PRELIMINARY STORMWATER MANAGEMENT DRAINAGE REPORT

Hamlet on Jerome
Dublin, OH

April 24, 2018

AMERICAN STRUCTUREPOINT INC.

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Registered Engineer **E-76866** **Date**

1.0 Project Information

The proposed project is located in Dublin, OH of Union County and consists of 8.687 acres of grassy area with scattered tree cover, some existing impervious areas, and an un-named creek flowing from northwest to southeast across the site. The proposed development will include 17 single family lots with associated drives and walks, open space and reserves, along with a public road extension and addition. The development will disturb 6.078 acres of the 8.687 acre site. Detention for the project will be provided per a wet retention basin located in the same location as the existing onsite pond.

The report will account for all tributary drainage, offsite and onsite, and design a storm detention system using the "Critical Storm Method" and the City of Dublin Stormwater Management Design Manual (CODSMDM). Additionally, the water quality requirements of the Ohio EPA will be met.

An project location map and soils map can be found in Appendix A of this report.

2.0 Existing Drainage Conditions

The project site located in Dublin, Ohio consisting of "Blount silt loam," "Glynwood clay loam" and "Glynwood silt loam," soils having a hydrologic soil group rating of 'D" suggests that in the current conditions there is a high chance of runoff. The pre-developed tributary area consists of 10.278 acres (5.618 acres of offsite drainage) of mostly a grassy area filled with trees and brush along with some areas of impervious conditions, which results in a weighted CN of 81. Additionally, the pre-developed time of concentration (TC) is 37.1 minutes.

In the current condition the site drains from north to south across the site into the existing onsite pond, with an offsite area draining to a point along the northwest property line and then being piped into the existing pond. From the existing pond the site drains into a small creek (unclassified) that runs across the site from northwest to southeast. The site drainage ultimately makes its way to the North Fork Indian Run via unnamed creeks and ditches.

The allowable release rates are based on the City of Dublin Stormwater Master Plan. The master plan sets forth the maximum allowable release rates based on disturbed area within set sub-areas. The total allowable release rates can be seen in Table 3.2.1 below. Under the current conditions, the site drains to the existing pond and into the onsite creek. The site will continue to drain to area into the proposed wet retention basin and then into the onsite creek through the proposed storage outlet structure.

Rainfall data was taken from the City of Dublin Stormwater Management Design Manual, a pre-developed tributary area map and pre-developed runoff calculations using HydroCAD Version 10.00 by HydroCAD Software Solutions, LLC can be found in Appendix C of this report.

3.0 Developed Drainage Conditions

The post-development conditions will be modified as described in the project description of this report. Due to the construction, a storm system will be required that outlets into a basin and an outlet control structure will be used for water quality and quantity treatment. The basin will provide storage for storm events 1-100 year events. The proposed wet retention basin will outlet into an onsite creek, ultimately making its way to the North Fork Indian Run. The post-developed tributary area consists of 10.855 acres (5.618 acres of offsite drainage consisting of trees and brush) of grassy areas with trees and houses and all associated walks and drives, along with public roadway and associated walks, which results in a weighted CN of 85. Additionally, the pre-developed time of concentration (TC) is 37.5 minutes. The proposed tributary map for the post-developed conditions can be found in Appendix D.

3.1 General Stormwater Control Narrative

The critical storm event was calculated by comparing the pre-developed conditions to the post-developed conditions 1-year, 24-hour event using the SCS Type II distribution curve. Detailed Calculations can be found in Appendix B.

- Percentage Increase = 51%
- Critical Storm = 10-Year Event

A percentage increase of 51% results in a critical storm of a 10-year event per City of Dublin Stormwater Management Design Manual, Chapter 2: Hydrologic & Hydraulic Design Criteria, Table 2-5 Critical Storm Determination. The post-developed 5 year storm and all preceding post-developed storms will be released at the same rate as the 1 year event in the pre-developed conditions. Additional post-developed storm events from 25-100 year will be released at equal to or less than their existing storm event.

3.2 Stormwater Quantity Control

The developed site lies within sub-basin 8070 (156.430 acres) of the North Fork Indian Run watershed in the City of Dublin Stormwater Master Plan. Through analysis of the sub-basin the maximum allowable release rate was calculated. For our proposed development, the more stringent City of Dublin Stormwater Master Plan will govern the allowable release rates. See Table 3.2.1 below.

Table 3.2.1 Proposed Basin Allowable Release Rates

Storm Event	Sub-Basin 8070 Total Allowed cfs	Sub-Basin 8070 (cfs/ac)	Allowable Master Plan Release Rate for site (cfs)	Critical Storm Release Rates (cfs)
1-Year	30	0.19	2.10	5.28
2-Year	38	0.24	2.66	5.28
5-Year	47	0.30	3.29	5.28
10-Year	55	0.35	3.85	5.28
25-Year	71	0.45	4.97	19.24
50-Year	93	0.59	6.51	23.18
100-Year	119	0.76	8.33	27.38

Table 3.2.2 Proposed Basin Outlet Structure

Invert	Description
978.50	18” Outlet Pipe
978.50	2.25” Water Quality Orifice
979.02	9” Orifice
981.90	4” Orifice
983.50	8”x24” Window
984.06	Top of Structure Grate

Table 3.2.3 Post-Developed Stormwater Management Summary

Storm Event	Allowable Release Rate (cfs)	Post-Developed Flow (cfs)	Detention Basin Release Rate (cfs)	Detention Elevation (feet)	Percent Allowable Peak Discharge
1-Year	2.10	7.46	1.98	980.13	94.29%
2-Year	2.66	10.28	2.58	980.67	96.99%
5-Year	3.29	14.48	3.28	981.47	99.70%
10-Year	3.85	18.04	3.85	982.12	100%
25-Year	4.97	23.11	4.67	982.95	93.96%
50-Year	6.51	27.36	5.34	983.59	82.03%
100-Year	8.33	31.89	8.14	984.06	97.72%

3.3 Stormwater Quality Control

Water quality drawdown per the Ohio EPA NPDES Permit No.: OHCO00002 for *large construction activities* has been provided for the entire 10.855 acre tributary area. Per Table 2 of the permit, “Wet Extended Detention Basins” shall provide a drain time of 24-hours. Additionally, the Extended Detention Volume (EDv) for a “Wet Extended Detention Basin” is to be sized at 75% of the Water Quality Volume (WQv) and the first half of the EDv shall not be released in the first one-third of the drain time. Based on this, the EDv for the basin is 0.103 acre-feet at an elevation of 979.02. Additionally, 0.052 acre-feet shall not be released in less than 8-hours.

Calculations for Water Quality Volumes and Drawdown can be found in Appendix F.

3.4 Storm Sewer

An onsite storm sewer system designed for the 2-year design storm and 5-year HGL check storm, per City of Dublin Stormwater Management Design Manual, will be installed to convey stormwater for the development to the proposed retention basin. Additionally, flood routing for storm events up to the 100-year event has been provided overland to the Basins.

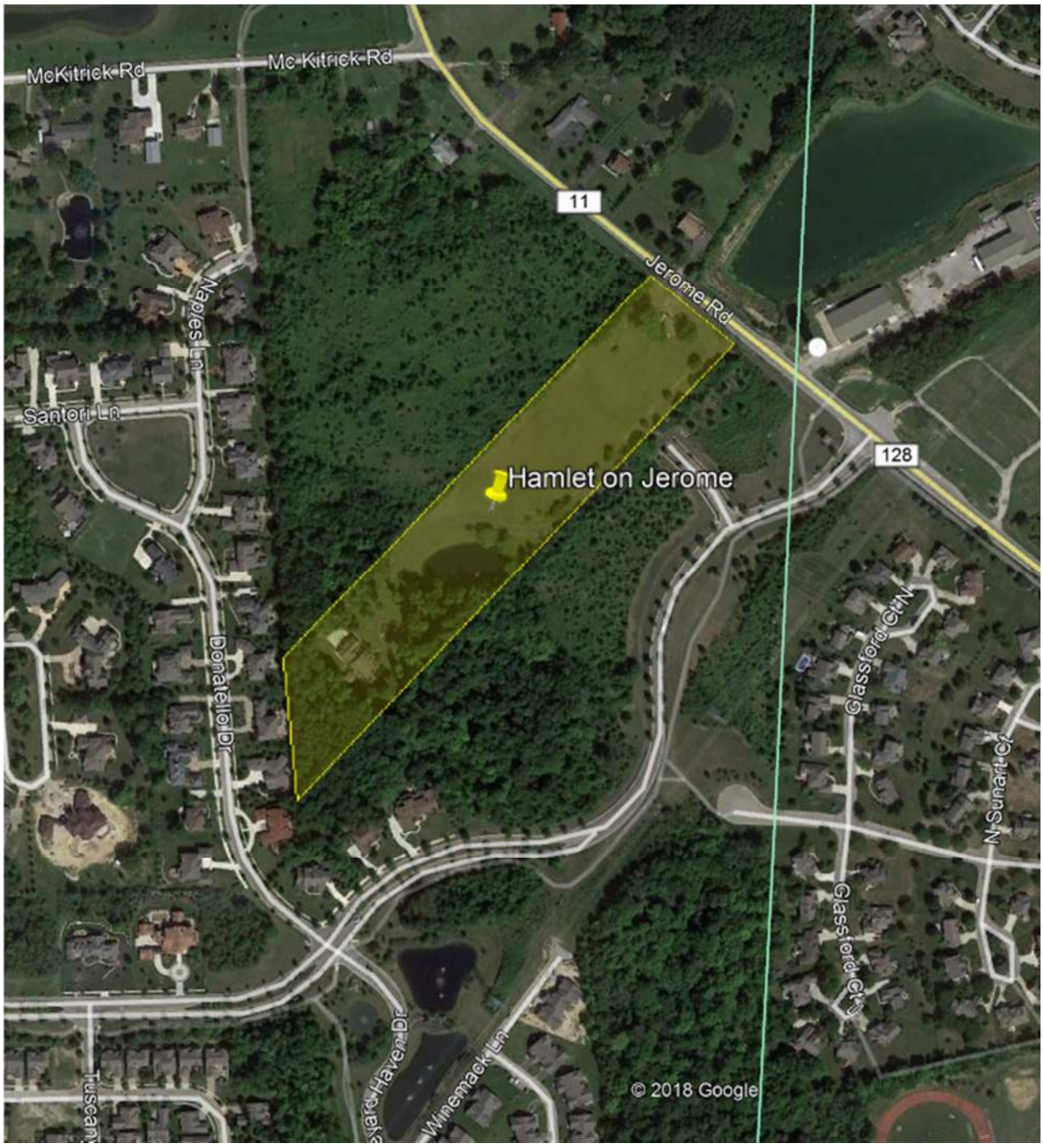
4.0 Summary and Conclusions

This project has analyzed the pre-developed and post-developed conditions for all storm frequencies (1-100 year) to determine the allowable peak discharge rates and storage requirements, while taking into account water quality calculations. The basin and storm system have been designed to meet or exceed the detention requirements set forth by the City of Dublin and the Ohio EPA water quality requirements for *large construction activities*.

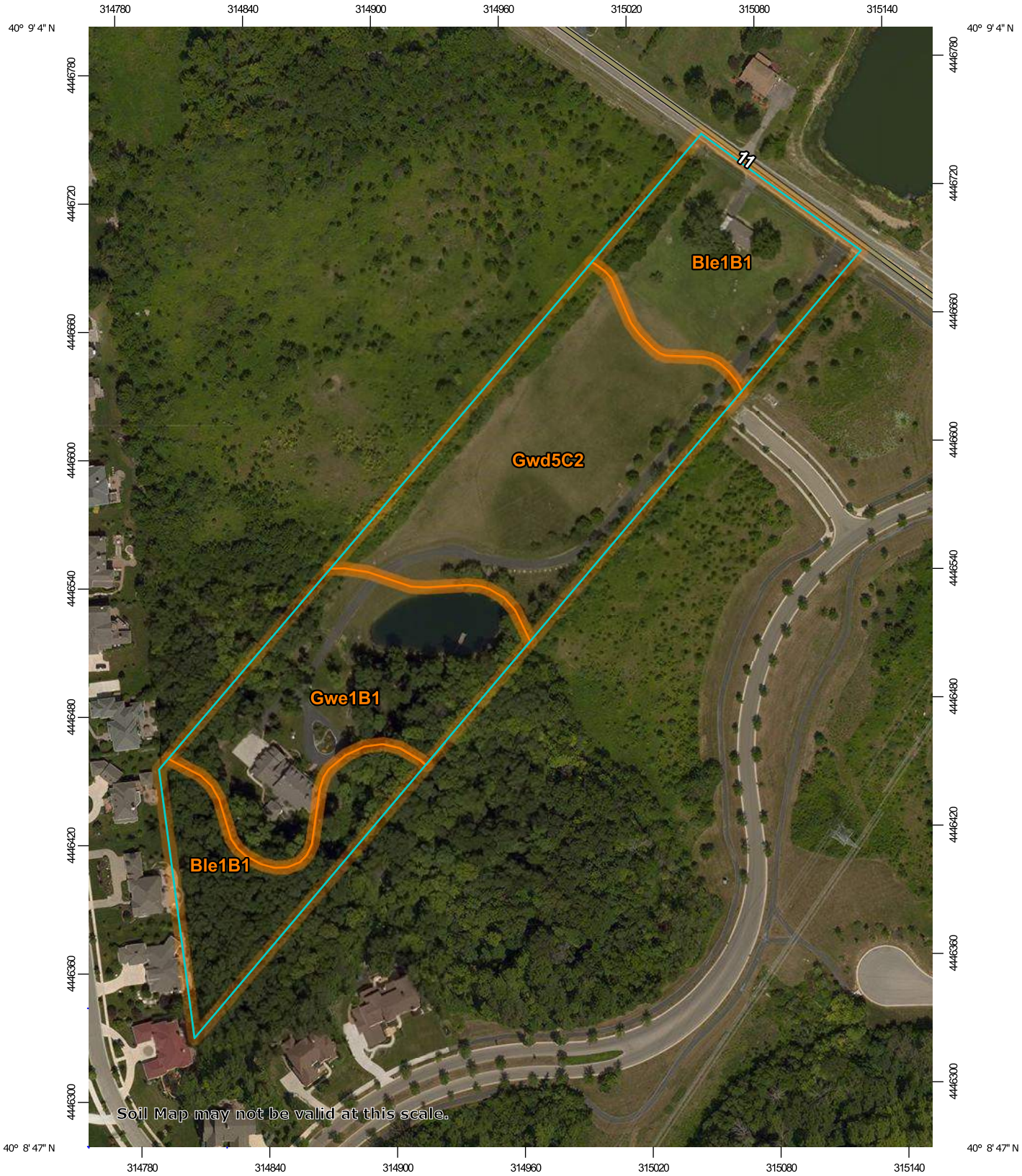
Accordingly, we believe the proposed improvements will not adversely affect this site, adjacent property owners, or the City of Dublin.

