Supplemental Stormwater Management Report

39 Jackson Road – Lot 2 – Site Development

Project Address:
33 Jackson Road
Devens, Massachusetts

Date:
May 06, 2021

Prepared For:
King Devens, LLC
800 Boylston Street, Suite 1570
Boston, MA 02199

Prepared by:
HIGHPOINT
Canton Corporate Place
45 Dan Road, Suite 140
Canton, MA 02021
www.highpointeng.com

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INTRODUCTION

This analysis summarizes the pre- and post-development stormwater impacts associated with the proposed site development at 39 Jackson Road in Devens, MA (the property). This is the third phase of a multi-phased five-building, 935,000± GSF biomanufacturing campus to provide state of the art facilities for production of medicines and associated life science products for market. This report will analyze the third development phase (the Project) constructed on the property which consists of the construction of a 140,000± GSF manufacturing/research and development facility on Lot 2 - 39 Jackson Road with the associated site improvements, driveways, and utility/stormwater infrastructure.

Work associated with the Project includes:

- Site mobilization, installation of soil erosion and sedimentation controls, and trailer/ equipment mobilization to stage the construction work.
- General earthwork including cuts, fills, and temporary soils stockpiling within the future development areas.
- Utility and stormwater infrastructure abandonment and/or relocation to align with Master Planned Development driveway configurations previously approved under the Lot 1 – 45 Jackson Road Unified Permit.
- Construction of a 140,000± GSF two-story core and shell building including parking lots, loading areas, and utility/pad mounted equipment areas.
- Construction of 157 surface parking spaces.
- Construction of site landscape/hardscape improvements throughout the driveway network and development site, including earth berms and vegetative screening along the east and southerly property lines.

For detailed information regarding existing site conditions and the proposed development, refer to the plans entitled, “39 Jackson Road – Lot 2 – Site Development Plans” dated May 6, 2021, and prepared by Highpoint Engineering, Inc.

METHODOLOGY

The Project site and related stormwater discharges will connect to existing municipal drainage infrastructure previously constructed under the Jackson Road Relocation Project, and modified under the 45 Jackson Construction Project. The municipal drainage infrastructure to be connected to includes drainage pipe network which flows to a surface conveyance swale, and stormwater detention/infiltration basin with outfall to the Nashua River. The document entitled, "Notice of Intent (NOI) for coverage under Small MS4 General Permit" dated 03/22/2018 designates the Nashua River as an Impaired Waterway for Phosphorus and E. coli contaminants. The NOI recommends that a TMDL be established for these constituents so that future project development, and maintenance of existing facilities that generate stormwater runoff, implement Best Management Practices (BMP's) to demonstrate reductions in Phosphorous and E. coli concentrations. While no specific TMDL limits are listed in the NOI for this reach of the Nashua River, the Project is obligated to meet the discharge requirements of the MS4 General Permit.

The document entitled, "Stormwater Management Plan - MS4 General Permit Compliance | June 2019", prepared by Weston & Sampson summarizes recommended stormwater design and discharge parameters, BMP strategies, and Operation and Maintenance (O&M) procedures that shall be implemented to achieve compliance with the MS4 General Permit.

Section 2.3.6 - Stormwater Management in New Development and Redevelopment (Post Construction Stormwater Management) of the Stormwater Management Plan includes recommendations for design of post-construction stormwater management facilities. For new development, the design standards generally reference the Massachusetts Stormwater Handbook, which is assumed for consistency between the guidance documents. This section also requires that new development 1) "Retain the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area on the site" AND/OR; 2) "Remove 90% of the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious surface area on the site and 60% of the average annual load of Total Phosphorus (TP) generated from the total post-construction impervious surface area on the site."

The Project design shall meet the requirements of the NOI Small MS4 General Permit and the Stormwater Management Plan by retaining and infiltrating total runoff generated by the 25-yr design storm (5.3 inch/24-hour rainfall) over both impervious and pervious surface prior to overflow to the municipal stormwater drainage system, which provides additional pre-treatment prior to discharge to the Nashua River. The Project design shall also meet the requirements of the Massachusetts Stormwater Management Handbook as applicable.

The hydrologic analysis models the pre- and post-development stormwater runoff characteristics for the site and compares changes in peak rate of runoff and water quality associated with the proposed development. Where increases to peak rate of runoff or reductions in water quality are identified, Stormwater Best Management Practices (BMP's) are implemented for mitigation. The analysis demonstrates that post-development hydrologic conditions generally mimic pre-development hydrologic conditions, and potential impacts to downstream properties, infrastructure, or environmentally sensitive areas are mitigated.

The pre-development hydrologic model establishes the limits of the study area and down-gradient Points of Analysis (POA's). The POA's are dependent on topographic and environmental conditions. The model quantifies watershed stormwater runoff characteristics related to topography, land use/cover types and

soil conditions, computing peak runoff rates for specific design storm frequencies under pre-development conditions at the POA's.

The hydrologic model accounts for changes in the watershed area topography, and land use/cover types associated with the proposed development. The model computes the changes to the peak runoff rates within the study area and includes BMP's utilized to mitigate stormwater of the development site. Furthermore, BMP's have been utilized to improve water quality and reduce Total Suspended Solid (TSS) pollutant concentrations.

The original pre-development hydrologic model submitted for the – 45 Jackson Road Unified Permit analyzed the entire 23.9 ac. property. This model established three (3) POA's including:

- POA-1 (Existing Pond): Runoff via overland flow is directed towards the municipal stormwater basin to the west of the site. A portion of the overland flow is collected in existing drainage infrastructure and a drainage swale located just off the southwestern property line, both of which direct runoff to the existing basin.
- POA-2 (Jackson Road): Runoff via overland flow is directed off-site towards the northeast corner of the property and into Jackson Road.
- POA-3 (Municipal Drain): Existing municipal drain line conveys water from abutting properties through the site to the existing conveyance swale, where stormwater is ultimately discharged to the existing stormwater management basin.

The original pre-development hydrologic model for – 45 Jackson Road is submitted with this – 39 Jackson Road Stormwater Management Report as the existing conditions and model assumptions within the proposed development area remain unchanged.

Under post-development conditions for 39 Jackson Road, POA-2 at Jackson Road is not impacted by the development plan because the landscape area at the eastern part of 39 Jackson Road contributing to POA-2 was analyzed under the Lot-1 45 Jackson design furthermore. POA-1 is not impacted under the post development conditions for 39 Jackson Road, because the drainage system is designed to fully infiltrate up to the 25 – year storm event and overflow the 50, and 100 – year storm events to the municipal drain POA-3.

To avoid revising the original pre-development model to exclude POA-1 and POA-2, for simplicity POA-1 and POA-2 are included in this report for existing conditions but is excluded from the pre to post-development peak rate of runoff summary.

The hydrologic model, analysis, and proposed mitigation measures have been developed using the following resources:

- Hydrologic modeling techniques and methods established in NRCS - Technical Releases No. 20 and No. 55 (TR-20 and TR-55) using proprietary HydroCAD® stormwater modeling software.
- Massachusetts Department of Environmental Protection (MADEP)– Stormwater Handbook Volumes #1 and #2 (as amended). (The Handbook)
- Devens Reuse Plan and By-laws (as amended – the Regulations)

The Project is defined as New Development under the MassDEP Stormwater Management Handbook, Vol. 1 and 2, as amended (the Handbook), and is subject to the Handbook and the requirements of the Devens Bylaws and Site Plan Review regulations (the Regulations). Furthermore, stormwater discharges from the

Project must comply with the contributing watershed assumptions summarized in the following documents provided by MassDevelopment

- Notice of Intent Application entitled, "Roadway, Utility and Drainage Improvements | Jackson Road Route 2 Gate to Hospital Road, Devens, Massachusetts, dated July 1999"
- Document entitled, "Stormwater Management Narrative and Calculations | Roadway Reconstruction of Jackson Road, Devens, MA (undated)"
- Document entitled, "Revised Calculations – Roadway, Utility and Drainage Improvements Jackson Road | Route 2 Gate to Hospital Road, dated February 2000.
- Jackson Road Reconstruction Phase 1 and Phase 2 - Proposed Watershed Maps #1 and #2 | prepared by Beta Engineering, Inc. (undated)
- Jackson Road Reconstruction – Phase 1 – Record Drawings Drainage Plan and Profile No. 3, 6, 7, and 10, dated June 2002.

Based upon a review of the referenced documents the following assumptions are made with respect to the stormwater management design for the Project:

- Rainfall data to reference "TP-40 – Rainfall Frequency Atlas of the United States". 24-hour total rainfall data to match rainfall data assumptions for the design of the Jackson Road watershed areas.
- Existing impervious areas on the Property are assumed to have a land use of open space in good condition when calculating existing conditions weighted runoff curve number.
- Proposed developments within the contributing watershed areas of the Jackson Road drainage area shall assume that post-development stormwater runoff rates shall not exceed pre-development runoff rates for up to the 25-yr storm event. Where possible Project stormwater discharges shall store and infiltrate runoff volume on-site. Stormwater discharges exceeding the 25 years storm up to and including the 100-year storm can be released to the drainage system.

Proposed stormwater management Best Management Practices (BMP's) include a combination of passive and proprietary components including the following:

- Closed drainage collection system consisting of deep sump catch basins, precast concrete manholes, and HDPE pipe.
- Proprietary water quality units including Contech CDS hydrodynamic separators.
- Rain gardens with overflow within the east parking field landscape island adjacent to the Project building. Rain gardens areas have overflow grates to subsurface stormwater infiltration system.
- Underground stormwater infiltration facilities including perforated corrugated metal pipe of varying diameters encased in stone with overflows piped to a pre-constructed pipe stub connecting to an existing drainage system that discharges to the municipal stormwater basin, or to the relocated municipal drain located within the south driveway.

The hydrologic model demonstrates that the underground infiltration facilities have the capacity to store and infiltrate the post-development runoff volume for up to and including the 25-yr storm event, with overflows exceeding the 25-yr storm discharging through the drainage collection system to the MassDevelopment drainage infrastructure both on and off-site.

Rainfall Data

Peak stormwater discharges are determined for total rainfall estimated for the 2, 10, 25, 50 and 100-year storm event recurrence intervals. For this analysis, the values used for the 24-hour rainfall calculations were taken from rainfall data in a previous document entitled, "Revised Calculations - Roadway to reference "TP-40 – Rainfall Frequency Atlas of the United States" which matches the rainfall data used for the design of the Jackson Road Watershed areas, of which the Project site is located. Equivalent rainfall data was used for consistency between analyzing peak rate of runoff and associated discharges for the Project, to the rainfall assumptions made for the design of the receiving Devens stormwater infrastructure.

Table 1 – Summary of Rainfall Data

Rainfall Recurrence Interval	24-Hour Rainfall Depth
2 Year Storm	3.00 inches
10 Year Storm	4.50 inches
25 Year Storm	5.30 inches
50 Year Storm	6.00 inches
100 Year Storm	6.70 inches

The stormwater management system and BMPs are designed to mitigate water quantity and quality impacts through implementation of new deep sump catch basins; a raingarden, new underground detention/infiltration facilities; and new proprietary water quality units. The proposed stormwater mitigation results in net decreases in peak runoff rates generated by all storm events up to and including the 25-year storm. The proposed drainage collection system is designed to collect and convey and infiltrate the 25-year storm event for.

Soils Data

Based upon the USDA – NRCS Soil Conservation Service (SCS) for Middlesex County, Massachusetts, soils underlying the site are classified as follows (see soils map):

Table 2. – Summary of USDA Soil Classification

Soil Classification	Hydrologic Soil Group (HSG)
254B – Merrimac Fine Sandy Loam	HSG A
245B – Hinckley Loamy Sand	HSG A

On-site soil evaluation was performed by Highpoint Engineering, Inc. in November 2019 and September 2020 in areas deemed feasible for location of new underground stormwater management systems. The test pit observations demonstrate that Sand and Sandy Loam soils exist on site and are suitable for design of infiltration facilities. In accordance with the MassDEP Stormwater Handbook this soil classification corresponds to an assumed infiltration rate of 1.02 in/hr. as published by Rawls for the most restrictive soil horizon.

Additional in-situ field permeability testing was performed by the geotechnical engineer, where a minimum infiltration rate of 5 in/hr. was measured at the test sites. During peer review of the 45 Jackson Road Unified Permit stormwater management design, it was agreed that an assumed composite infiltration rate of 3 in/hr., being the average of the published Rawls rate and in-situ field measured rate, is appropriate and could be applied to the stormwater infiltration design assumptions. This assumption is likewise incorporated into this hydrologic analysis.

Confirmatory test pits were performed by Highpoint Engineering on April 13, 2021 at the footprint of SWM-06 to confirm seasonal high groundwater elevations. Evidence of seasonal high groundwater conditions were not observed to a depth of 13’ (Elevation 323.50 +/-) which is consistent with the estimates obtained from previous soil testing.

PRE-DEVELOPMENT CONDITIONS

The existing site consists of two (2) watershed areas, and the peak flow rates were established under the design of 45 Jackson Road stormwater design. Due to the natural topography of 33 Jackson Road, POA#1 is the single point of analysis that receives overland discharges from the development site. POA#2 is not a downstream point of analysis for this design, and POA#3 (municipal drain) does not receive discharges under existing conditions.

The existing site consists of two (2) watershed areas as described below and is analyzed at the two (2) POA's described in the "Methodology" section of this report. The existing site is mostly undeveloped with natural wooded areas with minor development areas associated with the original use of the site by the Army. Existing impervious areas to be demolished on the Property were assumed to be open space in good condition when calculating curve numbers.

Existing watershed areas include:

- Ex Ws-1 –This watershed includes most of the property that slopes east to west across the property towards the existing pond. Runoff from this watershed is discharged to the pond via overland flow and the existing drainage swale off the southwest side of the property.
- Ex Ws-2 – This watershed includes the northeastern portion of the property. Runoff from this watershed is discharged towards Jackson Road via overland flow.

Refer to Figures – Pre-Development Watershed Plan for information and limits of the existing soils and watershed areas.

For the pre-development watershed analysis, Table 3 is a comparison of watershed areas, the weighted TR-55 runoff curve numbers (CN – based on ground cover types), and calculated Time of Concentrations (T_c) for each existing Watershed Areas:

Table 3. – Pre-Development Watershed Area and Runoff Curve Number

	Ex Ws-1	Ex Ws-2
Area (ft^2)	965,762	73,759
CN	33	38
Tc	18.6 min	8.5 min

POST-DEVELOPMENT CONDITIONS

The Project includes site and building construction activities associated with developing a core and shell industrial/manufacturing building for either single or multiple life sciences/manufacturing tenants, construction of new stormwater management facilities with connections to existing onsite stormwater infrastructure; new utility infrastructure; and installation of lighting, landscape, pedestrian access, fencing and signage, and bicycle parking. The new stormwater conveyance system will utilize a previously designed underground infiltration system (SWM-07, designed under the 33 Jackson Road Project), upsize previously approved underground infiltration system (SWM-06, designed under the 45 Jackson Road Project), one (1) new underground detention system, deep sump catch basins with hooded outlets, drain manholes, two (2) rain garden areas, and proprietary water quality units. The subsurface retention/infiltration systems are designed to store and infiltrate post-development runoff to mitigate peak runoff into the pond for all design storms up to and including the 25-yr storm event. Stormwater discharges exceeding the 25-year storm event up to and including the 100-year storm will be released to the existing pond.

- Pr Ws-13- This watershed includes the parking lot and landscape area at the eastern part of lot 2. Runoff from this watershed flows overland and is captured by the proposed rain gardens and discharged to Stormwater Management System-17 (SWM-17).
- Pr Ws-14 – This watershed includes the southern driveway, portion of the west driveway, and the parking field west of building 2. Runoff from this watershed is collected via the deep-sump catch basins and discharged to Stormwater Management System-6 (SWM-6).
- Pr Ws-R1 – This watershed includes the western half of the roof area. Runoff from this watershed is routed to Stormwater Management System-7 (SWM-7) which is designed under the Lot-3 33 Jackson Rd project.
- Pr Ws-R2 – This watershed includes the eastern half of the roof area. Runoff from this watershed is routed to Stormwater Management System-17 (SWM-17)

Refer to Figures - Post-Development Watershed Plan for information and limits of the proposed watershed areas.

Table 4 presents a comparison of watershed area, the weighted TR-55 runoff curve number (CN – based on ground cover types), and Time of Concentration (T_c) for the proposed watersheds:

Table 4. – Post-Development Watershed Areas and Runoff Curve Numbers

	Pr Ws-13	Pr Ws-14	Pr Ws-R1	Pr Ws-R2
Area	40,126 ft^2	88,144 ft^2	38,129 ft^2	39,599 ft^2
CN	66	77	98	98
Tc	5.0 min	5.0 min	5.0 min	5.0 min

The new stormwater management systems are designed to collect and redirect stormwater runoff to passive and active water quality BMP's to achieve a minimum 80% TSS removal prior to recharge to the infiltration facilities. Subsurface infiltration facilities collect and recharge both surface and roof runoff

and are distributed throughout the surface parking and open space areas to mimic pre-development hydrologic conditions regarding recharge in accordance with the Regulations.

STORMWATER MITIGATION

The new site stormwater management system will improve water quality, infiltrate captured runoff, and mitigate/reduce peak flow rates associated with the development.

The following is a summary of the drainage infrastructure and BMPs are proposed:

- Deep sump hooded precast concrete catch basins.
- Precast concrete manholes.
- Surface rain gardens located adjacent to the parking area.
- Proprietary water quality hydrodynamic separators.
- Pervious pavement within select parking areas.
- Subsurface retention/infiltration facilities consisting of perforated, corrugated metal pipe surrounded by ¾" to 1½ washed stone.

Under post-development, site runoff at all POA's will be reduced for all storm events up to and including the 25-year storm event.

The following tables summarize the pre- and post-development reduction peak rates for the Project.

Table 5. – Summary of Pre- and Post-Development Peak Rates of Runoff

Design Storm	POA–3 Municipal Drain/South Driveway		
	Pre-Dev	Post-Dev	Change
2-Year	0.00 cfs	0.00 cfs	0 cfs
10-Year	0.00 cfs	0.00 cfs	0 cfs
25-Year	0.00 cfs	0.00 cfs	0 cfs
50-Year	0.00 cfs	0.46 cfs	+0.46 cfs
100-Year	0.00 cfs	1.17 cfs	+1.17 cfs

The designed stormwater management system provides improvements to water quality. The proposed BMP's provide a minimum 80% TSS removal efficiency prior to infiltration for the first flush (1.0" rain). One-inch water quality runoff is selected due to the rapid infiltration rate of the underlying soils, the requirements of the Devens MS4 permit, and the stormwater management plan. TSS Removal calculations are provided and can be found in Appendix B – Hydraulic Calculations.

The subsurface retention/infiltration facilities are designed to store, and infiltrate runoff volume and control discharges up to the 25-yr storm event on-site. Discharges from rainfall exceeding the 25-yr storm event will overflow to Devens stormwater infrastructure as allowed for in the Regulations. Based upon

the soil investigations, the bottom of the infiltration facilities has been designed with greater than 4' separation from estimated seasonal high groundwater.

The Project design meets the requirements of the Devens NOI Small MS4 General Permit and the Devens Stormwater Management Plan by implementing BMP's to reduce impervious area, provide pre-treatment, and promote retention/infiltration of stormwater runoff generated by the 25-yr design storm (5.3 inch/24-hour rainfall) prior to overflow to the municipal stormwater drainage system and the Nashua River. The total recharge of runoff for the 25-year event with no overflow far exceeds the minimum retention/recharge requirement of one-inch (1.0") of runoff over impervious areas as outlined in the Stormwater Management Plan. The design eliminates discharges of potential "first-flush" runoff constituents and minimizes the average annual load of TSS and Phosphorus, from both contributing impervious and pervious watershed areas. Uncontrolled pervious areas such as graded slopes that do not discharge to the retention/infiltration facilities will be revegetated and preserved as open space in a natural condition.

The Project design shall also meet the requirements of the Massachusetts Stormwater Management Handbook as applicable.

A Construction Phase and Long-Term Stormwater Maintenance and Operation Plan (O&M Plan) is included in Appendix C.

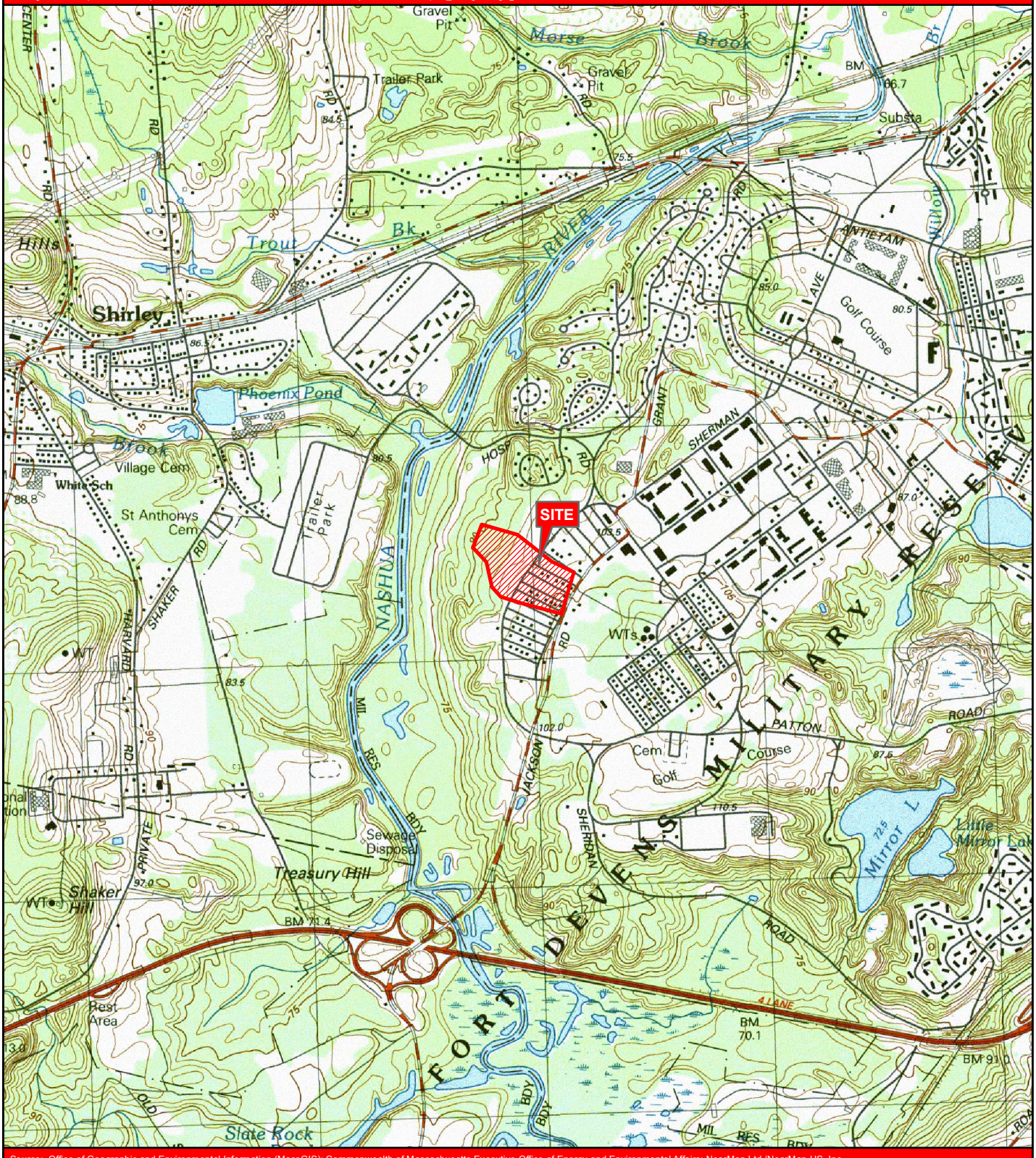
CONCLUSION

The proposed project provides substantial improvements to existing conditions. The proposed project will preserve the existing runoff patterns to the extent practicable and reduce peak rate of runoff and runoff volume for all storm events up to and including the 25-year storm event. Potential stormwater impacts associated with the site improvements have been mitigated by appropriate design methods and meet the requirements of the Handbook and the Regulations. The proposed project complies with the standards outlined in the Massachusetts Stormwater Management Handbook as follows:

STANDARD **1**	No New Untreated Discharges	**Met**, All discharge points are maintained. Water quality BMP's are added to treat the runoff generated by the development.
STANDARD **2**	Peak Rate Attenuation	**Met**, Peak discharge rates are decreased for the 2-, 10-, & 25-year storm events.
STANDARD **3**	Recharge	**Met**, The developed site is routed to surface subsurface infiltration facilities to recharge the required recharge volume.
STANDARD **4**	Water Quality	**Met**, The deep-sump hooded catch basins, CDS water quality units, the rain gardens, and recharge facilities are designed to capture and treat the 1" water quality volume from the contributing development area and improve the water quality of runoff prior to infiltration.
STANDARD **5**	Land Uses with Higher Potential Pollutant Loads	Not Applicable - The proposed project is not a listed activity associated with a LUHPPL defined in the Handbook.
STANDARD **6**	Critical Areas	Not Applicable - The project site is not located within a Critical Area.
STANDARD **7**	Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable	The proposed project does not qualify as a Redevelopment.
STANDARD **8**	Construction Period Pollution Prevention and Erosion and Sedimentation Control	The project is required to obtain an EPA - NPDES Construction General Permit prior to construction. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and submitted prior to the start construction phase.
STANDARD **9**	Operation & Maintenance Plan	**Met**, A long-term Operation and Maintenance Plan is included in the report.
STANDARD **10**	Prohibition of Illicit Discharges	An Illicit Discharge Compliance Statement will be submitted by the Owner prior to operation.

FIGURES

P:\King Street Properties\19019 (Devens Bio Manuf. Sites, 45 Jackson & 111 Hospital Rd, Devens)\04_Design\Dwg\@GIS\USGS.mxd



Source: Office of Geographic and Environmental Information (MassGIS); Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs; NearMap Ltd./NearMap US, Inc.

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LAND PLANNING
PERMIT EXPEDITING
CIVIL ENGINEERING
CONSULTING

CANTON CORPORATE PLACE
45 DAN ROAD, SUITE 140
CANTON, MA 02021

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USGS MAP

45 Jackson Road
Devens, MA 01434

November 2, 2020

N
W E
S

0 1,000 2,000 4,000 Feet

Scale: 1"=2,000'

P:\King Street Properties\19019 (Devens Bio Manuf. Sites, 45 Jackson & 111 Hospital Rd, Devens)\04_Design\Dwg\@GIS\SOILS.mxd

LEGEND

MassDOT Roads

Road Type

- Limited Access Highway
- Multi-lane Hwy, not limited access
- Other Numbered Highway
- Major Road, Collector
- Minor Road, Arterial
- Ramp
- Tunnel
- Tunnel (Limited Access Hwy)
- Tunnel (Multi-lane Hwy)
- Tunnel (Other Numbered Hwy)
- Worcester Northeast Soils

SOIL SUMMARY:

245B Hinckley loamy sand, 3-8% slopes (HSG A)
254B Merrimac fine sandy loam, 3-8% slopes (HSG A)
275A Agawam fine sandy loam, 0-3% slopes (HSG B)

Source: "Soil Survey of Worcester County, Massachusetts - Northeastern Part," USDA SCS, December 1985.

Source: Office of Geographic and Environmental Information (MassGIS); Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs; NearMap Ltd./NearMap US, Inc.

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SOILS MAP

45 Jackson Road
Devens, MA 01434

November 2, 2020

N
W E
S

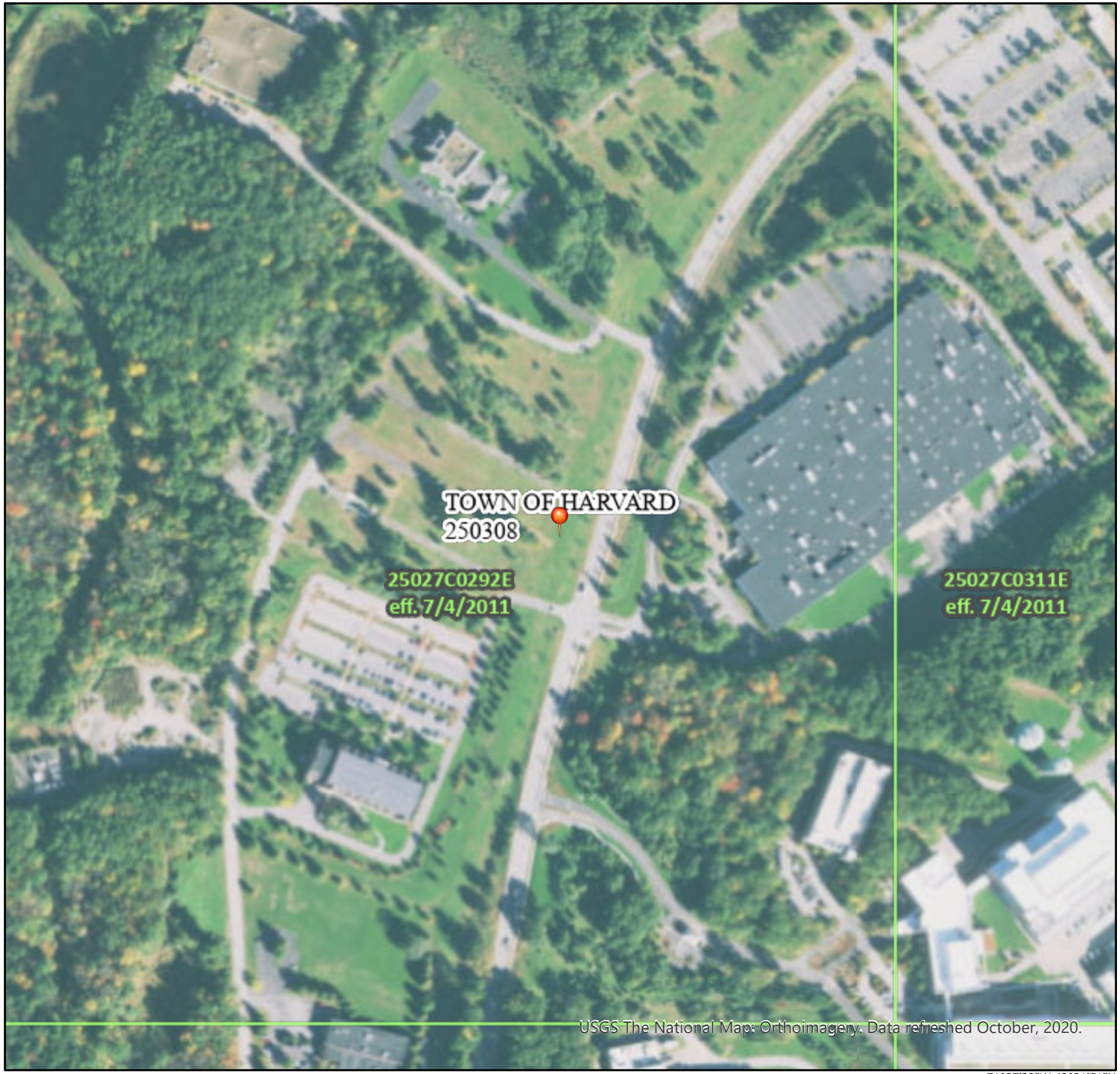
0 250 500 1,000 Feet

Scale: 1"=500'

National Flood Hazard Layer FIRMette

FEMA

71°38'W 42°32'18"N



71°37'23"W 42°31'51"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/4/2020 at 5:36 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

SYMBOL LEGEND

———	WATERSHED BOUNDARY
- - - - - - - -	TIME OF CONCENTRATION
➤	TIME OF CONCENTRATION FLOW PATH
POA 1	POINT OF ANALYSIS DESIGNATION
Ex Ws-1	WATERSHED DESIGNATION
|||||||||||	SOIL BOUNDARY

PRE-DEVELOPMENT WATERSHED SUMMARY

WATERSHED AREA: Ex Ws-1
- TOTAL AREA = 965,762 S.F
- WOODS = 640,465 S.F
- OPEN SPACE = 325,297 S.F
- CURVE NUMBER (CN) = 33
- TIME OF CONCENTRATION (Tc) =18.6 MIN.

WATERSHED AREA: Ex Ws-2
- TOTAL AREA = 73,759 S.F
- WOODS = 7,433 S.F
- OPEN SPACE = 66,326 S.F
- CURVE NUMBER (CN) = 38
- TIME OF CONCENTRATION (Tc) =8.5 MIN.

POA 1
POND
INVERT INV RCP 36 ELEV: 270.18'
INVERT INV 12 CPP FES ELEV: 307.89'
INVERT INV RCP 42 ELEV: 310.58'
INVERT INV 12" CMP ELEV: 333.06'
INVERT INV 10 CLAY ELEV: 324.31'
INVERT TOP 12" CMP (FILLED) ELEV: 329.90'
254B:MERRIMAC FINE SANDY LOAM HYDROLOGIC SOIL GROUP: A
275A: AGAWAM FINE SAND LOAM HYDROLOGIC SOIL GROUP: B
245B: HINCKLEY LOAMY SAND HYDROLOGIC SOIL GROUP: A
tc=18.6 mins.
tc=8.5 mins.
Ex Ws-1
Ex Ws-2
POA 2
JACKSON RD
JACKSON ROAD
OLD COACH ROAD
13-21-11.00
0.8
246.82'
658.56'
633.13'
S10°26'27"E 65.40'
SBDH L=45.10' R=60.00' Δ=43°04'06"
S16°23'30"W 660.54'
S72°30'49"W 227.06'
N72°58'02"W 643.08'
N72°30'49"W 227.06'
S72°30'49"E 227.06'
N=3020377.860 E=621835.070
N=3020271.433 E=621771.152
BENCHMARK: BMK-C BOMO XCUT ELEV: 335.25'
BENCHMARK: BMK A - BOMO XCUT ELEV: 347.95'
TP 306
TP 307
TP 308A
TP 302
TP 303
TP GZH-302
SBDH
IRF
WF A1 WF A2 WF A3 WF A4 WF A5 WF A6 WF A7 WF A8 WF A9 WF A10 WF A11 WF A12 WF A13 WF A14 WF A15 WF A16 WF A17 WF A18 WF A19 WF A20 WF A21 WF A22 WF A23 WF A24 WF A25 \STOP

GRAPHIC SCALE 60 0 30 60 120 240 — 1 inch = 60 ft.

HIGHPOINT ENGINEERING, INC.
LAND PLANNING
PERMIT EXPEDITING
CIVIL ENGINEERING
CONSULTING
CANTON CORPORATE PLACE
45 DAN ROAD, SUITE 140
CANTON, MA 02021
www.HighpointEng.com

CLIENT:
King Devens, LLC
800 Boylston Street, Suite 1570
Boston, MA 02199

CONSULTANT:

SEAL

LEVEL 2 - UNIFIED PERMIT
45 JACKSON ROAD - LOT 1

45 JACKSON ROAD
DEVENS, MA

OWNER/APPLICANT: KING DEVENS, LLC

REV	DATE	DESCRIPTION

ISSUE TYPE: LEVEL 2 - PERMIT SET
ISSUE DATE: 11-05-2020
PROJECT NUMBER: 19019

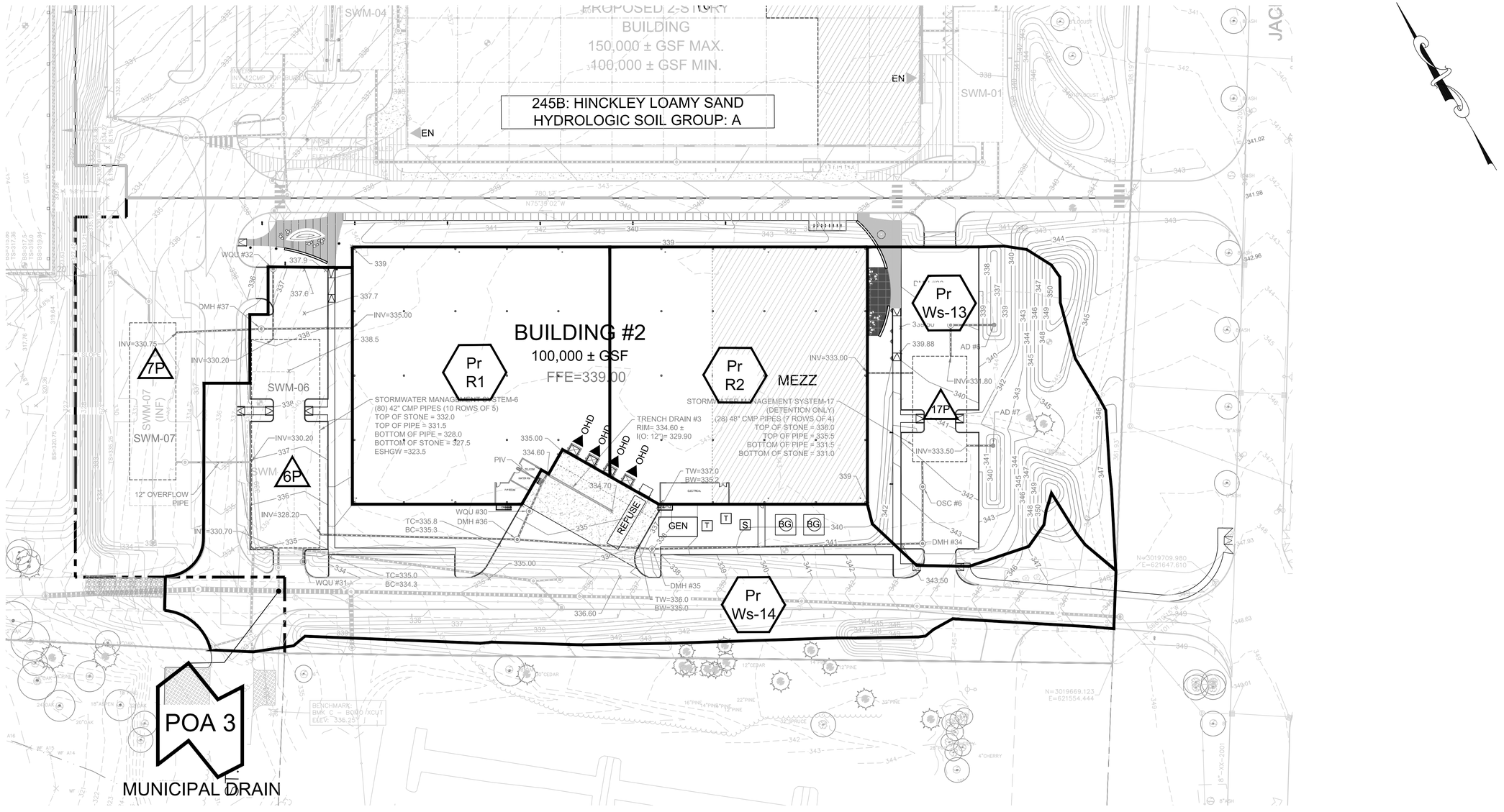
DRAWN BY: JJP
CHECKED BY: DH

SHEET TITLE:
PRE-DEVELOPMENT WATERSHED PLAN

SHEET NUMBER:
PRE

P:\King Street Properties\19019 (Devens Bio Manuf. Sites, 45 Jackson & 111 Hospital Rd, Devens)\04_Design\Dwg\@Hyd\45-Pre.dwg

ISSUED FOR : UNIFIED PERMIT



POST-DEVELOPMENT WATERSHED SUMMARY

WATERSHED AREA: Pr Ws-R1
- TOTAL AREA = 38,129 S.F
- ROOF AREA = 38,129 S.F
- CURVE NUMBER (CN) = 98
- TIME OF CONCENTRATION (Tc) =5.0 MIN.

WATERSHED AREA: Pr Ws-R2
- TOTAL AREA = 39,599 S.F
- ROOF AREA = 39,599 S.F
- CURVE NUMBER (CN) = 98
- TIME OF CONCENTRATION (Tc) =5.0 MIN.

WATERSHED AREA: Pr Ws-13
- TOTAL AREA = 40,126 S.F
- IMPERVIOUS AREA = 18,587 S.F
- OPEN SPACE = 21,539 S.F
- CURVE NUMBER (CN) = 66
- TIME OF CONCENTRATION (Tc) =5.0 MIN.

WATERSHED AREA: Pr Ws-14
- TOTAL AREA = 88,144 S.F
- IMPERVIOUS AREA = 56,656 S.F
- OPEN SPACE = 31,488 S.F
- CURVE NUMBER (CN) = 77
- TIME OF CONCENTRATION (Tc) =5.0 MIN.

SYMBOL LEGEND

———	WATERSHED BOUNDARY
- - - - - -	TIME OF CONCENTRATION
➤	TIME OF CONCENTRATION FLOW PATH
POA 1	POINT OF ANALYSIS DESIGNATION
Pr Ws-1	WATERSHED DESIGNATION
·····	SOIL BOUNDARY

GRAPHIC SCALE 1 inch = 40 ft. (40 0 20 40 80 160)

P:\King Street Properties\19019 (Devens Bio Manuf. Sites, 45 Jackson & 111 Hospital Rd, Devens)\04_Design\Dwg\@Hyd\45-Post-BLDG2.dwg

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www.HighpointEng.com

CLIENT:
King Devens, LLC
800 Boylston Street, Suite 1570
Boston, MA 02199

CONSULTANT:

SEAL

LEVEL 2 - UNIFIED PERMIT

39 JACKSON ROAD - LOT 2

39 JACKSON ROAD
DEVENS, MA

OWNER/APPLICANT: KING DEVENS, LLC

REV	DATE	DESCRIPTION

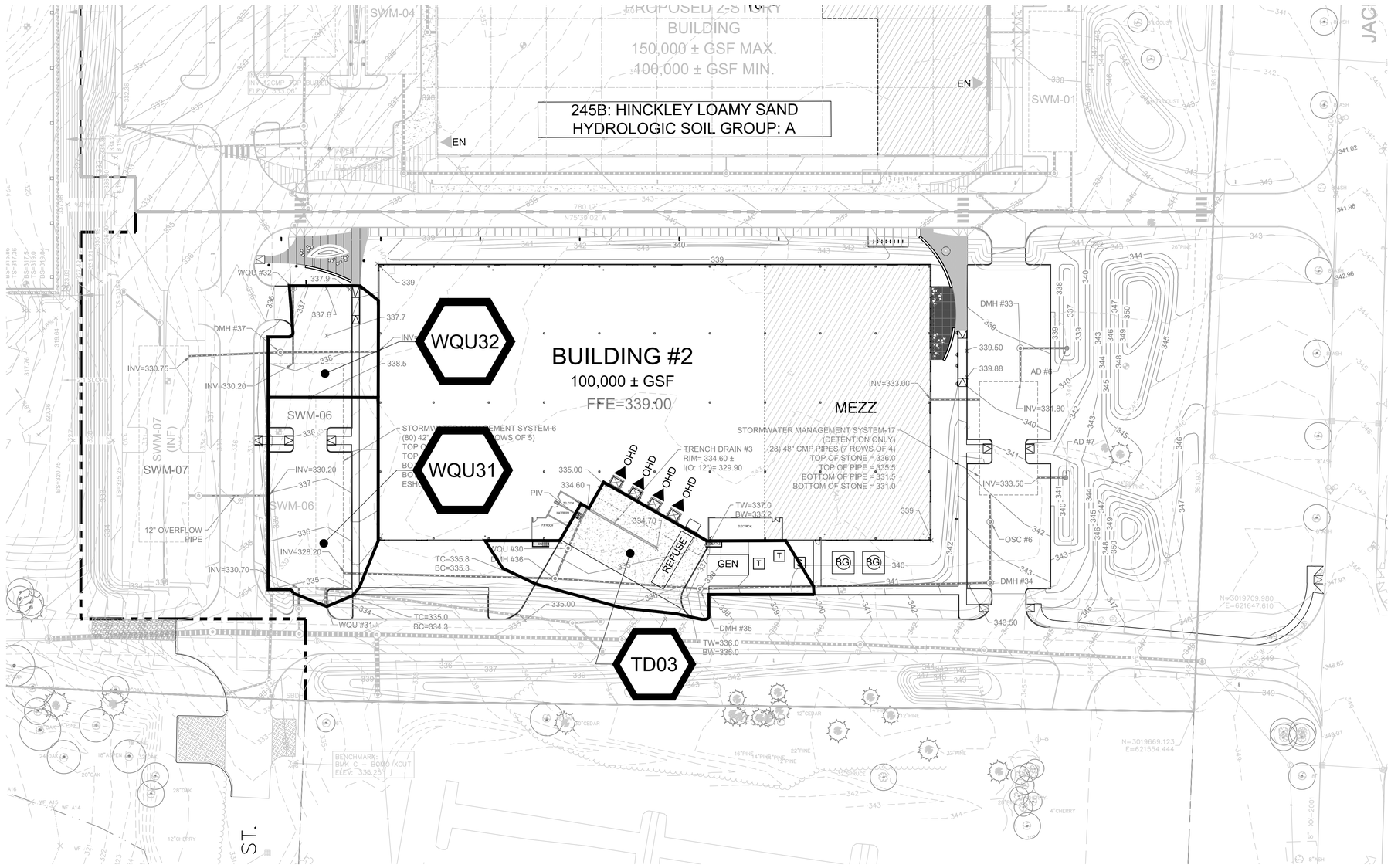
ISSUE TYPE: LEVEL 2 - PERMIT SET
ISSUE DATE: 05-06-2021
PROJECT NUMBER: 19019

DRAWN BY: JJP
CHECKED BY: DH

SHEET TITLE: POST-DEVELOPMENT WATERSHED PLAN

SHEET NUMBER: POST

ISSUED FOR : UNIFIED PERMIT



SUBCATCHMENT WATERSHED SUMMARY

SUBCAT: TD #03
- TOTAL AREA = 11,425 S.F
- IMPERVIOUS AREA = 8,187 S.F
- OPEN SPACE = 3,238 S.F

SUBCAT: WQU #31
- TOTAL AREA = 11,181 S.F
- IMPERVIOUS AREA = 9,531 S.F
- OPEN SPACE = 1,650 S.F

SUBCAT: WQU #32
- TOTAL AREA = 5,763 S.F
- IMPERVIOUS AREA = 4,734 S.F
- OPEN SPACE = 1,029 S.F

GRAPHIC SCALE 40 0 20 40 80 160 — 1 inch = 40 ft.

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Boston, MA 02199

CONSULTANT:

SEAL

LEVEL 2 - UNIFIED PERMIT
39 JACKSON ROAD - LOT 2
39 JACKSON ROAD
DEVENS, MA
OWNER/APPLICANT: KING DEVENS, LLC

REV	DATE	DESCRIPTION

ISSUE TYPE: LEVEL 2 - PERMIT SET
ISSUE DATE: 05-06-2021
PROJECT NUMBER: 19019

DRAWN BY: JJP
CHECKED BY: DH

SHEET TITLE: SUBCATCHMENT PLAN

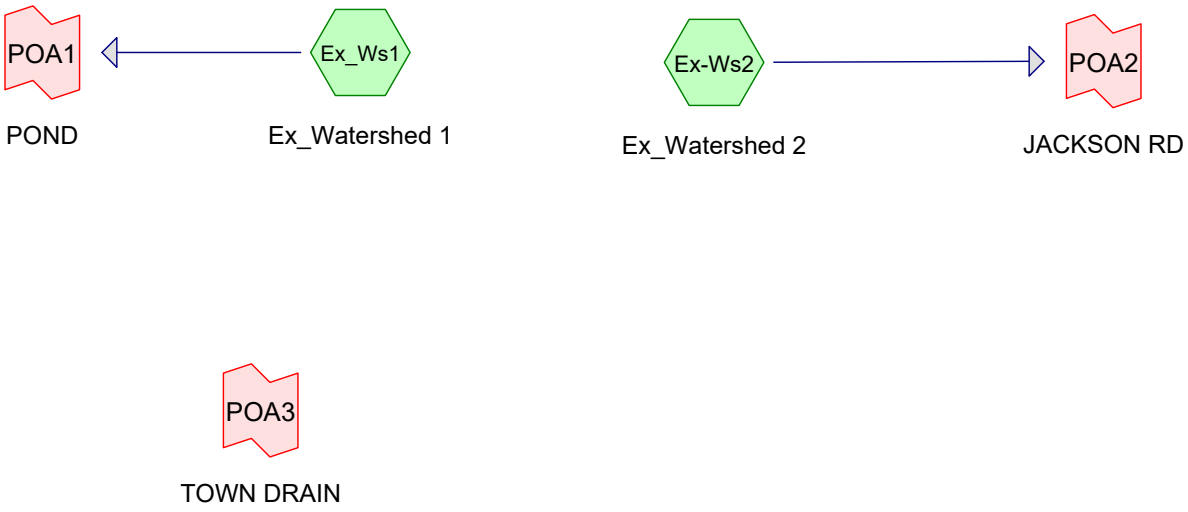
SHEET NUMBER: SUBCAT

ISSUED FOR : UNIFIED PERMIT

P:\King Street Properties\19019 (Devens Bio Manuf. Sites, 45 Jackson & 111 Hospital Rd, Devens)\04_Design\Dwg\@Hyd\45-Subcat-BLDG2.dwg

APPENDIX A

Hydrologic Calculations



Subcat Reach Pond Link

Routing Diagram for Pre-Dev
Prepared by Highpoint Engineering, Printed 2/11/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
391,623	39	>75% Grass cover, Good, HSG A (Ex-Ws2, Ex_Ws1)
647,898	30	Woods, Good, HSG A (Ex-Ws2, Ex_Ws1)

Summary for Subcatchment Ex-Ws2: Ex_Watershed 2

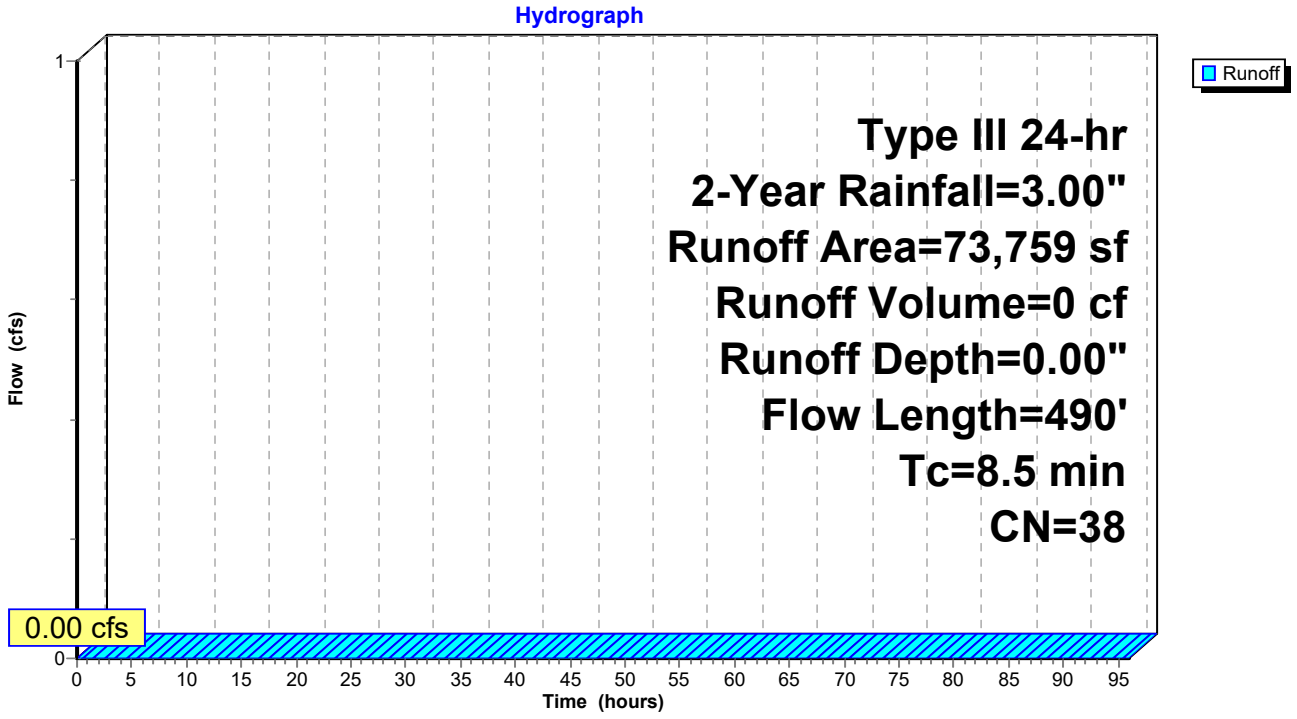
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
66,326	39	>75% Grass cover, Good, HSG A
7,433	30	Woods, Good, HSG A
73,759	38	Weighted Average
73,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0330	0.19		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
4.0	440	0.0130	1.84		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
8.5	490	Total			

Subcatchment Ex-Ws2: Ex_Watershed 2



Summary for Subcatchment Ex_Ws1: Ex_Watershed 1

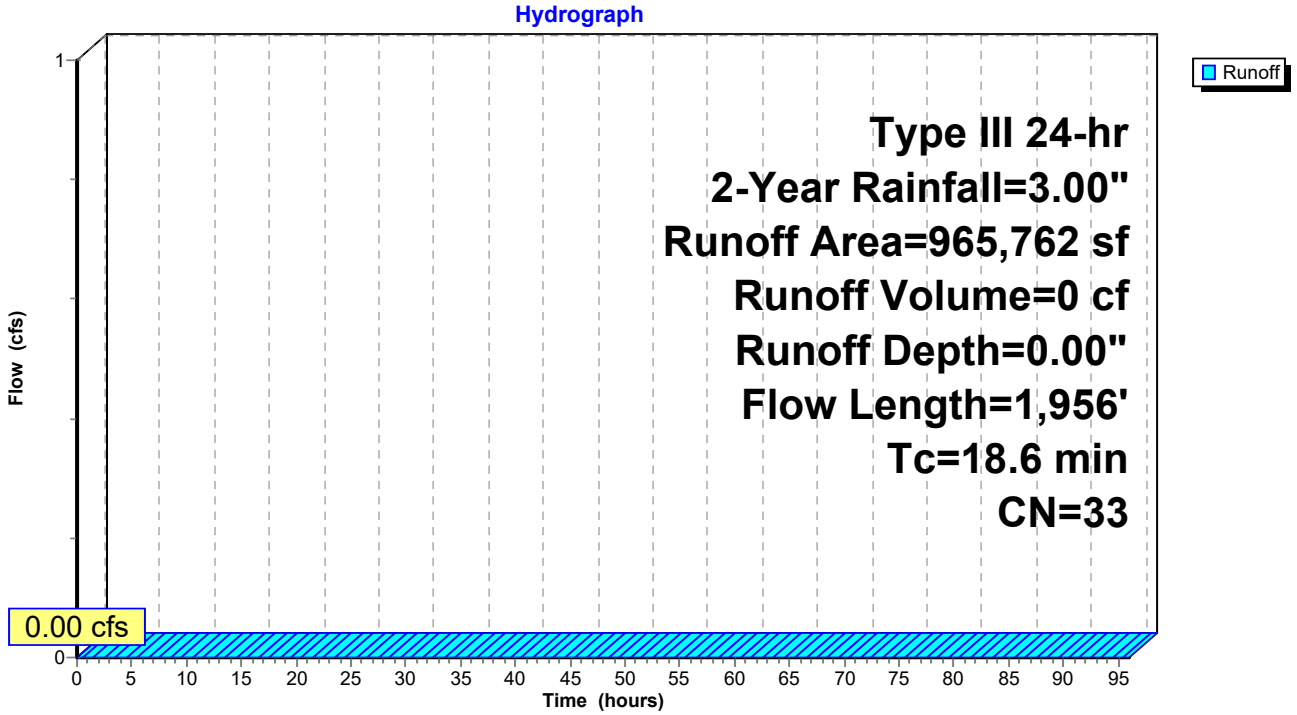
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
640,465	30	Woods, Good, HSG A
325,297	39	>75% Grass cover, Good, HSG A
965,762	33	Weighted Average
965,762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
6.3	635	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	228	0.0150	2.49		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
4.8	971	0.0440	3.38		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.2	72	0.1440	6.11		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
18.6	1,956	Total			

Subcatchment Ex_Ws1: Ex_Watershed 1

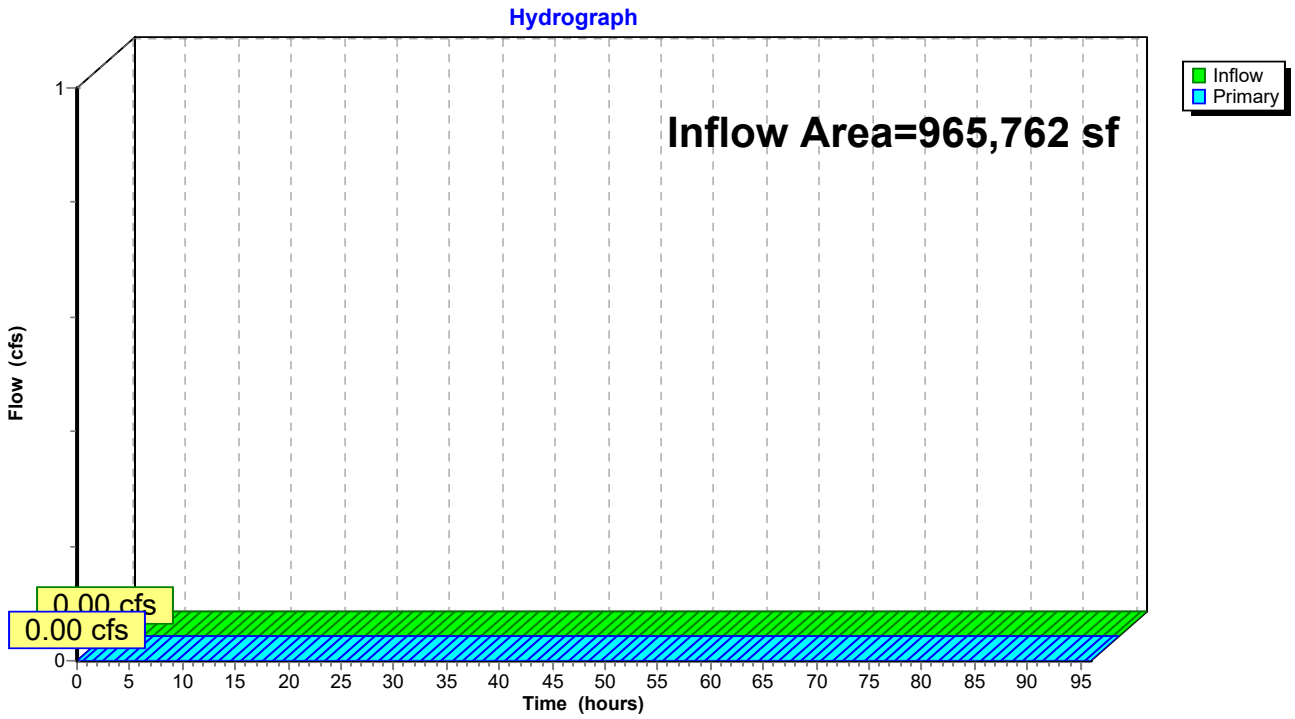


Summary for Link POA1: POND

Inflow Area = 965,762 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA1: POND

