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CIVIL & TRAFFIC ENGINEERS / LAND SURVEYORS / PLANNERS / LANDSCAPE ARCHITECTS
Serving Connecticut, Massachusetts, & Rhode Island

June 2, 2023

Jeff Doolittle, P.E.
Town Engineer
1540 Sullivan Ave.
South Windsor, CT 06074

Re: Newberry Brook Analysis
App. #23-11P ~ 75 Connecticut Ave Site Plan

Dear Mr. Doolittle:

In response to your request for more information on potential impacts of the subject development on the culvert conveying Newberry Brook underneath Main Street, DPI conducted a hydrologic analysis of the watershed draining to this culvert. The watershed boundary draining to this point of the brook was generated using the USGS StreamStats application. See **Attachment E** for our Watershed Map. HydroCAD computer modeling software was used to run the analysis. Analysis results are included as **Attachment A**. For more information on references to existing and proposed site conditions, please refer to our previously submitted stormwater management report titled "*Stormwater Management Report ~ Industrial Flex ~ 75 Connecticut Ave South Windsor, CT*" Dated March 10, 2023.

The Newberry Brook

The USGS stream stats application was used to delineate the watershed draining to the culvert conveying Newberry Brook underneath Main Street. The following basin characteristics were considered in the model:

- Area = 654.09 Acres (28,492,258 SQ FT)
- Longest Flow Path Length and Slope = 8457 LF @ 0.6% Slope ±
**Approximate path considering topology from digital elevation maps obtained from CT ECO's 2016 Orthophotography and Lidar Downloads*
- Time of Concentration = 178.9 mins
- Curve Number = 74
**Land cover types were obtained from NOAA Office for Coastal Management's C-CAP Land cover files of Connecticut and cross referenced with soil types obtained from NRCS soil map shape files using QGIS Geographic Information System analysis software.*

Model Overview

To assess the impact at the culvert of concern, a comparison of the resulting peak flow generated from the combined outflow from the Newberry Brook watershed and outflow from the site in both existing and proposed conditions was conducted. A schematic diagram of the model is included with the HydroCAD report for the analysis for reference. See **Attachment A**.

Model considerations made for the site's existing and proposed condition are discussed below:

- **Existing Site Watershed Modifications:** To account for the offsite flow path to the culvert of concern, an additional 85.8 minutes was added to the time of concentration of existing condition watershed area E1. A total flow path length of 5883 LF at 0.58% considered. Please refer to the previously submitted Storm Water Management Report for more information on the site's existing condition analysis.
- **Proposed Site Modifications:** To consider the overall impact from the proposed condition, an overall watershed was created from combining the area breakdowns from proposed condition watersheds P1 - P4. A time of concentration of 925.8 minutes was applied to the watershed to account for the proposed on site detention of flow and the offsite flow path to the culvert of concern. This time of concentration was determined from considering an observed 14 hour (840 minute) time to peak in the site's proposed condition, plus the 85.8 minutes of offsite travel time discussed above. Please refer to the previously submitted Storm Water Management Report for more information on the site's proposed condition analysis.

Analysis of Results

The following table contains the peak flow (cfs) data generated from the HydroCAD software:

Reach		2 year	10 year	25 year	50 year	100 year
Culvert @ Main Street (East Side)	Pre	131.82	332.26	472.06	577.48	696.56
	Post	130.56	328.88	467.18	571.47	689.25

As seen in the table above, all storm events evaluated for the proposed development will result in peak runoff rates in the proposed condition that are less than the peak runoff rates of the existing condition for 2-, 10-, 25-, 50- and 100-year design storms.

Observations and Final Conclusion

Observations of the flow conditions at this culvert were observed by DPI during the rain event that occurred on May 20, 2023. Based on observation from USGS stream gauge information for the North Branch of the Park River, the rain event started at 11:45 AM on that day and ended at 11:30 PM. A total of 2.01 inches of rain fell during this time period. See **Attachment B** for stream gauge data.

Photos of the stream were taken that day at 4:45 PM. These photos are included as **Attachment C**. Stream gauge data indicates that over half (1.07 in) of the rain that fell that day occurred before this time. Both the inlet and outlet ends of the culvert were observed to be fully submerged from the flow.

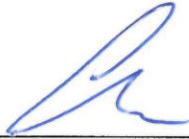
On May 21, 2023 at 4:00 PM, ~16.5 hours after the end of the rain event, a second iteration of photos of the stream were taken. These photos are included as **Attachment D** below. The crown of both the inlet and outlets were visible, but both ends were still substantially submerged.

With this and the model results presented above, it is DPI's opinion that there is an existing issue with the operation culvert conveying Newberry Brook underneath Main Street. The proposed conditions for the site will not exacerbate this problem.

Please contact us with any questions.

DESIGN PROFESSIONALS, INC.

By:

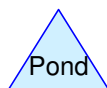
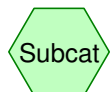
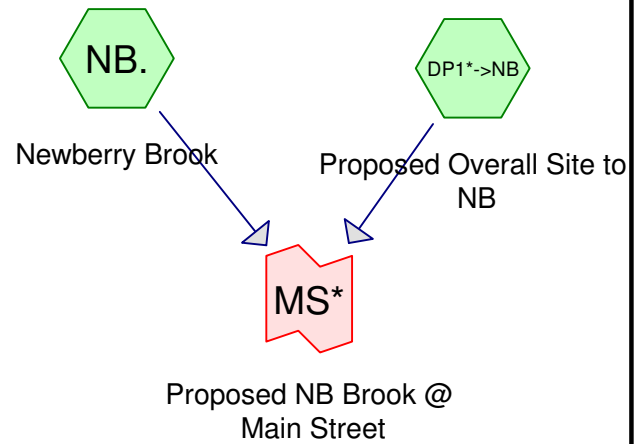
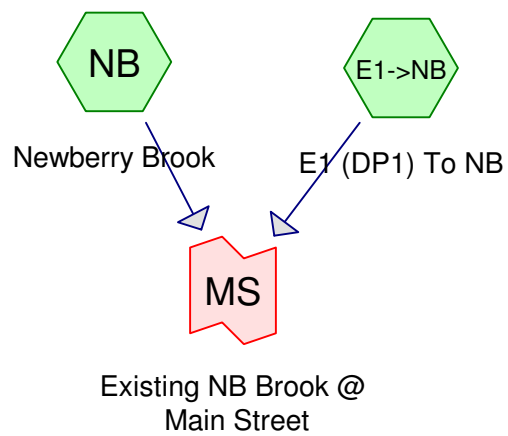


Andrew Krar, P.E.



Peter R. DeMallie

Attachment A
HydroCAD Report



4613.R - Newberry Brook HydroCAD

Type III 24-hr 2-Yr Rainfall=3.10"

Prepared by Daniel Jameson

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Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DP1*->NB: Proposed Overall Runoff Area=8.172 ac 0.00% Impervious Runoff Depth>1.39"
Flow Length=5,883' Slope=0.0058 '/' Tc=925.8 min CN=81 Runoff=0.71 cfs 0.945 af

Subcatchment E1->NB: E1 (DP1) To NB Runoff Area=318,750 sf 4.07% Impervious Runoff Depth=0.82"
Flow Length=7,051' Tc=155.1 min CN=71 Runoff=1.29 cfs 0.499 af

Subcatchment NB: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=0.97"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=130.56 cfs 52.997 af

Subcatchment NB.: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=0.97"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=130.56 cfs 52.997 af

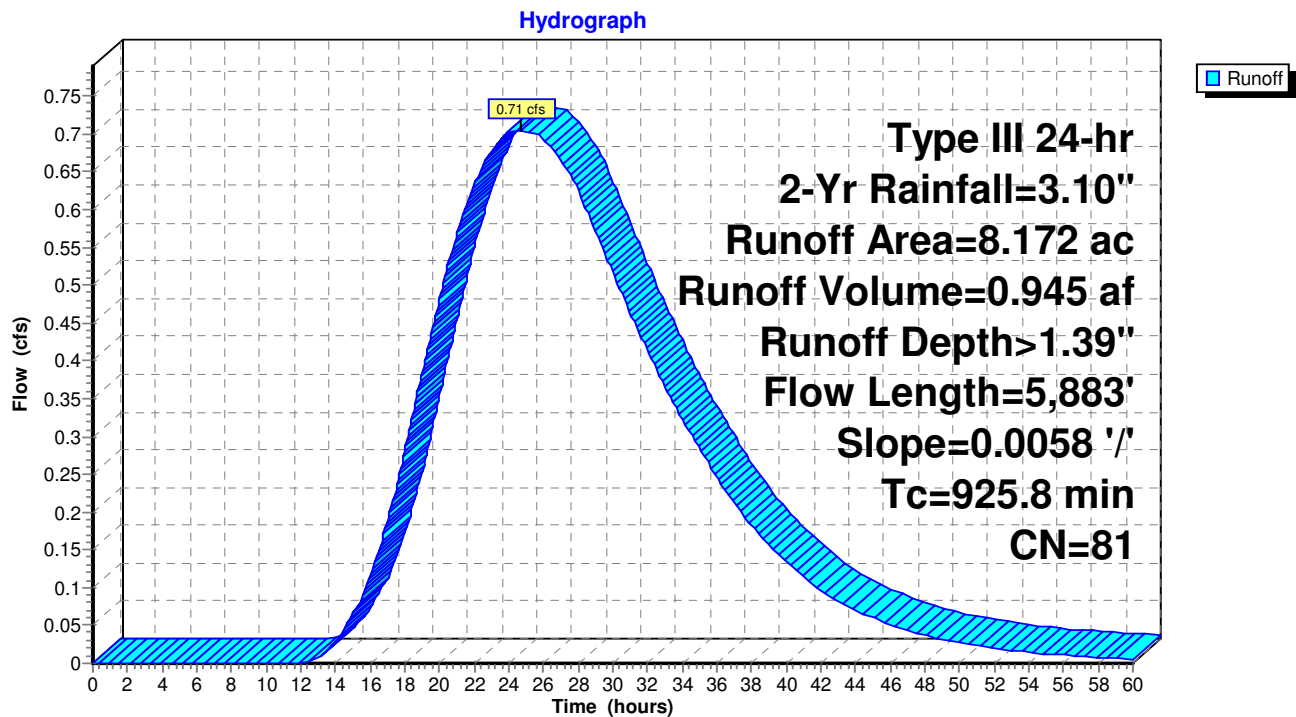
Link MS: Existing NB Brook @ Main Street

Inflow=131.82 cfs 53.497 af
Primary=131.82 cfs 53.497 af

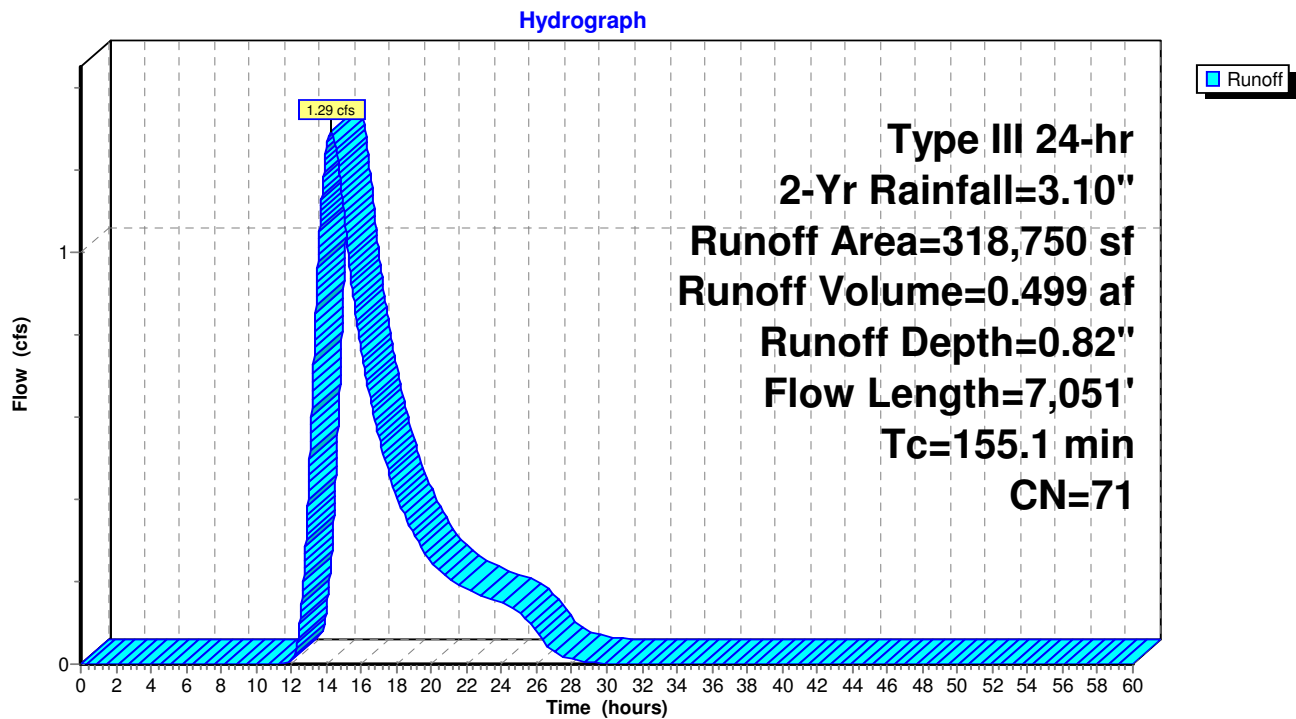
Link MS*: Proposed NB Brook @ Main Street

