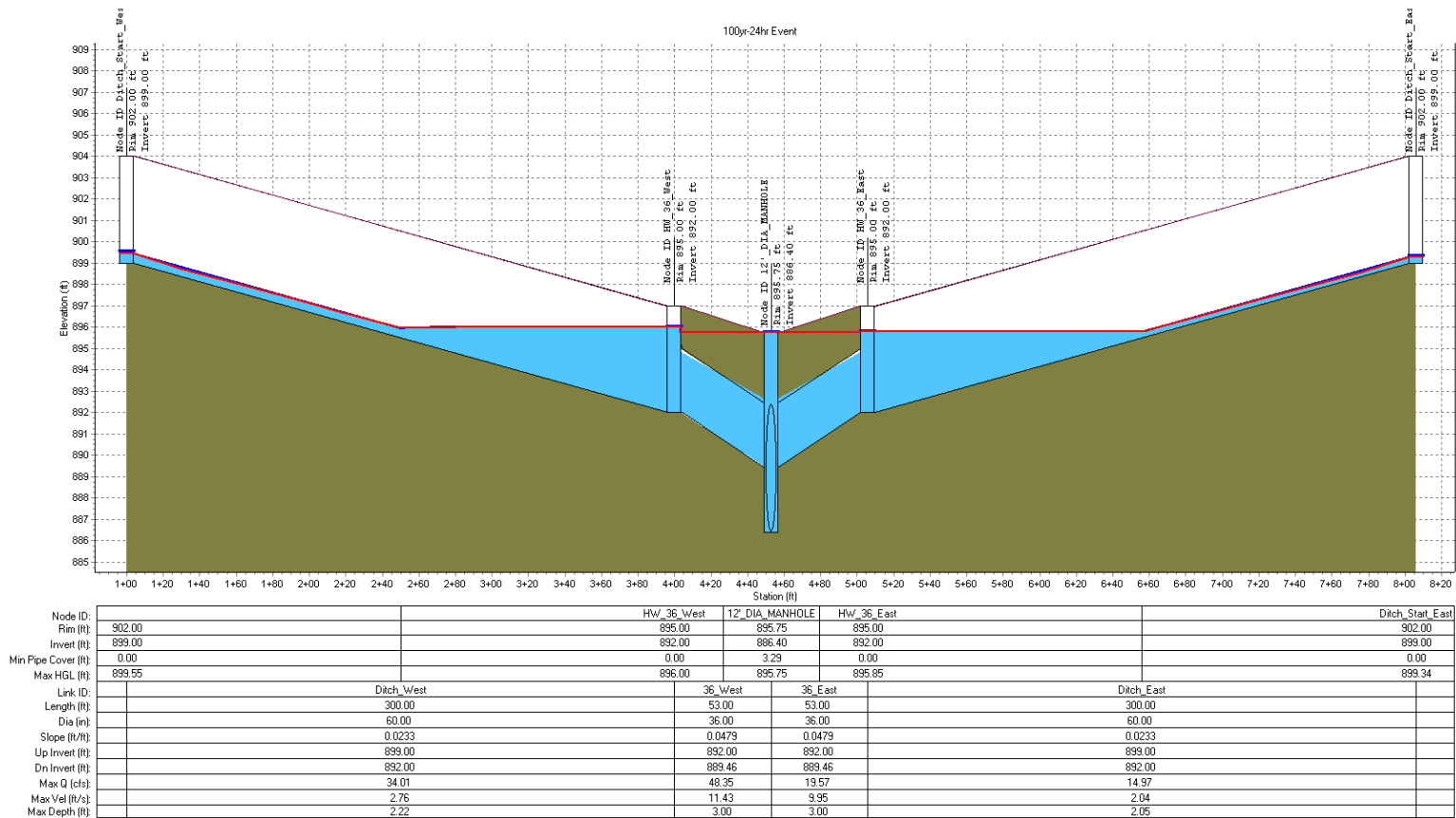
Total H (Ft)	Increm. H (Ft)	Flow Q (cfs)	Q Avg.	Delta Volume	Cum. Volume	Delta Hours	Cum. Hours
2.60		427.44					
	0.05		421.057	0	0	0.0	
2.55		414.68					0.0
	0.05		408.363	0	0	0.0	
2.50		402.05					0.0
	0.05		395.800	0	0	0.0	
2.44		389.55					0.0
	0.05		383.367	0	0	0.0	
2.39		377.18					0.0
	0.05		371.068	0	0	0.0	
2.34		364.95					0.0
	0.05		358.903	0	0	0.0	
2.29		352.85					0.0
	0.05		346.874	0	0	0.0	
2.24		340.89					0.0
	0.05		334.983	0	0	0.0	
2.18		329.07					0.0
	0.05		323.231	0	0	0.0	
2.13		317.39					0.0
	0.05		311.619	0	0	0.0	
2.08		305.85					0.0
	0.05		300.150	0	0	0.0	
2.03		294.45					0.0
	0.05		288.825	0	0	0.0	
1.98		283.20					0.0
	0.05		277.647	0	0	0.0	
1.92		272.09					0.0
	0.05		266.616	0	0	0.0	
1.87		261.14					0.0
	0.05		255.736	0	0	0.0	
1.82		250.33					0.0
	0.05		245.008	0	0	0.0	
1.77		239.68					0.0

100yr-24hr Event - Pond Volume vs Weir Discharge





Node ID:	IB_1_OCS		12_DIA_MANHOLE		Analysis_Point_1
Rim (ft):	905.50	900.80	895.75		
Invert (ft):	898.50	891.00	886.40		884.00
Min Pipe Cover (ft):	0.00		3.29		
Max HGL (ft):	903.40	900.80	895.75		889.16
Link ID:	OCS_Weir	Culvert_1_RCP_72		Culvert_1_CMP_72	
Length (ft):		201.00		117.00	
Dia (in):	120.00	72.00		72.00	
Slope (ft/ft):		0.0229		0.0205	
Up Invert (ft):	900.80	891.00		886.40	
Dn Invert (ft):	900.80	886.40		884.00	
Max Q (cfs):	438.00	406.04		366.52	
Max Vel (ft/s):	0.00	14.36		13.38	
Max Depth (ft):	0.00	6.00		5.58	



Project Description

File Name Single Pipe_09-21-2023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Hydrodynamic
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:03:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 7
Subbasins..... 6
Nodes..... 10
 Junctions 6
 Outfalls 2
 Flow Diversions 0
 Inlets 0
 Storage Nodes 2
Links..... 9
 Channels 2
 Pipes 5
 Pumps 0
 Orifices 1
 Weirs 1
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	1yr24hr	Time Series	1-inch	Cumulative	inches	Michigan	Calhoun	1.00	1.00	SCS Type II 24-hr
2	24hr100yr	Time Series	24hr100yr	Cumulative	inches	Michigan	Calhoun	100.00	5.60	SCS Type II 24-hr
3	24hr10yr	Time Series	24hr10yr	Cumulative	inches	Michigan	Calhoun	10.00	3.60	SCS Type II 24-hr
4	24hr25yr	Time Series	24hr25yr	Cumulative	inches	Michigan	Calhoun	25.00	4.30	SCS Type II 24-hr
5	24hr2yr	Time Series	24hr2yr	Cumulative	inches	Michigan	Calhoun	2.00	2.57	SCS Type II 24-hr
6	24hr50yr	Time Series	24hr50yr	Cumulative	inches	Michigan	Calhoun	50.00	4.91	SCS Type II 24-hr
7	24hr-5yr	Time Series	24hr-5yr	Cumulative	inches	Michigan	Calhoun	5.00	3.38	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	Drainage_Area_1	761.76	484.00	91.00	5.60	4.57	3478.20	2785.54	0 00:33:17
2	Drainage_Area_1b_East	7.81	484.00	74.00	5.60	2.85	22.27	14.99	0 00:45:00
3	Drainage_Area_1b_West	17.73	484.00	74.00	5.60	2.85	50.55	34.04	0 00:45:00
4	Drainage_Area_2	113.11	484.00	75.00	5.60	2.94	333.00	256.93	0 00:37:00
5	Drainage_Area_2b	12.47	484.00	75.00	5.60	2.94	36.70	24.77	0 00:45:00
6	Sub_Infiltration_Basin_1	98.48	484.00	74.00	5.60	2.85	280.77	309.01	0 00:20:00

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	Junction	886.40	895.75	886.40	895.75	0.00	448.17	895.75	0.00	0.00	0 12:51	26.87	50.00
2	Ditch_Start_East	Junction	899.00	902.00	899.00	902.00	0.00	14.99	899.34	0.00	4.66	0 00:00	0.00	0.00
3	Ditch_Start_West	Junction	899.00	902.00	899.00	902.00	0.00	34.04	899.55	0.00	4.45	0 00:00	0.00	0.00
4	HW_36_East	Junction	892.00	895.00	0.00	0.00	0.00	29.69	895.85	0.00	1.15	0 00:00	0.00	0.00
5	HW_36_West	Junction	892.00	895.00	892.00	899.00	0.00	34.01	896.00	0.00	1.00	0 00:00	0.00	0.00
6	IB_1_OCS	Junction	891.00	903.00	891.00	903.00	0.00	453.97	903.00	0.00	0.00	0 13:49	5.57	5.00
7	Analysis_Point_1	Outfall	884.00					368.29	889.17					
8	Analysis_Point_2	Outfall	890.65					264.90	893.72					
9	Culvert_2_Inlet	Storage Node	892.00	900.00	892.00		8168.00	280.24	898.32				0.00	0.00
10	Infiltration_Basin_1	Storage Node	898.50	905.50	898.50		1512370.00	3024.00	903.46				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	36_East	Pipe	HW_36_East	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	33.68	126.55	0.27	9.95	3.00	1.00	141.00 SURCHARGED
2	36_West	Pipe	HW_36_West	12'_DIA_MANHOLE	53.00	892.00	889.46	4.7900	36.000	0.0150	48.35	126.55	0.38	11.43	3.00	1.00	142.00 SURCHARGED
3	Culvert_1_CMP_72	Pipe	12'_DIA_MANHOLE	Analysis_Point_1	117.00	886.40	884.00	2.0500	72.000	0.0260	368.29	303.28	1.21	13.63	5.58	0.93	0.00 > CAPACITY
4	Culvert_1_RCP_72	Pipe	IB_1_OCS	12'_DIA_MANHOLE	201.00	891.00	886.40	2.2900	72.000	0.0130	448.17	640.68	0.70	15.85	6.00	1.00	146.00 SURCHARGED
5	Culvert_2	Pipe	Culvert_2_Inlet	Analysis_Point_2	111.00	892.25	890.65	1.4400	72.000	0.0130	264.90	508.46	0.52	11.55	4.54	0.76	0.00 Calculated
6	Ditch_East	Channel	Ditch_Start_East	HW_36_East	300.00	899.00	892.00	2.3300	60.000	0.0320	14.97	2363.82	0.01	2.04	2.05	0.41	0.00
7	Ditch_West	Channel	Ditch_Start_West	HW_36_West	300.00	899.00	892.00	2.3300	60.000	0.0320	34.01	2363.82	0.01	2.76	2.22	0.44	0.00
8	OCS_Weir	Orifice	Infiltration_Basin_1	IB_1_OCS		898.50	891.00		120.000		453.97						
9	IB_1_Spillway	Weir	Infiltration_Basin_1	Culvert_2_Inlet		898.50	892.00				0.00						

Subbasin Hydrology

Subbasin : Drainage_Area_1

Input Data

Area (ac)	761.76
Peak Rate Factor	484
Weighted Curve Number	91
Rain Gage ID	24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Urban industrial, 72% imp	761.76	C	91
Composite Area & Weighted CN	761.76		91

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$

Where :

- Tc = Time of Concentration (hr)
- n = Manning's roughness
- Lf = Flow Length (ft)
- P = 2 yr, 24 hr Rainfall (inches)
- Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

- V = 16.1345 * (Sf^0.5) (unpaved surface)
- V = 20.3282 * (Sf^0.5) (paved surface)
- V = 15.0 * (Sf^0.5) (grassed waterway surface)
- V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
- V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
- V = 7.0 * (Sf^0.5) (short grass pasture surface)
- V = 5.0 * (Sf^0.5) (woodland surface)
- V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
- Tc = (Lf / V) / (3600 sec/hr)

Where:

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3})) * (S_f^{0.5}) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

- Tc = Time of Concentration (hr)
- Lf = Flow Length (ft)
- R = Hydraulic Radius (ft)
- Aq = Flow Area (ft²)
- Wp = Wetted Perimeter (ft)
- V = Velocity (ft/sec)
- Sf = Slope (ft/ft)
- n = Manning's roughness

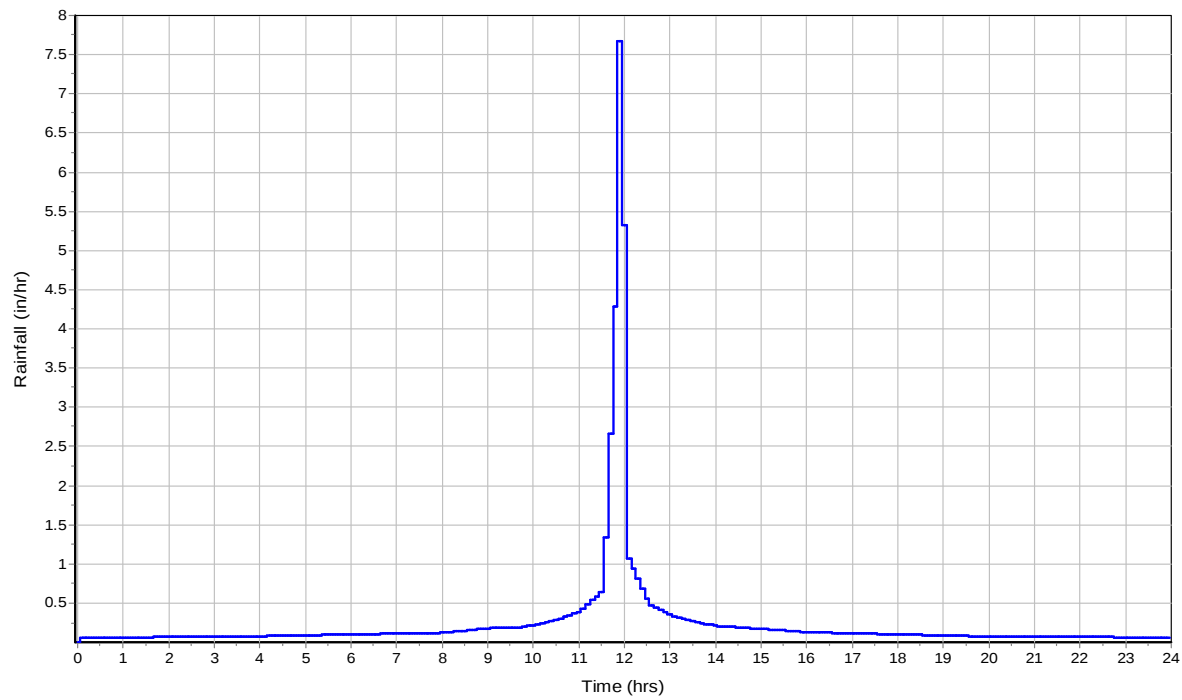
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.011	0
Flow Length (ft) :	150	150	0
Slope (%) :	0.5	0.5	0
2 yr, 24 hr Rainfall (in) :	2.53	2.53	0
Velocity (ft/sec) :	0.09	0.76	0
Computed Flow Time (min) :	26.54	3.28	0
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	300	0	0
Slope (%) :	0.5	0	0
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0	0
Computed Flow Time (min) :	3.47	0	0
Total TOC (min)	33.29		

Subbasin Runoff Results

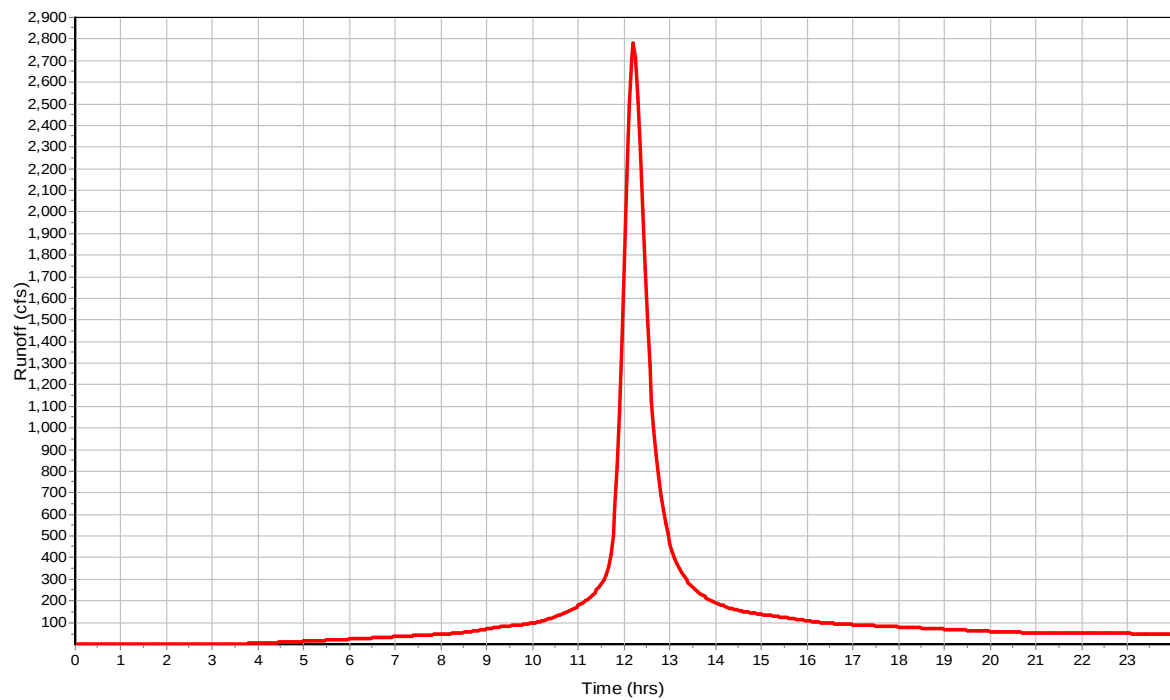
Total Rainfall (in)	5.6
Total Runoff (in)	4.57
Peak Runoff (cfs)	2785.54
Weighted Curve Number	91
Time of Concentration (days hh:mm:ss)	0 00:33:17

Subbasin : Drainage_Area_1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_East

Input Data

Area (ac)	7.81
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	7.81	C	74
Composite Area & Weighted CN	7.81		74

Time of Concentration

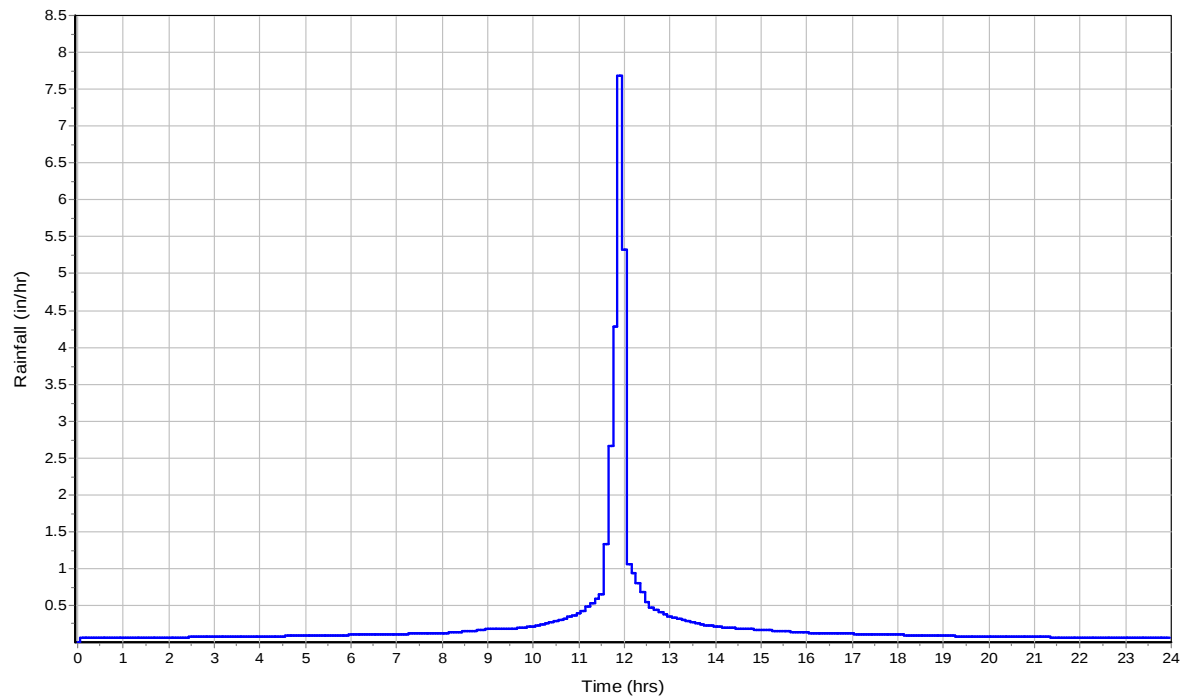
User-Defined TOC override (minutes): 45

Subbasin Runoff Results

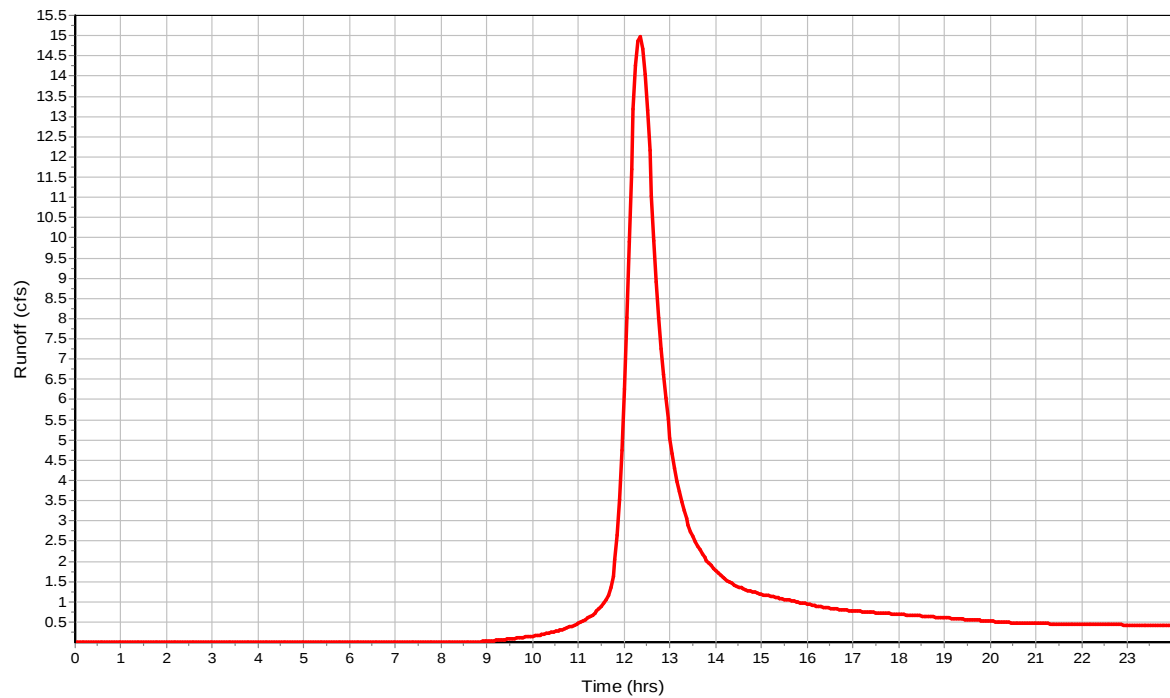
Total Rainfall (in)	5.6
Total Runoff (in)	2.85
Peak Runoff (cfs)	14.99
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:45:00

Subbasin : Drainage_Area_1b_East

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_1b_West

Input Data

Area (ac) 17.73
Peak Rate Factor 484
Weighted Curve Number 74
Rain Gage ID 24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	17.73	C	74
Composite Area & Weighted CN	17.73		74

Time of Concentration

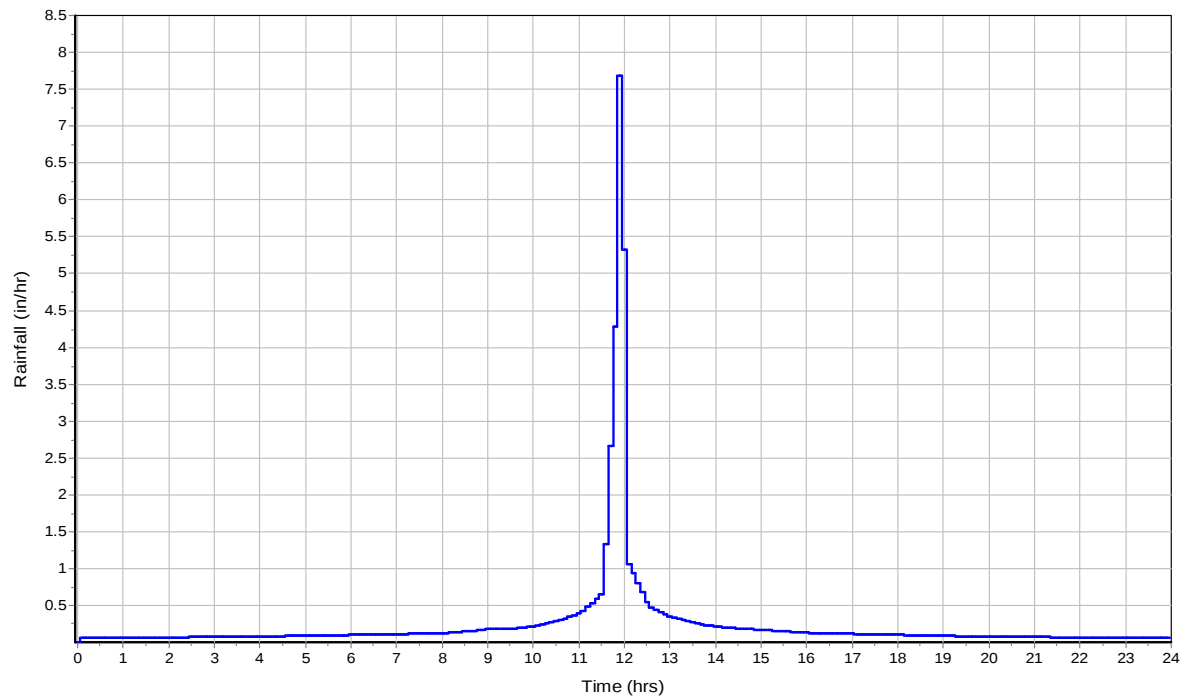
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

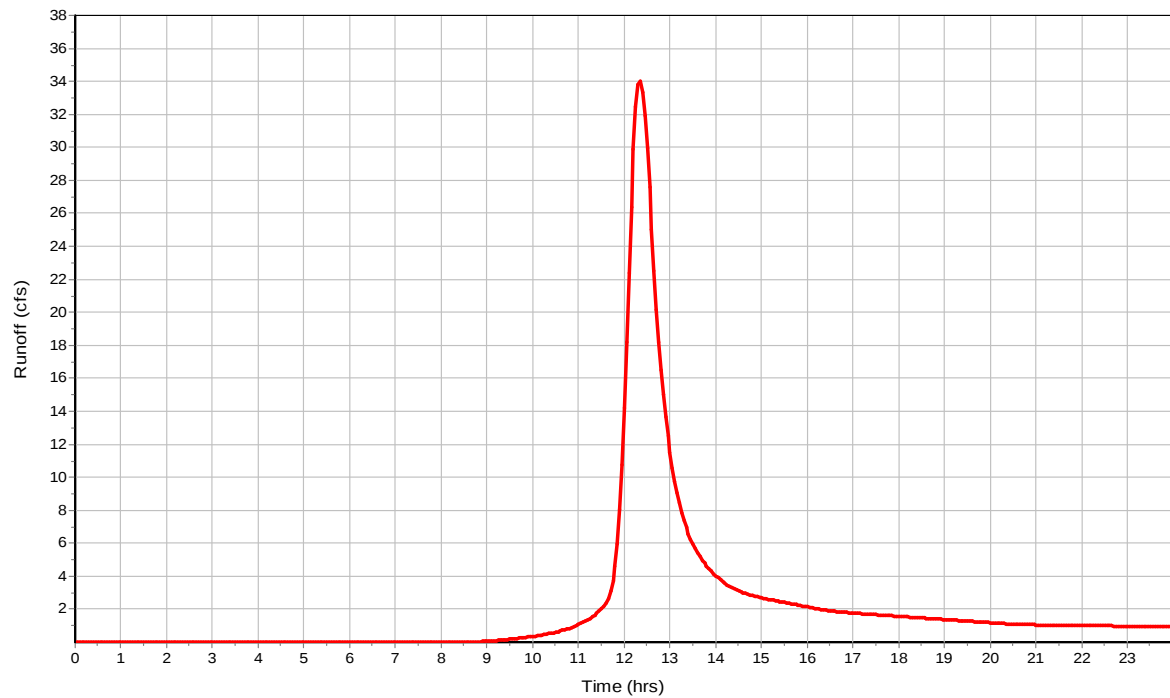
Total Rainfall (in) 5.6
Total Runoff (in) 2.85
Peak Runoff (cfs) 34.04
Weighted Curve Number 74
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_1b_West

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2

Input Data

Area (ac) 113.11
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Small grain, C + CR, Poor	113.11	C	75
Composite Area & Weighted CN	113.11		75

Time of Concentration

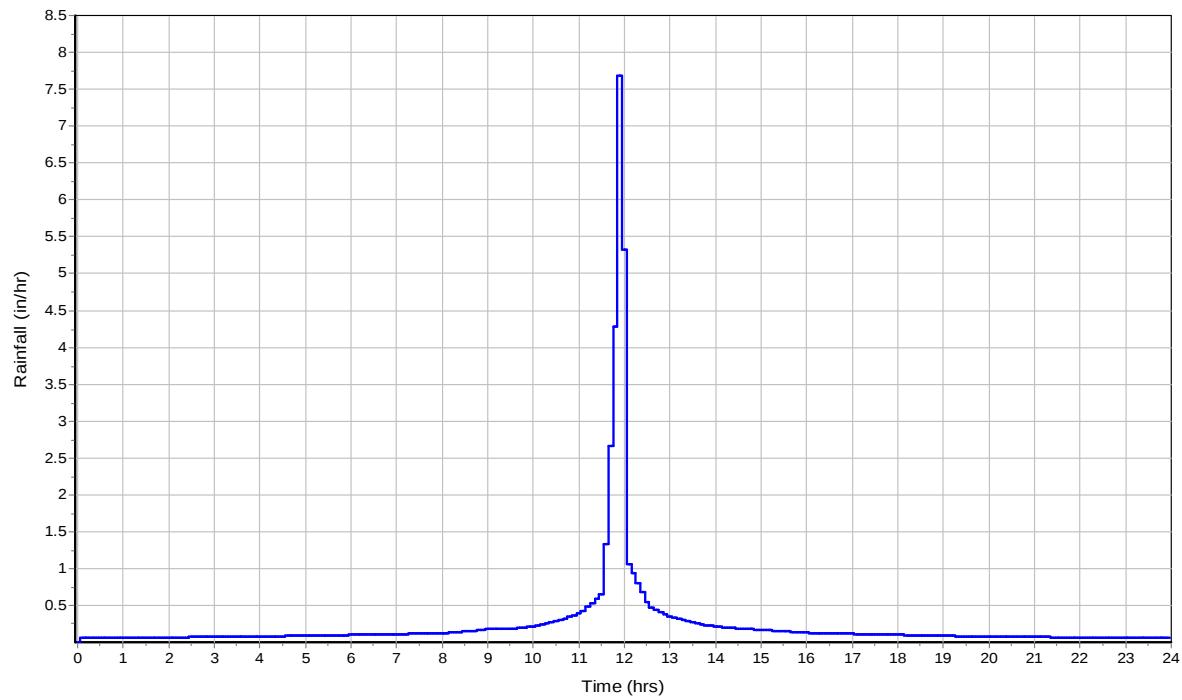
User-Defined TOC override (minutes): 37

Subbasin Runoff Results

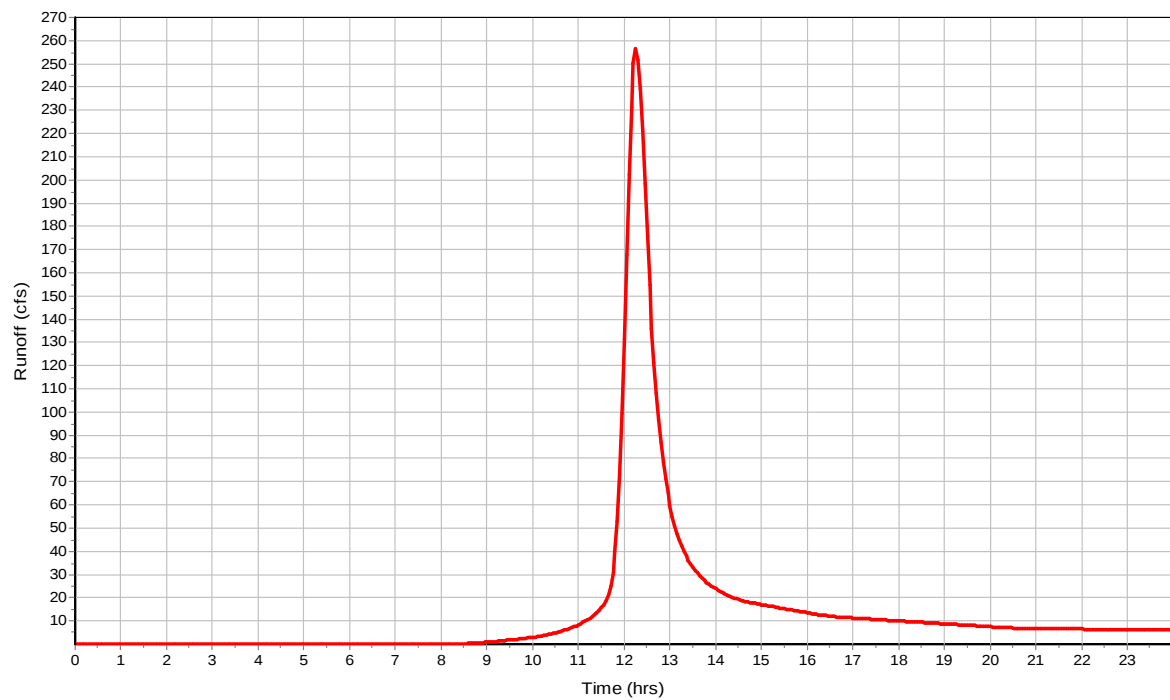
Total Rainfall (in) 5.6
Total Runoff (in) 2.94
Peak Runoff (cfs) 256.93
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:37:00