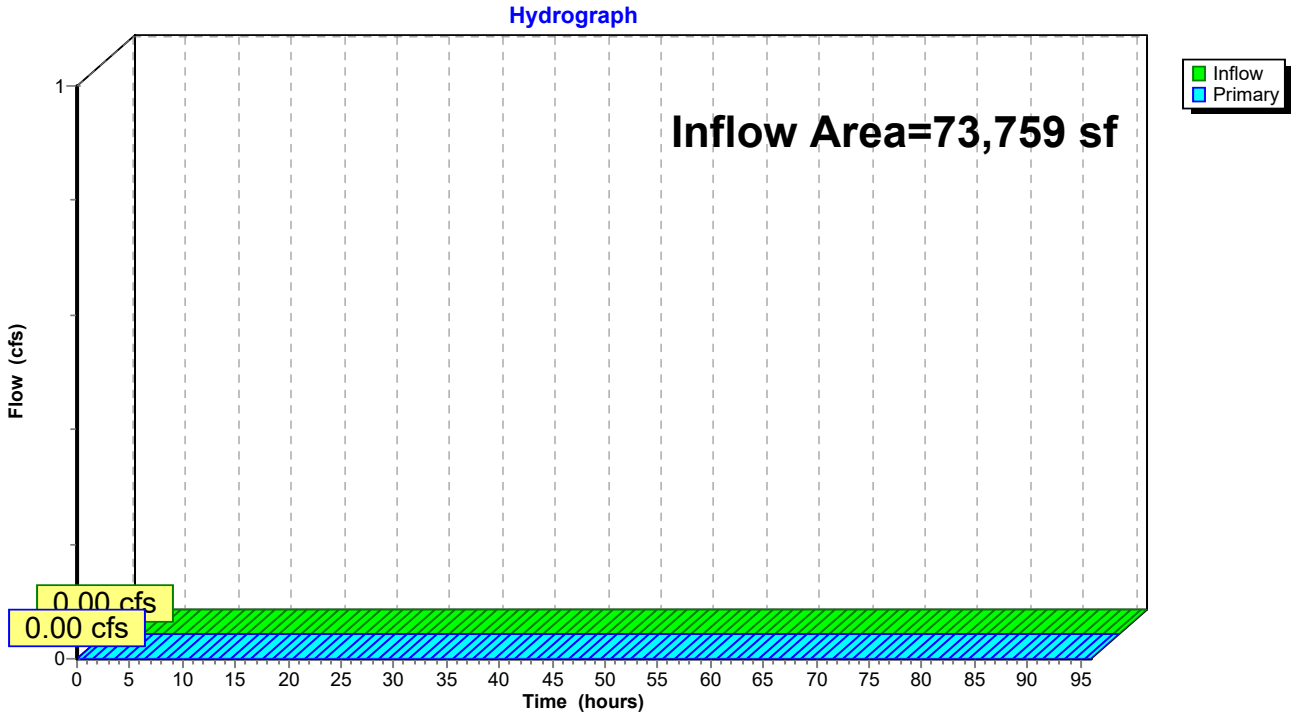


Summary for Link POA2: JACKSON RD

Inflow Area = 73,759 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA2: JACKSON RD

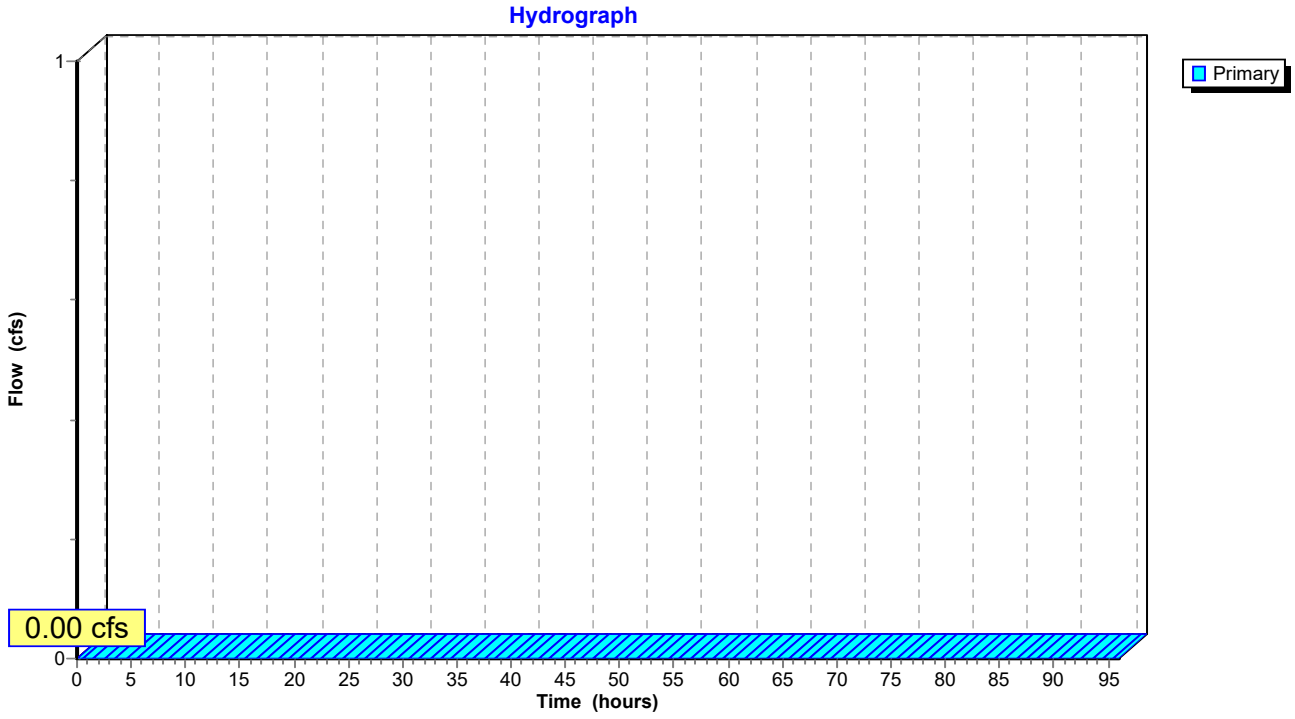


Summary for Link POA3: TOWN DRAIN

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA3: TOWN DRAIN



Summary for Subcatchment Ex-Ws2: Ex_Watershed 2

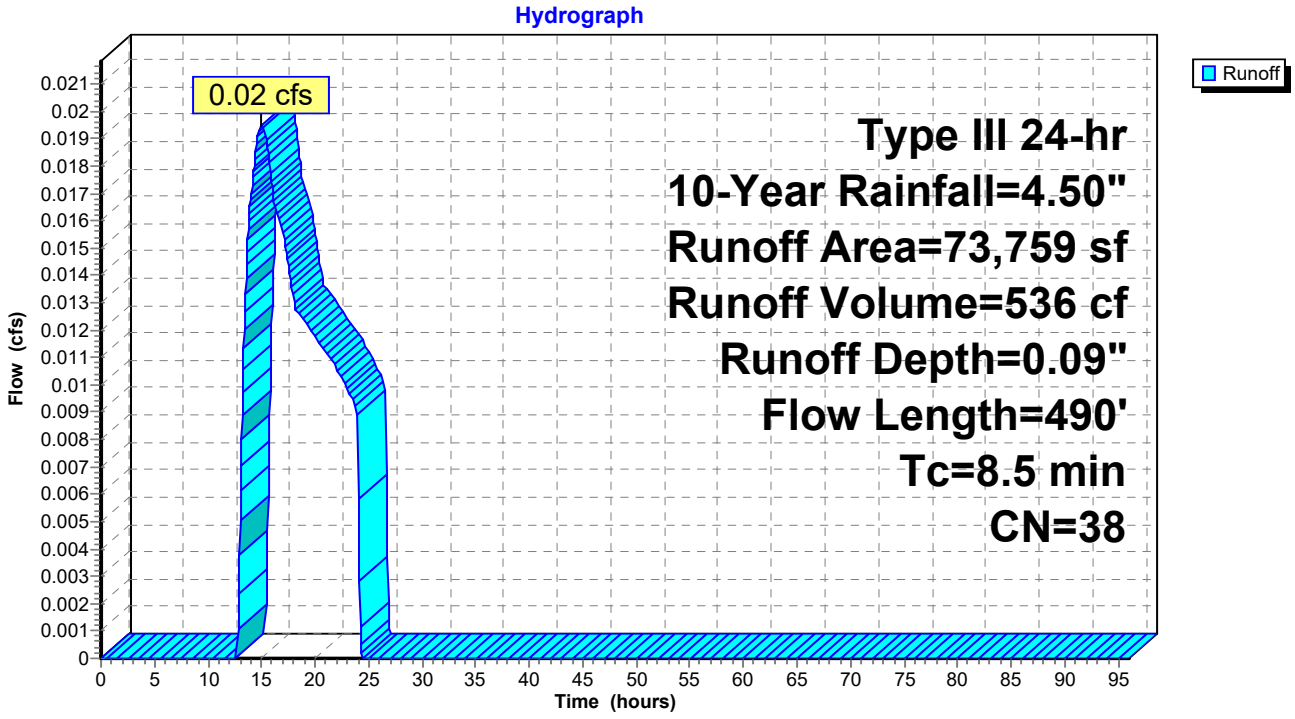
Runoff = 0.02 cfs @ 15.02 hrs, Volume= 536 cf, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
66,326	39	>75% Grass cover, Good, HSG A
7,433	30	Woods, Good, HSG A
73,759	38	Weighted Average
73,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0330	0.19		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
4.0	440	0.0130	1.84		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
8.5	490	Total			

Subcatchment Ex-Ws2: Ex_Watershed 2



Summary for Subcatchment Ex_Ws1: Ex_Watershed 1

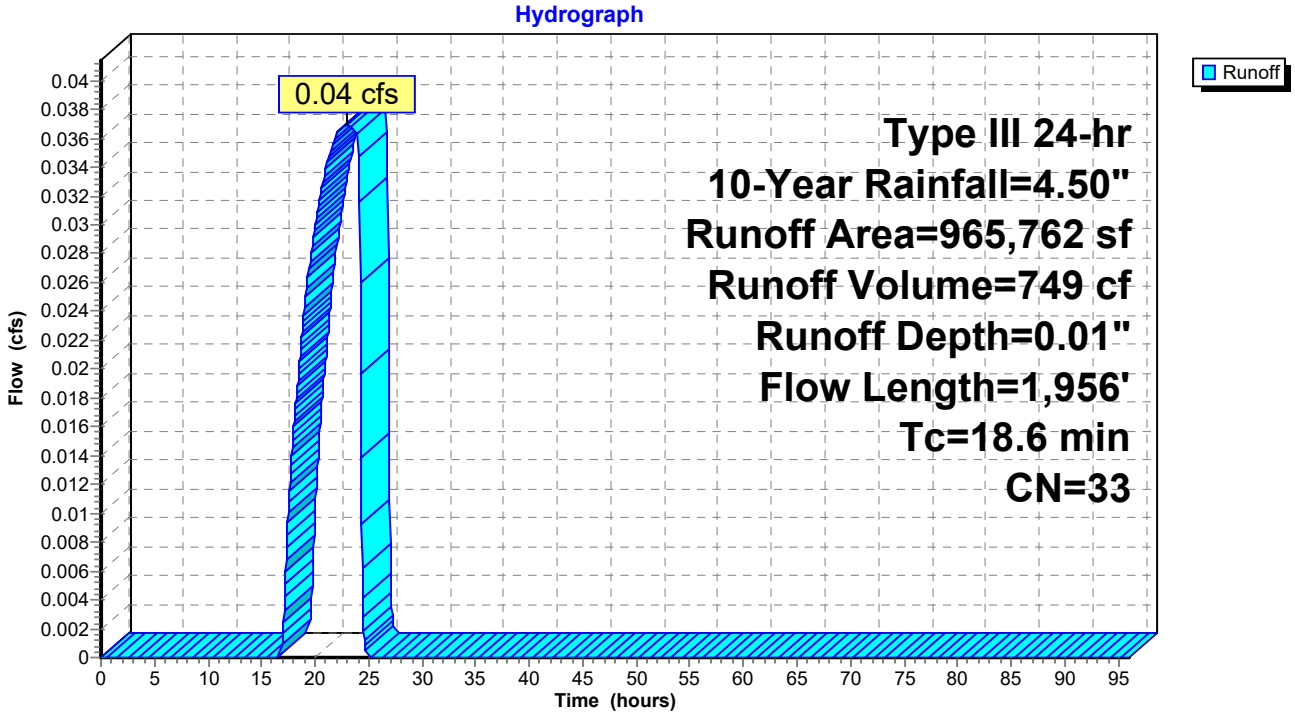
Runoff = 0.04 cfs @ 22.94 hrs, Volume= 749 cf, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
640,465	30	Woods, Good, HSG A
325,297	39	>75% Grass cover, Good, HSG A
965,762	33	Weighted Average
965,762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
6.3	635	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	228	0.0150	2.49		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
4.8	971	0.0440	3.38		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.2	72	0.1440	6.11		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
18.6	1,956	Total			

Subcatchment Ex_Ws1: Ex_Watershed 1

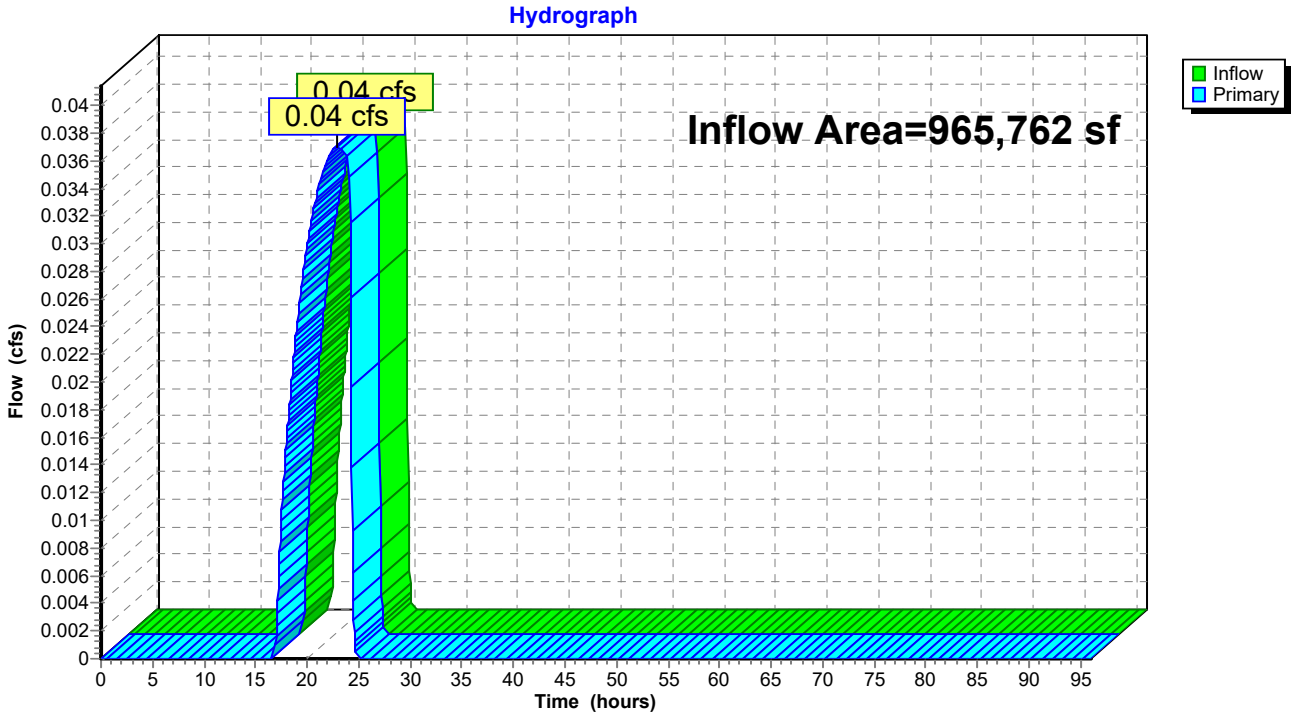


Summary for Link POA1: POND

Inflow Area = 965,762 sf, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.04 cfs @ 22.94 hrs, Volume= 749 cf
Primary = 0.04 cfs @ 22.94 hrs, Volume= 749 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA1: POND

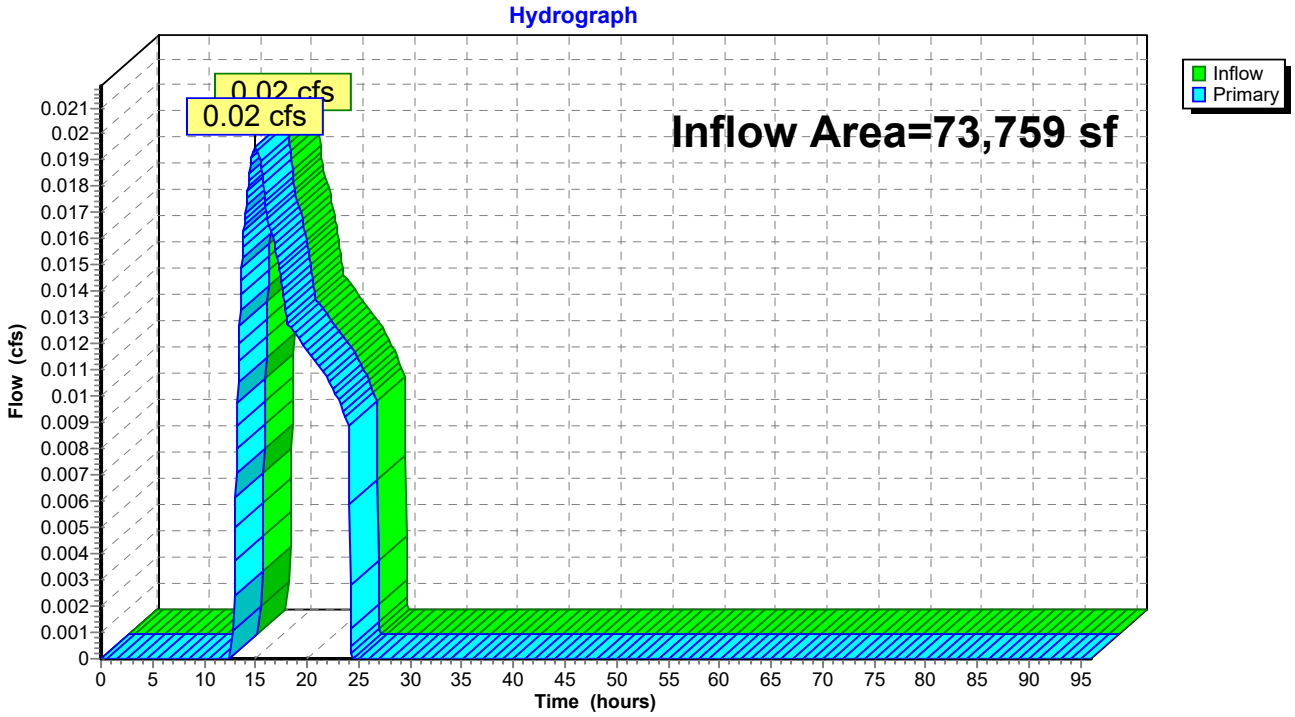


Summary for Link POA2: JACKSON RD

Inflow Area = 73,759 sf, 0.00% Impervious, Inflow Depth = 0.09" for 10-Year event
Inflow = 0.02 cfs @ 15.02 hrs, Volume= 536 cf
Primary = 0.02 cfs @ 15.02 hrs, Volume= 536 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA2: JACKSON RD

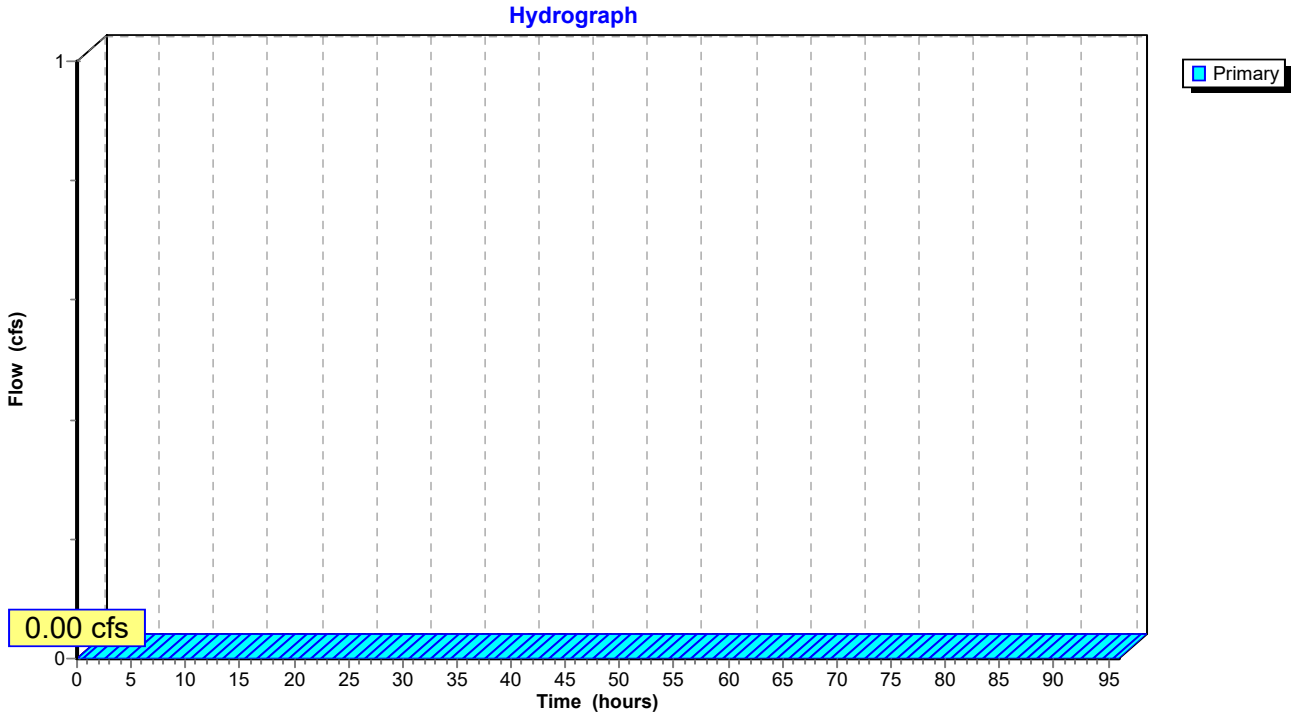


Summary for Link POA3: TOWN DRAIN

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA3: TOWN DRAIN



Summary for Subcatchment Ex-Ws2: Ex_Watershed 2

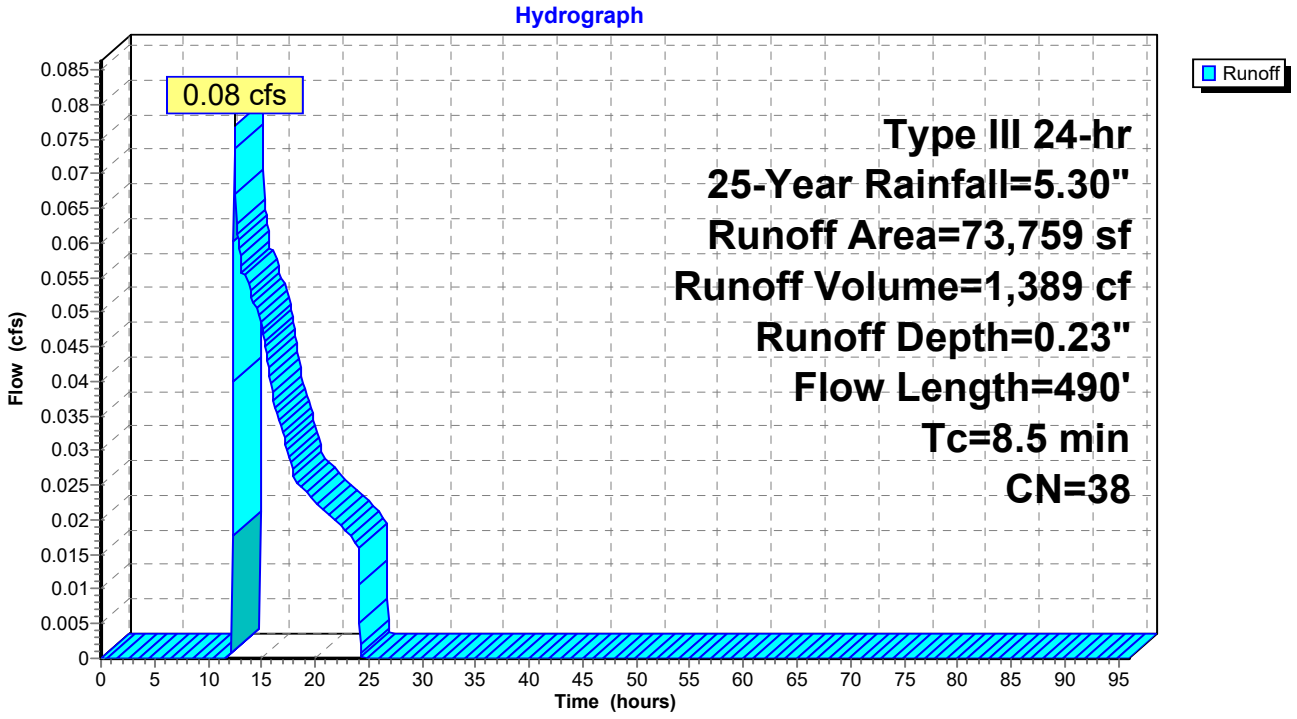
Runoff = 0.08 cfs @ 12.50 hrs, Volume= 1,389 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
66,326	39	>75% Grass cover, Good, HSG A
7,433	30	Woods, Good, HSG A
73,759	38	Weighted Average
73,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0330	0.19		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
4.0	440	0.0130	1.84		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
8.5	490	Total			

Subcatchment Ex-Ws2: Ex_Watershed 2



Summary for Subcatchment Ex_Ws1: Ex_Watershed 1

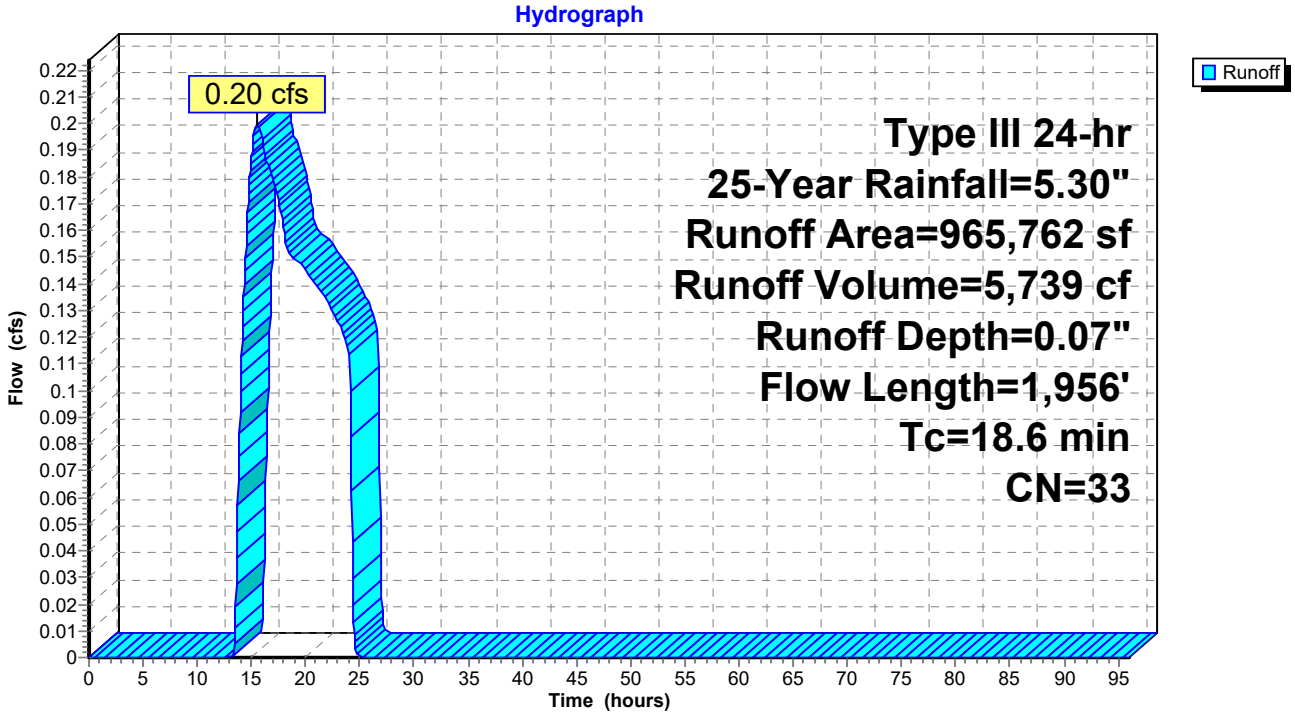
Runoff = 0.20 cfs @ 15.57 hrs, Volume= 5,739 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
640,465	30	Woods, Good, HSG A
325,297	39	>75% Grass cover, Good, HSG A
965,762	33	Weighted Average
965,762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
6.3	635	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	228	0.0150	2.49		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
4.8	971	0.0440	3.38		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.2	72	0.1440	6.11		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
18.6	1,956	Total			

Subcatchment Ex_Ws1: Ex_Watershed 1

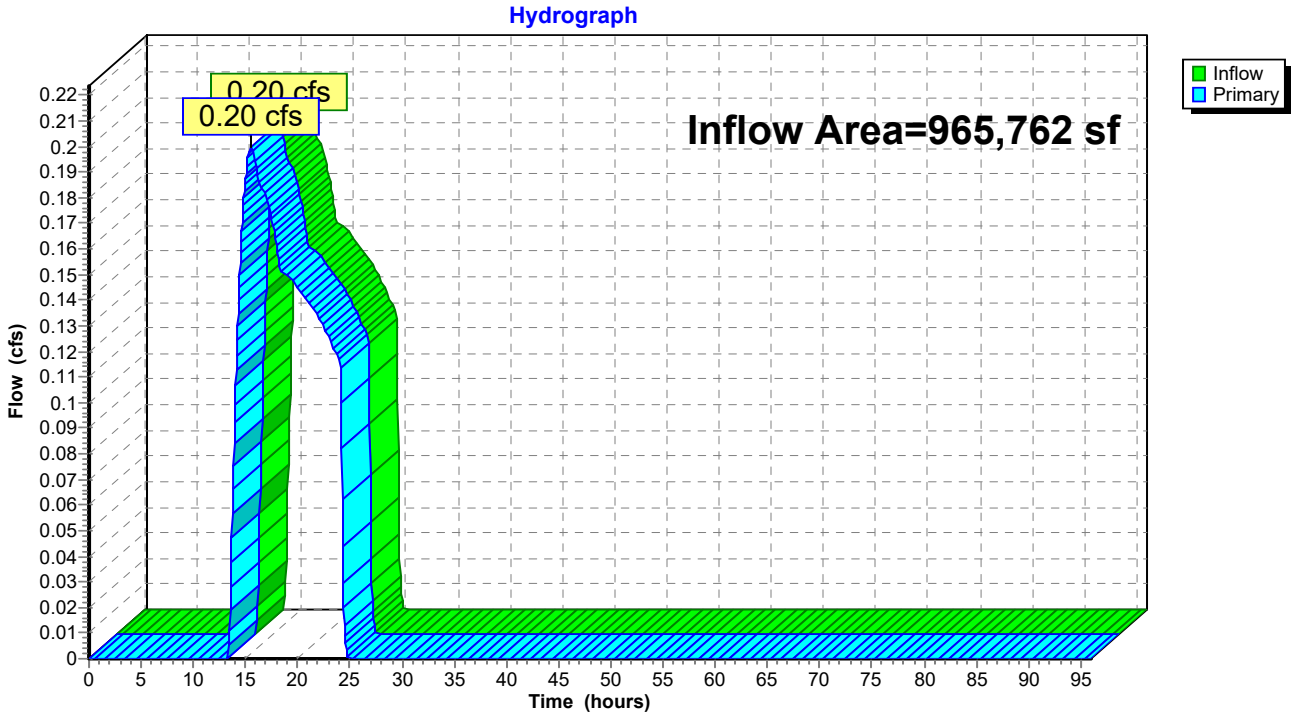


Summary for Link POA1: POND

Inflow Area = 965,762 sf, 0.00% Impervious, Inflow Depth = 0.07" for 25-Year event
Inflow = 0.20 cfs @ 15.57 hrs, Volume= 5,739 cf
Primary = 0.20 cfs @ 15.57 hrs, Volume= 5,739 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA1: POND

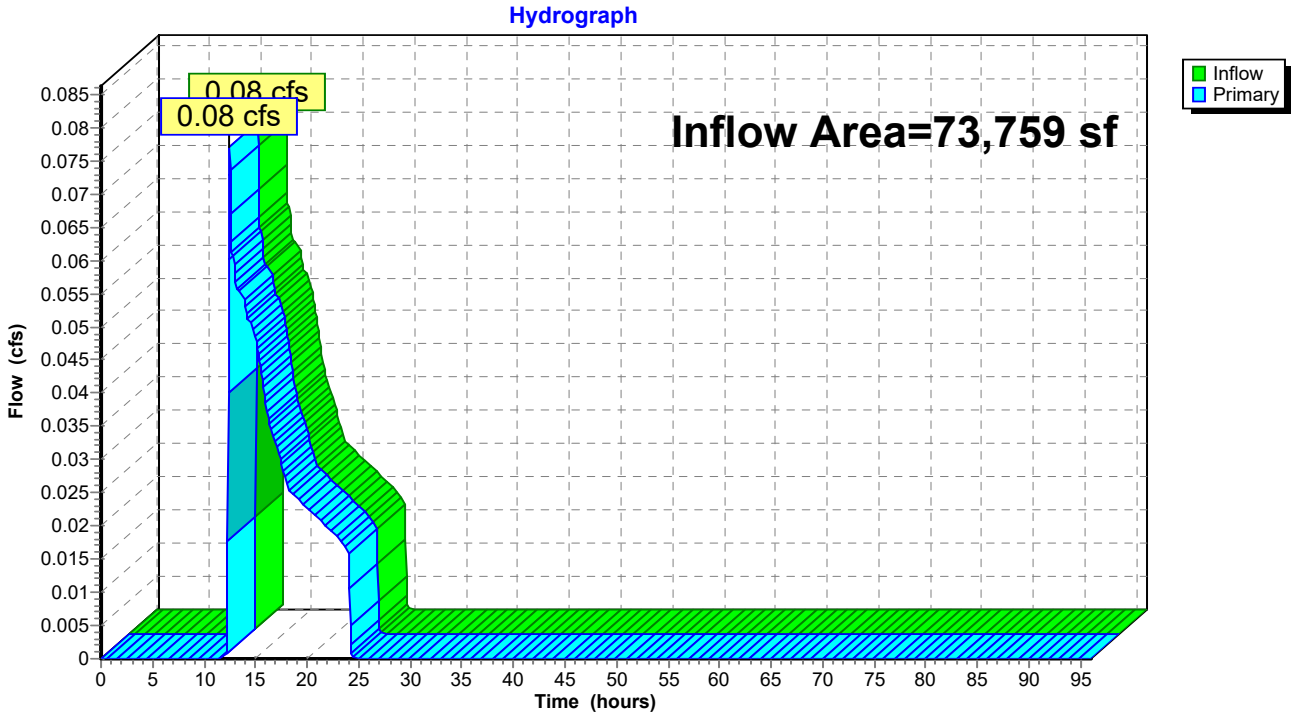


Summary for Link POA2: JACKSON RD

Inflow Area = 73,759 sf, 0.00% Impervious, Inflow Depth = 0.23" for 25-Year event
Inflow = 0.08 cfs @ 12.50 hrs, Volume= 1,389 cf
Primary = 0.08 cfs @ 12.50 hrs, Volume= 1,389 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA2: JACKSON RD

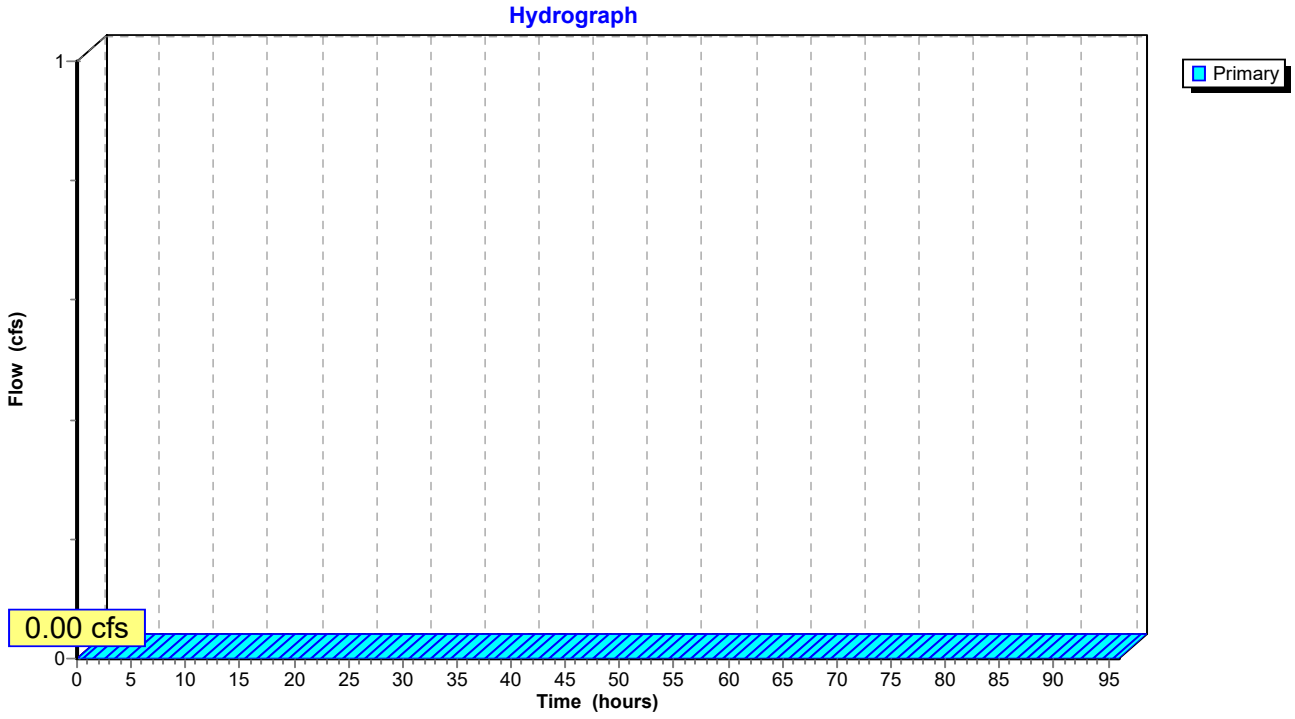


Summary for Link POA3: TOWN DRAIN

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA3: TOWN DRAIN



Summary for Subcatchment Ex-Ws2: Ex_Watershed 2

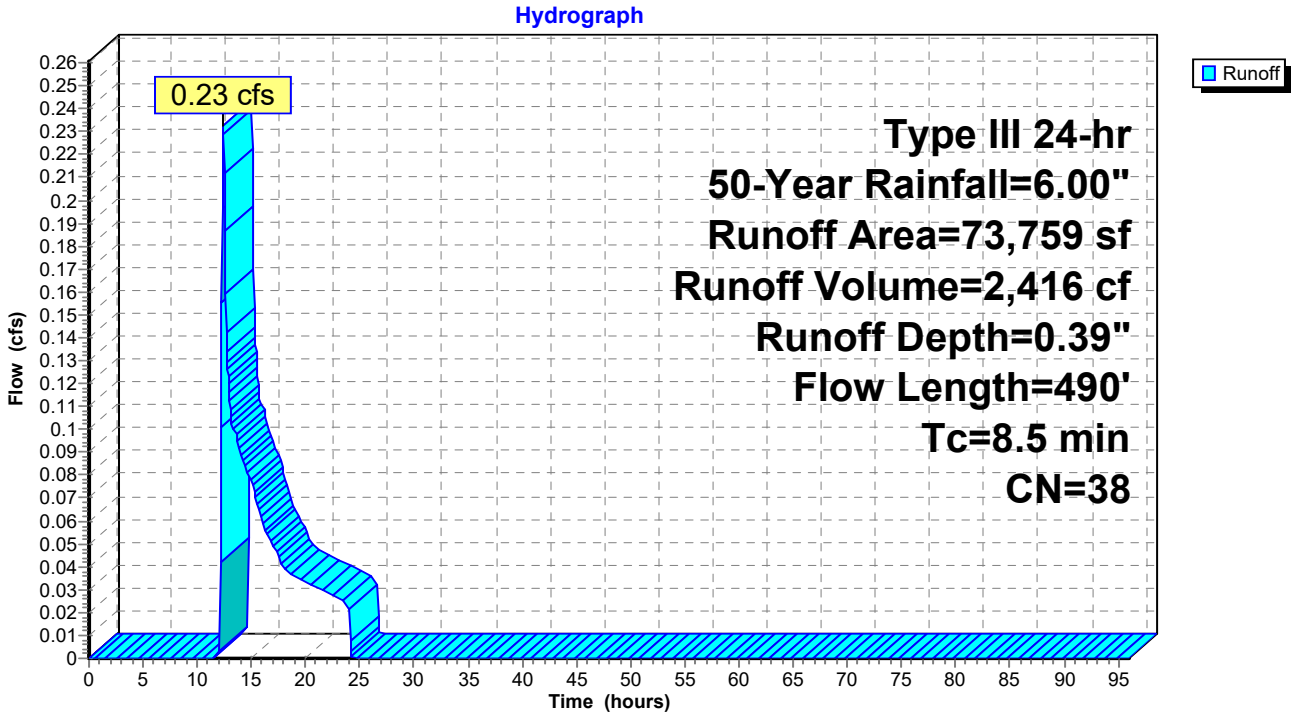
Runoff = 0.23 cfs @ 12.41 hrs, Volume= 2,416 cf, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
66,326	39	>75% Grass cover, Good, HSG A
7,433	30	Woods, Good, HSG A
73,759	38	Weighted Average
73,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0330	0.19		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
4.0	440	0.0130	1.84		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
8.5	490	Total			

Subcatchment Ex-Ws2: Ex_Watershed 2



Summary for Subcatchment Ex_Ws1: Ex_Watershed 1

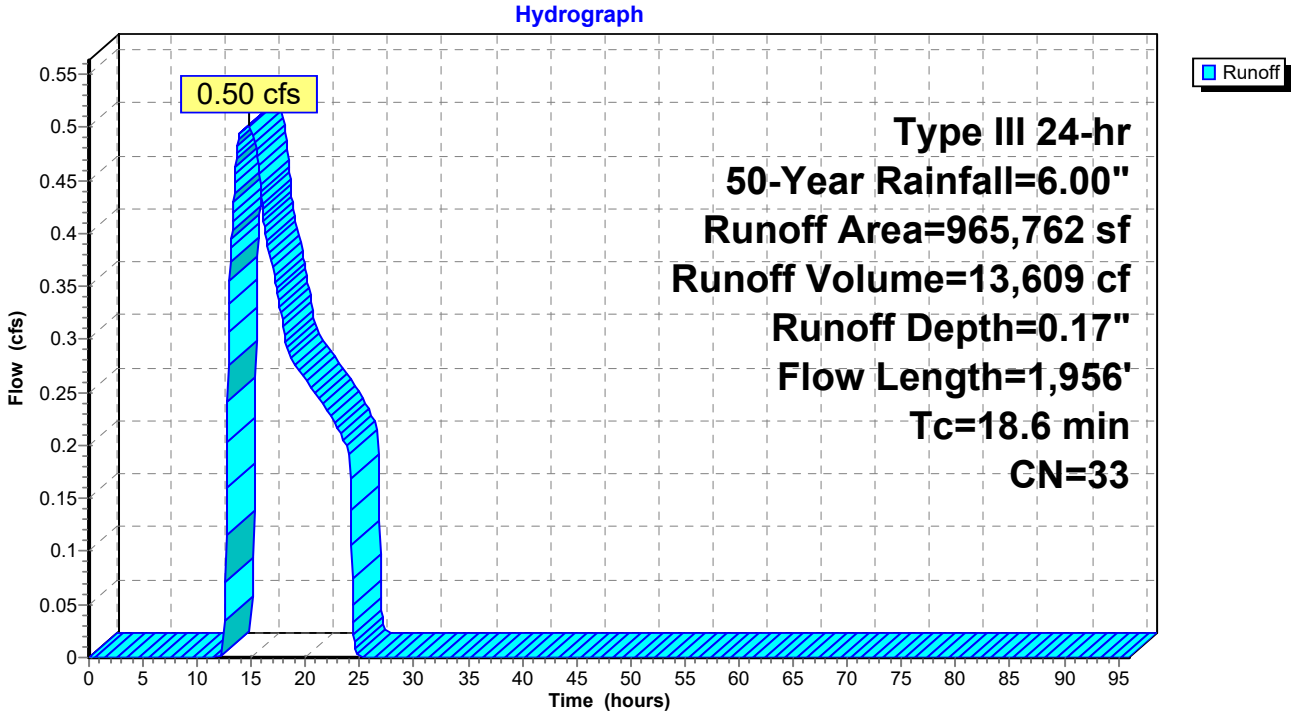
Runoff = 0.50 cfs @ 14.75 hrs, Volume= 13,609 cf, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
640,465	30	Woods, Good, HSG A
325,297	39	>75% Grass cover, Good, HSG A
965,762	33	Weighted Average
965,762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
6.3	635	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	228	0.0150	2.49		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
4.8	971	0.0440	3.38		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.2	72	0.1440	6.11		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
18.6	1,956	Total			

Subcatchment Ex_Ws1: Ex_Watershed 1

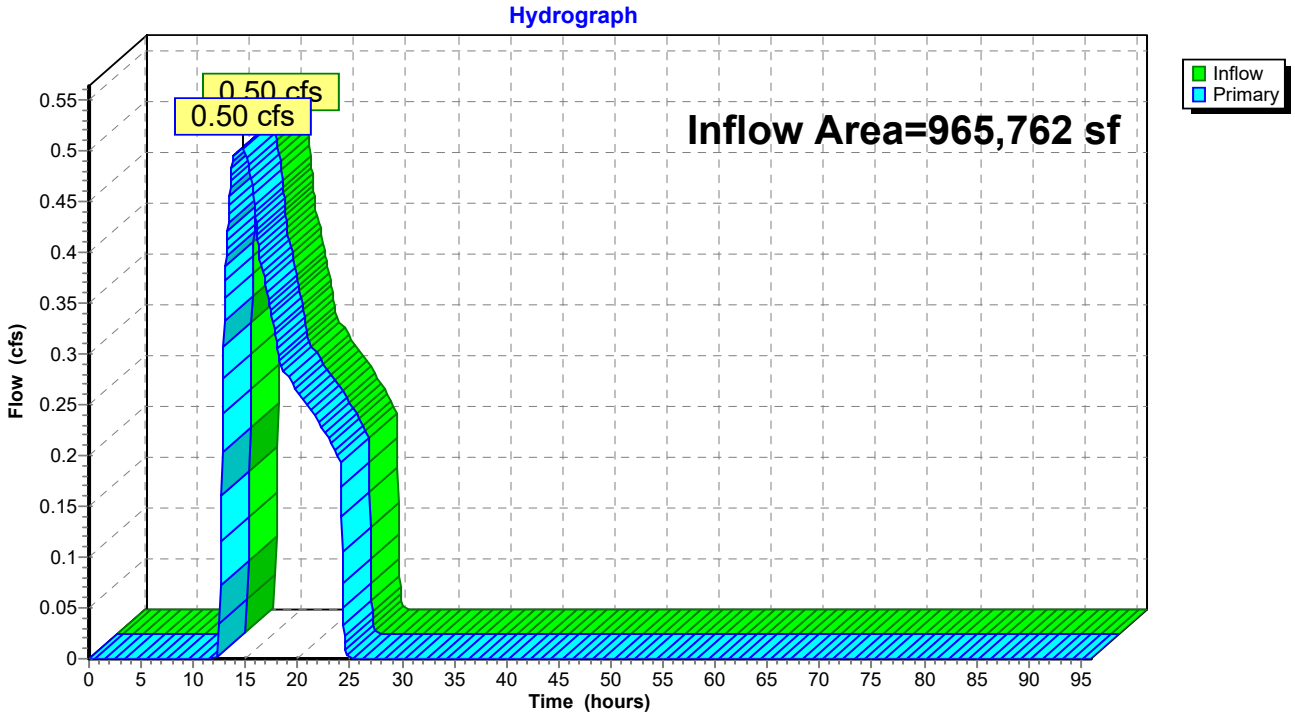


Summary for Link POA1: POND

Inflow Area = 965,762 sf, 0.00% Impervious, Inflow Depth = 0.17" for 50-Year event
Inflow = 0.50 cfs @ 14.75 hrs, Volume= 13,609 cf
Primary = 0.50 cfs @ 14.75 hrs, Volume= 13,609 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA1: POND

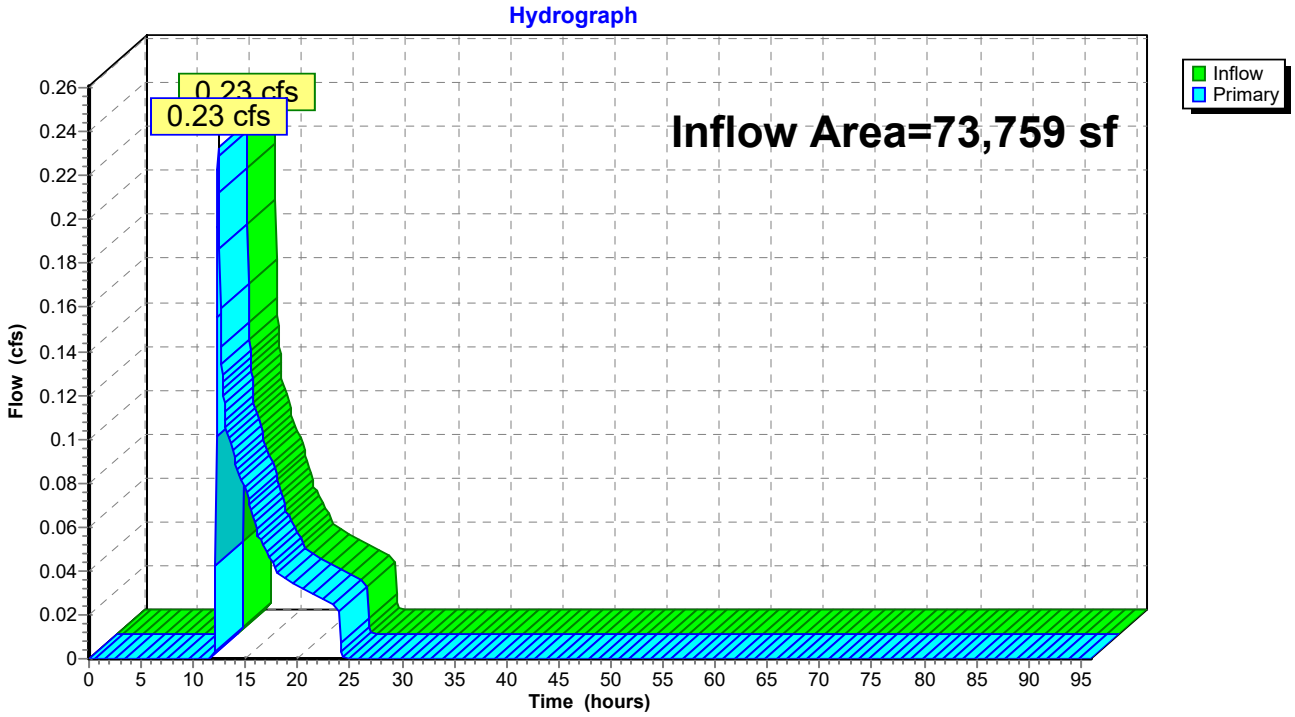


Summary for Link POA2: JACKSON RD

Inflow Area = 73,759 sf, 0.00% Impervious, Inflow Depth = 0.39" for 50-Year event
Inflow = 0.23 cfs @ 12.41 hrs, Volume= 2,416 cf
Primary = 0.23 cfs @ 12.41 hrs, Volume= 2,416 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA2: JACKSON RD

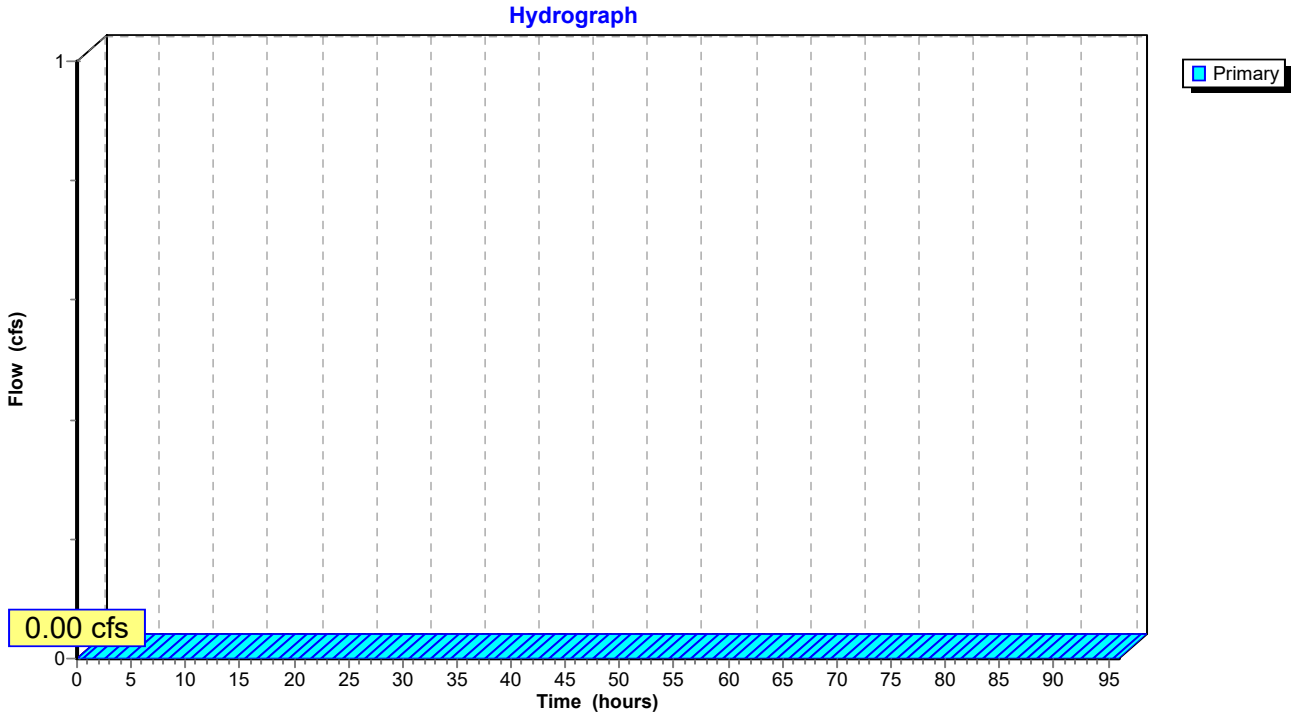


Summary for Link POA3: TOWN DRAIN

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA3: TOWN DRAIN



Summary for Subcatchment Ex-Ws2: Ex_Watershed 2

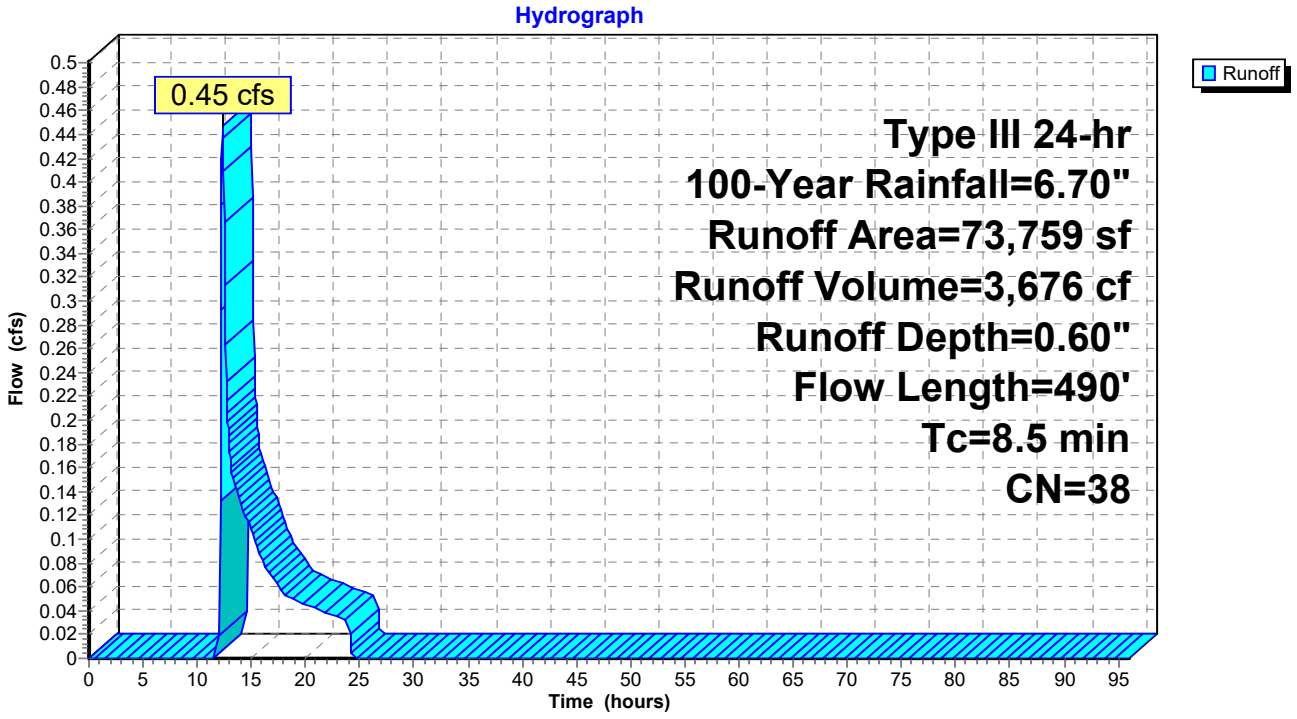
Runoff = 0.45 cfs @ 12.34 hrs, Volume= 3,676 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
66,326	39	>75% Grass cover, Good, HSG A
7,433	30	Woods, Good, HSG A
73,759	38	Weighted Average
73,759		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0330	0.19		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
4.0	440	0.0130	1.84		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
8.5	490	Total			

Subcatchment Ex-Ws2: Ex_Watershed 2



Summary for Subcatchment Ex_Ws1: Ex_Watershed 1

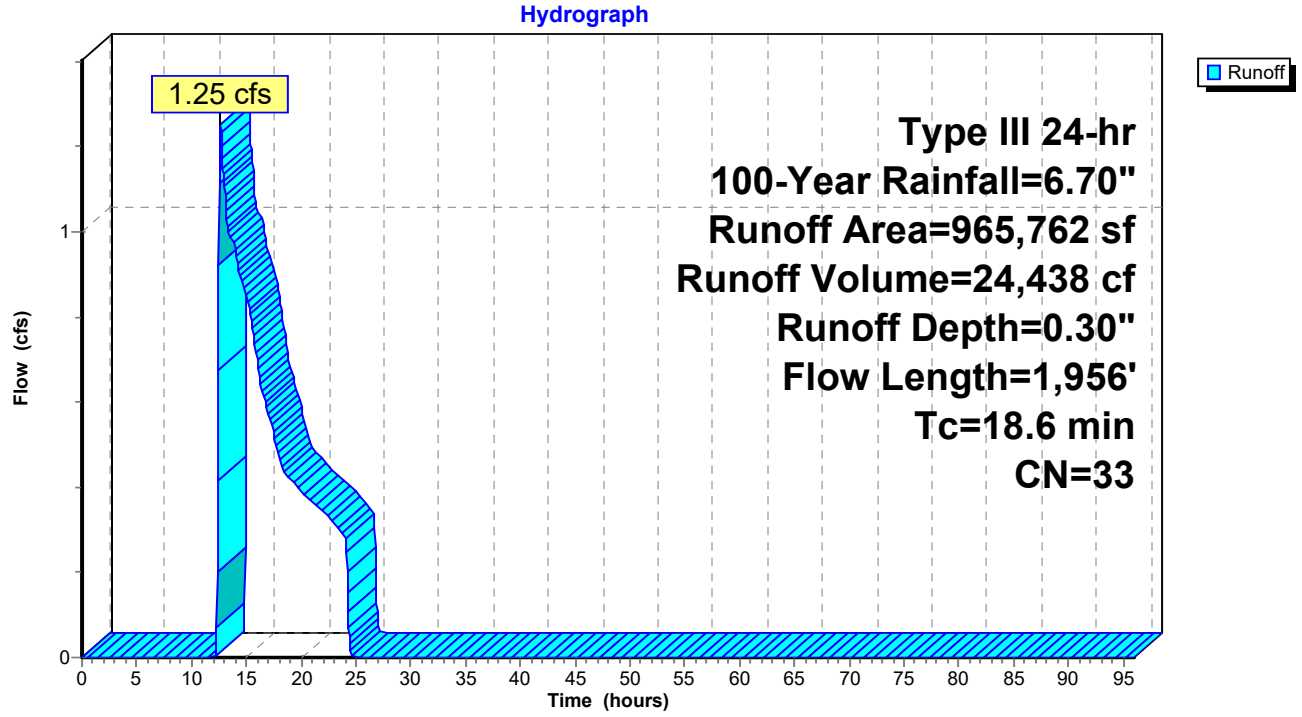
Runoff = 1.25 cfs @ 12.66 hrs, Volume= 24,438 cf, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
640,465	30	Woods, Good, HSG A
325,297	39	>75% Grass cover, Good, HSG A
965,762	33	Weighted Average
965,762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.40"
6.3	635	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.5	228	0.0150	2.49		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
4.8	971	0.0440	3.38		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.2	72	0.1440	6.11		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
18.6	1,956	Total			

