

**DRAINAGE CALCULATIONS AND
STORMWATER MANAGEMENT PLAN**

For:

**WELLESLEY SQUARE RESIDENCES
WELLESLEY, MA**

Located:

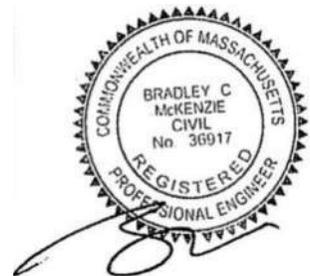
**DELANSON CIRCLE
WELLESLEY, MASSACHUSETTS**

Submitted to:

TOWN OF WELLESLEY

Prepared For:

**DELANSON REALTY PARTNERS, LLC
20 WOODWARD STREET
NEWTON, MASSACHUSETTS 02461**



**Professional Civil Engineering • Project Management • Land Planning
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061
Tel.: (781) 792-3900 Facsimile: (781) 792-0333
www.mckeng.com**

**February 21, 2020
Revised July 10, 2020
Revised August 12, 2020**

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**Drainage Calculations and Stormwater Management Plan
Municipal Systems Analysis
Wellesley Square Residences
Wellesley, Massachusetts**

Project Summary

The project proponent, Delanson Realty Partners, LLC, proposes to redevelop a 1.42-acre parcel of land located at Delanson Circle in Wellesley, Massachusetts. The proposed redevelopment will consist of 35 multi-family residential units and 4 existing multi-family residential units at 12-18 Hollis Street. The proposed development will involve the construction of a three (3) story plus one (1) basement level parking building, sidewalks, roof-top courtyard, retaining walls, access drive, stormwater management systems, utilities and other related infrastructure.

The project is comprised of seven (7) parcels which are shown on Assessors' Map 123 as Lots 9-14. The site is bounded by Hollis Street to the northeast, Linden Street to the southeast and developed residential property to the north and west as shown on Figure 1 - USGS Locus Map.

The project will access the existing utility infrastructure located on Linden Street, including sanitary sewer, water, gas, electric, telephone, and cable television. The stormwater management system will be designed to fully comply with all standards of the Department of Environment Protection's Stormwater Management Regulations and will utilize an existing closed drainage system on Linden Street as an overflow connection.

The existing and proposed site conditions are illustrated on the project *site plans* entitled "Wellesley Square Residences, Delanson Circle", prepared by McKenzie Engineering Group, Inc. dated February 21, 2020, and revised August 12, 2020.

This report contains stormwater runoff calculations for the pre-development and post-development conditions and includes the sizing of the proposed low impact drainage system and stormwater best management practices (BMPs). All stormwater management facilities will be designed to mitigate peak rates of runoff, provide renovation of stormwater and meet the requirements of the DEP's Stormwater Management Regulations.

Pre-Development Condition

The property is located within the Residential Incentive Overlay Zoning District. The majority of the 1.42 acre-development area consists of the Delanson Circle cul-de-sac, five (5) single family homes, bituminous roadway and driveways, retaining walls, concrete walkways and associated landscaping. Currently, the site is comprised of approximately 22% impervious surfaces. The existing homes have either direct access to Delanson Circle or Hollis Street.

The existing topography generally ranges in elevation from approximately 200 ft. (Wellesley Vertical Datum) in the northwest portion of the site to an elevation of approximately 157 ft. (Wellesley Vertical Datum) in the southeast portion of the site. The parcel slopes in a southerly direction from its northern boundary towards Linden Street and an easterly direction towards Hollis Street.

Review of available environmental databases such as MassGIS reveals that the site is not located within a mapped Natural Heritage Area, a Zone II Groundwater Recharge Area, the Town of Wellesley Aquifer Protection District Zone, an Interim Wellhead Protection Area (IWPA), or a Contributing Watershed to Outstanding Resource Water (ORW).

The site is located within Zone X, Area of Minimal Flooding as shown on FEMA Flood Insurance Rate Map Panel No. 25021C0016E with an effective date of July 17, 2012. Refer to Figure 2 – FEMA Flood Map.

The Natural Resources Conservation Service (NRCS) has identified the soil on the site as 602, Urban land, 0 to 15% slopes and does not further categorize the soil in terms of permeability or presence of groundwater, and 630C, Charlton-Hollis-Urban land complex, 3 to 15% slopes with hydrologic soil group (HSG) B C/D. Refer to Figure 3 - NRCS Soils Map.

The existing watershed analyzed in this report is comprised of approximately 3.1 acres which includes the subject parcel and offsite tributary areas to the north and west. The watershed consists of two sub-catchment areas and three design points Linden Street, Hollis Street and the closed drainage system within Linden Street. Refer to the Pre-Development Watershed Plan WS-1 in Appendix A for a delineation of drainage subcatchments for the pre-development design condition.

The SCS Technical Release 20 (TR-20) and Technical Release 55 (TR-55) method-based program “HydroCAD” was employed to develop pre- and post-development peak flows. Drainage calculations were prepared for the pre-development condition for the 2, 10, 25 and 100-year, Type III storm events. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations for all subareas.

Post-Development Condition

Wellesley Square residences is proposed as a 35-unit redevelopment with 4 existing multi-family residential units at 12-18 Hollis Street and will consist of the construction of a three (3) story plus one (1) basement level parking building, sidewalks, roof-top courtyard, retaining walls, access drive, stormwater management systems, utilities and other related infrastructure.

The project will access the existing utility infrastructure located on Linden Street, including sanitary sewer, water, gas, electric, telephone, and cable television. The stormwater management system and will be designed to fully comply with all standards of the Department of Environment Protection’s Stormwater Management Regulations and will utilize an existing closed drainage system on Linden Street.

Watershed areas were analyzed in the post-development condition to design low impact stormwater management facilities to mitigate impacts resulting from redeveloping the property. The objective in designing the proposed drainage facilities for the project was to maintain existing drainage patterns to the extent practicable and to ensure that the post-development rates of runoff are less than pre-development rates at the design point. Refer to the Post-Development Watershed Plan WS-2 in Appendix B for a delineation of post-development drainage subareas. The design point for the post-development design conditions correspond to those analyzed for the pre-development design condition.

Parking areas will be contained within the building and will drain to oil/sediment traps prior to discharge into the municipal sewer system, as required. The site will be

designed to comply with the Stormwater Management Regulations to the extent practicable as required under Standards 6 and 7 for a redevelopment project.

Refer to site plans for the drainage system design. All BMPs shall be supported by a comprehensive Construction Phase Pollution Prevention and Erosion Control Plan and Post-Development BMP Operation and Maintenance Plan.

Stormwater Detention and Infiltration Facilities

The proposed stormwater management basin and subsurface infiltration systems were designed to attenuate peak flows generated by all storm events to ensure that post-development peak flows generated by all storm events are less than pre-development flows at the design points and allow for recharge to groundwater. The proposed facilities were analyzed using the Soil Conservation Service (now Natural Resources Conservation Service) Technical Release 20 (TR-20) based computer program, "HydroCAD". The outlet control structures will consist of an outlet structure with an orifice, v-notch or rectangular sharp crested weir to provide 24-hour detention and attenuate the net increase in peak flows. Refer to Appendix B for the HydroCAD computer results for the storage characteristics of the stormwater management facilities.

Stormwater Best Management Practices (BMP's)

The stormwater management system was designed to be in full compliance with the DEP Stormwater Management Policy. A treatment stream consisting of deep-sump catch basins with hooded outlets, proprietary pre-treatment structures and subsurface infiltration chambers (P-1 and P-2) will be employed in the design of drainage facilities for the project to achieve the required removal of 80% total suspended solids. The proposed treatment streams will renovate the stormwater and improve the water quality by promoting the settlement of sediments and pollutants before runoff is released into the existing closed drainage system within Linden Street. Refer to the TSS Removal Worksheets in Appendix D for TSS removal rates.

Erosion and Siltation Control

Silt sock erosion control barriers will be placed where indicated on the plans prior to the commencement of any construction activity. The integrity of the silt sock erosion control barrier will be maintained by periodic inspection and replacement as necessary. The silt sock erosion control barrier will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established. Operation and Maintenance Plans including pollution prevention and erosion and sedimentation controls will be prepared in conjunction with the final construction plans as required by the DEP Stormwater Management Regulations and NPDES.

Compliance with Stormwater Management Standards

Standard 1 – No New Untreated Discharges

The site development is designed so that new stormwater conveyances do not discharge untreated pavement runoff into, or cause erosion to, wetlands.

Standard 2 – Peak Rate Attenuation

In the pre-development and post-development stormwater analysis, the watershed area analyzed was approximately 3.1 acres consisting of the subject parcel to be developed

and offsite tributary areas. Refer to Existing Watershed Delineation Plan WS-1 for a delineation of drainage subareas for the pre-development design condition and refer to Post-Development Watershed Delineation Plan WS-2 for a delineation of drainage subareas for the post-development design condition. The impervious area for post-development conditions vs existing conditions is as follows:

Existing vs Proposed Impervious Surfaces

	<u>Existing Conditions</u>	<u>Proposed Conditions</u>
Impervious Area	29,412 SF	46,690 SF
Increase		+17,278 SF

Impervious areas- roofs, pavement, sidewalks, walls, gravel, pavers

Drainage calculations were performed by employing SCS TR-20 methods for the 2, 10, 25, and 100-year Type III storm events. Refer to Appendix A and B for computer results. The stormwater management systems were designed to accommodate peak flows generated by a 100-year storm event.

The peak rates of runoff are as follows:

Pre-Development vs. Post-Development Peak Rates of Runoff

Design Point	<u>2 Year Storm (3.20 Inches)</u>		<u>10 Year Storm (4.70 Inches)</u>		<u>25 Year Storm (5.50 Inches)</u>		<u>100 Year Storm (6.70 Inches)</u>	
	Exist. (CFS)	Prop. (CFS)	Exist. (CFS)	Prop. (CFS)	Exist. (CFS)	Prop. (CFS)	Exist. (CFS)	Prop. (CFS)
Design Point 1 Linden Street	2.63	0.47	4.81	0.93	6.01	1.19	7.82	1.59
Design Point 2 Hollis Street	2.76	1.59	5.05	2.89	6.31	3.61	8.21	4.68
Design Point 3 Closed Drainage System	5.39	5.12	9.86	9.60	12.31	11.94	16.03	15.24

A comparison of the pre-development and post-development peak rates of runoff indicates that the peak rates of runoff for the post-development condition will be equal or less than the pre-development condition for all storm events.

Pre-Development vs. Post-Development Volume in ac-ft

Design Point	<u>2 Year Storm (3.20 Inches)</u>		<u>10 Year Storm (4.70 Inches)</u>		<u>25 Year Storm (5.50 Inches)</u>		<u>100 Year Storm (6.70 Inches)</u>	
	Exist. (ac-ft)	Prop. (ac-ft)	Exist. (ac-ft)	Prop. (ac-ft)	Exist. (ac-ft)	Prop. (ac-ft)	Exist. (ac-ft)	Prop. (ac-ft)
Design Point 1 Linden Street	0.191	0.034	0.349	0.066	0.439	0.085	0.576	0.113
Design Point 2 Hollis Street	0.201	0.113	0.367	0.206	0.460	0.258	0.605	0.338
Design Point 3 Closed Drainage System	0.392	0.320	0.716	0.637	0.899	0.816	1.181	1.092

Standard 3 – Groundwater Recharge

Runoff will be infiltrated by three subsurface infiltration systems (P-1 and P-2), which will meet the Stormwater Guidelines for infiltration:

- Infiltration structures will be a minimum of two feet above seasonal high groundwater.
- Utilize the “static” method for sizing the storage volume.
- Refer to Appendix D for supplemental BMP calculations and Appendix F for soil testing support data.

Groundwater Recharge Volume

Infiltration Basin	Soil Type	Target Depth Factor (F) (in)	Total Impervious Area (ac)	Required Recharge Volume (cf) ¹	Provided Recharge Volume (cf) ²
	C	0.25	1.07	973	
P-1 (Subsurface Chambers)					1,038
P-2 (Subsurface Chambers)					614
				973	1,268 ADJ
					1,652

1. Required Recharge Volume = Target Depth Factor x Impervious Area / (d+Kt)
2. Provided Recharge Volume = Volume Provided from Bottom of System to lowest outlet invert.

Per Standard 3, if stormwater runoff from less than 100%, but greater than 65% of the sites’ impervious cover is directed to the BMP intended to infiltrate the Required Recharge Volume, the storage capacity of the infiltration BMP needs to be increased so that the BMP can capture more of the runoff from the impervious surfaces located within the contributing drainage area. Refer to Appendix D for Capture Area Adjustment calculations.

The infiltration tank system will provide both water quality treatment and recharge. Per Standard 4, Water Quality, the BMP must be sized to treat or hold the Target Volume, the larger of the Required Water Quality Volume and the Required Recharge Volume. The Required Water Quality Volume is based on half-inch of runoff and the Required Recharge Volume is based on 0.25-inches (Soil Type C); half-inch is greater than 0.25 inches, therefore the Target Volume is the Required Water Quality Volume of 1,360 cubic feet. Refer to Appendix D supplemental calculations.

The infiltration tank systems have been designed to completely drain within 72 hours. The drawdown analysis is based on the required recharge volume exfiltrating at the Rawls Rates based on the soil textural analysis conducted at the proposed exfiltration location. Refer to Appendix D for calculations.

Standard 4 – Water Quality

The Long-Term Pollution Prevention Plan has been incorporated into the Post-Development Operation and Maintenance Plan. Refer to Appendix D for BMP Operation and Maintenance Plans.

The total required water quality treatment volume was calculated to be 1,360 cubic feet, based half-inch of runoff. The water quality treatment volume will be provided within the storm water management facilities as follows:

Water Quality Treatment Volume

Basin	Required WQ Volume (cf)	Proposed WQ Volume (cf)	
P-1	1,011	1,038	Subsurface infiltration system with pre-treatment
P-2	349	614	Subsurface infiltration system with pre-treatment
	1,360	1,652	

The water quality volume for the site redevelopment is pre-treated by proprietary treatment units – Fabco Stormsafe treatment units. MassDEP has adopted a standard method to convert required water quality volume to a discharge rate for sizing flow based on manufactured proprietary stormwater treatment practices. The half-inch rule has been applied to the water quality flow rate calculations. Refer to Appendix C for supporting calculations. The water quality treatment flow rate is provided within the storm water management facilities is as follows:

Water Quality Treatment Volume

First Defense Unit	Required WQ Flow Rate (cfs)	Proposed WQ Flow Rate (cfs)
Fabco Stormsafe 8 FT Dia Manhole (DMH 4)	0.112	2.64
Fabco Stormsafe 8 FT Dia Manhole (DMH 5)	0.125	2.64
Fabco Stormsafe 8 FT Dia Manhole (DMH 7)	0.011	2.64
Fabco Stormsafe 6 FT Dia Manhole (DMH 12)	0.116	2.64

The stormwater management system was designed to be in full compliance with the DEP Stormwater Management Policy. A treatment stream consisting of deep-sump catch basins with hooded outlets to a subsurface infiltration chamber system or Fabco Stormsafe pre-treatment units will be employed in the design of the drainage facilities for the project to achieve the required removal of 80% total suspended solids to the

maximum extent practicable. The proposed treatment streams will renovate the stormwater and improve the water quality by promoting the settlement of sediments and pollutants. Refer to the TSS Removal Worksheets for TSS removal rates and sizing calculations for treatment unit water quality flow rates in Appendix D.

The Town of Wellesley has developed a Phosphorus Control Plan as part of the EPA MS4 Permit to remove a certain percentage of Phosphorus from stormwater runoff. The Fabco Stormsafe pre-treatment units will achieve a Phosphorous load reduction of 50%. Refer to Appendix D.

Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPL)

The proposed project does not include land uses with higher potential pollutant loads. Not Applicable.

Standard 6 – Critical Areas

The proposed project does not discharge to any critical areas. Not Applicable.

Standard 7 - Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

The proposed project is considered a redevelopment project and as such meets the Stormwater Management Standards to the maximum extent practicable.

Standard 8 – Construction Period Pollution Prevention and Erosion and Sedimentation Control

The project will require a NPDES Construction General Permit but the Stormwater Pollution Prevention Plan (SWPPP) has not been submitted. The SWPPP will be submitted prior to any proposed construction. A Construction Phase BMP Operation and Maintenance Plan will be provided as a basis for the SWPPP during final design.

Standard 9 – Operation and Maintenance Plan

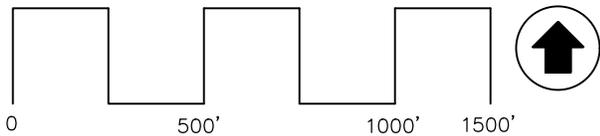
The Long-Term Operation and Maintenance Plan is provided in Appendix E.

Standard 10 – Prohibition of Illicit Discharges

No illicit discharges are anticipated on site. An Illicit Discharge Compliance Statement will be submitted prior to the discharge of any stormwater to the post-construction best management practices. Measures to prevent illicit discharges will be included in the Long-Term Pollution Prevention Plan.



FIGURE - 1



U.S. GEOLOGICAL SURVEY
7.5 X 15 MINUTE SERIES

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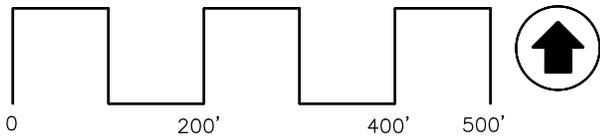
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PHONE: (781) 792-3900
FACSIMILE: (781) 792-0333
WWW.MCKENG.COM

USGS LOCUS MAP

DELANSON CIRCLE
MAP 123, LOTS 9-13
WELLESLEY, MASSACHUSETTS



FIGURE - 2



COMMUNITY PANEL NO: 25021C0016E
EFFECTIVE DATE: JULY 17, 2012

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FEMA FLOOD MAP

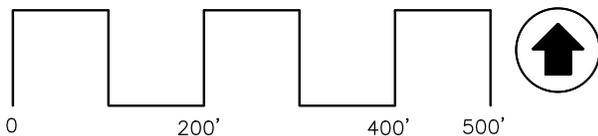
DELANSON CIRCLE
MAP 123, LOTS 9-13
WELLESLEY, MASSACHUSETTS



SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
602	URBAN LAND COMPLEX, 0-15 PERCENT SLOPES	
630C	CHARLTON-HOLLIS-URBAN LAND COMPLEX, 3-15 PERCENT SLOPES	B C/D

FIGURE - 3



NRCS SOIL SURVEY
NORFOLK & SUFFOLK COUNTY

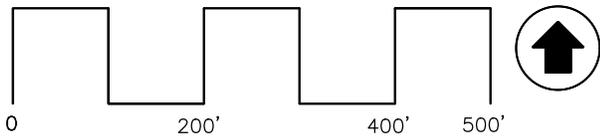


150 LONGWATER DRIVE, SUITE 101
NORWELL, MASSACHUSETTS 02061
PHONE: (781) 792-3900
FACSIMILE: (781) 792-0333
WWW.MCKENG.COM

NRCS SOILS MAP
DELANSON CIRCLE
MAP 123, LOTS 9-13
WELLESLEY, MASSACHUSETTS



FIGURE - 4



14TH EDITION MASSACHUSETTS
NATURAL HERITAGE ATLAS

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**NATURAL HERITAGE &
ENDANGERED SPECIES MAP**
DELANSON CIRCLE
MAP 123, LOTS 9-13
WELLESLEY, MASSACHUSETTS

A P P E N D I X A

Pre-Development Condition

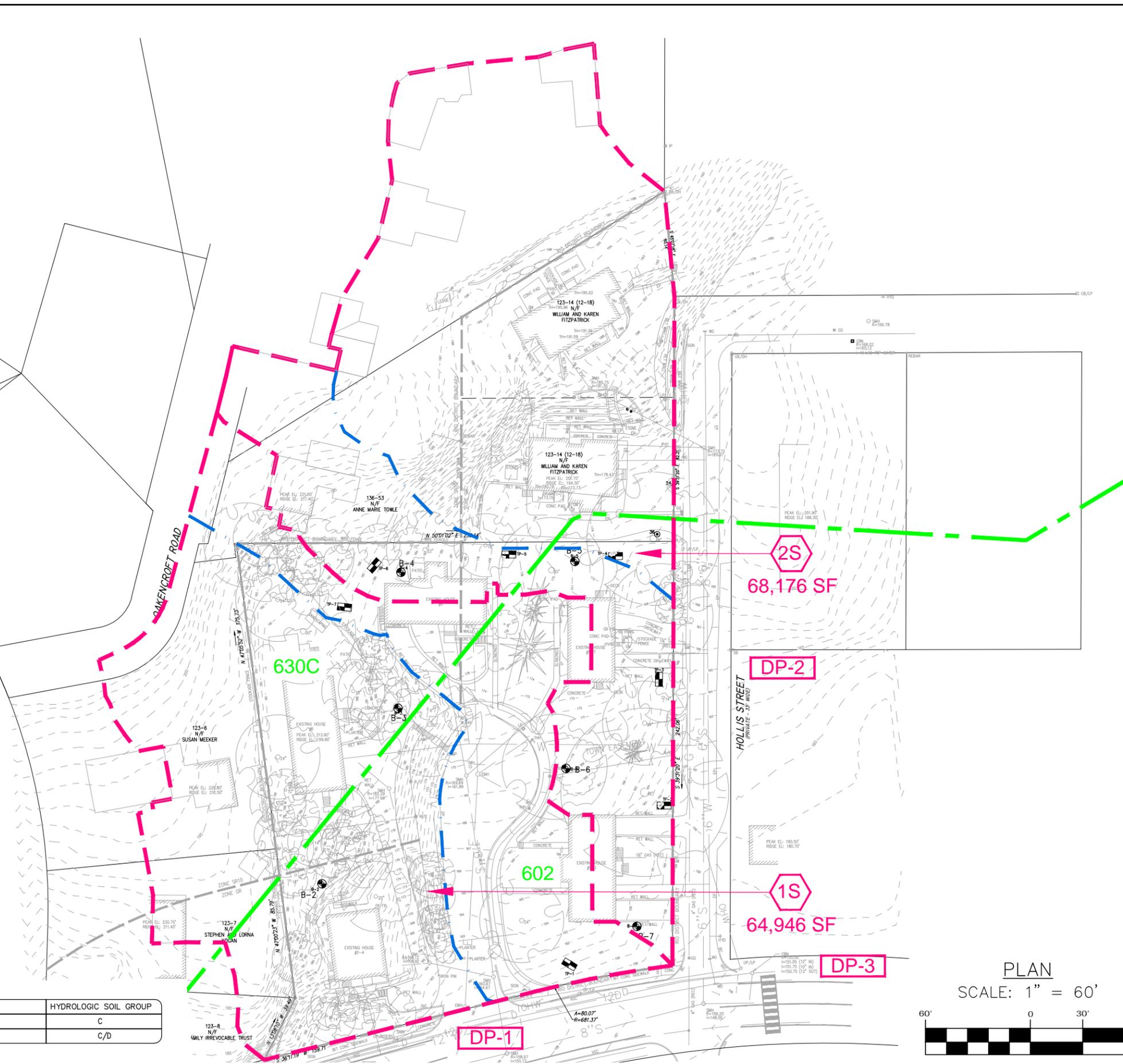


LEGEND

- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF WATERSHED
- SOIL TYPE BOUNDARY

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
602	URBAN LAND, 0 TO 15 PERCENT SLOPES	C
630C	CHARLTON-HOLLIS-URBAN LAND COMPLEX, 3 TO 15 PERCENT SLOPES	C/D



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REV	DATE	DESCRIPTION	BY	APP
1	7/10/2020	R/O SUBMISSION	SBS	BCM
2	8/12/2020	PS SUBMISSION	SBS	BCM

MCKENZIE ENGINEERING GROUP
 Assinipi Office Park
 150 Longwater Drive, Suite 101
 Norwell, MA 02061
 Ph: 781-792-3900
 www.mckeng.com

WELLESLEY SQUARE RESIDENCES
 (ASSESSOR'S PARCELS 123-9-13)
 DELANSON CIRCLE
 WELLESLEY, MASSACHUSETTS

PROFESSIONAL ENGINEER:

OWNER:
 DELANSON REALTY PARTNERS, LLC
 20 WOODWARD STREET
 NEWTON, MASSACHUSETTS 02461

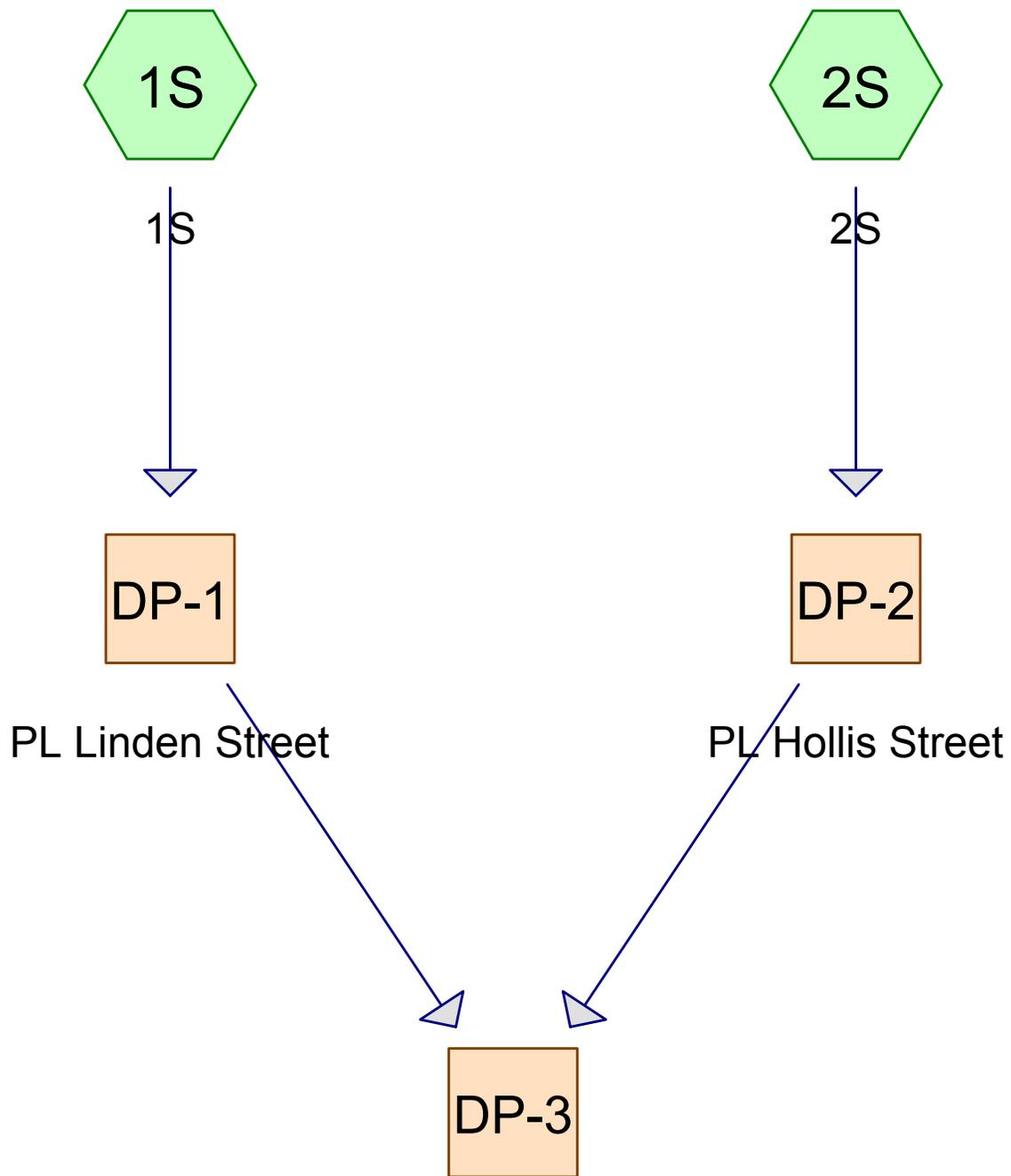
DRAWN BY: SBS
 DESIGNED BY: SBS
 CHECKED BY: BCM
 APPROVED BY: BCM
 DATE: FEBRUARY 21, 2020
 SCALE: 1" = 60'
 PROJECT NO.: 216-194
 DWG. TITLE:

Pre-Dev.
 Watershed
 Plan

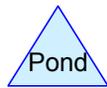
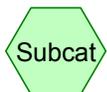
DWG. No: **WS-1**

PERMIT PLAN SET

M:\MKG\2016 PROJECTS\216-194 (DELANSON CIRCLE)\DWG\SUBMISSIONS\PC\216-194 WS-1 (PC) (R2).DWG



Closed Drainage System



216-194 Pre Development (PC) (R1)

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.009	74	>75% Grass cover, Good, HSG C (1S, 2S)
0.817	74	>75% Grass cover, Good, HSG C (offsite) (1S, 2S)
0.001	98	Conc Pad, HSG C (1S)
0.013	98	Decks/Stairs, HSG C (2S)
0.106	98	Drives, HSG C (2S)
0.131	98	Drives, HSG C (offsite) (1S, 2S)
0.011	98	Ledge, HSG C (1S)
0.015	98	Ledge, HSG C (offsite) (2S)
0.009	98	Misc Imp, HSG C (2S)
0.006	98	Patio, HSG C (1S, 2S)
0.213	98	Paved roads w/curbs & sewers, HSG C (1S)
0.227	98	Roofs, HSG C (1S, 2S)
0.215	98	Roofs, HSG C (offsite) (1S, 2S)
0.001	98	Stone pad, HSG C (offsite) (2S)
0.071	98	Walkways, HSG C (1S)
0.030	98	Walls, HSG C (1S, 2S)
0.004	98	Walls, HSG C (offsite) (2S)
0.178	70	Woods, Good, HSG C (offsite) (2S)
3.056	82	TOTAL AREA

216-194 Pre Development (PC) (R1)

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Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.056	HSG C	1S, 2S
0.000	HSG D	
0.000	Other	
3.056		TOTAL AREA

216-194 Pre Development (PC) (R1)

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.827	0.000	0.000	1.827	>75% Grass cover, Good	1S, 2S
0.000	0.000	0.001	0.000	0.000	0.001	Conc Pad	1S
0.000	0.000	0.013	0.000	0.000	0.013	Decks/Stairs	2S
0.000	0.000	0.237	0.000	0.000	0.237	Drives	1S, 2S
0.000	0.000	0.025	0.000	0.000	0.025	Ledge	1S, 2S
0.000	0.000	0.009	0.000	0.000	0.009	Misc Imp	2S
0.000	0.000	0.006	0.000	0.000	0.006	Patio	1S, 2S
0.000	0.000	0.213	0.000	0.000	0.213	Paved roads w/curbs & sewers	1S
0.000	0.000	0.442	0.000	0.000	0.442	Roofs	1S, 2S
0.000	0.000	0.001	0.000	0.000	0.001	Stone pad	2S
0.000	0.000	0.071	0.000	0.000	0.071	Walkways	1S
0.000	0.000	0.034	0.000	0.000	0.034	Walls	1S, 2S
0.000	0.000	0.178	0.000	0.000	0.178	Woods, Good	2S
0.000	0.000	3.056	0.000	0.000	3.056	TOTAL AREA	

216-194 Pre Development (PC) (R1)*Type III 24-hr 2-Year Rainfall=3.20"*

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Page 5

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: 1S	Runoff Area=64,946 sf 35.35% Impervious Runoff Depth=1.54" Tc=6.0 min CN=82 Runoff=2.63 cfs 0.191 af
Subcatchment2S: 2S	Runoff Area=68,176 sf 33.51% Impervious Runoff Depth=1.54" Tc=6.0 min CN=82 Runoff=2.76 cfs 0.201 af
Reach DP-1: PL Linden Street	Inflow=2.63 cfs 0.191 af Outflow=2.63 cfs 0.191 af
Reach DP-2: PL Hollis Street	Inflow=2.76 cfs 0.201 af Outflow=2.76 cfs 0.201 af
Reach DP-3: Closed Drainage System	Inflow=5.39 cfs 0.392 af Outflow=5.39 cfs 0.392 af
Total Runoff Area = 3.056 ac Runoff Volume = 0.392 af Average Runoff Depth = 1.54" 65.59% Pervious = 2.005 ac 34.41% Impervious = 1.052 ac	

Summary for Subcatchment 1S: 1S

Runoff = 2.63 cfs @ 12.09 hrs, Volume= 0.191 af, Depth= 1.54"

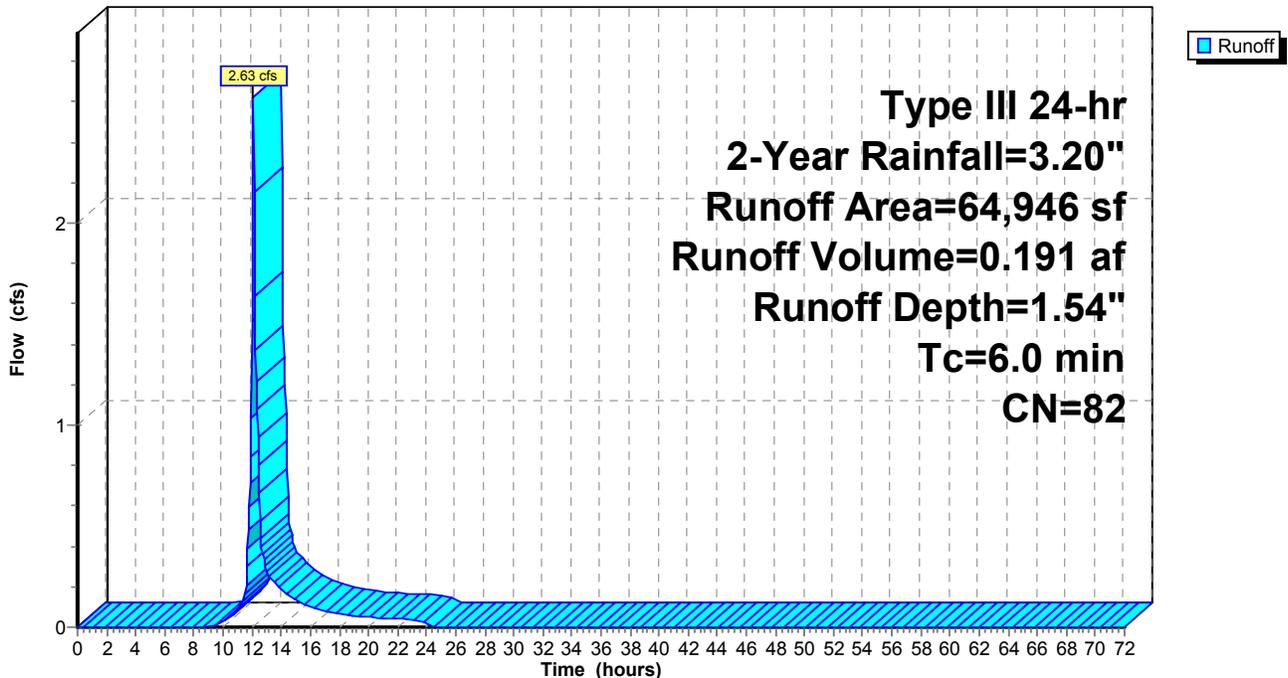
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
25,607	74	>75% Grass cover, Good, HSG C
* 5,950	98	Roofs, HSG C
* 9,290	98	Paved roads w/curbs & sewers, HSG C
* 462	98	Ledge, HSG C
* 427	98	Walls, HSG C
* 3,096	98	Walkways, HSG C
* 28	98	Conc Pad, HSG C
* 182	98	Patio, HSG C
* 1,658	98	Roofs, HSG C (offsite)
* 1,864	98	Drives, HSG C (offsite)
* 16,382	74	>75% Grass cover, Good, HSG C (offsite)
64,946	82	Weighted Average
41,989		64.65% Pervious Area
22,957		35.35% Impervious Area

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

Subcatchment 1S: 1S

Hydrograph



216-194 Pre Development (PC) (R1)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 2S: 2S

Runoff = 2.76 cfs @ 12.09 hrs, Volume= 0.201 af, Depth= 1.54"

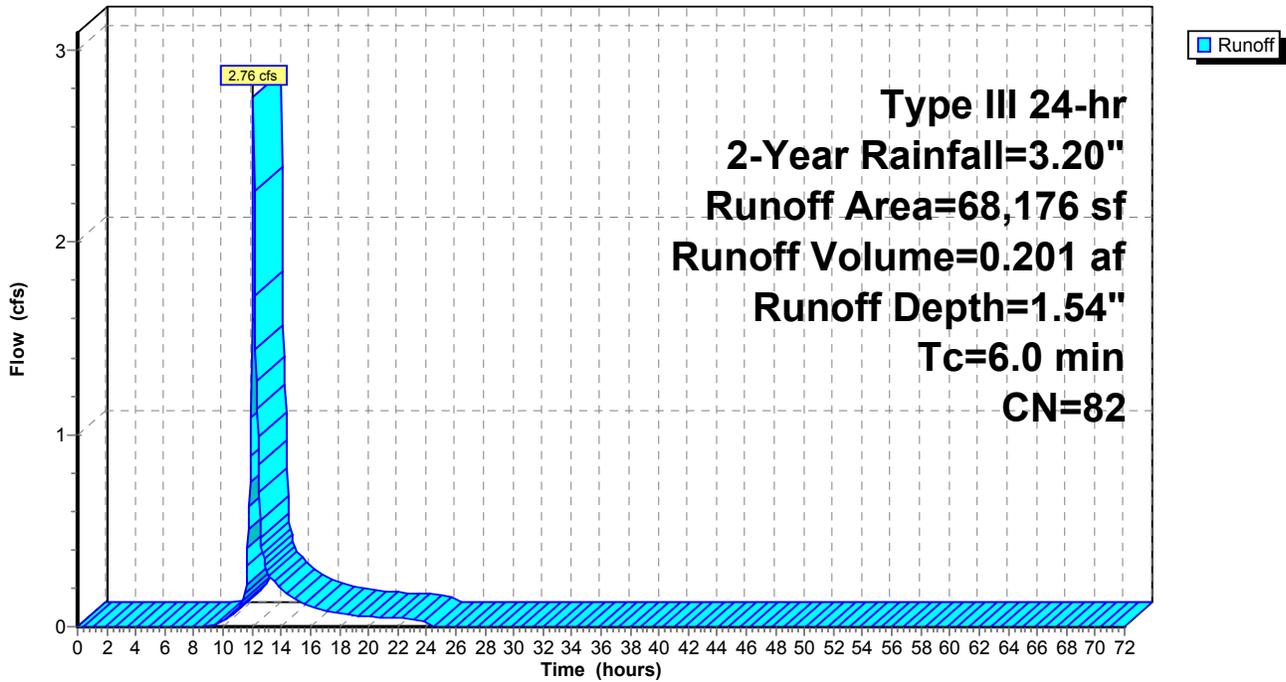
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
18,356	74	>75% Grass cover, Good, HSG C
* 3,927	98	Roofs, HSG C
* 4,618	98	Drives, HSG C
* 869	98	Walls, HSG C
* 568	98	Decks/Stairs, HSG C
* 85	98	Patio, HSG C
* 372	98	Misc Imp, HSG C
* 7,699	98	Roofs, HSG C (offsite)
* 19,218	74	>75% Grass cover, Good, HSG C (offsite)
* 3,842	98	Drives, HSG C (offsite)
* 7,755	70	Woods, Good, HSG C (offsite)
* 642	98	Ledge, HSG C (offsite)
* 171	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
68,176	82	Weighted Average
45,329		66.49% Pervious Area
22,847		33.51% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



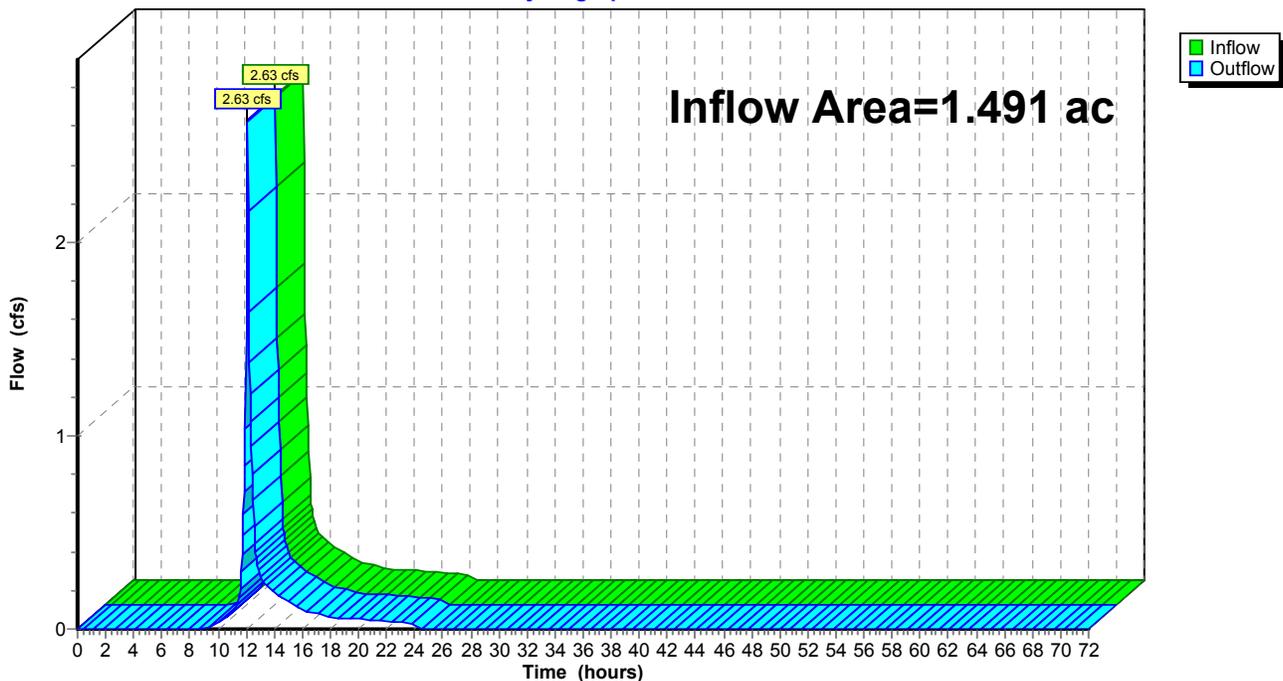
Summary for Reach DP-1: PL Linden Street

Inflow Area = 1.491 ac, 35.35% Impervious, Inflow Depth = 1.54" for 2-Year event
Inflow = 2.63 cfs @ 12.09 hrs, Volume= 0.191 af
Outflow = 2.63 cfs @ 12.09 hrs, Volume= 0.191 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: PL Linden Street

Hydrograph



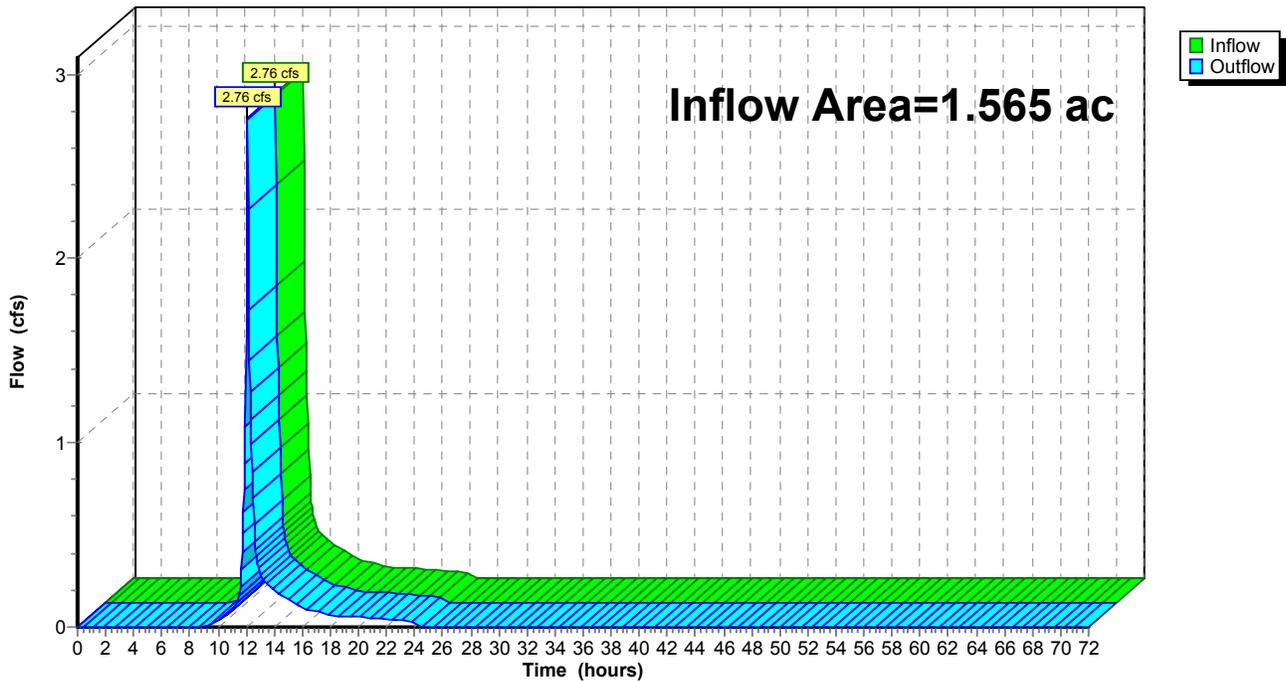
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 1.565 ac, 33.51% Impervious, Inflow Depth = 1.54" for 2-Year event
Inflow = 2.76 cfs @ 12.09 hrs, Volume= 0.201 af
Outflow = 2.76 cfs @ 12.09 hrs, Volume= 0.201 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: PL Hollis Street

Hydrograph



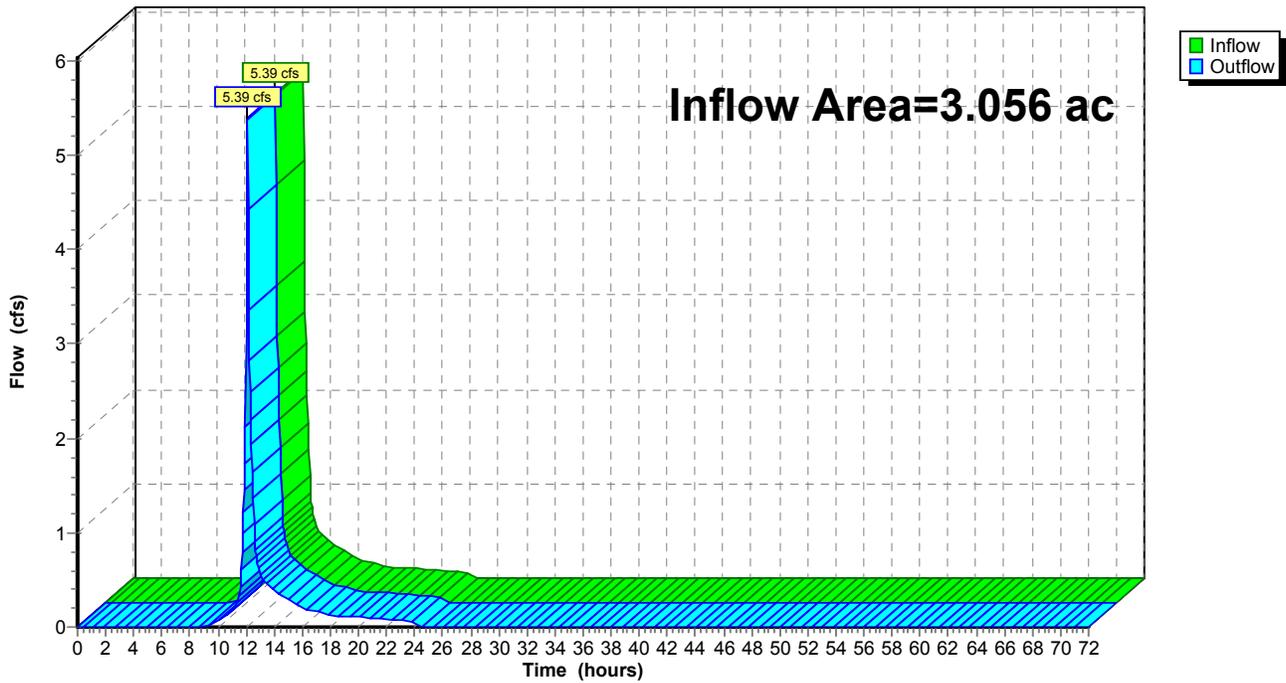
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 34.41% Impervious, Inflow Depth = 1.54" for 2-Year event
Inflow = 5.39 cfs @ 12.09 hrs, Volume= 0.392 af
Outflow = 5.39 cfs @ 12.09 hrs, Volume= 0.392 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-3: Closed Drainage System

Hydrograph



216-194 Pre Development (PC) (R1)*Type III 24-hr 10-Year Rainfall=4.70"*

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: 1S	Runoff Area=64,946 sf 35.35% Impervious Runoff Depth=2.81" Tc=6.0 min CN=82 Runoff=4.81 cfs 0.349 af
Subcatchment2S: 2S	Runoff Area=68,176 sf 33.51% Impervious Runoff Depth=2.81" Tc=6.0 min CN=82 Runoff=5.05 cfs 0.367 af
Reach DP-1: PL Linden Street	Inflow=4.81 cfs 0.349 af Outflow=4.81 cfs 0.349 af
Reach DP-2: PL Hollis Street	Inflow=5.05 cfs 0.367 af Outflow=5.05 cfs 0.367 af
Reach DP-3: Closed Drainage System	Inflow=9.86 cfs 0.716 af Outflow=9.86 cfs 0.716 af
Total Runoff Area = 3.056 ac Runoff Volume = 0.716 af Average Runoff Depth = 2.81" 65.59% Pervious = 2.005 ac 34.41% Impervious = 1.052 ac	

Summary for Subcatchment 1S: 1S

Runoff = 4.81 cfs @ 12.09 hrs, Volume= 0.349 af, Depth= 2.81"

