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Project Narrative

For

Serenity Acres
Broadlea Road
Town of Goshen
Orange County, New York

Prepared for:
Oak Hill Properties, LLC
PO Box 998
Goshen, New York 10924
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Prepared by:
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Prepared:
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A. Description of Project Site:

The project site is located in the Town of Goshen, Orange County, New York on the northerly side of Broadlea Road. The parcel is currently identified as tax map parcel: Section 9, Block 1, Lot 6.1. The site contains 36.48 acres of land located in the RU zoning district and AQ-3 Aquifer Overlay zone.

B. Existing Conditions:

The project site is currently wooded and vacant. According to the United States Department of Agriculture National Cooperative soil survey, the soils located on the project site are primarily Mardin gravelly silt loam and Erie gravelly silt loam, classified as hydrologic soils group (HSG) “D” soils; Alden silt loam, classified as HSG “C/D” soils; and Rock outcrop-Nassau complex, with an unlisted soil classification. Soils with a dual classification are classified as HSG “D” soils in their natural, un-drained state. Based upon multiple field inspections completed by this office the soils on the site have all been classified as HSG “D” soils. The contains federal wetlands under the jurisdiction of the United States Army Corps of Engineers (ACOE). Runoff from the project site is generally in the form of sheet flow.

C. Proposed Development:

The proposed development is a eight (8) lot residential subdivision resulting in the creation of seven (7) additional tax parcels. Each of the proposed lots will be served by an onsite well and subsurface sewage disposal system. The total disturbance associated with the proposed development is approximately 4.91-acres.

The minimum required lot size for the RU zoning district is 1-acre and subject to the Environmental Control Formula included on sheet 2 of the subdivision plan. The proposed lot areas are outlined in the following table:

Table 1: Proposed Lot Area Summary	
<i>Lot:</i>	<i>Area:</i>
1	1.91 acres
2	3.87 acres
3	2.26 acres
4	5.12 acres
5	5.57 acres
6	5.75 acres
7	5.37 acres
8	5.14 acres

All of the proposed lots meet the minimum lot area requirements

D. Existing Drainage Conditions:

Runoff from a portion of the proposed development area is tributary to the two (2) existing drainage culverts under Broadlea Road along the site frontage. A summary of the existing drainage system is included in the table below:



Table 2: Existing Drainage System Summary		
Designation	Type	Tributary Area from Site
A	24" CMP	±20.6 acres
B	24" CMP	±0.26 acres

Culvert 'A' is an existing 24" CMP pipe that conveys runoff from the northeasterly side of Broadlea Road. Based upon a field inspection of the project site the existing culvert is a 24" CMP culvert with approximately 20-inches of cover. The capacity of the existing culvert was determined utilizing *Hydraulic Design of Highway Culvert*, Chart 2B. Based upon the observed inlet conditions the maximum capacity of the existing culvert was determined to be approximately 22 cubic feet per second (cfs). A copy of the culvert capacity chart is included as **Attachment 1**.

Culvert 'B' is an existing 24" CMP pipe conveying runoff from the northeasterly side of Broadlea Road. The drainage area for Culvert 'B' is limited to that portion of the existing roadside swale extending approximately 500-feet east of the pipe inlet.

The location of the existing culverts are shown in Figure 1, below:

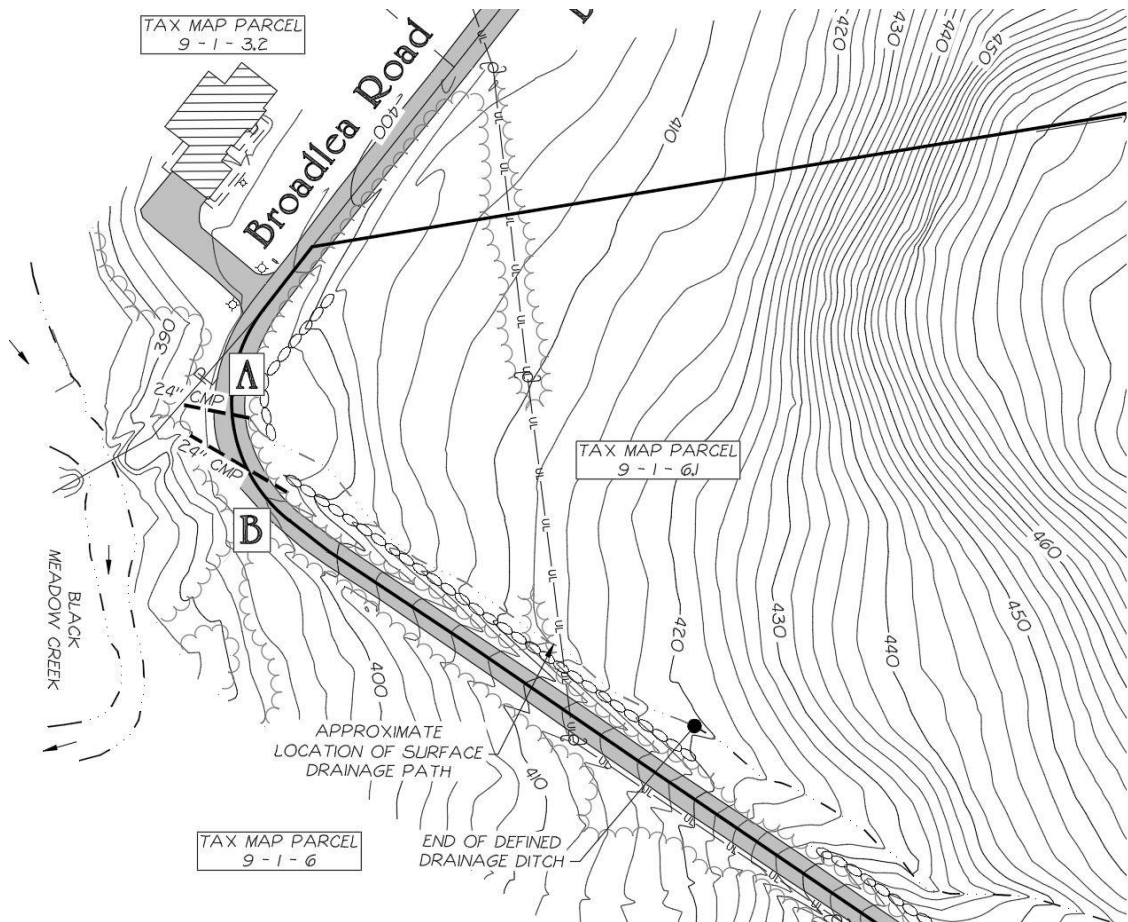


Figure 1: Existing Drainage Conditions



E. Analysis of Existing Culverts:

An analysis was completed to determine the capacity of the existing culverts to accommodate the proposed development conditions. The tributary drainage areas to the existing culverts resulting from the proposed development are shown in Figure 2, below:

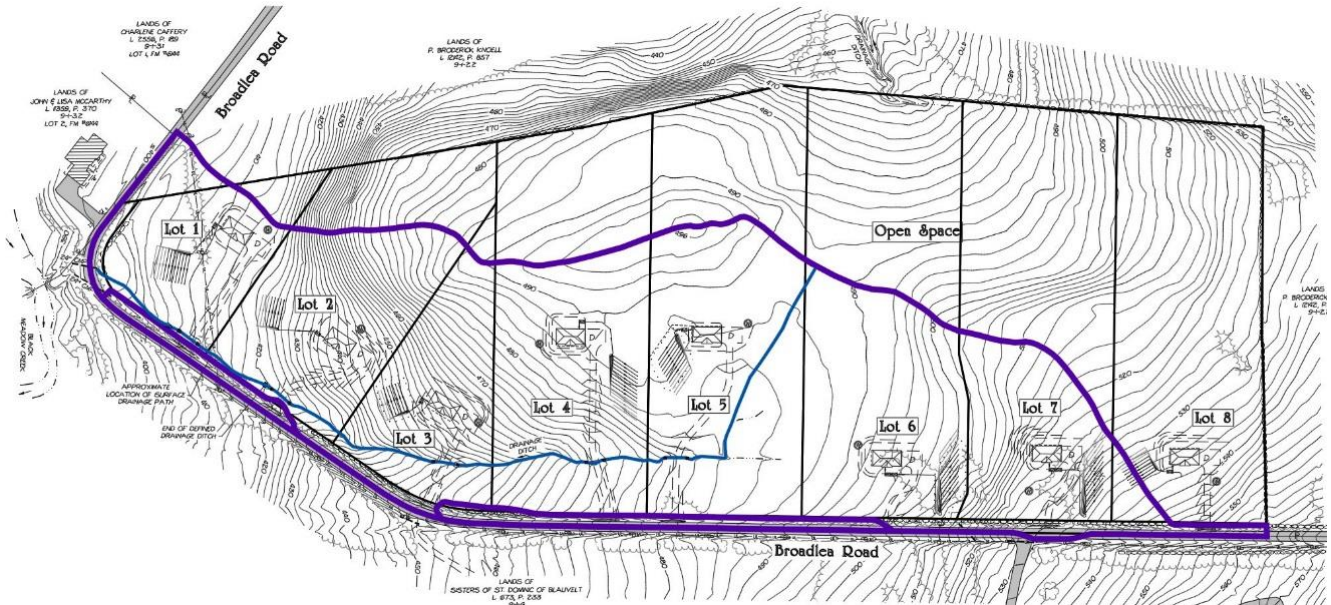


Figure 2: Tributary Drainage Area to Existing Culverts

To analyze the impacts of the proposed development on the existing culverts, drainage areas were approximated based upon the topography for the project site, United States Geological Survey maps, and field visits. The drainage area was bound at the northeasterly corner of the site along Broadlea Road for the purposes of this analysis. The hydrological analysis was completed for the proposed drainage areas tributary to the Culvert 'A'. The adjacent road elevation was utilized as a limiting / flood control level for the purposes of determining pipe capacity.

Due to the limited drainage area tributary to Culvert 'B' from the project site a hydrological analysis of this location was not completed. The proposed improvements are not anticipated to have a substantial impact, if any, of the overall runoff conditions tributary to Culvert 'B'.

Rainfall data utilized in the hydrological modelling was obtained from information prepared by Cornell University in a joint collaboration between the Northeast Regional Climate Center (NRCC) and the Natural Resources Conservation Service (NRCS). The referenced data is available online at the Extreme Precipitation in New York & New England website (<http://precip.net.eas.cornell.edu>). Utilizing the current rainfall frequency values generated for the specific project location, rainfall data was generated for the 1-, 5-, 10-, and 25-year, 24-hour storm events. All calculations were completed using HydroCAD 10.00 software. Copies of the pre- and post-development runoff calculations are included as **Attachment 2**.