Inflow=130.60 cfs 53.943 af
Primary=130.60 cfs 53.943 af

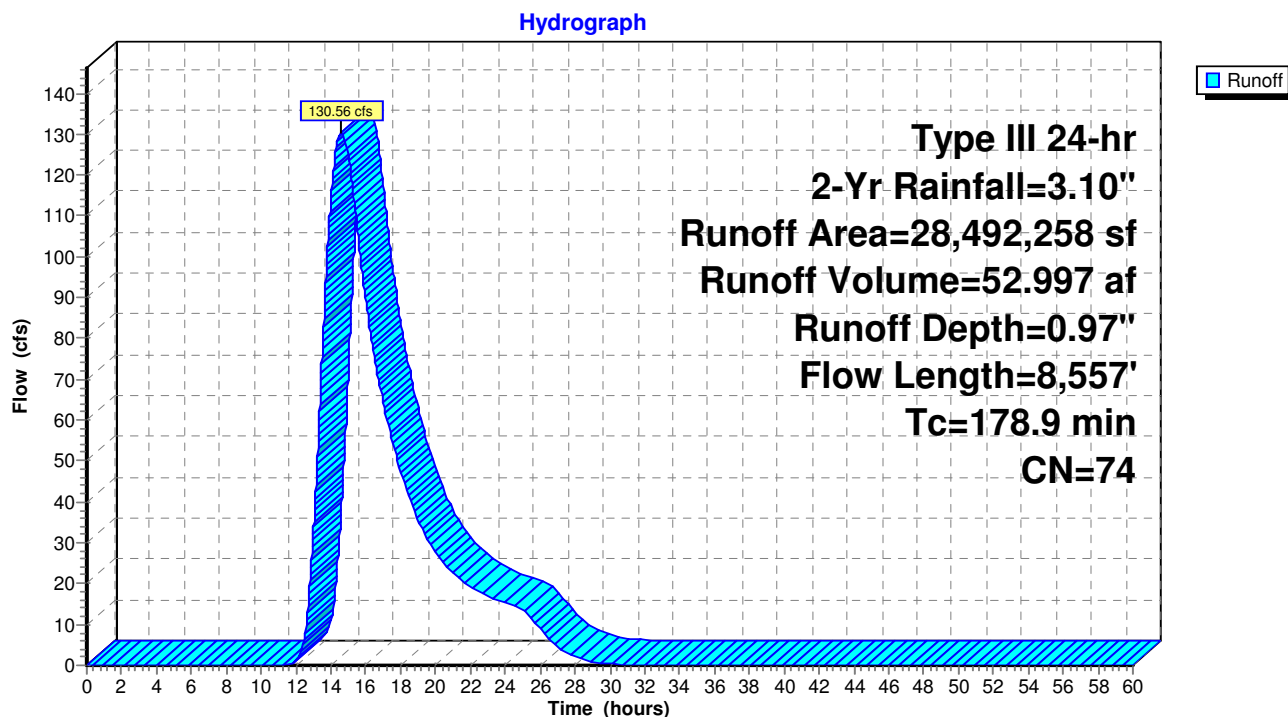
Subcatchment DP1*->NB: Proposed Overall Site to NB



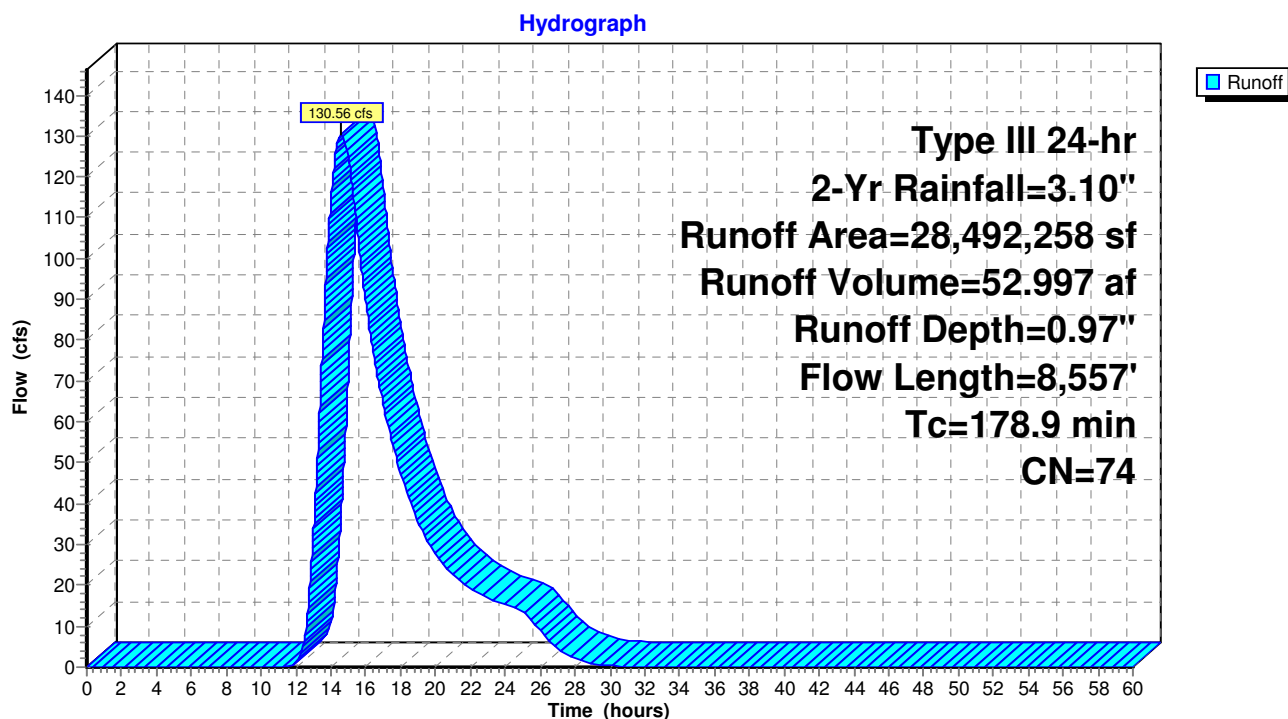
Subcatchment E1->NB: E1 (DP1) To NB



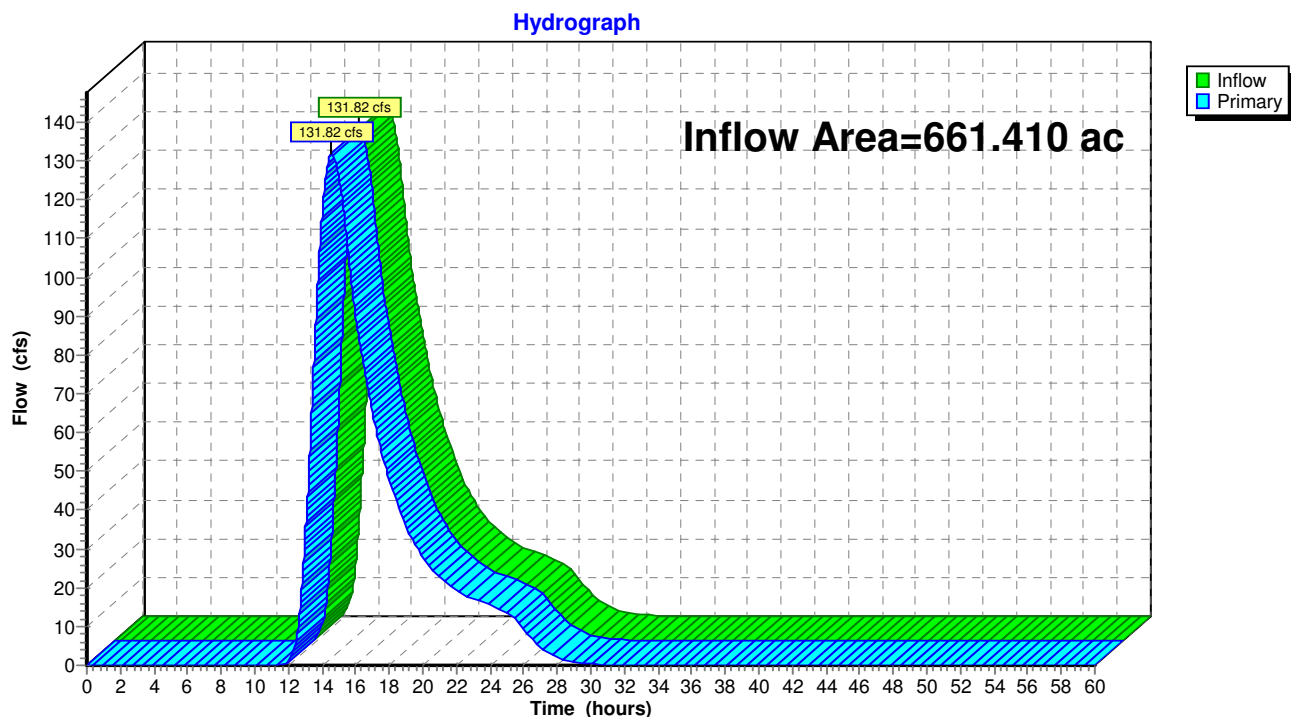
Subcatchment NB: Newberry Brook



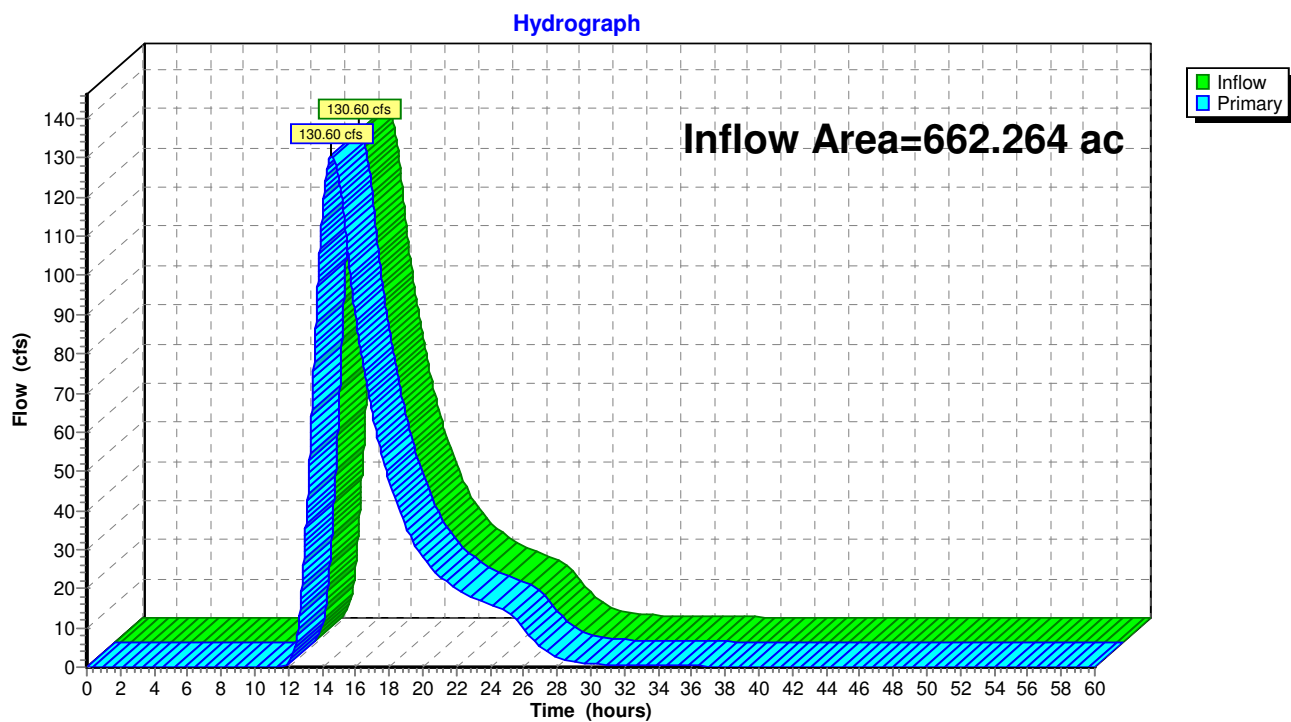
Subcatchment NB.: Newberry Brook



Link MS: Existing NB Brook @ Main Street



Link MS*: Proposed NB Brook @ Main Street



4613.R - Newberry Brook HydroCAD

Type III 24-hr 10-Yr Rainfall=4.92"

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Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DP1*->NB: Proposed Overall Runoff Area=8.172 ac 0.00% Impervious Runoff Depth>2.91"
Flow Length=5,883' Slope=0.0058 '/' Tc=925.8 min CN=81 Runoff=1.49 cfs 1.982 af

Subcatchment E1->NB: E1 (DP1) To NB Runoff Area=318,750 sf 4.07% Impervious Runoff Depth=2.06"
Flow Length=7,051' Tc=155.1 min CN=71 Runoff=3.55 cfs 1.254 af

Subcatchment NB: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=2.30"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=328.88 cfs 125.401 af

Subcatchment NB.: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=2.30"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=328.88 cfs 125.401 af