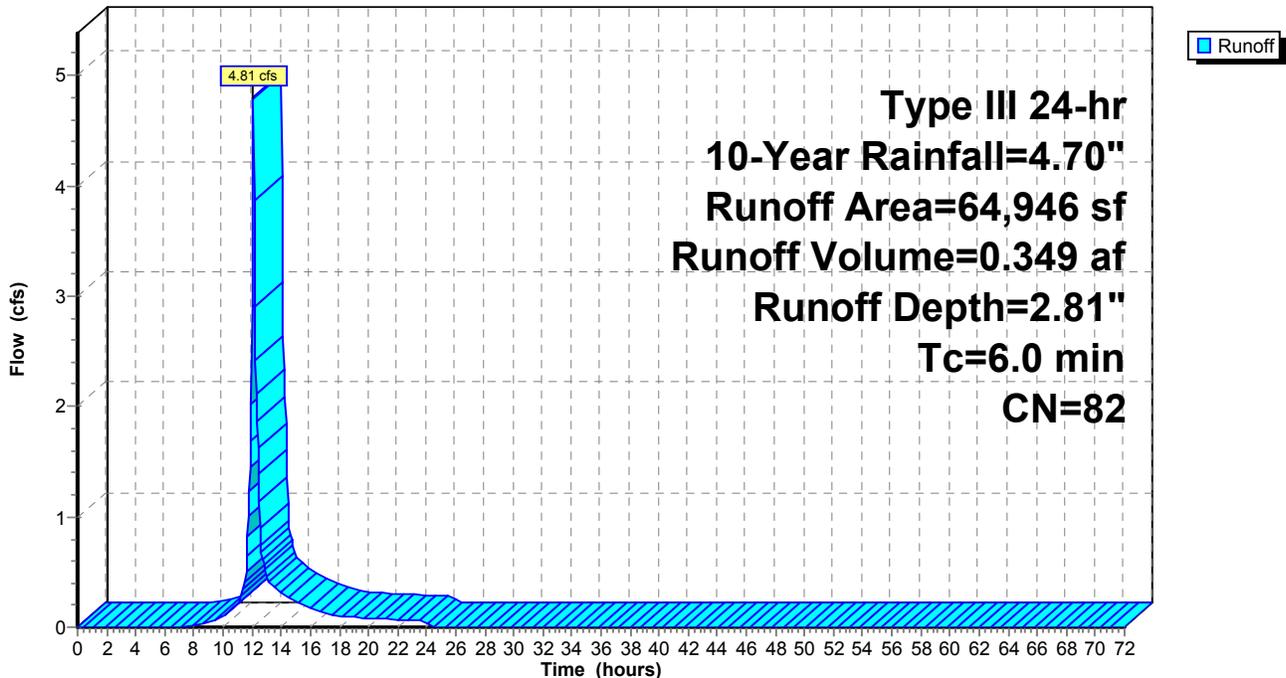
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
25,607	74	>75% Grass cover, Good, HSG C
* 5,950	98	Roofs, HSG C
* 9,290	98	Paved roads w/curbs & sewers, HSG C
* 462	98	Ledge, HSG C
* 427	98	Walls, HSG C
* 3,096	98	Walkways, HSG C
* 28	98	Conc Pad, HSG C
* 182	98	Patio, HSG C
* 1,658	98	Roofs, HSG C (offsite)
* 1,864	98	Drives, HSG C (offsite)
* 16,382	74	>75% Grass cover, Good, HSG C (offsite)
64,946	82	Weighted Average
41,989		64.65% Pervious Area
22,957		35.35% Impervious Area

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

Subcatchment 1S: 1S

Hydrograph



216-194 Pre Development (PC) (R1)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 2S: 2S

Runoff = 5.05 cfs @ 12.09 hrs, Volume= 0.367 af, Depth= 2.81"

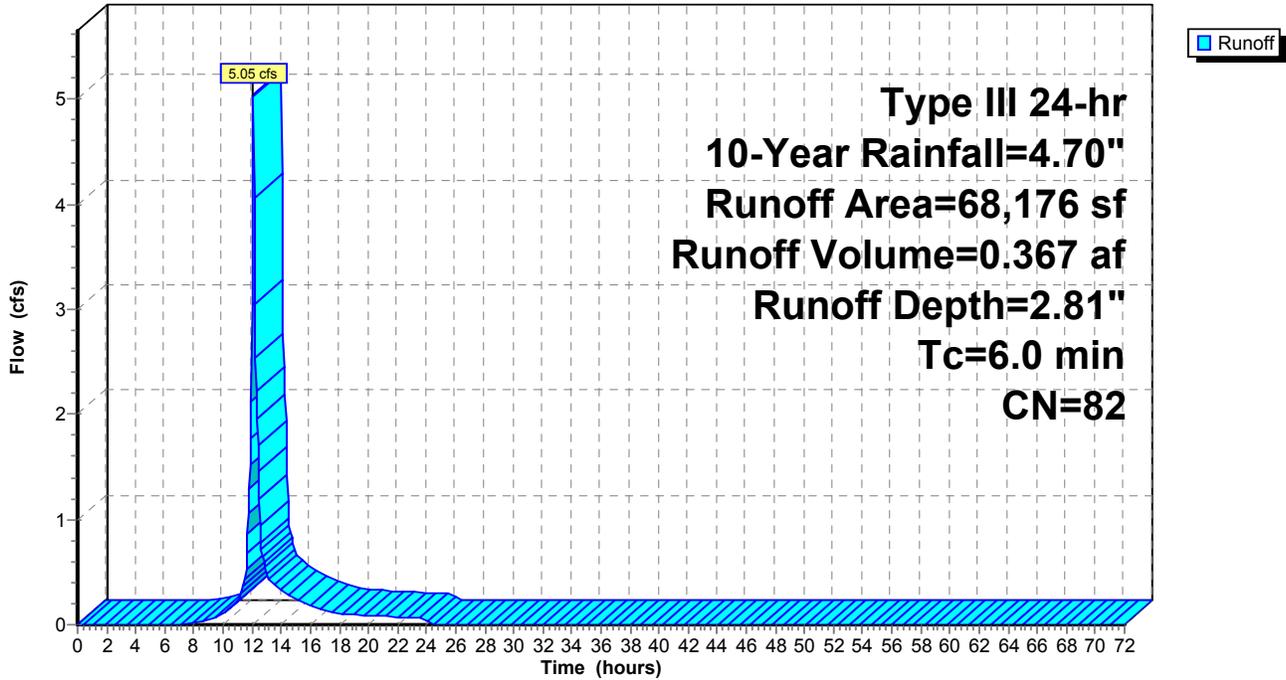
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
18,356	74	>75% Grass cover, Good, HSG C
* 3,927	98	Roofs, HSG C
* 4,618	98	Drives, HSG C
* 869	98	Walls, HSG C
* 568	98	Decks/Stairs, HSG C
* 85	98	Patio, HSG C
* 372	98	Misc Imp, HSG C
* 7,699	98	Roofs, HSG C (offsite)
* 19,218	74	>75% Grass cover, Good, HSG C (offsite)
* 3,842	98	Drives, HSG C (offsite)
* 7,755	70	Woods, Good, HSG C (offsite)
* 642	98	Ledge, HSG C (offsite)
* 171	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
68,176	82	Weighted Average
45,329		66.49% Pervious Area
22,847		33.51% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



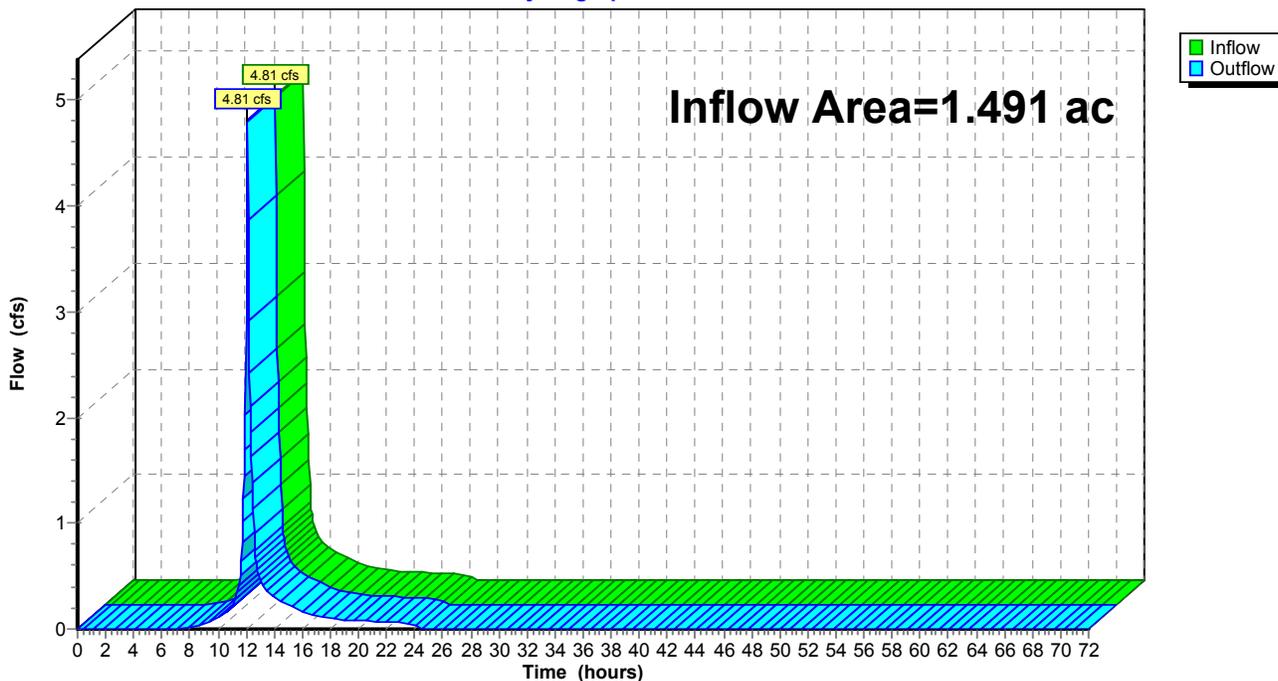
Summary for Reach DP-1: PL Linden Street

Inflow Area = 1.491 ac, 35.35% Impervious, Inflow Depth = 2.81" for 10-Year event
Inflow = 4.81 cfs @ 12.09 hrs, Volume= 0.349 af
Outflow = 4.81 cfs @ 12.09 hrs, Volume= 0.349 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: PL Linden Street

Hydrograph



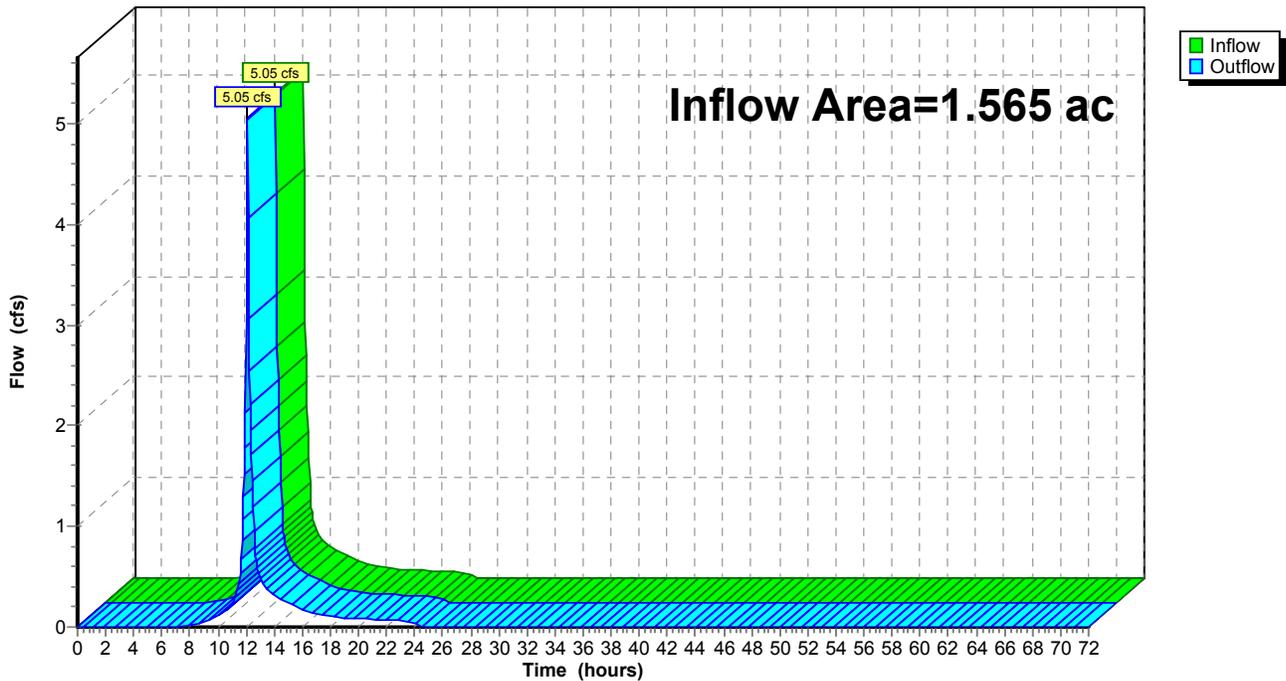
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 1.565 ac, 33.51% Impervious, Inflow Depth = 2.81" for 10-Year event
Inflow = 5.05 cfs @ 12.09 hrs, Volume= 0.367 af
Outflow = 5.05 cfs @ 12.09 hrs, Volume= 0.367 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: PL Hollis Street

Hydrograph



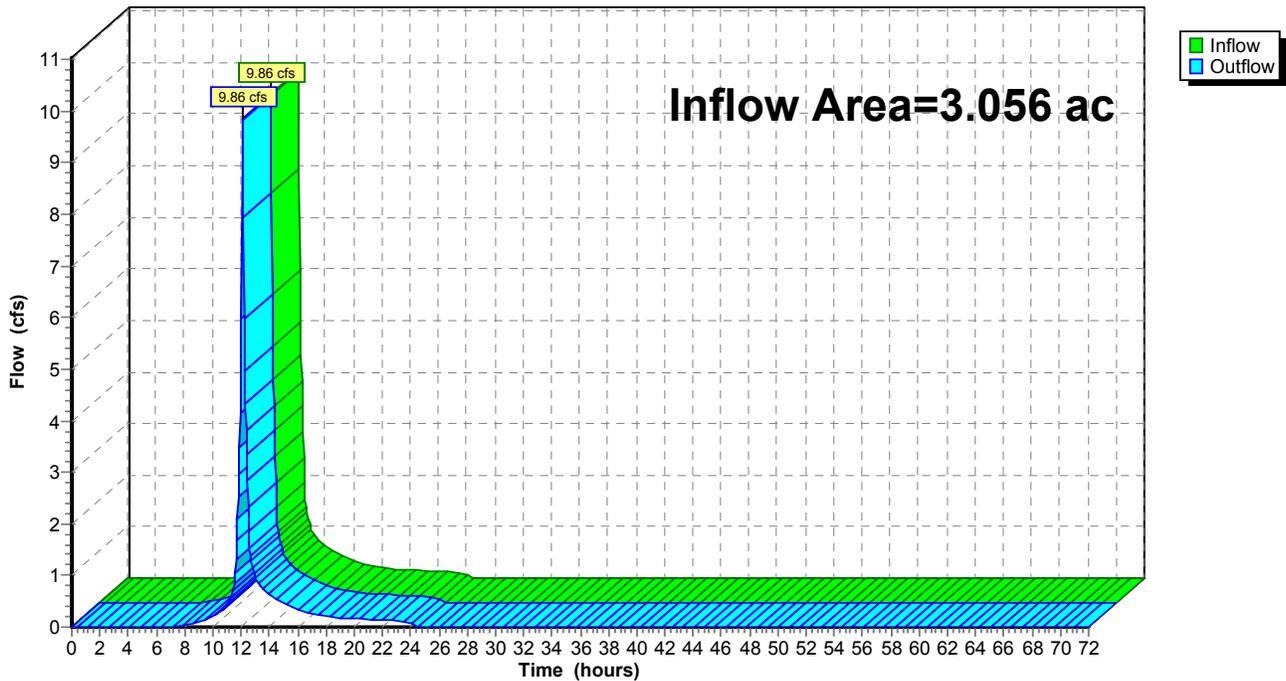
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 34.41% Impervious, Inflow Depth = 2.81" for 10-Year event
Inflow = 9.86 cfs @ 12.09 hrs, Volume= 0.716 af
Outflow = 9.86 cfs @ 12.09 hrs, Volume= 0.716 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-3: Closed Drainage System

Hydrograph



216-194 Pre Development (PC) (R1)*Type III 24-hr 25-Year Rainfall=5.50"*

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: 1S	Runoff Area=64,946 sf 35.35% Impervious Runoff Depth=3.53" Tc=6.0 min CN=82 Runoff=6.01 cfs 0.439 af
Subcatchment2S: 2S	Runoff Area=68,176 sf 33.51% Impervious Runoff Depth=3.53" Tc=6.0 min CN=82 Runoff=6.31 cfs 0.460 af
Reach DP-1: PL Linden Street	Inflow=6.01 cfs 0.439 af Outflow=6.01 cfs 0.439 af
Reach DP-2: PL Hollis Street	Inflow=6.31 cfs 0.460 af Outflow=6.31 cfs 0.460 af
Reach DP-3: Closed Drainage System	Inflow=12.31 cfs 0.899 af Outflow=12.31 cfs 0.899 af
Total Runoff Area = 3.056 ac Runoff Volume = 0.899 af Average Runoff Depth = 3.53" 65.59% Pervious = 2.005 ac 34.41% Impervious = 1.052 ac	

216-194 Pre Development (PC) (R1)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 1S: 1S

Runoff = 6.01 cfs @ 12.09 hrs, Volume= 0.439 af, Depth= 3.53"

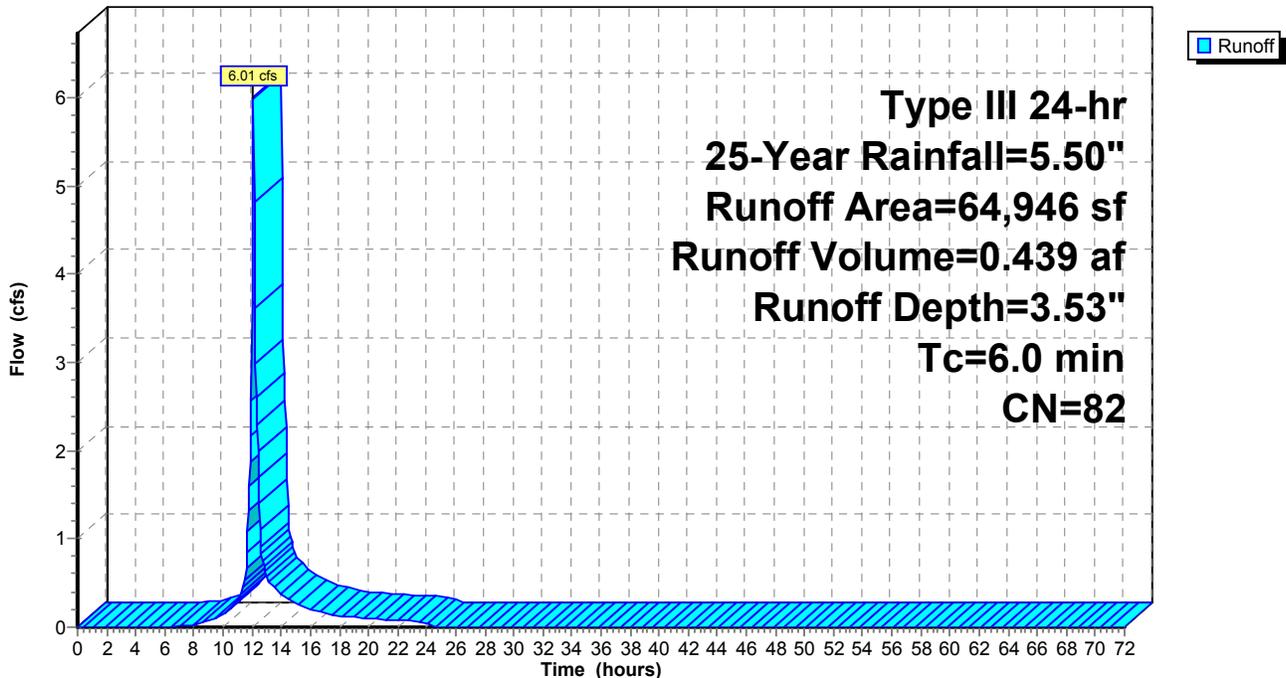
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
25,607	74	>75% Grass cover, Good, HSG C
* 5,950	98	Roofs, HSG C
* 9,290	98	Paved roads w/curbs & sewers, HSG C
* 462	98	Ledge, HSG C
* 427	98	Walls, HSG C
* 3,096	98	Walkways, HSG C
* 28	98	Conc Pad, HSG C
* 182	98	Patio, HSG C
* 1,658	98	Roofs, HSG C (offsite)
* 1,864	98	Drives, HSG C (offsite)
* 16,382	74	>75% Grass cover, Good, HSG C (offsite)
64,946	82	Weighted Average
41,989		64.65% Pervious Area
22,957		35.35% Impervious Area

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

Subcatchment 1S: 1S

Hydrograph



216-194 Pre Development (PC) (R1)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 2S: 2S

Runoff = 6.31 cfs @ 12.09 hrs, Volume= 0.460 af, Depth= 3.53"

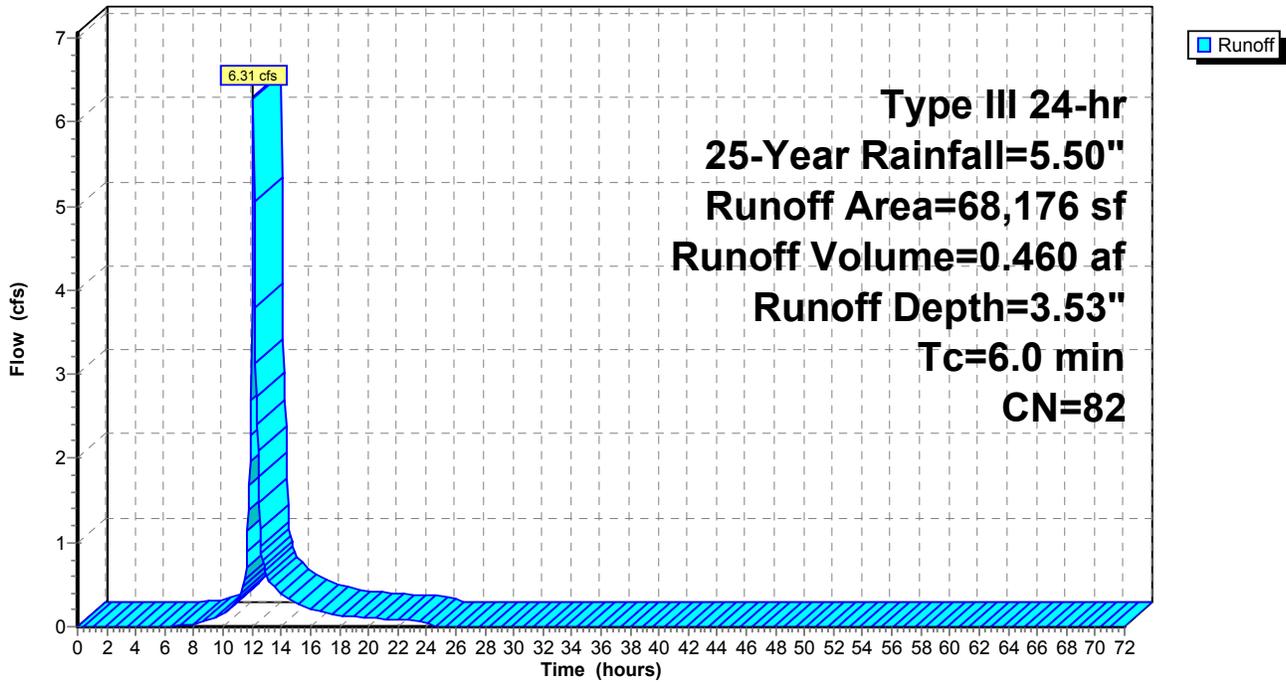
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
18,356	74	>75% Grass cover, Good, HSG C
* 3,927	98	Roofs, HSG C
* 4,618	98	Drives, HSG C
* 869	98	Walls, HSG C
* 568	98	Decks/Stairs, HSG C
* 85	98	Patio, HSG C
* 372	98	Misc Imp, HSG C
* 7,699	98	Roofs, HSG C (offsite)
* 19,218	74	>75% Grass cover, Good, HSG C (offsite)
* 3,842	98	Drives, HSG C (offsite)
* 7,755	70	Woods, Good, HSG C (offsite)
* 642	98	Ledge, HSG C (offsite)
* 171	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
68,176	82	Weighted Average
45,329		66.49% Pervious Area
22,847		33.51% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



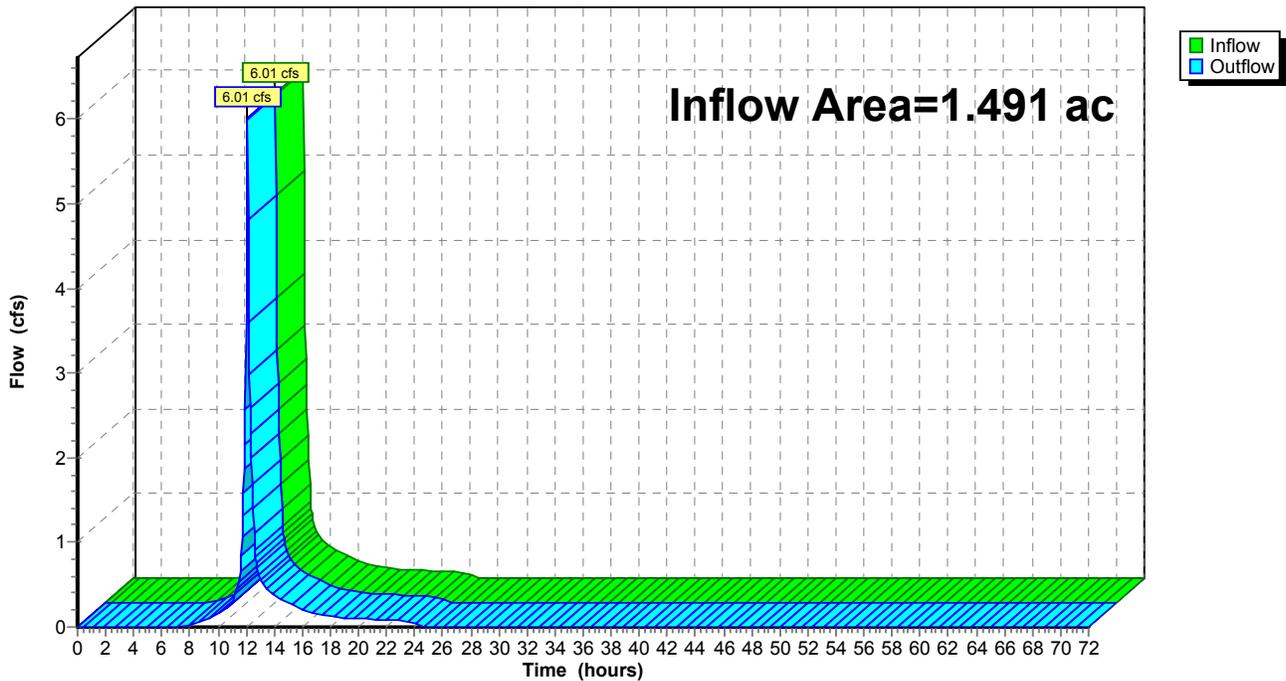
Summary for Reach DP-1: PL Linden Street

Inflow Area = 1.491 ac, 35.35% Impervious, Inflow Depth = 3.53" for 25-Year event
Inflow = 6.01 cfs @ 12.09 hrs, Volume= 0.439 af
Outflow = 6.01 cfs @ 12.09 hrs, Volume= 0.439 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: PL Linden Street

Hydrograph



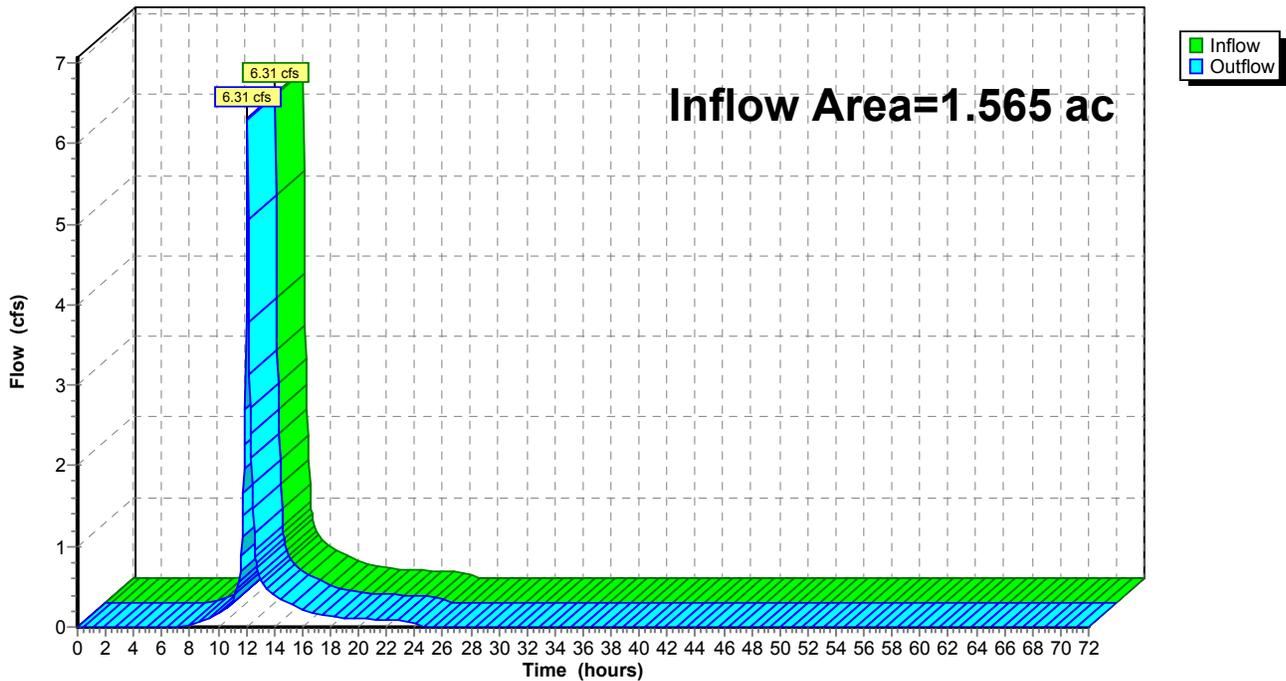
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 1.565 ac, 33.51% Impervious, Inflow Depth = 3.53" for 25-Year event
Inflow = 6.31 cfs @ 12.09 hrs, Volume= 0.460 af
Outflow = 6.31 cfs @ 12.09 hrs, Volume= 0.460 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: PL Hollis Street

Hydrograph



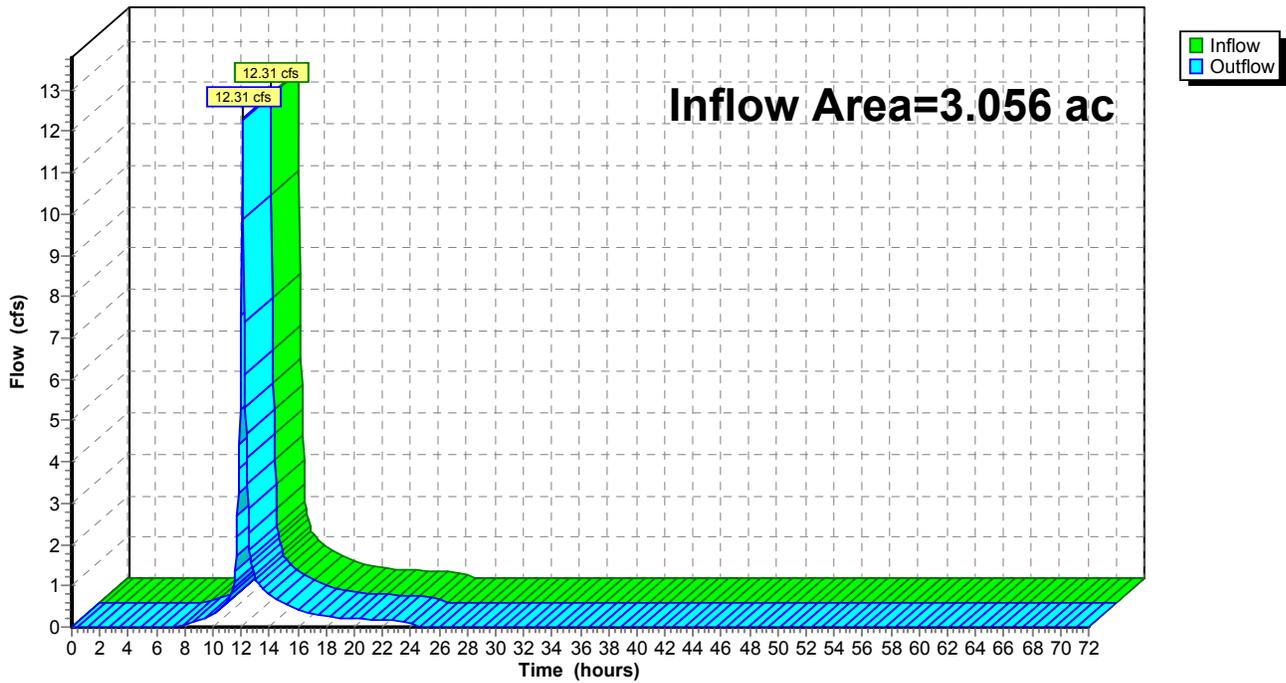
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 34.41% Impervious, Inflow Depth = 3.53" for 25-Year event
Inflow = 12.31 cfs @ 12.09 hrs, Volume= 0.899 af
Outflow = 12.31 cfs @ 12.09 hrs, Volume= 0.899 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-3: Closed Drainage System

Hydrograph



216-194 Pre Development (PC) (R1)

Type III 24-hr 100-Year Rainfall=6.70"

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: 1S Runoff Area=64,946 sf 35.35% Impervious Runoff Depth=4.64"
Tc=6.0 min CN=82 Runoff=7.82 cfs 0.576 af

Subcatchment2S: 2S Runoff Area=68,176 sf 33.51% Impervious Runoff Depth=4.64"
Tc=6.0 min CN=82 Runoff=8.21 cfs 0.605 af

Reach DP-1: PL Linden Street Inflow=7.82 cfs 0.576 af
Outflow=7.82 cfs 0.576 af

Reach DP-2: PL Hollis Street Inflow=8.21 cfs 0.605 af
Outflow=8.21 cfs 0.605 af

Reach DP-3: Closed Drainage System Inflow=16.03 cfs 1.181 af
Outflow=16.03 cfs 1.181 af

Total Runoff Area = 3.056 ac Runoff Volume = 1.181 af Average Runoff Depth = 4.64"
65.59% Pervious = 2.005 ac 34.41% Impervious = 1.052 ac

Summary for Subcatchment 1S: 1S

Runoff = 7.82 cfs @ 12.09 hrs, Volume= 0.576 af, Depth= 4.64"

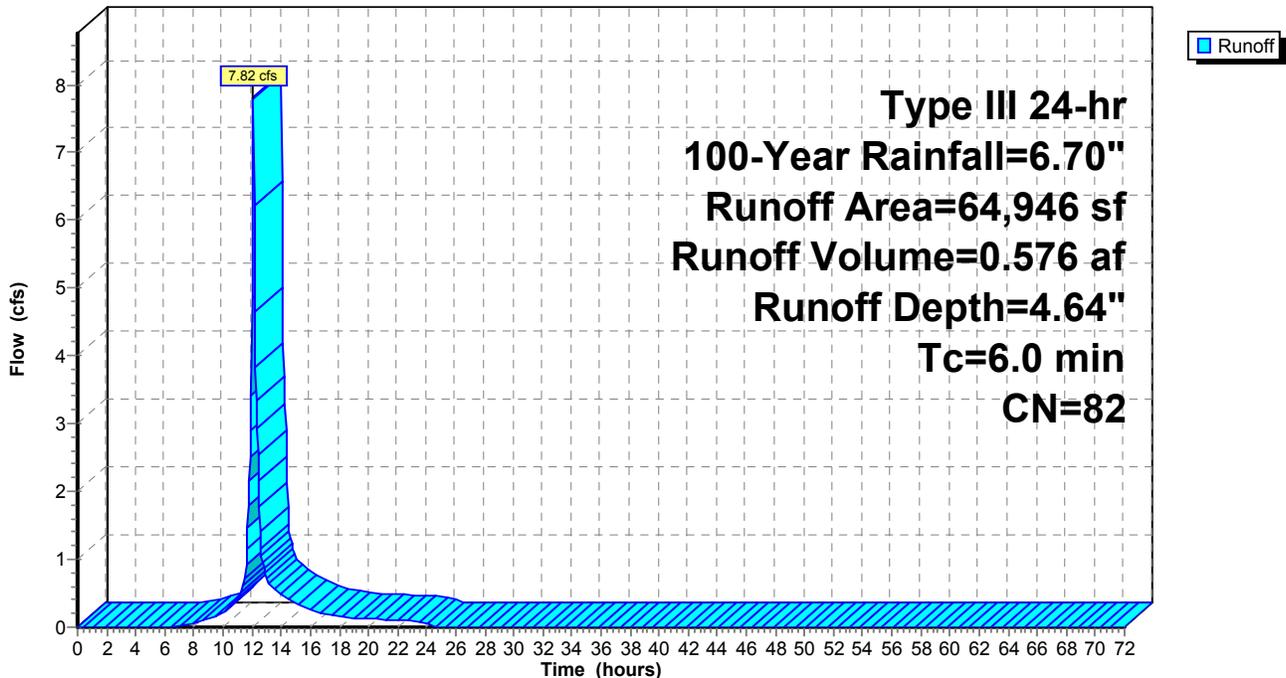
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
25,607	74	>75% Grass cover, Good, HSG C
* 5,950	98	Roofs, HSG C
* 9,290	98	Paved roads w/curbs & sewers, HSG C
* 462	98	Ledge, HSG C
* 427	98	Walls, HSG C
* 3,096	98	Walkways, HSG C
* 28	98	Conc Pad, HSG C
* 182	98	Patio, HSG C
* 1,658	98	Roofs, HSG C (offsite)
* 1,864	98	Drives, HSG C (offsite)
* 16,382	74	>75% Grass cover, Good, HSG C (offsite)
64,946	82	Weighted Average
41,989		64.65% Pervious Area
22,957		35.35% Impervious Area

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

Subcatchment 1S: 1S

Hydrograph



216-194 Pre Development (PC) (R1)

Type III 24-hr 100-Year Rainfall=6.70"

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Summary for Subcatchment 2S: 2S

Runoff = 8.21 cfs @ 12.09 hrs, Volume= 0.605 af, Depth= 4.64"

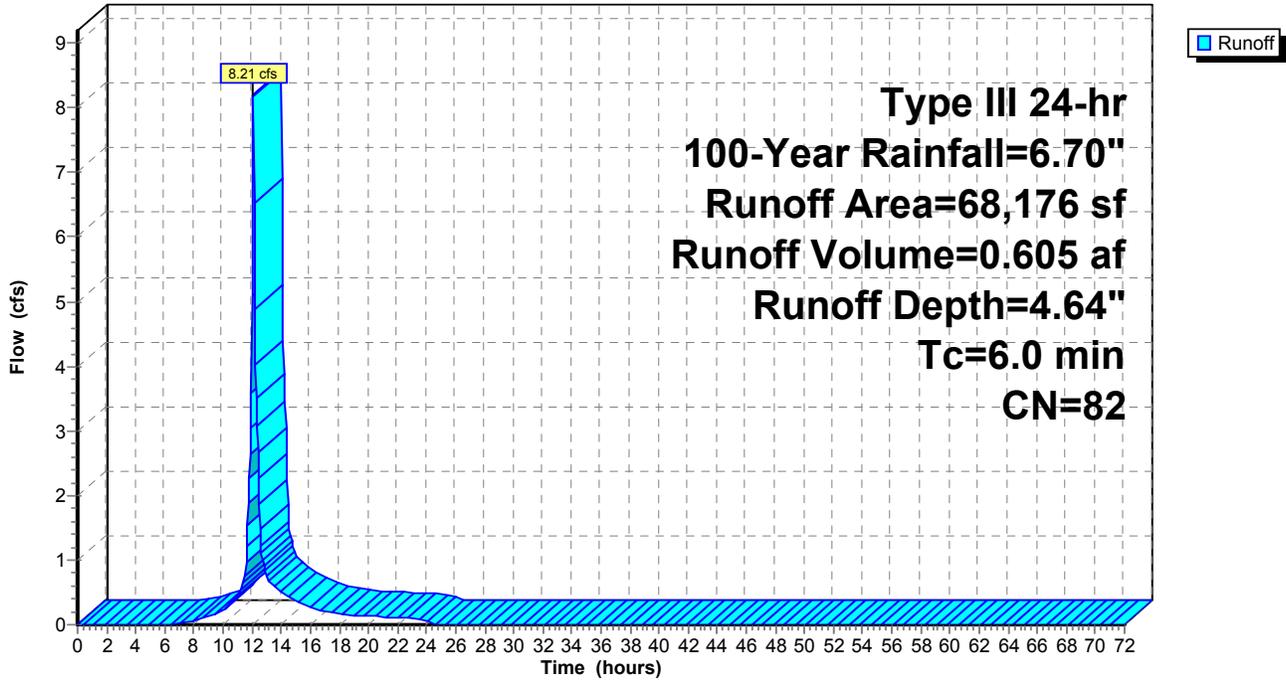
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
18,356	74	>75% Grass cover, Good, HSG C
* 3,927	98	Roofs, HSG C
* 4,618	98	Drives, HSG C
* 869	98	Walls, HSG C
* 568	98	Decks/Stairs, HSG C
* 85	98	Patio, HSG C
* 372	98	Misc Imp, HSG C
* 7,699	98	Roofs, HSG C (offsite)
* 19,218	74	>75% Grass cover, Good, HSG C (offsite)
* 3,842	98	Drives, HSG C (offsite)
* 7,755	70	Woods, Good, HSG C (offsite)
* 642	98	Ledge, HSG C (offsite)
* 171	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
68,176	82	Weighted Average
45,329		66.49% Pervious Area
22,847		33.51% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



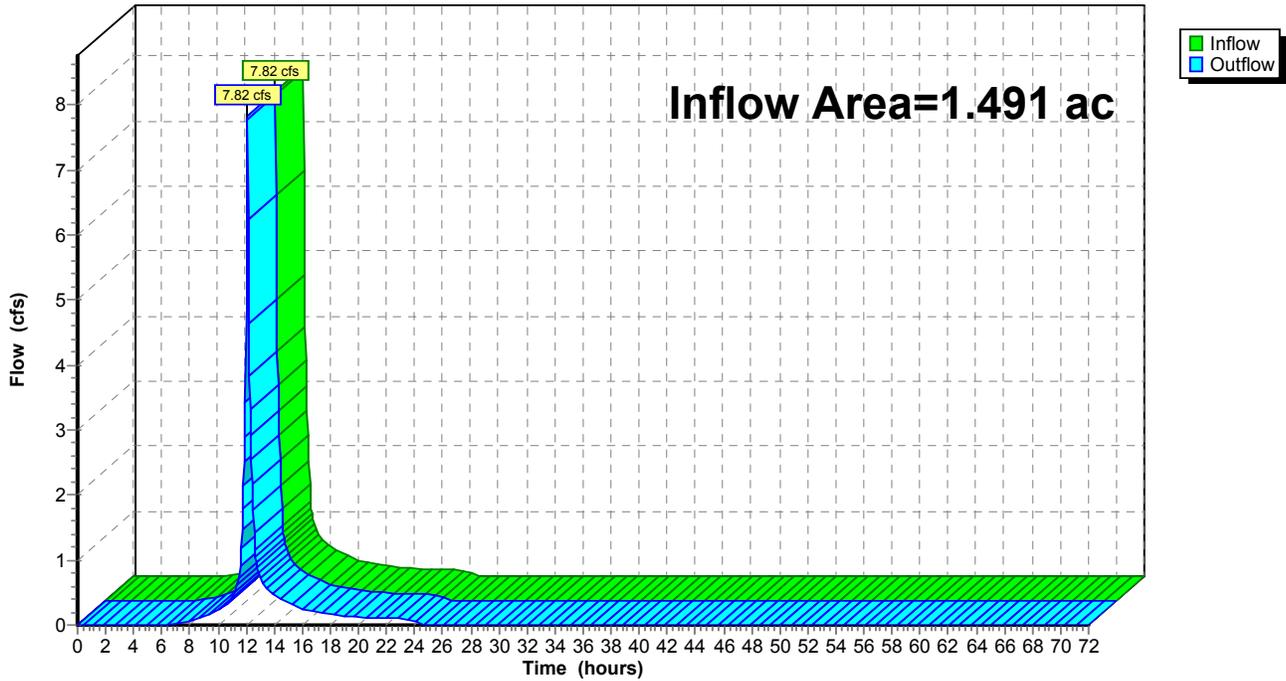
Summary for Reach DP-1: PL Linden Street

Inflow Area = 1.491 ac, 35.35% Impervious, Inflow Depth = 4.64" for 100-Year event
Inflow = 7.82 cfs @ 12.09 hrs, Volume= 0.576 af
Outflow = 7.82 cfs @ 12.09 hrs, Volume= 0.576 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: PL Linden Street

Hydrograph



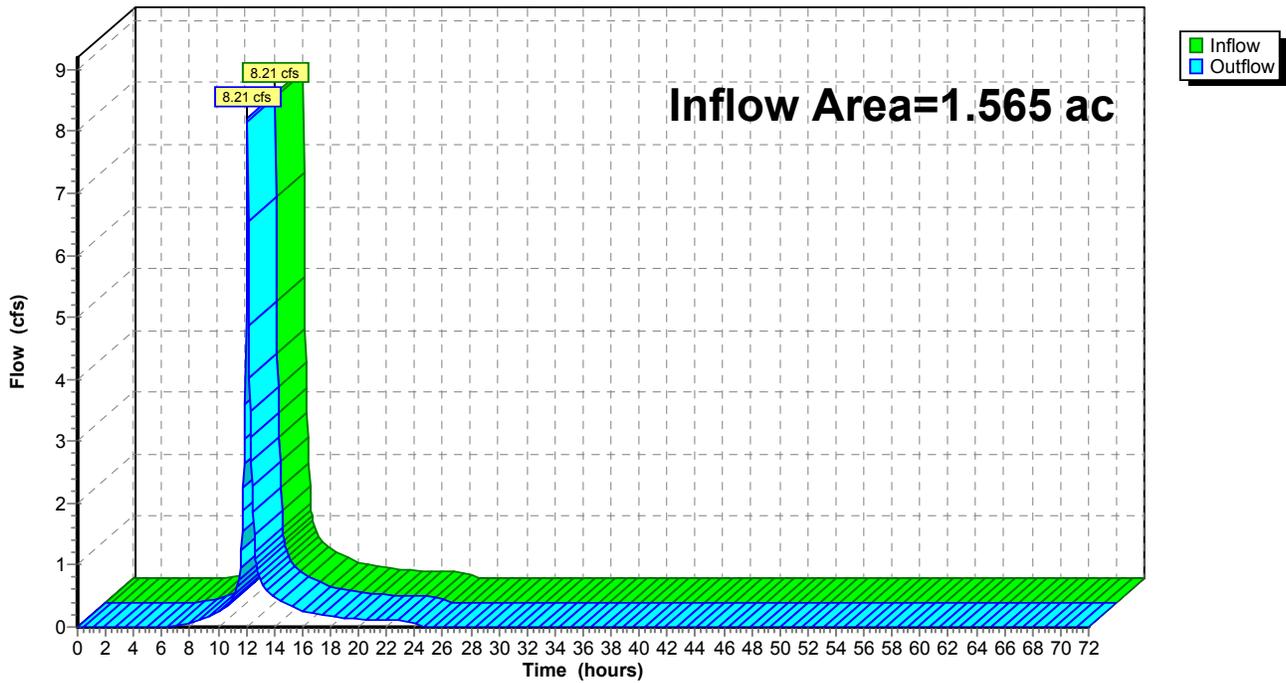
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 1.565 ac, 33.51% Impervious, Inflow Depth = 4.64" for 100-Year event
Inflow = 8.21 cfs @ 12.09 hrs, Volume= 0.605 af
Outflow = 8.21 cfs @ 12.09 hrs, Volume= 0.605 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: PL Hollis Street

Hydrograph



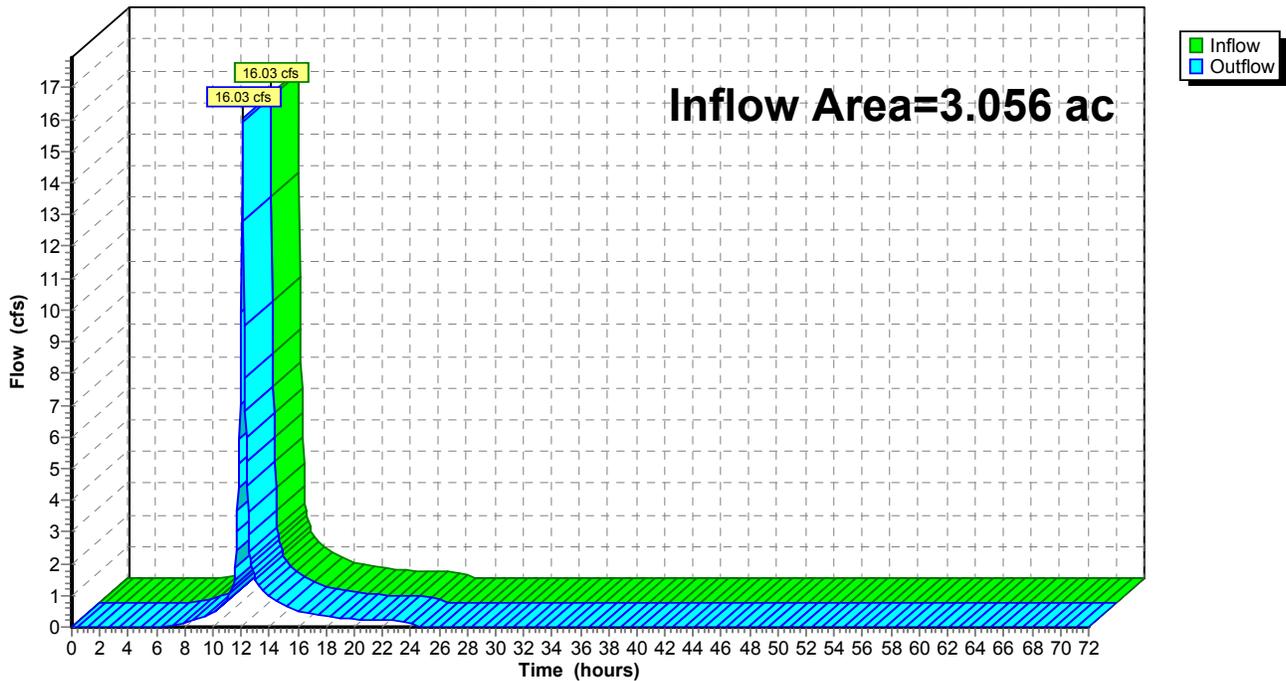
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 34.41% Impervious, Inflow Depth = 4.64" for 100-Year event
Inflow = 16.03 cfs @ 12.09 hrs, Volume= 1.181 af
Outflow = 16.03 cfs @ 12.09 hrs, Volume= 1.181 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