Subcatchment Ex_Ws1: Ex_Watershed 1

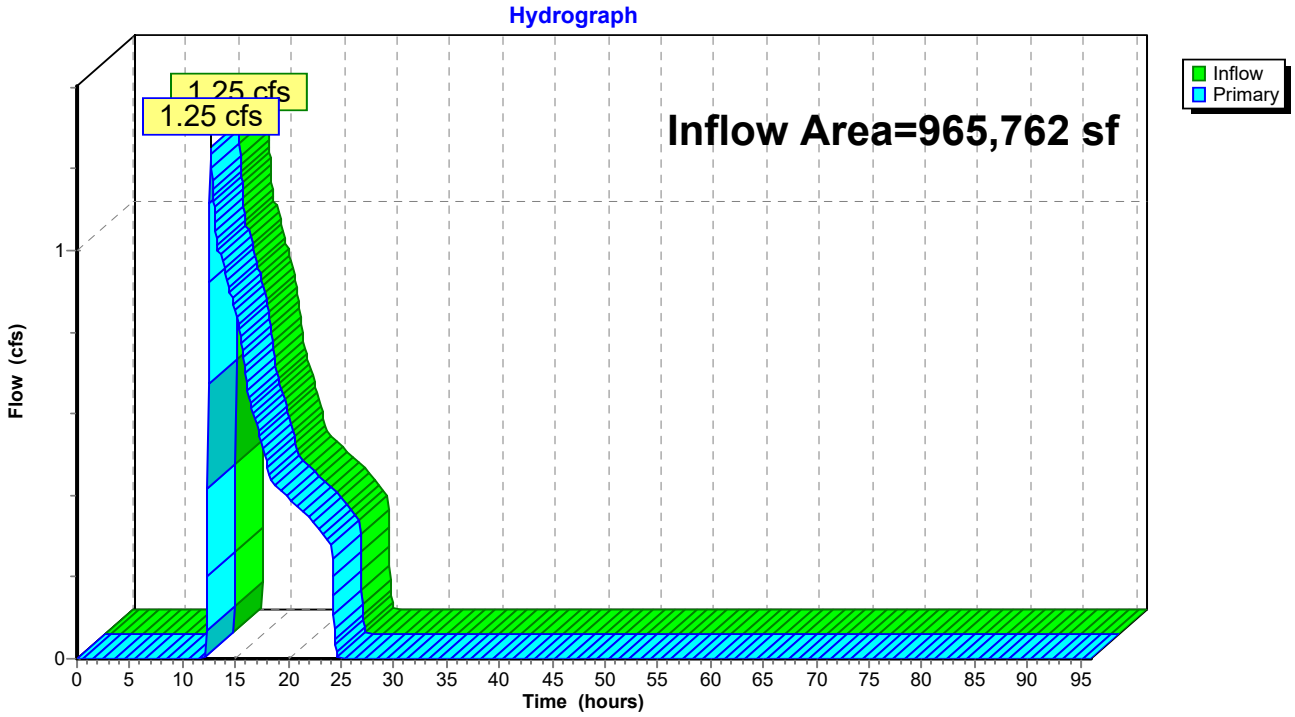


Summary for Link POA1: POND

Inflow Area = 965,762 sf, 0.00% Impervious, Inflow Depth = 0.30" for 100-Year event
Inflow = 1.25 cfs @ 12.66 hrs, Volume= 24,438 cf
Primary = 1.25 cfs @ 12.66 hrs, Volume= 24,438 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA1: POND

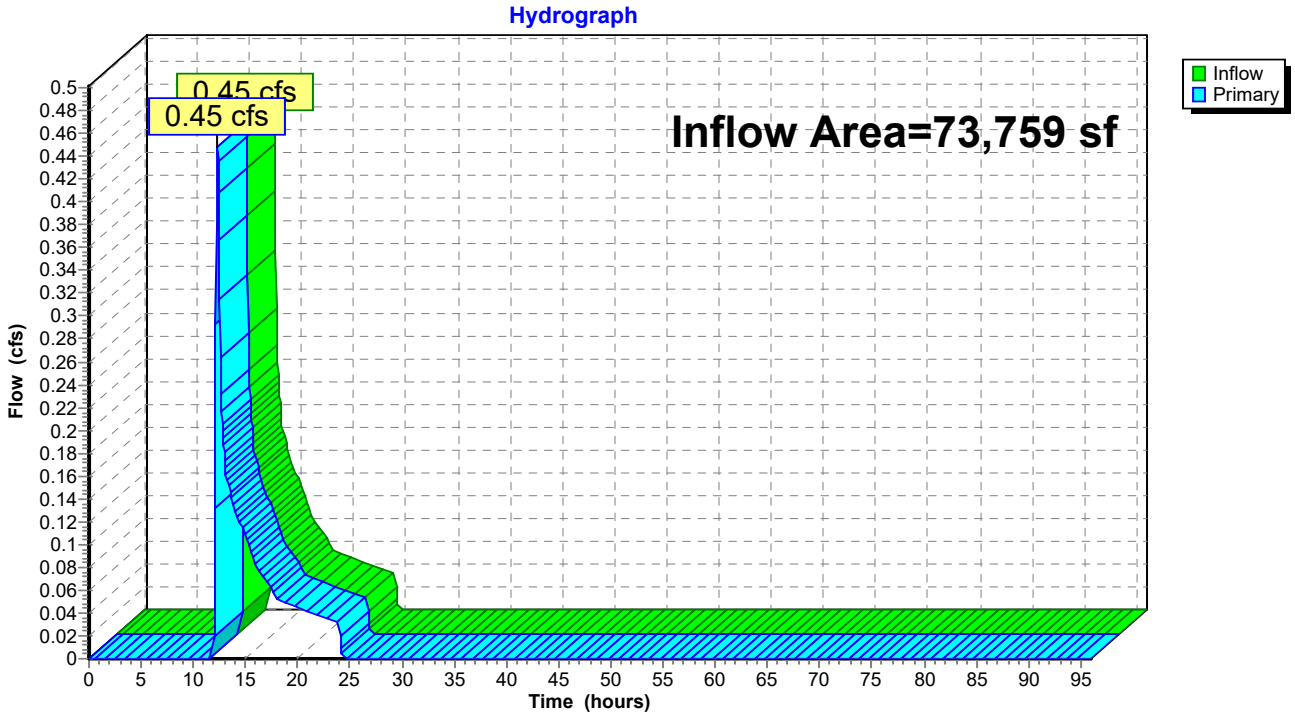


Summary for Link POA2: JACKSON RD

Inflow Area = 73,759 sf, 0.00% Impervious, Inflow Depth = 0.60" for 100-Year event
Inflow = 0.45 cfs @ 12.34 hrs, Volume= 3,676 cf
Primary = 0.45 cfs @ 12.34 hrs, Volume= 3,676 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA2: JACKSON RD

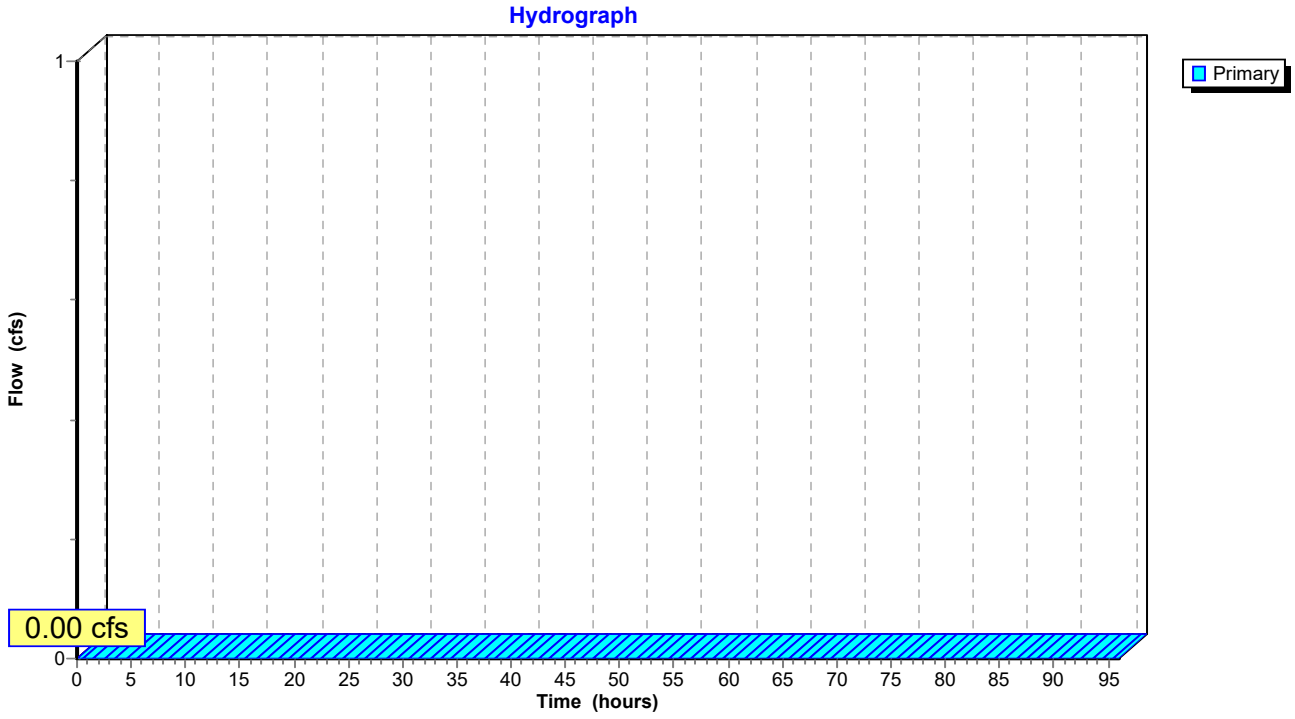


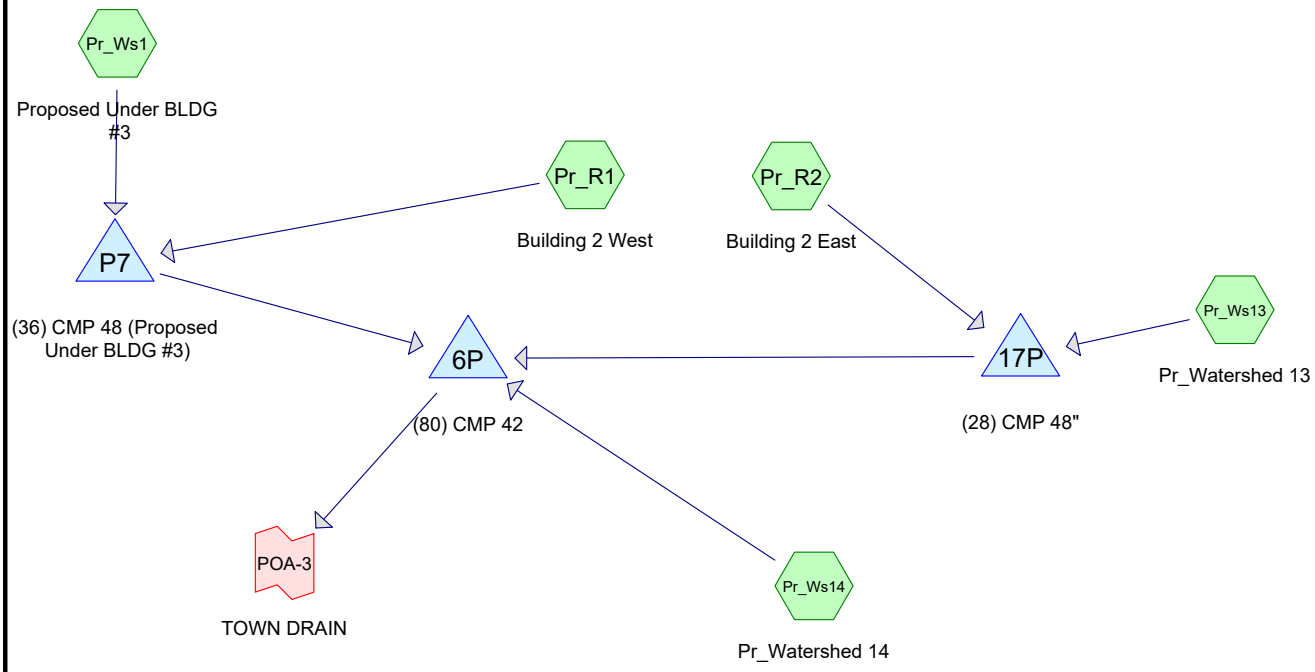
Summary for Link POA3: TOWN DRAIN

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA3: TOWN DRAIN





Subcat Reach Pond Link

Routing Diagram for Post-Dev (Bldg 2)

Prepared by {enter your company name here}, Printed 5/6/2021

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
60,351	0	0	0	0	60,351	>75% Grass cover, Good	
91,053	0	0	0	0	91,053	Paved parking	
38,129	0	0	0	0	38,129	Roofs	
39,599	0	0	0	0	39,599	Unconnected roofs	
229,132	**0**	**0**	**0**	**0**	**229,132**	**TOTAL AREA**	

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pr_R1: Building 2 West Runoff Area=38,129 sf 100.00% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=98 Runoff=2.49 cfs 8,796 cf

Subcatchment Pr_R2: Building 2 East Runoff Area=39,599 sf 100.00% Impervious Runoff Depth=2.77"
Tc=6.0 min CN=98 Runoff=2.58 cfs 9,135 cf

Subcatchment Pr_Ws1: Proposed Under Runoff Area=23,134 sf 68.34% Impervious Runoff Depth=1.19"
Tc=6.0 min CN=79 Runoff=0.71 cfs 2,291 cf

Subcatchment Pr_Ws13: Pr_Watershed 13 Runoff Area=40,126 sf 46.32% Impervious Runoff Depth=0.54"
Tc=6.0 min CN=66 Runoff=0.45 cfs 1,822 cf

Subcatchment Pr_Ws14: Pr_Watershed 14 Runoff Area=88,144 sf 64.28% Impervious Runoff Depth=1.07"
Tc=6.0 min CN=77 Runoff=2.41 cfs 7,867 cf

Pond 6P: (80) CMP 42 Peak Elev=328.43' Storage=3,837 cf Inflow=2.84 cfs 18,821 cf
Discarded=0.59 cfs 18,821 cf Primary=0.00 cfs 0 cf Outflow=0.59 cfs 18,821 cf

Pond 17P: (28) CMP 48" Peak Elev=332.80' Storage=3,656 cf Inflow=3.01 cfs 10,957 cf
Outflow=0.54 cfs 10,954 cf

Pond P7: (36) CMP 48 (Proposed Under Peak Elev=329.04' Storage=3,826 cf Inflow=3.19 cfs 11,087 cf
Discarded=0.30 cfs 11,098 cf Primary=0.00 cfs 0 cf Outflow=0.30 cfs 11,098 cf

Link POA-3: TOWN DRAIN Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 229,132 sf Runoff Volume = 29,911 cf Average Runoff Depth = 1.57"
26.34% Pervious = 60,351 sf 73.66% Impervious = 168,781 sf

Summary for Subcatchment Pr_R1: Building 2 West

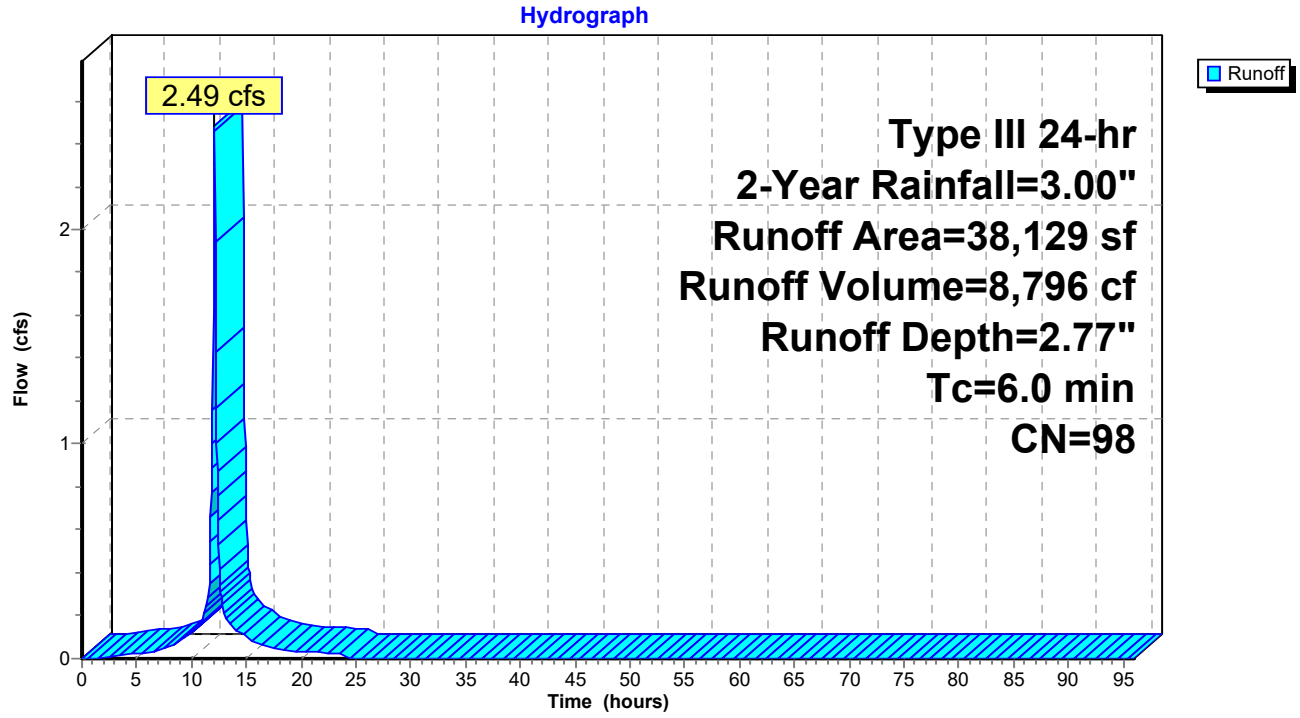
Runoff = 2.49 cfs @ 12.09 hrs, Volume= 8,796 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
38,129	98	Roofs, HSG A
38,129		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R1: Building 2 West



Summary for Subcatchment Pr_R2: Building 2 East

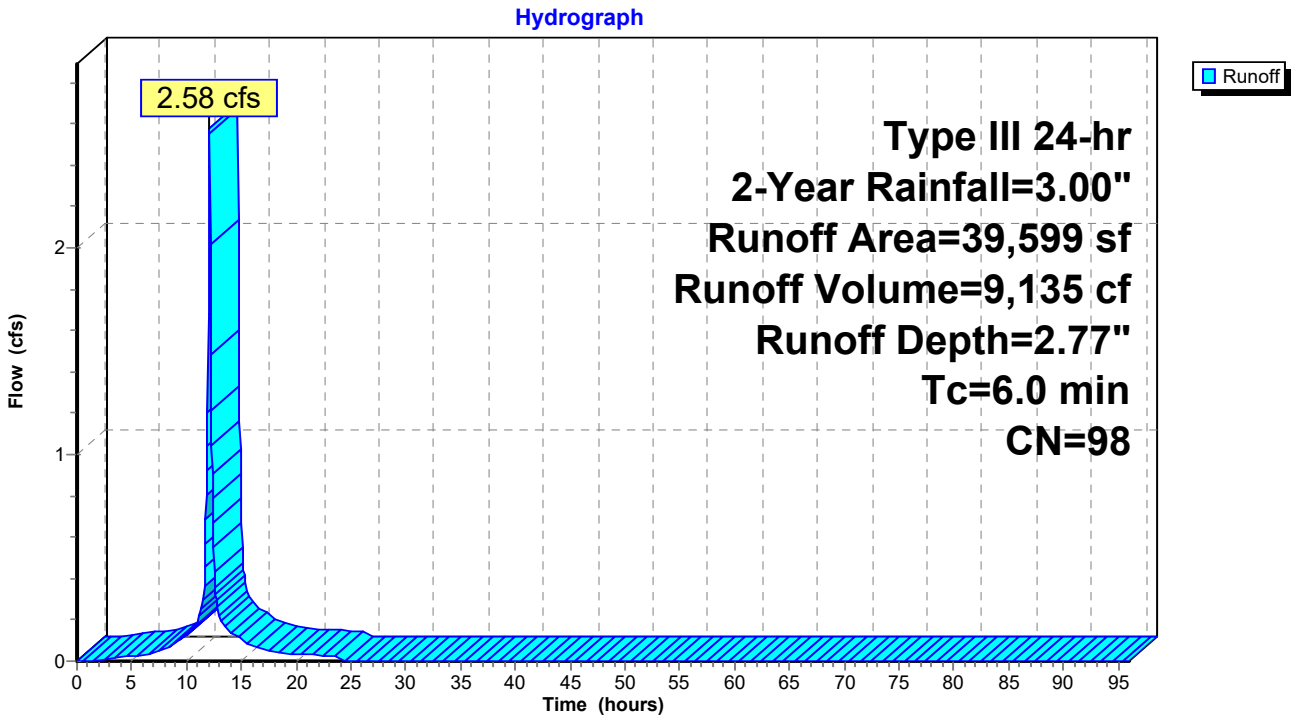
Runoff = 2.58 cfs @ 12.09 hrs, Volume= 9,135 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
39,599	98	Unconnected roofs, HSG A
39,599		100.00% Impervious Area
39,599		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R2: Building 2 East



Summary for Subcatchment Pr_Ws1: Proposed Under BLDG #3

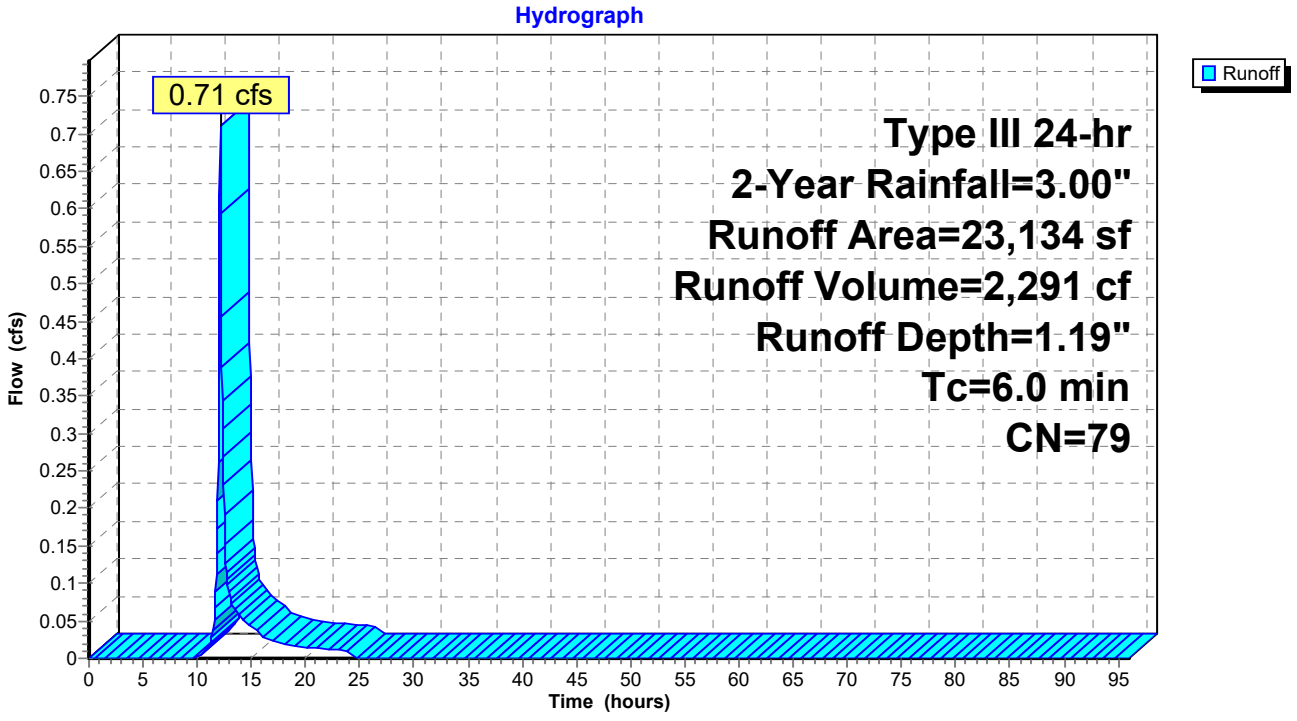
Runoff = 0.71 cfs @ 12.10 hrs, Volume= 2,291 cf, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
7,324	39	>75% Grass cover, Good, HSG A
15,810	98	Paved parking, HSG A
23,134	79	Weighted Average
7,324		31.66% Pervious Area
15,810		68.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws1: Proposed Under BLDG #3



Summary for Subcatchment Pr_Ws13: Pr_Watershed 13

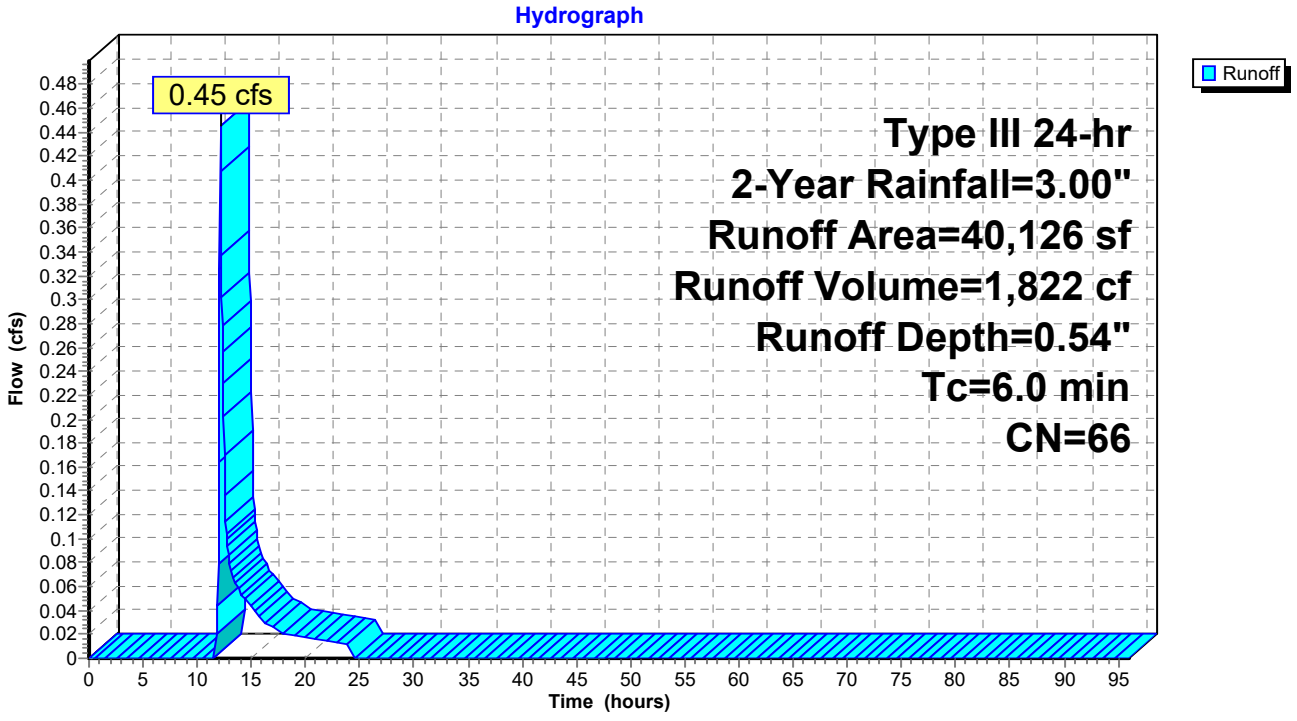
Runoff = 0.45 cfs @ 12.11 hrs, Volume= 1,822 cf, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
21,539	39	>75% Grass cover, Good, HSG A
18,587	98	Paved parking, HSG A
40,126	66	Weighted Average
21,539		53.68% Pervious Area
18,587		46.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws13: Pr_Watershed 13



Summary for Subcatchment Pr_Ws14: Pr_Watershed 14

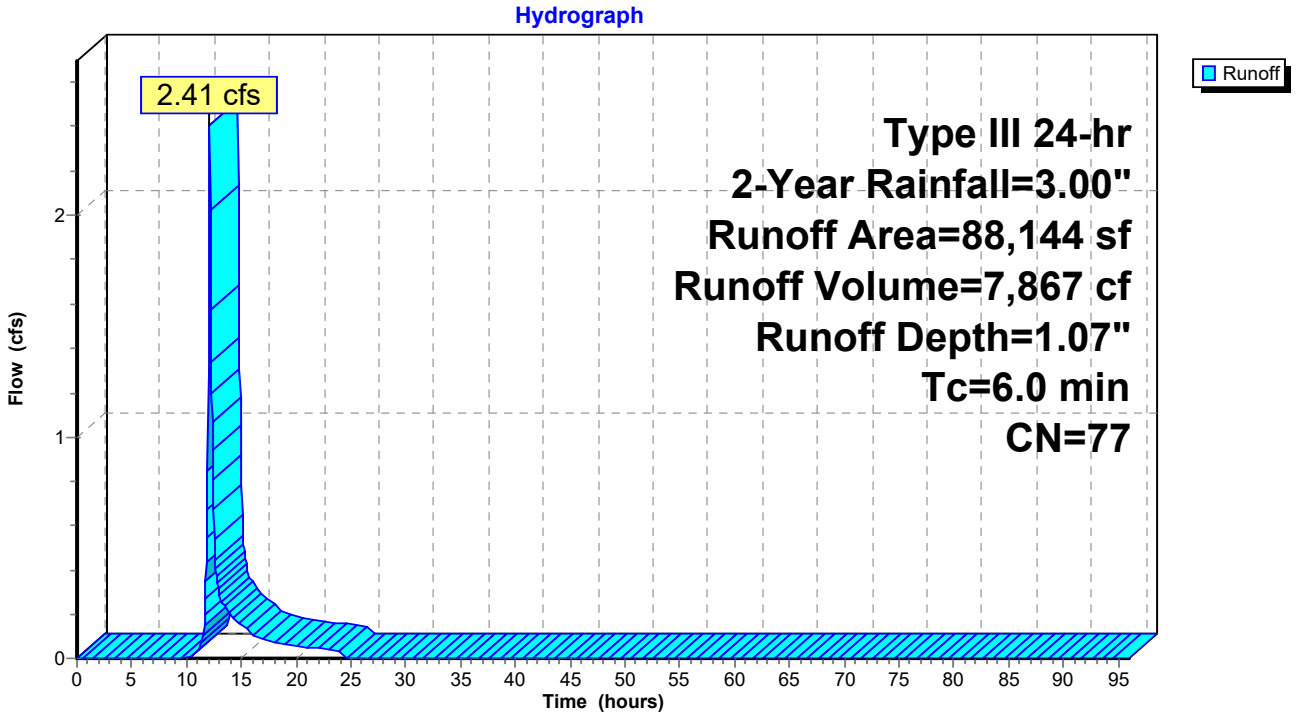
Runoff = 2.41 cfs @ 12.10 hrs, Volume= 7,867 cf, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
31,488	39	>75% Grass cover, Good, HSG A
56,656	98	Paved parking, HSG A
88,144	77	Weighted Average
31,488		35.72% Pervious Area
56,656		64.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws14: Pr_Watershed 14



Summary for Pond 6P: (80) CMP 42

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 0.99" for 2-Year event
Inflow = 2.84 cfs @ 12.10 hrs, Volume= 18,821 cf
Outflow = 0.59 cfs @ 11.95 hrs, Volume= 18,821 cf, Atten= 79%, Lag= 0.0 min
Discarded = 0.59 cfs @ 11.95 hrs, Volume= 18,821 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 328.43' @ 14.45 hrs Surf.Area= 8,546 sf Storage= 3,837 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 57.7 min (916.2 - 858.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	9,231 cf	**52.75'W x 162.00'L x 4.50'H Field A** 38,455 cf Overall - 15,377 cf Embedded = 23,078 cf x 40.0% Voids
#2A	328.00'	15,377 cf	**CMP Round- 42** x 80 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf Overall Size= 42.0"W x 42.0"H x 20.00'L 80 Chambers in 10 Rows
		24,608 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	330.70'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	330.70'	**15.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.70' / 330.70' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.59 cfs @ 11.95 hrs HW=327.56' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.59 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=327.50' TW=0.00' (Dynamic Tailwater)
↑—**3=Culvert** (Controls 0.00 cfs)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: (80) CMP 42 - Chamber Wizard Field A

Chamber Model = CMP Round- 42 (Round Corrugated Metal Pipe)
Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf
Overall Size= 42.0"W x 42.0"H x 20.00'L

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

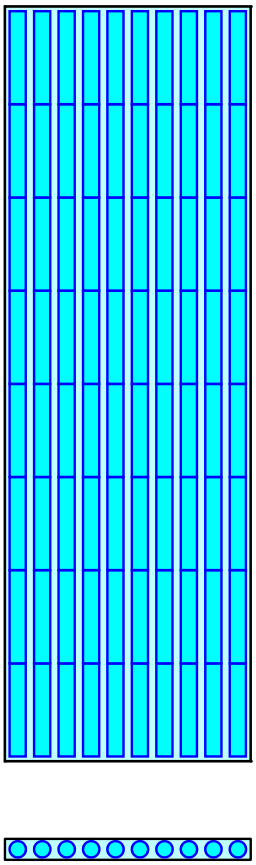
8 Chambers/Row x 20.00' Long = 160.00' Row Length +12.0" End Stone x 2 = 162.00' Base Length
10 Rows x 42.0" Wide + 21.0" Spacing x 9 + 12.0" Side Stone x 2 = 52.75' Base Width
6.0" Stone Base + 42.0" Chamber Height + 6.0" Stone Cover = 4.50' Field Height

80 Chambers x 192.2 cf = 15,376.7 cf Chamber Storage

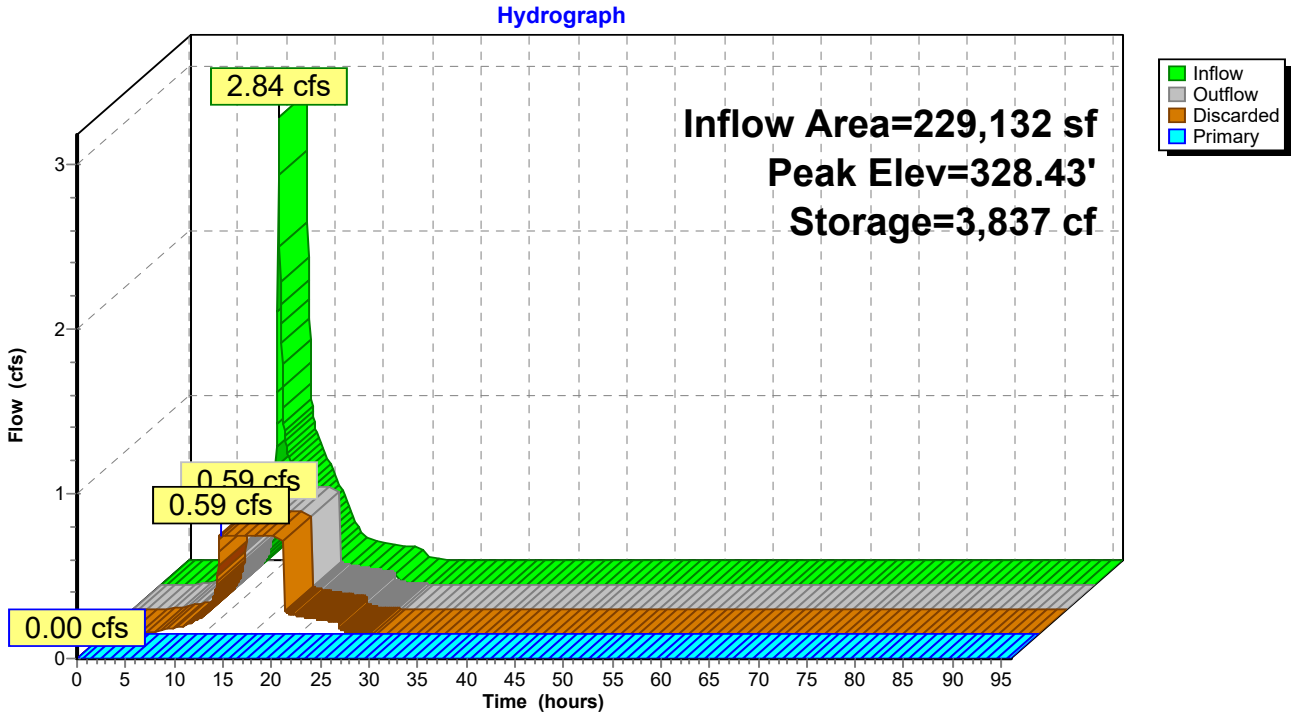
38,454.8 cf Field - 15,376.7 cf Chambers = 23,078.1 cf Stone x 40.0% Voids = 9,231.2 cf Stone Storage

Chamber Storage + Stone Storage = 24,607.9 cf = 0.565 af
Overall Storage Efficiency = 64.0%
Overall System Size = 162.00' x 52.75' x 4.50'

80 Chambers
1,424.2 cy Field
854.7 cy Stone



Pond 6P: (80) CMP 42



Summary for Pond 17P: (28) CMP 48"

Inflow Area = 79,725 sf, 72.98% Impervious, Inflow Depth = 1.65" for 2-Year event
Inflow = 3.01 cfs @ 12.09 hrs, Volume= 10,957 cf
Outflow = 0.54 cfs @ 12.57 hrs, Volume= 10,954 cf, Atten= 82%, Lag= 28.6 min
Primary = 0.54 cfs @ 12.57 hrs, Volume= 10,954 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 332.80' @ 12.57 hrs Surf.Area= 3,444 sf Storage= 3,656 cf

Plug-Flow detention time= 78.3 min calculated for 10,948 cf (100% of inflow)
Center-of-Mass det. time= 79.3 min (860.3 - 781.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	331.00'	4,082 cf	**42.00'W x 82.00'L x 5.00'H Field A** 17,220 cf Overall - 7,015 cf Embedded = 10,205 cf x 40.0% Voids
#2A	331.50'	7,015 cf	**CMP Round- 48** x 28 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 28 Chambers in 7 Rows
		11,097 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	331.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	335.40'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	330.90'	**12.0" Round Culvert** L= 509.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.90' / 328.20' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.54 cfs @ 12.57 hrs HW=332.80' TW=328.25' (Dynamic Tailwater)
↑└**3=Culvert** (Passes 0.54 cfs of 2.83 cfs potential flow)
↑ └**1=Orifice/Grate** (Orifice Controls 0.54 cfs @ 6.15 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: (28) CMP 48" - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

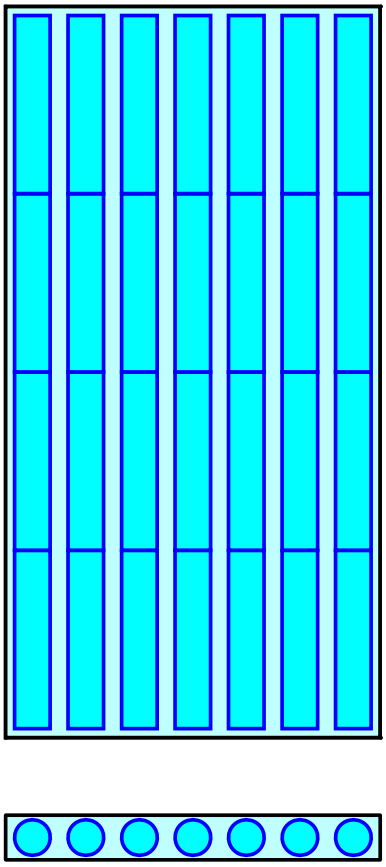
4 Chambers/Row x 20.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
7 Rows x 48.0" Wide + 24.0" Spacing x 6 + 12.0" Side Stone x 2 = 42.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

28 Chambers x 250.5 cf = 7,014.9 cf Chamber Storage

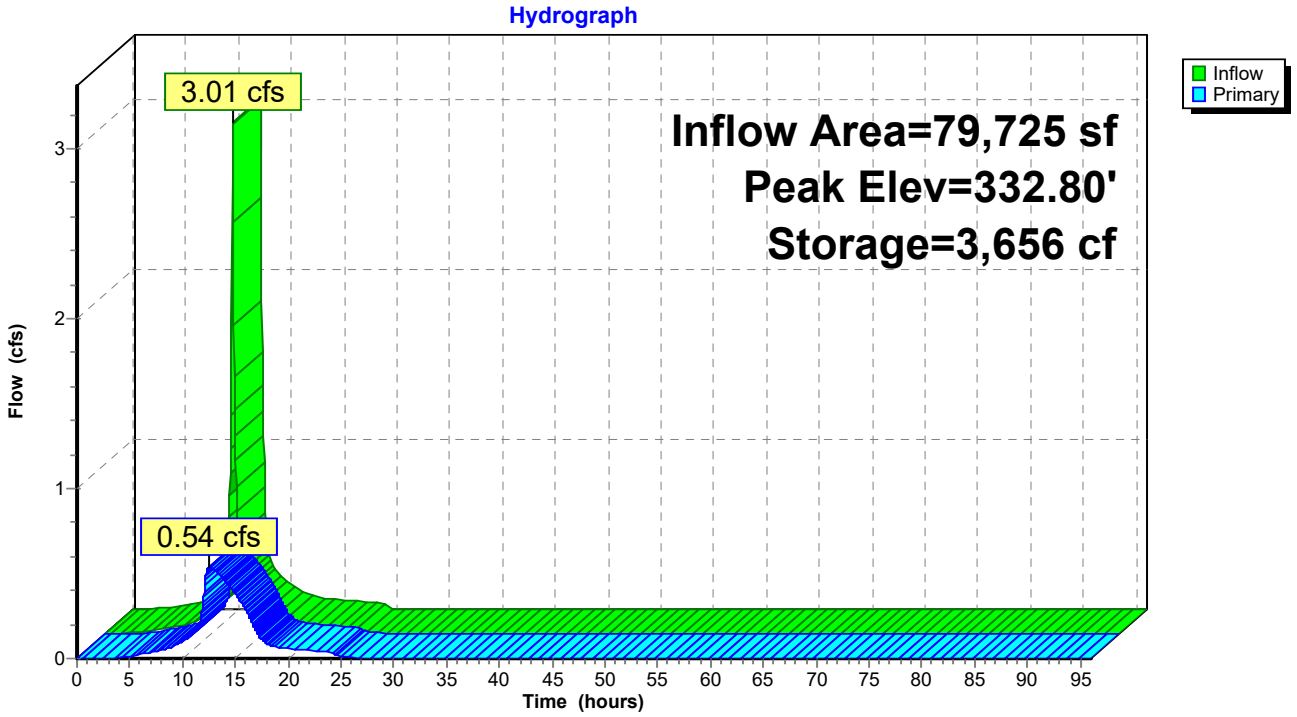
17,220.0 cf Field - 7,014.9 cf Chambers = 10,205.1 cf Stone x 40.0% Voids = 4,082.0 cf Stone Storage

Chamber Storage + Stone Storage = 11,097.0 cf = 0.255 af
Overall Storage Efficiency = 64.4%
Overall System Size = 82.00' x 42.00' x 5.00'

28 Chambers
637.8 cy Field
378.0 cy Stone



Pond 17P: (28) CMP 48"



Summary for Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

Inflow Area = 61,263 sf, 88.04% Impervious, Inflow Depth = 2.17" for 2-Year event
Inflow = 3.19 cfs @ 12.09 hrs, Volume= 11,087 cf
Outflow = 0.30 cfs @ 11.70 hrs, Volume= 11,098 cf, Atten= 90%, Lag= 0.0 min
Discarded = 0.30 cfs @ 11.70 hrs, Volume= 11,098 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 329.04' @ 12.97 hrs Surf.Area= 4,392 sf Storage= 3,826 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 91.0 min (867.7 - 776.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	5,176 cf	**36.00'W x 122.00'L x 5.00'H Field A** 21,960 cf Overall - 9,019 cf Embedded = 12,941 cf x 40.0% Voids
#2A	328.00'	9,019 cf	**CMP Round- 48** x 36 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 36 Chambers in 6 Rows
		14,196 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	331.20'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	331.20'	**15.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 331.20' / 331.20' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.30 cfs @ 11.70 hrs HW=327.55' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=327.50' TW=327.50' (Dynamic Tailwater)
↑└**3=Culvert** (Controls 0.00 cfs)
↑└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond P7: (36) CMP 48 (Proposed Under BLDG #3) - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

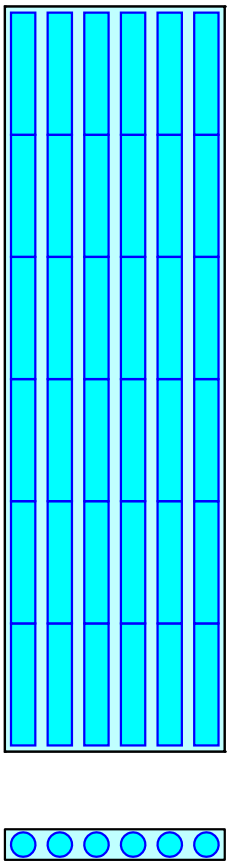
6 Chambers/Row x 20.00' Long = 120.00' Row Length +12.0" End Stone x 2 = 122.00' Base Length
6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 12.0" Side Stone x 2 = 36.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

36 Chambers x 250.5 cf = 9,019.2 cf Chamber Storage

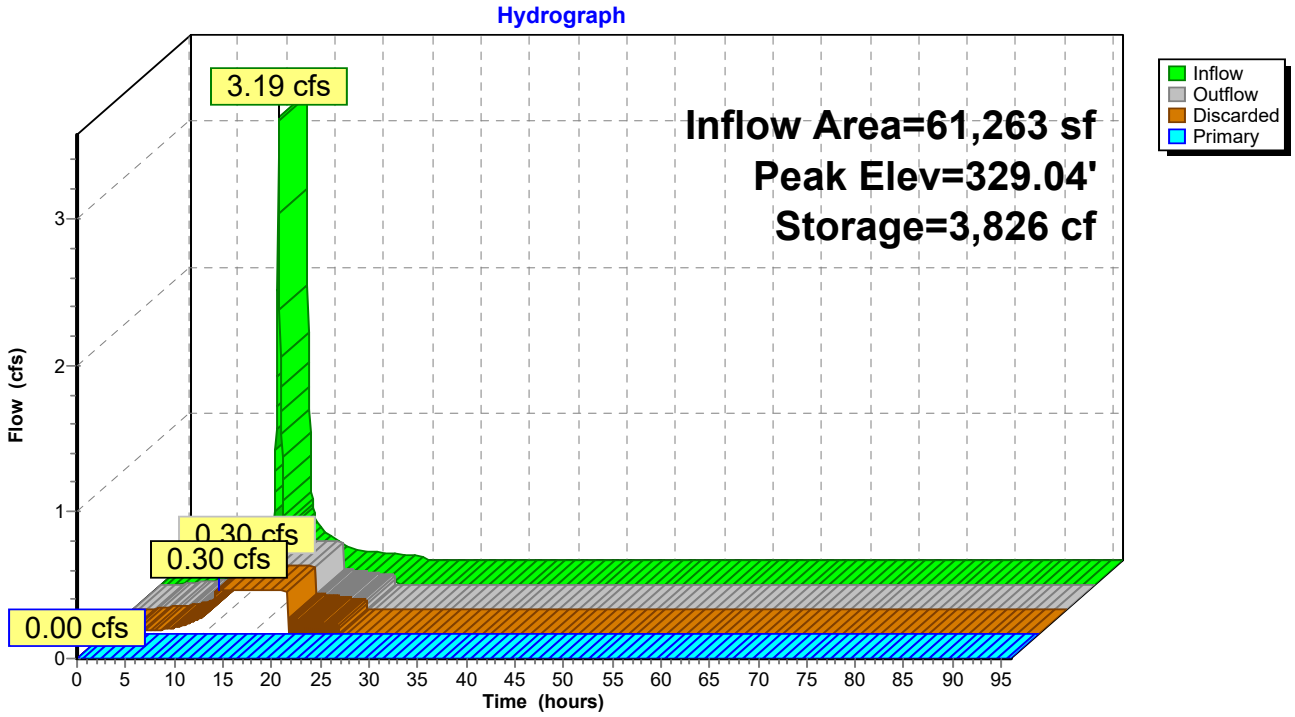
21,960.0 cf Field - 9,019.2 cf Chambers = 12,940.8 cf Stone x 40.0% Voids = 5,176.3 cf Stone Storage

Chamber Storage + Stone Storage = 14,195.5 cf = 0.326 af
Overall Storage Efficiency = 64.6%
Overall System Size = 122.00' x 36.00' x 5.00'

36 Chambers
813.3 cy Field
479.3 cy Stone



Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

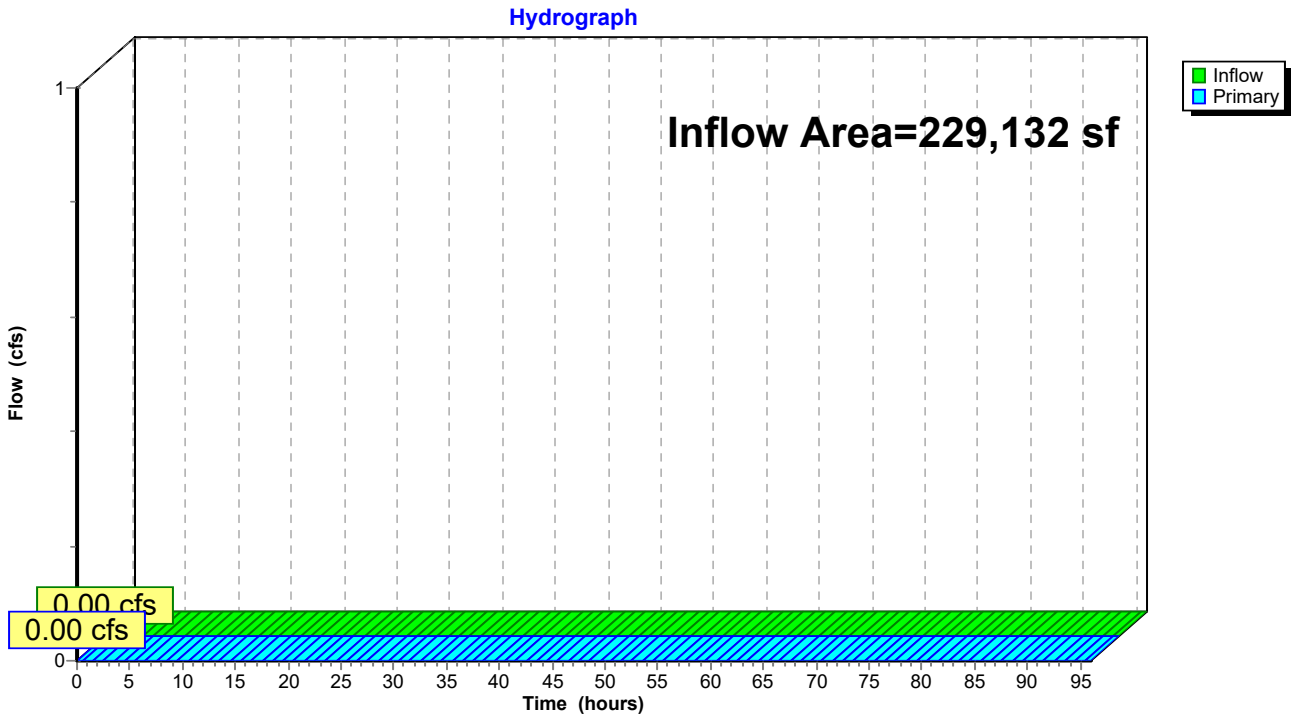


Summary for Link POA-3: TOWN DRAIN

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-3: TOWN DRAIN



Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pr_R1: Building 2 West Runoff Area=38,129 sf 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=3.76 cfs 13,549 cf

Subcatchment Pr_R2: Building 2 East Runoff Area=39,599 sf 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=3.90 cfs 14,071 cf

Subcatchment Pr_Ws1: Proposed Under Runoff Area=23,134 sf 68.34% Impervious Runoff Depth=2.38"
Tc=6.0 min CN=79 Runoff=1.45 cfs 4,581 cf

Subcatchment Pr_Ws13: Pr_Watershed 13 Runoff Area=40,126 sf 46.32% Impervious Runoff Depth=1.40"
Tc=6.0 min CN=66 Runoff=1.39 cfs 4,669 cf

Subcatchment Pr_Ws14: Pr_Watershed 14 Runoff Area=88,144 sf 64.28% Impervious Runoff Depth=2.21"
Tc=6.0 min CN=77 Runoff=5.13 cfs 16,238 cf

Pond 6P: (80) CMP 42 Peak Elev=329.79' Storage=12,571 cf Inflow=5.69 cfs 34,975 cf
Discarded=0.59 cfs 35,024 cf Primary=0.00 cfs 0 cf Outflow=0.59 cfs 35,024 cf

Pond 17P: (28) CMP 48" Peak Elev=334.03' Storage=6,987 cf Inflow=5.28 cfs 18,740 cf
Outflow=0.71 cfs 18,738 cf

Pond P7: (36) CMP 48 (Proposed Under Peak Elev=330.18' Storage=7,717 cf Inflow=5.21 cfs 18,130 cf
Discarded=0.30 cfs 18,147 cf Primary=0.00 cfs 0 cf Outflow=0.30 cfs 18,147 cf

Link POA-3: TOWN DRAIN Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 229,132 sf Runoff Volume = 53,108 cf Average Runoff Depth = 2.78"
26.34% Pervious = 60,351 sf 73.66% Impervious = 168,781 sf

Summary for Subcatchment Pr_R1: Building 2 West

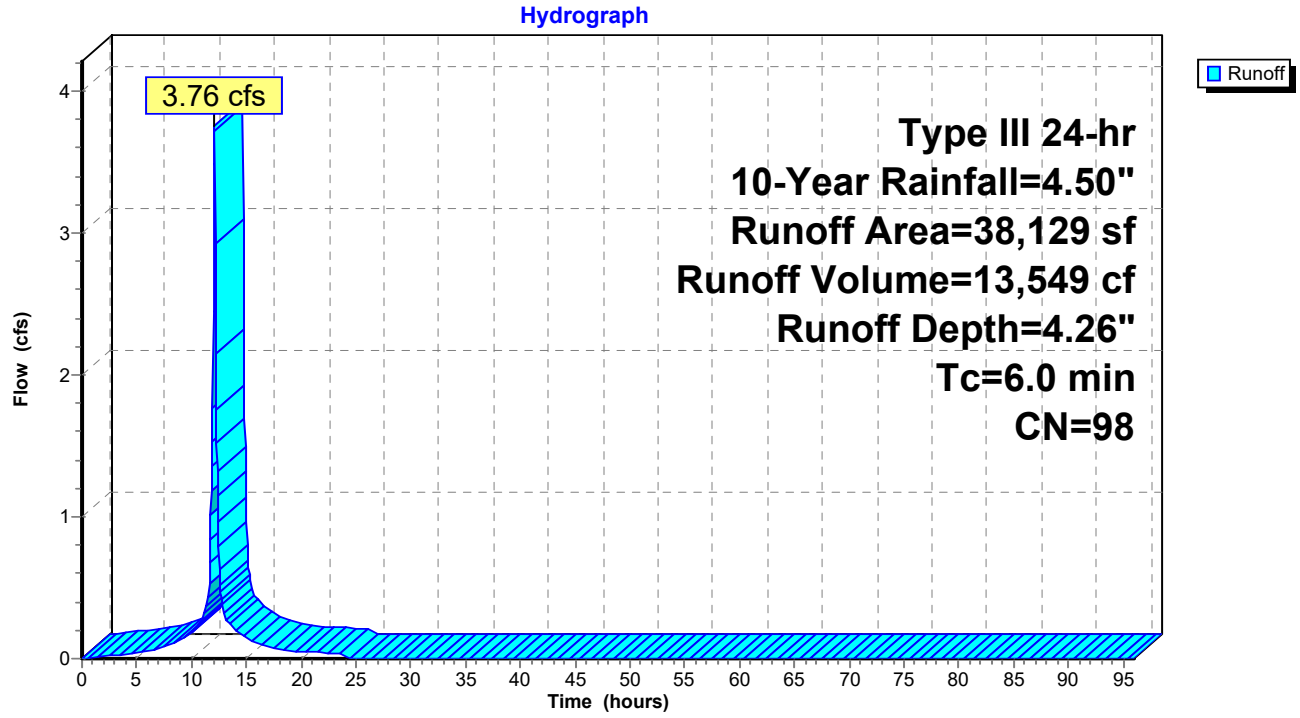
Runoff = 3.76 cfs @ 12.09 hrs, Volume= 13,549 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
38,129	98	Roofs, HSG A
38,129		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R1: Building 2 West



Summary for Subcatchment Pr_R2: Building 2 East

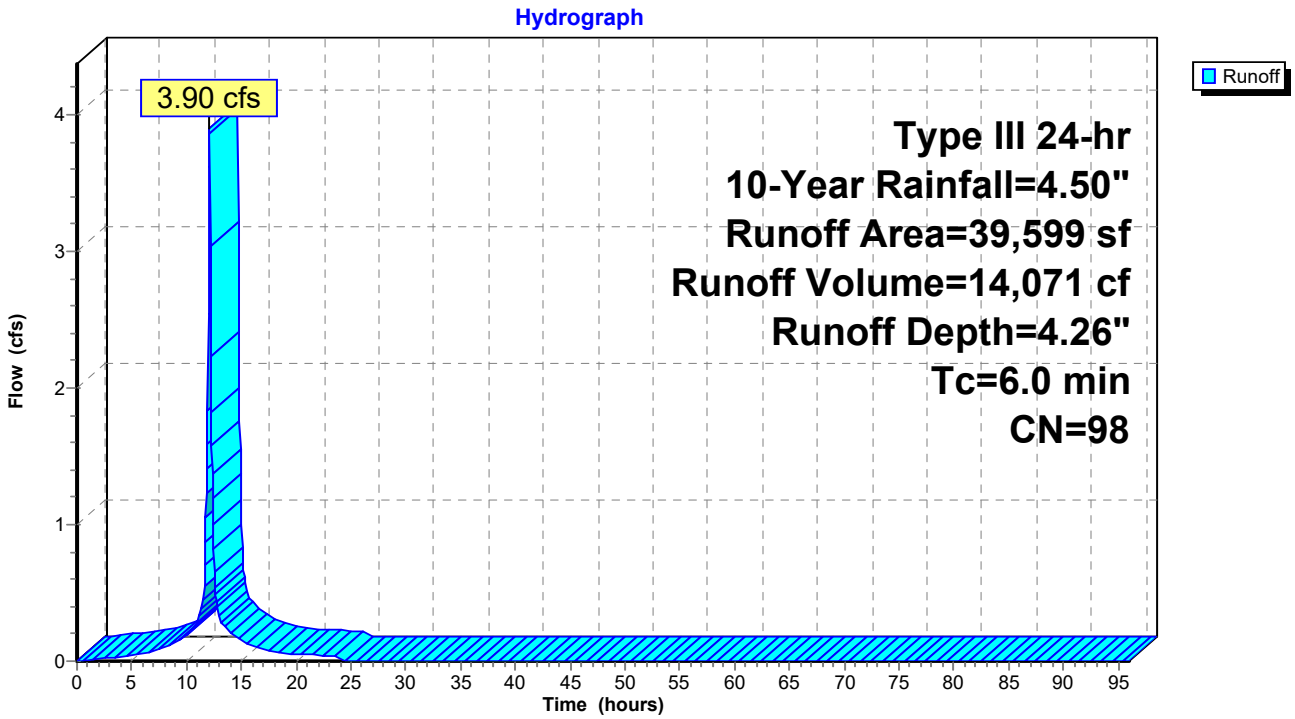
Runoff = 3.90 cfs @ 12.09 hrs, Volume= 14,071 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
39,599	98	Unconnected roofs, HSG A
39,599		100.00% Impervious Area
39,599		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R2: Building 2 East