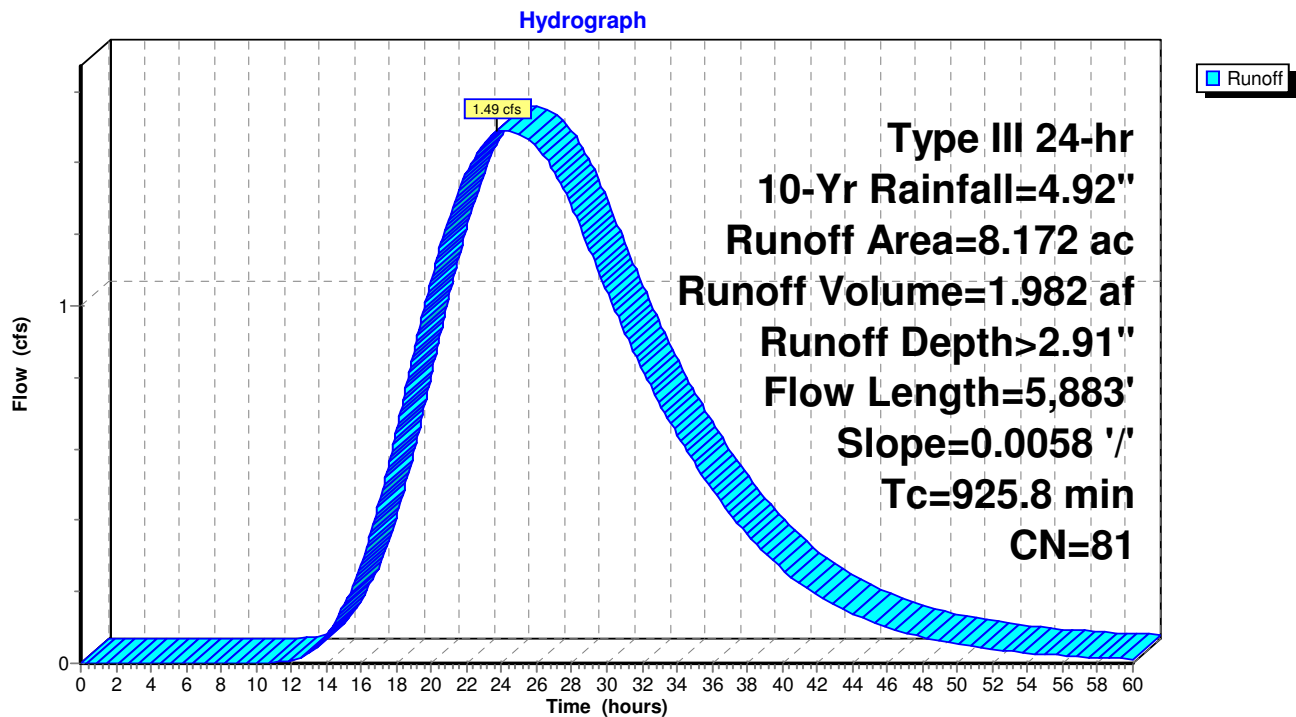
Link MS: Existing NB Brook @ Main Street

Inflow=332.26 cfs 126.655 af
Primary=332.26 cfs 126.655 af

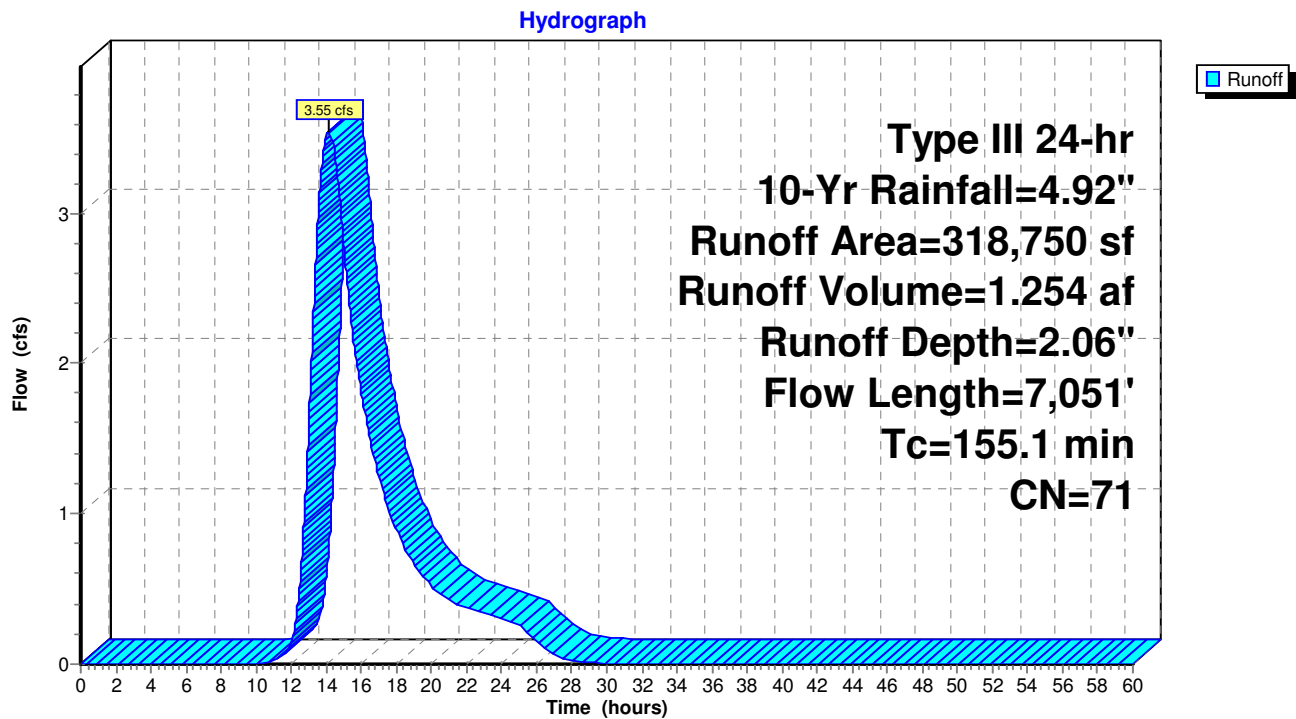
Link MS*: Proposed NB Brook @ Main Street

Inflow=329.00 cfs 127.383 af
Primary=329.00 cfs 127.383 af

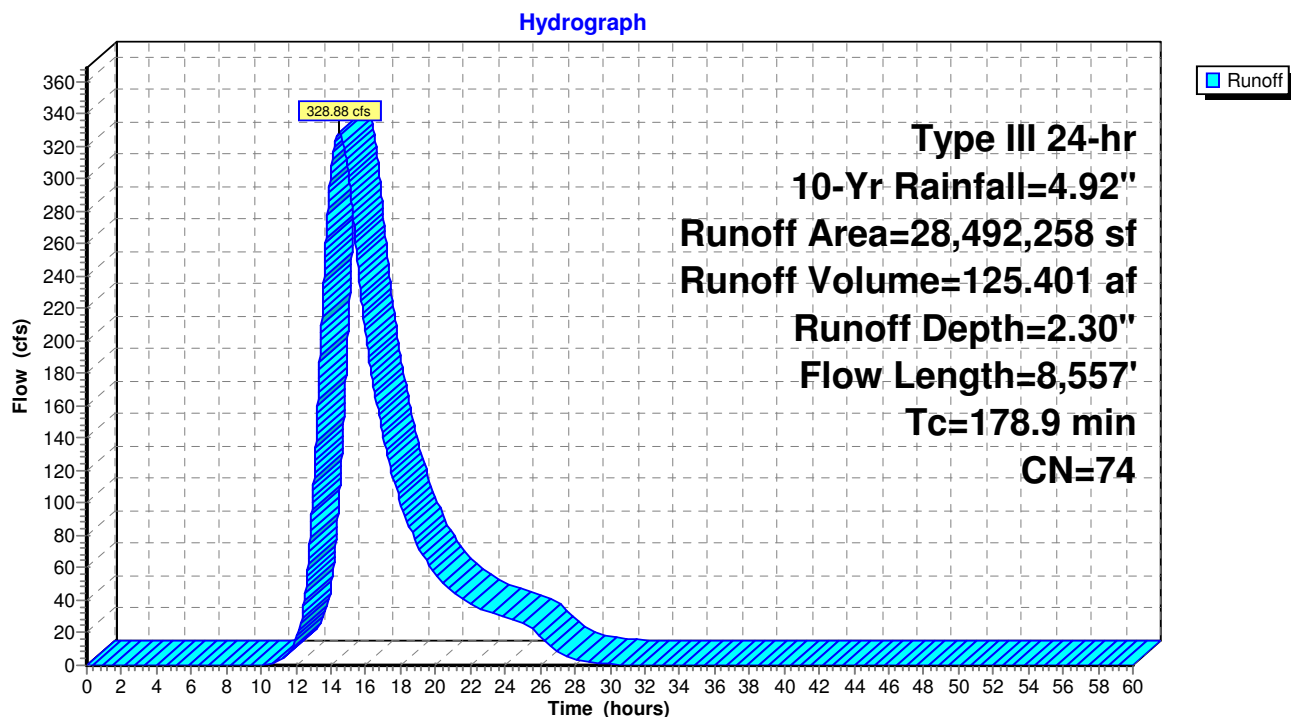
Subcatchment DP1*->NB: Proposed Overall Site to NB