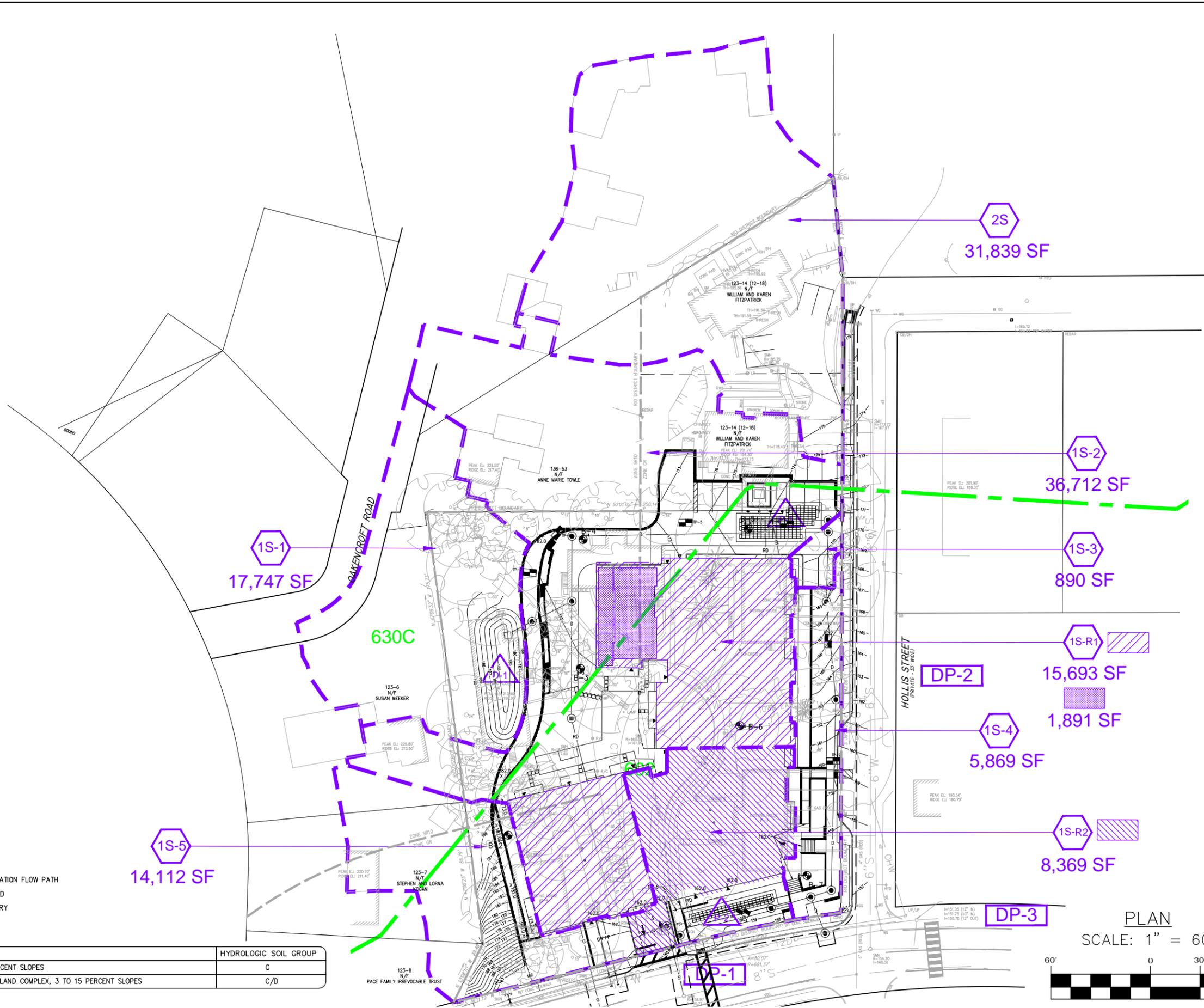
Reach DP-3: Closed Drainage System

Hydrograph



A P P E N D I X B

Post-Development Condition



LEGEND

- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF WATERSHED
- SOIL TYPE BOUNDARY

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
602	URBAN LAND, 0 TO 15 PERCENT SLOPES	C
630C	CHARLTON-HOLLIS-URBAN LAND COMPLEX, 3 TO 15 PERCENT SLOPES	C/D



REV	DATE	DESCRIPTION	BY	APP
1	7/10/20	RC SUBMISSION	SBS	BCM
2	8/12/20	PS SUBMISSION	SBS	BCM

MEG
MCKENZIE
ENGINEERING GROUP
Assinipi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
Ph: 781-792-3900
www.mckeng.com

WELLESLEY SQUARE RESIDENCES
(ASSESSOR'S PARCELS 123-9-13)
DELANSON CIRCLE
WELLESLEY, MASSACHUSETTS

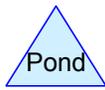
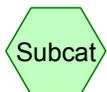
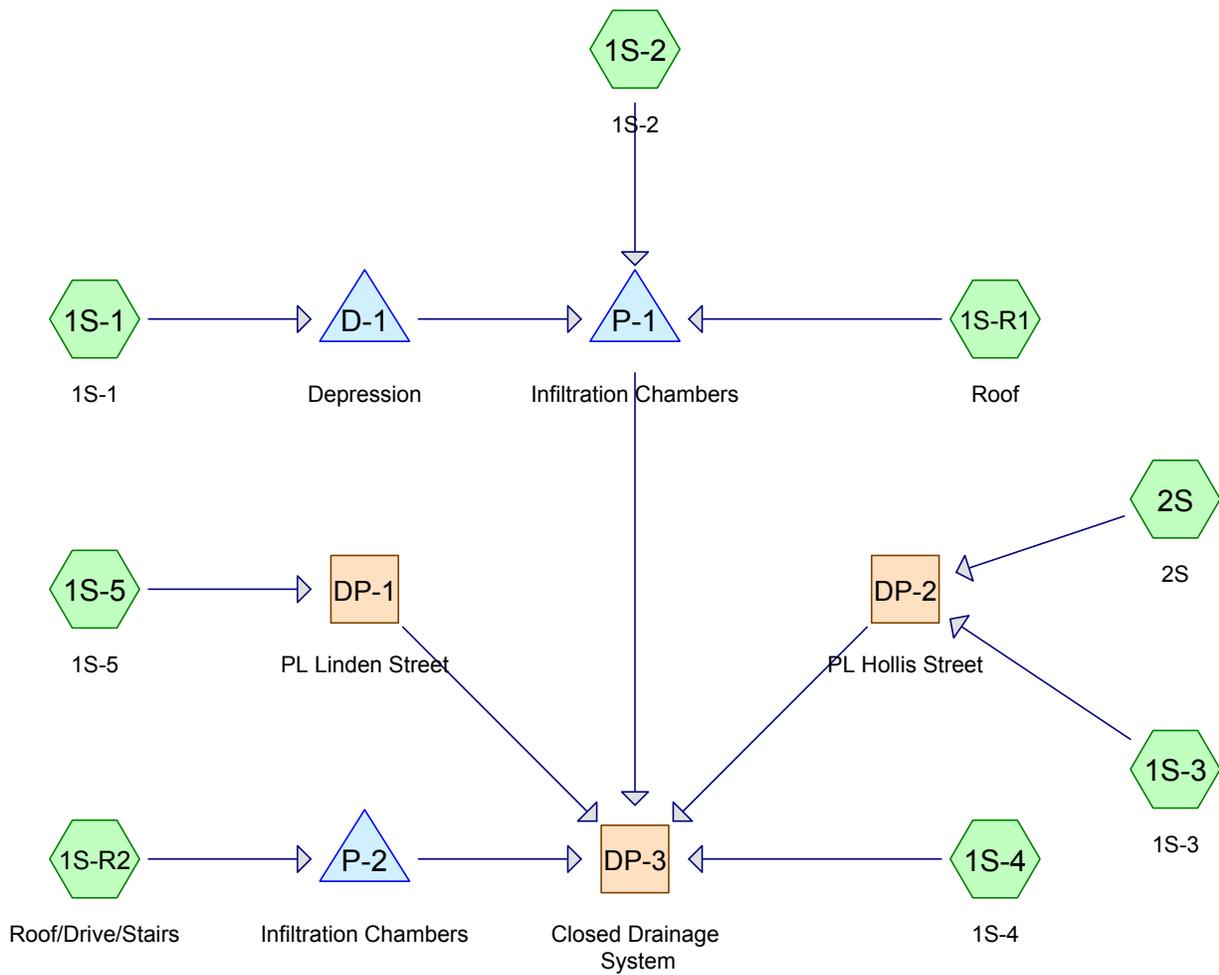
PROFESSIONAL ENGINEER:

OWNER:
DELANSON REALTY PARTNERS, LLC
20 WOODWARD STREET
NEWTON, MASSACHUSETTS 02461

DRAWN BY: SBS
DESIGNED BY: SBS
CHECKED BY: BCM
APPROVED BY: BCM
DATE: FEBRUARY 21, 2020
SCALE: 1"=60'
PROJECT NO.: 216-194
DWG. TITLE:

Post-Dev.
Watershed
Plan

DWG. No: **WS-2**



Routing Diagram for 216-194 Post Development (PC) (R2)
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216-194 Post Development (PC) (R2)

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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.283	74	>75% Grass cover, Good, HSG C (1S-1, 2S)
0.853	74	>75% Grass cover, Good, HSG C (offsite) (1S-1, 1S-2, 1S-5, 2S)
0.103	74	>75% Grass cover, Good, planting beds HSG C (1S-2)
0.219	74	>75% Grass cover, Good, planting beds, HSG C (1S-3, 1S-4, 1S-5)
0.007	98	Conc. pads, HSG C (offsite) (1S-2)
0.017	98	Decks, stairs, HSG C (2S)
0.076	98	Drives, HSG C (2S)
0.019	98	Drives, HSG C (offsite) (2S)
0.015	98	Driveway, HSG C (1S-4)
0.085	98	Driveway, HSG C (offsite) (1S-2, 1S-5)
0.020	98	Grass cover over garage, HSG C (1S-2)
0.024	96	Gravel surface, HSG C (1S-2, 1S-3, 1S-4)
0.043	74	Green roof, HSG C (1S-R1)
0.003	98	Ledge, HSG C (1S-5)
0.014	98	Ledge, HSG C (offsite) (1S-2, 2S)
0.008	98	Misc. imp, HSG C (2S)
0.017	98	Patio/Wall, HSG C (1S-5)
0.009	98	Patios, HSG C (1S-2)
0.114	98	Pavement, HSG C (1S-2, 1S-R2)
0.058	92	Permeable pavers, HSG C (1S-2)
0.574	98	Roofs, HSG C (1S-R1, 1S-R2, 2S)
0.212	98	Roofs, HSG C (offsite) (1S-1, 1S-2, 1S-5, 2S)
0.002	98	Stepping stones, HSG C (1S-2)
0.001	98	Stone pad, HSG C (offsite) (1S-2)
0.063	98	Walkways, HSG C (1S-2, 1S-3, 1S-4, 1S-5)
0.032	98	Walls, HSG C (1S-2, 1S-3, 1S-4, 2S)
0.008	98	Walls, HSG C (offsite) (1S-2, 2S)
0.178	70	Woods, Good, HSG C (offsite) (1S-2, 2S)
3.056	84	TOTAL AREA

216-194 Post Development (PC) (R2)

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.056	HSG C	1S-1, 1S-2, 1S-3, 1S-4, 1S-5, 1S-R1, 1S-R2, 2S
0.000	HSG D	
0.000	Other	
3.056		TOTAL AREA

216-194 Post Development (PC) (R2)

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcat Number
0.000	0.000	1.136	0.000	0.000	1.136	>75% Grass cover, Good	
0.000	0.000	0.322	0.000	0.000	0.322	>75% Grass cover, Good, planting beds	
0.000	0.000	0.007	0.000	0.000	0.007	Conc. pads	
0.000	0.000	0.017	0.000	0.000	0.017	Decks, stairs	
0.000	0.000	0.095	0.000	0.000	0.095	Drives	
0.000	0.000	0.100	0.000	0.000	0.100	Driveway	
0.000	0.000	0.020	0.000	0.000	0.020	Grass cover over garage	
0.000	0.000	0.024	0.000	0.000	0.024	Gravel surface	
0.000	0.000	0.043	0.000	0.000	0.043	Green roof	
0.000	0.000	0.017	0.000	0.000	0.017	Ledge	
0.000	0.000	0.008	0.000	0.000	0.008	Misc. imp	
0.000	0.000	0.017	0.000	0.000	0.017	Patio/Wall	
0.000	0.000	0.009	0.000	0.000	0.009	Patios	
0.000	0.000	0.114	0.000	0.000	0.114	Pavement	
0.000	0.000	0.058	0.000	0.000	0.058	Permeable pavers	
0.000	0.000	0.786	0.000	0.000	0.786	Roofs	
0.000	0.000	0.002	0.000	0.000	0.002	Stepping stones	
0.000	0.000	0.001	0.000	0.000	0.001	Stone pad	
0.000	0.000	0.063	0.000	0.000	0.063	Walkways	
0.000	0.000	0.040	0.000	0.000	0.040	Walls	
0.000	0.000	0.178	0.000	0.000	0.178	Woods, Good	
0.000	0.000	3.056	0.000	0.000	3.056	TOTAL AREA	

216-194 Post Development (PC) (R2)

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	D-1	179.40	179.33	12.0	0.0058	0.013	8.0	0.0	0.0
2	P-1	165.00	164.05	38.0	0.0250	0.013	12.0	0.0	0.0
3	P-2	156.00	155.00	20.0	0.0500	0.013	12.0	0.0	0.0

216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 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 1S-1: 1S-1	Runoff Area=17,747 sf 0.73% Impervious Runoff Depth=1.04" Tc=6.0 min CN=74 Runoff=0.47 cfs 0.035 af
Subcatchment 1S-2: 1S-2	Runoff Area=36,712 sf 41.90% Impervious Runoff Depth=1.76" Tc=6.0 min CN=85 Runoff=1.74 cfs 0.123 af
Subcatchment 1S-3: 1S-3	Runoff Area=5,869 sf 39.72% Impervious Runoff Depth=1.76" Tc=6.0 min CN=85 Runoff=0.28 cfs 0.020 af
Subcatchment 1S-4: 1S-4	Runoff Area=890 sf 89.89% Impervious Runoff Depth=2.86" Tc=6.0 min CN=97 Runoff=0.06 cfs 0.005 af
Subcatchment 1S-5: 1S-5	Runoff Area=14,112 sf 17.30% Impervious Runoff Depth=1.27" Tc=6.0 min CN=78 Runoff=0.47 cfs 0.034 af
Subcatchment 1S-R1: Roof	Runoff Area=17,584 sf 89.25% Impervious Runoff Depth=2.64" Tc=6.0 min CN=95 Runoff=1.18 cfs 0.089 af
Subcatchment 1S-R2: Roof/Drive/Stairs	Runoff Area=8,369 sf 100.00% Impervious Runoff Depth=2.97" Tc=6.0 min CN=98 Runoff=0.60 cfs 0.048 af
Subcatchment 2S: 2S	Runoff Area=31,839 sf 35.43% Impervious Runoff Depth=1.54" Tc=6.0 min CN=82 Runoff=1.31 cfs 0.094 af
Reach DP-1: PL Linden Street	Inflow=0.47 cfs 0.034 af Outflow=0.47 cfs 0.034 af
Reach DP-2: PL Hollis Street	Inflow=1.59 cfs 0.113 af Outflow=1.59 cfs 0.113 af
Reach DP-3: Closed Drainage System	Inflow=5.12 cfs 0.320 af Outflow=5.12 cfs 0.320 af
Pond D-1: Depression	Peak Elev=185.71' Storage=320 cf Inflow=0.47 cfs 0.035 af Outflow=0.18 cfs 0.035 af
Pond P-1: Infiltration Chambers	Peak Elev=169.36' Storage=1,700 cf Inflow=3.05 cfs 0.248 af Discarded=0.05 cfs 0.088 af Primary=2.99 cfs 0.159 af Outflow=3.04 cfs 0.248 af
Pond P-2: Infiltration Chambers	Peak Elev=159.39' Storage=764 cf Inflow=0.60 cfs 0.048 af Discarded=0.03 cfs 0.040 af Primary=0.10 cfs 0.008 af Outflow=0.12 cfs 0.048 af

Total Runoff Area = 3.056 ac Runoff Volume = 0.448 af Average Runoff Depth = 1.76"
57.61% Pervious = 1.761 ac 42.39% Impervious = 1.295 ac

Summary for Subcatchment 1S-1: 1S-1

Runoff = 0.47 cfs @ 12.10 hrs, Volume= 0.035 af, Depth= 1.04"

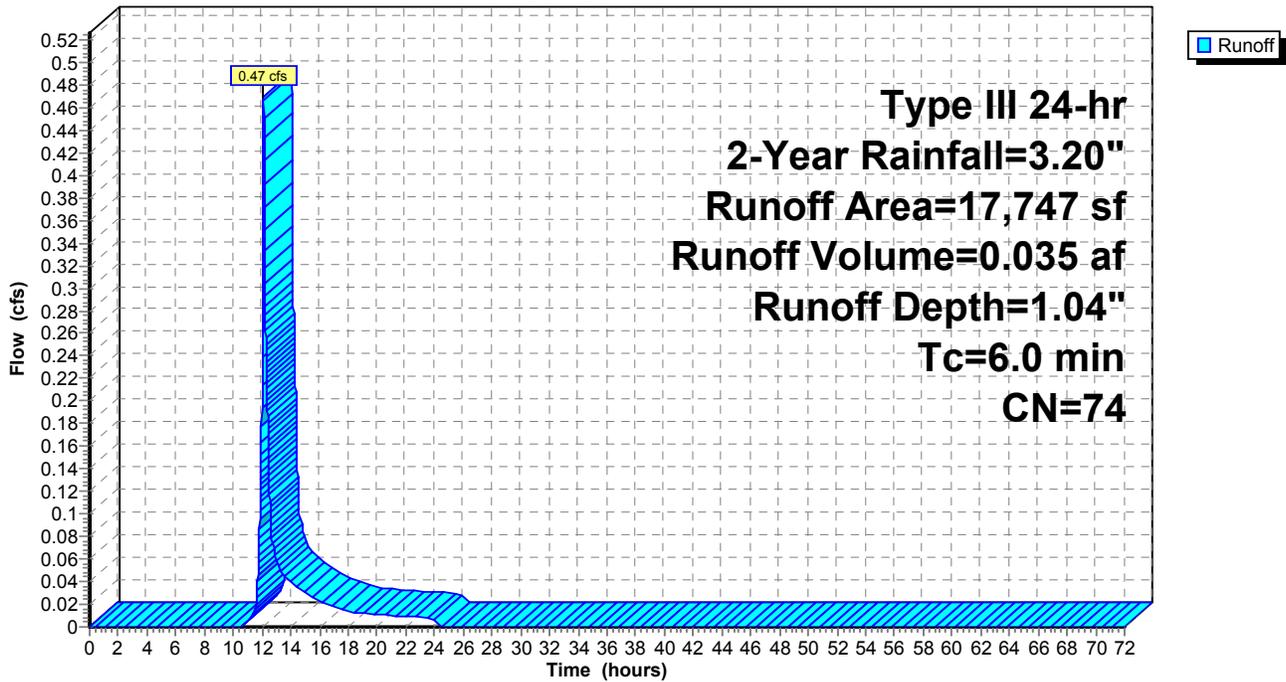
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
	6,714	74	>75% Grass cover, Good, HSG C
*	10,903	74	>75% Grass cover, Good, HSG C (offsite)
*	130	98	Roofs, HSG C (offsite)
	17,747	74	Weighted Average
	17,617		99.27% Pervious Area
	130		0.73% Impervious Area

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

Subcatchment 1S-1: 1S-1

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 1S-2: 1S-2

Runoff = 1.74 cfs @ 12.09 hrs, Volume= 0.123 af, Depth= 1.76"

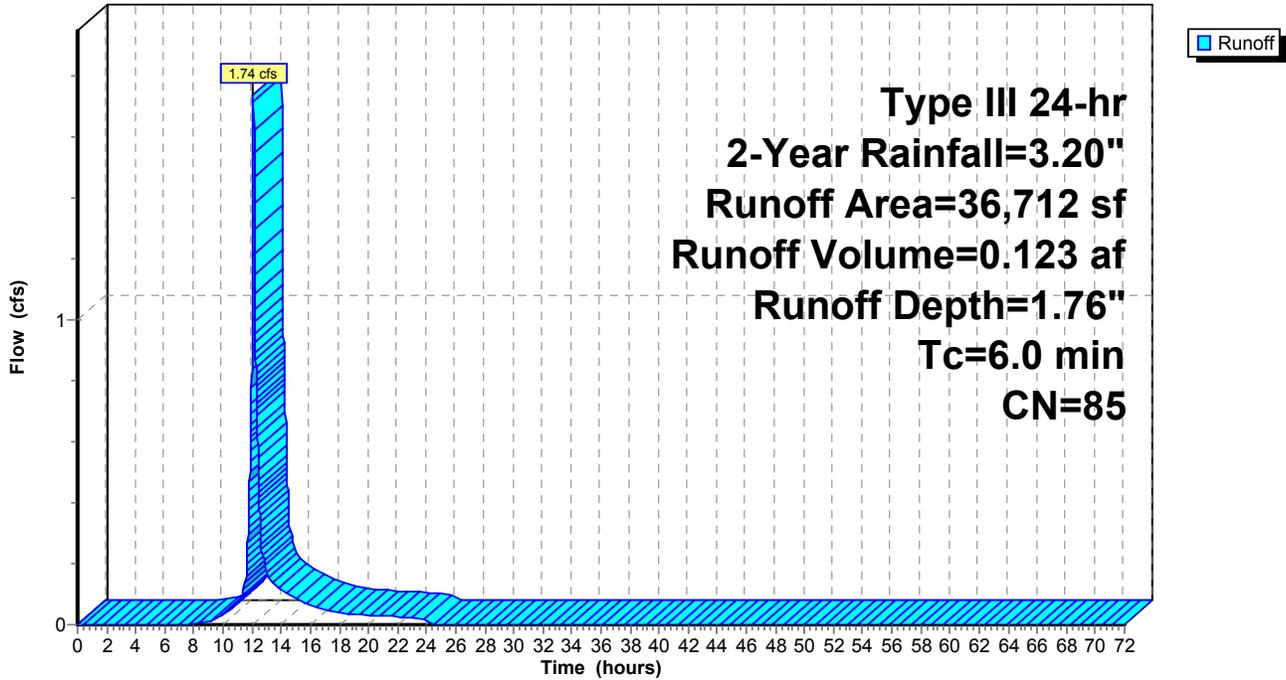
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
* 3,740	98	Roofs, HSG C (offsite)
* 7,808	74	>75% Grass cover, Good, HSG C (offsite)
* 2,415	98	Driveway, HSG C (offsite)
* 5,152	70	Woods, Good, HSG C (offsite)
* 539	98	Ledge, HSG C (offsite)
* 231	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
* 284	98	Conc. pads, HSG C (offsite)
* 888	98	Grass cover over garage, HSG C
* 4,504	74	>75% Grass cover, Good, planting beds HSG C
* 2,512	92	Permeable pavers, HSG C
* 4,301	98	Pavement, HSG C
* 390	98	Patios, HSG C
676	96	Gravel surface, HSG C
* 496	98	Walls, HSG C
* 515	98	Walkways, HSG C
* 85	98	Stepping stones, HSG C
* 856	98	Roofs, HSG C (offsite)
* 590	98	Driveway, HSG C (offsite)
* 676	74	>75% Grass cover, Good, HSG C (offsite)
36,712	85	Weighted Average
21,328		58.10% Pervious Area
15,384		41.90% Impervious Area

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

Subcatchment 1S-2: 1S-2

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 1S-3: 1S-3

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 0.020 af, Depth= 1.76"

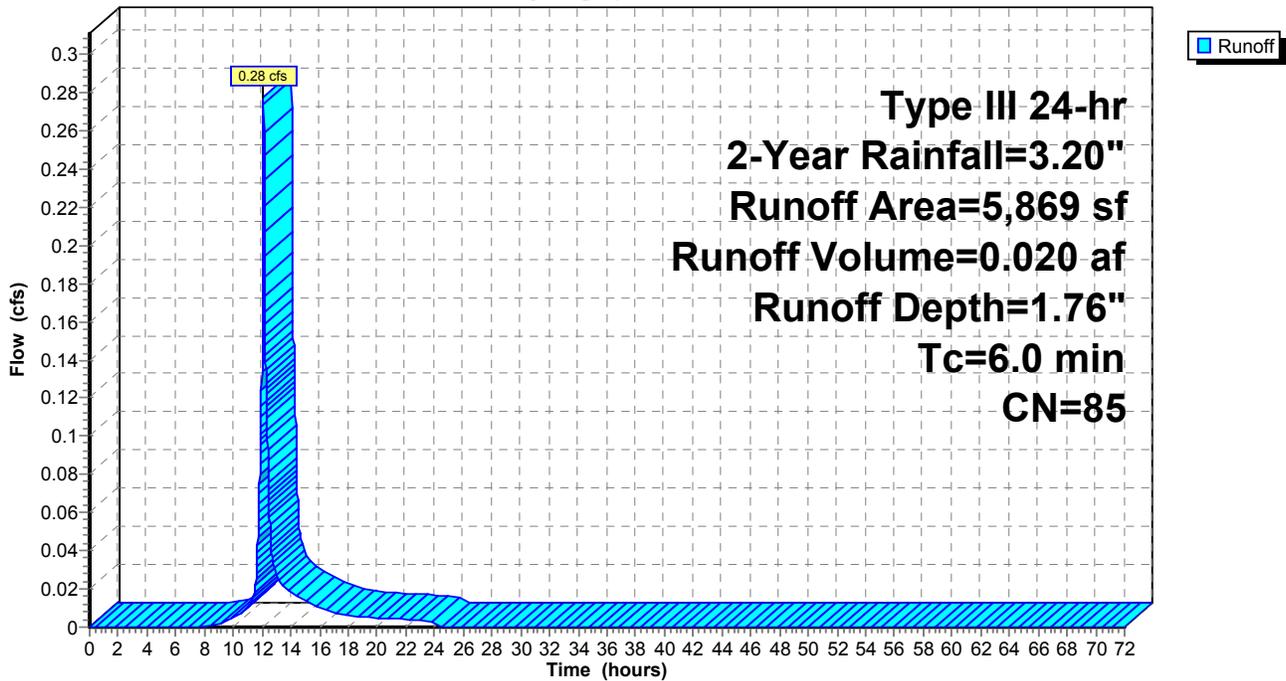
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	1,878	98	Walkways, HSG C
*	3,230	74	>75% Grass cover, Good, planting beds, HSG C
	308	96	Gravel surface, HSG C
*	453	98	Walls, HSG C
	5,869	85	Weighted Average
	3,538		60.28% Pervious Area
	2,331		39.72% Impervious Area

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

Subcatchment 1S-3: 1S-3

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 1S-4: 1S-4

Runoff = 0.06 cfs @ 12.08 hrs, Volume= 0.005 af, Depth= 2.86"

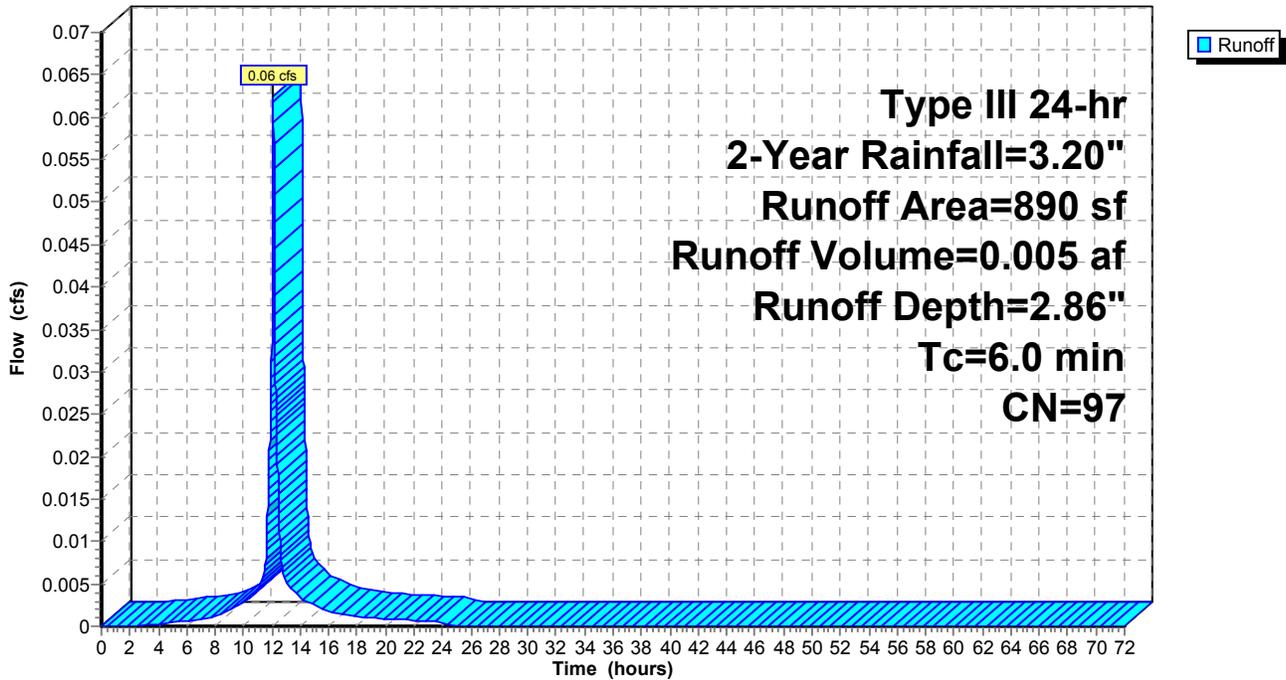
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	133	98	Walkways, HSG C
	48	96	Gravel surface, HSG C
*	641	98	Driveway, HSG C
*	42	74	>75% Grass cover, Good, planting beds, HSG C
*	26	98	Walls, HSG C
	890	97	Weighted Average
	90		10.11% Pervious Area
	800		89.89% Impervious Area

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

Subcatchment 1S-4: 1S-4

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 1S-5: 1S-5

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af, Depth= 1.27"

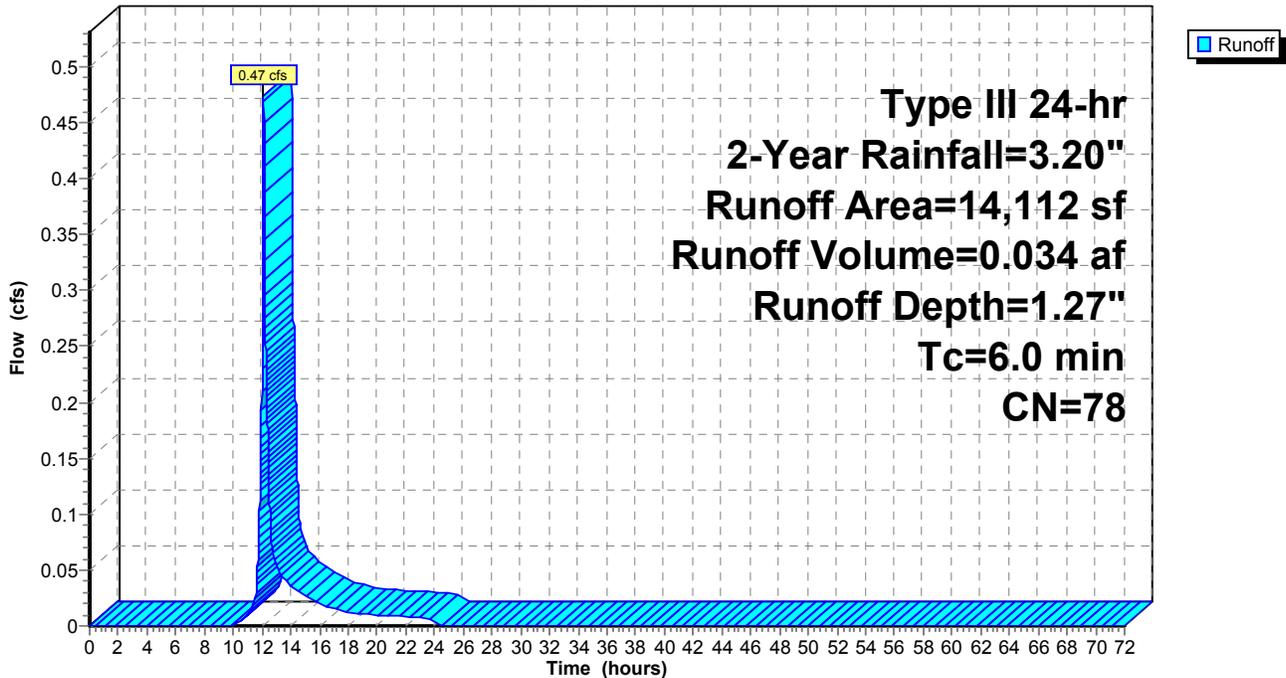
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
* 707	98	Driveway, HSG C (offsite)
* 5,410	74	>75% Grass cover, Good, HSG C (offsite)
* 672	98	Roofs, HSG C (offsite)
* 223	98	Walkways, HSG C
* 115	98	Ledge, HSG C
* 725	98	Patio/Wall, HSG C
* 6,260	74	>75% Grass cover, Good, planting beds, HSG C
14,112	78	Weighted Average
11,670		82.70% Pervious Area
2,442		17.30% Impervious Area

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

Subcatchment 1S-5: 1S-5

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 1S-R1: Roof

Runoff = 1.18 cfs @ 12.08 hrs, Volume= 0.089 af, Depth= 2.64"

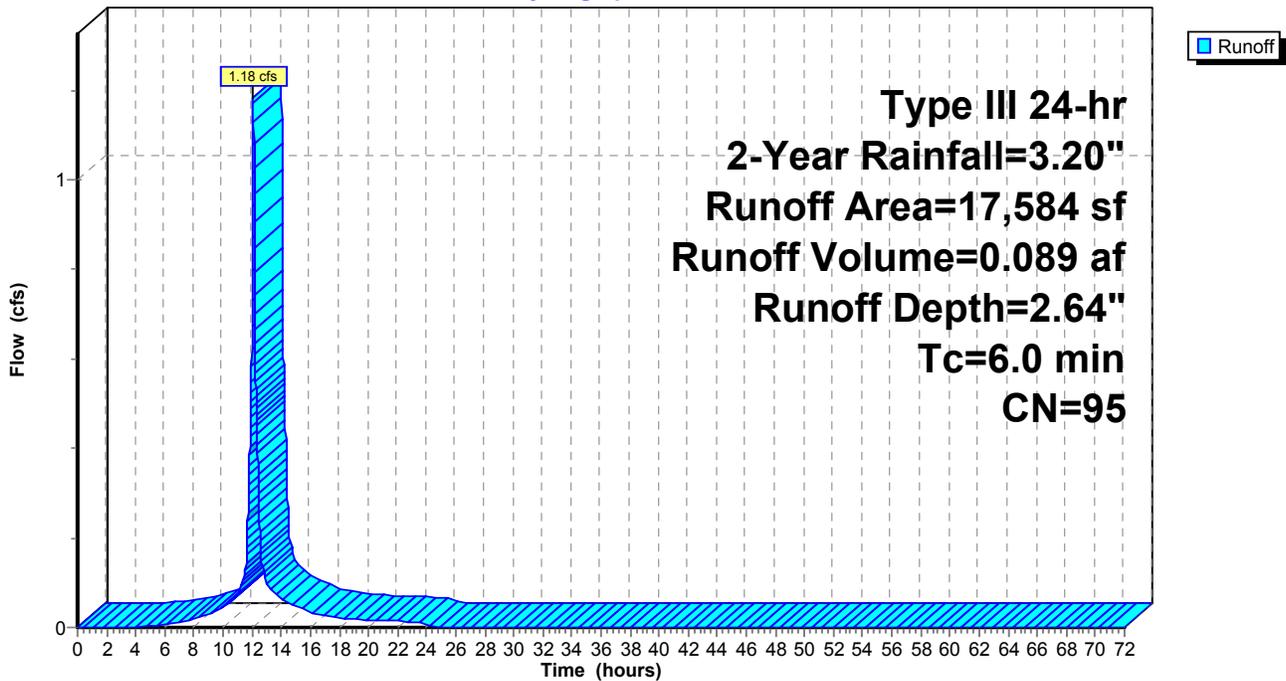
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
15,693	98	Roofs, HSG C
* 1,891	74	Green roof, HSG C
17,584	95	Weighted Average
1,891		10.75% Pervious Area
15,693		89.25% Impervious Area

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

Subcatchment 1S-R1: Roof

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 1S-R2: Roof/Drive/Stairs

Runoff = 0.60 cfs @ 12.08 hrs, Volume= 0.048 af, Depth= 2.97"

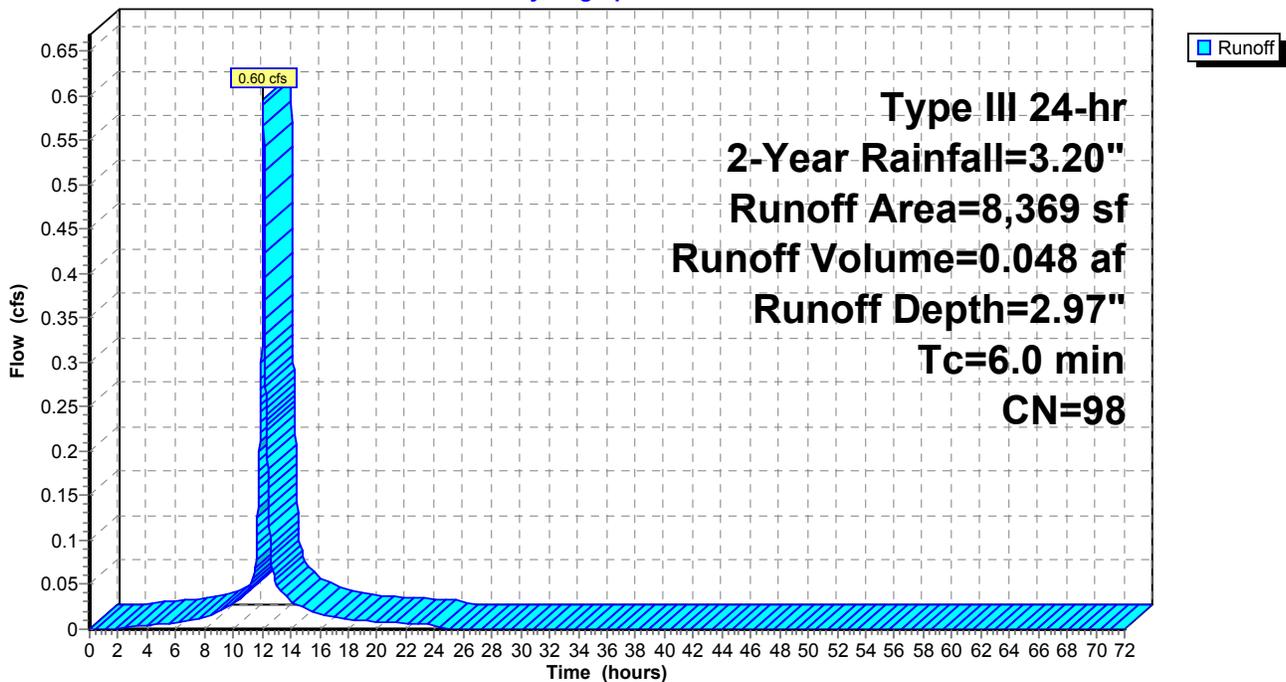
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	7,701	98	Roofs, HSG C
*	668	98	Pavement, HSG C
	8,369	98	Weighted Average
	8,369		100.00% Impervious Area

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

Subcatchment 1S-R2: Roof/Drive/Stairs

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

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Summary for Subcatchment 2S: 2S

Runoff = 1.31 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 1.54"

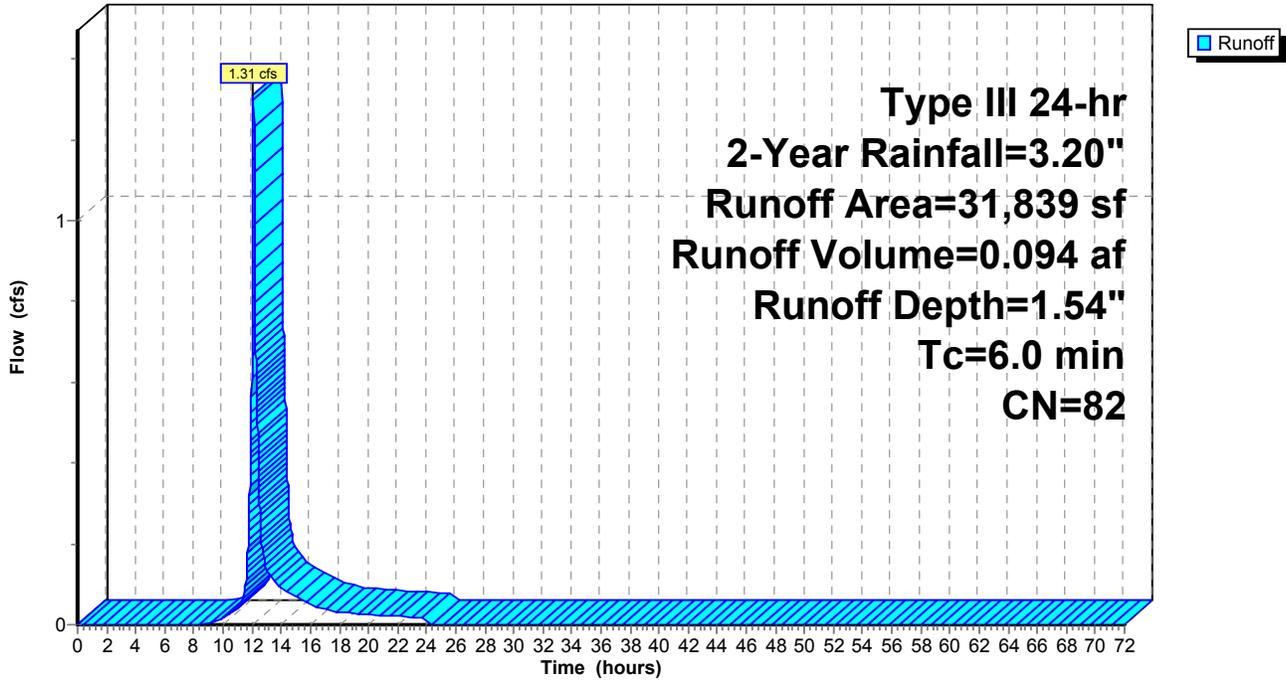
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
1,605	98	Roofs, HSG C
* 3,325	98	Drives, HSG C
* 756	98	Decks, stairs, HSG C
* 332	98	Misc. imp, HSG C
* 421	98	Walls, HSG C
5,598	74	>75% Grass cover, Good, HSG C
* 3,839	98	Roofs, HSG C (offsite)
* 12,359	74	>75% Grass cover, Good, HSG C (offsite)
* 830	98	Drives, HSG C (offsite)
* 2,603	70	Woods, Good, HSG C (offsite)
* 72	98	Ledge, HSG C (offsite)
* 99	98	Walls, HSG C (offsite)
31,839	82	Weighted Average
20,560		64.57% Pervious Area
11,279		35.43% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



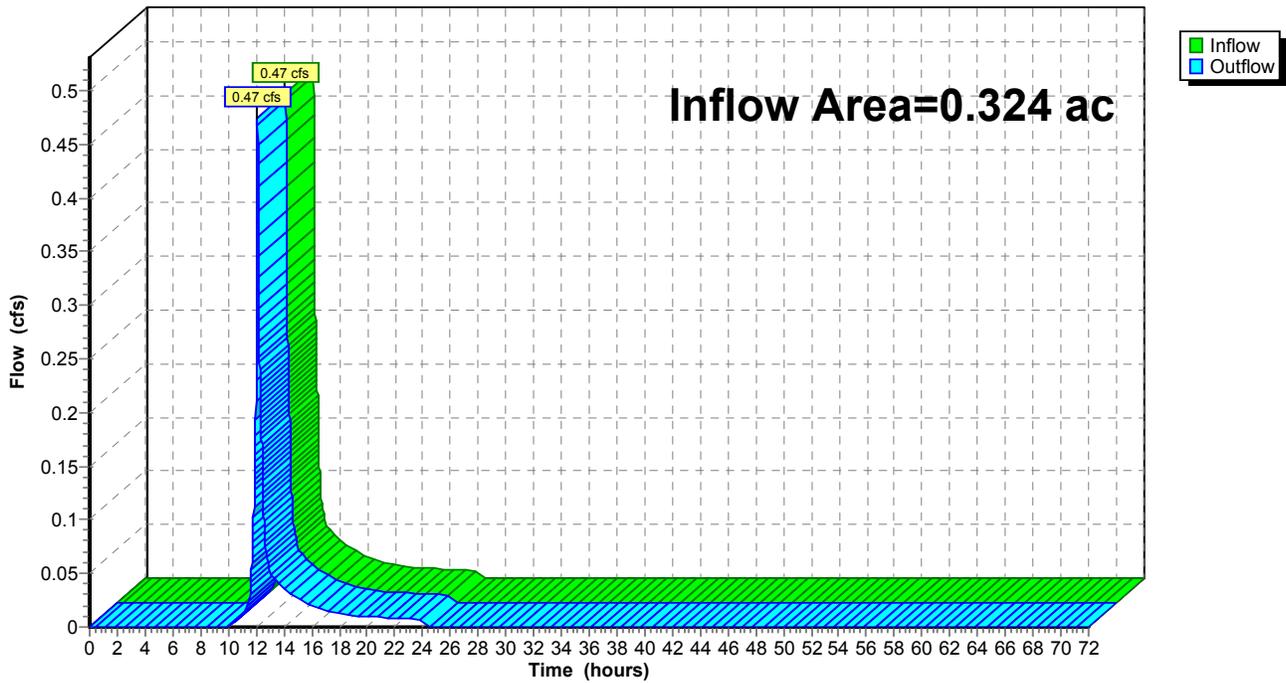
Summary for Reach DP-1: PL Linden Street

Inflow Area = 0.324 ac, 17.30% Impervious, Inflow Depth = 1.27" for 2-Year event
Inflow = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af
Outflow = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-1: PL Linden Street

Hydrograph



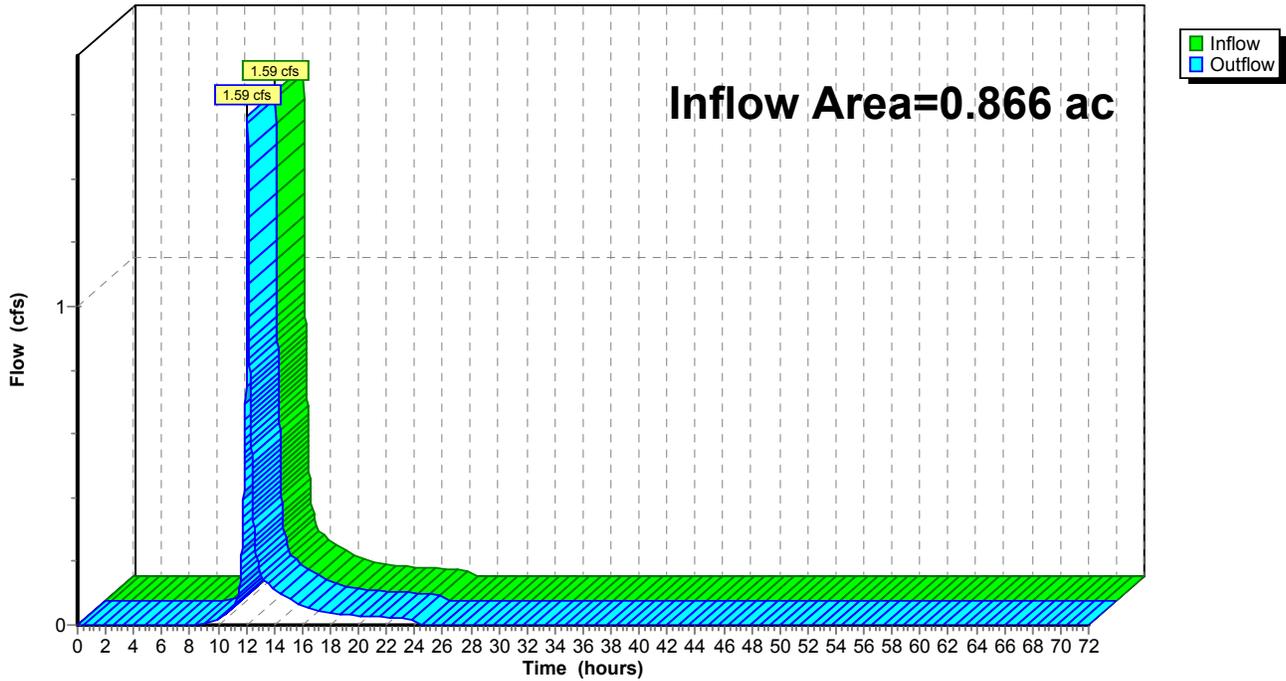
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 0.866 ac, 36.09% Impervious, Inflow Depth = 1.57" for 2-Year event
Inflow = 1.59 cfs @ 12.09 hrs, Volume= 0.113 af
Outflow = 1.59 cfs @ 12.09 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-2: PL Hollis Street

Hydrograph



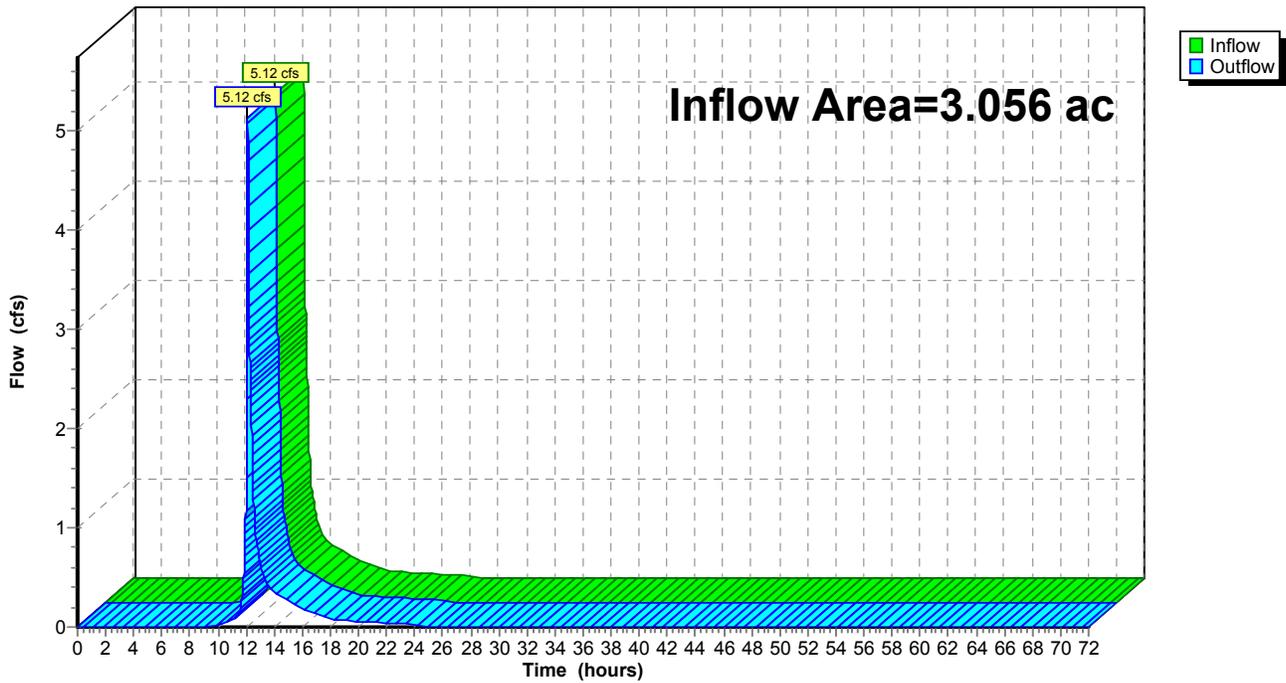
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 42.39% Impervious, Inflow Depth = 1.26" for 2-Year event
Inflow = 5.12 cfs @ 12.09 hrs, Volume= 0.320 af
Outflow = 5.12 cfs @ 12.09 hrs, Volume= 0.320 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-3: Closed Drainage System