Summary for Subcatchment Pr_Ws1: Proposed Under BLDG #3

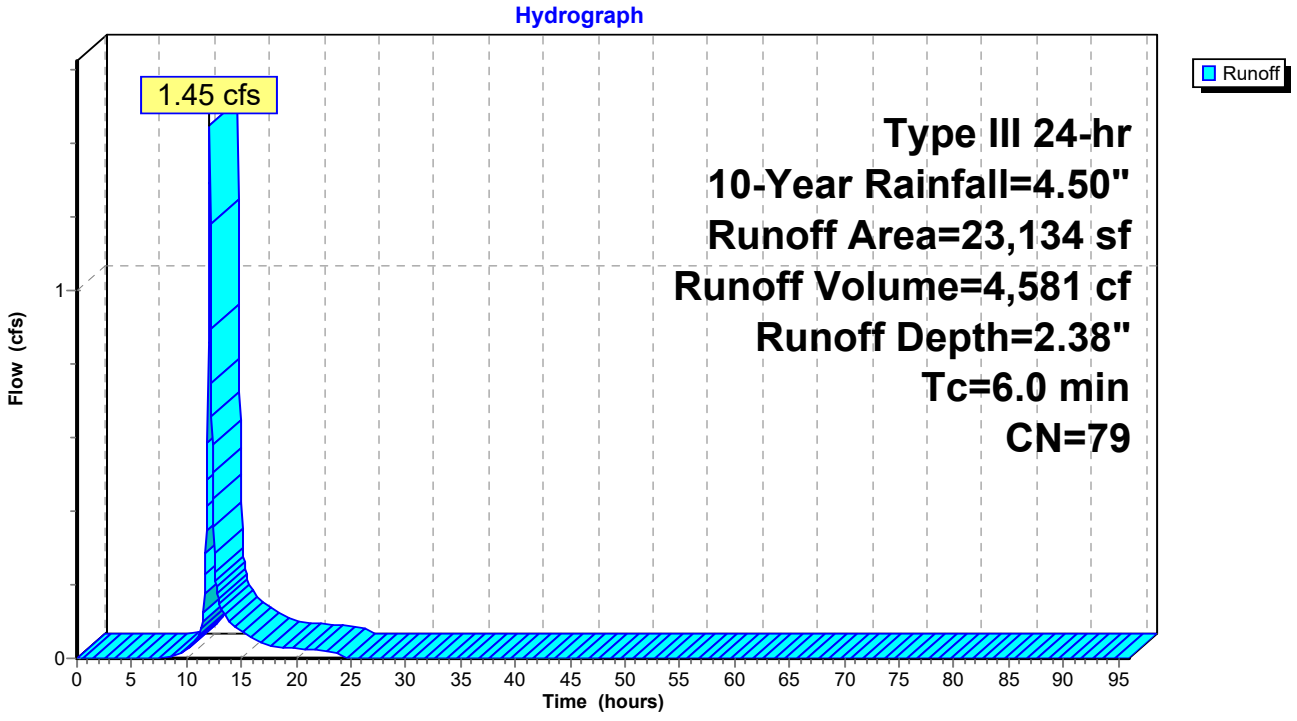
Runoff = 1.45 cfs @ 12.09 hrs, Volume= 4,581 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,324	39	>75% Grass cover, Good, HSG A
15,810	98	Paved parking, HSG A
23,134	79	Weighted Average
7,324		31.66% Pervious Area
15,810		68.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws1: Proposed Under BLDG #3



Summary for Subcatchment Pr_Ws13: Pr_Watershed 13

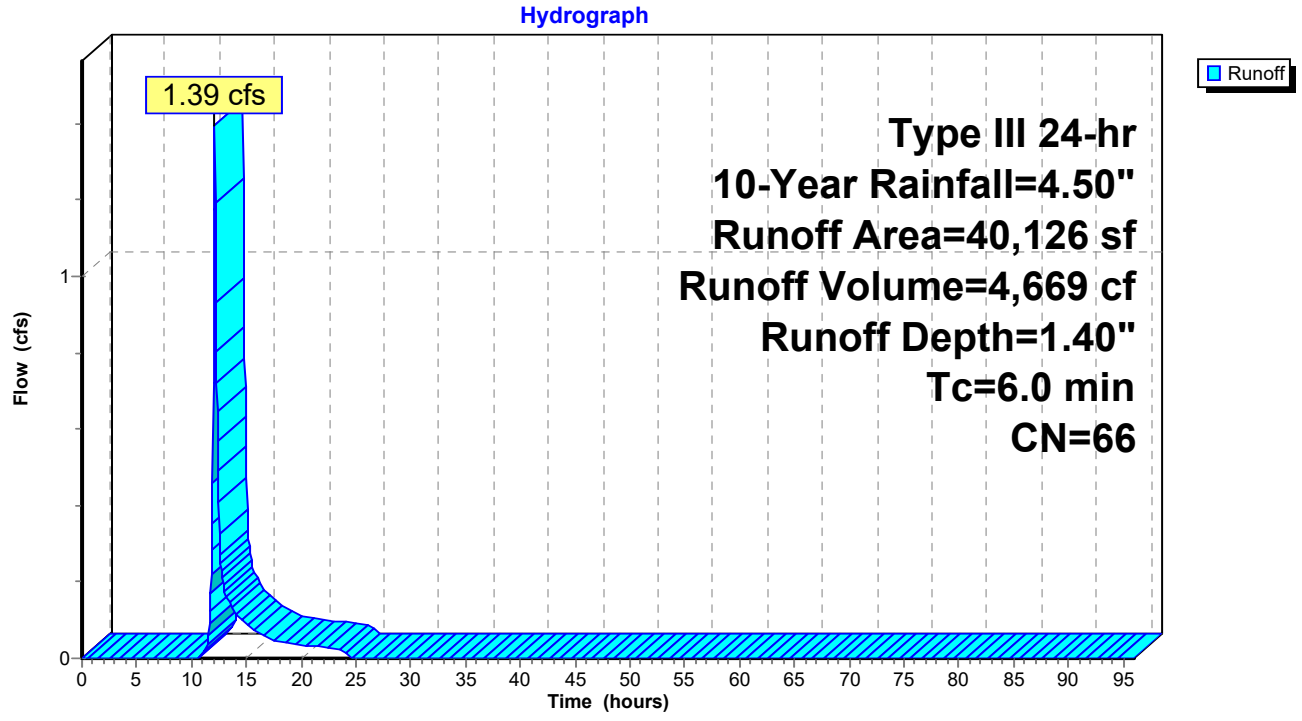
Runoff = 1.39 cfs @ 12.10 hrs, Volume= 4,669 cf, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
21,539	39	>75% Grass cover, Good, HSG A
18,587	98	Paved parking, HSG A
40,126	66	Weighted Average
21,539		53.68% Pervious Area
18,587		46.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws13: Pr_Watershed 13



Summary for Subcatchment Pr_Ws14: Pr_Watershed 14

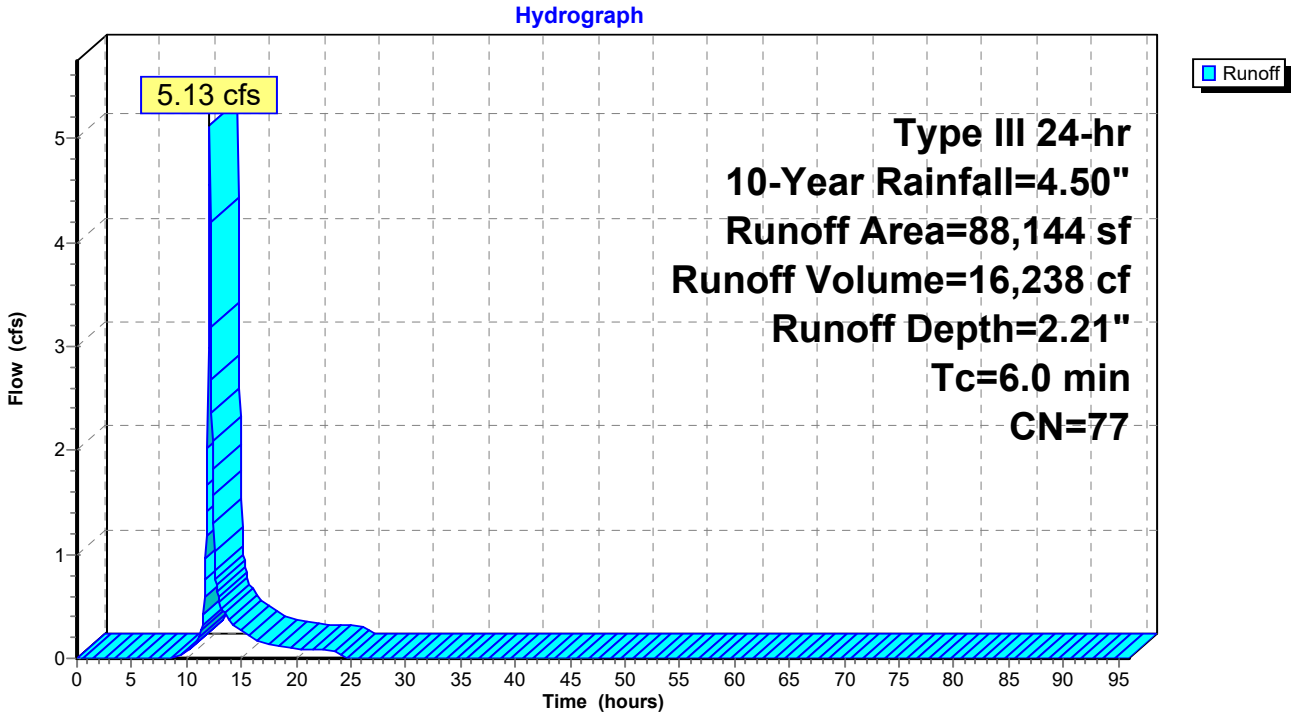
Runoff = 5.13 cfs @ 12.09 hrs, Volume= 16,238 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
31,488	39	>75% Grass cover, Good, HSG A
56,656	98	Paved parking, HSG A
88,144	77	Weighted Average
31,488		35.72% Pervious Area
56,656		64.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws14: Pr_Watershed 14



Summary for Pond 6P: (80) CMP 42

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 1.83" for 10-Year event
Inflow = 5.69 cfs @ 12.10 hrs, Volume= 34,975 cf
Outflow = 0.59 cfs @ 11.75 hrs, Volume= 35,024 cf, Atten= 90%, Lag= 0.0 min
Discarded = 0.59 cfs @ 11.75 hrs, Volume= 35,024 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 329.79' @ 16.99 hrs Surf.Area= 8,546 sf Storage= 12,571 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 209.7 min (1,070.6 - 861.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	9,231 cf	**52.75'W x 162.00'L x 4.50'H Field A** 38,455 cf Overall - 15,377 cf Embedded = 23,078 cf x 40.0% Voids
#2A	328.00'	15,377 cf	**CMP Round- 42** x 80 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf Overall Size= 42.0"W x 42.0"H x 20.00'L 80 Chambers in 10 Rows
		24,608 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	330.70'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	330.70'	**15.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.70' / 330.70' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.59 cfs @ 11.75 hrs HW=327.57' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.59 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=327.50' TW=0.00' (Dynamic Tailwater)
↑**3=Culvert** (Controls 0.00 cfs)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: (80) CMP 42 - Chamber Wizard Field A

Chamber Model = CMP Round- 42 (Round Corrugated Metal Pipe)
Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf
Overall Size= 42.0"W x 42.0"H x 20.00'L

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

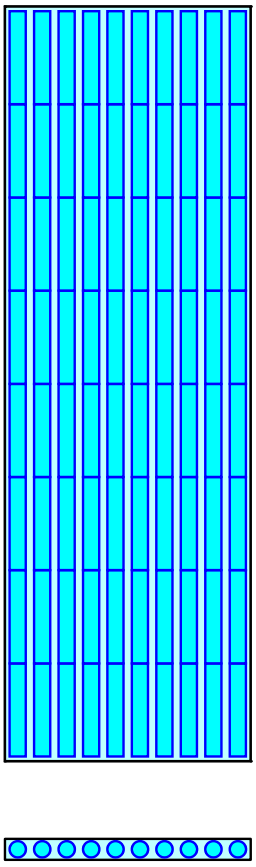
8 Chambers/Row x 20.00' Long = 160.00' Row Length +12.0" End Stone x 2 = 162.00' Base Length
10 Rows x 42.0" Wide + 21.0" Spacing x 9 + 12.0" Side Stone x 2 = 52.75' Base Width
6.0" Stone Base + 42.0" Chamber Height + 6.0" Stone Cover = 4.50' Field Height

80 Chambers x 192.2 cf = 15,376.7 cf Chamber Storage

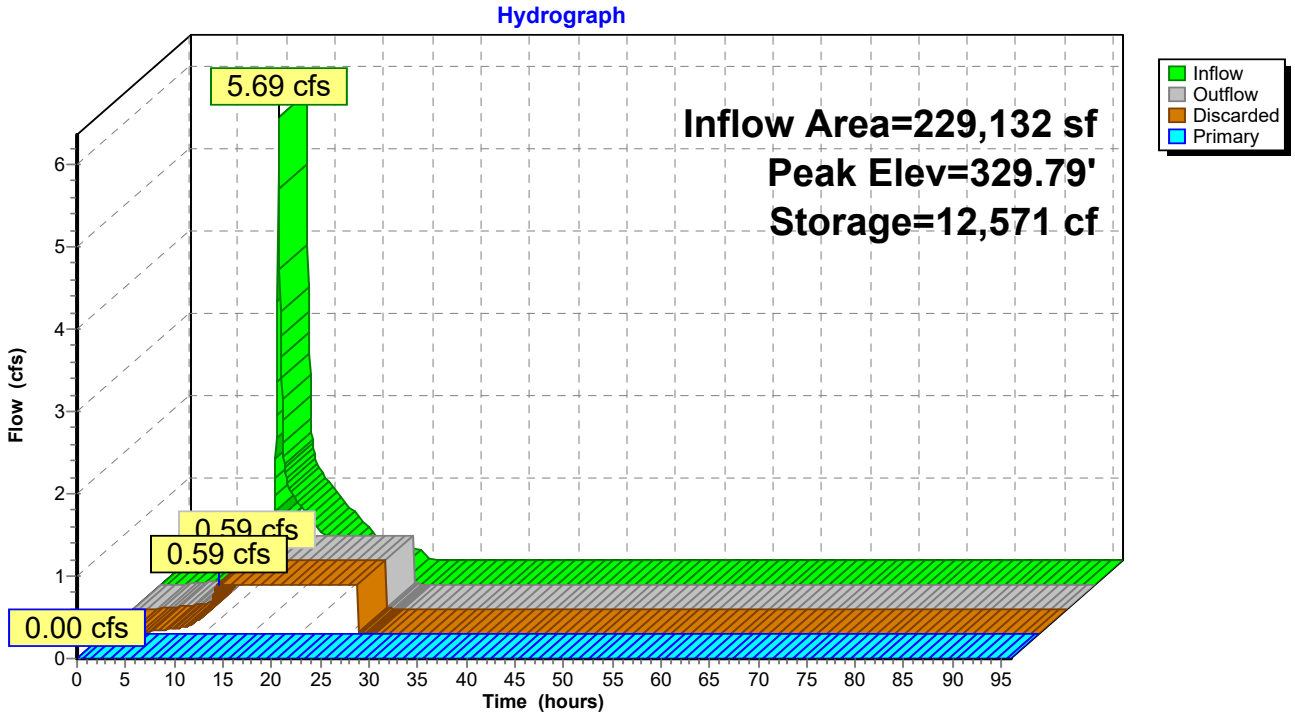
38,454.8 cf Field - 15,376.7 cf Chambers = 23,078.1 cf Stone x 40.0% Voids = 9,231.2 cf Stone Storage

Chamber Storage + Stone Storage = 24,607.9 cf = 0.565 af
Overall Storage Efficiency = 64.0%
Overall System Size = 162.00' x 52.75' x 4.50'

80 Chambers
1,424.2 cy Field
854.7 cy Stone



Pond 6P: (80) CMP 42



Summary for Pond 17P: (28) CMP 48"

Inflow Area = 79,725 sf, 72.98% Impervious, Inflow Depth = 2.82" for 10-Year event
Inflow = 5.28 cfs @ 12.09 hrs, Volume= 18,740 cf
Outflow = 0.71 cfs @ 12.67 hrs, Volume= 18,738 cf, Atten= 87%, Lag= 34.8 min
Primary = 0.71 cfs @ 12.67 hrs, Volume= 18,738 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 334.03' @ 12.67 hrs Surf.Area= 3,444 sf Storage= 6,987 cf

Plug-Flow detention time= 104.5 min calculated for 18,728 cf (100% of inflow)
Center-of-Mass det. time= 105.3 min (883.7 - 778.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	331.00'	4,082 cf	**42.00'W x 82.00'L x 5.00'H Field A** 17,220 cf Overall - 7,015 cf Embedded = 10,205 cf x 40.0% Voids
#2A	331.50'	7,015 cf	**CMP Round- 48** x 28 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 28 Chambers in 7 Rows
		11,097 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	331.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	335.40'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	330.90'	**12.0" Round Culvert** L= 509.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.90' / 328.20' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.71 cfs @ 12.67 hrs HW=334.03' TW=329.05' (Dynamic Tailwater)
↑**3=Culvert** (Passes 0.71 cfs of 3.28 cfs potential flow)
↑**1=Orifice/Grate** (Orifice Controls 0.71 cfs @ 8.15 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 17P: (28) CMP 48" - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

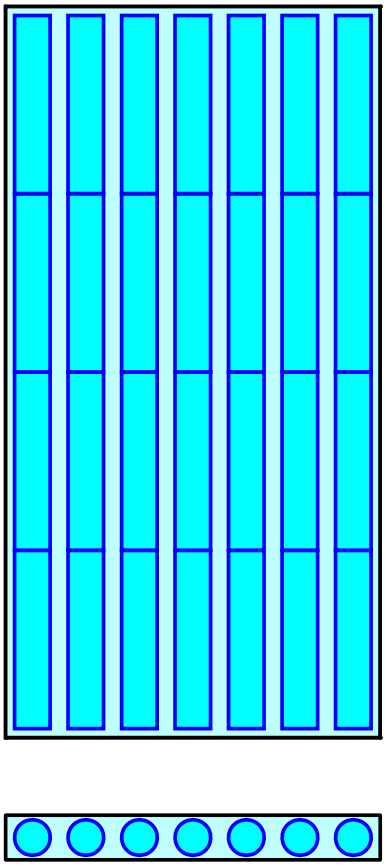
4 Chambers/Row x 20.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
7 Rows x 48.0" Wide + 24.0" Spacing x 6 + 12.0" Side Stone x 2 = 42.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

28 Chambers x 250.5 cf = 7,014.9 cf Chamber Storage

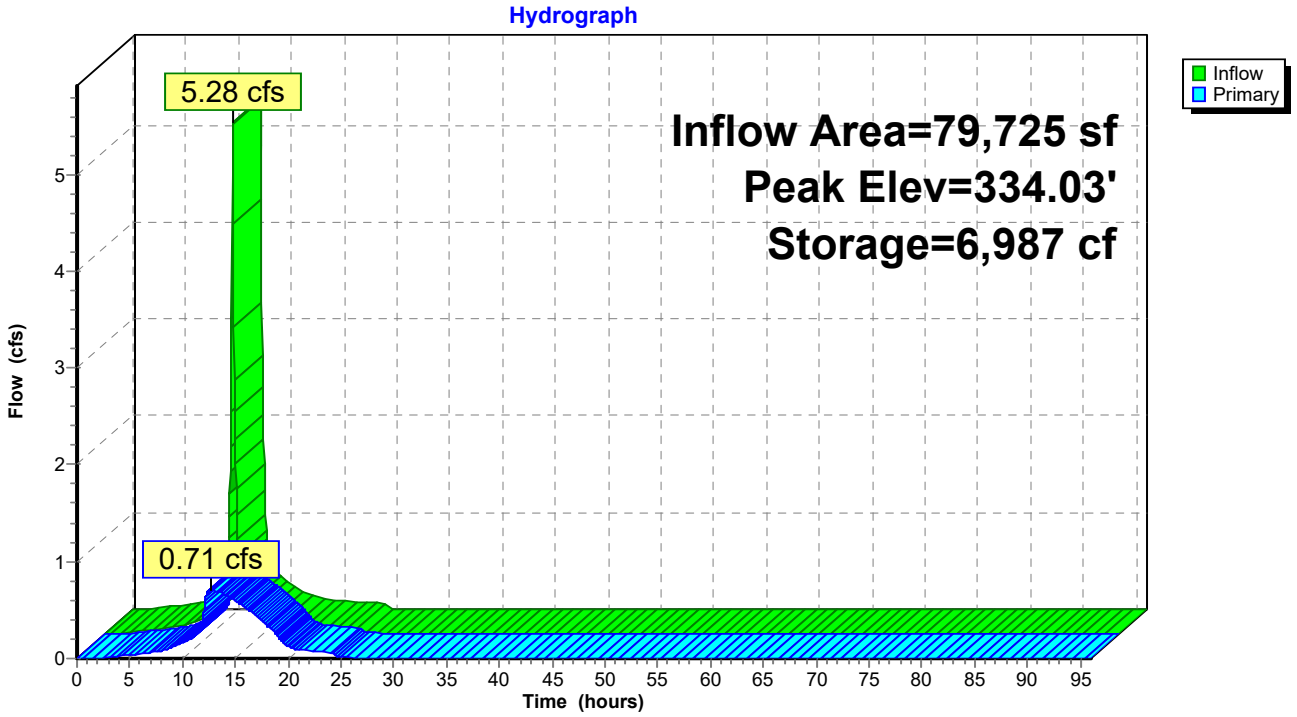
17,220.0 cf Field - 7,014.9 cf Chambers = 10,205.1 cf Stone x 40.0% Voids = 4,082.0 cf Stone Storage

Chamber Storage + Stone Storage = 11,097.0 cf = 0.255 af
Overall Storage Efficiency = 64.4%
Overall System Size = 82.00' x 42.00' x 5.00'

28 Chambers
637.8 cy Field
378.0 cy Stone



Pond 17P: (28) CMP 48"



Summary for Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

Inflow Area = 61,263 sf, 88.04% Impervious, Inflow Depth = 3.55" for 10-Year event
Inflow = 5.21 cfs @ 12.09 hrs, Volume= 18,130 cf
Outflow = 0.30 cfs @ 11.35 hrs, Volume= 18,147 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.30 cfs @ 11.35 hrs, Volume= 18,147 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 330.18' @ 13.96 hrs Surf.Area= 4,392 sf Storage= 7,717 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 210.4 min (980.3 - 769.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	5,176 cf	**36.00'W x 122.00'L x 5.00'H Field A** 21,960 cf Overall - 9,019 cf Embedded = 12,941 cf x 40.0% Voids
#2A	328.00'	9,019 cf	**CMP Round- 48** x 36 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 36 Chambers in 6 Rows
		14,196 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	331.20'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	331.20'	**15.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 331.20' / 331.20' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.30 cfs @ 11.35 hrs HW=327.56' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=327.50' TW=327.50' (Dynamic Tailwater)
↑└**3=Culvert** (Controls 0.00 cfs)
↑└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond P7: (36) CMP 48 (Proposed Under BLDG #3) - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

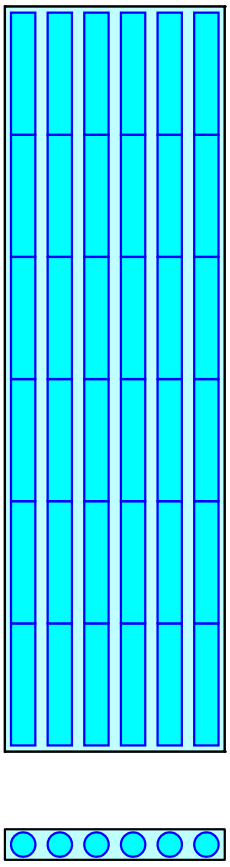
6 Chambers/Row x 20.00' Long = 120.00' Row Length +12.0" End Stone x 2 = 122.00' Base Length
6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 12.0" Side Stone x 2 = 36.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

36 Chambers x 250.5 cf = 9,019.2 cf Chamber Storage

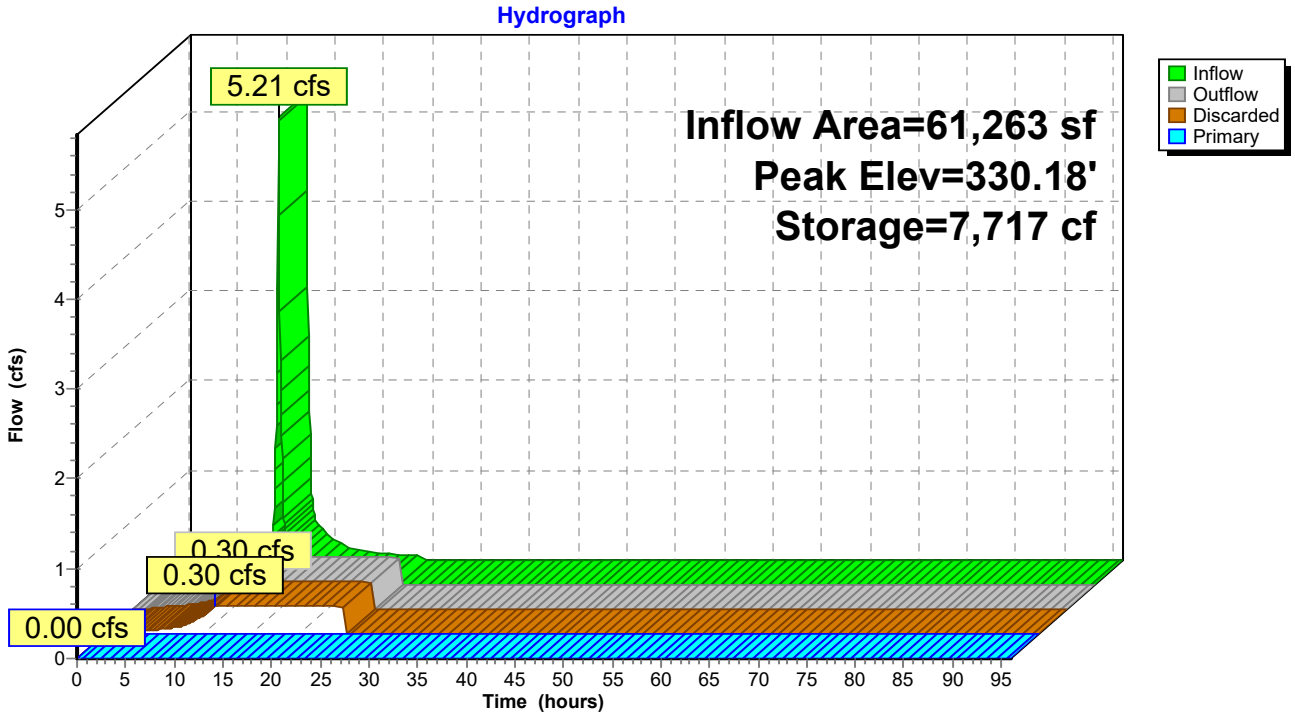
21,960.0 cf Field - 9,019.2 cf Chambers = 12,940.8 cf Stone x 40.0% Voids = 5,176.3 cf Stone Storage

Chamber Storage + Stone Storage = 14,195.5 cf = 0.326 af
Overall Storage Efficiency = 64.6%
Overall System Size = 122.00' x 36.00' x 5.00'

36 Chambers
813.3 cy Field
479.3 cy Stone



Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

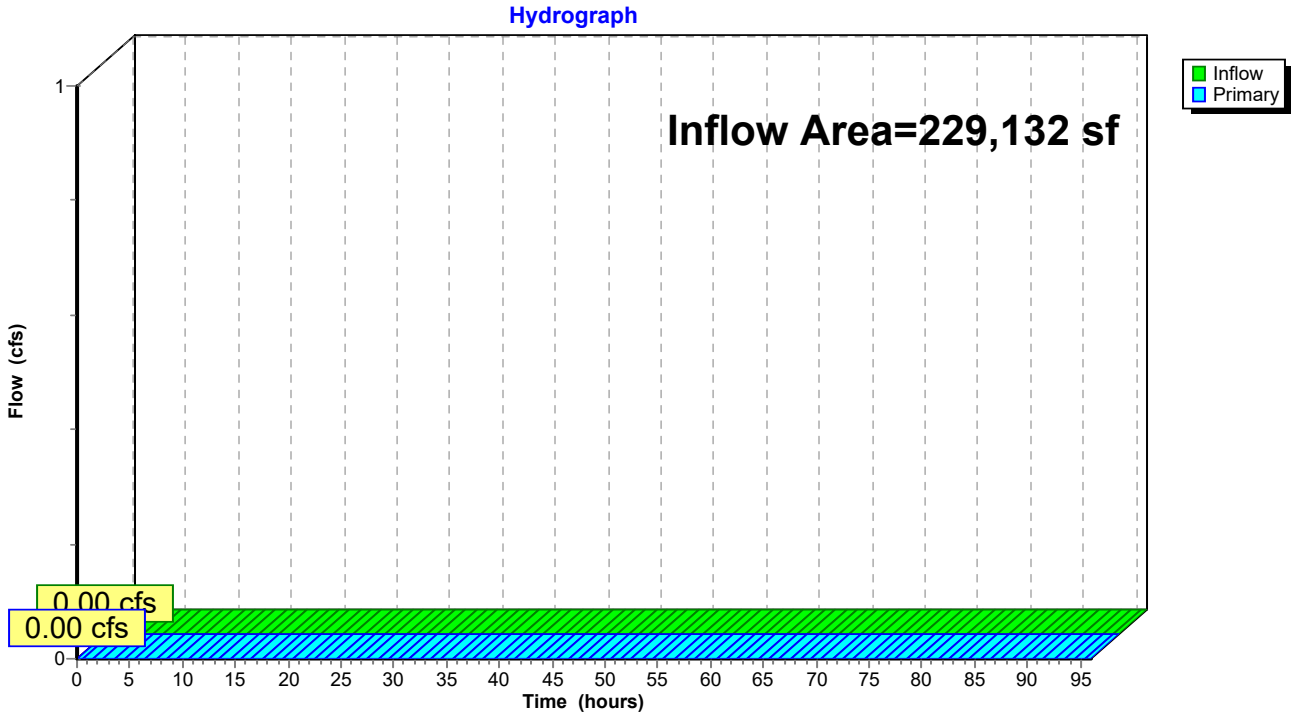


Summary for Link POA-3: TOWN DRAIN

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-3: TOWN DRAIN



Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pr_R1: Building 2 West Runoff Area=38,129 sf 100.00% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=98 Runoff=4.43 cfs 16,086 cf

Subcatchment Pr_R2: Building 2 East Runoff Area=39,599 sf 100.00% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=98 Runoff=4.61 cfs 16,707 cf

Subcatchment Pr_Ws1: Proposed Under Runoff Area=23,134 sf 68.34% Impervious Runoff Depth=3.06"
Tc=6.0 min CN=79 Runoff=1.87 cfs 5,902 cf

Subcatchment Pr_Ws13: Pr_Watershed 13 Runoff Area=40,126 sf 46.32% Impervious Runoff Depth=1.94"
Tc=6.0 min CN=66 Runoff=1.99 cfs 6,470 cf

Subcatchment Pr_Ws14: Pr_Watershed 14 Runoff Area=88,144 sf 64.28% Impervious Runoff Depth=2.88"
Tc=6.0 min CN=77 Runoff=6.69 cfs 21,124 cf

Pond 6P: (80) CMP 42 Peak Elev=330.68' Storage=18,477 cf Inflow=7.31 cfs 44,299 cf
Discarded=0.59 cfs 44,320 cf Primary=0.00 cfs 0 cf Outflow=0.59 cfs 44,320 cf

Pond 17P: (28) CMP 48" Peak Elev=334.83' Storage=9,034 cf Inflow=6.58 cfs 23,177 cf
Outflow=0.80 cfs 23,174 cf

Pond P7: (36) CMP 48 (Proposed Under Peak Elev=330.90' Storage=10,179 cf Inflow=6.30 cfs 21,989 cf
Discarded=0.30 cfs 21,990 cf Primary=0.00 cfs 0 cf Outflow=0.30 cfs 21,990 cf

Link POA-3: TOWN DRAIN Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 229,132 sf Runoff Volume = 66,290 cf Average Runoff Depth = 3.47"
26.34% Pervious = 60,351 sf 73.66% Impervious = 168,781 sf

Summary for Subcatchment Pr_R1: Building 2 West

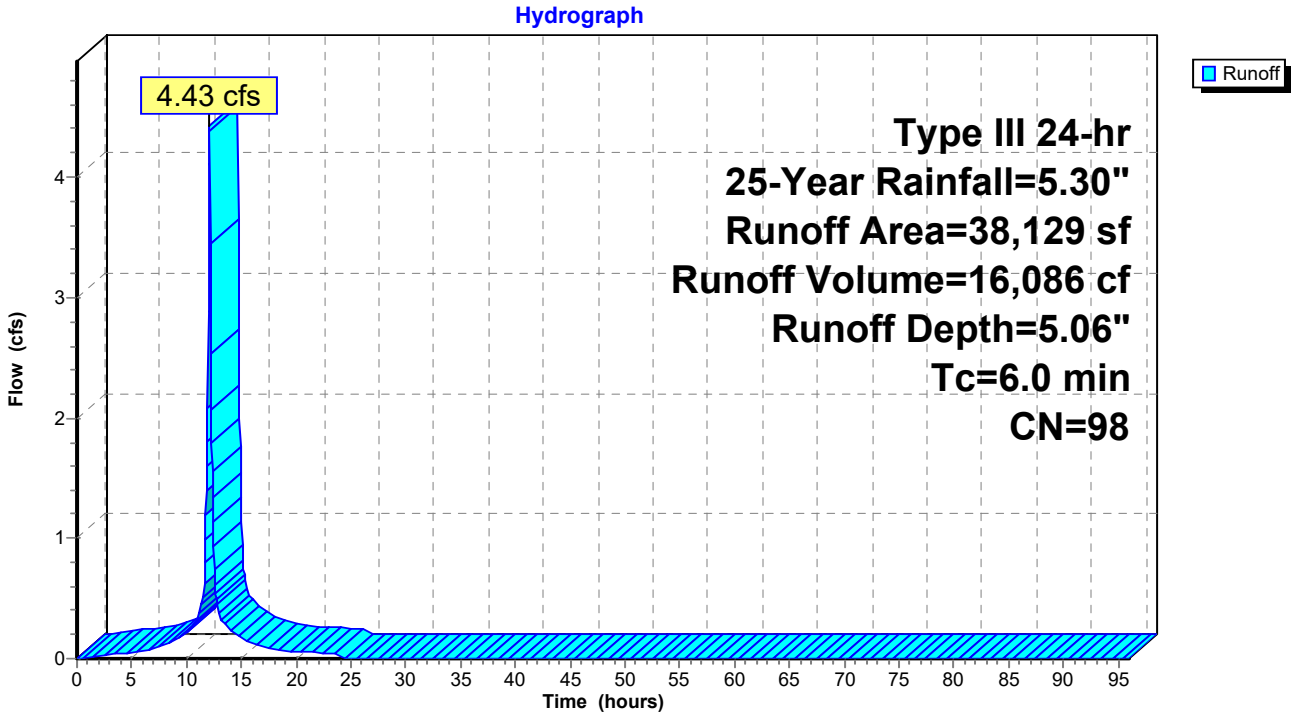
Runoff = 4.43 cfs @ 12.09 hrs, Volume= 16,086 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
38,129	98	Roofs, HSG A
38,129		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R1: Building 2 West



Summary for Subcatchment Pr_R2: Building 2 East

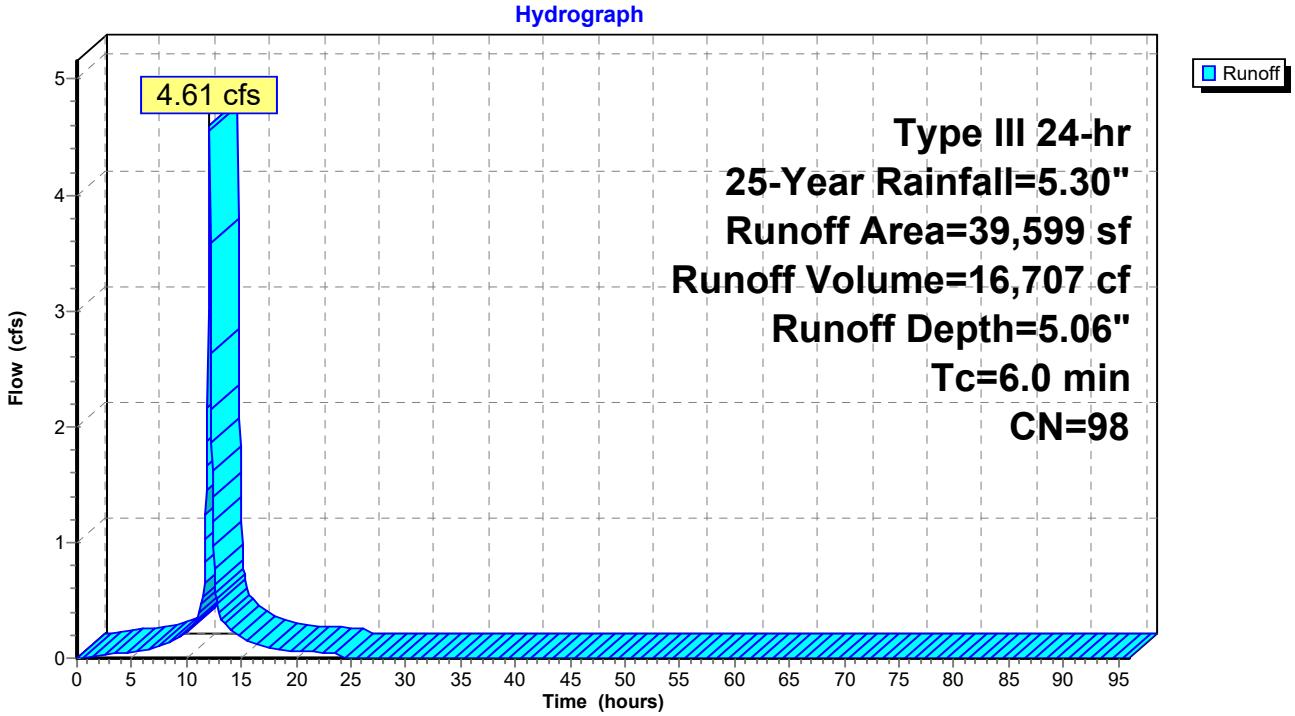
Runoff = 4.61 cfs @ 12.09 hrs, Volume= 16,707 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
39,599	98	Unconnected roofs, HSG A
39,599		100.00% Impervious Area
39,599		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R2: Building 2 East



Summary for Subcatchment Pr_Ws1: Proposed Under BLDG #3

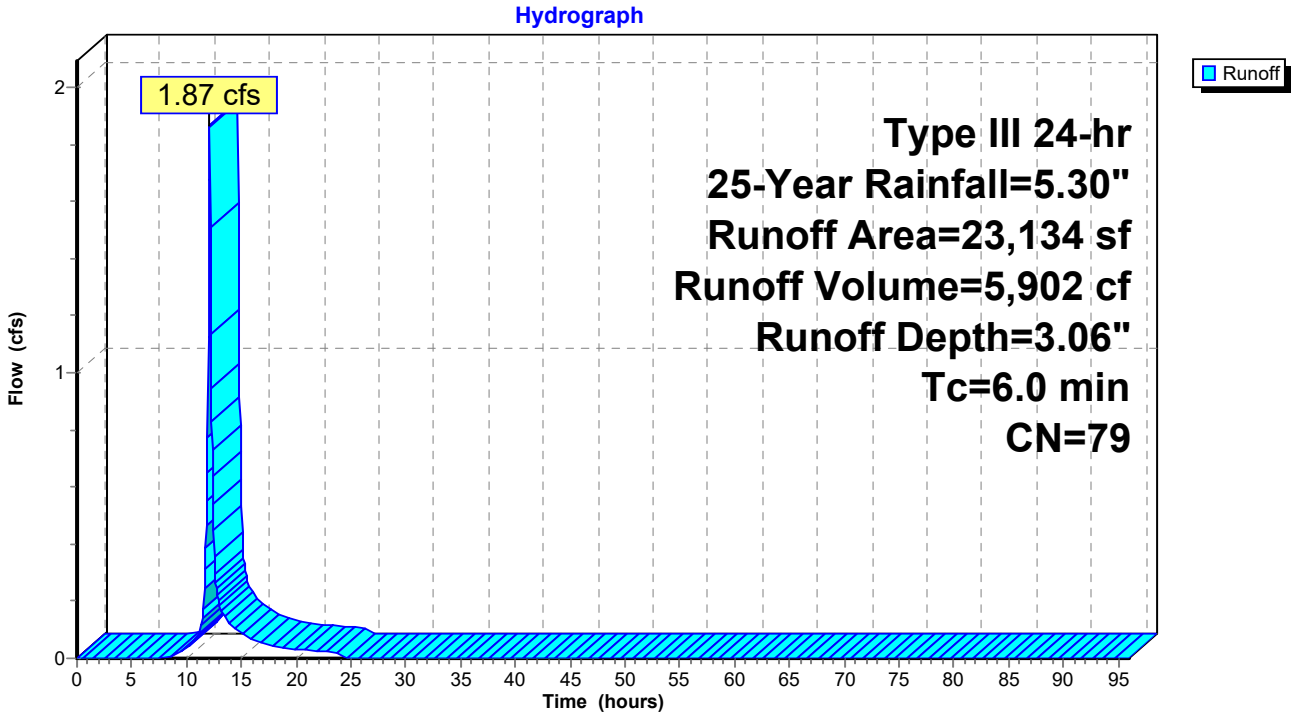
Runoff = 1.87 cfs @ 12.09 hrs, Volume= 5,902 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
7,324	39	>75% Grass cover, Good, HSG A
15,810	98	Paved parking, HSG A
23,134	79	Weighted Average
7,324		31.66% Pervious Area
15,810		68.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws1: Proposed Under BLDG #3



Summary for Subcatchment Pr_Ws13: Pr_Watershed 13

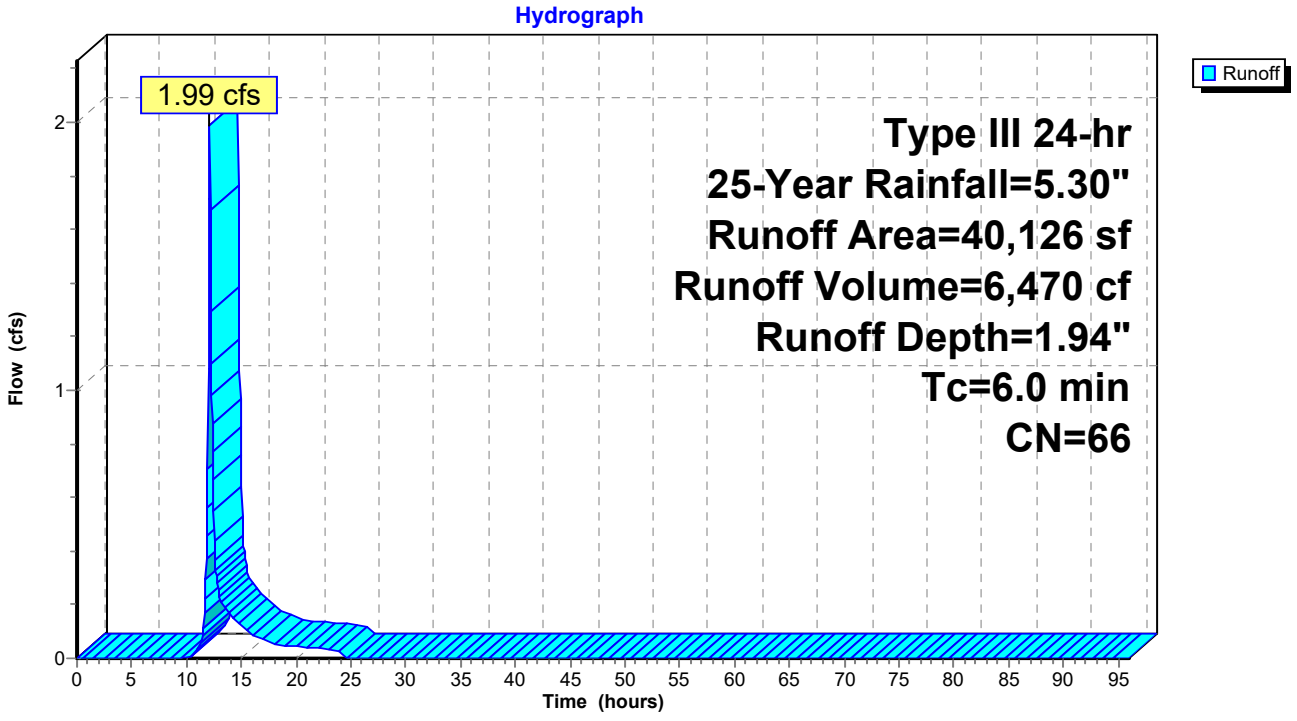
Runoff = 1.99 cfs @ 12.10 hrs, Volume= 6,470 cf, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
21,539	39	>75% Grass cover, Good, HSG A
18,587	98	Paved parking, HSG A
40,126	66	Weighted Average
21,539		53.68% Pervious Area
18,587		46.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws13: Pr_Watershed 13



Summary for Subcatchment Pr_Ws14: Pr_Watershed 14

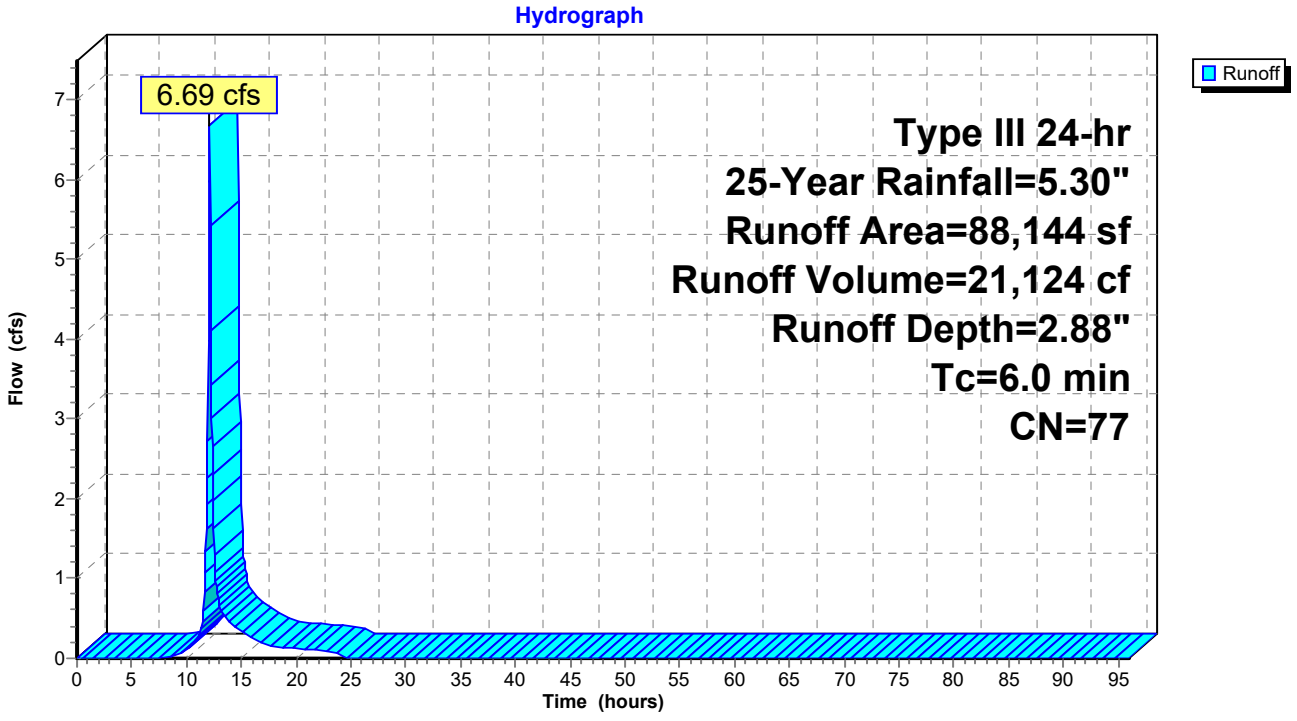
Runoff = 6.69 cfs @ 12.09 hrs, Volume= 21,124 cf, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
31,488	39	>75% Grass cover, Good, HSG A
56,656	98	Paved parking, HSG A
88,144	77	Weighted Average
31,488		35.72% Pervious Area
56,656		64.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws14: Pr_Watershed 14



Summary for Pond 6P: (80) CMP 42

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 2.32" for 25-Year event
Inflow = 7.31 cfs @ 12.09 hrs, Volume= 44,299 cf
Outflow = 0.59 cfs @ 11.55 hrs, Volume= 44,320 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.59 cfs @ 11.55 hrs, Volume= 44,320 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 330.68' @ 18.11 hrs Surf.Area= 8,546 sf Storage= 18,477 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 306.8 min (1,170.8 - 863.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	9,231 cf	**52.75'W x 162.00'L x 4.50'H Field A** 38,455 cf Overall - 15,377 cf Embedded = 23,078 cf x 40.0% Voids
#2A	328.00'	15,377 cf	**CMP Round- 42** x 80 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf Overall Size= 42.0"W x 42.0"H x 20.00'L 80 Chambers in 10 Rows
		24,608 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	330.70'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	330.70'	**15.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.70' / 330.70' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.59 cfs @ 11.55 hrs HW=327.55' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.59 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=327.50' TW=0.00' (Dynamic Tailwater)
↑**3=Culvert** (Controls 0.00 cfs)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: (80) CMP 42 - Chamber Wizard Field A

Chamber Model = CMP Round- 42 (Round Corrugated Metal Pipe)
Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf
Overall Size= 42.0"W x 42.0"H x 20.00'L

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

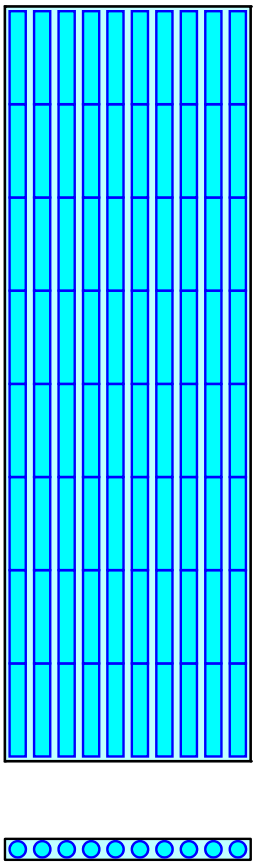
8 Chambers/Row x 20.00' Long = 160.00' Row Length +12.0" End Stone x 2 = 162.00' Base Length
10 Rows x 42.0" Wide + 21.0" Spacing x 9 + 12.0" Side Stone x 2 = 52.75' Base Width
6.0" Stone Base + 42.0" Chamber Height + 6.0" Stone Cover = 4.50' Field Height

80 Chambers x 192.2 cf = 15,376.7 cf Chamber Storage

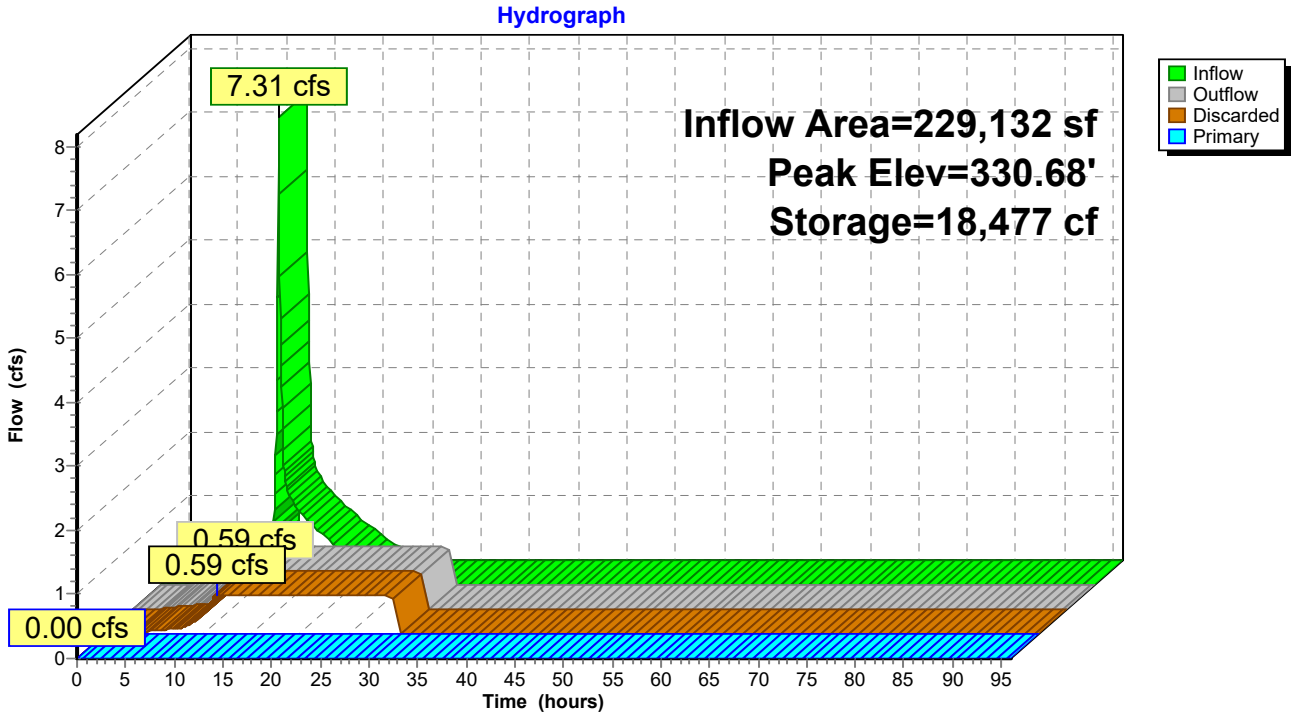
38,454.8 cf Field - 15,376.7 cf Chambers = 23,078.1 cf Stone x 40.0% Voids = 9,231.2 cf Stone Storage

Chamber Storage + Stone Storage = 24,607.9 cf = 0.565 af
Overall Storage Efficiency = 64.0%
Overall System Size = 162.00' x 52.75' x 4.50'

80 Chambers
1,424.2 cy Field
854.7 cy Stone



Pond 6P: (80) CMP 42



Summary for Pond 17P: (28) CMP 48"

Inflow Area = 79,725 sf, 72.98% Impervious, Inflow Depth = 3.49" for 25-Year event
Inflow = 6.58 cfs @ 12.09 hrs, Volume= 23,177 cf
Outflow = 0.80 cfs @ 12.75 hrs, Volume= 23,174 cf, Atten= 88%, Lag= 39.7 min
Primary = 0.80 cfs @ 12.75 hrs, Volume= 23,174 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 334.83' @ 12.75 hrs Surf.Area= 3,444 sf Storage= 9,034 cf

Plug-Flow detention time= 119.7 min calculated for 23,162 cf (100% of inflow)
Center-of-Mass det. time= 120.5 min (897.6 - 777.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	331.00'	4,082 cf	**42.00'W x 82.00'L x 5.00'H Field A** 17,220 cf Overall - 7,015 cf Embedded = 10,205 cf x 40.0% Voids
#2A	331.50'	7,015 cf	**CMP Round- 48** x 28 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 28 Chambers in 7 Rows
		11,097 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	331.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	335.40'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	330.90'	**12.0" Round Culvert** L= 509.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.90' / 328.20' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.80 cfs @ 12.75 hrs HW=334.83' TW=329.53' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.80 cfs of 3.43 cfs potential flow)
  ├**1=Orifice/Grate** (Orifice Controls 0.80 cfs @ 9.22 fps)
  └**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: (28) CMP 48" - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

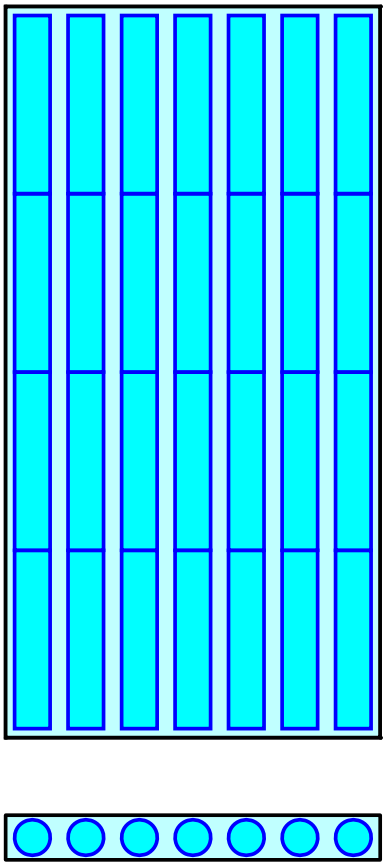
4 Chambers/Row x 20.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
7 Rows x 48.0" Wide + 24.0" Spacing x 6 + 12.0" Side Stone x 2 = 42.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

28 Chambers x 250.5 cf = 7,014.9 cf Chamber Storage

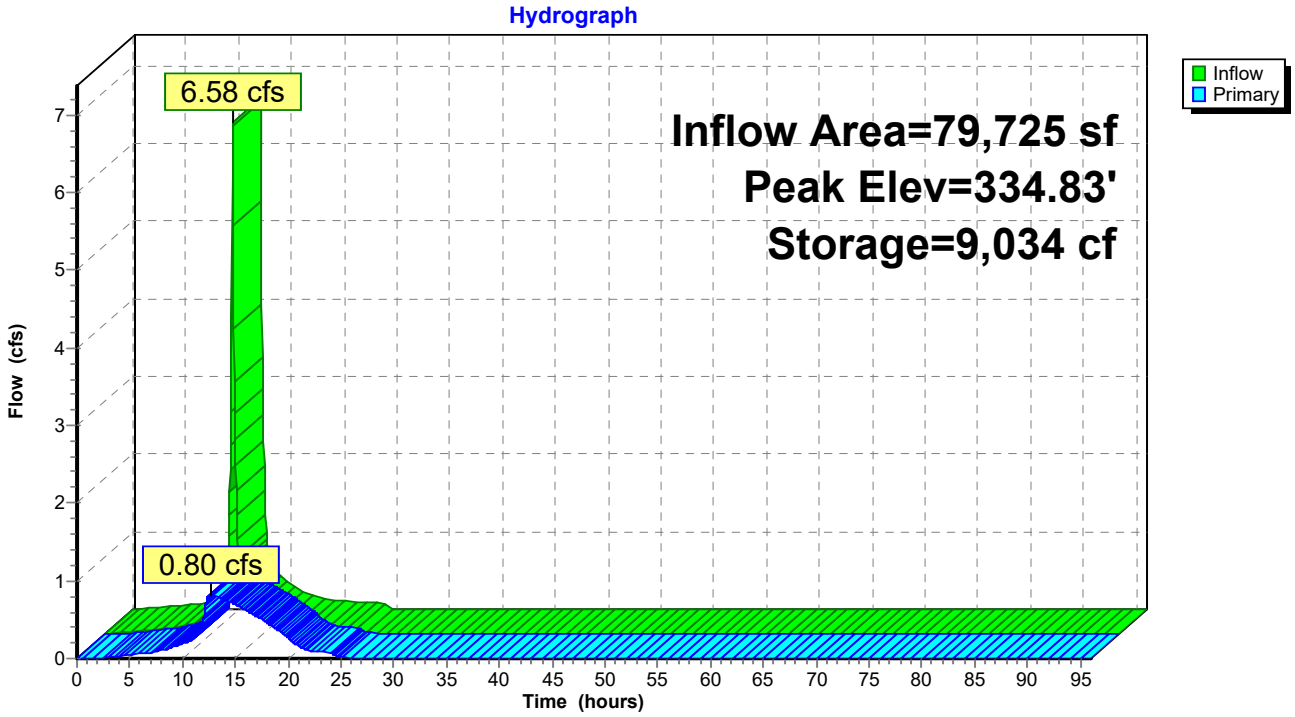
17,220.0 cf Field - 7,014.9 cf Chambers = 10,205.1 cf Stone x 40.0% Voids = 4,082.0 cf Stone Storage

Chamber Storage + Stone Storage = 11,097.0 cf = 0.255 af
Overall Storage Efficiency = 64.4%
Overall System Size = 82.00' x 42.00' x 5.00'

28 Chambers
637.8 cy Field
378.0 cy Stone



Pond 17P: (28) CMP 48"