Subbasin : Drainage_Area_2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage_Area_2b

Input Data

Area (ac) 12.47
Peak Rate Factor 484
Weighted Curve Number 75
Rain Gage ID 24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
-	12.47	-	75
Composite Area & Weighted CN	12.47		75

Time of Concentration

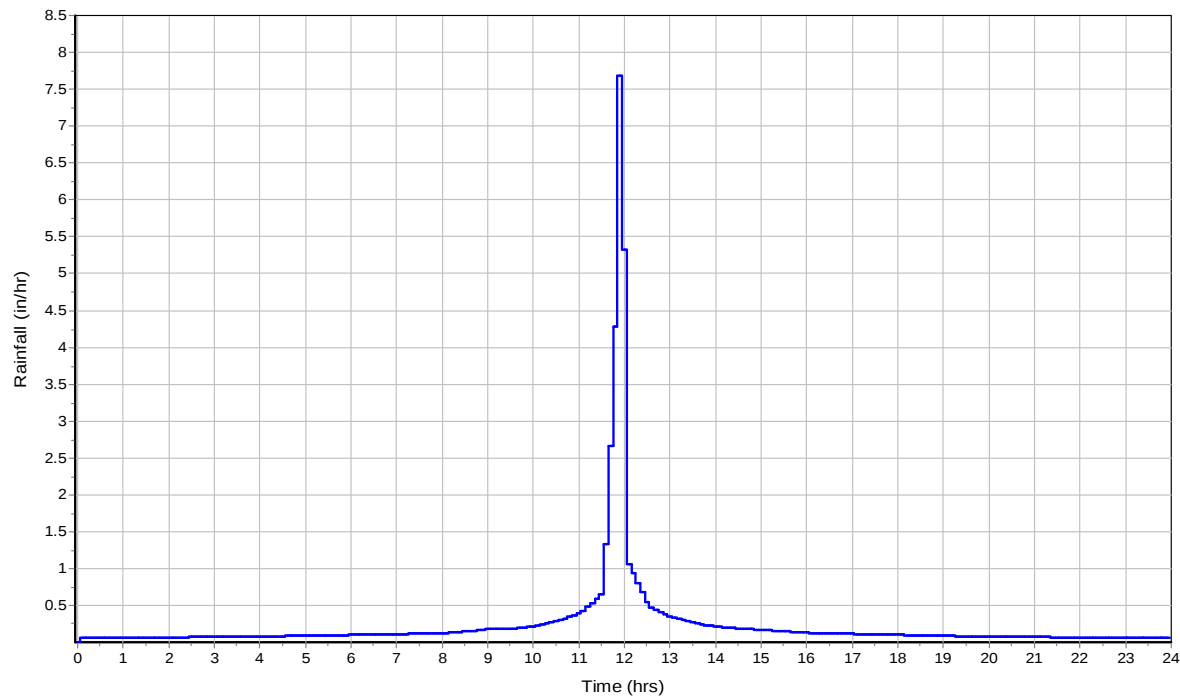
User-Defined TOC override (minutes): 45.00

Subbasin Runoff Results

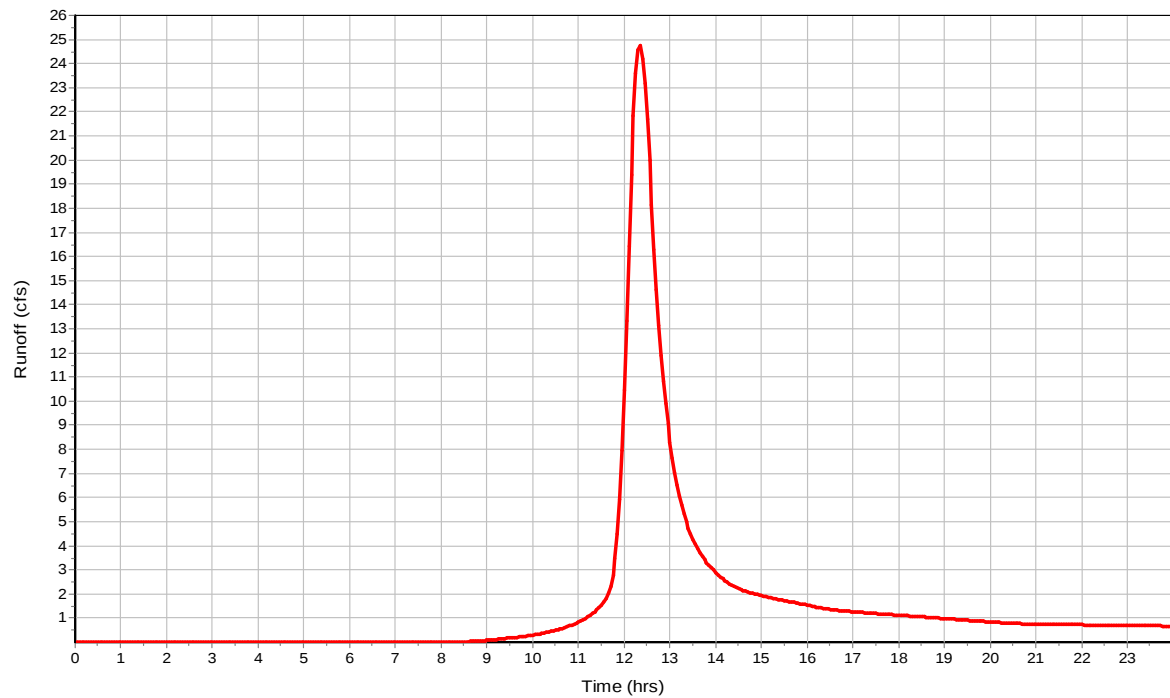
Total Rainfall (in) 5.6
Total Runoff (in) 2.94
Peak Runoff (cfs) 24.77
Weighted Curve Number 75
Time of Concentration (days hh:mm:ss) 0 00:45:00

Subbasin : Drainage_Area_2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Sub_Infiltration_Basin_1

Input Data

Area (ac)	98.48
Peak Rate Factor	484
Weighted Curve Number	74
Rain Gage ID	24hr100yr

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
> 75% grass cover, Good	98.48	C	74
Composite Area & Weighted CN	98.48		74

Time of Concentration

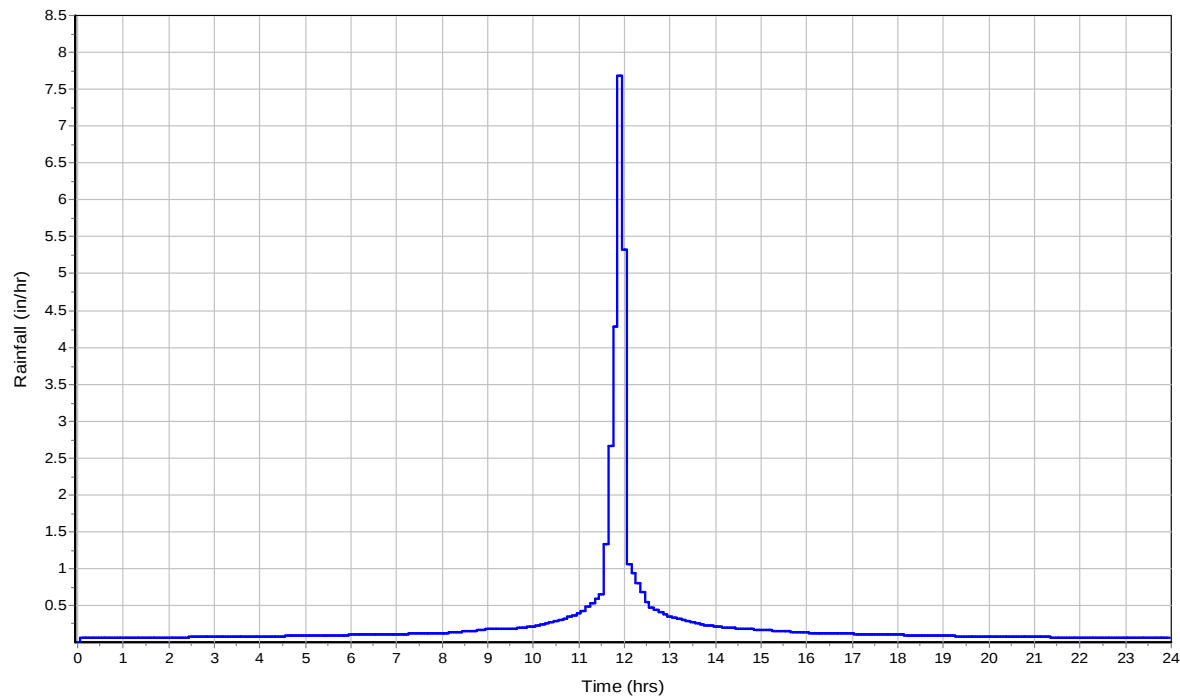
User-Defined TOC override (minutes): 20.00

Subbasin Runoff Results

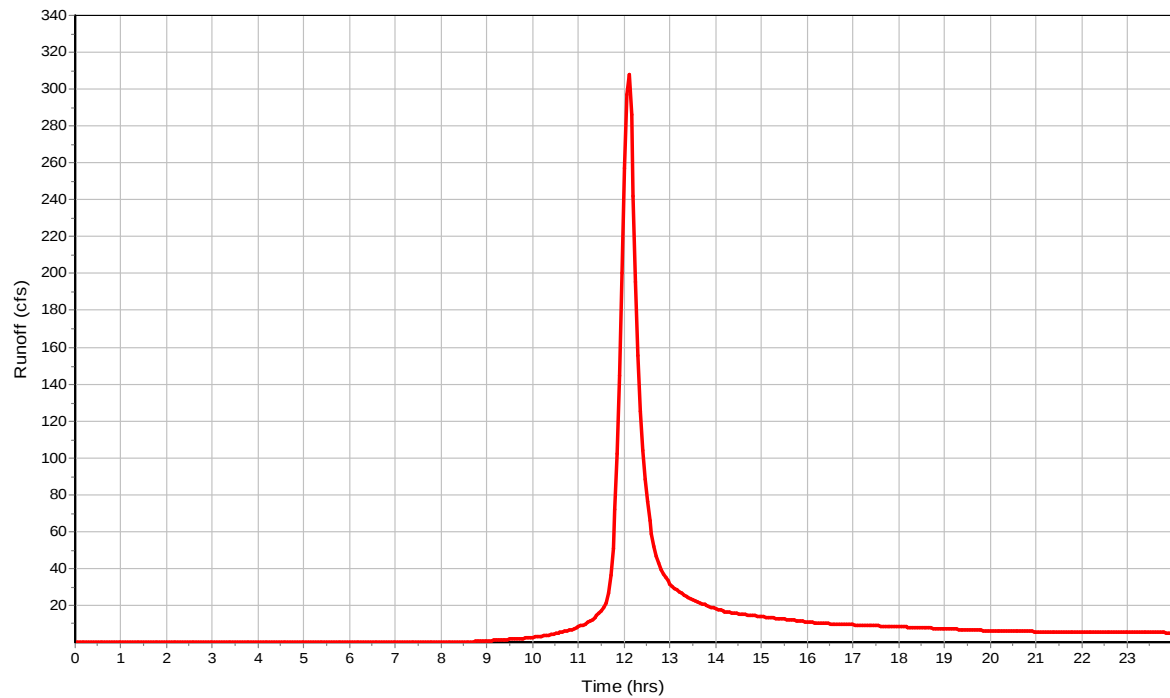
Total Rainfall (in)	5.6
Total Runoff (in)	2.85
Peak Runoff (cfs)	309.01
Weighted Curve Number	74
Time of Concentration (days hh:mm:ss)	0 00:20:00

Subbasin : Sub_Infiltration_Basin_1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	12" DIA MANHOLE	886.40	895.75	9.35	886.40	0.00	895.75	0.00	0.00	0.00
2	Ditch_Start_East	899.00	902.00	3.00	899.00	0.00	9020.00	8118.00	0.00	0.00
3	Ditch_Start_West	899.00	902.00	3.00	899.00	0.00	902.00	0.00	0.00	0.00
4	HW_36_East	892.00	895.00	3.00	0.00	-892.00	0.00	-895.00	0.00	0.00
5	HW_36_West	892.00	895.00	3.00	892.00	0.00	899.00	4.00	0.00	0.00
6	IB_1_OCS	891.00	903.00	12.00	891.00	0.00	903.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	12" DIA MANHOLE	448.17	0.00	895.75	9.35	0.00	0.00	888.96	2.56	0 12:38	0 12:51	26.87	50.00
2	Ditch_Start_East	14.99	14.99	899.34	0.34	0.00	4.66	899.05	0.05	0 12:24	0 00:00	0.00	0.00
3	Ditch_Start_West	34.04	34.04	899.55	0.55	0.00	4.45	899.07	0.07	0 12:24	0 00:00	0.00	0.00
4	HW_36_East	29.69	0.00	895.85	3.85	0.00	1.15	892.52	0.52	0 12:40	0 00:00	0.00	0.00
5	HW_36_West	34.01	0.00	896.00	4.00	0.00	1.00	892.57	0.57	0 12:42	0 00:00	0.00	0.00
6	IB_1_OCS	453.97	0.00	903.00	12.00	0.00	0.00	892.72	1.72	0 12:53	0 13:49	5.57	5.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch_East	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch_West	300.00	899.00	0.00	892.00	0.00	7.00	2.3300	Trapezoidal	5.000	52.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch_East	14.97	0 12:24	2363.82	0.01	2.04	2.45	2.05	0.41	0.00		
2	Ditch_West	34.01	0 12:24	2363.82	0.01	2.76	1.81	2.22	0.44	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Offset	Outlet Invert	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	36_East	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	36_West	53.00	892.00	0.00	889.46	3.06	2.54	4.7900	CIRCULAR	36.000	36.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	Culvert_1_CMP_72	117.00	886.40	0.00	884.00	0.00	2.40	2.0500	CIRCULAR	72.000	72.000	0.0260	0.5000	0.5000	0.0000	0.00	No
4	Culvert_1_RCP_72	201.00	891.00	0.00	886.40	0.00	4.60	2.2900	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No
5	Culvert_2	111.00	892.25	0.25	890.65	0.00	1.60	1.4400	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

	1
	1
	1
	1
	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	36_East	33.68	0 12:53	126.55	0.27	9.95	0.09	3.00	1.00	141.00		SURCHARGED
2	36_West	48.35	0 12:21	126.55	0.38	11.43	0.08	3.00	1.00	142.00		SURCHARGED
3	Culvert_1_CMP_72	368.29	0 13:49	303.28	1.21	13.63	0.14	5.58	0.93	0.00		> CAPACITY
4	Culvert_1_RCP_72	448.17	0 14:09	640.68	0.70	15.85	0.21	6.00	1.00	146.00		SURCHARGED
5	Culvert_2	264.90	0 12:24	508.46	0.52	11.55	0.16	4.54	0.76	0.00		Calculated

Storage Nodes

Storage Node : Culvert_2_Inlet

Input Data

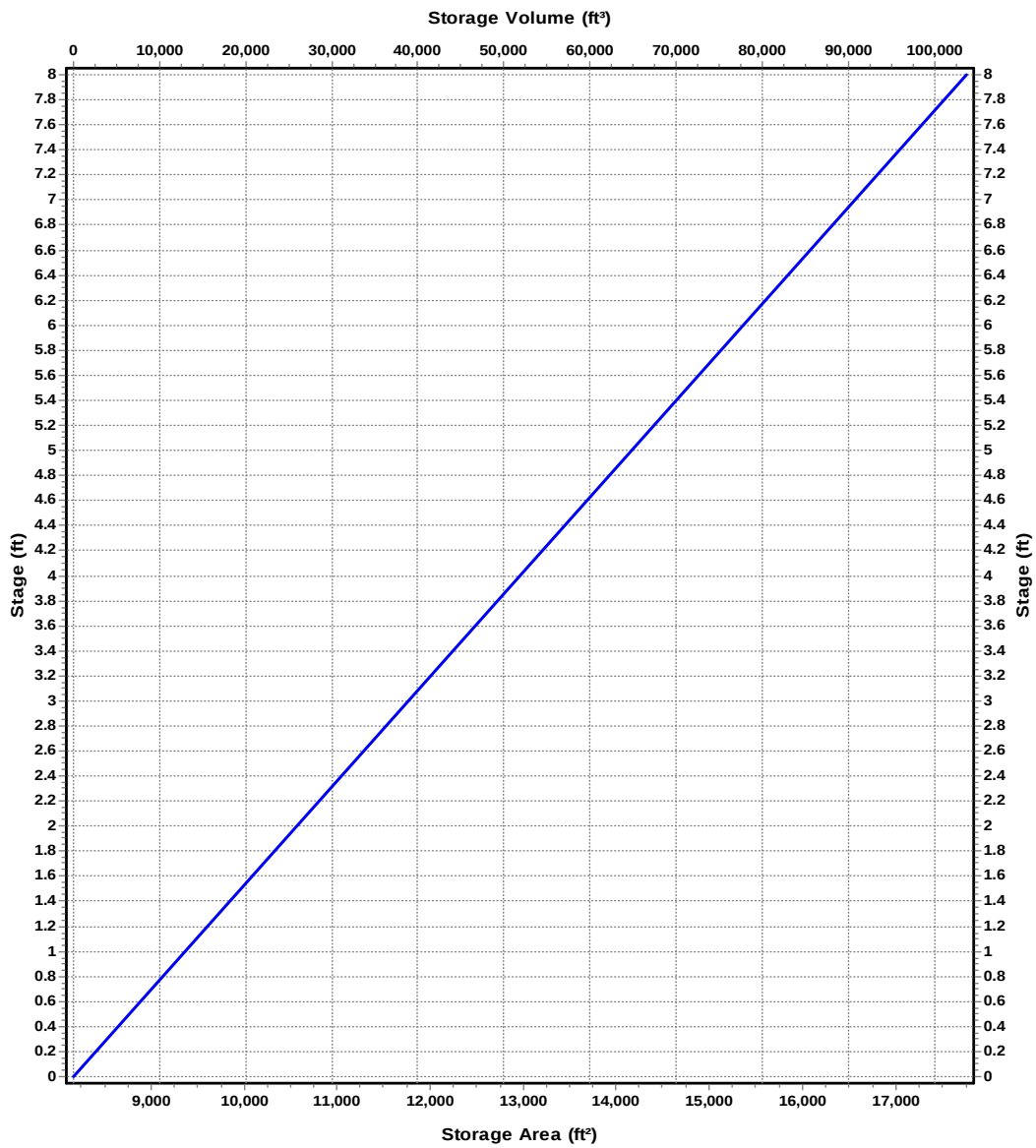
Invert Elevation (ft)	892.00
Max (Rim) Elevation (ft)	900.00
Max (Rim) Offset (ft)	8.00
Initial Water Elevation (ft)	892.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	8168.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Offsite_2

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	8168	0
8	17763	103724

Storage Area Volume Curves



Storage Area Storage Volume

Storage Node : Culvert_2_Inlet (continued)

Output Summary Results

Peak Inflow (cfs)	280.24
Peak Lateral Inflow (cfs)	280.24
Peak Outflow (cfs)	264.9
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	898.32
Max HGL Depth Attained (ft)	6.32
Average HGL Elevation Attained (ft)	892.79
Average HGL Depth Attained (ft)	0.79
Time of Max HGL Occurrence (days hh:mm)	0 12:24
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Infiltration_Basin_1

Input Data

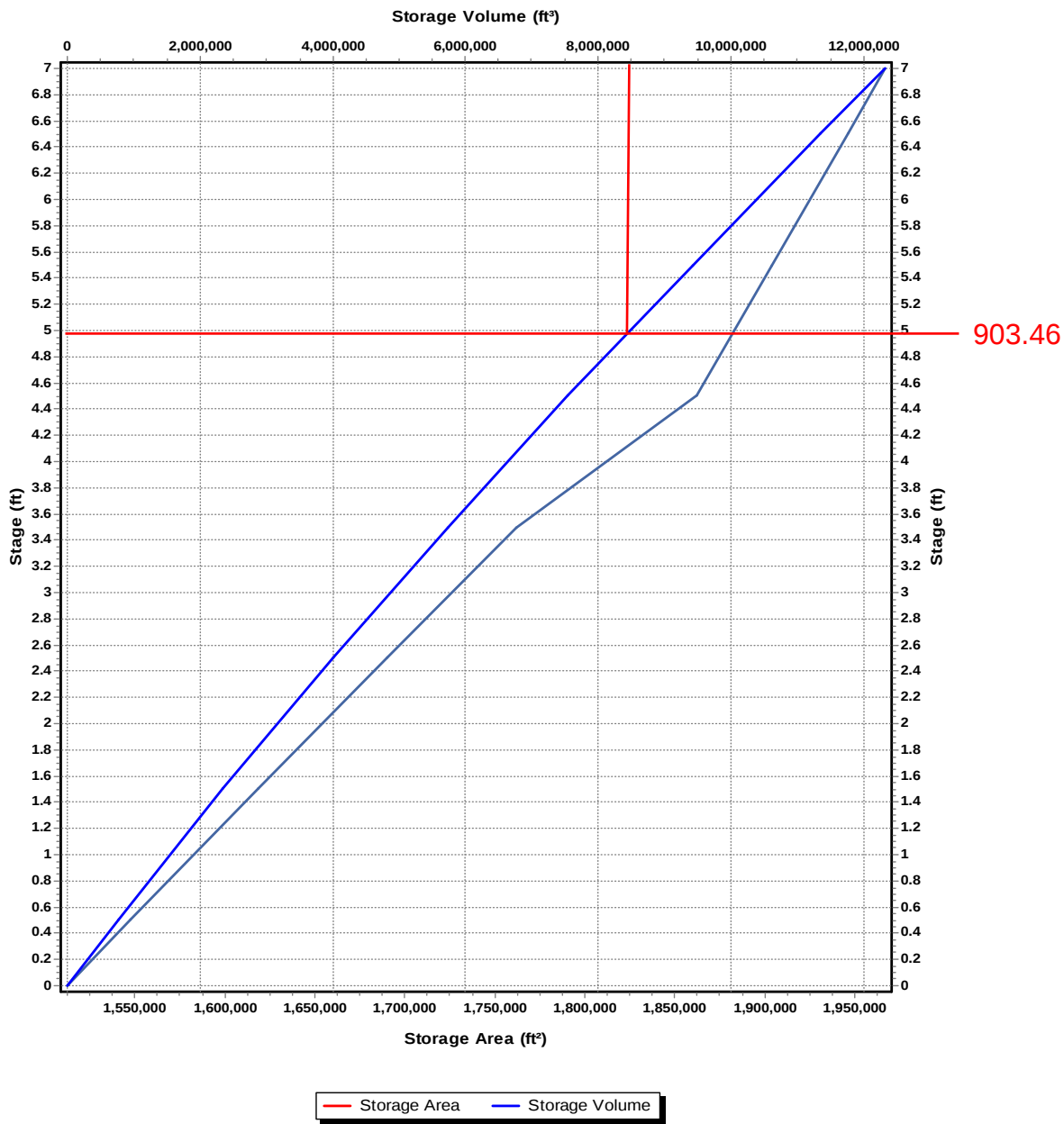
Invert Elevation (ft)	898.50
Max (Rim) Elevation (ft)	905.50
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	898.50
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	1512370.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : SME Pond

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	1512370	0
0.5	1547431	764950.25
1.5	1618709	2348020.25
2.5	1690091	4002420.25
3.5	1761575	5728253.25
4.5	1862035	7540058.25
5.5	1904021	9423086.25
6.5	1946087	11348140.25
7	1966758	12326351.5

Storage Area Volume Curves



Storage Node : Infiltration_Basin_1 (continued)

Outflow Weirs

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 IB_1_Spillway	Trapezoidal	No	903.50	5.00	350.00	2.20	3.40

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 OCS_Weir	Bottom	CIRCULAR	No	120.00			900.80	0.61

Output Summary Results

Peak Inflow (cfs)	3024
Peak Lateral Inflow (cfs)	3024
Peak Outflow (cfs)	453.97
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	903.46
Max HGL Depth Attained (ft)	4.96
Average HGL Elevation Attained (ft)	900.53
Average HGL Depth Attained (ft)	2.03
Time of Max HGL Occurrence (days hh:mm)	0 13:20
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0



Appendix C.

Autodesk Storm and Sanitary Analysis – Stormwater Conveyance

10-year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(inches)	(inches)		(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
1		Link-01	OCS	ST-1	201.00	891.00	3.24	886.40	0.71	4.60	2.2900	CIRCULAR	72.000	72.00	0.0130	104.90	0 14:36	11.50	0.29	640.68	0.16	0.36	0.00	2.15	Calculated
2		Link-02	ST-1	Analysis_Point_1	115.00	886.40	0.71	884.00	0.00	2.40	2.0900	CIRCULAR	72.000	72.00	0.0130	105.19	0 14:36	12.75	0.15	611.81	0.17	0.33	0.00	2.00	Calculated
3	Yes	Link-105	MH-F05-03	MH-F06-01	268.53	910.05	0.00	909.40	0.50	0.65	0.2400	CIRCULAR	36.000	36.00	0.0130	13.31	0 12:05	3.47	1.29	32.82	0.41	0.67	0.00	1.96	Calculated
4	Yes	Link-106	MH-F06-01	MH-F06-02	273.87	908.90	0.00	908.35	0.50	0.55	0.2000	CIRCULAR	42.000	42.00	0.0130	25.61	0 12:06	4.02	1.14	45.09	0.57	0.82	0.00	2.81	Calculated
5	Yes	Link-107	MH-F05-02	MH-F05-01	266.56	910.75	0.00	910.22	0.00	0.53	0.2000	CIRCULAR	42.000	42.00	0.0130	13.75	0 12:05	2.33	1.91	44.86	0.31	0.69	0.00	2.38	Calculated
6	Yes	Link-108	MH-F05-01	CB-F04-03	388.00	910.22	0.00	909.44	0.50	0.78	0.2000	CIRCULAR	48.000	48.00	0.0130	31.52	0 12:06	4.29	1.51	64.40	0.49	0.72	0.00	2.85	Calculated
7		Link-109	CB-G08-01	CB-G08-02	275.86	904.66	0.00	904.38	0.00	0.28	0.1000	CIRCULAR	84.000	84.00	0.0120	97.26	0 12:13	3.55	1.30	220.49	0.44	0.79	0.00	5.52	Calculated
8		Link-110	CB-G07-02	CB-G07-03	275.30	905.21	0.00	904.93	0.00	0.28	0.1000	CIRCULAR	84.000	84.00	0.0120	93.16	0 12:10	3.64	1.26	220.71	0.42	0.76	0.00	5.32	Calculated
9		Link-111	CB-G06-02	CB-G06-03	275.02	907.60	0.00	907.32	0.00	0.28	0.1000	CIRCULAR	72.000	72.00	0.0120	59.07	0 12:10	3.48	1.32	146.39	0.40	0.61	0.00	3.65	Calculated
10		Link-112	CB-G05-02	CB-G05-03	274.46	909.47	0.00	908.92	0.50	0.55	0.2000	CIRCULAR	54.000	54.00	0.0120	18.71	0 12:05	3.63	1.26	95.37	0.20	0.52	0.00	2.33	Calculated
11		Link-113	CB-G05-03	CB-G06-01	275.02	908.42	0.00	907.87	0.00	0.55	0.2000	CIRCULAR	60.000	60.00	0.0120	23.89	0 12:10	2.26	2.03	126.18	0.19	0.67	0.00	3.30	Calculated
12		Link-114	CB-G05-01	CB-F05-25	252.14	911.36	0.00	910.86	0.00	0.50	0.2000	CIRCULAR	30.000	30.00	0.0130	9.01	0 12:14	2.65	1.59	18.27	0.49	0.79	0.00	1.95	Calculated
13		Link-115	CB-F05-25	MH-F05-01	137.38	910.86	0.00	910.59	0.37	0.27	0.2000	CIRCULAR	30.000	30.00	0.0130	10.56	0 12:13	3.12	0.73	18.18	0.58	0.88	0.00	2.18	Calculated
14		Link-116	CB-G04-11	CB-G05-01	287.56	911.93	0.00	911.36	0.00	0.57	0.2000	CIRCULAR	24.000	24.00	0.0130	3.31	0 12:13	1.63	2.94	10.07	0.33	0.78	0.00	1.54	Calculated
15		Link-118	CB-F05-26	MH-F05-03	130.99	911.45	0.00	911.05	1.00	0.40	0.3100	CIRCULAR	24.000	24.00	0.0130	3.53	0 12:10	3.40	0.64	12.50	0.28	0.39	0.00	0.78	Calculated
16		Link-119	CB-F06-27	MH-F06-01	145.71	911.00	0.00	910.50	1.60	0.50	0.3400	CIRCULAR	18.000	18.00	0.0130	3.51	0 12:10	3.55	0.68	6.15	0.57	0.68	0.00	1.01	Calculated
17		Link-120	CB-F07-26	MH-F07-01	86.57	913.50	0.00	912.50	5.75	1.00	1.1600	CIRCULAR	18.000	18.00	0.0150	3.84	0 12:05	4.84	0.30	9.78	0.39	0.46	0.00	0.69	Calculated
18		Link-156	MH-09-02	MH-H09-01	371.00	904.84	0.00	904.10	0.00	0.74	0.2000	Rectangular	84.000	96.00	0.0120	263.38	0 12:19	5.81	1.06	469.53	0.56	0.87	0.00	6.05	Calculated
19		Link-157	MH-09-01	MH-09-02	628.61	905.70	0.00	904.84	0.00	0.86	0.1400	Rectangular	84.000	96.00	0.0120	261.56	0 12:18	5.59	1.87	388.86	0.67	0.86	0.00	6.01	Calculated
20	Yes	Link-161	CB-E05-01	CB-E04-03	200.50	906.67	0.00	906.27	0.00	0.40	0.2000	CIRCULAR	48.000	48.00	0.0130	45.99	0 12:06	4.16	0.80	64.16	0.72	0.88	0.00	3.48	Calculated
21		Link-164	CB-J02-04	CB-J02-03	84.71	907.00	0.00	906.80	0.00	0.20	0.2400	Rectangular	48.000	120.00	0.0120	226.87	0 12:15	5.67	0.25	305.29	0.74	1.00	41.00	4.00	SURCHARGED
22		Link-165	CB-J02-03	CB-J02-01	73.84	906.80	0.00	906.60	0.00	0.20	0.2700	Rectangular	48.000	120.00	0.0120	233.95	0 12:15	5.85	0.21	326.99	0.72	1.00	42.00	4.00	SURCHARGED
23		Link-166	CB-J02-01	MH-J02-01	37.76	906.60	0.00	906.47	0.00	0.13	0.3400	Rectangular	48.000	120.00	0.0120	304.67	0 12:14	7.62	0.08	368.66	0.83	1.00	41.00	4.00	SURCHARGED
24		Link-170	MH-H01-02	MH-H01-01	499.68	905.77	0.00	905.27	0.00	0.50	0.1000	Rectangular	84.000	108.00	0.0120	313.15	0 12:15	6.19	1.35	387.65	0.81	0.80	0.00	5.62	Calculated
25		Link-171	CB-E08-26	CB-E08-04	125.64	911.00	0.00	910.00	8.87	1.00	0.8000	CIRCULAR	18.000	18.00	0.0130	7.50	0 12:05	5.37	0.39	9.37	0.80	0.74	0.00	1.10	Calculated
26		Link-172	CB-E08-17	CB-E08-03	122.47	911.00	0.00	910.00	8.15	1.00	0.8200	CIRCULAR	18.000	18.00	0.0130	6.75	0 12:05	5.36	0.38	9.49	0.71	0.67	0.00	1.00	Calculated
27		Link-173	CB-E08-12	CB-E08-02	122.88	911.00	0.00	910.00	7.75	1.00	0.8100	CIRCULAR	18.000	18.00	0.0130	5.36	0 12:05	5.11	0.40	9.48	0.57	0.57	0.00	0.86	Calculated
28		Link-174	CB-E08-07	CB-E08-01	123.48	911.00	0.00	910.00	7.35	1.00	0.8100	CIRCULAR	18.000	18.00	0.0130	5.71	0 12:05	5.17	0.40	9.45	0.60	0.60	0.00	0.90	Calculated
29		Link-175	CB-E07-25	CB-E07-05	125.16	911.00	0.00	910.00	6.45	1.00	0.8000	CIRCULAR	18.000	18.00	0.0130	9.33	0 00:00	6.02	0.35	9.39	0.99	0.89	0.00	0.95	Calculated
30		Link-176	CB-E07-20	CB-E07-04	126.11	911.00	0.00	910.00	6.05	1.00	0.7900	CIRCULAR	18.000	18.00	0.0150	6.13	0 12:05	4.73	0.44	8.11	0.76	0.69	0.00	1.03	Calculated
31		Link-177	CB-E07-15	CB-E07-03	125.51	911.00	0.00	910.00	5.65	1.00	0.8000	CIRCULAR	18.000	18.00	0.0130	6.04	0 12:05	5.20	0.40	9.38	0.64	0.63	0.00	0.94	Calculated
32		Link-178	CB-E07-10	CB-E07-02	122.66	911.00	0.00	910.00	4.65	1.00	0.8200	CIRCULAR	18.000	18.00	0.0130	6.66	0 12:05	5.34	0.38	9.48	0.70	0.67	0.00	0.99	Calculated
33		Link-180	CB-E06-13	CB-E06-02	122.04	911.00	-3.00	910.00	1.93	1.00	0.8200	CIRCULAR	18.000	18.00	0.0130	4.93	0 12:05	8.47	0.24	19.02	0.26	0.36	0.00	0.55	Calculated
34		Link-181	CB-E06-18	CB-E06-03	122.06	911.00	-1.50	910.00	2.33	1.00	0.8200	CIRCULAR	18.000	18.00	0.0130	6.00	0 12:05	7.42	0.27	15.03	0.40	0.47	0.00	0.70	Calculated
35		Link-182	CB-E06-22	CB-E06-04	125.00	911.00	0.00	910.00	2.73	1.00	0.8000	CIRCULAR	18.000	18.00	0.0130	6.11	0 12:05	5.22	0.40	9.40	0.65	0.63	0.00	0.94	Calculated
36		Link-183	CB-E06-27	CB-E07-01	132.20	911.00	0.00	910.00	4.13	1.00	0.7600	CIRCULAR	18.000	18.00	0.0130	5.98	0 12:05	5.10	0.43	9.14	0.65	0.63	0.00	0.94	Calculated
37		Link-184	CB-E05-24	CB-E05-04	125.20	911.00	-3.00	910.00	1.81	1.00	0.8000	CIRCULAR	18.000	18.00	0.0130	6.55	0 12:05	8.98	0.23	18.78	0.35	0.44	0.00	0.65	Calculated
38		Link-185	CB-E05-18	CB-E05-03	121.75	911.00	-3.00	910.00	2.21	1.00	0.8200	CIRCULAR	18.000	18.00	0.0130	6.74	0 12:05	9.12	0.22	19.04	0.35	0.44	0.00	0.65	Calculated
39		Link-186	CB-E05-13	CB-E05-02	121.67	911.00	-3.00	910.00	2.61	1.00	0.8200	CIRCULAR	24.000	24.00	0.0130	9.88	0 12:05	9.82	0.21	41.02	0.24	0.36	0.00	0.71	Calculated
40		Link-187	CB-E05-05	CB-E05-01	119.37	911.00	-3.00	910.00	3.33	1.00	0.8400	CIRCULAR	18.000	18.00	0.0130	5.52	0 12:05	8.76	0.23	19.23	0.29	0.39	0.00	0.58	Calculated
41		Link-189	CB-E08-21	CB-E08-22	39.88	915.50	0.00	915.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.79	0.24	3.99	0.30	0.54	0.00	0.54	Calculated
42		Link-190	CB-E08-22	CB-E08-23	32.59	915.00	0.00	914.50	0.00	0.50	1.5300	CIRCULAR	12.000	12.00	0.0130	2.24	0 12:05	3.62	0.15	4.41	0.51	0.73	0.00	0.73	Calculated
43		Link-191	CB-E08-23	CB-E08-24	39.88	914.50	0.00	914.00	0.00	0.50	1.2500	CIRCULAR	15.000	15.00	0.0130	3.39	0 12:05	3.65	0.18	7.23	0.47	0.73	0.00	0.91	Calculated
44		Link-192	CB-E08-27	CB-E08-26	39.88	915.50	0.00	915.00	4.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	0.68	0 12:05	3.51	0.19	3.99	0.17	0.30	0.00	0.30	Calculated
45		Link-193	CB-E08-25	CB-E08-26	40.37	913.50	0.00	913.00	2.00	0.50	1.2400	CIRCULAR	15.000	15.00	0.0130	5.65	0 12:05	5.57	0.12	7.19	0.79	0.77	0.00	0.96	Calculated
46		Link-194	CB-E08-24	CB-E08-25	39.40	914.00	0.00	913.50	0.00	0.50	1.2700	CIRCULAR	15.000	15.00	0.0130	4.47	0 12:05	4.05	0.16	7.28	0.61	0.84	0.00	1.05	Calculated
47		Link-195	CB-F08-23	CB-F08-24	40.07	915.50	0.00	915.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0120	1.15	0 12:05	2.61	0.26	4.31	0.27	0.61	0.00	0.60	Calculated
48		Link-196	CB-F08-24	CB-F08-25	40.06																				