Hydrograph



Summary for Pond D-1: Depression

Inflow Area = 0.407 ac, 0.73% Impervious, Inflow Depth = 1.04" for 2-Year event
 Inflow = 0.47 cfs @ 12.10 hrs, Volume= 0.035 af
 Outflow = 0.18 cfs @ 12.41 hrs, Volume= 0.035 af, Atten= 62%, Lag= 18.9 min
 Primary = 0.18 cfs @ 12.41 hrs, Volume= 0.035 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 185.71' @ 12.41 hrs Surf.Area= 595 sf Storage= 320 cf

Plug-Flow detention time= 27.2 min calculated for 0.035 af (100% of inflow)
 Center-of-Mass det. time= 27.3 min (889.4 - 862.1)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	2,886 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	309	0	0
186.00	713	511	511
187.00	1,174	944	1,455
188.00	1,689	1,432	2,886

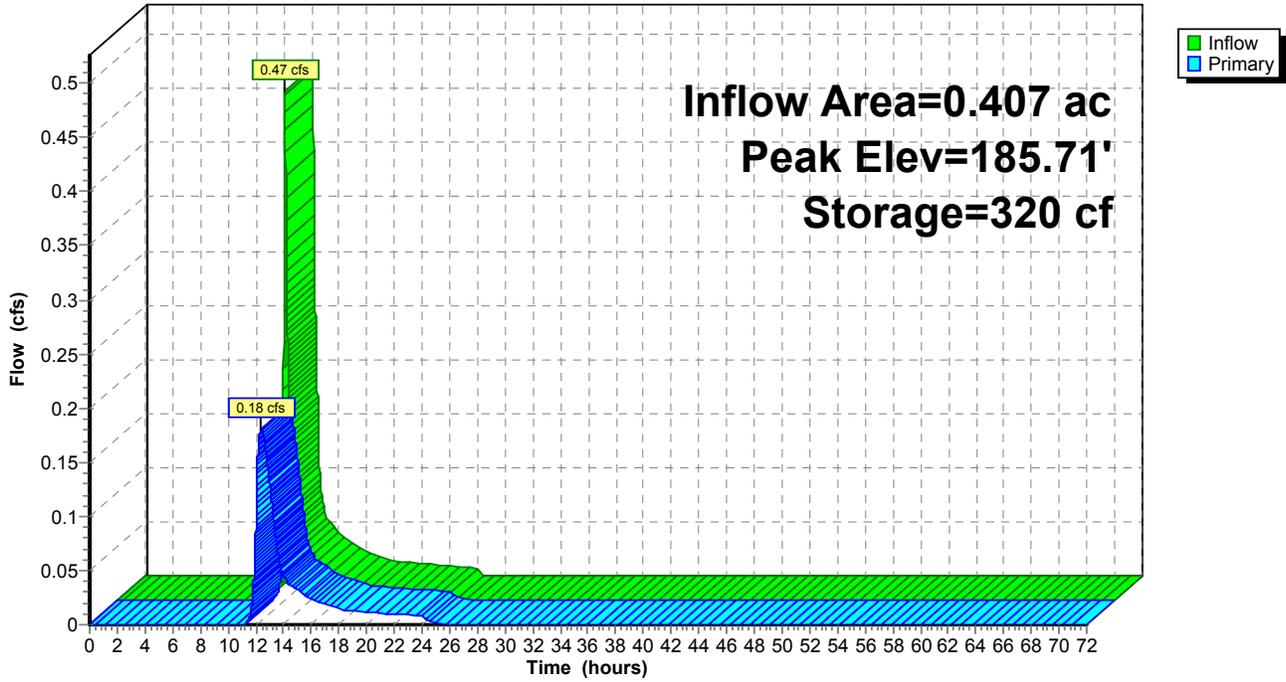
Device	Routing	Invert	Outlet Devices
#1	Primary	179.40'	8.0" Round Culvert L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.40' / 179.33' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	185.00'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	187.30'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.18 cfs @ 12.41 hrs HW=185.71' TW=169.16' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 0.18 cfs of 4.11 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.18 cfs @ 3.68 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond D-1: Depression

Hydrograph



Summary for Pond P-1: Infiltration Chambers

Inflow Area = 1.654 ac, 43.32% Impervious, Inflow Depth = 1.80" for 2-Year event
 Inflow = 3.05 cfs @ 12.09 hrs, Volume= 0.248 af
 Outflow = 3.04 cfs @ 12.10 hrs, Volume= 0.248 af, Atten= 1%, Lag= 0.5 min
 Discarded = 0.05 cfs @ 9.68 hrs, Volume= 0.088 af
 Primary = 2.99 cfs @ 12.10 hrs, Volume= 0.159 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 169.36' @ 12.10 hrs Surf.Area= 852 sf Storage= 1,700 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 105.6 min (924.4 - 818.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.50'	665 cf	18.44'W x 46.22'L x 3.50'H Field A 2,982 cf Overall - 1,320 cf Embedded = 1,662 cf x 40.0% Voids
#2A	166.83'	1,254 cf	ACF R-Tank HD 1.5 x 198 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 11 Rows of 18 Chambers
		1,919 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	165.00'	12.0" Round Culvert L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 165.00' / 164.05' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	168.20'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	169.00'	4.0' long x 1.00' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	166.50'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.05 cfs @ 9.68 hrs HW=166.54' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=2.99 cfs @ 12.10 hrs HW=169.36' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert (Passes 2.99 cfs of 7.43 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 0.24 cfs @ 4.89 fps)
 ↳3=Sharp-Crested Rectangular Weir(Weir Controls 2.75 cfs @ 1.96 fps)

Pond P-1: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF Environmental R-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

18 Chambers/Row x 2.35' Long = 42.22' Row Length +24.0" End Stone x 2 = 46.22' Base Length

11 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 18.44' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

198 Chambers x 6.3 cf = 1,253.9 cf Chamber Storage

198 Chambers x 6.7 cf = 1,319.9 cf Displacement

2,981.5 cf Field - 1,319.9 cf Chambers = 1,661.6 cf Stone x 40.0% Voids = 664.7 cf Stone Storage

Chamber Storage + Stone Storage = 1,918.5 cf = 0.044 af

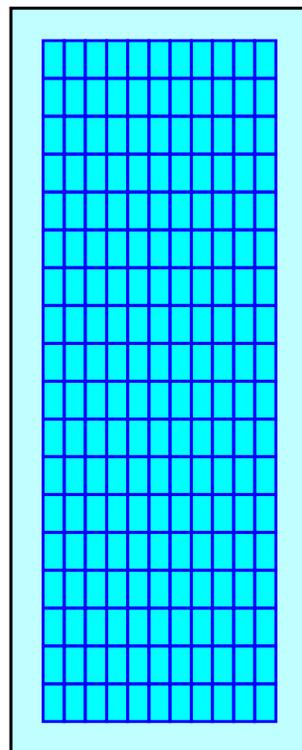
Overall Storage Efficiency = 64.3%

Overall System Size = 46.22' x 18.44' x 3.50'

198 Chambers

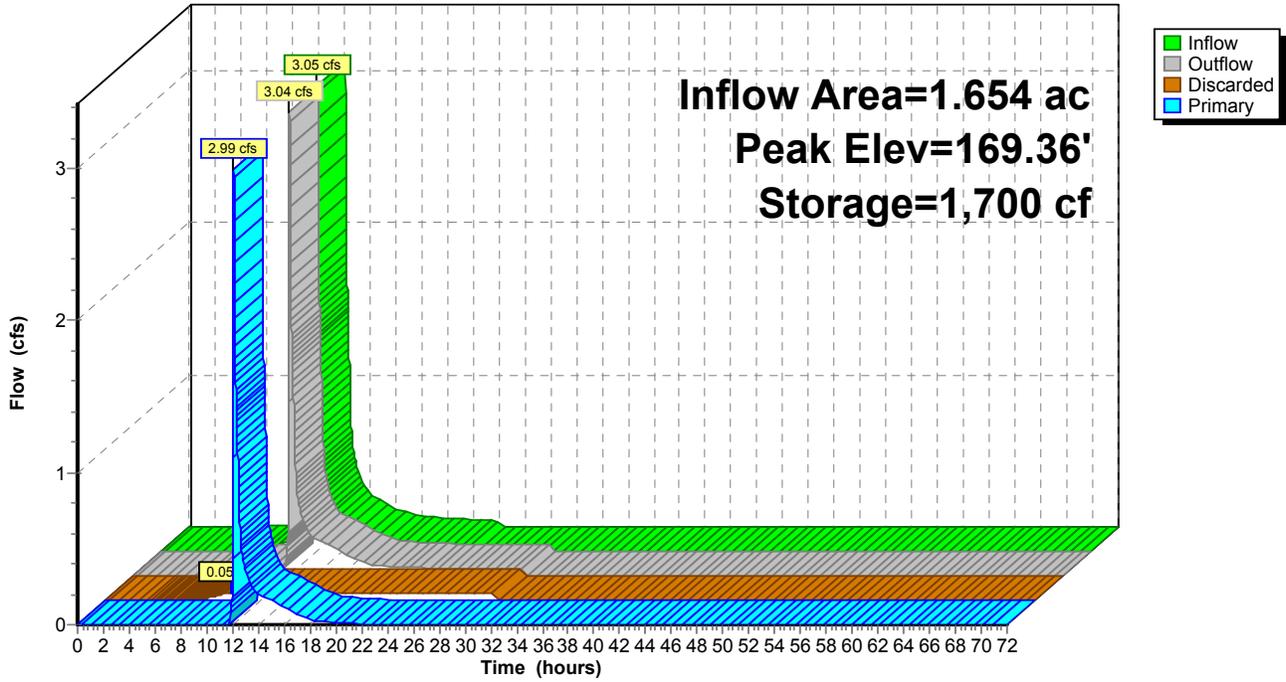
110.4 cy Field

61.5 cy Stone



Pond P-1: Infiltration Chambers

Hydrograph



Summary for Pond P-2: Infiltration Chambers

Inflow Area = 0.192 ac, 100.00% Impervious, Inflow Depth = 2.97" for 2-Year event
 Inflow = 0.60 cfs @ 12.08 hrs, Volume= 0.048 af
 Outflow = 0.12 cfs @ 12.50 hrs, Volume= 0.048 af, Atten= 79%, Lag= 25.1 min
 Discarded = 0.03 cfs @ 10.47 hrs, Volume= 0.040 af
 Primary = 0.10 cfs @ 12.50 hrs, Volume= 0.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 159.39' @ 12.50 hrs Surf.Area= 493 sf Storage= 764 cf

Plug-Flow detention time= 160.2 min calculated for 0.048 af (100% of inflow)
 Center-of-Mass det. time= 160.2 min (916.6 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	157.00'	465 cf	9.25'W x 53.26'L x 3.50'H Field A 1,724 cf Overall - 560 cf Embedded = 1,164 cf x 40.0% Voids
#2A	157.33'	532 cf	ACF R-Tank HD 1.5 x 84 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 4 Rows of 21 Chambers
		997 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	12.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.00' S= 0.0500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	158.95'	2.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	159.50'	4.0' long x 0.65' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	157.00'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 10.47 hrs HW=157.04' (Free Discharge)

↑ **4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.10 cfs @ 12.50 hrs HW=159.39' TW=0.00' (Dynamic Tailwater)

↑ **1=Culvert** (Passes 0.10 cfs of 6.43 cfs potential flow)
 ↑ **2=Orifice/Grate** (Orifice Controls 0.10 cfs @ 2.80 fps)
 ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-2: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF EnvironmentalIR-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

21 Chambers/Row x 2.35' Long = 49.26' Row Length +24.0" End Stone x 2 = 53.26' Base Length

4 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 9.25' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

84 Chambers x 6.3 cf = 531.9 cf Chamber Storage

84 Chambers x 6.7 cf = 559.9 cf Displacement

1,723.6 cf Field - 559.9 cf Chambers = 1,163.6 cf Stone x 40.0% Voids = 465.5 cf Stone Storage

Chamber Storage + Stone Storage = 997.4 cf = 0.023 af

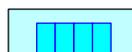
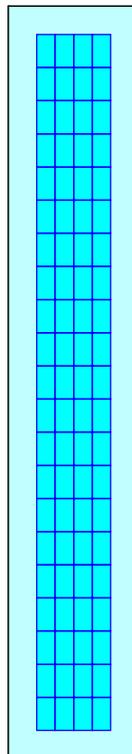
Overall Storage Efficiency = 57.9%

Overall System Size = 53.26' x 9.25' x 3.50'

84 Chambers

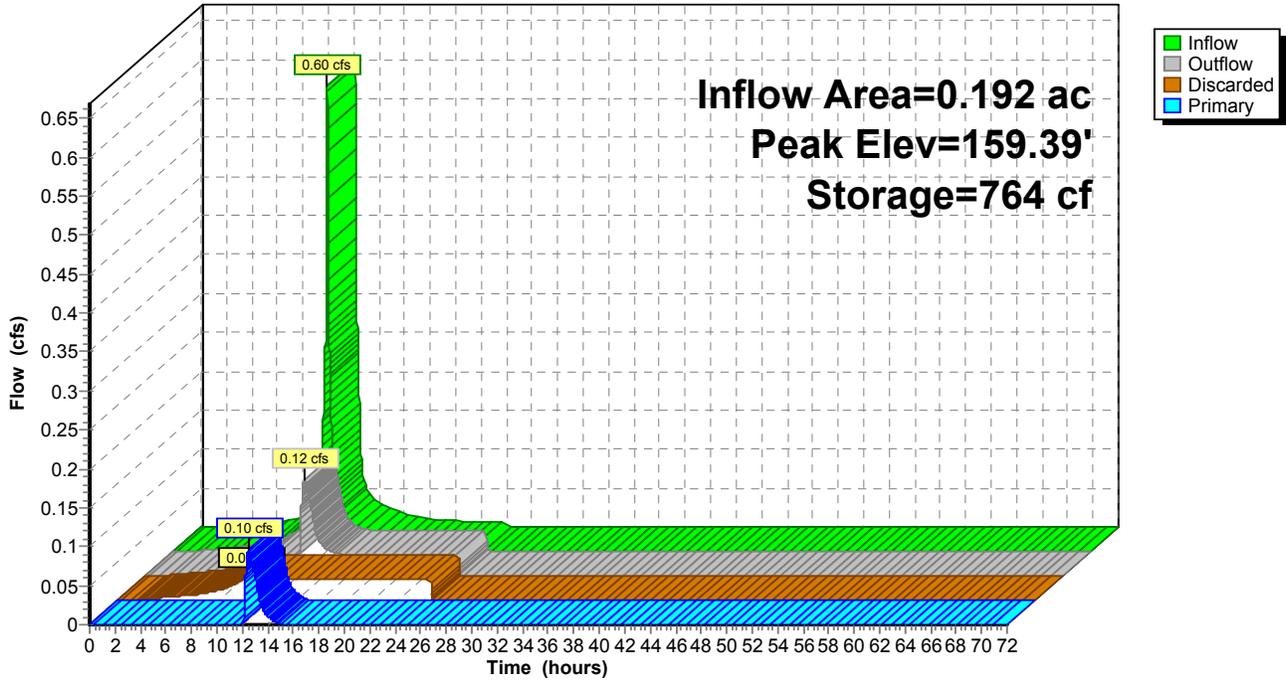
63.8 cy Field

43.1 cy Stone



Pond P-2: Infiltration Chambers

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 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 1S-1: 1S-1	Runoff Area=17,747 sf 0.73% Impervious Runoff Depth=2.13" Tc=6.0 min CN=74 Runoff=1.01 cfs 0.072 af
Subcatchment 1S-2: 1S-2	Runoff Area=36,712 sf 41.90% Impervious Runoff Depth=3.09" Tc=6.0 min CN=85 Runoff=3.03 cfs 0.217 af
Subcatchment 1S-3: 1S-3	Runoff Area=5,869 sf 39.72% Impervious Runoff Depth=3.09" Tc=6.0 min CN=85 Runoff=0.48 cfs 0.035 af
Subcatchment 1S-4: 1S-4	Runoff Area=890 sf 89.89% Impervious Runoff Depth=4.35" Tc=6.0 min CN=97 Runoff=0.09 cfs 0.007 af
Subcatchment 1S-5: 1S-5	Runoff Area=14,112 sf 17.30% Impervious Runoff Depth=2.46" Tc=6.0 min CN=78 Runoff=0.93 cfs 0.066 af
Subcatchment 1S-R1: Roof	Runoff Area=17,584 sf 89.25% Impervious Runoff Depth=4.12" Tc=6.0 min CN=95 Runoff=1.80 cfs 0.139 af
Subcatchment 1S-R2: Roof/Drive/Stairs	Runoff Area=8,369 sf 100.00% Impervious Runoff Depth=4.46" Tc=6.0 min CN=98 Runoff=0.88 cfs 0.071 af
Subcatchment 2S: 2S	Runoff Area=31,839 sf 35.43% Impervious Runoff Depth=2.81" Tc=6.0 min CN=82 Runoff=2.41 cfs 0.171 af
Reach DP-1: PL Linden Street	Inflow=0.93 cfs 0.066 af Outflow=0.93 cfs 0.066 af
Reach DP-2: PL Hollis Street	Inflow=2.89 cfs 0.206 af Outflow=2.89 cfs 0.206 af
Reach DP-3: Closed Drainage System	Inflow=9.60 cfs 0.637 af Outflow=9.60 cfs 0.637 af
Pond D-1: Depression	Peak Elev=186.43' Storage=863 cf Inflow=1.01 cfs 0.072 af Outflow=0.27 cfs 0.072 af
Pond P-1: Infiltration Chambers	Peak Elev=169.52' Storage=1,754 cf Inflow=5.04 cfs 0.428 af Discarded=0.05 cfs 0.096 af Primary=4.97 cfs 0.332 af Outflow=5.02 cfs 0.428 af
Pond P-2: Infiltration Chambers	Peak Elev=159.64' Storage=828 cf Inflow=0.88 cfs 0.071 af Discarded=0.03 cfs 0.046 af Primary=0.81 cfs 0.025 af Outflow=0.84 cfs 0.071 af

Total Runoff Area = 3.056 ac Runoff Volume = 0.779 af Average Runoff Depth = 3.06"
57.61% Pervious = 1.761 ac 42.39% Impervious = 1.295 ac

216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 1S-1: 1S-1

Runoff = 1.01 cfs @ 12.09 hrs, Volume= 0.072 af, Depth= 2.13"

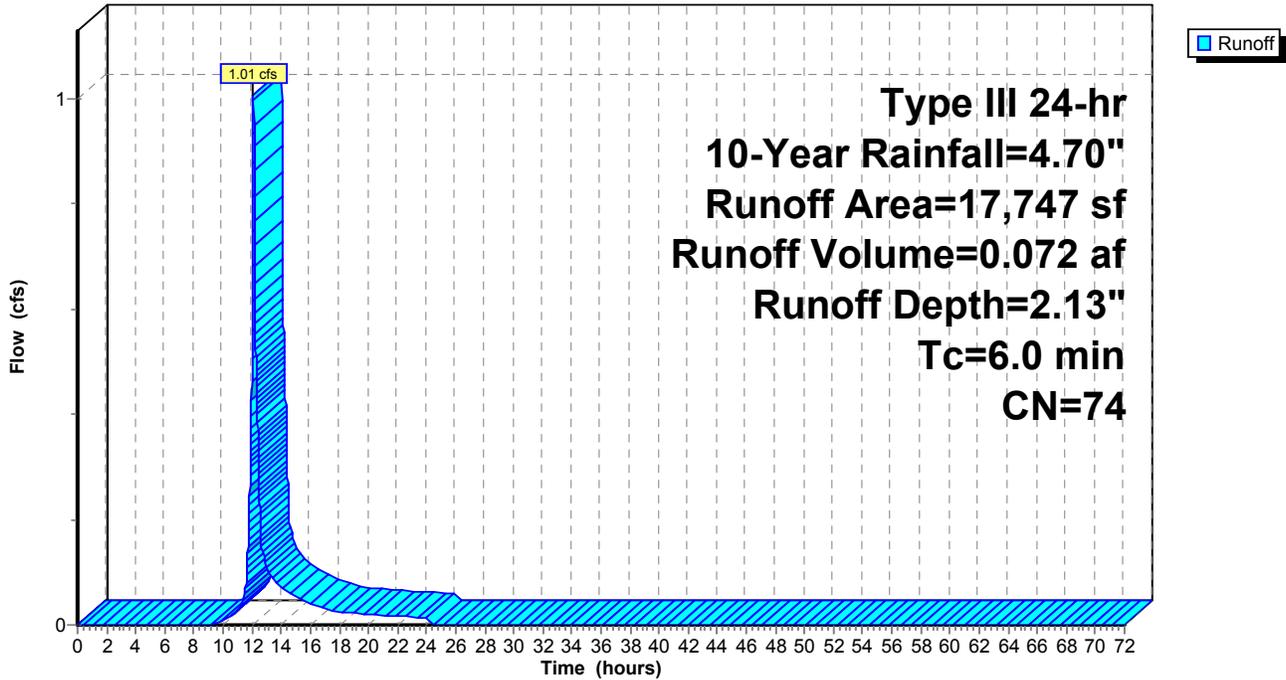
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
6,714	74	>75% Grass cover, Good, HSG C
* 10,903	74	>75% Grass cover, Good, HSG C (offsite)
* 130	98	Roofs, HSG C (offsite)
17,747	74	Weighted Average
17,617		99.27% Pervious Area
130		0.73% Impervious Area

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

Subcatchment 1S-1: 1S-1

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 1S-2: 1S-2

Runoff = 3.03 cfs @ 12.09 hrs, Volume= 0.217 af, Depth= 3.09"

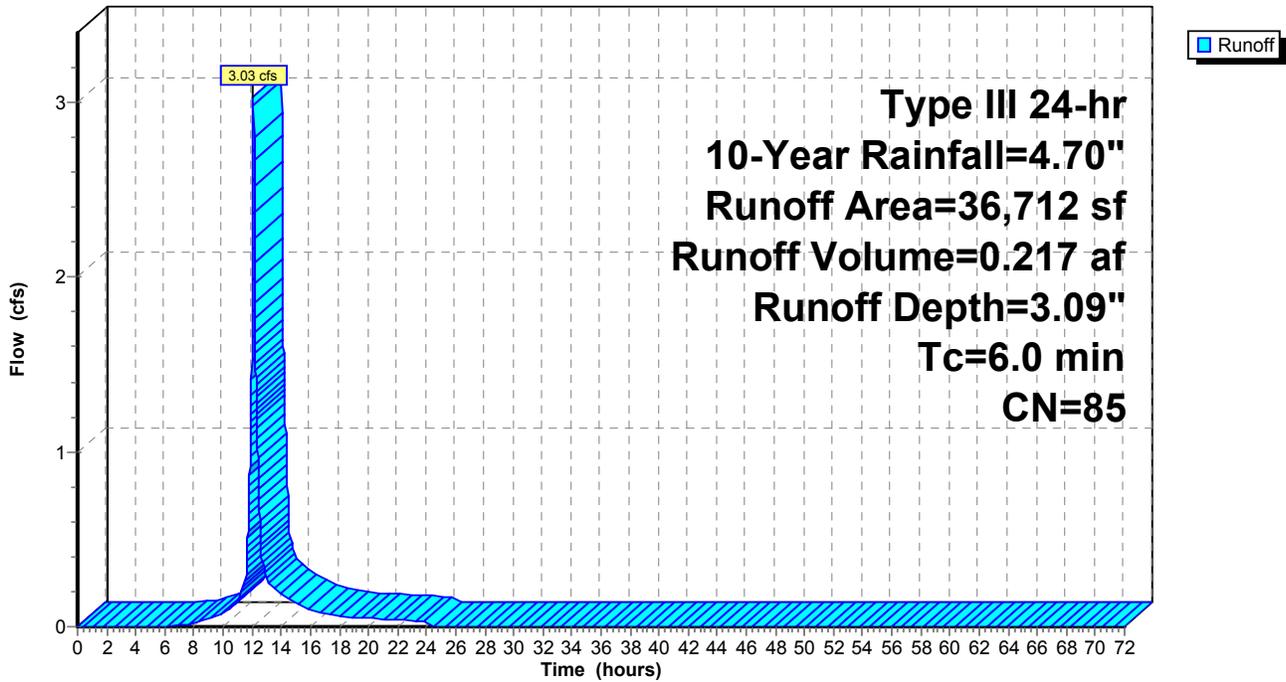
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
* 3,740	98	Roofs, HSG C (offsite)
* 7,808	74	>75% Grass cover, Good, HSG C (offsite)
* 2,415	98	Driveway, HSG C (offsite)
* 5,152	70	Woods, Good, HSG C (offsite)
* 539	98	Ledge, HSG C (offsite)
* 231	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
* 284	98	Conc. pads, HSG C (offsite)
* 888	98	Grass cover over garage, HSG C
* 4,504	74	>75% Grass cover, Good, planting beds HSG C
* 2,512	92	Permeable pavers, HSG C
* 4,301	98	Pavement, HSG C
* 390	98	Patios, HSG C
676	96	Gravel surface, HSG C
* 496	98	Walls, HSG C
* 515	98	Walkways, HSG C
* 85	98	Stepping stones, HSG C
* 856	98	Roofs, HSG C (offsite)
* 590	98	Driveway, HSG C (offsite)
* 676	74	>75% Grass cover, Good, HSG C (offsite)
36,712	85	Weighted Average
21,328		58.10% Pervious Area
15,384		41.90% Impervious Area

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

Subcatchment 1S-2: 1S-2

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 1S-3: 1S-3

Runoff = 0.48 cfs @ 12.09 hrs, Volume= 0.035 af, Depth= 3.09"

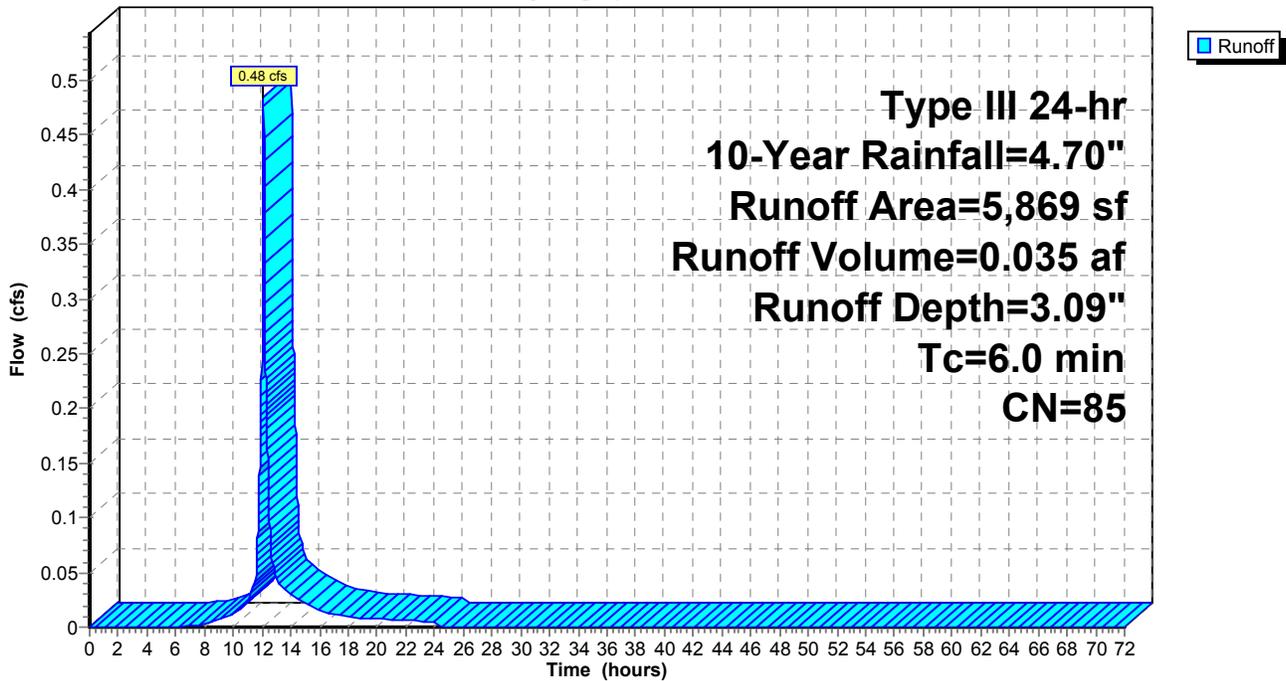
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	1,878	98	Walkways, HSG C
*	3,230	74	>75% Grass cover, Good, planting beds, HSG C
	308	96	Gravel surface, HSG C
*	453	98	Walls, HSG C
	5,869	85	Weighted Average
	3,538		60.28% Pervious Area
	2,331		39.72% Impervious Area

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

Subcatchment 1S-3: 1S-3

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 1S-4: 1S-4

Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.007 af, Depth= 4.35"

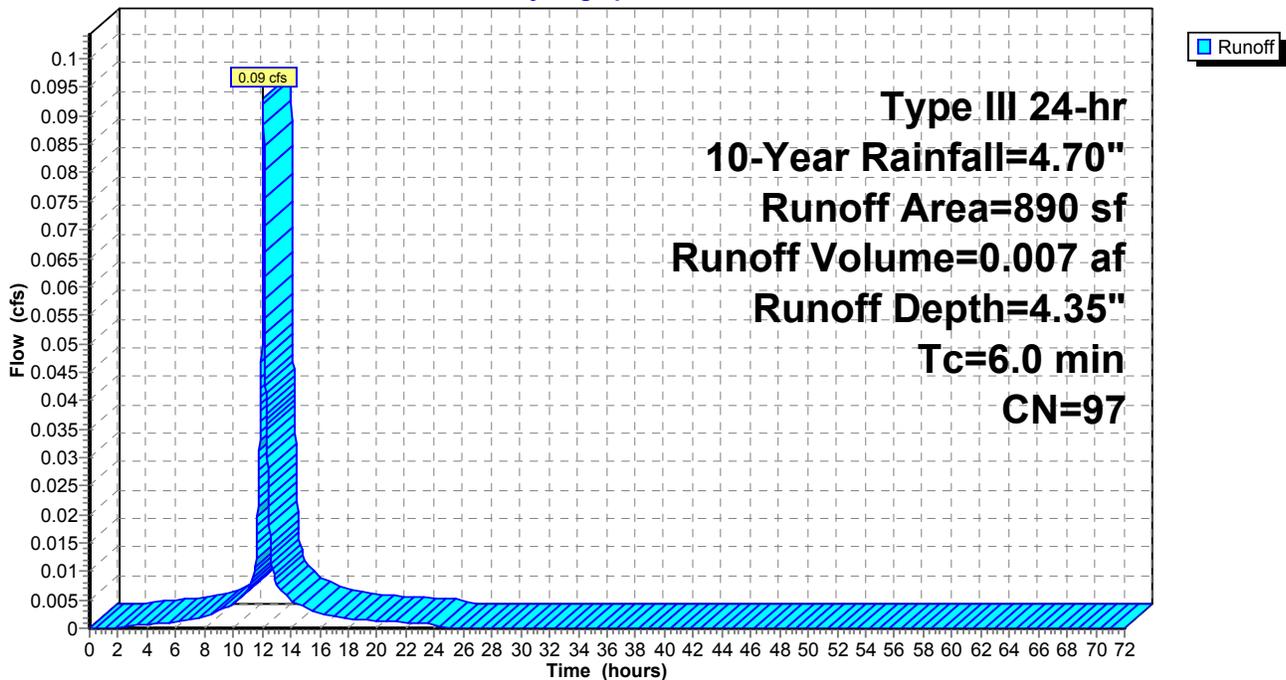
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	133	98	Walkways, HSG C
	48	96	Gravel surface, HSG C
*	641	98	Driveway, HSG C
*	42	74	>75% Grass cover, Good, planting beds, HSG C
*	26	98	Walls, HSG C
			Weighted Average
	890	97	
	90		10.11% Pervious Area
	800		89.89% Impervious Area

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

Subcatchment 1S-4: 1S-4

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 1S-5: 1S-5

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 2.46"

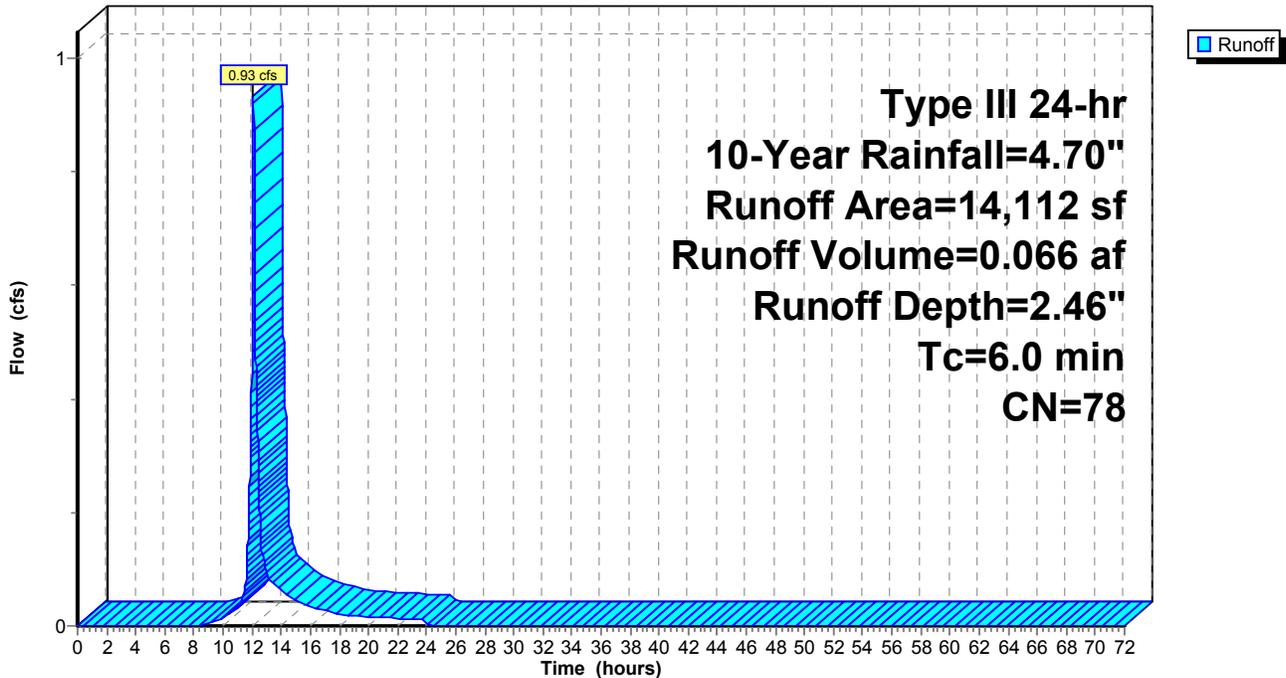
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
* 707	98	Driveway, HSG C (offsite)
* 5,410	74	>75% Grass cover, Good, HSG C (offsite)
* 672	98	Roofs, HSG C (offsite)
* 223	98	Walkways, HSG C
* 115	98	Ledge, HSG C
* 725	98	Patio/Wall, HSG C
* 6,260	74	>75% Grass cover, Good, planting beds, HSG C
14,112	78	Weighted Average
11,670		82.70% Pervious Area
2,442		17.30% Impervious Area

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

Subcatchment 1S-5: 1S-5

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 1S-R1: Roof

Runoff = 1.80 cfs @ 12.08 hrs, Volume= 0.139 af, Depth= 4.12"

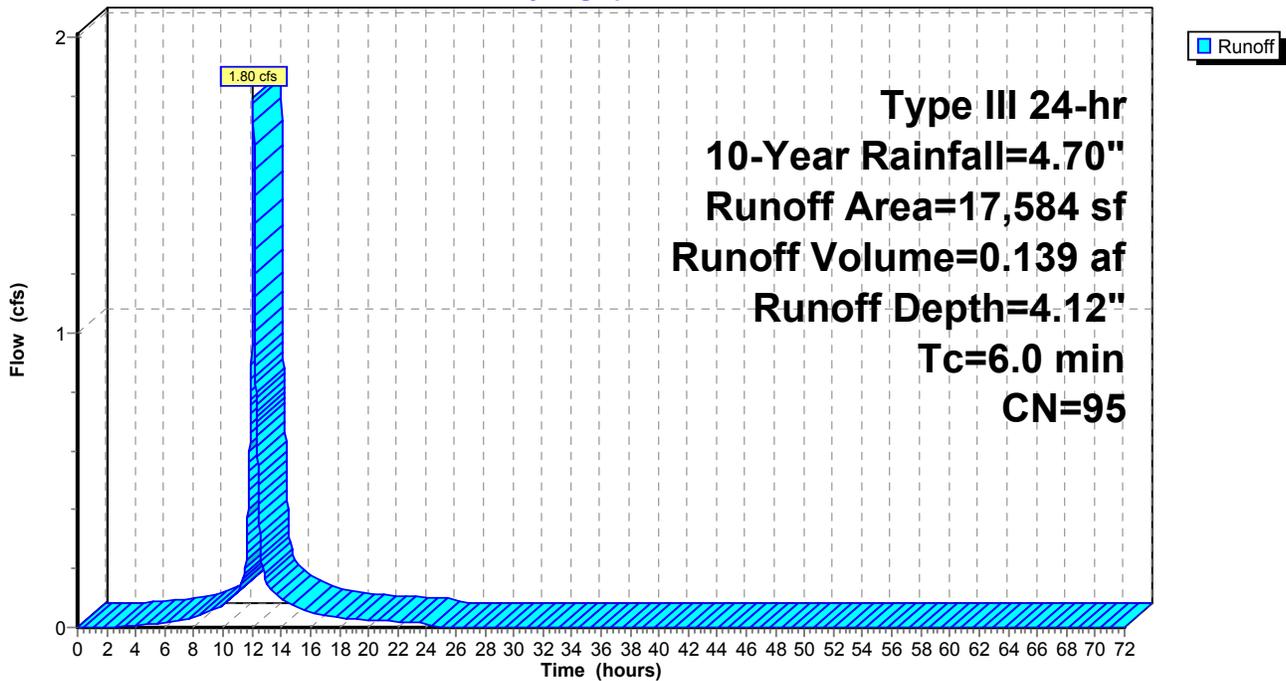
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
15,693	98	Roofs, HSG C
* 1,891	74	Green roof, HSG C
17,584	95	Weighted Average
1,891		10.75% Pervious Area
15,693		89.25% Impervious Area

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

Subcatchment 1S-R1: Roof

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 1S-R2: Roof/Drive/Stairs

Runoff = 0.88 cfs @ 12.08 hrs, Volume= 0.071 af, Depth= 4.46"

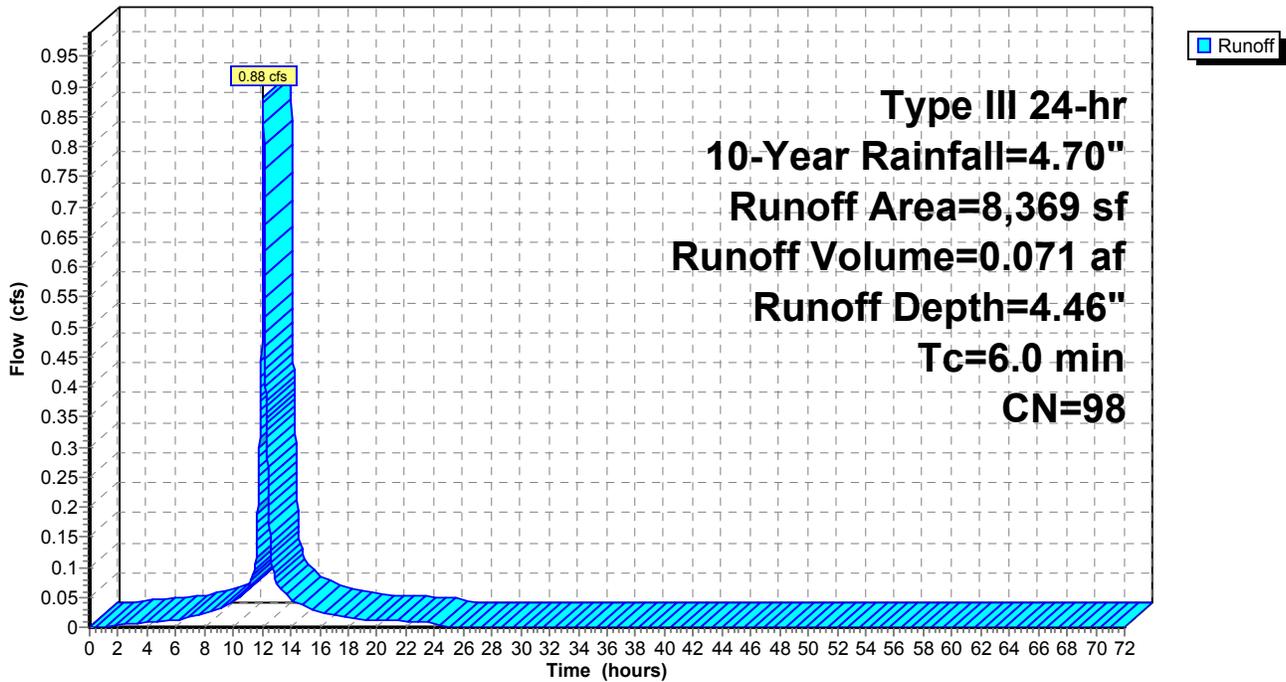
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	7,701	98	Roofs, HSG C
*	668	98	Pavement, HSG C
	8,369	98	Weighted Average
	8,369		100.00% Impervious Area

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

Subcatchment 1S-R2: Roof/Drive/Stairs

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 10-Year Rainfall=4.70"

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Summary for Subcatchment 2S: 2S

Runoff = 2.41 cfs @ 12.09 hrs, Volume= 0.171 af, Depth= 2.81"

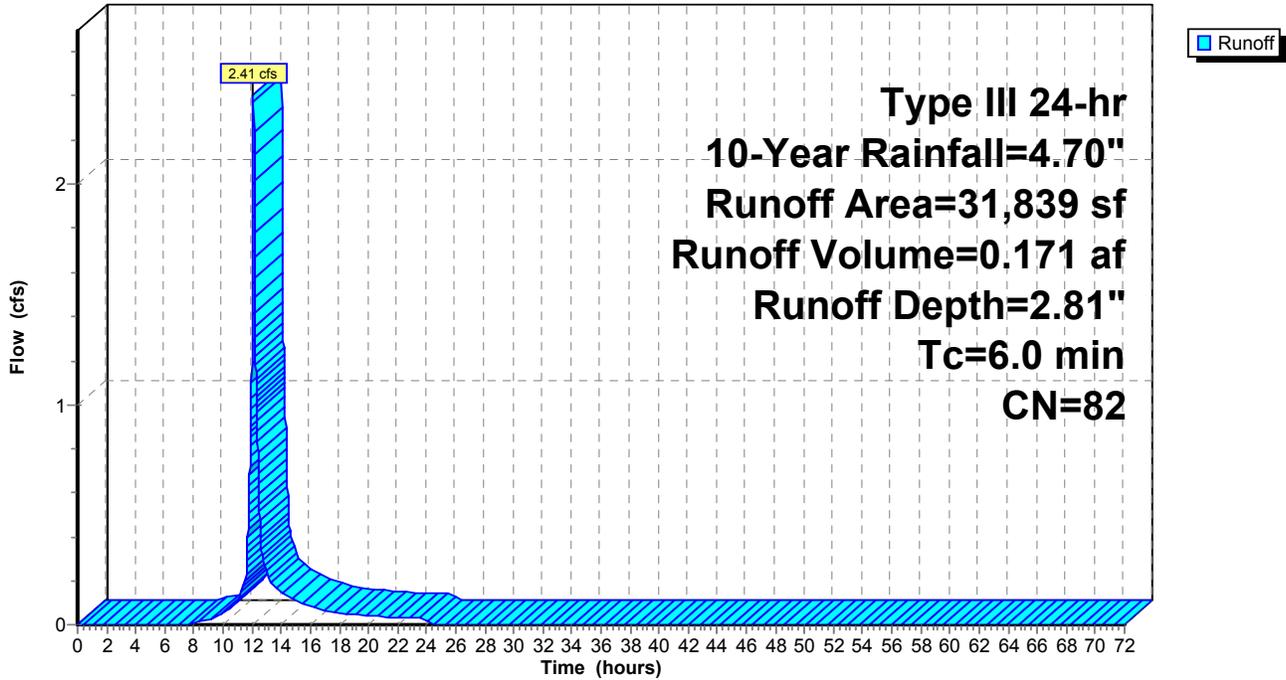
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
1,605	98	Roofs, HSG C
* 3,325	98	Drives, HSG C
* 756	98	Decks, stairs, HSG C
* 332	98	Misc. imp, HSG C
* 421	98	Walls, HSG C
5,598	74	>75% Grass cover, Good, HSG C
* 3,839	98	Roofs, HSG C (offsite)
* 12,359	74	>75% Grass cover, Good, HSG C (offsite)
* 830	98	Drives, HSG C (offsite)
* 2,603	70	Woods, Good, HSG C (offsite)
* 72	98	Ledge, HSG C (offsite)
* 99	98	Walls, HSG C (offsite)
31,839	82	Weighted Average
20,560		64.57% Pervious Area
11,279		35.43% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



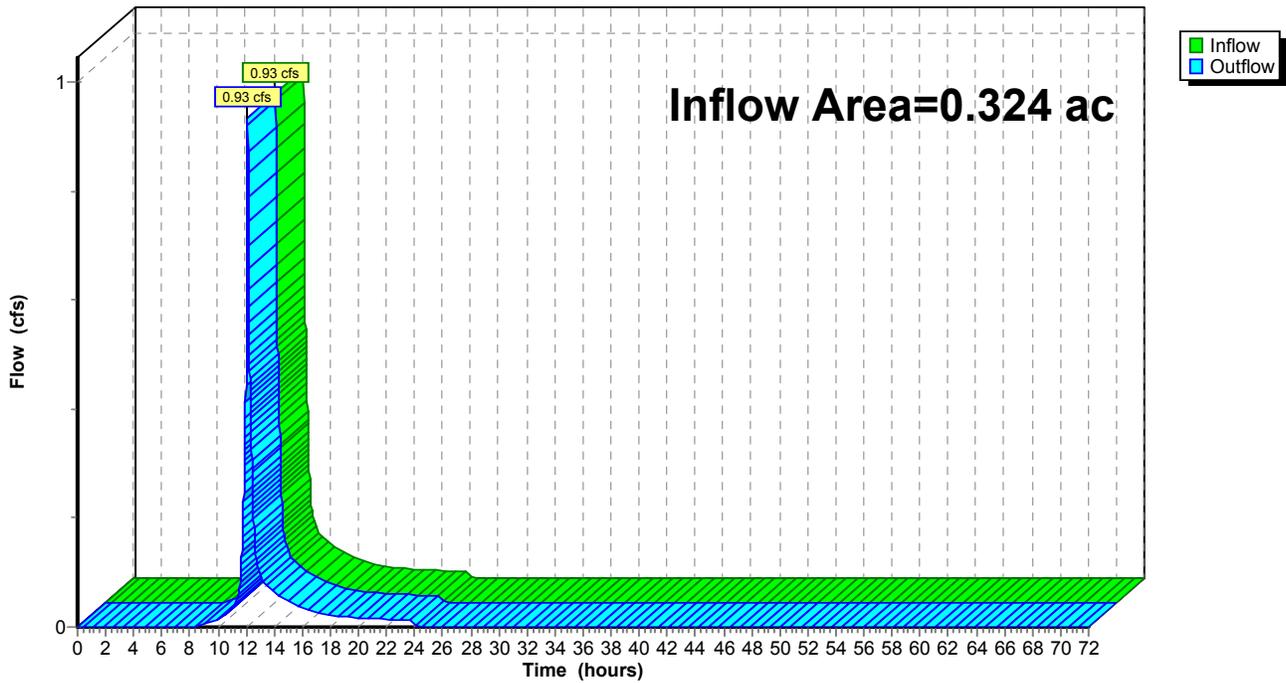
Summary for Reach DP-1: PL Linden Street

Inflow Area = 0.324 ac, 17.30% Impervious, Inflow Depth = 2.46" for 10-Year event
Inflow = 0.93 cfs @ 12.09 hrs, Volume= 0.066 af
Outflow = 0.93 cfs @ 12.09 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-1: PL Linden Street

Hydrograph



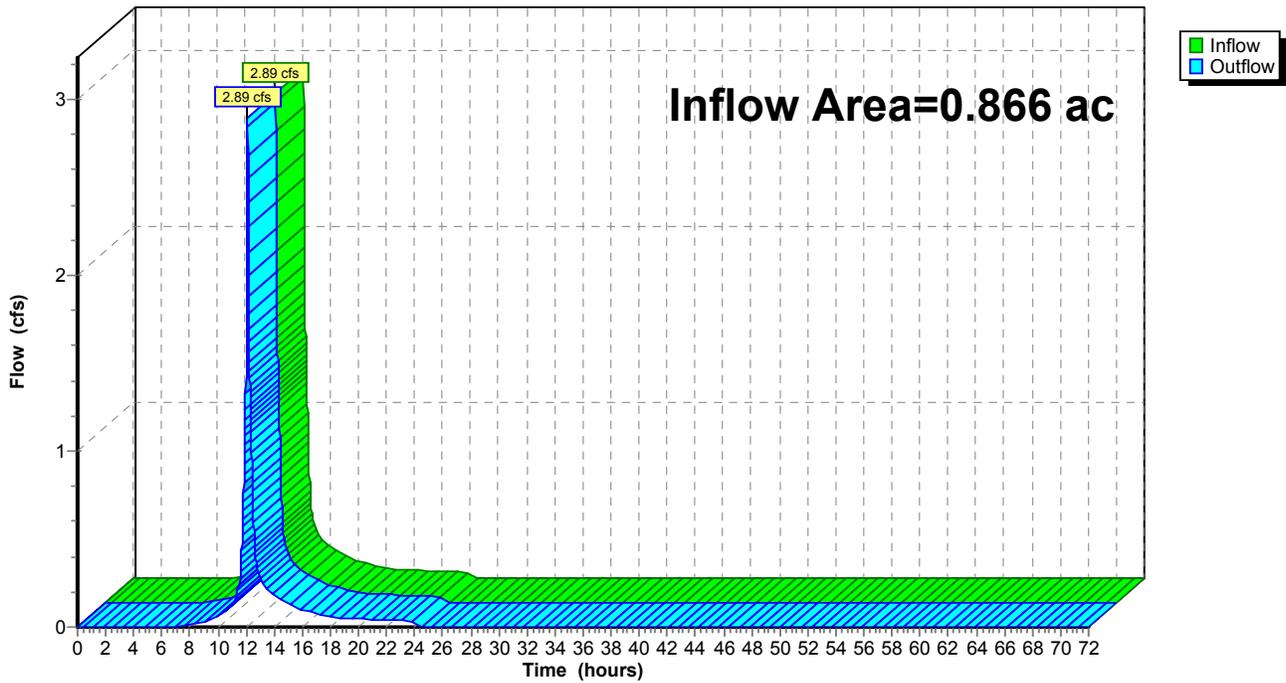
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 0.866 ac, 36.09% Impervious, Inflow Depth = 2.86" for 10-Year event
Inflow = 2.89 cfs @ 12.09 hrs, Volume= 0.206 af
Outflow = 2.89 cfs @ 12.09 hrs, Volume= 0.206 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-2: PL Hollis Street