The proposed runoff conditions at the subject culvert are outlined in the table below:

Table 3: Culvert 'A' Drainage Summary – 24" CMP		
<i>Storm Event</i>	<i>Pre-Development Peak Flow (cfs)</i>	<i>Post-Development Peak Flow (cfs)</i>
1-year	6.79	7.31
5-year	14.65	15.24
10-year	19.04	19.64
25-year	26.45	27.04

The proposed development will increase the peak flows tributary to the existing culvert by approximately 0.6 cubic feet per second for each of the analyzed storm events. The calculated flows for the post-development conditions represent an increase of approximately 3.2% and 2.2% for the 10-year and 25-year storm events, respectively. With an anticipated capacity of approximately 22 cubic feet per second, the existing 24" CMP culvert adequately conveys the calculated peak runoff from the 10-year storm event for both pre- and post-development conditions.

The calculated 25-year storm event peak runoff for the existing site conditions exceeds the capacity of the culvert based upon the analysis completed. This office is not aware of any drainage concerns associated with the existing culverts during large storm events that would be consistent with the modelling. The difference between the calculated peak runoff and actual capacity of the existing culvert is presumed to be the result of intricacies within the tributary drainage area that are beyond the scope of what can be accurately depicted by the modelling. The TR-55 methodologies utilized for the analysis have limited ability to model the effects of extremely flat, densely vegetated areas similar to those found on the project site. Actual runoff conditions will include isolated detention in the wetland area and other shallow depressions within the site that cannot be properly depicted by the modelling. As such, the calculated peak flows represent a conservative estimate of the runoff conditions from the project site.

Based upon the analysis above, the proposed improvements are not anticipated to significantly alter the existing peak flows tributary to the existing 24" CMP culvert under Broadlea Road. The ability of the culvert to convey peak runoff from the developed project site is expected to be generally consistent with the existing drainage conditions.

F. Analysis of Road Swales:

An analysis was completed to determine the impacts of the proposed driveway culverts in the existing roadside swales located along Broadlea Road. Specifically, whether the proposed driveway culvert installation would contribute to or result in erosion along the existing swales. The proposed Lot 3 driveway culvert was chosen as the representative study point as it includes the largest tributary drainage area (approximately 0.5-acres).



To determine the peak runoff volume from the tributary drainage area, a drainage analysis was completed based upon the rational method equation:

$$Q = CiA$$

Where;

$$\begin{aligned} Q &= \text{peak runoff (cubic feet per second)} \\ C &= \text{rational coefficient} \\ i &= \text{rainfall intensity (inches/hour)} \\ A &= \text{tributary drainage area (acres)} \end{aligned}$$

To provide a conservative estimate of the runoff tributary to the roadside swale, the rational coefficient (C) was estimated to be 0.95 for the entirety of the tributary drainage area (both grassed swale and pavement). Peak runoff was calculated for the 25-year storm event for the drainage area tributary to the culvert and swale.

$$Q = CiA = (0.95)*(5.98)*(0.5) = 2.84 \text{ cubic feet per second (cfs)}$$

The velocity at the culvert outlet within the swale was determined using the following formula:

$$V = Q / A$$

Where;

$$\begin{aligned} V &= \text{flow velocity (feet per second)} \\ Q &= \text{flow rate (cubic feet per second)} \\ A &= \text{interior area of pipe (square feet)} \end{aligned}$$

$$V = Q / A = (2.84) / (\pi*(1.25/2)^2) = 2.31 \text{ feet per second (fps)}$$

In accordance with Table 3.1 of the *New York State Standards and Specifications for Erosion and Sediment Control*, November 2016 edition, the maximum permissible velocity is 2.5 feet per second for small grain grasses in sandy soil types. Based upon the specific onsite soil and cover conditions the maximum permissible velocity to prevent erosion within the swale is anticipated to be closer to 3.0 – 3.5 feet per second. These values are consistent with the maximum permissible velocity in Appendix L, Table L.1 of the *New York State Stormwater Management Design Manual*, 2015 edition for the most comparable site conditions.

