
Drainage Report

Prepared for:

Mark Goerner

1900 Garden Street

Santa Barbara, CA 93101

Prepared By:

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Goerner Residence

1017 Hot Springs Road
Santa Barbara, CA 93150

APN 011-010-08 & 011-010-015

March 8, 2021

March 8, 2021

Mark Goerner
1900 Garden Street
Santa Barbara, CA 93101

Subject: Goerner Residence

Re: Drainage Report

Mark:

Please find enclosed the Preliminary Drainage Report for the above referenced project.

This project was analyzed to verify proposed drainage system provides a storm drain system with the capacity to carry the 25-year storm, provides an overland escape with the capacity to carry the 100-year storm.

Please contact me for any clarifications or supporting information you need with reference to this plan.

Regards,

Jason Gotsis, PE



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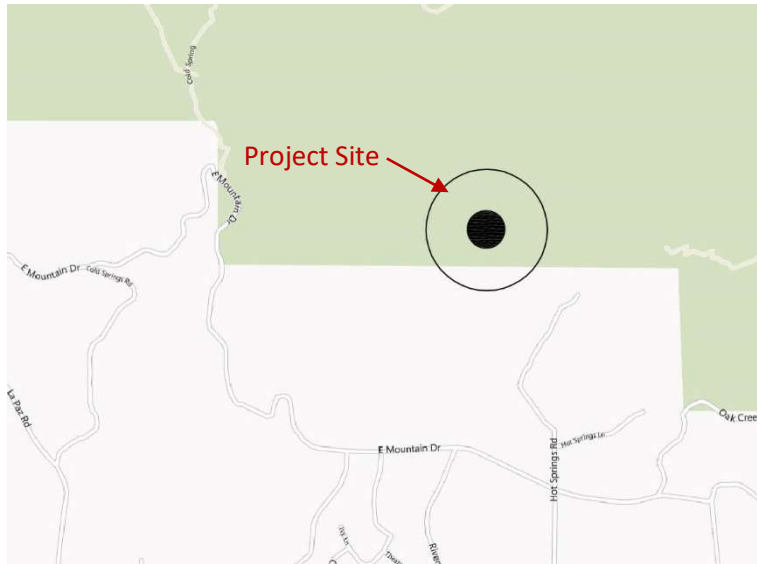
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Project Setting

Project Location and Description

This project is located at 1017 Hot Springs Road in the unincorporated area of Santa Barbara County. The project will include a new main residence and guest house and a 2,500 foot long asphalt and concrete driveway.

Vicinity Map



Existing Site Drainage

The existing 40 acre lot is currently undeveloped. An existing dirt driveway provides access to the proposed house site with some culvert improvements at drainage crossings. The majority of the on-site drainage runs to the south property line and is divided by 3 main watersheds. A small portion of the southern edge of the site flows off the property to the south outside of the three watersheds, however the improvements will have no effect on the hydrology of these areas. Two additional watersheds were analyzed west of the project property as they contribute flow to the proposed driveway improvements. See Existing Watershed Exhibit for details.

Proposed Site Drainage

The proposed development maintains the existing drainage pattern for most of the site. The existing dirt driveway will be replaced with a concrete and asphalt driveway. A new single-family residence with garage, guest house, and pool area is proposed on the site. The majority of the on-site drainage runs to the south property line and is divided by 3 main watersheds. Watershed 3 is divided into three sub-watersheds to allow for analysis of the proposed culverts under the proposed driveway. Two additional watersheds were analyzed west of the project property as they contribute flow to the proposed driveway improvements. See Proposed Watershed Exhibit for details.

Hydrology Analysis

Existing Site Hydrology

The analyzed watersheds consist mostly of dense brush and chaparral on steep hillsides with sandstone and decomposed sandstone soil. USDA web soil survey analysis indicates a hydrologic soil group of D or not applicable for sandstone areas which are assumed to be group D for the purposes of analysis.

Existing Watershed Exhibit shows runoff areas by land use and hydrologic soil group. See table below for drainage area totals.

Analysis Area	Hydrologic Group	Area (ac)	CN	Tc (min)
Area 1	D	63.3	85	60
Area 2	D	3.1	85	15
Area 3	D	15.4	85	30
Area 4	D	8.9	85	20
Area 5	D	2.8	85	15

The hydrology for the site based on the SBUH method and a 24 hour Type I rain event of 6.71 inches for the 25 year storm event and 8.28 inches for the 100 year storm event. Time of concentration based on standard lag analysis. HydroCAD software was utilized to perform the hydrology analysis. Model results are provided in the table below. See the attached HydroCAD Analysis Report for additional information.

Analysis Area	25 year peak flow (cfs)	100 year peak flow (cfs)
Area 1	73.93	98.29
Area 2	7.91	10.44
Area 3	27.65	36.60
Area 4	19.42	25.67
Area 5	7.07	9.34

Proposed Site Hydrology

The analyzed watersheds consist mostly of dense brush and chaparral on steep hillsides with sandstone and decomposed sandstone soil. USDA web soil survey analysis indicates a hydrologic soil group of D or not applicable for sandstone areas which are assumed to be group D for the purposes of analysis.

Proposed Watershed Exhibit shows runoff areas by land use and hydrologic soil group. CN number is adjusted for proposed improvements. See table below for drainage area totals.

Analysis Area	Hydrologic Group	Area (ac)	CN - Adjusted	Tc (min)
Area 1	D	63.3	85	60
Area 2	D	3.1	86	15
Area 3	D	15.4	85	30
Area 3A	D	6.3	85	30
Area 3B	D	2.7	86	15
Area 3C	D	6.3	85	15
Area 4	D	8.9	85	20
Area 5	D	2.8	85	15

The hydrology for the site based on the SBUH method and a 24 hour Type I rain event of 6.71 inches for the 25 year storm event and 8.28 inches for the 100 year storm event. Time of concentration based on standard lag analysis. HydroCAD software was utilized to perform the hydrology analysis. Model results are provided in the table below. See the attached HydroCAD Analysis Report for additional information.

Analysis Area	25 year peak flow (cfs)	100 year peak flow (cfs)
Area 1	73.99	98.35
Area 2	7.97	10.50
Area 3	11.34	14.98
Area 3A	7.80	10.24
Area 3B	15.45	20.40
Area 3C	27.84	36.77
Area 4	19.50	25.74
Area 5	7.15	9.40

Storm Drain Analysis

Description of Storm Drain System

Proposed storm drain system consists of area drains around the proposed residence, use of the proposed driveway to carry collected flow in an in-sloped gutter, and culverts under the driveway at watershed flow path crossings.

Storm Drain Analysis Approach

All driveway culverts are analyzed using standard culvert analysis method to verify culvert capacity. Peak precipitation rates for the 25-year storm derived from the previously described hydrology analysis. See table below for results of culvert analysis. Calculations provided in the calculations section of this report.

Culvert Watershed	Design Flow (cfs)	Culvert Diameter (in)	Flow Depth (in)
Area 3A	11.3	24	24.3
Area 3B	7.8	18	11.3
Area 4	19.5	30	17.2

Driveway capacity for overland escape was analyzed at highest flow section of proposed driveway. Hydraulic analysis of the driveway capacity is based on a basic Manning's equation analysis of the channel adjacent to the proposed development. Peak precipitation rates for the 100-year storm derived from the previously described hydrology analysis. Maximum flow depth during design event is 0.33 feet and is contained within the roadway section. Calculations provided in the calculations section of this report.

Results

Hydrology analysis indicates the runoff from the site shall be increased from the existing to proposed condition. Analysis results for both conditions for the 25 year storm are provided below.

	Area 1	Area 2	Area 3	Area 4	Area 5
Existing Peak Runoff (cfs)	73.93	7.91	27.65	19.42	7.07
Proposed Peak Runoff (cfs)	73.99	7.97	27.84	19.50	7.15
Flow Increase (cfs)	0.06	0.06	0.19	0.08	0.08

Culvert analysis indicates all culverts meet the demand of the 25-year design storm.

Overland escape analysis indicates the driveway meets the demand of the 100-year design storm.

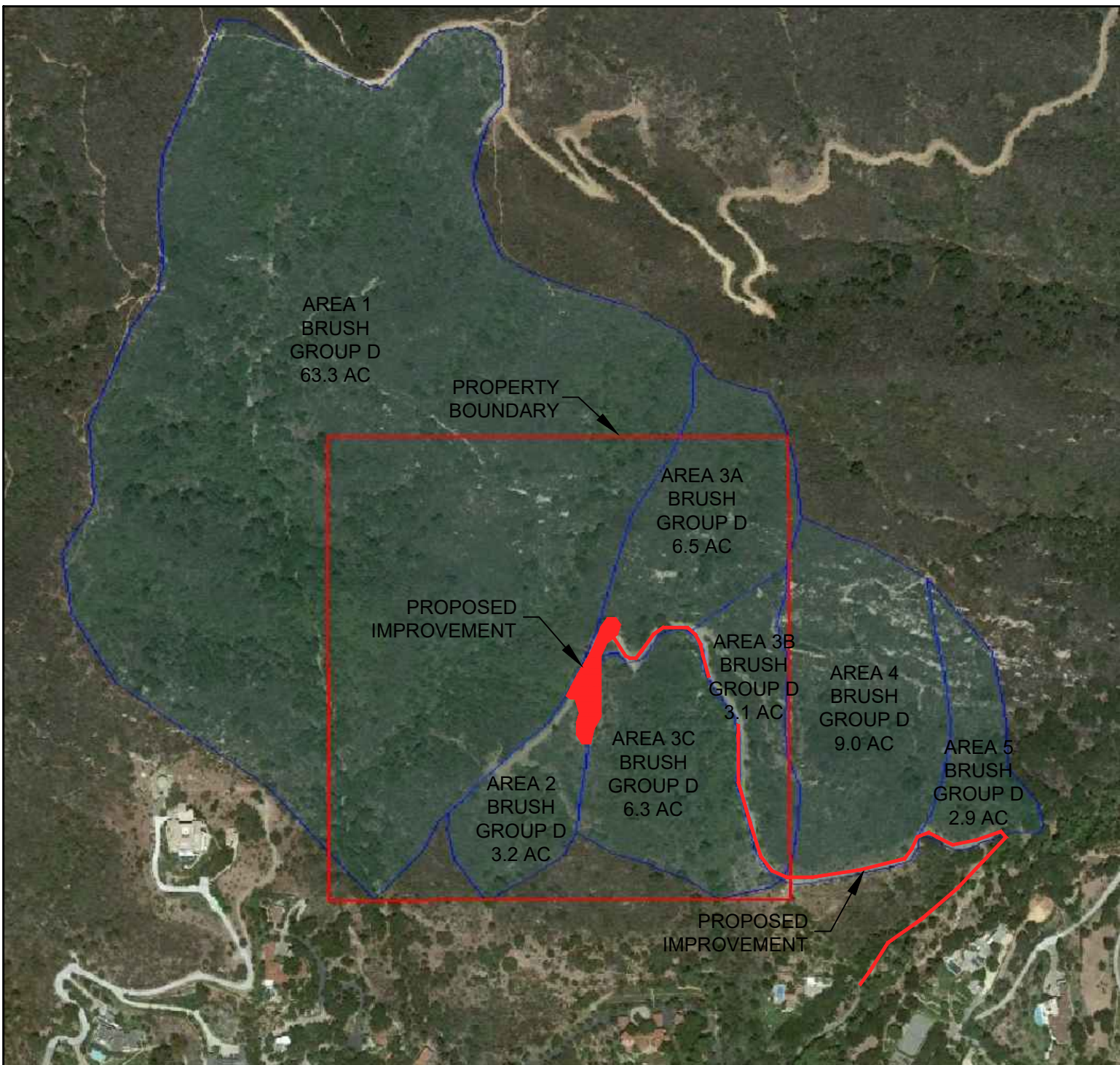


GOERNER RESIDENCE
EXISTING WATERSHED EXHIBIT

1017 HOT SPRINGS ROAD
SANTA BARBARA, CA 93150



210 East Cota Street
Santa Barbara, CA 93101
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CIVIL • STRUCTURAL



GOERNER RESIDENCE
PROPOSED WATERSHED EXHIBIT

1017 HOT SPRINGS ROAD
SANTA BARBARA, CA 93150



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Summary for Subcatchment 1E: Existing - Area 1

Runoff = 73.93 cfs @ 10.13 hrs, Volume= 26.249 af, Depth> 4.98"