Summary for Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

Inflow Area = 61,263 sf, 88.04% Impervious, Inflow Depth = 4.31" for 25-Year event
Inflow = 6.30 cfs @ 12.09 hrs, Volume= 21,989 cf
Outflow = 0.30 cfs @ 10.95 hrs, Volume= 21,990 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.30 cfs @ 10.95 hrs, Volume= 21,990 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 330.90' @ 14.59 hrs Surf.Area= 4,392 sf Storage= 10,179 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 285.0 min (1,052.2 - 767.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	5,176 cf	**36.00'W x 122.00'L x 5.00'H Field A** 21,960 cf Overall - 9,019 cf Embedded = 12,941 cf x 40.0% Voids
#2A	328.00'	9,019 cf	**CMP Round- 48** x 36 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 36 Chambers in 6 Rows
		14,196 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	331.20'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	331.20'	**15.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 331.20' / 331.20' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.30 cfs @ 10.95 hrs HW=327.55' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=327.50' TW=327.50' (Dynamic Tailwater)
↑└**3=Culvert** (Controls 0.00 cfs)
↑└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond P7: (36) CMP 48 (Proposed Under BLDG #3) - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

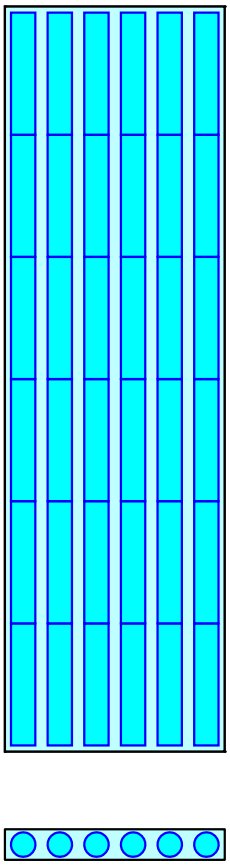
6 Chambers/Row x 20.00' Long = 120.00' Row Length +12.0" End Stone x 2 = 122.00' Base Length
6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 12.0" Side Stone x 2 = 36.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

36 Chambers x 250.5 cf = 9,019.2 cf Chamber Storage

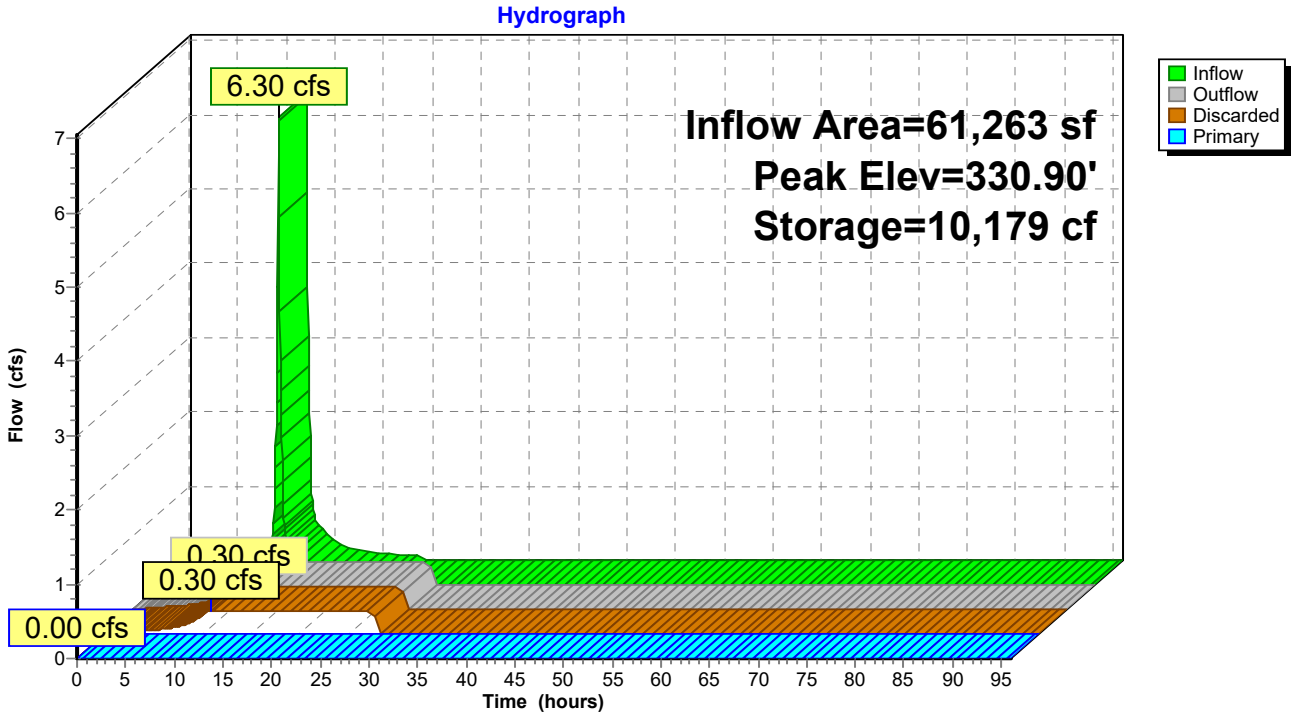
21,960.0 cf Field - 9,019.2 cf Chambers = 12,940.8 cf Stone x 40.0% Voids = 5,176.3 cf Stone Storage

Chamber Storage + Stone Storage = 14,195.5 cf = 0.326 af
Overall Storage Efficiency = 64.6%
Overall System Size = 122.00' x 36.00' x 5.00'

36 Chambers
813.3 cy Field
479.3 cy Stone



Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

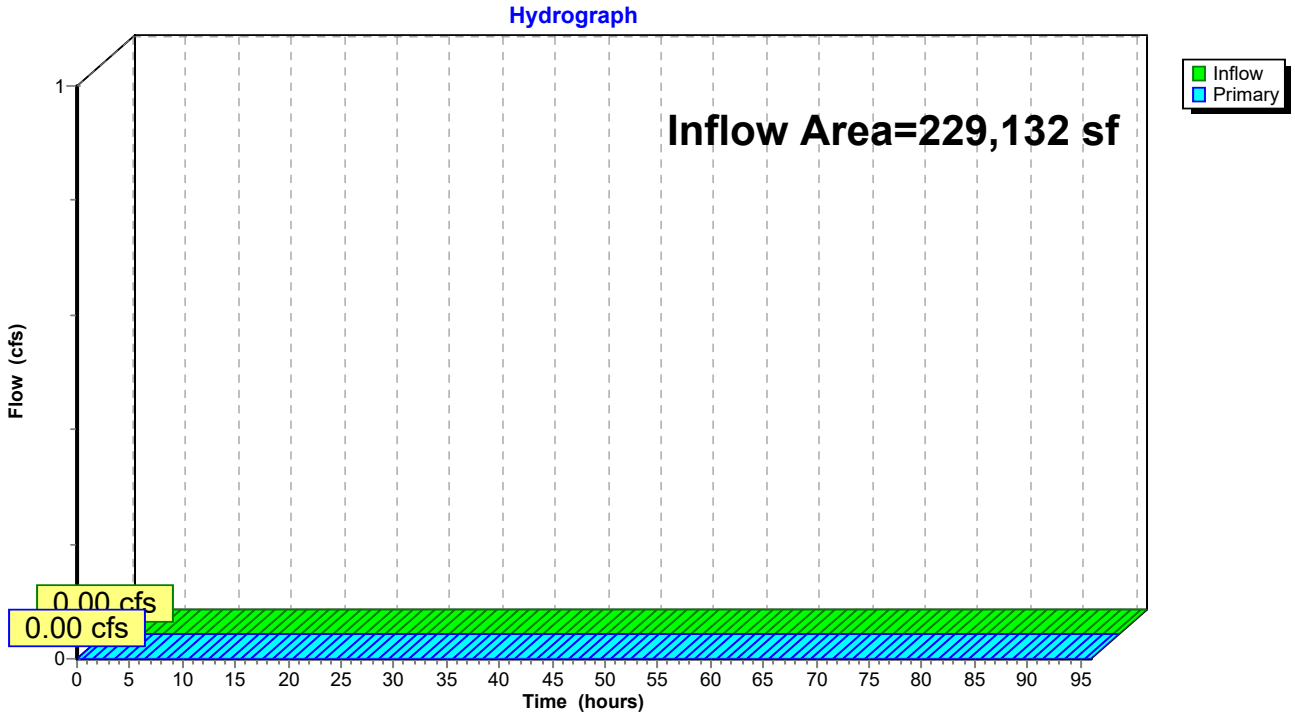


Summary for Link POA-3: TOWN DRAIN

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 0.00" for 25-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-3: TOWN DRAIN



Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pr_R1: Building 2 West Runoff Area=38,129 sf 100.00% Impervious Runoff Depth=5.76"
Tc=6.0 min CN=98 Runoff=5.03 cfs 18,308 cf

Subcatchment Pr_R2: Building 2 East Runoff Area=39,599 sf 100.00% Impervious Runoff Depth=5.76"
Tc=6.0 min CN=98 Runoff=5.22 cfs 19,014 cf

Subcatchment Pr_Ws1: Proposed Under Runoff Area=23,134 sf 68.34% Impervious Runoff Depth=3.68"
Tc=6.0 min CN=79 Runoff=2.24 cfs 7,094 cf

Subcatchment Pr_Ws13: Pr_Watershed 13 Runoff Area=40,126 sf 46.32% Impervious Runoff Depth=2.44"
Tc=6.0 min CN=66 Runoff=2.54 cfs 8,160 cf

Subcatchment Pr_Ws14: Pr_Watershed 14 Runoff Area=88,144 sf 64.28% Impervious Runoff Depth=3.48"
Tc=6.0 min CN=77 Runoff=8.08 cfs 25,555 cf

Pond 6P: (80) CMP 42 Peak Elev=331.16' Storage=21,291 cf Inflow=8.76 cfs 53,594 cf
Discarded=0.59 cfs 48,054 cf Primary=0.46 cfs 5,557 cf Outflow=1.05 cfs 53,611 cf

Pond 17P: (28) CMP 48" Peak Elev=335.58' Storage=10,516 cf Inflow=7.75 cfs 27,173 cf
Outflow=1.72 cfs 27,171 cf

Pond P7: (36) CMP 48 (Proposed Under Peak Elev=331.48' Storage=11,985 cf Inflow=7.26 cfs 25,402 cf
Discarded=0.30 cfs 24,534 cf Primary=0.13 cfs 869 cf Outflow=0.43 cfs 25,403 cf

Link POA-3: TOWN DRAIN Inflow=0.46 cfs 5,557 cf
Primary=0.46 cfs 5,557 cf

Total Runoff Area = 229,132 sf Runoff Volume = 78,130 cf Average Runoff Depth = 4.09"
26.34% Pervious = 60,351 sf 73.66% Impervious = 168,781 sf

Summary for Subcatchment Pr_R1: Building 2 West

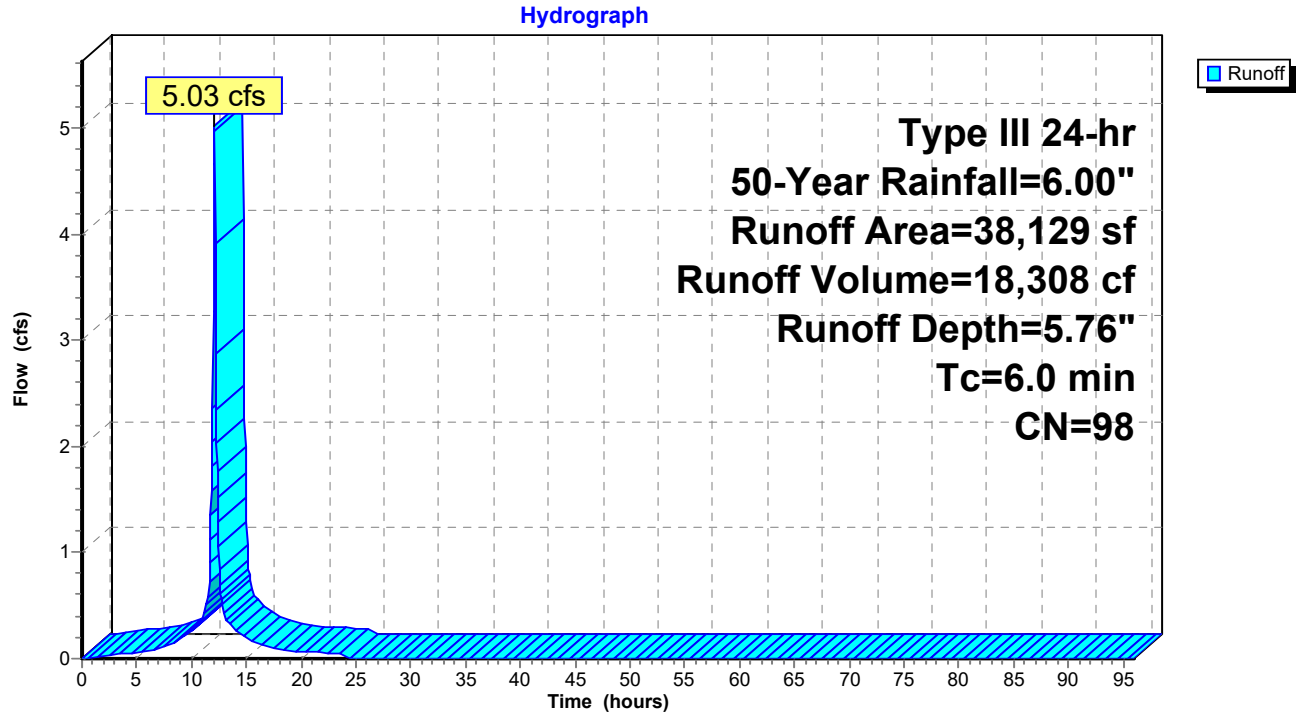
Runoff = 5.03 cfs @ 12.09 hrs, Volume= 18,308 cf, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
38,129	98	Roofs, HSG A
38,129		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R1: Building 2 West



Summary for Subcatchment Pr_R2: Building 2 East

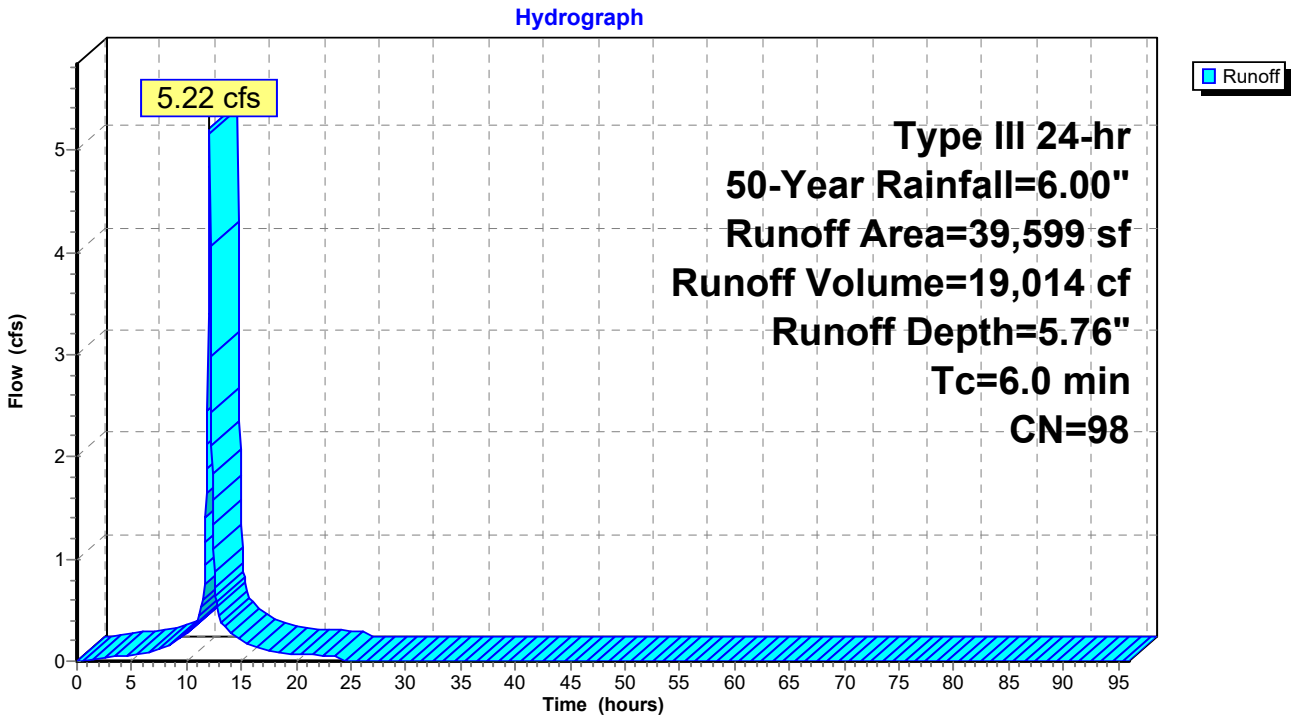
Runoff = 5.22 cfs @ 12.09 hrs, Volume= 19,014 cf, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
39,599	98	Unconnected roofs, HSG A
39,599		100.00% Impervious Area
39,599		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R2: Building 2 East



Summary for Subcatchment Pr_Ws1: Proposed Under BLDG #3

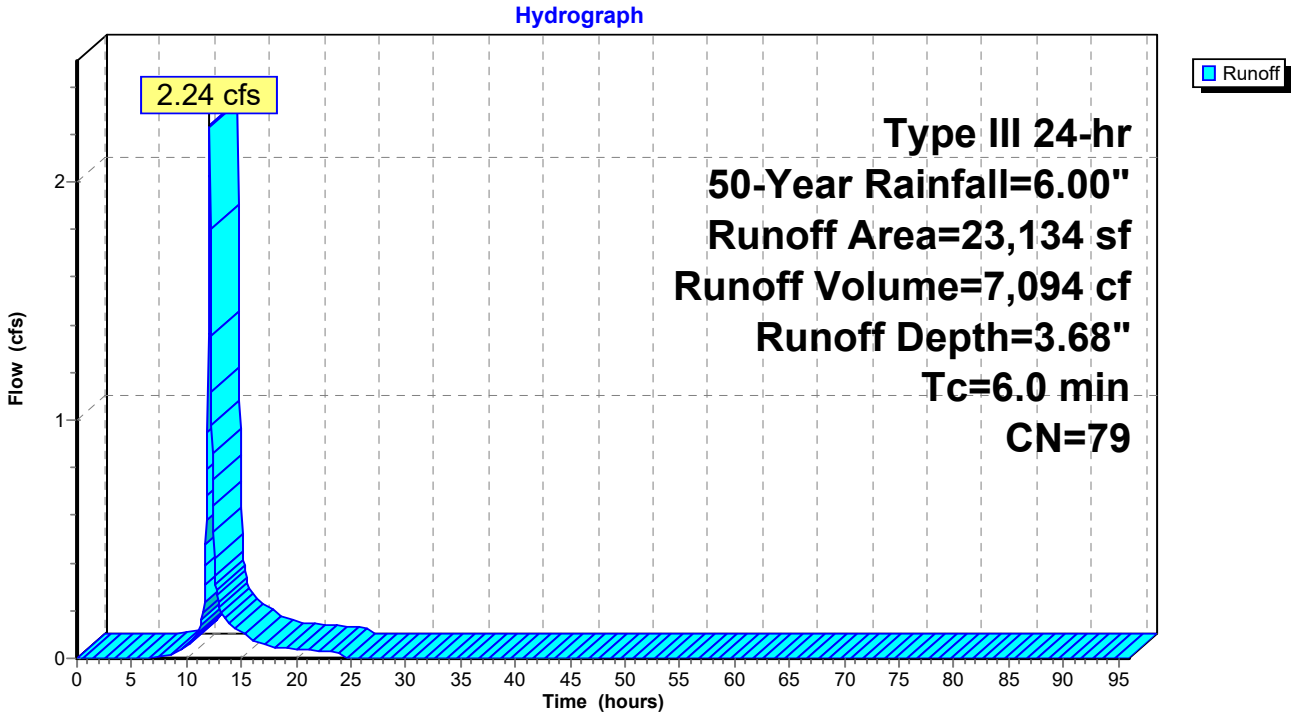
Runoff = 2.24 cfs @ 12.09 hrs, Volume= 7,094 cf, Depth= 3.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
7,324	39	>75% Grass cover, Good, HSG A
15,810	98	Paved parking, HSG A
23,134	79	Weighted Average
7,324		31.66% Pervious Area
15,810		68.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws1: Proposed Under BLDG #3



Summary for Subcatchment Pr_Ws13: Pr_Watershed 13

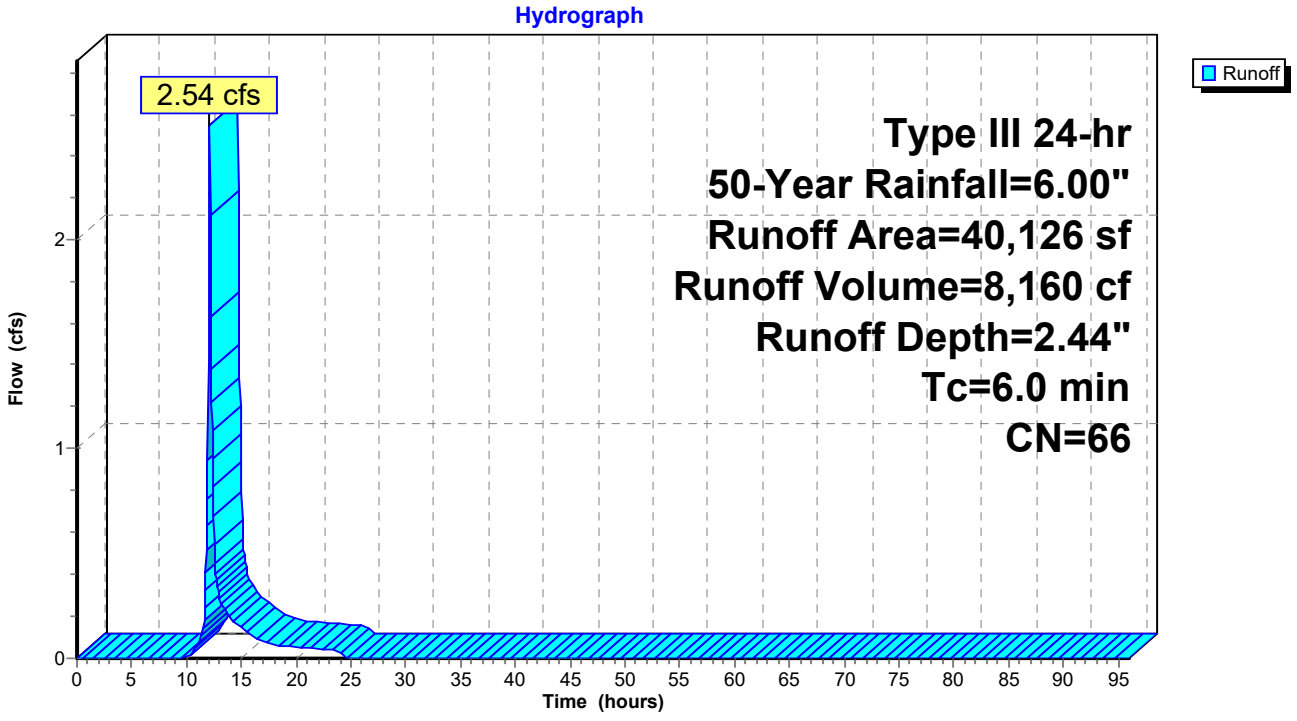
Runoff = 2.54 cfs @ 12.10 hrs, Volume= 8,160 cf, Depth= 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
21,539	39	>75% Grass cover, Good, HSG A
18,587	98	Paved parking, HSG A
40,126	66	Weighted Average
21,539		53.68% Pervious Area
18,587		46.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws13: Pr_Watershed 13



Summary for Subcatchment Pr_Ws14: Pr_Watershed 14

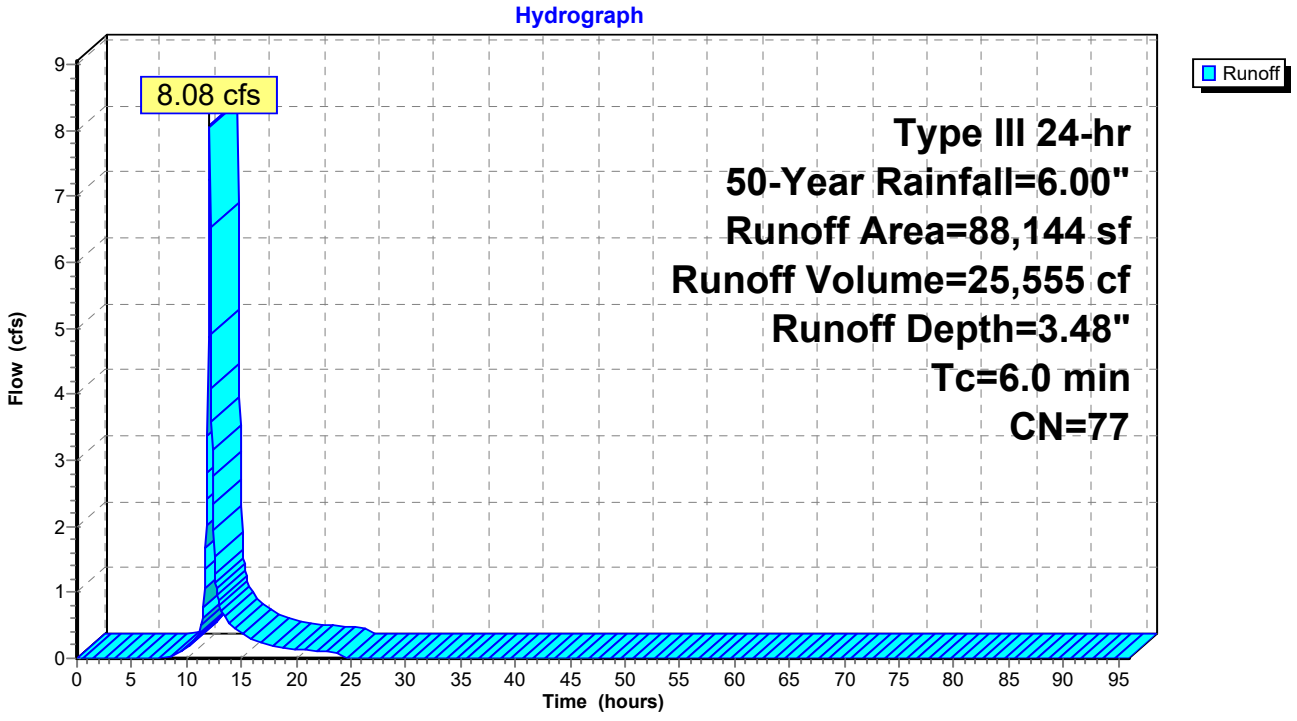
Runoff = 8.08 cfs @ 12.09 hrs, Volume= 25,555 cf, Depth= 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
31,488	39	>75% Grass cover, Good, HSG A
56,656	98	Paved parking, HSG A
88,144	77	Weighted Average
31,488		35.72% Pervious Area
56,656		64.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws14: Pr_Watershed 14



Summary for Pond 6P: (80) CMP 42

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 2.81" for 50-Year event
Inflow = 8.76 cfs @ 12.09 hrs, Volume= 53,594 cf
Outflow = 1.05 cfs @ 15.73 hrs, Volume= 53,611 cf, Atten= 88%, Lag= 218.0 min
Discarded = 0.59 cfs @ 11.35 hrs, Volume= 48,054 cf
Primary = 0.46 cfs @ 15.73 hrs, Volume= 5,557 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 331.16' @ 15.73 hrs Surf.Area= 8,546 sf Storage= 21,291 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 313.8 min (1,177.0 - 863.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	9,231 cf	**52.75'W x 162.00'L x 4.50'H Field A** 38,455 cf Overall - 15,377 cf Embedded = 23,078 cf x 40.0% Voids
#2A	328.00'	15,377 cf	**CMP Round- 42** x 80 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf Overall Size= 42.0"W x 42.0"H x 20.00'L 80 Chambers in 10 Rows
		24,608 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	330.70'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	330.70'	**15.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.70' / 330.70' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.59 cfs @ 11.35 hrs HW=327.56' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.59 cfs)

Primary OutFlow Max=0.46 cfs @ 15.73 hrs HW=331.16' TW=0.00' (Dynamic Tailwater)
↑└**3=Culvert** (Barrel Controls 0.46 cfs @ 1.65 fps)
↑└**2=Orifice/Grate** (Passes 0.46 cfs of 1.75 cfs potential flow)

Pond 6P: (80) CMP 42 - Chamber Wizard Field A

Chamber Model = CMP Round- 42 (Round Corrugated Metal Pipe)
Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf
Overall Size= 42.0"W x 42.0"H x 20.00'L

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

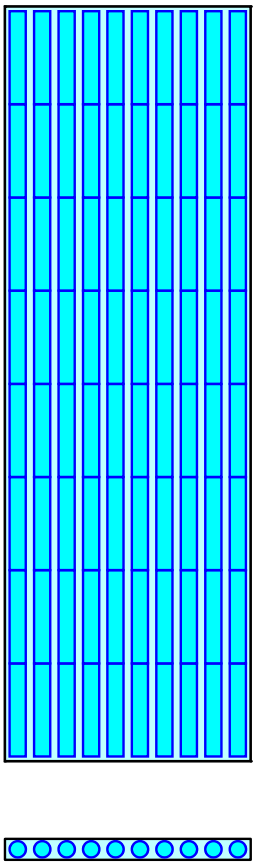
8 Chambers/Row x 20.00' Long = 160.00' Row Length +12.0" End Stone x 2 = 162.00' Base Length
10 Rows x 42.0" Wide + 21.0" Spacing x 9 + 12.0" Side Stone x 2 = 52.75' Base Width
6.0" Stone Base + 42.0" Chamber Height + 6.0" Stone Cover = 4.50' Field Height

80 Chambers x 192.2 cf = 15,376.7 cf Chamber Storage

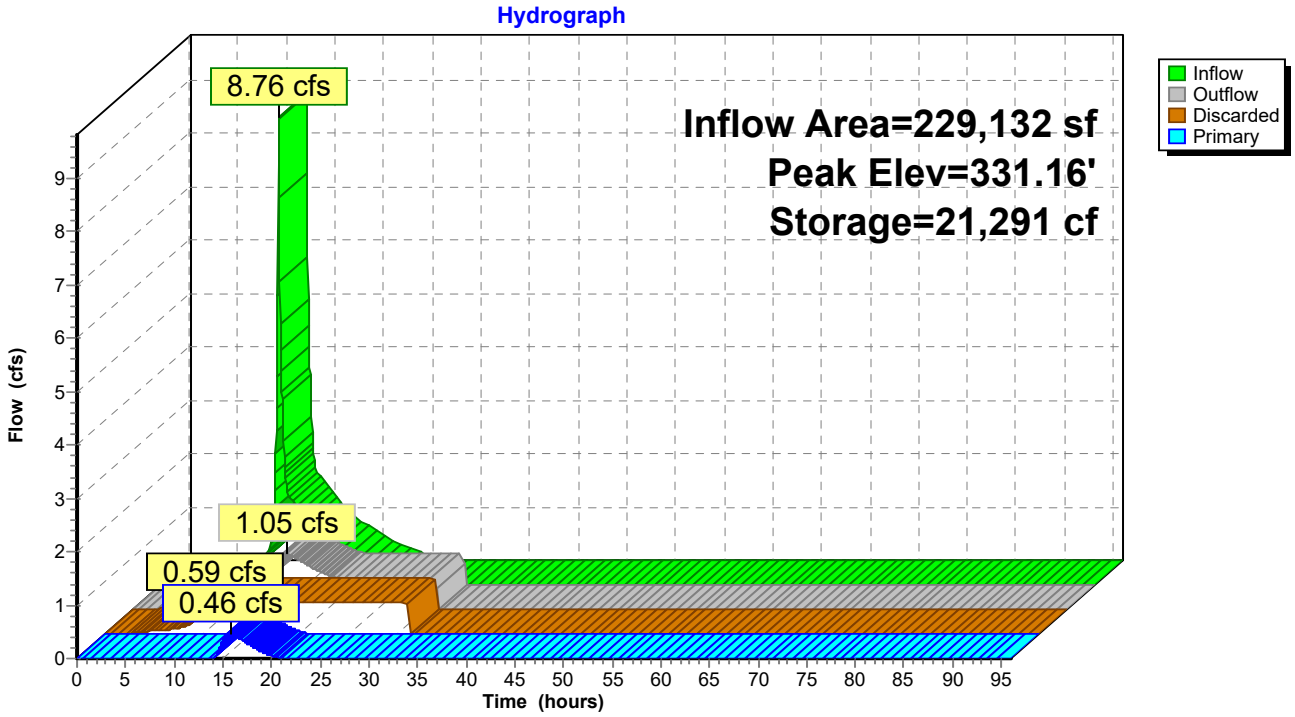
38,454.8 cf Field - 15,376.7 cf Chambers = 23,078.1 cf Stone x 40.0% Voids = 9,231.2 cf Stone Storage

Chamber Storage + Stone Storage = 24,607.9 cf = 0.565 af
Overall Storage Efficiency = 64.0%
Overall System Size = 162.00' x 52.75' x 4.50'

80 Chambers
1,424.2 cy Field
854.7 cy Stone



Pond 6P: (80) CMP 42



Summary for Pond 17P: (28) CMP 48"

Inflow Area = 79,725 sf, 72.98% Impervious, Inflow Depth = 4.09" for 50-Year event
Inflow = 7.75 cfs @ 12.09 hrs, Volume= 27,173 cf
Outflow = 1.72 cfs @ 12.52 hrs, Volume= 27,171 cf, Atten= 78%, Lag= 25.7 min
Primary = 1.72 cfs @ 12.52 hrs, Volume= 27,171 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 335.58' @ 12.52 hrs Surf.Area= 3,444 sf Storage= 10,516 cf

Plug-Flow detention time= 127.2 min calculated for 27,171 cf (100% of inflow)
Center-of-Mass det. time= 126.6 min (902.5 - 776.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	331.00'	4,082 cf	**42.00'W x 82.00'L x 5.00'H Field A** 17,220 cf Overall - 7,015 cf Embedded = 10,205 cf x 40.0% Voids
#2A	331.50'	7,015 cf	**CMP Round- 48** x 28 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 28 Chambers in 7 Rows
		11,097 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	331.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	335.40'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	330.90'	**12.0" Round Culvert** L= 509.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.90' / 328.20' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.66 cfs @ 12.52 hrs HW=335.57' TW=329.77' (Dynamic Tailwater)
↑**3=Culvert** (Passes 1.66 cfs of 3.59 cfs potential flow)
↑**1=Orifice/Grate** (Orifice Controls 0.88 cfs @ 10.10 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 0.78 cfs @ 1.15 fps)

Pond 17P: (28) CMP 48" - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

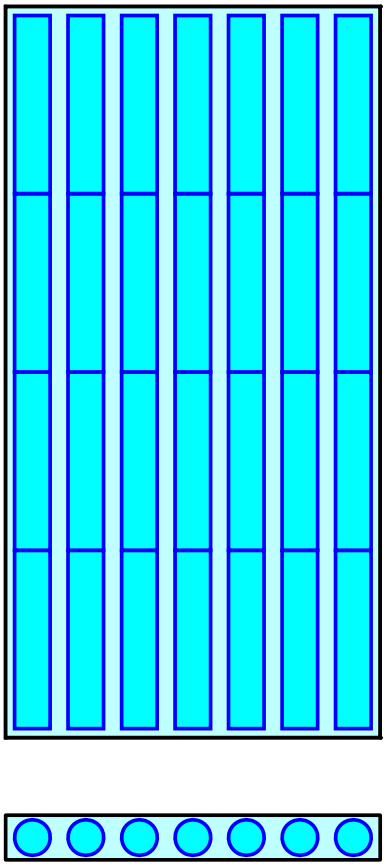
4 Chambers/Row x 20.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
7 Rows x 48.0" Wide + 24.0" Spacing x 6 + 12.0" Side Stone x 2 = 42.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

28 Chambers x 250.5 cf = 7,014.9 cf Chamber Storage

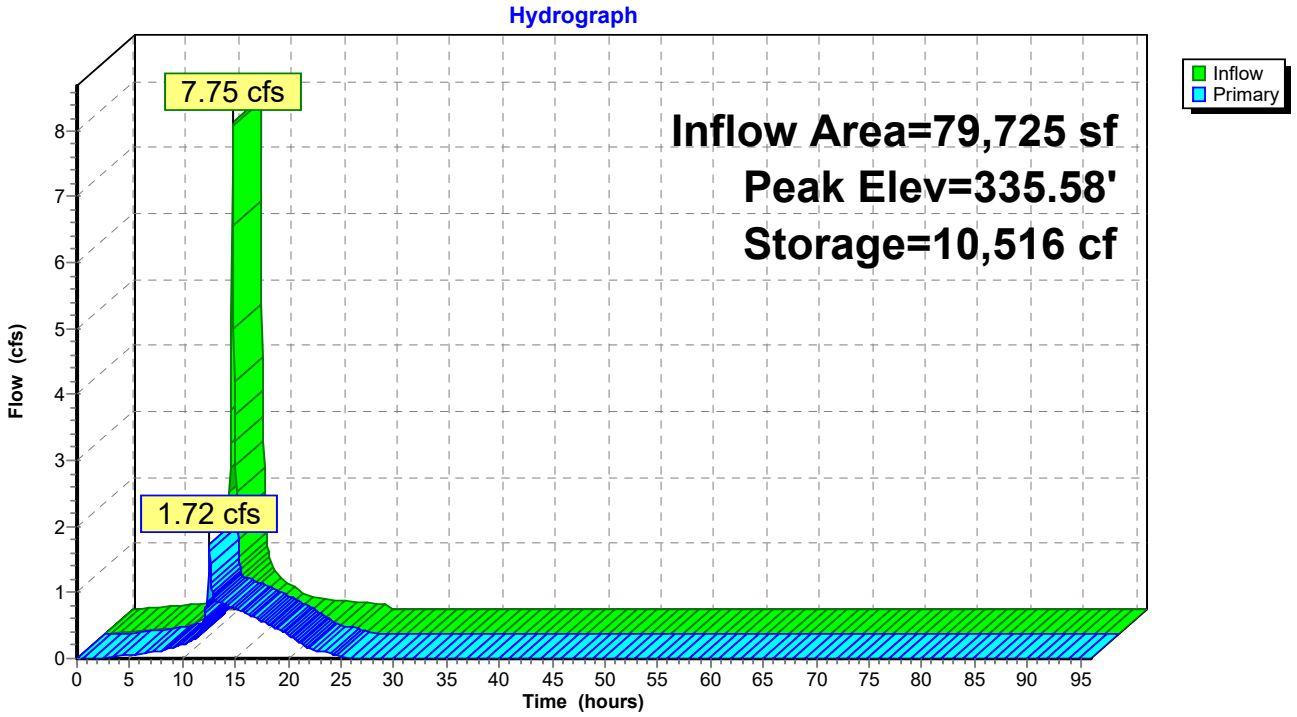
17,220.0 cf Field - 7,014.9 cf Chambers = 10,205.1 cf Stone x 40.0% Voids = 4,082.0 cf Stone Storage

Chamber Storage + Stone Storage = 11,097.0 cf = 0.255 af
Overall Storage Efficiency = 64.4%
Overall System Size = 82.00' x 42.00' x 5.00'

28 Chambers
637.8 cy Field
378.0 cy Stone



Pond 17P: (28) CMP 48"



Summary for Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

Inflow Area = 61,263 sf, 88.04% Impervious, Inflow Depth = 4.98" for 50-Year event
Inflow = 7.26 cfs @ 12.09 hrs, Volume= 25,402 cf
Outflow = 0.43 cfs @ 13.90 hrs, Volume= 25,403 cf, Atten= 94%, Lag= 108.8 min
Discarded = 0.30 cfs @ 10.65 hrs, Volume= 24,534 cf
Primary = 0.13 cfs @ 13.90 hrs, Volume= 869 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 331.48' @ 13.90 hrs Surf.Area= 4,392 sf Storage= 11,985 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 321.6 min (1,086.7 - 765.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	5,176 cf	**36.00'W x 122.00'L x 5.00'H Field A** 21,960 cf Overall - 9,019 cf Embedded = 12,941 cf x 40.0% Voids
#2A	328.00'	9,019 cf	**CMP Round- 48** x 36 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 36 Chambers in 6 Rows
		14,196 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	331.20'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	331.20'	**15.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 331.20' / 331.20' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.30 cfs @ 10.65 hrs HW=327.56' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.13 cfs @ 13.90 hrs HW=331.48' TW=330.69' (Dynamic Tailwater)
↑└**3=Culvert** (Barrel Controls 0.13 cfs @ 0.94 fps)
↑└**2=Orifice/Grate** (Passes 0.13 cfs of 0.79 cfs potential flow)

Pond P7: (36) CMP 48 (Proposed Under BLDG #3) - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

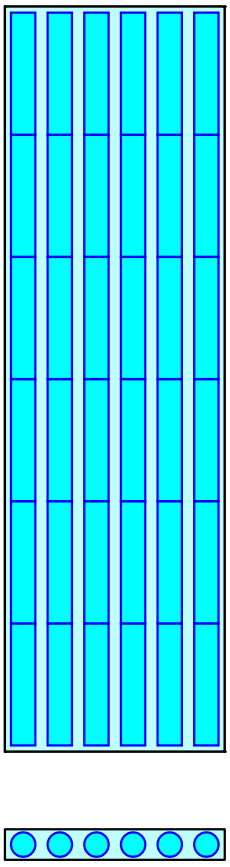
6 Chambers/Row x 20.00' Long = 120.00' Row Length +12.0" End Stone x 2 = 122.00' Base Length
6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 12.0" Side Stone x 2 = 36.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

36 Chambers x 250.5 cf = 9,019.2 cf Chamber Storage

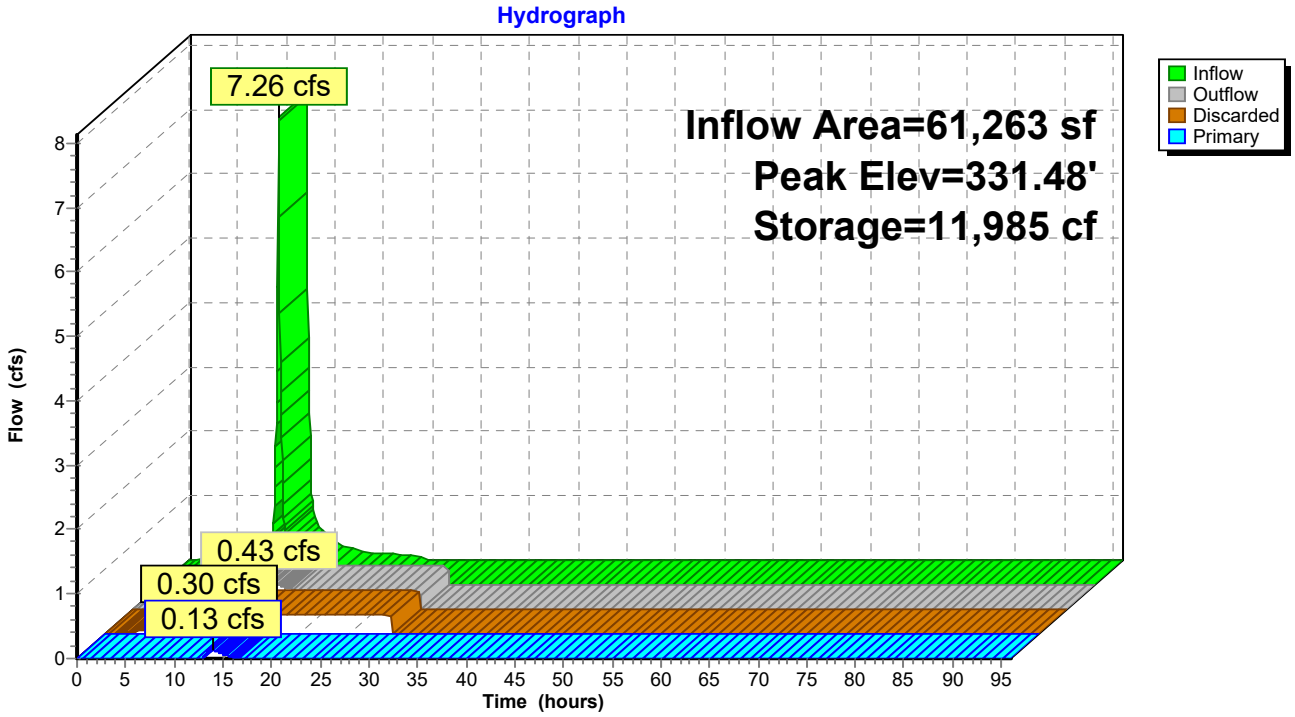
21,960.0 cf Field - 9,019.2 cf Chambers = 12,940.8 cf Stone x 40.0% Voids = 5,176.3 cf Stone Storage

Chamber Storage + Stone Storage = 14,195.5 cf = 0.326 af
Overall Storage Efficiency = 64.6%
Overall System Size = 122.00' x 36.00' x 5.00'

36 Chambers
813.3 cy Field
479.3 cy Stone



Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

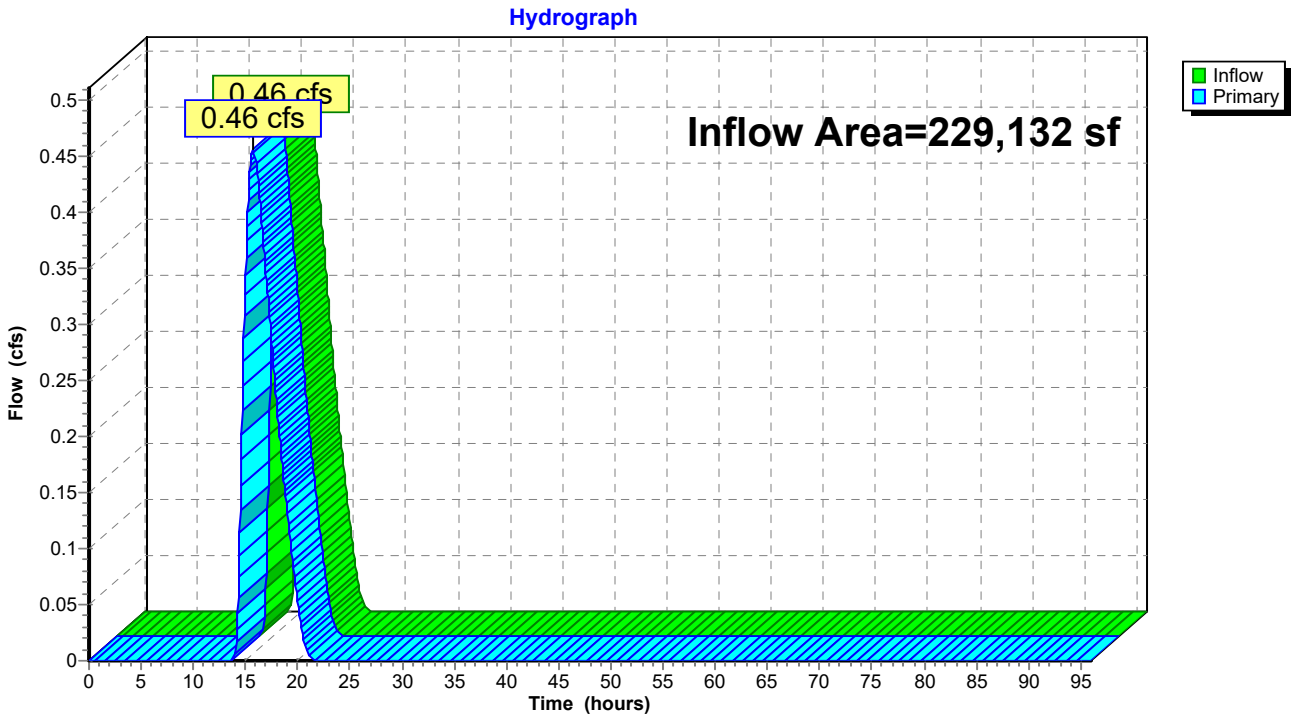


Summary for Link POA-3: TOWN DRAIN

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 0.29" for 50-Year event
Inflow = 0.46 cfs @ 15.73 hrs, Volume= 5,557 cf
Primary = 0.46 cfs @ 15.73 hrs, Volume= 5,557 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-3: TOWN DRAIN



Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Pr_R1: Building 2 West Runoff Area=38,129 sf 100.00% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=5.62 cfs 20,530 cf

Subcatchment Pr_R2: Building 2 East Runoff Area=39,599 sf 100.00% Impervious Runoff Depth=6.46"
Tc=6.0 min CN=98 Runoff=5.83 cfs 21,321 cf

Subcatchment Pr_Ws1: Proposed Under Runoff Area=23,134 sf 68.34% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=79 Runoff=2.61 cfs 8,310 cf

Subcatchment Pr_Ws13: Pr_Watershed 13 Runoff Area=40,126 sf 46.32% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=66 Runoff=3.12 cfs 9,933 cf

Subcatchment Pr_Ws14: Pr_Watershed 14 Runoff Area=88,144 sf 64.28% Impervious Runoff Depth=4.10"
Tc=6.0 min CN=77 Runoff=9.50 cfs 30,095 cf

Pond 6P: (80) CMP 42 Peak Elev=331.43' Storage=22,637 cf Inflow=10.23 cfs 64,651 cf
Discarded=0.59 cfs 49,989 cf Primary=1.15 cfs 14,684 cf Outflow=1.74 cfs 64,673 cf

Pond 17P: (28) CMP 48" Peak Elev=335.78' Storage=10,788 cf Inflow=8.94 cfs 31,255 cf
Outflow=3.57 cfs 31,252 cf

Pond P7: (36) CMP 48 (Proposed Under Peak Elev=331.74' Storage=12,709 cf Inflow=8.23 cfs 28,840 cf
Discarded=0.30 cfs 25,546 cf Primary=0.55 cfs 3,305 cf Outflow=0.85 cfs 28,850 cf

Link POA-3: TOWN DRAIN Inflow=1.15 cfs 14,684 cf
Primary=1.15 cfs 14,684 cf

Total Runoff Area = 229,132 sf Runoff Volume = 90,190 cf Average Runoff Depth = 4.72"
26.34% Pervious = 60,351 sf 73.66% Impervious = 168,781 sf

Summary for Subcatchment Pr_R1: Building 2 West

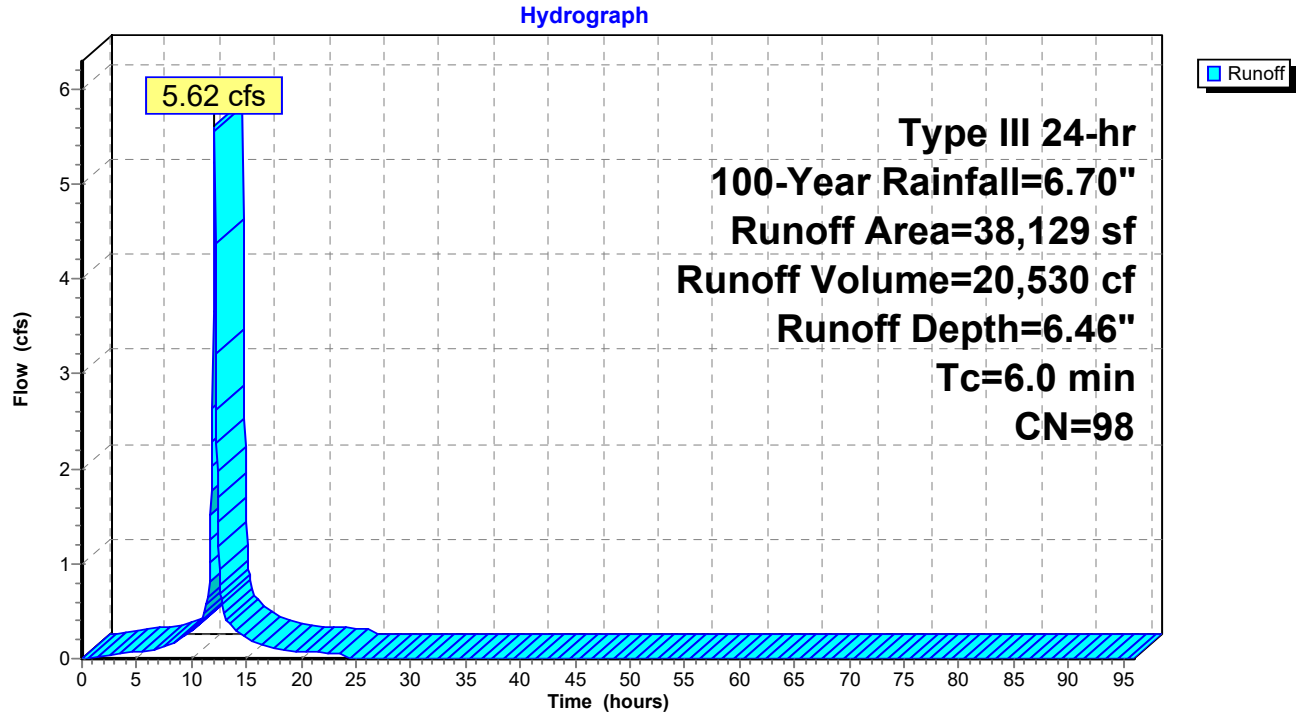
Runoff = 5.62 cfs @ 12.09 hrs, Volume= 20,530 cf, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
38,129	98	Roofs, HSG A
38,129		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R1: Building 2 West



Summary for Subcatchment Pr_R2: Building 2 East

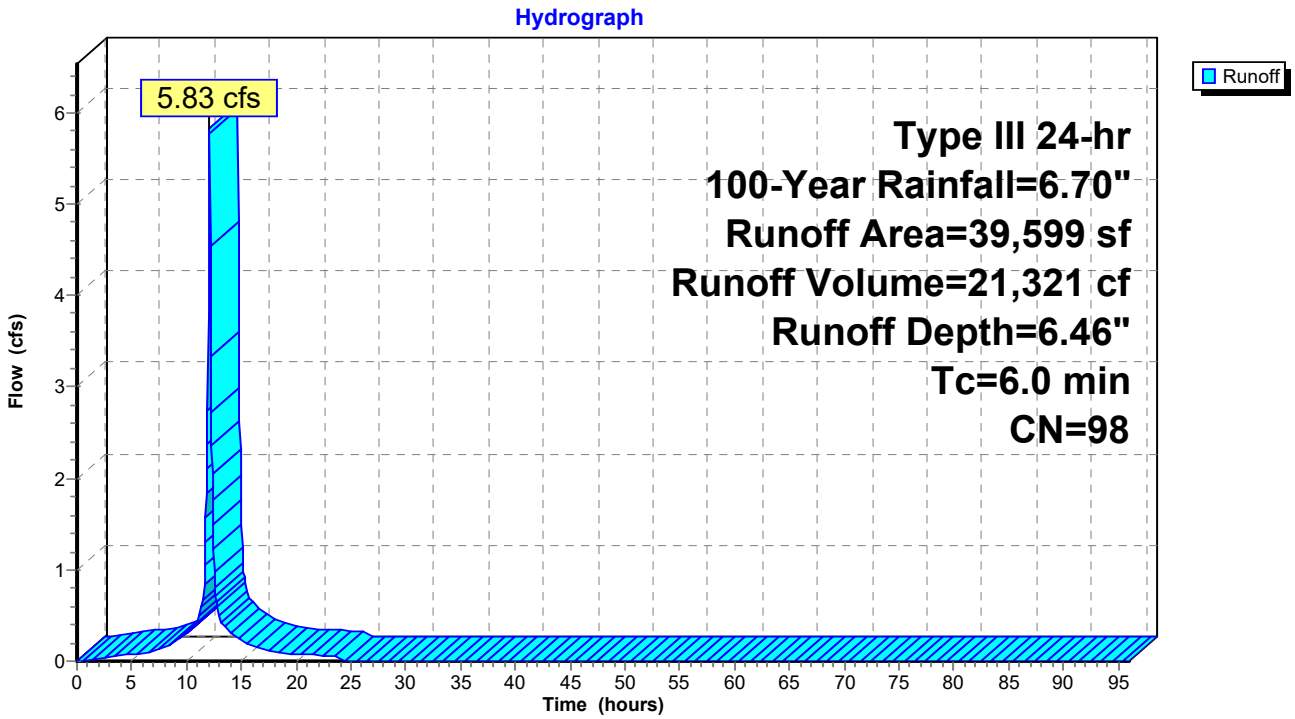
Runoff = 5.83 cfs @ 12.09 hrs, Volume= 21,321 cf, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
39,599	98	Unconnected roofs, HSG A
39,599		100.00% Impervious Area
39,599		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_R2: Building 2 East



Summary for Subcatchment Pr_Ws1: Proposed Under BLDG #3

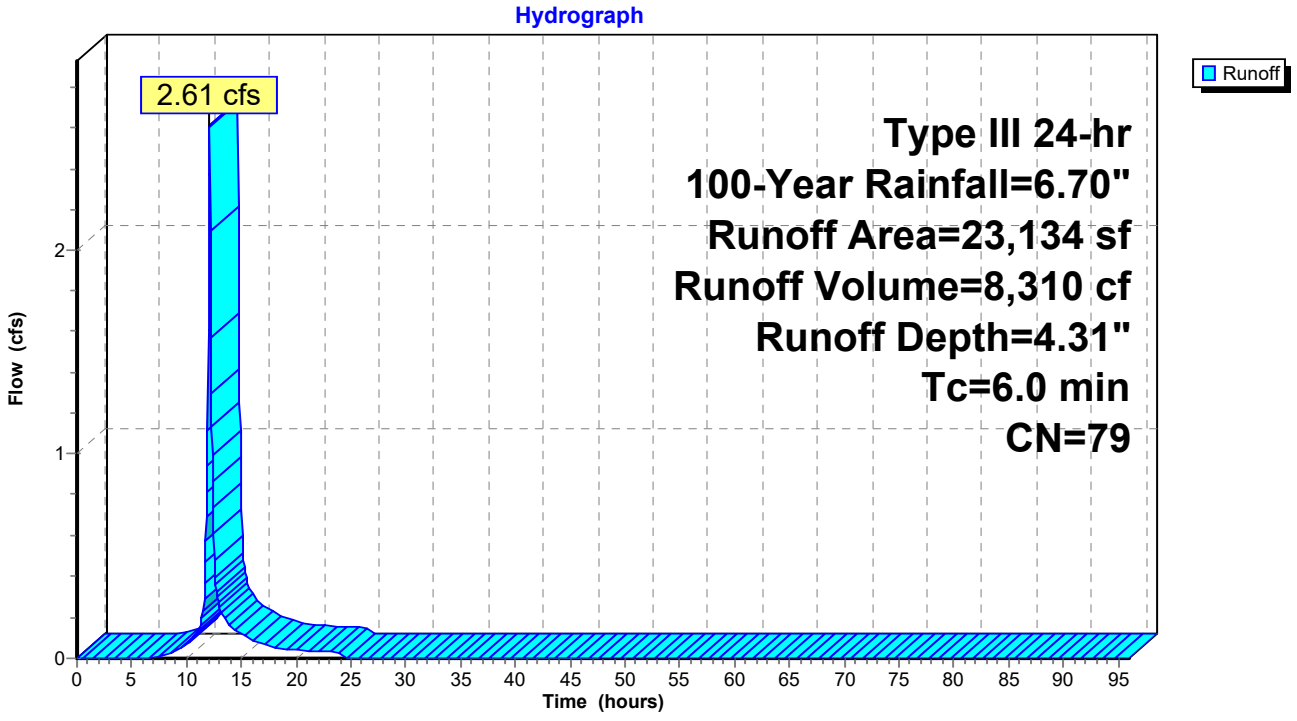
Runoff = 2.61 cfs @ 12.09 hrs, Volume= 8,310 cf, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
7,324	39	>75% Grass cover, Good, HSG A
15,810	98	Paved parking, HSG A
23,134	79	Weighted Average
7,324		31.66% Pervious Area
15,810		68.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws1: Proposed Under BLDG #3