Appendix A – Project Site Data

Project Location Map



Soil Map—Union County, Ohio
(Hamlet on Jerome)



Map Scale: 1:2,550 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Union County, Ohio
Survey Area Data: Version 16, Oct 5, 2017

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

Date(s) aerial images were photographed: Aug 4, 2014—Aug 27, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ble1B1	Blount silt loam, end moraine, 2 to 4 percent slopes	3.5	34.9%
Gwd5C2	Glynwood clay loam, 6 to 12 percent slopes, eroded	3.7	36.1%
Gwe1B1	Glynwood silt loam, end moraine, 2 to 6 percent slopes	2.9	28.9%
Totals for Area of Interest		**10.1**	**100.0%**

Union County, Ohio

Ble1B1—Blount silt loam, end moraine, 2 to 4 percent slopes

Map Unit Setting

National map unit symbol: 2s1j5
Elevation: 700 to 1,300 feet
Mean annual precipitation: 34 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Blount, end moraine, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blount, End Moraine

Setting

Landform: End moraines on till plains
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wisconsin till derived from limestone and shale

Typical profile

Ap - 0 to 9 inches: silt loam
Bt - 9 to 32 inches: silty clay
BC - 32 to 37 inches: clay loam
Cd - 37 to 79 inches: clay loam

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: 30 to 56 inches to densic material
Natural drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Glynwood, end moraine
Percent of map unit: 9 percent
Landform: End moraines on till plains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pewamo, end moraine
Percent of map unit: 6 percent
Landform: End moraines on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Union County, Ohio
Survey Area Data: Version 16, Oct 5, 2017

Union County, Ohio

Gwd5C2—Glynwood clay loam, 6 to 12 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2psgn
Elevation: 750 to 1,300 feet
Mean annual precipitation: 34 to 42 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Glynwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glynwood

Setting

Landform: End moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey till

Typical profile

Ap - 0 to 7 inches: clay loam
Bt - 7 to 24 inches: clay
BC - 24 to 29 inches: clay loam
Cd - 29 to 80 inches: clay loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 24 to 36 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D

Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Blount
Percent of map unit: 8 percent
Landform: Flats on ground moraines, rises on ground moraines
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Morley
Percent of map unit: 7 percent
Landform: Till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Union County, Ohio
Survey Area Data: Version 16, Oct 5, 2017

Union County, Ohio

Gwe1B1—Glynwood silt loam, end moraine, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2v4bm
Elevation: 720 to 1,320 feet
Mean annual precipitation: 34 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glynwood, end moraine, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glynwood, End Moraine

Setting

Landform: End moraines on till plains
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Wisconsin till derived from limestone and shale

Typical profile

Ap - 0 to 8 inches: silt loam
Bt - 8 to 29 inches: clay
BC - 29 to 34 inches: clay loam
Cd - 34 to 79 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 28 to 45 inches to densic material
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Blount, end moraine
Percent of map unit: 9 percent
Landform: End moraines on till plains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear
Hydric soil rating: No

Pewamo
Percent of map unit: 6 percent
Landform: End moraines on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Union County, Ohio
Survey Area Data: Version 16, Oct 5, 2017

Appendix B – Critical Storm Calculation

Critical Storm Calculation

Project:	**Hamlet on Jerome**
Job #:	**2017.0118**
Location:	**Dublin, OH**
Date	**4/24/18**

AMERICAN STRUCTUREPOINT INC.

Calc By:	MHS
Chk By:	BJM

Existing Conditions
1 Year, 24 Hour Storm

Project Area	10.278	Acres
Ranfail, P	2.20	Inches
Curve Number, CN	81	
Runoff, Q	5.28	CFS
Total Runoff Volume	0.56	Acre-Feet

Developed Conditions
1 Year, 24 Hour Storm

Project Area	10.855	Acres
Ranfail, P	2.20	Inches
Curve Number, CN	85	
Runoff, Q	7.46	CFS
Total Runoff Volume	0.845	Acre-Feet

Runoff Increse Due to Development

Existing Runoff	0.56	Acre-Feet
Development Runoff	0.845	Acre-Feet
Percent Increase	51	%

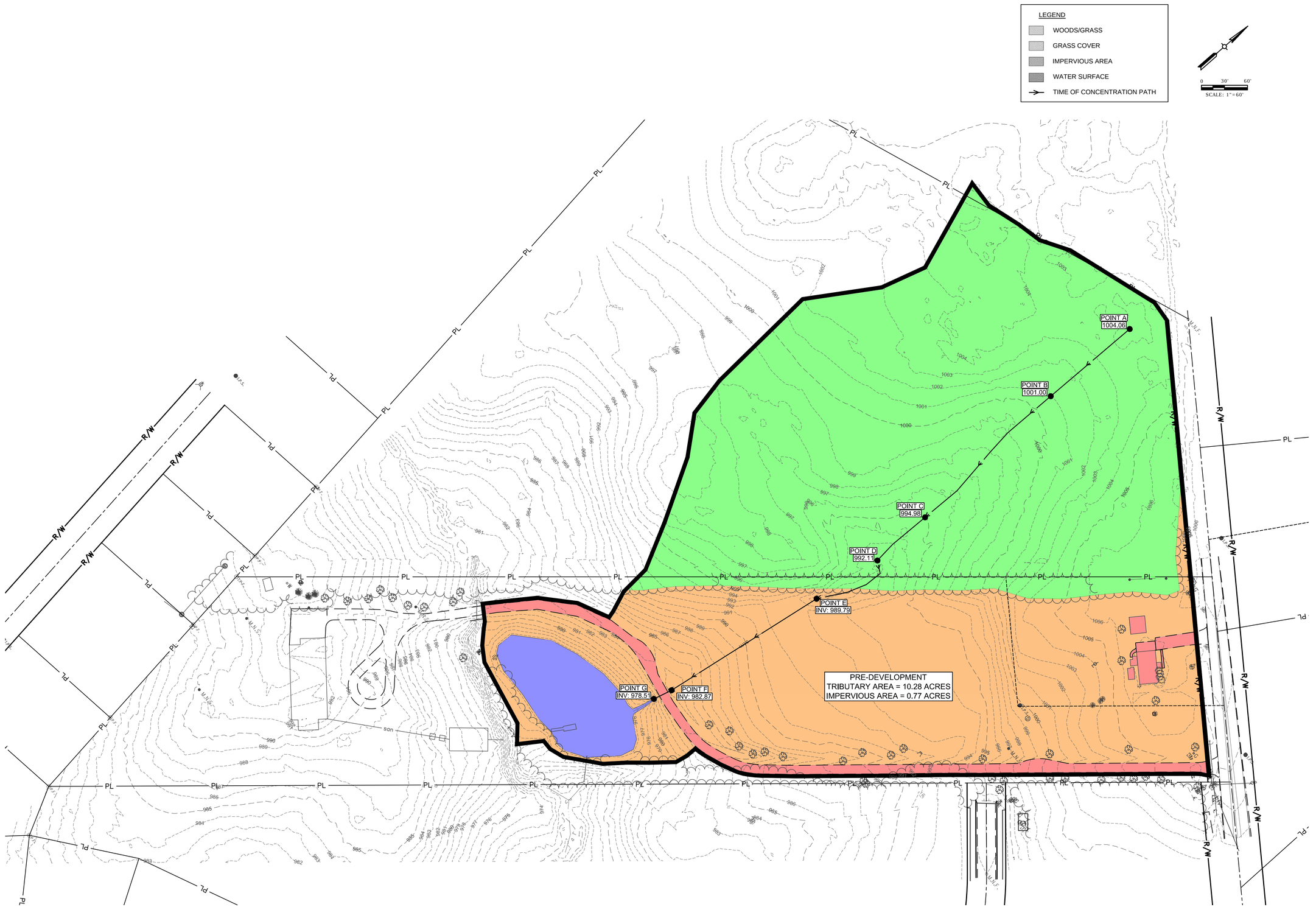
Critical Storm

51% Increase in Runoff; Requires a 10-year critical storm.

A. Stormwater runoff peak for the 10-year, developed storm will not exceed the stormwater runoff peak for the 1 year, existing storm.

B. For storms great than the 10-year storm, the developed stormwater runoff will not exceed the existing stormwater runoff peak for each storm. Refer to the stormwater runoff summary for allowable and design peaks.

Appendix C – Pre-Development Calculations



PLOT SCALE: 1:1 EDIT DATE: 4/24/18 - 1:15 PM EDITED BY: MSCHULZE DRAWING FILE: O:\2017\01180\D. DRAWINGS\C\VALEXHIBITS\TRIBUTARY MAPS\20180 01180.CE.PRE-DEVELOPMENT TRIB.MAP.DWG

The Hamlet on Jerome

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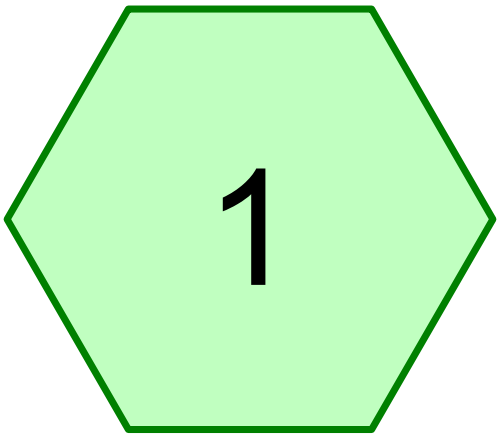
PRE-DEVELOPMENT TRIBUTARY MAP
FOR
HAMLET ON JEROME
CITY OF DUBLIN, UNION COUNTY, OHIO

REVISIONS	DATE	SHEET NO.	DESCRIPTION	APPROVED	DATE

DATE:	04/24/2018
DRAWN BY:	MHS
CHECKED BY:	BJM
JOB NUMBER:	2017.01180

PRE



Pre-Development Tributary Area

Subcat Reach Pond Link

Routing Diagram for 2017.01180.CE.Drainage.Calcs
Prepared by American Structurepoint, Printed 4/24/2018

Summary for Subcatchment 1: Pre-Development Tributary Area

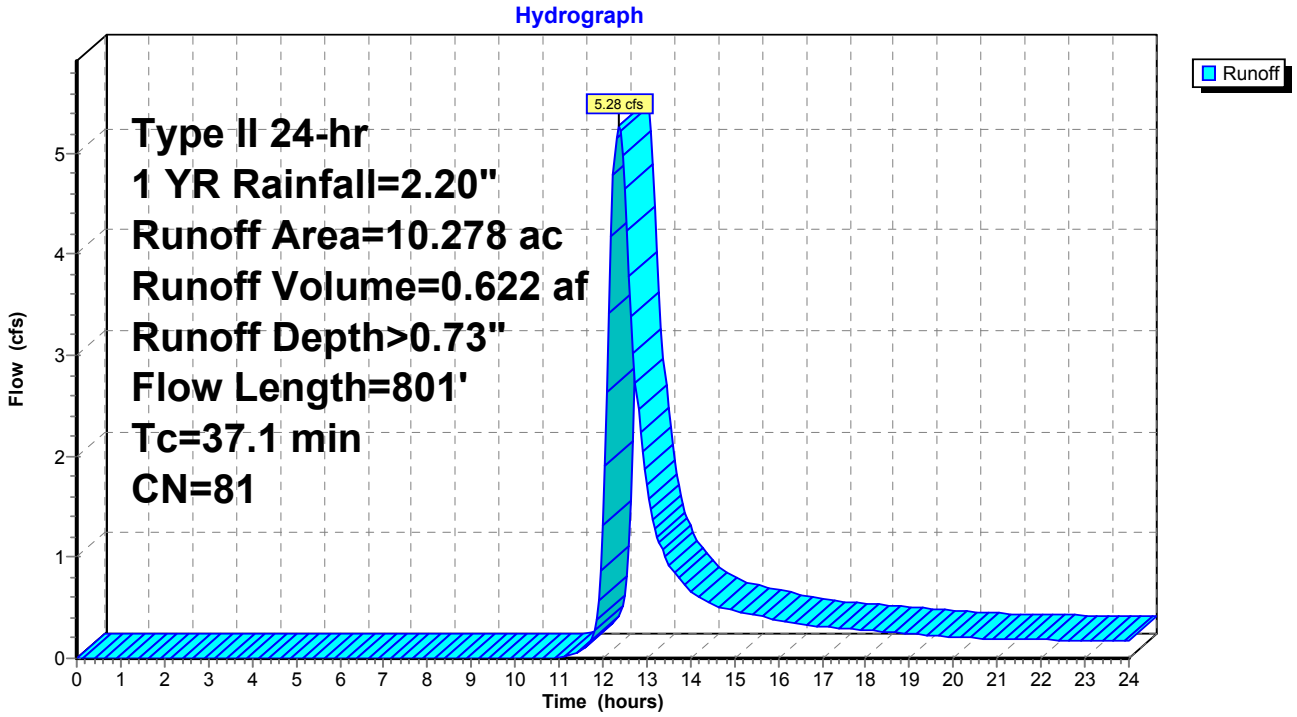
Runoff = 5.28 cfs @ 12.36 hrs, Volume= 0.622 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 YR Rainfall=2.20"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.294	79	Woods/grass comb., Good, HSG D
	0.398	98	Water Surface, HSG D
*	0.367	98	Impervious areas, HSG D
	3.601	80	>75% Grass cover, Good, HSG D
	10.278	81	Weighted Average
	9.513		92.56% Pervious Area
	0.765		7.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	222	0.0550	10.64	8.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.0	24	0.0438	12.44	21.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
37.1	801	Total			

Subcatchment 1: Pre-Development Tributary Area



Summary for Subcatchment 1: Pre-Development Tributary Area

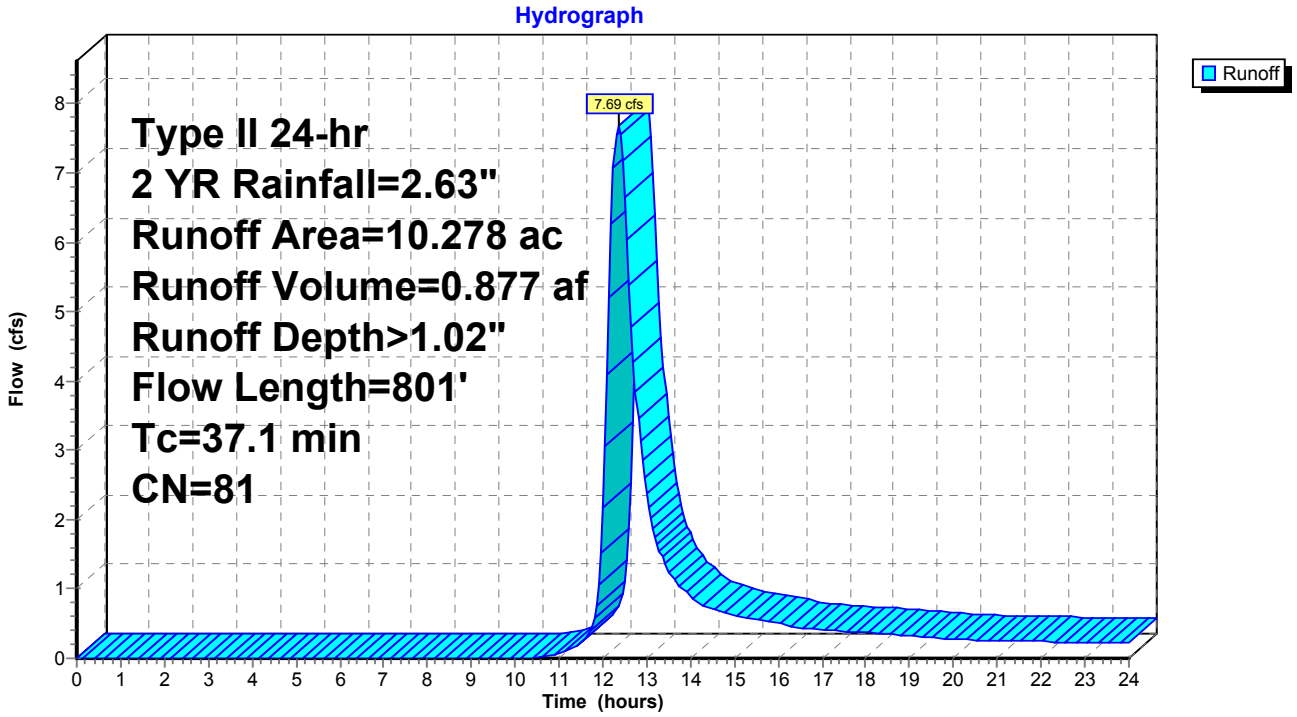
Runoff = 7.69 cfs @ 12.35 hrs, Volume= 0.877 af, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 YR Rainfall=2.63"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.294	79	Woods/grass comb., Good, HSG D
	0.398	98	Water Surface, HSG D
*	0.367	98	Impervious areas, HSG D
	3.601	80	>75% Grass cover, Good, HSG D
	10.278	81	Weighted Average
	9.513		92.56% Pervious Area
	0.765		7.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	222	0.0550	10.64	8.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.0	24	0.0438	12.44	21.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
37.1	801	Total			