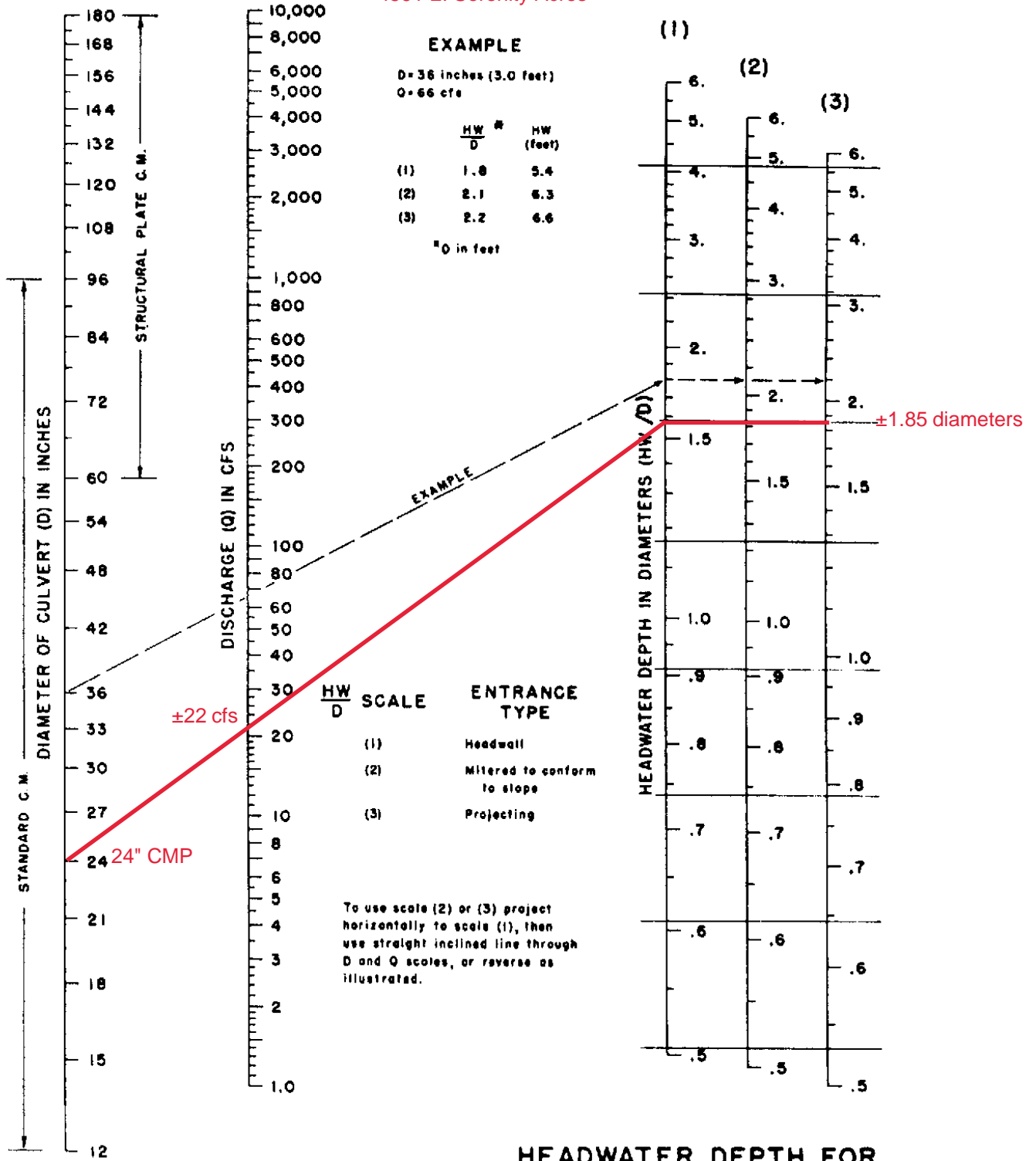
Based on the information above, the maximum anticipated velocity at the driveway culvert outlets is not anticipated to result in erosion of the existing swale.



Attachment 1

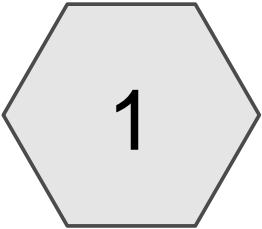
CHART 2B

4591-2: Serenity Acres

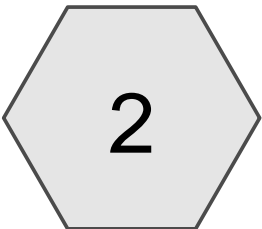


HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

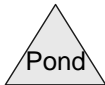
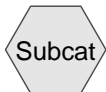
Attachment 2



Pre-Development
Drainage Area Tributary
to Ex. 24" HDPE



Post-Development
Drainage Area Tributary
to Ex. 24" HDPE



Summary for Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 6.79 cfs @ 13.09 hrs, Volume= 1.667 af, Depth= 0.97"

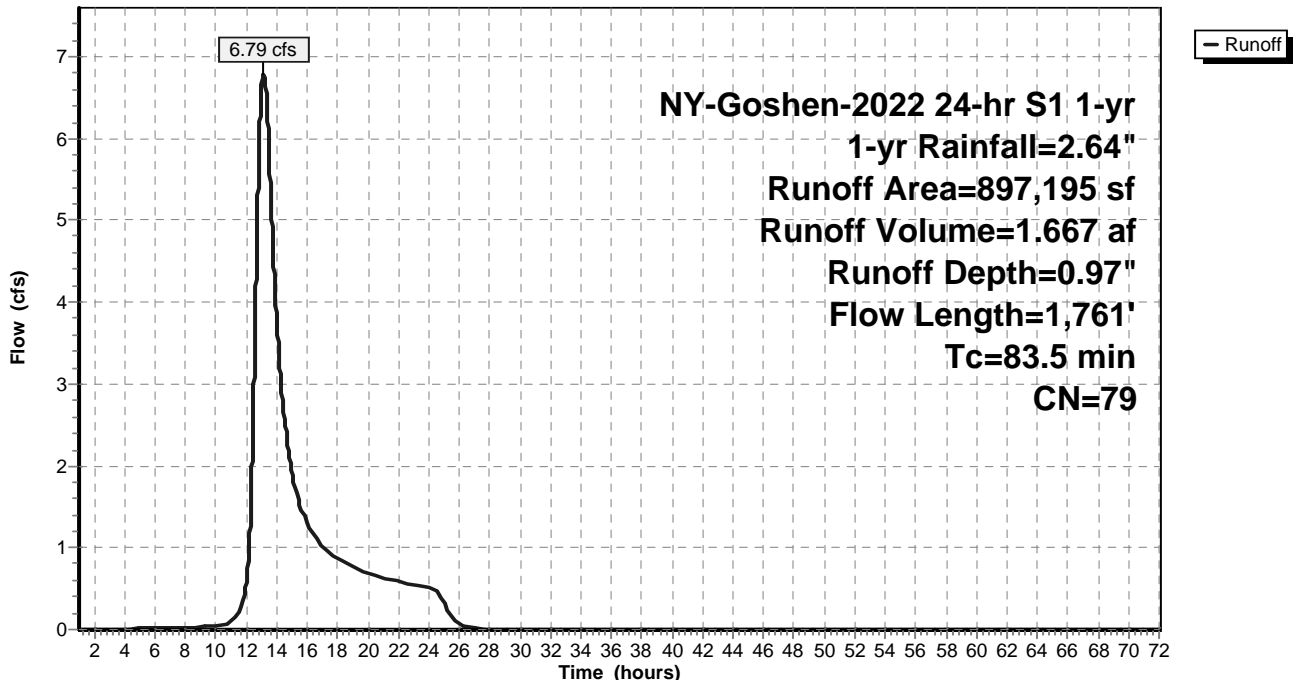
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 1-yr 1-yr Rainfall=2.64"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
873,616	79	Woods, Fair, HSG D
897,195	79	Weighted Average
873,616	79	97.37% Pervious Area
23,579	98	2.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph



Summary for Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 7.31 cfs @ 13.09 hrs, Volume= 1.798 af, Depth= 1.05"

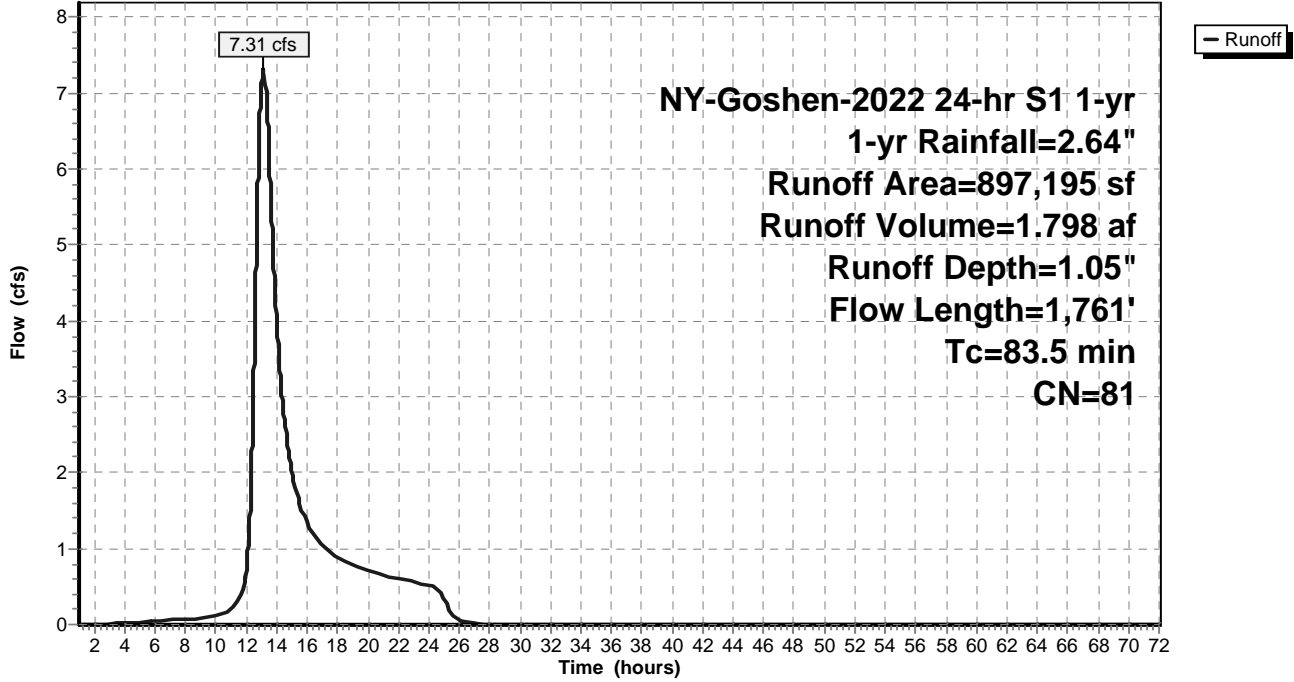
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 1-yr 1-yr Rainfall=2.64"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
* 40,530	98	Prop. Impervious
680,976	79	Woods, Fair, HSG D
152,110	80	>75% Grass cover, Good, HSG D
897,195	81	Weighted Average
833,086	79	92.85% Pervious Area
64,109	98	7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph



Summary for Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 14.65 cfs @ 13.08 hrs, Volume= 3.465 af, Depth= 2.02"

