TETRA TECH

Appendix 1
Exhibit 4

December 9, 2022
Revised January 30, 2023

District Mining – Pottsville DMO
2nd Floor 5 West Laurel Blvd
Pottsville, PA 17901

Subject: FINDINGS LETTER REPORT
SOLEBURY TOWNSHIP - BUCKS COUNTY, PA
NEW HOPE CRUSHED STONE & LIME COMPANY, INC. (NHCS)
QUARRY DISCHARGE OUTLET

New Hope Crushed Stone & Lime Co., Inc. (NHCS) operated a quarry in Solebury Township, Bucks County. The permittee, NHCS, has forfeited the site, and PADEP District Mining Operations (DMO) is taking over reclamation at the site. Tetra Tech was retained to assist PADEP with stream restoration of Primrose Creek where it exits the quarry pit and downstream to the existing channel. Elements of the stream restoration work involve designing a channel that will run from the pit to the Primrose Creek. Through consultation between DMO and the Department's Division of Dam Safety, it was established that the elevation of the historic natural surface will govern the elevation of the outlet from the quarry and ultimate elevation of the quarry lake.

LOCATION AND DESCRIPTION

The New Hope Crushed Stone Quarry is located in Solebury Township along Phillips Mill Road, west of the intersection with River Road (Route 32), and approximately 0.90 miles from the Delaware River. Two unnamed tributaries drain a contiguous unnamed basin to the northeast and flow east to the Delaware River Canal. Three small unnamed tributaries drain the Primrose Basin in the northwest and form the Primrose Creek near Phillips Mill Road.

On the downgradient side of the quarry, the Primrose Creek serves as the NPDES discharge point of the quarry and flows year-round. The area of the Primrose Creek basin is approximately 2.75 square miles.

REGIONAL GEOLOGY

The New Hope Quarry Pit is located in the Piedmont Province, Gettysburg-Newark Lowland Section. The regional topography is characterized by rolling lowlands, shallow valleys and isolated hills. The dominate underlying geology is red shale, siltstone and sandstone with some conglomerate and diabase. The structure comprises a depressed block boarded by parallel faults with low, monoclinal, northwest-dipping beds. The Furlong Fault bisects the quarry pit trending N30E.

Along the east rim of the quarry pit and outlet area, the Jurassic and Triassic Age, Brunswick Formation is found and typically consists of reddish-brown shale, mudstone, and siltstone, with beds of green shale and brown shale. Near its base, the rock is tough, red argillite interbedded in some places with dark-gray argillite. Bedding is moderately well developed, thin, and flaggy. The Brunswick Formation has been intruded by many diabase dikes and sills. Since the Brunswick Formation is composed of very fine-grained rocks, groundwater movement is typically through secondary openings, consisting of fractures or joint planes. Previous studies found that the secondary openings are often plugged with weathered materials such as residual clay to depths ranging up to 200 feet below ground surface.

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Along the west rim of the quarry pit, the Cambrian Age, Allentown Formation is found and typically consists of laminated, medium-gray dolomite and impure limestone, dark-gray chert stringers and nodules, some calcareous siltstone, and some oolites, stromatolites, and sharpstone conglomerate. Karst surface depressions are noted on north rim and west of the quarry pit.

SITE EXPLORATION

A subsurface exploration for the site consisted of six (6) test pits (TP) along the eastern rim of the quarry. The intent of the exploration program was to determine the top of rock (overburden-rock interface) at the outlet from the quarry pit. On June 22, 2022, Eric DiFatta, PE, of Tetra Tech met representatives from DMO to review existing site conditions and finalize test pit locations. Test pit locations were selected along the eastern rim of the quarry to identify the native rock elevations and also selected at the potential location of the quarry outlet. Exploration locations were field located by Tetra Tech personnel and located with a handheld Global Positioning System ("GPS") unit. All test pits were excavated to the either the top of rock or the maximum arm reach of the excavator. The test pits, soil interval elevations, inferred rock elevation, and groundwater levels presented in this report are based upon these GPS unit coordinates and a topographic survey performed by NE Surveyors on October 3, 2022. A plan of the TPs can be found on the attached Site Plan. A summary of test pits is provided on Table 1.

Within each test pit, Tetra Tech noted visual observations of major soil units, depth of major soil units, depth to top of rock and depth to native material. Based on our observations within the test pits, the upper most layer along the eastern rim of the quarry was hardpack (i.e. gravel that has been compressed over time) that had an average thickness of four (4) feet. Hardpack was found along the road surface test pits only, TP-1, TP-2, TP-4 and TP-5. Fill material was encountered along the proposed channel route and on the outer edges of the eastern rim of the quarry. The fill material thickness ranged from 5 to 9 feet. Native material consisted of weathered to highly weathered reddish-brown claystone. Refusal was encountered in two test pits, TP-1, and TP-2. During the excavation of TP-1 it was assumed that we had encountered competent bedrock at 15 ft below ground surface (bgs) and at TP-2 refusal was meet at 7 ft bgs. Tetra Tech believes that refusal in TP-2 was due to the excavators' limits because the hard pack was not diggable. The soil and rock conditions discussed in this report were observed to be present at the test pit locations. The subsurface conditions may differ between the exploratory locations or be inferred differently by others.

Water was located in 3 of the 6 test pits. In TP-3 water was encountered at 7 ft bgs and 14 ft bgs, shortly after reaching the bottom of the test pit the hole collapsed from the water rushing in. TP-5 had encountered a seep at the bottom of the test pit at 14.5 bgs. Approximately one hour after opening the test pit, it had filled with approximately 1 foot of water. TP-6 encountered a seep at 9 ft bgs, at the interface between the fill material and native material.

OUTLET AND CHANNEL

The outlet and channel will be constructed as the sole outlet for the water impounded at the reclaimed quarry. The weir outlet and channel are designed to have a 2-tier configuration. The bottom tier of the channel will be lined with R-4 riprap, and the upper tier will be lined with NAGreen Vmax SC-250 channel liner and vegetated. As discussed with DMO and Dam Safety, the breach (quarry outlet) was sized so that the water surface upstream would be limited to an approximate 1-foot increase as compared to natural conditions. Dam Safety also recommended the lower tier be sized with a maximum bottom width of 10 ft. The bottom tier will be 1 foot deep and the top tier will be a total of 3 feet deep. The bottom tier weir outlet

will pass the 5-year storm event, and the upper tier weir outlet will pass the 100-year storm flowing at 1.5' deep, for a total flow depth of 2.5' deep. Refer to the attached calculation brief.

CONCLUSION

In summary, the Project intent was to conduct a geotechnical investigation by the use of test pits to determine the historic elevation of the natural ground surface and the geological nature of the contact between the overburden fill material and the buried bedrock along the eastern rim of the quarry, specifically at the proposed location of the outlet from the quarry.

Tetra Tech has submitted this stream restoration plan for the proposed outlet from the quarry lake and downstream channel to the existing stream. The outlet and channel design incorporated a wider floodplain to manage higher flows and a low flow notch to manage smaller storm events. The proposed outlet is designed to be constructed in native ground. The outlet elevation was selected based on the test pits performed for this project in the vicinity of the proposed quarry outlet which identified the contact between fill material and bedrock or native material. In addition to the native ground elevation, the outlet was sized so that the water surface upstream would not increase by more than approximately 1 foot as compared to natural conditions. It is anticipated that constructing the quarry outlet in native ground will minimize seepage and uncontrolled discharge through the fill material. However, considering the variability of the native rock elevations and mining history, the rock surface will likely vary in three dimensions. If the pool level is raised above the level of the native soil/rock that defines the quarry rim, there is a chance for uncontrolled seepage and discharge into the fill material potentially saturating the material downstream.

Respectfully Submitted,

Heather Trexler, PG

Project Manager

TABLE

Tetra Tech, Inc.

TABLE 1 - SCHEDULE OF TEST PITS

New Hope Crushed Stone & Lime Co., Inc. (NHCS)
Solebury Township, Bucks County, PA

TP Designation	Latitude	Longitude	Surveyed GS EL (feet)	Inferred Thickness of hardpack (feet)	Inferred Thickness of fill Mat'l (feet)	Bottom EL of fill Mat'l (feet)	Inferred thickness of Native Mat'l (feet)	Total Depth (feet)	Bottom EL (feet)
TP-1	40.37710	-74.97683	116.3	2	5	109.3	15	15	101.3
TP-2	40.37786	-74.97667	105.2	7	NE	NE	NE	7	98.2
TP-3	40.37787	-74.97602	100.8	NE	5	95.8	16	16	84.8
TP-4	40.37891	-74.97624	111.8	2	6	103.8	15	15	96.8
TP-5	40.37965	-74.97567	110.1	5	NE	NE	9.5	14.5	95.6
TP-6	40.37753	-74.97668	101.5	NE	9	92.5	14	14	87.5

NE = Not Encountered
GS = Ground Surface
EL = Elevation
Surveyed Ground Surface Elevations provided by Northeast Surveyors on October 3, 2022

H&H CALCULATIONS

STANDARD DESIGN CALCULATION WORKSHEET

TETRA TECH	CALCULATION WORKSHEET		PAGE 1 OF 2
Client: Pennsylvania Department of Environmental Protection		**Project Number: 212C-PB-02248**	
Subject: Quarry Discharge Outlet Project – Outlet Design			
By: JP	**Checked By: ED**	**Approved By: HT**	**Date: 12/7/2022**

The purpose of this calculation package is to present the procedures and assumptions used to calculate the size of a principle spillway and outlet channel from an existing quarry pond for the Quarry Discharge Outlet Project.

Peak-flow conditions and hydraulic analysis for the proposed post mining development area were modeled in HydroCAD and Streamstats. Per Streamstats, the drainage area of 1,382 acres was used to model the watershed surrounding the proposed development area. Aerial photography was utilized to derive a curve number of 58. The Tc values in HydroCAD were adjusted so that the peak flows generated by the HydroCAD model matched the Streamstats report peak flows.

The runoff was then routed through the proposed post mining development pond. The associated Streamstats drainage report and HydroCAD outlet reports are attached. The proposed basin routing utilizes an open channel/spillway only. The proposed invert elevation was set to be within native material/bedrock per geotechnical test pits conducted for this project. Test Pit 3 was used as a representative elevation. See Attachment 6 for a Schedule of Test Pits and their elevations.

The channel will be constructed as the sole outlet for the water impounded at the reclaimed quarry. The weir and outlet channel are designed to have a 2-tier configuration. The bottom tier of the channel will be lined with R-4 riprap, and the upper tier will be lined with NAGreen Vmax SC-250 channel liner and vegetated. The bottom tier will be 1 foot deep and the top tier will be a total of 3 feet deep. The bottom tier weir outlet will pass the 5-year storm event, and the upper tier weir outlet will pass the 100-year storm flowing at 1.5’ deep, for a total flow depth of 2.5’ deep. The two-tier geometry was modeled in HydroCAD. The results of the routed 2-, 5-, 10-, 50-, 100- and 500-year storm events are summarized in the attached documents.

The bottom and top tiers were analyzed as separate channels to determine each channel liner. The lower tier of the channel, lined with riprap, was analyzed as flowing full to determine the required channel lining. The upper channel was analyzed to pass the 100-year storm with HydroCAD, with the lower tier bankfull flow mentioned above separate, to determine the required channel liner.

During the temporary condition, the water elevations calculated in the channel design worksheet for the 100-year storm event (representing the channel downstream of the weir interface with the pond) are similar to the water elevations calculated to flow into the weir interface at the pond in HydroCAD. In the vegetated condition during the 100-year storm event, after water enters the weir inlet of the channel, it will slightly rise in elevation downstream as a result of a higher manning’s “n” for vegetated channels. The gradual slope and large width of the channel results in low velocities occurring in the channel at all storm events. As a result, both channel liners will mitigate any erosion in the channel.

STANDARD DESIGN CALCULATION WORKSHEET

TETRA TECH	CALCULATION WORKSHEET		PAGE 2 OF 2
Client: Pennsylvania Department of Environmental Protection		**Project Number: 212C-PB-02248**	
Subject: Quarry Discharge Outlet Project – Outlet Design			
By: JP	**Checked By: ED**	**Approved By: HT**	**Date: 12/07/2022**

The outlet weir and channel are proposed to be approximately 74’ wide when considering the bottom width of the upper channel. The requirement for the design is for the 1’ deep bottom tier channel to pass the 5-year storm event and for the 100-year storm to flow at an additional 1.5’ of depth in the upper tier channel portion. The large width of the upper weir and channel is the result of head loss or entrance loss taken into account in the weir equations utilized in HydroCAD while maintaining the aforementioned flow elevations. As water flows through the channel, Manning’s Equation is utilized in the attached channel design worksheets to account for friction between the water and the lining of the channel. The 5-year storm event will flow at 1’ deep in the bottom-tier of the weir interface of the pond. The 100-year storm event will flow at total depth of 2.5’ at the interface of the pond and weir.