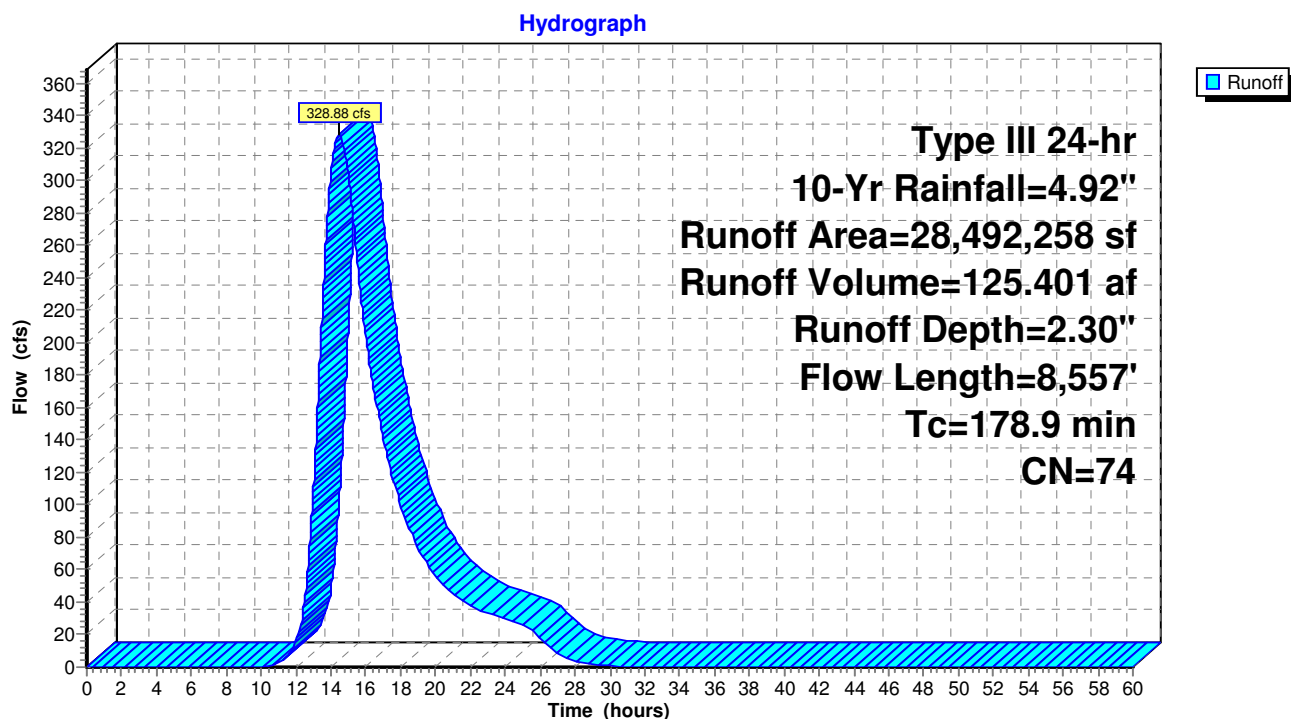
Subcatchment E1->NB: E1 (DP1) To NB



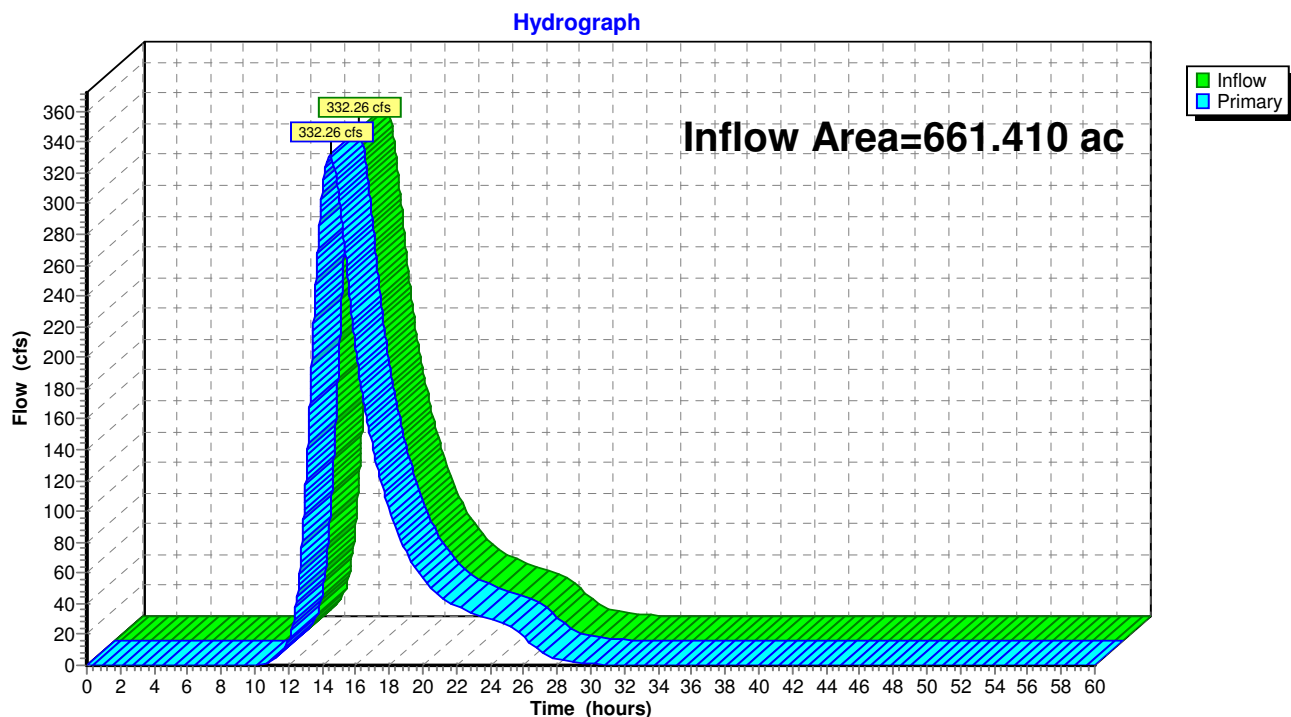
Subcatchment NB: Newberry Brook



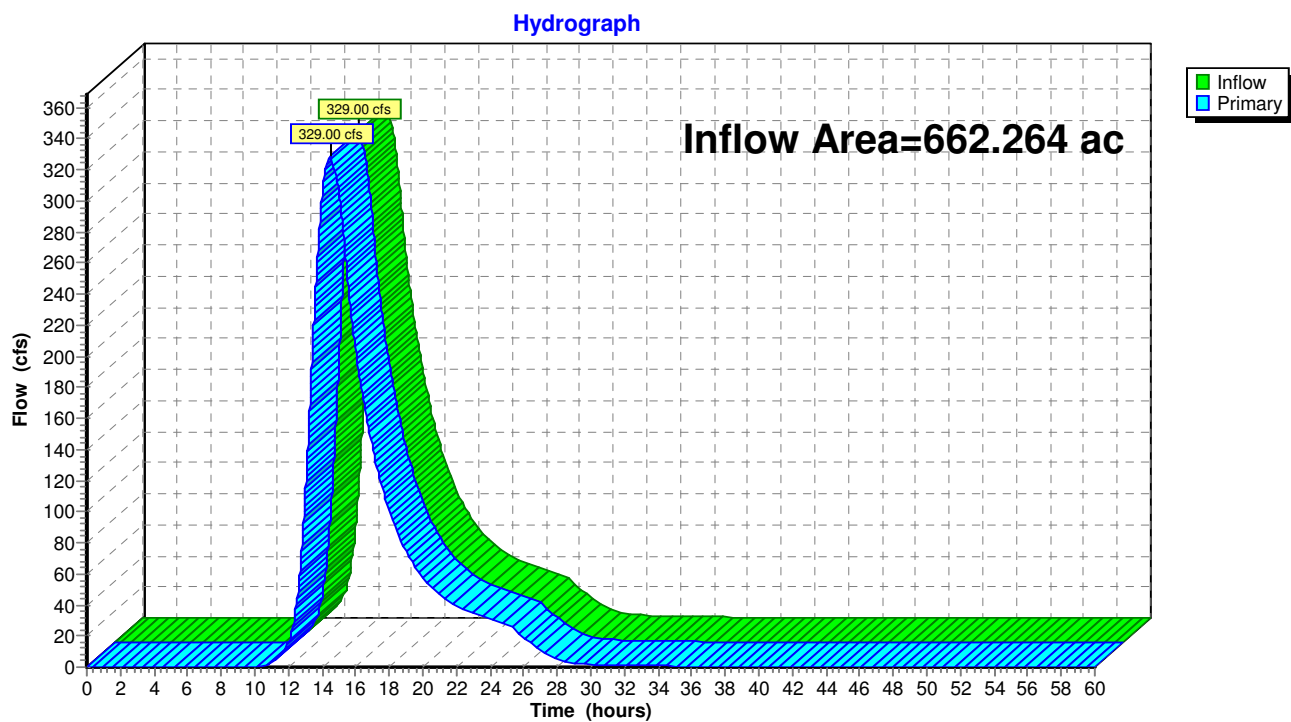
Subcatchment NB.: Newberry Brook



Link MS: Existing NB Brook @ Main Street



Link MS*: Proposed NB Brook @ Main Street



4613.R - Newberry Brook HydroCAD

Type III 24-hr 25-Yr Rainfall=6.06"

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Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DP1*->NB: Proposed Overall Runoff Area=8.172 ac 0.00% Impervious Runoff Depth=3.93"
Flow Length=5,883' Slope=0.0058 '/' Tc=925.8 min CN=81 Runoff=2.03 cfs 2.678 af

Subcatchment E1->NB: E1 (DP1) To NB Runoff Area=318,750 sf 4.07% Impervious Runoff Depth=2.95"
Flow Length=7,051' Tc=155.1 min CN=71 Runoff=5.18 cfs 1.797 af

Subcatchment NB: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=3.24"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=467.18 cfs 176.354 af

Subcatchment NB.: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=3.24"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=467.18 cfs 176.354 af

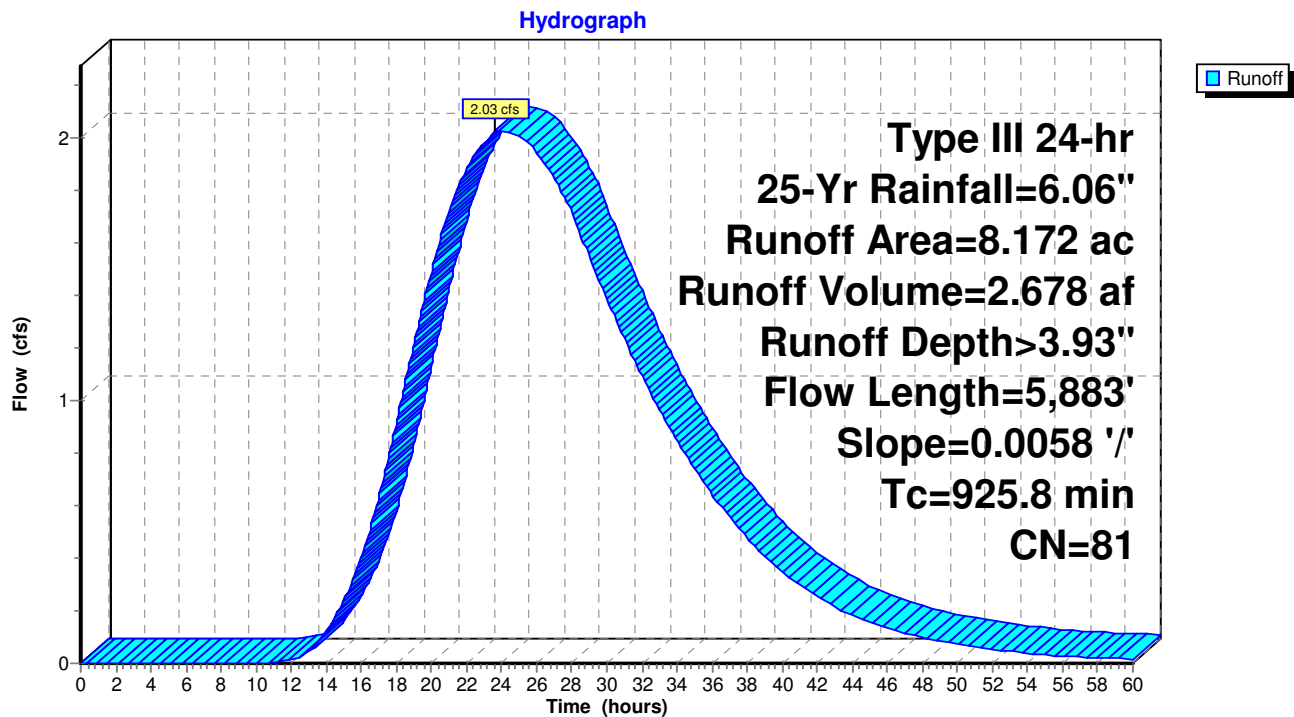
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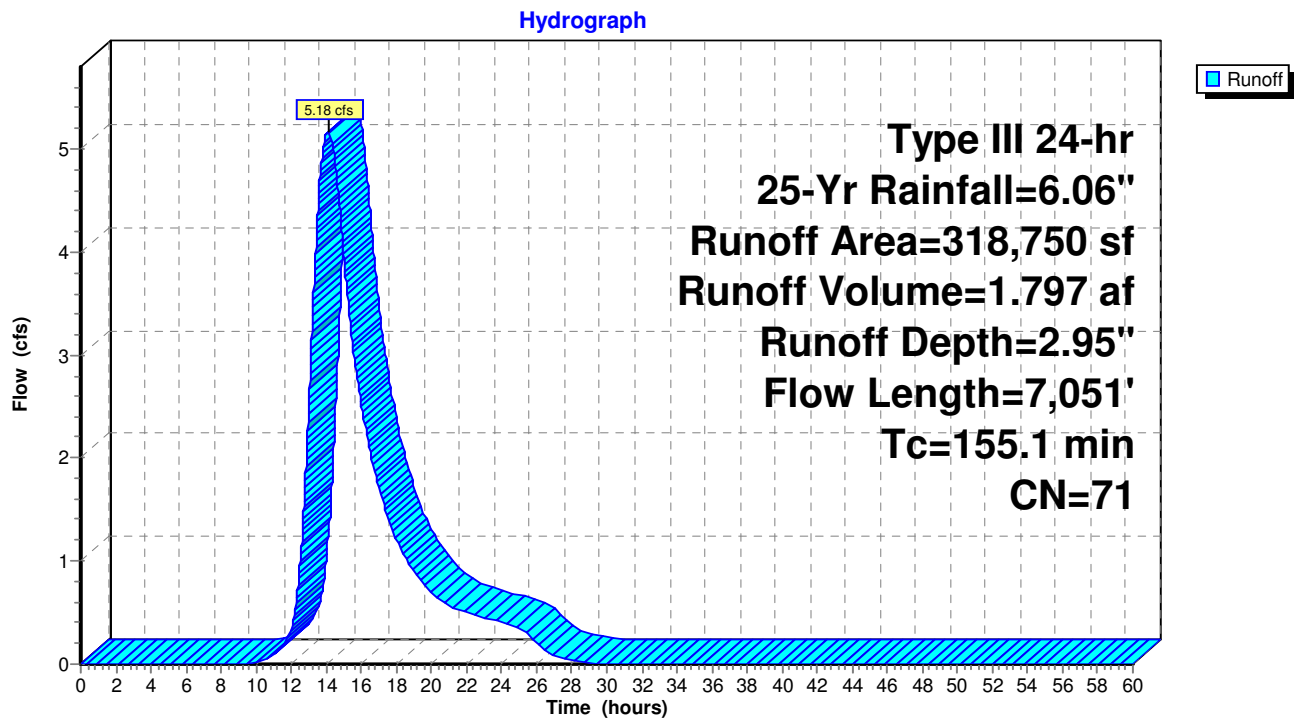
Link MS*: Proposed NB Brook @ Main Street

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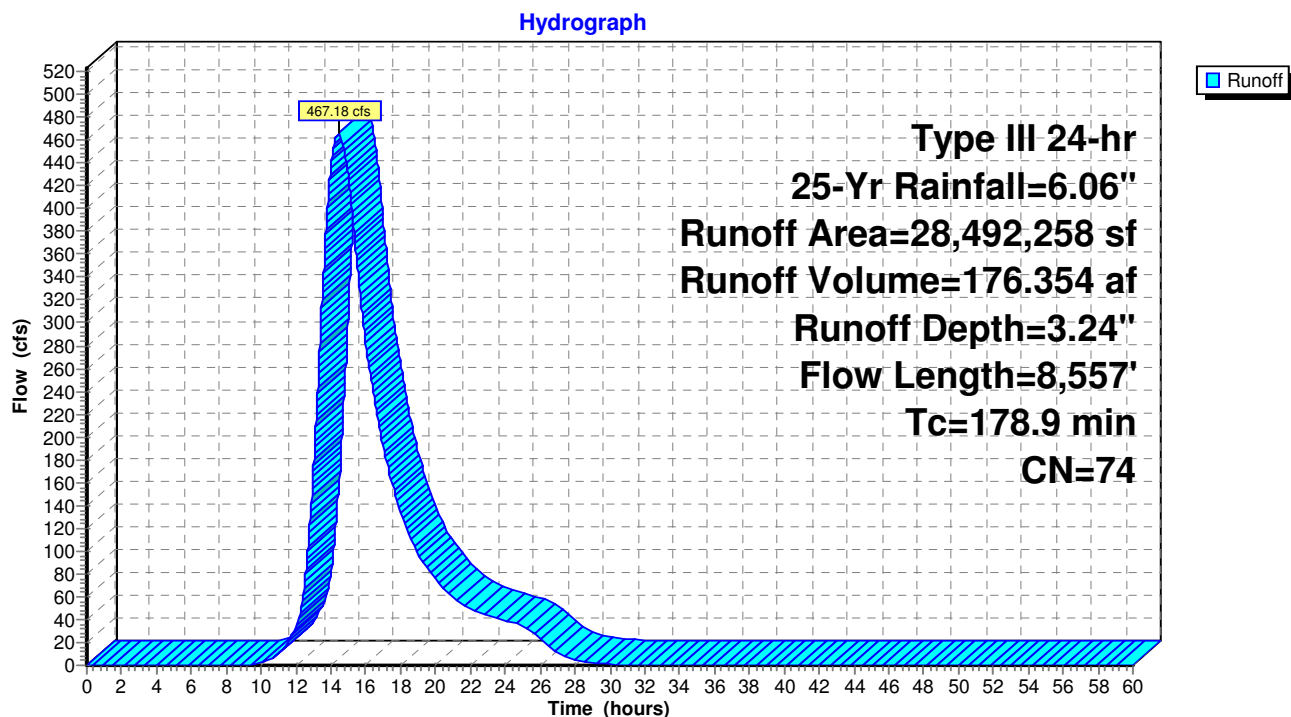
Subcatchment DP1*->NB: Proposed Overall Site to NB