Hydrograph



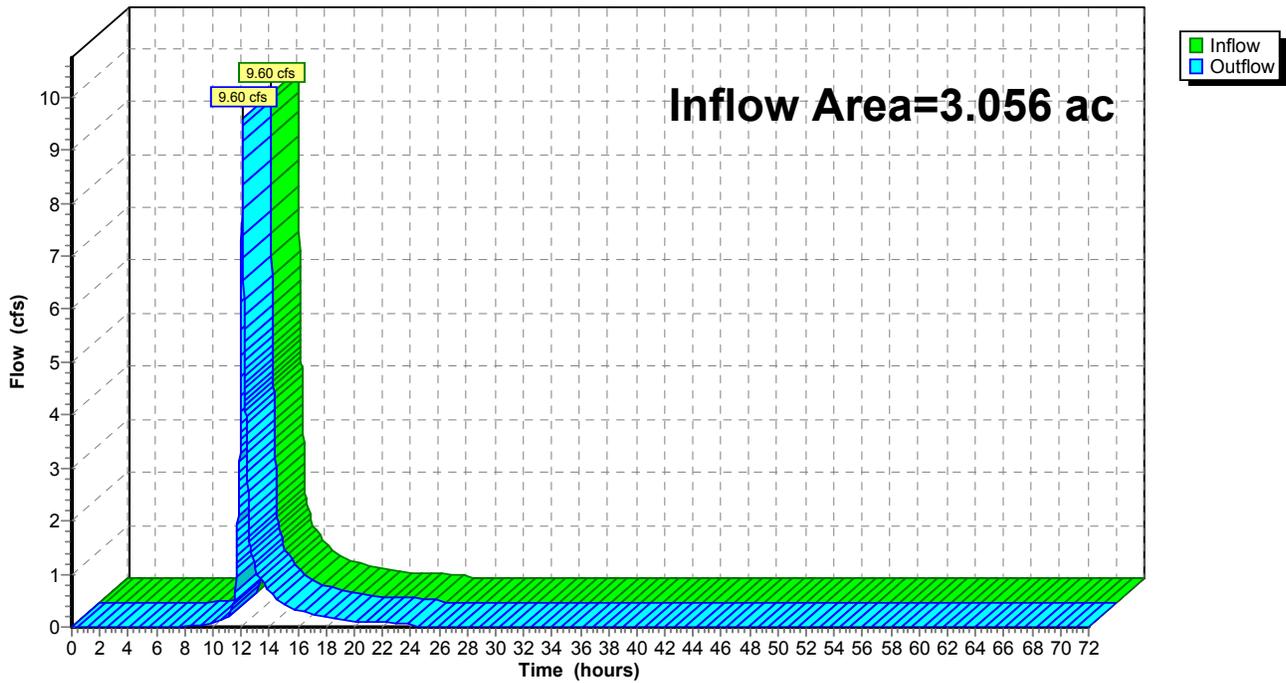
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 42.39% Impervious, Inflow Depth = 2.50" for 10-Year event
Inflow = 9.60 cfs @ 12.10 hrs, Volume= 0.637 af
Outflow = 9.60 cfs @ 12.10 hrs, Volume= 0.637 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-3: Closed Drainage System

Hydrograph



Summary for Pond D-1: Depression

Inflow Area = 0.407 ac, 0.73% Impervious, Inflow Depth = 2.13" for 10-Year event
 Inflow = 1.01 cfs @ 12.09 hrs, Volume= 0.072 af
 Outflow = 0.27 cfs @ 12.49 hrs, Volume= 0.072 af, Atten= 73%, Lag= 23.7 min
 Primary = 0.27 cfs @ 12.49 hrs, Volume= 0.072 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 186.43' @ 12.49 hrs Surf.Area= 913 sf Storage= 863 cf

Plug-Flow detention time= 34.1 min calculated for 0.072 af (100% of inflow)
 Center-of-Mass det. time= 34.0 min (874.5 - 840.5)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	2,886 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	309	0	0
186.00	713	511	511
187.00	1,174	944	1,455
188.00	1,689	1,432	2,886

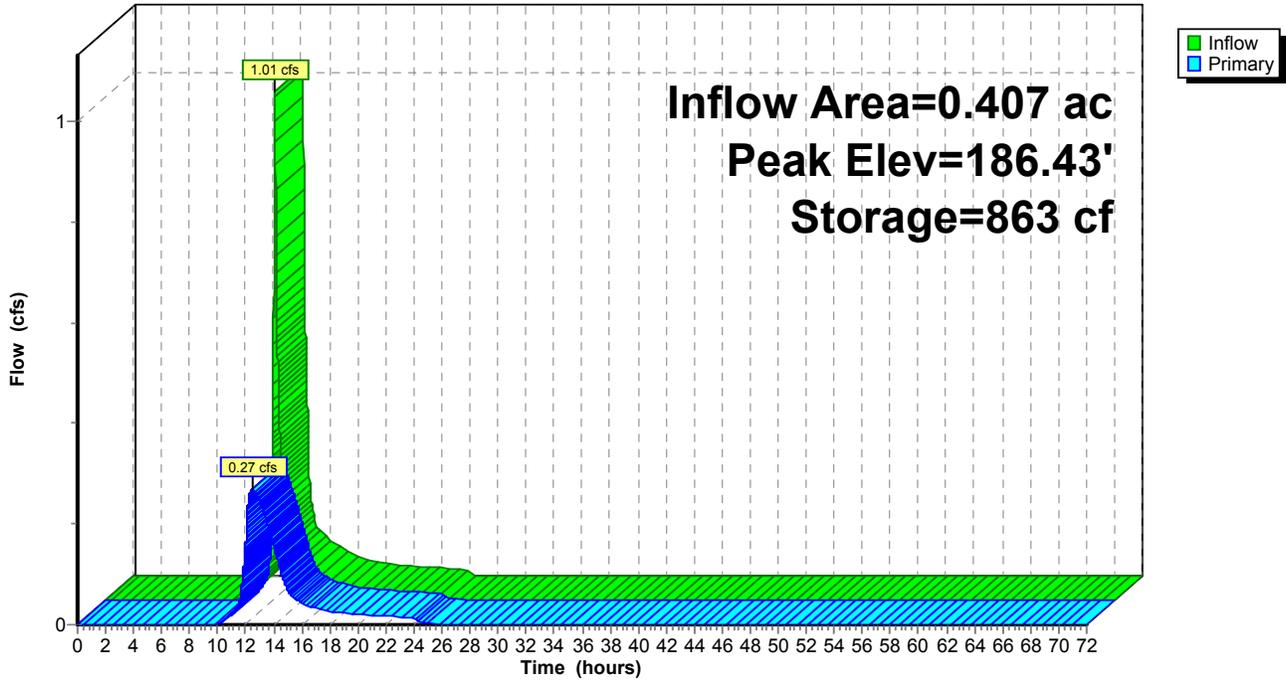
Device	Routing	Invert	Outlet Devices
#1	Primary	179.40'	8.0" Round Culvert L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.40' / 179.33' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	185.00'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	187.30'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.27 cfs @ 12.49 hrs HW=186.43' TW=169.20' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 0.27 cfs of 4.35 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 5.51 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond D-1: Depression

Hydrograph



Summary for Pond P-1: Infiltration Chambers

Inflow Area = 1.654 ac, 43.32% Impervious, Inflow Depth = 3.11" for 10-Year event
 Inflow = 5.04 cfs @ 12.09 hrs, Volume= 0.428 af
 Outflow = 5.02 cfs @ 12.09 hrs, Volume= 0.428 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.05 cfs @ 8.34 hrs, Volume= 0.096 af
 Primary = 4.97 cfs @ 12.09 hrs, Volume= 0.332 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 169.52' @ 12.09 hrs Surf.Area= 852 sf Storage= 1,754 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 70.9 min (878.8 - 807.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.50'	665 cf	18.44'W x 46.22'L x 3.50'H Field A 2,982 cf Overall - 1,320 cf Embedded = 1,662 cf x 40.0% Voids
#2A	166.83'	1,254 cf	ACF R-Tank HD 1.5 x 198 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 11 Rows of 18 Chambers
		1,919 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	165.00'	12.0" Round Culvert L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 165.00' / 164.05' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	168.20'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	169.00'	4.0' long x 1.00' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	166.50'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.05 cfs @ 8.34 hrs HW=166.54' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=4.97 cfs @ 12.09 hrs HW=169.51' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert (Passes 4.97 cfs of 7.58 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 0.26 cfs @ 5.25 fps)
 ↳3=Sharp-Crested Rectangular Weir(Weir Controls 4.71 cfs @ 2.35 fps)

Pond P-1: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF Environmental R-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

18 Chambers/Row x 2.35' Long = 42.22' Row Length +24.0" End Stone x 2 = 46.22' Base Length

11 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 18.44' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

198 Chambers x 6.3 cf = 1,253.9 cf Chamber Storage

198 Chambers x 6.7 cf = 1,319.9 cf Displacement

2,981.5 cf Field - 1,319.9 cf Chambers = 1,661.6 cf Stone x 40.0% Voids = 664.7 cf Stone Storage

Chamber Storage + Stone Storage = 1,918.5 cf = 0.044 af

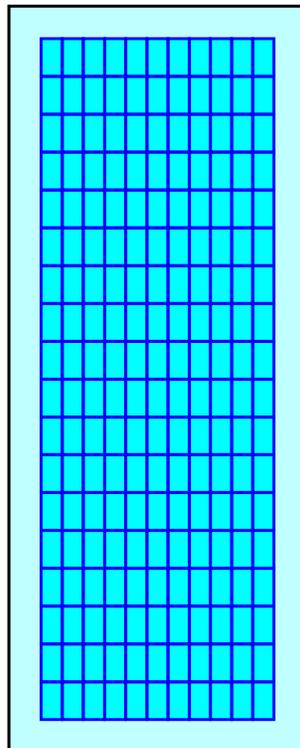
Overall Storage Efficiency = 64.3%

Overall System Size = 46.22' x 18.44' x 3.50'

198 Chambers

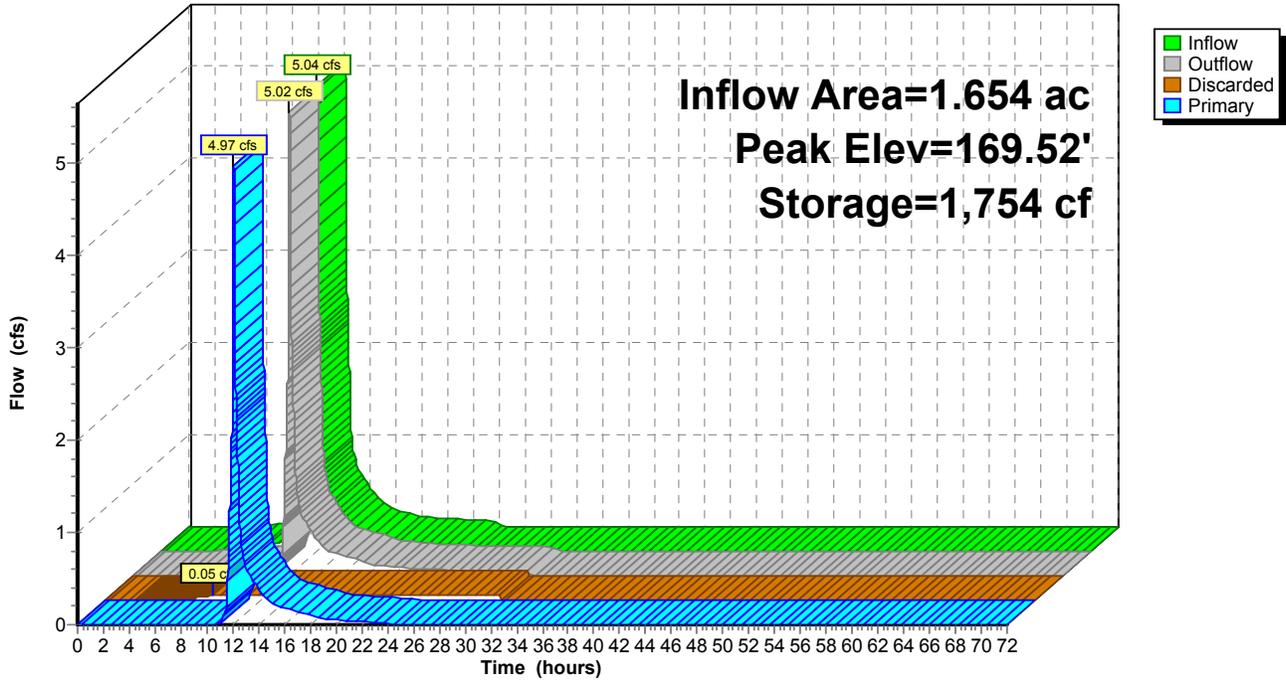
110.4 cy Field

61.5 cy Stone



Pond P-1: Infiltration Chambers

Hydrograph



Summary for Pond P-2: Infiltration Chambers

Inflow Area = 0.192 ac, 100.00% Impervious, Inflow Depth = 4.46" for 10-Year event
 Inflow = 0.88 cfs @ 12.08 hrs, Volume= 0.071 af
 Outflow = 0.84 cfs @ 12.11 hrs, Volume= 0.071 af, Atten= 5%, Lag= 1.8 min
 Discarded = 0.03 cfs @ 9.16 hrs, Volume= 0.046 af
 Primary = 0.81 cfs @ 12.11 hrs, Volume= 0.025 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 159.64' @ 12.11 hrs Surf.Area= 493 sf Storage= 828 cf

Plug-Flow detention time= 134.1 min calculated for 0.071 af (100% of inflow)
 Center-of-Mass det. time= 134.1 min (883.2 - 749.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	157.00'	465 cf	9.25'W x 53.26'L x 3.50'H Field A 1,724 cf Overall - 560 cf Embedded = 1,164 cf x 40.0% Voids
#2A	157.33'	532 cf	ACF R-Tank HD 1.5 x 84 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 4 Rows of 21 Chambers
		997 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	12.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.00' S= 0.0500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	158.95'	2.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	159.50'	4.0' long x 0.65' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	157.00'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 9.16 hrs HW=157.04' (Free Discharge)
 ↳ **4=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.81 cfs @ 12.11 hrs HW=159.64' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Passes 0.81 cfs of 6.70 cfs potential flow)
 ↳ ↳ **2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 3.69 fps)
 ↳ ↳ ↳ **3=Sharp-Crested Rectangular Weir** (Weir Controls 0.68 cfs @ 1.22 fps)

Pond P-2: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF Environmental R-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

21 Chambers/Row x 2.35' Long = 49.26' Row Length +24.0" End Stone x 2 = 53.26' Base Length

4 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 9.25' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

84 Chambers x 6.3 cf = 531.9 cf Chamber Storage

84 Chambers x 6.7 cf = 559.9 cf Displacement

1,723.6 cf Field - 559.9 cf Chambers = 1,163.6 cf Stone x 40.0% Voids = 465.5 cf Stone Storage

Chamber Storage + Stone Storage = 997.4 cf = 0.023 af

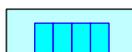
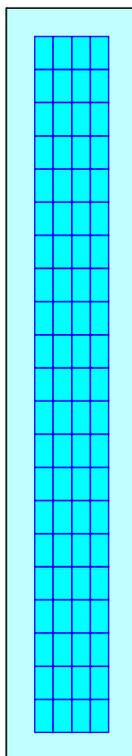
Overall Storage Efficiency = 57.9%

Overall System Size = 53.26' x 9.25' x 3.50'

84 Chambers

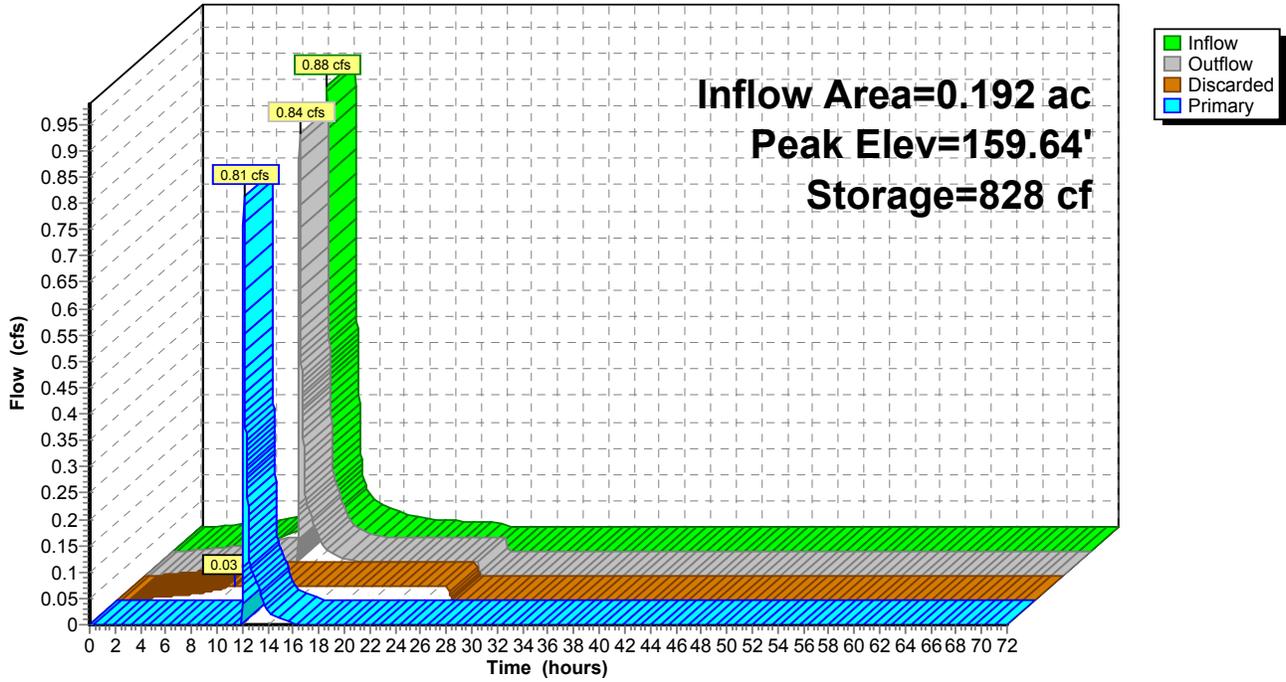
63.8 cy Field

43.1 cy Stone



Pond P-2: Infiltration Chambers

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 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 1S-1: 1S-1	Runoff Area=17,747 sf 0.73% Impervious Runoff Depth=2.77" Tc=6.0 min CN=74 Runoff=1.32 cfs 0.094 af
Subcatchment 1S-2: 1S-2	Runoff Area=36,712 sf 41.90% Impervious Runoff Depth=3.83" Tc=6.0 min CN=85 Runoff=3.73 cfs 0.269 af
Subcatchment 1S-3: 1S-3	Runoff Area=5,869 sf 39.72% Impervious Runoff Depth=3.83" Tc=6.0 min CN=85 Runoff=0.60 cfs 0.043 af
Subcatchment 1S-4: 1S-4	Runoff Area=890 sf 89.89% Impervious Runoff Depth=5.15" Tc=6.0 min CN=97 Runoff=0.11 cfs 0.009 af
Subcatchment 1S-5: 1S-5	Runoff Area=14,112 sf 17.30% Impervious Runoff Depth=3.14" Tc=6.0 min CN=78 Runoff=1.19 cfs 0.085 af
Subcatchment 1S-R1: Roof	Runoff Area=17,584 sf 89.25% Impervious Runoff Depth=4.92" Tc=6.0 min CN=95 Runoff=2.12 cfs 0.165 af
Subcatchment 1S-R2: Roof/Drive/Stairs	Runoff Area=8,369 sf 100.00% Impervious Runoff Depth=5.26" Tc=6.0 min CN=98 Runoff=1.03 cfs 0.084 af
Subcatchment 2S: 2S	Runoff Area=31,839 sf 35.43% Impervious Runoff Depth=3.53" Tc=6.0 min CN=82 Runoff=3.01 cfs 0.215 af
Reach DP-1: PL Linden Street	Inflow=1.19 cfs 0.085 af Outflow=1.19 cfs 0.085 af
Reach DP-2: PL Hollis Street	Inflow=3.61 cfs 0.258 af Outflow=3.61 cfs 0.258 af
Reach DP-3: Closed Drainage System	Inflow=11.94 cfs 0.816 af Outflow=11.94 cfs 0.816 af
Pond D-1: Depression	Peak Elev=186.80' Storage=1,226 cf Inflow=1.32 cfs 0.094 af Outflow=0.31 cfs 0.094 af
Pond P-1: Infiltration Chambers	Peak Elev=169.59' Storage=1,779 cf Inflow=6.10 cfs 0.529 af Discarded=0.05 cfs 0.099 af Primary=6.03 cfs 0.429 af Outflow=6.08 cfs 0.529 af
Pond P-2: Infiltration Chambers	Peak Elev=159.67' Storage=833 cf Inflow=1.03 cfs 0.084 af Discarded=0.03 cfs 0.049 af Primary=1.00 cfs 0.035 af Outflow=1.03 cfs 0.084 af

Total Runoff Area = 3.056 ac Runoff Volume = 0.964 af Average Runoff Depth = 3.79"
57.61% Pervious = 1.761 ac 42.39% Impervious = 1.295 ac

216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 1S-1: 1S-1

Runoff = 1.32 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 2.77"

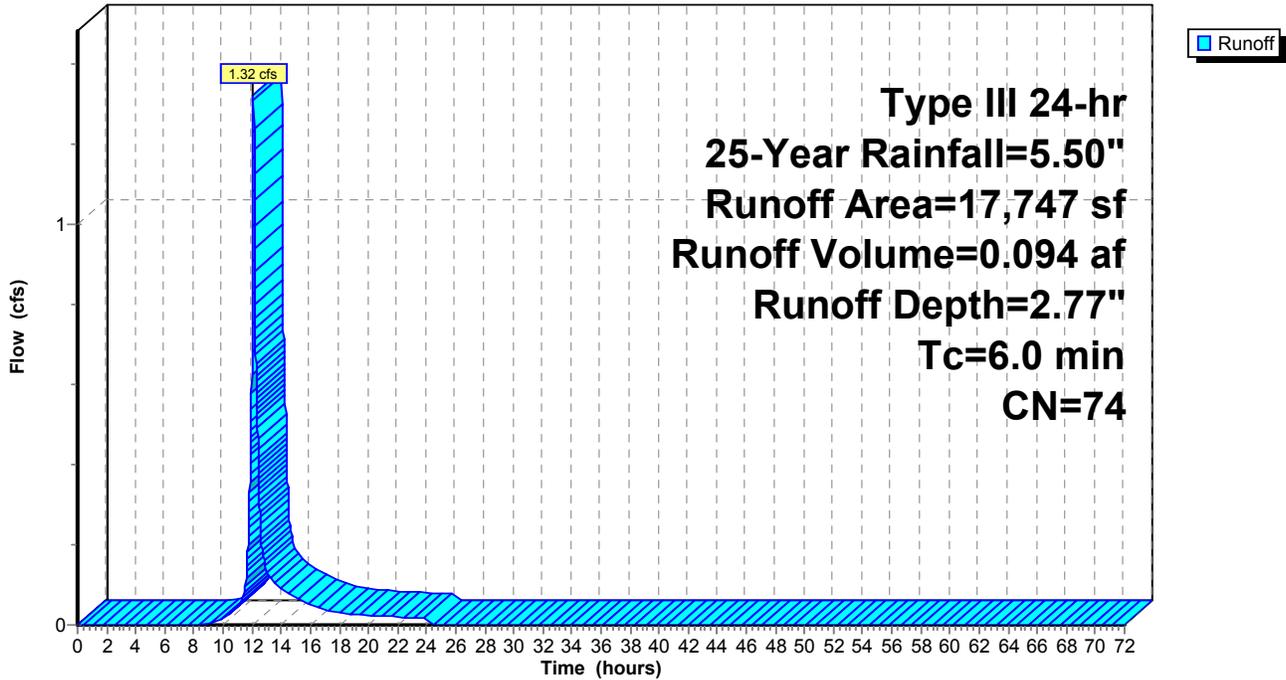
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
6,714	74	>75% Grass cover, Good, HSG C
* 10,903	74	>75% Grass cover, Good, HSG C (offsite)
* 130	98	Roofs, HSG C (offsite)
17,747	74	Weighted Average
17,617		99.27% Pervious Area
130		0.73% Impervious Area

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

Subcatchment 1S-1: 1S-1

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 1S-2: 1S-2

Runoff = 3.73 cfs @ 12.09 hrs, Volume= 0.269 af, Depth= 3.83"

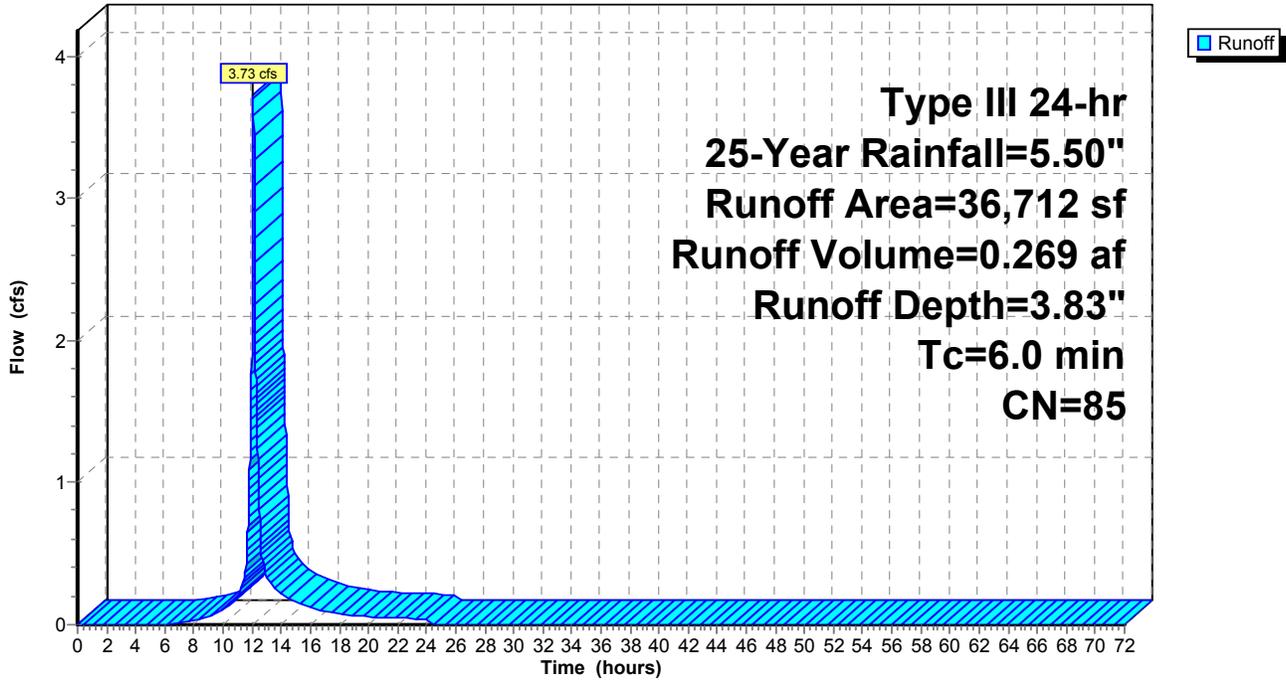
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
* 3,740	98	Roofs, HSG C (offsite)
* 7,808	74	>75% Grass cover, Good, HSG C (offsite)
* 2,415	98	Driveway, HSG C (offsite)
* 5,152	70	Woods, Good, HSG C (offsite)
* 539	98	Ledge, HSG C (offsite)
* 231	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
* 284	98	Conc. pads, HSG C (offsite)
* 888	98	Grass cover over garage, HSG C
* 4,504	74	>75% Grass cover, Good, planting beds HSG C
* 2,512	92	Permeable pavers, HSG C
* 4,301	98	Pavement, HSG C
* 390	98	Patios, HSG C
676	96	Gravel surface, HSG C
* 496	98	Walls, HSG C
* 515	98	Walkways, HSG C
* 85	98	Stepping stones, HSG C
* 856	98	Roofs, HSG C (offsite)
* 590	98	Driveway, HSG C (offsite)
* 676	74	>75% Grass cover, Good, HSG C (offsite)
36,712	85	Weighted Average
21,328		58.10% Pervious Area
15,384		41.90% Impervious Area

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

Subcatchment 1S-2: 1S-2

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 1S-3: 1S-3

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 3.83"

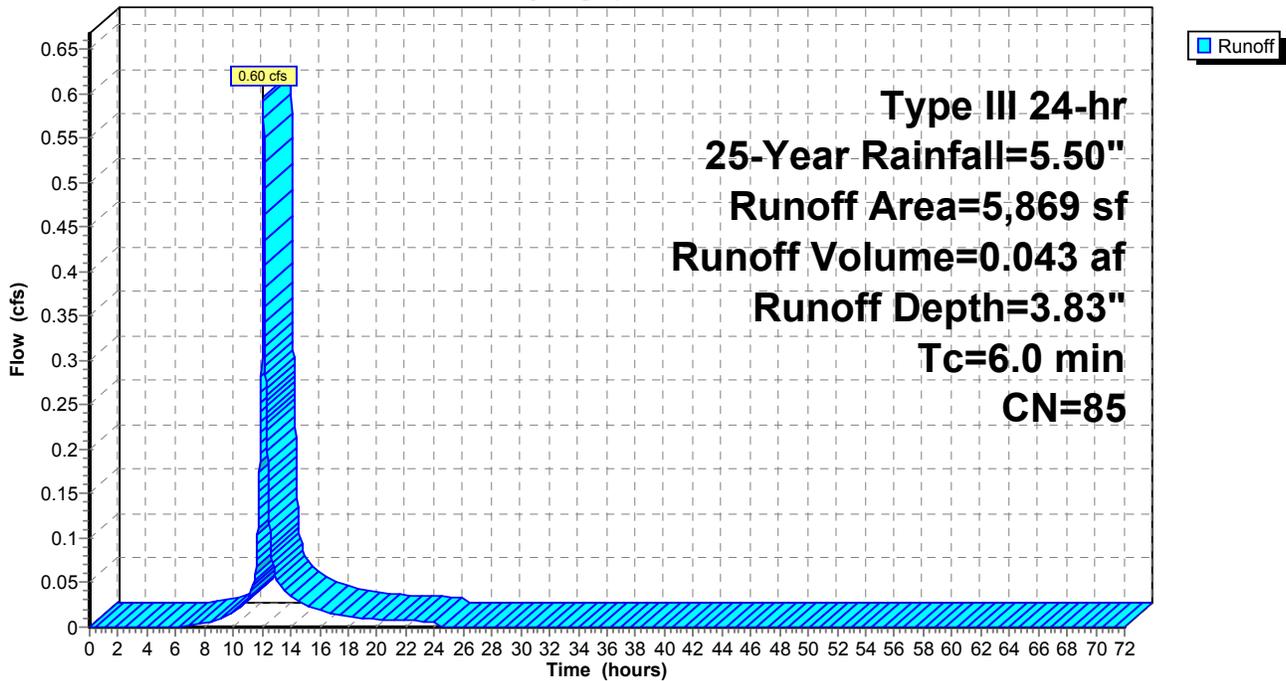
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	1,878	98	Walkways, HSG C
*	3,230	74	>75% Grass cover, Good, planting beds, HSG C
	308	96	Gravel surface, HSG C
*	453	98	Walls, HSG C
	5,869	85	Weighted Average
	3,538		60.28% Pervious Area
	2,331		39.72% Impervious Area

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

Subcatchment 1S-3: 1S-3

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 1S-4: 1S-4

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 0.009 af, Depth= 5.15"

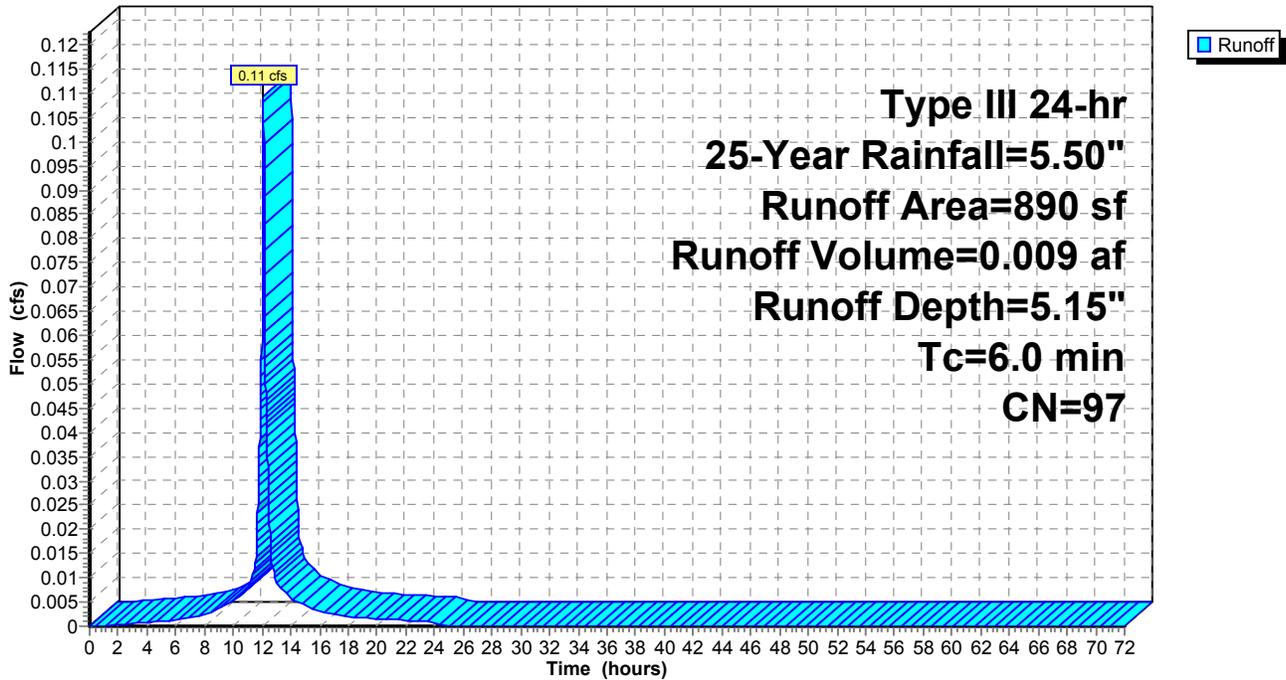
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	133	98	Walkways, HSG C
	48	96	Gravel surface, HSG C
*	641	98	Driveway, HSG C
*	42	74	>75% Grass cover, Good, planting beds, HSG C
*	26	98	Walls, HSG C
	890	97	Weighted Average
	90		10.11% Pervious Area
	800		89.89% Impervious Area

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

Subcatchment 1S-4: 1S-4

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 1S-5: 1S-5

Runoff = 1.19 cfs @ 12.09 hrs, Volume= 0.085 af, Depth= 3.14"

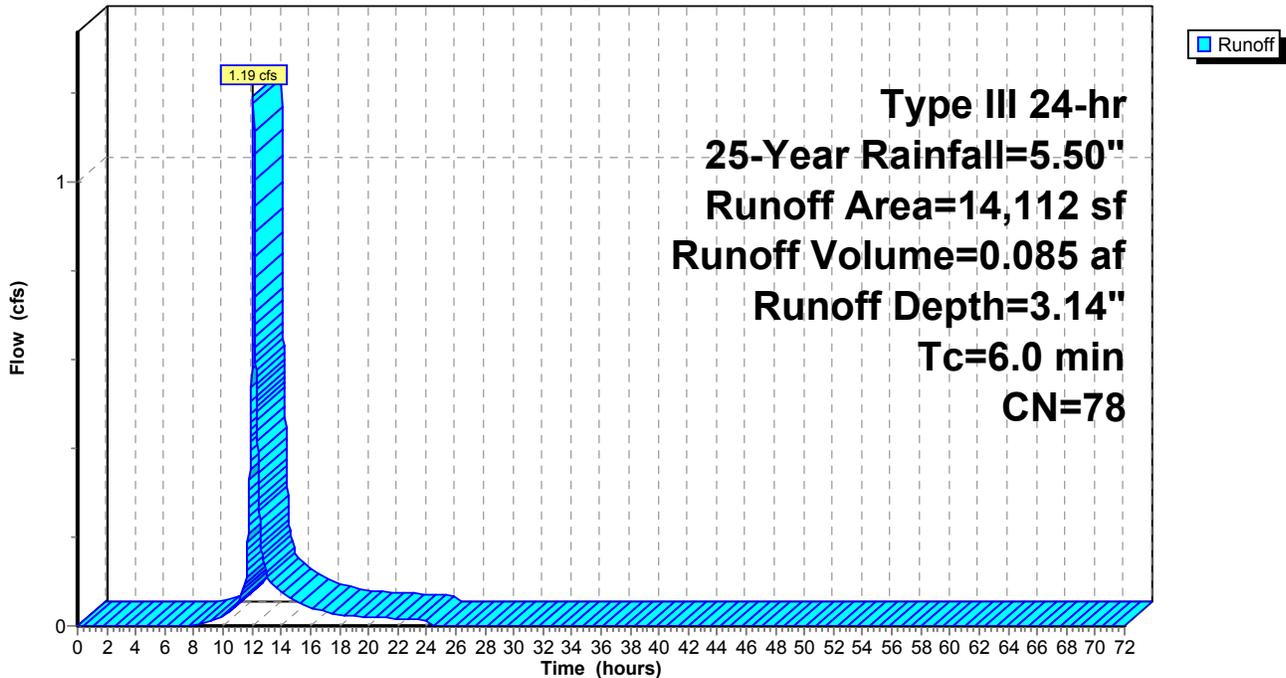
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
* 707	98	Driveway, HSG C (offsite)
* 5,410	74	>75% Grass cover, Good, HSG C (offsite)
* 672	98	Roofs, HSG C (offsite)
* 223	98	Walkways, HSG C
* 115	98	Ledge, HSG C
* 725	98	Patio/Wall, HSG C
* 6,260	74	>75% Grass cover, Good, planting beds, HSG C
14,112	78	Weighted Average
11,670		82.70% Pervious Area
2,442		17.30% Impervious Area

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

Subcatchment 1S-5: 1S-5

Hydrograph



Summary for Subcatchment 1S-R1: Roof

Runoff = 2.12 cfs @ 12.08 hrs, Volume= 0.165 af, Depth= 4.92"

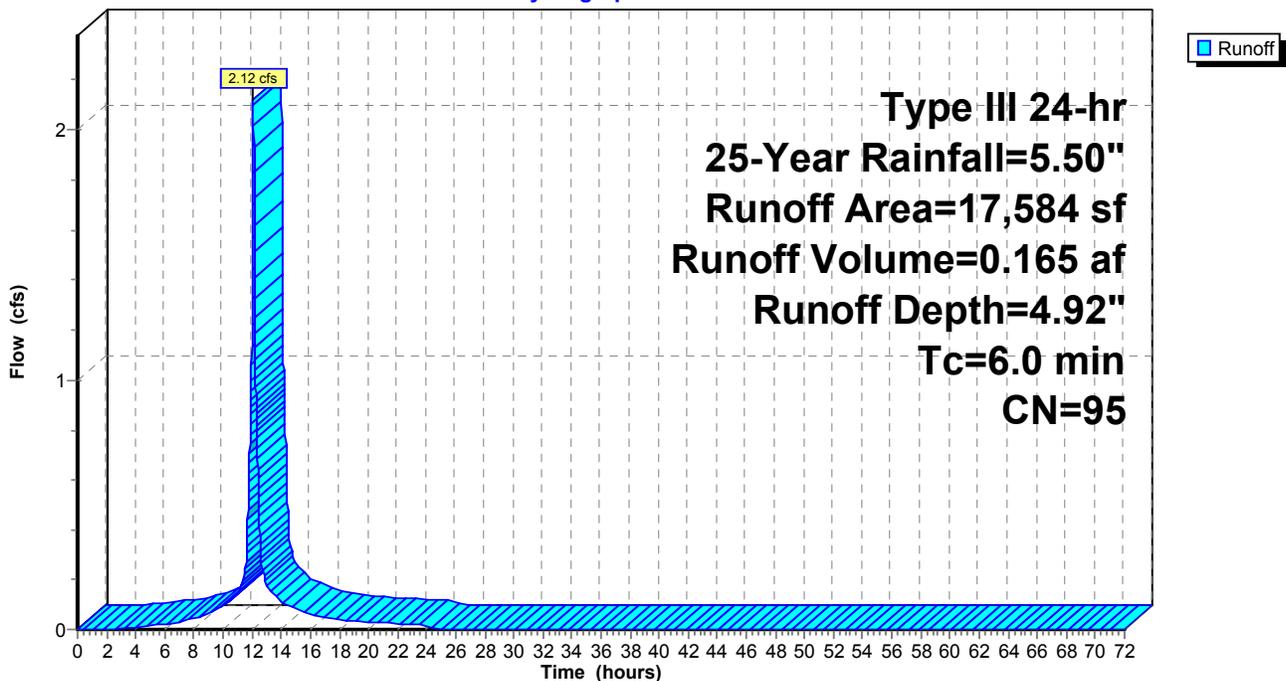
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
15,693	98	Roofs, HSG C
* 1,891	74	Green roof, HSG C
17,584	95	Weighted Average
1,891		10.75% Pervious Area
15,693		89.25% Impervious Area

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

Subcatchment 1S-R1: Roof

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 1S-R2: Roof/Drive/Stairs

Runoff = 1.03 cfs @ 12.08 hrs, Volume= 0.084 af, Depth= 5.26"

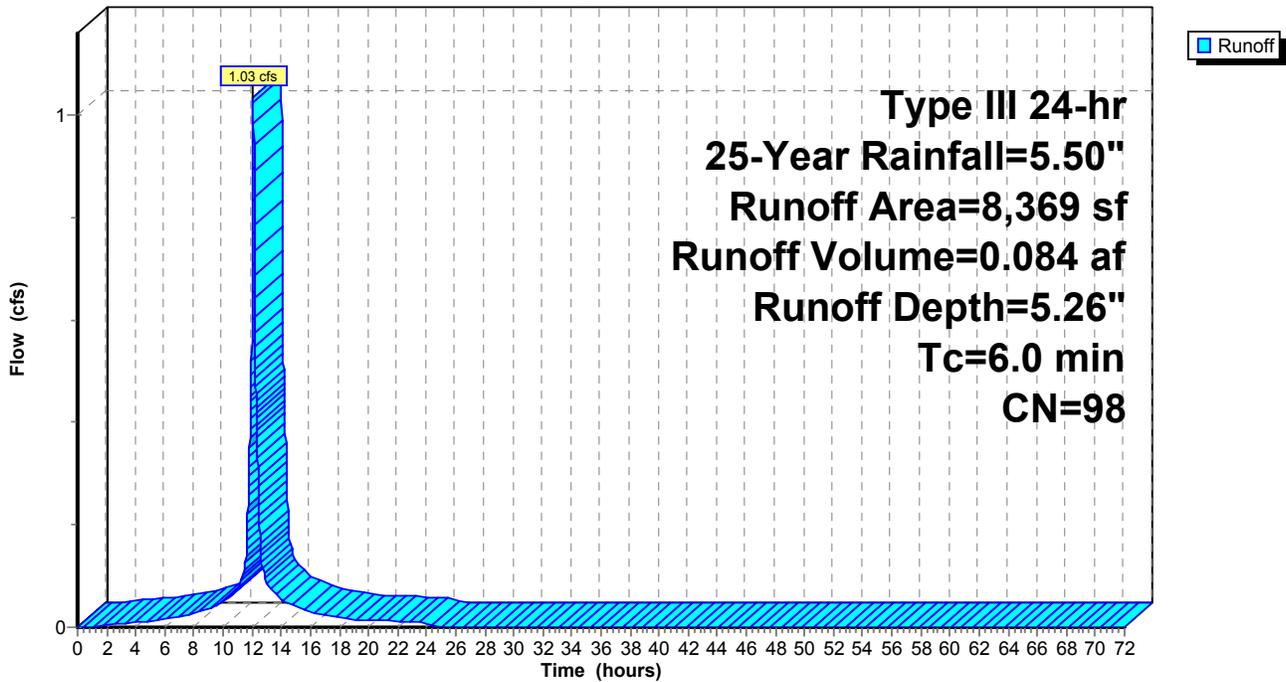
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	7,701	98	Roofs, HSG C
*	668	98	Pavement, HSG C
	8,369	98	Weighted Average
	8,369		100.00% Impervious Area

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

Subcatchment 1S-R2: Roof/Drive/Stairs

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Subcatchment 2S: 2S

Runoff = 3.01 cfs @ 12.09 hrs, Volume= 0.215 af, Depth= 3.53"

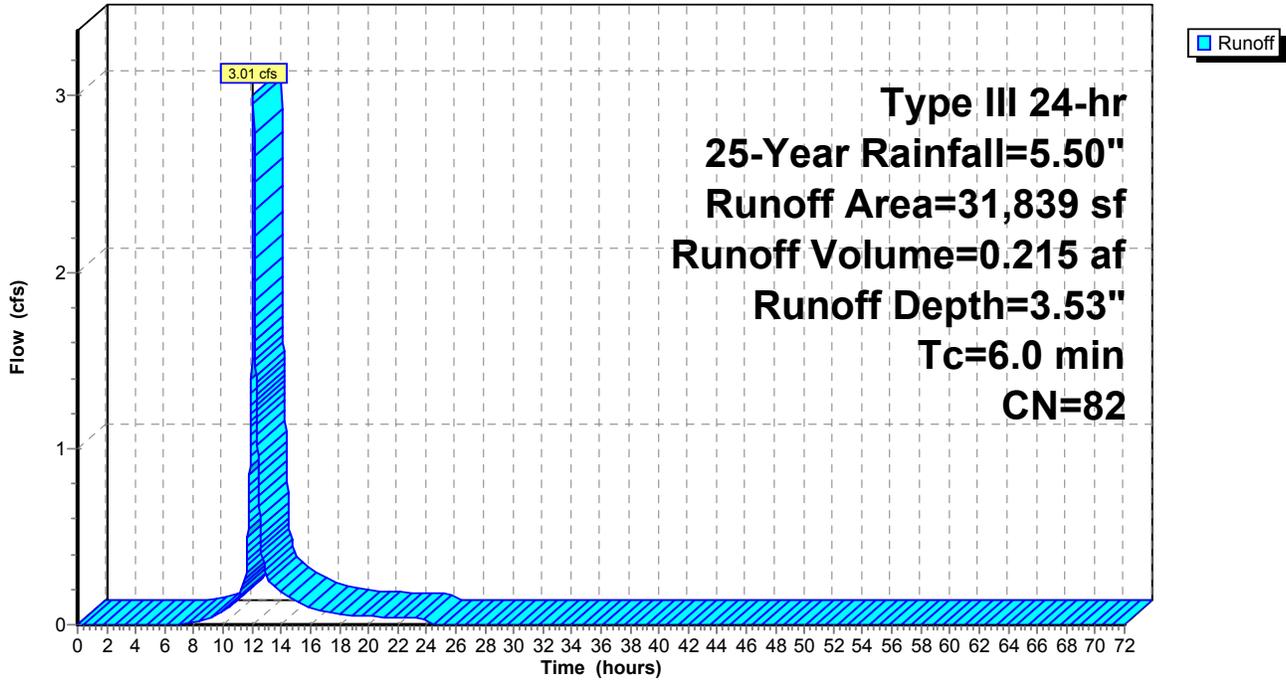
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
1,605	98	Roofs, HSG C
* 3,325	98	Drives, HSG C
* 756	98	Decks, stairs, HSG C
* 332	98	Misc. imp, HSG C
* 421	98	Walls, HSG C
5,598	74	>75% Grass cover, Good, HSG C
* 3,839	98	Roofs, HSG C (offsite)
* 12,359	74	>75% Grass cover, Good, HSG C (offsite)
* 830	98	Drives, HSG C (offsite)
* 2,603	70	Woods, Good, HSG C (offsite)
* 72	98	Ledge, HSG C (offsite)
* 99	98	Walls, HSG C (offsite)
31,839	82	Weighted Average
20,560		64.57% Pervious Area
11,279		35.43% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



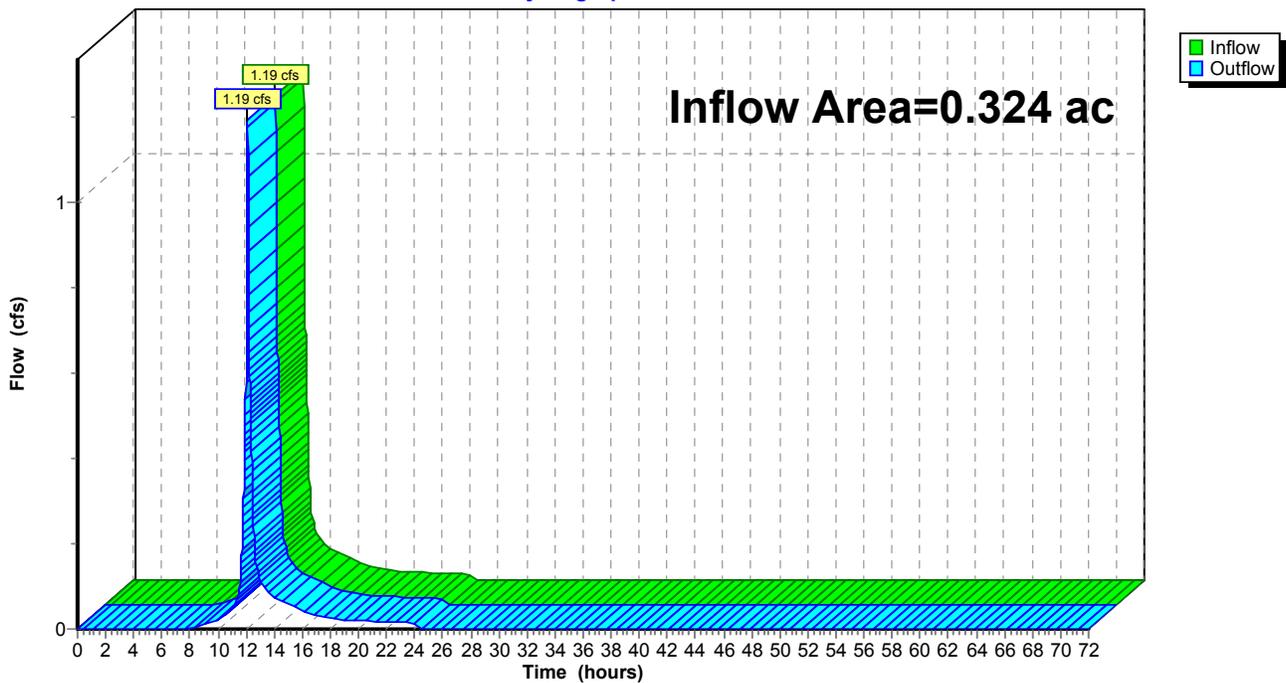
Summary for Reach DP-1: PL Linden Street