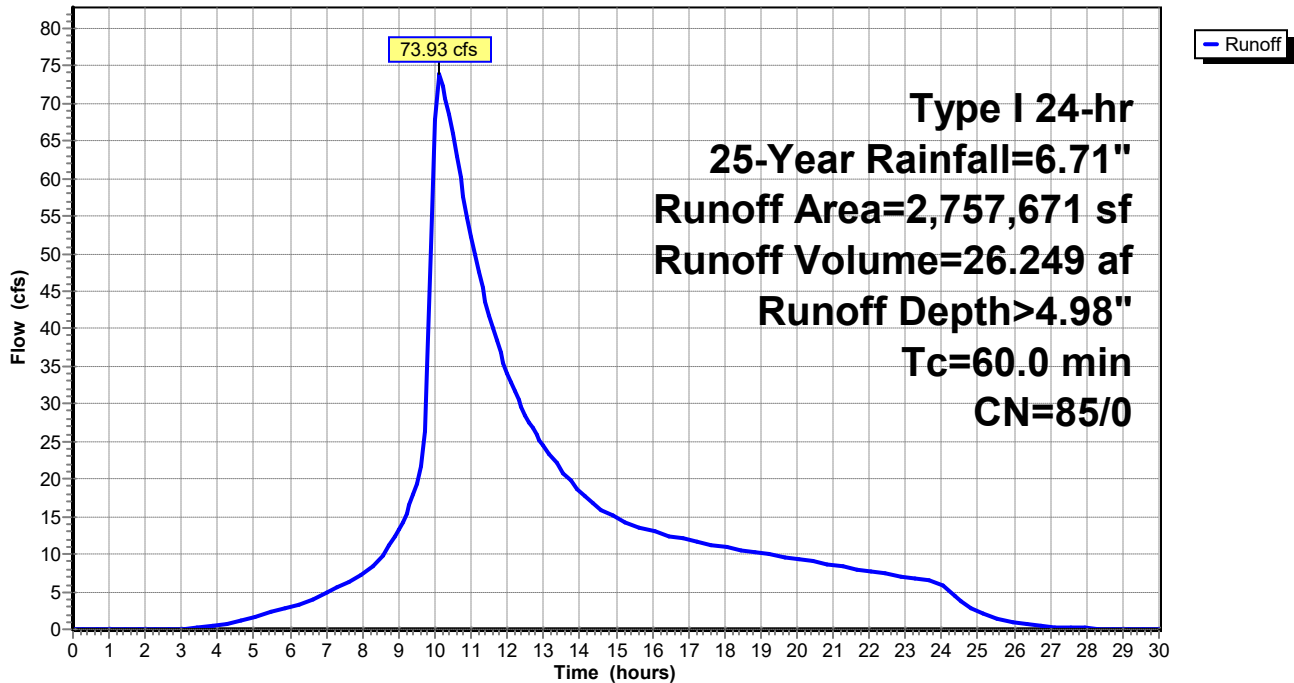
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
2,757,671	85	Herbaceous range, Good, HSG D
2,757,671	85	Weighted Average
2,757,671	85	100.00% Pervious Area

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

Subcatchment 1E: Existing - Area 1

Hydrograph



Summary for Subcatchment 2E: Existing - Area 2

Runoff = 7.91 cfs @ 10.03 hrs, Volume= 1.340 af, Depth= 4.98"

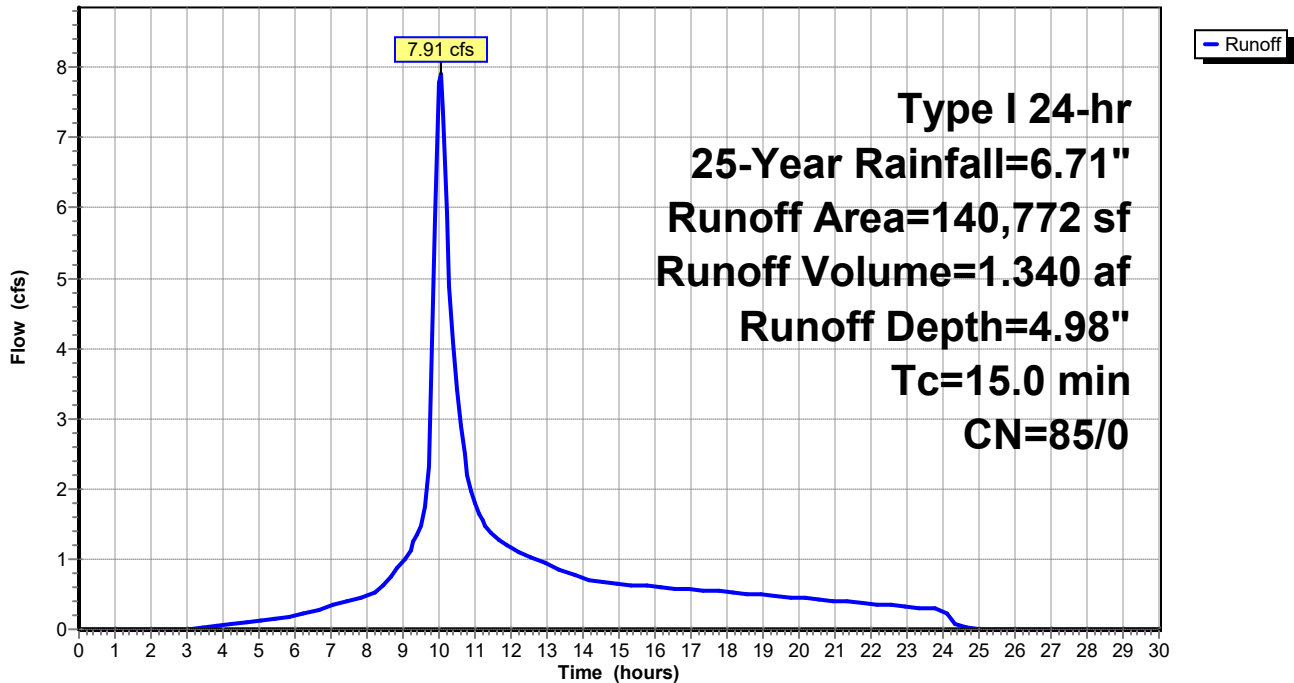
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
6,560	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
134,212	85	Herbaceous range, Good, HSG D
140,772	85	Weighted Average
140,772	85	100.00% Pervious Area

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

Subcatchment 2E: Existing - Area 2

Hydrograph



Summary for Subcatchment 3E: Existing - Area 3

Runoff = 27.65 cfs @ 10.08 hrs, Volume= 6.609 af, Depth= 4.98"

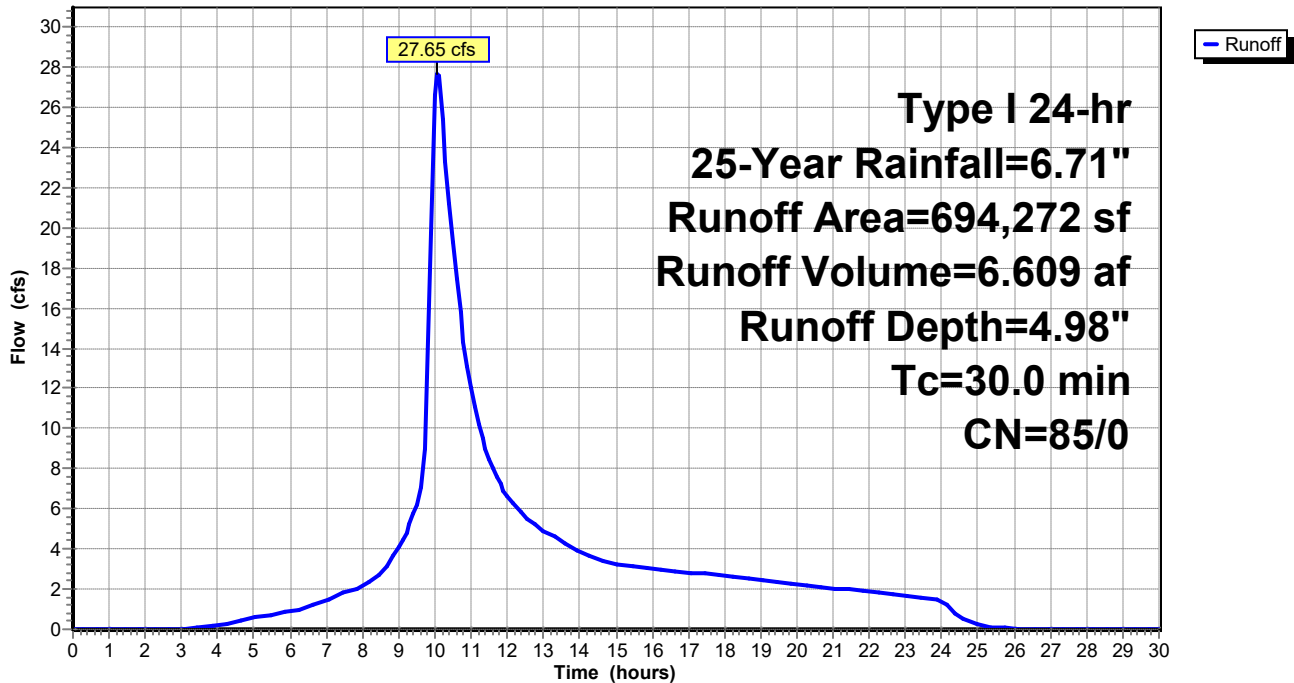
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
24,320	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
669,952	85	Herbaceous range, Good, HSG D
694,272	85	Weighted Average
694,272	85	100.00% Pervious Area

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

Subcatchment 3E: Existing - Area 3

Hydrograph



Summary for Subcatchment 4E: Existing - Area 4

Runoff = 19.42 cfs @ 10.05 hrs, Volume= 3.744 af, Depth= 4.98"

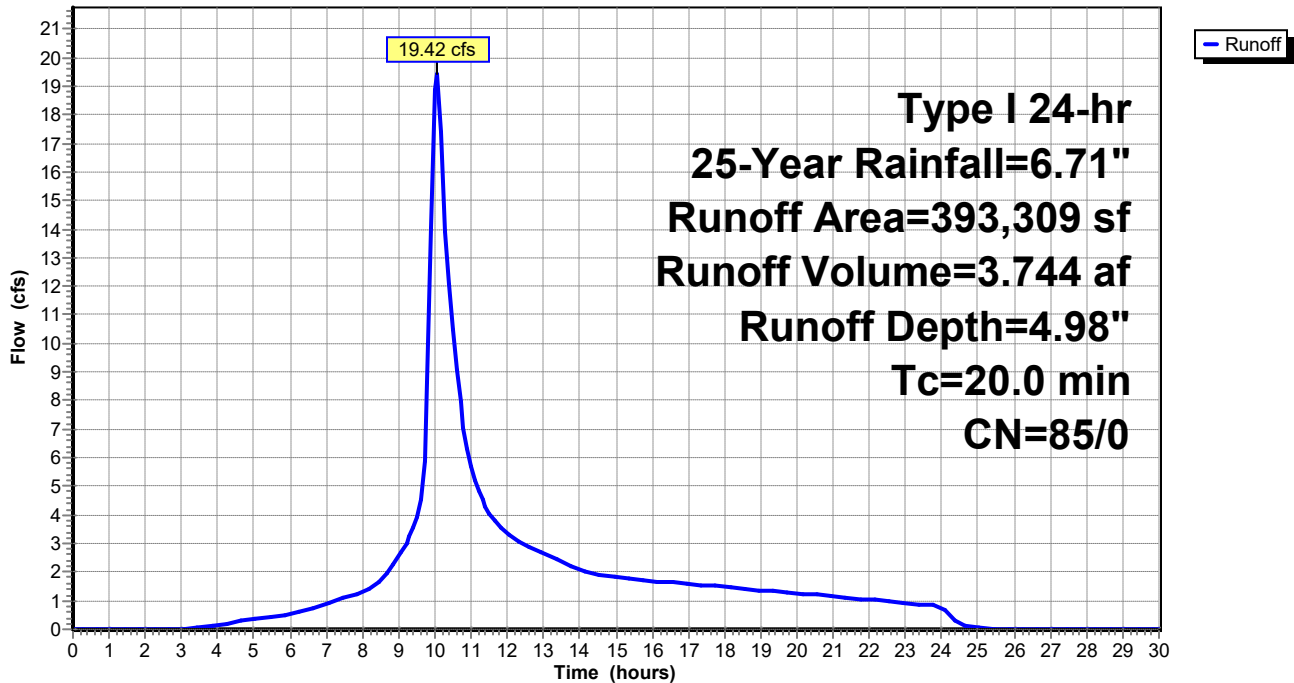
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
7,360	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
385,949	85	Herbaceous range, Good, HSG D
393,309	85	Weighted Average
393,309	85	100.00% Pervious Area

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

Subcatchment 4E: Existing - Area 4

Hydrograph



Summary for Subcatchment 5E: Existing - Area 5

Runoff = 7.07 cfs @ 10.03 hrs, Volume= 1.199 af, Depth= 4.98"

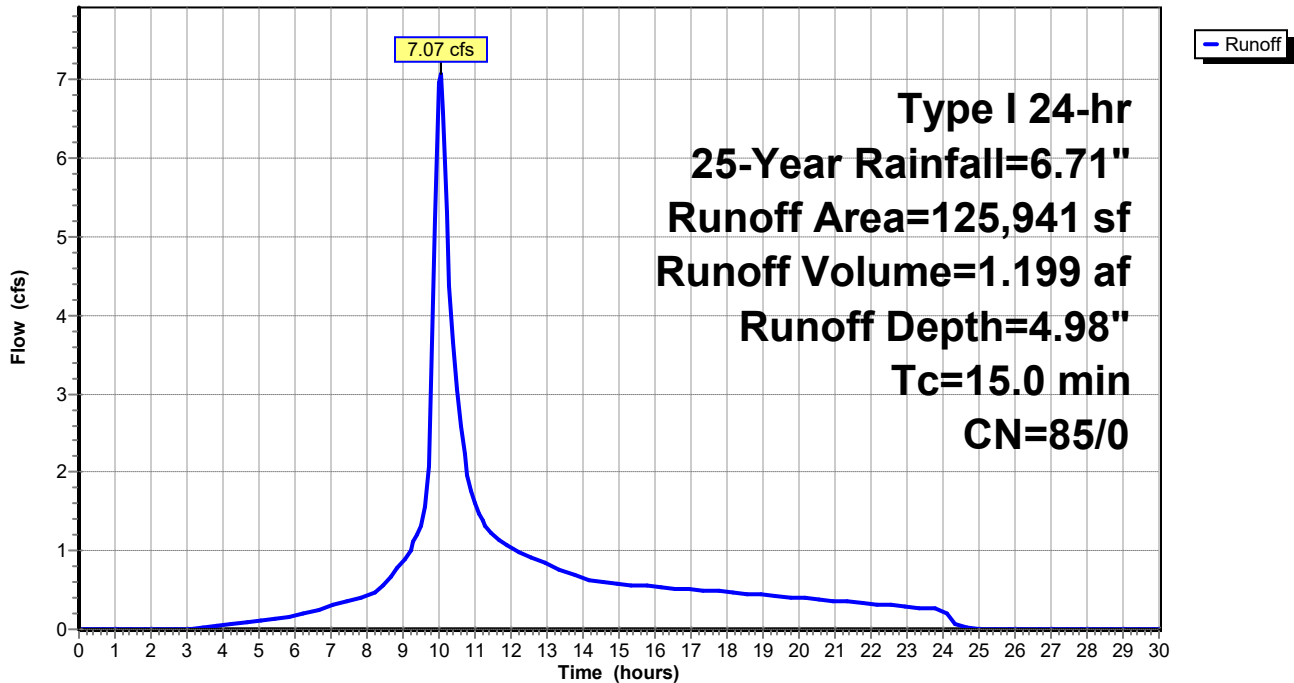
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
6,080	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
119,861	85	Herbaceous range, Good, HSG D
125,941	85	Weighted Average
125,941	85	100.00% Pervious Area