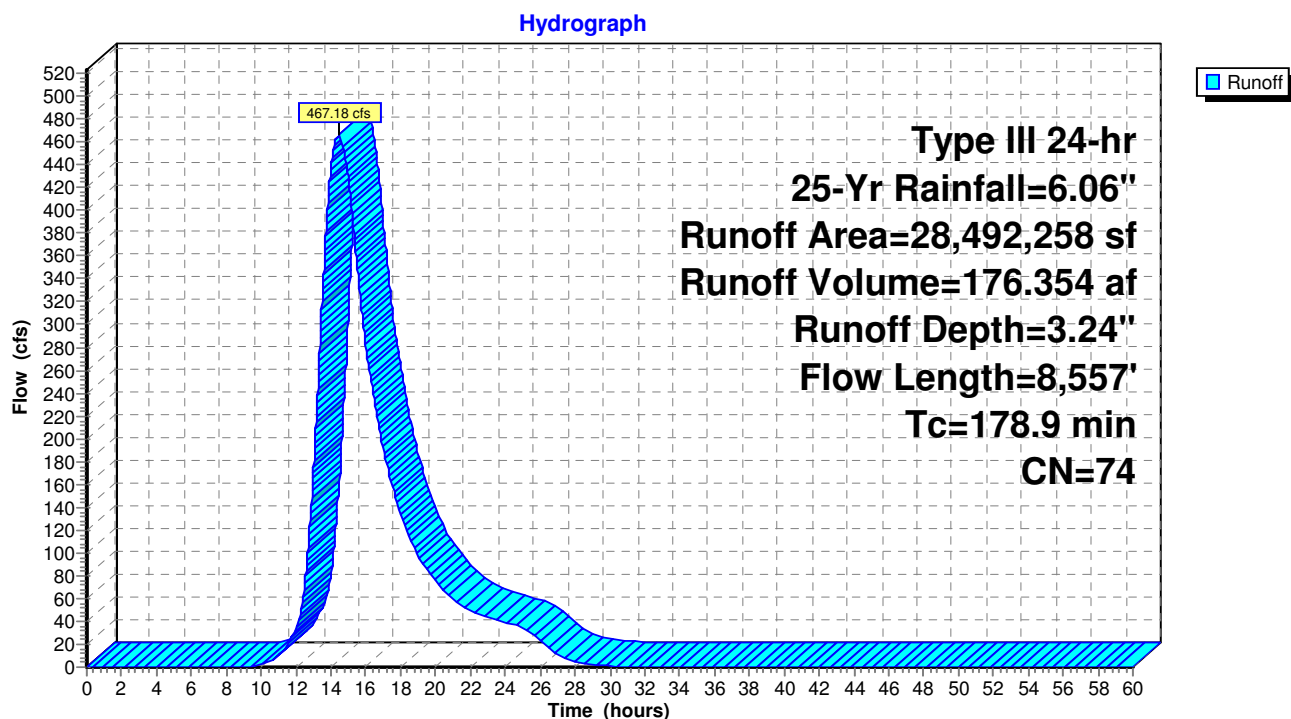
Subcatchment E1->NB: E1 (DP1) To NB



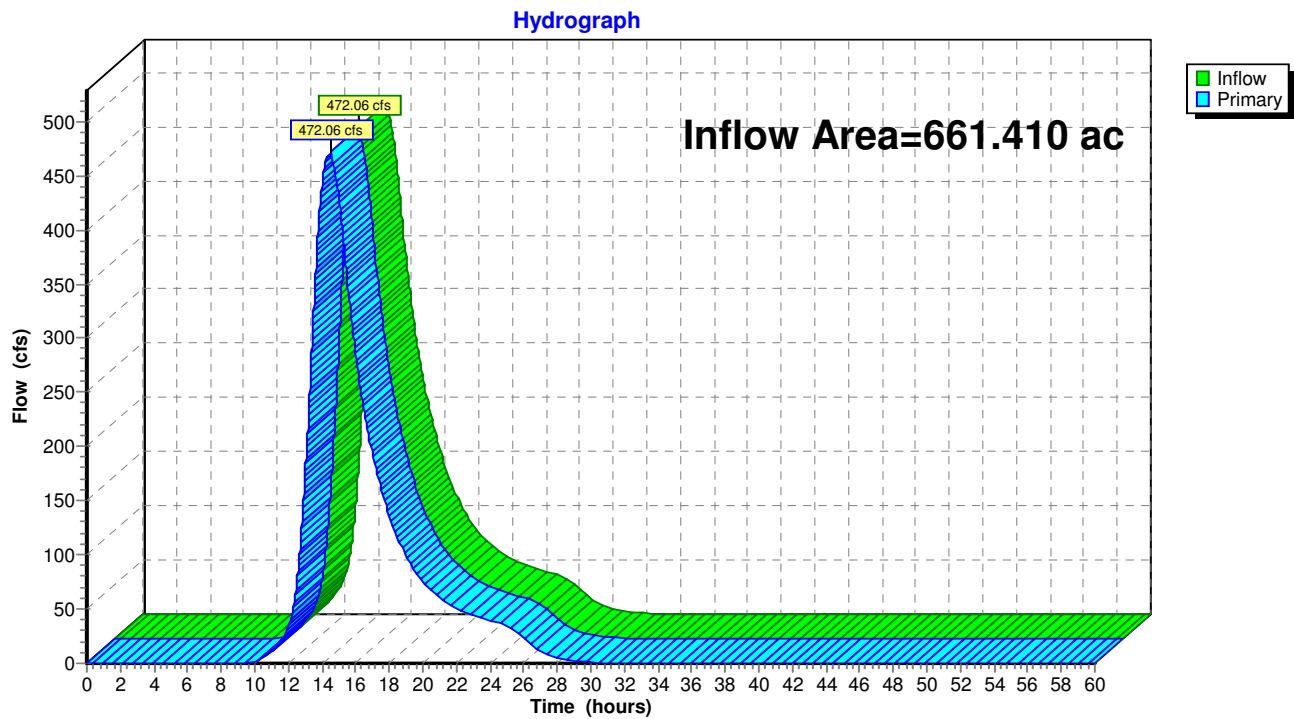
Subcatchment NB: Newberry Brook



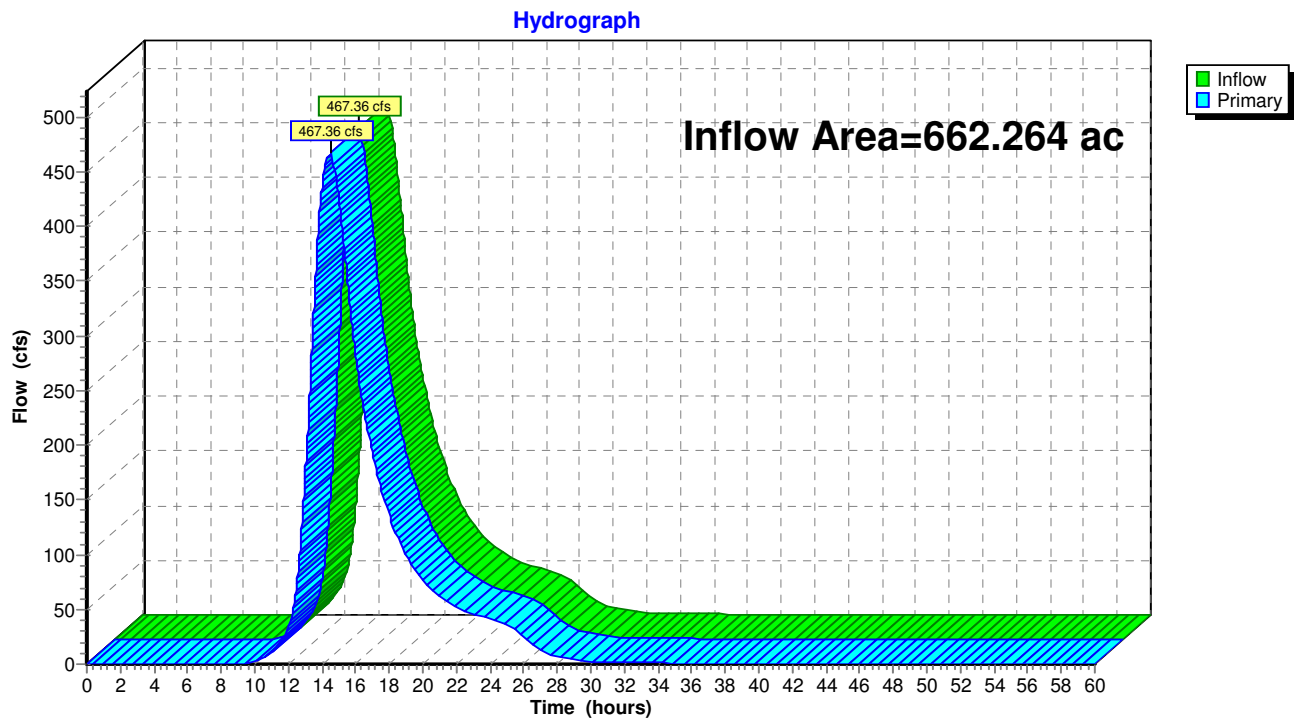
Subcatchment NB.: Newberry Brook



Link MS: Existing NB Brook @ Main Street



Link MS*: Proposed NB Brook @ Main Street



4613.R - Newberry Brook HydroCAD

Type III 24-hr 50-Yr Rainfall=6.89"

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Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DP1*->NB: Proposed Overall Runoff Area=8.172 ac 0.00% Impervious Runoff Depth=4.70"
Flow Length=5,883' Slope=0.0058 '/' Tc=925.8 min CN=81 Runoff=2.43 cfs 3.198 af

Subcatchment E1->NB: E1 (DP1) To NB Runoff Area=318,750 sf 4.07% Impervious Runoff Depth=3.63"
Flow Length=7,051' Tc=155.1 min CN=71 Runoff=6.43 cfs 2.214 af

Subcatchment NB: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=3.95"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=571.47 cfs 215.106 af

Subcatchment NB.: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=3.95"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=571.47 cfs 215.106 af