Subcatchment 1: Pre-Development Tributary Area



Summary for Subcatchment 1: Pre-Development Tributary Area

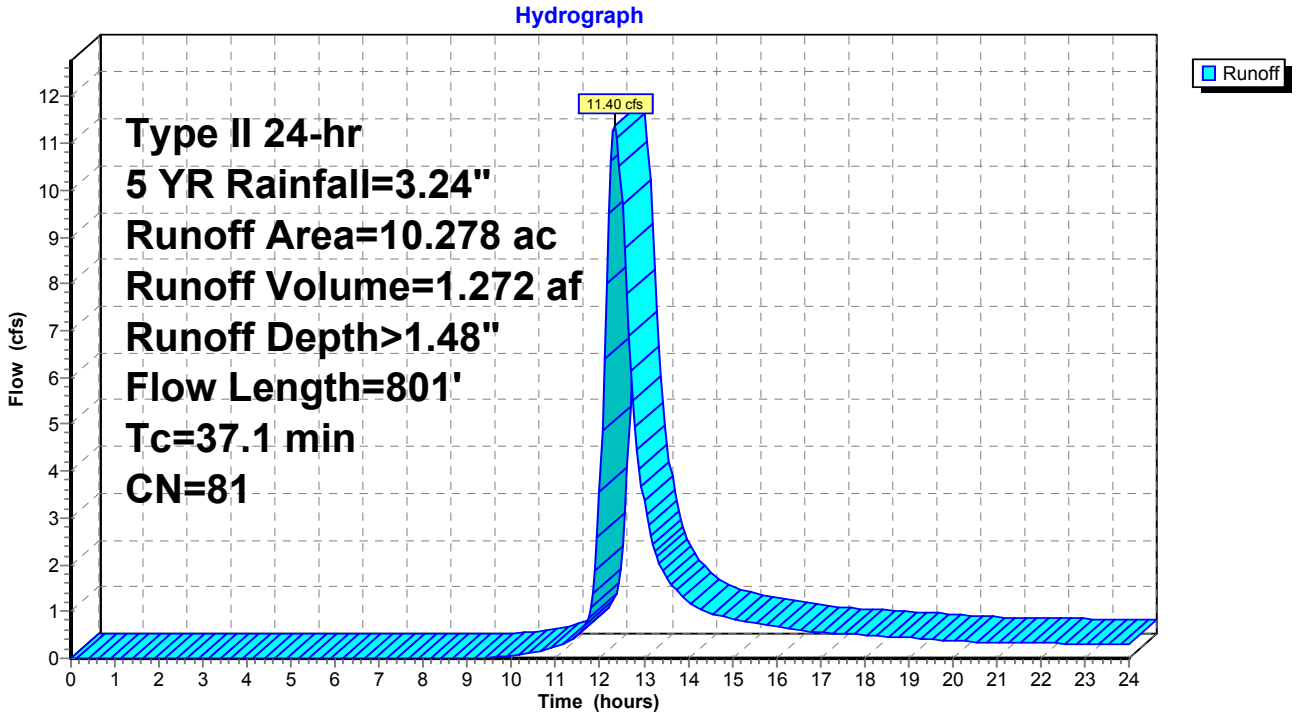
Runoff = 11.40 cfs @ 12.34 hrs, Volume= 1.272 af, Depth> 1.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 5 YR Rainfall=3.24"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.294	79	Woods/grass comb., Good, HSG D
	0.398	98	Water Surface, HSG D
*	0.367	98	Impervious areas, HSG D
	3.601	80	>75% Grass cover, Good, HSG D
	10.278	81	Weighted Average
	9.513		92.56% Pervious Area
	0.765		7.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	222	0.0550	10.64	8.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.0	24	0.0438	12.44	21.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
37.1	801	Total			

Subcatchment 1: Pre-Development Tributary Area



Summary for Subcatchment 1: Pre-Development Tributary Area

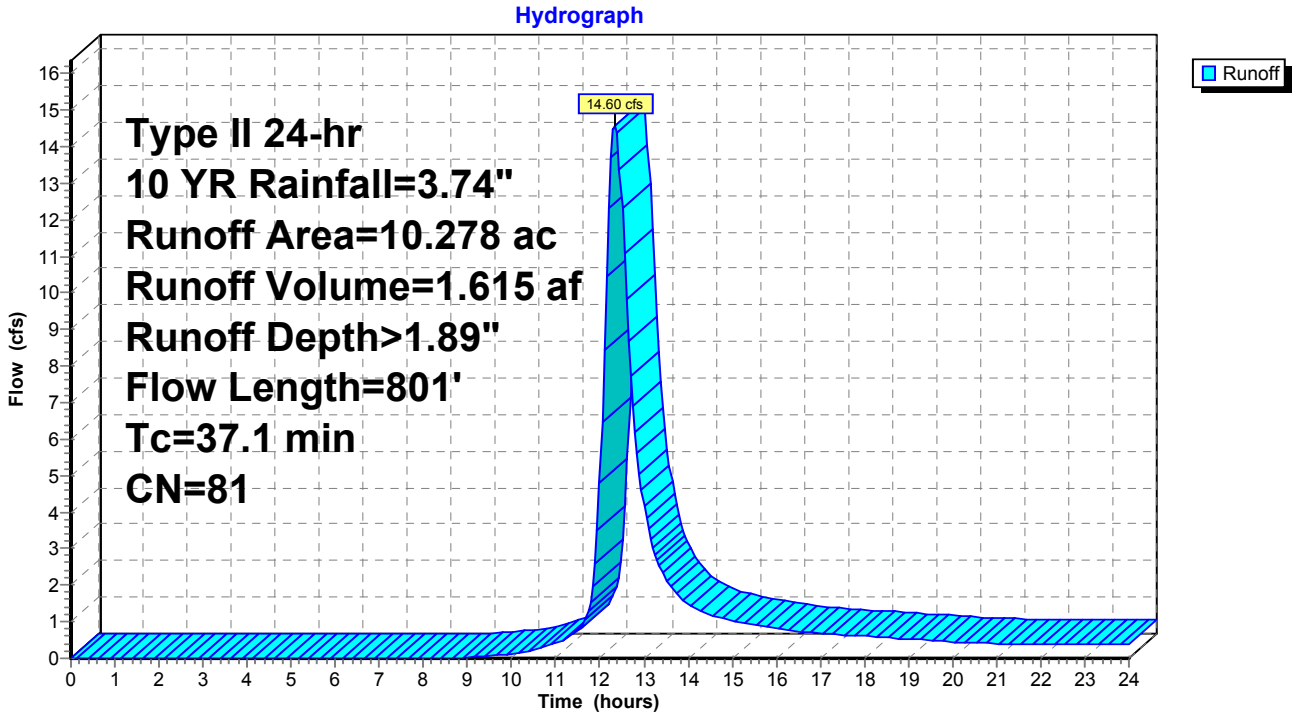
Runoff = 14.60 cfs @ 12.34 hrs, Volume= 1.615 af, Depth> 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 YR Rainfall=3.74"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.294	79	Woods/grass comb., Good, HSG D
	0.398	98	Water Surface, HSG D
*	0.367	98	Impervious areas, HSG D
	3.601	80	>75% Grass cover, Good, HSG D
	10.278	81	Weighted Average
	9.513		92.56% Pervious Area
	0.765		7.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	222	0.0550	10.64	8.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.0	24	0.0438	12.44	21.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
37.1	801	Total			

Subcatchment 1: Pre-Development Tributary Area



Summary for Subcatchment 1: Pre-Development Tributary Area

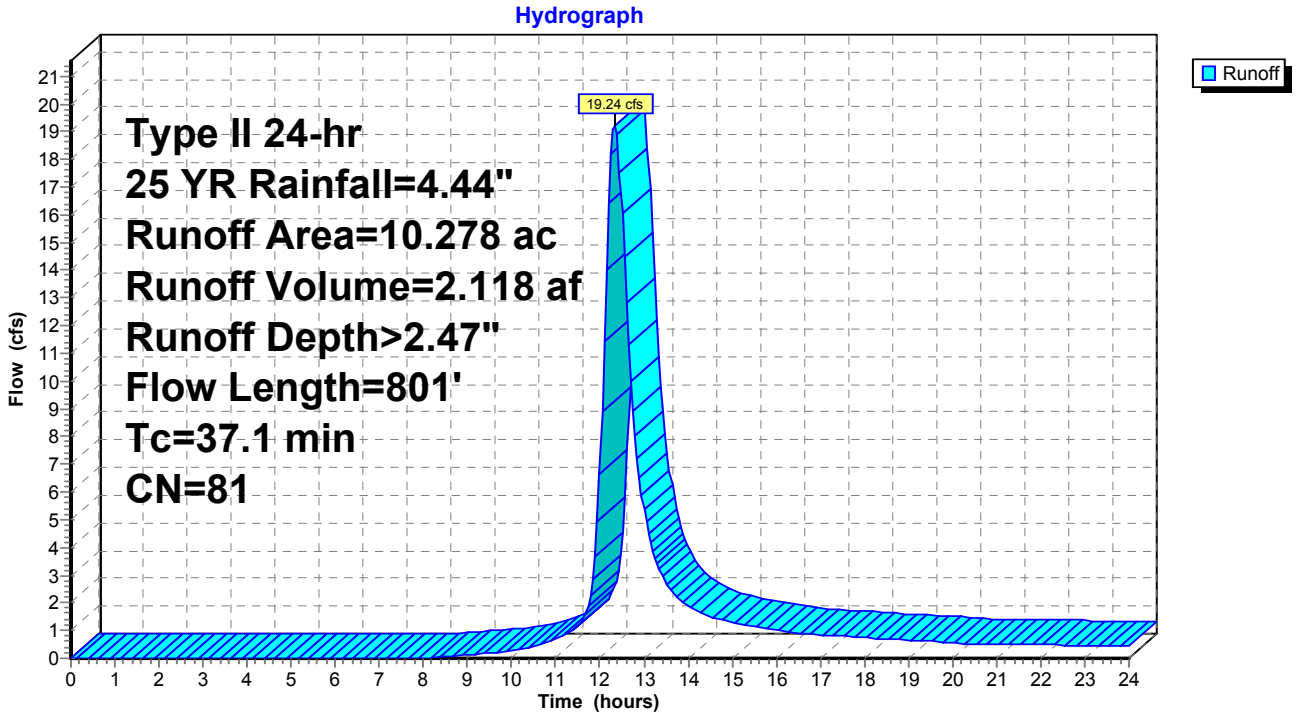
Runoff = 19.24 cfs @ 12.33 hrs, Volume= 2.118 af, Depth> 2.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YR Rainfall=4.44"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.294	79	Woods/grass comb., Good, HSG D
	0.398	98	Water Surface, HSG D
*	0.367	98	Impervious areas, HSG D
	3.601	80	>75% Grass cover, Good, HSG D
	10.278	81	Weighted Average
	9.513		92.56% Pervious Area
	0.765		7.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	222	0.0550	10.64	8.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.0	24	0.0438	12.44	21.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
37.1	801	Total			

Subcatchment 1: Pre-Development Tributary Area



Summary for Subcatchment 1: Pre-Development Tributary Area

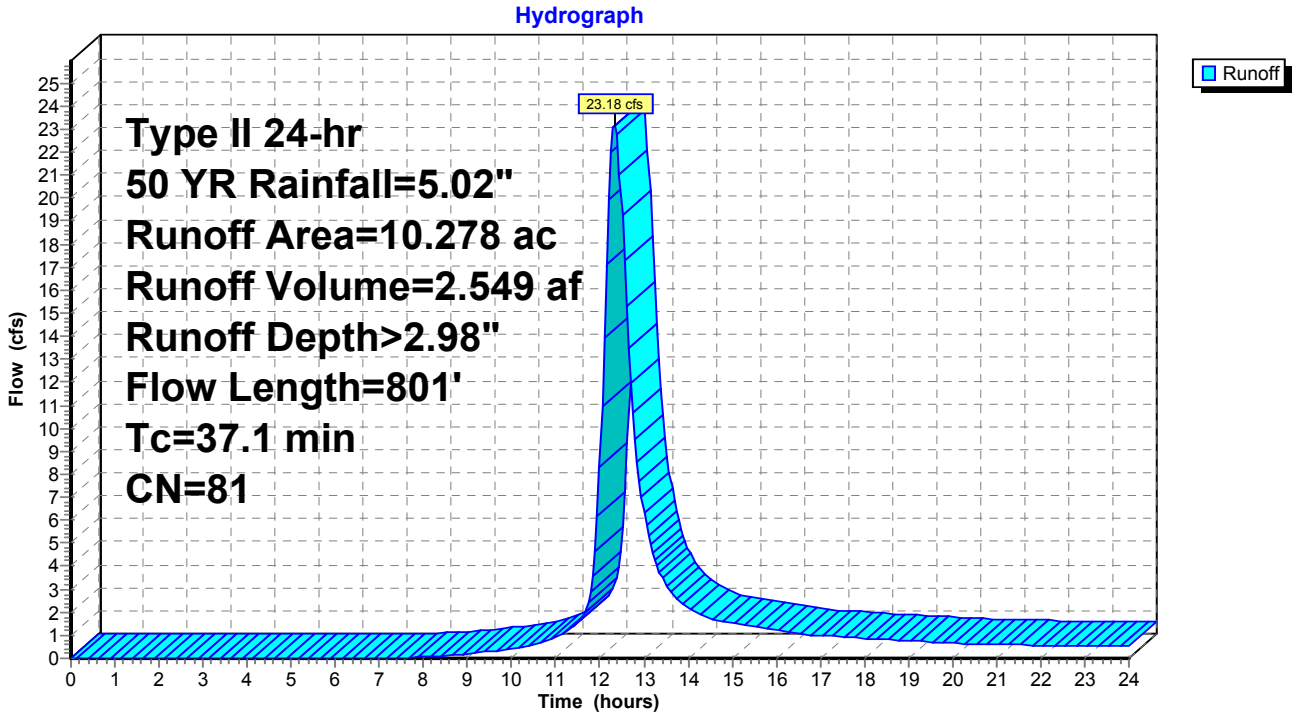
Runoff = 23.18 cfs @ 12.33 hrs, Volume= 2.549 af, Depth> 2.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 YR Rainfall=5.02"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.294	79	Woods/grass comb., Good, HSG D
	0.398	98	Water Surface, HSG D
*	0.367	98	Impervious areas, HSG D
	3.601	80	>75% Grass cover, Good, HSG D
	10.278	81	Weighted Average
	9.513		92.56% Pervious Area
	0.765		7.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	222	0.0550	10.64	8.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.0	24	0.0438	12.44	21.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
37.1	801	Total			