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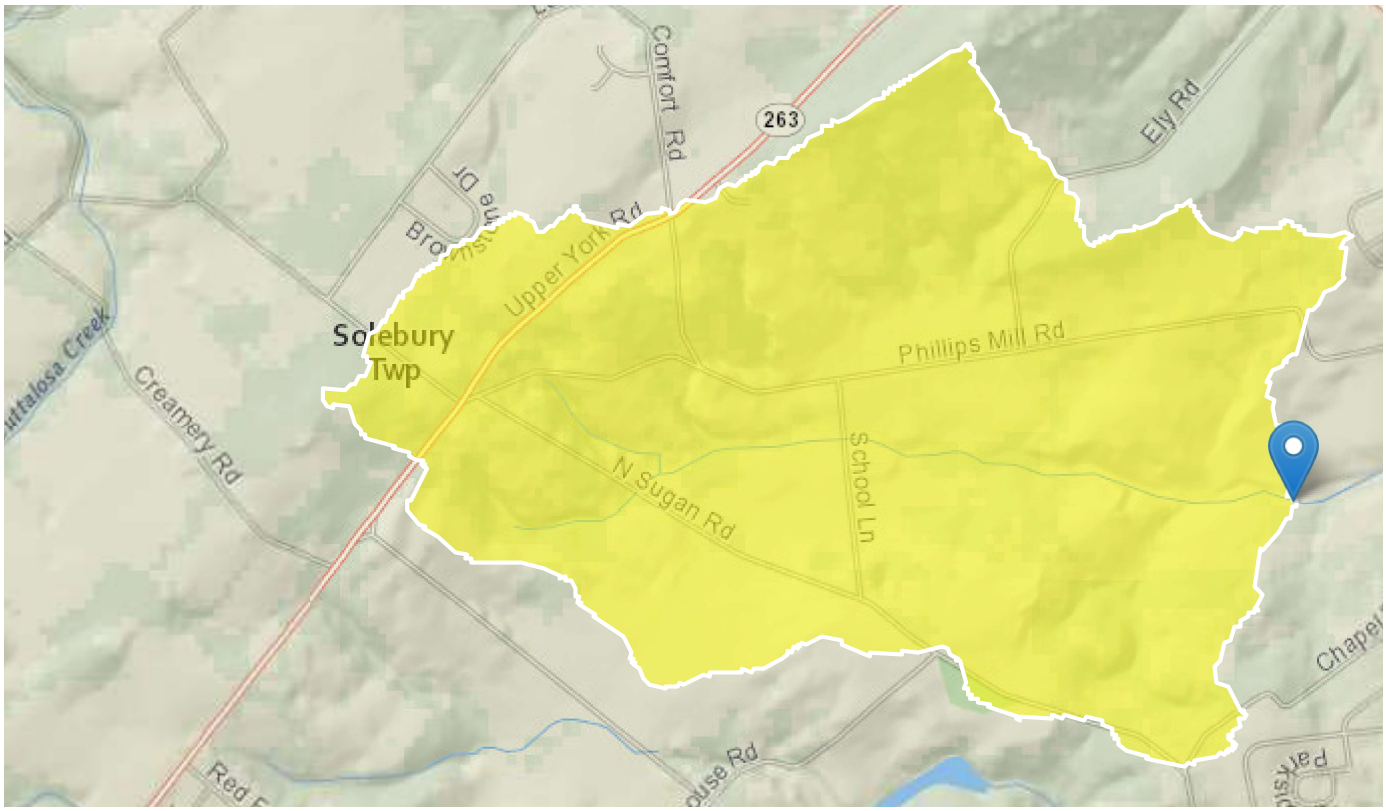
Attachments:

1 – Streamstats Report
2 – HydroCAD Results
3 – HydroCAD Image of Weir Configuration
4 – Channel Design Worksheet – Riprap Lower Tier – 5-year/24-hour storm
5 – Channel Design Worksheet – NAG Vmax SC-250 Vegetated Liner - Channel Upper Tier - 100-year/24-hour storm
6 – Schedule of Test Pits
7 – NOAA Atlas 14

1. STREAMSTATS REPORT

StreamStats Report

Region ID: PA
Workspace ID: PA20220510181923915000
Clicked Point (Latitude, Longitude): 40.37758, -74.97251
Time: 2022-05-10 14:19:52 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLOPD	Mean basin slope measured in degrees	4.1669	degrees
BSLOPDRAW	Unadjusted basin slope, in degrees	4.3669	degrees
BSLPDRPA20	Unadjusted basin slope, in degrees, from PA v1	5.6173	degrees
CARBON	Percentage of area of carbonate rock	57.12	percent
CENTROXA83	X coordinate of the centroid, in NAD_1983_Albers, meters	255493.5138	meters

Parameter Code	Parameter Description	Value	Unit
CENTROYA83	Basin centroid horizontal (y) location in NAD 1983 Albers	157632.2756	meters
DRN	Drainage quality index from STATSGO	3.7	dimensionless
DRNAREA	Area that drains to a point on a stream	2.16	square miles
ELEV	Mean Basin Elevation	231	feet
ELEVMAX	Maximum basin elevation	457	feet
FOREST	Percentage of area covered by forest	58.5882	percent
GLACIATED	Percentage of basin area that was historically covered by glaciers	0	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	5.871	percent
LC01DEV	Percentage of land-use from NLCD 2001 classes 21-24	12.1239	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	13.2425	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	1.2791	percent
LONG_OUT	Longitude of Basin Outlet	-74.9725	degrees
MAXTEMP	Mean annual maximum air temperature over basin area from PRISM 1971-2000 800-m grid	63.2	degrees F
OUTLETXA83	X coordinate of the outlet, in NAD_1983_Albers,meters	257025.2443	meters
OUTLETYA83	Y coordinate of the outlet, in NAD_1983_Albers, meters	157384.506	meters
PRECIP	Mean Annual Precipitation	45	inches
ROCKDEP	Depth to rock	4.8	feet
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0.61	percent
STRDEN	Stream Density -- total length of streams divided by drainage area	2.41	miles per square mile
STRMTOT	total length of all mapped streams (1:24,000-scale) in the basin	5.19	miles
URBAN	Percentage of basin with urban development	6.1872	percent

Peak-Flow Statistics Parameters [Peak Flow Region 4 SIR 2019 5094]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.16	square miles	1.2	512
CARBON	Percent Carbonate	57.12	percent	0	68.5

Peak-Flow Statistics Flow Report [Peak Flow Region 4 SIR 2019 5094]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	ASEp
50-percent AEP flood	273	ft^3/s	40.4
20-percent AEP flood	479	ft^3/s	33.1
10-percent AEP flood	654	ft^3/s	30.9
4-percent AEP flood	910	ft^3/s	29.8
2-percent AEP flood	1130	ft^3/s	30.4
1-percent AEP flood	1370	ft^3/s	31.5
0.5-percent AEP flood	1630	ft^3/s	32.7
0.2-percent AEP flood	2030	ft^3/s	35.4

Peak-Flow Statistics Citations

Roland, M.A., and Stuckey, M.H.,2019, Development of regression equations for the estimation of flood flows at ungaged streams in Pennsylvania: U.S. Geological Survey Scientific Investigations Report 2019–5094, 36 p. (https:// doi.org/10.3133/sir20195094)

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Application Version: 4.8.1
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

2. HYDROCAD RESULTS

2-year/24-hour Storm

Summary for Subcatchment 2-Yr: 2- Year

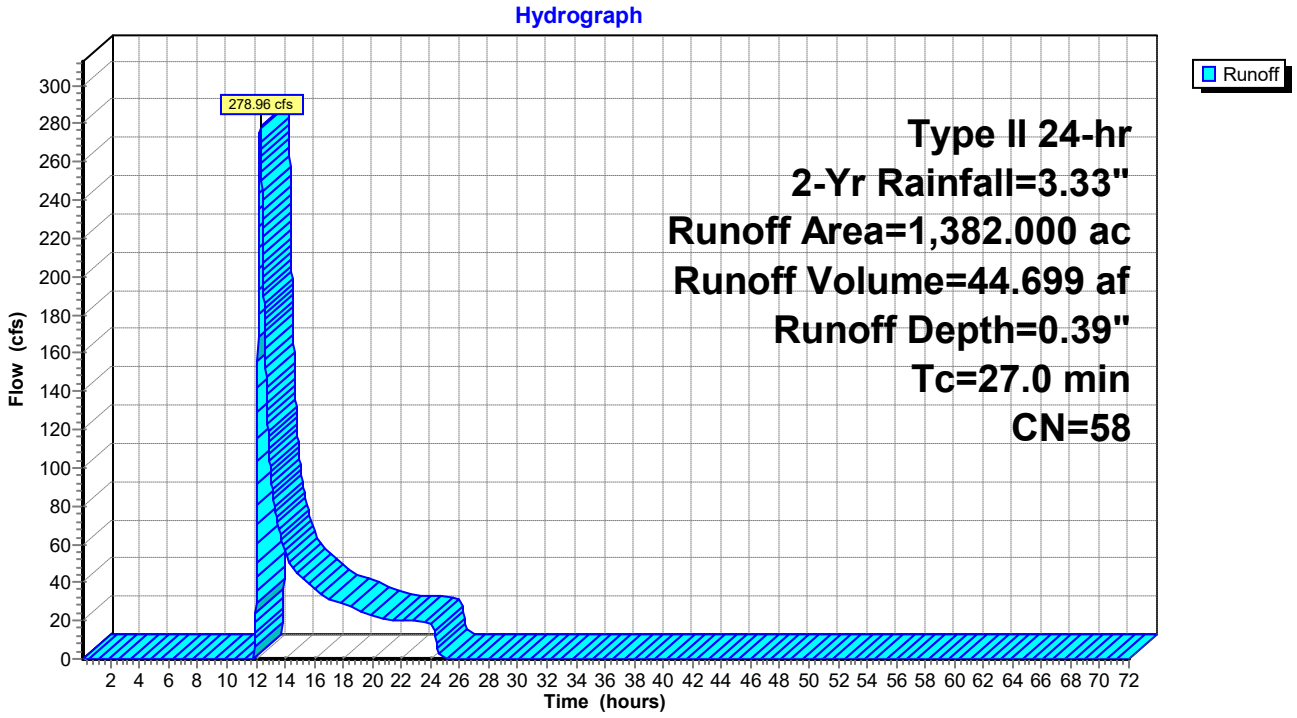
Runoff = 278.96 cfs @ 12.30 hrs, Volume= 44.699 af, Depth= 0.39"
Routed to Pond P-2 : POND-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-Yr Rainfall=3.33"

	Area (ac)	CN	Description
*	1,382.000	58	
	1,382.000		100.00% Pervious Area

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

Subcatchment 2-Yr: 2- Year



Summary for Pond P-2: POND-2

Inflow Area = 1,382.000 ac, 0.00% Impervious, Inflow Depth = 0.39" for 2-Yr event
Inflow = 278.96 cfs @ 12.30 hrs, Volume= 44.699 af
Outflow = 16.18 cfs @ 24.23 hrs, Volume= 36.459 af, Atten= 94%, Lag= 716.3 min
Primary = 16.18 cfs @ 24.23 hrs, Volume= 36.459 af
Routed to Link OUT-2 : OUT-2

Routing by Stor-Ind method, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Peak Elev= 93.86' @ 24.23 hrs Surf.Area= 2,493,692 sf Storage= 1,407,488 cf

Plug-Flow detention time= 1,144.9 min calculated for 36.454 af (82% of inflow)
Center-of-Mass det. time= 1,061.8 min (2,007.1 - 945.3)