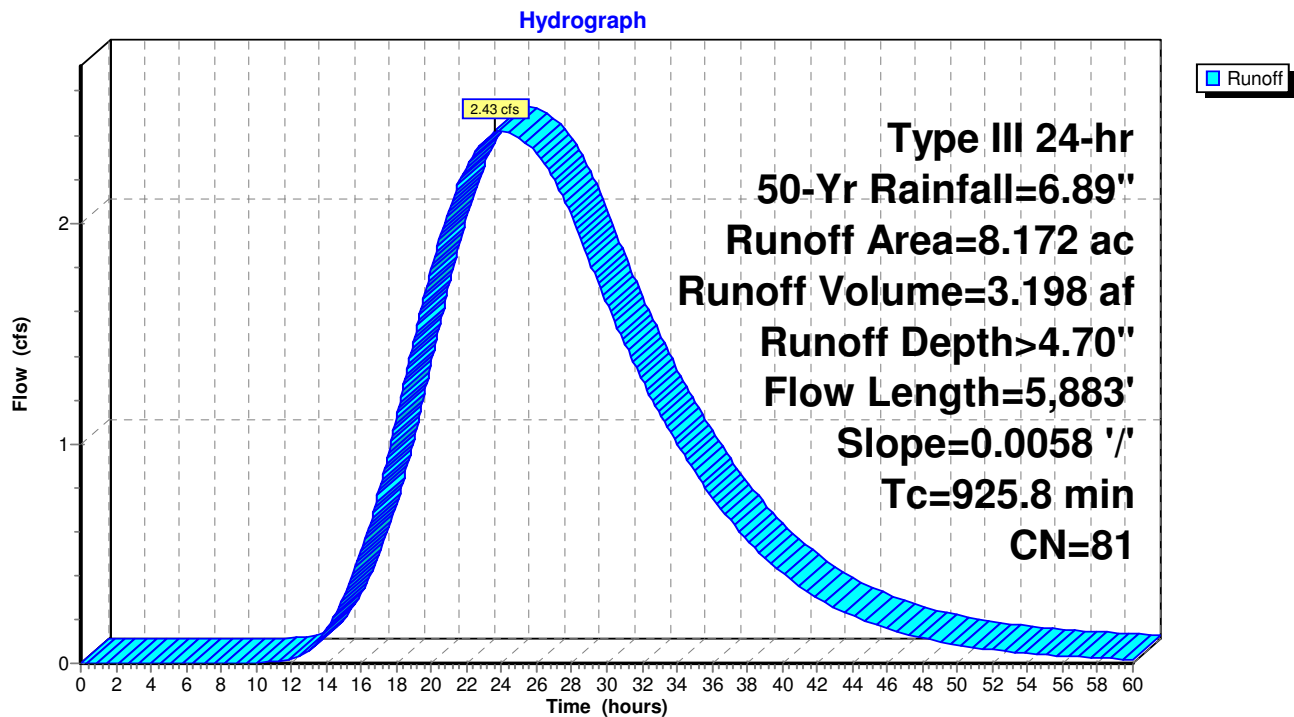
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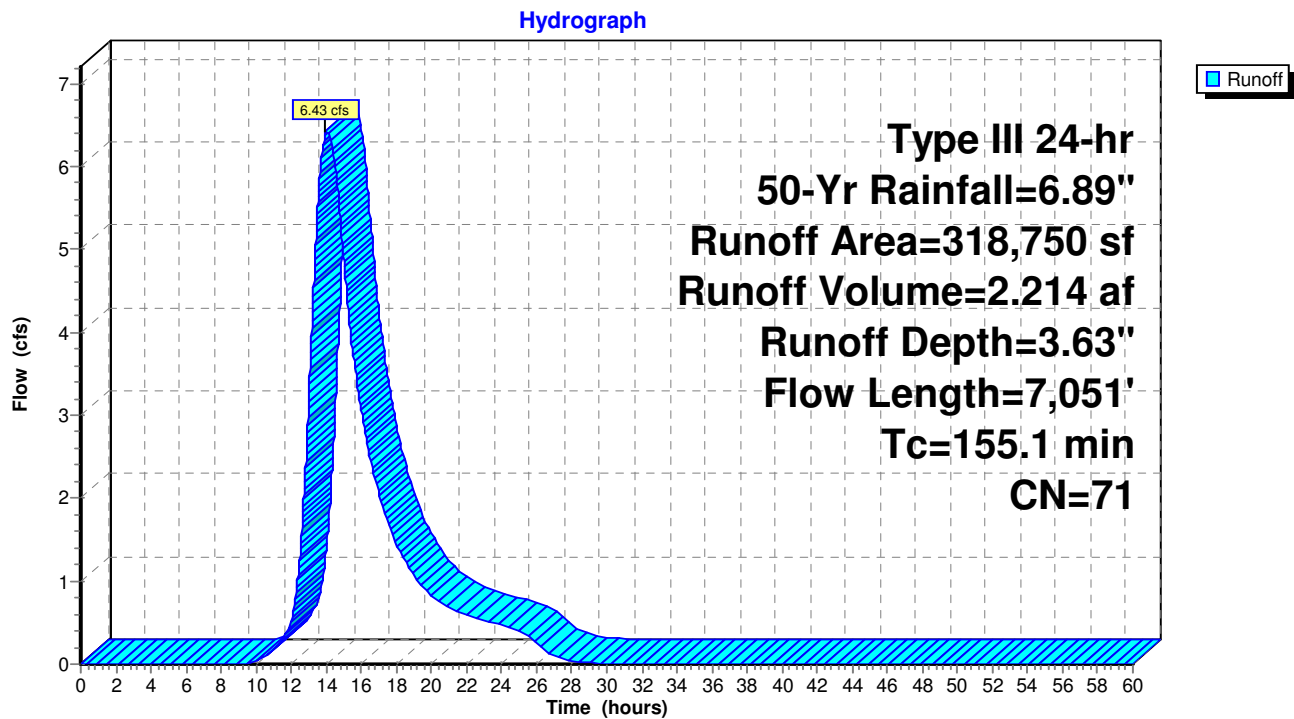
Link MS*: Proposed NB Brook @ Main Street

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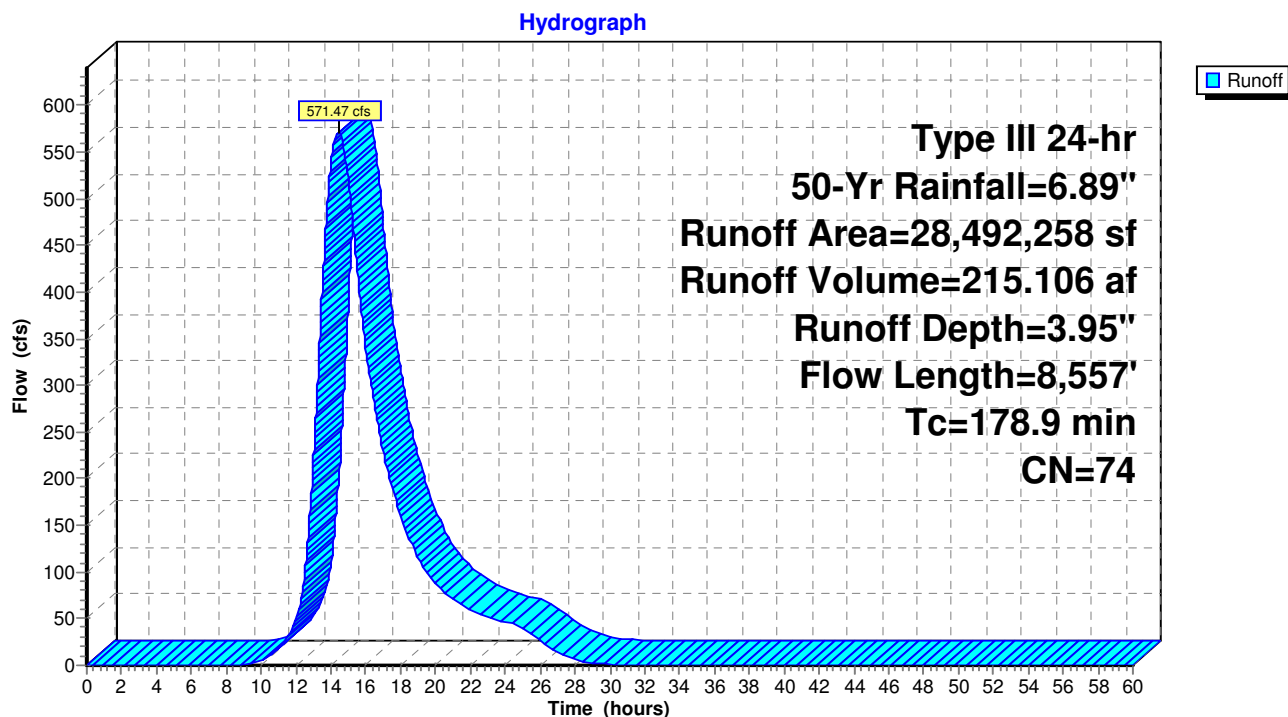
Subcatchment DP1*->NB: Proposed Overall Site to NB