Inflow Area = 0.324 ac, 17.30% Impervious, Inflow Depth = 3.14" for 25-Year event
Inflow = 1.19 cfs @ 12.09 hrs, Volume= 0.085 af
Outflow = 1.19 cfs @ 12.09 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-1: PL Linden Street

Hydrograph



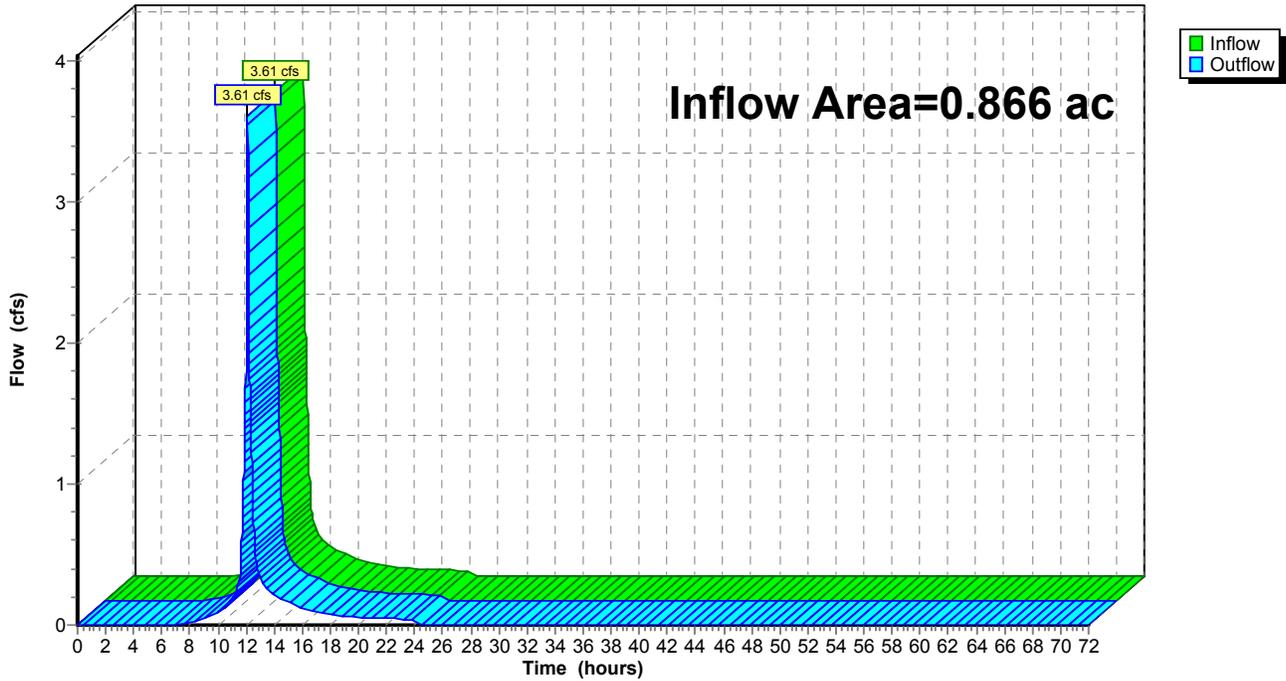
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 0.866 ac, 36.09% Impervious, Inflow Depth = 3.58" for 25-Year event
Inflow = 3.61 cfs @ 12.09 hrs, Volume= 0.258 af
Outflow = 3.61 cfs @ 12.09 hrs, Volume= 0.258 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-2: PL Hollis Street

Hydrograph



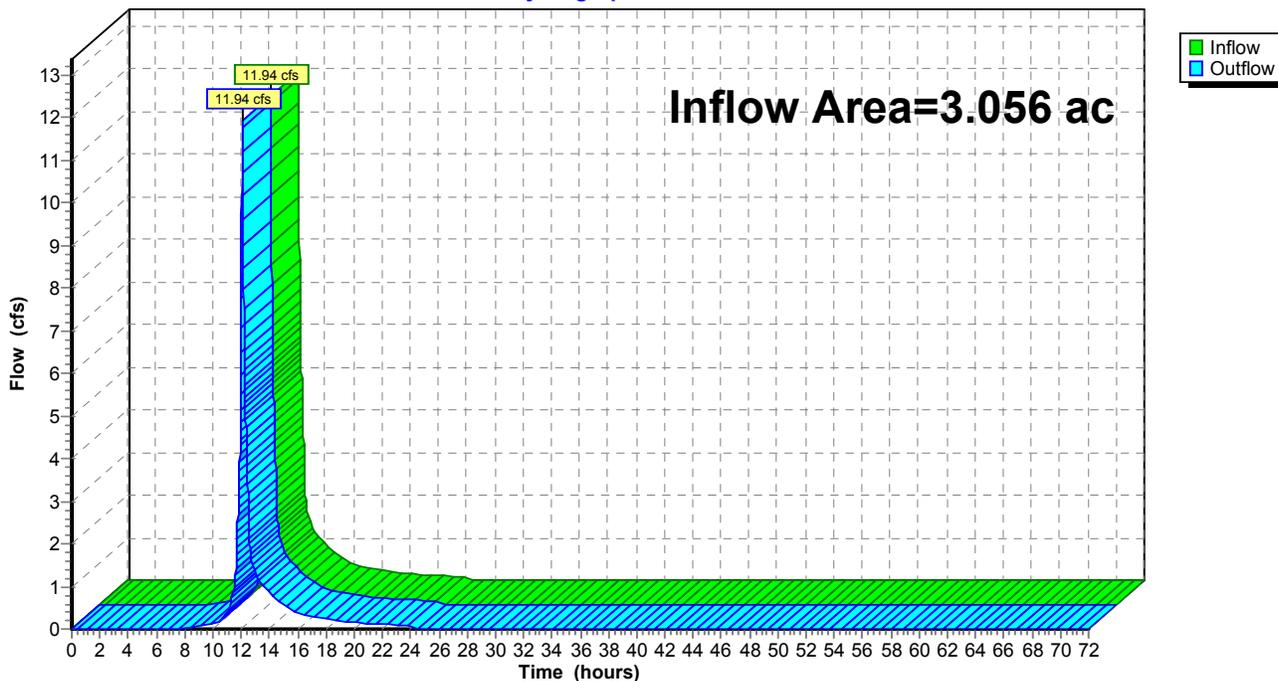
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 42.39% Impervious, Inflow Depth = 3.20" for 25-Year event
Inflow = 11.94 cfs @ 12.09 hrs, Volume= 0.816 af
Outflow = 11.94 cfs @ 12.09 hrs, Volume= 0.816 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-3: Closed Drainage System

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Pond D-1: Depression

Inflow Area = 0.407 ac, 0.73% Impervious, Inflow Depth = 2.77" for 25-Year event
 Inflow = 1.32 cfs @ 12.09 hrs, Volume= 0.094 af
 Outflow = 0.31 cfs @ 12.51 hrs, Volume= 0.094 af, Atten= 77%, Lag= 25.4 min
 Primary = 0.31 cfs @ 12.51 hrs, Volume= 0.094 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 186.80' @ 12.51 hrs Surf.Area= 1,081 sf Storage= 1,226 cf

Plug-Flow detention time= 39.6 min calculated for 0.094 af (100% of inflow)
 Center-of-Mass det. time= 39.8 min (872.7 - 832.8)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	2,886 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	309	0	0
186.00	713	511	511
187.00	1,174	944	1,455
188.00	1,689	1,432	2,886

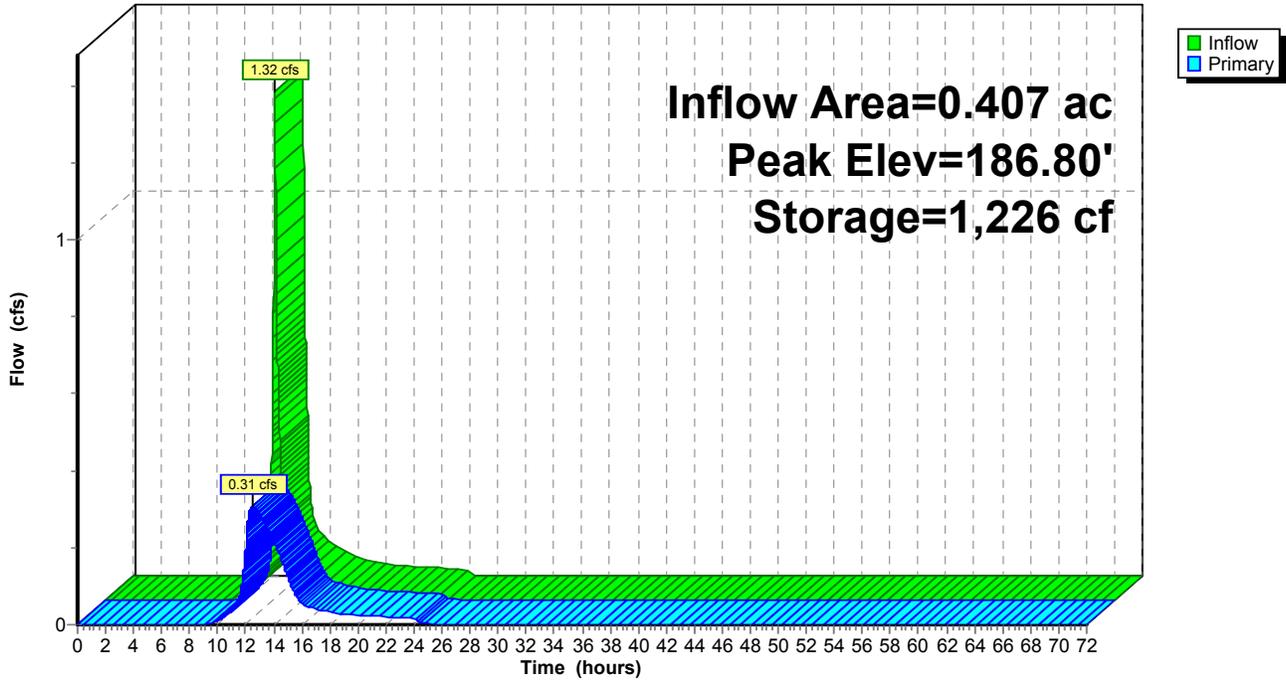
Device	Routing	Invert	Outlet Devices
#1	Primary	179.40'	8.0" Round Culvert L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.40' / 179.33' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	185.00'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	187.30'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.31 cfs @ 12.51 hrs HW=186.80' TW=169.22' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 0.31 cfs of 4.47 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.31 cfs @ 6.23 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond D-1: Depression

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Pond P-1: Infiltration Chambers

Inflow Area = 1.654 ac, 43.32% Impervious, Inflow Depth = 3.83" for 25-Year event
 Inflow = 6.10 cfs @ 12.09 hrs, Volume= 0.529 af
 Outflow = 6.08 cfs @ 12.09 hrs, Volume= 0.529 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.05 cfs @ 7.66 hrs, Volume= 0.099 af
 Primary = 6.03 cfs @ 12.09 hrs, Volume= 0.429 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 169.59' @ 12.09 hrs Surf.Area= 852 sf Storage= 1,779 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 61.0 min (865.2 - 804.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.50'	665 cf	18.44'W x 46.22'L x 3.50'H Field A 2,982 cf Overall - 1,320 cf Embedded = 1,662 cf x 40.0% Voids
#2A	166.83'	1,254 cf	ACF R-Tank HD 1.5 x 198 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 11 Rows of 18 Chambers
		1,919 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	165.00'	12.0" Round Culvert L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 165.00' / 164.05' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	168.20'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	169.00'	4.0' long x 1.00' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	166.50'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.05 cfs @ 7.66 hrs HW=166.54' (Free Discharge)↑**4=Exfiltration** (Exfiltration Controls 0.05 cfs)**Primary OutFlow** Max=6.02 cfs @ 12.09 hrs HW=169.59' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Passes 6.02 cfs of 7.65 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 5.42 fps)↑**3=Sharp-Crested Rectangular Weir**(Weir Controls 5.76 cfs @ 2.51 fps)

Pond P-1: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF Environmental R-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

18 Chambers/Row x 2.35' Long = 42.22' Row Length +24.0" End Stone x 2 = 46.22' Base Length

11 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 18.44' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

198 Chambers x 6.3 cf = 1,253.9 cf Chamber Storage

198 Chambers x 6.7 cf = 1,319.9 cf Displacement

2,981.5 cf Field - 1,319.9 cf Chambers = 1,661.6 cf Stone x 40.0% Voids = 664.7 cf Stone Storage

Chamber Storage + Stone Storage = 1,918.5 cf = 0.044 af

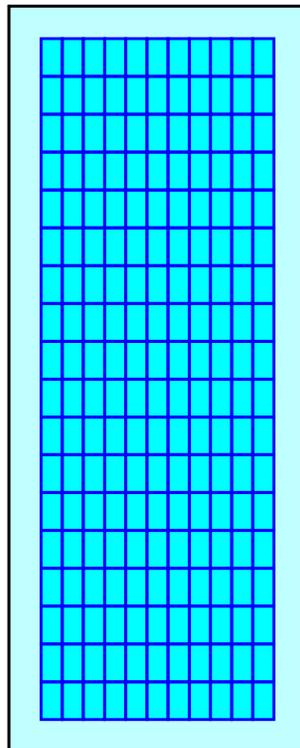
Overall Storage Efficiency = 64.3%

Overall System Size = 46.22' x 18.44' x 3.50'

198 Chambers

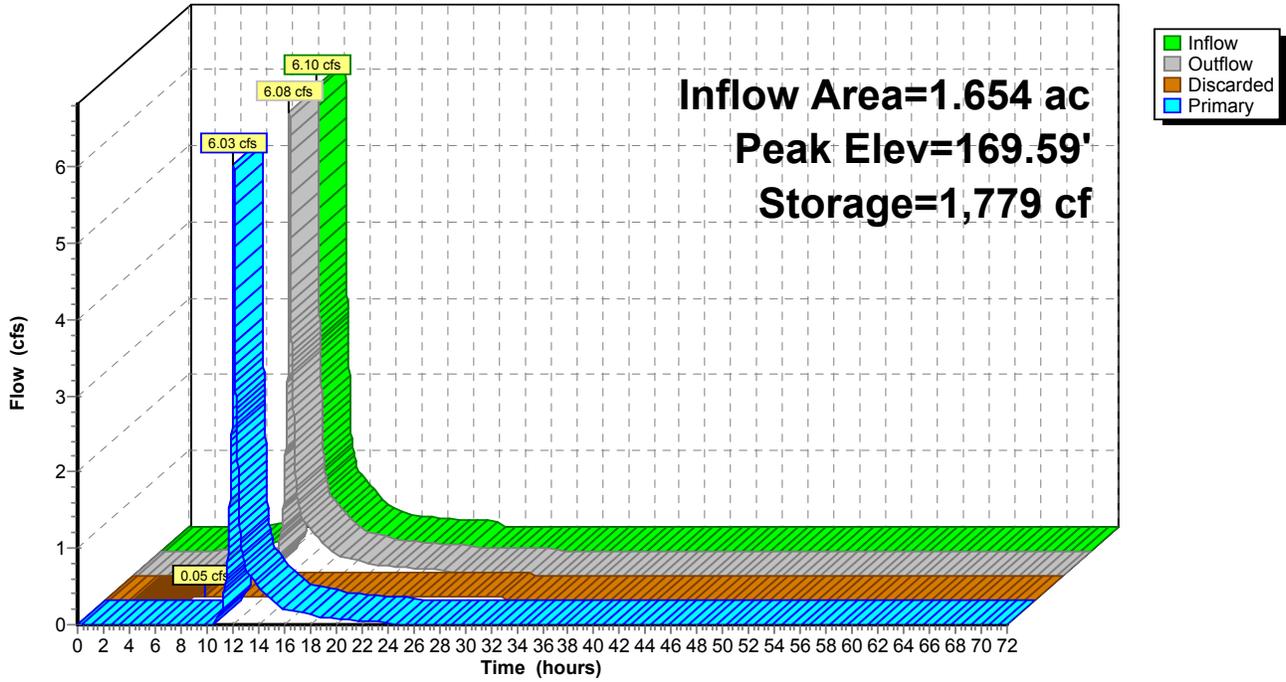
110.4 cy Field

61.5 cy Stone



Pond P-1: Infiltration Chambers

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 25-Year Rainfall=5.50"

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Summary for Pond P-2: Infiltration Chambers

Inflow Area = 0.192 ac, 100.00% Impervious, Inflow Depth = 5.26" for 25-Year event
 Inflow = 1.03 cfs @ 12.08 hrs, Volume= 0.084 af
 Outflow = 1.03 cfs @ 12.09 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.03 cfs @ 8.70 hrs, Volume= 0.049 af
 Primary = 1.00 cfs @ 12.09 hrs, Volume= 0.035 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 159.67' @ 12.09 hrs Surf.Area= 493 sf Storage= 833 cf

Plug-Flow detention time= 125.2 min calculated for 0.084 af (100% of inflow)
 Center-of-Mass det. time= 125.2 min (871.7 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	157.00'	465 cf	9.25'W x 53.26'L x 3.50'H Field A 1,724 cf Overall - 560 cf Embedded = 1,164 cf x 40.0% Voids
#2A	157.33'	532 cf	ACF R-Tank HD 1.5 x 84 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 4 Rows of 21 Chambers
		997 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	12.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.00' S= 0.0500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	158.95'	2.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	159.50'	4.0' long x 0.65' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	157.00'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 8.70 hrs HW=157.04' (Free Discharge)↑**4=Exfiltration** (Exfiltration Controls 0.03 cfs)**Primary OutFlow** Max=1.00 cfs @ 12.09 hrs HW=159.67' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Passes 1.00 cfs of 6.73 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 3.77 fps)↑**3=Sharp-Crested Rectangular Weir**(Weir Controls 0.88 cfs @ 1.33 fps)

Pond P-2: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF Environmental R-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

21 Chambers/Row x 2.35' Long = 49.26' Row Length +24.0" End Stone x 2 = 53.26' Base Length

4 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 9.25' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

84 Chambers x 6.3 cf = 531.9 cf Chamber Storage

84 Chambers x 6.7 cf = 559.9 cf Displacement

1,723.6 cf Field - 559.9 cf Chambers = 1,163.6 cf Stone x 40.0% Voids = 465.5 cf Stone Storage

Chamber Storage + Stone Storage = 997.4 cf = 0.023 af

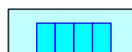
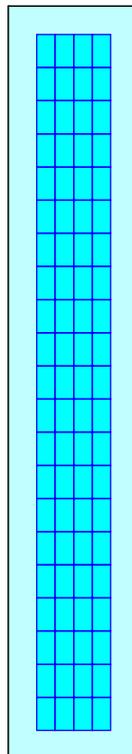
Overall Storage Efficiency = 57.9%

Overall System Size = 53.26' x 9.25' x 3.50'

84 Chambers

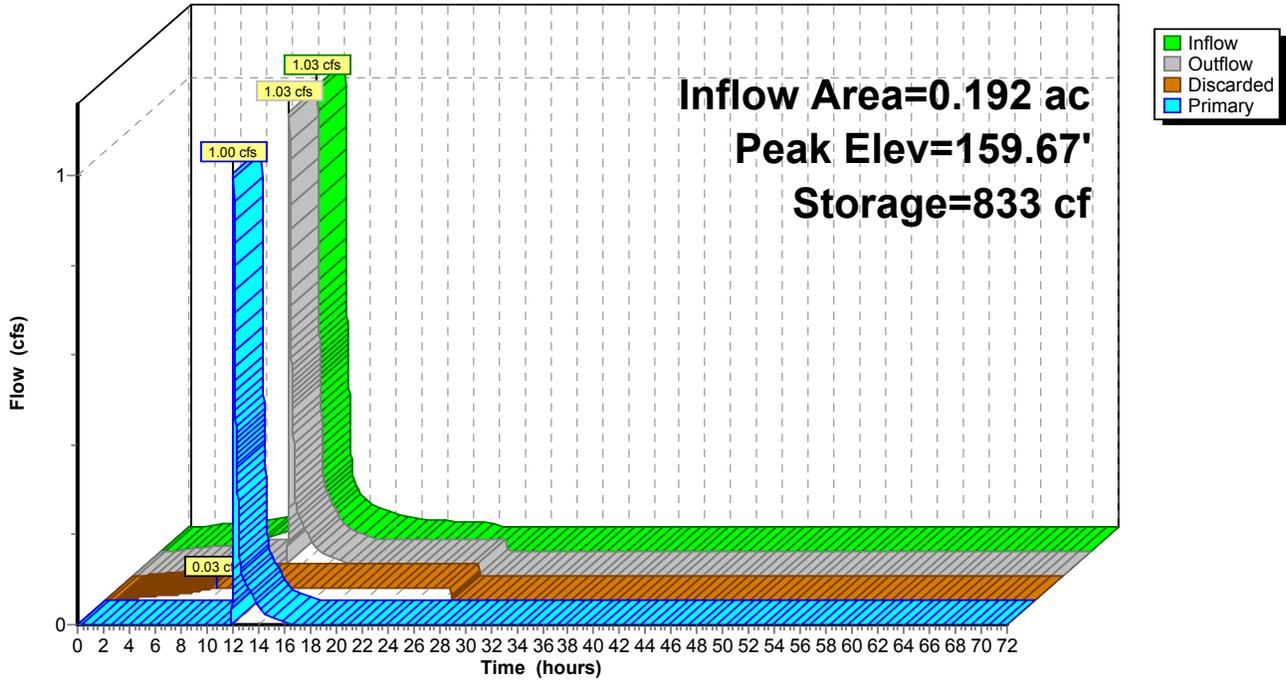
63.8 cy Field

43.1 cy Stone



Pond P-2: Infiltration Chambers

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 100-Year Rainfall=6.70"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S-1: 1S-1	Runoff Area=17,747 sf 0.73% Impervious Runoff Depth=3.78" Tc=6.0 min CN=74 Runoff=1.81 cfs 0.128 af
Subcatchment1S-2: 1S-2	Runoff Area=36,712 sf 41.90% Impervious Runoff Depth=4.97" Tc=6.0 min CN=85 Runoff=4.78 cfs 0.349 af
Subcatchment1S-3: 1S-3	Runoff Area=5,869 sf 39.72% Impervious Runoff Depth=4.97" Tc=6.0 min CN=85 Runoff=0.76 cfs 0.056 af
Subcatchment1S-4: 1S-4	Runoff Area=890 sf 89.89% Impervious Runoff Depth=6.34" Tc=6.0 min CN=97 Runoff=0.13 cfs 0.011 af
Subcatchment1S-5: 1S-5	Runoff Area=14,112 sf 17.30% Impervious Runoff Depth=4.20" Tc=6.0 min CN=78 Runoff=1.59 cfs 0.113 af
Subcatchment1S-R1: Roof	Runoff Area=17,584 sf 89.25% Impervious Runoff Depth=6.11" Tc=6.0 min CN=95 Runoff=2.61 cfs 0.205 af
Subcatchment1S-R2: Roof/Drive/Stairs	Runoff Area=8,369 sf 100.00% Impervious Runoff Depth=6.46" Tc=6.0 min CN=98 Runoff=1.26 cfs 0.103 af
Subcatchment2S: 2S	Runoff Area=31,839 sf 35.43% Impervious Runoff Depth=4.64" Tc=6.0 min CN=82 Runoff=3.92 cfs 0.282 af
Reach DP-1: PL Linden Street	Inflow=1.59 cfs 0.113 af Outflow=1.59 cfs 0.113 af
Reach DP-2: PL Hollis Street	Inflow=4.68 cfs 0.338 af Outflow=4.68 cfs 0.338 af
Reach DP-3: Closed Drainage System	Inflow=15.24 cfs 1.092 af Outflow=15.24 cfs 1.092 af
Pond D-1: Depression	Peak Elev=187.30' Storage=1,836 cf Inflow=1.81 cfs 0.128 af Outflow=0.35 cfs 0.128 af
Pond P-1: Infiltration Chambers	Peak Elev=169.70' Storage=1,815 cf Inflow=7.67 cfs 0.683 af Discarded=0.05 cfs 0.103 af Primary=7.60 cfs 0.580 af Outflow=7.65 cfs 0.683 af
Pond P-2: Infiltration Chambers	Peak Elev=159.69' Storage=839 cf Inflow=1.26 cfs 0.103 af Discarded=0.03 cfs 0.053 af Primary=1.23 cfs 0.050 af Outflow=1.26 cfs 0.103 af

Total Runoff Area = 3.056 ac Runoff Volume = 1.248 af Average Runoff Depth = 4.90"
57.61% Pervious = 1.761 ac 42.39% Impervious = 1.295 ac

216-194 Post Development (PC) (R2)

Type III 24-hr 100-Year Rainfall=6.70"

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Summary for Subcatchment 1S-1: 1S-1

Runoff = 1.81 cfs @ 12.09 hrs, Volume= 0.128 af, Depth= 3.78"

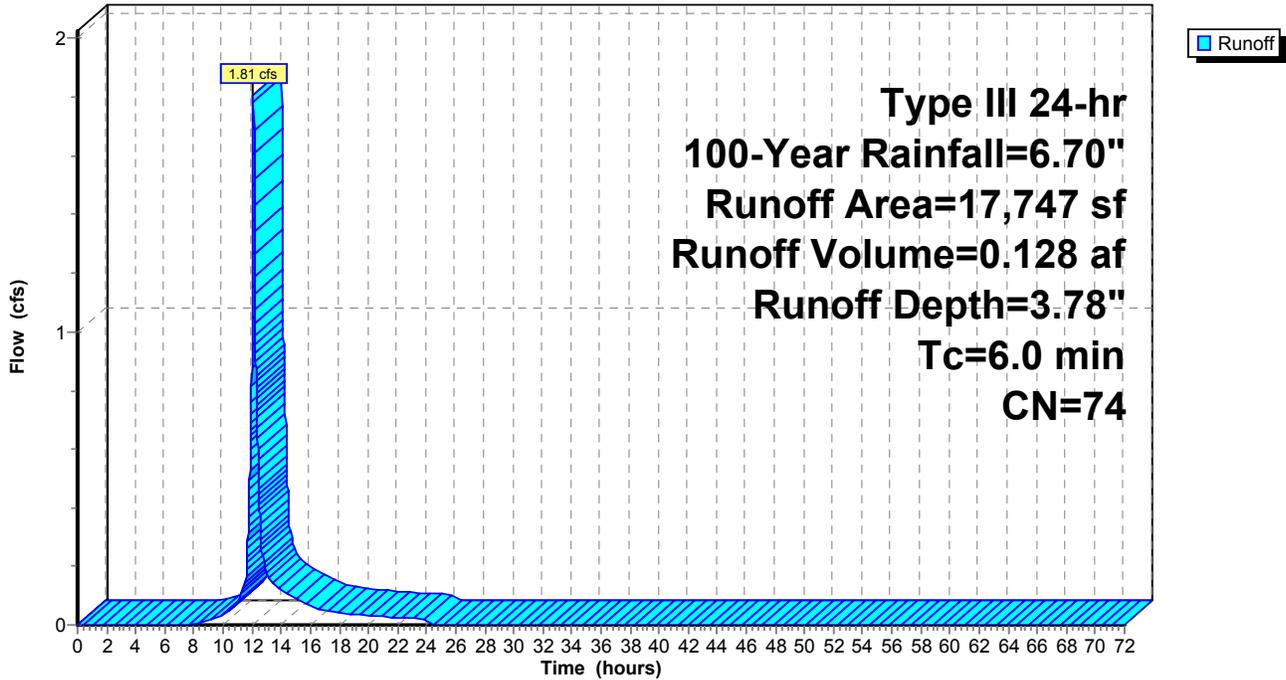
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
6,714	74	>75% Grass cover, Good, HSG C
* 10,903	74	>75% Grass cover, Good, HSG C (offsite)
* 130	98	Roofs, HSG C (offsite)
17,747	74	Weighted Average
17,617		99.27% Pervious Area
130		0.73% Impervious Area

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

Subcatchment 1S-1: 1S-1

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 100-Year Rainfall=6.70"

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Summary for Subcatchment 1S-2: 1S-2

Runoff = 4.78 cfs @ 12.09 hrs, Volume= 0.349 af, Depth= 4.97"

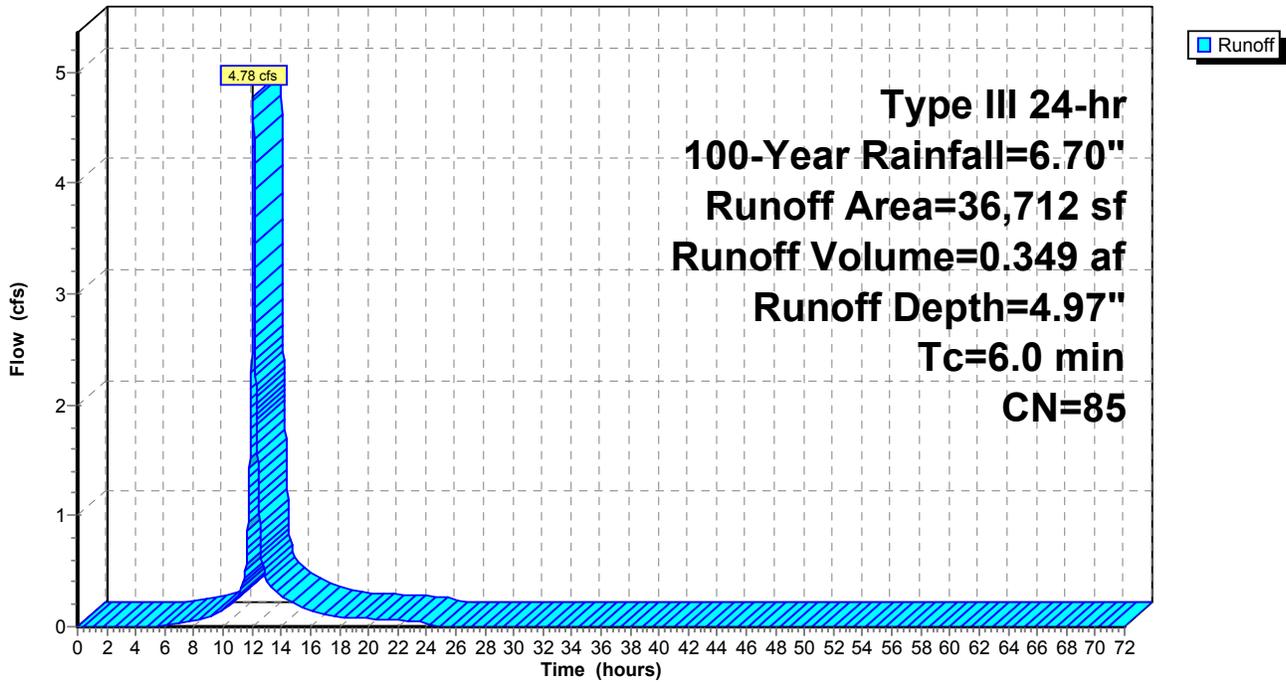
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
* 3,740	98	Roofs, HSG C (offsite)
* 7,808	74	>75% Grass cover, Good, HSG C (offsite)
* 2,415	98	Driveway, HSG C (offsite)
* 5,152	70	Woods, Good, HSG C (offsite)
* 539	98	Ledge, HSG C (offsite)
* 231	98	Walls, HSG C (offsite)
* 54	98	Stone pad, HSG C (offsite)
* 284	98	Conc. pads, HSG C (offsite)
* 888	98	Grass cover over garage, HSG C
* 4,504	74	>75% Grass cover, Good, planting beds HSG C
* 2,512	92	Permeable pavers, HSG C
* 4,301	98	Pavement, HSG C
* 390	98	Patios, HSG C
676	96	Gravel surface, HSG C
* 496	98	Walls, HSG C
* 515	98	Walkways, HSG C
* 85	98	Stepping stones, HSG C
* 856	98	Roofs, HSG C (offsite)
* 590	98	Driveway, HSG C (offsite)
* 676	74	>75% Grass cover, Good, HSG C (offsite)
36,712	85	Weighted Average
21,328		58.10% Pervious Area
15,384		41.90% Impervious Area

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

Subcatchment 1S-2: 1S-2

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 100-Year Rainfall=6.70"

Prepared by McKenzie Engineering Group, Inc.

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Summary for Subcatchment 1S-3: 1S-3

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 4.97"

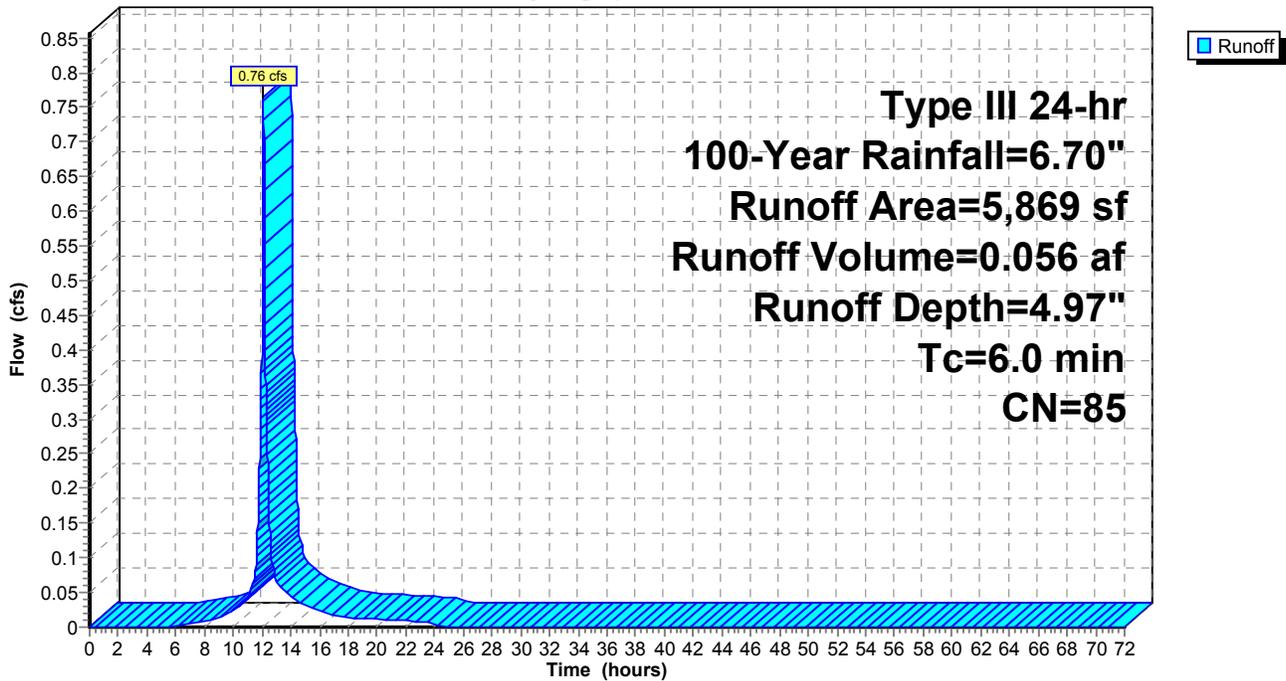
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
*	1,878	98	Walkways, HSG C
*	3,230	74	>75% Grass cover, Good, planting beds, HSG C
	308	96	Gravel surface, HSG C
*	453	98	Walls, HSG C
	5,869	85	Weighted Average
	3,538		60.28% Pervious Area
	2,331		39.72% Impervious Area

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

Subcatchment 1S-3: 1S-3

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 100-Year Rainfall=6.70"

Prepared by McKenzie Engineering Group, Inc.

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Summary for Subcatchment 1S-4: 1S-4

Runoff = 0.13 cfs @ 12.08 hrs, Volume= 0.011 af, Depth= 6.34"

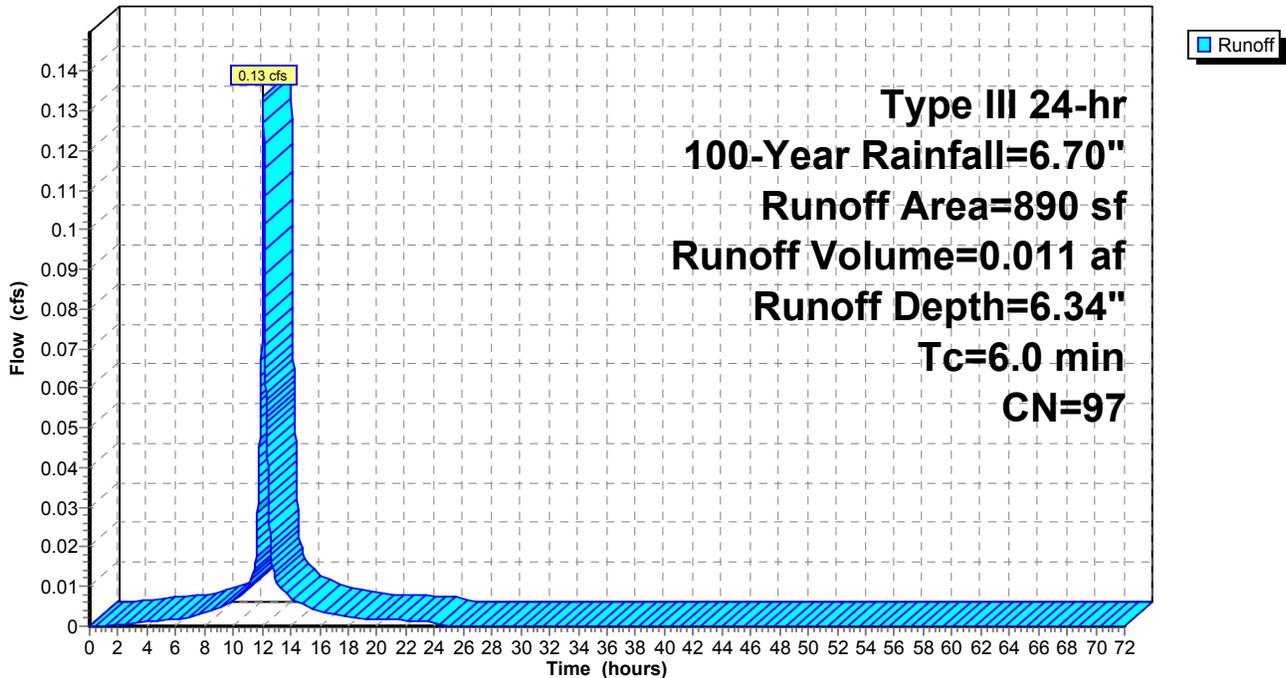
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
*	133	98	Walkways, HSG C
	48	96	Gravel surface, HSG C
*	641	98	Driveway, HSG C
*	42	74	>75% Grass cover, Good, planting beds, HSG C
*	26	98	Walls, HSG C
890			97 Weighted Average
90			10.11% Pervious Area
800			89.89% Impervious Area

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

Subcatchment 1S-4: 1S-4

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 100-Year Rainfall=6.70"

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Summary for Subcatchment 1S-5: 1S-5

Runoff = 1.59 cfs @ 12.09 hrs, Volume= 0.113 af, Depth= 4.20"

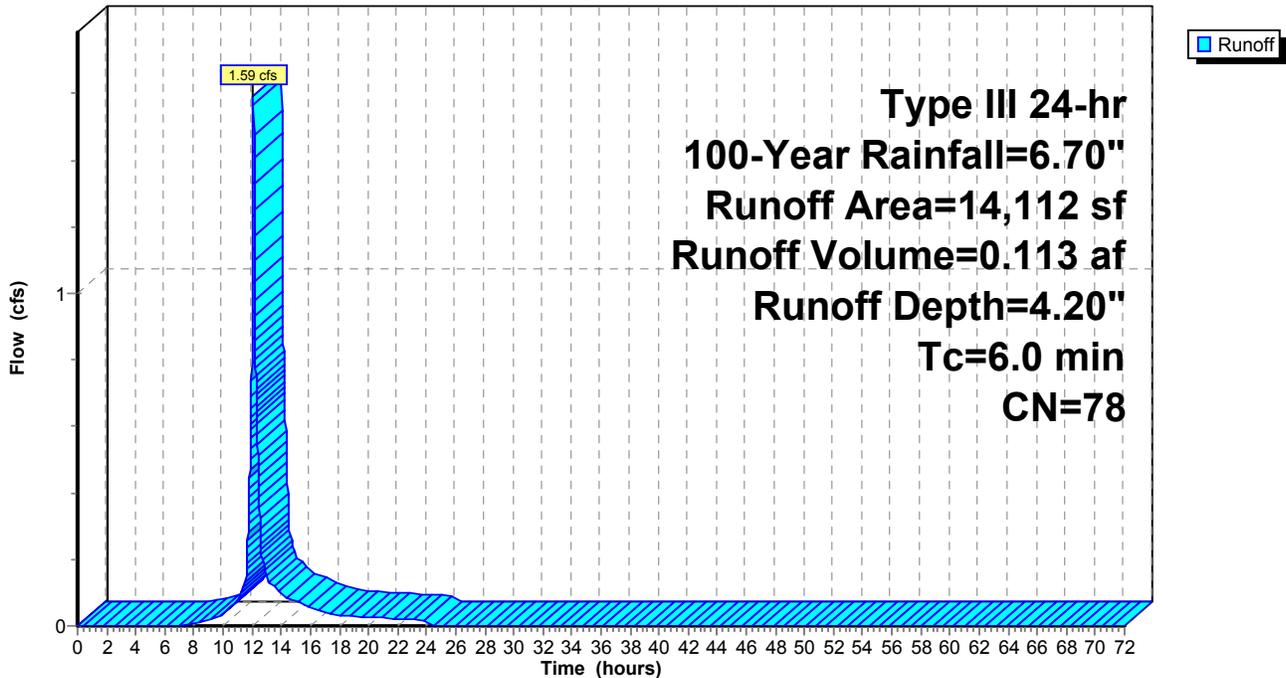
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
* 707	98	Driveway, HSG C (offsite)
* 5,410	74	>75% Grass cover, Good, HSG C (offsite)
* 672	98	Roofs, HSG C (offsite)
* 223	98	Walkways, HSG C
* 115	98	Ledge, HSG C
* 725	98	Patio/Wall, HSG C
* 6,260	74	>75% Grass cover, Good, planting beds, HSG C
14,112	78	Weighted Average
11,670		82.70% Pervious Area
2,442		17.30% Impervious Area

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

Subcatchment 1S-5: 1S-5

Hydrograph



Summary for Subcatchment 1S-R1: Roof

Runoff = 2.61 cfs @ 12.08 hrs, Volume= 0.205 af, Depth= 6.11"

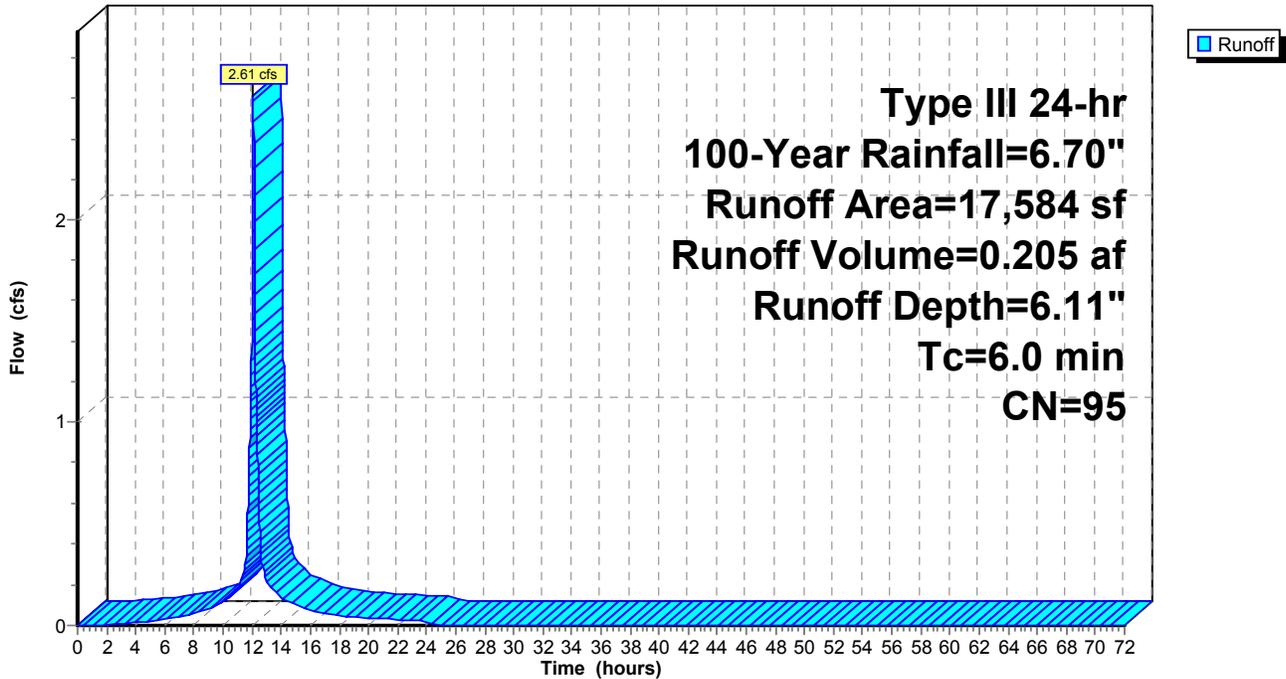
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
15,693	98	Roofs, HSG C
* 1,891	74	Green roof, HSG C
17,584	95	Weighted Average
1,891		10.75% Pervious Area
15,693		89.25% Impervious Area

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

Subcatchment 1S-R1: Roof

Hydrograph



Summary for Subcatchment 1S-R2: Roof/Drive/Stairs

Runoff = 1.26 cfs @ 12.08 hrs, Volume= 0.103 af, Depth= 6.46"

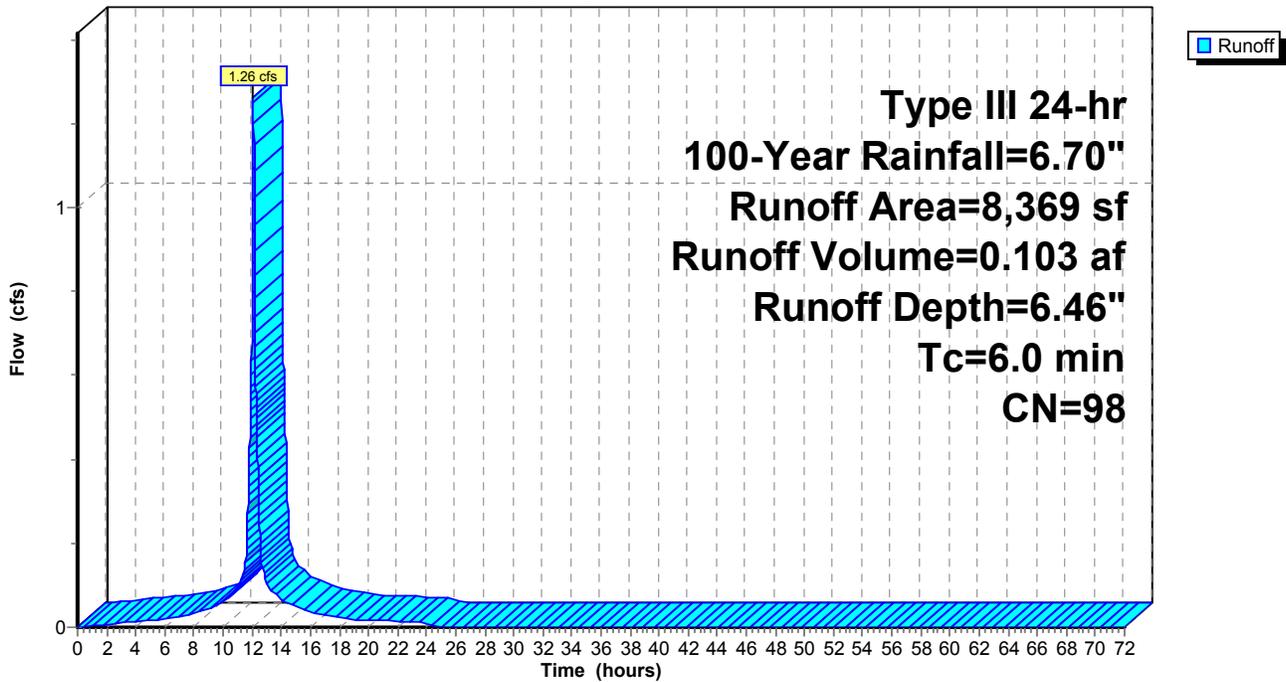
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
*	7,701	98	Roofs, HSG C
*	668	98	Pavement, HSG C
	8,369	98	Weighted Average
	8,369		100.00% Impervious Area

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

Subcatchment 1S-R2: Roof/Drive/Stairs

Hydrograph



216-194 Post Development (PC) (R2)

Type III 24-hr 100-Year Rainfall=6.70"

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Summary for Subcatchment 2S: 2S

Runoff = 3.92 cfs @ 12.09 hrs, Volume= 0.282 af, Depth= 4.64"