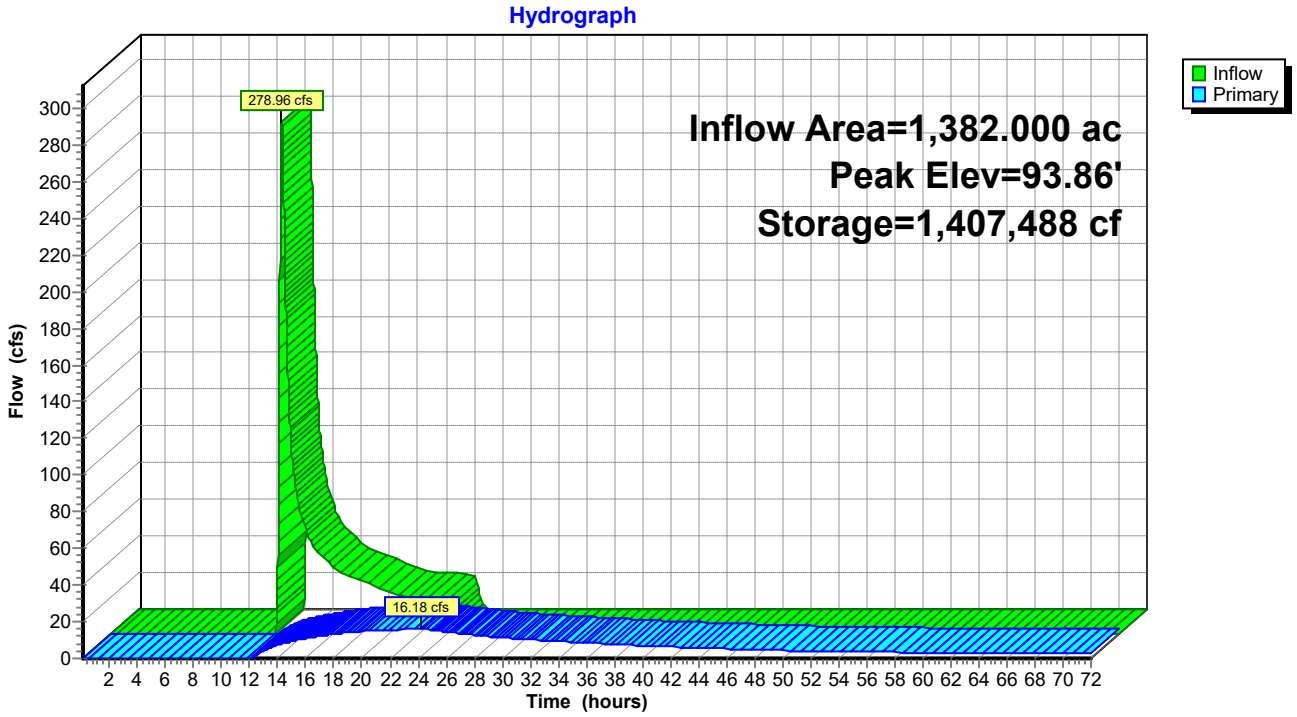
Volume	Invert	Avail.Storage	Storage Description
#1	93.30'	59,724,847 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
93.30	2,489,522	0	0
93.80	2,493,195	1,245,679	1,245,679
94.00	2,494,728	498,792	1,744,472
95.00	2,502,320	2,498,524	4,242,996
96.00	2,510,434	2,506,377	6,749,373
98.00	2,526,096	5,036,530	11,785,903
100.00	2,542,970	5,069,066	16,854,969
102.00	2,563,183	5,106,153	21,961,122
104.00	2,582,931	5,146,114	27,107,236
106.00	2,607,890	5,190,821	32,298,057
108.00	2,666,611	5,274,501	37,572,558
110.00	2,734,603	5,401,214	42,973,772
112.00	2,775,646	5,510,249	48,484,021
114.00	2,807,738	5,583,384	54,067,405
116.00	2,849,704	5,657,442	59,724,847

Device	Routing	Invert	Outlet Devices
#1	Primary	93.30'	**Custom Weir/Orifice, Cv= 2.65 (C= 3.31)** Head (feet) 0.00 1.00 1.00 3.00 Width (feet) 10.00 16.00 74.00 86.00

Primary OutFlow Max=15.97 cfs @ 24.23 hrs HW=93.86' (Free Discharge)
↑—**1=Custom Weir/Orifice** (Weir Controls 15.97 cfs @ 2.42 fps)

Pond P-2: POND-2



5-year/24-hour Storm

Summary for Subcatchment 5-Yr: 5 - Year

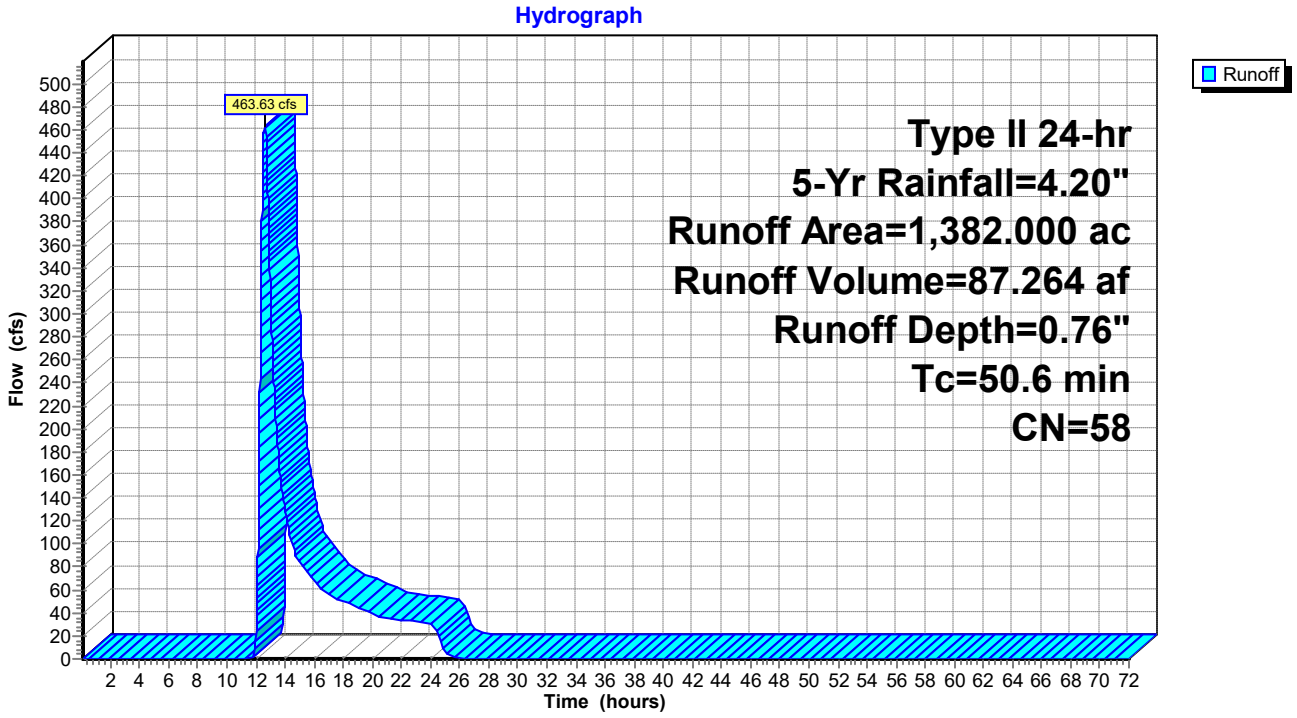
Runoff = 463.63 cfs @ 12.60 hrs, Volume= 87.264 af, Depth= 0.76"
Routed to Pond P-5 : POND-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 5-Yr Rainfall=4.20"

	Area (ac)	CN	Description
*	1,382.000	58	
	1,382.000		100.00% Pervious Area

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

Subcatchment 5-Yr: 5 - Year



Summary for Pond P-5: POND-5

Inflow Area = 1,382.000 ac, 0.00% Impervious, Inflow Depth = 0.76" for 5-Yr event
Inflow = 463.63 cfs @ 12.60 hrs, Volume= 87.264 af
Outflow = 38.66 cfs @ 20.09 hrs, Volume= 76.583 af, Atten= 92%, Lag= 449.3 min
Primary = 38.66 cfs @ 20.09 hrs, Volume= 76.583 af
Routed to Link OUT-5 : OUT-5

Routing by Stor-Ind method, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Peak Elev= 94.26' @ 20.09 hrs Surf.Area= 2,496,733 sf Storage= 2,403,454 cf

Plug-Flow detention time= 941.7 min calculated for 76.572 af (88% of inflow)
Center-of-Mass det. time= 882.1 min (1,819.0 - 936.9)

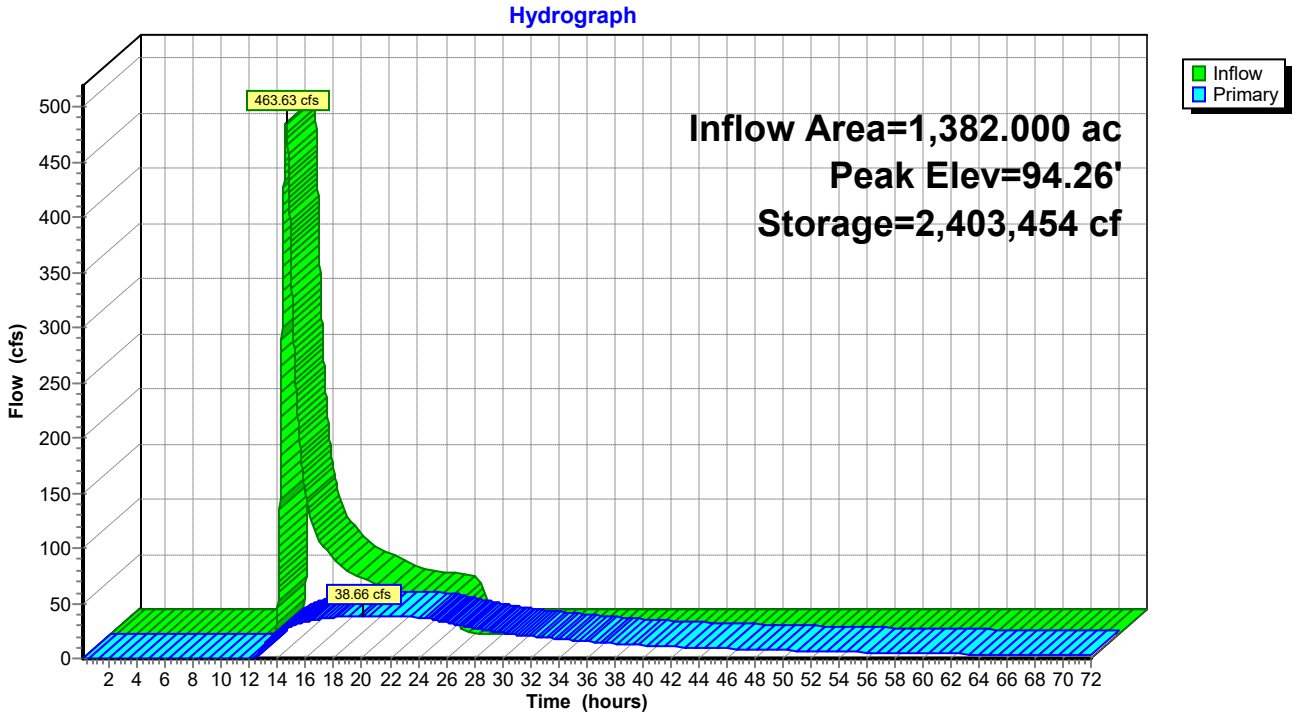
Volume	Invert	Avail.Storage	Storage Description
#1	93.30'	59,724,847 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
93.30	2,489,522	0	0
93.80	2,493,195	1,245,679	1,245,679
94.00	2,494,728	498,792	1,744,472
95.00	2,502,320	2,498,524	4,242,996
96.00	2,510,434	2,506,377	6,749,373
98.00	2,526,096	5,036,530	11,785,903
100.00	2,542,970	5,069,066	16,854,969
102.00	2,563,183	5,106,153	21,961,122
104.00	2,582,931	5,146,114	27,107,236
106.00	2,607,890	5,190,821	32,298,057
108.00	2,666,611	5,274,501	37,572,558
110.00	2,734,603	5,401,214	42,973,772
112.00	2,775,646	5,510,249	48,484,021
114.00	2,807,738	5,583,384	54,067,405
116.00	2,849,704	5,657,442	59,724,847

Device	Routing	Invert	Outlet Devices
#1	Primary	93.30'	**Custom Weir/Orifice, Cv= 2.65 (C= 3.31)** Head (feet) 0.00 1.00 1.00 3.00 Width (feet) 10.00 16.00 74.00 86.00