10-year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(inches)	(inches)		(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
55		Link-204	CB-F08-21	CB-F08-20	41.49	915.00	0.00	914.50	0.00	0.50	1.2100	CIRCULAR	12.000	12.00	0.0130	2.23	0 12:05	3.29	0.21	3.91	0.57	0.82	0.00	0.82	Calculated
56		Link-205	CB-F08-20	CB-F08-19	38.41	914.50	0.00	914.00	7.00	0.50	1.3000	CIRCULAR	12.000	12.00	0.0130	3.42	0 12:05	5.03	0.13	4.06	0.84	0.82	0.00	0.82	Calculated
57		Link-206	CB-F08-19	MH-F08-03	61.98	911.00	4.00	910.00	6.15	1.00	1.6100	CIRCULAR	18.000	18.00	0.0130	8.26	0 12:05	6.85	0.15	13.34	0.62	0.65	0.00	0.97	Calculated
58		Link-207	CB-F08-18	CB-F08-19	40.46	914.50	0.00	914.00	7.00	0.50	1.2400	CIRCULAR	15.000	15.00	0.0130	3.62	0 12:05	5.09	0.13	7.18	0.50	0.56	0.00	0.70	Calculated
59		Link-208	CB-F08-09	CB-F08-10	40.46	915.50	0.00	915.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.23	0 12:04	2.63	0.26	3.96	0.31	0.62	0.00	0.61	Calculated
60		Link-209	CB-F08-10	CB-F08-11	39.75	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	2.41	0 12:05	3.38	0.20	4.00	0.60	0.91	0.00	0.91	Calculated
61		Link-210	CB-F08-11	CB-F08-12	39.75	914.50	0.00	914.00	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	3.59	0 12:05	5.29	0.13	4.00	0.90	0.84	0.00	0.84	Calculated
62		Link-211	CB-F08-15	CB-F08-14	40.35	915.50	0.00	915.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.61	0.26	3.97	0.30	0.57	0.00	0.57	Calculated
63		Link-212	CB-F08-14	CB-F08-13	40.11	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.44	0 12:05	3.61	0.19	3.98	0.61	0.80	0.00	0.80	Calculated
64		Link-213	CB-F08-13	CB-F08-12	43.98	914.50	0.00	914.00	0.00	0.50	1.1400	CIRCULAR	12.000	12.00	0.0130	3.11	0 12:05	4.80	0.15	3.80	0.82	0.77	0.00	0.77	Calculated
65		Link-214	CB-F08-12	MH-F08-02	61.83	911.00	-3.00	910.00	5.59	1.00	1.6200	CIRCULAR	18.000	18.00	0.0130	7.89	0 12:05	11.51	0.09	26.72	0.30	0.41	0.00	0.62	Calculated
66		Link-215	CB-F07-23	CB-F07-24	40.43	915.50	0.00	915.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.20	0 12:05	2.60	0.26	3.96	0.30	0.79	0.00	0.78	Calculated
67		Link-216	CB-F07-24	CB-F07-25	40.03	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.19	0.21	3.98	0.60	1.00	1.00	1.00	SURCHARGED
68		Link-217	CB-F07-25	CB-F08-05	44.84	914.50	0.00	914.00	5.50	0.50	1.1200	CIRCULAR	12.000	12.00	0.0130	3.69	0 12:05	4.95	0.15	3.76	0.98	0.90	0.00	0.90	Calculated
69		Link-218	CB-F08-05	MH-F08-01	61.33	911.00	2.50	910.00	5.04	1.00	1.6300	CIRCULAR	18.000	18.00	0.0130	8.50	0 12:05	6.90	0.15	13.41	0.63	0.66	0.00	0.98	Calculated
70		Link-219	CB-F08-08	CB-F08-07	40.83	915.50	0.00	915.00	0.00	0.50	1.2200	CIRCULAR	12.000	12.00	0.0130	1.22	0 12:05	2.64	0.26	3.94	0.31	0.67	0.00	0.66	Calculated
71		Link-220	CB-F08-07	CB-F08-06	38.43	915.00	0.00	914.50	0.00	0.50	1.3000	CIRCULAR	12.000	12.00	0.0130	2.42	0 12:05	3.35	0.19	4.06	0.60	0.94	0.00	0.94	Calculated
72		Link-221	CB-F08-06	CB-F08-05	40.48	914.50	0.00	914.00	5.50	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	3.61	0 12:05	4.95	0.14	3.96	0.91	0.88	0.00	0.87	Calculated
73		Link-222	CB-F07-16	CB-F07-17	40.24	915.50	0.00	915.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.19	0 12:05	2.61	0.26	3.97	0.30	0.68	0.00	0.67	Calculated
74		Link-223	CB-F07-17	CB-F07-18	39.63	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.29	0.20	4.00	0.60	0.95	0.00	0.95	Calculated
75		Link-224	CB-F07-18	CB-F07-19	44.44	914.50	0.00	914.00	0.00	0.50	1.1300	CIRCULAR	12.000	12.00	0.0130	3.58	0 12:05	5.01	0.15	3.78	0.95	0.86	0.00	0.86	Calculated
76		Link-225	CB-F07-22	CB-F07-21	39.93	915.50	0.00	915.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.20	0 12:05	2.62	0.25	3.99	0.30	0.64	0.00	0.63	Calculated
77		Link-226	CB-F07-21	CB-F07-20	39.64	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.34	0.20	4.00	0.60	0.93	0.00	0.92	Calculated
78		Link-227	CB-F07-20	CB-F07-19	40.24	914.50	0.00	914.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	3.58	0 12:05	5.07	0.13	3.97	0.90	0.86	0.00	0.86	Calculated
79		Link-228	CB-F07-19	MH-F07-03	63.62	911.00	-3.00	910.00	4.49	1.00	1.5700	CIRCULAR	18.000	18.00	0.0130	8.49	0 12:05	11.60	0.09	26.34	0.32	0.43	0.00	0.65	Calculated
80		Link-229	CB-F07-09	CB-F07-10	40.44	915.50	0.00	915.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.03	0 12:05	2.49	0.27	3.96	0.26	0.53	0.00	0.53	Calculated
81		Link-230	CB-F07-10	CB-F07-11	39.63	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	2.23	0 12:05	3.28	0.20	4.00	0.56	0.84	0.00	0.83	Calculated
82		Link-231	CB-F07-11	CB-F07-12	40.04	914.50	0.00	914.00	5.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	3.42	0 12:05	4.94	0.14	3.98	0.86	0.84	0.00	0.84	Calculated
83		Link-232	CB-F07-15	CB-F07-14	40.44	915.50	0.00	915.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.60	0.26	3.96	0.30	0.59	0.00	0.58	Calculated
84		Link-233	CB-F07-14	CB-F07-13	40.04	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.43	0 12:05	3.43	0.19	3.98	0.61	0.86	0.00	0.85	Calculated
85		Link-234	CB-F07-13	CB-F07-12	40.04	914.50	0.00	914.00	5.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0120	3.61	0 12:05	5.26	0.13	4.31	0.84	0.83	0.00	0.82	Calculated
86		Link-235	CB-F07-12	MH-F07-02	66.47	911.00	2.00	910.00	3.94	1.00	1.5000	CIRCULAR	18.000	18.00	0.0130	8.25	0 12:05	6.71	0.17	12.88	0.64	0.66	0.00	0.98	Calculated
87		Link-236	CB-F06-25	CB-F06-26	39.94	915.50	0.00	915.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:04	2.61	0.26	3.99	0.30	0.61	0.00	0.60	Calculated
88		Link-237	CB-F06-26	CB-F07-04	40.24	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	2.38	0 12:05	3.38	0.20	3.97	0.60	0.91	0.00	0.90	Calculated
89		Link-238	CB-F07-04	CB-F07-05	39.64	914.50	0.00	914.00	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	3.60	0 12:06	5.37	0.12	4.00	0.90	0.84	0.00	0.84	Calculated
90		Link-239	CB-F07-05	MH-F07-01	61.83	911.00	-3.00	910.00	3.25	1.00	1.6200	CIRCULAR	18.000	18.00	0.0130	7.96	0 12:05	11.53	0.09	26.72	0.30	0.45	0.00	0.63	Calculated
91		Link-240	CB-F07-08	CB-F07-07	27.95	915.50	0.00	915.00	0.00	0.50	1.7900	CIRCULAR	12.000	12.00	0.0130	0.86	0 12:05	2.41	0.19	4.77	0.18	0.47	0.00	0.47	Calculated
92		Link-241	CB-F07-07	CB-F07-06	44.12	915.00	0.00	914.50	0.00	0.50	1.1300	CIRCULAR	12.000	12.00	0.0130	2.01	0 12:05	3.16	0.23	3.79	0.53	0.76	0.00	0.76	Calculated
93		Link-242	CB-F07-06	CB-F07-05	40.24	914.50	0.00	914.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	3.21	0 12:05	5.00	0.13	3.97	0.81	0.77	0.00	0.77	Calculated
94		Link-243	CB-F06-18	CB-F06-19	40.05	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.61	0.26	3.98	0.30	0.57	0.00	0.57	Calculated
95		Link-244	CB-F06-19	CB-F06-20	40.05	914.50	0.00	914.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.44	0 12:05	3.77	0.18	3.98	0.61	0.77	0.00	0.77	Calculated
96		Link-245	CB-F06-20	CB-F06-21	44.05	914.00	0.00	913.50	0.00	0.50	1.1400	CIRCULAR	15.000	15.00	0.0130	3.65	0 12:05	4.74	0.15	6.88	0.53	0.61	0.00	0.76	Calculated
97		Link-246	CB-F06-21	CB-F06-22	40.45	913.50	0.00	914.00	0.00	-0.50	-1.2400	CIRCULAR	18.000	18.00	0.0130	3.62	0 12:05	4.42	0.15	11.68	0.31	0.48	0.00	0.72	Calculated
98		Link-247	CB-F06-24	CB-F06-23	40.45	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.65	0.25	3.96	0.31	0.56	0.00	0.56	Calculated
99		Link-248	CB-F06-23	CB-F06-22	39.65	914.50	0.00	914.00	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	2.41	0 12:05	4.00	0.17	4.00	0.60	0.72	0.00	0.72	Calculated
100		Link-249	CB-F06-21	MH-F06-03	63.11	911.00	-2.50	910.00	2.70	1.00	1.5800	CIRCULAR	18.000	18.00	0.0130	8.61	0 12:05	10.98	0.10	24.74	0.35	0.56	0.00	0.79	Calculated
101		Link-250	CB-F05-04	CB-F05-05	39.52	917.00	0.00	916.50	0.00	0.50	1.2700	CIRCULAR	12.000	12.00	0.0130	0.68	0 12:05	2.04	0.32	4.01	0.17	0.44	0.00	0.44	Calculated
102		Link-251	CB-F05-05	CB-F05-06	40.05	916.50	0.00	916.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.											

10-year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(inches)	(inches)		(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
109		Link-258	CB-F05-12	CB-F05-13	32.57	916.00	0.00	915.50	0.00	0.50	1.5400	CIRCULAR	12.000	12.00	0.0130	2.38	0 12:05	3.48	0.16	4.41	0.54	0.84	0.00	0.83	Calculated
110		Link-259	CB-F05-13	CB-F05-14	40.05	915.50	0.00	915.00	1.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	3.40	0 12:05	4.94	0.14	3.98	0.85	0.83	0.00	0.83	Calculated
111		Link-260	CB-F05-17	CB-F05-16	40.05	916.50	0.00	916.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.20	0 12:05	2.60	0.26	3.98	0.30	0.66	0.00	0.65	Calculated
112		Link-261	CB-F05-16	CB-F05-15	40.05	916.00	0.00	915.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.42	0 12:05	3.35	0.20	3.98	0.61	0.94	0.00	0.94	Calculated
113		Link-262	CB-F05-15	CB-F05-14	39.52	915.50	0.00	915.00	1.00	0.50	1.2700	CIRCULAR	12.000	12.00	0.0130	3.61	0 12:05	4.98	0.13	4.01	0.90	0.87	0.00	0.87	Calculated
114		Link-263	CB-F05-14	MH-F05-02	61.14	914.00	0.00	912.25	1.50	1.75	2.8600	CIRCULAR	24.000	24.00	0.0130	8.20	0 12:05	8.37	0.12	38.27	0.21	0.35	0.00	0.70	Calculated
115		Link-264	CB-F05-21	MH-F05-03	60.92	911.00	-3.00	910.00	-0.05	1.00	1.6400	CIRCULAR	18.000	18.00	0.0130	8.43	0 12:05	6.25	0.16	26.75	0.32	0.71	0.00	1.07	Calculated
116		Link-265	CB-F05-18	CB-F05-19	40.58	915.50	0.00	915.00	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.61	0.26	3.95	0.31	0.58	0.00	0.58	Calculated
117		Link-266	CB-F05-19	CB-F05-20	39.52	915.00	0.00	914.50	0.00	0.50	1.2700	CIRCULAR	12.000	12.00	0.0130	2.40	0 12:05	3.38	0.19	4.01	0.60	0.86	0.00	0.86	Calculated
118		Link-267	CB-F05-20	CB-F05-21	40.05	914.50	0.00	914.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	3.60	0 12:05	5.40	0.12	3.98	0.90	0.80	0.00	0.80	Calculated
119		Link-268	CB-F06-04	CB-F05-24	28.84	916.00	0.00	915.50	0.00	0.50	1.7300	CIRCULAR	12.000	12.00	0.0130	0.78	0 12:05	2.45	0.20	4.69	0.17	0.43	0.00	0.43	Calculated
120		Link-269	CB-F05-24	CB-F05-23	38.45	915.50	0.00	915.00	0.00	0.50	1.3000	CIRCULAR	12.000	12.00	0.0130	1.81	0 12:05	3.06	0.21	4.06	0.45	0.72	0.00	0.72	Calculated
121		Link-270	CB-F05-23	CB-F05-22	32.57	915.00	0.00	914.50	0.00	0.50	1.5400	CIRCULAR	12.000	12.00	0.0130	2.96	0 12:05	3.98	0.14	4.41	0.67	0.90	0.00	0.90	Calculated
122		Link-271	CB-F05-22	CB-F05-21	28.31	914.50	0.00	914.00	0.00	0.50	1.7700	CIRCULAR	12.000	12.00	0.0130	3.81	0 12:05	5.78	0.08	4.73	0.80	0.79	0.00	0.79	Calculated
123		Link-272	CB-F06-07	MH-F06-01	70.45	911.00	0.50	910.00	1.10	1.00	1.4200	CIRCULAR	18.000	18.00	0.0130	8.58	0 12:05	6.45	0.18	12.51	0.69	0.91	0.00	1.31	Calculated
124		Link-273	CB-F06-05	CB-F06-06	40.05	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.73	0.24	3.98	0.30	0.55	0.00	0.55	Calculated
125		Link-274	CB-F06-06	CB-F06-07	40.05	914.50	0.00	914.00	3.50	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.41	0 12:05	4.69	0.14	3.98	0.61	0.62	0.00	0.62	Calculated
126		Link-275	CB-F06-11	CB-F06-10	43.26	916.00	0.00	915.50	0.00	0.50	1.1600	CIRCULAR	12.000	12.00	0.0130	1.34	0 12:05	2.69	0.27	3.83	0.35	0.61	0.00	0.60	Calculated
127		Link-276	CB-F06-10	CB-F06-09	40.58	915.50	0.00	915.00	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	2.56	0 12:05	4.01	0.17	3.95	0.65	0.76	0.00	0.76	Calculated
128		Link-277	CB-F06-09	CB-F06-08	39.52	915.00	0.00	914.50	0.00	0.50	1.2700	CIRCULAR	18.000	18.00	0.0130	3.79	0 12:05	3.89	0.17	11.82	0.32	0.54	0.00	0.81	Calculated
129		Link-278	CB-F06-08	CB-F06-07	40.05	914.50	0.00	914.00	3.50	0.50	1.2500	CIRCULAR	18.000	18.00	0.0130	4.99	0 12:05	5.45	0.12	11.74	0.43	0.51	0.00	0.77	Calculated
130		Link-279	CB-F06-14	MH-F06-02	65.23	911.00	0.50	910.00	2.15	1.00	1.5300	CIRCULAR	18.000	18.00	0.0130	7.24	0 12:05	6.52	0.17	13.01	0.56	0.76	0.00	1.05	Calculated
131		Link-280	CB-F06-12	CB-F06-13	40.05	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.23	0 12:05	2.73	0.24	3.98	0.31	0.56	0.00	0.56	Calculated
132		Link-281	CB-F06-13	CB-F06-14	40.59	914.50	0.00	914.00	3.50	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	2.46	0 12:05	4.69	0.14	3.95	0.62	0.63	0.00	0.63	Calculated
133		Link-282	CB-F06-17	CB-F06-16	40.05	915.50	0.00	915.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.20	0 12:05	2.61	0.26	3.98	0.30	0.63	0.00	0.63	Calculated
134		Link-283	CB-F06-16	CB-F06-15	40.05	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.35	0.20	3.98	0.60	0.92	0.00	0.92	Calculated
135		Link-284	CB-F06-15	CB-F06-14	38.98	914.50	0.00	914.00	3.50	0.50	1.2800	CIRCULAR	12.000	12.00	0.0130	3.58	0 12:05	5.00	0.13	4.04	0.89	0.87	0.00	0.87	Calculated
136		Link-286	CB-E08-20	CB-E08-19	41.10	915.50	0.00	915.00	0.00	0.50	1.2200	CIRCULAR	12.000	12.00	0.0130	1.20	0 12:05	2.61	0.26	3.93	0.30	0.66	0.00	0.66	Calculated
137		Link-287	CB-E08-19	CB-E08-18	39.49	915.00	0.00	914.50	0.00	0.50	1.2700	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.32	0.20	4.01	0.60	0.94	0.00	0.94	Calculated
138		Link-288	CB-E08-15	CB-E08-16	40.20	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.07	0 12:05	2.70	0.25	3.97	0.27	0.50	0.00	0.50	Calculated
139		Link-289	CB-E08-16	CB-E08-17	39.88	914.50	0.00	914.00	3.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.11	0 12:05	4.57	0.15	3.99	0.53	0.57	0.00	0.57	Calculated
140		Link-290	CB-E08-18	CB-E08-17	40.34	914.50	0.00	914.00	3.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	3.61	0 12:05	4.95	0.14	3.97	0.91	0.87	0.00	0.87	Calculated
141		Link-291	CB-E08-10	CB-E08-11	40.52	915.00	0.00	914.50	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	1.07	0 12:05	2.70	0.25	3.96	0.27	0.50	0.00	0.50	Calculated
142		Link-292	CB-E08-11	CB-E08-12	40.10	914.50	0.00	914.00	3.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.11	0 12:05	4.56	0.15	3.98	0.53	0.57	0.00	0.57	Calculated
143		Link-293	CB-E08-13	CB-E08-12	44.01	914.50	0.00	914.00	3.00	0.50	1.1400	CIRCULAR	12.000	12.00	0.0130	2.22	0 12:05	4.49	0.16	3.80	0.59	0.60	0.00	0.60	Calculated
144		Link-294	CB-E08-14	CB-E08-13	39.74	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	1.05	0 12:05	2.58	0.26	4.00	0.26	0.51	0.00	0.51	Calculated
145		Link-295	CB-E08-05	CB-E08-06	40.21	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.73	0.25	3.97	0.30	0.55	0.00	0.55	Calculated
146		Link-296	CB-E08-06	CB-E08-07	40.35	914.50	0.00	914.00	3.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	2.41	0 12:05	4.68	0.14	3.97	0.61	0.62	0.00	0.62	Calculated
147		Link-299	CB-E08-09	CB-E08-08	39.77	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	1.07	0 12:05	2.71	0.24	3.99	0.27	0.50	0.00	0.50	Calculated
148		Link-300	CB-E08-08	CB-E08-07	39.19	914.50	0.00	914.00	3.00	0.50	1.2800	CIRCULAR	12.000	12.00	0.0130	2.11	0 12:05	4.59	0.14	4.02	0.52	0.57	0.00	0.57	Calculated
149		Link-301	CB-E07-23	CB-E07-24	39.78	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	1.23	0 12:05	2.75	0.24	3.99	0.31	0.56	0.00	0.56	Calculated
150		Link-302	CB-E07-24	CB-E07-25	39.93	914.50	0.00	914.00	3.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.44	0 12:05	4.71	0.14	3.99	0.61	0.63	0.00	0.63	Calculated
151		Link-303	CB-E07-27	CB-E07-26	40.20	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.34	0 12:05	2.83	0.24	3.97	0.34	0.58	0.00	0.58	Calculated
152		Link-304	CB-E07-26	CB-E07-25	40.04	914.50	0.00	914.00	3.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.54	0 12:05	4.74	0.14	3.98	0.64	0.65	0.00	0.64	Calculated
153		Link-305	CB-E07-18	CB-E07-19	40.21	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.73	0.25	3.97	0.30	0.55	0.00	0.55	Calculated
154		Link-306	CB-E07-19	CB-E07-20	39.94	914.50	0.00	914.00	3.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.41	0 12:05	4.70	0.14	3.99	0.61	0.62	0.00	0.62	Calculated
155		Link-307	CB-E07-22	CB-E07-21	39.77	915.00	0.00	914.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.62	0.25	3.99	0.30	0.57	0.00	0.57	Calculated
156		Link-308	CB-E07-21	CB-E07-20	44.36	914.50	0.00	914.00	3.00	0.50															

10-year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(inches)	(inches)		(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
163		Link-315	CB-E07-12	CB-E07-11	40.63	915.00	0.00	914.50	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.94	0.23	3.95	0.31	0.52	0.00	0.52	Calculated
164		Link-316	CB-E07-11	CB-E07-10	26.62	914.50	0.00	914.00	3.00	0.50	1.8800	CIRCULAR	12.000	12.00	0.0130	2.24	0 12:05	5.17	0.09	4.88	0.46	0.54	0.00	0.54	Calculated
165		Link-317	CB-E07-09	CB-E07-10	32.60	914.50	0.00	914.00	3.00	0.50	1.5300	CIRCULAR	12.000	12.00	0.0130	3.59	0 12:05	5.33	0.10	4.41	0.81	0.80	0.00	0.80	Calculated
166		Link-318	CB-E06-24	CB-E06-25	39.77	915.50	0.00	915.00	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	1.20	0 12:05	2.61	0.25	3.99	0.30	0.65	0.00	0.65	Calculated
167		Link-319	CB-E06-25	CB-E06-26	40.20	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.33	0.20	3.97	0.60	0.94	0.00	0.93	Calculated
168		Link-320	CB-E06-26	CB-E06-27	40.39	914.50	0.00	914.00	3.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	3.58	0 12:05	4.93	0.14	3.96	0.90	0.87	0.00	0.87	Calculated
169		Link-321	CB-E07-06	CB-E06-27	39.58	914.50	0.00	914.00	3.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	4.04	0.16	4.00	0.30	0.41	0.00	0.41	Calculated
170		Link-322	CB-E06-19	CB-E06-20	40.20	915.50	0.00	915.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.22	0 12:05	2.65	0.25	3.97	0.31	0.65	0.00	0.65	Calculated
171		Link-323	CB-E06-20	CB-E06-21	39.92	915.00	0.00	914.50	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.33	0.20	3.99	0.60	0.93	0.00	0.93	Calculated
172		Link-324	CB-E06-21	CB-E06-22	40.25	914.50	0.00	914.00	3.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	3.58	0 12:05	4.94	0.14	3.97	0.90	0.87	0.00	0.87	Calculated
173		Link-325	CB-E06-23	CB-E06-22	43.03	914.50	0.00	914.00	3.00	0.50	1.1600	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	3.94	0.18	3.84	0.31	0.41	0.00	0.41	Calculated
174		Link-326	CB-E06-15	CB-E06-16	39.77	915.50	0.00	915.00	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	2.39	0 12:05	3.15	0.21	3.99	0.60	0.98	0.00	0.98	Calculated
175		Link-327	CB-E06-14	CB-E06-15	39.77	916.00	0.00	915.50	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	1.19	0 12:05	2.61	0.25	3.99	0.30	0.74	0.00	0.73	Calculated
176		Link-328	CB-E06-16	CB-E06-17	40.40	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	3.60	0 12:05	4.61	0.15	3.96	0.91	0.97	0.00	0.97	Calculated
177		Link-329	CB-E06-17	CB-E06-18	40.00	914.50	0.00	914.00	1.50	0.50	1.2500	CIRCULAR	15.000	15.00	0.0130	4.80	0 12:05	5.42	0.12	7.22	0.66	0.68	0.00	0.85	Calculated
178		Link-330	CB-E06-09	CB-E06-10	40.63	916.00	0.00	915.50	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.62	0.26	3.95	0.31	0.58	0.00	0.58	Calculated
179		Link-331	CB-E06-10	CB-E06-11	39.99	915.50	0.00	915.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	2.41	0 12:05	3.49	0.19	3.98	0.60	0.83	0.00	0.83	Calculated
180		Link-332	CB-E06-12	CB-E06-13	40.20	914.50	0.00	914.00	0.00	0.50	1.2400	CIRCULAR	15.000	15.00	0.0130	4.33	0 12:05	5.92	0.11	7.20	0.60	0.58	0.00	0.72	Calculated
181		Link-333	CB-E06-11	CB-E06-12	43.89	915.00	0.00	914.50	0.00	0.50	1.1400	CIRCULAR	12.000	12.00	0.0130	3.01	0 12:05	4.07	0.18	3.80	0.79	0.89	0.00	0.89	Calculated
182		Link-334	CB-E05-23	CB-E05-24	40.78	914.50	0.00	914.00	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	1.14	0 12:05	2.64	0.26	3.95	0.29	0.54	0.00	0.54	Calculated
183		Link-335	CB-E06-08	CB-E06-07	40.20	916.00	0.00	915.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.23	0 12:05	2.63	0.25	3.97	0.31	0.60	0.00	0.60	Calculated
184		Link-336	CB-E06-07	CB-E06-06	39.77	915.50	0.00	915.00	0.00	0.50	1.2600	CIRCULAR	12.000	12.00	0.0130	2.42	0 12:05	3.39	0.20	3.99	0.61	0.89	0.00	0.89	Calculated
185		Link-337	CB-E06-06	CB-E06-05	31.99	915.00	0.00	914.50	0.00	0.50	1.5600	CIRCULAR	12.000	12.00	0.0130	3.49	0 12:05	4.63	0.12	4.45	0.78	0.92	0.00	0.92	Calculated
186		Link-338	CB-E06-05	CB-E05-24	27.52	914.50	0.00	914.00	0.00	0.50	1.8200	CIRCULAR	15.000	15.00	0.0130	4.39	0 12:05	5.62	0.08	8.71	0.50	0.61	0.00	0.76	Calculated
187		Link-339	CB-E05-17	CB-E05-18	40.27	914.50	0.00	914.00	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.71	0.25	3.97	0.30	0.55	0.00	0.55	Calculated
188		Link-340	CB-E05-19	CB-E05-18	39.34	914.50	0.00	914.00	0.00	0.50	1.2700	CIRCULAR	15.000	15.00	0.0130	4.31	0 12:05	5.34	0.12	7.28	0.59	0.63	0.00	0.78	Calculated
189		Link-341	CB-E05-20	CB-E05-19	40.63	915.00	0.00	914.50	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	3.08	0 12:05	4.15	0.16	3.95	0.78	0.90	0.00	0.90	Calculated
190		Link-342	CB-E05-21	CB-E05-20	39.14	915.50	0.00	915.00	0.00	0.50	1.2800	CIRCULAR	12.000	12.00	0.0130	1.88	0 12:05	2.99	0.22	4.03	0.47	0.77	0.00	0.77	Calculated
191		Link-343	CB-E05-22	CB-E05-21	28.39	916.00	0.00	915.50	0.00	0.50	1.7600	CIRCULAR	12.000	12.00	0.0130	0.86	0 12:05	2.52	0.19	4.73	0.18	0.45	0.00	0.45	Calculated
192		Link-344	CB-E05-12	CB-E05-13	28.10	914.50	0.00	914.00	0.00	0.50	1.7800	CIRCULAR	18.000	18.00	0.0130	5.24	0 12:05	5.37	0.09	14.01	0.37	0.54	0.00	0.81	Calculated
193		Link-345	CB-E05-14	CB-E05-13	40.20	914.50	0.00	914.00	0.00	0.50	1.2400	CIRCULAR	15.000	15.00	0.0130	3.62	0 12:05	4.49	0.15	7.20	0.50	0.62	0.00	0.78	Calculated
194		Link-346	CB-E05-15	CB-E05-14	40.21	915.00	0.00	914.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	2.41	0 12:05	3.75	0.18	3.97	0.61	0.76	0.00	0.76	Calculated
195		Link-347	CB-E05-16	CB-E05-15	40.00	915.50	0.00	915.00	0.00	0.50	1.2500	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	2.63	0.25	3.98	0.30	0.57	0.00	0.57	Calculated
196		Link-348	CB-E05-08	CB-E05-07	40.20	916.00	0.00	915.50	0.00	0.50	1.2400	CIRCULAR	12.000	12.00	0.0130	1.21	0 12:05	3.08	0.22	3.97	0.30	0.50	0.00	0.50	Calculated
197		Link-349	CB-E05-09	CB-E05-10	53.17	916.00	0.00	915.50	0.00	0.50	0.9400	CIRCULAR	12.000	12.00	0.0130	1.49	0 12:05	2.62	0.34	3.45	0.43	0.70	0.00	0.70	Calculated
198		Link-350	CB-E05-10	CB-E05-11	40.74	915.50	0.00	915.00	0.00	0.50	1.2300	CIRCULAR	12.000	12.00	0.0130	2.86	0 12:05	3.89	0.17	3.95	0.72	0.89	0.00	0.88	Calculated
199		Link-351	CB-E05-25	CB-E05-05	39.77	914.50	0.00	914.00	0.00	0.50	1.2600	CIRCULAR	18.000	18.00	0.0130	4.90	0 12:05	5.78	0.11	11.78	0.42	0.48	0.00	0.72	Calculated
200		Link-352	CB-E05-06	CB-E05-25	40.91	915.00	0.00	914.50	0.00	0.50	1.2200	CIRCULAR	18.000	18.00	0.0130	3.64	0 12:05	3.85	0.18	11.61	0.31	0.53	0.00	0.79	Calculated
201		Link-353	CB-E05-07	CB-E05-06	39.09	915.50	0.00	915.00	0.00	0.50	1.2800	CIRCULAR	18.000	18.00	0.0130	2.44	0 12:05	3.30	0.20	11.88	0.21	0.44	0.00	0.65	Calculated
202	Yes	Link-365	MH-E09-04	NULL-545	144.82	900.33	0.00	900.20	0.00	0.13	0.0900	Rectangular	84.000	216.00	0.0120	650.40	0 12:16	6.19	0.39	865.70	0.75	0.83	0.00	5.82	Calculated
203		Link-366	CB-E09-07	MH-E09-04	142.59	901.50	0.00	900.77	0.44	0.73	0.5100	CIRCULAR	36.000	36.00	0.0120	10.74	0 12:10	1.60	1.49	51.70	0.21	1.00	41.00	3.00	SURCHARGED
204		Link-369	Jun-380	Jun-379	113.18	917.25	0.00	917.00	0.00	0.25	0.2200	CIRCULAR	36.000	36.00	0.0130	30.33	0 12:17	5.33	0.35	31.35	0.97	0.77	0.00	2.30	Calculated
205		Link-378	CB-F01-02	MH-F01-01	40.79	909.00	0.00	908.50	3.94	0.50	1.2300	CIRCULAR	24.000	24.00	0.0130	7.86	0 12:07	5.91	0.12	25.05	0.31	0.63	0.00	1.26	Calculated
206		Link-394	Jun-405	Jun-406	85.89	917.90	0.00	917.66	-0.02	0.24	0.2800	CIRCULAR	24.000	24.00	0.0130	5.43	0 12:05	2.17	0.66	11.45	0.47	1.00	2.00	2.00	SURCHARGED
207		Link-411	CB-G10-04	CB-G09-02	815.12	904.50	0.00	903.93	1.01	0.57	0.0700	CIRCULAR	72.000	72.00	0.0130	102.75	0 12:10	5.39	2.52	111.99	0.92	0.84	0.00	5.06	Calculated
208	Yes	Link-418	MH-E02-01	MH-D02-03	235.58	903.63	0.00	903.39	0.00	0.24	0.1000	Rectangular	84.000	216.00	0.0120	502.57	0 12:16	5.78	0.68	922.24	0.54	0.69	0.00	4.82	Calculated
209		Link-419	MH-G04-01	MH-G03-02	388.33	909.70	0.00	909.30	1.00	0.40	0.1000	CIRCULAR	36.000	36.00	0.0130	15.52	0 12:06	3.66	1.77	21.41	0.72	0.59	0.00	1.73	Calculated
210		Link-420	MH-G03-02	MH-G03-01	386.98	908.30	0.00																		