Summary for Subcatchment Pr_Ws13: Pr_Watershed 13

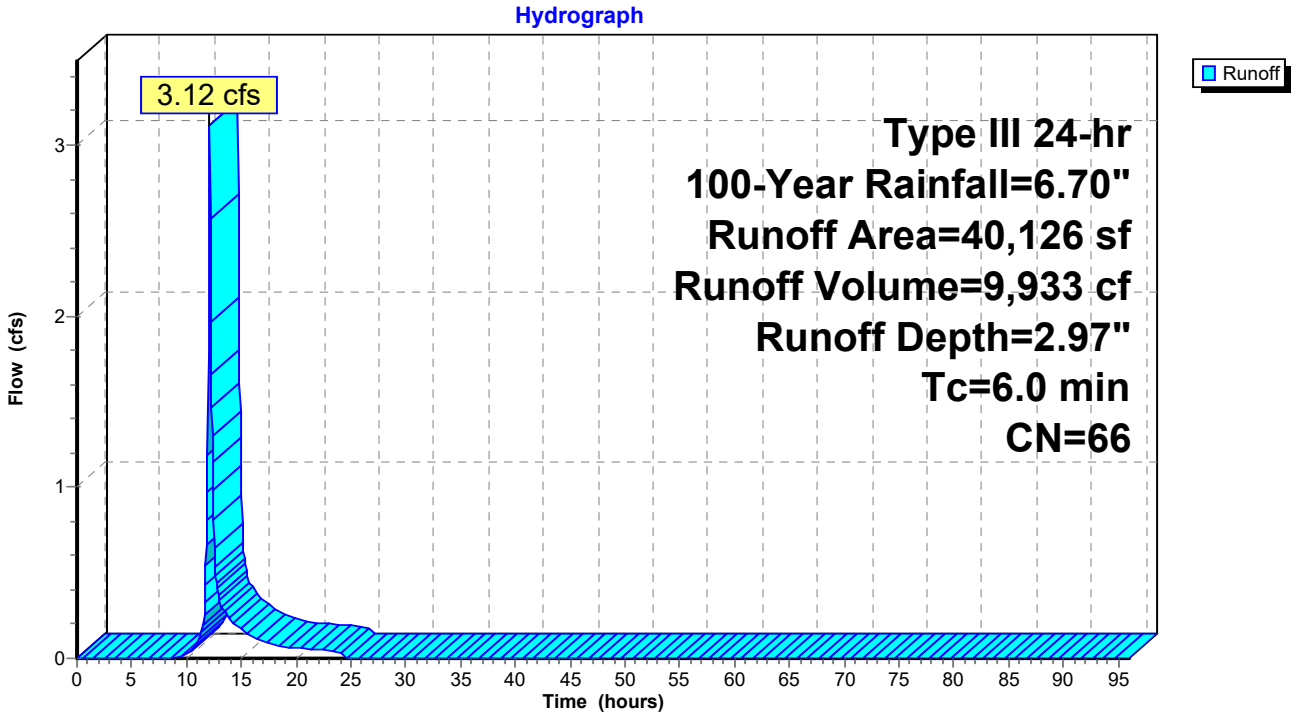
Runoff = 3.12 cfs @ 12.10 hrs, Volume= 9,933 cf, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
21,539	39	>75% Grass cover, Good, HSG A
18,587	98	Paved parking, HSG A
40,126	66	Weighted Average
21,539		53.68% Pervious Area
18,587		46.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws13: Pr_Watershed 13



Summary for Subcatchment Pr_Ws14: Pr_Watershed 14

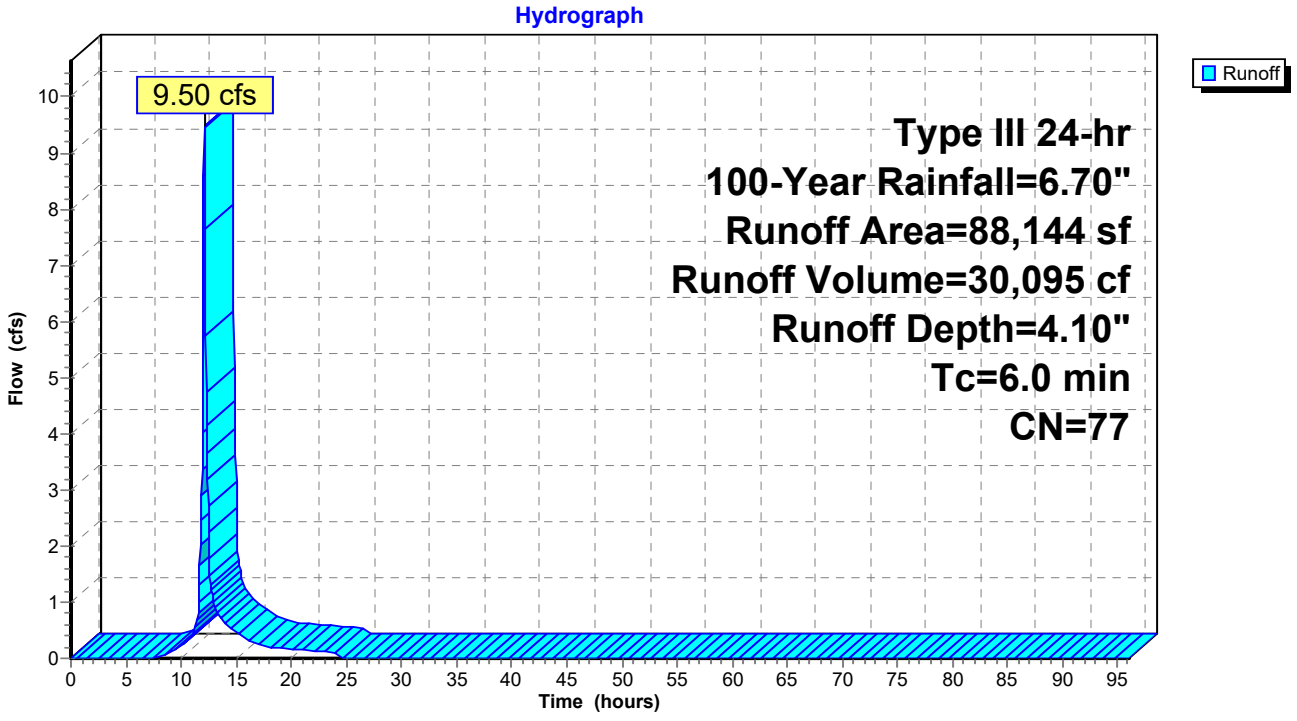
Runoff = 9.50 cfs @ 12.09 hrs, Volume= 30,095 cf, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
31,488	39	>75% Grass cover, Good, HSG A
56,656	98	Paved parking, HSG A
88,144	77	Weighted Average
31,488		35.72% Pervious Area
56,656		64.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment Pr_Ws14: Pr_Watershed 14



Summary for Pond 6P: (80) CMP 42

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 3.39" for 100-Year event
Inflow = 10.23 cfs @ 12.09 hrs, Volume= 64,651 cf
Outflow = 1.74 cfs @ 13.85 hrs, Volume= 64,673 cf, Atten= 83%, Lag= 105.6 min
Discarded = 0.59 cfs @ 11.05 hrs, Volume= 49,989 cf
Primary = 1.15 cfs @ 13.85 hrs, Volume= 14,684 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 331.43' @ 13.85 hrs Surf.Area= 8,546 sf Storage= 22,637 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 283.0 min (1,138.4 - 855.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	9,231 cf	**52.75'W x 162.00'L x 4.50'H Field A** 38,455 cf Overall - 15,377 cf Embedded = 23,078 cf x 40.0% Voids
#2A	328.00'	15,377 cf	**CMP Round- 42** x 80 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf Overall Size= 42.0"W x 42.0"H x 20.00'L 80 Chambers in 10 Rows
		24,608 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	330.70'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	330.70'	**15.0" Round Culvert** L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.70' / 330.70' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.59 cfs @ 11.05 hrs HW=327.55' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.59 cfs)

Primary OutFlow Max=1.15 cfs @ 13.85 hrs HW=331.43' TW=0.00' (Dynamic Tailwater)
↑—**3=Culvert** (Barrel Controls 1.15 cfs @ 2.21 fps)
↑—**2=Orifice/Grate** (Passes 1.15 cfs of 2.63 cfs potential flow)

Pond 6P: (80) CMP 42 - Chamber Wizard Field A

Chamber Model = CMP Round- 42 (Round Corrugated Metal Pipe)
Effective Size= 42.0"W x 42.0"H => 9.61 sf x 20.00'L = 192.2 cf
Overall Size= 42.0"W x 42.0"H x 20.00'L

42.0" Wide + 21.0" Spacing = 63.0" C-C Row Spacing

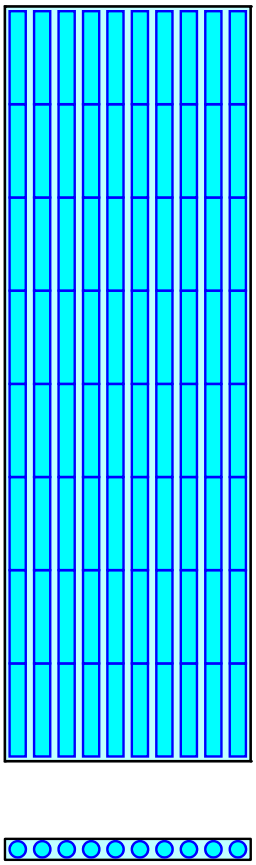
8 Chambers/Row x 20.00' Long = 160.00' Row Length +12.0" End Stone x 2 = 162.00' Base Length
10 Rows x 42.0" Wide + 21.0" Spacing x 9 + 12.0" Side Stone x 2 = 52.75' Base Width
6.0" Stone Base + 42.0" Chamber Height + 6.0" Stone Cover = 4.50' Field Height

80 Chambers x 192.2 cf = 15,376.7 cf Chamber Storage

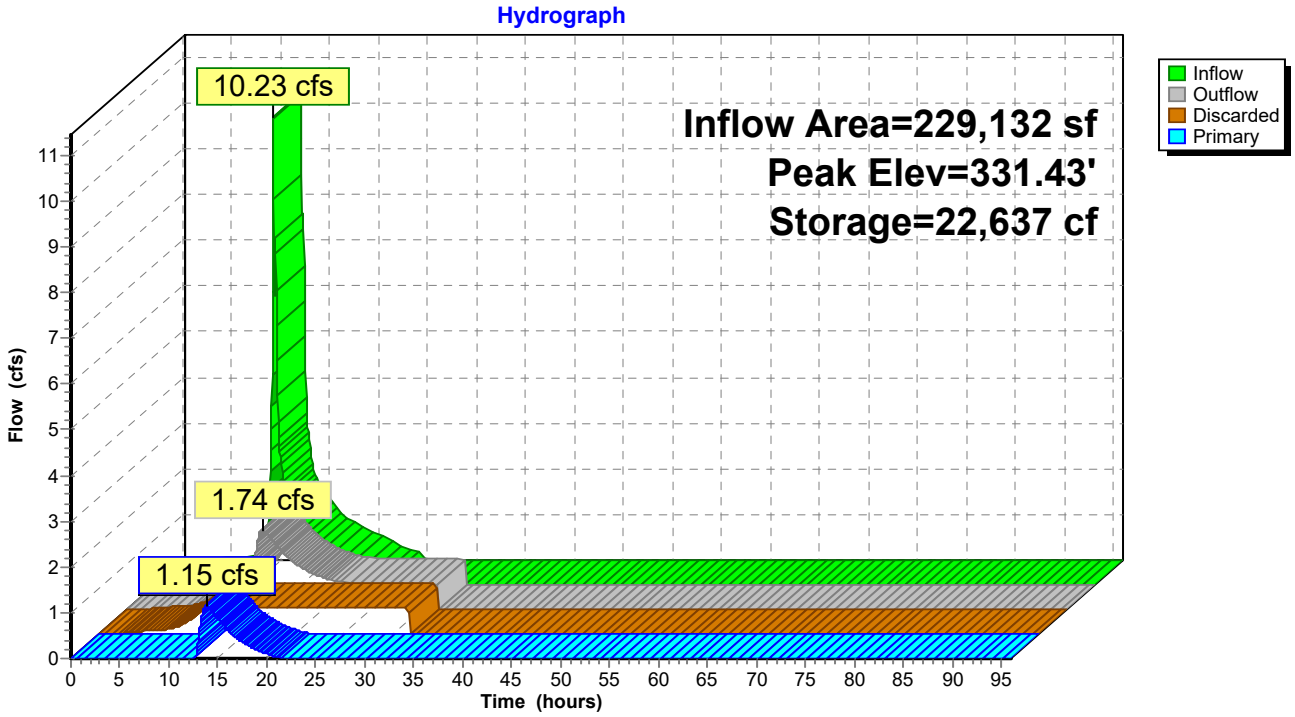
38,454.8 cf Field - 15,376.7 cf Chambers = 23,078.1 cf Stone x 40.0% Voids = 9,231.2 cf Stone Storage

Chamber Storage + Stone Storage = 24,607.9 cf = 0.565 af
Overall Storage Efficiency = 64.0%
Overall System Size = 162.00' x 52.75' x 4.50'

80 Chambers
1,424.2 cy Field
854.7 cy Stone



Pond 6P: (80) CMP 42



Summary for Pond 17P: (28) CMP 48"

Inflow Area = 79,725 sf, 72.98% Impervious, Inflow Depth = 4.70" for 100-Year event
Inflow = 8.94 cfs @ 12.09 hrs, Volume= 31,255 cf
Outflow = 3.57 cfs @ 12.34 hrs, Volume= 31,252 cf, Atten= 60%, Lag= 14.9 min
Primary = 3.57 cfs @ 12.34 hrs, Volume= 31,252 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 335.78' @ 12.34 hrs Surf.Area= 3,444 sf Storage= 10,788 cf

Plug-Flow detention time= 122.1 min calculated for 31,252 cf (100% of inflow)
Center-of-Mass det. time= 121.5 min (896.3 - 774.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	331.00'	4,082 cf	**42.00'W x 82.00'L x 5.00'H Field A** 17,220 cf Overall - 7,015 cf Embedded = 10,205 cf x 40.0% Voids
#2A	331.50'	7,015 cf	**CMP Round- 48** x 28 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 28 Chambers in 7 Rows
		11,097 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	331.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	335.40'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	330.90'	**12.0" Round Culvert** L= 509.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 330.90' / 328.20' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.53 cfs @ 12.34 hrs HW=335.77' TW=329.93' (Dynamic Tailwater)
└**3=Culvert** (Passes 3.53 cfs of 3.60 cfs potential flow)
  ├**1=Orifice/Grate** (Orifice Controls 0.90 cfs @ 10.33 fps)
  └**2=Broad-Crested Rectangular Weir** (Weir Controls 2.63 cfs @ 1.77 fps)

Pond 17P: (28) CMP 48" - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

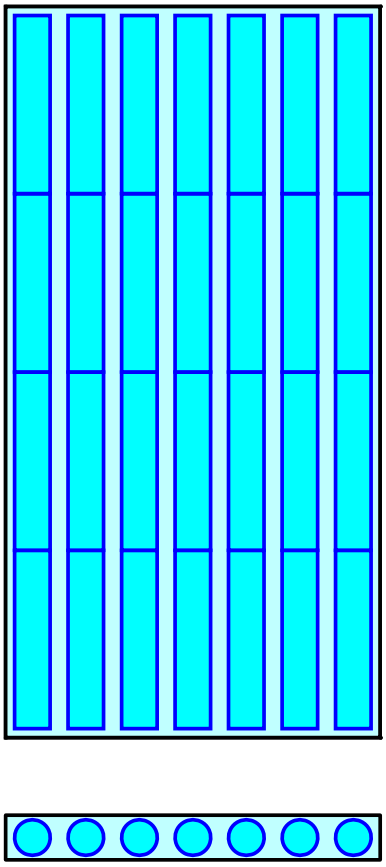
4 Chambers/Row x 20.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
7 Rows x 48.0" Wide + 24.0" Spacing x 6 + 12.0" Side Stone x 2 = 42.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

28 Chambers x 250.5 cf = 7,014.9 cf Chamber Storage

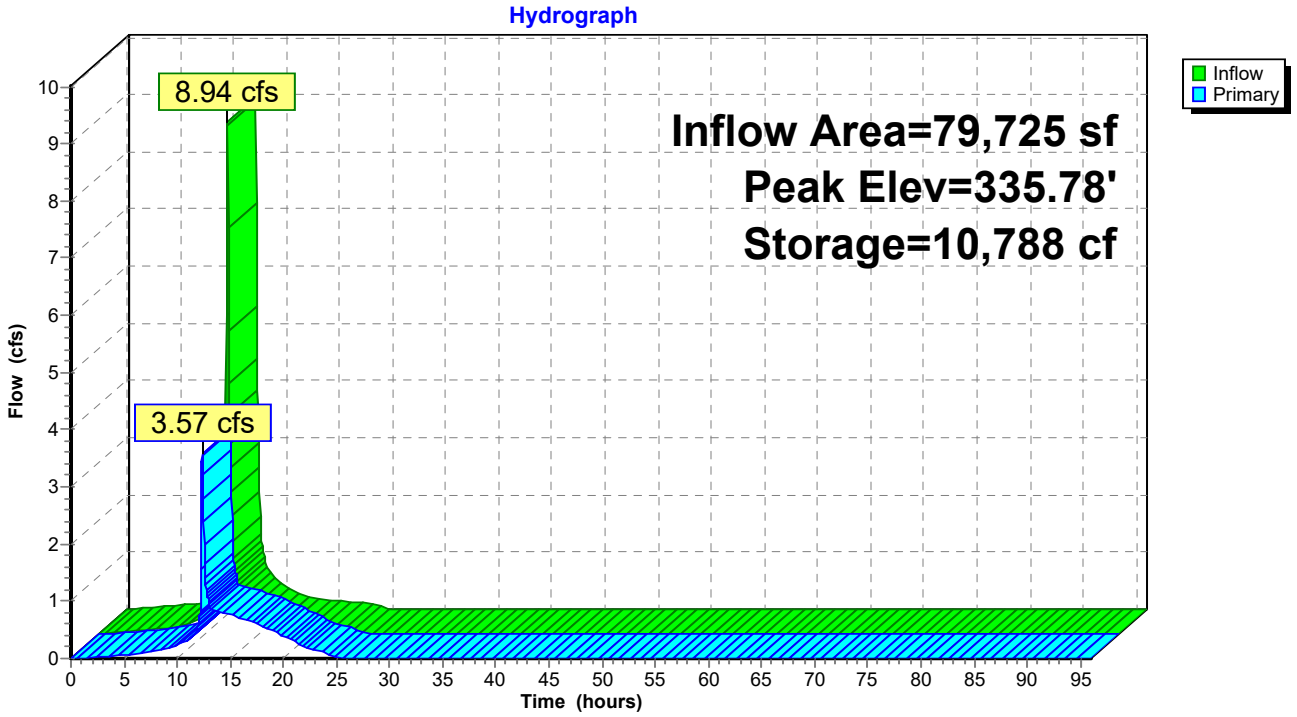
17,220.0 cf Field - 7,014.9 cf Chambers = 10,205.1 cf Stone x 40.0% Voids = 4,082.0 cf Stone Storage

Chamber Storage + Stone Storage = 11,097.0 cf = 0.255 af
Overall Storage Efficiency = 64.4%
Overall System Size = 82.00' x 42.00' x 5.00'

28 Chambers
637.8 cy Field
378.0 cy Stone



Pond 17P: (28) CMP 48"



Summary for Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

Inflow Area = 61,263 sf, 88.04% Impervious, Inflow Depth = 5.65" for 100-Year event
Inflow = 8.23 cfs @ 12.09 hrs, Volume= 28,840 cf
Outflow = 0.85 cfs @ 12.85 hrs, Volume= 28,850 cf, Atten= 90%, Lag= 45.9 min
Discarded = 0.30 cfs @ 10.30 hrs, Volume= 25,546 cf
Primary = 0.55 cfs @ 12.85 hrs, Volume= 3,305 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 331.74' @ 12.85 hrs Surf.Area= 4,392 sf Storage= 12,709 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 302.2 min (1,065.6 - 763.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	327.50'	5,176 cf	**36.00'W x 122.00'L x 5.00'H Field A** 21,960 cf Overall - 9,019 cf Embedded = 12,941 cf x 40.0% Voids
#2A	328.00'	9,019 cf	**CMP Round- 48** x 36 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf Overall Size= 48.0"W x 48.0"H x 20.00'L 36 Chambers in 6 Rows
		14,196 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	327.50'	**3.000 in/hr Exfiltration over Surface area**
#2	Device 3	331.20'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Primary	331.20'	**15.0" Round Culvert** L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 331.20' / 331.20' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.30 cfs @ 10.30 hrs HW=327.55' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.55 cfs @ 12.85 hrs HW=331.74' TW=330.97' (Dynamic Tailwater)
↑└**3=Culvert** (Barrel Controls 0.55 cfs @ 1.61 fps)
↑└**2=Orifice/Grate** (Passes 0.55 cfs of 2.02 cfs potential flow)

Pond P7: (36) CMP 48 (Proposed Under BLDG #3) - Chamber Wizard Field A

Chamber Model = CMP Round- 48 (Round Corrugated Metal Pipe)
Effective Size= 48.0"W x 48.0"H => 12.53 sf x 20.00'L = 250.5 cf
Overall Size= 48.0"W x 48.0"H x 20.00'L

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

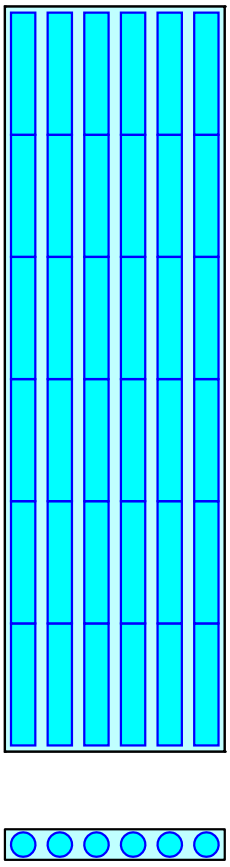
6 Chambers/Row x 20.00' Long = 120.00' Row Length +12.0" End Stone x 2 = 122.00' Base Length
6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 12.0" Side Stone x 2 = 36.00' Base Width
6.0" Stone Base + 48.0" Chamber Height + 6.0" Stone Cover = 5.00' Field Height

36 Chambers x 250.5 cf = 9,019.2 cf Chamber Storage

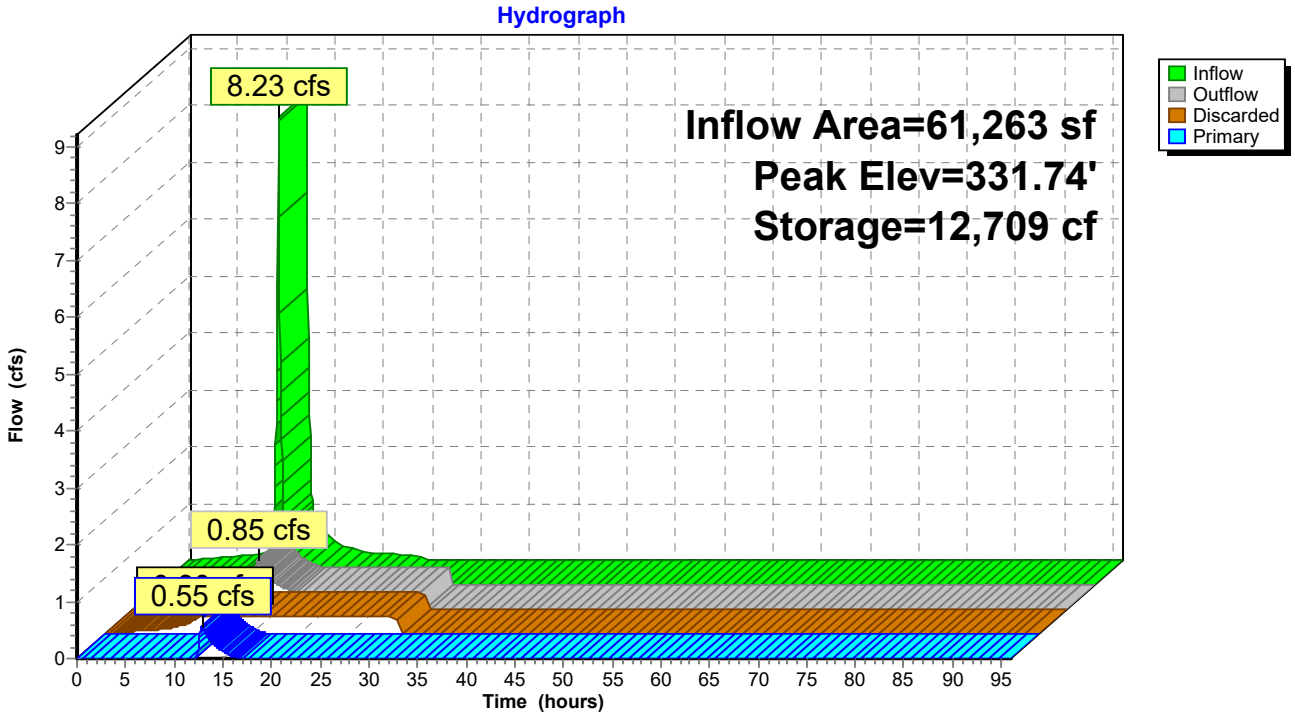
21,960.0 cf Field - 9,019.2 cf Chambers = 12,940.8 cf Stone x 40.0% Voids = 5,176.3 cf Stone Storage

Chamber Storage + Stone Storage = 14,195.5 cf = 0.326 af
Overall Storage Efficiency = 64.6%
Overall System Size = 122.00' x 36.00' x 5.00'

36 Chambers
813.3 cy Field
479.3 cy Stone



Pond P7: (36) CMP 48 (Proposed Under BLDG #3)

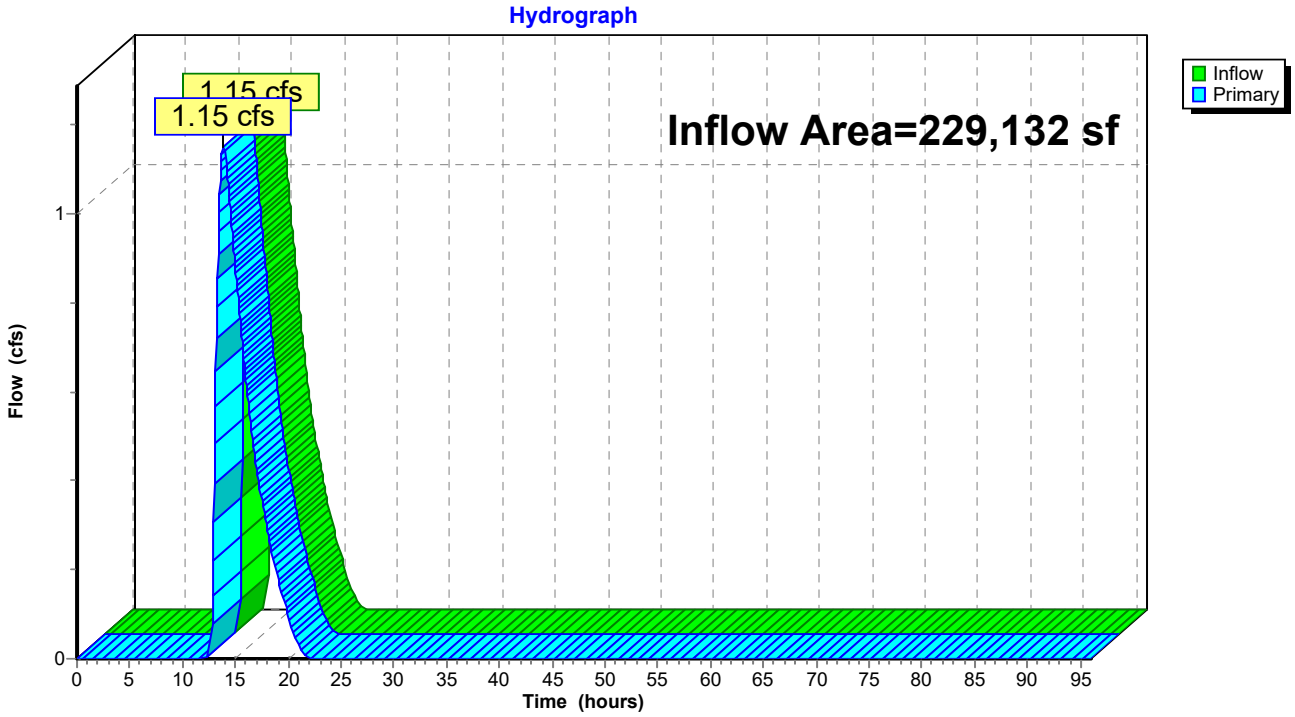


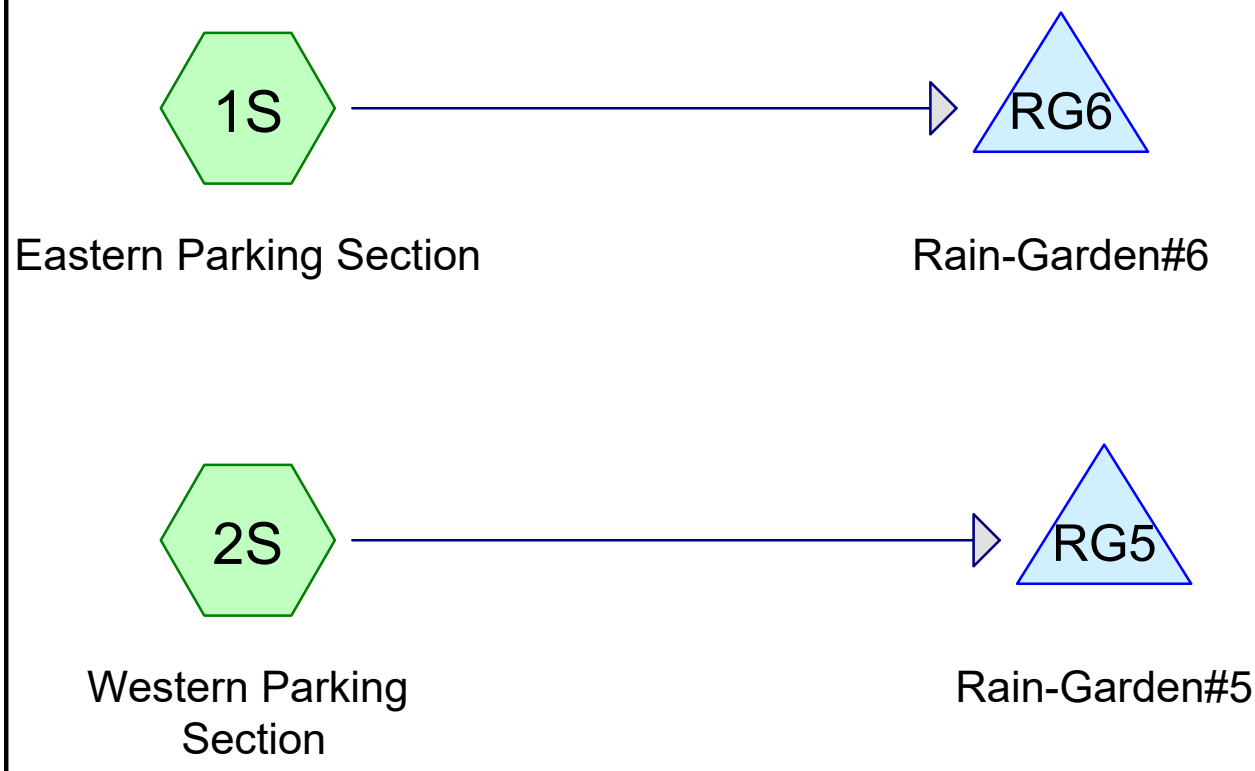
Summary for Link POA-3: TOWN DRAIN

Inflow Area = 229,132 sf, 73.66% Impervious, Inflow Depth = 0.77" for 100-Year event
Inflow = 1.15 cfs @ 13.85 hrs, Volume= 14,684 cf
Primary = 1.15 cfs @ 13.85 hrs, Volume= 14,684 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link POA-3: TOWN DRAIN





Subcat Reach Pond Link

Routing Diagram for Post-Dev (Bldg 2)
Prepared by {enter your company name here}, Printed 5/6/2021

Summary for Subcatchment 1S: Eastern Parking Section

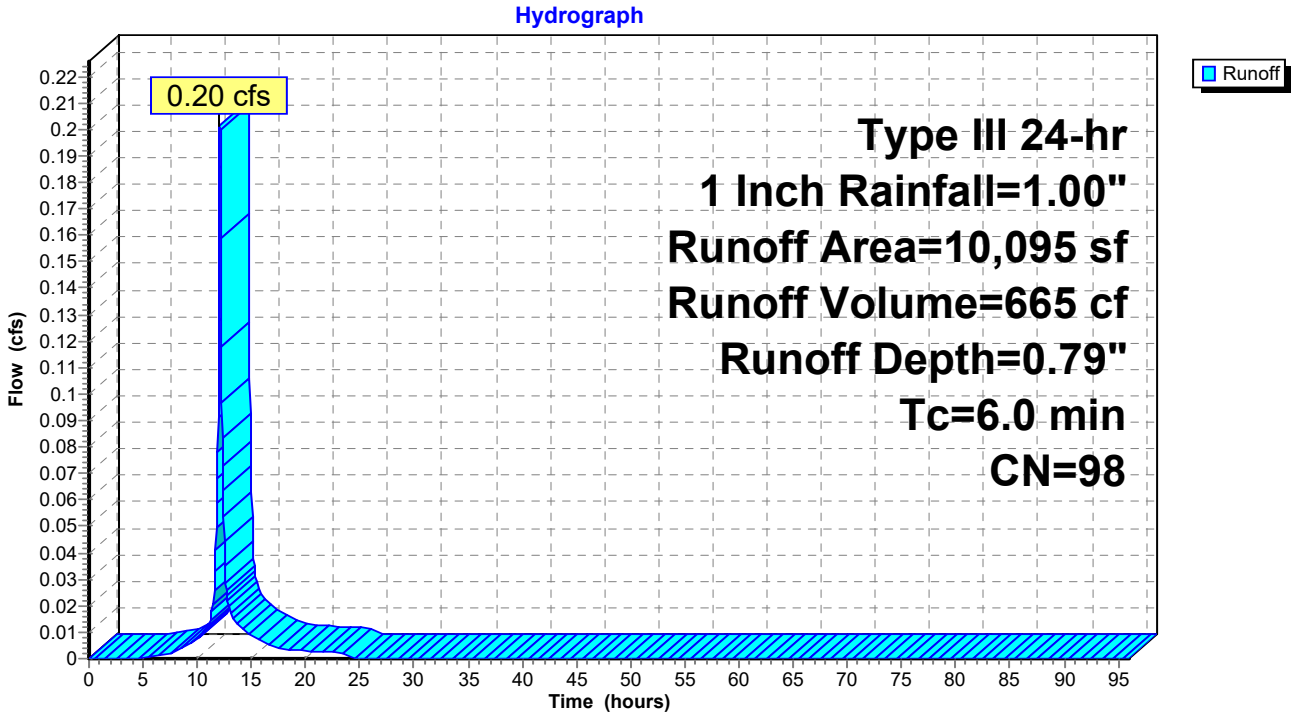
Runoff = 0.20 cfs @ 12.09 hrs, Volume= 665 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 Inch Rainfall=1.00"

Area (sf)	CN	Description
10,095	98	Paved parking, HSG A
10,095		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: Eastern Parking Section



Summary for Subcatchment 2S: Western Parking Section

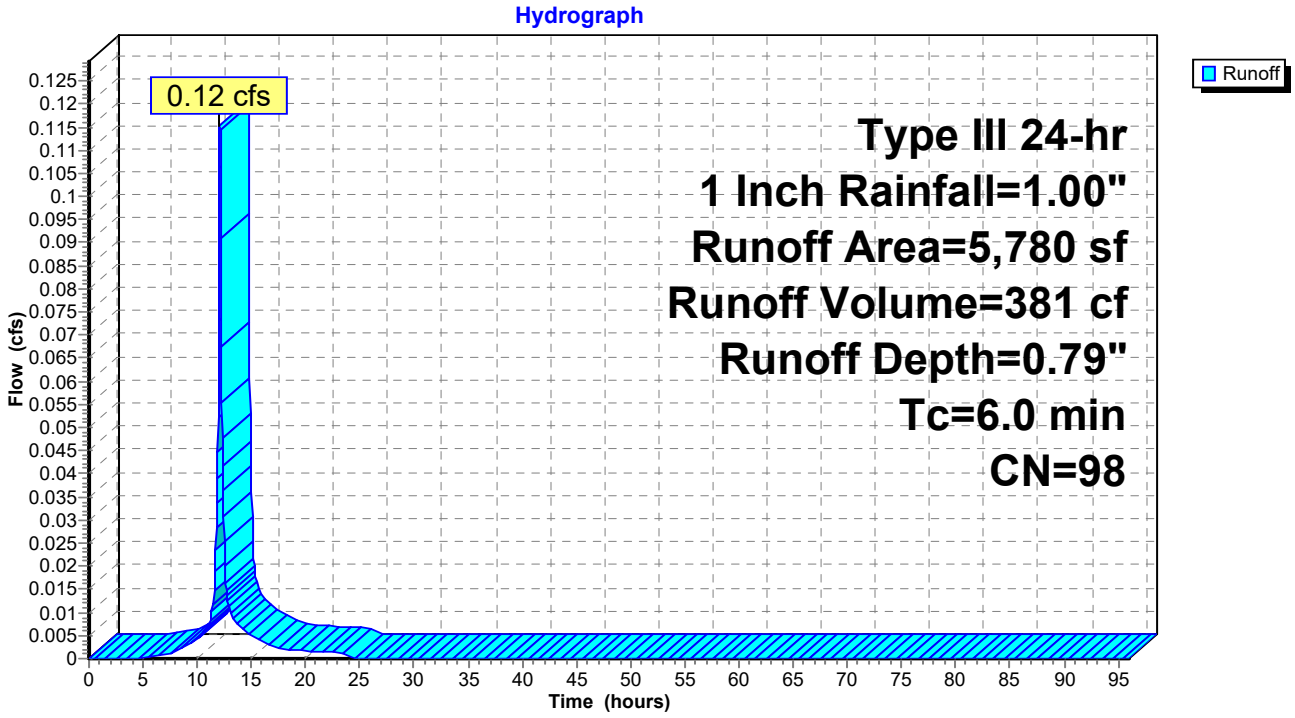
Runoff = 0.12 cfs @ 12.09 hrs, Volume= 381 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 Inch Rainfall=1.00"

Area (sf)	CN	Description
5,780	98	Paved parking, HSG A
5,780		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Western Parking Section



Summary for Pond RG5: Rain-Garden#5

Inflow Area = 5,780 sf,100.00% Impervious, Inflow Depth = 0.79" for 1 Inch event
Inflow = 0.12 cfs @ 12.09 hrs, Volume= 381 cf
Outflow = 0.02 cfs @ 12.51 hrs, Volume= 382 cf, Atten= 79%, Lag= 25.0 min
Discarded = 0.02 cfs @ 12.51 hrs, Volume= 382 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 340.34' @ 12.51 hrs Surf.Area= 357 sf Storage= 100 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 25.3 min (813.2 - 787.9)

Volume	Invert	Avail.Storage	Storage Description
#1	340.00'	760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

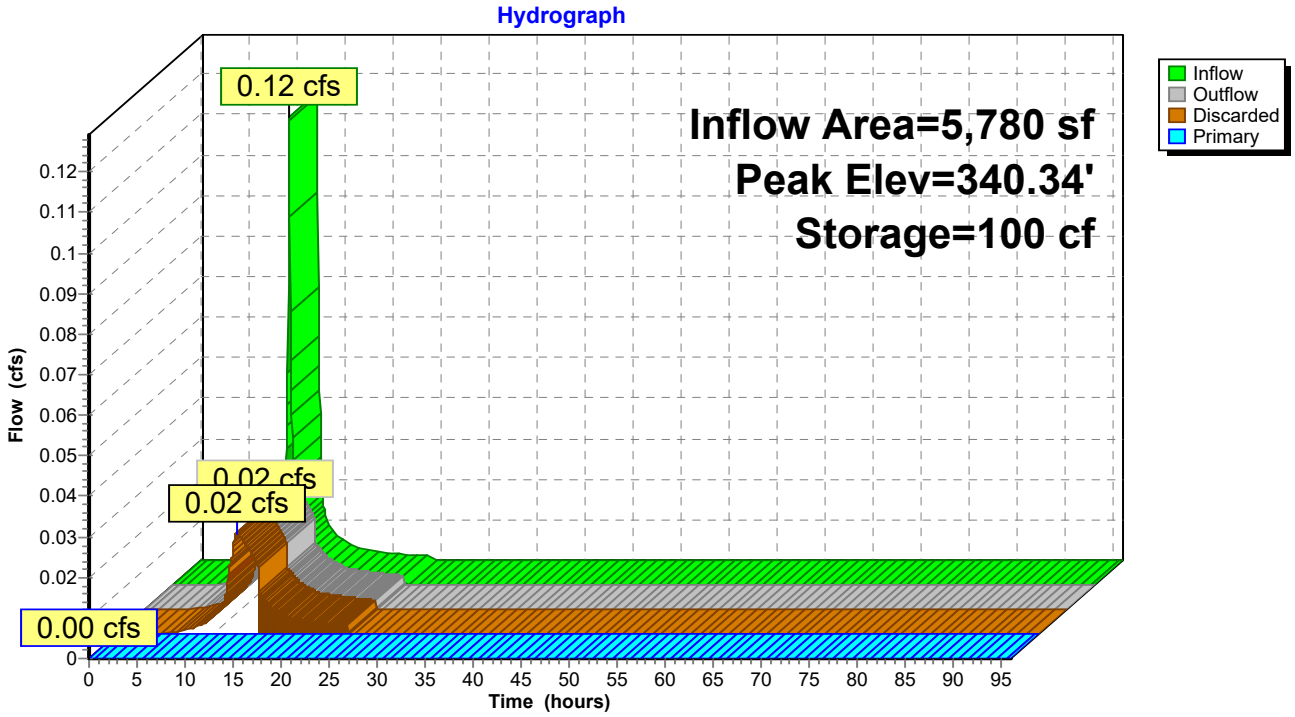
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
340.00	239	0	0
341.00	591	415	415
341.50	787	345	760

Device	Routing	Invert	Outlet Devices
#1	Discarded	340.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	341.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.51 hrs HW=340.34' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=340.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond RG5: Rain-Garden#5



Summary for Pond RG6: Rain-Garden#6

Inflow Area = 10,095 sf,100.00% Impervious, Inflow Depth = 0.79" for 1 Inch event
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 665 cf
Outflow = 0.04 cfs @ 12.55 hrs, Volume= 666 cf, Atten= 82%, Lag= 27.5 min
Discarded = 0.04 cfs @ 12.55 hrs, Volume= 666 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 337.47' @ 12.55 hrs Surf.Area= 522 sf Storage= 198 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 37.8 min (825.7 - 787.9)

Volume	Invert	Avail.Storage	Storage Description
#1	337.00'	970 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

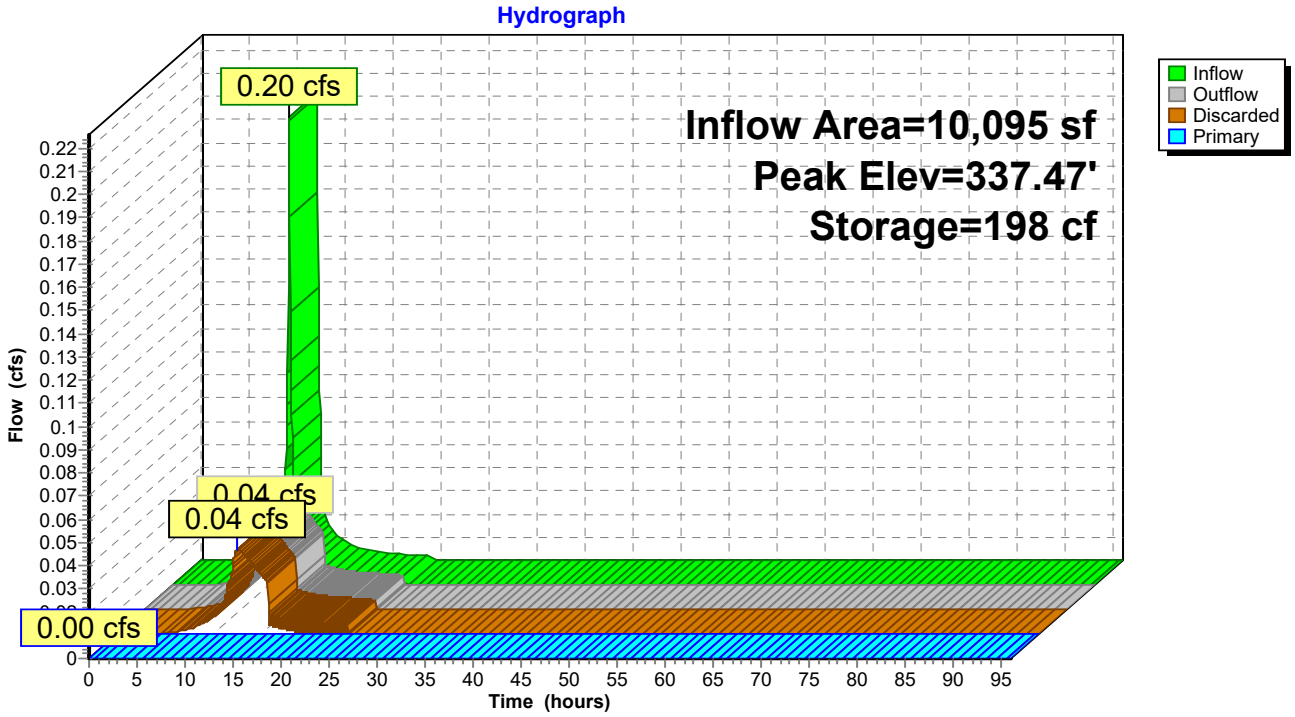
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
337.00	313	0	0
338.00	753	533	533
338.50	993	437	970

Device	Routing	Invert	Outlet Devices
#1	Discarded	337.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	338.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 12.55 hrs HW=337.47' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=337.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond RG6: Rain-Garden#6



Summary for Subcatchment 1S: Eastern Parking Section

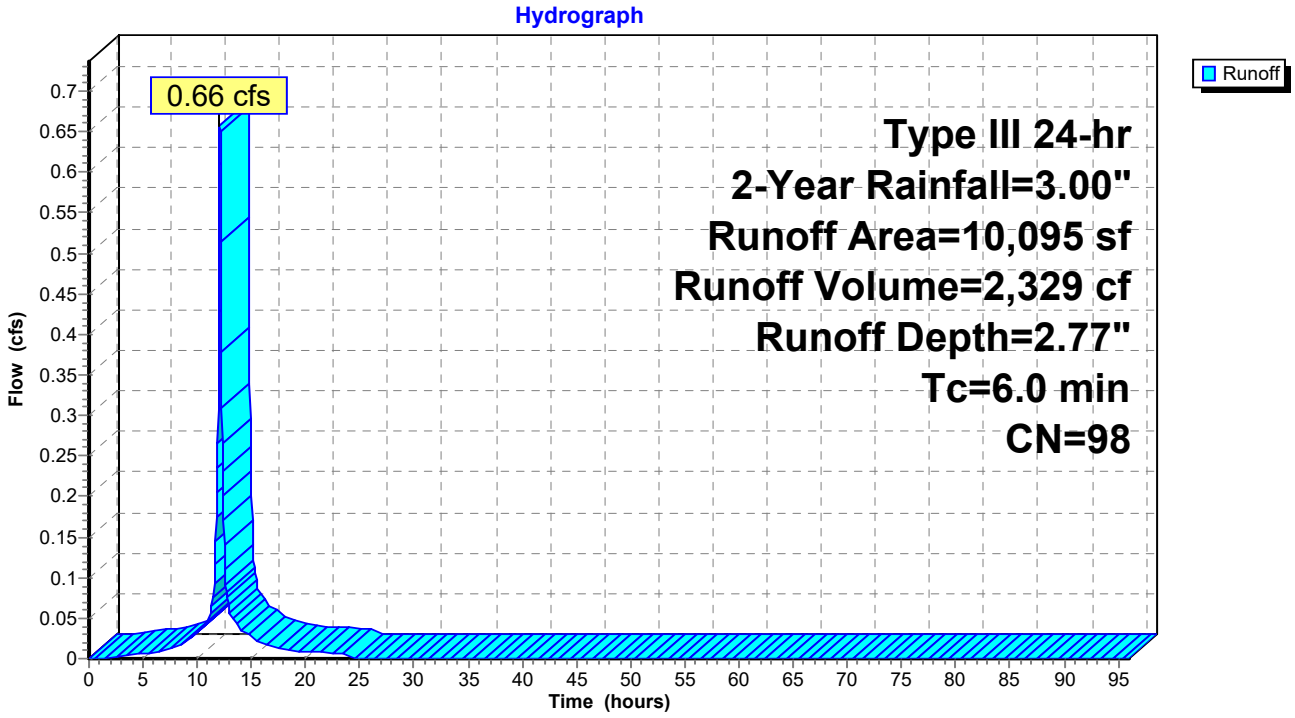
Runoff = 0.66 cfs @ 12.09 hrs, Volume= 2,329 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
10,095	98	Paved parking, HSG A
10,095		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: Eastern Parking Section



Summary for Subcatchment 2S: Western Parking Section

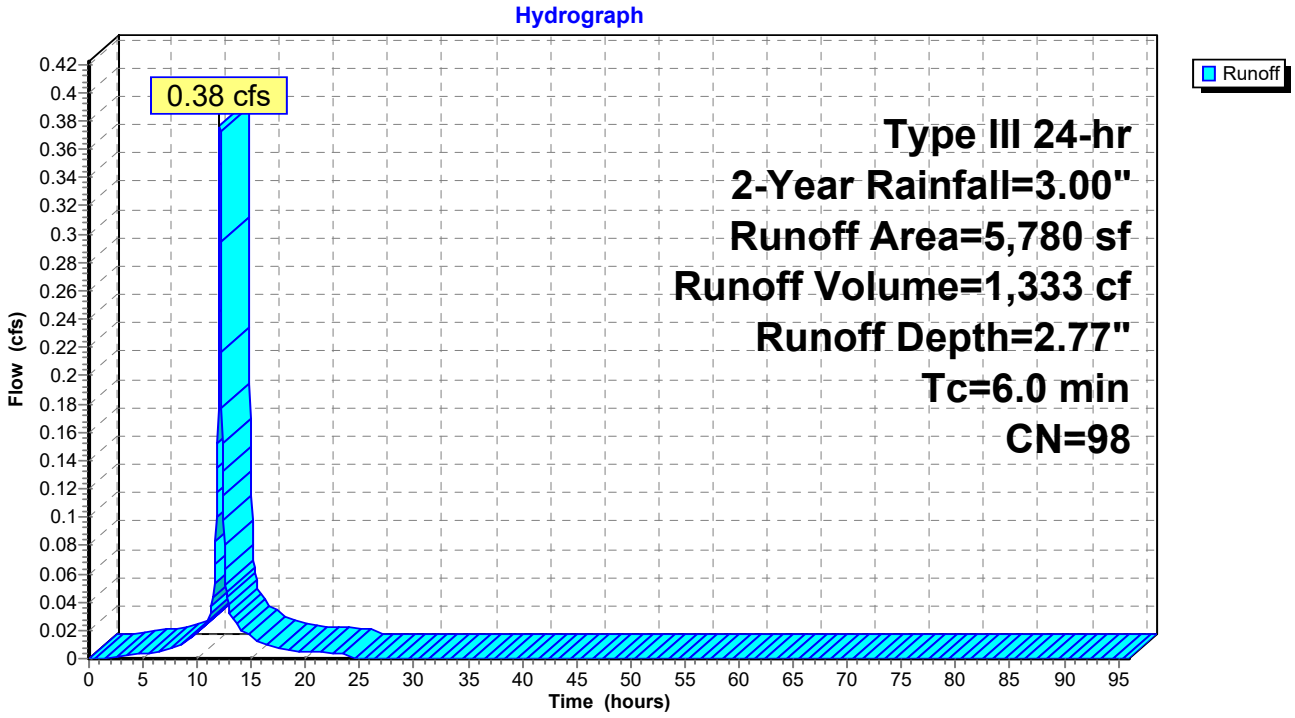
Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,333 cf, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
5,780	98	Paved parking, HSG A
5,780		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Western Parking Section



Summary for Pond RG5: Rain-Garden#5

Inflow Area = 5,780 sf,100.00% Impervious, Inflow Depth = 2.77" for 2-Year event
Inflow = 0.38 cfs @ 12.09 hrs, Volume= 1,333 cf
Outflow = 0.08 cfs @ 12.49 hrs, Volume= 1,334 cf, Atten= 78%, Lag= 24.5 min
Discarded = 0.04 cfs @ 12.49 hrs, Volume= 1,271 cf
Primary = 0.04 cfs @ 12.49 hrs, Volume= 63 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 341.09' @ 12.49 hrs Surf.Area= 628 sf Storage= 473 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 85.4 min (843.2 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	340.00'	760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

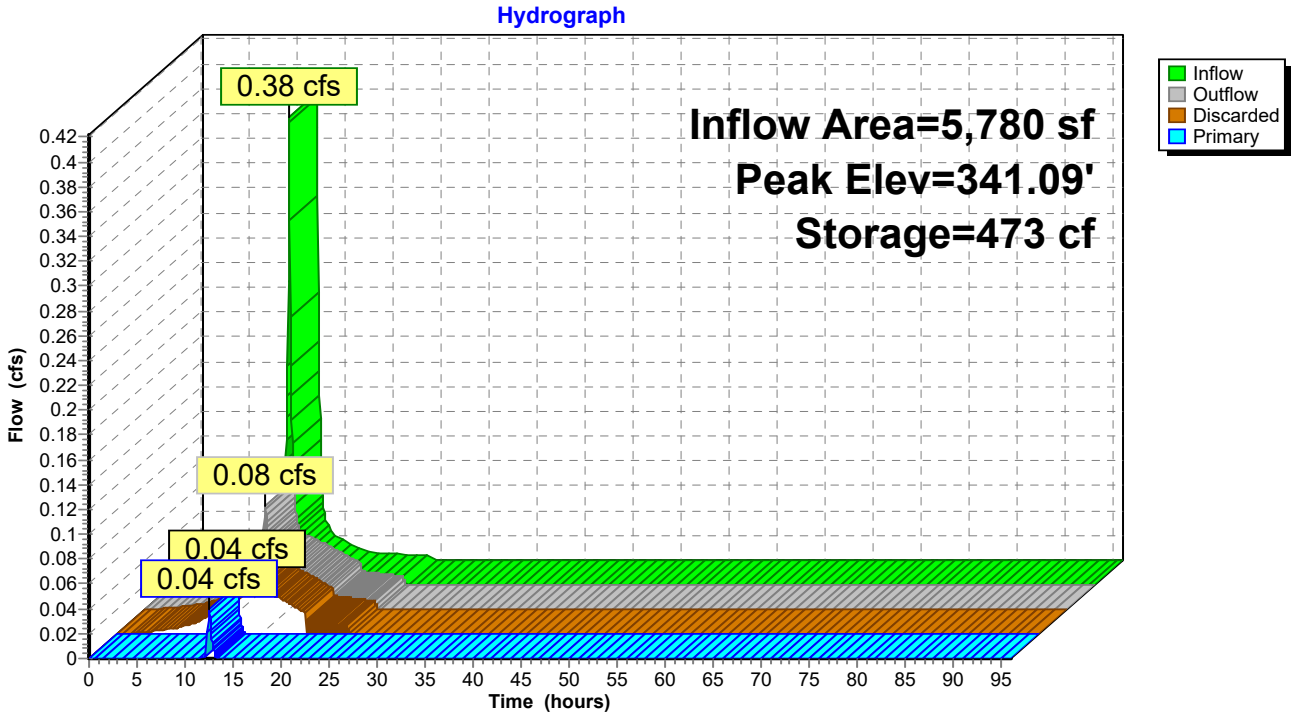
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
340.00	239	0	0
341.00	591	415	415
341.50	787	345	760

Device	Routing	Invert	Outlet Devices
#1	Discarded	340.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	341.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 12.49 hrs HW=341.09' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.04 cfs @ 12.49 hrs HW=341.09' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 1.05 fps)

Pond RG5: Rain-Garden#5



Summary for Pond RG6: Rain-Garden#6

Inflow Area = 10,095 sf,100.00% Impervious, Inflow Depth = 2.77" for 2-Year event
Inflow = 0.66 cfs @ 12.09 hrs, Volume= 2,329 cf
Outflow = 0.45 cfs @ 12.18 hrs, Volume= 2,329 cf, Atten= 31%, Lag= 5.5 min
Discarded = 0.06 cfs @ 12.18 hrs, Volume= 1,876 cf
Primary = 0.40 cfs @ 12.18 hrs, Volume= 453 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 338.11' @ 12.18 hrs Surf.Area= 808 sf Storage= 622 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 74.7 min (832.5 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	337.00'	970 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

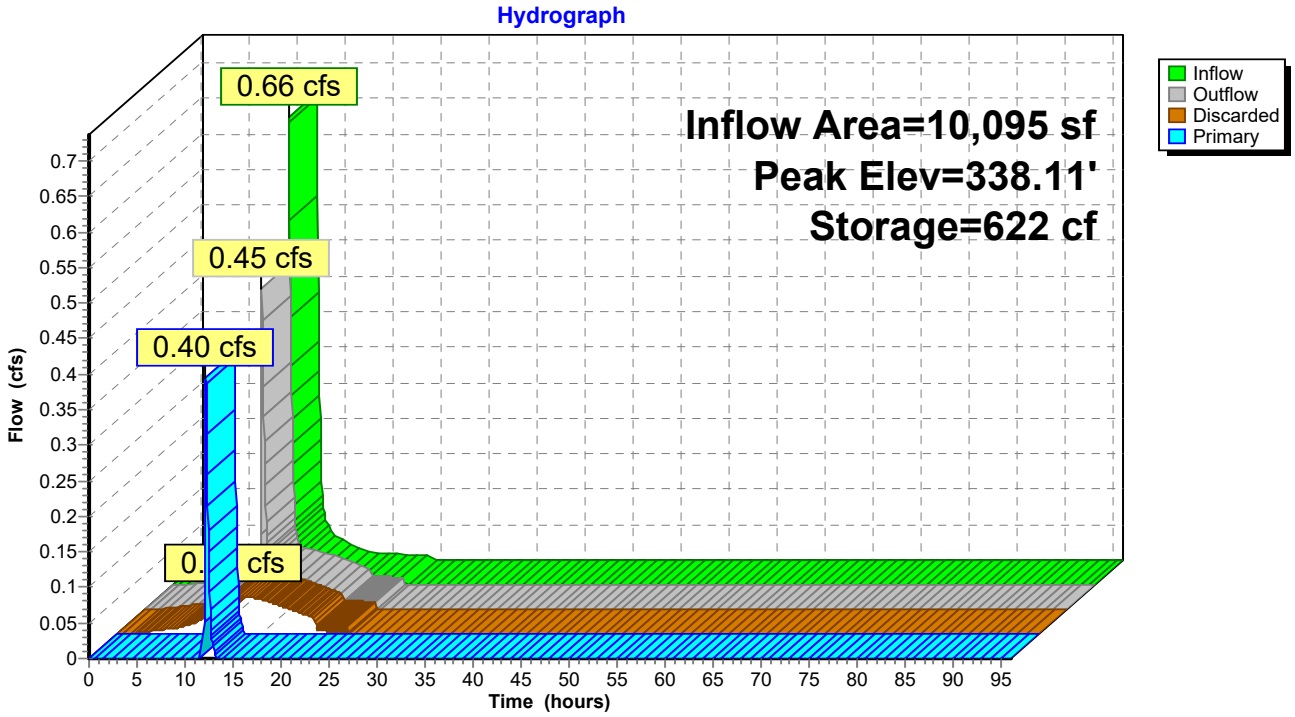
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
337.00	313	0	0
338.00	753	533	533
338.50	993	437	970

Device	Routing	Invert	Outlet Devices
#1	Discarded	337.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	338.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.18 hrs HW=338.11' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.39 cfs @ 12.18 hrs HW=338.11' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.39 cfs @ 1.10 fps)