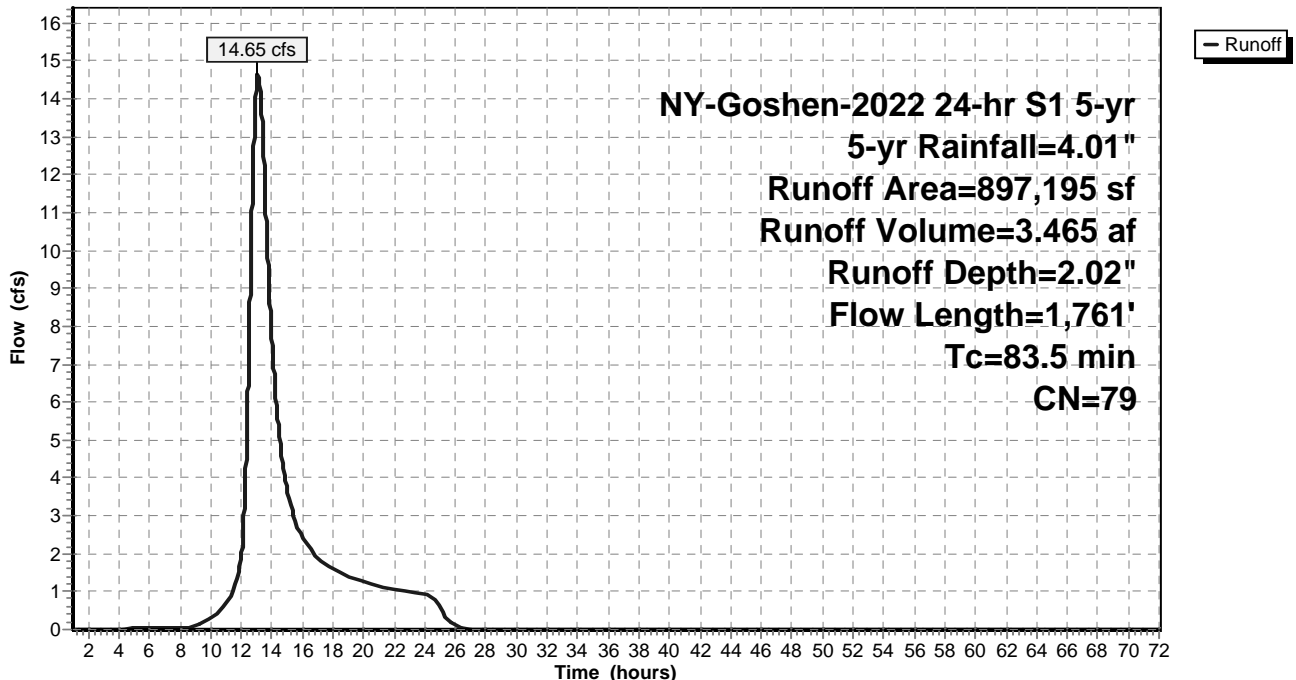
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 5-yr 5-yr Rainfall=4.01"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
873,616	79	Woods, Fair, HSG D
897,195	79	Weighted Average
873,616	79	97.37% Pervious Area
23,579	98	2.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph



Summary for Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 15.24 cfs @ 13.08 hrs, Volume= 3.628 af, Depth= 2.11"

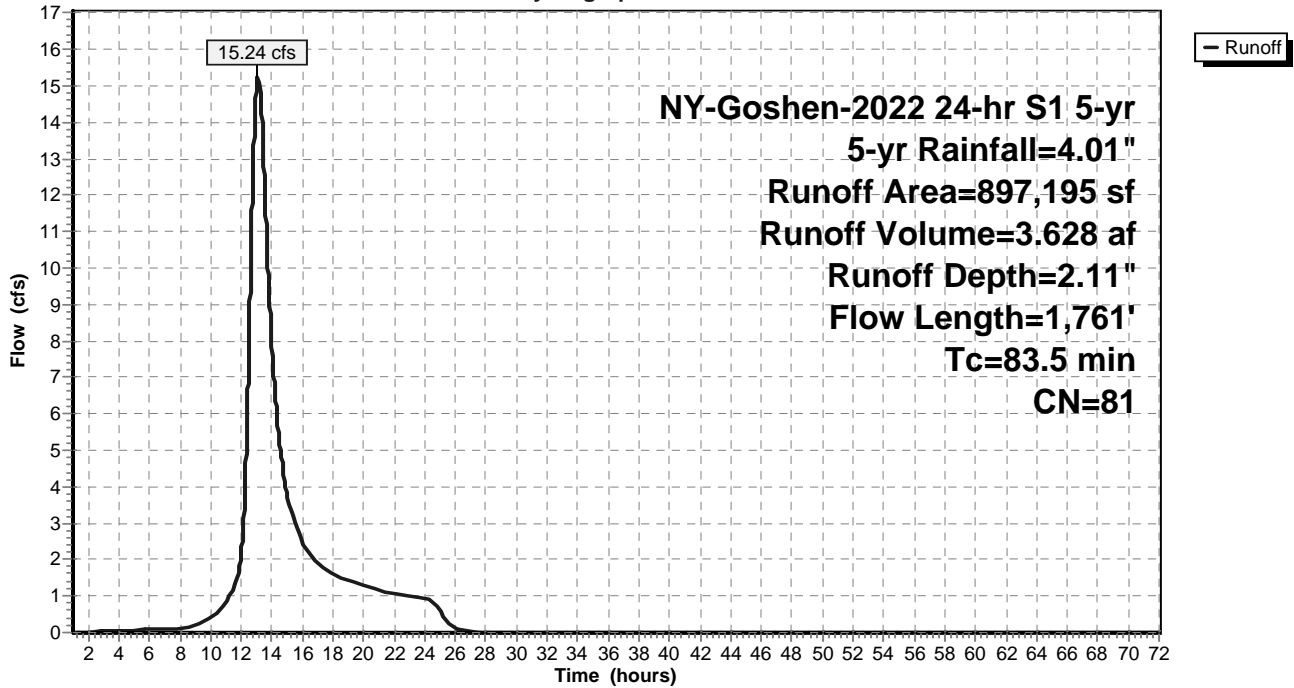
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 5-yr 5-yr Rainfall=4.01"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
* 40,530	98	Prop. Impervious
680,976	79	Woods, Fair, HSG D
152,110	80	>75% Grass cover, Good, HSG D
897,195	81	Weighted Average
833,086	79	92.85% Pervious Area
64,109	98	7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph



Summary for Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 19.04 cfs @ 13.08 hrs, Volume= 4.543 af, Depth= 2.65"