10-year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(inches)	(inches)		(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
217		Link-432	CB-E05-11	CB-E05-12	43.55	915.00	0.00	914.50	0.00	0.50	1.1500	CIRCULAR	15.000	15.00	0.0130	4.09	0 12:05	4.40	0.16	6.92	0.59	0.71	0.00	0.88	Calculated
218	Yes	Link-433	MH-F02-02	MH-F02-01	348.95	905.43	0.00	905.08	0.00	0.35	0.1000	CIRCULAR	84.000	84.00	0.0120	126.71	0 12:10	4.36	1.33	219.18	0.58	0.74	0.00	5.19	Calculated
219		Link-439	CB-F09-06	MH-F09-02	38.26	903.00	0.00	902.29	0.00	0.71	1.8600	CIRCULAR	48.000	48.00	0.0130	28.24	0 12:10	2.37	0.27	195.68	0.14	1.00	27.00	4.00	SURCHARGED
220		Link-440	HW-D03-01	CB-D03-02	74.00	915.00	0.00	911.50	1.00	3.50	4.7300	CIRCULAR	18.000	18.00	0.0130	3.63	0 12:16	8.73	0.14	22.84	0.16	0.53	0.00	0.49	Calculated
221		Link-441	HW-D07-01	CB-D07-02	74.46	916.20	0.20	913.50	0.50	2.70	3.6300	CIRCULAR	12.000	12.00	0.0130	0.50	0 12:12	4.66	0.27	6.78	0.07	0.27	0.00	0.27	Calculated
222		Link-442	MH-J07-01	MH-J08.01	395.99	908.07	0.00	907.28	0.00	0.79	0.2000	CIRCULAR	84.000	84.00	0.0130	228.77	0 12:17	6.11	1.08	285.34	0.80	0.95	0.00	6.60	Calculated
223		Link-443	MH-J08.01	MH-J08-02	327.82	907.28	0.00	906.63	0.00	0.65	0.2000	CIRCULAR	84.000	84.00	0.0130	249.89	0 12:15	7.21	0.76	284.46	0.88	0.89	0.00	6.14	Calculated
224		Link-444	MH-J08-02	MH-09-01	454.72	906.63	0.00	905.70	0.00	0.93	0.2000	Rectangular	84.000	96.00	0.0130	263.18	0 12:16	5.97	1.27	438.88	0.60	0.85	0.00	5.91	Calculated
225		Link-445	MH-H09-01	MH-G09-01	371.00	904.10	0.00	903.36	0.00	0.74	0.2000	Rectangular	84.000	96.00	0.0120	289.69	0 12:18	6.46	0.96	469.53	0.62	0.88	0.00	6.07	Calculated
226	Yes	Link-446	MH-G09-01	CB-G09-02	211.28	903.36	0.00	902.92	0.00	0.44	0.2100	Rectangular	84.000	180.00	0.0130	418.59	0 12:18	4.75	0.74	978.11	0.43	0.87	0.00	6.08	Calculated
227		Link-447	CB-E09-02	MH-E09-05	136.06	910.00	0.00	909.00	8.55	1.00	0.7300	CIRCULAR	18.000	18.00	0.0130	4.58	0 12:10	4.78	0.47	9.01	0.51	0.53	0.00	0.80	Calculated
228		Link-450	CB-J07-04	CB-J07-03	73.19	909.50	0.00	909.00	0.00	0.50	0.6800	Rectangular	48.000	72.00	0.0150	174.34	0 12:13	7.26	0.17	221.91	0.79	1.00	34.00	4.00	SURCHARGED
229		Link-451	CB-J07-03	CB-J07-02	75.38	909.00	0.00	908.50	0.00	0.50	0.6600	Rectangular	48.000	72.00	0.0150	184.67	0 12:27	7.69	0.16	218.67	0.84	1.00	35.00	4.00	SURCHARGED
230		Link-452	CB-J07-02	MH-J07-01	37.63	908.50	0.00	908.07	0.00	0.43	1.1400	Rectangular	48.000	72.00	0.0150	209.55	0 12:24	8.73	0.07	287.01	0.73	1.00	36.00	4.00	SURCHARGED
231		Link-453	HW-D05-01	CB-D05-02	42.24	916.52	0.00	913.00	0.50	3.52	8.3300	CIRCULAR	12.000	12.00	0.0150	0.83	0 12:21	5.12	0.14	8.91	0.09	0.67	0.00	0.67	Calculated
232		Link-454	HW-D06-03	CB-D06-04	71.03	916.00	0.00	912.22	0.50	3.78	5.3200	CIRCULAR	12.000	12.00	0.0150	1.63	0 12:13	5.73	0.21	7.12	0.23	0.57	0.00	0.55	Calculated
233		Link-455	CB-D03-02	Infiltration_Basin_1	107.00	910.50	0.00	909.00	10.50	1.50	1.4000	CIRCULAR	24.000	24.00	0.0150	34.46	0 00:02	11.03	0.16	23.21	1.48	0.98	0.00	1.69	> CAPACITY
234		Link-456	CB-D05-02	Infiltration_Basin_1	115.00	912.50	0.00	910.00	11.50	2.50	2.1700	CIRCULAR	12.000	12.00	0.0150	6.33	0 12:13	8.05	0.24	4.55	1.39	1.00	19.00	1.00	SURCHARGED
235		Link-457	CB-D06-04	Infiltration_Basin_1	96.00	911.72	0.00	910.00	11.50	1.72	1.7900	CIRCULAR	18.000	18.00	0.0150	10.48	0 12:11	6.96	0.23	12.19	0.86	0.79	0.00	1.18	Calculated
236		Link-467	CB-D07-02	Infiltration_Basin_1	74.00	913.00	0.00	911.67	13.17	1.33	1.8000	CIRCULAR	18.000	18.00	0.0130	6.58	0 12:07	6.92	0.18	14.08	0.47	0.53	0.00	0.78	Calculated
237		Link-471	CB-D08-05	Infiltration_Basin_1	84.00	911.50	0.00	911.00	12.50	0.50	0.6000	CIRCULAR	18.000	18.00	0.0130	4.91	0 12:07	4.33	0.32	8.10	0.61	0.61	0.00	0.89	Calculated
238		Link-472	CB-G04-03	CB-G04-02	106.27	913.00	0.00	912.50	0.00	0.50	0.4700	CIRCULAR	18.000	18.00	0.0150	4.15	0 12:09	2.35	0.75	6.24	0.66	1.00	12.00	1.50	SURCHARGED
239		Link-473	CB-G04-02	CB-F04-04	126.59	912.50	0.00	912.00	0.00	0.50	0.3900	CIRCULAR	18.000	18.00	0.0150	9.23	0 12:08	6.20	0.34	5.72	1.61	0.79	0.00	1.18	> CAPACITY
240		Link-474	CB-F04-04	MH-F04-01	65.69	912.00	0.00	909.50	2.97	2.50	3.8100	CIRCULAR	24.000	24.00	0.0150	13.30	0 12:07	8.42	0.13	38.25	0.35	0.71	0.00	1.43	Calculated
241		Link-475	Jun-491	CB-E04-01	195.27	915.00	0.00	906.00	1.33	9.00	4.6100	CIRCULAR	18.000	18.00	0.0150	3.72	0 12:07	4.90	0.66	19.54	0.19	0.65	0.00	0.97	Calculated
242		Link-484	HW-F01-03	CB-F01-02	74.26	912.50	0.00	912.00	3.00	0.50	0.6700	CIRCULAR	18.000	18.00	0.0150	4.61	0 12:07	4.14	0.30	7.47	0.62	0.60	0.00	0.88	Calculated
243		Link-486	CB--E02-03	CB-E02-02	79.28	911.50	-4.30	911.20	0.00	0.30	0.3800	CIRCULAR	18.000	18.00	0.0130	19.71	0 00:07	11.71	0.11	25.30	0.78	0.91	0.00	1.32	Calculated
244		Link-487	CB-E02-02	MH-E02-01	31.21	911.20	0.00	907.50	3.87	3.70	11.8600	CIRCULAR	18.000	18.00	0.0150	19.71	0 00:07	13.96	0.04	31.35	0.63	0.75	0.00	1.10	Calculated
245		Link-499	HW-D04-01	CB-DO4-02	68.61	916.50	0.00	913.00	0.50	3.50	5.1000	CIRCULAR	12.000	12.00	0.0150	2.34	0 12:11	7.54	0.15	6.97	0.34	0.42	0.00	0.41	Calculated
246		Link-500	CB-DO4-02	Infiltration_Basin_1	100.00	912.50	0.00	910.50	12.00	2.00	2.0000	CIRCULAR	18.000	18.00	0.0150	5.27	0 12:07	6.44	0.26	12.87	0.41	0.47	0.00	0.70	Calculated
247		Link-505	CB-G04-03	CB-G04-02	106.28	916.80	3.80	915.50	3.00	1.30	1.2200	CIRCULAR	18.000	18.00	0.0150	0.00	0 00:00	0.00		10.07	0.00	0.00	0.00	0.00	Calculated
248		Link-517	HW-J09-04	Jun-384	172.93	921.80	-0.05	921.30	0.00	0.50	0.2900	CIRCULAR	18.000	18.00	0.0150	5.08	0 12:21	4.50	0.64	5.13	0.99	0.63	0.00	0.94	Calculated
249		Link-520	HW-J09-05	HW-J09-04	120.87	922.51	0.00	921.85	0.00	0.66	0.5500	CIRCULAR	18.000	18.00	0.0150	2.96	0 12:14	2.55	0.79	6.73	0.44	0.68	0.00	1.01	Calculated
250		Link-527	HW-E10-01	HW-E10-02	74.05	918.50	0.00	918.40	0.00	0.10	0.1400	CIRCULAR	18.000	18.00	0.0150	1.52	0 12:11	2.06	0.60	3.35	0.45	0.44	0.00	0.65	Calculated
251		Link-530	CB-D09-04	CB-D09-03	103.39	912.00	0.00	911.00	7.00	1.00	0.9700	CIRCULAR	18.000	18.00	0.0150	3.10	0 12:09	4.34	0.40	8.95	0.35	0.42	0.00	0.63	Calculated
252	Yes	Link-531	NULL-545	HW-D09-01	129.53	900.20	0.00	900.00	0.00	0.20	0.1500	Rectangular	84.000	216.00	0.0120	659.44	0 12:16	7.32	0.29	1135.37	0.58	0.72	0.00	5.00	Calculated
253		Link-532	CB-D09-03	NULL-545	87.87	904.00	0.00	903.00	2.80	1.00	1.1400	CIRCULAR	18.000	18.00	0.0130	8.29	0 12:12	5.57	0.26	11.21	0.74	1.00	20.00	1.50	SURCHARGED
254		Link-534	CB-G10-08	CB-G10-07	86.27	907.50	0.00	907.00	0.00	0.50	0.5800	CIRCULAR	54.000	54.00	0.0130	81.58	0 12:10	5.38	0.27	149.71	0.54	0.91	0.00	4.08	Calculated
255		Link-535	CB-G10-07	CB-G10-06	82.50	907.00	0.00	906.50	0.00	0.50	0.6100	CIRCULAR	54.000	54.00	0.0130	87.98	0 12:10	6.11	0.23	153.09	0.57	0.87	0.00	3.90	Calculated
256		Link-536	CB-G10-06	CB-G10-04	78.68	906.50	0.00	906.00	1.50	0.50	0.6400	CIRCULAR	54.000	54.00	0.0130	90.50	0 12:10	7.81	0.17	156.76	0.58	0.80	0.00	3.59	Calculated
257		Link-537	CB-G10-05	CB-G10-03	109.04	912.00	0.00	911.50	0.50	0.50	0.4600	CIRCULAR	18.000	18.00	0.0130	5.30	0 12:05	4.15	0.44	7.11	0.74	0.70	0.00	1.05	Calculated
258		Link-538	CB-G10-03	CB-G10-02	85.18	911.00	0.00	910.50	0.00	0.50	0.5900	CIRCULAR	24.000	24.00	0.0130	9.42	0 12:05	3.56	0.40	17.33	0.54	0.79	0.00	1.56	Calculated
259		Link-539	CB-G10-02	CB-G10-01	74.38	910.50	0.00	910.00	0.50	0.50	0.6700	CIRCULAR	24.000	24.00	0.0130	14.00	0 12:05	5.61	0.22	18.55	0.75	0.74	0.00	1.47	Calculated
260		Link-540	CB-G10-01	CB-G10-04	82.08	909.50	0.00	909.00	4.50	0.50	0.6100	CIRCULAR	30.000	30.00	0.0130	16.33	0 12:05	5.72	0.24	32.01	0.51	0.56	0.00	1.40	Calculated
261	Yes	Link-541	NULL-545	CB-D08-05	452.91	900.20	0.00	916.00	4.50	-15.80	-3.4900	CIRCULAR	18.000	18.00	0.0130	0.00	0 00:00	0.00		19.62	0.00	0.50	0.00	0.75	Calculated
262		Link-543	HW-D08-04	CB-D08-05	68.24	916.00	1.50	911.50	0.00	4.50	6.5900	CIRCULAR	18.000	18.00	0.0130	0.00	0 00:00	0.00		26.97	0.00	0.33	0.00	0.48	Calculated
263		Link-544	HW-D06-01	HW-D06-02	137.15	917.02	0.00	916.17	0.00	0.85	0.6200	CIRCULAR	18.000	18.00	0.0130	0.54	0 12:11	1.54	1.48	8.27	0.07	0.25	0.00	0.38	Calculated

10-year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(inches)	(inches)		(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
271	Yes	Pipe-101	CB-E06-02	CB-E06-03	199.83	908.07	0.00	907.67	0.00	0.40	0.2000	CIRCULAR	36.000	36.00	0.0120	9.06	0 12:06	1.90	1.75	32.33	0.28	0.67	0.00	1.94	Calculated
272	Yes	Pipe-101A	CB-E06-03	CB-E06-04	198.94	907.67	0.00	907.27	0.00	0.40	0.2000	CIRCULAR	42.000	42.00	0.0120	19.24	0 12:06	2.99	1.11	48.87	0.39	0.65	0.00	2.19	Calculated
273	Yes	Pipe-102	CB-E06-04	CB-E07-01	199.78	907.27	0.00	906.87	1.00	0.40	0.2000	CIRCULAR	42.000	42.00	0.0130	29.49	0 12:06	5.13	0.65	45.02	0.66	0.62	0.00	2.05	Calculated
274	Yes	Pipe-102A	CB-E07-01	CB-E07-02	161.47	905.87	0.00	905.35	0.00	0.52	0.3200	CIRCULAR	54.000	54.00	0.0130	39.44	0 12:06	3.63	0.74	111.60	0.35	0.69	0.00	3.00	Calculated
275	Yes	Pipe-102B	CB-E07-02	CB-E07-03	200.11	905.35	0.00	904.95	0.60	0.40	0.2000	CIRCULAR	54.000	54.00	0.0130	48.59	0 12:06	4.57	0.73	87.92	0.55	0.73	0.00	3.17	Calculated
276	Yes	Pipe-103	CB-E07-03	CB-E07-04	200.48	904.35	0.00	903.95	0.00	0.40	0.2000	CIRCULAR	60.000	60.00	0.0120	57.96	0 12:07	3.66	0.91	126.03	0.46	0.79	0.00	3.86	Calculated
277	Yes	PIPE-104	CB-E07-04	CB-E07-05	199.13	903.95	0.00	903.55	0.00	0.40	0.2000	CIRCULAR	60.000	60.00	0.0120	67.83	0 12:07	4.11	0.81	126.45	0.54	0.81	0.00	3.96	Calculated
278	Yes	Pipe-105	CB-E07-05	CB-E08-01	200.64	903.55	0.00	903.15	0.50	0.40	0.2000	CIRCULAR	60.000	60.00	0.0120	77.34	0 12:07	4.77	0.70	125.98	0.61	0.81	0.00	3.96	Calculated
279	Yes	Pipe-106	CB-E08-01	CB-E08-02	199.09	902.65	0.00	902.25	0.00	0.40	0.2000	CIRCULAR	66.000	66.00	0.0120	86.41	0 12:07	4.16	0.80	163.06	0.53	0.82	0.00	4.44	Calculated
280	Yes	Pipe-107	CB-E08-02	CB-E08-03	200.41	902.25	0.00	901.85	0.00	0.40	0.2000	CIRCULAR	66.000	66.00	0.0120	95.21	0 12:08	4.60	0.73	162.53	0.59	0.81	0.00	4.43	Calculated
281	Yes	Pipe-109	CB-E08-04	CB-E09-01	200.00	901.13	0.00	900.73	0.00	0.40	0.2000	CIRCULAR	72.000	72.00	0.0120	118.92	0 12:08	5.51	0.60	205.18	0.58	0.71	0.00	4.27	Calculated
282	Yes	Pipe-110	CB-E09-01	MH-E09-05	140.00	900.73	0.00	900.45	0.00	0.28	0.2000	CIRCULAR	84.000	84.00	0.0130	121.08	0 12:08	5.50	0.42	285.69	0.42	0.56	0.00	3.89	Calculated
283	Yes	Pipe-130	MH-F06-02	MH-F06-03	275.38	907.85	0.00	907.30	0.00	0.55	0.2000	CIRCULAR	48.000	48.00	0.0120	37.52	0 12:07	3.51	1.31	69.54	0.54	0.91	0.00	3.59	Calculated
284	Yes	Pipe-130A	MH-F06-03	MH-F07-01	275.60	907.30	0.00	906.75	0.00	0.55	0.2000	CIRCULAR	54.000	54.00	0.0120	50.72	0 12:07	3.81	1.21	95.17	0.53	0.87	0.00	3.86	Calculated
285	Yes	Pipe-132	MH-F07-02	MH-F07-03	274.04	906.06	0.00	905.51	0.00	0.55	0.2000	CIRCULAR	60.000	60.00	0.0120	76.26	0 12:07	4.31	1.06	126.40	0.60	0.87	0.00	4.32	Calculated
286	Yes	PIPE-132A	MH-F07-03	MH-F08-01	275.99	905.51	0.00	904.96	0.00	0.55	0.2000	CIRCULAR	66.000	66.00	0.0120	88.80	0 12:07	4.44	1.04	162.40	0.55	0.81	0.00	4.48	Calculated
287	Yes	Pipe-133	MH-F08-01	MH-F08-02	274.88	904.96	0.00	904.41	0.00	0.55	0.2000	CIRCULAR	72.000	72.00	0.0120	100.94	0 12:07	4.55	1.01	205.23	0.49	0.78	0.00	4.65	Calculated
288	Yes	PIPE-133A	MH-F08-02	MH-F08-03	274.91	904.41	0.00	903.85	0.00	0.56	0.2000	CIRCULAR	72.000	72.00	0.0120	111.54	0 12:07	5.00	0.92	207.07	0.54	0.83	0.00	4.90	Calculated
289	Yes	Pipe-134	MH-F08-03	MH-F08-04	278.24	903.85	0.00	903.29	0.00	0.56	0.2000	CIRCULAR	84.000	84.00	0.0120	121.00	0 12:07	4.83	0.96	310.48	0.39	0.76	0.00	5.28	Calculated
290	Yes	Pipe-135	MH-F08-04	MH-F09-01	410.74	903.29	0.00	902.47	0.00	0.82	0.2000	CIRCULAR	84.000	84.00	0.0120	129.68	0 12:07	4.98	1.37	309.22	0.42	0.83	0.00	5.82	Calculated
291	Yes	Pipe-136	MH-F09-01	MH-F09-02	90.00	902.47	0.00	902.29	0.00	0.18	0.2000	CIRCULAR	84.000	84.00	0.0130	123.90	0 12:08	4.79	0.31	285.69	0.43	0.88	0.00	6.18	Calculated
292		Pipe-160	CB-G06-01	CB-G06-02	274.74	907.87	0.00	907.60	0.00	0.27	0.1000	CIRCULAR	66.000	66.00	0.0120	54.75	0 12:10	3.52	1.30	114.04	0.48	0.65	0.00	3.56	Calculated
293		Pipe-161	CB-G06-03	CB-G07-01	275.02	907.32	0.00	907.05	0.00	0.27	0.1000	CIRCULAR	72.000	72.00	0.0120	63.25	0 12:11	3.75	1.22	143.76	0.44	0.62	0.00	3.72	Calculated
294		Pipe-162	CB-G07-01	CB-G07-02	274.74	907.05	0.00	906.21	1.00	0.84	0.3100	CIRCULAR	72.000	72.00	0.0120	92.07	0 12:10	6.23	0.73	253.69	0.36	0.67	0.00	4.00	Calculated
295		Pipe-163	CB-G07-03	CB-G08-01	274.46	904.93	0.00	904.66	0.00	0.27	0.1000	CIRCULAR	84.000	84.00	0.0120	94.29	0 12:13	3.60	1.27	217.07	0.43	0.78	0.00	5.43	Calculated
296		Pipe-164	CB-G08-02	CB-G08-03	274.74	904.38	0.00	904.11	0.00	0.27	0.1000	CIRCULAR	84.000	84.00	0.0120	101.02	0 12:15	3.47	1.32	216.96	0.47	0.80	0.00	5.61	Calculated
297		Pipe-165	CB-G08-03	CB-G08-04	275.30	904.11	0.00	903.84	0.00	0.27	0.1000	CIRCULAR	84.000	84.00	0.0120	123.10	0 12:14	5.81	0.79	216.73	0.57	0.81	0.00	5.62	Calculated
298		Pipe-166	CB-G08-04	MH-G09-01	485.00	903.84	0.00	903.36	0.00	0.48	0.1000	Rectangular	84.000	180.00	0.0120	126.65	0 12:15	1.44	5.61	730.47	0.17	0.84	0.00	5.83	Calculated
299	Yes	Pipe-168	CB-G09-02	MH-F09-02	325.00	902.92	0.00	902.29	0.00	0.63	0.1900	Rectangular	84.000	180.00	0.0120	499.70	0 12:17	5.44	1.00	1022.30	0.49	0.88	0.00	6.16	Calculated
300	Yes	Pipe-169	MH-F09-02	MH-F09-03	334.00	902.29	0.00	901.62	0.00	0.67	0.2000	Rectangular	84.000	192.00	0.0120	613.05	0 12:15	6.23	0.89	1124.24	0.55	0.88	0.00	6.15	Calculated
301	Yes	Pipe-170	MH-F09-05	MH-E09-03	369.00	901.62	0.00	900.88	0.00	0.74	0.2000	Rectangular	84.000	216.00	0.0120	623.00	0 12:16	5.60	1.10	1293.93	0.48	0.88	0.00	6.16	Calculated
302	Yes	Pipe-171	MH-E09-03	MH-E09-04	275.00	900.88	0.00	900.33	0.00	0.55	0.2000	Rectangular	84.000	216.00	0.0120	641.82	0 12:16	5.74	0.80	1292.18	0.50	0.89	0.00	6.19	Calculated
303	Yes	Pipe-200	CB-E05-04	CB-E05-03	199.70	908.19	0.00	907.79	0.00	0.40	0.2000	CIRCULAR	42.000	42.00	0.0130	10.56	0 12:05	1.79	1.86	45.03	0.23	0.77	0.00	2.59	Calculated
304	Yes	Pipe-201A	CB-E05-03	CB-E05-02	199.38	907.79	0.00	907.39	0.00	0.40	0.2000	CIRCULAR	42.000	42.00	0.0130	20.93	0 12:06	2.64	1.26	45.06	0.46	0.86	0.00	2.90	Calculated
305	Yes	Pipe-202	CB-E05-02	CB-E05-01	361.63	907.39	0.00	906.67	0.00	0.72	0.2000	CIRCULAR	48.000	48.00	0.0120	37.48	0 12:06	3.64	1.66	69.44	0.54	0.83	0.00	3.25	Calculated
306	Yes	Pipe-202A	CB-E04-03	CB-E04-02	200.61	906.27	0.00	905.87	1.00	0.40	0.2000	CIRCULAR	48.000	48.00	0.0120	49.93	0 12:07	4.98	0.67	69.49	0.72	0.88	0.00	3.48	Calculated
307	Yes	Pipe-203	CB-E04-02	CB-E04-01	198.94	904.87	0.00	904.67	0.00	0.20	0.1000	CIRCULAR	60.000	60.00	0.0120	61.15	0 12:08	3.32	1.00	89.46	0.68	0.89	0.00	4.44	Calculated
308	Yes	Pipe-204	CB-E04-01	MH-E03-02	485.59	904.67	0.00	904.19	0.00	0.48	0.1000	CIRCULAR	60.000	60.00	0.0120	70.91	0 12:09	3.86	2.10	88.71	0.80	0.88	0.00	4.41	Calculated
309	Yes	Pipe-205	MH-E03-02	MH-E03-01	497.49	904.19	0.00	903.69	0.00	0.50	0.1000	CIRCULAR	72.000	72.00	0.0120	96.14	0 12:08	4.41	1.88	145.45	0.66	0.73	0.00	4.38	Calculated
310	Yes	Pipe-206	MH-E03-01	MH-E02-03	329.72	903.69	0.00	903.36	0.00	0.33	0.1000	CIRCULAR	84.000	84.00	0.0120	117.38	0 12:10	4.89	1.12	218.94	0.54	0.60	0.00	4.20	Calculated
311	Yes	Pipe-207	MH-E02-03	Infiltration_Basin_1	367.00	903.36	0.00	903.00	4.50	0.36	0.1000	CIRCULAR	84.000	84.00	0.0120	132.00	0 12:10	6.85	0.89	216.75	0.61	0.50	0.00	3.50	Calculated
312	Yes	Pipe-230	CB-F04-03		319.00	908.94	0.00	908.30	0.50	0.64	0.2000	CIRCULAR	54.000	54.00	0.0120	48.85	0 12:09	4.18	1.27	95.42	0.51	0.84	0.00	3.76	Calculated
313	Yes	Pipe-231	MH-F04-02		273.76	907.80	0.00	907.53	1.00	0.27	0.1000	CIRCULAR	60.000	60.00	0.0120	78.37	0 12:10	4.83	0.94	88.61	0.88	0.86	0.00	4.30	Calculated
314	Yes	Pipe-232	MH-F04-01		391.79	906.53	0.00	906.14	0.00	0.39	0.1000	CIRCULAR	72.000	72.00	0.0120	96.70	0 12:10	3.71	1.76	144.75	0.67	0.87	0.00	5.18	Calculated
315	Yes	Pipe-233	MH-F03-02	MH-F03-01	362.89	906.14	0.00	905.78	0.00	0.36	0.1000	CIRCULAR	72.000	72.00	0.0120	107.54	0 12:10	4.18	1.45	144.51	0.74	0.86	0.00	5.14	Calculated
316	Yes	Pipe-234	MH-F03-01	MH-F02-02	350.84	905.78	0.00	905.43	0.00	0.35	0.1000	CIRCULAR	84.000	84.00	0.0120	117.42	0 12:10	3.97	1.47	218.59	0.54	0.73	0.00	5.11	Calculated
317	Yes	Pipe-236	MH-F02-01	MH-F01-01	517.91	905.08	0.00																		

25-Year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
1		CB-D03-02	12942164.05	279268.13	910.50	915.70	5.20	910.50	0.00	917.70	2.00	0.00	0.00	52.19	0.00	916.01	5.51	0.00	1.69	910.86	0.36	0 00:02	0 00:00	0.00	0.00
2		CB-D05-02	12943712.79	279269.22	912.50	916.37	3.87	912.50	0.00	918.37	2.00	0.00	0.00	15.37	0.00	917.12	4.62	0.00	1.25	913.14	0.64	0 12:14	0 00:00	0.00	0.00
3		CB-D06-04	12945063.49	279265.29	911.72	914.00	2.28	911.72	0.00	916.00	2.00	0.00	0.00	14.00	0.00	914.24	2.52	0.00	1.76	912.07	0.35	0 12:13	0 00:00	0.00	0.00
4		CB-D07-02	12946012.48	279264.14	913.00	915.50	2.50	913.00	0.00	917.50	2.00	0.00	0.00	8.63	0.00	914.06	1.06	0.00	3.44	913.22	0.22	0 12:07	0 00:00	0.00	0.00
5		CB-D08-05	12946965.45	279269.40	911.50	916.00	4.50	911.50	0.00	918.00	2.00	0.00	0.00	6.31	0.00	912.71	1.21	0.00	5.29	911.73	0.23	0 12:07	0 00:00	0.00	0.00
6		CB-D09-03	12947511.02	279268.64	904.00	915.75	11.75	904.00	0.00	917.75	2.00	0.00	0.00	11.13	0.00	907.97	3.97	0.00	9.78	904.50	0.50	0 12:13	0 00:00	0.00	0.00
7		CB-D09-04	12947590.08	279335.27	912.00	916.00	4.00	912.00	0.00	918.00	2.00	0.00	0.00	3.98	0.00	912.77	0.77	0.00	6.48	912.19	0.19	0 12:08	0 00:00	0.00	0.00
8		CB-D04-02	12943022.53	279268.74	912.50	916.10	3.60	912.50	0.00	918.10	2.00	0.00	0.00	6.84	0.00	913.38	0.88	0.00	4.72	912.70	0.20	0 12:07	0 00:00	0.00	0.00
9		CB-E02-02	12940787.01	279487.92	911.20	916.00	4.80	911.20	0.00	918.00	2.00	0.00	0.00	19.71	0.00	912.59	1.39	0.00	5.41	911.53	0.33	0 00:07	0 00:00	0.00	0.00
10		CB--E02-03	12940736.62	279426.72	915.80	917.80	2.00	915.80	0.00	917.80	0.00	0.00	0.00	70.66	0.00	917.15	1.35	0.00	0.65	916.10	0.30	0 00:07	0 00:00	0.00	0.00
11	Yes	CB-E04-01	12942884.63	279527.68	904.67	915.75	11.08	904.67	0.00	915.75	0.00	0.00	0.00	97.30	8.47	914.23	9.56	0.00	1.52	905.64	0.97	0 12:05	0 00:00	0.00	0.00
12	Yes	CB-E04-02	12943083.57	279527.68	904.87	915.75	10.88	904.87	0.00	915.75	0.00	0.00	0.00	84.13	8.69	914.91	10.04	0.00	0.84	905.84	0.97	0 12:05	0 00:00	0.00	0.00
13	Yes	CB-E04-03	12943284.18	279528.99	906.27	915.75	9.48	906.27	0.00	915.75	0.00	0.00	0.00	68.35	0.00	913.36	7.09	0.00	2.39	907.03	0.76	0 12:05	0 00:00	0.00	0.00
14		CB-E04-04	12943379.94	279812.17	907.20	913.50	6.30	907.20	0.00	913.50	0.00	0.00	45.60	8.34	8.34	913.50	6.30	0.00	0.00	907.60	0.40	0 12:05	0 12:05	0.00	0.00
15	Yes	CB-E05-01	12943484.68	279529.95	906.67	915.75	9.08	906.67	0.00	915.75	0.00	0.00	0.00	62.46	0.00	915.04	8.37	0.00	0.71	907.43	0.76	0 12:05	0 00:00	0.00	0.00
16	Yes	CB-E05-02	12943846.38	279529.00	907.39	915.75	8.36	907.39	0.00	915.75	0.00	0.00	0.00	50.83	0.00	914.95	7.56	0.00	0.80	908.04	0.65	0 12:05	0 00:00	0.00	0.00
17	Yes	CB-E05-03	12944045.88	279528.79	907.79	915.75	7.96	907.79	0.00	915.75	0.00	0.00	0.00	28.09	0.00	914.97	7.18	0.00	0.78	908.36	0.57	0 12:05	0 00:00	0.00	0.00
18	Yes	CB-E05-04	12944245.53	279529.51	908.19	915.75	7.56	908.19	0.00	915.75	0.00	0.00	0.00	13.83	0.00	915.11	6.92	0.00	0.64	908.65	0.46	0 12:05	0 00:00	0.00	0.00
19		CB-E05-05	12943495.77	279649.03	914.00	920.35	6.35	914.00	0.00	920.35	0.00	0.00	58.20	6.76	0.77	914.68	0.68	0.00	5.67	914.14	0.14	0 12:03	0 00:00	0.00	0.00
20		CB-E05-06	12943576.43	279648.25	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	46.20	4.47	1.48	915.86	0.86	0.00	4.49	915.16	0.16	0 12:05	0 00:00	0.00	0.00
21		CB-E05-07	12943615.38	279649.06	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	40.20	2.99	1.51	916.15	0.65	0.00	4.20	915.62	0.12	0 12:05	0 00:00	0.00	0.00
22		CB-E05-08	12943655.72	279649.46	916.00	920.35	4.35	916.00	0.00	920.35	0.00	0.00	40.20	1.48	1.48	916.50	0.50	0.00	3.85	916.10	0.10	0 12:05	0 00:00	0.00	0.00
23		CB-E05-09	12943695.92	279649.46	916.00	920.35	4.35	916.00	0.00	920.35	0.00	0.00	40.20	1.82	1.82	917.00	1.00	0.00	3.35	916.12	0.12	0 12:05	0 00:00	0.00	0.00
24		CB-E05-10	12943749.09	279649.03	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	3.49	1.70	916.81	1.31	0.00	3.54	915.67	0.17	0 12:05	0 00:00	0.00	0.00
25		CB-E05-11	12943789.83	279649.03	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	49.20	5.00	1.51	916.08	1.08	0.00	4.27	915.18	0.18	0 12:05	0 00:00	0.00	0.00
26		CB-E05-12	12943833.38	279649.46	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	52.20	6.41	1.42	915.48	0.98	0.00	4.87	914.68	0.18	0 12:05	0 00:00	0.00	0.00
27		CB-E05-13	12943861.48	279649.46	914.00	920.45	6.45	914.00	0.00	920.45	0.00	0.00	59.40	12.09	1.26	914.83	0.83	0.00	5.62	914.17	0.17	0 12:02	0 00:00	0.00	0.00
28		CB-E05-14	12943901.68	279649.03	914.50	920.45	5.95	914.50	0.00	920.45	0.00	0.00	56.40	4.43	1.48	915.41	0.91	0.00	5.04	914.67	0.17	0 12:05	0 00:00	0.00	0.00
29		CB-E05-15	12943941.89	279648.59	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	2.96	1.48	915.89	0.89	0.00	4.46	915.15	0.15	0 12:05	0 00:00	0.00	0.00
30		CB-E05-16	12943981.89	279649.12	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	1.48	1.48	916.01	0.51	0.00	4.34	915.60	0.10	0 12:05	0 00:00	0.00	0.00
31		CB-E05-17	12944021.79	279649.42	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	1.48	1.48	915.01	0.51	0.00	5.34	914.60	0.10	0 12:06	0 00:00	0.00	0.00
32		CB-E05-18	12944062.06	279649.46	914.00	920.35	6.35	914.00	0.00	920.35	0.00	0.00	61.20	8.25	1.51	914.93	0.93	0.00	5.42	914.16	0.16	0 12:06	0 00:00	0.00	0.00
33		CB-E05-19	12944101.40	279649.03	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	55.20	5.27	1.51	915.55	1.05	0.00	4.80	914.68	0.18	0 12:06	0 00:00	0.00	0.00
34		CB-E05-20	12944142.03	279649.03	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	3.76	1.48	916.33	1.33	0.00	4.02	915.18	0.18	0 12:04	0 00:00	0.00	0.00
35		CB-E05-21	12944181.76	279649.42	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	2.30	1.26	916.62	1.12	0.00	3.73	915.63	0.13	0 12:05	0 00:00	0.00	0.00
36		CB-E05-22	12944209.47	279649.46	916.00	920.35	4.35	916.00	0.00	920.35	0.00	0.00	40.20	1.05	1.05	916.65	0.65	0.00	3.70	916.08	0.08	0 12:05	0 00:00	0.00	0.00
37		CB-E05-23	12944241.46	279649.46	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	1.39	1.39	915.00	0.50	0.00	5.35	914.59	0.09	0 12:06	0 00:00	0.00	0.00
38		CB-E05-24	12944282.24	279649.21	914.00	920.35	6.35	914.00	0.00	920.35	0.00	0.00	61.20	8.05	1.26	914.93	0.93	0.00	5.42	914.16	0.16	0 12:06	0 00:00	0.00	0.00
39		CB-E05-25	12943535.54	279649.46	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	52.20	5.99	1.54	915.46	0.96	0.00	4.89	914.68	0.18	0 12:05	0 00:00	0.00	0.00
40	Yes	CB-E06-01	12944447.08	279529.77	909.47	915.75	6.28	909.47	0.00	915.75	0.00	0.00	0.00	0.63	0.00	910.76	1.29	0.00	4.99	909.52	0.05	0 12:08	0 00:00	0.00	0.00
41	Yes	CB-E06-02	12944646.25	279529.08	908.07	915.75	7.68	908.07	0.00	915.75	0.00	0.00	0.00	11.85	0.00	910.71	2.64	0.00	5.04	908.42	0.35	0 12:08	0 00:00	0.00	0.00
42	Yes	CB-E06-03	12944846.09	279529.08	907.67	915.75	8.08	907.67	0.00	915.75	0.00	0.00	0.00	23.80	0.00	910.64	2.97	0.00	5.11	908.12	0.45	0 12:08	0 00:00	0.00	0.00
43	Yes	CB-E06-04	12945046.60	279528.66	907.27	915.75	8.48	907.27	0.00	915.75	0.00	0.00	0.00	36.10	0.00	910.48	3.21	0.00	5.27	907.83	0.56	0 12:08	0 00:00	0.00	0.00
44		CB-E06-05	12944309.76	279649.03	914.50	920.45	5.95	914.50	0.00	920.45	0.00	0.00	56.40	5.42	1.11	915.51	1.01	0.00	4.94	914.67	0.17	0 12:06	0 00:00	0.00	0.00
45		CB-E06-06	12944341.75	279649.46	915.00	920.45	5.45	915.00	0.00	920.45															