Subcatchment 1: Pre-Development Tributary Area



Summary for Subcatchment 1: Pre-Development Tributary Area

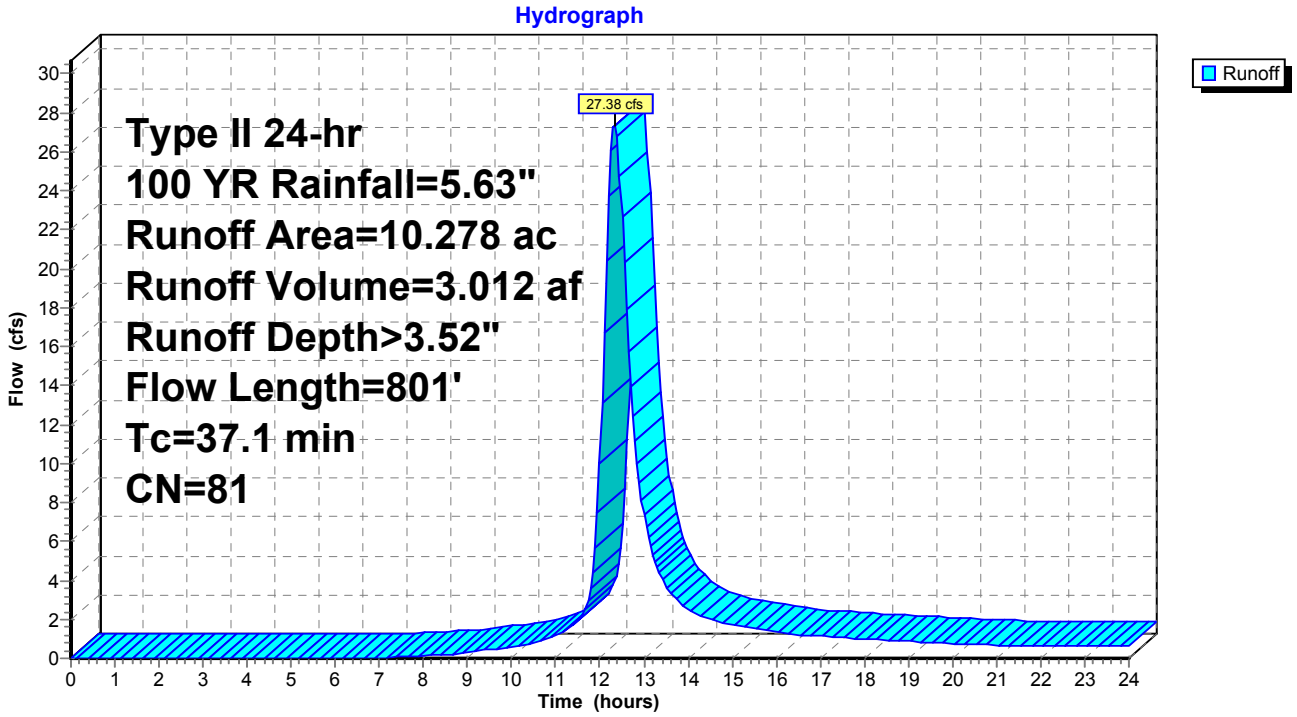
Runoff = 27.38 cfs @ 12.33 hrs, Volume= 3.012 af, Depth> 3.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YR Rainfall=5.63"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.294	79	Woods/grass comb., Good, HSG D
	0.398	98	Water Surface, HSG D
*	0.367	98	Impervious areas, HSG D
	3.601	80	>75% Grass cover, Good, HSG D
	10.278	81	Weighted Average
	9.513		92.56% Pervious Area
	0.765		7.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	222	0.0550	10.64	8.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.0	24	0.0438	12.44	21.98	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
37.1	801	Total			

Subcatchment 1: Pre-Development Tributary Area



Appendix D – Post-Development Calculations

LEGEND

- WOODS/GRASS
- GRASS COVER
- IMPERVIOUS AREA
- WATER SURFACE
- 65% IMPERVIOUS
- TIME OF CONCENTRATION PATH

0 30' 60'
SCALE: 1" = 60'

POINT A
1004.06

POINT B
1001.00

POINT C
994.98

POINT D
992.11

POINT E
INV: 991.56

POINT F
INV: 978.50

POST-DEVELOPMENT
TRIBUTARY AREA = 10.86 ACRES
IMPERVIOUS AREA = 2.99 ACRES

The Hamlet on Jerome

AMERICAN STRUCTUREPOINT INC.
2550 Corporate Exchange Drive | Suite 300
Columbus, Ohio 43231
TEL 614.901.2235 | FAX 614.901.2236
www.structurepoint.com

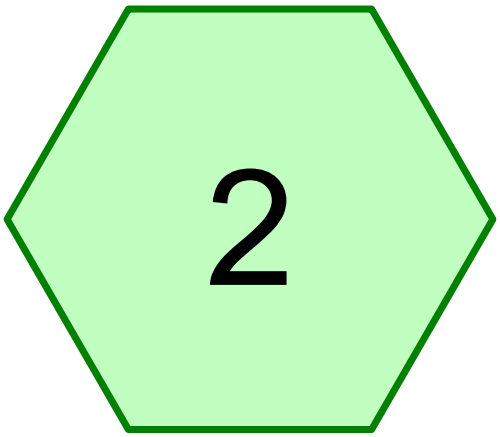
POST-DEVELOPMENT TRIBUTARY MAP
FOR
HAMLET ON JEROME
CITY OF DUBLIN, UNION COUNTY, OHIO

REVISIONS	DATE	SHEET NO.	DESCRIPTION	APPROVED	DATE

DATE:	04/24/2018
DRAWN BY:	MHS
CHECKED BY:	BJM
JOB NUMBER:	2017.01180

POST

PLOT SCALE: 1:1 EDIT DATE: 4/24/18 - 1:38 PM EDITED BY: MSCHULZE DRAWING FILE: O:\2017\01180\D. DRAWINGS\C\VALEXHIBITS\TRIBUTARY MAPS\20180 01180.CE.POST-DEVELOPMENT.TRIB.MAP.DWG



Post-Development Tributary Area

Subcat Reach Pond Link

Routing Diagram for 2017.01180.CE.Drainage.Calcs
Prepared by American Structurepoint, Printed 4/24/2018

Summary for Subcatchment 2: Post-Development Tributary Area

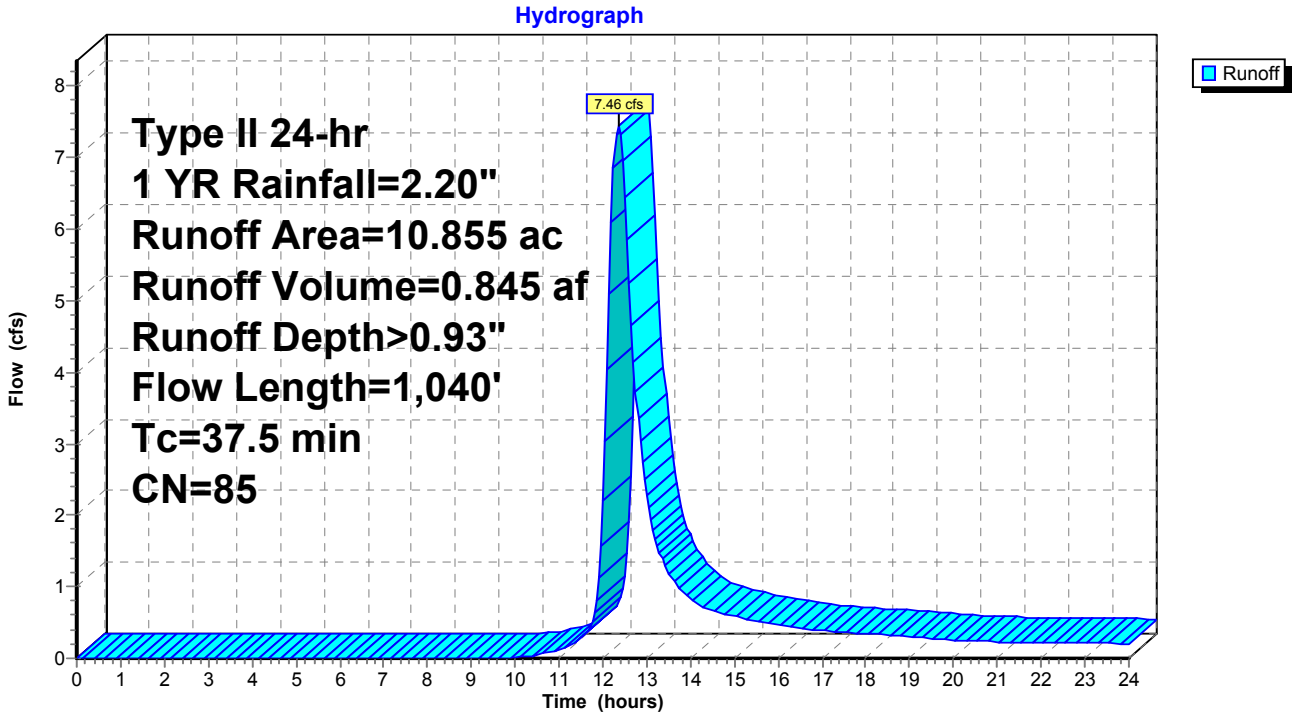
Runoff = 7.46 cfs @ 12.35 hrs, Volume= 0.845 af, Depth> 0.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 YR Rainfall=2.20"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.893	98	Paved roads w/curbs & sewers, HSG D
	2.439	92	1/8 acre lots, 65% imp, HSG D
	0.515	98	Water Surface, HSG D
	1.390	80	>75% Grass cover, Good, HSG D
	10.855	85	Weighted Average
	7.862		72.42% Pervious Area
	2.993		27.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow, Point A-B** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow, Point B-C** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow, Point C-D** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow, Point D-E** Short Grass Pasture Kv= 7.0 fps
0.7	485	0.0269	11.81	37.10	**Pipe Channel, Point E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
37.5	1,040	Total			

Subcatchment 2: Post-Development Tributary Area



Summary for Subcatchment 2: Post-Development Tributary Area

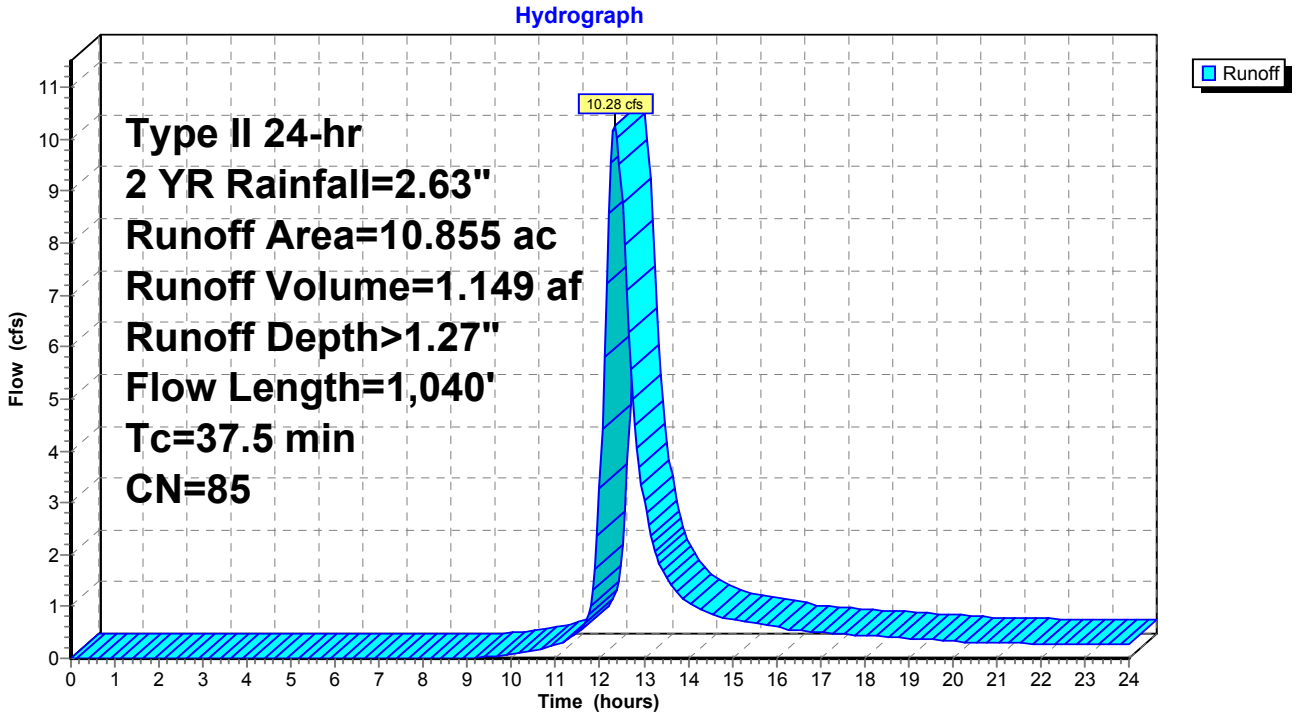
Runoff = 10.28 cfs @ 12.34 hrs, Volume= 1.149 af, Depth> 1.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 YR Rainfall=2.63"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.893	98	Paved roads w/curbs & sewers, HSG D
	2.439	92	1/8 acre lots, 65% imp, HSG D
	0.515	98	Water Surface, HSG D
	1.390	80	>75% Grass cover, Good, HSG D
	10.855	85	Weighted Average
	7.862		72.42% Pervious Area
	2.993		27.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow, Point A-B** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow, Point B-C** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow, Point C-D** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow, Point D-E** Short Grass Pasture Kv= 7.0 fps
0.7	485	0.0269	11.81	37.10	**Pipe Channel, Point E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
37.5	1,040	Total			