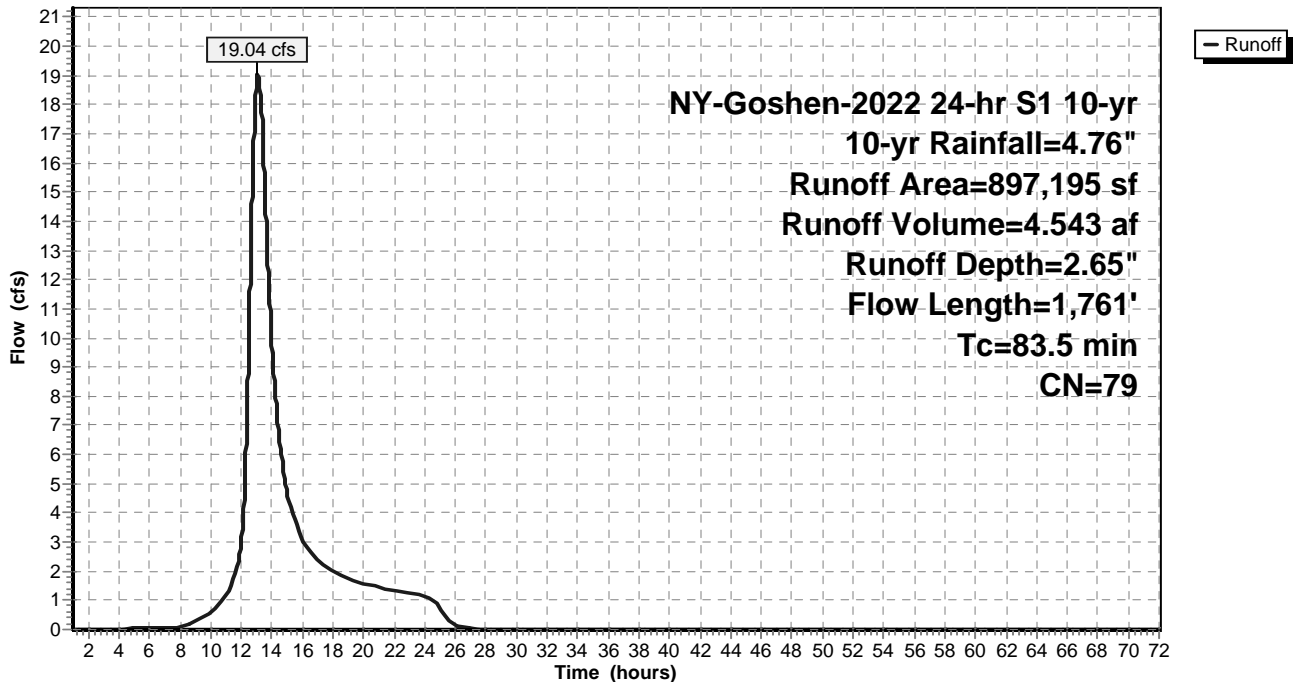
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 10-yr 10-yr Rainfall=4.76"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
873,616	79	Woods, Fair, HSG D
897,195	79	Weighted Average
873,616	79	97.37% Pervious Area
23,579	98	2.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph



Summary for Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 19.64 cfs @ 13.08 hrs, Volume= 4.718 af, Depth= 2.75"

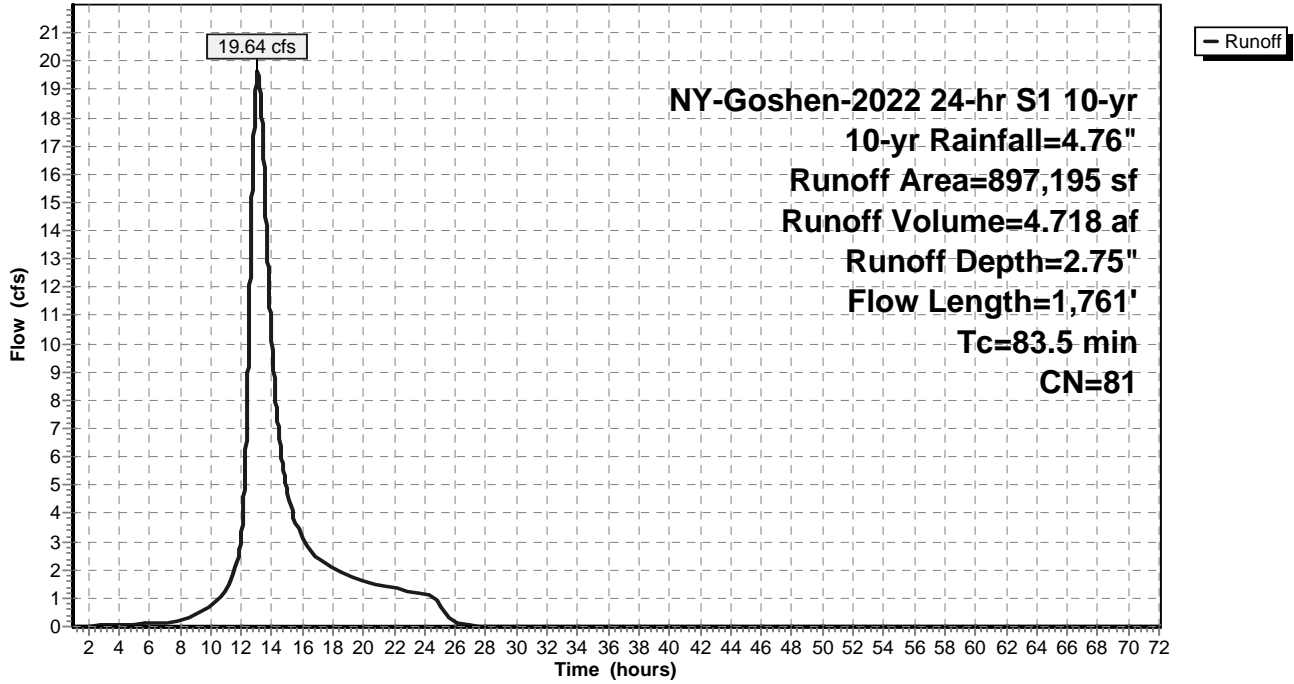
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 10-yr 10-yr Rainfall=4.76"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
* 40,530	98	Prop. Impervious
680,976	79	Woods, Fair, HSG D
152,110	80	>75% Grass cover, Good, HSG D
897,195	81	Weighted Average
833,086	79	92.85% Pervious Area
64,109	98	7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph



Summary for Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 26.45 cfs @ 13.08 hrs, Volume= 6.379 af, Depth= 3.72"

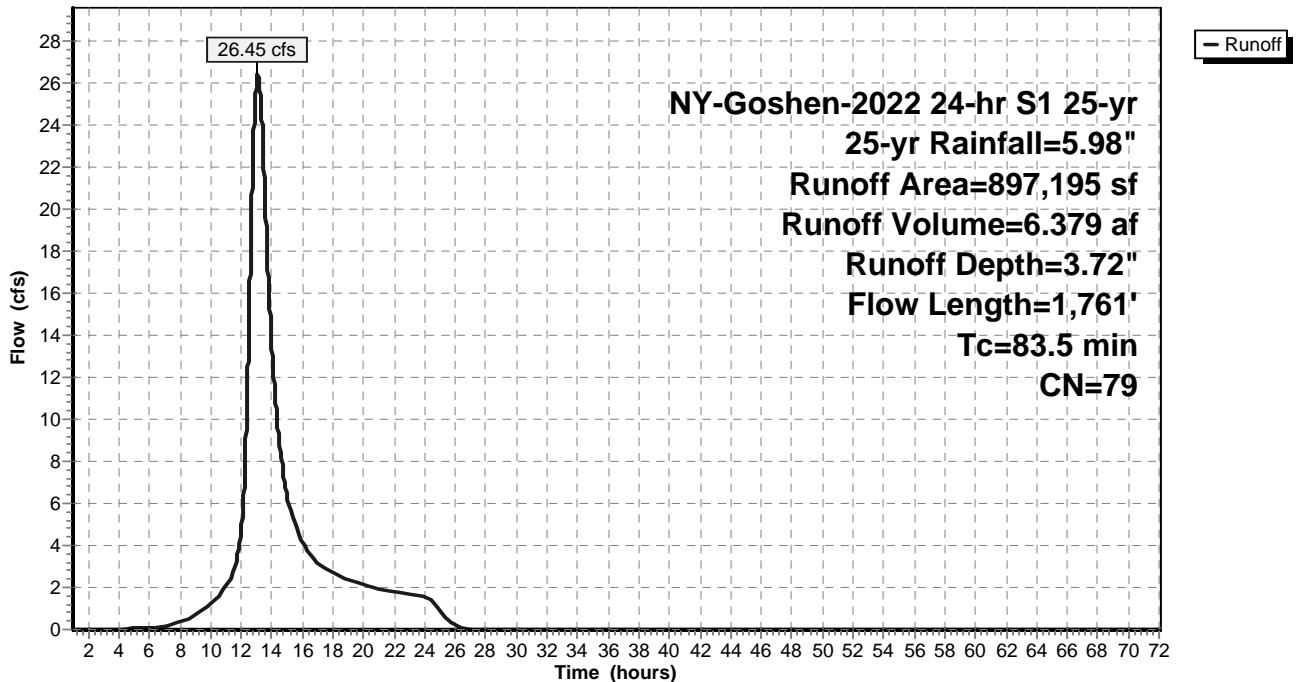
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 25-yr 25-yr Rainfall=5.98"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
873,616	79	Woods, Fair, HSG D
897,195	79	Weighted Average
873,616	79	97.37% Pervious Area
23,579	98	2.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 1: Pre-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph



Summary for Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Runoff = 27.04 cfs @ 13.08 hrs, Volume= 6.570 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
 NY-Goshen-2022 24-hr S1 25-yr 25-yr Rainfall=5.98"

Area (sf)	CN	Description
* 23,579	98	Ex. Impervious
* 40,530	98	Prop. Impervious
680,976	79	Woods, Fair, HSG D
152,110	80	>75% Grass cover, Good, HSG D
897,195	81	Weighted Average
833,086	79	92.85% Pervious Area
64,109	98	7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
56.9	100	0.0070	0.03		Sheet Flow, Sheet1 Woods: Dense underbrush n= 0.800 P2= 3.20"
18.9	311	0.0120	0.27		Shallow Concentrated Flow, Shallow1 Forest w/Heavy Litter Kv= 2.5 fps
2.3	950	0.0674	6.90	34.49	Channel Flow, Channel1 Area= 5.0 sf Perim= 10.1' r= 0.50' n= 0.035 Earth, dense weeds
5.4	400	0.0600	1.22		Shallow Concentrated Flow, Shallow2 Woodland Kv= 5.0 fps
83.5	1,761	Total			

Subcatchment 2: Post-Development Drainage Area Tributary to Ex. 24" HDPE

Hydrograph