25-Year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
57		CB-E06-18	12944825.90	279649.46	912.50	920.35	7.85	912.50	0.00	920.35	0.00	0.00	61.20	7.41	1.48	913.35	0.85	0.00	7.00	912.67	0.17	0 12:05	0 00:00	0.00	0.00
58		CB-E06-19	12944865.67	279649.03	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	1.51	1.51	916.66	1.16	0.00	3.69	915.61	0.11	0 12:04	0 00:00	0.00	0.00
59		CB-E06-20	12944905.87	279649.46	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	2.96	1.45	916.56	1.56	0.00	3.79	915.16	0.16	0 12:04	0 00:00	0.00	0.00
60		CB-E06-21	12944945.79	279649.11	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	4.45	1.48	916.06	1.56	0.00	4.29	914.70	0.20	0 12:04	0 00:00	0.00	0.00
61		CB-E06-22	12944986.04	279649.12	911.00	920.35	9.35	911.00	0.00	920.35	0.00	0.00	64.20	7.56	1.64	912.20	1.20	0.00	8.15	911.22	0.22	0 12:05	0 00:00	0.00	0.00
62		CB-E06-23	12945029.07	279649.46	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	1.48	1.48	915.00	0.50	0.00	5.35	914.60	0.10	0 12:05	0 00:00	0.00	0.00
63		CB-E06-24	12945069.71	279649.46	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	1.48	1.48	916.66	1.16	0.00	3.69	915.61	0.11	0 12:04	0 00:00	0.00	0.00
64		CB-E06-25	12945109.48	279649.03	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	2.97	1.48	916.56	1.56	0.00	3.79	915.17	0.17	0 12:04	0 00:00	0.00	0.00
65		CB-E06-26	12945149.68	279649.46	914.50	920.45	5.95	914.50	0.00	920.45	0.00	0.00	59.40	4.45	1.48	916.06	1.56	0.00	4.39	914.70	0.20	0 12:04	0 00:00	0.00	0.00
66		CB-E06-27	12945190.07	279649.12	911.00	920.45	9.45	911.00	0.00	920.45	0.00	0.00	65.40	7.41	1.48	912.20	1.20	0.00	8.25	911.22	0.22	0 12:05	0 00:00	0.00	0.00
67	Yes	CB-E07-01	12945246.38	279529.51	905.87	915.75	9.88	905.87	0.00	915.75	0.00	0.00	0.00	47.95	0.00	910.08	4.21	0.00	5.67	906.45	0.58	0 12:07	0 00:00	0.00	0.00
68	Yes	CB-E07-02	12945407.85	279529.13	905.35	918.21	12.86	905.35	0.00	918.21	0.00	0.00	80.52	58.44	4.77	909.88	4.53	0.00	8.33	906.06	0.71	0 12:07	0 00:00	0.00	0.00
69	Yes	CB-E07-03	12945607.96	279529.45	904.35	915.75	11.40	904.35	0.00	915.75	0.00	0.00	0.00	69.37	0.00	909.52	5.17	0.00	6.23	905.12	0.77	0 12:07	0 00:00	0.00	0.00
70	Yes	CB-E07-04	12945808.44	279529.52	903.95	915.75	11.80	903.95	0.00	915.75	0.00	0.00	0.00	81.18	0.00	909.21	5.26	0.00	6.54	904.77	0.82	0 12:07	0 00:00	0.00	0.00
71	Yes	CB-E07-05	12946007.57	279529.04	903.55	915.75	12.20	903.55	0.00	915.75	0.00	0.00	0.00	93.32	0.00	908.78	5.23	0.00	6.97	904.42	0.87	0 12:07	0 00:00	0.00	0.00
72		CB-E07-06	12945229.65	279649.03	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	1.48	1.48	914.99	0.49	0.00	5.36	914.60	0.10	0 12:05	0 00:00	0.00	0.00
73		CB-E07-07	12945269.42	279649.03	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	1.51	1.51	916.49	0.99	0.00	3.86	915.61	0.11	0 12:05	0 00:00	0.00	0.00
74		CB-E07-08	12945309.94	279648.93	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	2.98	1.48	916.40	1.40	0.00	3.95	915.16	0.16	0 12:05	0 00:00	0.00	0.00
75		CB-E07-09	12945349.83	279649.14	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	4.39	1.42	915.90	1.40	0.00	4.45	914.69	0.19	0 12:04	0 00:00	0.00	0.00
76		CB-E07-10	12945382.43	279649.12	911.00	920.35	9.35	911.00	0.00	920.35	0.00	0.00	64.20	8.17	1.05	912.30	1.30	0.00	8.05	911.23	0.23	0 12:05	0 00:00	0.00	0.00
77		CB-E07-11	12945409.05	279649.03	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	2.74	1.26	915.20	0.70	0.00	5.15	914.63	0.13	0 12:05	0 00:00	0.00	0.00
78		CB-E07-12	12945449.68	279649.46	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	1.48	1.48	915.49	0.49	0.00	4.86	915.10	0.10	0 12:05	0 00:00	0.00	0.00
79		CB-E07-13	12945489.74	279648.88	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	1.48	1.48	915.49	0.49	0.00	4.86	915.10	0.10	0 12:05	0 00:00	0.00	0.00
80		CB-E07-14	12945529.66	279649.03	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	2.96	1.48	915.30	0.80	0.00	5.05	914.65	0.15	0 12:05	0 00:00	0.00	0.00
81		CB-E07-15	12945569.84	279649.03	911.00	920.45	9.45	911.00	0.00	920.45	0.00	0.00	65.40	7.41	1.51	912.18	1.18	0.00	8.27	911.22	0.22	0 12:05	0 00:00	0.00	0.00
82		CB-E07-16	12945610.04	279649.35	914.50	920.45	5.95	914.50	0.00	920.45	0.00	0.00	59.40	2.96	1.48	915.30	0.80	0.00	5.15	914.65	0.15	0 12:05	0 00:00	0.00	0.00
83		CB-E07-17	12945649.62	279648.88	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	1.48	1.48	915.49	0.49	0.00	4.86	915.09	0.09	0 12:05	0 00:00	0.00	0.00
84		CB-E07-18	12945689.60	279649.03	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	1.48	1.48	915.49	0.49	0.00	4.86	915.10	0.10	0 12:05	0 00:00	0.00	0.00
85		CB-E07-19	12945729.80	279649.89	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	2.96	1.48	915.30	0.80	0.00	5.05	914.65	0.15	0 12:05	0 00:00	0.00	0.00
86		CB-E07-20	12945769.74	279649.55	911.00	920.35	9.35	911.00	0.00	920.35	0.00	0.00	64.20	7.52	1.48	912.35	1.35	0.00	8.00	911.24	0.24	0 12:05	0 00:00	0.00	0.00
87		CB-E07-21	12945814.10	279649.46	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	3.11	1.64	915.37	0.87	0.00	4.98	914.65	0.15	0 12:05	0 00:00	0.00	0.00
88		CB-E07-22	12945853.87	279649.46	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	1.48	1.48	915.50	0.50	0.00	4.85	915.09	0.09	0 12:05	0 00:00	0.00	0.00
89		CB-E07-23	12945894.07	279649.89	915.00	920.45	5.45	915.00	0.00	920.45	0.00	0.00	53.40	1.51	1.51	915.50	0.50	0.00	4.95	915.10	0.10	0 12:05	0 00:00	0.00	0.00
90		CB-E07-24	12945933.84	279649.03	914.50	920.45	5.95	914.50	0.00	920.45	0.00	0.00	59.40	2.99	1.48	915.31	0.81	0.00	5.14	914.65	0.15	0 12:05	0 00:00	0.00	0.00
91		CB-E07-25	12945973.77	279649.55	911.00	920.35	9.35	914.00	3.00	920.35	0.00	0.00	64.20	7.59	1.51	914.00	3.00	0.00	6.35	911.22	0.22	0 00:00	0 00:00	0.00	0.00
92		CB-E07-26	12946013.81	279649.46	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	3.11	1.48	915.34	0.84	0.00	5.01	914.65	0.15	0 12:05	0 00:00	0.00	0.00
93		CB-E07-27	12946054.01	279649.46	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	1.64	1.64	915.53	0.53	0.00	4.82	915.10	0.10	0 12:05	0 00:00	0.00	0.00
94	Yes	CB-E08-01	12946208.21	279529.33	902.65	915.75	13.10	902.65	0.00	915.75	0.00	0.00	0.00	105.06	0.00	908.21	5.56	0.00	7.54	903.57	0.92	0 12:07	0 00:00	0.00	0.00
95	Yes	CB-E08-02	12946407.02	279529.68	902.25	915.75	13.50	902.25	0.00	915.75	0.00	0.00	0.00	116.62	0.00	907.74	5.49	0.00	8.01	903.20	0.95	0 12:07	0 00:00	0.00	0.00
96	Yes	CB-E08-03	12946608.00	279528.62	901.85	915.75	13.90	901.85	0.00	915.75	0.00	0.00	0.00	129.67	0.00	907.17	5.32	0.00	8.58	902.79	0.94	0 12:07	0 00:00	0.00	0.00
97	Yes	CB-E08-04	12946969.51	279528.77	901.13	915.75	14.62	901.13	0.00	915.75	0.00	0.00	0.00	147.72	0.00	906.28	5.15	0.00	9.47	902.17	1.04	0 12:08	0 00:00	0.00	0.00
98		CB-E08-05	12946097.67	279649.46	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	1.48	1.48	915.49	0.49	0.00	4.86	915.10	0.10	0 12:05	0 00:00	0.00	0.00
99		CB-E08-06	12946137.88	279649.46	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	58.20	2.96	1.48	915.30	0.80	0.00	5.05	914.65	0.15	0 12:05	0 00:00	0.00	0.00
100		CB-E08-07	12946178.23	279649.12	911.00	920.45	9.45	911.00	0.00	920.45	0.00	0.00	65.40	7.10	1.48	912.13	1.13	0.00	8.32	911.21	0.21	0 12:05	0 00:00	0.00	0.00
101		CB-E08-08	12946217.42	279649.03	914.50	920.45	5.95	914.50																	

25-Year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
113		CB-E08-20	12946702.62	279648.43	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	1.48	1.48	916.67	1.17	0.00	3.68	915.61	0.11	0 12:04	0 00:00	0.00	0.00
114		CB-E08-21	12946742.01	279648.67	915.50	920.35	4.85	915.50	0.00	920.35	0.00	0.00	46.20	1.48	1.48	916.46	0.96	0.00	3.89	915.60	0.10	0 12:05	0 00:00	0.00	0.00
115		CB-E08-22	12946781.89	279649.16	915.00	920.35	5.35	915.00	0.00	920.35	0.00	0.00	52.20	2.73	1.26	916.37	1.37	0.00	3.98	915.14	0.14	0 12:05	0 00:00	0.00	0.00
116		CB-E08-23	12946814.47	279648.67	914.50	920.35	5.85	914.50	0.00	920.35	0.00	0.00	55.20	4.12	1.42	915.98	1.48	0.00	4.37	914.67	0.17	0 12:05	0 00:00	0.00	0.00
117		CB-E08-24	12946854.35	279649.16	914.00	920.35	6.35	914.00	0.00	920.35	0.00	0.00	61.20	5.45	1.33	915.66	1.66	0.00	4.69	914.21	0.21	0 12:05	0 00:00	0.00	0.00
118		CB-E08-25	12946893.74	279648.43	913.50	920.40	6.90	913.50	0.00	920.40	0.00	0.00	67.80	6.92	1.48	915.06	1.56	0.00	5.34	913.73	0.23	0 12:05	0 00:00	0.00	0.00
119		CB-E08-26	12946934.11	279648.92	911.00	920.14	9.14	911.00	0.00	920.14	0.00	0.00	49.68	9.23	1.48	912.65	1.65	0.00	7.49	911.26	0.26	0 12:05	0 00:00	0.00	0.00
120		CB-E08-27	12946973.98	279649.40	915.50	919.91	4.41	915.50	0.00	919.91	0.00	0.00	40.92	0.83	0.83	915.85	0.35	0.00	4.06	915.57	0.07	0 12:05	0 00:00	0.00	0.00
121	Yes	CB-E09-01	12947170.16	279528.75	900.73	915.75	15.02	900.73	0.00	915.75	0.00	0.00	0.00	150.35	0.00	905.44	4.71	0.00	10.31	901.89	1.16	0 12:08	0 00:00	0.00	0.00
122		CB-E09-02	12947365.35	279506.86	910.00	919.09	9.09	910.00	0.00	919.09	0.00	0.00	91.08	5.85	5.85	910.99	0.99	0.00	8.10	910.21	0.21	0 12:10	0 00:00	0.00	0.00
123		CB-E09-05	12947129.71	279784.92	908.45	913.50	5.05	908.45	0.00	913.50	0.00	0.00	36.60	9.70	9.70	910.32	1.87	0.00	3.18	908.74	0.29	0 12:05	0 00:00	0.00	0.00
124		CB-E09-06	12947130.08	279924.83	908.00	913.50	5.50	908.00	0.00	913.50	0.00	0.00	42.00	12.64	3.03	909.97	1.97	0.00	3.53	908.35	0.35	0 12:05	0 00:00	0.00	0.00
125		CB-E09-07	12947557.23	279445.22	901.50	919.05	17.55	901.50	0.00	919.05	0.00	0.00	174.60	13.67	13.67	907.48	5.98	0.00	11.57	902.53	1.03	0 12:14	0 00:00	0.00	0.00
126		CB-F01-02	12940644.52	280424.72	909.00	918.50	9.50	909.00	0.00	918.50	0.00	0.00	12.00	10.12	0.00	911.31	2.31	0.00	7.19	909.29	0.29	0 12:13	0 00:00	0.00	0.00
127	Yes	CB-F04-03	12943244.95	280433.45	908.94	916.50	7.56	908.94	0.00	916.50	0.00	0.00	36.72	66.69	25.88	914.71	5.77	0.00	1.79	909.78	0.84	0 12:08	0 00:00	0.00	0.00
128		CB-F04-04	12942665.25	280496.07	912.00	915.51	3.51	912.00	0.00	917.51	2.00	0.00	18.12	16.28	0.00	913.70	1.70	0.00	1.81	912.25	0.25	0 12:13	0 00:00	0.00	0.00
129		CB-F05-04	12943495.75	280333.77	917.00	920.21	3.21	917.00	0.00	920.21	0.00	0.00	26.52	0.83	0.83	918.09	1.09	0.00	2.12	917.08	0.08	0 12:05	0 00:00	0.00	0.00
130		CB-F05-05	12943535.27	280334.30	916.50	920.38	3.88	916.50	0.00	920.38	0.00	0.00	34.56	2.36	1.51	918.06	1.56	0.00	2.32	916.64	0.14	0 12:05	0 00:00	0.00	0.00
131		CB-F05-06	12943575.32	280334.30	916.00	920.45	4.45	916.00	0.00	920.45	0.00	0.00	41.40	3.86	1.51	917.75	1.75	0.00	2.70	916.19	0.19	0 12:04	0 00:00	0.00	0.00
132		CB-F05-07	12943615.37	280334.30	915.25	920.20	4.95	915.25	0.00	920.20	0.00	0.00	44.40	5.34	1.48	916.88	1.63	0.00	3.32	915.45	0.20	0 12:05	0 00:00	0.00	0.00
133		CB-F05-08	12943655.42	280334.30	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	50.40	9.50	1.51	916.29	1.79	0.00	3.91	914.77	0.27	0 12:05	0 00:00	0.00	0.00
134		CB-F05-09	12943699.21	280334.30	915.50	920.20	4.70	915.50	0.00	920.20	0.00	0.00	44.40	2.67	1.02	916.72	1.22	0.00	3.48	915.65	0.15	0 12:05	0 00:00	0.00	0.00
135		CB-F05-10	12943749.40	280334.84	916.00	920.20	4.20	916.00	0.00	920.20	0.00	0.00	38.40	1.67	1.67	916.87	0.87	0.00	3.33	916.11	0.11	0 12:05	0 00:00	0.00	0.00
136		CB-F05-11	12943789.99	280334.30	916.50	920.42	3.92	916.50	0.00	920.42	0.00	0.00	35.04	1.51	1.51	917.43	0.93	0.00	2.99	916.61	0.11	0 12:05	0 00:00	0.00	0.00
137		CB-F05-12	12943829.51	280334.84	916.00	920.45	4.45	916.00	0.00	920.45	0.00	0.00	41.40	2.92	1.42	917.35	1.35	0.00	3.10	916.15	0.15	0 12:05	0 00:00	0.00	0.00
138		CB-F05-13	12943862.08	280334.30	915.50	920.45	4.95	915.50	0.00	920.45	0.00	0.00	47.40	4.17	1.26	916.92	1.42	0.00	3.53	915.69	0.19	0 12:05	0 00:00	0.00	0.00
139		CB-F05-14	12943902.13	280334.30	914.00	920.45	6.45	914.00	0.00	920.45	0.00	0.00	53.40	10.13	1.48	915.34	1.34	0.00	5.11	914.18	0.18	0 12:08	0 00:00	0.00	0.00
140		CB-F05-15	12943941.65	280334.30	915.50	920.45	4.95	915.50	0.00	920.45	0.00	0.00	47.40	4.48	1.48	917.07	1.57	0.00	3.38	915.70	0.20	0 12:04	0 00:00	0.00	0.00
141		CB-F05-16	12943981.70	280334.30	916.00	920.45	4.45	916.00	0.00	920.45	0.00	0.00	41.40	3.00	1.51	917.58	1.58	0.00	2.87	916.17	0.17	0 12:04	0 00:00	0.00	0.00
142		CB-F05-17	12944021.75	280334.30	916.50	920.25	3.75	916.50	0.00	920.25	0.00	0.00	33.00	1.48	1.48	917.67	1.17	0.00	2.58	916.61	0.11	0 12:04	0 00:00	0.00	0.00
143		CB-F05-18	12944061.27	280334.30	915.50	920.20	4.70	915.50	0.00	920.20	0.00	0.00	44.40	1.48	1.48	918.32	2.82	0.00	1.88	915.62	0.12	0 12:05	0 00:00	0.00	0.00
144		CB-F05-19	12944101.85	280334.30	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	2.97	1.48	918.14	3.14	0.00	2.06	915.17	0.17	0 12:05	0 00:00	0.00	0.00
145		CB-F05-20	12944141.37	280333.77	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.45	1.48	917.56	3.06	0.00	2.64	914.71	0.21	0 12:05	0 00:00	0.00	0.00
146		CB-F05-21	12944181.42	280334.30	914.00	920.20	6.20	914.00	0.00	920.20	0.00	0.00	62.40	10.39	1.26	916.47	2.47	0.00	3.73	914.16	0.16	0 12:05	0 00:00	0.00	0.00
147		CB-F05-22	12944209.72	280334.84	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.70	1.05	917.33	2.83	0.00	2.87	914.70	0.20	0 12:05	0 00:00	0.00	0.00
148		CB-F05-23	12944242.29	280334.30	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	3.64	1.42	918.04	3.04	0.00	2.16	915.19	0.19	0 12:05	0 00:00	0.00	0.00
149		CB-F05-24	12944280.74	280333.77	915.50	920.20	4.70	915.50	0.00	920.20	0.00	0.00	44.40	2.22	1.26	918.41	2.91	0.00	1.79	915.65	0.15	0 12:05	0 00:00	0.00	0.00
150		CB-F05-25	12943675.17	280525.47	910.86	917.31	6.45	910.86	0.00	917.31	0.00	0.00	47.40	13.72	2.75	915.46	4.60	0.00	1.85	911.38	0.52	0 12:06	0 00:00	0.00	0.00
151		CB-F05-26	12944088.54	280480.84	911.45	919.51	8.06	911.45	0.00	919.51	0.00	0.00	72.72	6.83	4.50	919.51	8.06	0.00	0.00	911.74	0.29	0 12:04	0 12:04	0.00	0.00
152		CB-F06-04	12944309.58	280334.30	916.00	920.45	4.45	916.00	0.00	920.45	0.00	0.00	41.40	0.96	0.96	918.49	2.49	0.00	1.96	916.09	0.09	0 12:05	0 00:00	0.00	0.00
153		CB-F06-05	12944341.62	280334.30	915.00	920.45	5.45	915.00	0.00	920.45	0.00	0.00	53.40	1.48	1.48	915.82	0.82	0.00	4.63	915.10	0.10	0 12:07	0 00:00	0.00	0.00
154		CB-F06-06	12944381.67	280334.30	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	2.96	1.48	916.38	1.88	0.00	3.82	914.65	0.15	0 12:05	0 00:00	0.00	0.00
155		CB-F06-07	12944421.72	280333.77	910.50	920.20	9.70	910.50	0.00	920.20	0.00	0.00	56.40	10.52	1.48	915.35	4.85	0.00	4.85	911.29	0.79	0 12:07	0 00:00	0.00	0.00
156		CB-F06-08	12944461.77	280333.77	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	50.40	6.11	1.48	915.60	1.10	0.00	4.60	914.69	0.19	0 12:07	0 00:00	0.00	0.00
157		CB-F06-09	12944501.29	280334.30	915.00</																				

25-Year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
169		CB-F06-21	12944989.54	280334.08	913.50	920.20	6.70	913.50	0.00	920.20	0.00	0.00	62.40	10.41	1.61	914.55	1.05	0.00	5.65	913.67	0.17	0 12:06	0 00:00	0.00	0.00
170		CB-F06-22	12945029.98	280334.08	914.00	920.20	6.20	914.00	0.00	920.20	0.00	0.00	56.40	4.42	1.48	914.85	0.85	0.00	5.35	914.16	0.16	0 12:05	0 00:00	0.00	0.00
171		CB-F06-23	12945069.63	280334.08	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	2.96	1.48	915.37	0.87	0.00	4.83	914.65	0.15	0 12:05	0 00:00	0.00	0.00
172		CB-F06-24	12945110.08	280334.08	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	1.48	1.48	915.50	0.50	0.00	4.70	915.10	0.10	0 12:05	0 00:00	0.00	0.00
173		CB-F06-25	12945149.72	280334.04	915.50	920.45	4.95	915.50	0.00	920.45	0.00	0.00	47.40	1.48	1.48	916.59	1.09	0.00	3.86	915.61	0.11	0 12:04	0 00:00	0.00	0.00
174		CB-F06-26	12945189.66	280333.74	915.00	920.45	5.45	915.00	0.00	920.45	0.00	0.00	53.40	2.97	1.48	916.50	1.50	0.00	3.95	915.16	0.16	0 12:05	0 00:00	0.00	0.00
175		CB-F06-27	12944337.64	280480.41	911.00	919.51	8.51	911.00	0.00	919.51	0.00	0.00	84.12	4.46	4.46	915.72	4.72	0.00	3.79	911.32	0.32	0 12:04	0 00:00	0.00	0.00
176		CB-F07-04	12945229.91	280333.74	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.45	1.48	915.99	1.49	0.00	4.21	914.70	0.20	0 12:04	0 00:00	0.00	0.00
177		CB-F07-05	12945269.55	280334.04	914.00	920.20	6.20	914.00	0.00	920.20	0.00	0.00	62.40	9.84	1.48	914.81	0.81	0.00	5.39	914.15	0.15	0 12:06	0 00:00	0.00	0.00
178		CB-F07-06	12945309.79	280334.04	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	3.91	1.48	915.72	1.22	0.00	4.48	914.68	0.18	0 12:05	0 00:00	0.00	0.00
179		CB-F07-07	12945353.91	280334.07	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	2.44	1.42	916.08	1.08	0.00	4.12	915.14	0.14	0 12:05	0 00:00	0.00	0.00
180		CB-F07-08	12945381.86	280333.74	915.50	920.20	4.70	915.50	0.00	920.20	0.00	0.00	44.40	1.05	1.05	916.12	0.62	0.00	4.08	915.58	0.08	0 12:05	0 00:00	0.00	0.00
181		CB-F07-09	12945409.53	280333.75	915.50	920.24	4.74	915.50	0.00	920.24	0.00	0.00	44.88	1.26	1.26	916.40	0.90	0.00	3.84	915.60	0.10	0 12:05	0 00:00	0.00	0.00
182		CB-F07-10	12945449.97	280334.15	915.00	920.30	5.30	915.00	0.00	920.30	0.00	0.00	51.60	2.73	1.48	916.36	1.36	0.00	3.94	915.15	0.15	0 12:05	0 00:00	0.00	0.00
183		CB-F07-11	12945489.60	280334.15	914.50	920.45	5.95	914.50	0.00	920.45	0.00	0.00	59.40	4.21	1.48	915.94	1.44	0.00	4.51	914.69	0.19	0 12:04	0 00:00	0.00	0.00
184		CB-F07-12	12945529.64	280334.15	909.00	920.45	11.45	909.00	0.00	920.45	0.00	0.00	65.40	10.19	1.51	913.10	4.10	0.00	7.35	911.05	2.05	0 12:08	0 00:00	0.00	0.00
185		CB-F07-13	12945569.67	280334.15	914.50	920.45	5.95	914.50	0.00	920.45	0.00	0.00	59.40	4.48	1.48	915.98	1.48	0.00	4.47	914.69	0.19	0 12:04	0 00:00	0.00	0.00
186		CB-F07-14	12945609.71	280333.75	915.00	920.45	5.45	915.00	0.00	920.45	0.00	0.00	53.40	3.00	1.51	916.50	1.50	0.00	3.95	915.16	0.16	0 12:04	0 00:00	0.00	0.00
187		CB-F07-15	12945650.14	280333.75	915.50	920.45	4.95	915.50	0.00	920.45	0.00	0.00	47.40	1.48	1.48	916.59	1.09	0.00	3.86	915.61	0.11	0 12:05	0 00:00	0.00	0.00
188		CB-F07-16	12945689.54	280334.16	915.50	920.40	4.90	915.50	0.00	920.40	0.00	0.00	46.80	1.48	1.48	916.71	1.21	0.00	3.69	915.61	0.11	0 12:04	0 00:00	0.00	0.00
189		CB-F07-17	12945729.78	280333.86	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	2.97	1.48	916.61	1.61	0.00	3.59	915.17	0.17	0 12:04	0 00:00	0.00	0.00
190		CB-F07-18	12945769.41	280333.86	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.45	1.48	916.11	1.61	0.00	4.09	914.70	0.20	0 12:04	0 00:00	0.00	0.00
191		CB-F07-19	12945813.85	280333.56	914.00	920.20	6.20	914.00	0.00	920.20	0.00	0.00	62.40	10.53	1.64	914.82	0.82	0.00	5.38	914.15	0.15	0 12:05	0 00:00	0.00	0.00
192		CB-F07-20	12945854.08	280334.16	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.45	1.48	916.05	1.55	0.00	4.15	914.70	0.20	0 12:04	0 00:00	0.00	0.00
193		CB-F07-21	12945893.72	280333.86	915.00	920.45	5.45	915.00	0.00	920.45	0.00	0.00	53.40	2.97	1.48	916.55	1.55	0.00	3.90	915.16	0.16	0 12:04	0 00:00	0.00	0.00
194		CB-F07-22	12945933.65	280333.86	915.50	920.45	4.95	915.50	0.00	920.45	0.00	0.00	47.40	1.48	1.48	916.64	1.14	0.00	3.81	915.61	0.11	0 12:05	0 00:00	0.00	0.00
195		CB-F07-23	12945973.31	280333.80	915.50	920.28	4.78	915.50	0.00	920.28	0.00	0.00	45.36	1.48	1.48	916.83	1.33	0.00	3.45	915.62	0.12	0 12:04	0 00:00	0.00	0.00
196		CB-F07-24	12946013.74	280333.40	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	2.97	1.48	916.73	1.73	0.00	3.47	915.17	0.17	0 12:04	0 00:00	0.00	0.00
197		CB-F07-25	12946053.77	280333.40	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.60	1.64	916.23	1.73	0.00	3.97	914.71	0.21	0 12:04	0 00:00	0.00	0.00
198		CB-F07-26	12945262.94	280479.55	913.50	918.88	5.38	913.50	0.00	918.88	0.00	0.00	46.56	4.90	4.90	914.35	0.85	0.00	4.53	913.68	0.18	0 12:05	0 00:00	0.00	0.00
199		CB-F08-05	12946098.60	280334.20	908.50	920.20	11.70	908.50	0.00	920.20	0.00	0.00	62.40	10.56	1.48	912.34	3.84	0.00	7.86	910.97	2.47	0 12:05	0 00:00	0.00	0.00
200		CB-F08-06	12946139.03	280333.80	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.48	1.48	916.08	1.58	0.00	4.12	914.70	0.20	0 12:04	0 00:00	0.00	0.00
201		CB-F08-07	12946177.46	280333.80	915.00	920.45	5.45	915.00	0.00	920.45	0.00	0.00	53.40	3.00	1.48	916.58	1.58	0.00	3.87	915.17	0.17	0 12:04	0 00:00	0.00	0.00
202		CB-F08-08	12946218.29	280333.80	915.50	920.45	4.95	915.50	0.00	920.45	0.00	0.00	47.40	1.51	1.51	916.68	1.18	0.00	3.77	915.61	0.11	0 12:04	0 00:00	0.00	0.00
203		CB-F08-09	12946257.72	280333.66	915.50	920.20	4.70	915.50	0.00	920.20	0.00	0.00	44.40	1.51	1.51	916.65	1.15	0.00	3.55	915.61	0.11	0 12:04	0 00:00	0.00	0.00
204		CB-F08-10	12946298.18	280333.66	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	2.99	1.48	916.55	1.55	0.00	3.65	915.16	0.16	0 12:04	0 00:00	0.00	0.00
205		CB-F08-11	12946337.93	280333.66	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	4.48	1.48	916.04	1.54	0.00	4.16	914.70	0.20	0 12:04	0 00:00	0.00	0.00
206		CB-F08-12	12946377.69	280333.66	914.00	920.20	6.20	914.00	0.00	920.20	0.00	0.00	62.40	9.76	1.48	914.78	0.78	0.00	5.42	914.15	0.15	0 12:05	0 00:00	0.00	0.00
207		CB-F08-13	12946421.66	280333.66	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	56.40	3.81	0.83	915.75	1.25	0.00	4.45	914.68	0.18	0 12:04	0 00:00	0.00	0.00
208		CB-F08-14	12946461.77	280334.01	915.00	920.45	5.45	915.00	0.00	920.45	0.00	0.00	53.40	2.98	1.51	916.26	1.26	0.00	4.19	915.16	0.16	0 12:05	0 00:00	0.00	0.00
209		CB-F08-15	12946502.12	280333.63	915.50	920.45	4.95	915.50	0.00	920.45	0.00	0.00	47.40	1.48	1.48	916.34	0.84	0.00	4.11	915.60	0.10	0 12:05	0 00:00	0.00	0.00
210		CB-F08-16	12946541.63	280333.63	915.50	920.20	4.70	915.50	0.00	920.20	0.00	0.00	44.40	1.48	1.48	916.00	0.50	0.00	4.20	915.60	0.10	0 12:05	0 00:00	0.00	0.00
211		CB-F08-17	12946581.41	280333.63	915.00	920.20	5.20	915.00	0.00	920.20	0.00	0.00	50.40	2.96	1.48	915.88	0.88	0.00	4.32	915.15	0.15	0 12:05	0 00:00	0.00	0.00
212		CB-F08-18	12946621.53	280333.63	914.50	920.20	5.70	914.50	0.00	920.20	0.00	0.00	53.40	4.42	1.48	915.39	0.89	0.00	4.81	914.67	0.17	0 12:05	0 00:00	0.00	0.00
213		CB-F08-19	12946662.00	280333.63	907.00	920.20																			