Primary OutFlow Max=38.61 cfs @ 20.09 hrs HW=94.26' (Free Discharge)
1=Custom Weir/Orifice (Weir Controls 38.61 cfs @ 3.11 fps)

Pond P-5: POND-5



10-year/24-hour Storm

Summary for Subcatchment 10-Yr: 10 - Year

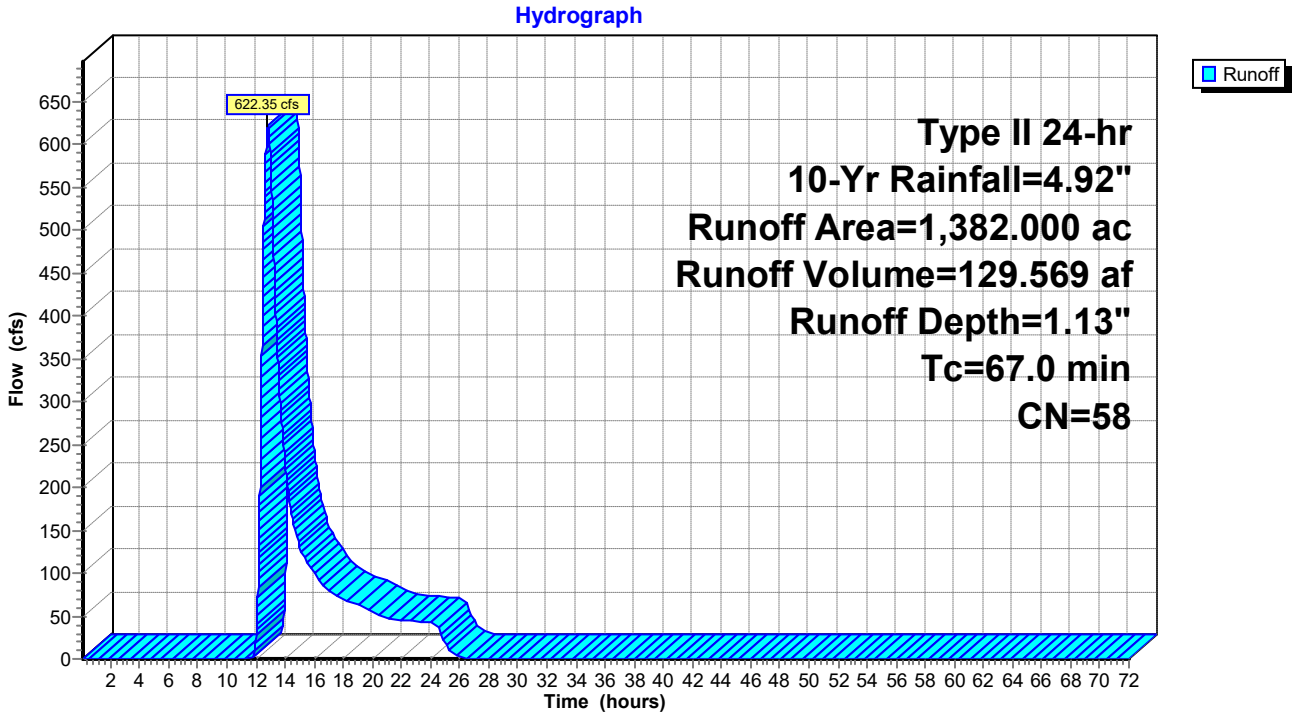
Runoff = 622.35 cfs @ 12.81 hrs, Volume= 129.569 af, Depth= 1.13"
Routed to Pond P-10 : POND-10

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-Yr Rainfall=4.92"

	Area (ac)	CN	Description
*	1,382.000	58	
	1,382.000		100.00% Pervious Area

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

Subcatchment 10-Yr: 10 - Year



Summary for Pond P-10: POND-10

Inflow Area = 1,382.000 ac, 0.00% Impervious, Inflow Depth = 1.13" for 10-Yr event
Inflow = 622.35 cfs @ 12.81 hrs, Volume= 129.569 af
Outflow = 87.44 cfs @ 16.55 hrs, Volume= 118.184 af, Atten= 86%, Lag= 224.6 min
Primary = 87.44 cfs @ 16.55 hrs, Volume= 118.184 af
Routed to Link OUT-10 : OUT-10

Routing by Stor-Ind method, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Peak Elev= 94.55' @ 16.55 hrs Surf.Area= 2,498,937 sf Storage= 3,128,827 cf

Plug-Flow detention time= 748.6 min calculated for 118.184 af (91% of inflow)
Center-of-Mass det. time= 703.3 min (1,640.2 - 936.9)

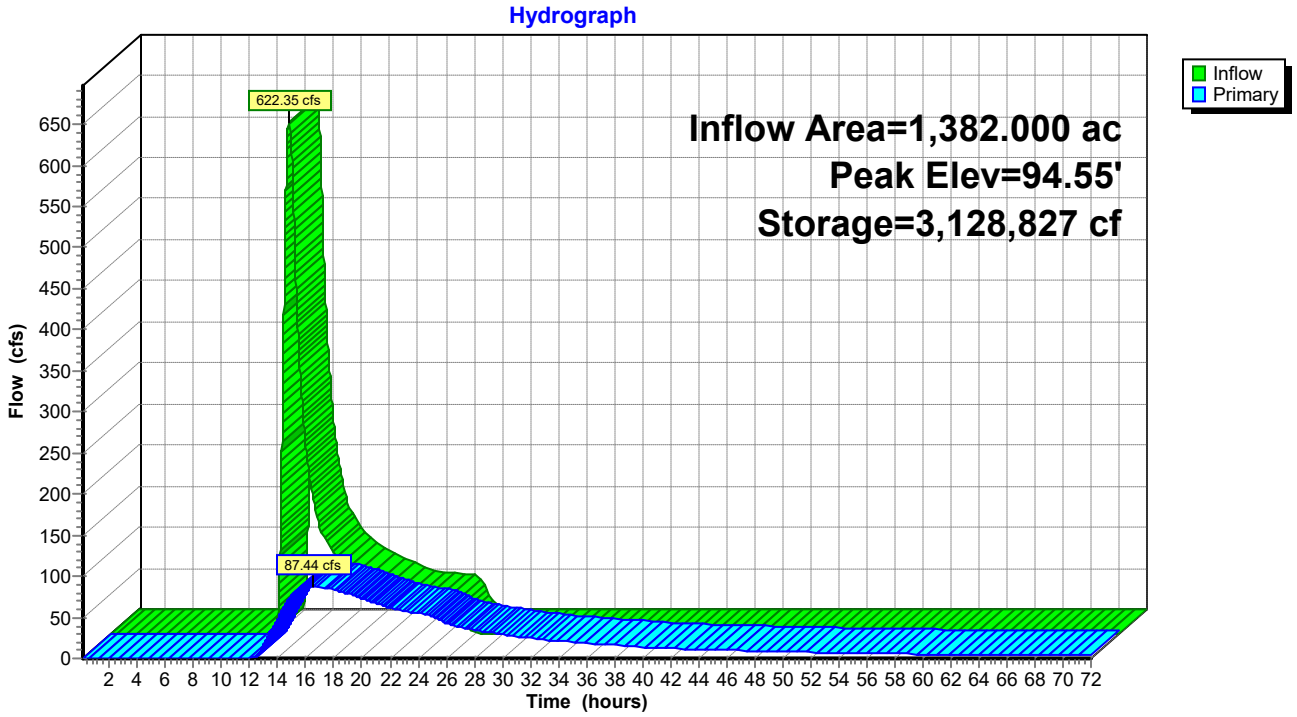
Volume	Invert	Avail.Storage	Storage Description
#1	93.30'	59,724,847 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
93.30	2,489,522	0	0
93.80	2,493,195	1,245,679	1,245,679
94.00	2,494,728	498,792	1,744,472
95.00	2,502,320	2,498,524	4,242,996
96.00	2,510,434	2,506,377	6,749,373
98.00	2,526,096	5,036,530	11,785,903
100.00	2,542,970	5,069,066	16,854,969
102.00	2,563,183	5,106,153	21,961,122
104.00	2,582,931	5,146,114	27,107,236
106.00	2,607,890	5,190,821	32,298,057
108.00	2,666,611	5,274,501	37,572,558
110.00	2,734,603	5,401,214	42,973,772
112.00	2,775,646	5,510,249	48,484,021
114.00	2,807,738	5,583,384	54,067,405
116.00	2,849,704	5,657,442	59,724,847

Device	Routing	Invert	Outlet Devices
#1	Primary	93.30'	**Custom Weir/Orifice, Cv= 2.65 (C= 3.31)** Head (feet) 0.00 1.00 1.00 3.00 Width (feet) 10.00 16.00 74.00 86.00

Primary OutFlow Max=85.21 cfs @ 16.55 hrs HW=94.55' (Free Discharge)
1=Custom Weir/Orifice (Weir Controls 85.21 cfs @ 2.66 fps)

Pond P-10: POND-10



50-year/24-hour Storm

Summary for Subcatchment 50-Yr: 50 - Year

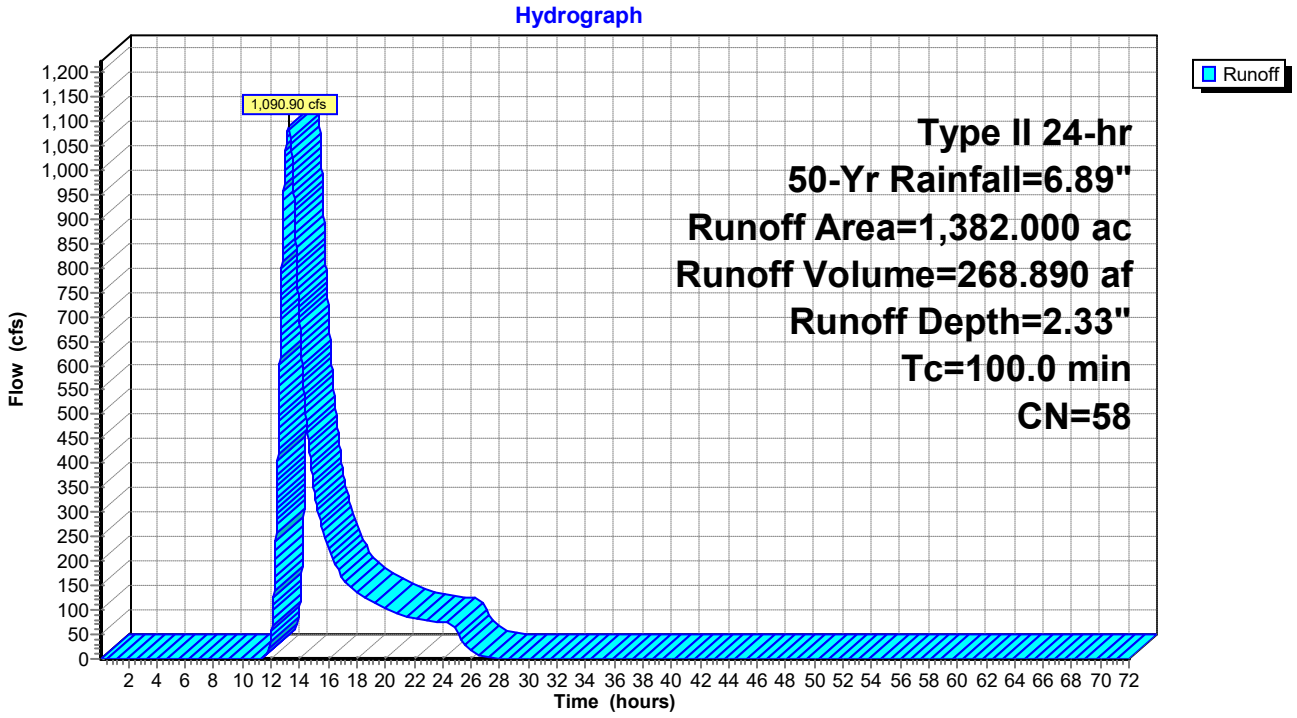
Runoff = 1,090.90 cfs @ 13.22 hrs, Volume= 268.890 af, Depth= 2.33"
Routed to Pond P-50 : POND-50

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-Yr Rainfall=6.89"