Pond RG6: Rain-Garden#6



Summary for Subcatchment 1S: Eastern Parking Section

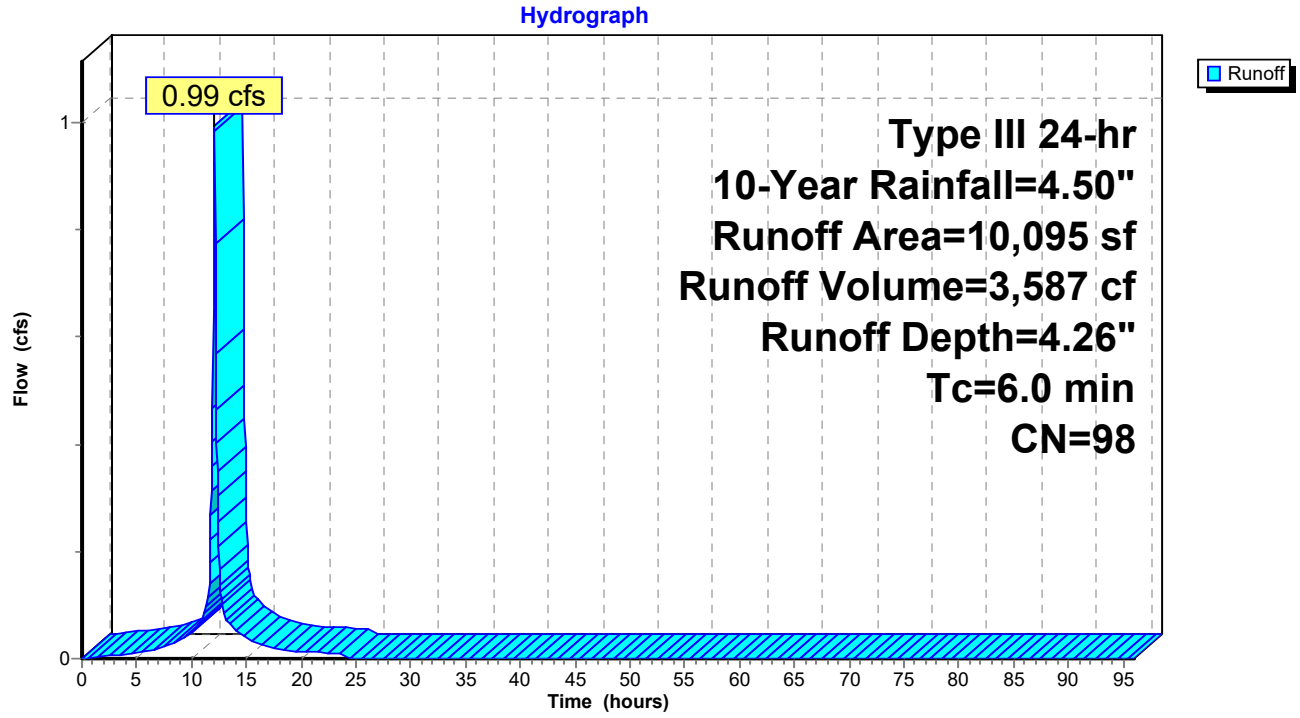
Runoff = 0.99 cfs @ 12.09 hrs, Volume= 3,587 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
10,095	98	Paved parking, HSG A
10,095		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: Eastern Parking Section



Summary for Subcatchment 2S: Western Parking Section

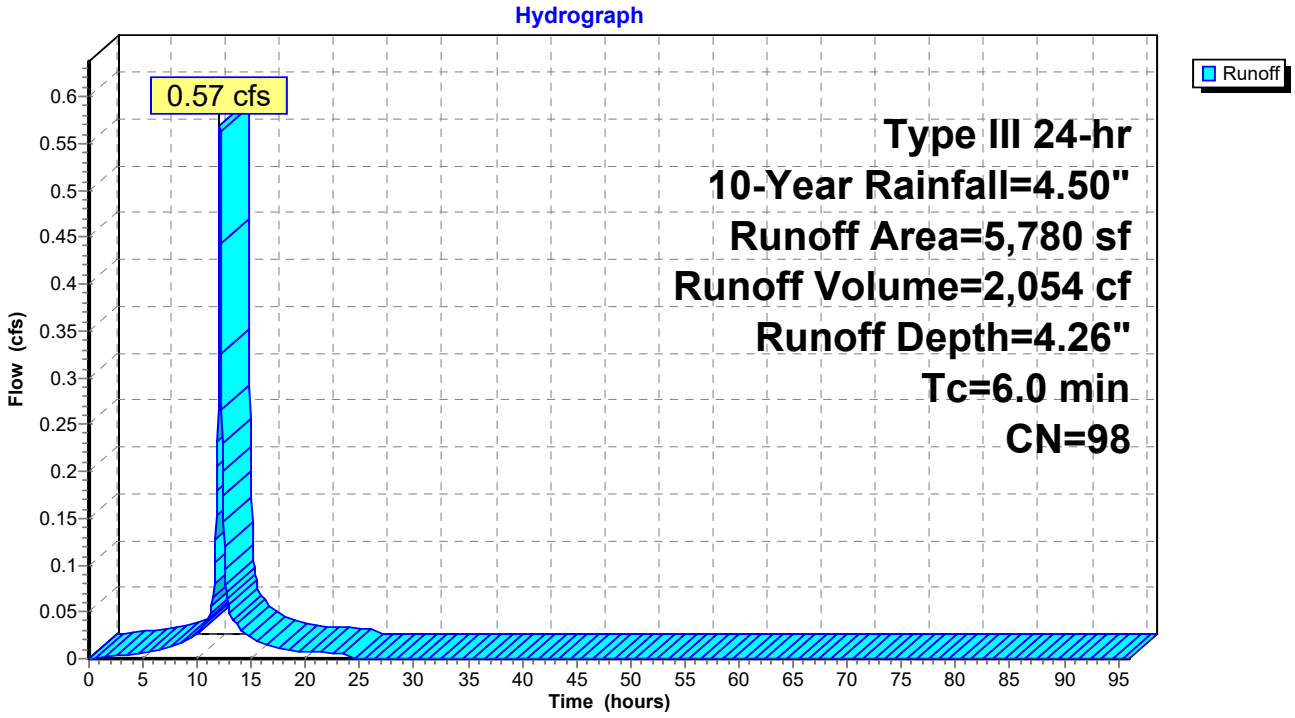
Runoff = 0.57 cfs @ 12.09 hrs, Volume= 2,054 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
5,780	98	Paved parking, HSG A
5,780		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Western Parking Section



Summary for Pond RG5: Rain-Garden#5

Inflow Area = 5,780 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.57 cfs @ 12.09 hrs, Volume= 2,054 cf
Outflow = 0.33 cfs @ 12.21 hrs, Volume= 2,054 cf, Atten= 42%, Lag= 7.6 min
Discarded = 0.05 cfs @ 12.21 hrs, Volume= 1,602 cf
Primary = 0.28 cfs @ 12.21 hrs, Volume= 452 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 341.26' @ 12.21 hrs Surf.Area= 693 sf Storage= 581 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 75.7 min (825.5 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	340.00'	760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

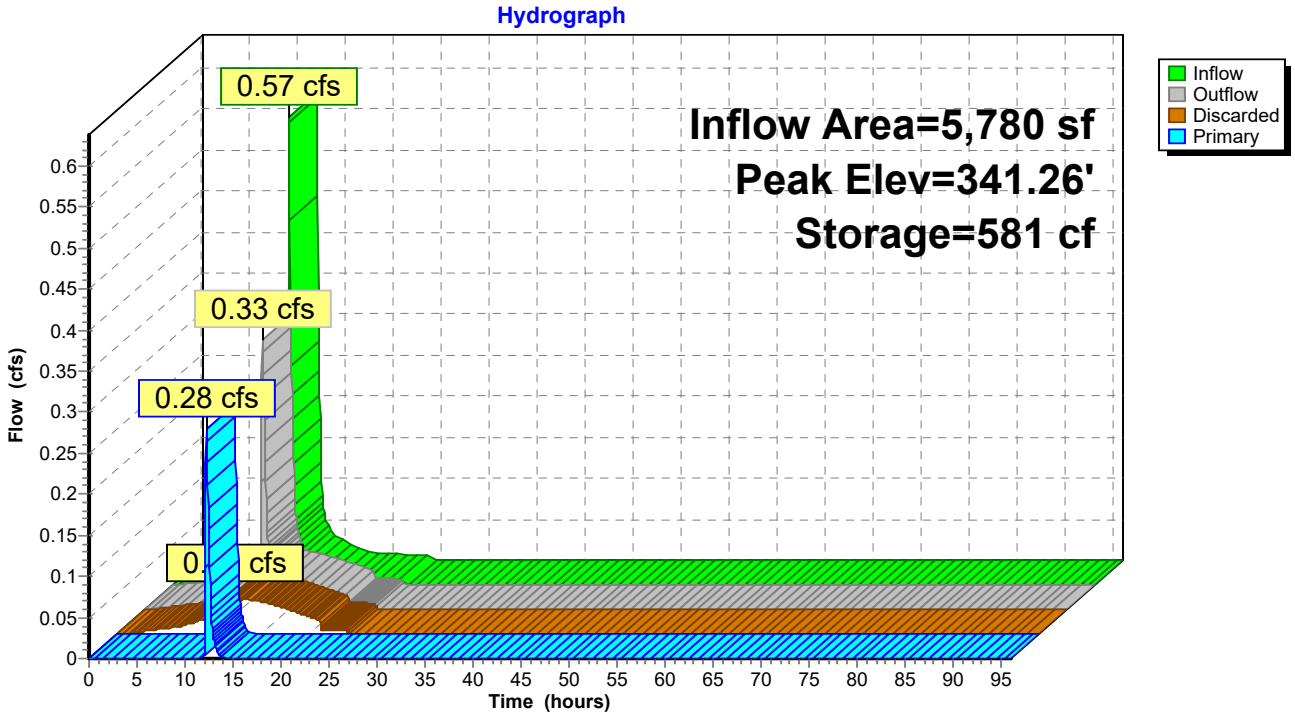
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
340.00	239	0	0
341.00	591	415	415
341.50	787	345	760

Device	Routing	Invert	Outlet Devices
#1	Discarded	340.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	341.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 12.21 hrs HW=341.26' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.27 cfs @ 12.21 hrs HW=341.26' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 1.72 fps)

Pond RG5: Rain-Garden#5



Summary for Pond RG6: Rain-Garden#6

Inflow Area = 10,095 sf,100.00% Impervious, Inflow Depth = 4.26" for 10-Year event
Inflow = 0.99 cfs @ 12.09 hrs, Volume= 3,587 cf
Outflow = 0.93 cfs @ 12.12 hrs, Volume= 3,587 cf, Atten= 7%, Lag= 2.0 min
Discarded = 0.06 cfs @ 12.12 hrs, Volume= 2,367 cf
Primary = 0.87 cfs @ 12.12 hrs, Volume= 1,220 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 338.19' @ 12.12 hrs Surf.Area= 846 sf Storage= 687 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 67.2 min (817.0 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	337.00'	970 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

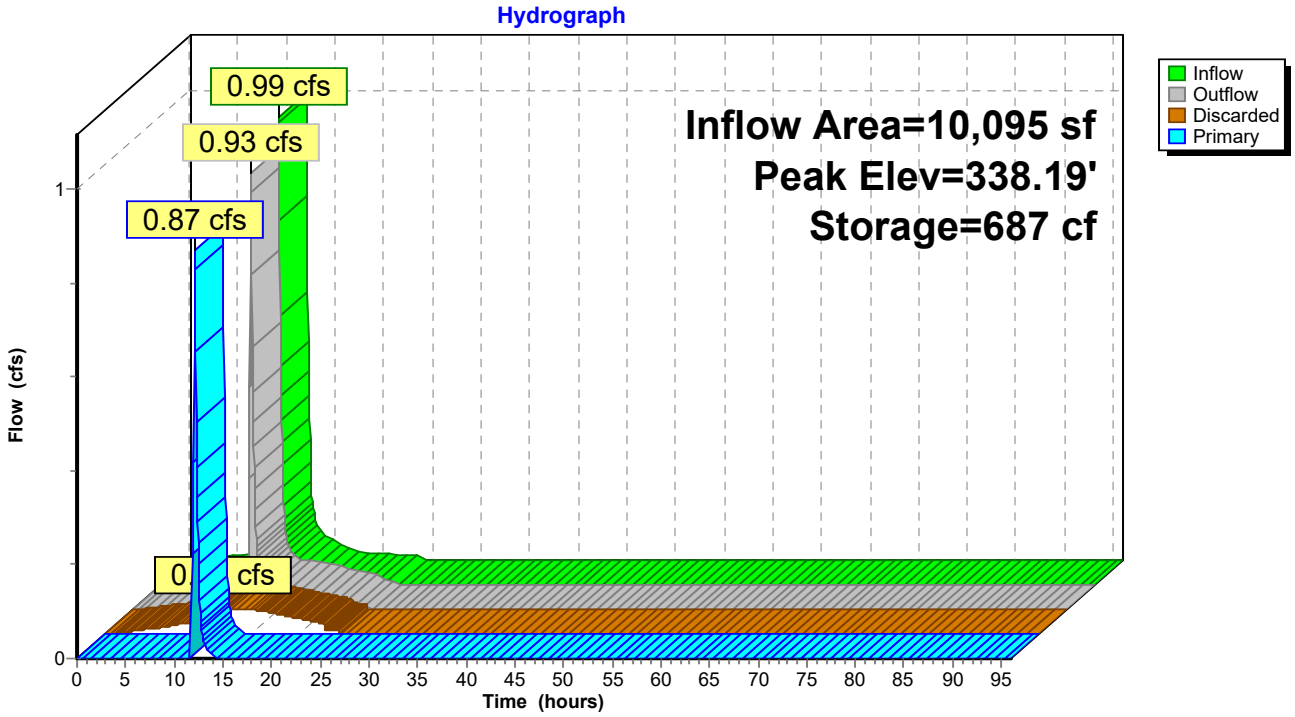
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
337.00	313	0	0
338.00	753	533	533
338.50	993	437	970

Device	Routing	Invert	Outlet Devices
#1	Discarded	337.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	338.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.12 hrs HW=338.19' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.84 cfs @ 12.12 hrs HW=338.19' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.84 cfs @ 1.42 fps)

Pond RG6: Rain-Garden#6



Summary for Subcatchment 1S: Eastern Parking Section

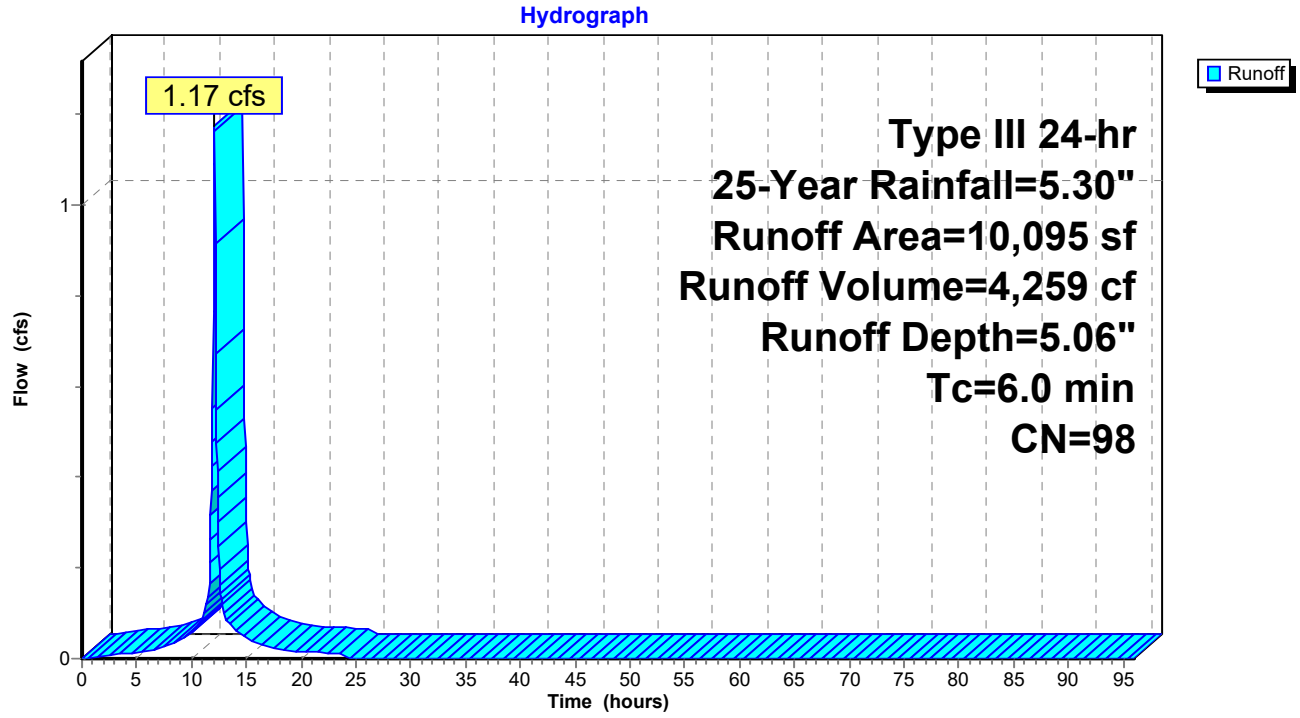
Runoff = 1.17 cfs @ 12.09 hrs, Volume= 4,259 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
10,095	98	Paved parking, HSG A
10,095		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: Eastern Parking Section



Summary for Subcatchment 2S: Western Parking Section

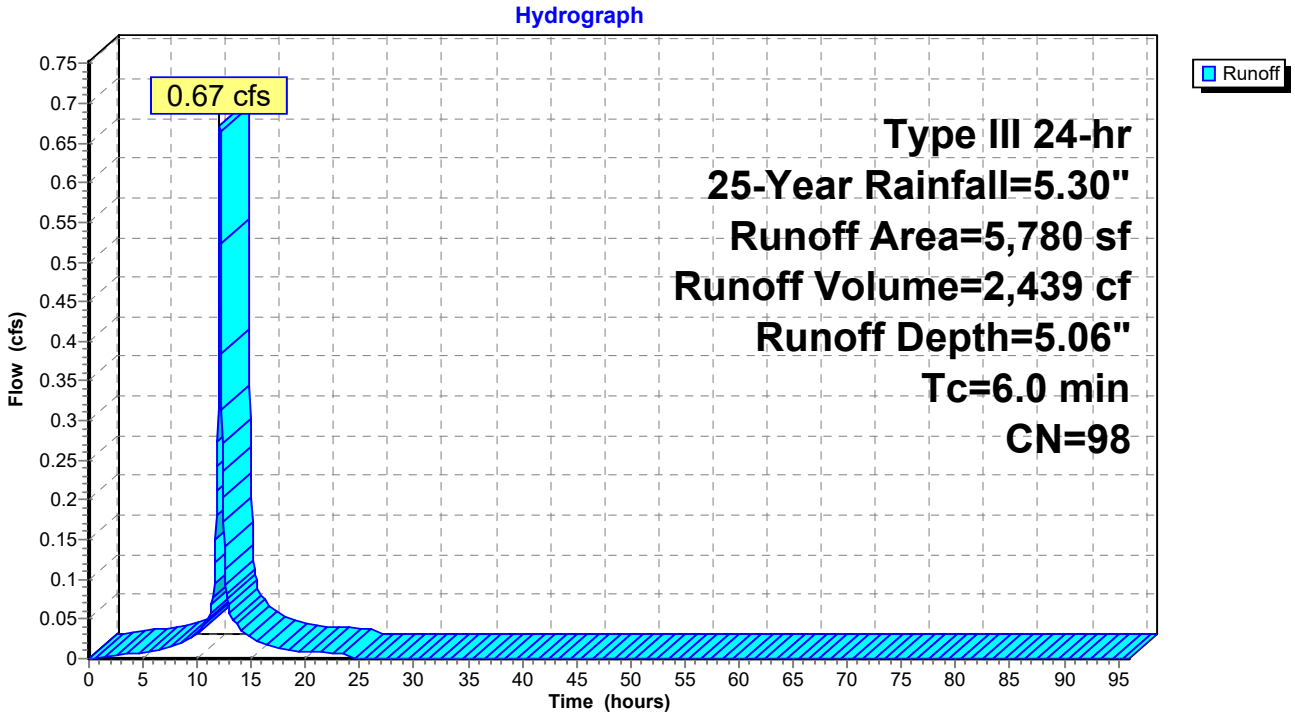
Runoff = 0.67 cfs @ 12.09 hrs, Volume= 2,439 cf, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
5,780	98	Paved parking, HSG A
5,780		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Western Parking Section



Summary for Pond RG5: Rain-Garden#5

Inflow Area = 5,780 sf,100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 0.67 cfs @ 12.09 hrs, Volume= 2,439 cf
Outflow = 0.48 cfs @ 12.17 hrs, Volume= 2,439 cf, Atten= 28%, Lag= 5.1 min
Discarded = 0.05 cfs @ 12.17 hrs, Volume= 1,759 cf
Primary = 0.43 cfs @ 12.17 hrs, Volume= 680 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 341.33' @ 12.17 hrs Surf.Area= 719 sf Storage= 629 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 72.6 min (819.7 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	340.00'	760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

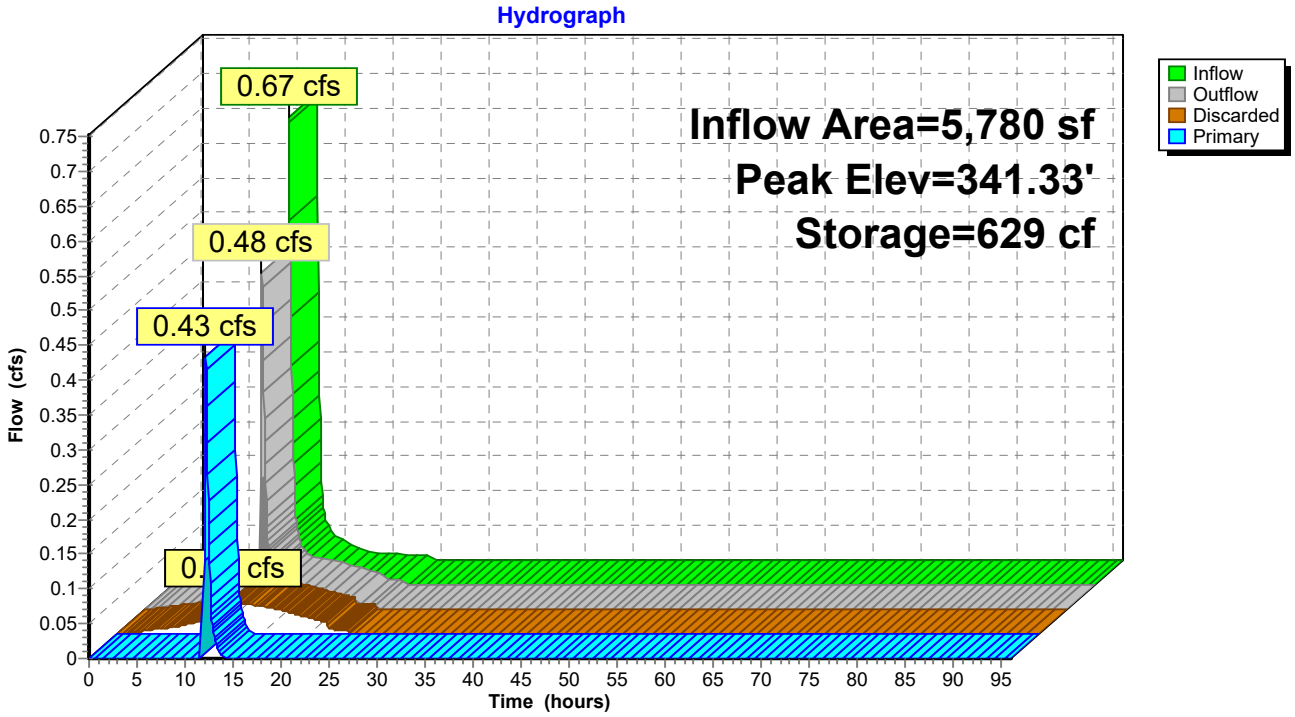
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
340.00	239	0	0
341.00	591	415	415
341.50	787	345	760

Device	Routing	Invert	Outlet Devices
#1	Discarded	340.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	341.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 12.17 hrs HW=341.32' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.42 cfs @ 12.17 hrs HW=341.32' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.42 cfs @ 1.93 fps)

Pond RG5: Rain-Garden#5



Summary for Pond RG6: Rain-Garden#6

Inflow Area = 10,095 sf,100.00% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 4,259 cf
Outflow = 1.10 cfs @ 12.12 hrs, Volume= 4,259 cf, Atten= 6%, Lag= 1.8 min
Discarded = 0.06 cfs @ 12.12 hrs, Volume= 2,591 cf
Primary = 1.04 cfs @ 12.12 hrs, Volume= 1,669 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 338.22' @ 12.12 hrs Surf.Area= 857 sf Storage= 708 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 64.8 min (811.9 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	337.00'	970 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

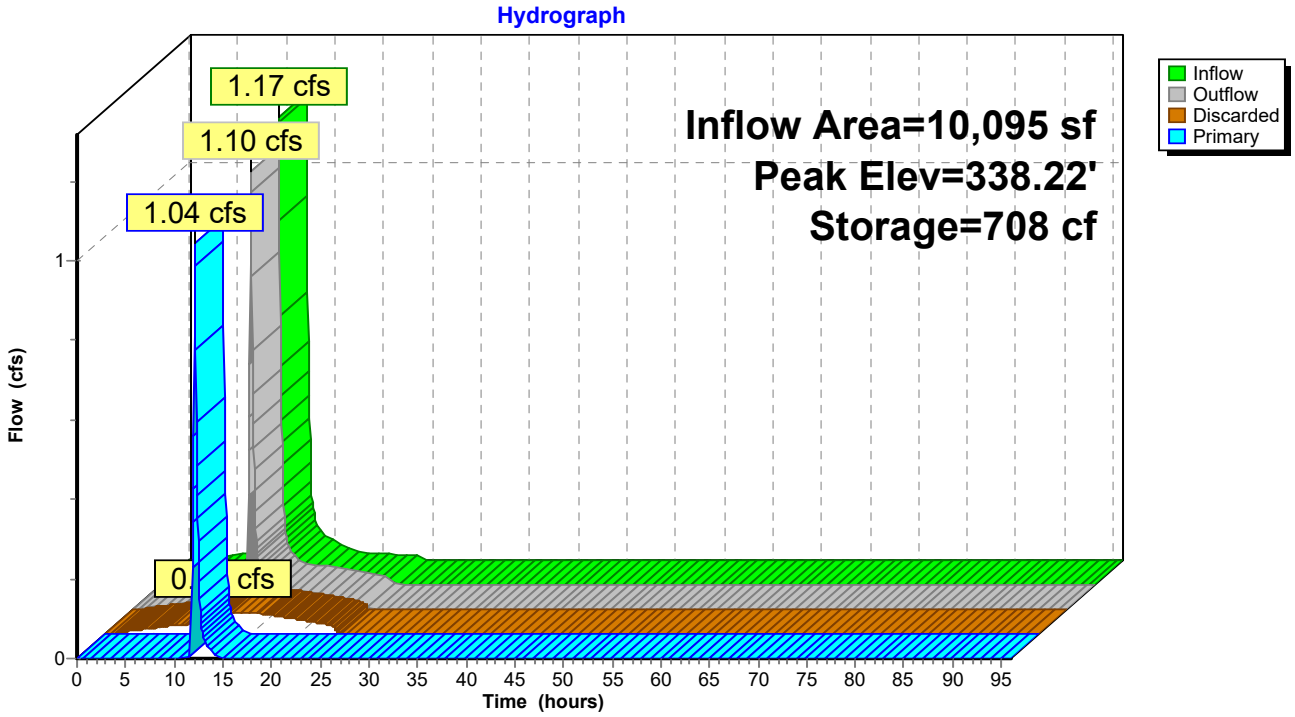
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
337.00	313	0	0
338.00	753	533	533
338.50	993	437	970

Device	Routing	Invert	Outlet Devices
#1	Discarded	337.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	338.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.12 hrs HW=338.21' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.01 cfs @ 12.12 hrs HW=338.21' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 1.01 cfs @ 1.51 fps)

Pond RG6: Rain-Garden#6



Summary for Subcatchment 1S: Eastern Parking Section

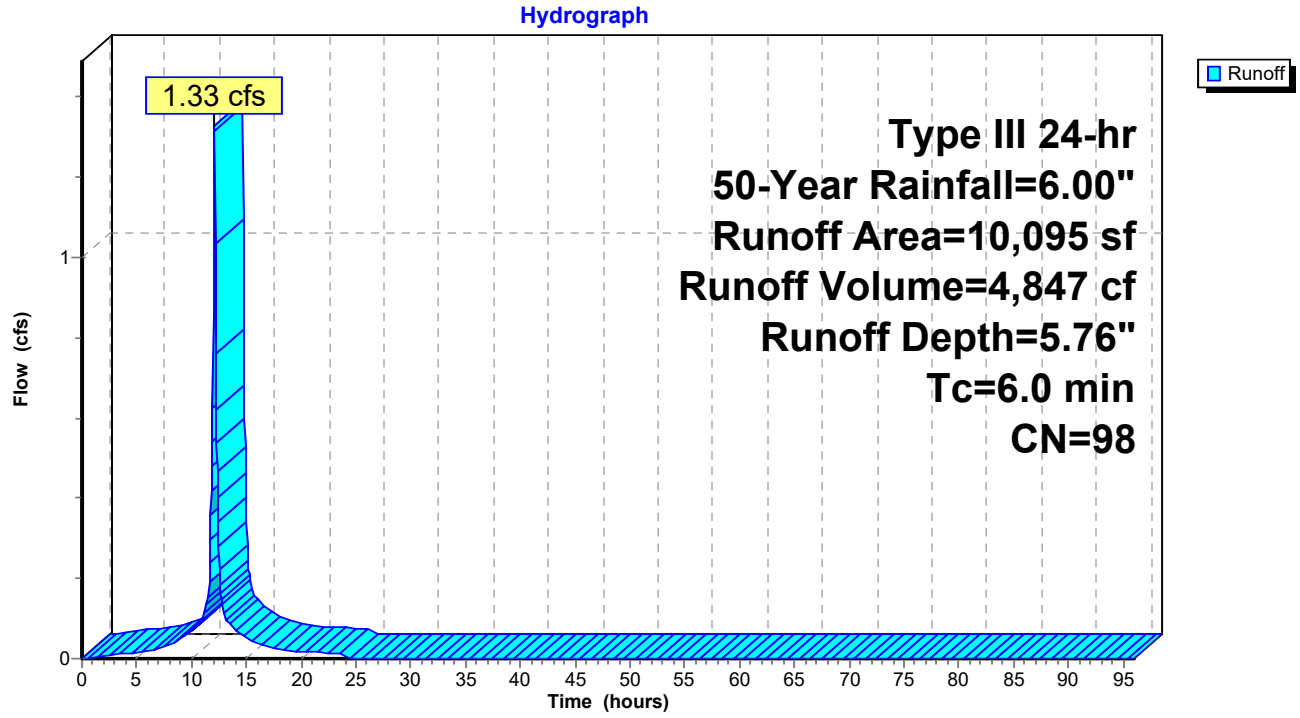
Runoff = 1.33 cfs @ 12.09 hrs, Volume= 4,847 cf, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
10,095	98	Paved parking, HSG A
10,095		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: Eastern Parking Section



Summary for Subcatchment 2S: Western Parking Section

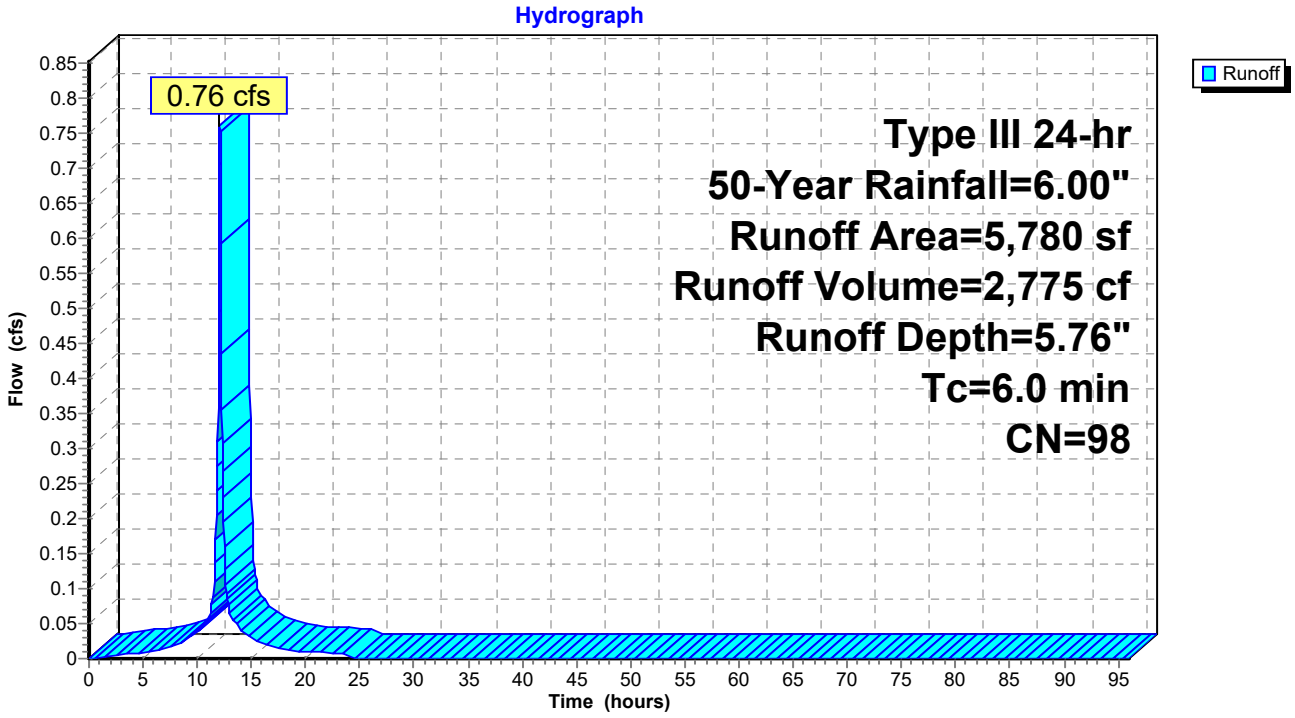
Runoff = 0.76 cfs @ 12.09 hrs, Volume= 2,775 cf, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
5,780	98	Paved parking, HSG A
5,780		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Western Parking Section



Summary for Pond RG5: Rain-Garden#5

Inflow Area = 5,780 sf,100.00% Impervious, Inflow Depth = 5.76" for 50-Year event
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 2,775 cf
Outflow = 0.60 cfs @ 12.16 hrs, Volume= 2,776 cf, Atten= 21%, Lag= 4.2 min
Discarded = 0.05 cfs @ 12.16 hrs, Volume= 1,886 cf
Primary = 0.55 cfs @ 12.16 hrs, Volume= 890 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 341.37' @ 12.16 hrs Surf.Area= 736 sf Storage= 661 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 70.7 min (815.9 - 745.1)

Volume	Invert	Avail.Storage	Storage Description
#1	340.00'	760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

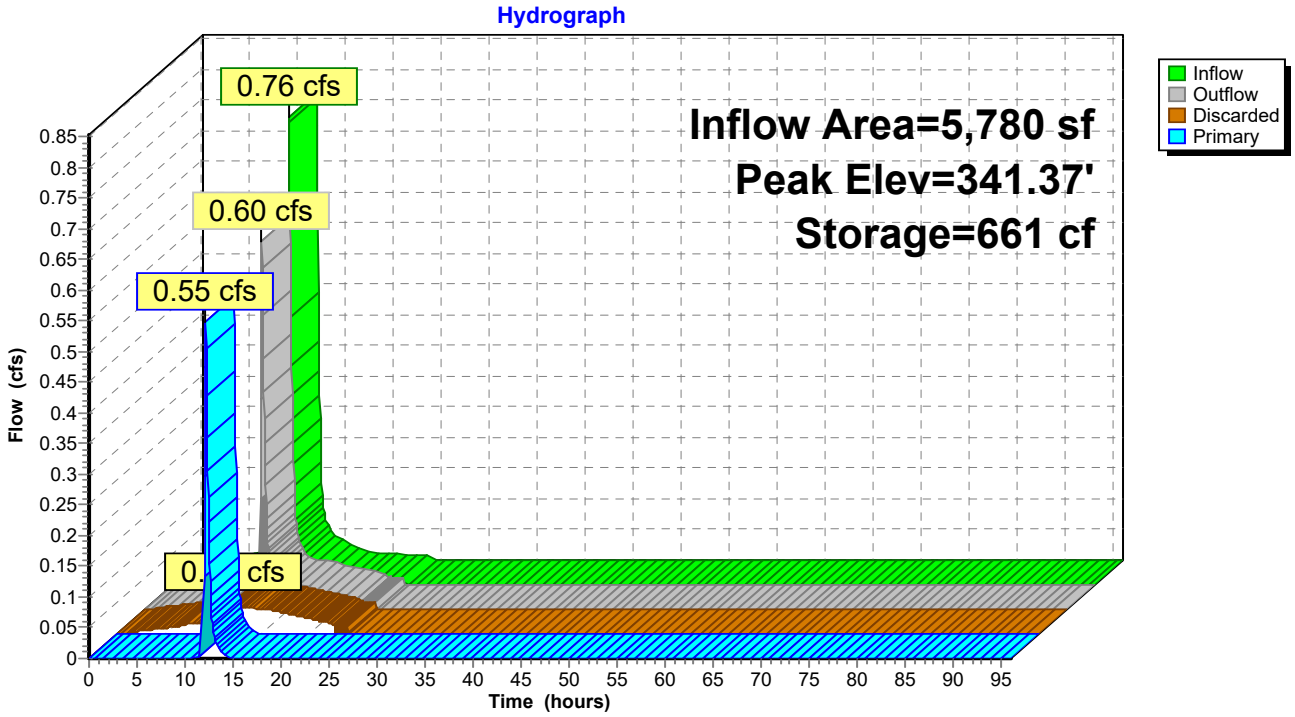
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
340.00	239	0	0
341.00	591	415	415
341.50	787	345	760

Device	Routing	Invert	Outlet Devices
#1	Discarded	340.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	341.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 12.16 hrs HW=341.37' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.54 cfs @ 12.16 hrs HW=341.37' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.54 cfs @ 2.06 fps)

Pond RG5: Rain-Garden#5



Summary for Pond RG6: Rain-Garden#6

Inflow Area = 10,095 sf,100.00% Impervious, Inflow Depth = 5.76" for 50-Year event
Inflow = 1.33 cfs @ 12.09 hrs, Volume= 4,847 cf
Outflow = 1.25 cfs @ 12.12 hrs, Volume= 4,847 cf, Atten= 6%, Lag= 1.8 min
Discarded = 0.06 cfs @ 12.12 hrs, Volume= 2,767 cf
Primary = 1.19 cfs @ 12.12 hrs, Volume= 2,080 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 338.24' @ 12.12 hrs Surf.Area= 867 sf Storage= 726 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 63.0 min (808.1 - 745.1)

Volume	Invert	Avail.Storage	Storage Description
#1	337.00'	970 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

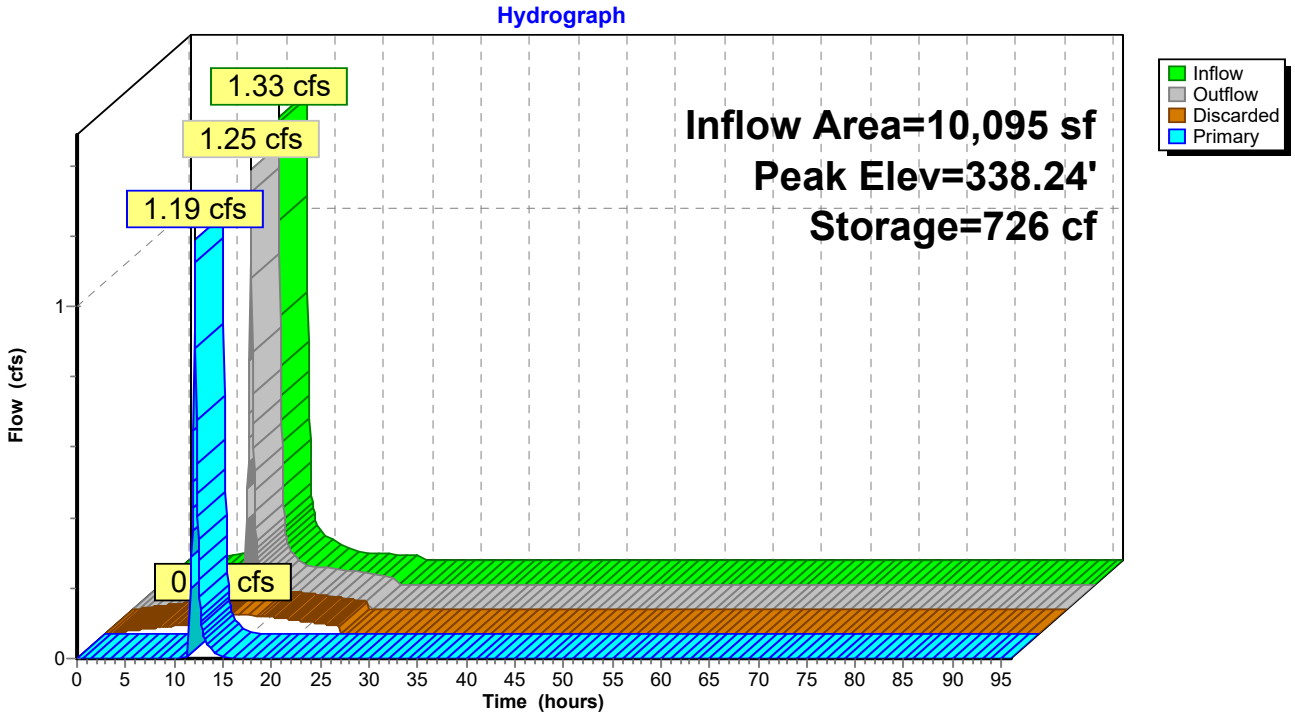
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
337.00	313	0	0
338.00	753	533	533
338.50	993	437	970

Device	Routing	Invert	Outlet Devices
#1	Discarded	337.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	338.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.12 hrs HW=338.23' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.16 cfs @ 12.12 hrs HW=338.23' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 1.16 cfs @ 1.58 fps)

Pond RG6: Rain-Garden#6



Summary for Subcatchment 1S: Eastern Parking Section

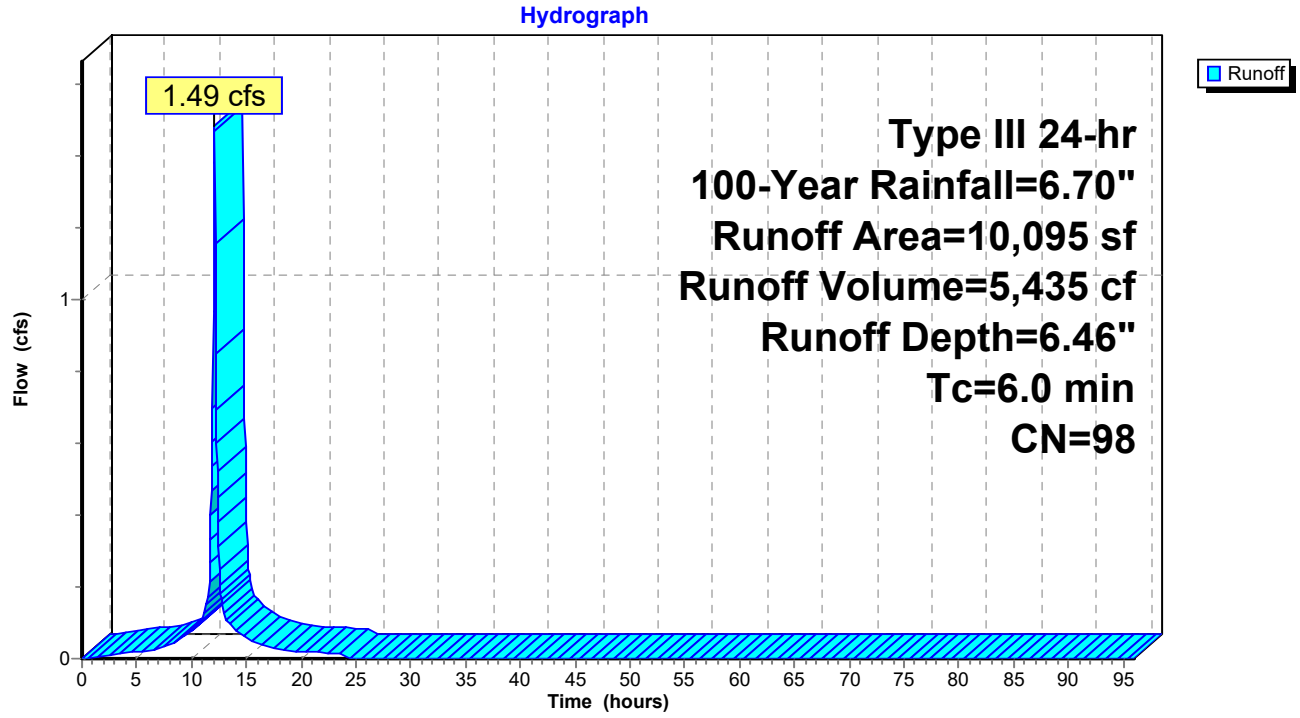
Runoff = 1.49 cfs @ 12.09 hrs, Volume= 5,435 cf, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
10,095	98	Paved parking, HSG A
10,095		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: Eastern Parking Section



Summary for Subcatchment 2S: Western Parking Section

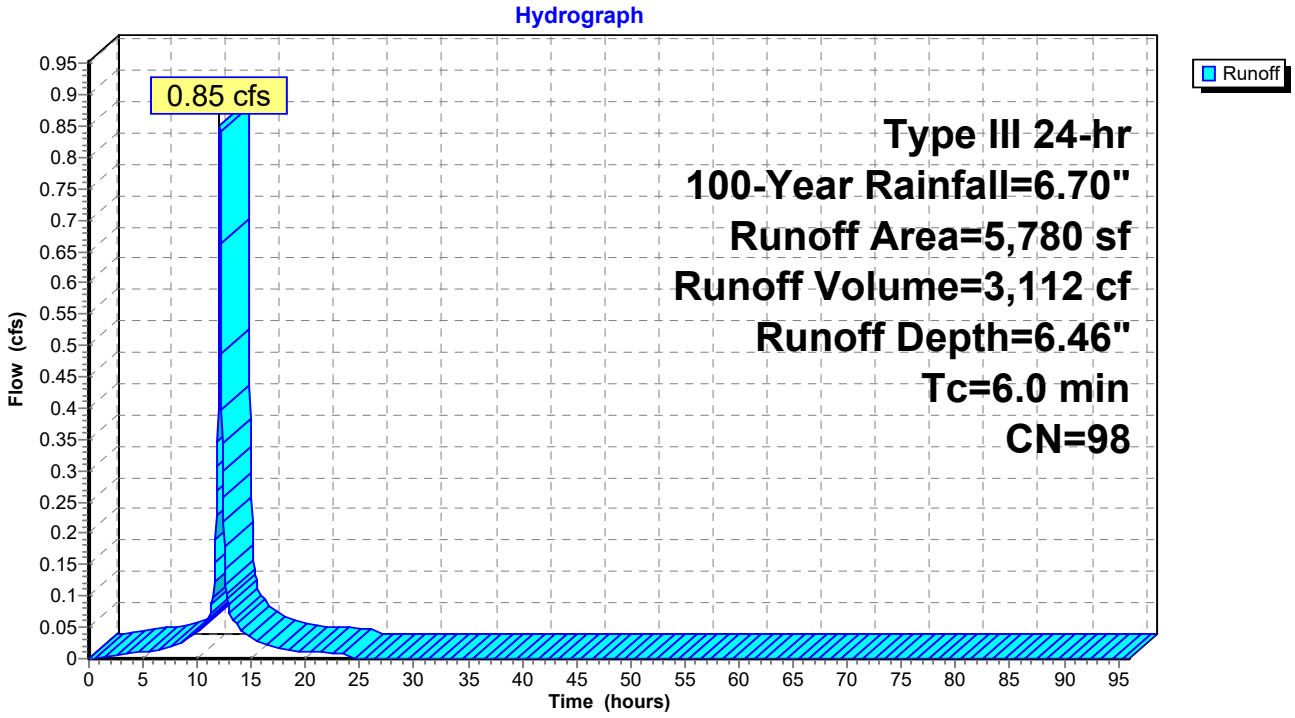
Runoff = 0.85 cfs @ 12.09 hrs, Volume= 3,112 cf, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
5,780	98	Paved parking, HSG A
5,780		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Western Parking Section



Summary for Pond RG5: Rain-Garden#5

Inflow Area = 5,780 sf,100.00% Impervious, Inflow Depth = 6.46" for 100-Year event
Inflow = 0.85 cfs @ 12.09 hrs, Volume= 3,112 cf
Outflow = 0.70 cfs @ 12.15 hrs, Volume= 3,112 cf, Atten= 18%, Lag= 3.8 min
Discarded = 0.05 cfs @ 12.15 hrs, Volume= 2,005 cf
Primary = 0.65 cfs @ 12.15 hrs, Volume= 1,107 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 341.40' @ 12.15 hrs Surf.Area= 750 sf Storage= 686 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 69.1 min (812.6 - 743.6)

Volume	Invert	Avail.Storage	Storage Description
#1	340.00'	760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

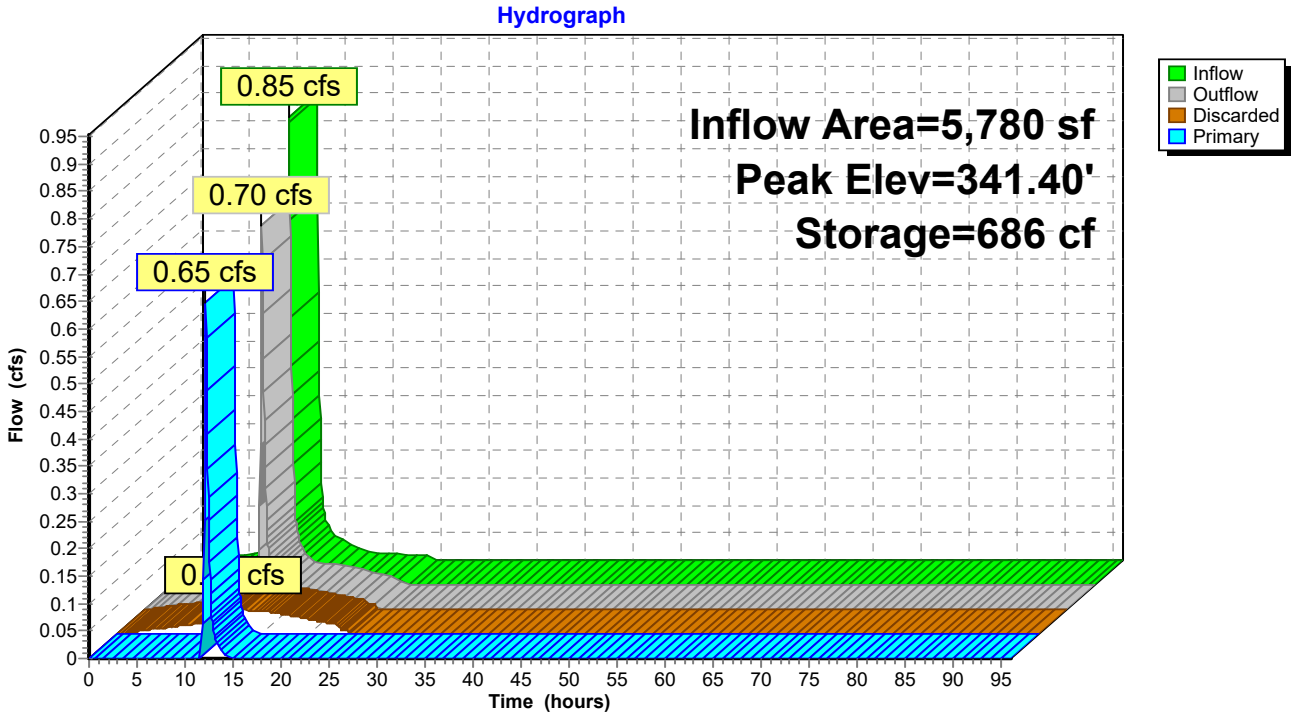
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
340.00	239	0	0
341.00	591	415	415
341.50	787	345	760

Device	Routing	Invert	Outlet Devices
#1	Discarded	340.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	341.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 12.15 hrs HW=341.40' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.64 cfs @ 12.15 hrs HW=341.40' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.64 cfs @ 2.17 fps)

Pond RG5: Rain-Garden#5



Summary for Pond RG6: Rain-Garden#6

Inflow Area = 10,095 sf,100.00% Impervious, Inflow Depth = 6.46" for 100-Year event
Inflow = 1.49 cfs @ 12.09 hrs, Volume= 5,435 cf
Outflow = 1.40 cfs @ 12.12 hrs, Volume= 5,437 cf, Atten= 6%, Lag= 1.7 min
Discarded = 0.06 cfs @ 12.12 hrs, Volume= 2,932 cf
Primary = 1.34 cfs @ 12.12 hrs, Volume= 2,505 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 338.26' @ 12.12 hrs Surf.Area= 877 sf Storage= 743 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 61.5 min (805.1 - 743.6)

Volume	Invert	Avail.Storage	Storage Description
#1	337.00'	970 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

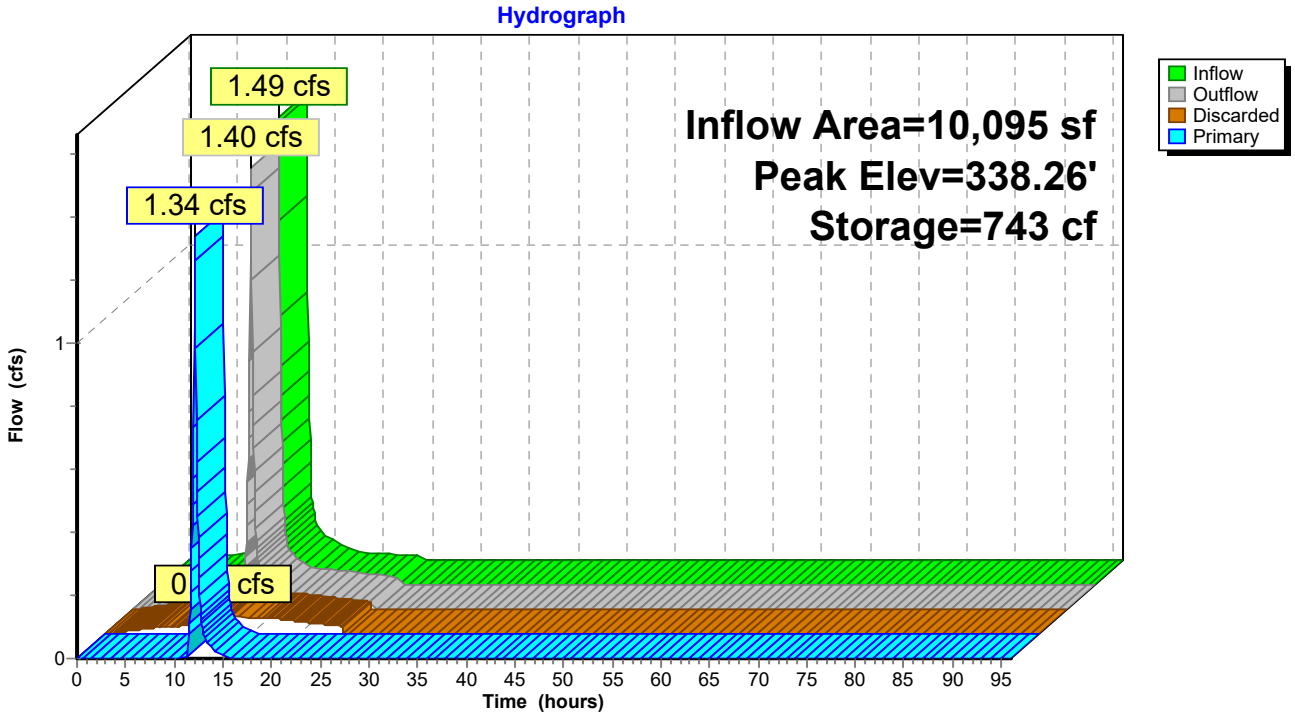
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
337.00	313	0	0
338.00	753	533	533
338.50	993	437	970

Device	Routing	Invert	Outlet Devices
#1	Discarded	337.00'	**3.000 in/hr Exfiltration over Surface area**
#2	Primary	338.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.12 hrs HW=338.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.31 cfs @ 12.12 hrs HW=338.25' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 1.31 cfs @ 1.64 fps)

Pond RG6: Rain-Garden#6



APPENDIX B

Supporting Information

HIGHPOINT ENGINEERING, INC.
45 DAN ROAD, SUITE 140
CANTON, MASSACHUSETTS 02021

Location: 39 Jackson Rd, Devens MA BLDG2
Development: Site Development Project
Project No.: 19019
Storm Frequency: 25-Year Storm Event
Run: **3 Runs**

Date: 6-May-21
Revised:
Computed By: AK
Checked By: DJH

From	To	Drainage Area (s.f.)	C	Total C x A (acres)	Tc (min)	I(10) (in/hr)	Q = (CIA) (cfs)	Flow from others (cfs)	Total Q (cfs)	Min. Slope (ft/ft)	Pipe Material	Manning's n	Dia (in)	Q (full) (cfs)	V (full) (fps)	Q/Q(full) < 1?	INV. IN (ft)	INV. OUT (ft)	Length (ft)	Pipe Rad. (ft)	Hydraulic Radius (ft)	Area (ft2)	Perimeter (ft)
RUN #1																							
Subcat TD #3	TD #3	0	0.20																				
		3238	0.30																				
		8187	0.90																				
				0.19	5	5.30	1.01	0.00	1.01														
TD #3	WQU#30	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	5.30	0.00	1.01	1.01	0.016	HDPE	0.013	12	4.54	5.78	0.22	329.4	329.9	31	0.5	0.25	0.785	3.142
WQU#30	DMH #36	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	5.30	0.00	1.01	1.01	0.028	HDPE	0.013	12	5.99	7.63	0.17	328.85	329.3	16	0.5	0.25	0.785	3.142
WQU-14	DMH #36	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	5.30	0.00	0.80	0.80	(FROM HYDROCAD 25-YEAR RELEASE FROM WQU-17)													
DMH #36	SWM-06	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	5.30	0.00	1.81	1.81	0.004	HDPE	0.013	12	2.13	2.72	0.85	328.2	328.75	154	0.5	0.25	0.785	3.142
RUN #2																							
Subcat WQU #31	WQU #31	0	0.20																				
		1650	0.30																				
		9531	0.90																				
				0.21	5	5.30	1.10	0.00	1.10														
WQU #31	SWM-06	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	5.30	0.00	1.10	1.10	0.020	HDPE	0.013	12	5.05	6.43	0.22	329.8	330	10	0.5	0.25	0.785	3.142
RUN #3																							
Subcat WQU #32	WQU #32	0	0.20																				
		1029	0.30																				
		4734	0.90																				
				0.10	5	5.30	0.56	0.00	0.56														
WQU #32	SWM-06	0	0.20																				
		0	0.30																				
		0	0.90																				
				0.00	5	5.30	0.00	0.56	0.56	0.011	HDPE	0.013	12	3.73	4.75	0.15	330.2	330.8	55	0.5	0.25	0.785	3.142

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 45 JACKSON ROAD, DEVENS,MA (SWM-6)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
CDS Water Quality Unit #30	0.80	**1.00**	0.80	0.20
Infiltration Facility #6	0.80	0.20	0.16	0.04

Total TSS Removal = 0.96

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BIOMANUFACTURING BUILDING

Prepared By: AK

Date: 05-06-2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 45 JACKSON ROAD, DEVENS,MA (SWM-6)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
CDS Water Quality Unit #31	0.80	**1.00**	0.80	0.20
Infiltration Facility #6	0.80	0.20	0.16	0.04

Total TSS Removal = 0.96

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BIOMANUFACTURING BUILDING

Prepared By: AK

Date: 05-06-2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 45 JACKSON ROAD, DEVENS,MA (SWM-6)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
CDS Water Quality Unit #32	0.80	**1.00**	0.80	0.20
Infiltration Facility #6	0.80	0.20	0.16	0.04

Total TSS Removal = 0.96

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BIOMANUFACTURING BUILDING

Prepared By: AK

Date: 05-06-2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 45 JACKSON ROAD, DEVENS,MA (SWM-17)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Rain Garden #5	0.80	**1.00**	0.80	0.20
Detention Facility #17	0.00	0.20	0.00	0.20

Total TSS Removal = 0.80

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BIOMANUFACTURING BUILDING

Prepared By: CA

Date: 03-10-2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 45 JACKSON ROAD, DEVENS,MA (SWM-17)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Rain Garden #6	0.80	**1.00**	0.80	0.20
Detention Facility #17	0.00	0.20	0.00	0.20

Total TSS Removal = 0.80

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BIOMANUFACTURING BUILDING

Prepared By: CA

Date: 03-10-2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

45 JACKSON ROAD - LOT 1
DEVENS, MA

Area	0.51 ac	Unit Site Designation	
Weighted C	0.9	Rainfall Station #	71
t_c	6 min		
CDS Model	1515-3	CDS Treatment Capacity	1.0 cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.08	37.6%	37.6%	0.04	0.04	7.34	94.7	35.6
0.16	22.6%	60.2%	0.07	0.07	14.69	92.2	20.9
0.24	11.9%	72.1%	0.11	0.11	22.03	89.7	10.7
0.32	7.6%	79.7%	0.15	0.15	29.38	87.2	6.6
0.40	4.3%	84.1%	0.18	0.18	36.72	84.7	3.7
0.48	2.3%	86.4%	0.22	0.22	44.06	82.2	1.9
0.56	1.8%	88.2%	0.26	0.26	51.41	79.7	1.4
0.64	1.4%	89.6%	0.29	0.29	58.75	77.2	1.1
0.72	0.9%	90.4%	0.33	0.33	66.10	74.7	0.6
0.80	1.2%	91.6%	0.37	0.37	73.44	72.2	0.8
0.88	1.5%	93.1%	0.40	0.40	80.78	69.7	1.0
0.96	0.9%	94.0%	0.44	0.44	88.13	67.2	0.6
1.04	0.4%	94.4%	0.48	0.48	95.47	64.7	0.2
1.12	0.4%	94.8%	0.51	0.51	102.82	62.2	0.3
1.20	0.6%	95.4%	0.55	0.55	110.16	59.7	0.3
1.28	0.3%	95.7%	0.59	0.59	117.50	57.2	0.2
1.36	0.2%	95.9%	0.62	0.62	124.85	54.7	0.1
1.44	0.9%	96.7%	0.66	0.66	132.19	52.2	0.5
1.52	0.6%	97.3%	0.70	0.70	139.54	49.7	0.3
1.60	0.4%	97.7%	0.73	0.73	146.88	47.2	0.2
1.80	0.2%	97.9%	0.83	0.83	165.24	40.9	0.1
							87.5
						Removal Efficiency Adjustment[2] =	0.0%
						Predicted % Annual Rainfall Treated =	98.8%
						Predicted Net Annual Load Removal Efficiency =	**87.5%**

1 - Based on 13 years of 15 minute precipitation data for Station 0666, Birch Hill Dam, Worcester County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices

Site Development Project
39 Jackson Rd
Devens, Massachusetts

Converting Required Water Quality Volume (WQV) to a Discharge Rate (Q)

The proposed underground infiltration facility #6 will collect runoff form Subcatchment Area TD #3. Prior to discharge, the required WQV of 1.0" for the contributing impervious areas will utilize the Contech CDS Model 1515-3 (WQU#30) for pre-treatment. Total impervious area to be pretreated is 8,187 sf.