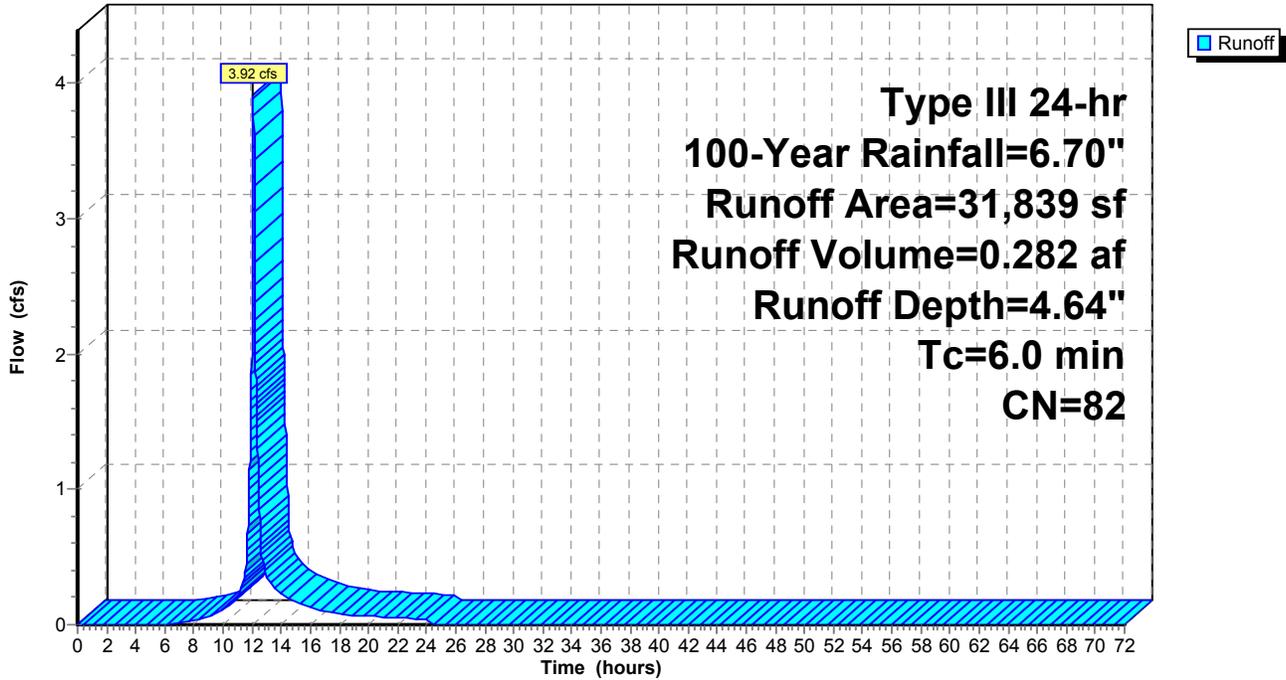
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
1,605	98	Roofs, HSG C
* 3,325	98	Drives, HSG C
* 756	98	Decks, stairs, HSG C
* 332	98	Misc. imp, HSG C
* 421	98	Walls, HSG C
5,598	74	>75% Grass cover, Good, HSG C
* 3,839	98	Roofs, HSG C (offsite)
* 12,359	74	>75% Grass cover, Good, HSG C (offsite)
* 830	98	Drives, HSG C (offsite)
* 2,603	70	Woods, Good, HSG C (offsite)
* 72	98	Ledge, HSG C (offsite)
* 99	98	Walls, HSG C (offsite)
31,839	82	Weighted Average
20,560		64.57% Pervious Area
11,279		35.43% Impervious Area

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

Subcatchment 2S: 2S

Hydrograph



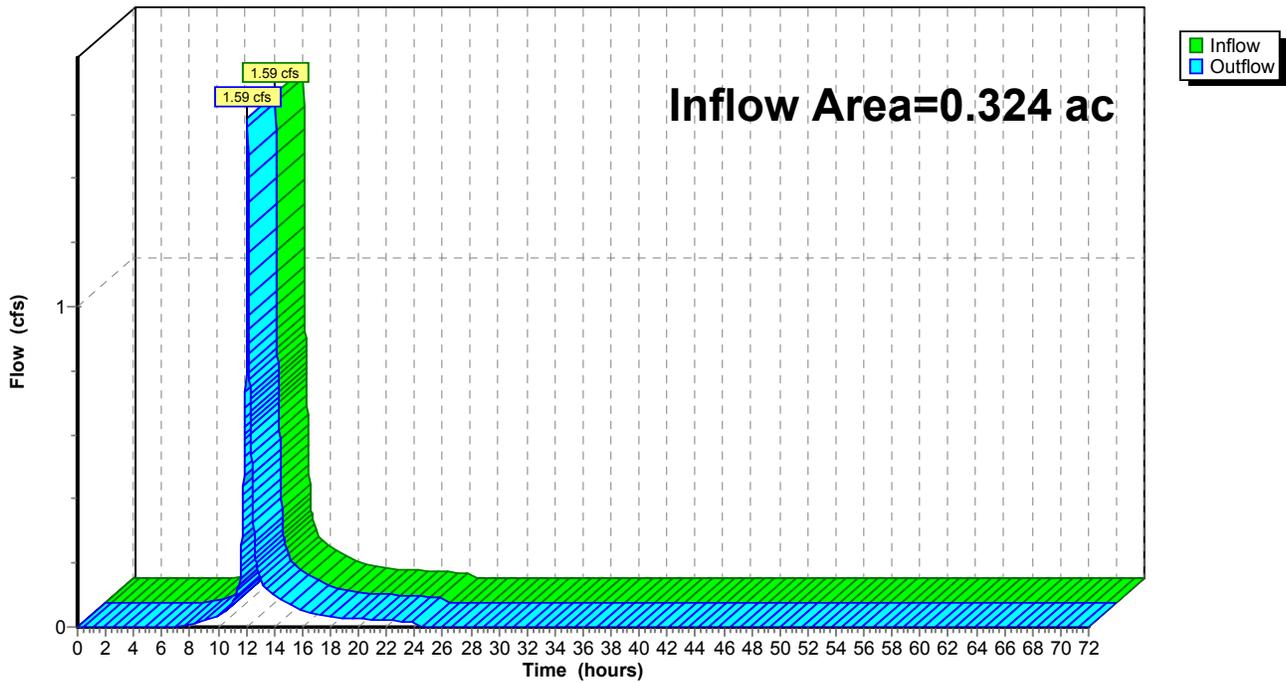
Summary for Reach DP-1: PL Linden Street

Inflow Area = 0.324 ac, 17.30% Impervious, Inflow Depth = 4.20" for 100-Year event
Inflow = 1.59 cfs @ 12.09 hrs, Volume= 0.113 af
Outflow = 1.59 cfs @ 12.09 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-1: PL Linden Street

Hydrograph



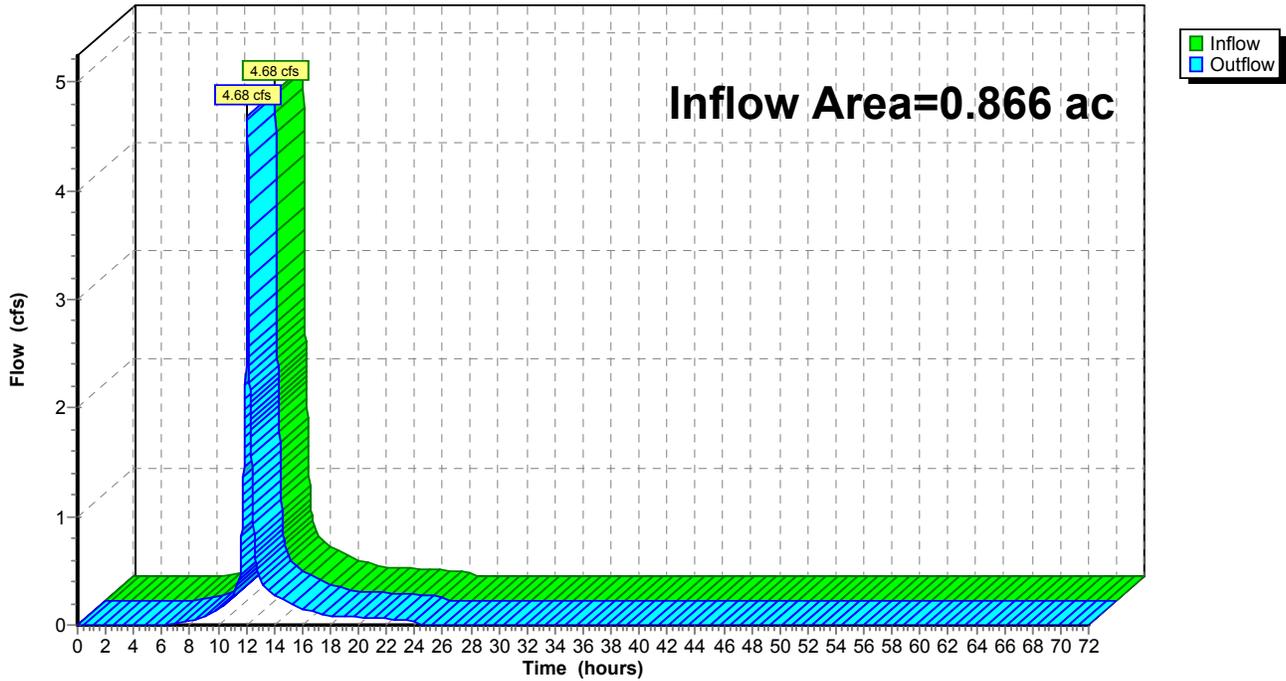
Summary for Reach DP-2: PL Hollis Street

Inflow Area = 0.866 ac, 36.09% Impervious, Inflow Depth = 4.69" for 100-Year event
Inflow = 4.68 cfs @ 12.09 hrs, Volume= 0.338 af
Outflow = 4.68 cfs @ 12.09 hrs, Volume= 0.338 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-2: PL Hollis Street

Hydrograph



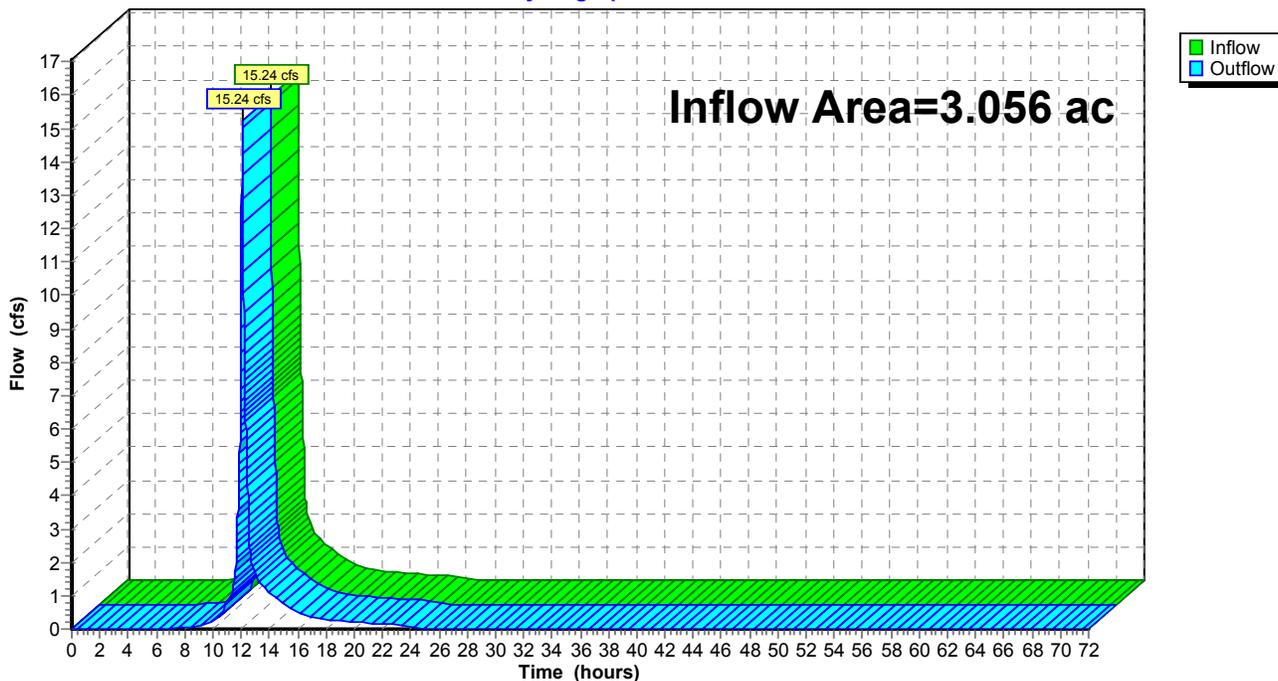
Summary for Reach DP-3: Closed Drainage System

Inflow Area = 3.056 ac, 42.39% Impervious, Inflow Depth = 4.29" for 100-Year event
Inflow = 15.24 cfs @ 12.09 hrs, Volume= 1.092 af
Outflow = 15.24 cfs @ 12.09 hrs, Volume= 1.092 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Reach DP-3: Closed Drainage System

Hydrograph



Summary for Pond D-1: Depression

Inflow Area = 0.407 ac, 0.73% Impervious, Inflow Depth = 3.78" for 100-Year event
 Inflow = 1.81 cfs @ 12.09 hrs, Volume= 0.128 af
 Outflow = 0.35 cfs @ 12.54 hrs, Volume= 0.128 af, Atten= 81%, Lag= 27.2 min
 Primary = 0.35 cfs @ 12.54 hrs, Volume= 0.128 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 187.30' @ 12.54 hrs Surf.Area= 1,331 sf Storage= 1,836 cf

Plug-Flow detention time= 49.8 min calculated for 0.128 af (100% of inflow)
 Center-of-Mass det. time= 49.9 min (873.8 - 823.9)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	2,886 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	309	0	0
186.00	713	511	511
187.00	1,174	944	1,455
188.00	1,689	1,432	2,886

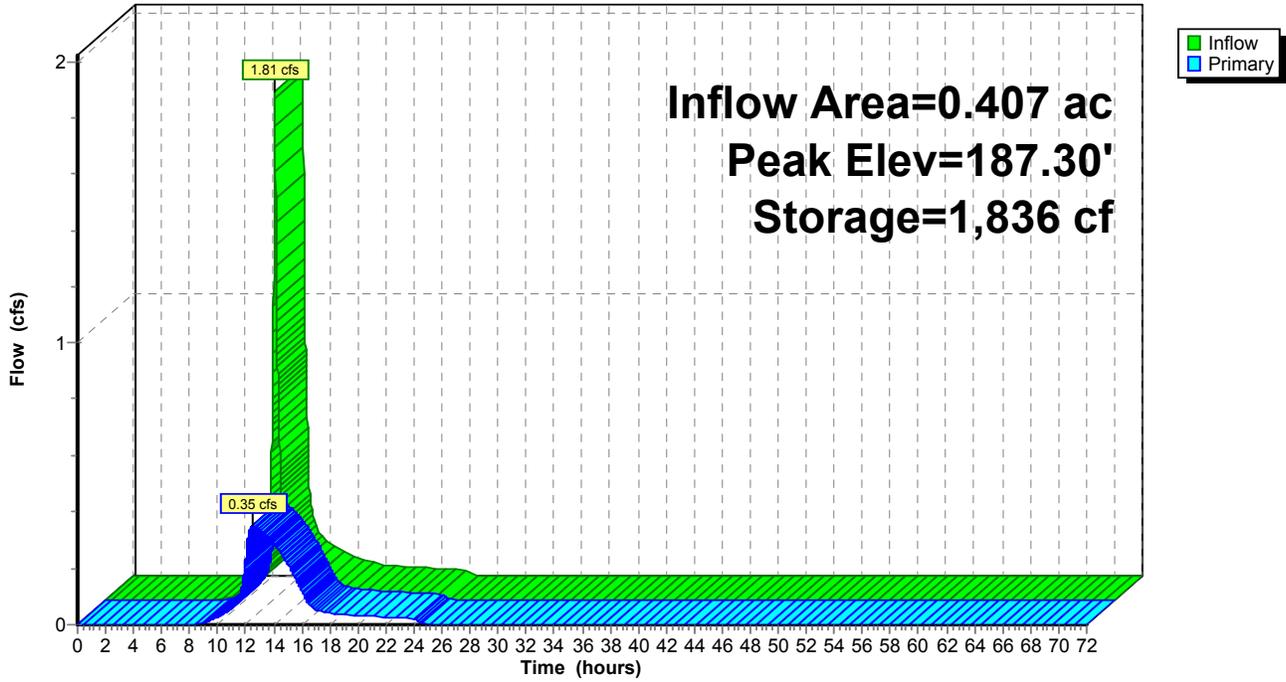
Device	Routing	Invert	Outlet Devices
#1	Primary	179.40'	8.0" Round Culvert L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 179.40' / 179.33' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	185.00'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	187.30'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.35 cfs @ 12.54 hrs HW=187.30' TW=169.23' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 0.35 cfs of 4.62 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.35 cfs @ 7.11 fps)
- ↑ **3=Sharp-Crested Rectangular Weir**(Weir Controls 0.00 cfs @ 0.23 fps)

Pond D-1: Depression

Hydrograph



Summary for Pond P-1: Infiltration Chambers

Inflow Area = 1.654 ac, 43.32% Impervious, Inflow Depth = 4.95" for 100-Year event
 Inflow = 7.67 cfs @ 12.09 hrs, Volume= 0.683 af
 Outflow = 7.65 cfs @ 12.09 hrs, Volume= 0.683 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.05 cfs @ 6.83 hrs, Volume= 0.103 af
 Primary = 7.60 cfs @ 12.09 hrs, Volume= 0.580 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 169.70' @ 12.09 hrs Surf.Area= 852 sf Storage= 1,815 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 51.1 min (851.5 - 800.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.50'	665 cf	18.44'W x 46.22'L x 3.50'H Field A 2,982 cf Overall - 1,320 cf Embedded = 1,662 cf x 40.0% Voids
#2A	166.83'	1,254 cf	ACF R-Tank HD 1.5 x 198 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 11 Rows of 18 Chambers
		1,919 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	165.00'	12.0" Round Culvert L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 165.00' / 164.05' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	168.20'	3.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	169.00'	4.0' long x 1.00' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	166.50'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.05 cfs @ 6.83 hrs HW=166.54' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=7.60 cfs @ 12.09 hrs HW=169.70' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert (Passes 7.60 cfs of 7.75 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 0.28 cfs @ 5.64 fps)
 ↳3=Sharp-Crested Rectangular Weir (Weir Controls 7.32 cfs @ 2.73 fps)

Pond P-1: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF Environmental R-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

18 Chambers/Row x 2.35' Long = 42.22' Row Length +24.0" End Stone x 2 = 46.22' Base Length

11 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 18.44' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

198 Chambers x 6.3 cf = 1,253.9 cf Chamber Storage

198 Chambers x 6.7 cf = 1,319.9 cf Displacement

2,981.5 cf Field - 1,319.9 cf Chambers = 1,661.6 cf Stone x 40.0% Voids = 664.7 cf Stone Storage

Chamber Storage + Stone Storage = 1,918.5 cf = 0.044 af

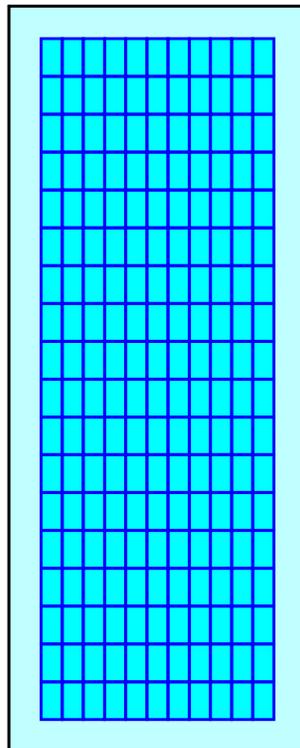
Overall Storage Efficiency = 64.3%

Overall System Size = 46.22' x 18.44' x 3.50'

198 Chambers

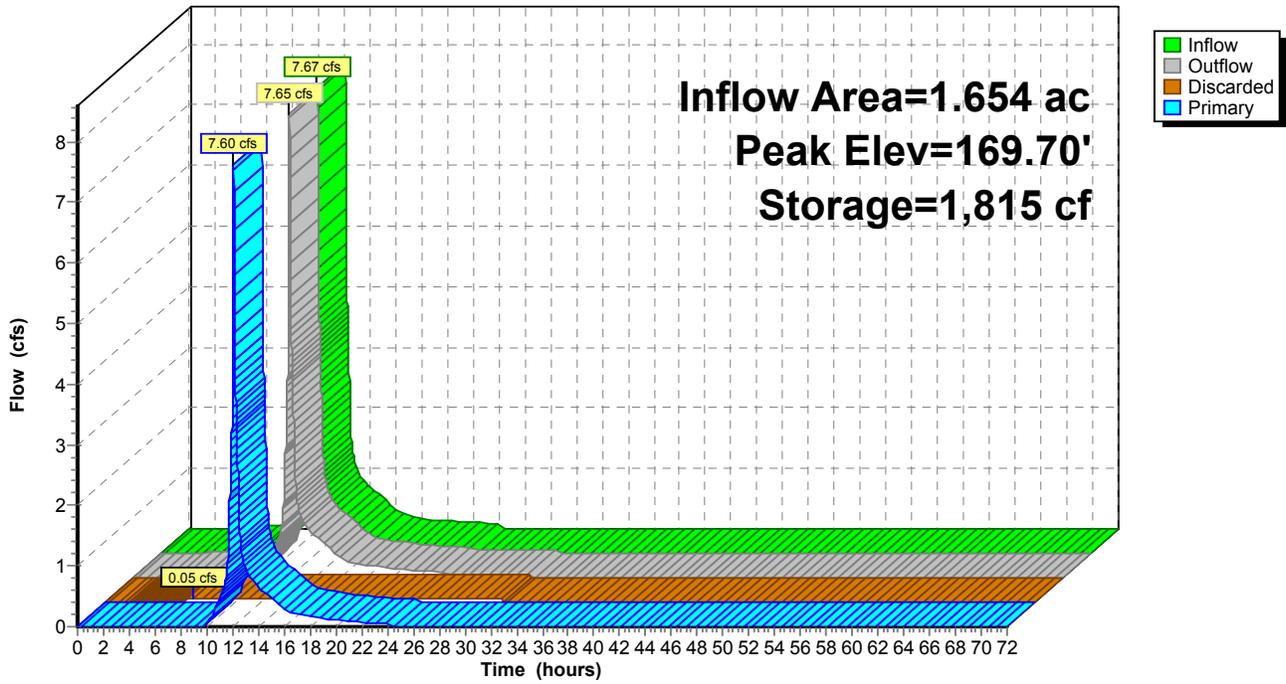
110.4 cy Field

61.5 cy Stone



Pond P-1: Infiltration Chambers

Hydrograph



Summary for Pond P-2: Infiltration Chambers

Inflow Area = 0.192 ac, 100.00% Impervious, Inflow Depth = 6.46" for 100-Year event
 Inflow = 1.26 cfs @ 12.08 hrs, Volume= 0.103 af
 Outflow = 1.26 cfs @ 12.09 hrs, Volume= 0.103 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.03 cfs @ 8.05 hrs, Volume= 0.053 af
 Primary = 1.23 cfs @ 12.09 hrs, Volume= 0.050 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 159.69' @ 12.09 hrs Surf.Area= 493 sf Storage= 839 cf

Plug-Flow detention time= 115.2 min calculated for 0.103 af (100% of inflow)
 Center-of-Mass det. time= 115.2 min (858.8 - 743.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	157.00'	465 cf	9.25'W x 53.26'L x 3.50'H Field A 1,724 cf Overall - 560 cf Embedded = 1,164 cf x 40.0% Voids
#2A	157.33'	532 cf	ACF R-Tank HD 1.5 x 84 Inside #1 Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf 4 Rows of 21 Chambers
		997 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.00'	12.0" Round Culvert L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.00' / 155.00' S= 0.0500 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	158.95'	2.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	159.50'	4.0' long x 0.65' rise Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Discarded	157.00'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 8.05 hrs HW=157.04' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.23 cfs @ 12.09 hrs HW=159.69' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert (Passes 1.23 cfs of 6.76 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 0.13 cfs @ 3.85 fps)
 ↳3=Sharp-Crested Rectangular Weir (Weir Controls 1.10 cfs @ 1.44 fps)

Pond P-2: Infiltration Chambers - Chamber Wizard Field A

Chamber Model = ACF R-Tank HD 1.5 (ACF EnvironmentalIR-Tank HD)

Inside= 15.7"W x 26.0"H => 2.70 sf x 2.35'L = 6.3 cf

Outside= 15.7"W x 26.0"H => 2.84 sf x 2.35'L = 6.7 cf

21 Chambers/Row x 2.35' Long = 49.26' Row Length +24.0" End Stone x 2 = 53.26' Base Length

4 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 9.25' Base Width

4.0" Base + 26.0" Chamber Height + 12.0" Cover = 3.50' Field Height

84 Chambers x 6.3 cf = 531.9 cf Chamber Storage

84 Chambers x 6.7 cf = 559.9 cf Displacement

1,723.6 cf Field - 559.9 cf Chambers = 1,163.6 cf Stone x 40.0% Voids = 465.5 cf Stone Storage

Chamber Storage + Stone Storage = 997.4 cf = 0.023 af

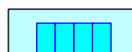
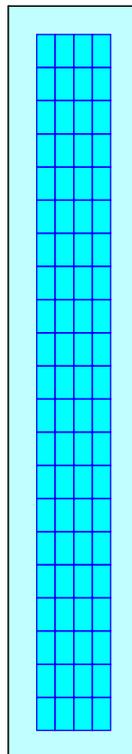
Overall Storage Efficiency = 57.9%

Overall System Size = 53.26' x 9.25' x 3.50'

84 Chambers

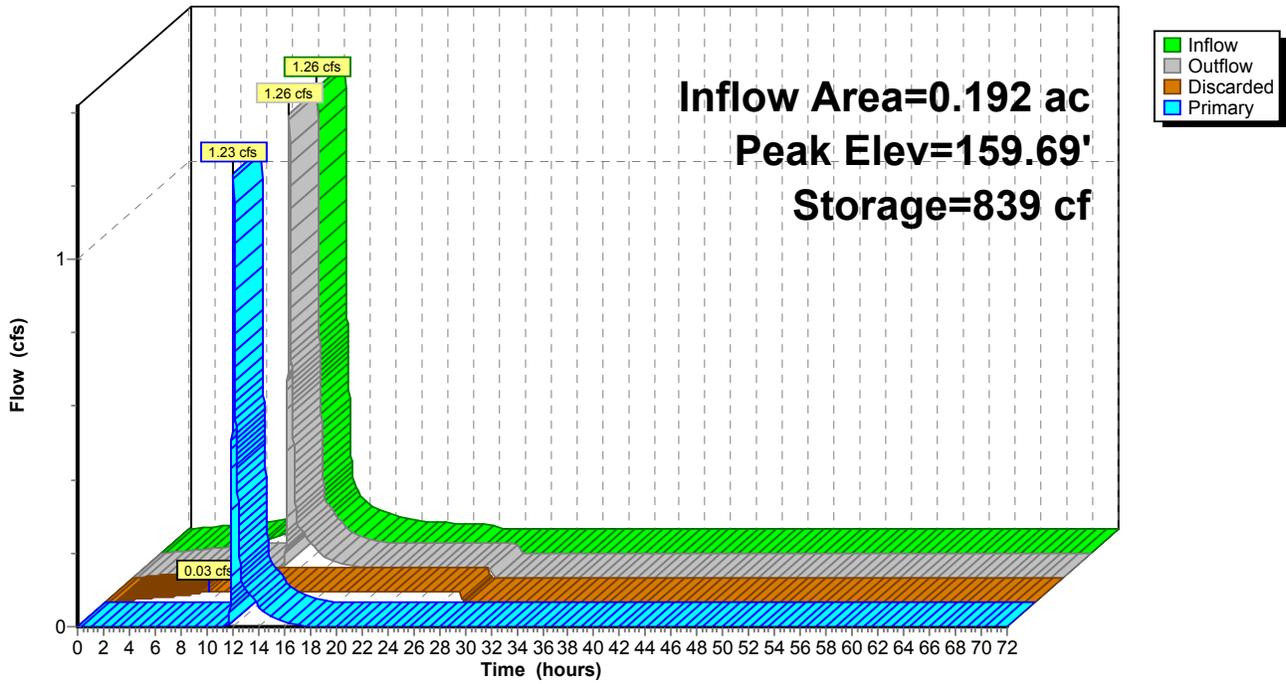
63.8 cy Field

43.1 cy Stone



Pond P-2: Infiltration Chambers

Hydrograph



APPENDIX C

Checklist for Stormwater Report



Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



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

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- 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): Infiltration Chambers

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 Field¹
- 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.

A P P E N D I X D

**Illicit Discharge Compliance Statement
Supplemental BMP Calculations**

Illicit Discharge Compliance Statement

I, Bradley C. McKenzie, P.E., hereby notify the Wellesley Conservation Commission that I have not witnessed, nor am aware of any existing illicit discharges at the site known as 148 Weston Road in Wellesley, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled "148 Weston Road," prepared by McKenzie Engineering Group, Inc. dated February 28, 2020 and as revised and approved by the Wellesley Conservation Commission and maintenance thereof in accordance with the "Construction Phase Operations and Maintenance Plan" and "Long-Term Operations and Maintenance Plan" prepared by McKenzie Engineering Group, Inc. dated February 28, 2020 and as revised and approved by the Wellesley Conservation Commission will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

Name: Bradley C. McKenzie, P.E.

Company: McKenzie Engineering Group, Inc.

Title: Owner's Representative

Signature:  _____

Date: July 1, 2020



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 150 Longwater Drive, Suite 101
 Norwell, MA 02061

WELLESLEY SQUARE RESIDENCES
 WELLESLEY, MA

2/21/2020
 Revised 7/10/2020
 Revised 8/12/2020

REQUIRED RECHARGE VOLUME (CF) "STATIC METHOD"

WATERSHED #	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) A SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) B SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) C SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) D SOIL	REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE		0.60		0.35	46,690	0.25		0.10	973
		0.60		0.35		0.25		0.10	0
		0.60		0.35		0.25		0.10	0
							TOTAL		973

CAPTURE ADJUSTMENT

WATERSHED #	TOTAL IMPERVIOUS AREA (SF)	TOTAL IMPERVIOUS COLLECTED	% DIRECTED TOWARDS INFILTRATION SYSTEM	STANDARD NO. 3 > 65% CAPTURED < 100%	CAPTURE ADJUSTMENT	ADJUSTED REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE	46,690	35,816	76.71%	CAPTURE ADJUSTMENT REQUIRED	1.30	1,268

**PROVIDED RECHARGE VOLUME (CF)
 BELOW LOWEST INVERT**

REQUIRED RECHARGE VOLUME (CF)	POND	STORAGE VOLUME PROVIDED (CF)	NET STORAGE VOLUME PROVIDED (CF)
1,268	P-1	1,038	
	P-2	614	
TOTAL		1,652	384



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WELLESLEY SQUARE RESIDENCES
WELLESLEY, MA

2/21/2020
Revised 7/10/2020
Revised 8/12/2020

DRAWDOWN WITHIN 72 HOURS ANALYSIS

POND	RAWLS RATE (IN/HR)	STORAGE VOLUME PROVIDED (CF)	BOTTOM AREA (FT ²)	DRAWDOWN (HR)
P-1	2.41	1,038	952	5
P-2	2.41	614	493	6



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WELLESLEY SQUARE RESIDENCES
WELLESLEY, MA

2/21/2020
Revised 7/10/2020
Revised 8/12/2020

WATER QUALITY VOLUME ANALYSIS

POND	IMPERVIOUS AREA (SF) CN=98	PRECIPITATION (IN)	WATER QUALITY VOLUME REQUIRED (CF)	TREATMENT VOLUME PROVIDED (CF) UP TO INVERT ELEVATION	NET TREATMENT VOLUME PROVIDED (CF)
P-1	23,044	0.50	960	1,038	78
P-2	8,369	0.50	349	614	265
TOTAL	31,413		1,309	1,652	343

P-1, & P-2 Require 44% TSS removal prior to infiltration use treatment units

WATER QUALITY VOLUME ANALYSIS - PROPRIETARY STORMWATER TREATMENTS UNITS (FABCO STORMSAFE MANHOLES)

WATERSHED	IMPERVIOUS AREA (SF) CN=98	PRECIPITATION (IN)	qu (Fig 4) Tc 6 min. (CSM/IN)	AREA (SM)	WATER QUALITY REQUIRED (CFS)
DMH 4	8,053	0.50	774	2.889E-04	0.112
DMH 5	8,975	0.50	774	3.219E-04	0.125
DMH 7	800	0.50	774	2.870E-05	0.011
DMH 12	8,369	0.50	774	3.002E-04	0.116
				TOTAL	0.364

*Use 4' Diameter First Defense Units

216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

Prepared by McKenzie Engineering Group, Inc.

HydroCAD® 10.00-21 s/n 00452 © 2018 HydroCAD Software Solutions LLC

Stage-Area-Storage for Pond P-1: Infiltration Chambers

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
166.50	852	0	169.10	852	1,612
166.55	852	17	169.15	852	1,629
166.60	852	34	169.20	852	1,646
166.65	852	51	169.25	852	1,663
166.70	852	68	169.30	852	1,680
166.75	852	85	169.35	852	1,697
166.80	852	102	169.40	852	1,714
166.85	852	125	169.45	852	1,731
166.90	852	159	169.50	852	1,749
166.95	852	193	169.55	852	1,766
167.00	852	226	169.60	852	1,783
167.05	852	260	169.65	852	1,800
167.10	852	294	169.70	852	1,817
167.15	852	328	169.75	852	1,834
167.20	852	362	169.80	852	1,851
167.25	852	395	169.85	852	1,868
167.30	852	429	169.90	852	1,885
167.35	852	463	169.95	852	1,902
167.40	852	497	170.00	852	1,919
167.45	852	531			
167.50	852	564			
167.55	852	598			
167.60	852	632			
167.65	852	666			
167.70	852	700			
167.75	852	733			
167.80	852	767			
167.85	852	801			
167.90	852	835			
167.95	852	869			
168.00	852	902			
168.05	852	936			
168.10	852	970			
168.15	852	1,004			
168.20	852	1,038			
168.25	852	1,071			
168.30	852	1,105			
168.35	852	1,139			
168.40	852	1,173			
168.45	852	1,207			
168.50	852	1,240			
168.55	852	1,274			
168.60	852	1,308			
168.65	852	1,342			
168.70	852	1,376			
168.75	852	1,410			
168.80	852	1,443			
168.85	852	1,477			
168.90	852	1,511			
168.95	852	1,545			
169.00	852	1,578			
169.05	852	1,595			

216-194 Post Development (PC) (R2)

Type III 24-hr 2-Year Rainfall=3.20"

Prepared by McKenzie Engineering Group, Inc.

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Stage-Area-Storage for Pond P-2: Infiltration Chambers

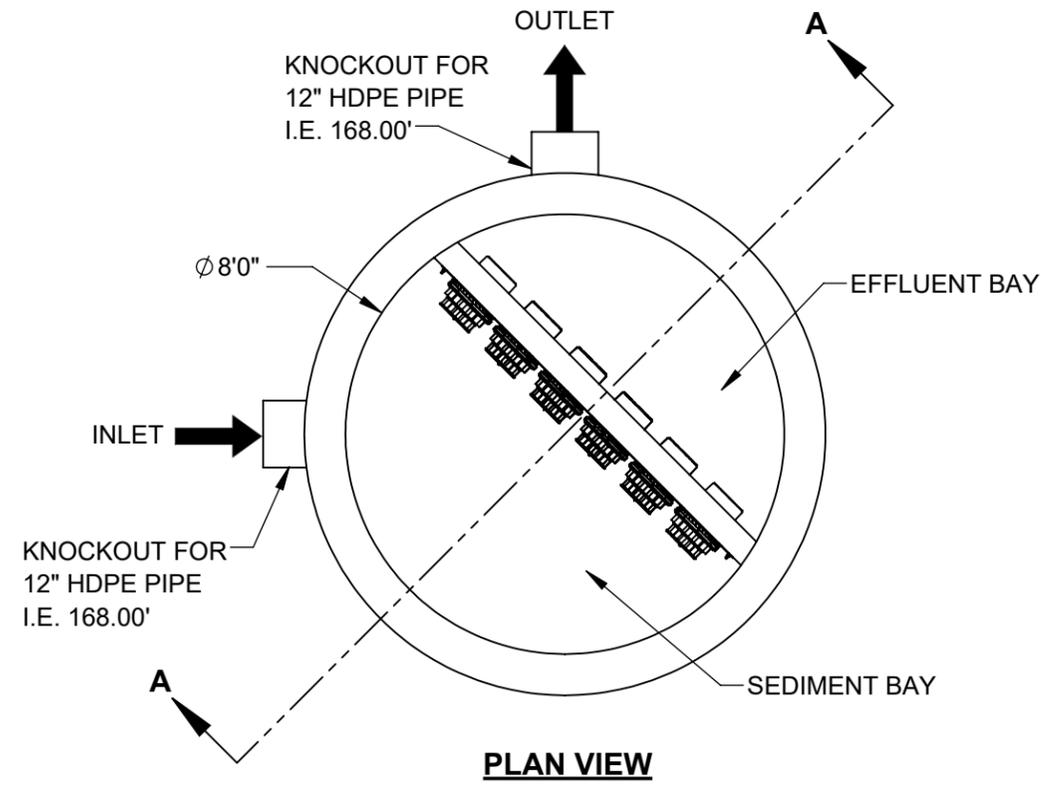
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
157.00	493	0	159.60	493	820
157.05	493	10	159.65	493	830
157.10	493	20	159.70	493	840
157.15	493	30	159.75	493	850
157.20	493	39	159.80	493	860
157.25	493	49	159.85	493	870
157.30	493	59	159.90	493	879
157.35	493	71	159.95	493	889
157.40	493	88	160.00	493	899
157.45	493	105	160.05	493	909
157.50	493	122	160.10	493	919
157.55	493	139	160.15	493	929
157.60	493	156	160.20	493	939
157.65	493	173	160.25	493	948
157.70	493	190	160.30	493	958
157.75	493	207	160.35	493	968
157.80	493	224	160.40	493	978
157.85	493	241	160.45	493	988
157.90	493	258	160.50	493	997
157.95	493	275			
158.00	493	292			
158.05	493	309			
158.10	493	326			
158.15	493	343			
158.20	493	360			
158.25	493	377			
158.30	493	394			
158.35	493	411			
158.40	493	428			
158.45	493	445			
158.50	493	462			
158.55	493	478			
158.60	493	495			
158.65	493	512			
158.70	493	529			
158.75	493	546			
158.80	493	563			
158.85	493	580			
158.90	493	597			
158.95	493	614			
159.00	493	631			
159.05	493	648			
159.10	493	665			
159.15	493	682			
159.20	493	699			
159.25	493	716			
159.30	493	733			
159.35	493	750			
159.40	493	767			
159.45	493	784			
159.50	493	801			
159.55	493	810			

Figure 4: for First 1-inch Runoff, Table of qu values for Ia/P Curve = 0.034, listed by tc, for Type III Storm Distribution

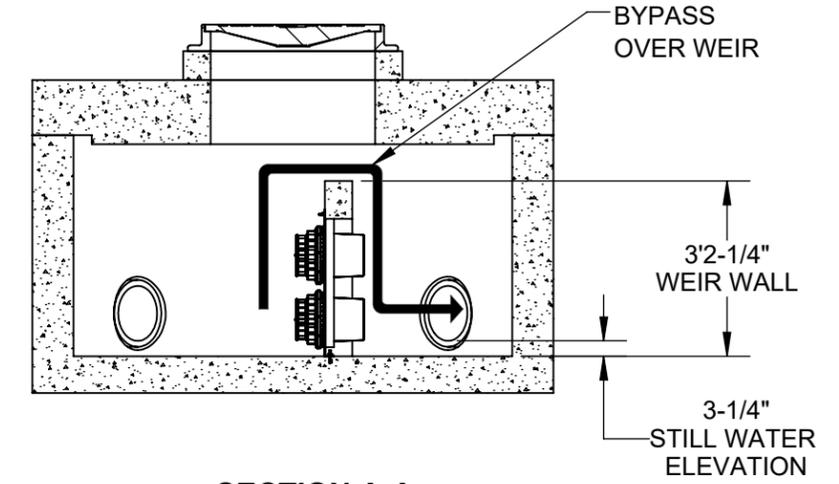
Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)	Tc (Hours)	qu (csm/in)
0.01	835	2.7	197	7.1	95
0.03	835	2.8	192	7.2	94
0.05	831	2.9	187	7.3	93
0.067	814	3	183	7.4	92
0.083	795	3.1	179	7.5	91
0.1	774	3.2	175	7.6	90
0.116	755	3.3	171	7.7	89
0.133	736	3.4	168	7.8	88
0.15	717	3.5	164	7.9	87
0.167	700	3.6	161	8	86
0.183	685	3.7	158	8.1	85
0.2	669	3.8	155	8.2	84
0.217	654	3.9	152	8.3	84
0.233	641	4	149	8.4	83
0.25	628	4.1	146	8.5	82
0.3	593	4.2	144	8.6	81
0.333	572	4.3	141	8.7	80
0.35	563	4.4	139	8.8	79
0.4	536	4.5	137	8.9	79
0.416	528	4.6	134	9	78
0.5	491	4.7	132	9.1	77
0.583	460	4.8	130	9.2	76
0.6	454	4.9	128	9.3	76
0.667	433	5	126	9.4	75
0.7	424	5.1	124	9.5	74
0.8	398	5.2	122	9.6	74
0.9	376	5.3	120	9.7	73
1	356	5.4	119	9.8	72
1.1	339	5.5	117	9.9	72
1.2	323	5.6	115	10	71
1.3	309	5.7	114		
1.4	296	5.8	112		
1.5	285	5.9	111		
1.6	274	6	109		
1.7	264	6.1	108		
1.8	255	6.2	106		
1.9	247	6.3	105		
2	239	6.4	104		
2.1	232	6.5	102		
2.2	225	6.6	101		
2.3	219	6.7	100		
2.4	213	6.8	99		
2.5	207	6.9	98		
2.6	202	7	96		

NOTES (REF):

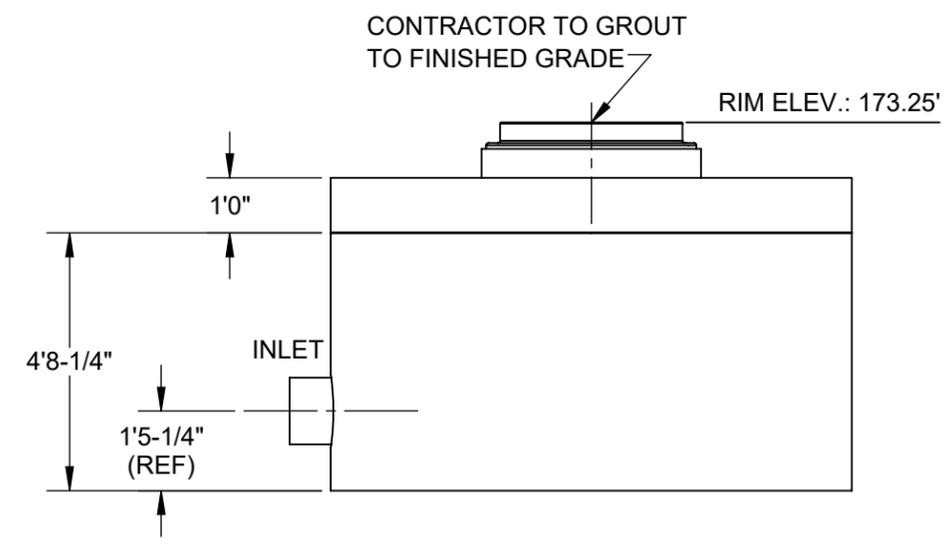
- 1.0 WEIGHT ESTIMATE:
 - 1.1 COVER: 10,500-LB
 - 1.2 BASE W/ FILTERS: 21,000-LB
- 2.0 MATERIALS MEET OR EXCEEDS REQUIREMENTS:
 - 2.1 VAULT:
 - 2.1.1 REBAR: ASTM A-615 GRADE 60
 - 2.1.2 CEMENT: ASTM C-150 SPECIFICATIONS
CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 5000 PSI (MIN)
 - 2.2 ACCESS: 30" MANHOLE CLEAR OPENING
- 3.0 CONCRETE STRUCTURE DESIGN LOADINGS:
 - 3.1 AASHTO HS-20 LOAD RATING (CONCRETE ONLY).
 - 3.2 SOIL WEIGHT = 120 PCF
 - 3.3 DEPTH OF OVERBURDEN: <8-FT
 - 3.4 EQUIVALENT FLUID PRESSURE = 40 PCF
 - 3.5 LATERAL LIVE LOAD SURCHARGE PER SPECS.
- 4.0 PERFORMANCE CHARACTERISTICS (NUTRIENT CARTRIDGE):
 - 4.1 MAXIMUM CARTRIDGE CAPACITY = 12
 - 4.2 MAXIMUM TREATMENT CAPACITY = 2.64 CFS (1,200 GPM)
 - 4.3 BYPASS: AREA OVER WEIR IS GREATER THAN PIPE CROSS-SECTIONAL AREA.
- 5.0 MANHOLE CASTING: CASTINGS ARE RATED FOR REPEATED VEHICULAR TRAFFIC AND CONFORM TO AASHTO M306 STANDARDS. FINAL MANHOLE OR ACCESS HATCH INSTALLATION, AND ADJUSTMENT TO GRADE, SHALL BE PERFORMED BY QUALIFIED PERSONNEL. IF REQUIRED, GRADE RINGS OR LEVELING BLOCKS SHALL BE SUPPLIED BY THE CONTRACTOR.
- 6.0 OFF-LOADING, SETTING, EXCAVATION, DEWATERING, DRAINAGE, AND BACK FILL OPERATIONS SHALL BE PERFORMED IN ACCORDANCE WITH OSHA AND LOCAL REGULATIONS AND ARE THE RESPONSIBILITY OF THE CONTRACTOR. SUB-BASE AND BACKFILL DEPTH ARE SITE SPECIFIC AND SHALL BE SPECIFIED BY THE ENGINEER OF RECORD.
- 7.0 THE CONTRACTOR SHALL VERIFY THAT THE UNIT IS VERTICALLY AND HORIZONTALLY PLUMB AND STABLE, WITH MINIMUM VOIDS AND MINIMUM UN-COMPACTED SOIL AFTER BACK FILL OPERATION.
- 8.0 CONNECT EXISTING DRAIN LINE TO STORMSAFE INLET AND OUTLET PORTS WITH APPROVED NON-SHRINKING GROUT-FILL IN ACCORDANCE WITH GROUT MANUFACTURERS INSTRUCTIONS. ALL GROUT-FILL MATERIALS SHALL BE SUPPLIED BY THE CONTRACTOR. THE STORMSAFE "INLET" AND "OUTLET" PORTS ARE CLEARLY LABELED WITH BLACK PAINT. INLET AND OUTLET DRAIN LINES ARE TO BE ALIGNED FLUSH WITH RESPECT TO THE INTERIOR VAULT WALLS.
- 9.0 MAINTENANCE AND CARTRIDGE FILTER REPLACEMENT INSTRUCTIONS ARE PROVIDED SEPARATELY BY FABCO AND ARE SITE SPECIFIC.
- 10.0 CARTRIDGE FILTER REPLACEMENT (IN GENERAL):
FOR BEST PERFORMANCE REPLACE CARTRIDGE FILTERS IAW FABCO RECOMMENDATIONS. HIGH CONTAMINANT LOCATIONS MAY REQUIRE MORE FREQUENT CARTRIDGE REPLACEMENT. REMOVE ANY DEBRIS OR HEAVY SEDIMENT FROM THE SEDIMENT AND EFFLUENT BAYS. ENTER THE STORMSAFE MANHOLE IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS FOR ENCLOSED SPACE ENTRY. REMOVE EACH CARTRIDGE BY ROTATING 30-DEGREES IN THE CLOCKWISE DIRECTION AND LIFTING. LIKEWISE, INSTALL THE NEW CARTRIDGE AND LOCK IN PLACE BY ROTATING 30-DEGREES IN THE COUNTER CLOCKWISE DIRECTION. DISPOSE OF USED FILTER CARTRIDGES PER LOCAL REGULATIONS.



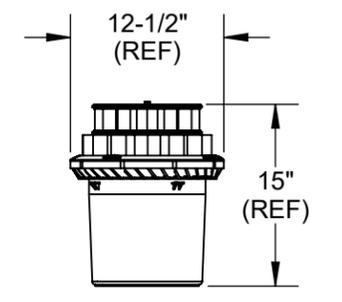
PLAN VIEW



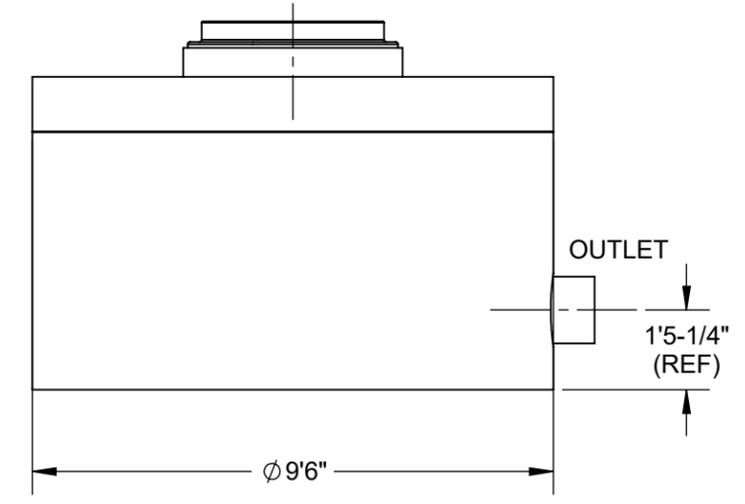
SECTION A-A



CONTRACTOR TO GROUT TO FINISHED GRADE
RIM ELEV.: 173.25'



REFERENCE DETAIL
REPLACEABLE CARTRIDGE



PROPRIETARY AND CONFIDENTIAL THIS DOCUMENT IS THE PROPERTY OF FABCO INDUSTRIES AND IS CONVEYED WITH THE EXPRESS CONDITION THAT IT AND THE INFORMATION CONTAINED IN IT ARE NOT TO BE USED, DISCLOSED, OR REPRODUCED IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN CONSENT OF FABCO INDUSTRIES; AND THAT NO RIGHT IS GRANTED TO DISCLOSE OR SO USE ANY INFORMATION CONTAINED IN SAID DOCUMENT.	UNLESS OTHERWISE SPECIFIED REMOVE ALL BURRS BREAK SHARP EDGES .002 - .020 FILLETS .020 MAX DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES	TOLERANCES: DEC .00 ± .01 DEC .000 ± .005 FRACT ± 1/16 ANGLE ± 2°	APPROVAL	DATE	 STORMSAFE MANHOLE 8-FT 12-CARTRIDGE FILTER
	DWN	J.C.	8/6/2020	FABCO INDUSTRIES, INC. 24 CENTRAL DRIVE FARMINGDALE, NY 11735 WWW.FABCO-INDUSTRIES.COM	
	ENGR	J.P.	8/6/2020		
	UPD				
PROJECT	WELLESLEY UNIT 1			SIZE DWG. NO. B 10072-83-000	REV A
MATERIAL				SCALE: NONE	SHEET 1 OF 1

NOTES (REF):

1.0 WEIGHT ESTIMATE:

- 1.1 COVER: 10,300-LB
- 1.2 BASE W/ FILTERS: 16,600-LB

2.0 MATERIALS MEET OR EXCEEDS REQUIREMENTS:

- 2.1 VAULT:
 - 2.1.1 REBAR: ASTM A-615 GRADE 60
 - 2.1.2 CEMENT: ASTM C-150 SPECIFICATIONS
CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 5000 PSI (MIN)

2.2 ACCESS: 30" MANHOLE CLEAR OPENING

3.0 CONCRETE STRUCTURE DESIGN LOADINGS:

- 3.1 AASHTO HS-20 LOAD RATING (CONCRETE ONLY).
- 3.2 SOIL WEIGHT = 120 PCF
- 3.3 DEPTH OF OVERBURDEN: <8-FT
- 3.4 EQUIVALENT FLUID PRESSURE = 40 PCF
- 3.5 LATERAL LIVE LOAD SURCHARGE PER SPECS.