25-Year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
225		CB-G04-02	12942669.76	280622.58	912.50	915.56	3.06	912.50	0.00	917.56	2.00	0.00	0.00	12.02	0.00	916.01	3.51	0.00	1.55	912.98	0.48	0 12:11	0 00:00	0.00	0.00
226		CB-G04-03	12942775.94	280618.06	913.00	916.80	3.80	913.00	0.00	918.80	2.00	0.00	0.00	5.36	0.00	916.48	3.48	0.00	2.32	913.37	0.37	0 12:08	0 00:00	0.00	0.00
227		CB-G04-11	12943393.60	280832.48	911.93	917.00	5.07	911.93	0.00	917.00	0.00	0.00	36.84	4.32	4.32	917.00	5.07	0.00	0.00	912.26	0.33	0 12:06	0 12:06	0.00	0.00
228		CB-G05-01	12943675.35	280774.95	911.36	917.31	5.95	911.36	0.00	917.31	0.00	0.00	41.40	11.67	7.34	917.31	5.95	0.00	0.00	911.81	0.45	0 12:06	0 12:06	0.00	0.00
229		CB-G05-02	12943906.14	280928.86	909.47	918.00	8.53	909.47	0.00	918.00	0.00	0.00	48.36	24.99	24.99	913.28	3.81	0.00	4.72	910.13	0.66	0 12:15	0 00:00	0.00	0.00
230		CB-G05-03	12944180.59	280929.42	908.42	918.00	9.58	908.42	0.00	918.00	0.00	0.00	54.96	31.22	7.99	913.23	4.81	0.00	4.77	909.19	0.77	0 12:15	0 00:00	0.00	0.00
231		CB-G06-01	12944455.61	280928.86	907.87	918.00	10.13	907.87	0.00	918.00	0.00	0.00	55.56	69.70	41.21	913.08	5.21	0.00	4.92	908.90	1.03	0 12:15	0 00:00	0.00	0.00
232		CB-G06-02	12944730.35	280929.14	907.60	918.00	10.40	907.60	0.00	918.00	0.00	0.00	52.80	74.45	7.52	912.89	5.29	0.00	5.11	908.64	1.04	0 12:15	0 00:00	0.00	0.00
233		CB-G06-03	12945005.37	280929.14	907.32	918.00	10.68	907.32	0.00	918.00	0.00	0.00	56.16	78.16	7.59	912.78	5.46	0.00	5.22	908.38	1.06	0 12:14	0 00:00	0.00	0.00
234		CB-G07-01	12945280.39	280929.14	907.05	918.00	10.95	907.05	0.00	918.00	0.00	0.00	59.40	113.99	40.97	912.63	5.58	0.00	5.37	908.04	0.99	0 12:14	0 00:00	0.00	0.00
235		CB-G07-02	12945555.13	280929.42	905.21	918.00	12.79	905.21	0.00	918.00	0.00	0.00	69.48	115.72	7.63	913.03	7.82	0.00	4.97	906.56	1.35	0 12:12	0 00:00	0.00	0.00
236		CB-G07-03	12945830.43	280928.86	904.93	918.00	13.07	904.93	0.00	918.00	0.00	0.00	72.84	116.98	7.45	913.06	8.13	0.00	4.94	906.32	1.39	0 12:12	0 00:00	0.00	0.00
237		CB-G08-01	12946104.88	280928.86	904.66	918.00	13.34	904.66	0.00	918.00	0.00	0.00	76.08	121.29	7.63	912.44	7.78	0.00	5.56	906.07	1.41	0 12:12	0 00:00	0.00	0.00
238		CB-G08-02	12946380.74	280928.86	904.38	916.57	12.19	904.38	0.00	916.57	0.00	0.00	62.28	127.55	7.54	912.15	7.77	0.00	4.42	905.81	1.43	0 12:12	0 00:00	0.00	0.00
239		CB-G08-03	12946655.48	280929.14	904.11	915.77	11.66	904.11	0.00	915.77	0.00	0.00	55.92	155.26	35.53	911.90	7.79	0.00	3.87	905.54	1.43	0 12:12	0 00:00	0.00	0.00
240		CB-G08-04	12946930.78	280929.39	903.84	920.45	16.61	903.84	0.00	920.45	0.00	0.00	115.32	160.82	9.41	911.45	7.61	0.00	9.00	904.90	1.06	0 12:12	0 00:00	0.00	0.00
241	Yes	CB-G09-02	12947420.21	280722.42	902.92	918.94	16.02	902.92	0.00	918.94	0.00	0.00	108.12	595.64	11.64	910.88	7.96	0.00	8.06	904.28	1.36	0 12:12	0 00:00	0.00	0.00
242		CB-G10-01	12948251.36	280618.40	909.50	918.28	8.78	909.50	0.00	920.28	2.00	0.00	0.00	20.79	0.00	911.80	2.30	0.00	8.48	909.87	0.37	0 12:13	0 00:00	0.00	0.00
243		CB-G10-02	12948324.51	280604.96	910.50	919.00	8.50	910.50	0.00	921.00	2.00	0.00	0.00	17.87	5.56	912.67	2.17	0.00	8.33	910.86	0.36	0 12:05	0 00:00	0.00	0.00
244		CB-G10-03	12948408.05	280588.33	911.00	919.45	8.45	911.00	0.00	921.00	1.55	0.00	0.00	12.08	3.42	913.14	2.14	0.00	8.32	911.31	0.31	0 12:05	0 00:00	0.00	0.00
245		CB-G10-04	12948234.99	280698.83	904.50	921.86	17.36	904.50	0.00	921.86	0.00	0.00	124.32	136.77	7.22	911.63	7.13	0.00	10.23	905.91	1.41	0 12:12	0 00:00	0.00	0.00
246		CB-G10-05	12948430.58	280695.02	912.00	917.78	5.78	912.00	0.00	917.78	0.00	0.00	51.36	6.71	6.71	913.81	1.81	0.00	3.97	912.25	0.25	0 12:05	0 00:00	0.00	0.00
247		CB-G10-06	12948251.57	280775.74	906.50	919.76	13.26	906.50	0.00	921.76	2.00	0.00	0.00	114.88	0.00	912.50	6.00	0.00	9.26	907.41	0.91	0 12:13	0 00:00	0.00	0.00
248		CB-G10-07	12948331.52	280796.08	907.00	920.15	13.15	907.00	0.00	922.15	2.00	0.00	0.00	111.99	0.00	913.34	6.34	0.00	8.81	907.93	0.93	0 12:13	0 00:00	0.00	0.00
249		CB-G10-08	12948417.58	280802.09	907.50	919.16	11.66	907.50	0.00	921.00	1.84	0.00	0.00	103.99	99.51	914.11	6.61	0.00	7.05	908.42	0.92	0 12:13	0 00:00	0.00	0.00
250		CB-J02-01	12941091.73	281957.74	906.60	918.33	11.73	906.60	0.00	918.33	0.00	0.00	0.00	373.51	29.72	916.05	9.45	0.00	2.78	908.27	1.67	0 12:16	0 00:00	0.00	0.00
251		CB-J02-03	12941091.73	282031.58	906.80	916.00	9.20	906.80	0.00	918.00	2.00	0.00	45.00	289.72	4.31	917.01	10.21	1.01	0.00	908.42	1.62	0 12:17	0 00:00	0.00	0.00
252		CB-J02-04	12941089.40	282107.71	907.00	918.33	11.33	907.00	0.00	918.33	0.00	0.00	0.00	296.69	71.32	917.95	10.95	0.00	0.88	908.61	1.61	0 12:17	0 00:00	0.00	0.00
253		CB-J07-02	12945878.83	281957.31	908.50	916.25	7.75	908.50	0.00	919.25	3.00	0.00	0.00	220.67	43.19	917.42	8.92	0.00	2.33	910.18	1.68	0 12:18	0 00:00	0.00	0.00
254		CB-J07-03	12945880.29	282032.68	909.00	916.00	7.00	909.00	0.00	918.00	2.00	0.00	0.00	198.78	6.39	918.33	9.33	0.33	0.00	910.57	1.57	0 12:22	0 00:00	0.00	0.00
255		CB-J07-04	12945878.10	282105.84	909.50	915.00	5.50	909.50	0.00	918.00	3.00	0.00	0.00	226.06	23.67	919.29	9.79	0.79	0.00	911.06	1.56	0 12:17	0 00:00	0.00	0.00
256		CB-J08-01	12946782.62	282110.91	920.00	923.00	3.00	920.00	0.00	923.00	0.00	0.00	0.00	31.58	18.92	921.04	1.04	0.00	2.46	920.23	0.23	0 12:11	0 00:00	0.00	0.00
257	HW-D02-01	12941301.37	279153.19	903.00	918.00	15.00	903.00	0.00	918.00	0.00	0.00	0.00	701.99	42.92	907.32	4.32	0.00	10.68	904.27	1.27	0 12:15	0 00:00	0.00	0.00	
258	HW-D03-01	12942164.75	279344.15	915.00	917.00	2.00	915.00	0.00	917.00	0.00	0.00	0.00	5.83	0.00	915.54	0.54	0.00	1.46	915.14	0.14	0 12:15	0 00:00	0.00	0.00	
259	HW-D04-01	12943013.83	279336.80	916.50	916.50	0.00	916.50	0.00	918.50	2.00	0.00	0.00	3.48	0.00	917.02	0.52	0.00	1.48	916.62	0.12	0 12:11	0 00:00	0.00	0.00	
260	HW-D05-01	12943716.72	279336.98	916.52	919.52	3.00	916.52	0.00	919.52	0.00	0.00	12.00	1.66	0.00	917.13	0.61	0.00	2.39	916.60	0.08	0 12:15	0 00:00	0.00	0.00	
261	HW-D06-01	12944408.88	279339.92	917.02	917.02	0.00	917.02	0.00	919.02	2.00	0.00	0.00	0.92	0.00	917.33	0.31	0.00	1.69	917.10	0.08	0 12:10	0 00:00	0.00	0.00	
262	HW-D06-02	12944405.51	279263.96	916.17	916.17	0.00	916.17	0.00	918.17	2.00	0.00	0.00	8.78	0.00	916.75	0.58	0.00	1.42	916.30	0.13	0 12:10	0 00:00	0.00	0.00	
263	HW-D06-03	12945060.91	279339.53	916.00	918.00	2.00	916.00	0.00	918.00	0.00	0.00	0.00	2.62	0.00	916.38	0.38	0.00	1.62	916.10	0.10	0 12:12	0 00:00	0.00	0.00	
264	HW-D07-01	12946014.14	279338.58	916.00	916.00	0.00	916.00	0.00	918.00	2.00	0.00	0.00	0.92	0.00	916.43	0.43	0.00	1.57	916.21	0.21	0 12:10	0 00:00	0.00	0.00	
265	HW-D08-04	12946964.20	279337.05	914.50	914.50	0.00	914.50	0.00	916.50	2.00	0.00	0.00	2.47	0.00	915.75	1.25	0.00	1.75	915.28	0.78	1 00:00	0 00:00	0.00	0.00	
266	HW-D09-01	12947419.43	279141.43	900.00	918.00	18.00	900.00	0.00	918.00	0.00	0.00	24.00	833.88	0.00	904.90	4.90	0.00	13.10	901.90	1.90	0 12:13	0 00:00	0.00	0.00	
267	HW-E10-01	12948254.01	279816.46	918.50	918.50	0.00	918.50	0.00	920.50	2.00	0.00	0.00	2.27	0.00	919.33	0.83	0.00	1.17	918.70	0.20	0 12:11	0 00:00	0.00	0.00	
268	HW-E10-02	12948328.06	279815.50	918.40	918.40	0.00	918.40	0.00	920.40	2.00	0.00	0.00	13.12	10.35	919.11	0.71	0.00	1.29	918.60	0.20	0 12:13	0 00:00	0.00	0.00	
269	HW-F01-03	12940570.27	280424.16	912.50																					

25-Year Storm Event Analysis

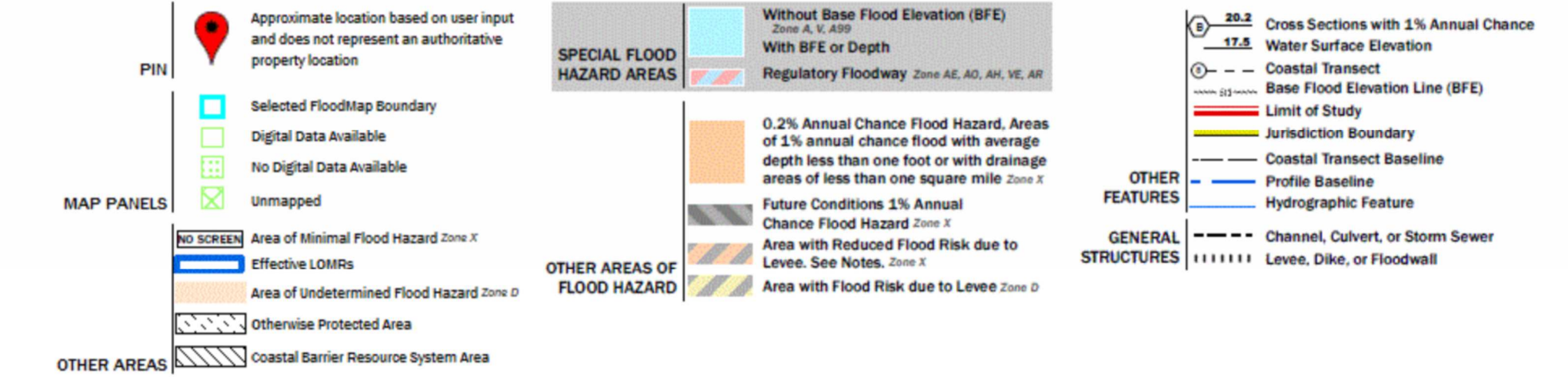
SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
281		Jun-184	12943160.94	282111.35	917.61	920.61	3.00	917.61	0.00	920.61	0.00	0.00	0.00	98.53	59.47	920.43	2.82	0.00	0.68	918.42	0.81	0 12:13	0 00:00	0.00	0.00
282		Jun-366	12947457.52	282133.72	923.61	923.50	-0.11	923.61	0.00	926.50	3.00	0.00	0.00	12.98	12.98	924.26	0.65	0.00	2.85	923.75	0.14	0 12:10	0 00:00	0.00	0.00
283		Jun-378	12940492.76	281956.54	917.00	920.00	3.00	917.00	0.00	920.00	0.00	0.00	0.00	5.62	5.62	918.43	1.43	0.00	2.97	917.90	0.90	0 12:08	0 00:00	0.00	0.00
284		Jun-379	12942681.22	281923.37	917.00	920.00	3.00	917.00	0.00	920.00	0.00	0.00	0.00	74.54	44.85	919.32	2.32	0.00	1.18	917.67	0.67	0 12:10	0 00:00	0.00	0.00
285		Jun-380	12942794.40	281923.37	917.25	920.25	3.00	917.25	0.00	920.25	0.00	0.00	0.00	38.45	0.00	920.18	2.93	0.00	0.57	918.07	0.82	0 12:12	0 00:00	0.00	0.00
286		Jun-381	12943811.16	281953.61	920.00	923.00	3.00	920.00	0.00	923.00	0.00	0.00	0.00	43.95	43.95	921.04	1.04	0.00	2.46	920.24	0.24	0 12:10	0 00:00	0.00	0.00
287		Jun-383	12946599.28	281954.79	918.50	920.50	2.00	918.50	0.00	920.50	0.00	0.00	0.00	14.30	6.05	919.58	1.08	0.00	0.92	918.86	0.36	0 12:13	0 00:00	0.00	0.00
288		Jun-384	12947417.49	281953.19	921.30	926.66	5.36	921.30	0.00	926.66	0.00	0.00	40.32	9.67	5.94	922.06	0.76	0.00	4.60	921.53	0.23	0 12:10	0 00:00	0.00	0.00
289		Jun-387	12940642.24	280019.56	917.70	919.70	2.00	917.70	0.00	919.70	0.00	0.00	0.00	8.36	8.36	918.27	0.57	0.00	1.43	917.83	0.13	0 12:07	0 00:00	0.00	0.00
290		Jun-393	12945740.15	279340.38	917.00	919.00	2.00	917.00	0.00	919.00	0.00	0.00	0.00	0.59	0.59	917.16	0.16	0.00	1.84	917.03	0.03	0 12:06	0 00:00	0.00	0.00
291		Jun-395	12945671.75	279339.46	917.25	919.25	2.00	917.25	0.00	919.25	0.00	0.00	0.00	1.89	1.89	917.63	0.38	0.00	1.62	917.32	0.07	0 12:06	0 00:00	0.00	0.00
292		Jun-397	12944637.81	279338.96	917.29	919.29	2.00	917.29	0.00	919.29	0.00	0.00	0.00	0.92	0.92	917.50	0.21	0.00	1.79	917.33	0.04	0 12:07	0 00:00	0.00	0.00
293		Jun-398	12944058.70	279337.74	917.50	919.50	2.00	917.50	0.00	919.50	0.00	0.00	0.00	0.76	0.76	917.70	0.20	0.00	1.80	917.54	0.04	0 12:06	0 00:00	0.00	0.00
294		Jun-401	12941225.02	279338.46	917.92	919.92	2.00	917.92	0.00	919.92	0.00	0.00	0.00	4.88	4.88	918.30	0.38	0.00	1.62	918.00	0.08	0 12:08	0 00:00	0.00	0.00
295		Jun-403	12942615.88	279346.57	916.00	918.00	2.00	916.00	0.00	918.00	0.00	0.00	0.00	3.93	1.27	916.51	0.51	0.00	1.49	916.11	0.11	0 12:09	0 00:00	0.00	0.00
296		Jun-405	12942929.14	282037.78	917.90	919.90	2.00	917.90	0.00	919.90	0.00	0.00	0.00	15.88	0.00	919.90	2.00	0.00	0.00	918.34	0.44	0 12:07	0 12:11	2.92	15.00
297		Jun-406	12942929.14	281954.37	917.68	920.68	3.00	917.68	0.00	920.68	0.00	0.00	0.00	57.49	39.04	920.19	2.51	0.00	0.99	918.22	0.54	0 12:12	0 00:00	0.00	0.00
298		Jun-407	12940544.90	282030.26	918.25	920.25	2.00	918.25	0.00	918.25	-2.00	0.00	27.00	5.28	5.28	918.48	0.23	0.00	1.77	918.30	0.05	0 12:05	0 00:00	0.00	0.00
299		Jun-408	12942584.17	282036.67	918.50	920.50	2.00	918.50	0.00	920.50	0.00	0.00	0.00	4.11	4.11	919.00	0.50	0.00	1.50	918.66	0.16	0 12:13	0 00:00	0.00	0.00
300		Jun-409	12941886.55	282031.87	918.00	920.00	2.00	918.00	0.00	920.00	0.00	0.00	0.00	6.55	5.14	918.29	0.29	0.00	1.96	918.08	0.08	0 12:07	0 00:00	0.00	0.00
301		Jun-411	12943643.45	282037.10	921.00	923.00	2.00	921.00	0.00	923.00	0.00	0.00	0.00	8.51	8.51	921.43	0.43	0.00	1.57	921.08	0.08	0 12:06	0 00:00	0.00	0.00
302		Jun-412	12943872.65	282028.57	919.20	921.20	2.00	919.20	0.00	921.20	0.00	0.00	0.00	3.94	3.94	919.53	0.33	0.00	1.67	919.26	0.06	0 12:06	0 00:00	0.00	0.00
303		Jun-413	12944486.50	282033.37	917.94	919.94	2.00	917.94	0.00	919.94	0.00	0.00	0.00	8.57	5.17	918.46	0.52	0.00	1.48	918.05	0.11	0 12:10	0 00:00	0.00	0.00
304		Jun-414	12945232.23	282030.97	916.70	918.70	2.00	916.70	0.00	918.70	0.00	0.00	0.00	33.30	5.36	918.40	1.70	0.00	0.30	916.98	0.28	0 12:21	0 00:00	0.00	0.00
305		Jun-416	12946601.29	282031.65	919.31	921.31	2.00	919.31	0.00	921.31	0.00	0.00	0.00	10.52	5.91	919.81	0.50	0.00	1.50	919.43	0.12	0 12:07	0 00:00	0.00	0.00
306		Jun-417	12947433.50	282031.65	924.61	926.61	2.00	924.61	0.00	926.61	0.00	0.00	0.00	5.17	5.17	924.89	0.28	0.00	1.72	924.66	0.05	0 12:06	0 00:00	0.00	0.00
307		Jun-437	12941869.06	281950.52	916.11	919.11	3.00	916.11	0.00	919.11	0.00	0.00	0.00	91.15	29.00	918.80	2.69	0.00	0.81	917.03	0.92	0 12:13	0 00:00	0.00	0.00
308		Jun-459	12946794.20	280380.52	900.00	906.00	6.00	900.00	0.00	906.00	0.00	0.00	0.00	0.00	0.00	900.00	0.00	0.00	6.00	900.00	0.00	0 00:00	0 00:00	0.00	0.00
309		Jun-469	12943722.19	283693.67	921.16	923.16	2.00	921.16	0.00	923.16	0.00	0.00	0.00	7.39	7.39	921.65	0.49	0.00	1.51	921.25	0.09	0 12:07	0 00:00	0.00	0.00
310		Jun-470	12943702.61	282224.55	918.31	920.31	2.00	918.31	0.00	920.31	0.00	0.00	0.00	56.50	0.00	920.31	2.00	0.00	0.00	918.78	0.47	0 12:05	0 12:13	11.46	18.00
311		Jun-471	12943699.93	282938.60	919.70	921.70	2.00	919.70	0.00	921.70	0.00	0.00	0.00	12.33	5.97	920.40	0.70	0.00	1.30	919.84	0.14	0 12:10	0 00:00	0.00	0.00
312		Jun-472	12943812.55	283673.86	921.17	923.17	2.00	921.17	0.00	923.17	0.00	0.00	0.00	6.80	6.80	921.63	0.46	0.00	1.54	921.26	0.09	0 12:07	0 00:00	0.00	0.00
313		Jun-473	12943786.69	282221.28	918.34	920.34	2.00	918.34	0.00	920.34	0.00	0.00	0.00	12.93	0.00	920.27	1.93	0.00	0.07	918.65	0.31	0 12:15	0 00:00	0.00	0.00
314		Jun-474	12943793.15	282932.48	919.70	925.70	6.00	919.70	0.00	925.70	0.00	0.00	48.00	14.00	8.16	920.37	0.67	0.00	5.33	919.84	0.14	0 12:10	0 00:00	0.00	0.00
315		Jun-475	12946198.47	279340.66	917.00	919.00	2.00	917.00	0.00	919.00	0.00	0.00	0.00	0.39	0.39	917.11	0.11	0.00	1.89	917.02	0.02	0 12:05	0 00:00	0.00	0.00
316		Jun-476	12945907.11	279264.77	916.50	918.50	2.00	916.50	0.00	918.50	0.00	0.00	0.00	3.49	3.49	916.75	0.25	0.00	1.75	916.55	0.05	0 12:05	0 00:00	0.00	0.00
317		Jun-478	12944554.33	279339.77	917.50	919.50	2.00	917.50	0.00	919.50	0.00	0.00	0.00	0.33	0.33	917.62	0.12	0.00	1.88	917.52	0.02	0 12:05	0 00:00	0.00	0.00
318		Jun-479	12944124.67	279339.06	917.92	919.92	2.00	917.92	0.00	919.92	0.00	0.00	0.00	0.65	0.65	918.09	0.17	0.00	1.83	917.95	0.03	0 12:06	0 00:00	0.00	0.00
319		Jun-481	12944295.36	279264.61	917.47	919.74	2.27	917.47	0.00	919.47	-0.27	0.00	2.88	8.21	8.21	917.82	0.35	0.00	1.92	917.55	0.08	0 12:05	0 00:00	0.00	0.00
320		Jun-491	12942809.82	279657.69	915.00	915.00	0.00	915.00	0.00	917.00	2.00	0.00	0.00	4.71	0.00	915.50	0.50	0.00	1.60	915.11	0.11	0 12:06	0 00:00	0.00	0.00
321		Jun-493	12942813.88	279349.44	917.25	917.25	0.00	917.25	0.00	919.25	2.00	0.00	0.00	2.69	0.45	917.63	0.38	0.00	1.62	917.32	0.07	0 12:07	0 00:00	0.00	0.00
322		Jun-494	12943482.90	279338.92	917.44	919.44	2.00	917.44	0.00	919.44	0.00	0.00	0.00	1.04	1.04	917.69	0.25	0.00	1.75	917.49	0.05	0 12:07	0 00:00	0.00	0.00
323		Jun-495	12943577.91	279339.83	917.00	919.00	2.00	917.00	0.00	919.00	0.00	0.00	0.00	0.31	0.31	917.14	0.14	0.00	1.86	917.02	0.02	0 12:14	0 00:00	0.00	0.00
324		Jun-496	12946297.40	279340.68	917.00	919.00	2.00	917.00	0.00	919.00	0.00	0.00	0.00	1.53	1.53	917.26	0.26	0.00	1.74	917.05	0.05	0 12:07	0 00:00	0.00	0.00
325		Jun-497	12947422.76	279340.61	917.72	917.72	0.00	917.72	0.00	919.72	2.00	0.00	0.00	2.15	2.15	918.02	0.30	0.00							

25-Year Storm Event Analysis																									
SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
337		Jun-512	12942704.18	281258.37	920.35	922.35	2.00	920.35	0.00	922.35	0.00	0.00	0.00	7.39	7.39	920.95	0.60	0.00	1.40	920.48	0.13	0 12:07	0 00:00	0.00	0.00
338		Jun-513	12942772.66	281260.78	920.35	922.35	2.00	920.35	0.00	922.35	0.00	0.00	0.00	4.97	4.97	920.91	0.56	0.00	1.44	920.48	0.13	0 12:08	0 00:00	0.00	0.00
339		Jun-514	12942774.87	279997.62	918.50	918.50	0.00	918.50	0.00	920.50	2.00	0.00	0.00	6.46	6.46	918.90	0.40	0.00	1.60	918.59	0.09	0 12:06	0 00:00	0.00	0.00
340		Jun-515	12942701.17	279996.02	918.50	918.50	0.00	918.50	0.00	920.50	2.00	0.00	0.00	8.11	8.11	918.89	0.39	0.00	1.61	918.57	0.07	0 12:05	0 00:00	0.00	0.00
341		Jun-516	12942805.71	279569.32	917.90	917.90	0.00	917.90	0.00	919.90	2.00	0.00	0.00	2.27	2.27	918.30	0.40	0.00	1.60	917.97	0.07	0 12:05	0 00:00	0.00	0.00
342		Jun-526	12948329.34	281608.62	924.75	924.75	0.00	924.75	0.00	926.75	2.00	0.00	0.00	5.59	5.59	925.28	0.53	0.00	1.47	924.87	0.12	0 12:08	0 00:00	0.00	0.00
343		Jun-528	12948311.63	281421.40	925.73	925.73	0.00	925.73	0.00	927.73	2.00	0.00	0.00	17.89	17.89	926.16	0.43	0.00	1.57	925.82	0.09	0 12:06	0 00:00	0.00	0.00
344		Jun-529	12948245.91	281382.04	924.30	924.30	0.00	924.30	0.00	926.30	2.00	0.00	0.00	4.42	4.42	924.76	0.46	0.00	1.54	924.40	0.10	0 12:07	0 00:00	0.00	0.00
345		Jun-530	12948396.47	280135.25	920.35	920.35	0.00	920.35	0.00	922.35	2.00	0.00	0.00	9.44	9.44	920.91	0.56	0.00	1.44	920.48	0.13	0 12:09	0 00:00	0.00	0.00
346		Jun-531	12947473.09	279186.96	915.00	915.00	0.00	915.00	0.00	917.00	2.00	0.00	0.00	28.18	23.61	915.95	0.95	0.00	1.05	915.21	0.21	0 12:07	0 00:00	0.00	0.00
347		Jun-532	12948326.53	280057.10	921.00	921.00	0.00	921.00	0.00	923.00	2.00	0.00	0.00	1.98	1.98	921.11	0.11	0.00	1.89	921.02	0.02	0 12:07	0 00:00	0.00	0.00
348		Jun-534	12948226.13	281498.53	924.30	924.30	0.00	924.30	0.00	926.30	2.00	0.00	0.00	6.25	6.25	924.90	0.60	0.00	1.40	924.42	0.12	0 12:07	0 00:00	0.00	0.00
349		Jun-538	12948137.72	279484.19	918.50	918.50	0.00	918.50	0.00	920.50	2.00	0.00	0.00	3.99	3.99	919.05	0.55	0.00	1.45	918.63	0.13	0 12:09	0 00:00	0.00	0.00
350		Jun-542	12948254.01	280193.82	920.00	920.00	0.00	920.00	0.00	922.00	2.00	0.00	0.00	5.84	5.84	920.54	0.54	0.00	1.46	920.12	0.12	0 12:06	0 00:00	0.00	0.00
351		Jun-544	12946656.46	279272.12	917.00	917.00	0.00	917.00	0.00	919.00	2.00	0.00	0.00	6.94	6.94	917.55	0.55	0.00	1.45	917.11	0.11	0 12:06	0 00:00	0.00	0.00
352		MH-09-01	12947055.78	281926.13	905.70	923.95	18.25	905.70	0.00	923.95	0.00	0.00	135.00	287.07	0.00	914.09	8.39	0.00	9.86	907.10	1.40	0 12:13	0 00:00	0.00	0.00
353		MH-09-02	12947415.56	281669.35	904.84	922.95	18.11	904.84	0.00	922.95	0.00	0.00	133.32	288.57	0.00	913.49	8.65	0.00	9.46	906.18	1.34	0 12:13	0 00:00	0.00	0.00
354	Yes	MH-D02-03	12941002.31	279373.55	903.39	918.40	15.01	903.39	0.00	918.40	0.00	0.00	96.12	665.45	10.51	908.79	5.40	0.00	9.61	904.66	1.27	0 12:14	0 00:00	0.00	0.00
355	Yes	MH-E01-01	12940680.13	279924.75	904.06	918.86	14.80	904.06	0.00	918.86	0.00	0.00	93.60	646.06	7.22	910.41	6.35	0.00	8.45	905.38	1.32	0 12:13	0 00:00	0.00	0.00
356	Yes	MH-E02-01	12940809.27	279509.79	903.63	918.58	14.95	903.63	0.00	918.85	0.27	0.00	95.40	662.13	10.09	909.69	6.06	0.00	8.89	904.99	1.36	0 12:14	0 00:00	0.00	0.00
357	Yes	MH-E02-03	12941571.83	279529.34	903.36	918.00	14.64	903.36	0.00	918.00	0.00	0.00	91.68	174.05	19.41	908.08	4.72	0.00	9.92	904.46	1.10	0 12:08	0 00:00	0.00	0.00
358	Yes	MH-E03-01	12941901.55	279528.92	903.69	918.00	14.31	903.69	0.00	918.00	0.00	0.00	87.72	158.66	29.09	908.80	5.11	0.00	9.20	904.77	1.08	0 12:07	0 00:00	0.00	0.00
359	Yes	MH-E03-02	12942399.04	279529.16	904.19	918.00	13.81	904.19	0.00	918.00	0.00	0.00	93.72	135.45	40.68	909.54	5.35	0.00	8.46	905.22	1.03	0 12:06	0 00:00	0.00	0.00
360	Yes	MH-E09-03	12947427.96	279692.75	900.88	916.00	15.12	900.88	0.00	916.00	0.00	0.00	97.44	790.69	31.08	908.26	7.38	0.00	7.74	902.51	1.63	0 12:12	0 00:00	0.00	0.00
361	Yes	MH-E09-04	12947426.99	279415.68	900.33	918.83	18.50	900.33	0.00	918.83	0.00	0.00	138.00	812.42	0.00	907.40	7.07	0.00	11.43	902.29	1.96	0 12:14	0 00:00	0.00	0.00
362	Yes	MH-E09-05	12947260.16	279420.56	900.45	917.38	16.93	900.45	0.00	917.38	0.00	0.00	82.56	155.73	0.00	904.63	4.18	0.00	12.75	901.71	1.26	0 12:08	0 00:00	0.00	0.00
363	Yes	MH-F01-01	12940679.94	280424.65	904.56	918.73	14.17	904.56	0.00	918.73	0.00	0.00	86.04	651.73	24.14	911.15	6.59	0.00	7.58	905.91	1.35	0 12:13	0 00:00	0.00	0.00
364	Yes	MH-F02-01	12941197.85	280424.05	905.08	915.50	10.42	905.08	0.00	915.50	0.00	0.00	41.04	170.98	15.29	911.58	6.50	0.00	3.92	906.49	1.41	0 12:12	0 00:00	0.00	0.00
365	Yes	MH-F02-02	12941546.79	280426.53	905.43	916.00	10.57	905.43	0.00	916.00	0.00	0.00	42.84	164.19	19.80	911.95	6.52	0.00	4.05	906.79	1.36	0 12:11	0 00:00	0.00	0.00
366	Yes	MH-F03-01	12941897.63	280427.44	905.78	917.00	11.22	905.78	0.00	917.00	0.00	0.00	50.64	152.08	20.06	912.26	6.48	0.00	4.74	907.10	1.32	0 12:11	0 00:00	0.00	0.00
367	Yes	MH-F03-02	12942260.51	280429.44	906.14	917.50	11.36	906.14	0.00	917.50	0.00	0.00	64.32	136.25	21.36	912.87	6.73	0.00	4.63	907.44	1.30	0 12:10	0 00:00	0.00	0.00
368	Yes	MH-F04-01	12942652.38	280431.66	906.53	918.50	11.97	906.53	0.00	918.50	0.00	0.00	71.64	119.21	10.98	913.38	6.85	0.00	5.12	907.77	1.24	0 12:10	0 00:00	0.00	0.00
369	Yes	MH-F04-02	12942926.14	280432.40	907.80	917.00	9.20	907.80	0.00	917.00	0.00	0.00	50.40	103.03	36.92	914.14	6.34	0.00	2.86	908.91	1.11	0 12:09	0 00:00	0.00	0.00
370	Yes	MH-F05-01	12943630.64	280395.51	910.22	918.90	8.68	910.22	0.00	918.90	0.00	0.00	40.80	42.66	4.34	915.09	4.87	0.00	3.81	910.90	0.68	0 12:08	0 00:00	0.00	0.00
371	Yes	MH-F05-02	12943897.20	280395.24	910.75	917.52	6.77	910.75	0.00	917.52	0.00	0.00	39.24	17.86	7.74	915.17	4.42	0.00	2.35	911.24	0.49	0 12:07	0 12:07	0.00	0.00
372	Yes	MH-F05-03	12944187.42	280394.92	910.05	917.52	7.47	910.05	0.00	917.52	0.00	0.00	53.64	17.69	3.19	916.20	6.15	0.00	1.32	910.54	0.49	0 12:04	0 00:00	0.00	0.00
373	Yes	MH-F06-01	12944455.94	280395.34	908.90	917.52	8.62	908.90	0.00	917.52	0.00	0.00	61.44	34.56	3.19	914.40	5.50	0.00	3.12	909.57	0.67	0 12:05	0 00:00	0.00	0.00
374	Yes	MH-F06-02	12944729.81	280395.17	907.85	917.52	9.67	907.85	0.00	917.52	0.00	0.00	68.04	51.42	8.06	913.92	6.07	0.00	3.60	908.61	0.76	0 12:07	0 00:00	0.00	0.00
375	Yes	MH-F06-03	12945005.59	280395.12	907.30	917.52	10.22	907.30	0.00	917.52	0.00	0.00	68.64	69.62	8.16	913.47	6.17	0.00	4.05	908.14	0.84	0 12:08	0 00:00	0.00	0.00
376	Yes	MH-F07-01	12945280.79	280394.84	906.75	917.52	10.77	906.75	0.00	917.52	0.00	0.00	42.24	87.18	3.24	913.03	6.28	0.00	4.49	907.64	0.89	0 12:09	0 00:00	0.00	0.00
377	Yes	MH-F07-02	12945555.52	280395.37	906.06	917.52	11.46	906.06	0.00	917.52	0.00	0.00	72.24	100.70	8.15	912.33	6.27	0.00	5.19	907.04	0.98	0 12:09	0 00:00	0.00	0.00
378	Yes	MH-F07-03	12945829.55	280395.22	905.51	917.52	12.01	905.51	0.00	917.52	0.00	0.00	72.24	117.90	7.91	911.75	6.24	0.00	5.77	906.55	1.04	0 12:10	0 00:00	0.00	0.00
379	Yes	MH-F08-01	12946106.07	280396.49	904.96	917.52	12.56	904.96	0.00	917.52	0.00	0.00	72.24	131.85	8.14	911.26	6.30	0.00	6.26	906.06	1.10	0 12:10	0 00:00	0.00	0.00
380	Yes	MH-F08-02																							