	Area (ac)	CN	Description
*	1,382.000	58	
	1,382.000		100.00% Pervious Area

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

Subcatchment 50-Yr: 50 - Year



Summary for Pond P-50: POND-50

Inflow Area = 1,382.000 ac, 0.00% Impervious, Inflow Depth = 2.33" for 50-Yr event
Inflow = 1,090.90 cfs @ 13.22 hrs, Volume= 268.890 af
Outflow = 370.09 cfs @ 14.90 hrs, Volume= 256.822 af, Atten= 66%, Lag= 101.0 min
Primary = 370.09 cfs @ 14.90 hrs, Volume= 256.822 af
Routed to Link OUT-50 : OUT-50

Routing by Stor-Ind method, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Peak Elev= 95.39' @ 14.90 hrs Surf.Area= 2,505,491 sf Storage= 5,221,424 cf

Plug-Flow detention time= 444.7 min calculated for 256.822 af (96% of inflow)
Center-of-Mass det. time= 419.4 min (1,362.5 - 943.1)

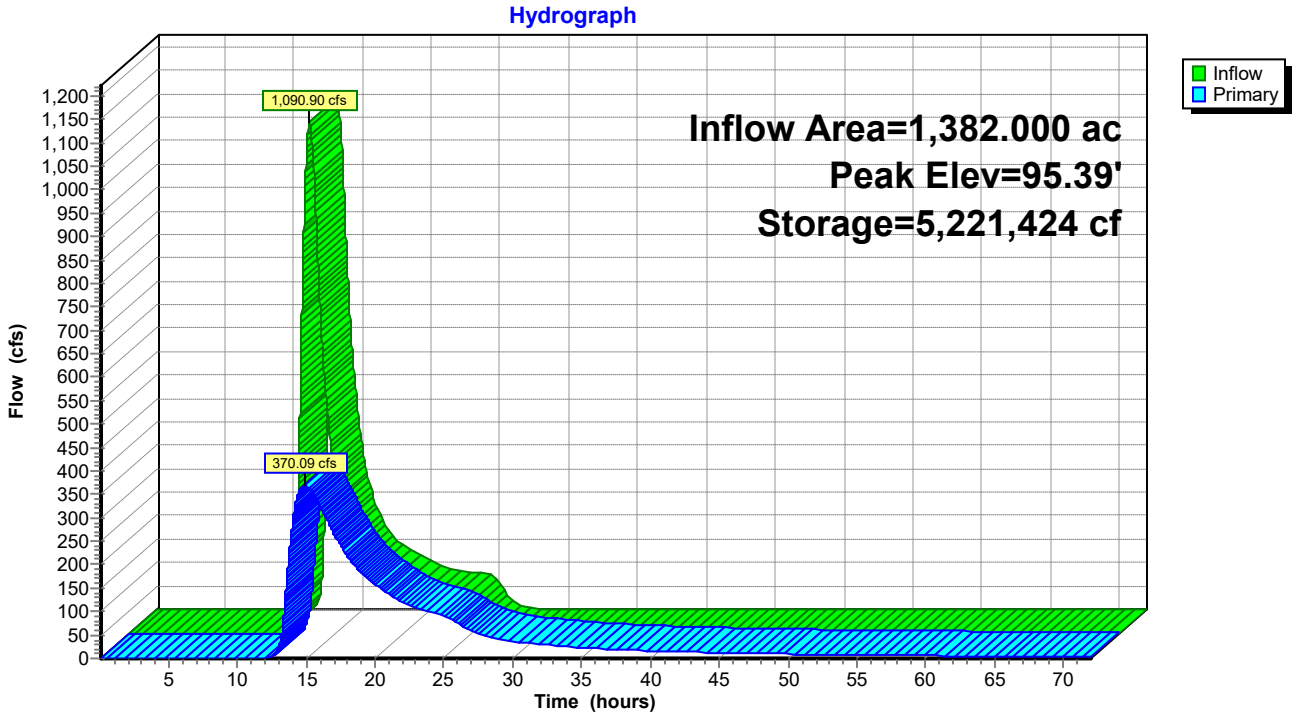
Volume	Invert	Avail.Storage	Storage Description
#1	93.30'	59,724,847 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
93.30	2,489,522	0	0
93.80	2,493,195	1,245,679	1,245,679
94.00	2,494,728	498,792	1,744,472
95.00	2,502,320	2,498,524	4,242,996
96.00	2,510,434	2,506,377	6,749,373
98.00	2,526,096	5,036,530	11,785,903
100.00	2,542,970	5,069,066	16,854,969
102.00	2,563,183	5,106,153	21,961,122
104.00	2,582,931	5,146,114	27,107,236
106.00	2,607,890	5,190,821	32,298,057
108.00	2,666,611	5,274,501	37,572,558
110.00	2,734,603	5,401,214	42,973,772
112.00	2,775,646	5,510,249	48,484,021
114.00	2,807,738	5,583,384	54,067,405
116.00	2,849,704	5,657,442	59,724,847

Device	Routing	Invert	Outlet Devices
#1	Primary	93.30'	**Custom Weir/Orifice, Cv= 2.65 (C= 3.31)** Head (feet) 0.00 1.00 1.00 3.00 Width (feet) 10.00 16.00 74.00 86.00

Primary OutFlow Max=369.25 cfs @ 14.90 hrs HW=95.39' (Free Discharge)
1=Custom Weir/Orifice (Weir Controls 369.25 cfs @ 3.80 fps)

Pond P-50: POND-50



100-year/24-hour Storm

Summary for Subcatchment 100-Yr: 100 - Year

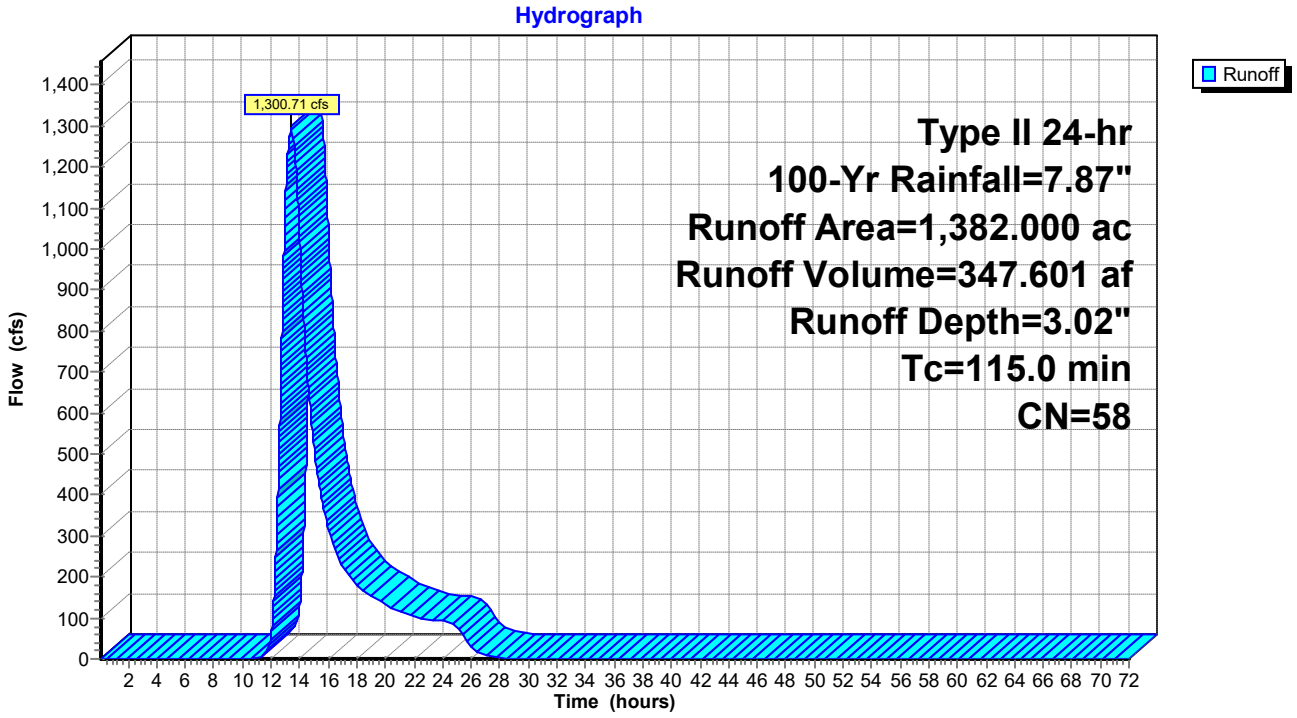
Runoff = 1,300.71 cfs @ 13.42 hrs, Volume= 347.601 af, Depth= 3.02"
Routed to Pond P-100 : POND-100

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-Yr Rainfall=7.87"

	Area (ac)	CN	Description
*	1,382.000	58	
	1,382.000		100.00% Pervious Area

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

Subcatchment 100-Yr: 100 - Year



Summary for Pond P-100: POND-100

Inflow Area = 1,382.000 ac, 0.00% Impervious, Inflow Depth = 3.02" for 100-Yr event
Inflow = 1,300.71 cfs @ 13.42 hrs, Volume= 347.601 af
Outflow = 558.88 cfs @ 14.88 hrs, Volume= 335.300 af, Atten= 57%, Lag= 87.9 min
Primary = 558.88 cfs @ 14.88 hrs, Volume= 335.300 af
Routed to Link OUT-100 : OUT-100

Routing by Stor-Ind method, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Peak Elev= 95.79' @ 14.88 hrs Surf.Area= 2,508,753 sf Storage= 6,229,393 cf

Plug-Flow detention time= 371.8 min calculated for 335.254 af (96% of inflow)
Center-of-Mass det. time= 351.6 min (1,300.8 - 949.2)

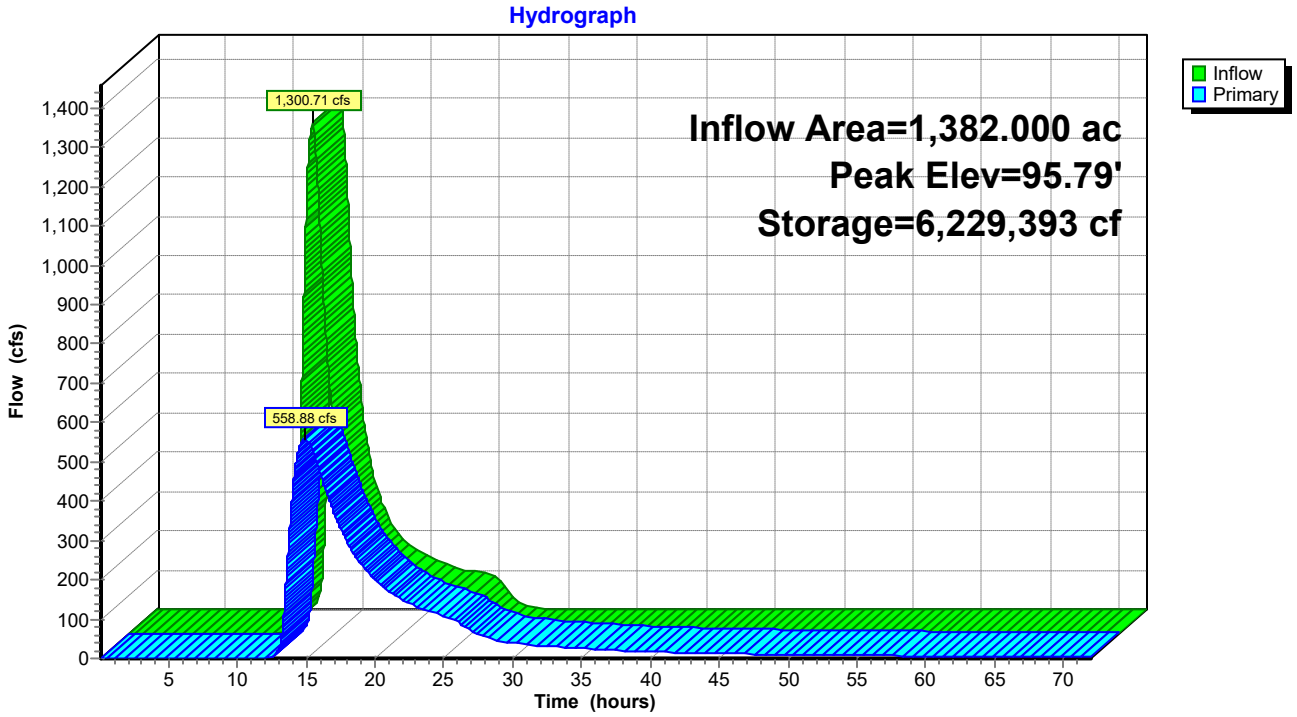
Volume	Invert	Avail.Storage	Storage Description
#1	93.30'	59,724,847 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
93.30	2,489,522	0	0
93.80	2,493,195	1,245,679	1,245,679
94.00	2,494,728	498,792	1,744,472
95.00	2,502,320	2,498,524	4,242,996
96.00	2,510,434	2,506,377	6,749,373
98.00	2,526,096	5,036,530	11,785,903
100.00	2,542,970	5,069,066	16,854,969
102.00	2,563,183	5,106,153	21,961,122
104.00	2,582,931	5,146,114	27,107,236
106.00	2,607,890	5,190,821	32,298,057
108.00	2,666,611	5,274,501	37,572,558
110.00	2,734,603	5,401,214	42,973,772
112.00	2,775,646	5,510,249	48,484,021
114.00	2,807,738	5,583,384	54,067,405
116.00	2,849,704	5,657,442	59,724,847