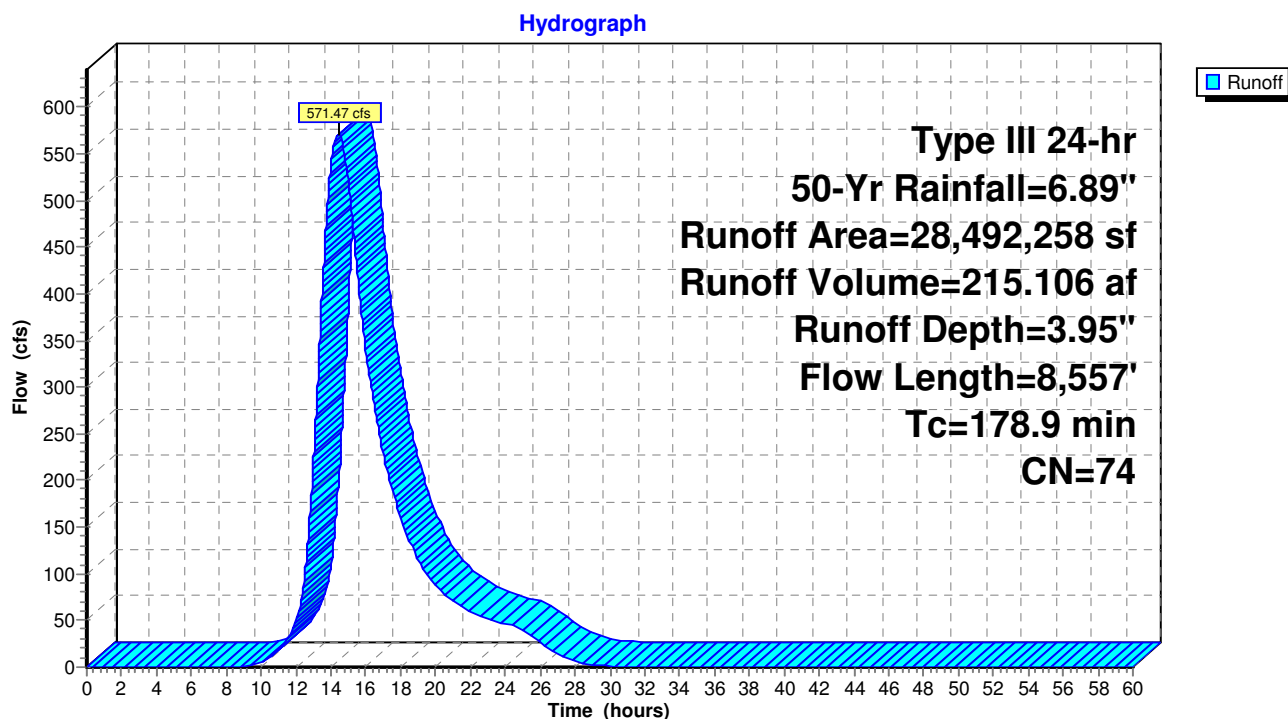
Subcatchment E1->NB: E1 (DP1) To NB



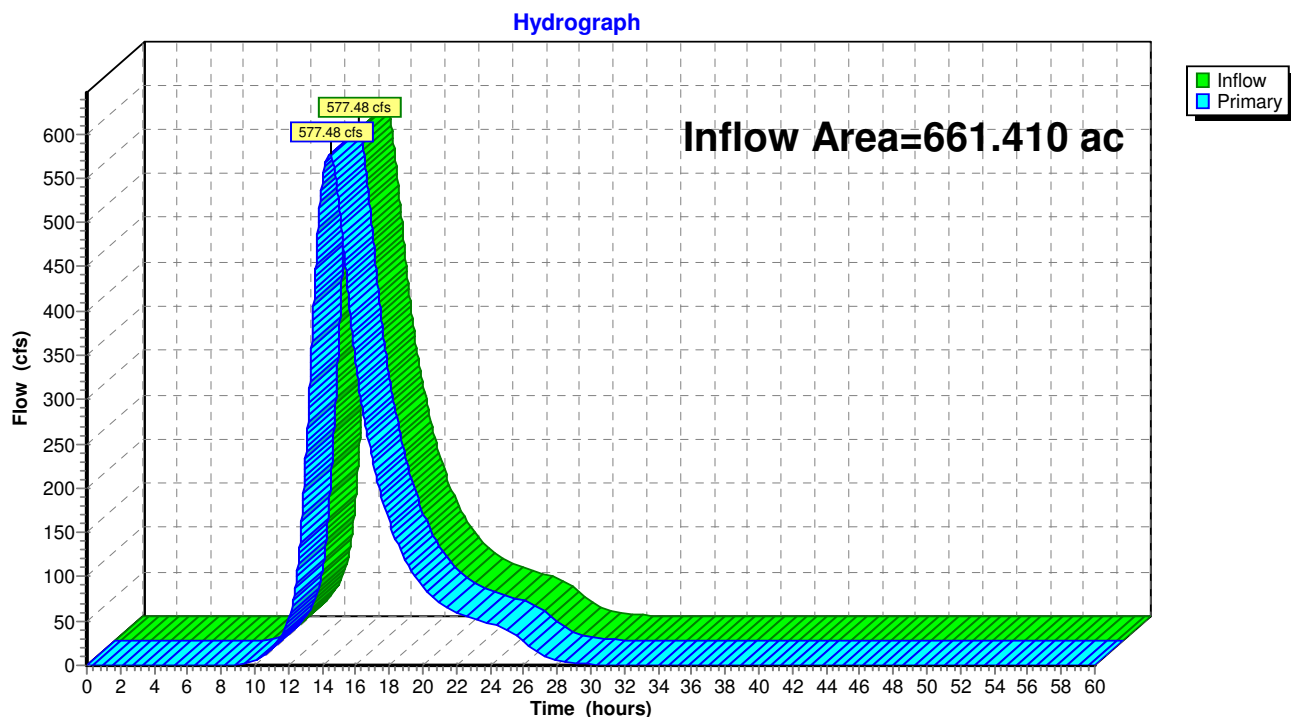
Subcatchment NB: Newberry Brook



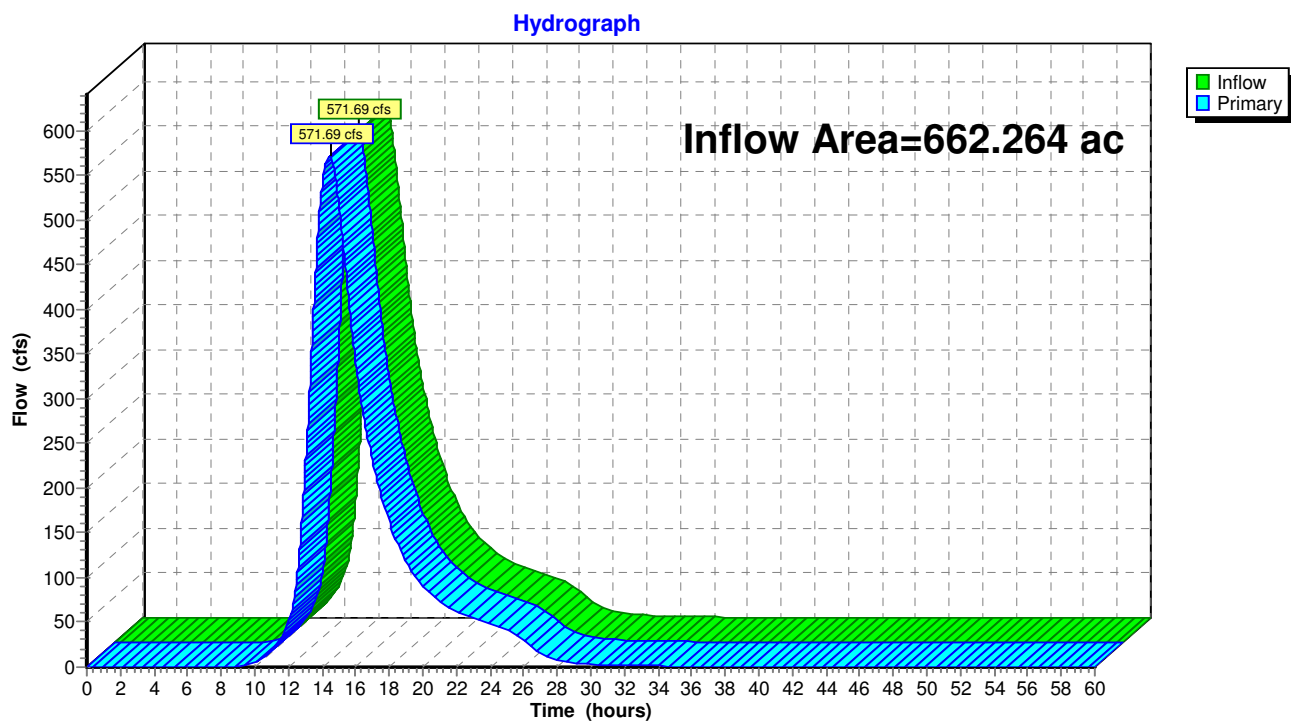
Subcatchment NB.: Newberry Brook



Link MS: Existing NB Brook @ Main Street



Link MS*: Proposed NB Brook @ Main Street



4613.R - Newberry Brook HydroCAD

Type III 24-hr 100-Yr Rainfall=7.81"

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Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DP1*->NB: Proposed Overall Runoff Area=8.172 ac 0.00% Impervious Runoff Depth=5.55"
Flow Length=5,883' Slope=0.0058 '/' Tc=925.8 min CN=81 Runoff=2.88 cfs 3.783 af

Subcatchment E1->NB: E1 (DP1) To NB Runoff Area=318,750 sf 4.07% Impervious Runoff Depth=4.41"
Flow Length=7,051' Tc=155.1 min CN=71 Runoff=7.87 cfs 2.692 af

Subcatchment NB: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=4.76"
Flow Length=8,557' Tc=178.9 min CN=74 Runoff=689.25 cfs 259.244 af

Subcatchment NB.: Newberry Brook Runoff Area=28,492,258 sf 28.82% Impervious Runoff Depth=4.76"
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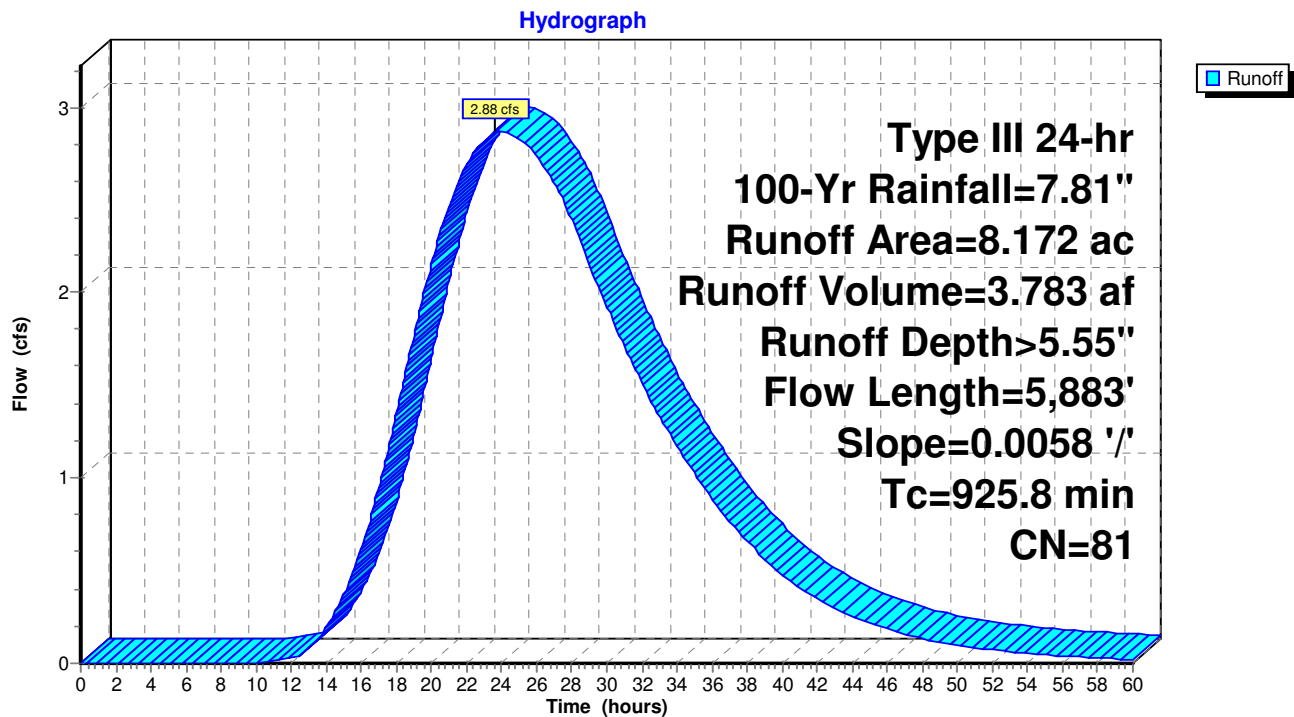
Link MS: Existing NB Brook @ Main Street

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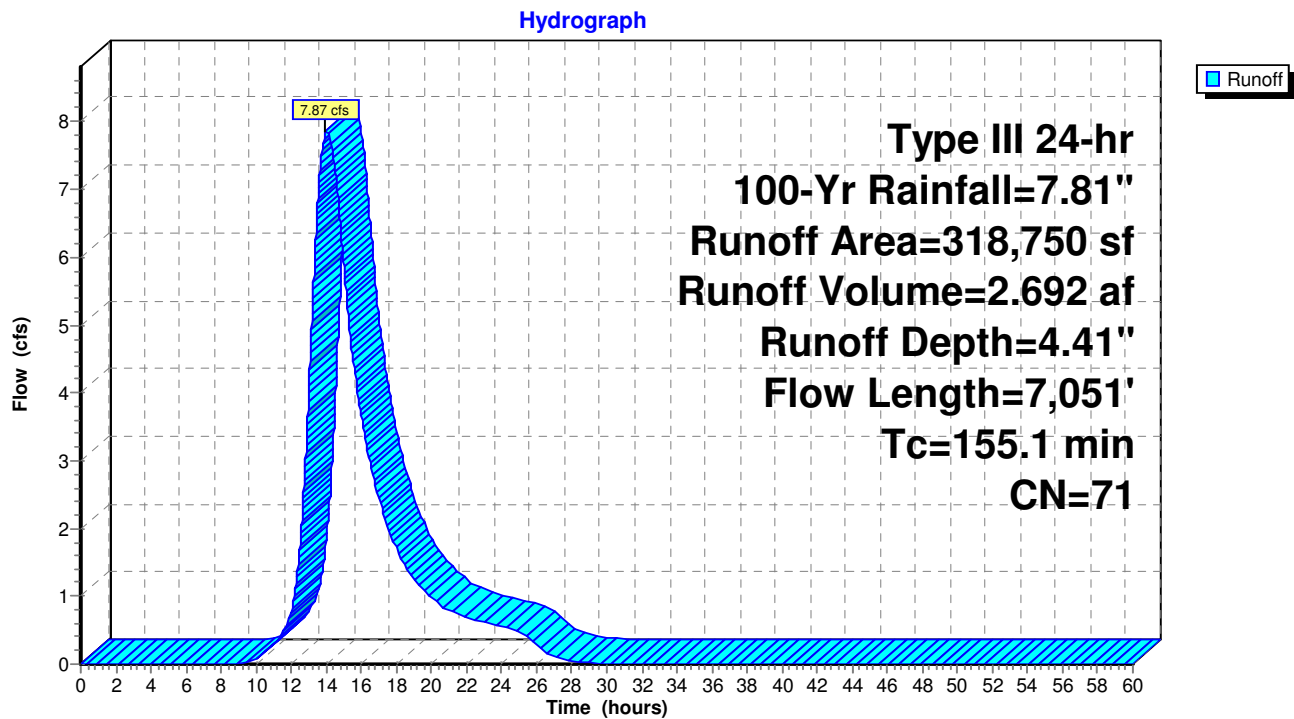
Link MS*: Proposed NB Brook @ Main Street

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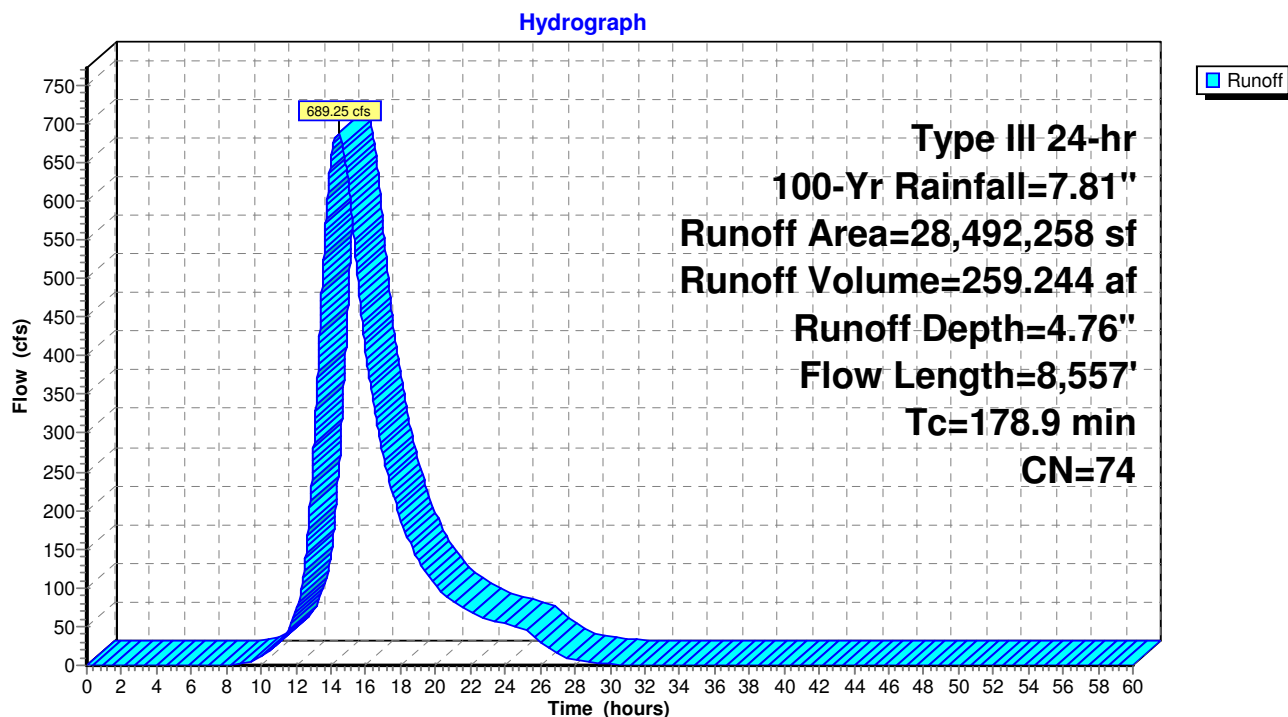
Subcatchment DP1*->NB: Proposed Overall Site to NB