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

Subcatchment 5E: Existing - Area 5

Hydrograph



Summary for Subcatchment 1P: Proposed - Area 1

Runoff = 73.99 cfs @ 10.13 hrs, Volume= 26.275 af, Depth> 4.98"

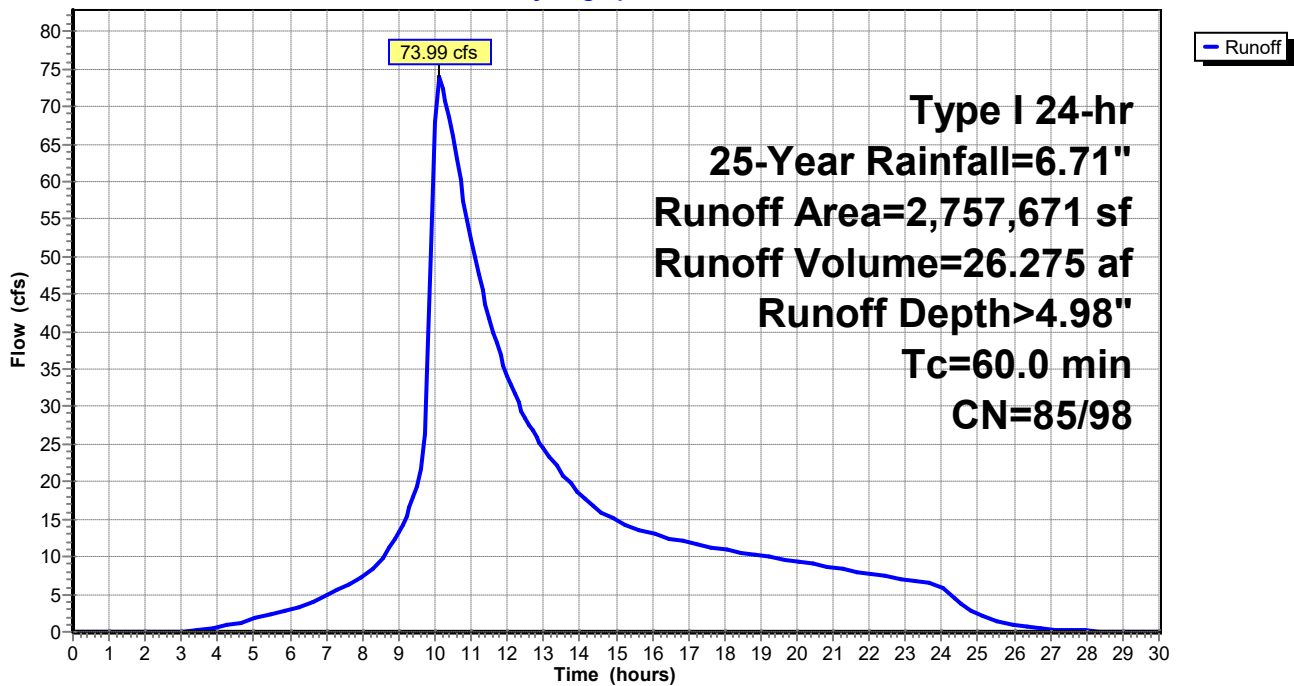
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
5,253	98	Paved parking, HSG D
3,730	98	Roofs, HSG D
2,748,688	85	Herbaceous range, Good, HSG D
2,757,671	85	Weighted Average
2,748,688	85	99.67% Pervious Area
8,983	98	0.33% Impervious Area

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

Subcatchment 1P: Proposed - Area 1

Hydrograph



Summary for Subcatchment 2P: Proposed - Area 2

Runoff = 7.97 cfs @ 10.03 hrs, Volume= 1.356 af, Depth= 5.03"

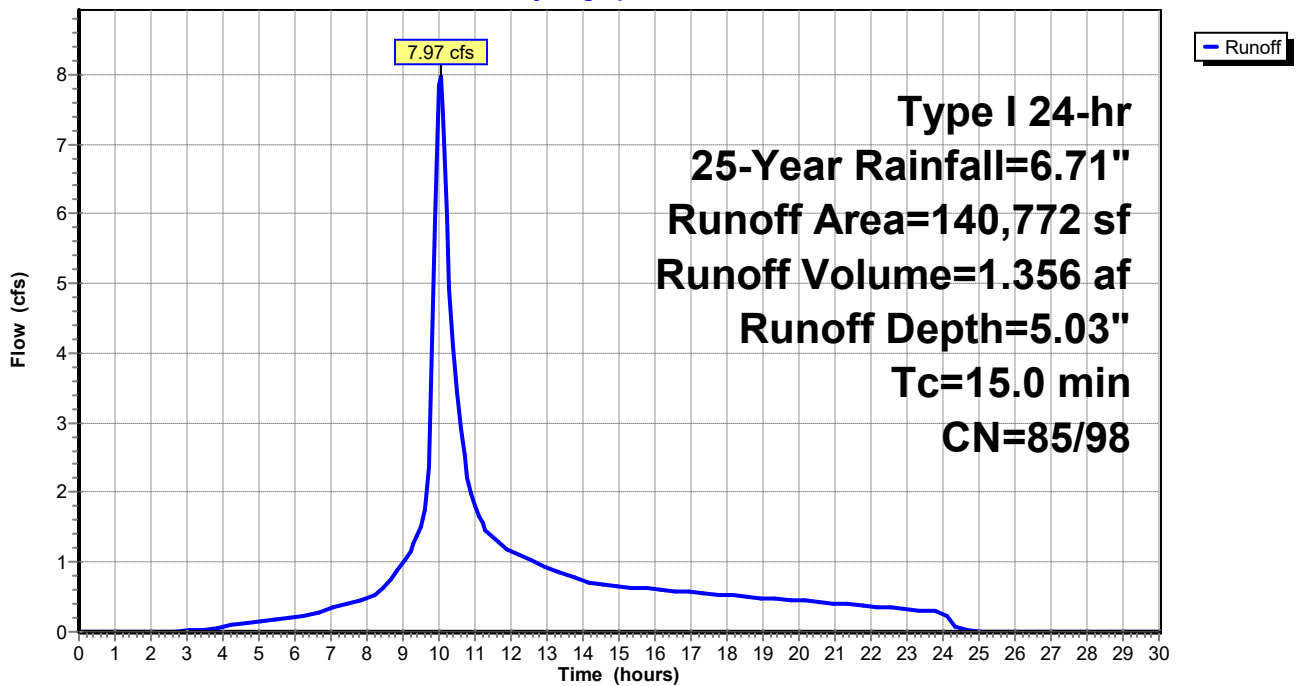
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
3,680	89	Dirt roads, HSG D
2,500	98	Paved parking, HSG D
2,955	98	Roofs, HSG D
131,637	85	Herbaceous range, Good, HSG D
140,772	86	Weighted Average
135,317	85	96.12% Pervious Area
5,455	98	3.88% Impervious Area

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

Subcatchment 2P: Proposed - Area 2

Hydrograph



Summary for Subcatchment 3AP: Proposed - Area 3A

Runoff = 11.34 cfs @ 10.08 hrs, Volume= 2.715 af, Depth= 5.02"

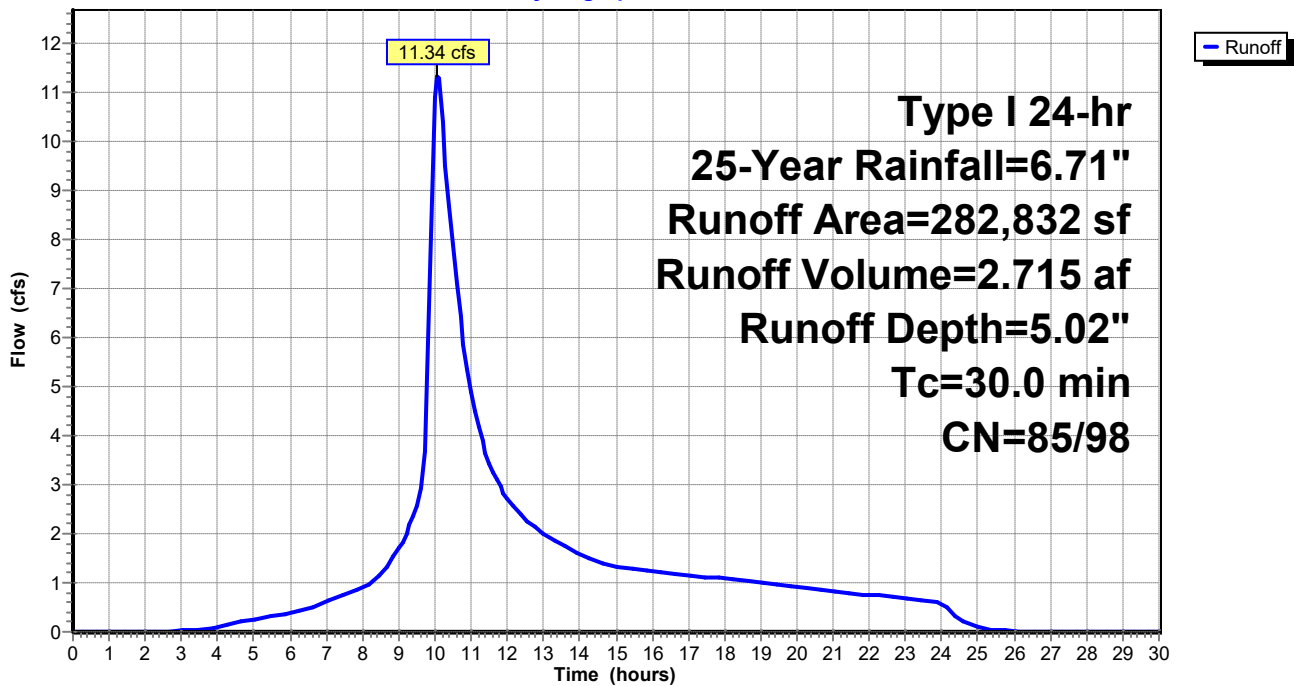
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
7,870	98	Paved parking, HSG D
0	98	Roofs, HSG D
274,962	85	Herbaceous range, Good, HSG D
282,832	85	Weighted Average
274,962	85	97.22% Pervious Area
7,870	98	2.78% Impervious Area

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

Subcatchment 3AP: Proposed - Area 3A

Hydrograph



Summary for Subcatchment 3BP: Proposed - Area 3B

Runoff = 7.80 cfs @ 10.03 hrs, Volume= 1.333 af, Depth= 5.11"

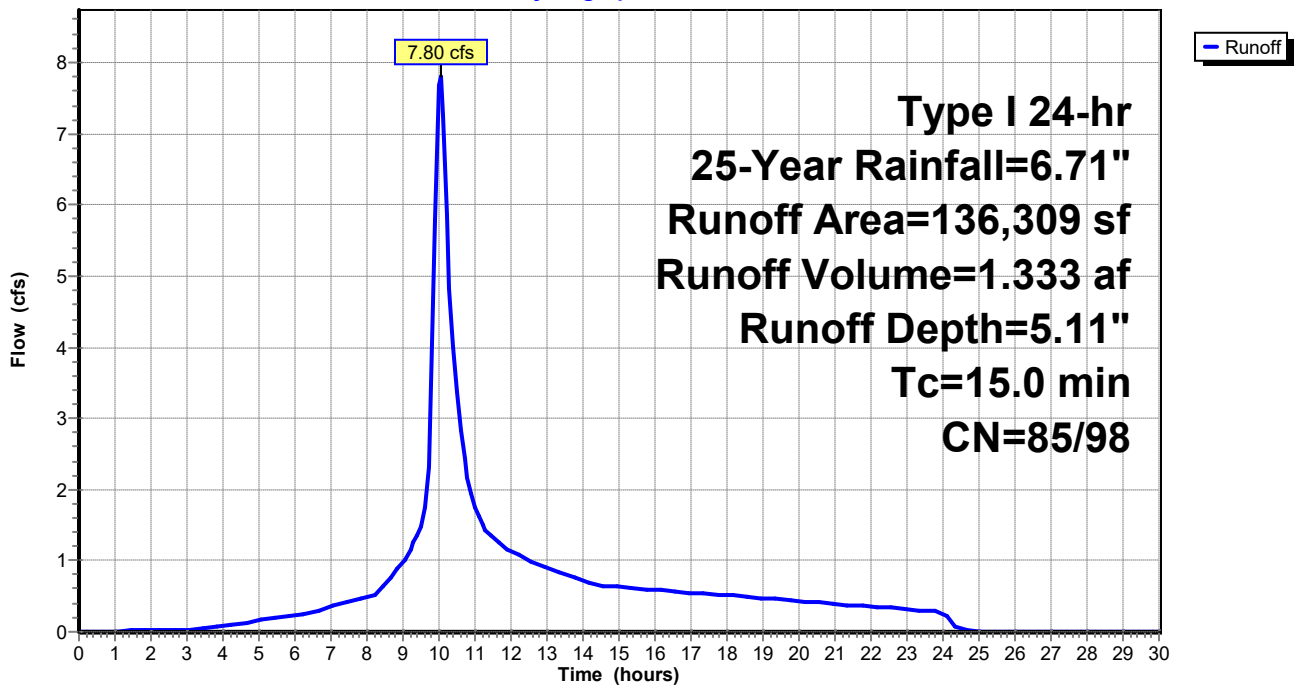
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
5,120	89	Dirt roads, HSG D
12,480	98	Paved parking, HSG D
0	98	Roofs, HSG D
118,709	85	Herbaceous range, Good, HSG D
136,309	86	Weighted Average
123,829	85	90.84% Pervious Area
12,480	98	9.16% Impervious Area