Device	Routing	Invert	Outlet Devices
#1	Primary	93.30'	**Custom Weir/Orifice, Cv= 2.65 (C= 3.31)** Head (feet) 0.00 1.00 1.00 3.00 Width (feet) 10.00 16.00 74.00 86.00

Primary OutFlow Max=558.79 cfs @ 14.88 hrs HW=95.79' (Free Discharge)
1=Custom Weir/Orifice (Weir Controls 558.79 cfs @ 4.29 fps)

Pond P-100: POND-100



500-year/24-hour Storm

Summary for Subcatchment 500-Yr: 500 - Year

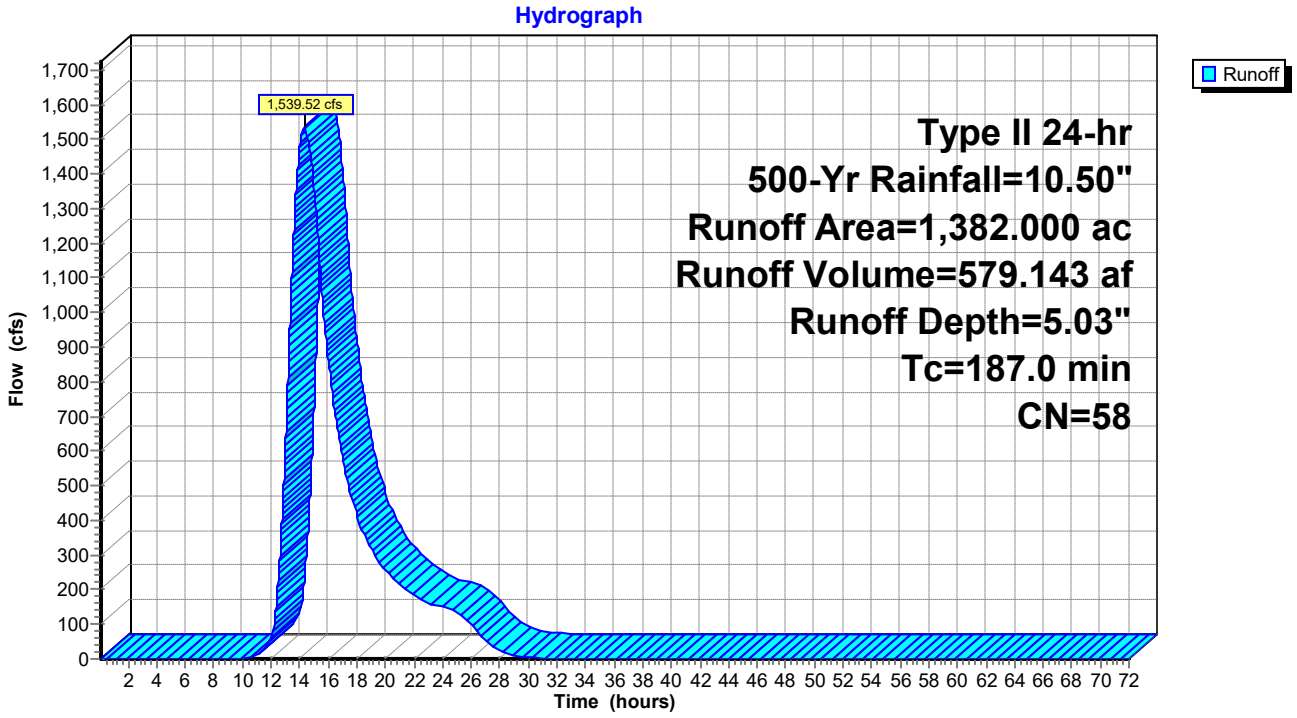
Runoff = 1,539.52 cfs @ 14.34 hrs, Volume= 579.143 af, Depth= 5.03"
Routed to Pond P-500 : POND-500

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 500-Yr Rainfall=10.50"

	Area (ac)	CN	Description
*	1,382.000	58	
	1,382.000		100.00% Pervious Area

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

Subcatchment 500-Yr: 500 - Year



Summary for Pond P-500: POND-500

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 1,382.000 ac, 0.00% Impervious, Inflow Depth = 5.03" for 500-Yr event
Inflow = 1,539.52 cfs @ 14.34 hrs, Volume= 579.143 af
Outflow = 992.36 cfs @ 15.69 hrs, Volume= 566.129 af, Atten= 36%, Lag= 81.3 min
Primary = 992.36 cfs @ 15.69 hrs, Volume= 566.129 af
Routed to Link OUT-500 : OUT-500

Routing by Stor-Ind method, Time Span= 0.10-72.00 hrs, dt= 0.01 hrs
Peak Elev= 96.64' @ 15.69 hrs Surf.Area= 2,515,420 sf Storage= 8,349,487 cf

Plug-Flow detention time= 269.3 min calculated for 566.051 af (98% of inflow)
Center-of-Mass det. time= 255.3 min (1,256.1 - 1,000.8)

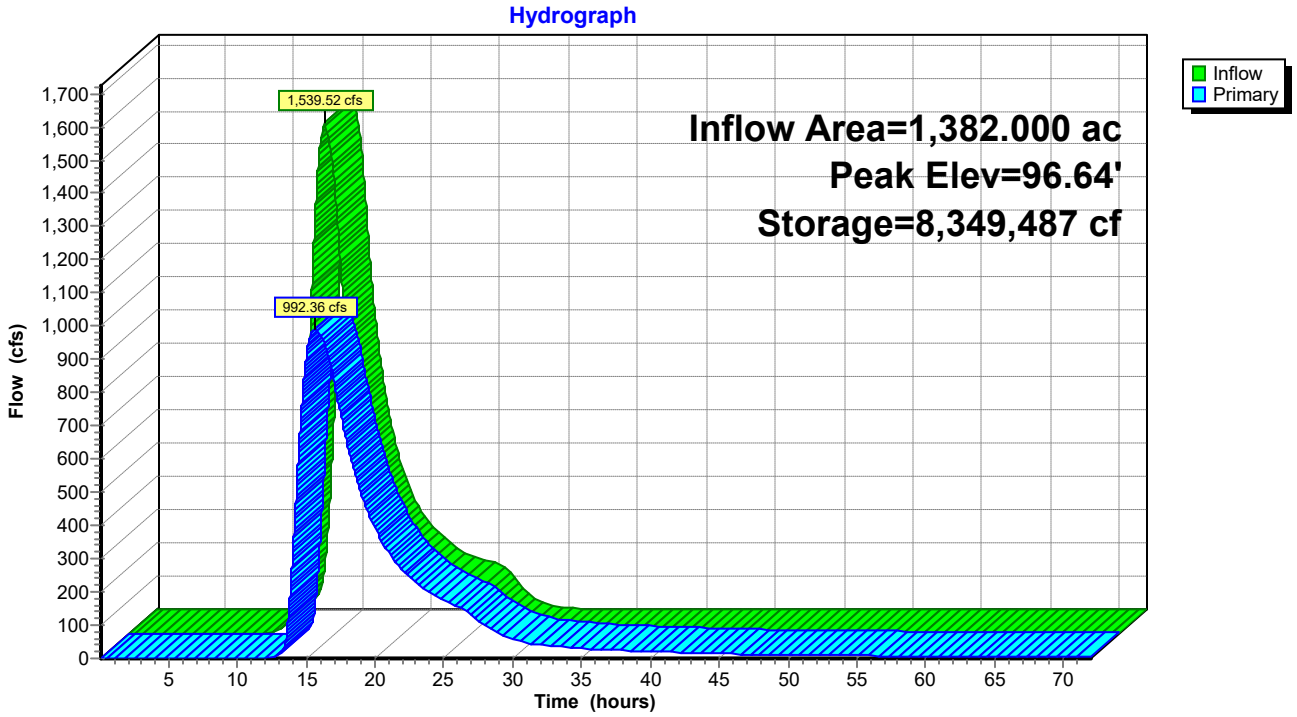
Volume	Invert	Avail.Storage	Storage Description
#1	93.30'	59,724,847 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
93.30	2,489,522	0	0
93.80	2,493,195	1,245,679	1,245,679
94.00	2,494,728	498,792	1,744,472
95.00	2,502,320	2,498,524	4,242,996
96.00	2,510,434	2,506,377	6,749,373
98.00	2,526,096	5,036,530	11,785,903
100.00	2,542,970	5,069,066	16,854,969
102.00	2,563,183	5,106,153	21,961,122
104.00	2,582,931	5,146,114	27,107,236
106.00	2,607,890	5,190,821	32,298,057
108.00	2,666,611	5,274,501	37,572,558
110.00	2,734,603	5,401,214	42,973,772
112.00	2,775,646	5,510,249	48,484,021
114.00	2,807,738	5,583,384	54,067,405
116.00	2,849,704	5,657,442	59,724,847

Device	Routing	Invert	Outlet Devices
#1	Primary	93.30'	**Custom Weir/Orifice, Cv= 2.65 (C= 3.31)** Head (feet) 0.00 1.00 1.00 3.00 Width (feet) 10.00 16.00 74.00 86.00

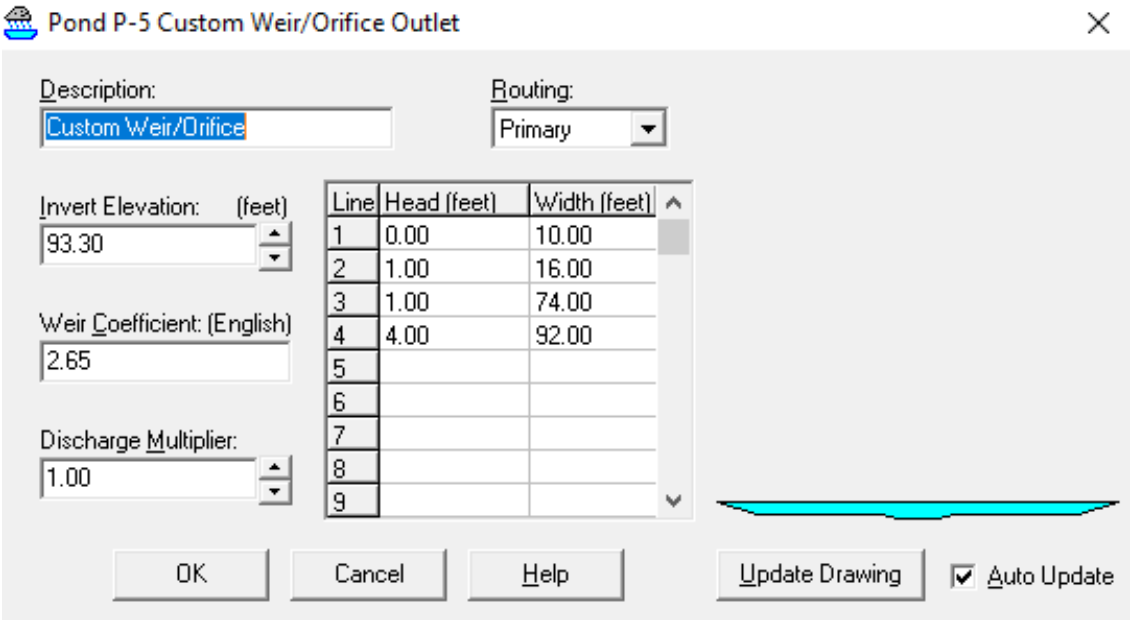
Primary OutFlow Max=993.68 cfs @ 15.69 hrs HW=96.64' (Free Discharge)
1=Custom Weir/Orifice (Orifice Controls 993.68 cfs @ 5.74 fps)