25-Year Storm Event Analysis

SN	Phase 1 Deep Stormwater	Element ID	X Coordinate	Y Coordinate	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover	Peak Inflow	Peak Lateral Inflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Maximum Surcharge Depth Attained	Minimum Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
	Yes/No				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(inches)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-inches)	(minutes)
393		MH-H01-01	12940680.20	281136.45	905.27	921.39	16.12	905.27	0.00	921.39	0.00	0.00	109.44	395.73	26.53	911.80	6.53	0.00	9.59	906.50	1.23	0 12:13	0 00:00	0.00	0.00
394		MH-H01-02	12940680.41	281636.13	905.77	921.39	15.62	905.77	0.00	921.39	0.00	0.00	103.44	384.98	24.31	912.85	7.08	0.00	8.54	907.26	1.49	0 12:13	0 00:00	0.00	0.00
395		MH-H09-01	12947415.10	281300.99	904.10	922.26	18.16	904.10	0.00	922.26	0.00	0.00	133.92	322.23	64.72	912.89	8.79	0.00	9.37	905.51	1.41	0 12:13	0 00:00	0.00	0.00
396		MH-J01-01	12940680.78	281921.19	906.06	918.97	12.91	906.06	0.00	918.97	0.00	0.00	70.92	377.86	10.20	913.65	7.59	0.00	5.32	907.61	1.55	0 12:13	0 00:00	0.00	0.00
397		MH-J02-01	12941091.73	281919.98	906.47	917.95	11.48	906.47	0.00	917.95	0.00	0.00	53.76	375.00	0.00	914.57	8.10	0.00	3.38	908.05	1.58	0 12:15	0 00:00	0.00	0.00
398		MH-J07-01	12945877.28	281919.71	908.07	920.47	12.40	908.07	0.00	920.47	0.00	0.00	64.80	245.42	40.60	916.22	8.15	0.00	4.25	909.90	1.83	0 12:14	0 00:00	0.00	0.00
399		MH-J08.01	12946273.26	281921.01	907.28	920.26	12.98	907.28	0.00	920.26	0.00	0.00	71.76	271.42	34.61	915.83	8.55	0.00	4.43	909.08	1.80	0 12:13	0 00:00	0.00	0.00
400		MH-J08-02	12946601.09	281921.65	906.63	919.67	13.04	906.63	0.00	919.67	0.00	0.00	72.48	292.05	22.95	914.76	8.13	0.00	4.91	907.96	1.33	0 12:13	0 00:00	0.00	0.00
401		NULL-545	12947420.52	279268.90	900.20	906.20	6.00	900.20	0.00	906.20	0.00	0.00	0.00	819.82	3.80	906.40	6.20	0.00	0.80	902.11	1.91	0 12:14	0 00:00	0.00	0.00
402		OCS	12943731.51	278479.06	887.76	903.00	15.24	887.76	0.00	903.00	0.00	0.00	0.00	197.24	0.00	894.06	6.30	0.00	8.94	891.32	3.56	0 13:46	0 00:00	0.00	0.00
403		ST-1	12943719.24	278330.32	885.69	899.00	13.31	885.69	0.00	899.00	0.00	0.00	0.00	197.78	0.00	889.89	4.20	0.00	11.30	887.98	2.29	0 13:46	0 00:00	0.00	0.00

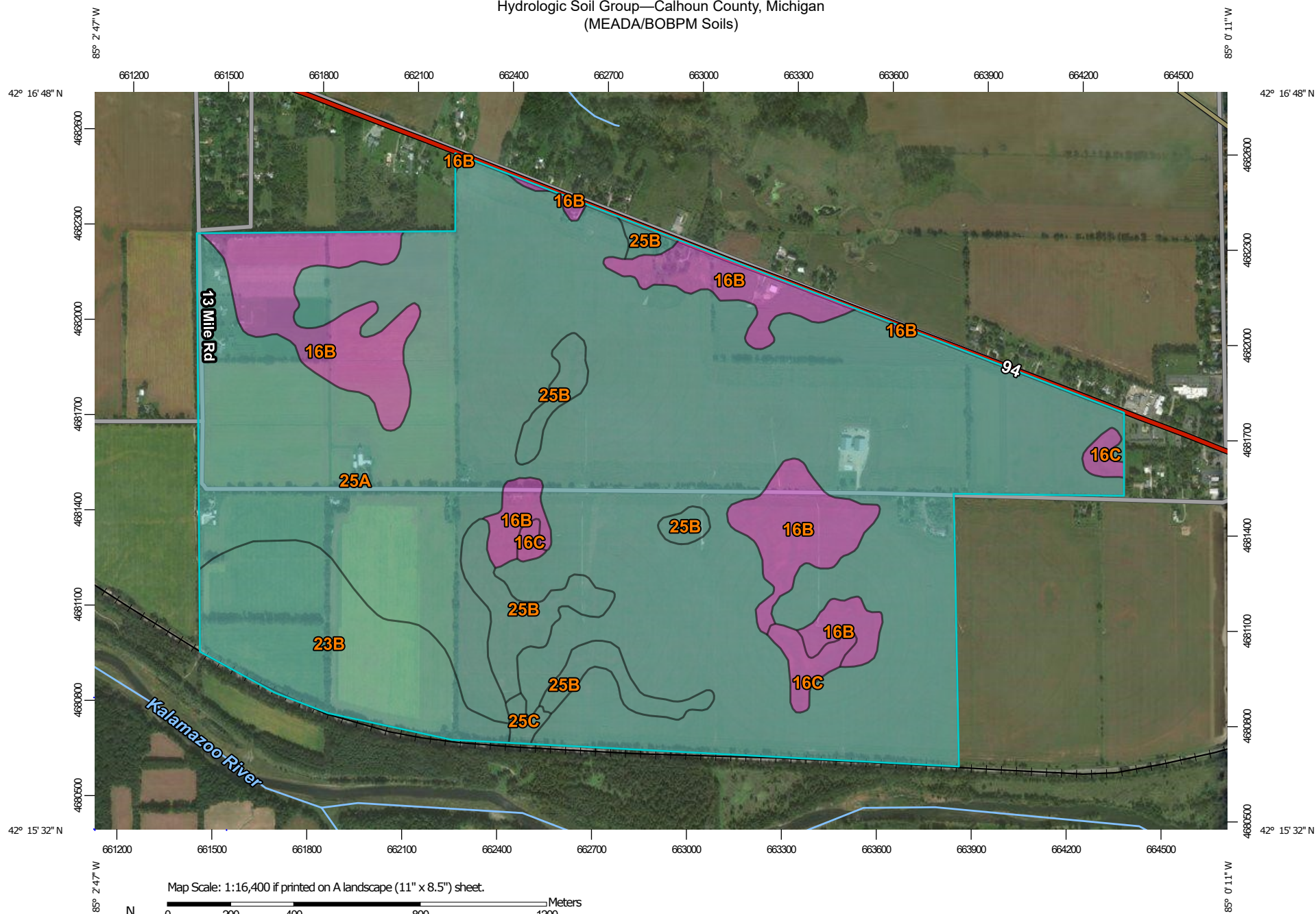
Appendix D. FEMA – Firmette Map





Appendix E. Web Soil Survey Report

Hydrologic Soil Group—Calhoun County, Michigan (MEADA/BOBPM Soils)



Hydrologic Soil Group—Calhoun County, Michigan (MEADA/BOBPM Soils)

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Calhoun County, Michigan

Survey Area Data: Version 20, Aug 25, 2022

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

Date(s) aerial images were photographed: Jul 1, 2011—Mar 10, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
16B	Oshtemo sandy loam, 0 to 6 percent slopes	A	114.2	11.8%
16C	Oshtemo sandy loam, 6 to 12 percent slopes	A	12.8	1.3%
23B	Hixton loam, 0 to 6 percent slopes	C	83.3	8.6%
25A	Kalamazoo loam, 0 to 2 percent slopes	C	710.5	73.3%
25B	Kalamazoo loam, 2 to 6 percent slopes	C	45.7	4.7%
25C	Kalamazoo loam, 6 to 12 percent slopes	C	3.2	0.3%
Totals for Area of Interest			969.8	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Appendix F. HY-8 Reports

HY-8 Culvert Analysis Report

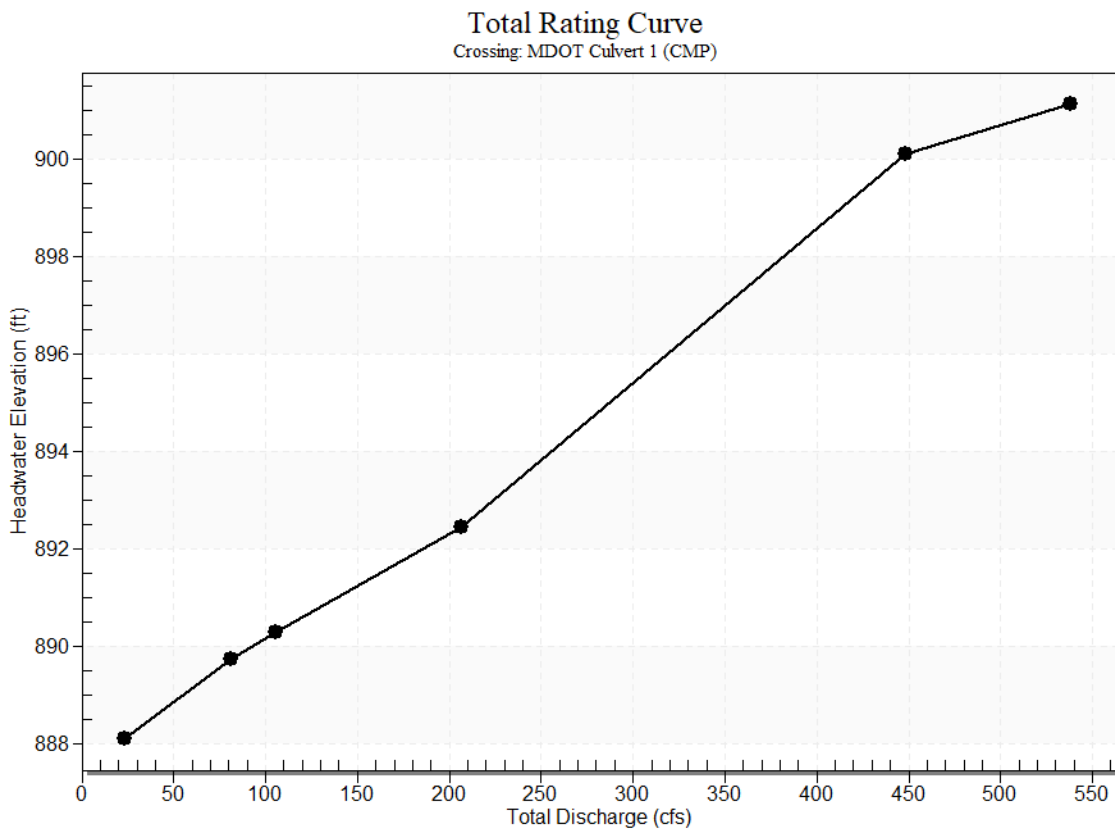
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: MDOT Culvert 1 (CMP)

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
888.11	2 year	23.32	23.32	0.00	1
889.73	5 year	81.40	81.40	0.00	1
890.30	10 year	105.81	105.81	0.00	1
892.44	25 year	206.38	206.38	0.00	1
900.10	100 year	448.17	448.17	0.00	1
901.00	Overtopping	466.80	466.80	0.00	Overtopping

Rating Curve Plot for Crossing: MDOT Culvert 1 (CMP)



Culvert Data: Culvert 1

Table 1 - Culvert Summary Table: Culvert 1

Disc harg e Nam es	Total Disc harg e (cfs)	Culv ert Disc harg e (cfs)	Head water Eleva tion (ft)	Inle t Con trol Dep th (ft)	Out let Con trol Dep th (ft)	Fl o w Ty pe	Nor mal Dep th (ft)	Crit ical De pth (ft)	Ou tle t De pth (ft)	Tail water r Dept h (ft)	Outl et Vel ocit y (ft/ s)	Tail water r Velo city (ft/s)
2 year	23.32 cfs	23.32 cfs	888.1 1	1.71	1.12 8	1- JS 1t	1.08	1.2 7	3.5 0	3.50	1.36	0.00
5 year	81.40 cfs	81.40 cfs	889.7 3	3.33	1.44 0	1- JS 1t	2.03	2.4 2	3.5 0	3.50	4.75	0.00
10 year	105.8 1 cfs	105.8 1 cfs	890.3 0	3.90	1.67 4	1- S2 n	2.34	2.7 7	2.3 6	3.50	10.2 4	0.00
25 year	206.3 8 cfs	206.3 8 cfs	892.4 4	6.04	3.71 1	5- S2 n	3.44	3.9 3	3.4 7	3.50	12.1 8	0.00
100 year	448.1 7 cfs	448.1 7 cfs	900.1 0	13.6 5	13.7 00	7- M 2c	6.00	5.5 3	5.5 3	3.50	16.4 6	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

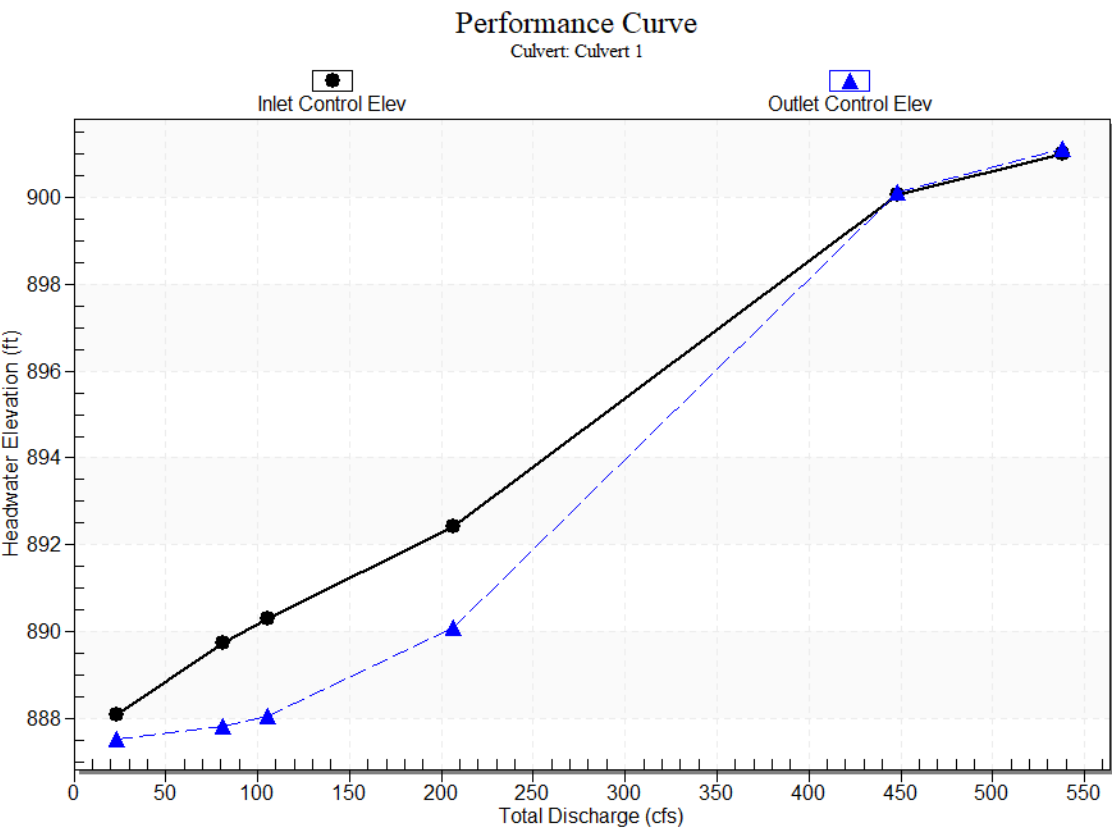
Inlet Elevation (invert): 886.40 ft,

Outlet Elevation (invert): 884.00 ft

Culvert Length: 117.02 ft,

Culvert Slope: 0.0205

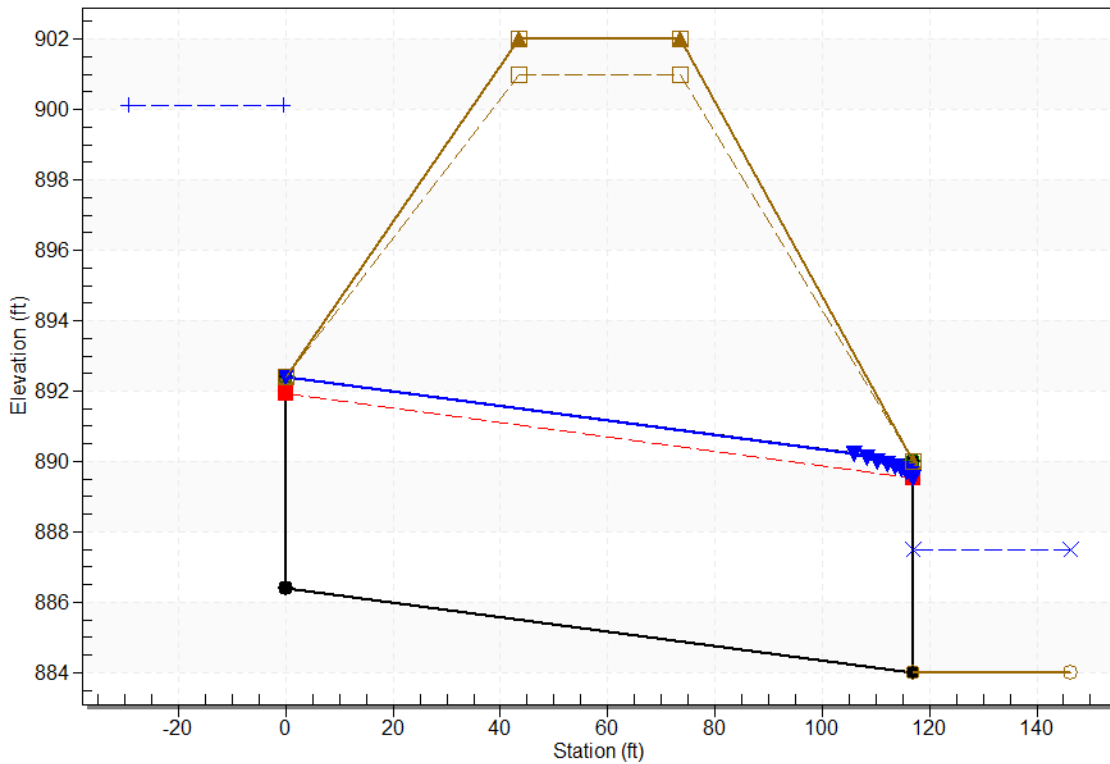
Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1

Crossing - MDOT Culvert 1 (CMP), Design Discharge - 448.2 cfs

Culvert - Culvert 1, Culvert Discharge - 448.2 cfs



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 886.40 ft

Outlet Station: 117.00 ft

Outlet Elevation: 884.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 6.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: MDOT Culvert 1 (CMP)

Table 2 - Downstream Channel Rating Curve (Crossing: MDOT Culvert 1 (CMP))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
23.32	887.50	3.50
81.40	887.50	3.50
105.81	887.50	3.50
206.38	887.50	3.50
448.17	887.50	3.50

Tailwater Channel Data - MDOT Culvert 1 (CMP)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 887.50 ft

Roadway Data for Crossing: MDOT Culvert 1 (CMP)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	0.00	902.00
1	100.00	901.00
2	650.00	901.00
3	750.00	902.00

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

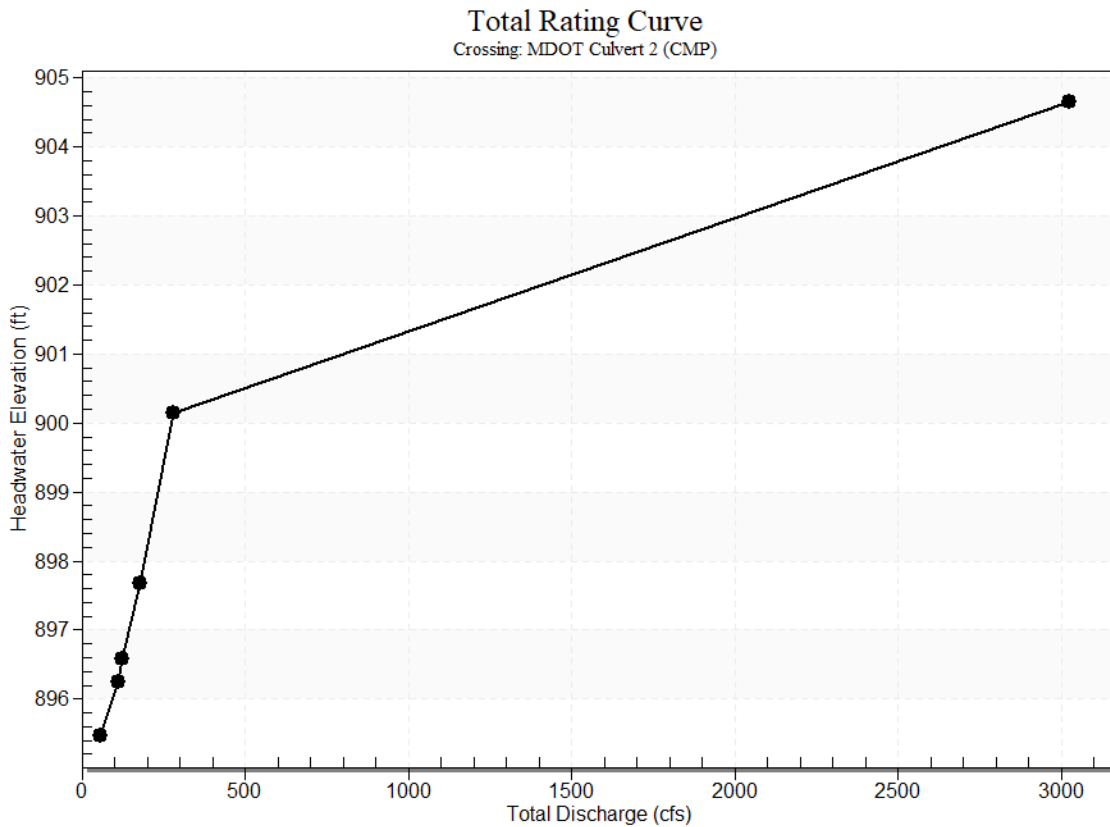
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 3 - Summary of Culvert Flows at Crossing: MDOT Culvert 2 (CMP)

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
895.47	2 year	58.23	58.23	0.00	1
896.26	5 year	110.00	110.00	0.00	1
896.59	10 year	125.36	125.36	0.00	1
897.68	25 year	177.33	177.33	0.00	1
900.14	100 year	280.24	280.24	0.00	1
904.65	500 year	3024.00	406.81	2617.12	8
904.00	Overtopping	391.58	391.58	0.00	Overtopping

Rating Curve Plot for Crossing: MDOT Culvert 2 (CMP)



Culvert Data: Culvert 2

Table 2 - Culvert Summary Table: Culvert 2

Disc charg e Nam es	Total Disc charg e (cfs)	Culv ert Disc charg e (cfs)	Head water Eleva tion (ft)	Inle t Con trol Dep th (ft)	Out let Con trol Dep th (ft)	Fl ow Ty pe	Nor mal Dep th (ft)	Crit ical Dep th (ft)	Ou tle t Dep th (ft)	Tail water r Dept h (ft)	Outl et Vel ocit y (ft/ s)	Tail water r Velo city (ft/s)
2 year	58.23 cfs	58.23 cfs	895.4 7	2.78	3.22 3	1- S1 t	1.87	2.0 3	4.3 5	4.35	2.65	0.00
5 year	110.0 0 cfs	110.0 0 cfs	896.2 6	4.01	3.35 6	1- JS 1t	2.63	2.8 3	4.3 5	4.35	5.01	0.00
10 year	125.3 6 cfs	125.3 6 cfs	896.5 9	4.34	3.53 8	1- JS 1t	2.84	3.0 3	4.3 5	4.35	5.71	0.00
25 year	177.3 3 cfs	177.3 3 cfs	897.6 8	5.43	4.32 6	1- JS 1t	3.50	3.6 3	4.3 5	4.35	8.08	0.00

100 year	280.2 4 cfs	280.2 4 cfs	900.1 4	7.84	7.88 9	7- M 2c	5.01	4.5 8	4.5 8	4.35	12.1 0	0.00
500 year	3024. 00 cfs	406.8 1 cfs	904.6 5	11.9 7	12.4 00	7- M 2c	6.00	5.3 6	5.3 6	4.35	15.2 5	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

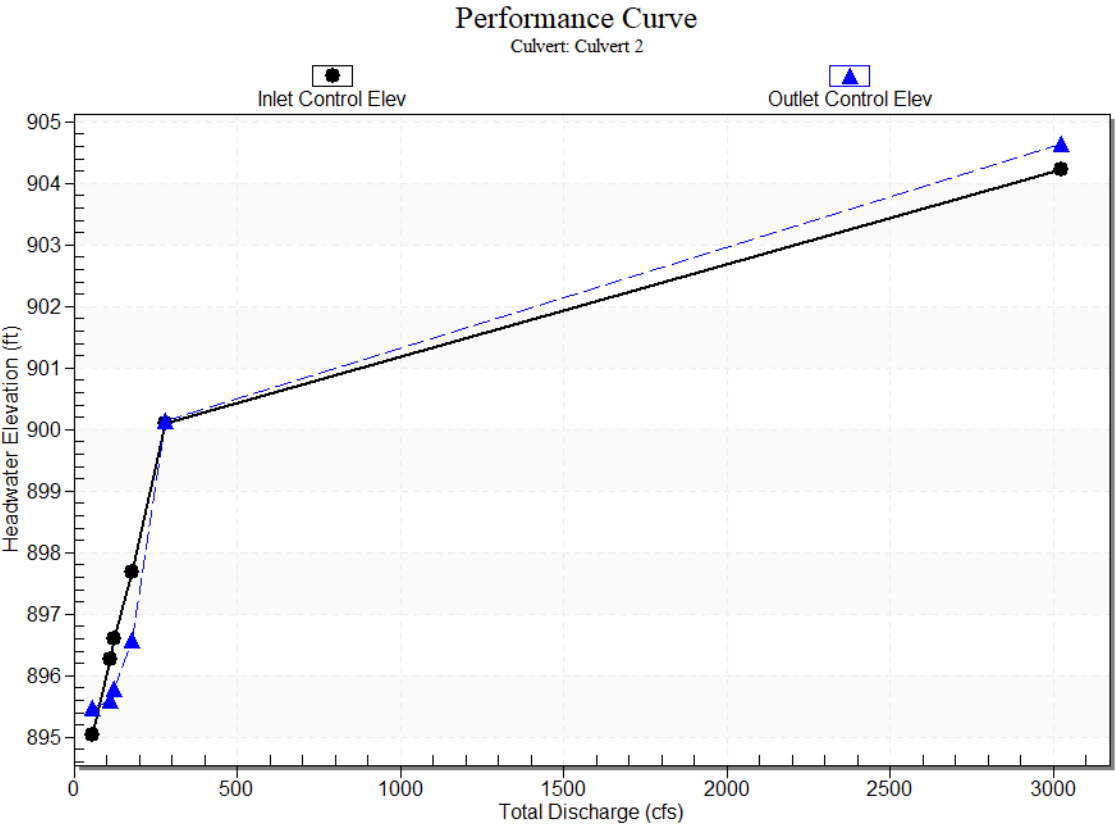
Inlet Elevation (invert): 892.25 ft,

Outlet Elevation (invert): 890.65 ft

Culvert Length: 111.01 ft,

Culvert Slope: 0.0144

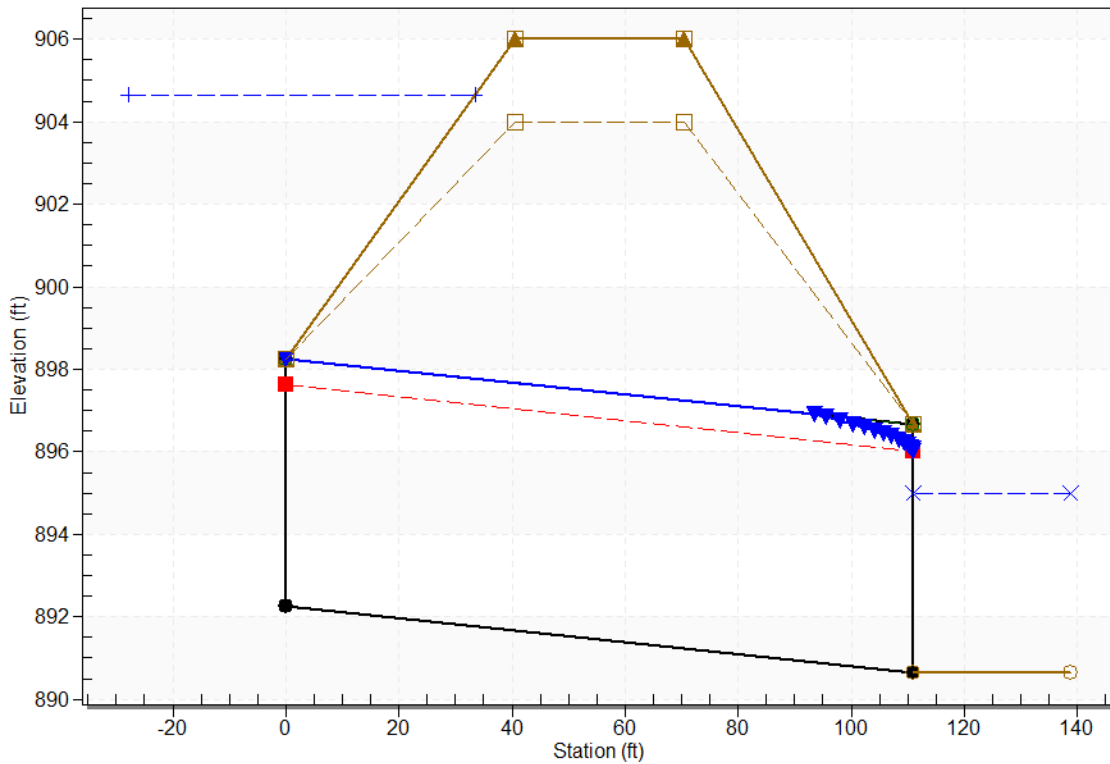
Culvert Performance Curve Plot: Culvert 2



Water Surface Profile Plot for Culvert: Culvert 2

Crossing - MDOT Culvert 2 (CMP), Design Discharge - 3024.0 cfs

Culvert - Culvert 2, Culvert Discharge - 406.8 cfs



Site Data - Culvert 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 892.25 ft

Outlet Station: 111.00 ft

Outlet Elevation: 890.65 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2

Barrel Shape: Circular

Barrel Diameter: 6.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: MDOT Culvert 2 (CMP)

Table 4 - Downstream Channel Rating Curve (Crossing: MDOT Culvert 2 (CMP))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
58.23	895.00	4.35
110.00	895.00	4.35
125.36	895.00	4.35
177.33	895.00	4.35
280.24	895.00	4.35
3024.00	895.00	4.35

Tailwater Channel Data - MDOT Culvert 2 (CMP)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 895.00 ft

Roadway Data for Crossing: MDOT Culvert 2 (CMP)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	0.00	906.00
1	200.00	904.00
2	1800.00	904.00
3	2000.00	906.00

Roadway Surface: Paved

Roadway Top Width: 30.00 ft



Appendix G. Plunge Pool Calculations

Plunge Pool Design HEC-14

Culvert 1

Q	448.17	cfs	Design flow for the culvert
D	6	ft	Culvert diameter or span
y _o	4.92	ft	Outlet depth
A	24.81	sq ft	Wetted culvert area
V _o	18.06	ft/s	Outlet velocity
y _e	3.52	ft	Equivalent brink outlet depth
Fr	1.43	--	Froude number
h _s	3.5	ft	Plunge pool depth
Co	1.4	--	Coefficient
D ₅₀	1.43	ft	Median stone size
D ₅₀	17.2	in	Median stone size
W _o	6	ft	Riprap width at outlet
L _s	35	ft	Pool length
L _a	17.5	ft	Apron Length
L _b	52.5	ft	Basin length
W _b	41	ft	Width at end of apron

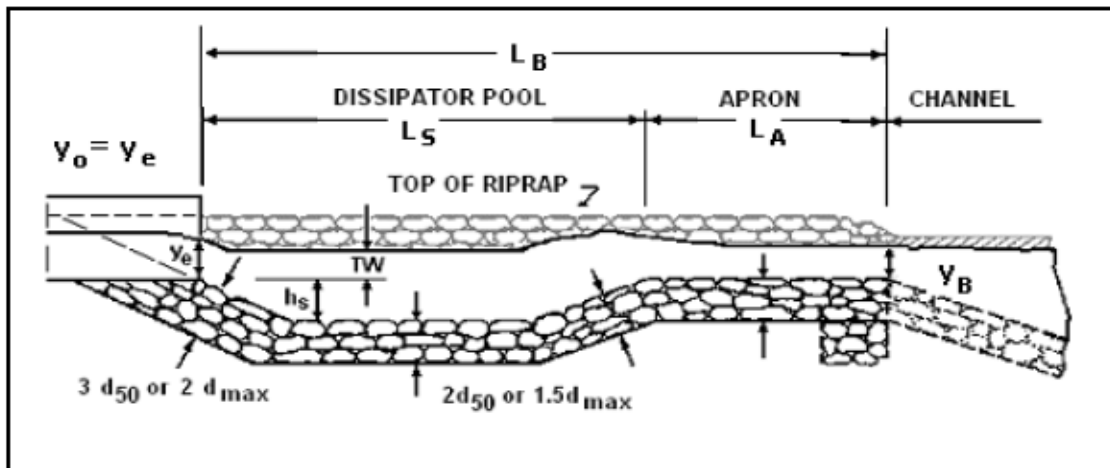


Figure 10.1. Profile of Riprap Basin

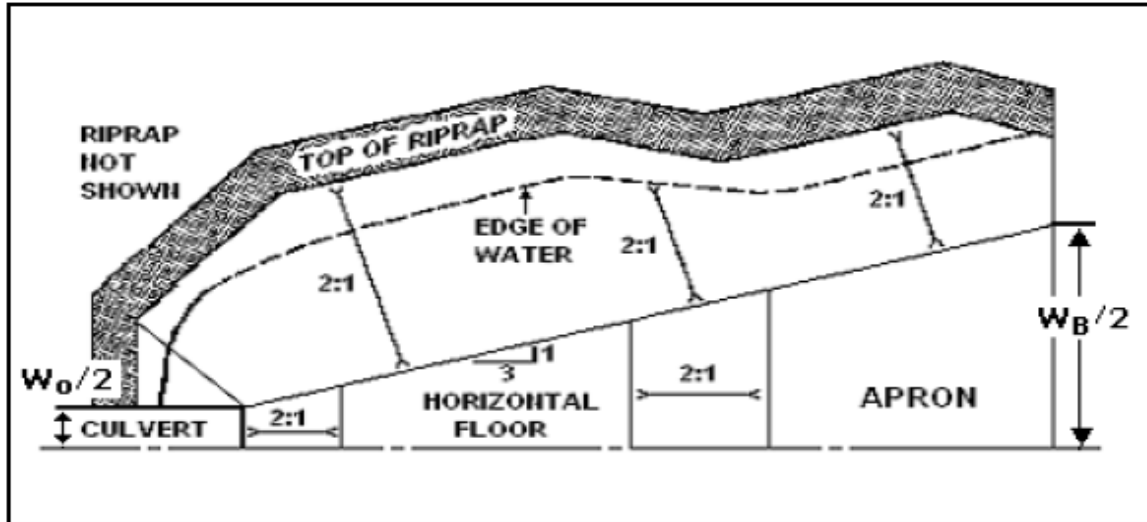


Figure 10.2. Half Plan of Riprap Basin

$$\frac{h_s}{y_e} = 0.86 \left(\frac{D_{50}}{y_e} \right)^{-0.55} \left(\frac{V_o}{\sqrt{g y_e}} \right) - C_o \quad (10.1)$$

where,

- h_s = dissipator pool depth, m (ft)
- y_e = equivalent brink (outlet) depth, m (ft)
- D_{50} = median rock size by weight, m (ft)
- C_o = tailwater parameter

The tailwater parameter, C_o , is defined as:

$$\begin{aligned} C_o &= 1.4 & TW/y_e < 0.75 \\ C_o &= 4.0(TW/y_e) - 1.6 & 0.75 < TW/y_e < 1.0 \\ C_o &= 2.4 & 1.0 < TW/y_e \end{aligned} \quad (10.2)$$

Table 5.1. Minimum and Maximum Allowable Particle Size in Inches.