Subcatchment 2: Post-Development Tributary Area



Summary for Subcatchment 2: Post-Development Tributary Area

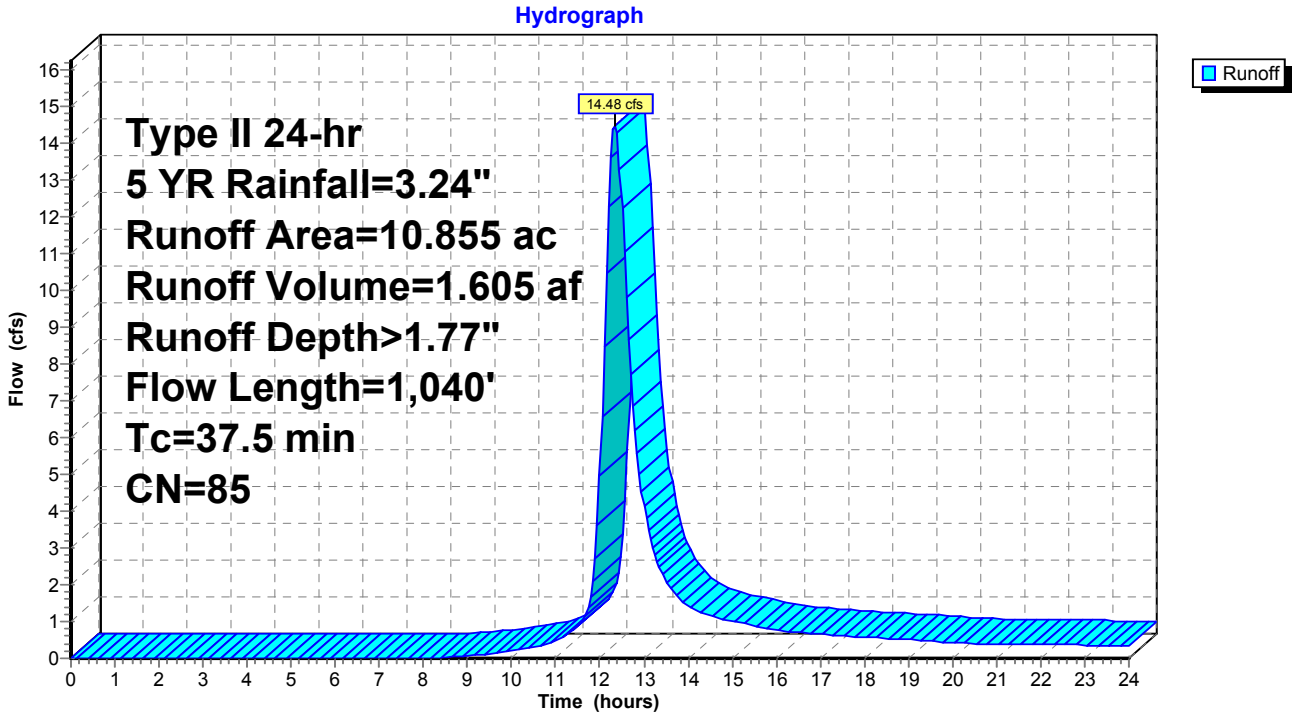
Runoff = 14.48 cfs @ 12.34 hrs, Volume= 1.605 af, Depth> 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 5 YR Rainfall=3.24"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.893	98	Paved roads w/curbs & sewers, HSG D
	2.439	92	1/8 acre lots, 65% imp, HSG D
	0.515	98	Water Surface, HSG D
	1.390	80	>75% Grass cover, Good, HSG D
	10.855	85	Weighted Average
	7.862		72.42% Pervious Area
	2.993		27.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow, Point A-B** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow, Point B-C** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow, Point C-D** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow, Point D-E** Short Grass Pasture Kv= 7.0 fps
0.7	485	0.0269	11.81	37.10	**Pipe Channel, Point E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
37.5	1,040	Total			

Subcatchment 2: Post-Development Tributary Area



Summary for Subcatchment 2: Post-Development Tributary Area

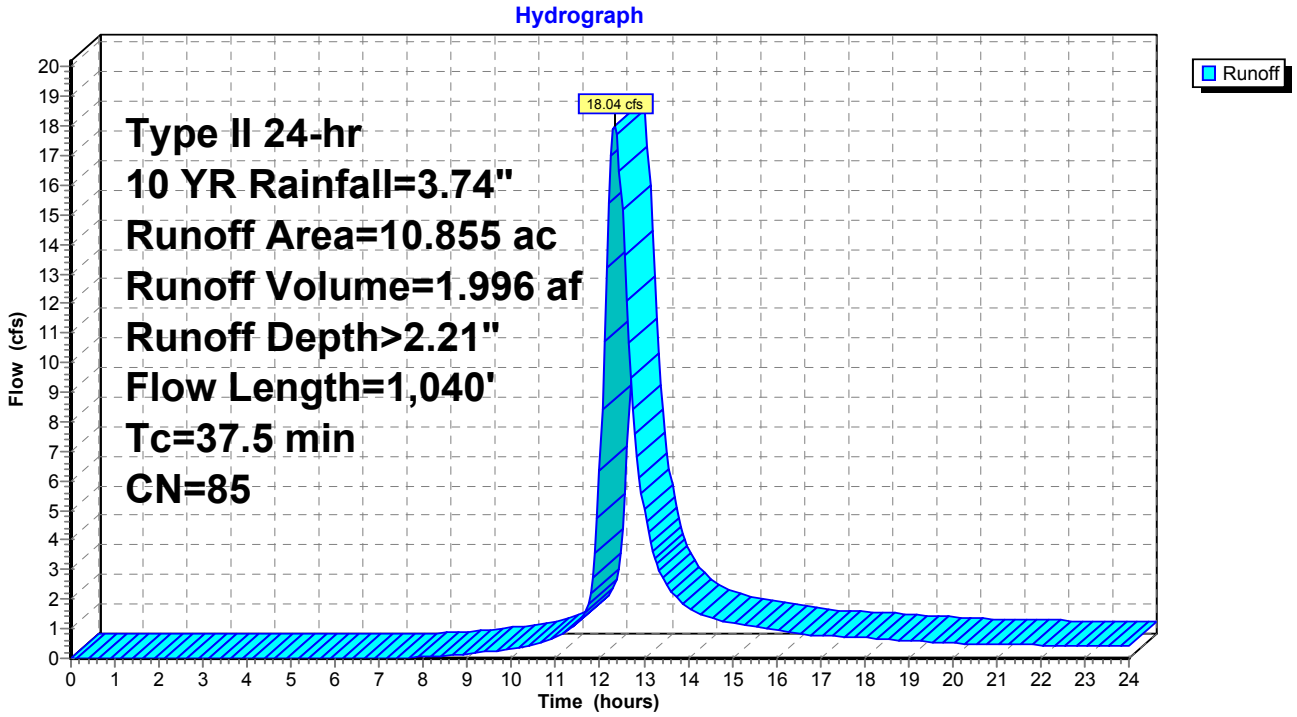
Runoff = 18.04 cfs @ 12.33 hrs, Volume= 1.996 af, Depth> 2.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 YR Rainfall=3.74"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.893	98	Paved roads w/curbs & sewers, HSG D
	2.439	92	1/8 acre lots, 65% imp, HSG D
	0.515	98	Water Surface, HSG D
	1.390	80	>75% Grass cover, Good, HSG D
	10.855	85	Weighted Average
	7.862		72.42% Pervious Area
	2.993		27.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow, Point A-B** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow, Point B-C** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow, Point C-D** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow, Point D-E** Short Grass Pasture Kv= 7.0 fps
0.7	485	0.0269	11.81	37.10	**Pipe Channel, Point E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
37.5	1,040	Total			

Subcatchment 2: Post-Development Tributary Area



Summary for Subcatchment 2: Post-Development Tributary Area

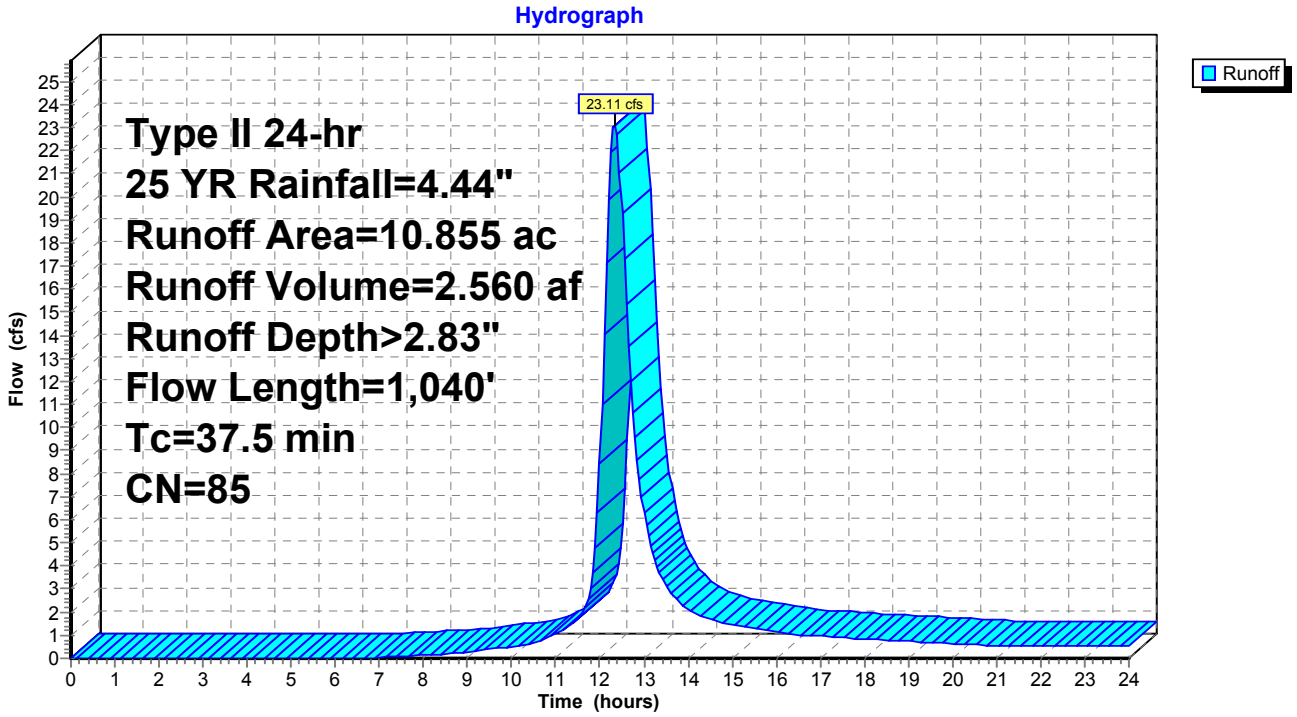
Runoff = 23.11 cfs @ 12.33 hrs, Volume= 2.560 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YR Rainfall=4.44"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.893	98	Paved roads w/curbs & sewers, HSG D
	2.439	92	1/8 acre lots, 65% imp, HSG D
	0.515	98	Water Surface, HSG D
	1.390	80	>75% Grass cover, Good, HSG D
	10.855	85	Weighted Average
	7.862		72.42% Pervious Area
	2.993		27.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow, Point A-B** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow, Point B-C** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow, Point C-D** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow, Point D-E** Short Grass Pasture Kv= 7.0 fps
0.7	485	0.0269	11.81	37.10	**Pipe Channel, Point E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
37.5	1,040	Total			

Subcatchment 2: Post-Development Tributary Area



Summary for Subcatchment 2: Post-Development Tributary Area

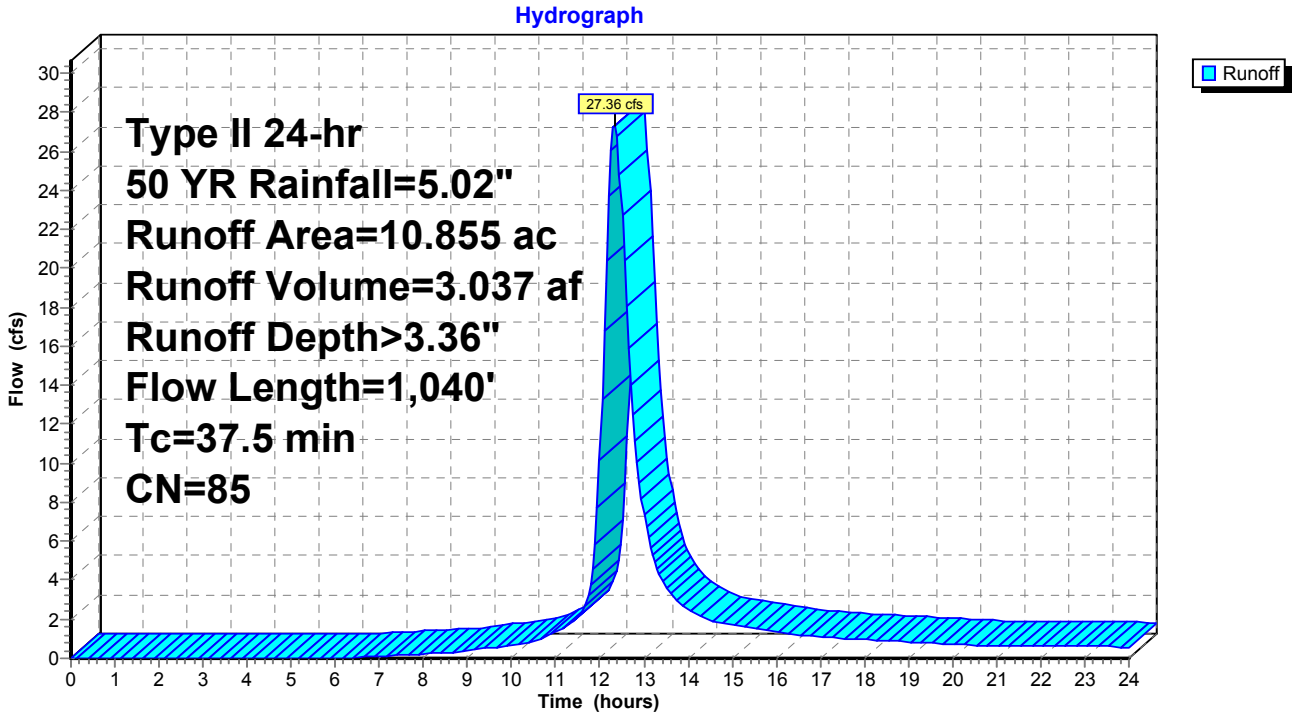
Runoff = 27.36 cfs @ 12.33 hrs, Volume= 3.037 af, Depth> 3.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 YR Rainfall=5.02"

	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.893	98	Paved roads w/curbs & sewers, HSG D
	2.439	92	1/8 acre lots, 65% imp, HSG D
	0.515	98	Water Surface, HSG D
	1.390	80	>75% Grass cover, Good, HSG D
	10.855	85	Weighted Average
	7.862		72.42% Pervious Area
	2.993		27.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow, Point A-B** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow, Point B-C** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow, Point C-D** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow, Point D-E** Short Grass Pasture Kv= 7.0 fps
0.7	485	0.0269	11.81	37.10	**Pipe Channel, Point E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
37.5	1,040	Total			