Pond P-500: POND-500

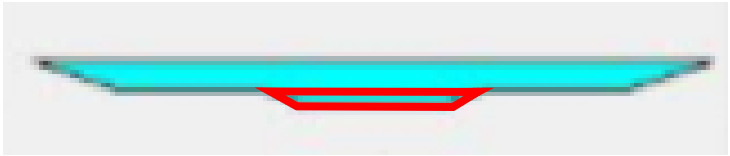


3. HYDROCAD IMAGE OF WEIR CONFIGURATION

HydroCAD channel configuration



Lower Channel Analysis Portion



Upper Channel Analysis Portion

4. CHANNEL DESIGN WORKSHEET – RIPRAP LOWER TIER – 5-YEAR/24-HOUR STORM

STANDARD E&S WORKSHEET #11
Channel Design Data

PROJECT NAME: New Hope

LOCATION: BUCKS COUNTY, PA

PREPARED BY: JRP **DATE:** November 15, 2022

CHECKED BY: **DATE:**

CHANNEL OR CHANNEL SECTION	Lower Tier	Lower Tier			
TEMPORARY OR PERMANENT? (T OR P)	P	P			
SPECIAL PROTECTION WATERSHED? (YES OR NO)	Yes	Yes			
DESIGN STORM (2, 5, OR 10 YR)	NA - Channel Full	NA - Channel Full			
ACRES (AC)	--	--			
MULTIPLIER (1.6, 2.25, OR 2.75)[1]	--	--			
Qr (REQUIRED CAPACITY) (CFS)	47.50	47.50			
Q (CALCULATED AT FLOW DEPTH d) (CFS)	47.50	-			
VEGETATIVE LINING RETARDANCE	--	--			
PROTECTIVE LINING[2]	R-4	R-4			
n (MANNING'S COEFFICIENT)[2]	0.0450	0.0488			
Va (ALLOWABLE VELOCITY) (FPS)	9.00	9.00			
V (CALCULATED AT FLOW DEPTH d) (FPS)	2.49	-			
τ_a (MAX ALLOWABLE SHEAR STRESS) (LB/FT^2)	N/A	N/A			
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d) (LB/FT^2)	N/A	N/A			
CHANNEL BOTTOM WIDTH (FT)	10.00	10.00			
CHANNEL SIDE SLOPES LEFT, Z_1 (H:V)	3.00	3.00			
CHANNEL SIDE SLOPES RIGHT, Z_2 (H:V)	3.00	3.00			
D (TOTAL DEPTH) (FT)	1.00	-			
CHANNEL TOP WIDTH @ D (FT)	16.00	-			
d (CALCULATED FLOW DEPTH) (FT)	1.36	1.00			
CHANNEL TOP WIDTH @ FLOW DEPTH d (FT)	18.13				
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	7.38	-			
d_{50} STONE SIZE (IN)	6.00	6.00			
A (CROSS-SECTIONAL AREA) (SQ. FT.)	19.06	13.00			
R (HYDRAULIC RADIUS)	1.026	-			
S (BED SLOPE)[3] (%)	0.55	0.55			
S_c (CRITICAL SLOPE) (%)	2.99	-			
$.7S_c$ (%)	2.10	-			
$1.3S_c$ (%)	3.89	-			
STABLE FLOW? (Y/N)	Y	-			
FREEBOARD BASED ON UNSTABLE FLOW (FT)	n/a	n/a			
FREEBOARD BASED ON STABLE FLOW (FT)	0.34	-			
MINIMUM REQUIRED FREEBOARD[4] (FT)	0.50	-			
DESIGN METHOD FOR PROTECTIVE LINING[5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	V	V			

Velocity!

1. The channel lining on this sheet is sized for the depth of flow that is known to be at the channel.

2. Adjust "n" value for changes in channel liner and flow depth. For vegetated channels, provide data for manufactured linings without vegetation and with vegetation in separate columns.
3. Slopes may not be averaged.
4. Minimum Freeboard is 0.5 ft. or 1/4 Total Channel Depth, whichever is greater.
5. Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is required for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

* Riprap size obtained from page 17 of Appendix A (BMP Construction Details) in the E&S Model Plan.

5. CHANNEL DESIGN WORKSHEET – NAG VMAX SC-250 VEGETATED LINER – CHANNEL UPPER TIER – 100-YEAR/24-HOUR STORM

Project: Quarry Discharge Outlet Project	By: JRP	Date: 11/15/2022
Channel Lining Calculations	Checked:	Date:
Channel: **Discharge Outlet Channel**		

Channel Section	Discharge Outlet Channel	
Temporary or Permanent	Temporary	Permanent
Design Storm	100 minus lower tier flow	100 minus lower tier flow
Acres (AC)	--	--
Multiplier (1.6, 2.25 or 2.75) [1]	--	--
Q_r (Required Capacity in CFS)	511.29	511.29
Q (at Flow Depth d in CFS)	511.29	511.29
Protective Lining [2]	NAG VMax SC250* - Temp. Stabilization	NAG Vmax SC250*, Veg.-Class C-Final Stabilization
n (Manning's Coefficient) [2]	0.023	0.060
V_a (Allowable Velocity in FPS)	9.5	15.0
V (at Flow Depth d in FPS)	5.3	2.9
t_a (Max Allowable Shear Stress in PSF)	--	--
t_d (Shear Stress at Flow Depth d in PSF)	0.4	0.7
Channel Bottom Width (FT)	74.00	74.00
Channel Side Slopes (Z=H:V)	3.00	3.00
D (Total Depth in FT)	3.00	3.00
Channel Top Width at D (FT)	92.00	92.00
d (Flow Depth in FT)	1.23	2.18
Channel Top Width at d (FT)	81.39	81.39
Bottom Width:Depth Ratio (12:1 Max)	60.1	34.0
d_{50} Stone Size (IN)	N/A	N/A
A (Area in SQ. FT)	95.68	175.44
R (Hydraulic Radius)	1.17	2.00
S (Bed Slope in FT/FT) [3]	0.0055	0.0055
S_c (Critical Slope in FT/FT)	0.007	0.045
Qr w/in 5% of Q?	0.00	0.00
$.7S_c$ (FT/FT)	0.005	0.031
$1.3S_c$ (FT/FT)	0.009	0.058
Stable Flow? (Yes or No)	NO	YES
Freeboard Based on Unstable Flow (FT)	0.5	0.5
Freeboard Based on Stable Flow (FT)	0.3	0.5
Minimum Required Freeboard (FT) [4]	0.5	0.5
Design Method for Protective Lining [5] (Permissible Velocity (V) or Shear Stress (S))	V	V

*Or approved equal

[1] In this case the channel lining is being determined with a known depth and channel configuration, so Acreage and multiplier will be disregarded.

[2] For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.

[3] Slopes may not be averaged.

[4] Minimum freeboard, F, is 0.5 FT.

[5] Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% of greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

6. SCHEDULE OF TEST PITS

Tetra Tech, Inc.

TABLE 1 - SCHEDULE OF TEST PITS

New Hope Crushed Stone & Lime Co., Inc. (NHCS)
Solebury Township, Bucks County, PA

TP Designation	Latitude	Longitude	Surveyed GS EL (feet)	Inferred Thickness of hardpack (feet)	Inferred Thickness of fill Mat'l (feet)	Bottom EL of fill Mat'l (feet)	Inferred thickness of Native Mat'l (feet)	Total Depth (feet)	Bottom EL (feet)
TP-1	40.37710	-74.97683	116.3	2	5	109.3	15	15	101.3
TP-2	40.37786	-74.97667	105.2	7	NE	NE	NE	7	98.2
TP-3	40.37787	-74.97602	100.8	NE	7	93.8	16	16	84.8
TP-4	40.37891	-74.97624	111.8	2	6	103.8	15	15	96.8
TP-5	40.37965	-74.97567	110.1	5	NE	NE	9.5	14.5	95.6
TP-6	40.37753	-74.97668	101.5	NE	9	92.5	14	14	87.5

NE = Not Encountered
GS = Ground Surface
EL = Elevation
Surveyed Ground Surface Elevations provided by Northeast Surveyors on October 3, 2022