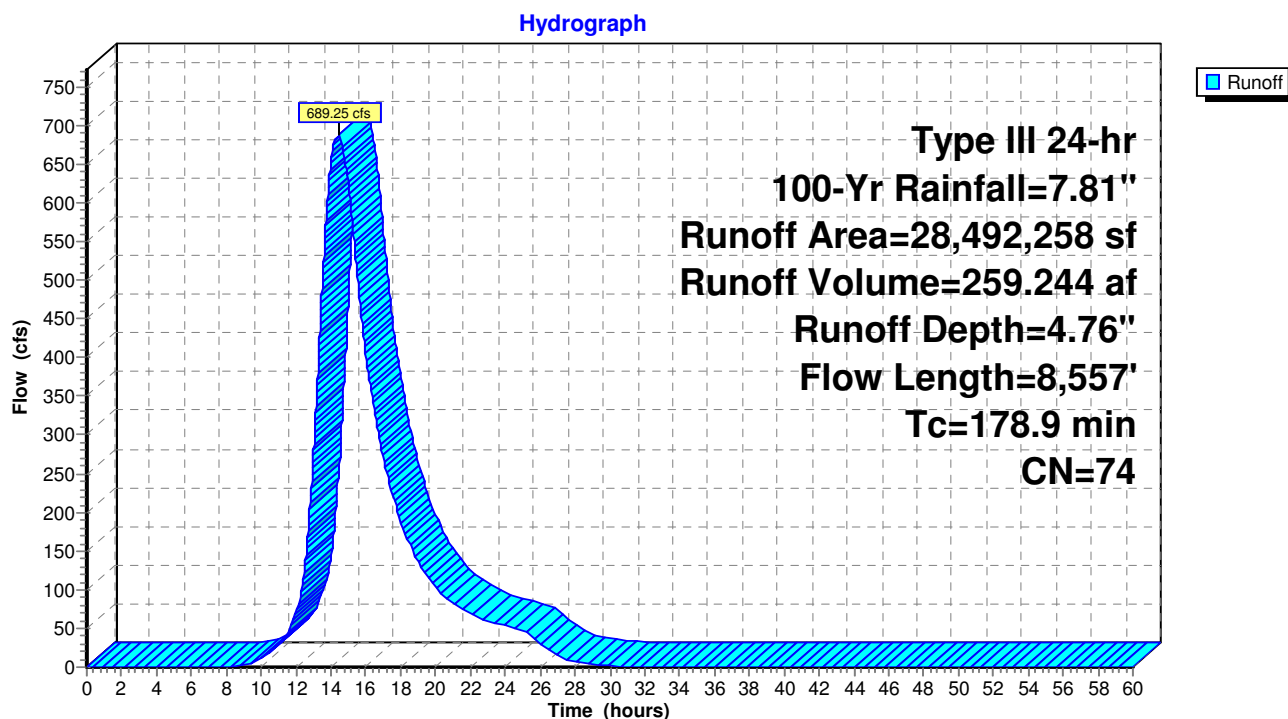
Subcatchment E1->NB: E1 (DP1) To NB



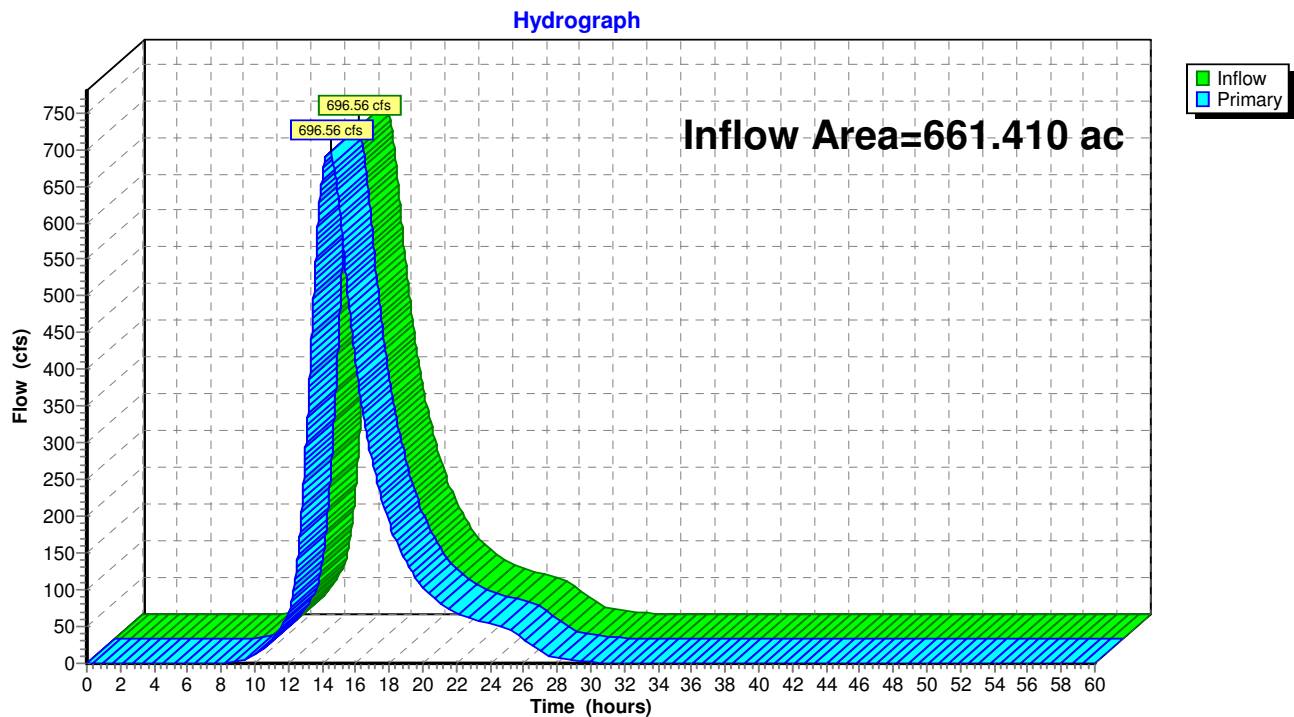
Subcatchment NB: Newberry Brook



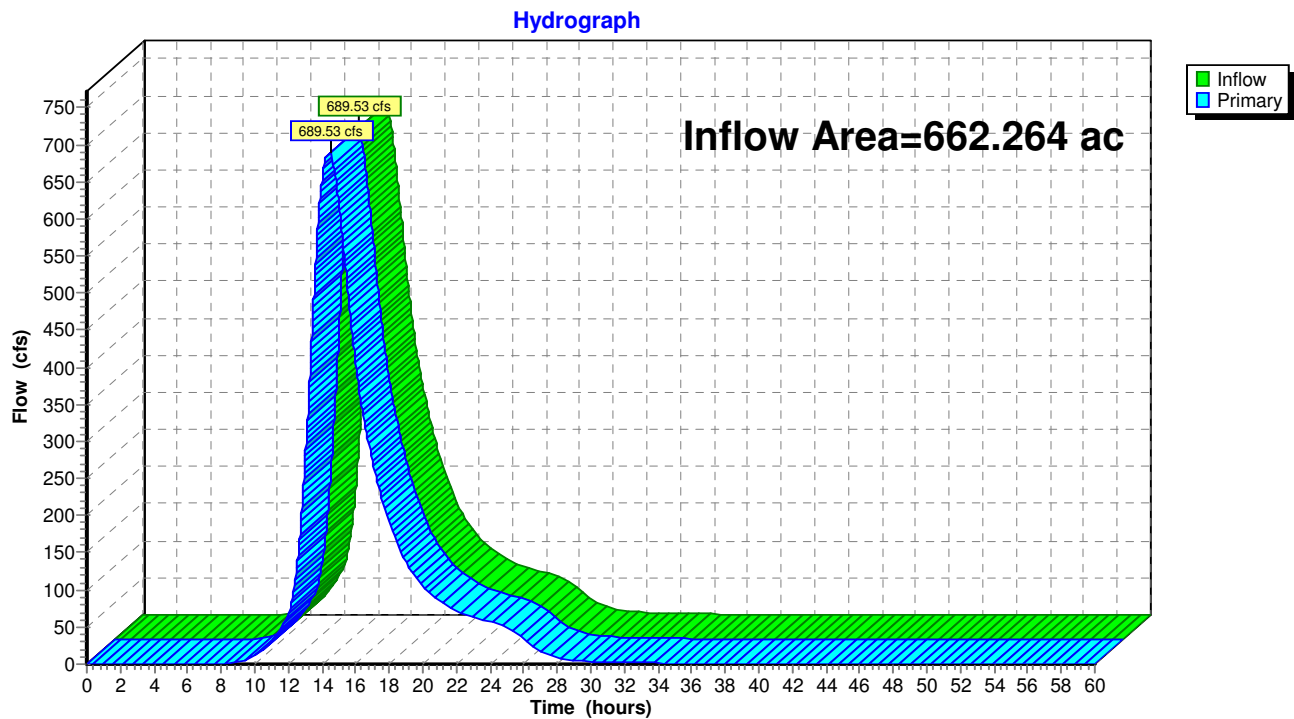
Subcatchment NB.: Newberry Brook



Link MS: Existing NB Brook @ Main Street



Link MS*: Proposed NB Brook @ Main Street



Attachment B
USGS 414704072422901
NORTH BRANCH PARK PRECIPITATION AT HARTFORD, CT
May 2023

USGS 414704072422901 NORTH BRANCH PARK PRECIPITATION AT HARTFORD, CT

#

TS_ID - An internal number representing a time series.

#

Data provided for site 414704072422901

TS_ID Parameter Description

166533 00045 Precipitation, total, inches

#

Data-value qualification codes included in this output:

P Provisional data subject to revision.

#

agency_cd	site_no	datetime	tz_cd	166533_00045	166533_00045_cd	
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						1.07
USGS	414704072422901	2023-05-20 17:00	EDT		0.06	P
USGS	414704072422901	2023-05-20 17:15	EDT		0.01	P
USGS	414704072422901	2023-05-20 17:30	EDT		0.00	P
USGS	414704072422901	2023-05-20 17:45	EDT		0.04	P
USGS	414704072422901	2023-05-20 18:00	EDT		0.07	P
USGS	414704072422901	2023-05-20 18:15	EDT		0.02	P
USGS	414704072422901	2023-05-20 18:30	EDT		0.08	P
USGS	414704072422901	2023-05-20 18:45	EDT		0.02	P
USGS	414704072422901	2023-05-20 19:00	EDT		0.04	P
USGS	414704072422901	2023-05-20 19:15	EDT		0.08	P
USGS	414704072422901	2023-05-20 19:30	EDT		0.13	P
USGS	414704072422901	2023-05-20 19:45	EDT		0.10	P
USGS	414704072422901	2023-05-20 20:00	EDT		0.02	P
USGS	414704072422901	2023-05-20 20:15	EDT		0.07	P

USGS	414704072422901	2023-05-20 20:30	EDT	0.03	P	
USGS	414704072422901	2023-05-20 20:45	EDT	0.06	P	
USGS	414704072422901	2023-05-20 21:00	EDT	0.09	P	
USGS	414704072422901	2023-05-20 21:15	EDT	0.01	P	
USGS	414704072422901	2023-05-20 21:30	EDT	0.00	P	
USGS	414704072422901	2023-05-20 21:45	EDT	0.00	P	
USGS	414704072422901	2023-05-20 22:00	EDT	0.00	P	
USGS	414704072422901	2023-05-20 22:15	EDT	0.00	P	
USGS	414704072422901	2023-05-20 22:30	EDT	0.00	P	
USGS	414704072422901	2023-05-20 22:45	EDT	0.00	P	
USGS	414704072422901	2023-05-20 23:00	EDT	0.00	P	
USGS	414704072422901	2023-05-20 23:15	EDT	0.00	P	
USGS	414704072422901	2023-05-20 23:30	EDT	0.01	P	2.0100
USGS	414704072422901	2023-05-20 23:45	EDT	0.00	P	
USGS	414704072422901	2023-05-21 00:00	EDT	0.00	P	
USGS	414704072422901	2023-05-21 00:15	EDT	0.00	P	
USGS	414704072422901	2023-05-21 00:30	EDT	0.00	P	
USGS	414704072422901	2023-05-21 00:45	EDT	0.00	P	
USGS	414704072422901	2023-05-21 01:00	EDT	0.00	P	
USGS	414704072422901	2023-05-21 01:15	EDT	0.00	P	
USGS	414704072422901	2023-05-21 01:30	EDT	0.00	P	
USGS	414704072422901	2023-05-21 01:45	EDT	0.00	P	
USGS	414704072422901	2023-05-21 02:00	EDT	0.00	P	
USGS	414704072422901	2023-05-21 02:15	EDT	0.00	P	

Attachment C
Main Street Culvert Photos
May 20, 2023

Photos Taken By Daniel Jameson 05/20/23



Upstream End (East Side of Main Street)



Downstream End (East Side of Main Street)

Attachment D
Main Street Downstream Culvert Photos
May 21, 2023

Photos Taken By Daniel Jameson 05/21/23



Upstream End (East Side of Main Street)



Downstream End (East Side of Main Street)

Attachment D
Newbury Brook Watershed Map



REFERENCES:
THIS PLAN REFERS TO THE FOLLOWING:
1. PLAN ENTITLED "DATA ACCUMULATION PLAN & WETLANDS SURVEY, SOUTH WINDSOR, CONNECTICUT" DATED 8/17/2016 PREPARED BY DESIGN PROFESSIONALS, INC.

DRAINAGE MAP NOTES:
1. OFFSITE CONTOURS ACQUIRED ONLINE: UCONN CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION CONNECTICUT ENVIRONMENTAL CONDITIONS ONLINE MAPS AND GEOSPATIAL DATA FOR EVERYONE (<http://cteco.uconn.edu/viewers/index.htm>)

NEWBERRY BROOK DRAINAGE AREA MAP SHEET C-DA3	NO. 1 DATE 4/10/23	REVISIONS ADD WALKING TRAIL AND EXISTING TREES	BY GMM	PROJECT NO. 06074 DATE 03/10/23 DESIGNED BY BKM/CMM CHECKED BY BKM/CMM APP'D BY ALV/PRD	PREPARED FOR TRIO INVESTMENT PROPERTIES LLC 85 FELT ROAD, UNIT 504 SOUTH WINDSOR, CT	design professionals CIVIL & TRAFFIC ENGINEERS / LAND SURVEYORS PLANNERS / LANDSCAPE ARCHITECTS 21 JEFFREY DRIVE PO BOX 1167 SOUTH WINDSOR, CT 06074 860-291-8295 860-291-8757 - F www.designprofessionals.com