Subcatchment 2: Post-Development Tributary Area



Summary for Subcatchment 2: Post-Development Tributary Area

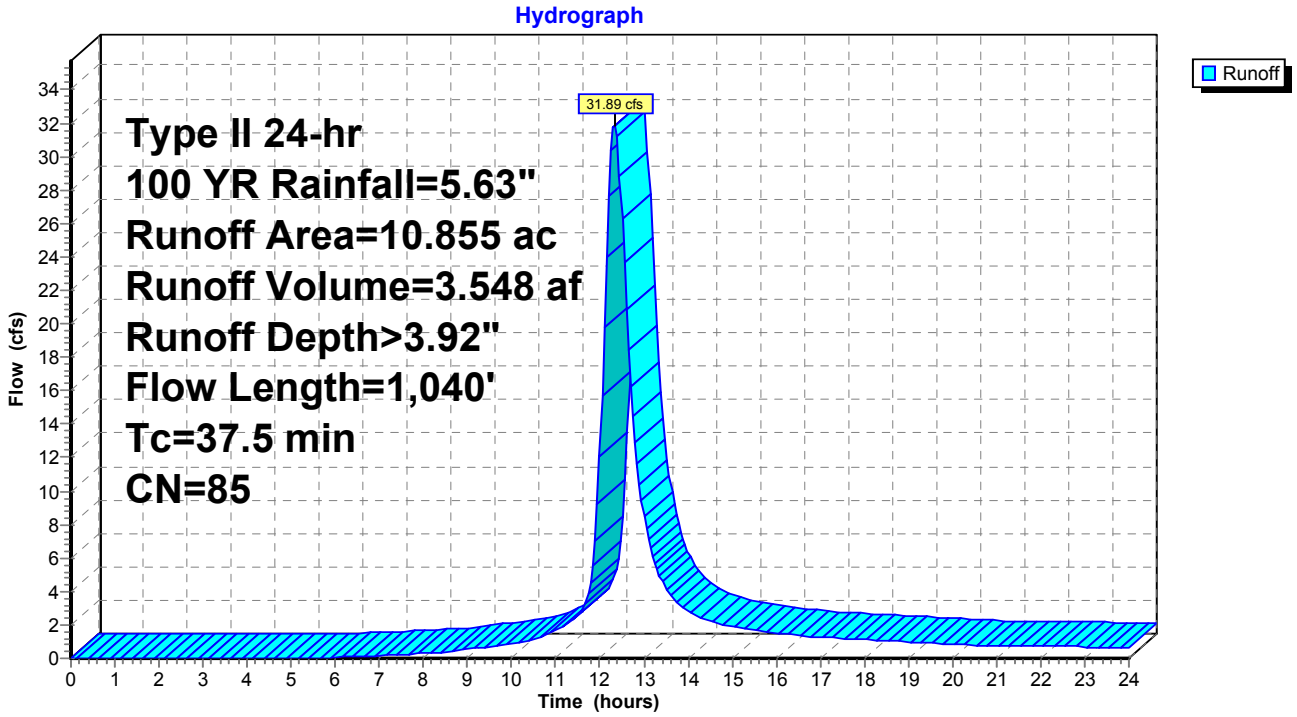
Runoff = 31.89 cfs @ 12.32 hrs, Volume= 3.548 af, Depth> 3.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YR Rainfall=5.63"

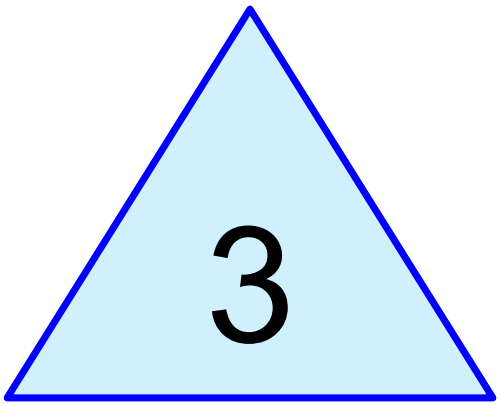
	Area (ac)	CN	Description
*	5.593	79	Woods/grass comb., Good, HSG D (offsite)
*	0.025	80	>75% Grass cover, Good, HSG D (offiste)
	0.893	98	Paved roads w/curbs & sewers, HSG D
	2.439	92	1/8 acre lots, 65% imp, HSG D
	0.515	98	Water Surface, HSG D
	1.390	80	>75% Grass cover, Good, HSG D
	10.855	85	Weighted Average
	7.862		72.42% Pervious Area
	2.993		27.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.8	135	0.0223	0.08		**Sheet Flow, Point A-B** Woods: Light underbrush n= 0.400 P2= 2.63"
4.7	228	0.0263	0.81		**Shallow Concentrated Flow, Point B-C** Woodland Kv= 5.0 fps
1.5	84	0.0358	0.95		**Shallow Concentrated Flow, Point C-D** Woodland Kv= 5.0 fps
1.8	108	0.0204	1.00		**Shallow Concentrated Flow, Point D-E** Short Grass Pasture Kv= 7.0 fps
0.7	485	0.0269	11.81	37.10	**Pipe Channel, Point E-F** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
37.5	1,040	Total			

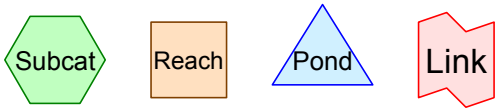
Subcatchment 2: Post-Development Tributary Area



Appendix E – Routed Calculations



Wet Retention Basin



Summary for Pond 3: Wet Retention Basin

Inflow Area = 10.855 ac, 27.58% Impervious, Inflow Depth > 0.93" for 1 YR event
Inflow = 7.46 cfs @ 12.35 hrs, Volume= 0.845 af
Outflow = 1.98 cfs @ 13.09 hrs, Volume= 0.703 af, Atten= 74%, Lag= 44.5 min
Primary = 1.98 cfs @ 13.09 hrs, Volume= 0.703 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 980.13' @ 13.09 hrs Surf.Area= 0.250 ac Storage= 0.355 af

Plug-Flow detention time= 157.4 min calculated for 0.701 af (83% of inflow)
Center-of-Mass det. time= 85.4 min (948.9 - 863.5)

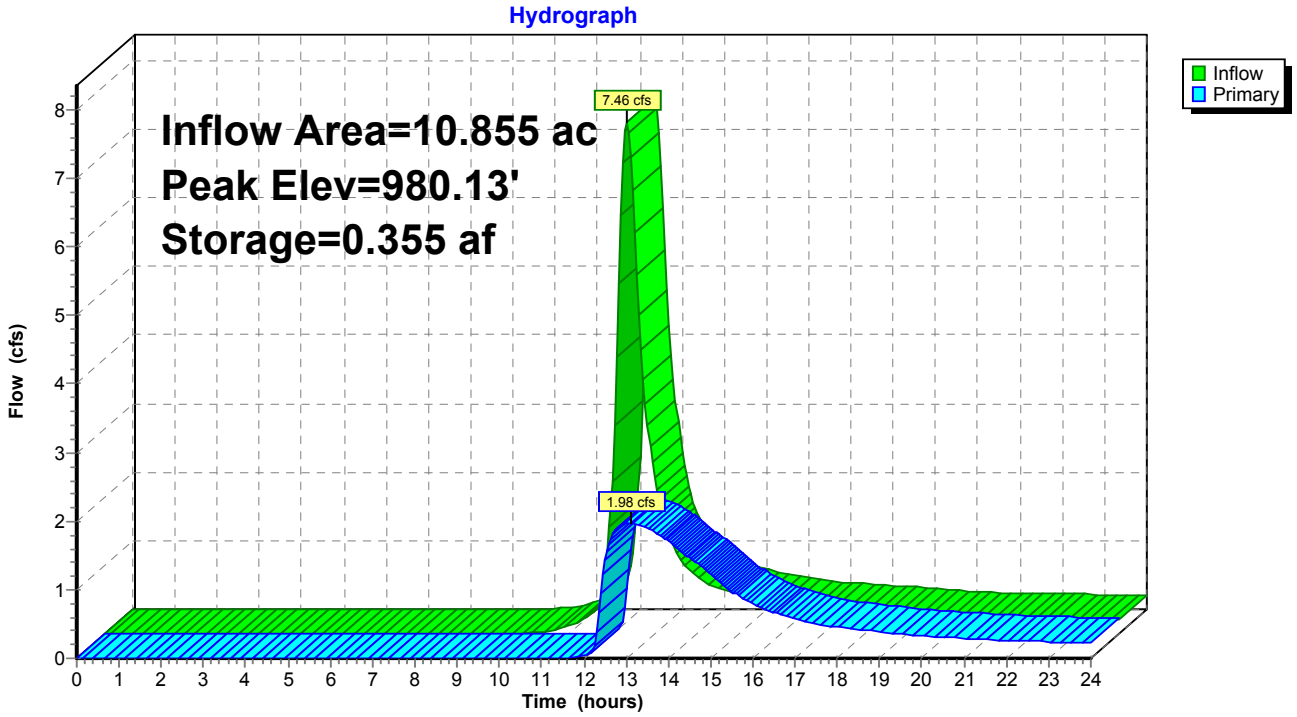
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600
#6	Device 1	984.06'	**24.0" x 24.0" Horiz. Top of Structure Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.98 cfs @ 13.09 hrs HW=980.13' (Free Discharge)
└**1=18" Outlet Pipe** (Passes 1.98 cfs of 7.96 cfs potential flow)
  ├**2=2.25" WQ Orifice** (Orifice Controls 0.16 cfs @ 5.96 fps)
  ├**3=9" Orifice** (Orifice Controls 1.82 cfs @ 4.12 fps)
  ├**4=4" Orifice** (Controls 0.00 cfs)
  ├**5=8"x24" Window** (Controls 0.00 cfs)
  └**6=Top of Structure Grate** (Controls 0.00 cfs)

Pond 3: Wet Retention Basin



Summary for Pond 3: Wet Retention Basin

Inflow Area = 10.855 ac, 27.58% Impervious, Inflow Depth > 1.27" for 2 YR event
Inflow = 10.28 cfs @ 12.34 hrs, Volume= 1.149 af
Outflow = 2.58 cfs @ 13.10 hrs, Volume= 0.998 af, Atten= 75%, Lag= 45.3 min
Primary = 2.58 cfs @ 13.10 hrs, Volume= 0.998 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 980.67' @ 13.10 hrs Surf.Area= 0.272 ac Storage= 0.497 af

Plug-Flow detention time= 147.4 min calculated for 0.996 af (87% of inflow)
Center-of-Mass det. time= 87.8 min (942.7 - 854.9)

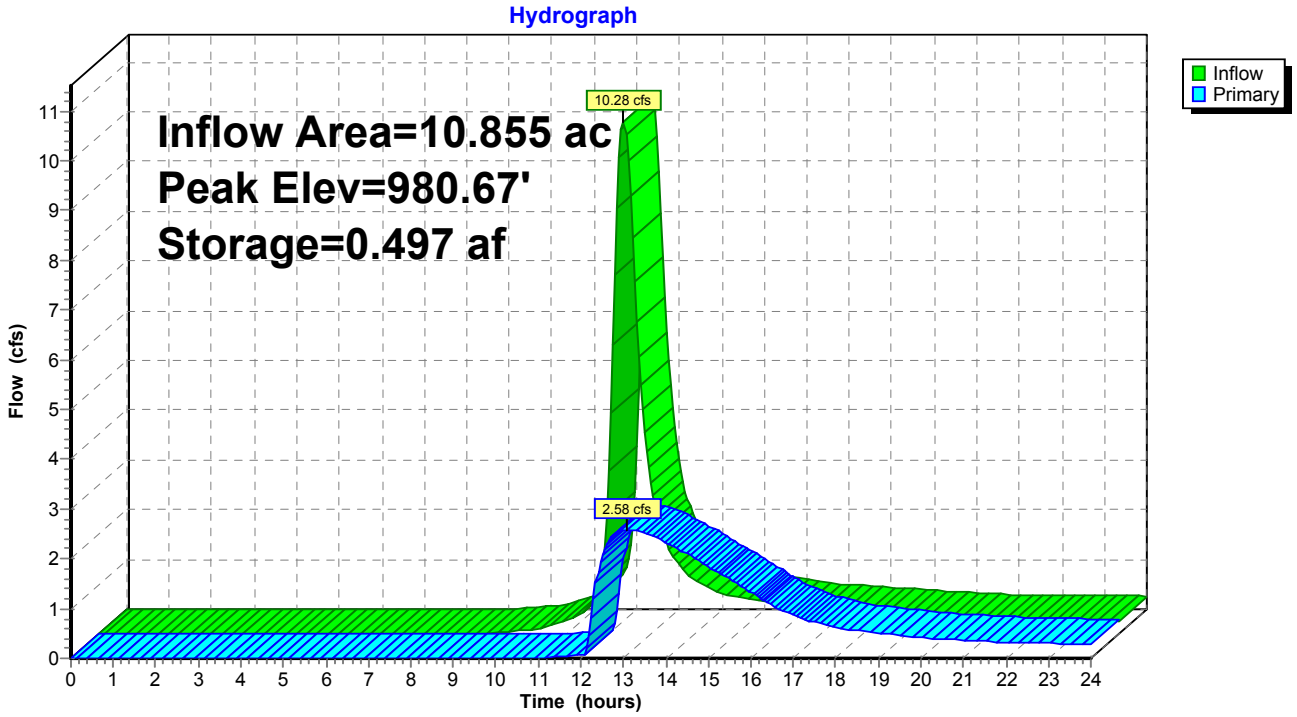
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600
#6	Device 1	984.06'	**24.0" x 24.0" Horiz. Top of Structure Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.58 cfs @ 13.10 hrs HW=980.67' (Free Discharge)
└**1=18" Outlet Pipe** (Passes 2.58 cfs of 10.14 cfs potential flow)
  ├**2=2.25" WQ Orifice** (Orifice Controls 0.18 cfs @ 6.94 fps)
  ├**3=9" Orifice** (Orifice Controls 2.40 cfs @ 5.43 fps)
  ├**4=4" Orifice** (Controls 0.00 cfs)
  ├**5=8"x24" Window** (Controls 0.00 cfs)
  └**6=Top of Structure Grate** (Controls 0.00 cfs)

Pond 3: Wet Retention Basin



Summary for Pond 3: Wet Retention Basin

Inflow Area = 10.855 ac, 27.58% Impervious, Inflow Depth > 1.77" for 5 YR event
Inflow = 14.48 cfs @ 12.34 hrs, Volume= 1.605 af
Outflow = 3.28 cfs @ 13.14 hrs, Volume= 1.444 af, Atten= 77%, Lag= 48.1 min
Primary = 3.28 cfs @ 13.14 hrs, Volume= 1.444 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 981.47' @ 13.14 hrs Surf.Area= 0.306 ac Storage= 0.729 af

Plug-Flow detention time= 148.7 min calculated for 1.444 af (90% of inflow)
Center-of-Mass det. time= 100.0 min (945.7 - 845.7)