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

Subcatchment 3BP: Proposed - Area 3B

Hydrograph



Summary for Subcatchment 3CP: Proposed - Area 3C

Runoff = 15.45 cfs @ 10.03 hrs, Volume= 2.619 af, Depth= 4.98"

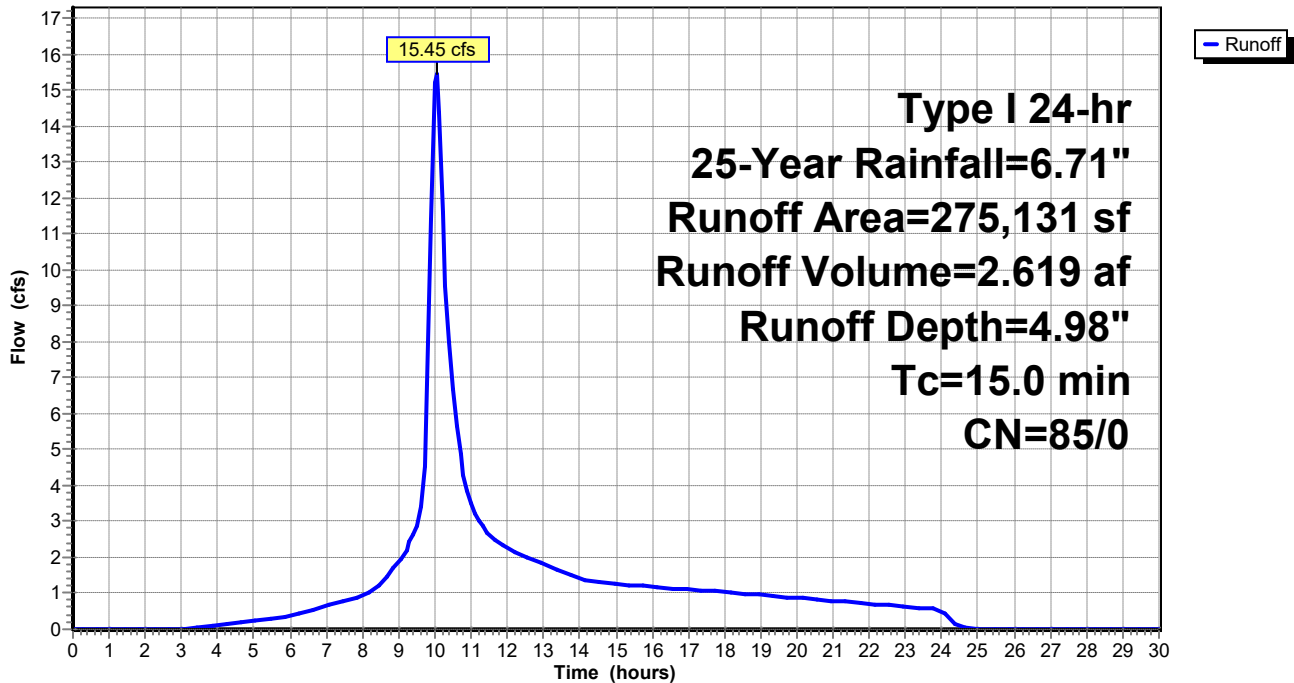
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
275,131	85	Herbaceous range, Good, HSG D
275,131	85	Weighted Average
275,131	85	100.00% Pervious Area

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

Subcatchment 3CP: Proposed - Area 3C

Hydrograph



Summary for Subcatchment 3P: Proposed - Area 3

Runoff = 27.84 cfs @ 10.08 hrs, Volume= 6.667 af, Depth= 5.02"

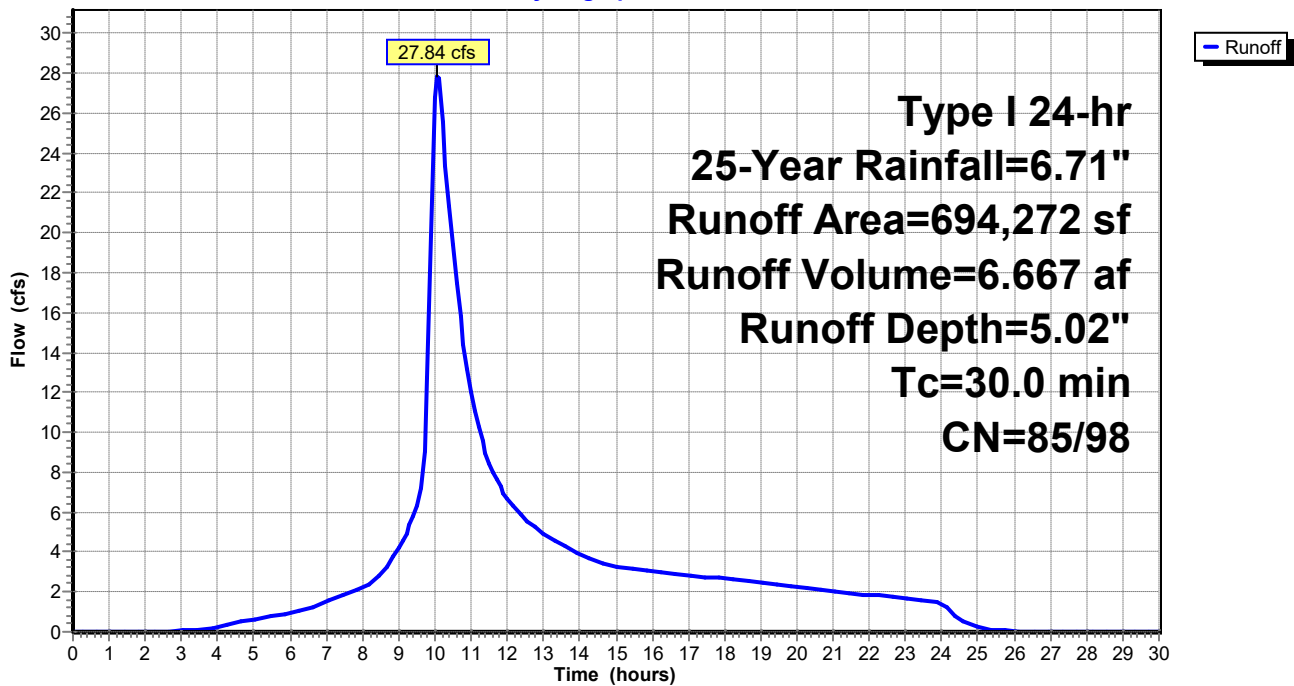
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
5,120	89	Dirt roads, HSG D
20,350	98	Paved parking, HSG D
0	98	Roofs, HSG D
668,802	85	Herbaceous range, Good, HSG D
694,272	85	Weighted Average
673,922	85	97.07% Pervious Area
20,350	98	2.93% Impervious Area

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

Subcatchment 3P: Proposed - Area 3

Hydrograph



Summary for Subcatchment 4P: Proposed - Area 4

Runoff = 19.50 cfs @ 10.05 hrs, Volume= 3.765 af, Depth= 5.00"

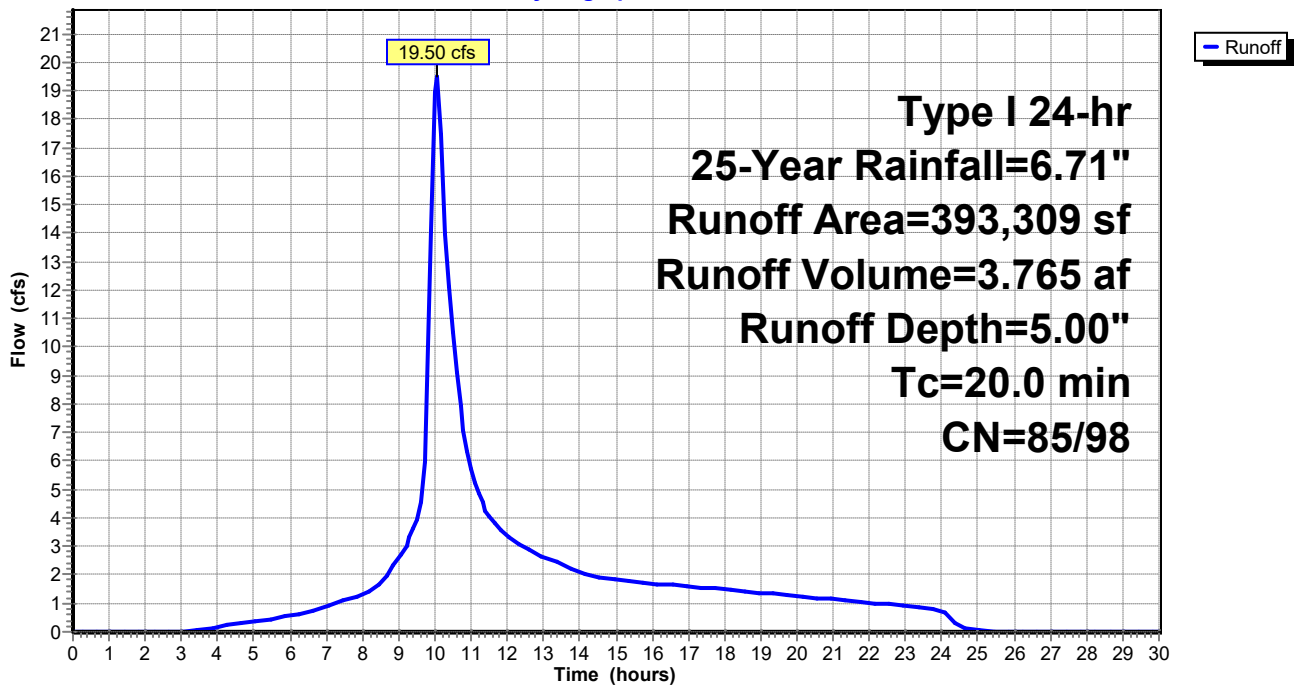
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
7,360	98	Paved parking, HSG D
0	98	Roofs, HSG D
385,949	85	Herbaceous range, Good, HSG D
393,309	85	Weighted Average
385,949	85	98.13% Pervious Area
7,360	98	1.87% Impervious Area

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

Subcatchment 4P: Proposed - Area 4

Hydrograph



Summary for Subcatchment 5P: Proposed - Area 5

Runoff = 7.15 cfs @ 10.03 hrs, Volume= 1.216 af, Depth= 5.05"

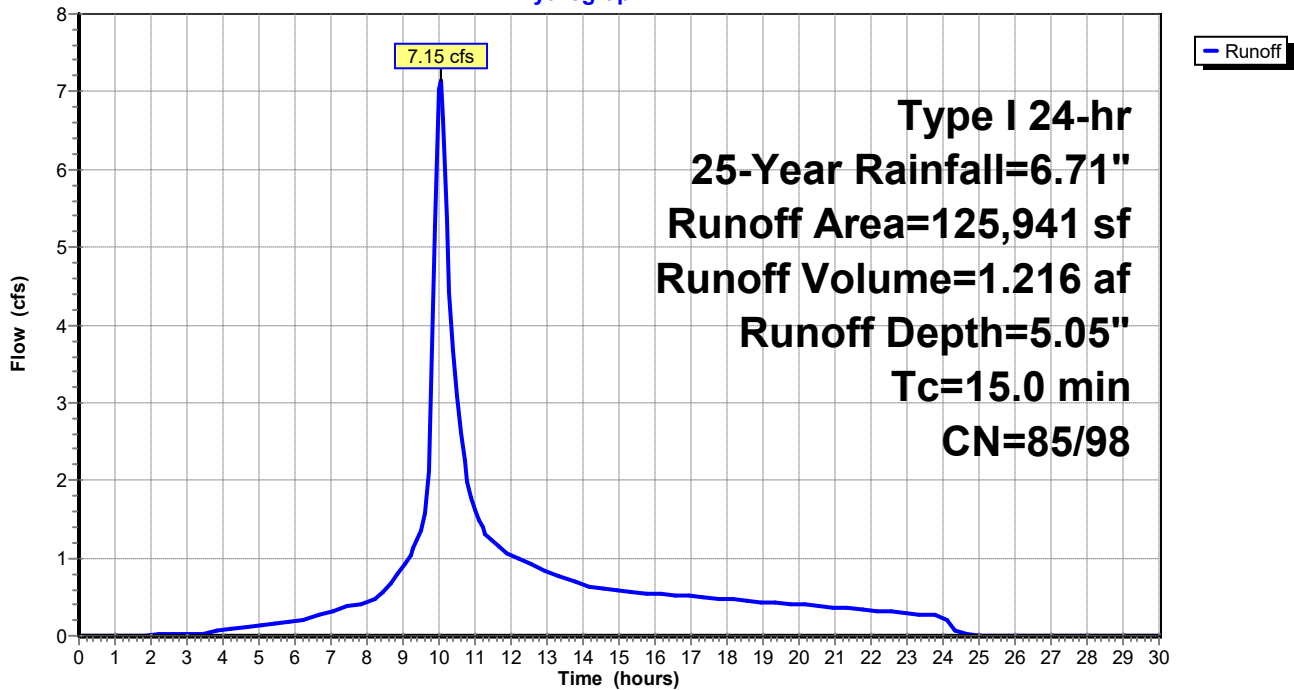
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 25-Year Rainfall=6.71"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
6,080	98	Paved parking, HSG D
0	98	Roofs, HSG D
119,861	85	Herbaceous range, Good, HSG D
125,941	86	Weighted Average
119,861	85	95.17% Pervious Area
6,080	98	4.83% Impervious Area