7. NOAA ATLAS 14

NOAA Atlas 14, Volume 2, Version 3
Location name: Solebury Twp, Pennsylvania, USA*
Latitude: 40.3799°, Longitude: -74.9788°
Elevation: -131.28 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.341** (0.310-0.376)	**0.407** (0.370-0.448)	**0.480** (0.435-0.528)	**0.533** (0.483-0.586)	**0.598** (0.538-0.657)	**0.643** (0.576-0.707)	**0.688** (0.614-0.758)	**0.729** (0.647-0.805)	**0.779** (0.686-0.864)	**0.817** (0.713-0.909)
10-min	**0.545** (0.495-0.600)	**0.651** (0.591-0.716)	**0.769** (0.697-0.845)	**0.853** (0.772-0.938)	**0.952** (0.858-1.05)	**1.02** (0.918-1.13)	**1.09** (0.976-1.20)	**1.16** (1.03-1.28)	**1.23** (1.09-1.37)	**1.29** (1.12-1.43)
15-min	**0.682** (0.619-0.751)	**0.818** (0.743-0.901)	**0.972** (0.882-1.07)	**1.08** (0.977-1.19)	**1.21** (1.09-1.33)	**1.30** (1.16-1.43)	**1.38** (1.23-1.52)	**1.46** (1.29-1.61)	**1.55** (1.37-1.72)	**1.62** (1.41-1.80)
30-min	**0.934** (0.849-1.03)	**1.13** (1.03-1.24)	**1.38** (1.25-1.52)	**1.56** (1.42-1.72)	**1.79** (1.61-1.97)	**1.95** (1.75-2.15)	**2.12** (1.89-2.33)	**2.27** (2.02-2.51)	**2.47** (2.17-2.74)	**2.62** (2.28-2.91)
60-min	**1.17** (1.06-1.28)	**1.42** (1.29-1.56)	**1.77** (1.61-1.95)	**2.04** (1.84-2.24)	**2.38** (2.14-2.62)	**2.65** (2.37-2.91)	**2.92** (2.60-3.21)	**3.18** (2.83-3.52)	**3.54** (3.12-3.93)	**3.82** (3.33-4.25)
2-hr	**1.40** (1.27-1.55)	**1.71** (1.55-1.88)	**2.14** (1.94-2.37)	**2.48** (2.24-2.73)	**2.94** (2.64-3.23)	**3.31** (2.95-3.64)	**3.68** (3.26-4.05)	**4.07** (3.58-4.48)	**4.60** (4.00-5.09)	**5.01** (4.32-5.57)
3-hr	**1.54** (1.39-1.71)	**1.88** (1.69-2.09)	**2.36** (2.13-2.62)	**2.74** (2.46-3.04)	**3.26** (2.91-3.61)	**3.67** (3.26-4.06)	**4.10** (3.61-4.54)	**4.54** (3.97-5.04)	**5.15** (4.44-5.74)	**5.63** (4.81-6.30)
6-hr	**1.94** (1.76-2.16)	**2.35** (2.13-2.62)	**2.95** (2.67-3.28)	**3.44** (3.09-3.82)	**4.13** (3.69-4.58)	**4.71** (4.17-5.21)	**5.32** (4.67-5.89)	**5.97** (5.18-6.62)	**6.90** (5.89-7.68)	**7.66** (6.45-8.56)
12-hr	**2.37** (2.14-2.65)	**2.86** (2.59-3.20)	**3.62** (3.27-4.03)	**4.25** (3.82-4.74)	**5.18** (4.61-5.75)	**5.98** (5.28-6.64)	**6.85** (5.97-7.60)	**7.80** (6.71-8.68)	**9.22** (7.76-10.3)	**10.4** (8.62-11.7)
24-hr	**2.76** (2.56-2.98)	**3.33** (3.09-3.60)	**4.20** (3.89-4.53)	**4.92** (4.55-5.31)	**5.99** (5.50-6.45)	**6.89** (6.29-7.41)	**7.87** (7.13-8.47)	**8.94** (8.02-9.62)	**10.5** (9.30-11.3)	**11.8** (10.3-12.7)
2-day	**3.21** (2.96-3.50)	**3.87** (3.57-4.22)	**4.88** (4.50-5.33)	**5.72** (5.25-6.22)	**6.91** (6.31-7.50)	**7.90** (7.18-8.57)	**8.97** (8.09-9.72)	**10.1** (9.05-11.0)	**11.8** (10.4-12.8)	**13.1** (11.5-14.3)
3-day	**3.39** (3.13-3.68)	**4.09** (3.78-4.45)	**5.14** (4.74-5.58)	**5.99** (5.52-6.51)	**7.22** (6.61-7.82)	**8.24** (7.51-8.92)	**9.32** (8.44-10.1)	**10.5** (9.42-11.3)	**12.1** (10.8-13.2)	**13.5** (11.9-14.7)
4-day	**3.57** (3.30-3.86)	**4.30** (3.99-4.67)	**5.39** (4.98-5.84)	**6.27** (5.79-6.79)	**7.53** (6.92-8.15)	**8.57** (7.84-9.26)	**9.68** (8.80-10.4)	**10.8** (9.80-11.7)	**12.5** (11.2-13.6)	**13.9** (12.3-15.1)
7-day	**4.18** (3.89-4.51)	**5.02** (4.66-5.41)	**6.21** (5.76-6.69)	**7.19** (6.66-7.75)	**8.59** (7.93-9.24)	**9.74** (8.96-10.5)	**11.0** (10.0-11.8)	**12.3** (11.2-13.2)	**14.1** (12.7-15.3)	**15.7** (14.0-16.9)
10-day	**4.76** (4.45-5.11)	**5.69** (5.32-6.11)	**6.94** (6.48-7.44)	**7.95** (7.41-8.52)	**9.36** (8.69-10.0)	**10.5** (9.72-11.2)	**11.7** (10.8-12.5)	**12.9** (11.8-13.8)	**14.6** (13.3-15.7)	**16.0** (14.4-17.2)
20-day	**6.43** (6.05-6.85)	**7.63** (7.18-8.13)	**9.11** (8.56-9.71)	**10.3** (9.63-10.9)	**11.8** (11.1-12.6)	**13.1** (12.2-13.9)	**14.3** (13.3-15.2)	**15.5** (14.4-16.6)	**17.2** (15.8-18.4)	**18.5** (16.9-19.8)
30-day	**8.02** (7.59-8.45)	**9.44** (8.95-9.96)	**11.0** (10.4-11.6)	**12.2** (11.6-12.9)	**13.8** (13.1-14.6)	**15.1** (14.2-15.9)	**16.2** (15.2-17.1)	**17.4** (16.3-18.4)	**18.9** (17.6-20.0)	**20.1** (18.6-21.3)
45-day	**10.2** (9.70-10.7)	**12.0** (11.4-12.6)	**13.8** (13.1-14.5)	**15.1** (14.4-15.9)	**16.9** (16.0-17.7)	**18.1** (17.2-19.1)	**19.3** (18.3-20.4)	**20.5** (19.4-21.6)	**21.9** (20.7-23.1)	**22.9** (21.6-24.3)
60-day	**12.2** (11.7-12.8)	**14.3** (13.7-15.0)	**16.3** (15.6-17.1)	**17.8** (17.0-18.7)	**19.7** (18.8-20.7)	**21.1** (20.1-22.1)	**22.4** (21.2-23.5)	**23.6** (22.3-24.7)	**25.0** (23.6-26.3)	**26.0** (24.5-27.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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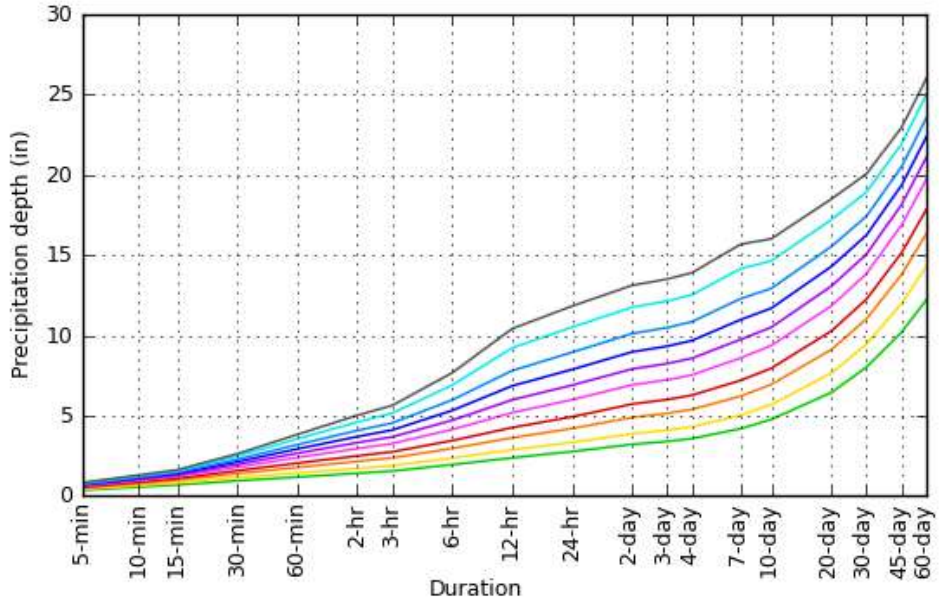
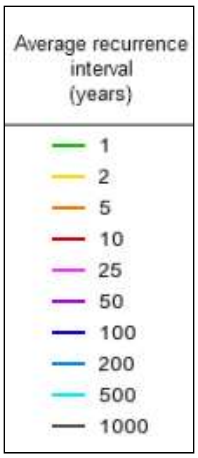
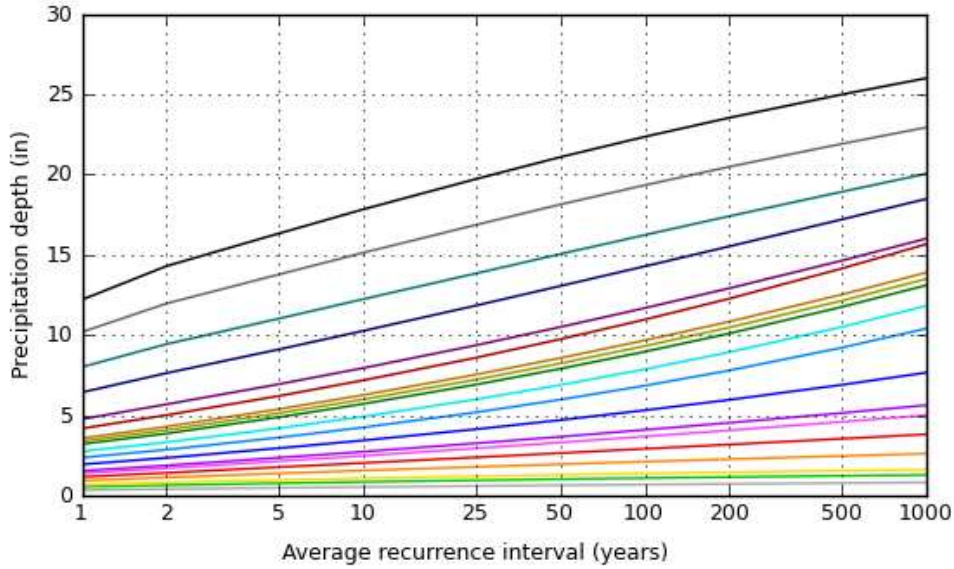
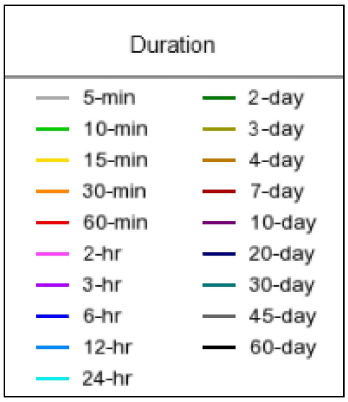
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.3799°, Longitude: -74.9788°









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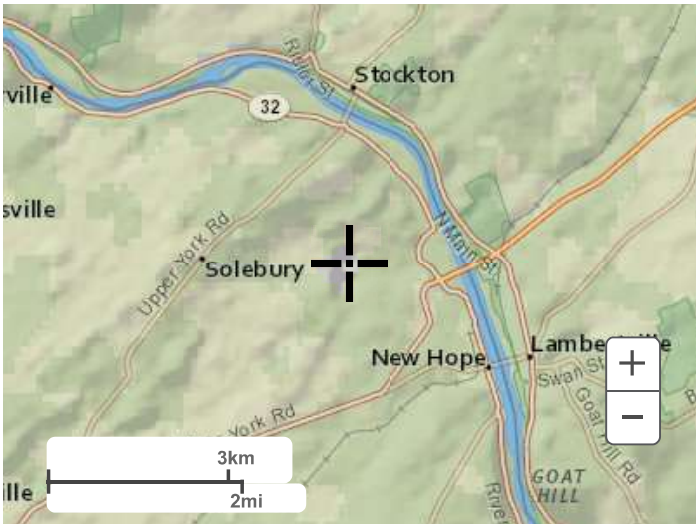
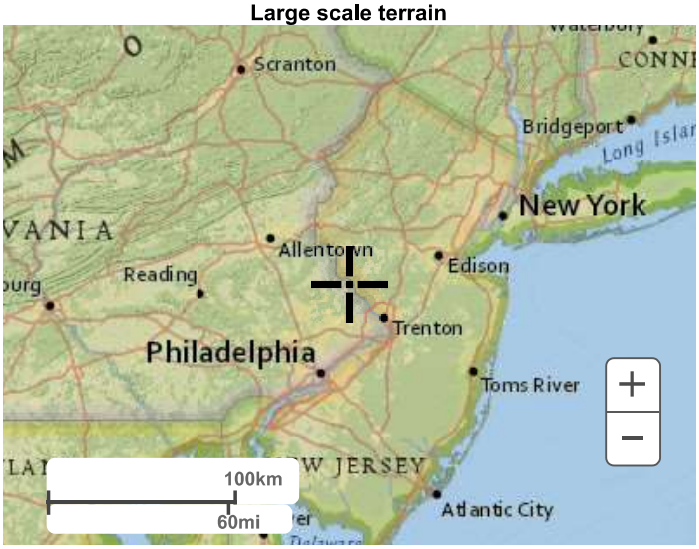
Maps & aerials

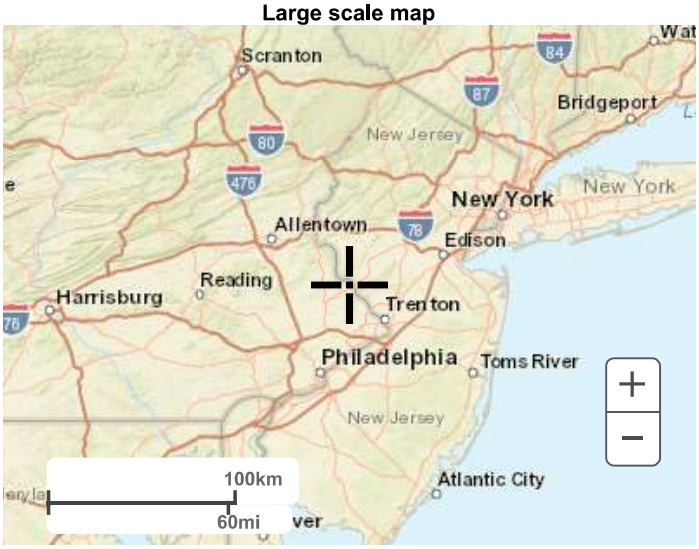
Small scale terrain



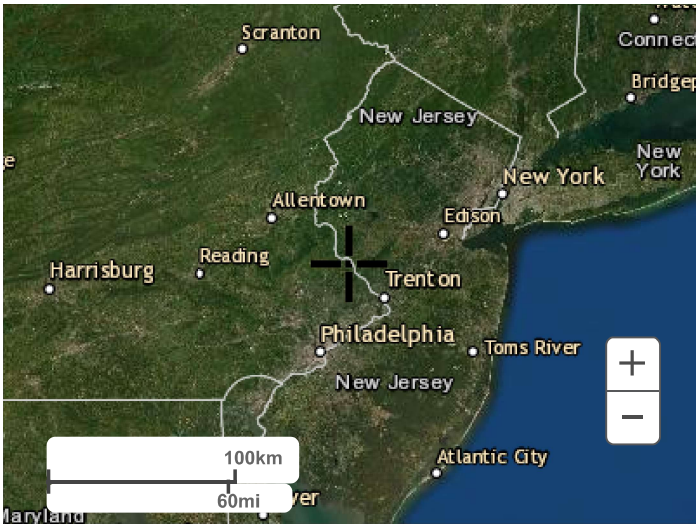
Large scale terrain



Large scale map



Large scale aerial



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