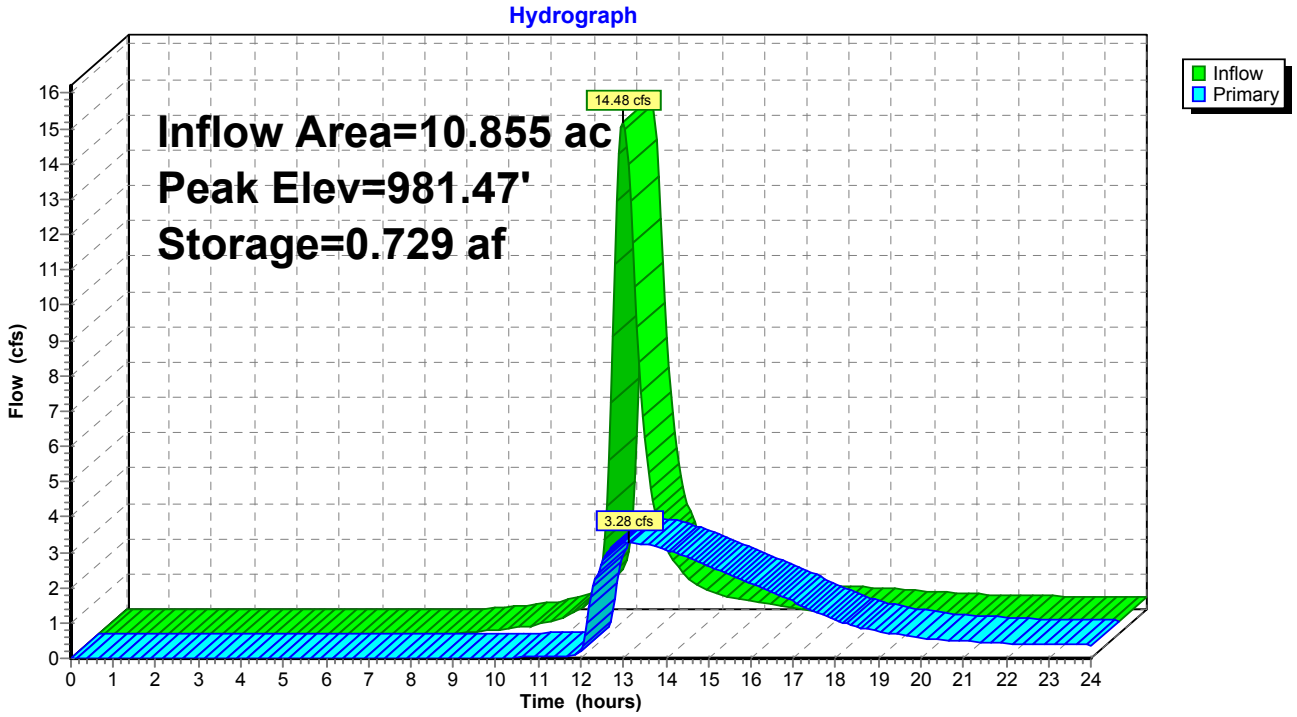
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600
#6	Device 1	984.06'	**24.0" x 24.0" Horiz. Top of Structure Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.28 cfs @ 13.14 hrs HW=981.47' (Free Discharge)
- **1=18" Outlet Pipe** (Passes 3.28 cfs of 12.69 cfs potential flow)
  - **2=2.25" WQ Orifice** (Orifice Controls 0.22 cfs @ 8.17 fps)
  - **3=9" Orifice** (Orifice Controls 3.07 cfs @ 6.94 fps)
  - **4=4" Orifice** (Controls 0.00 cfs)
  - **5=8"x24" Window** (Controls 0.00 cfs)
  - **6=Top of Structure Grate** (Controls 0.00 cfs)

Pond 3: Wet Retention Basin



Summary for Pond 3: Wet Retention Basin

Inflow Area = 10.855 ac, 27.58% Impervious, Inflow Depth > 2.21" for 10 YR event
Inflow = 18.04 cfs @ 12.33 hrs, Volume= 1.996 af
Outflow = 3.85 cfs @ 13.16 hrs, Volume= 1.827 af, Atten= 79%, Lag= 49.8 min
Primary = 3.85 cfs @ 13.16 hrs, Volume= 1.827 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 982.12' @ 13.16 hrs Surf.Area= 0.335 ac Storage= 0.937 af

Plug-Flow detention time= 154.9 min calculated for 1.827 af (92% of inflow)
Center-of-Mass det. time= 112.3 min (952.0 - 839.7)

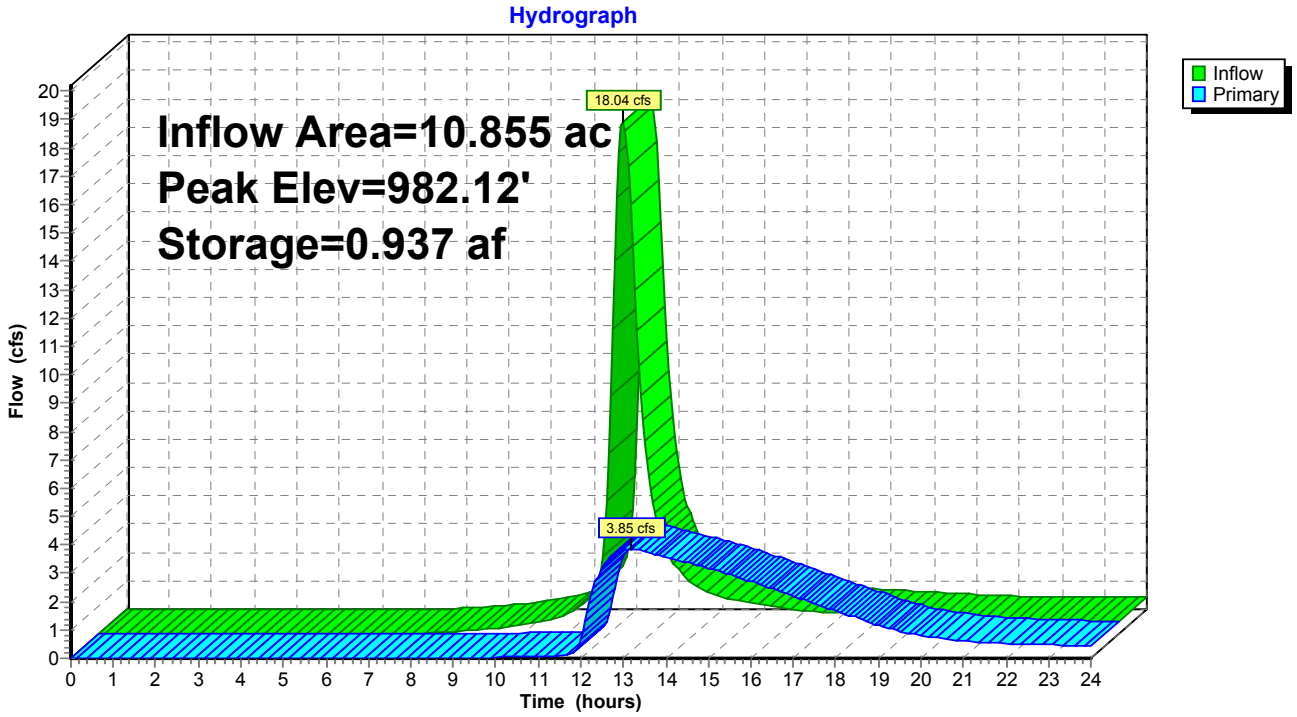
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600
#6	Device 1	984.06'	**24.0" x 24.0" Horiz. Top of Structure Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.85 cfs @ 13.16 hrs HW=982.12' (Free Discharge)
└**1=18" Outlet Pipe** (Passes 3.85 cfs of 14.42 cfs potential flow)
  ├**2=2.25" WQ Orifice** (Orifice Controls 0.24 cfs @ 9.05 fps)
  ├**3=9" Orifice** (Orifice Controls 3.51 cfs @ 7.95 fps)
  ├**4=4" Orifice** (Orifice Controls 0.10 cfs @ 1.60 fps)
  ├**5=8"x24" Window** (Controls 0.00 cfs)
  └**6=Top of Structure Grate** (Controls 0.00 cfs)

Pond 3: Wet Retention Basin



Summary for Pond 3: Wet Retention Basin

Inflow Area = 10.855 ac, 27.58% Impervious, Inflow Depth > 2.83" for 25 YR event
Inflow = 23.11 cfs @ 12.33 hrs, Volume= 2.560 af
Outflow = 4.67 cfs @ 13.18 hrs, Volume= 2.380 af, Atten= 80%, Lag= 51.2 min
Primary = 4.67 cfs @ 13.18 hrs, Volume= 2.380 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 982.95' @ 13.18 hrs Surf.Area= 0.374 ac Storage= 1.229 af

Plug-Flow detention time= 162.5 min calculated for 2.380 af (93% of inflow)
Center-of-Mass det. time= 126.0 min (958.8 - 832.8)

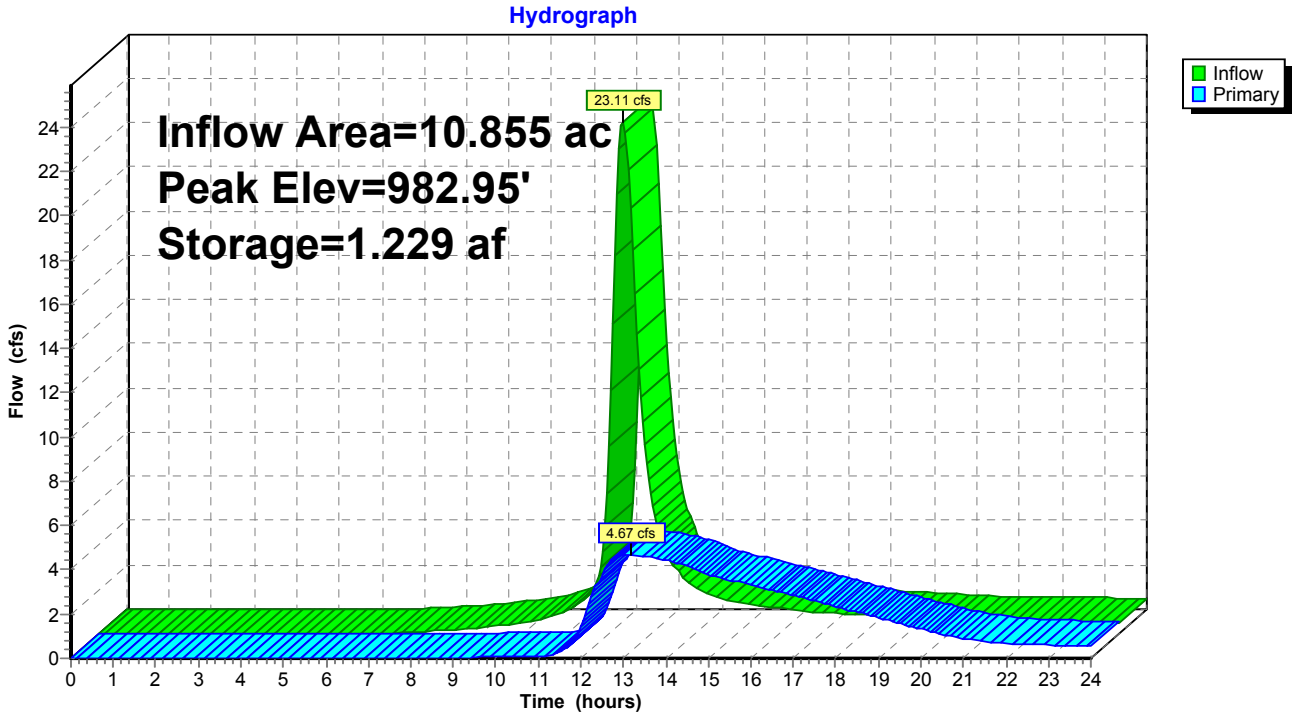
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600
#6	Device 1	984.06'	**24.0" x 24.0" Horiz. Top of Structure Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.67 cfs @ 13.18 hrs HW=982.95' (Free Discharge)
└**1=18" Outlet Pipe** (Passes 4.67 cfs of 16.36 cfs potential flow)
  ├**2=2.25" WQ Orifice** (Orifice Controls 0.27 cfs @ 10.05 fps)
  ├**3=9" Orifice** (Orifice Controls 4.01 cfs @ 9.07 fps)
  ├**4=4" Orifice** (Orifice Controls 0.39 cfs @ 4.51 fps)
  ├**5=8"x24" Window** (Controls 0.00 cfs)
  └**6=Top of Structure Grate** (Controls 0.00 cfs)

Pond 3: Wet Retention Basin



Summary for Pond 3: Wet Retention Basin

Inflow Area = 10.855 ac, 27.58% Impervious, Inflow Depth > 3.36" for 50 YR event
Inflow = 27.36 cfs @ 12.33 hrs, Volume= 3.037 af
Outflow = 5.34 cfs @ 13.20 hrs, Volume= 2.848 af, Atten= 80%, Lag= 52.2 min
Primary = 5.34 cfs @ 13.20 hrs, Volume= 2.848 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 983.59' @ 13.20 hrs Surf.Area= 0.405 ac Storage= 1.480 af

Plug-Flow detention time= 169.9 min calculated for 2.848 af (94% of inflow)
Center-of-Mass det. time= 136.7 min (964.9 - 828.1)

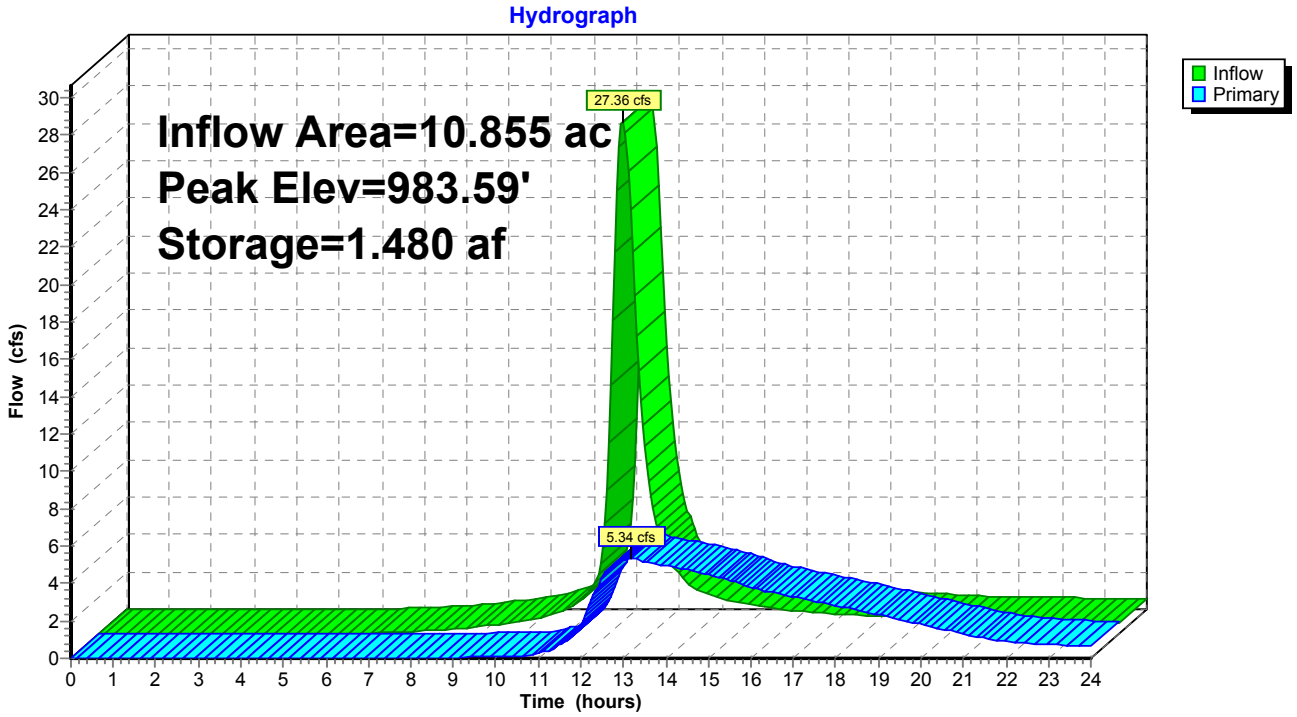
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600
#6	Device 1	984.06'	**24.0" x 24.0" Horiz. Top of Structure Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.33 cfs @ 13.20 hrs HW=983.59' (Free Discharge)
└**1=18" Outlet Pipe** (Passes 5.33 cfs of 17.73 cfs potential flow)
  ├**2=2.25" WQ Orifice** (Orifice Controls 0.28 cfs @ 10.76 fps)
  ├**3=9" Orifice** (Orifice Controls 4.36 cfs @ 9.86 fps)
  ├**4=4" Orifice** (Orifice Controls 0.52 cfs @ 5.94 fps)
  ├**5=8"x24" Window** (Orifice Controls 0.17 cfs @ 0.96 fps)
  └**6=Top of Structure Grate** (Controls 0.00 cfs)