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

Subcatchment 5P: Proposed - Area 5

Hydrograph



Summary for Subcatchment 1E: Existing - Area 1

Runoff = 98.29 cfs @ 10.13 hrs, Volume= 34.714 af, Depth> 6.58"

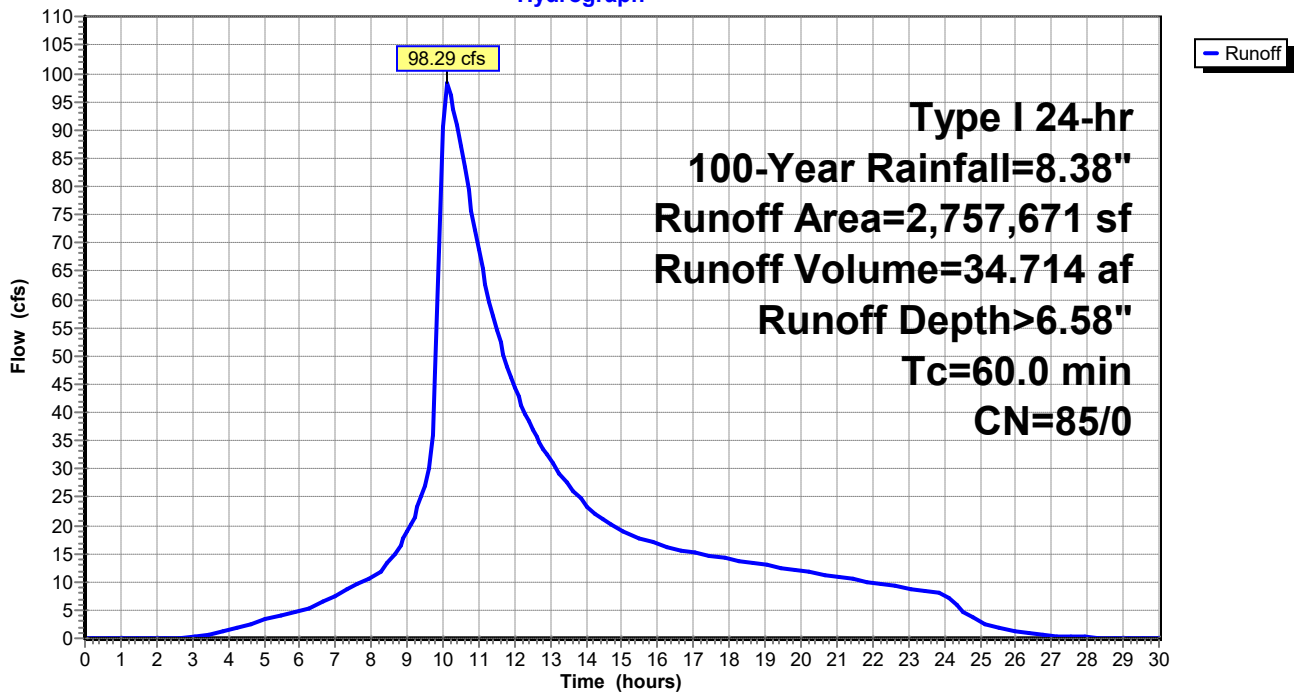
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
2,757,671	85	Herbaceous range, Good, HSG D
2,757,671	85	Weighted Average
2,757,671	85	100.00% Pervious Area

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

Subcatchment 1E: Existing - Area 1

Hydrograph



Summary for Subcatchment 2E: Existing - Area 2

Runoff = 10.44 cfs @ 10.03 hrs, Volume= 1.772 af, Depth= 6.58"

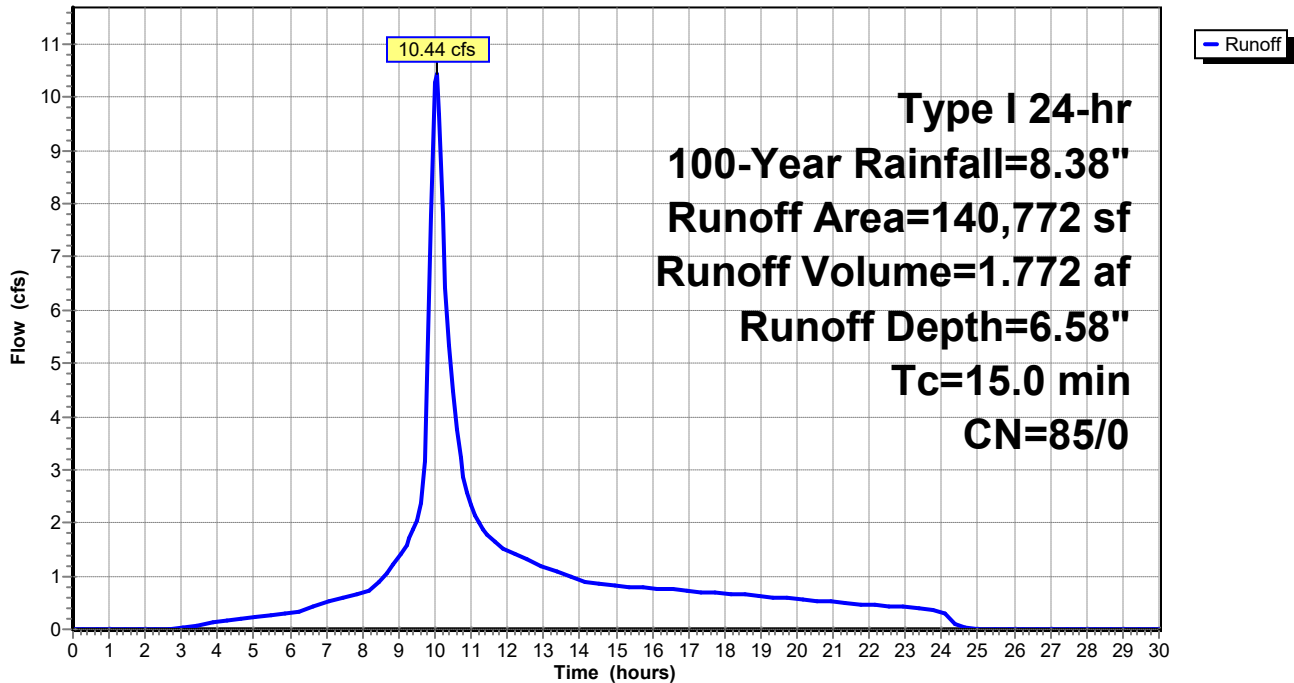
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
6,560	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
134,212	85	Herbaceous range, Good, HSG D
140,772	85	Weighted Average
140,772	85	100.00% Pervious Area

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

Subcatchment 2E: Existing - Area 2

Hydrograph



Summary for Subcatchment 3E: Existing - Area 3

Runoff = 36.60 cfs @ 10.08 hrs, Volume= 8.740 af, Depth= 6.58"

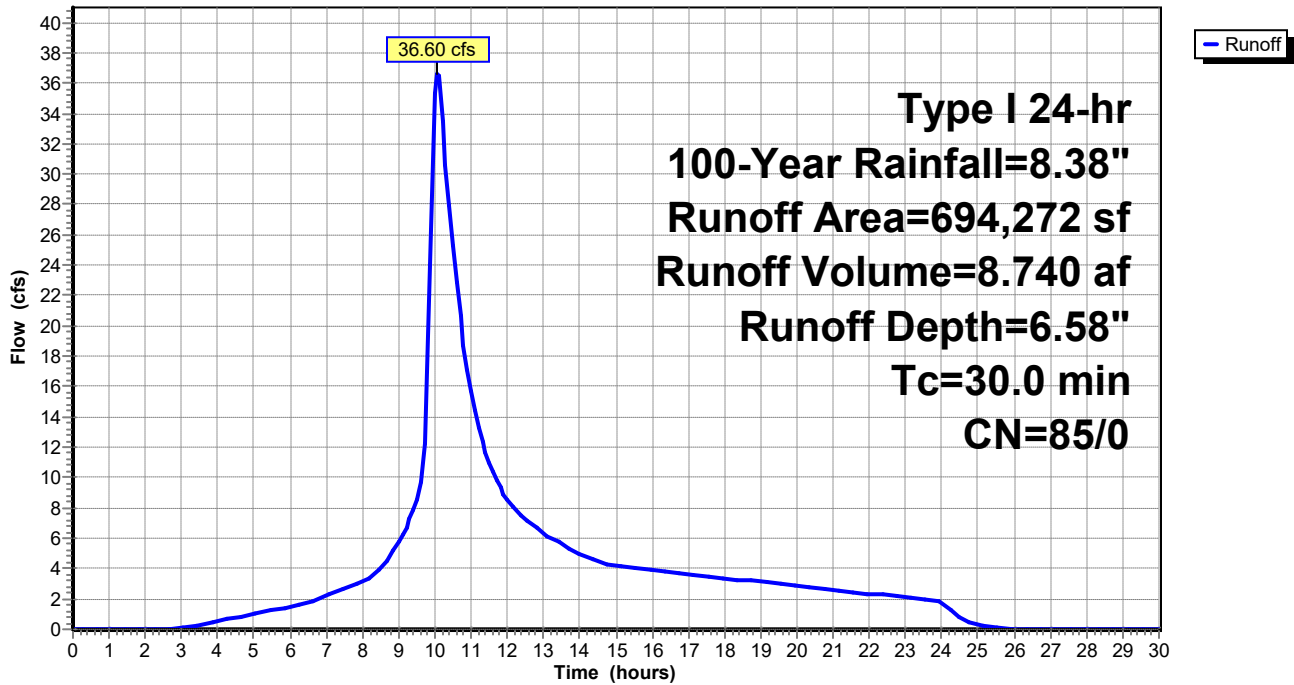
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
24,320	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
669,952	85	Herbaceous range, Good, HSG D
694,272	85	Weighted Average
694,272	85	100.00% Pervious Area

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

Subcatchment 3E: Existing - Area 3

Hydrograph



Summary for Subcatchment 4E: Existing - Area 4

Runoff = 25.67 cfs @ 10.04 hrs, Volume= 4.951 af, Depth= 6.58"

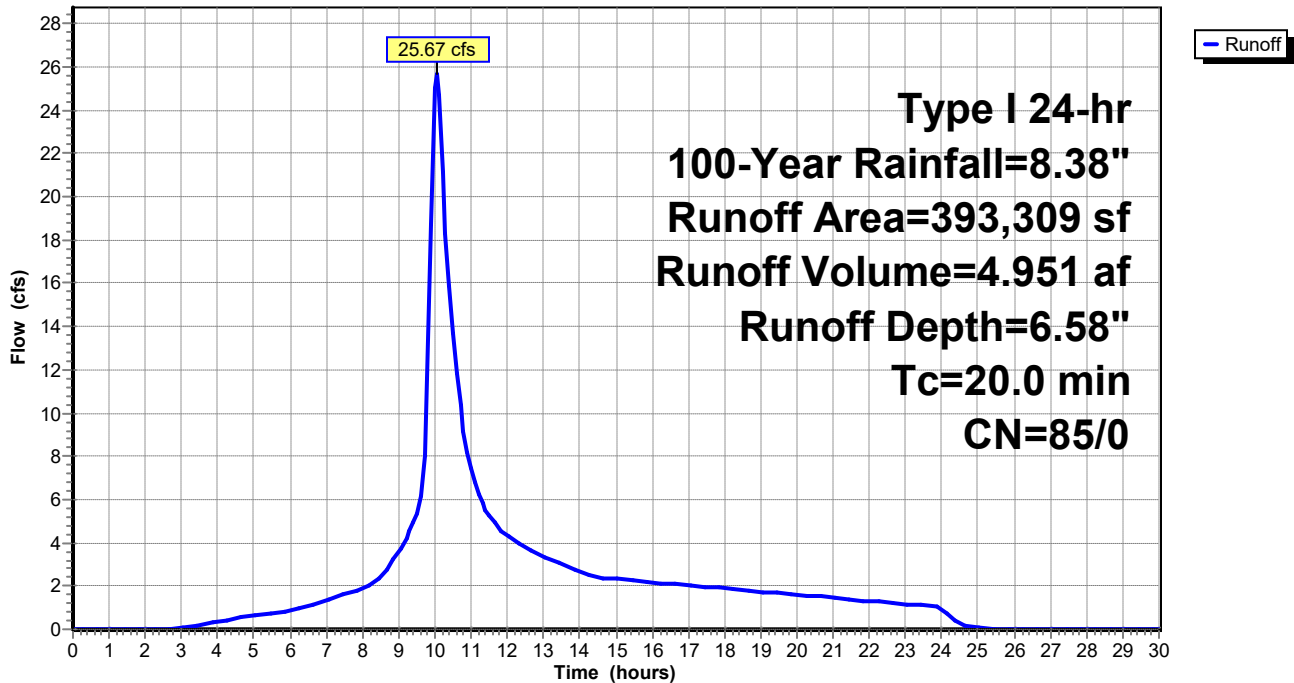
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
7,360	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
385,949	85	Herbaceous range, Good, HSG D
393,309	85	Weighted Average
393,309	85	100.00% Pervious Area

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

Subcatchment 4E: Existing - Area 4

Hydrograph



Summary for Subcatchment 5E: Existing - Area 5

Runoff = 9.34 cfs @ 10.03 hrs, Volume= 1.585 af, Depth= 6.58"