Nominal Riprap Class by Median Particle Diameter		d_{15}		d_{50}		d_{85}		d_{100}
Class	Size	Min	Max	Min	Max	Min	Max	Max
I	6 in	3.7	5.2	5.7	6.9	7.8	9.2	12.0
II	9 in	5.5	7.8	8.5	10.5	11.5	14.0	18.0
III	12 in	7.3	10.5	11.5	14.0	15.5	18.5	24.0
IV	15 in	9.2	13.0	14.5	17.5	19.5	23.0	30.0
V	18 in	11.0	15.5	17.0	20.5	23.5	27.5	36.0
VI	21 in	13.0	18.5	20.0	24.0	27.5	32.5	42.0
VII	24 in	14.5	21.0	23.0	27.5	31.0	37.0	48.0
VIII	30 in	18.5	26.0	28.5	34.5	39.0	46.0	60.0
IX	36 in	22.0	31.5	34.0	41.5	47.0	55.5	72.0
X	42 in	25.5	36.5	40.0	48.5	54.5	64.5	84.0

Note: Particle size d corresponds to the intermediate ("B") axis of the particle.

Outlet Depth Calculation - Circular Culverts - HEC-14

Culvert 1

Q	448.17	cfs	Design flow for the culvert
D	6	ft	Culvert diameter or span
$K_u Q/D^{2.5}$	5.08	--	Used in Figure 3.4
Tw	0	ft	Tailwater depth in downstream channel
Tw/D	0.00	--	Used in Figure 3.4
y_o/D	0.82	--	Obtained from Figure 3.4
y_o	4.92	ft	Outlet depth

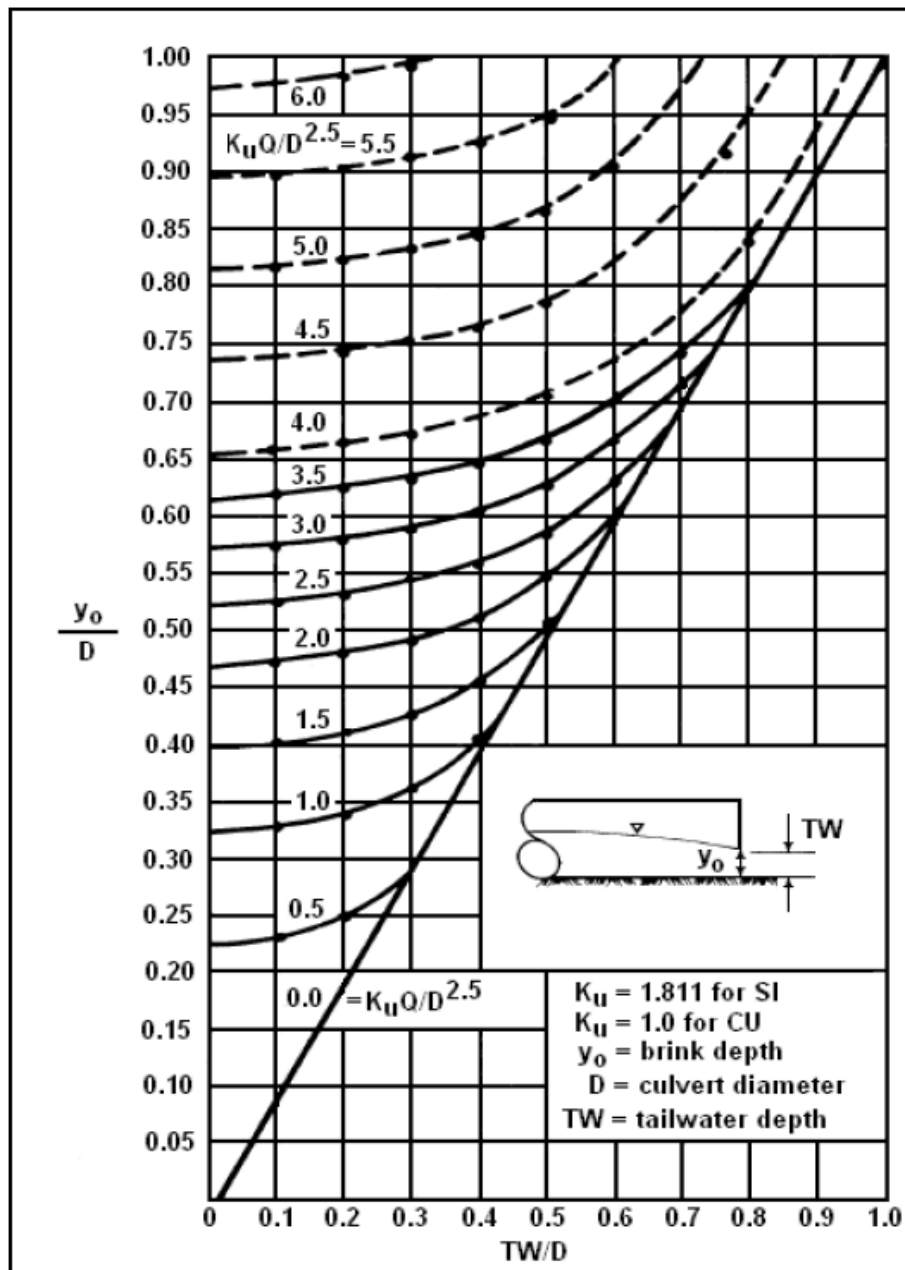


Figure 3.4. Dimensionless Rating Curves for the Outlets of Circular Culverts on Horizontal and Mild Slopes (Simons, 1970)

Plunge Pool Design HEC-14

Culvert 2

Q	280.24	cfs	Design flow for the culvert
D	6	ft	Culvert diameter or span
y _o	3.48	ft	Outlet depth
A	17.00	sq ft	Wetted culvert area
V _o	16.48	ft/s	Outlet velocity
y _e	2.92	ft	Equivalent brink outlet depth
Fr	1.56	--	Froude number
h _s	2.5	ft	Plunge pool depth
Co	1.4	--	Coefficient
D ₅₀	1.32	ft	Median stone size
D ₅₀	15.9	in	Median stone size
W _o	6	ft	Riprap width at outlet
L _s	25	ft	Pool length
L _a	12.5	ft	Apron Length
L _b	37.5	ft	Basin length
W _b	31	ft	Width at end of apron

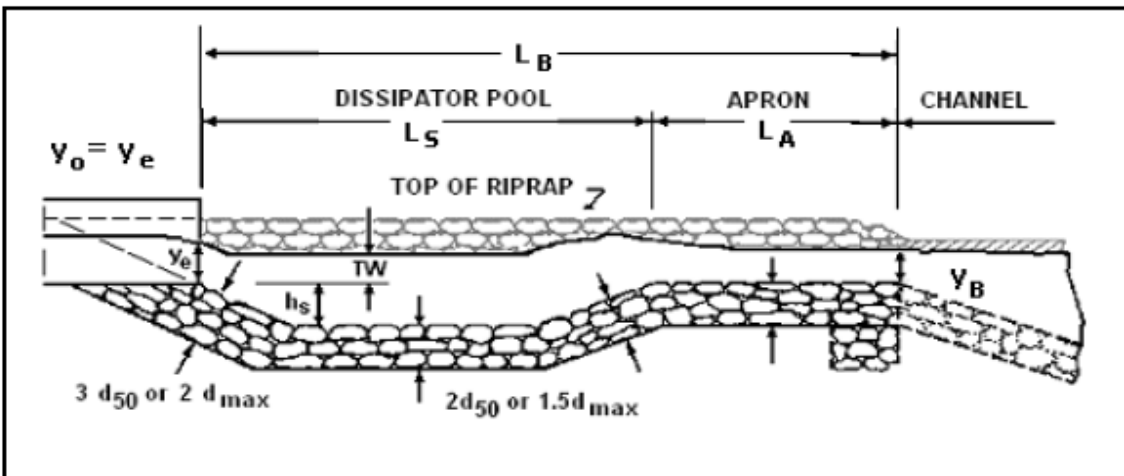


Figure 10.1. Profile of Riprap Basin

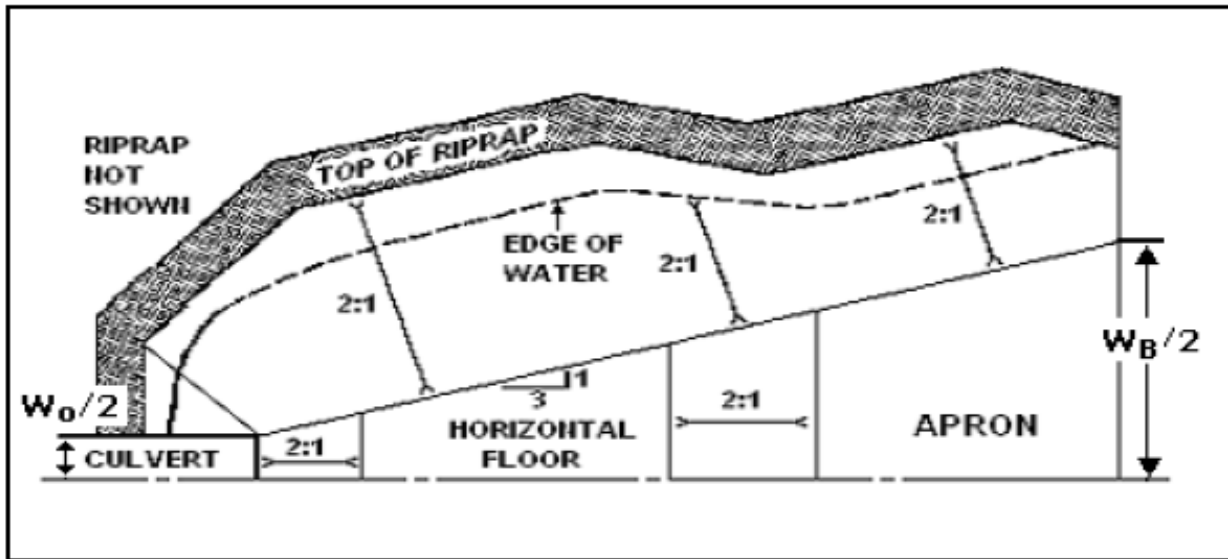


Figure 10.2. Half Plan of Riprap Basin

$$\frac{h_s}{y_e} = 0.86 \left(\frac{D_{50}}{y_e} \right)^{-0.55} \left(\frac{V_o}{\sqrt{gy_e}} \right) - C_o \quad (10.1)$$

where,

- h_s = dissipator pool depth, m (ft)
- y_e = equivalent brink (outlet) depth, m (ft)
- D_{50} = median rock size by weight, m (ft)
- C_o = tailwater parameter

The tailwater parameter, C_o , is defined as:

$$\begin{aligned} C_o &= 1.4 & TW/y_e < 0.75 \\ C_o &= 4.0(TW/y_e) - 1.6 & 0.75 < TW/y_e < 1.0 \\ C_o &= 2.4 & 1.0 < TW/y_e \end{aligned} \quad (10.2)$$

Table 5.1. Minimum and Maximum Allowable Particle Size in Inches.

Nominal Riprap Class by Median Particle Diameter		d_{15}		d_{50}		d_{85}		d_{100}
Class	Size	Min	Max	Min	Max	Min	Max	Max
I	6 in	3.7	5.2	5.7	6.9	7.8	9.2	12.0
II	9 in	5.5	7.8	8.5	10.5	11.5	14.0	18.0
III	12 in	7.3	10.5	11.5	14.0	15.5	18.5	24.0
IV	15 in	9.2	13.0	14.5	17.5	19.5	23.0	30.0
V	18 in	11.0	15.5	17.0	20.5	23.5	27.5	36.0
VI	21 in	13.0	18.5	20.0	24.0	27.5	32.5	42.0
VII	24 in	14.5	21.0	23.0	27.5	31.0	37.0	48.0
VIII	30 in	18.5	26.0	28.5	34.5	39.0	46.0	60.0
IX	36 in	22.0	31.5	34.0	41.5	47.0	55.5	72.0
X	42 in	25.5	36.5	40.0	48.5	54.5	64.5	84.0

Note: Particle size d corresponds to the intermediate ("B") axis of the particle.

Outlet Depth Calculation - Circular Culverts - HEC-14

Culvert 2

Q	280.24	cfs	Design flow for the culvert
D	6	ft	Culvert diameter or span
$K_u Q/D^{2.5}$	3.18	--	Used in Figure 3.4
Tw	0	ft	Tailwater depth in downstream channel
Tw/D	0.00	--	Used in Figure 3.4
y_o/D	0.58	--	Obtained from Figure 3.4
y_o	3.48	ft	Outlet depth

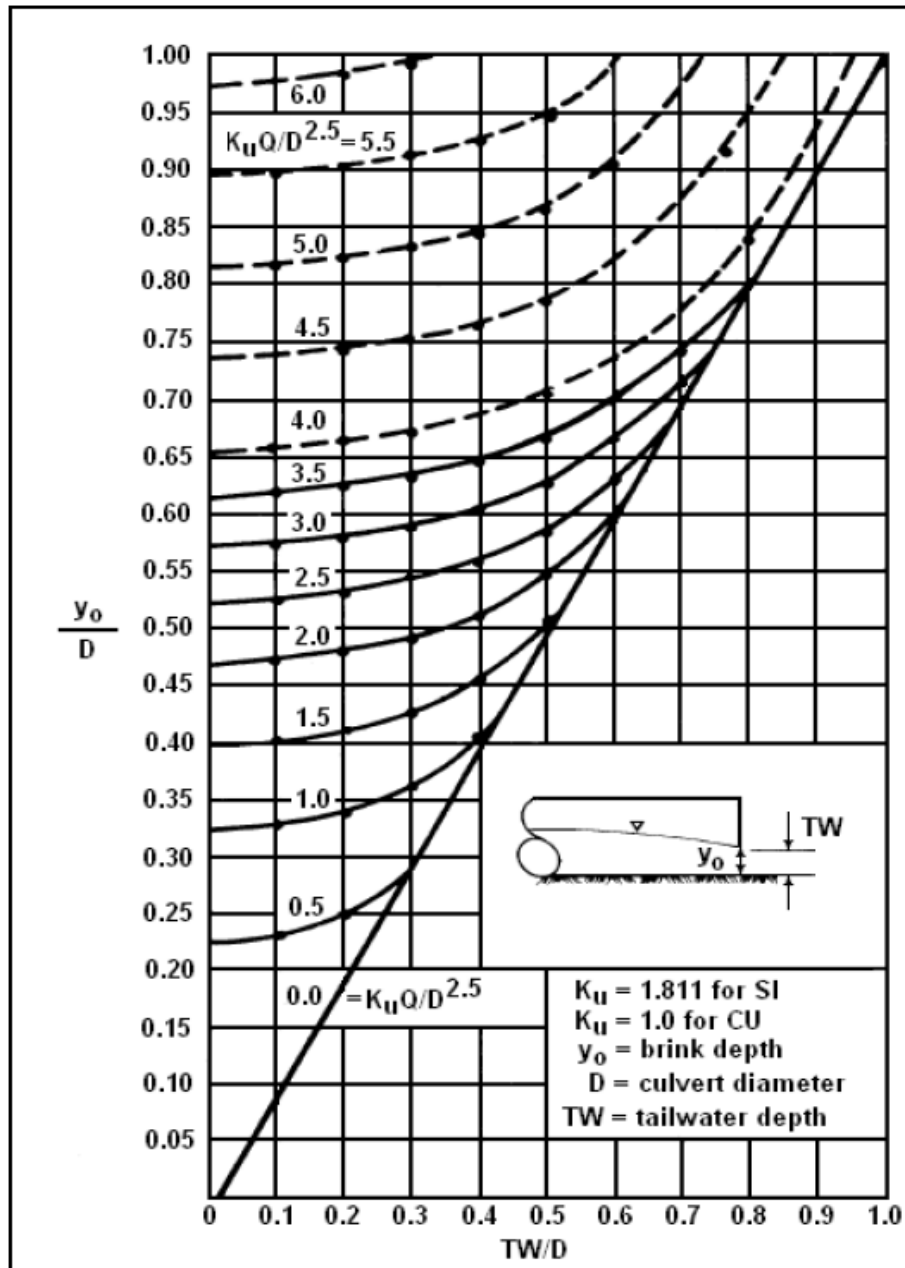


Figure 3.4. Dimensionless Rating Curves for the Outlets of Circular Culverts on Horizontal and Mild Slopes (Simons, 1970)

Appendix H. Emergency Overflow Spillway Calculation

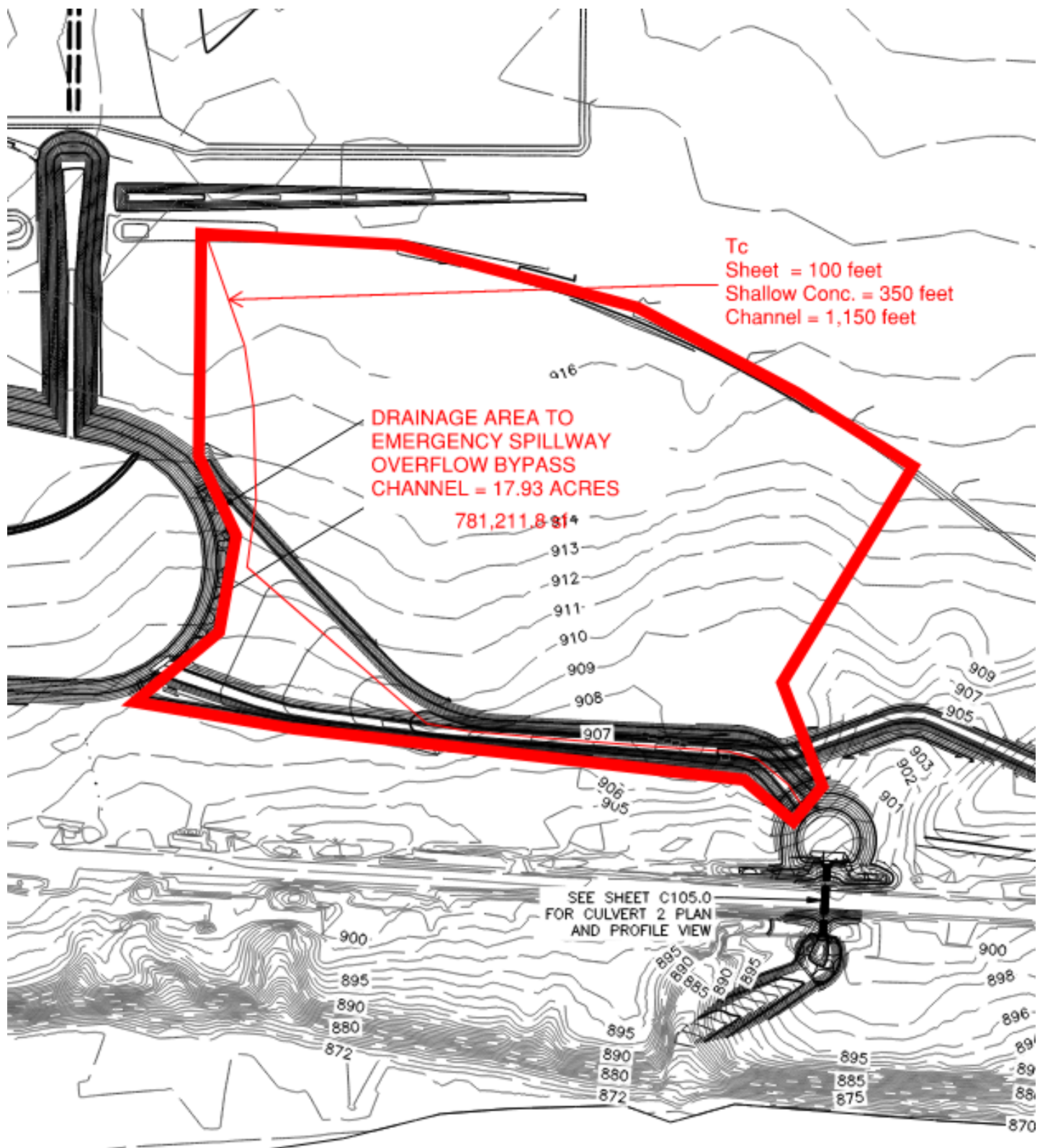
Worksheet for Weir - Undetained 100

Project Description	
Solve For	Headwater Elevation
Input Data	
Discharge	3,024.00 cfs
Crest Elevation	903.50 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Gravel
Crest Breadth	8.00 ft
Crest Length	350.0 ft
Results	
Headwater Elevation	905.50 ft
Headwater Height Above Crest	2.00 ft
Tailwater Height Above Crest	-903.50 ft
Weir Coefficient	$3.06 \text{ ft}^{(1/2)}/\text{s}$
Submergence Factor	1.000
Adjusted Weir Coefficient	$3.06 \text{ ft}^{(1/2)}/\text{s}$
Flow Area	699.6 ft ²
Velocity	4.32 ft/s
Wetted Perimeter	354.0 ft
Top Width	350.00 ft

Worksheet for Channel - Undetained 100

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.008 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	10.00 ft
Discharge	3,024.00 cfs
Results	
Normal Depth	92.7 in
Flow Area	256.1 ft ²
Wetted Perimeter	58.8 ft
Hydraulic Radius	52.2 in
Top Width	56.33 ft
Critical Depth	91.6 in
Critical Slope	0.008 ft/ft
Velocity	11.81 ft/s
Velocity Head	2.17 ft
Specific Energy	9.89 ft
Froude Number	0.977
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	92.7 in
Critical Depth	91.6 in
Channel Slope	0.008 ft/ft
Critical Slope	0.008 ft/ft

Bypass Channel Erosion Calculation



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

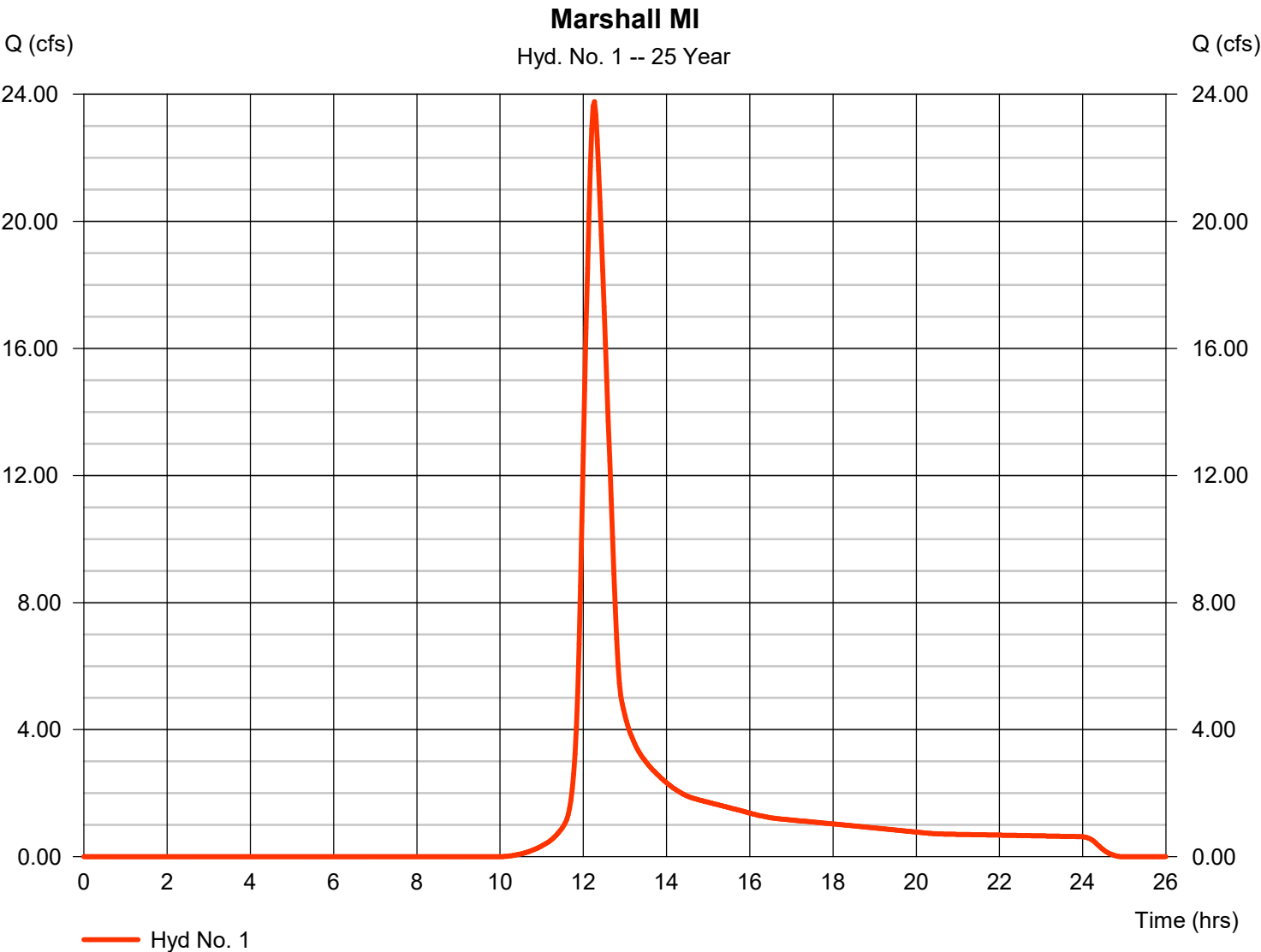
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	23.78	2	736	110,935	-----	-----	-----	Marshall MI
New.gpw					Return Period: 25 Year			Tuesday, 10 / 24 / 2023	

Hydrograph Report

Hyd. No. 1

Marshall MI

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.78 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.27 hrs
Time interval	=	2 min	Hyd. volume	=	110,935 cuft
Drainage area	=	17.930 ac	Curve number	=	73
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	33.90 min
Total precip.	=	4.27 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 1

Marshall MI

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.53	0.00	0.00	
Land slope (%)	= 0.50	0.00	0.00	
Travel Time (min)	= 27.94	+	0.00	+
			0.00	= 27.94
Shallow Concentrated Flow				
Flow length (ft)	= 350.00	0.00	0.00	
Watercourse slope (%)	= 1.10	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=1.69	0.00	0.00	
Travel Time (min)	= 3.45	+	0.00	+
			0.00	= 3.45
Channel Flow				
X sectional flow area (sqft)	= 45.60	0.00	0.00	
Wetted perimeter (ft)	= 55.50	0.00	0.00	
Channel slope (%)	= 0.80	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=7.79	0.00	0.00	
Flow length (ft)	(0)1150.0	0.0	0.0	
Travel Time (min)	= 2.46	+	0.00	+
			0.00	= 2.46
Total Travel Time, Tc				33.90 min

Worksheet for Channel - 25-year

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.008 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	10.00 ft
Discharge	23.78 cfs
Results	
Normal Depth	7.9 in
Flow Area	7.9 ft ²
Wetted Perimeter	14.2 ft
Hydraulic Radius	6.7 in
Top Width	13.96 ft
Critical Depth	6.4 in
Critical Slope	0.017 ft/ft
Velocity	3.01 ft/s
Velocity Head	0.14 ft
Specific Energy	0.80 ft
Froude Number	0.704
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	7.9 in
Critical Depth	6.4 in
Channel Slope	0.008 ft/ft
Critical Slope	0.017 ft/ft



Appendix I. Underdrain Dewatering Calculation

Underdrain Dewatering Calculation

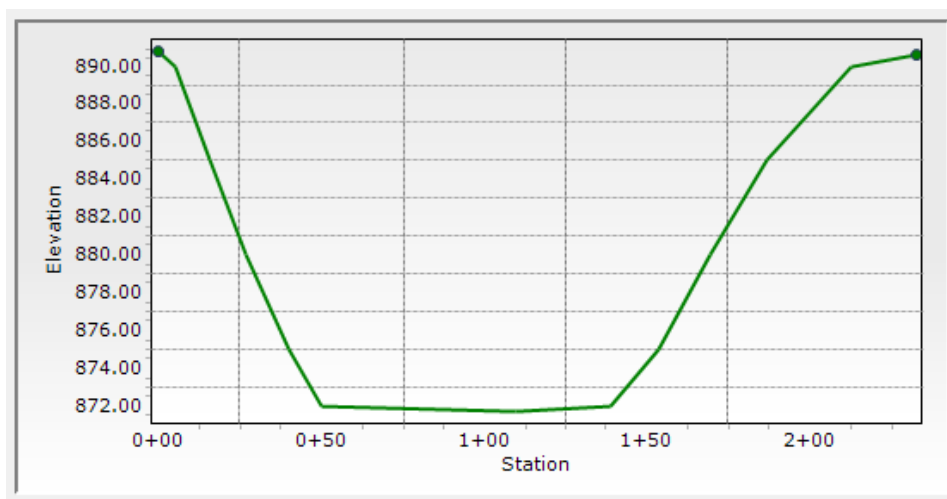
Input Data		
Job Name		
Engineer	M. Reineke	
Date	9-7-2023	
Surface area at high water stage, [Atop]	1654400	ft²
Surface area at low water stage, [Abot]	1512370	ft²
Permeability of filter sand, [k]	16	ft/day
Driving head at high water stage, [Htop]	5.05	ft
Driving head at low water stage, [Hbot]	3.05	ft
Drawdown time, [t]	2	days
Average flow path length, [Xo]	.5	ft
Exposed underdrain width, [Lo]	5	ft
Slope of underdrain face, [S]	999	?H : 1V
Factor of safety for analysis, [FS]	1	
Percent drawdown for analysis, [P]	95	%
Background seepage rate, [Q]	0	gpm
Note: For efficient and economical underdrain sizing, design for P <= 95% (See help screen)		

Input Data		
Total length of side/bottom drain filter required	2326.173	ft
Total length of side/bottom drain filter required to recover treatment volume only	2326.173	ft
Total length of side/bottom drain filter required to accomodate background seepage	0	ft
Percent drawdown simulated	95	%
Maximum flow rate through filter	4.19756	gpm / lin ft
Average flow rate through filter	2.09878	gpm / lin ft
Volume of water between Atop and Abot	2.369061E+07	gallons
Recovery (or treatment) volume	2.250608E+07	gallons
Recovery (or treatment) volume	69.06409	acre-ft
Note: Drain pipe diameter should be checked to ensure that peak flow can be accomodated.		



Appendix J. Outfall Section at Wetland W-4

Cross Sections from Outfall to Kalamazoo River



Section 1+00