Pond 3: Wet Retention Basin



Summary for Pond 3: Wet Retention Basin

Inflow Area = 10.855 ac, 27.58% Impervious, Inflow Depth > 3.92" for 100 YR event
Inflow = 31.89 cfs @ 12.32 hrs, Volume= 3.548 af
Outflow = 8.14 cfs @ 13.03 hrs, Volume= 3.348 af, Atten= 74%, Lag= 42.1 min
Primary = 8.14 cfs @ 13.03 hrs, Volume= 3.348 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 984.06' @ 13.03 hrs Surf.Area= 0.428 ac Storage= 1.674 af

Plug-Flow detention time= 165.2 min calculated for 3.341 af (94% of inflow)
Center-of-Mass det. time= 134.8 min (958.6 - 823.8)

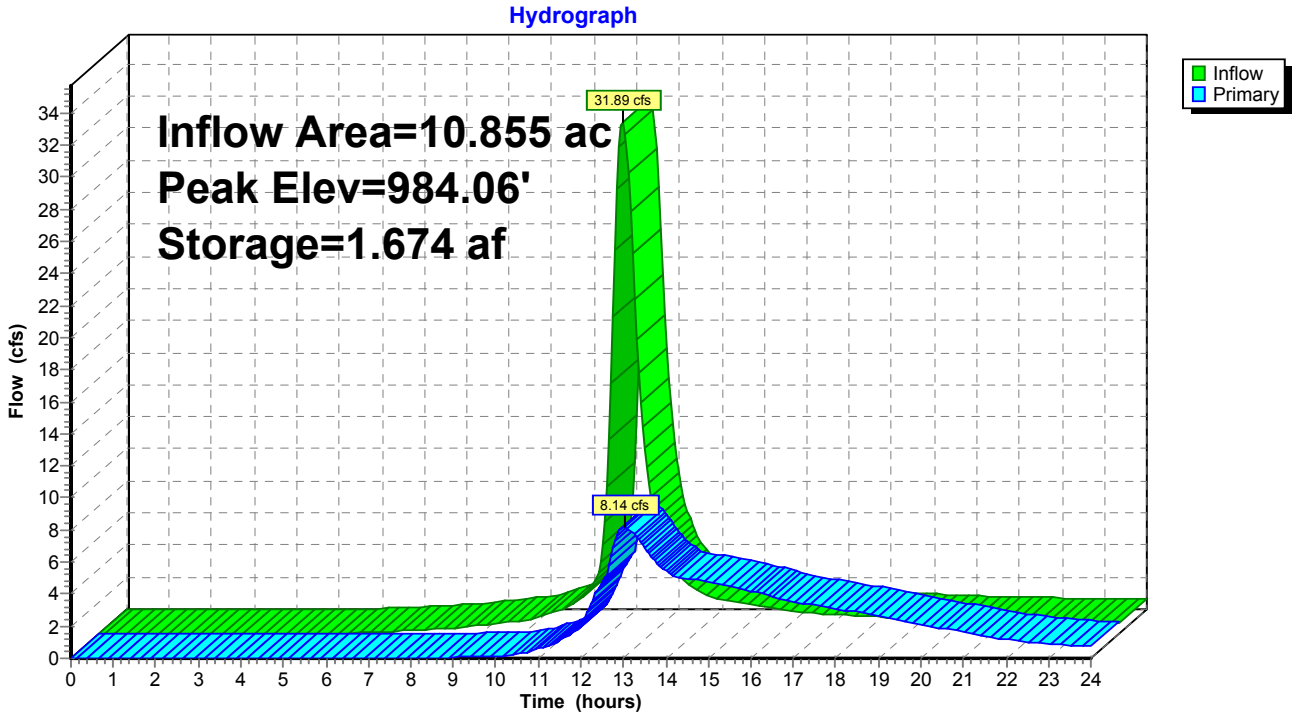
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600
#6	Device 1	984.06'	**24.0" x 24.0" Horiz. Top of Structure Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=8.14 cfs @ 13.03 hrs HW=984.05' (Free Discharge)
└**1=18" Outlet Pipe** (Passes 8.14 cfs of 18.65 cfs potential flow)
  ├**2=2.25" WQ Orifice** (Orifice Controls 0.30 cfs @ 11.25 fps)
  ├**3=9" Orifice** (Orifice Controls 4.59 cfs @ 10.39 fps)
  ├**4=4" Orifice** (Orifice Controls 0.59 cfs @ 6.79 fps)
  ├**5=8"x24" Window** (Orifice Controls 2.65 cfs @ 2.39 fps)
  └**6=Top of Structure Grate** (Controls 0.00 cfs)

Pond 3: Wet Retention Basin



Appendix F – Water Quality Calculations

WATER QUALITY VOLUME CALCULATIONS

Project:	**Hamlet on Jerome**
Job #:	**2017.01180**
Location:	**Dublin, OH**
Date	4/24/18

AMERICAN STRUCTUREPOINT INC.

Calc By: MHS

Chk By: BJM

Post-Developed Tributary Area

Total Area	10.860	acres
Impervious Area	2.750	acres
% Impervious	0.253	
C Value	0.20	
WQ_V	0.136	acre-ft
Total 75% WQv	0.102	acre-ft
WQ_V Elevation	979.02	ft
Provided WQv	0.103	acre-ft

Ohio EPA WQ Formula

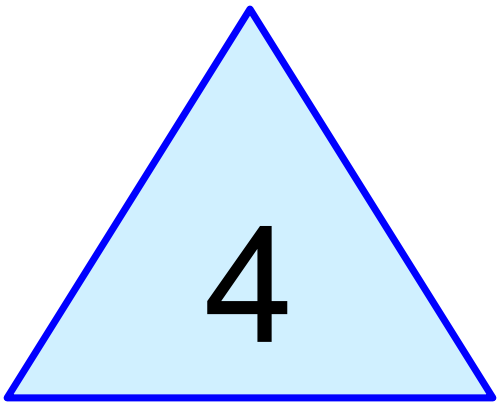
$WQ_V = CPA/12$

$C = 0.858i^3 - 0.780i^2 + 0.774i + 0.04$

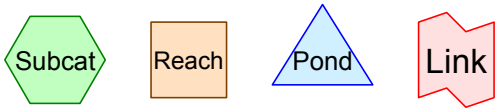
i = fraction of impervious surface

P = 0.75" precipitation depth

A = drainage area in acres



Water Quality Drawdown



Routing Diagram for 2017.01180.CE.Drainage.Calcs
Prepared by American Structurepoint, Printed 4/24/2018

Summary for Pond 4: Water Quality Drawdown

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.08 cfs @ 0.00 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min
Primary = 0.08 cfs @ 0.00 hrs, Volume= 0.087 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Starting Elev= 979.02' Surf.Area= 0.207 ac Storage= 0.103 af
Peak Elev= 979.02' @ 0.00 hrs Surf.Area= 0.207 ac Storage= 0.103 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

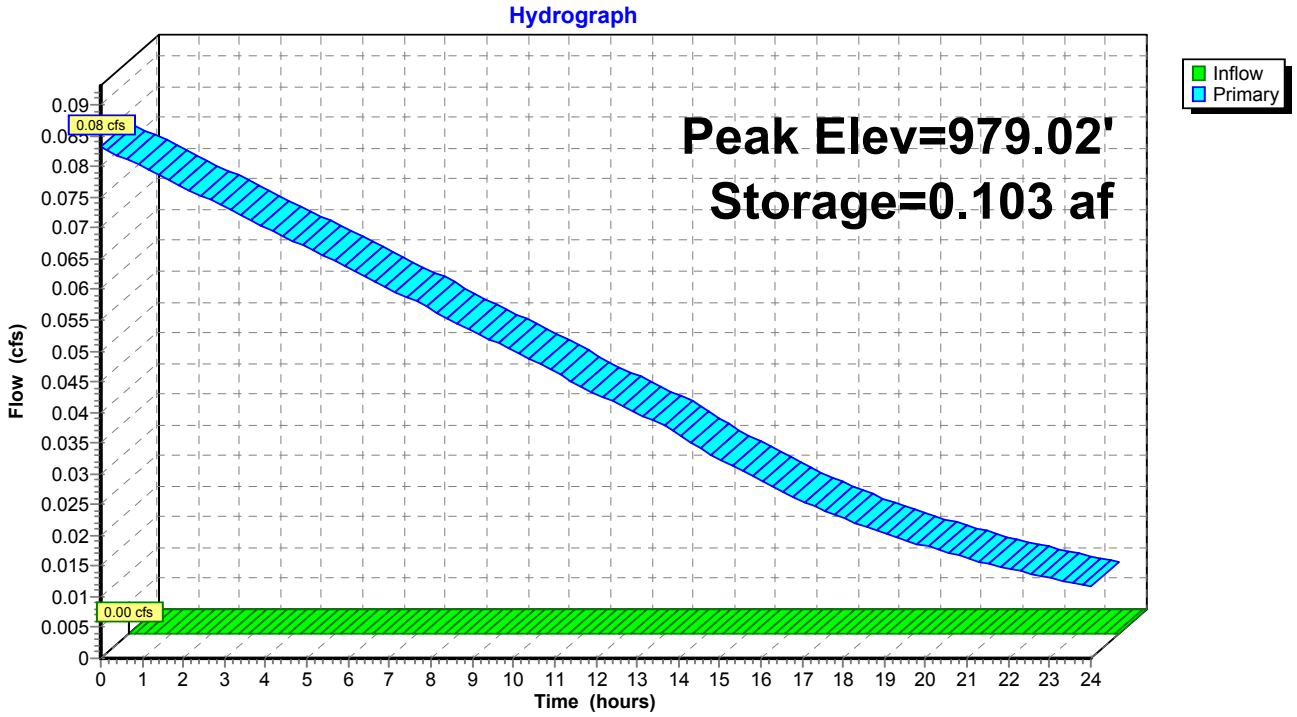
Volume	Invert	Avail.Storage	Storage Description
#1	978.50'	1.869 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
978.50	0.188	0.000	0.000
979.50	0.225	0.206	0.206
980.50	0.265	0.245	0.452
981.50	0.307	0.286	0.737
982.50	0.353	0.330	1.067
983.50	0.400	0.376	1.444
984.50	0.450	0.425	1.869

Device	Routing	Invert	Outlet Devices
#1	Primary	978.50'	**18.0" Round 18" Outlet Pipe** L= 50.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 978.50' / 977.25' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	978.50'	**2.2" Vert. 2.25" WQ Orifice** C= 0.600
#3	Device 1	979.02'	**9.0" Vert. 9" Orifice** C= 0.600
#4	Device 1	981.90'	**4.0" Vert. 4" Orifice** C= 0.600
#5	Device 1	983.50'	**24.0" W x 8.0" H Vert. 8"x24" Window** C= 0.600

Primary OutFlow Max=0.08 cfs @ 0.00 hrs HW=979.02' (Free Discharge)
└**1=18" Outlet Pipe** (Passes 0.08 cfs of 1.34 cfs potential flow)
  ├**2=2.25" WQ Orifice** (Orifice Controls 0.08 cfs @ 3.15 fps)
  ├**3=9" Orifice** (Controls 0.00 cfs)
  ├**4=4" Orifice** (Controls 0.00 cfs)
  └**5=8"x24" Window** (Controls 0.00 cfs)

Pond 4: Water Quality Drawdown



Hydrograph for Pond 4: Water Quality Drawdown

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**0.103**	**979.02**	**0.08**
0.50	0.00	0.099	979.00	0.08
1.00	0.00	0.096	978.99	0.08
1.50	0.00	0.093	978.97	0.08
2.00	0.00	0.090	978.96	0.08
2.50	0.00	0.086	978.94	0.08
3.00	0.00	0.083	978.93	0.07
3.50	0.00	0.080	978.91	0.07
4.00	0.00	0.077	978.90	0.07
4.50	0.00	0.075	978.88	0.07
5.00	0.00	0.072	978.87	0.07
5.50	0.00	0.069	978.85	0.07
6.00	0.00	0.066	978.84	0.06
6.50	0.00	0.064	978.83	0.06
7.00	0.00	0.061	978.82	0.06
7.50	0.00	0.059	978.80	0.06
8.00	0.00	0.056	978.79	0.06
8.50	0.00	0.054	978.78	0.06
9.00	0.00	0.052	978.77	0.05
9.50	0.00	0.050	978.76	0.05
10.00	0.00	0.048	978.75	0.05
10.50	0.00	0.046	978.74	0.05
11.00	0.00	0.044	978.73	0.05
11.50	0.00	0.042	978.72	0.04
12.00	0.00	0.040	978.71	0.04
12.50	0.00	0.038	978.70	0.04
13.00	0.00	0.036	978.69	0.04
13.50	0.00	0.035	978.68	0.04
14.00	0.00	0.033	978.67	0.04
14.50	0.00	0.032	978.67	0.03
15.00	0.00	0.030	978.66	0.03
15.50	0.00	0.029	978.65	0.03
16.00	0.00	0.028	978.65	0.03
16.50	0.00	0.027	978.64	0.03
17.00	0.00	0.026	978.63	0.03
17.50	0.00	0.025	978.63	0.02
18.00	0.00	0.024	978.62	0.02
18.50	0.00	0.023	978.62	0.02
19.00	0.00	0.022	978.62	0.02
19.50	0.00	0.021	978.61	0.02
20.00	0.00	0.020	978.61	0.02
20.50	0.00	0.020	978.60	0.02
21.00	0.00	0.019	978.60	0.02
21.50	0.00	0.018	978.60	0.02
22.00	0.00	0.018	978.59	0.01
22.50	0.00	0.017	978.59	0.01
23.00	0.00	0.016	978.59	0.01
23.50	0.00	0.016	978.58	0.01
24.00	0.00	0.015	978.58	0.01