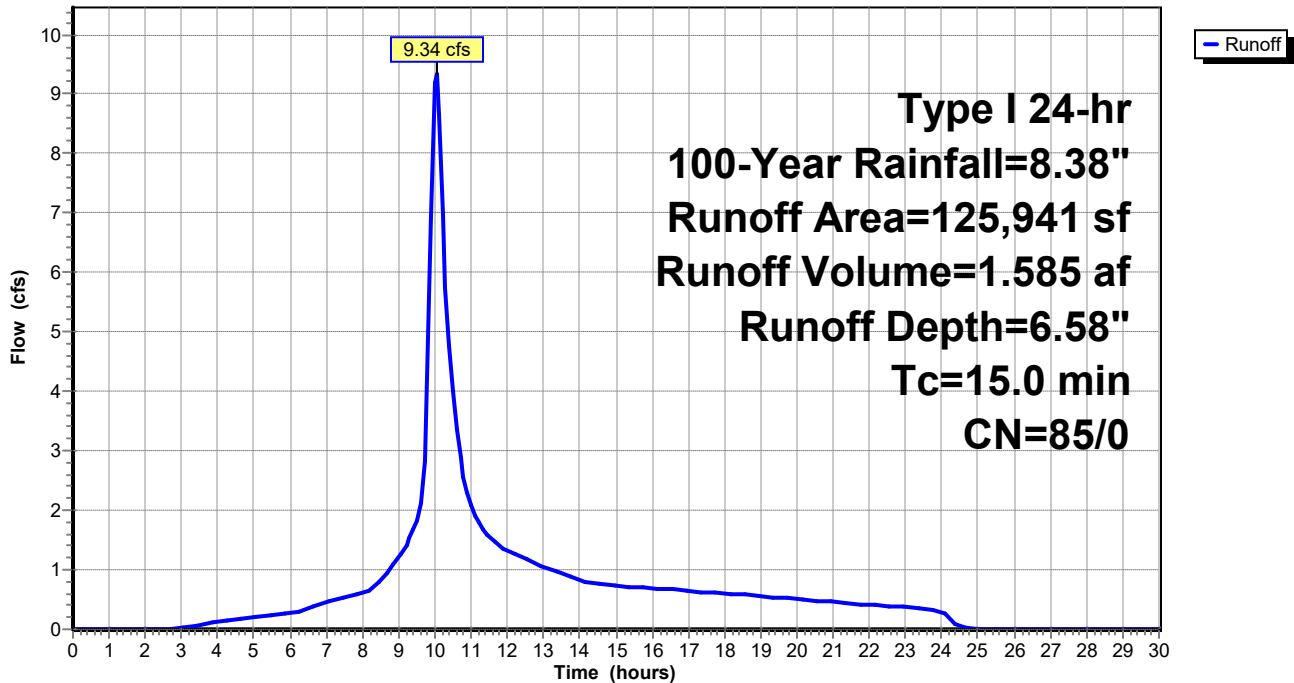
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
6,080	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
119,861	85	Herbaceous range, Good, HSG D
125,941	85	Weighted Average
125,941	85	100.00% Pervious Area

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

Subcatchment 5E: Existing - Area 5

Hydrograph



Summary for Subcatchment 1P: Proposed - Area 1

Runoff = 98.35 cfs @ 10.13 hrs, Volume= 34.741 af, Depth> 6.59"

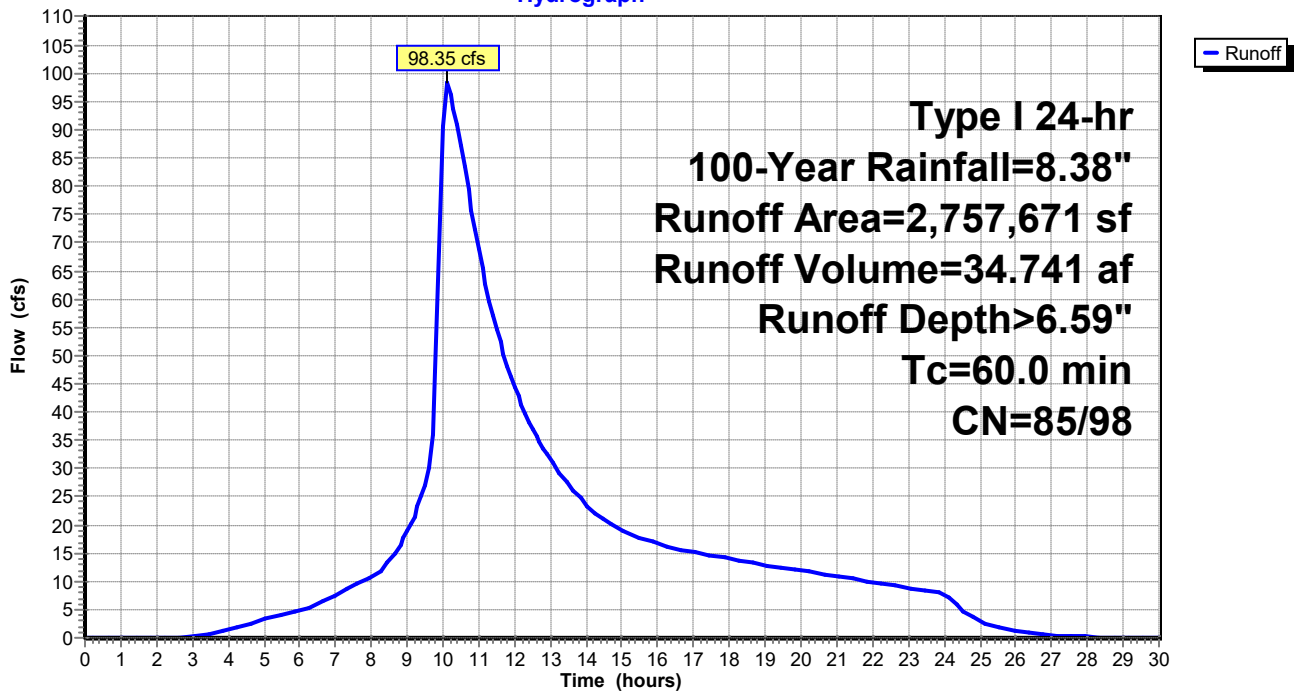
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
5,253	98	Paved parking, HSG D
3,730	98	Roofs, HSG D
2,748,688	85	Herbaceous range, Good, HSG D
2,757,671	85	Weighted Average
2,748,688	85	99.67% Pervious Area
8,983	98	0.33% Impervious Area

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

Subcatchment 1P: Proposed - Area 1

Hydrograph



Summary for Subcatchment 2P: Proposed - Area 2

Runoff = 10.50 cfs @ 10.03 hrs, Volume= 1.788 af, Depth= 6.64"

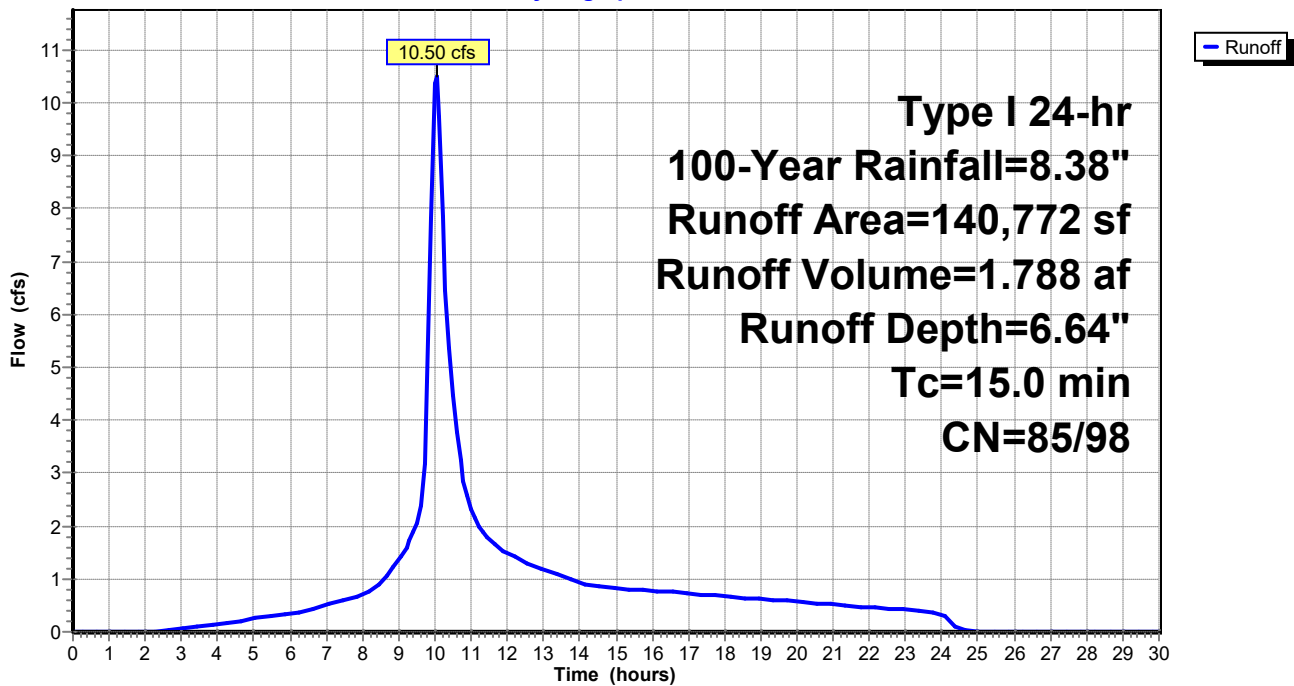
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
3,680	89	Dirt roads, HSG D
2,500	98	Paved parking, HSG D
2,955	98	Roofs, HSG D
131,637	85	Herbaceous range, Good, HSG D
140,772	86	Weighted Average
135,317	85	96.12% Pervious Area
5,455	98	3.88% Impervious Area

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

Subcatchment 2P: Proposed - Area 2

Hydrograph



Summary for Subcatchment 3AP: Proposed - Area 3A

Runoff = 14.98 cfs @ 10.08 hrs, Volume= 3.584 af, Depth= 6.62"

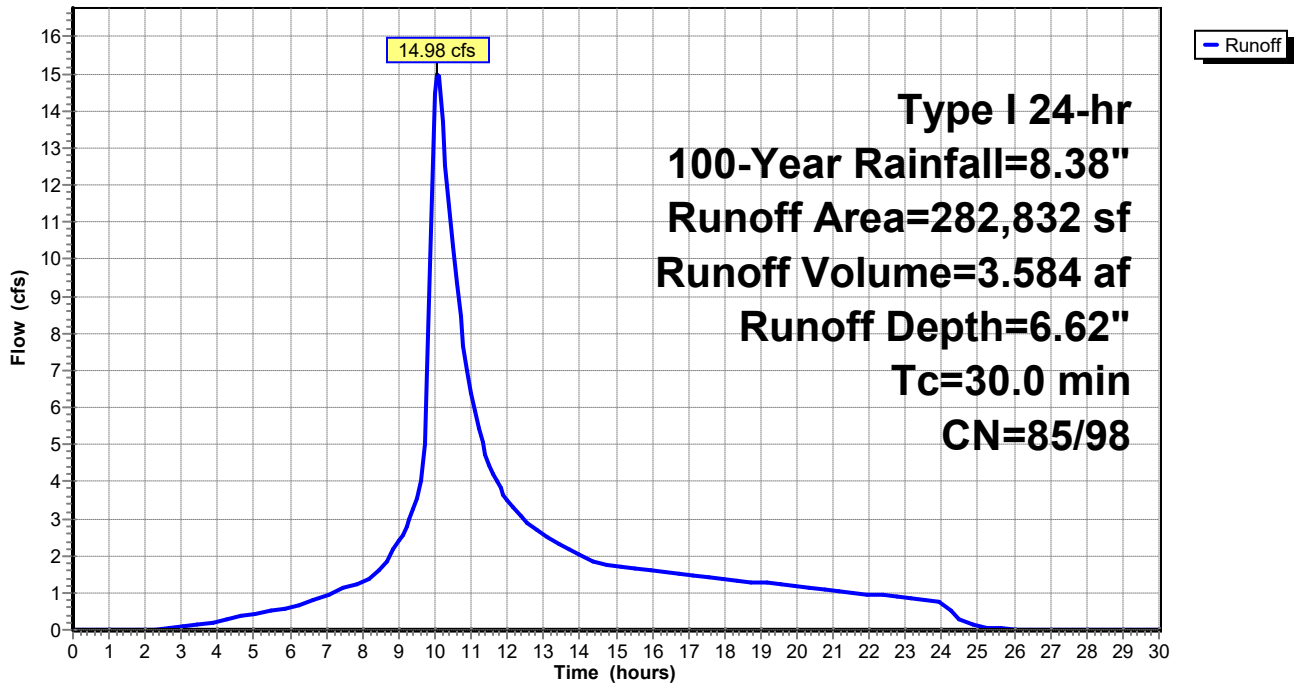
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
7,870	98	Paved parking, HSG D
0	98	Roofs, HSG D
274,962	85	Herbaceous range, Good, HSG D
282,832	85	Weighted Average
274,962	85	97.22% Pervious Area
7,870	98	2.78% Impervious Area

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

Subcatchment 3AP: Proposed - Area 3A

Hydrograph



Summary for Subcatchment 3BP: Proposed - Area 3B

Runoff = 10.24 cfs @ 10.03 hrs, Volume= 1.753 af, Depth= 6.72"