Since manufactured proprietary stormwater separators are designed with respect to discharge rates and not volume, MassDEP requires a standardized method be used to convert the required WQV to a discharge rate (Q).

Mass DEP Requirement

Q = (qu)(A)(WQV), where;

Q = Peak Flow associated with first 1" of runoff, cfs
qu = Unit Peak Discharge = 774 csm/in
(From Figure 4, related to Tc)
Tc = Time of Concentration = 6.0 min = 0.1 hours
A = Impervious Surface Drainage Area = 0.00029 mi^2
WQV = 1"

Q = (774 csm/in)(0.00029 mi^2)(1")
Q = 0.22 cfs

Contech CDS Model 1515-3 is designed to achieve at least 80% TSS removal for a max discharge rate of 1.0 cfs. Proposed WQU#1 will achieve and exceed pretreatment of 44% prior to infiltration.

Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices

Site Development Project
39 Jackson Rd
Devens, Massachusetts

Converting Required Water Quality Volume (WQV) to a Discharge Rate (Q)

The proposed underground infiltration facility #6 will collect runoff form Subcatchment Area WQU #31. Prior to discharge, the required WQV of 1.0" for the contributing impervious areas will utilize the Contech CDS Model 1515-3 (WQU#31) for pre-treatment. Total impervious area to be pretreated is 9,531 sf.

Since manufactured proprietary stormwater separators are designed with respect to discharge rates and not volume, MassDEP requires a standardized method be used to convert the required WQV to a discharge rate (Q).

Mass DEP Requirement

Q = (qu)(A)(WQV), where;

Q = Peak Flow associated with first 1" of runoff, cfs
qu = Unit Peak Discharge = 774 csm/in
(From Figure 4, related to Tc)
Tc = Time of Concentration = 6.0 min = 0.1 hours
A = Impervious Surface Drainage Area = 0.00034 mi^2
WQV = 1"

Q = (774 csm/in)(0.00034 mi^2)(1")
Q = 0.26 cfs

Contech CDS Model 1515-3 is designed to achieve at least 80% TSS removal for a max discharge rate of 1.0 cfs. Proposed WQU#1 will achieve and exceed pretreatment of 44% prior to infiltration.

Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices

Site Development Project
39 Jackson Rd
Devens, Massachusetts

Converting Required Water Quality Volume (WQV) to a Discharge Rate (Q)

The proposed underground infiltration facility #6 will collect runoff form Subcatchment Area WQU #32. Prior to discharge, the required WQV of 1.0" for the contributing impervious areas will utilize the Contech CDS Model 1515-3 (WQU#32) for pre-treatment. Total impervious area to be pretreated is 9,531 sf.

Since manufactured proprietary stormwater separators are designed with respect to discharge rates and not volume, MassDEP requires a standardized method be used to convert the required WQV to a discharge rate (Q).

Mass DEP Requirement

Q = (qu)(A)(WQV), where;

Q = Peak Flow associated with first 1" of runoff, cfs
qu = Unit Peak Discharge = 774 csm/in
(From Figure 4, related to Tc)
Tc = Time of Concentration = 6.0 min = 0.1 hours
A = Impervious Surface Drainage Area = 0.00017 mi^2
WQV = 1"

Q = (774 csm/in)(0.00017 mi^2)(1")
Q = 0.13 cfs

Contech CDS Model 1515-3 is designed to achieve at least 80% TSS removal for a max discharge rate of 1.0 cfs. Proposed WQU#1 will achieve and exceed pretreatment of 44% prior to infiltration.

Recharge Volume Calculation

Level 2 – Unified Permit Submission
Site Development Plan
39 Jackson Road-Bldg 2
Devens, Massachusetts

Recharge to Groundwater Required

Review of the United States Department of Agricultural (USDA) Natural Resources Conservation Service (NRCS) indicates that the parent soils on site consist of Hinckley Loamy Sand (245B) and Merrimac Fine Sandy Loam (254B), with a Hydrologic Soils Group A (HSG A). However, based on on-site investigations, the calculations provided will be according to Group B soils.

The Massachusetts Stormwater Handbook regulates the required recharge volume using a calculation of 0.60 inches of runoff for "A" soils multiplied by the total impervious cover of the site. This infiltration/detention facility will achieve the required recharge volume by collecting runoff from the impervious surfaces throughout the site.

The total impervious cover of the total watersheds is equal to 174,510 ft^2, therefore;

Mass DEP Requirement
Required Recharge Volume#1 = 0.60 inches x Total Impervious Area
= 0.60 inches x 174,510 ft^2 x (1/12 in/ft) = 8,726 ft^3

Total Required Recharge Volume required for the entire site= 8,726 ft^3

Recharge to Groundwater Provided

1. The required recharge volume is achieved in the underground infiltration basin #6. This basin will provide infiltration below the outlets.

   Total Volume provided in basins = 18,580 ft^3 > 8,726 ft^3

Stage-Area-Storage for Pond 6P: (80) CMP 42

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
327.50	**8,546**	0
327.55	8,546	171
327.60	8,546	342
327.65	8,546	513
327.70	8,546	684
327.75	8,546	855
327.80	8,546	1,025
327.85	8,546	1,196
327.90	8,546	1,367
327.95	8,546	1,538
328.00	8,546	1,709
328.05	8,546	1,902
328.10	8,546	2,121
328.15	8,546	2,354
328.20	8,546	2,598
328.25	8,546	2,851
328.30	8,546	3,112
328.35	8,546	3,380
328.40	8,546	3,655
328.45	8,546	3,936
328.50	8,546	4,222
328.55	8,546	4,512
328.60	8,546	4,808
328.65	8,546	5,107
328.70	8,546	5,411
328.75	8,546	5,718
328.80	8,546	6,028
328.85	8,546	6,342
328.90	8,546	6,658
328.95	8,546	6,977
329.00	8,546	7,299
329.05	8,546	7,622
329.10	8,546	7,948
329.15	8,546	8,276
329.20	8,546	8,606
329.25	8,546	8,937
329.30	8,546	9,270
329.35	8,546	9,604
329.40	8,546	9,939
329.45	8,546	10,275
329.50	8,546	10,612
329.55	8,546	10,950
329.60	8,546	11,288
329.65	8,546	11,626
329.70	8,546	11,965
329.75	8,546	12,304
329.80	8,546	12,643
329.85	8,546	12,982
329.90	8,546	13,320
329.95	8,546	13,658
330.00	8,546	13,996
330.05	8,546	14,333
330.10	8,546	14,669
330.15	8,546	15,004
330.20	8,546	15,338
330.25	8,546	15,671
330.30	8,546	16,002
330.35	8,546	16,332
330.40	8,546	16,660
330.45	8,546	16,986
330.50	8,546	17,309
330.55	8,546	17,631
330.60	8,546	17,950
330.65	8,546	18,266
330.70	8,546	18,580
330.75	8,546	18,890
330.80	8,546	19,197
330.85	8,546	19,501
330.90	8,546	19,800
330.95	8,546	20,095
331.00	8,546	20,386
331.05	8,546	20,672
331.10	8,546	20,953
331.15	8,546	21,228
331.20	8,546	21,496
331.25	8,546	21,757
331.30	8,546	22,010
331.35	8,546	22,254
331.40	8,546	22,487
331.45	8,546	22,706
331.50	8,546	22,899
331.55	8,546	23,070
331.60	8,546	23,241
331.65	8,546	23,412
331.70	8,546	23,582
331.75	8,546	23,753
331.80	8,546	23,924
331.85	8,546	24,095
331.90	8,546	24,266
331.95	8,546	24,437
332.00	8,546	**24,608**

Table 3: Stormwater Management Strategy for Proposed Watersheds (continued).

ap3	Provided by Devens	Not Provided by Devens	Not Provided by Devens
b1	Provided by Devens	Not Provided by Devens	Not Provided by Devens
WATERSHED #4 **SWM Functions provided by Devens at the Detention Basin on Lot 12**			
Lot/Subarea	Water Quality (½" Runoff)	Infiltration	Detention
Lot 9	Provided by Devens	Provided by Devens	Provided by Devens
Lot 12 (a12-1, -2)	Provided by Devens	Provided by Devens	Provided by Devens
Area a13-2	Provided by Devens	Provided by Devens	Provided by Devens
Area a14-1	Provided by Devens	Provided by Devens	Provided by Devens
Roadway system	Provided by Devens	Provided by Devens	Provided by Devens
Lot 15 (a15-1) and Lot 16 (a16-1): Developer must provide on-site water quality treatment, groundwater recharge, and detention for up to the 25-year event. Detention in excess of the 25-year event (up to the 100-yr event) will be provided for in the Detention Basin at Lot 12.			
WATERSHED #5 **SWM Functions provided by Devens at the Detention Basin on Lot 13**			
Lot/Subarea	Water Quality (½" Runoff)	Infiltration	Detention
Area a3	Provided by Devens	Provided by Devens	Provided by Devens
Lot 13	Provided by Devens	Provided by Devens	Provided by Devens
Lot 14 (a14)	Provided by Devens	Provided by Devens	Provided by Devens
Roadway system	Provided by Devens	Provided by Devens	Provided by Devens
Lot 6, Lot 7, Lot 15 (a15) and Lot 16 (a16): Developer must provide on-site water quality treatment, groundwater recharge, and detention for up to the 25-year event. Detention in excess of the 25-year event (up to the 100-yr event) will be provided for in the Detention Basin at Lot 13.			

DEC Copy

Devens, Massachusetts

Revised Calculations

Roadway,Utility and Drainage Improvements
Jackson Road
Route 2 Gate to Hospital Road

DEP File No. 352-010

February 2000

BETA Group, Inc.
Engineers • Scientists • Planners
1420 Providence Highway, Suite 117, Norwood, MA 02062 781.255.1982 fax: 781.255.1974
6 Blackstone Valley Place, Lincoln, RI 02865 401.333.2382 fax: 401.333.9225
88D Howard Street, New London, CT 06329 860.437.0239
email: BETA@BETA-eng.com

Pond at Hospital Road (Formerly Pond on Lot 12)

Revised Watershed No. 4

The Pond at Lot 12 was located on property owned by U.S. Fish and Wildlife. It was originally believed that construction of the pond would be acceptable based on MassDevelopment's understanding of a previous agreement. Following numerous discussions between MassDevelopment and Fish and Wildlife it became apparent that the pond could not be located as proposed in the Notice of Intent.

The revised location, now referred to as the Hospital Road Pond, is located south and east of the Fish and Wildlife property and south of the previous pond location. The pond is designed to mitigate increases in runoff rates for storms up to the 25 year, 24 hour storm. The Pond at Lot 12 was designed with the assumption that Lot 16 would provide storage to mitigate increases in runoff rates and water quality impacts independently of the Pond at Lot 12. Due to the location of the Hospital Road pond, adjacent to Lot 16, and the change in watershed areas it was determined that the water quantity and quality mitigation for Lot 16 would be provided in the Hospital Road pond. In addition, the overflow structure has been sized to allow passage of the 100 year storm to the Nashua River without downstream flooding.

The proposed discharge location at the Nashua River is at the same location as the previous discharge from the Lot 12 Pond.

Existing Conditions

Watershed No. 4 consists of approximately 56.33 acres (0.088 sq. mi.) of land to the west of Jackson Road. The area extends approximately 700 feet northerly along the roadway and approximately 2000 feet to the west. The watershed includes the following areas: a9, a16-1, and a16-2. The watershed can be seen on the revised Watershed Plan No. 2. The area consists of open grassed fields and woodlands. Runoff from this watershed flows overland in a westerly direction to the Nashua River. A summary of the peak discharge rates for each design storm can be found in Table 1.

Proposed Conditions

Under the proposed conditions Watershed No.4 will be increased to approximately 72.26 acres (0.1129 sq. mi.). The increase in area is to accommodate future land development projects. The watershed includes the following areas: a9, a16-1, a13-2, a14-1, a15-1and a16-2. The watershed can be seen on the revised Watershed Plan No. 2.

Runoff from watershed including the new roadways and the future developed lots will be collected by the proposed drainage system. The drainage system will discharge the stormwater to the proposed basin where it will be treated for water quality and quantity. The basin will discharge to the Nashua River through a proposed 42-inch concrete pipe. A summary of the peak discharge rates for each design storm can be found in Table 1.

Table 1: Summary of Pre and Post Development Discharges with Detention (cfs).

WATERSHED No. 4				
Storm Frequency	2-Year	10-Year	25-Year	100-Year
Existing Conditions	0.16	3.92	10.78	29.48
Post-Development Conditions	53.60	98.40	123.95	169.63
Post-Development w/ Detention	1.58	4.44	7.82	67.35

Conclusions

- The proposed pond will mitigate increases in peak runoff rates for storms up to the 25 year storm
- The proposed pond will provide water quality enhancements that exceed 80 % TSS removal
- The pond has been sized to mitigate water quantity/quality impacts from the Lot 16 development
- The discharge pipes are sized to allow the 100 year storm to flow to the Nashua River
- The proposed discharge to the Nashua River is located at the same location as previously proposed
- No additional impacts to the wetland areas or buffers are anticipated

Watershed No. 4 - Pond on Lot 12

Pre-developed Conditions

Area a15-1 (Netstal)

Existing Flow to Existing Pond on Lot 15

Routing Calculation Existing Pond on Lot 15

Combined hydrographs

for existing discharge

Areas a12-1, a13-2, a14-1

Routed a15-1

Post-developed Conditions

Direct Discharge to Pond

Area a12-1

Lot 16

Area a16-1 Existing Flow to Assumed Pond

Area a16-1 Proposed Flow to Assumed Pond

Area a16-1 Routed Flow through Assumed Pond

Roadway Drainage System

Areas a9, roads

Areas a14-1, a13-2

Pre-developed Conditions

Area a15-1 (Netstal)

Existing Flow to Existing Pond on Lot 15

Routing Calculation Existing Pond on Lot 15

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Netstal Lot 15 2 Yr.
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0062 mi2

Peak Time ..... 12.3000 hrs
Peak Flow ..... 0.3843 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a15-1		0.0062	56	0.0800	0.0000	3.0000

Support Data:

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Netstal Lot 15 10 Yr.
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0062 mi2

Peak Time ..... 12.2000 hrs
Peak Flow ..... 2.4933 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a15-1		0.0062	56	0.0800	0.0000	4.5000

Support Data:

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Netstal Lot 15 25Yr.
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0062 mi2

Peak Time ..... 12.2000 hrs
Peak Flow ..... 4.4500 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a15-1		0.0062	56	0.0800	0.0000	5.3000

Support Data:

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Netstal Lot 15 100 Yr.
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0062 mi2

Peak Time ..... 12.2000 hrs
Peak Flow ..... 7.7643 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a15-1		0.0062	56	0.0800	0.0000	6.7000

Support Data:

~~DEVELOPED~~ - POST-DEVELOPMENT

RAINFALL / Q ASSUMPTIONS
LOT 16
2yr STORM - 3.00"

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Lot 16 developed - 2 year
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0362 mi2

Peak Time ..... 12.4000 hrs
Peak Flow ..... 25.3700 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a16-1		0.0362	83	0.2900	0.0000	3.0000

Support Data:

Subarea Name: a16-1, Row: 1

POST DEVELOPMENT RAINFALL / Q ASSUMPTIONS
LOT 16
10 yr. SBUCM - 4.5"

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Lot 16 developed - 10 year
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0362 mi2

Peak Time ..... 12.4000 hrs
Peak Flow ..... 49.1355 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a16-1		0.0362	83	0.2900	0.0000	4.5000

Support Data:

Subarea Name: a16-1, Row: 1

POST DEVELOPMENT
RAINFALL / Q ASSUMPTION
25 YR 5014 2M - 5.3"

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Lot 16 developed
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0362 mi2

Peak Time ..... 12.4000 hrs
Peak Flow ..... 62.1371 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a16-1		0.0362	83	0.2900	0.0000	5.3000

Support Data:

POST. DEVELOPMENT
RAINFALL / Q ASSUMPTIONS
LOT 16
100 YR. STORM 6.7"

TR-55 Tabular Hydrograph Method
Input Summary

Description .....
Lot 16 developed - 100 year
Rainfall Distribution ..... Type III
Ia/P Interpolation ..... On
Total Area 0.0362 mi2

Peak Time ..... 12.4000 hrs
Peak Flow ..... 85.5457 cfs

Given Input Data:

Subarea Description	D/S Subareas	Area (mi2)	CN	Tc (hrs)	Tt (hrs)	Rainfall (in)
a16-1		0.0362	83	0.2900	0.0000	6.7000

Support Data:

Subarea Name: a16-1, Row: 1

Nashua River

Nashua River

PROP. 15" RCP DISCHARGE

POND AT HOSPITAL ROAD (FORMERLY POND ON LOT 12)

PROP. POND ON LOT 12

Area a12-1

Lot 12

PROP. LIMIT OF WATER SHED NO 4

PROP. SWALE

Area a12-2

WATERSHED 4

Lot 16
Area a16-1
a16.1

LIMIT OF SUB-WATERSHED (TYP.)

Area a14-1
14.1

Lot 15
Natural
Area a15-1
a15-1

Area a13

Lot 13

PROP. DISCHARGE TO EXIST. 36" PIPE

PROP. POND ON LOT 13

9
Lot 9
Area a9

FUTURE CUL-DE-SAC ROADWAY CONSTRUCTION

Area a15
915

9-14

a16

Area a16

Jackson Rd.

PROP. ROADWAY AREA

Lot 14
Area a14

Areas a4, a5-1, a5-2, a6

WATERSHED NO. 1

EXIST. LIMIT OF WETLANDS (TYP.)

WATERSHED 5

Patton Rd.

EXIST. LIMIT OF WATERSHED NO. 3

Lot 7
Area a7

WATERSHED NO. 5

FUTURE ROADWAY CONSTRUCTION

Area a3

Lot 6
Area a6

PROP. LIMIT OF WATERSHED NO. 5

Sherman Ave.

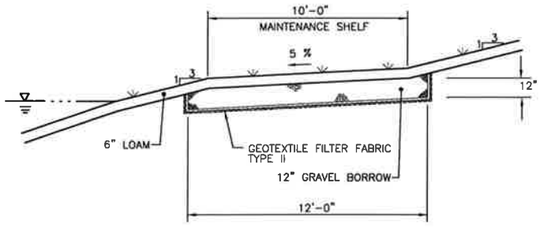
DRAWN BY

DEVENS ENTERPRISE COMMISSION

BETA Engineering, Inc.

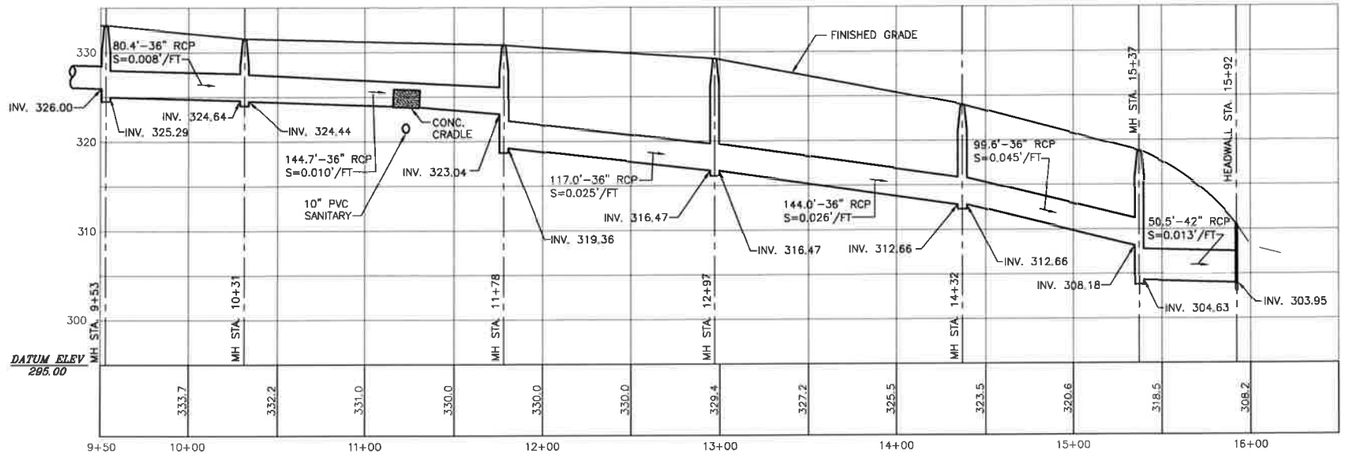
SCALE:

JOB



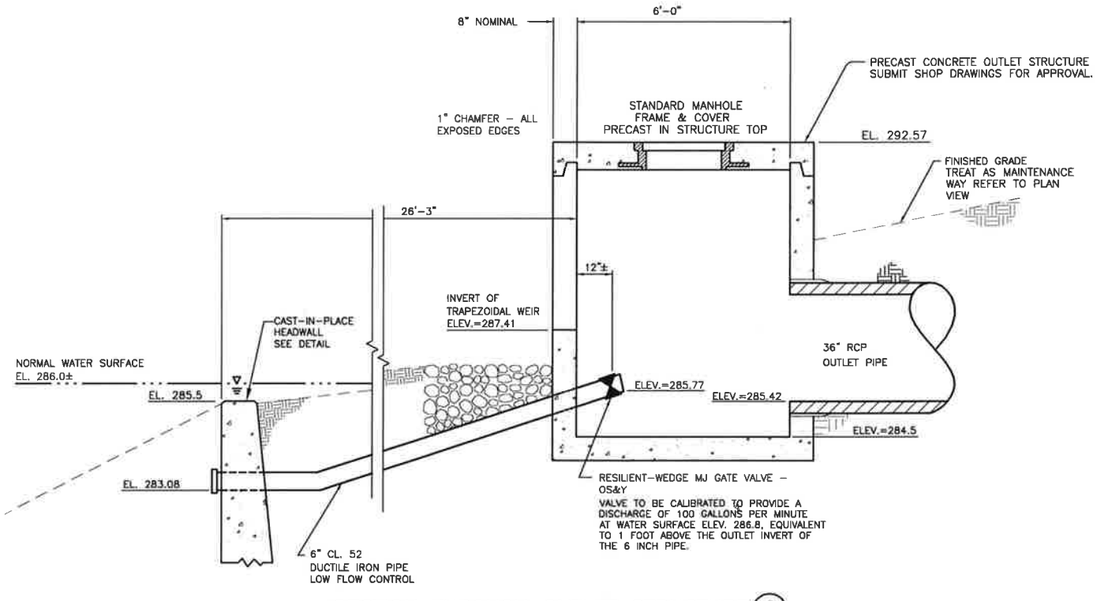
TYPICAL SECTION – MAINTENANCE WAY

NTS



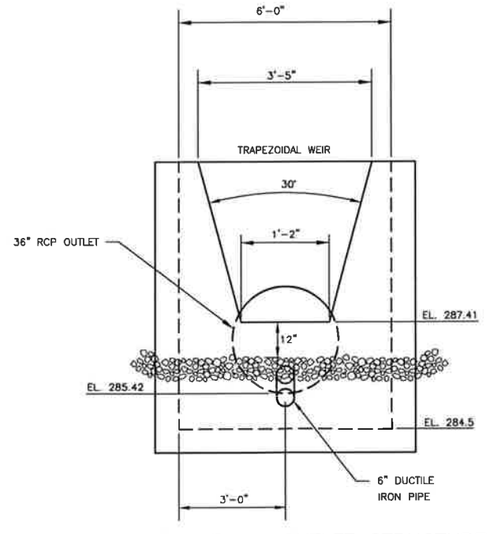
PROFILE

SCALE: HOR. 1"=40'
VERT. 1"=8'



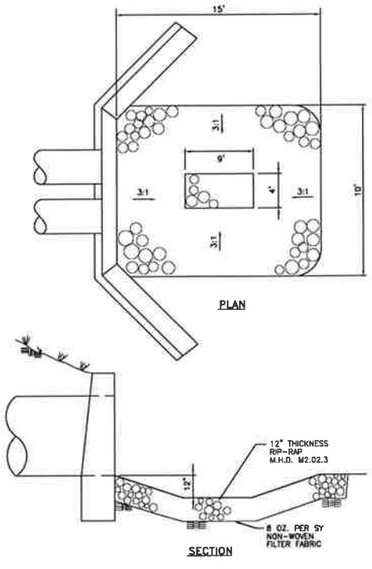
SECTION THROUGH OUTLET STRUCTURE (2)

1"=2'



ELEVATION VIEW – OUTLET STRUCTURE (2)

1"=2'



PLUNGE POOL DETAIL

NTS

DRAWN BY: MJZ

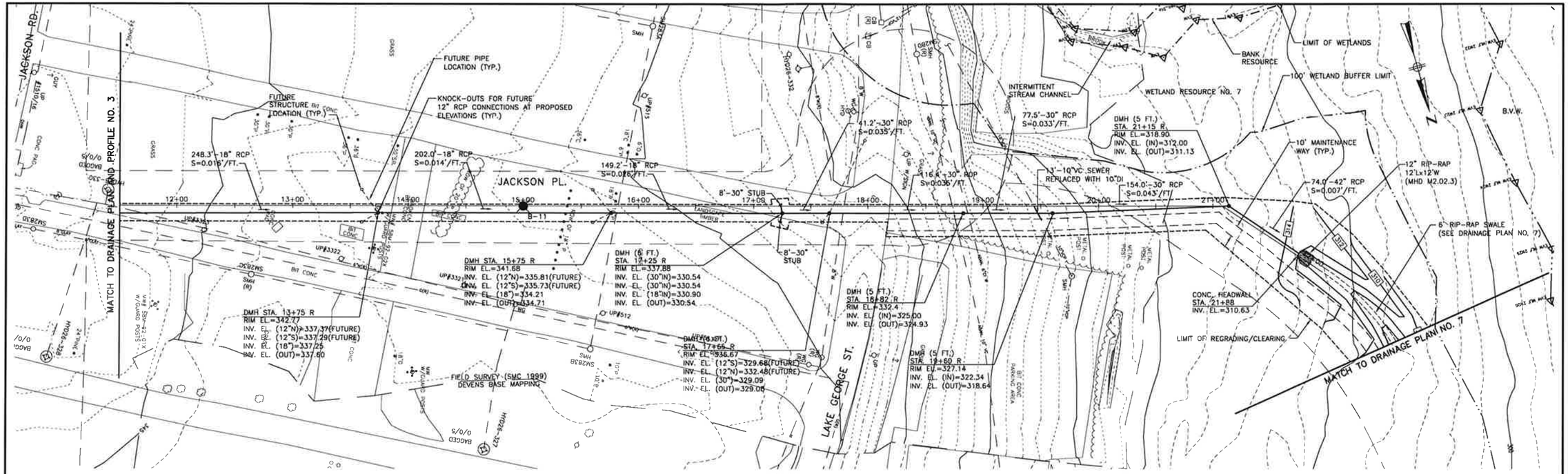
BETA Group, Inc.

315 Norwood Park South
Norwood, MA 02062
781.255.1982 fax: 781.255.1974

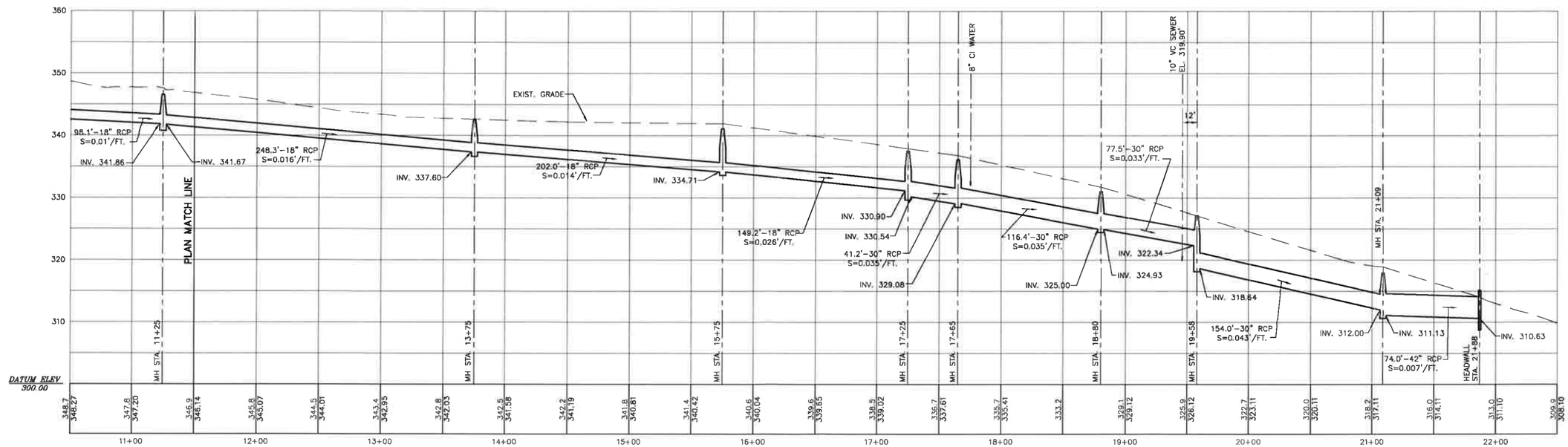
SCALE:

JACKSON ROAD RECONSTRUCTION
PHASE I - RECORD DRAWINGS

JOB 1117 As-Built



PLAN
SCALE: 1"=40'



PROFILE
SCALE: HORIZONTAL 1"= 40'
VERTICAL 1"=8'

NUMBER	DATE	MADE BY	CHECKED BY	DESCRIPTION
				REVISIONS

DRAWN BY: MJZ
DEPT. CHECK: KMA
PROJ. CHECK: MSV

BETA Group, Inc.
Engineers · Scientists · Planners
315 Norwood Park South
Norwood, MA 02062
781.255.1982 fax: 781.255.1974
Boston, MA · Lincoln, RI · New London, CT
email: BETA@BETAinc.com

BAYSTATE ENVIRONMENTAL CONSULTANTS INC.
286 North Main Street East Longmeadow, MA 01028

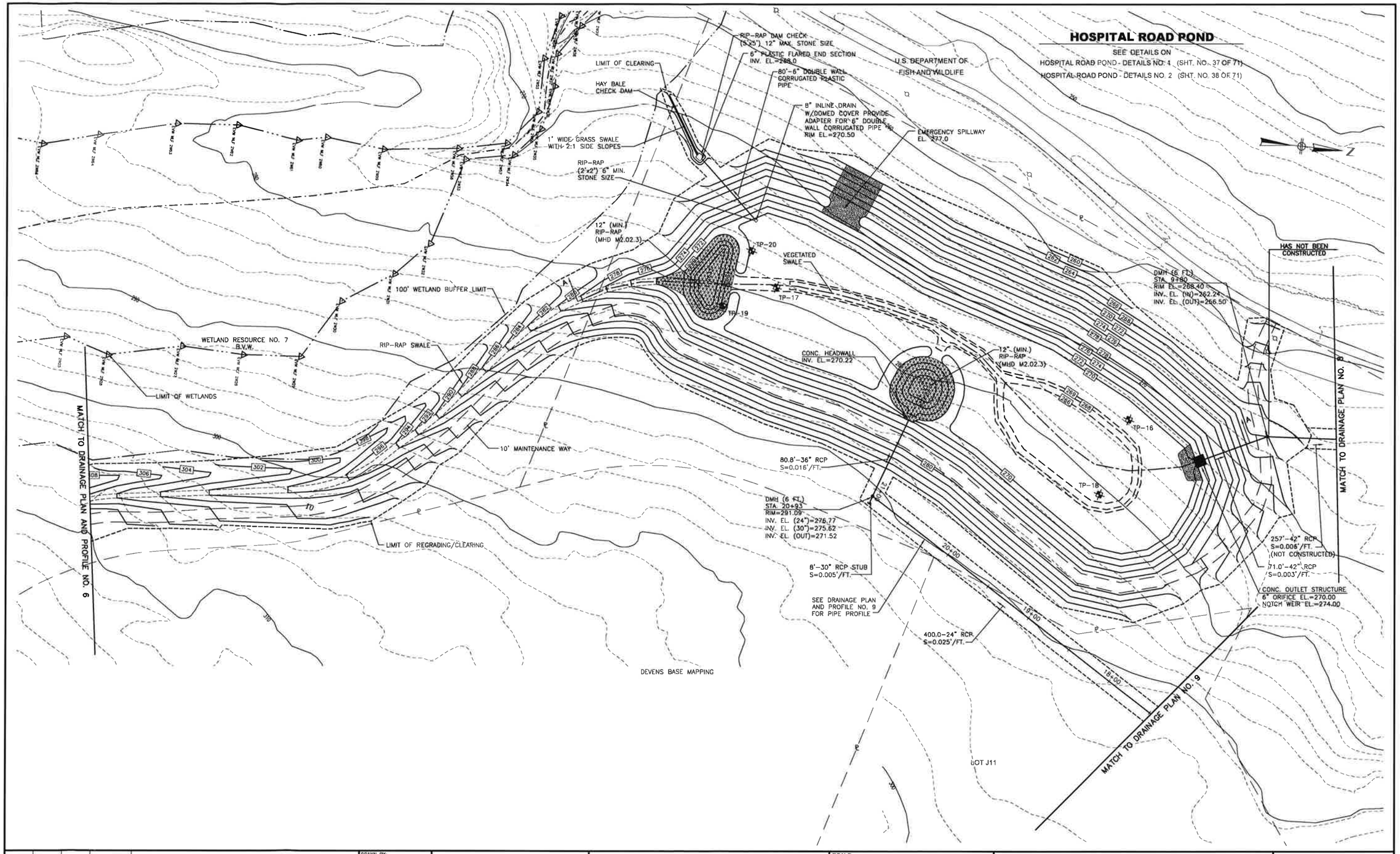
SCALE: AS SHOWN

JACKSON ROAD RECONSTRUCTION
PHASE I - RECORD DRAWINGS

DRAINAGE PLAN AND PROFILE NO. 6

DEVENS, MASSACHUSETTS
EDA PROJECT NO. 01-49-03798

JOB 1117 As-Built
FILE NO. DrnPlan06.dwg
PLOT DATE 6/02
SHEET 26 of 71



NUMBER	DATE	MADE BY	CHECKED BY	DESCRIPTION

REVISIONS

DRAWN BY: MJZ
DEPT. CHECK: KMA
PROJ. CHECK: MSV

BETA Group, Inc.
Engineers · Scientists · Planners
315 Norwood Park South
Norwood, MA 02062
781.255.1982 fax: 781.255.1974
Boston, MA · Lincoln, RI · New London, CT
email: BETA@BETA-inc.com

BAYSTATE ENVIRONMENTAL CONSULTANTS INC.
296 North Main Street East Longmeadow, MA 01028

SCALE: AS SHOWN

JACKSON ROAD RECONSTRUCTION
PHASE I - RECORD DRAWINGS

DRAINAGE PLAN NO. 7

DEVENS, MASSACHUSETTS
EDA PROJECT NO. 01-49-03798

JOB 1117 As-Built
FILE NO. DrnPlan07AB.dwg
PLOT DATE 6/02
SHEET 27 of 71

Hydrograph for Pond 6P: (80) CMP 42

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	327.50	0.00	0.00	0.00
2.50	0.02	0	327.50	0.02	0.02	0.00
5.00	0.07	0	327.50	0.07	0.07	0.00
7.50	0.13	0	327.50	0.13	0.13	0.00
10.00	**0.45**	0	327.50	0.45	**0.45**	0.00
12.50	**4.89**	**16,768**	**330.42**	**0.59**	**0.59**	**0.00**
15.00	1.34	**22,199**	**331.34**	**1.47**	0.59	**0.88**
17.50	0.84	21,014	331.11	0.95	0.59	0.36
20.00	0.56	19,954	330.93	0.69	0.59	0.10
22.50	0.29	18,177	330.64	0.59	0.59	0.00
25.00	0.03	14,379	330.06	0.59	0.59	0.00
27.50	0.00	9,127	329.28	0.59	0.59	0.00
30.00	0.00	3,807	328.43	0.59	0.59	0.00
32.50	0.00	0	327.50	0.00	0.00	0.00
35.00	0.00	0	327.50	0.00	0.00	0.00
37.50	0.00	0	327.50	0.00	0.00	0.00
40.00	0.00	0	327.50	0.00	0.00	0.00
42.50	0.00	0	327.50	0.00	0.00	0.00
45.00	0.00	0	327.50	0.00	0.00	0.00
47.50	0.00	0	327.50	0.00	0.00	0.00
50.00	0.00	0	327.50	0.00	0.00	0.00
52.50	0.00	0	327.50	0.00	0.00	0.00
55.00	0.00	0	327.50	0.00	0.00	0.00
57.50	0.00	0	327.50	0.00	0.00	0.00
60.00	0.00	0	327.50	0.00	0.00	0.00
62.50	0.00	0	327.50	0.00	0.00	0.00
65.00	0.00	0	327.50	0.00	0.00	0.00
67.50	0.00	0	327.50	0.00	0.00	0.00
70.00	0.00	0	327.50	0.00	0.00	0.00
72.50	0.00	0	327.50	0.00	0.00	0.00
75.00	0.00	0	327.50	0.00	0.00	0.00
77.50	0.00	0	327.50	0.00	0.00	0.00
80.00	0.00	0	327.50	0.00	0.00	0.00
82.50	0.00	0	327.50	0.00	0.00	0.00
85.00	0.00	0	327.50	0.00	0.00	0.00
87.50	0.00	0	327.50	0.00	0.00	0.00
90.00	0.00	0	327.50	0.00	0.00	0.00
92.50	0.00	0	327.50	0.00	0.00	0.00
95.00	0.00	0	327.50	0.00	0.00	0.00

Hydrograph for Pond 17P: (28) CMP 48"

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	331.00	0.00
2.50	0.04	118	331.09	0.02
5.00	0.08	243	331.18	0.07
7.50	0.13	339	331.25	0.12
10.00	**0.31**	**668**	**331.49**	**0.24**
12.50	**2.04**	**10,627**	**335.66**	**2.38**
15.00	0.41	8,548	334.63	0.76
17.50	0.20	4,903	333.26	0.61
20.00	0.14	1,839	332.07	0.40
22.50	0.11	440	331.32	0.17
25.00	0.00	142	331.10	0.03
27.50	0.00	53	331.04	0.00
30.00	0.00	32	331.02	0.00
32.50	0.00	23	331.02	0.00
35.00	0.00	18	331.01	0.00
37.50	0.00	15	331.01	0.00
40.00	0.00	13	331.01	0.00
42.50	0.00	11	331.01	0.00
45.00	0.00	10	331.01	0.00
47.50	0.00	9	331.01	0.00
50.00	0.00	8	331.01	0.00
52.50	0.00	7	331.01	0.00
55.00	0.00	6	331.00	0.00
57.50	0.00	6	331.00	0.00
60.00	0.00	6	331.00	0.00
62.50	0.00	5	331.00	0.00
65.00	0.00	5	331.00	0.00
67.50	0.00	5	331.00	0.00
70.00	0.00	4	331.00	0.00
72.50	0.00	4	331.00	0.00
75.00	0.00	4	331.00	0.00
77.50	0.00	4	331.00	0.00
80.00	0.00	4	331.00	0.00
82.50	0.00	3	331.00	0.00
85.00	0.00	3	331.00	0.00
87.50	0.00	3	331.00	0.00
90.00	0.00	3	331.00	0.00
92.50	0.00	3	331.00	0.00
95.00	0.00	3	331.00	0.00

APPENDIX C

Operation and Maintenance Plan

HIGHPOINT

CONSTRUCTION PHASE STORMWATER OPERATION AND MAINTENANCE PLAN

Proposed Biomanufacturing Building (Bldg#2)
39 Jackson Road
Devens, Massachusetts

Dated: May 6, 2021

I. OWNER:

King Devens, LLC
800 Boylston Street| Suite 1570
Boston, MA 02199

II. RESPONSIBLE PARTY:

King Devens, LLC
800 Boylston Street| Suite 1570
Boston, MA 02199

III. PROJECT OVERVIEW:

Prevention of offsite flooding and improvement to existing water quality of stormwater runoff generated on site are the main priorities of the project with respect to the drainage design. The project will improve stormwater management within the property with respect to what occurs today by installing Best Management Practices (BMPs) within the new stormwater collection system. Straw wattle erosion control barriers will be used to mitigate the runoff generated by the site improvements during construction, as well as periodic sweeping to remove sand and sediment.

It is the intent of the stormwater management design to achieve an 80% Total Suspended Solids (TSS) removal efficiency or 44% removal efficiency prior to infiltration to the maximum extent practicable for the redevelopment as outlined in the DEP Stormwater Management Standards.

The BMPs used in this design were chosen for their effectiveness and ease of maintenance. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality and infiltration of on-site stormwater runoff generated by the proposed improvements. This plan will be provided to the property owner and general contractor to educate them on the recommendations of this plan and the DEP Stormwater Management Guidelines.

IV. CONSTRUCTION PERIOD – BEST MANAGEMENT PRACTICES:

a) MONITORING

During construction operations, the stormwater management systems will be inspected at least once every seven (7) calendar days, or once every fourteen (14) calendar days and within twenty-four (24) hours after a storm event of one quarter inch (0.25") or greater. Sediment accumulation shall be removed once a depth of one-third the height of the erosion control device is achieved unless otherwise stated. Damaged erosion controls shall be replaced immediately.

b) WASTE DISPOSAL

Metal dumpster type waste disposal receptacles will be located on-site. The project site will be policed daily by a person appointed by the general contractor to be kept the project site free of construction debris.

c) DUST MONITORING PLAN

A dust monitoring plan will be established prior to the start of construction to be kept on site at all times. This will reduce the amount of particulates in the air and reduce impacts to the surrounding areas. Recommended methods for controlling dust include:

- Provide a vegetative cover to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Apply a mulch layer to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Cover stockpiles unused for a maximum of 7 days with poly sheeting or tarps.
- Water surface materials and soil stockpiles.
- Use covered trucks.
- Minimize spoils stockpiled on site.
- Monitor construction practices to minimize unnecessary disturbance and transfer of soil materials.
- Conduct periodic street cleaning along the site frontage during excavation and hauling of materials.
- Pave driveways and parking surfaces (where applicable and feasible).
- Assign a person to remove windblown debris daily.
- Limit the idling of engines or stopped vehicles (with the exception of asphalt and cement concrete mixing trucks and equipment) to five minutes.

d) SPILL PREVENTION AND RESPONSE

Construction activities for this project will necessitate the use of equipment fuels, engine fluids, paints, and adhesives on the construction site and must be considered in the spill prevention and response practices for the project.

The general contractor will ensure areas where potential pollutants can occur are well protected with erosion control barriers and clean up equipment to prevent discharge of waste water, fuels, and oil from vehicles and any other toxic or hazardous spills from the project site.

Should a spill occur, equipment necessary to attend to spills or leaks shall be stored on site in an equipment trailer and shall consist of the following:

- Safety goggles;
- Chemically resistant gloves and overshoe boots;
- Water and chemical fire extinguishers;
- Shovels;
- Absorbent materials;
- Containers suitable for storage of site specific materials; and
- First aid kits.

Spills and leaks shall be treated according to the type, volume, and location of the released material. Generally, mitigation shall consist of the following:

- Prevention of additional material storage;
- Containment of spilled material;
- Safe, thorough, and environmentally sound removal of spilled material; and
- Remediation of environmental damage.

The following describes specific preventative methods to be employed for materials to be used on site.

Fuels, Antifreeze, and Coolant for Construction Equipment and Generators:

In the case of a fuel spill on a pervious surface, the spill shall be contained and treated with absorbent polymer material immediately and the affected soil shall be excavated and stored in an impervious, bermed area for removal by a professional hazardous material removal company. In the case of a fuel spill on an impervious surface, the spill shall be contained to prevent runoff and treated with absorbent material.

Adhesive and Paints:

Adhesive and paint materials shall be transferred to the site on an as needed basis. Any containers to be stored on site shall be clearly labeled and stored in non-flammable lockers. Wash water from paints shall be containerized; washing of paints into the storm drainage system shall be prohibited. Water-based and latex paints shall either be recycled or dried up and thrown out with the regular household trash, and oil-based paints and thinners shall be removed from the site by a local professional hazardous material removal company.

Town of Stoughton Emergency Contacts are as Follows:

- Emergency Management: (888) 304-1133 (MassDEP 24-Hour Spill Reporting)
- Police Department: 911
- Fire Department: (978) 772-4600 (Devens Fire Department)

For spills of less than five (5) gallons of material, mitigation shall consist of source control, containment, and clean-up with absorbent materials, unless an imminent hazard necessitates that a local professional hazardous material removal company become involved to mitigate the spill.

For spills greater than five (5) gallons of material, the incident shall be reported immediately to the MassDEP Hazardous Waste Incident Response Group at (617)-792-7653 and a professional emergency response contractor. Information that shall be provided to the said contractor is as follows:

- Type of material spilled;
- Quantity of material spilled;
- Location of the spill; and
- Time of the spill.

The contractor shall then employ measures to prevent further spillage, contain and/or clean up the spill.

If a Reportable Quantity (RQ) of material is spilled during construction, the National Response Center (NRC) shall be notified immediately at (800) 424-8802. Reportable Quantities of hazardous material are available in 310 CMR 40: Massachusetts Contingency Plan Subpart P: Massachusetts Oil and Hazardous Material List. Within 14 days a report shall be submitted to the EPA New England Regional Office describing the following:

- Type of material released;
- Date and circumstances of the release; and
- Measures taken to prevent future releases.

The report shall be submitted to the EPA New England Regional Office at the following address:

EPA New England, Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Frequent inspections of areas where potential spill could occur is key to prevention. Inspection shall take place, at a minimum of once every calendar days or once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater or the occurrence of runoff from snowmelt sufficient to cause a discharge.

An inspection report must be completed within 24 hours of completing any site inspection. Each inspection report must include the following:

- The inspection date;
- Names and titles of personnel making the inspection;
- A summary of your inspection findings, covering at a minimum the observations you made in accordance with Part 4.6 of the 2017 Construction General Permit, including any necessary maintenance or corrective actions;
- If inspecting because of rainfall measuring 0.25 inches or greater, include the applicable rain gauge or weather station readings that triggered the inspection; and
- If determined that it is unsafe to inspect a portion of the site, describe the reason found to be unsafe and specify the locations to which the conditions apply.

e) STATE & LOCAL SANITARY LAWS

Portable sanitary units will be placed on-site during construction and will be serviced weekly.

V. CONSTRUCTION PERIOD - STRUCTURAL BEST MANAGEMENT PRACTICES

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance, promote longevity, and decrease operator maintenance costs. The structural BMPs selected for the proposed site development include straw wattle erosion control barrier, Siltsack® temporary catch basin inserts, construction entrance anti-tracking pad and temporary detention basin.

a) STRAW WATTLES

Straw wattles shall be installed as specified on the "Soil Erosion & Sedimentation Control/Site Preparation Plan", Sheet C300, dated November 5, 2020 prior to commencing construction activities. The straw wattles shall be inspected daily and maintained throughout construction. Sediment shall be removed before it has accumulated to one-half of the above ground height of the wattles. Any breach in the barrier shall be repaired within 24 hours. Wattles to remain in place for the duration of construction.

b) **SILTSACK® CATCH BASIN INSERTS**

SiltSack® catch basin inserts shall be placed under the grate of all existing/proposed catch basins prior to commencing construction activities. SiltSacks® shall remain in place until construction is complete and the site is stabilized. During construction all catch basins and SiltSacks® shall be inspected every fourteen (14) calendar days and after a storm of a quarter inch (0.25") or greater. Sediment accumulation shall be removed once a depth of six-inches (6") is accumulated in the sack. Damaged SiltSacks® shall be repaired/replaced immediately. Disposal of accumulated sediment and trash is to be in accordance with applicable local, state and federal guidelines and regulations.

c) **CONSTRUCTION ENTRANCE ANTI-TRACKING PAD**

Two (2) construction entrance anti-tracking pads will be installed as specified on the "Soil Erosion & Sedimentation Control/Site Preparation Plan", Sheet C300, dated November 5, 2020, to minimize the track-out of sediment onto streets and sidewalks from vehicles leaving the construction site. The sub-base for the pads will be compacted and covered with a filter cloth. Two-inch crushed stone will be placed on top of the filter cloth at a minimum thickness of 6-inches. The anti-tracking pads will remain in place and maintained until the parking lot receives an asphalt binder course.

Anti-tracking pads to be installed once the existing pavement is removed from the parking lot. Maintenance requirements include:

- Construction vehicles will be restricted to using only the designated entrance/exit armored with the tracking pad until the site has been stabilized with an asphalt binder course. The removed stone and sediment from the pad will be hauled off site and disposed in accordance with local, state and federal regulations.

- The exit will be maintained in a condition that will prevent tracking or flowing of sediment off-site. This could require additional crushed stone to be placed within the exits. Sediment shall be swept form the anti-tracking pads at least weekly, or more often if necessary. If excess sediment has clogged the pads, the exit will be top dressed with new crushed stone. Replacement of entire pad may be necessary when it becomes completely filled with sediment. The pad will be reshaped as needed for drainage and runoff control.

- Where sediment has been tracked-out from the site, the deposited sediment shall be removed by the end of the same work day. Sediment must be removed by sweeping, shoveling, or vacuuming of these surfaces. Hosing or sweeping tracked-out sediment into a public or private stormwater system is prohibited.

- The exit will be inspected once every seven (7) calendar days and within 24-hours of storm events of 0.25 inches or greater, or the occurrence of runoff from snowmelt

sufficient to cause a discharge.

d) **TEMPORARY SEDIMENT BASIN**

The proposed detention basin shall be created during the early stages of construction and utilized as a temporary sediment basin to control runoff during construction. The limits of the basin shall be staked with temporary construction fence to prevent construction vehicles and equipment from entering the area.

At the end of construction, accumulated sediment and debris should be removed from the basin. The basin shall be regraded to provide the volume required per the stormwater management design then seeded to promote stabilization.

e) **UNDERGROUND INFILTRATION/DETENTION SYSTEM**

Two (2) underground infiltration systems of 42" - 48" round CMP (corrugated metal pipe) are proposed to provide detention volume for landscape, hardscape, and roof runoff for the development. The locations of the four systems can be found on the "Grading & Drainage Plan", Sheet C500, dated May 6, 2021. The infiltration systems are sized to provide groundwater recharge volume to the maximum extent practicable for all storm events up to and including the 100-year storm event and is designed to drain completely within 72 hours. Inspection ports with at-grade access will be installed to provide inspection and maintenance access to the chambers and stone bed.

It is anticipated that maintenance of the infiltration systems will be limited. Post-construction, the system shall be inspected twice per year, at the beginning of July and late October/ early November, to determine if any loss of capacity has occurred. The system shall also be inspected 24 hours after a rainstorm of over 2.5 inches in a 24-hour period to ensure that the system is free of extraneous debris and fines and is draining adequately. If inspections indicate accumulation of sediment within the system, cleaning shall be conducted through the inspection ports via vacuum truck. Removed materials shall be hauled off site and disposed of in compliance with all local, state, and federal guidelines.

END

HIGHPOINT

LONG-TERM STORMWATER OPERATION AND MAINTENANCE PLAN

Proposed Biomanufacturing Building (Bldg#2)
39 Jackson Road
Devens, Massachusetts

Dated: May 6, 2021

I. OWNER:

King Devens, LLC
800 Boylston Street| Suite 1570
Boston, MA 02199

II. RESPONSIBLE PARTY:

King Devens, LLC
800 Boylston Street| Suite 1570
Boston, MA 02199

III. PROJECT OVERVIEW:

Prevention of offsite flooding and improvement to existing water quality of stormwater runoff generated are the main priorities of the project with respect to the drainage design. The project will improve stormwater management within the property with respect to what occurs today by installing Best Management Practices (BMPs) within the new stormwater collection system. Long-term water quality BMPs to mitigate the runoff generated by the site improvements include, deep sump hooded catch basins, underground infiltration, bioretention areas, and periodic sweeping to remove sand and sediment from paved surfaces.

The intent of the stormwater management design is to improve existing conditions to the maximum extent practicable for the redevelopment as defined in the DEP Stormwater Management Standards.

The BMPs used in this design were chosen for their effectiveness and ease of maintenance with respect to developed site conditions. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality and peak attenuation, of on-site stormwater runoff generated by the proposed improvements. This plan will be provided to the property owner to educate them on the recommendations of this plan and the DEP Stormwater Management Guidelines.

IV. POST CONSTRUCTION - BEST MANAGEMENT PRACTICES:

a) NON-STRUCTURAL BEST MANAGEMENT PRACTICES

Implementing source controls can aid in reducing the types and concentrations of contaminants in stormwater runoff. This principle for pollution prevention and non-structural controls, or BMPs, is to minimize the volume of runoff and to minimize contact of stormwater with potential pollutants. Measures such as, managing snow removal, and educating the owner of good maintenance practices are examples of non-structural BMPs.

i. PUBLIC AWARENESS

The responsible party shall avoid dumping or releasing pollutants into the storm drains and onto the ground.

ii. STREET SWEEPING

Driveway and parking lot sweeping is an integral part of the storm water management plan as a fundamental component of source reduction efforts. Typically, parking lot and roadway sweeping activities will begin around April 1. However, sweeping may be done after of winter thaw and the onset of early spring. It is critical to remove the accumulated sediment in the parking areas from the winter months as soon as possible before heavy and frequent spring precipitation.

Parking lot sweeping should be performed a minimum of two times annually (April 1 and September 1).

iii. SNOW AND SNOWMELT MANAGEMENT

The removal contractor shall avoid stockpiling snow directly on top of the catch basin grates. In the paved parking area stockpiled snow shall not extend more than 2 feet from the edge of pavement to allow normal vehicular maneuverability.

It is suggested that during snowfall events, the snow be stockpiled in the designated landscape area to the north of the parking lot. It is the responsibility of the owner to make sure the snow removal contractor utilizes previously approved areas. The owner shall remove sediment from snow storage areas every spring.

It is suggested that no de-icing compounds such as calcium chloride ($CaCl_2$), calcium magnesium acetate (CMA) or the like be used on the site. The snow removal contractor shall store all sand off-site. No quantities of sand compounds shall be stored on site.

iv. PUBLIC SAFETY FEATURES

The project has been designed with consideration for public safety and does not require any specific features as part of the stormwater management system.

b) STRUCTURAL BEST MANAGEMENT PRACTICES:

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance and promote longevity of the structure and may decrease operator maintenance costs.

i. DEEP SUMP HOODED CATCH BASINS

All proposed catch basins are to be a minimum of four feet in diameter and equipped with four-foot deep sumps to trap sediments and any debris/trash. The pipe outlets shall be hooded to prevent floating debris and oils from entering the subsurface drainage conveyance system. The actual removal of sediments, trash, and associated pollutants only occurs when the deep sumps are cleaned out; therefore, frequent maintenance is required. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future storms and enhances overall performance.

The recommended inspection frequency of the deep sumps is every three months, and cleaning two to three times per year, if necessary, post-construction. Disposal of accumulated sediment and trash is to be in accordance with applicable local, state and federal guidelines and regulations.

ii. UNDERGROUND INFILTRATION/DETENTION SYSTEM

Two (2) underground infiltration/detention systems of 42" - 48" round CMP (corrugated metal pipe) are proposed to provide detention volume for landscape, hardscape, and roof runoff for the development. The locations of the four systems can be found on the "Grading & Drainage Plan", Sheet C500, dated May 6, 2021. The infiltration systems are sized to provide groundwater recharge volume to the maximum extent practicable for all storm events up to and including the 100-year storm event and is designed to drain completely within 72 hours. Inspection ports with at-grade access will be installed to provide inspection and maintenance access to the chambers and stone bed.

It is anticipated that maintenance of the infiltration systems will be limited. Post-construction, the system shall be inspected twice per year, at the beginning of July and late October/ early November, to determine if any loss of capacity has occurred. The system shall also be inspected 24 hours after a rainstorm of over 2.5 inches in a 24-hour period to ensure that the system is free of extraneous debris and fines and is draining adequately. If inspections indicate accumulation of sediment within the system, cleaning shall be conducted through the inspection ports via vacuum truck. Removed materials shall be hauled off site and disposed of in compliance with all local, state, and federal guidelines.

iii. RAIN GARDENS

The rain gardens shall be inspected regularly when first created to ensure proper establishment of the plants. Once the plants are established, the bioretention maintenance schedule is as follows:

- The bioretention area shall be inspected monthly, year-round. Repair eroded soils and remove liter and debris during this time.
- The mulch layer shall be inspected annually in the spring and replaced, at a minimum, every two years.
- Remove invasive species as needed to prevent these species from spreading into the bioretention area.
- Remove dead vegetation annually in the fall or spring. Replace dead vegetation annually in the spring.
- Prune established vegetation annually in the fall or spring.
- Replace entire media and all vegetation as necessary in the late spring/early summer.

Refer to the Massachusetts Stormwater Handbook, Volume 2, Chapter 2, Bioretention Areas & Rain Gardens for additional detail.

iv. CONTECH CDS® WATER QUALITY UNITS

Contech CDS© water quality units are proposed to prevent sediments and oils from entering the underground infiltration/detention basin & detention basin and being released off-site. The actual removal of sediments, trash, and associated pollutants only occurs when the structures are cleaned out; therefore, frequent maintenance is required. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future storms and enhances overall performance. Contech CDS structures are an approved means of BMP for storm water management. See the TSS Removal Calculation Worksheet included in the Appendix C for the specific TSS removal rate of the Contech CDS© units for the project.

Post-construction, the units shall be inspected every six months for the first year of operation to determine the oil and sediment accumulation rate. After the first year, inspections can be based on the first-year observations or local requirements. Cleaning, by full pump out, is recommended on an annual basis or when 15% of the unit unit's storage capacity is filled with solids, if sooner. Inspect the unit immediately after an oil, fuel or chemical spill. Maintenance is performed by conventional vacuum truck. Disposal of accumulated sediment, trash, and hydrocarbons shall be in accordance with applicable local, state, and federal guidelines and regulations. Refer to attached manufacturers "inspection and maintenance guide" for more information.

End.

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date 05.06.2021

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- [x] New development
- [ ] Redevelopment
- [ ] Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☐ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.