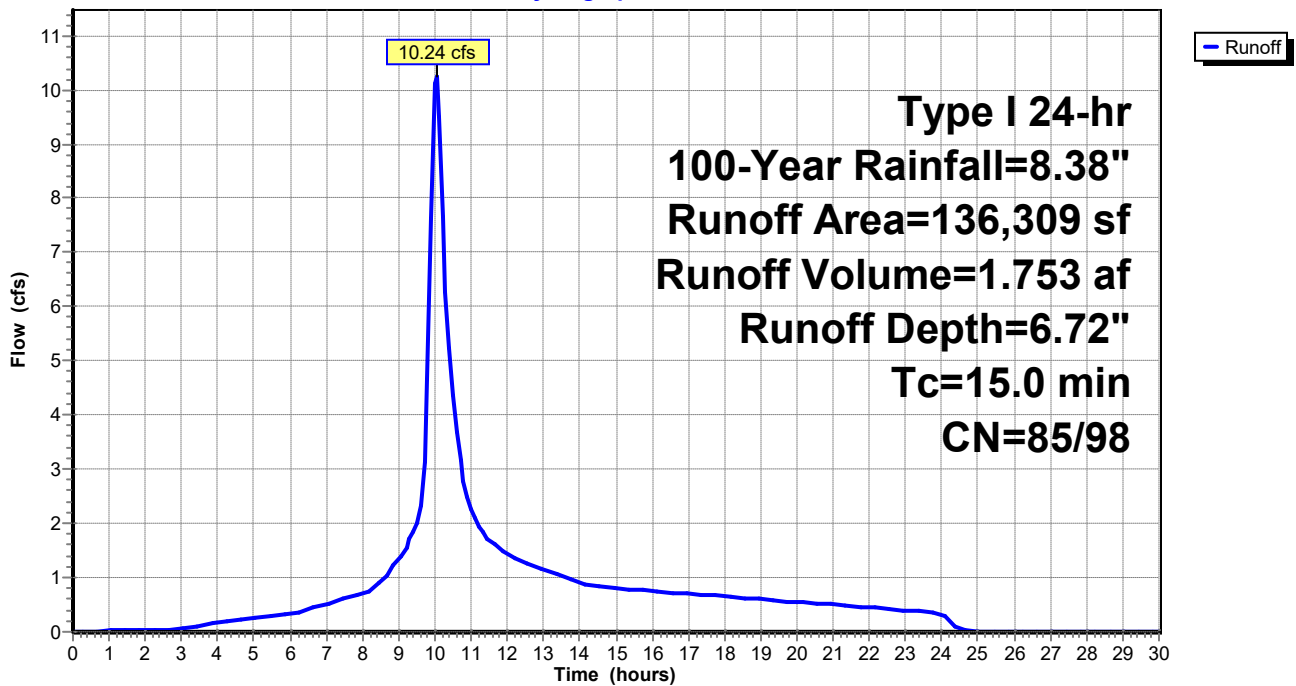
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
5,120	89	Dirt roads, HSG D
12,480	98	Paved parking, HSG D
0	98	Roofs, HSG D
118,709	85	Herbaceous range, Good, HSG D
136,309	86	Weighted Average
123,829	85	90.84% Pervious Area
12,480	98	9.16% Impervious Area

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

Subcatchment 3BP: Proposed - Area 3B

Hydrograph



Summary for Subcatchment 3CP: Proposed - Area 3C

Runoff = 20.40 cfs @ 10.03 hrs, Volume= 3.464 af, Depth= 6.58"

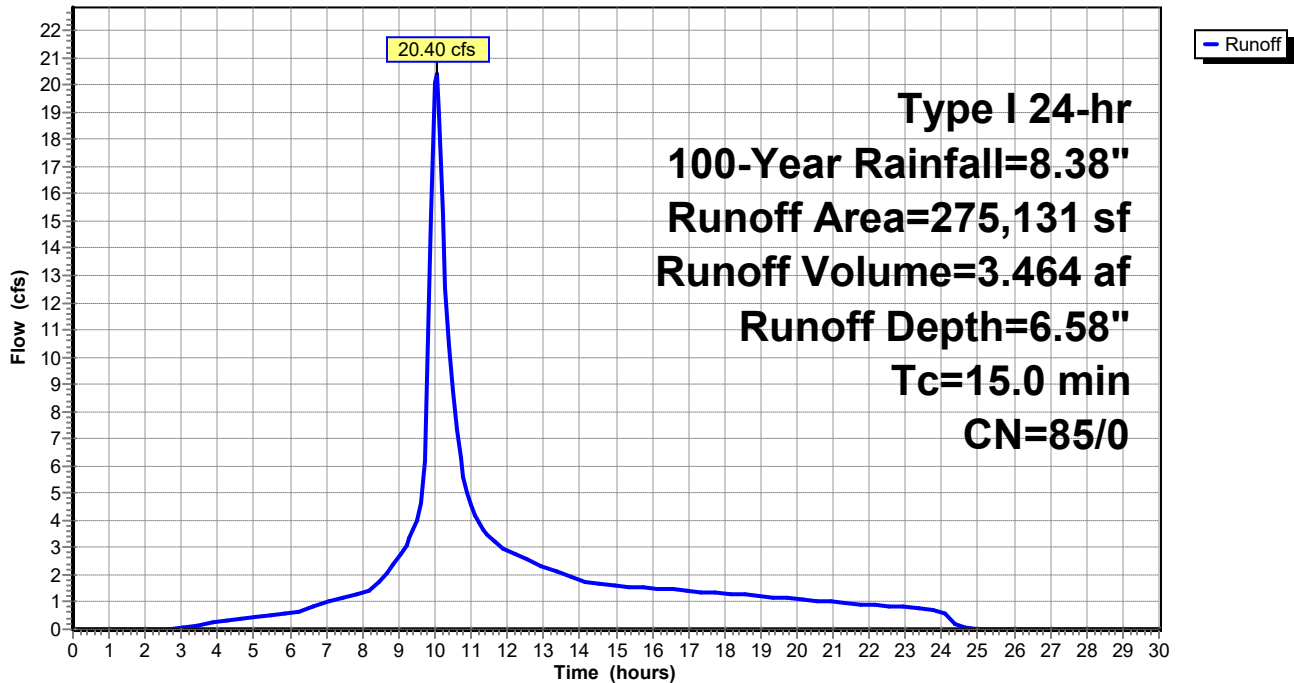
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
0	98	Paved parking, HSG D
0	98	Roofs, HSG D
275,131	85	Herbaceous range, Good, HSG D
275,131	85	Weighted Average
275,131	85	100.00% Pervious Area

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

Subcatchment 3CP: Proposed - Area 3C

Hydrograph



Summary for Subcatchment 3P: Proposed - Area 3

Runoff = 36.77 cfs @ 10.08 hrs, Volume= 8.801 af, Depth= 6.63"

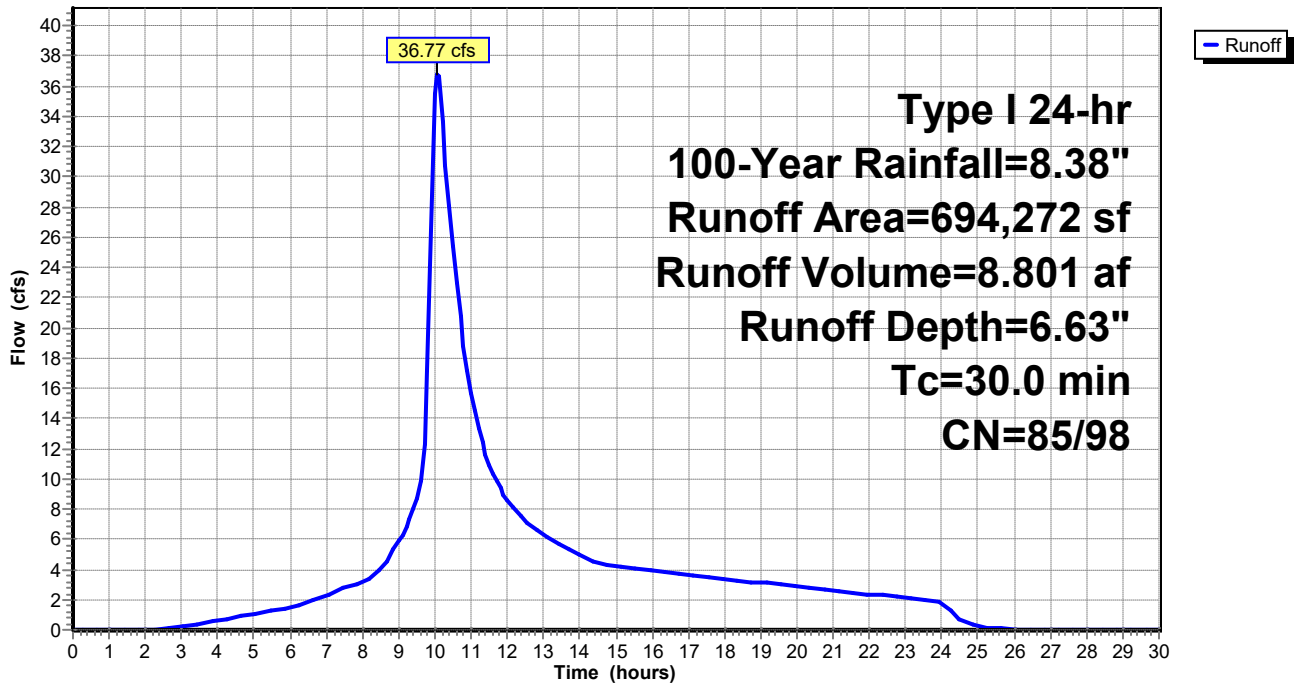
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
5,120	89	Dirt roads, HSG D
20,350	98	Paved parking, HSG D
0	98	Roofs, HSG D
668,802	85	Herbaceous range, Good, HSG D
694,272	85	Weighted Average
673,922	85	97.07% Pervious Area
20,350	98	2.93% Impervious Area

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

Subcatchment 3P: Proposed - Area 3

Hydrograph



Summary for Subcatchment 4P: Proposed - Area 4

Runoff = 25.74 cfs @ 10.04 hrs, Volume= 4.973 af, Depth= 6.61"

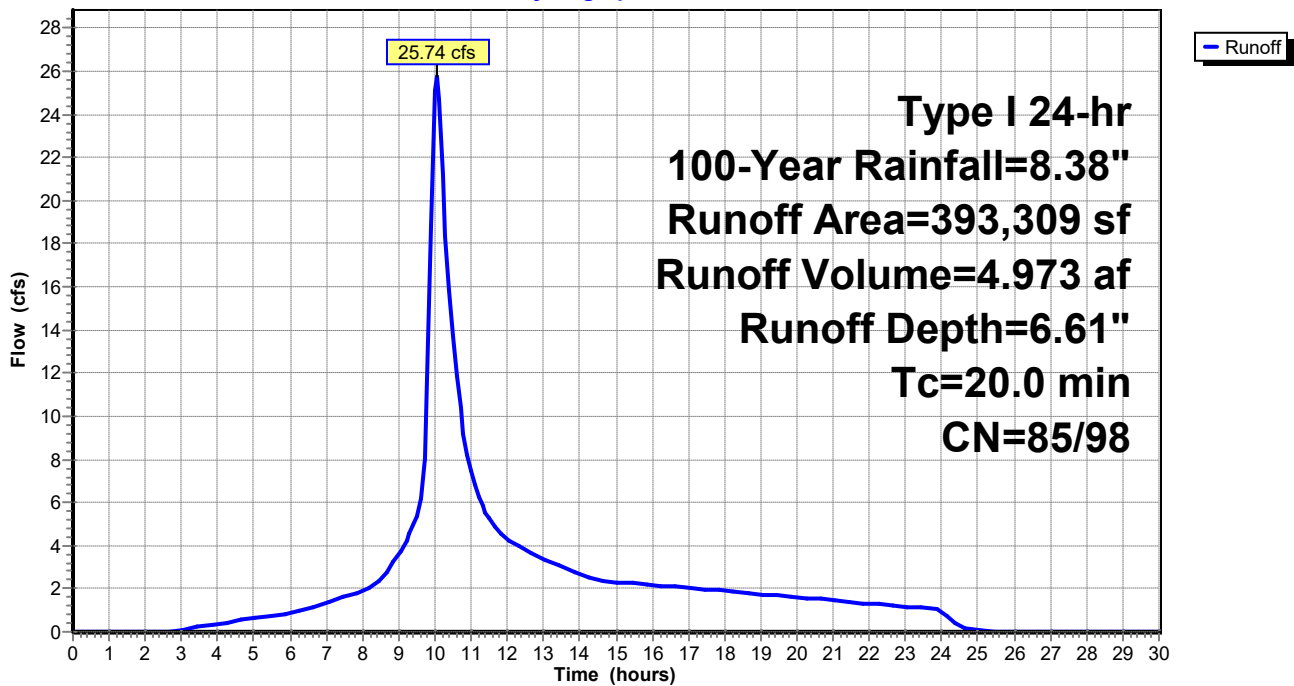
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
7,360	98	Paved parking, HSG D
0	98	Roofs, HSG D
385,949	85	Herbaceous range, Good, HSG D
393,309	85	Weighted Average
385,949	85	98.13% Pervious Area
7,360	98	1.87% Impervious Area

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

Subcatchment 4P: Proposed - Area 4

Hydrograph



Summary for Subcatchment 5P: Proposed - Area 5

Runoff = 9.40 cfs @ 10.03 hrs, Volume= 1.604 af, Depth= 6.66"

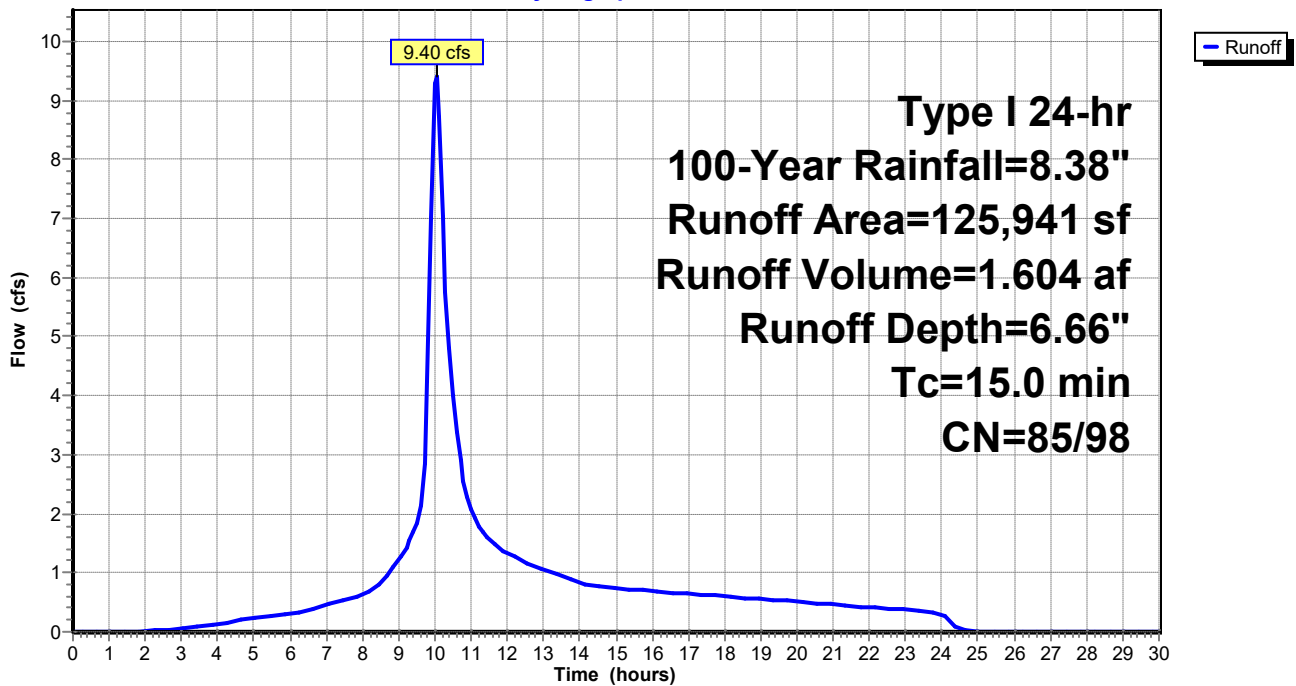
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.10 hrs
 Type I 24-hr 100-Year Rainfall=8.38"

Area (sf)	CN	Description
0	89	Dirt roads, HSG D
6,080	98	Paved parking, HSG D
0	98	Roofs, HSG D
119,861	85	Herbaceous range, Good, HSG D
125,941	86	Weighted Average
119,861	85	95.17% Pervious Area
6,080	98	4.83% Impervious Area

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

Subcatchment 5P: Proposed - Area 5

Hydrograph



Culvert Report

25 Year Storm - Watershed 3A Culvert

Invert Elev Dn (ft) = 1076.00
Pipe Length (ft) = 36.00
Slope (%) = 1.00
Invert Elev Up (ft) = 1076.36
Rise (in) = 24.0
Shape = Circular
Span (in) = 24.0
No. Barrels = 1
n-Value = 0.012
Culvert Type = Circular Concrete
Culvert Entrance = Square edge w/headwall (C)
Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

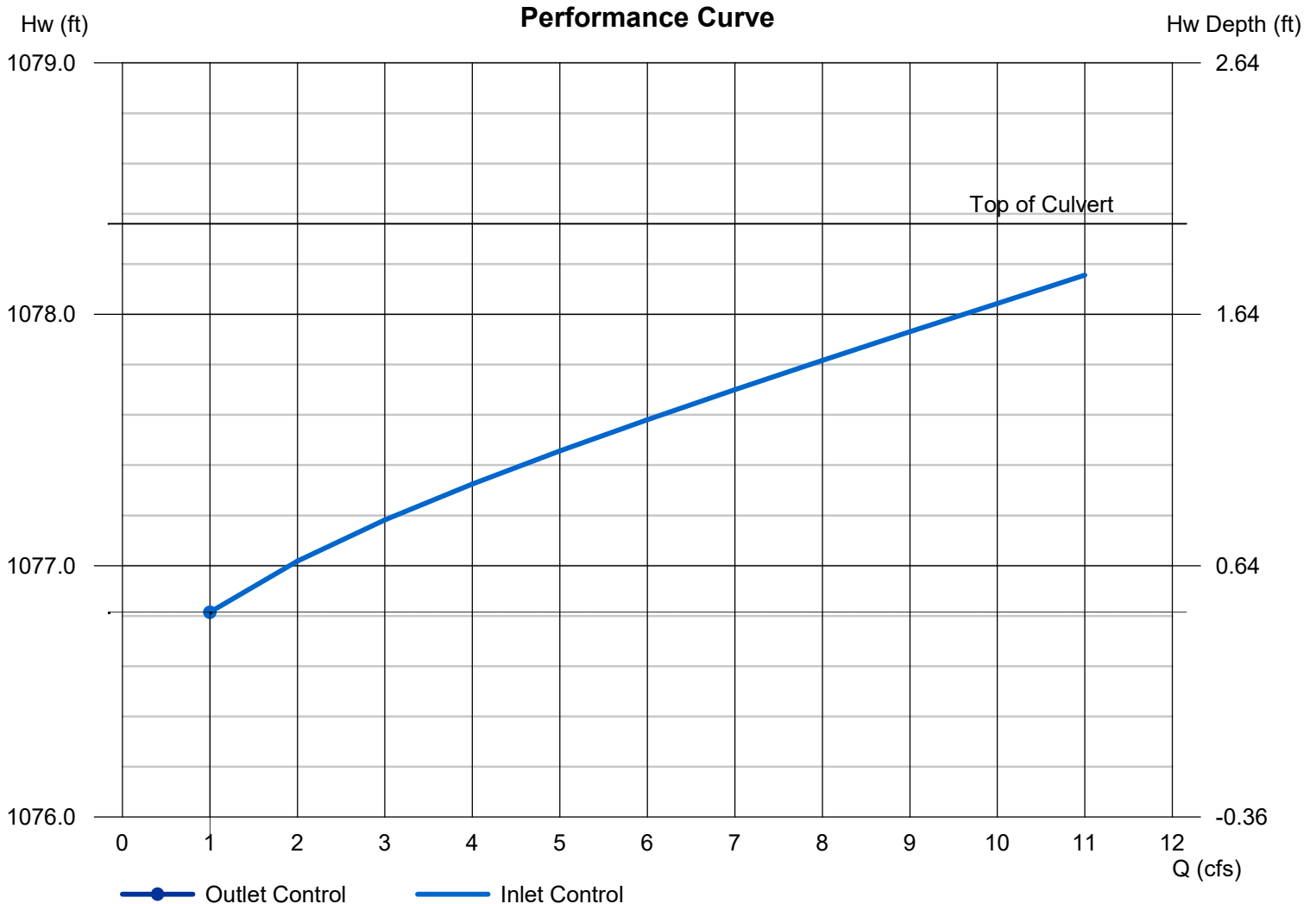
Top Elevation (ft) = 1089.00
Top Width (ft) = 20.00
Crest Width (ft) = 17.00

Calculations

Qmin (cfs) = 0.00
Qmax (cfs) = 11.34
Tailwater Elev (ft) = 0.00

Highlighted

Qtotal (cfs) = 1.00
Qpipe (cfs) = 1.00
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 3.77
Veloc Up (ft/s) = 2.77
HGL Dn (ft) = 1076.28
HGL Up (ft) = 1076.70
Hw Elev (ft) = 1076.82
Hw/D (ft) = 0.23
Flow Regime = Inlet Control



Culvert Report

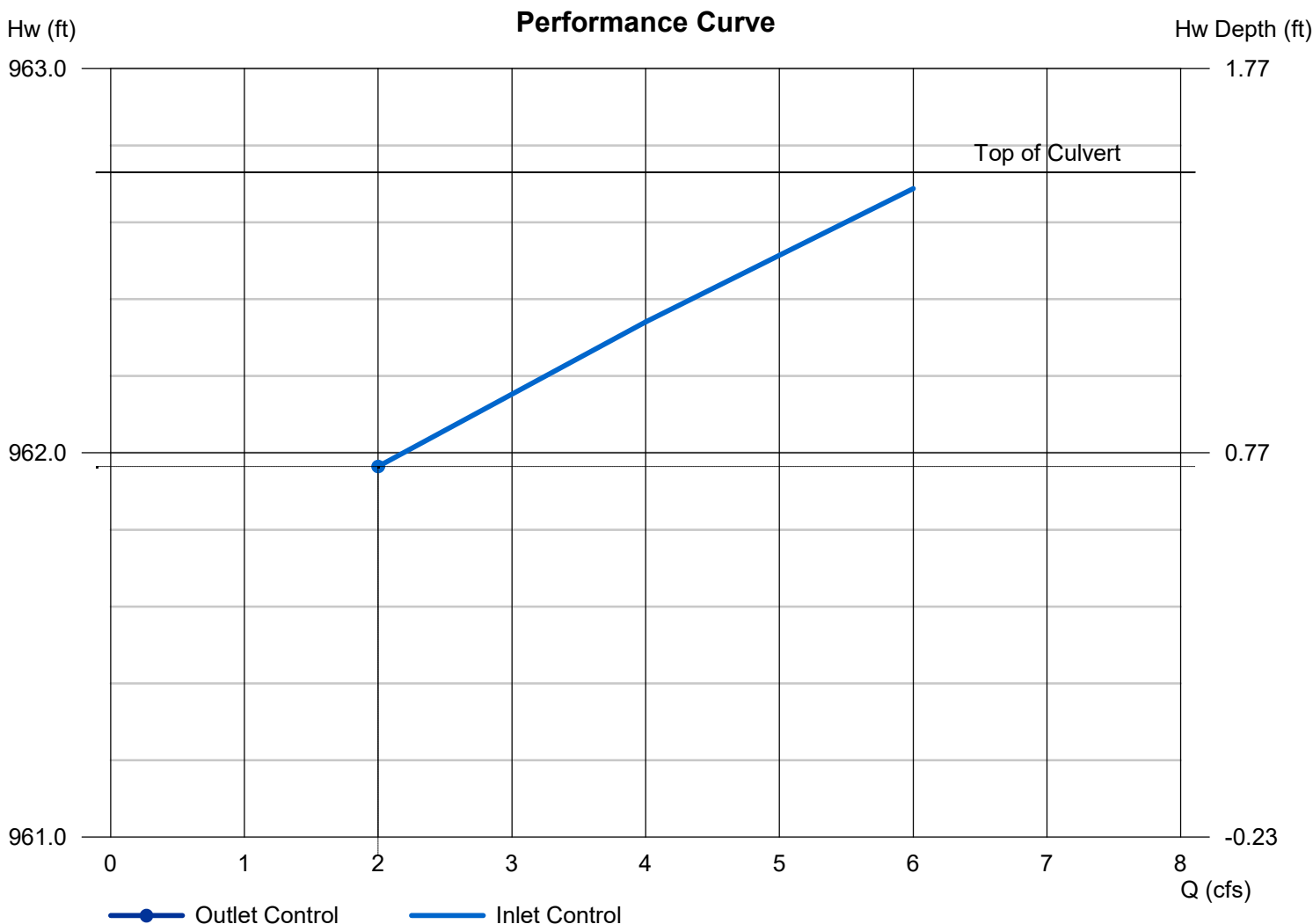
25 Year Storm - Watershed 3B Culvert

Invert Elev Dn (ft) = 961.00
 Pipe Length (ft) = 23.00
 Slope (%) = 1.00
 Invert Elev Up (ft) = 961.23
 Rise (in) = 18.0
 Shape = Circular
 Span (in) = 18.0
 No. Barrels = 1
 n-Value = 0.012
 Culvert Type = Circular Concrete
 Culvert Entrance = Square edge w/headwall (C)
 Coeff. K,M,c,Y,k = 0.0098, 2, 0.0398, 0.67, 0.5

Embankment
 Top Elevation (ft) = 967.00
 Top Width (ft) = 20.00
 Crest Width (ft) = 17.00

Calculations
 Qmin (cfs) = 0.00
 Qmax (cfs) = 7.80
 Tailwater Elev (ft) = 0.00

Highlighted
 Qtotal (cfs) = 2.00
 Qpipe (cfs) = 2.00
 Qovertop (cfs) = 0.00
 Veloc Dn (ft/s) = 4.67
 Veloc Up (ft/s) = 3.56
 HGL Dn (ft) = 961.44
 HGL Up (ft) = 961.76
 Hw Elev (ft) = 961.96
 Hw/D (ft) = 0.49
 Flow Regime = Inlet Control



Culvert Report

25 Year Storm - Watershed 4 Culvert

Invert Elev Dn (ft)	= 905.00
Pipe Length (ft)	= 28.00
Slope (%)	= 1.00
Invert Elev Up (ft)	= 905.28
Rise (in)	= 30.0
Shape	= Circular
Span (in)	= 30.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment	
Top Elevation (ft)	= 908.50
Top Width (ft)	= 20.00
Crest Width (ft)	= 17.00

Calculations	
Qmin (cfs)	= 0.00
Qmax (cfs)	= 19.50
Tailwater Elev (ft)	= 0.00

Highlighted	
Qtotal (cfs)	= 18.00
Qpipe (cfs)	= 18.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 7.68
Veloc Up (ft/s)	= 6.17
HGL Dn (ft)	= 906.21
HGL Up (ft)	= 906.72
Hw Elev (ft)	= 907.43
Hw/D (ft)	= 0.86
Flow Regime	= Inlet Control



Channel Report

100 year - Road Cannel Capacity

Gutter

Cross Sl, Sx (ft/ft) = 0.020
Cross Sl, Sw (ft/ft) = 0.080
Gutter Width (ft) = 1.00
Invert Elev (ft) = 908.00
Slope (%) = 20.00
N-Value = 0.015

Highlighted

Depth (ft) = 0.33
Q (cfs) = 25.74
Area (sqft) = 1.83
Velocity (ft/s) = 14.10
Wetted Perim (ft) = 13.73
Crit Depth, Yc (ft) = 0.64
Spread Width (ft) = 13.40
EGL (ft) = 3.42

Calculations

Compute by: Known Q
Known Q (cfs) = 25.74