4.0 PERFORMANCE CHARACTERISTICS (NUTRIENT CARTRIDGE):

- 4.1 MAXIMUM CARTRIDGE CAPACITY = 6
- 4.2 MAXIMUM TREATMENT CAPACITY = 1.32 CFS (600 GPM)
- 4.3 BYPASS: AREA OVER WEIR IS GREATER THAN PIPE CROSS-SECTIONAL AREA.

5.0 MANHOLE CASTING: CASTINGS ARE RATED FOR REPEATED VEHICULAR TRAFFIC AND CONFORM TO AASHTO M306 STANDARDS. FINAL MANHOLE OR ACCESS HATCH INSTALLATION, AND ADJUSTMENT TO GRADE, SHALL BE PERFORMED BY QUALIFIED PERSONNEL. IF REQUIRED, GRADE RINGS OR LEVELING BLOCKS SHALL BE SUPPLIED BY THE CONTRACTOR.

6.0 OFF-LOADING, SETTING, EXCAVATION, DEWATERING, DRAINAGE, AND BACK FILL OPERATIONS SHALL BE PERFORMED IN ACCORDANCE WITH OSHA AND LOCAL REGULATIONS AND ARE THE RESPONSIBILITY OF THE CONTRACTOR. SUB-BASE AND BACKFILL DEPTH ARE SITE SPECIFIC AND SHALL BE SPECIFIED BY THE ENGINEER OF RECORD.

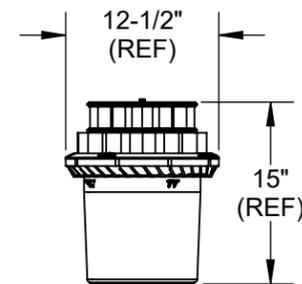
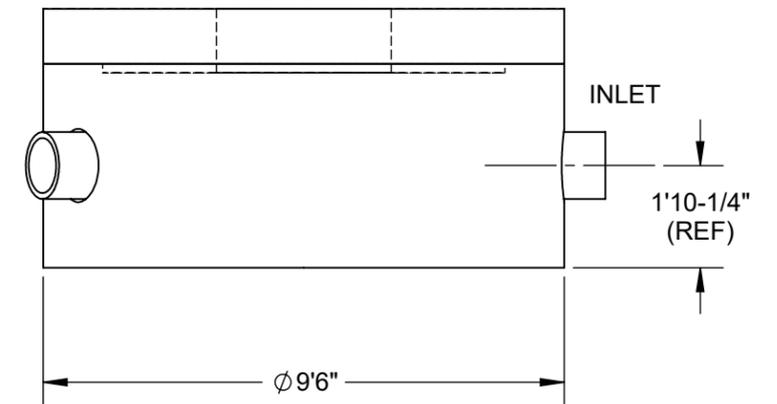
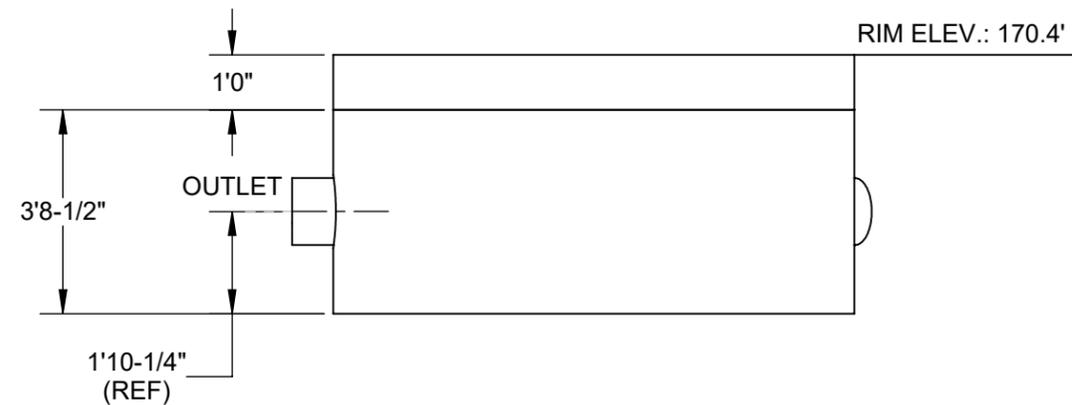
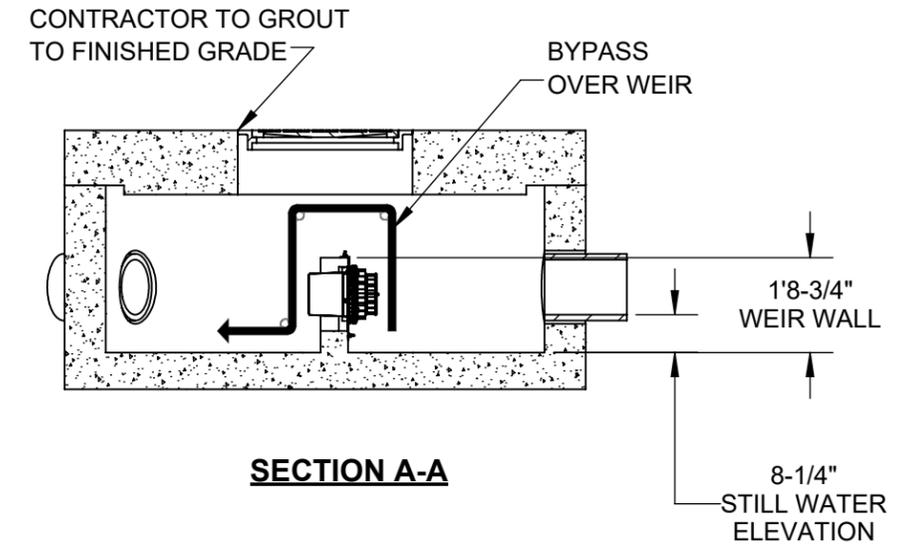
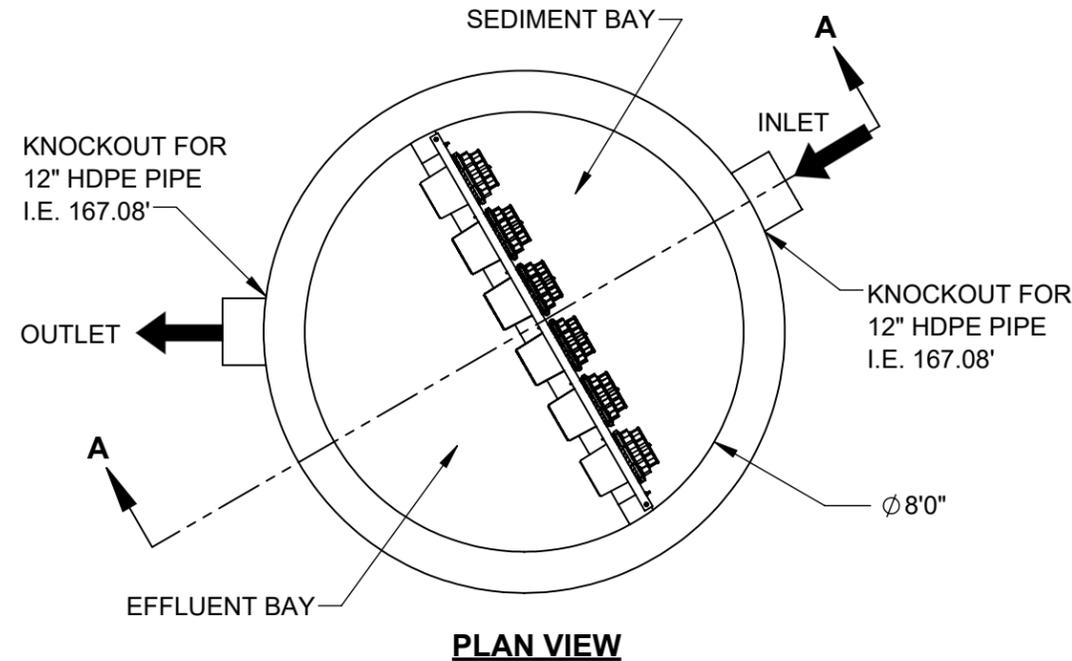
7.0 THE CONTRACTOR SHALL VERIFY THAT THE UNIT IS VERTICALLY AND HORIZONTALLY PLUMB AND STABLE, WITH MINIMUM VOIDS AND MINIMUM UN-COMPACTED SOIL AFTER BACK FILL OPERATION.

8.0 CONNECT EXISTING DRAIN LINE TO STORMSAFE INLET AND OUTLET PORTS WITH APPROVED NON-SHRINKING GROUT-FILL IN ACCORDANCE WITH GROUT MANUFACTURERS INSTRUCTIONS. ALL GROUT-FILL MATERIALS SHALL BE SUPPLIED BY THE CONTRACTOR. THE STORMSAFE "INLET" AND "OUTLET" PORTS ARE CLEARLY LABELED WITH BLACK PAINT. INLET AND OUTLET DRAIN LINES ARE TO BE ALIGNED FLUSH WITH RESPECT TO THE INTERIOR VAULT WALLS.

9.0 MAINTENANCE AND CARTRIDGE FILTER REPLACEMENT INSTRUCTIONS ARE PROVIDED SEPARATELY BY FABCO AND ARE SITE SPECIFIC.

10.0 CARTRIDGE FILTER REPLACEMENT (IN GENERAL):

FOR BEST PERFORMANCE REPLACE CARTRIDGE FILTERS IAW FABCO RECOMMENDATIONS. HIGH CONTAMINANT LOCATIONS MAY REQUIRE MORE FREQUENT CARTRIDGE REPLACEMENT. REMOVE ANY DEBRIS OR HEAVY SEDIMENT FROM THE SEDIMENT AND EFFLUENT BAYS. ENTER THE STORMSAFE MANHOLE IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS FOR ENCLOSED SPACE ENTRY. REMOVE EACH CARTRIDGE BY ROTATING 30-DEGREES IN THE CLOCKWISE DIRECTION AND LIFTING. LIKEWISE, INSTALL THE NEW CARTRIDGE AND LOCK IN PLACE BY ROTATING 30-DEGREES IN THE COUNTER CLOCKWISE DIRECTION. DISPOSE OF USED FILTER CARTRIDGES PER LOCAL REGULATIONS.



REFERENCE DETAIL
REPLACEABLE CARTRIDGE

PROPRIETARY AND CONFIDENTIAL
THIS DOCUMENT IS THE PROPERTY OF FABCO INDUSTRIES AND IS CONVEYED WITH THE EXPRESS CONDITION THAT IT AND THE INFORMATION CONTAINED IN IT ARE NOT TO BE USED, DISCLOSED, OR REPRODUCED IN WHOLE OR IN PART, FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN CONSENT OF FABCO INDUSTRIES; AND THAT NO RIGHT IS GRANTED TO DISCLOSE OR SO USE ANY INFORMATION CONTAINED IN SAID DOCUMENT.

UNLESS OTHERWISE SPECIFIED REMOVE ALL BURRS BREAK SHARP EDGES .002 - .020 FILLETS .020 MAX DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES	TOLERANCES: DEC .00 ± .01 DEC .000 ± .005 FRACT ± 1/16 ANGLE ± 2°
PROJECT WELLESLEY UNIT 2	MATERIAL

APPROVAL	DATE
DWN J.C.	8/6/2020
ENGR J.P.	8/6/2020
UPD	
FABCO INDUSTRIES, INC. 24 CENTRAL DRIVE FARMINGDALE, NY 11735 WWW.FABCO-INDUSTRIES.COM	

		STORMSAFE MANHOLE 8-FT	
		6-CARTRIDGE FILTER	
SIZE	DWG. NO.	REV	
B	10072-84-000	A	
SCALE: NONE		SHEET 1 OF 1	

NOTES (REF):

1.0 WEIGHT ESTIMATE:

- 1.1 COVER: 10,300-LB
- 1.2 BASE W/ FILTERS: 27,300-LB

2.0 MATERIALS MEET OR EXCEEDS REQUIREMENTS:

- 2.1 VAULT:
 - 2.1.1 REBAR: ASTM A-615 GRADE 60
 - 2.1.2 CEMENT: ASTM C-150 SPECIFICATIONS
CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 5000 PSI (MIN)

2.2 ACCESS: 30" MANHOLE CLEAR OPENING

3.0 CONCRETE STRUCTURE DESIGN LOADINGS:

- 3.1 AASHTO HS-20 LOAD RATING (CONCRETE ONLY).
- 3.2 SOIL WEIGHT = 120 PCF
- 3.3 DEPTH OF OVERBURDEN: <8-FT
- 3.4 EQUIVALENT FLUID PRESSURE = 40 PCF
- 3.5 LATERAL LIVE LOAD SURCHARGE PER SPECS.

4.0 PERFORMANCE CHARACTERISTICS (NUTRIENT CARTRIDGE):

- 4.1 MAXIMUM CARTRIDGE CAPACITY = 6
- 4.2 MAXIMUM TREATMENT CAPACITY = 1.32 CFS (600 GPM)
- 4.3 BYPASS: AREA OVER WEIR IS GREATER THAN PIPE CROSS-SECTIONAL AREA.

5.0 MANHOLE CASTING: CASTINGS ARE RATED FOR REPEATED VEHICULAR TRAFFIC AND CONFORM TO AASHTO M306 STANDARDS. FINAL MANHOLE OR ACCESS HATCH INSTALLATION, AND ADJUSTMENT TO GRADE, SHALL BE PERFORMED BY QUALIFIED PERSONNEL. IF REQUIRED, GRADE RINGS OR LEVELING BLOCKS SHALL BE SUPPLIED BY THE CONTRACTOR.

6.0 OFF-LOADING, SETTING, EXCAVATION, DEWATERING, DRAINAGE, AND BACK FILL OPERATIONS SHALL BE PERFORMED IN ACCORDANCE WITH OSHA AND LOCAL REGULATIONS AND ARE THE RESPONSIBILITY OF THE CONTRACTOR. SUB-BASE AND BACKFILL DEPTH ARE SITE SPECIFIC AND SHALL BE SPECIFIED BY THE ENGINEER OF RECORD.

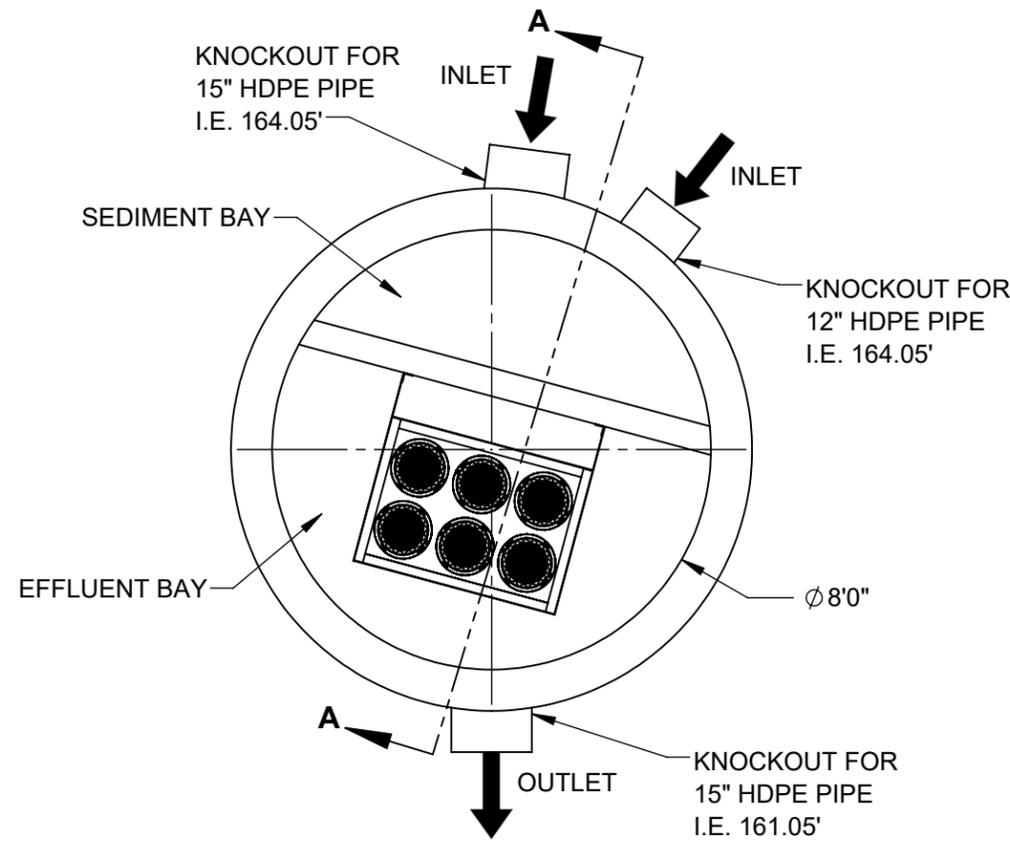
7.0 THE CONTRACTOR SHALL VERIFY THAT THE UNIT IS VERTICALLY AND HORIZONTALLY PLUMB AND STABLE, WITH MINIMUM VOIDS AND MINIMUM UN-COMPACTED SOIL AFTER BACK FILL OPERATION.

8.0 CONNECT EXISTING DRAIN LINE TO STORMSAFE INLET AND OUTLET PORTS WITH APPROVED NON-SHRINKING GROUT-FILL IN ACCORDANCE WITH GROUT MANUFACTURERS INSTRUCTIONS. ALL GROUT-FILL MATERIALS SHALL BE SUPPLIED BY THE CONTRACTOR. THE STORMSAFE "INLET" AND "OUTLET" PORTS ARE CLEARLY LABELED WITH BLACK PAINT. INLET AND OUTLET DRAIN LINES ARE TO BE ALIGNED FLUSH WITH RESPECT TO THE INTERIOR VAULT WALLS.

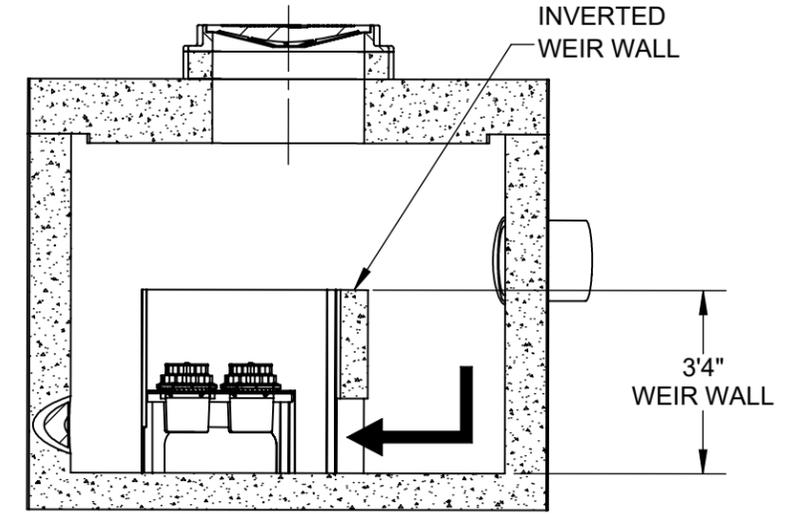
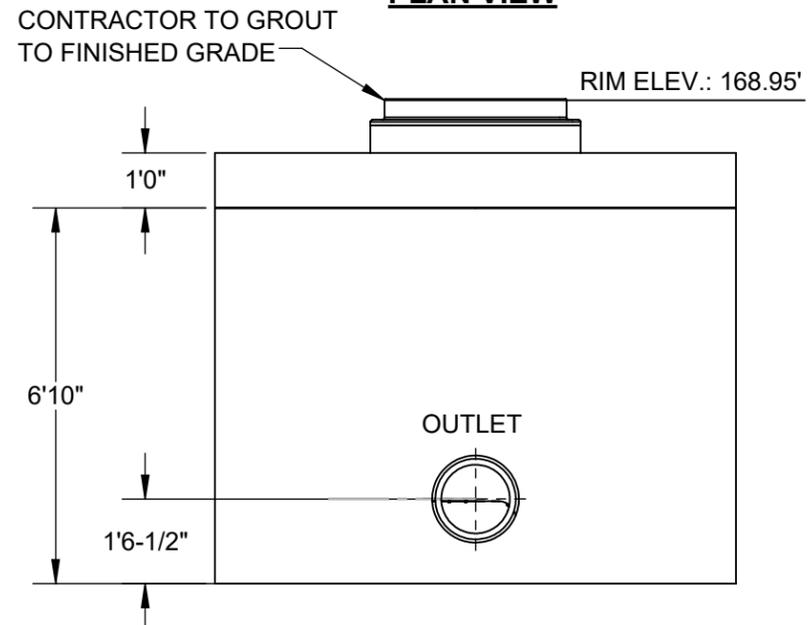
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10.0 CARTRIDGE FILTER REPLACEMENT (IN GENERAL):

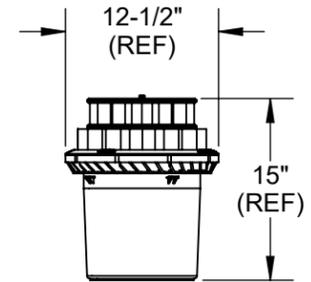
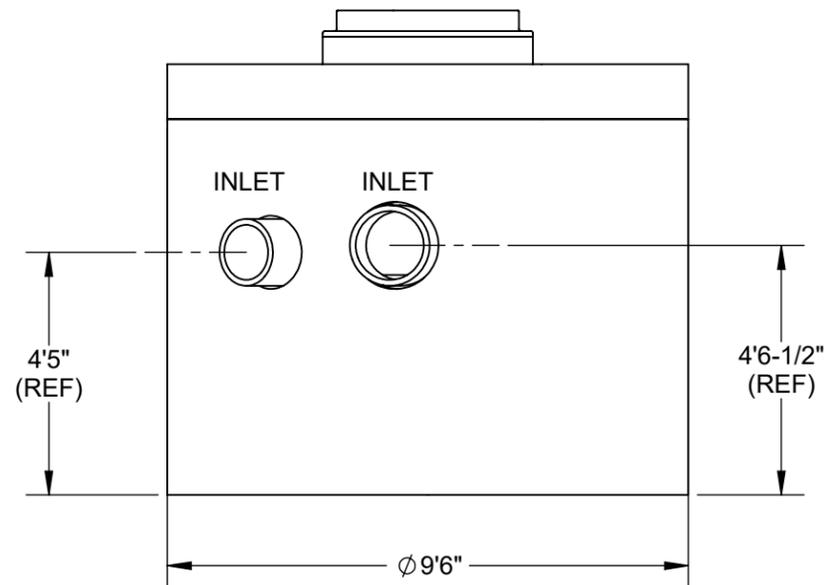
FOR BEST PERFORMANCE REPLACE CARTRIDGE FILTERS IAW FABCO RECOMMENDATIONS. HIGH CONTAMINANT LOCATIONS MAY REQUIRE MORE FREQUENT CARTRIDGE REPLACEMENT. REMOVE ANY DEBRIS OR HEAVY SEDIMENT FROM THE SEDIMENT AND EFFLUENT BAYS. ENTER THE STORMSAFE MANHOLE IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS FOR ENCLOSED SPACE ENTRY. REMOVE EACH CARTRIDGE BY ROTATING 30-DEGREES IN THE CLOCKWISE DIRECTION AND LIFTING. LIKEWISE, INSTALL THE NEW CARTRIDGE AND LOCK IN PLACE BY ROTATING 30-DEGREES IN THE COUNTER CLOCKWISE DIRECTION. DISPOSE OF USED FILTER CARTRIDGES PER LOCAL REGULATIONS.



PLAN VIEW



SECTION A-A



REFERENCE DETAIL
REPLACEABLE CARTRIDGE

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	<p>PROJECT: WELLESLEY UNIT 3</p>		<p>FABCO INDUSTRIES, INC. 24 CENTRAL DRIVE FARMINGDALE, NY 11735 WWW.FABCO-INDUSTRIES.COM</p>	
	<p>MATERIAL:</p>		<p>CONTRACTOR TO GROUT TO FINISHED GRADE</p>	
	<p>RIM ELEV.: 168.95'</p>			

NOTES (REF):

1.0 WEIGHT ESTIMATE:

- 1.1 COVER: 6,000-LB
- 1.2 BASE W/ FILTERS: 10,000-LB

2.0 MATERIALS MEET OR EXCEEDS REQUIREMENTS:

- 2.1 VAULT:
 - 2.1.1 REBAR: ASTM A-615 GRADE 60
 - 2.1.2 CEMENT: ASTM C-150 SPECIFICATIONS
CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 5000 PSI (MIN)

2.2 ACCESS: 30" MANHOLE CLEAR OPENING

3.0 CONCRETE STRUCTURE DESIGN LOADINGS:

- 3.1 AASHTO HS-20 LOAD RATING (CONCRETE ONLY).
- 3.2 SOIL WEIGHT = 120 PCF
- 3.3 DEPTH OF OVERBURDEN: <8-FT
- 3.4 EQUIVALENT FLUID PRESSURE = 40 PCF
- 3.5 LATERAL LIVE LOAD SURCHARGE PER SPECS.

4.0 PERFORMANCE CHARACTERISTICS (NUTRIENT CARTRIDGE):

- 4.1 MAXIMUM CARTRIDGE CAPACITY = 2
- 4.2 MAXIMUM TREATMENT CAPACITY = 0.45 CFS (200 GPM)
- 4.3 BYPASS: AREA OVER WEIR IS GREATER THAN PIPE CROSS-SECTIONAL AREA.

5.0 MANHOLE CASTING: CASTINGS ARE RATED FOR REPEATED VEHICULAR TRAFFIC AND CONFORM TO AASHTO M306 STANDARDS. FINAL MANHOLE OR ACCESS HATCH INSTALLATION, AND ADJUSTMENT TO GRADE, SHALL BE PERFORMED BY QUALIFIED PERSONNEL. IF REQUIRED, GRADE RINGS OR LEVELING BLOCKS SHALL BE SUPPLIED BY THE CONTRACTOR.

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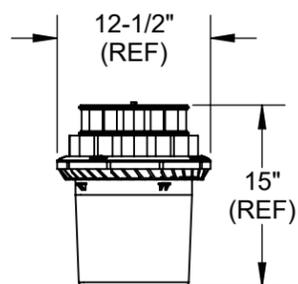
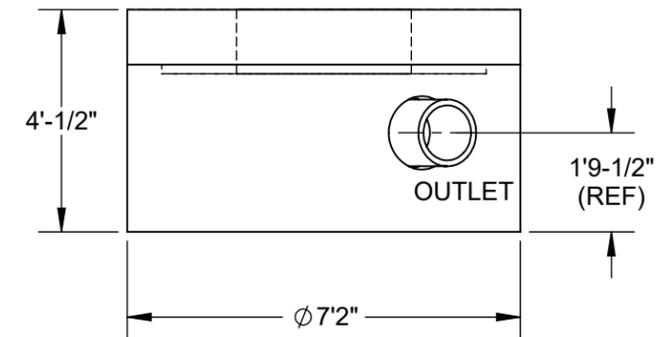
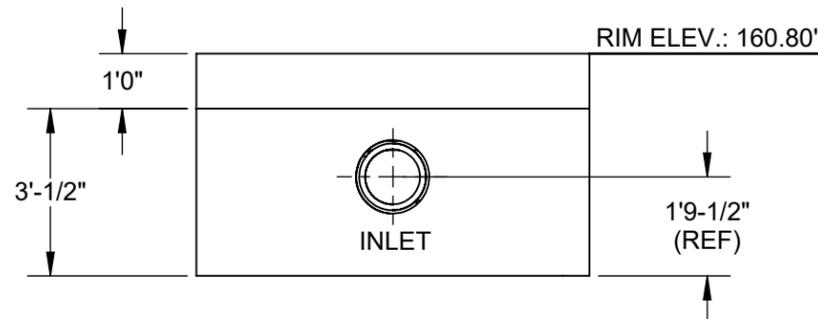
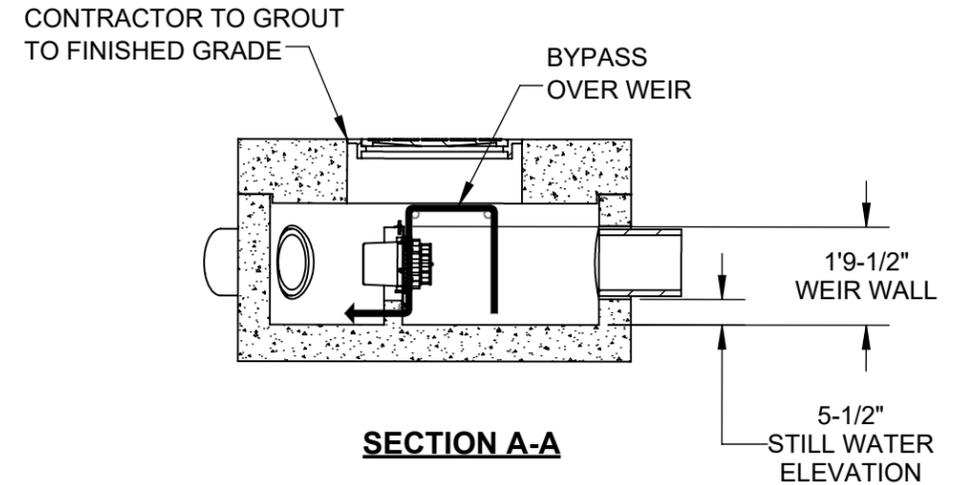
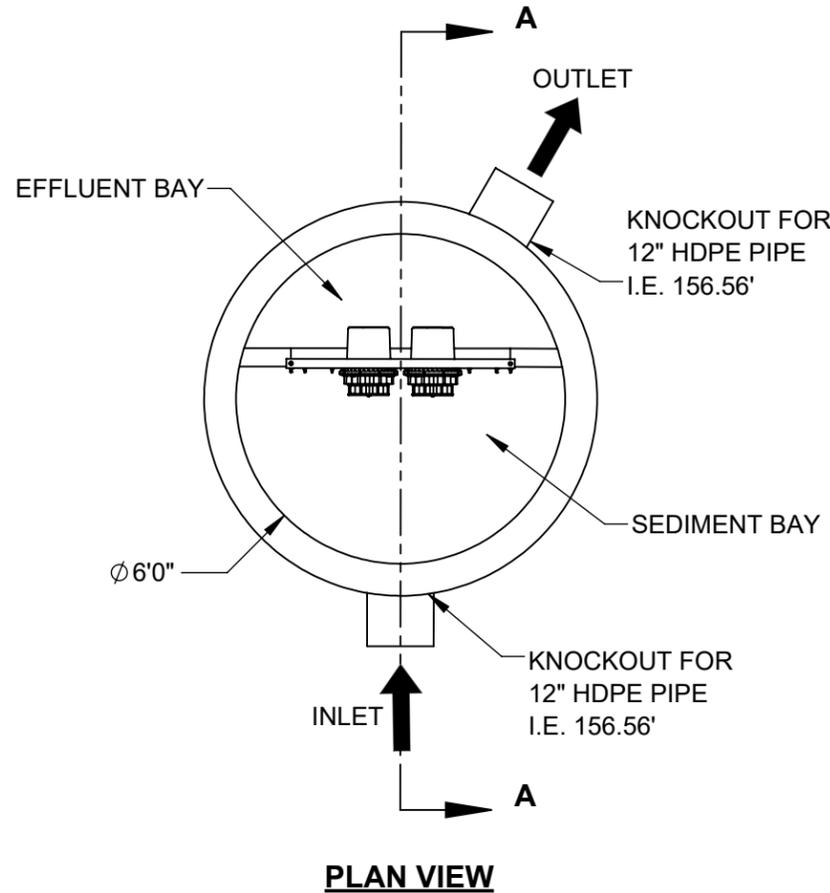
7.0 THE CONTRACTOR SHALL VERIFY THAT THE UNIT IS VERTICALLY AND HORIZONTALLY PLUMB AND STABLE, WITH MINIMUM VOIDS AND MINIMUM UN-COMPACTED SOIL AFTER BACK FILL OPERATION.

8.0 CONNECT EXISTING DRAIN LINE TO STORMSAFE INLET AND OUTLET PORTS WITH APPROVED NON-SHRINKING GROUT-FILL IN ACCORDANCE WITH GROUT MANUFACTURERS INSTRUCTIONS. ALL GROUT-FILL MATERIALS SHALL BE SUPPLIED BY THE CONTRACTOR. THE STORMSAFE "INLET" AND "OUTLET" PORTS ARE CLEARLY LABELED WITH BLACK PAINT. INLET AND OUTLET DRAIN LINES ARE TO BE ALIGNED FLUSH WITH RESPECT TO THE INTERIOR VAULT WALLS.

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REFERENCE DETAIL
REPLACEABLE CARTRIDGE

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	<p>PROJECT</p> <p>WELLESLEY UNIT 4</p>	<p>FABCO INDUSTRIES, INC. 24 CENTRAL DRIVE FARMINGDALE, NY 11735 WWW.FABCO-INDUSTRIES.COM</p>	<p>SIZE DWG. NO.</p> <p>B 10072-86-000</p>	<p>REV</p> <p>A</p>	
	<p>MATERIAL</p>	<p>SCALE: NONE</p>	<p>SHEET 1 OF 1</p>		

Avg											
Tot. Kjeldahl N.	mg/l		2.53					Tot. Kjeldahl N.	mg/L	1.33	
Nitrate as N			0.96					Nitrate as N	mg/L	0.49	
Nitrogen, total as N			3.33					Nitrogen, total as N	mg/L	1.67	
Ortho Phosphate as P			0.99					Ortho Phosphate as P	mg/L	0.17	
Tot. Phosphate as P			1.00					Tot. Phosphate as P	mg/L	0.24	
								Avg			
								Tot. Kjeldahl N.			42.84%
								Nitrate as N			38.33%
								Nitrogen, total as N			43.91%
								Ortho Phosphate as P			79.55%
								Tot. Phosphate as P			66.26%

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777 • FAX (631) 422-5770

LAB NO. 274758.01 Email: ecotestlab@aol.com Website: www.ecotestlabs.com
11/09/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma

PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court

SOURCE OF SAMPLE:

COLLECTED BY: Client DATE COL'D: 10/30/07 RECEIVED: 10/30/07

TIME COL'D: 1530

MATRIX: Water SAMPLE: 0365 (IN)

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	0.8		11/01/07	0.2	SM4500NorgB
Nitrate as N	mg/L	< 0.5		10/30/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	0.8		11/01/07	0.2	SM4500NH3C
ortho Phosphate as P	mg/L	< 0.5	*	10/31/07	0.02	EPA365.3
Tot. Phosphate as P	mg/L	0.33		11/02/07	0.1	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS: *elevated lab reporting limit due to interferenc in sample.

DIRECTOR 

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777 • FAX (631) 422-5770

LAB NO. 274758.02 Email: ecotestlab@aol.com Website: www.ecotestlabs.com
11/09/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma

PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court

SOURCE OF SAMPLE:

COLLECTED BY: Client DATE COL'D: 10/30/07 RECEIVED: 10/30/07
TIME COL'D: 1530

MATRIX: Water SAMPLE: 0366 (OUT)

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	0.6		11/01/07	0.2	SM4500NorgB
Nitrate as N	mg/L	< 0.5		10/30/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	0.6		11/01/07	0.2	SM4500NH3C
ortho Phosphate as P	mg/L	< 0.1		10/31/07	0.1	EPA365.3
Tot. Phosphate as P	mg/L	< 0.1		11/02/07	0.1	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR



rn = 33082

NYSDOH ID # 10320

Page 1 of 1

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777 • FAX (631) 422-5770

Email: ecotestlab@aol.com Website: www.ecotestlabs.com
LAB NO. 274866.01 11/16/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma

PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court

SOURCE OF SAMPLE:

COLLECTED BY: Client DATE COL'D: 11/07/07 RECEIVED: 11/07/07

TIME COL'D: 1300

MATRIX: Water SAMPLE: 0367 (IN)

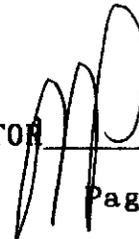
ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	3.8		11/12/07	0.2	SM4500NorgB
Nitrate as N	mg/L	1.4		11/07/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	5.2		11/12/07	0.2	EPA351,353
ortho Phosphate as P	mg/L	0.58		11/07/07	0.1	EPA365.3
Tot. Phosphate as P	mg/L	0.57		11/14/07	0.02	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR



rn = 33860

NYSDOH ID # 10320

Page 1 of 1

ECOTEST LABORATORIES, INC.

ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (631) 422-5777 • FAX (631) 422-5770

Email: ecotestlab@aol.com Website: www.ecotestlabs.com
LAB NO.274866.02 11/16/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma

PO#:

SOURCE OF SAMPLE: Huntington Town, Country Lakes Court

SOURCE OF SAMPLE:

COLLECTED BY: Client DATE COL'D:11/07/07 RECEIVED:11/07/07

TIME COL'D:1300

MATRIX:Water SAMPLE: 0368 (OUT)

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	2.4		11/12/07	0.2	SM4500NorgB
Nitrate as N	mg/L	< 0.5		11/07/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	2.9		11/12/07	0.2	EPA351,353
ortho Phosphate as P	mg/L	0.17		11/07/07	0.02	EPA365.3
Tot. Phosphate as P	mg/L	0.34		11/14/07	0.02	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR



rn = 33861

NYSDOH ID # 10320

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Email: ecotestlab@aol.com Website: www.ecotestlabs.com
LAB NO. 275079.01 12/04/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317
ATTN: Len Emma PO#:

SOURCE OF SAMPLE: Country Lake Court

SOURCE OF SAMPLE:

COLLECTED BY: Client DATE COL'D: 11/20/07 RECEIVED: 11/21/07
TIME COL'D: 1330

MATRIX: Water SAMPLE: 112101

ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	3.0		11/27/07	0.2	SM4500NORGB
Nitrate as N	mg/L	1		11/27/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	4.0		11/27/07	0.2	EPA351,353
ortho Phosphate as P	mg/L	1.9		11/21/07	0.1	EPA365.3
Tot. Phosphate as P	mg/L	2.1		11/30/07	0.1	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR

rn = 35210

NYSDOH ID # 10320

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Email: ecotestlab@aol.com Website: www.ecotestlabs.com

LAB NO. 275079.02

12/04/07

Fabco Industries, Inc.
350 Jericho Turnpike, Suite 300
Jericho, NY 11753-1317

ATTN: Len Emma

PO#:

SOURCE OF SAMPLE: Country Lake Court

SOURCE OF SAMPLE:

COLLECTED BY: Client

DATE COL'D: 11/20/07 RECEIVED: 11/21/07

TIME COL'D: 1330

MATRIX: Water SAMPLE: 112102

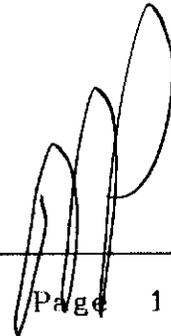
ANALYTICAL PARAMETERS	UNITS	RESULT	FLAG	DATE OF ANALYSIS	LRL	ANALYTICAL METHOD
Tot. Kjeldahl N.	mg/L	1		11/27/07	0.2	SM4500NORGB
Nitrate as N	mg/L	0.5		11/27/07	0.5	EPA353.2
Nitrogen, total as N	mg/L	1.5		11/27/07	0.2	EPA351,353
ortho Phosphate as P	mg/L	0.26		11/21/07	0.02	EPA365.3
Tot. Phosphate as P	mg/L	0.3		11/30/07	0.1	EPA365.3

cc:

LRL=Laboratory Reporting Limit

REMARKS:

DIRECTOR



rn = 35211

NYSDOH ID # 10320

Page 1 of 1



Standard 4: Pretreatment: Subsurface Chambers P-1

NAME: Wellesley Square Residence
 Norwell, MA
CLIENT: Delanson Circle Holding, LLC
COUNTY: Norfolk

Proj. No.: 216-194
Date: 2/21/2020
Revised: 7/10/2020; 8/12/2020
Computed by: SBS
Checked by: BCM

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 150 Longwater Drive, Suite 101
 Norwell, MA 02061

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)

TSS Removal Calculation

	0.00	1.00	0.00	1.00
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
ACF Environmental-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
	0.00	0.23	0.00	0.23
	0.00	0.23	0.00	0.23

Total TSS Removal =

78%

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



Standard 4: Total Suspended Solids Calculation: Subsurface Chambers P-1

NAME: Wellesley Square Residence
 Norwell, MA
CLIENT: Delanson Circle Holding, LLC
COUNTY: Norfolk

Proj. No.: 216-194
Date: 2/21/2020
Revised: 7/10/2020; 8/12/2020
Computed by: SBS
Checked by: BCM

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 150 Longwater Drive, Suite 101
 Norwell, MA 02061

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)

TSS Removal Calculation

	0.00	1.00	0.00	1.00
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
ACF Environmental-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
Subsurface Infiltration Structure	0.80	0.23	0.18	0.05
	0.00	0.05	0.00	0.05

Total TSS Removal =

96%

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



Standard 4: Pretreatment: Subsurface Chambers P-1

NAME: Wellesley Square Residence
 Norwell, MA
CLIENT: Delanson Circle Holding, LLC
COUNTY: Norfolk

Proj. No.: 216-194
Date: 2/21/2020
Revised: 7/10/2020; 8/12/2020
Computed by: SBS
Checked by: BCM

Assinippi Office Park
 150 Longwater Drive, Suite 101
 Norwell, MA 02061

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)

TSS Removal Calculation

	0.00	1.00	0.00	1.00
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
ACF Environmental-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
	0.00	0.23	0.00	0.23
	0.00	0.23	0.00	0.23

Total TSS Removal = 78%

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



Standard 4: Total Suspended Solids Calculation: Subsurface Chambers P-1

NAME: Wellesley Square Residence
 Norwell, MA
CLIENT: Delanson Circle Holding, LLC
COUNTY: Norfolk

Proj. No.: 216-194
Date: 2/21/2020
Revised: 7/10/2020; 8/12/2020
Computed by: SBS
Checked by: BCM

Assinippi Office Park
 150 Longwater Drive, Suite 101
 Norwell, MA 02061

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)

TSS Removal Calculation

	0.00	1.00	0.00	1.00
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
ACF Environmental-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
Subsurface Infiltration Structure	0.80	0.23	0.18	0.05
	0.00	0.05	0.00	0.05

Total TSS Removal =

96%

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



Standard 4: Pretreatment: Subsurface Chambers P-2

NAME: Wellesley Square Residence
 Norwell, MA
CLIENT: Delanson Circle Holding, LLC
COUNTY: Norfolk

Proj. No.: 216-194
Date: 2/21/2020
Revised: 7/10/2020; 8/12/2020
Computed by: SBS
Checked by: BCM

Assinippi Office Park
 150 Longwater Drive, Suite 101
 Norwell, MA 02061

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)

TSS Removal Calculation

	0.00	1.00	0.00	1.00
	0.00	1.00	0.00	1.00
ACF Environmental-Recommended TSS Removal Per Mass STEP	0.70	1.00	0.70	0.30
	0.00	0.30	0.00	0.30
	0.00	0.30	0.00	0.30

Total TSS Removal =

70%

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



Standard 4: Total Suspended Solids Calculation: P-2

NAME: Wellesley Square Residence
 Norwell, MA
CLIENT: Delanson Circle Holding, LLC
COUNTY: Norfolk

Proj. No.: 216-194
Date: 2/21/2020
Revised: 7/10/2020; 8/12/2020
Computed by: SBS
Checked by: BCM

Assinippi Office Park
 150 Longwater Drive, Suite 101
 Norwell, MA 02061

	B	C	D	E	F
	BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)
TSS Removal Calculation		0.00	1.00	0.00	1.00
	ACF Environmental-Recommended TSS Removal Per Mass STEP	0.70	1.00	0.70	0.30
	Subsurface Infiltration Structure	0.80	0.30	0.24	0.06
		0.00	0.06	0.00	0.06
		0.00	0.06	0.00	0.06

Total TSS Removal = 94%

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



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NYSDOH ELAP# 11693
USEPA# NY01273
CTDOH# PH-0284
NJDEP# NY012
PADEP# 68-2943

SUSPENDED SOILS REMOVAL TEST Of Stormwater Filtration System

Prepared For:
FABCO INDUSTRIES INC.
66 Central Avenue
Farmingdale, NY 11735

June 2015

Prepared By:
Long Island Analytical Laboratories Inc.
110 Colin Drive
Holbrook, NY 11741

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2 Introduction

Long Island Analytical Laboratories Inc. (LIAL) has been retained by Fabco Industries Inc. to conduct a sediment removal efficiency test for a storm water filtration system's cartridge; identified as Fabco Industries Inc. Standard Filter Cartridge, part number 9718-1-000. [1] The efficiency test was conducted at the Fabco Industries location in Farmingdale, N.Y., using OK-85 silica sand.

3 Overview of Test Apparatus

The testing apparatus is composed of two reinforced wooden boxes, each wrapped with a PVC liner to create two water tight vessels. The boxes are vertically stacked so that the lower box, hereafter referred to as the collection tank, will collect the effluent water from the filter test cartridge which is contained in the upper box, hereafter referred to as the testing tank. The testing tank included a standard aluminum cartridge attachment plate of which configuration is typically used in Fabco Industries standard products to securely lock and seal cartridges in place. [2] Clean water is then pumped from a 5,000 GAL holding tank through a series of control valves and through an initial (coarse) flow meter. The water is then piped to a second meter, at the testing tank inlet, where a butterfly valve is used for fine flow adjustment. The regulated influent water is immediately allowed to freefall into the testing tank, where a calibrated lead screw auger introduces the OK-85 Silica Sand. Furthermore, the testing tank incorporates a propeller style mixer to keep the tank in a turbulent state during testing, thereby preventing the silica sand from falling out of suspension. The homogeneous mixture is then filtered through the test cartridge and discharges (freefall) into the collection tank below, which in turn drains into a 2,000 GAL discharge tank. [3]

Testing Equipment	
Burks 7.5 HP Centrifugal Pump	CAT. 469-4
Blue-White Industries Digital Flow Monitoring System (2)	F-2000
Lead-Screw Auger Feeder [Calibrated by Fabco Industries]	NA
Butterfly Valves	NA
Leeson Agitator Speed: 1725 RPM	CAT. 102954.00

Table 1: Equipment used for sediment removal testing.





4 Test Sediment:

The OK-85 silica sand used for the sediment removal efficiency testing was produced by U.S. Silica Company at a plant in Mill Creek, Oklahoma. The sediment was produced by screening the crystalline silica through different sized sieves and then mixing a percentage of the silica that was retained on each sieve together (Figure 1). The OK-85 silica sand is a fairly homogeneous, inert material composed of 99.8% Silicon Dioxide (SiO_2) and has the following physical properties. [4]

pH	6.7
AFS Grain Fineness	81.8
Grain Shape	Round
Hardness	7 Mohs
Specific Gravity	2.65
Moisture Content	<0.50%
Mineral	Quartz
Color	White
Melting Point	3100°F

Table 2: Typical physical properties of OK-85 Silica sand. [4]

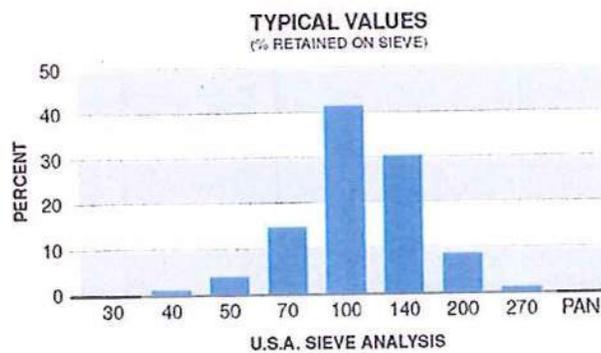
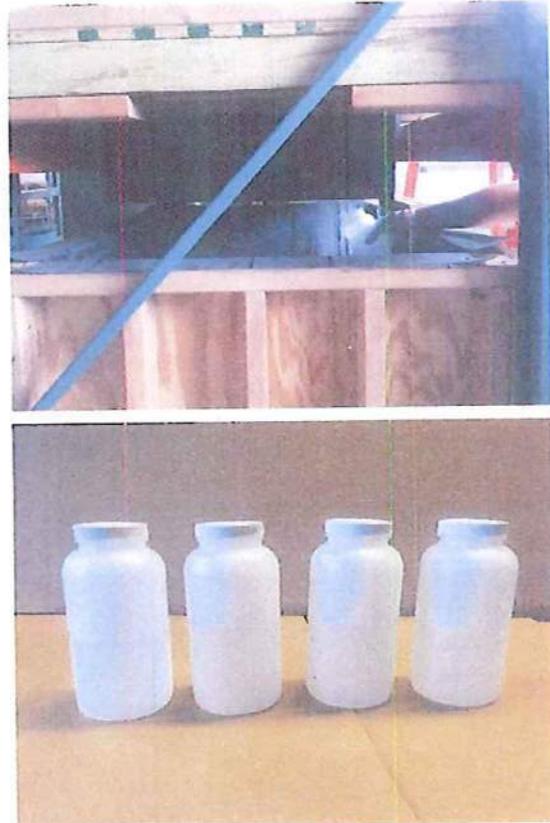
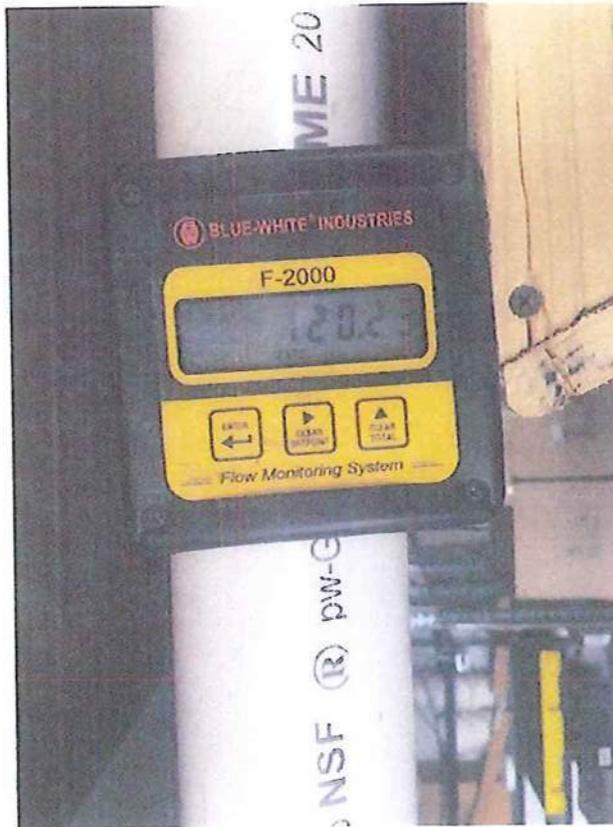


Figure 1: Sieve analysis for OK-85 Silica sand. [4]

5 Testing Procedure

Prior to sampling, Fabco Industries, Inc. conducted calibration tests on the lead screw auger and the flow meters to ensure proper functionality and accuracy. The calibration test for the "lead screw auger was conducted through timed trials of sediment expulsion and collection." [5] The calibration test for the flow meters "was conducted through a timed volume displacement trial." [5] The sampling procedure consisted of recirculating water through the pump to achieve a flow rate of 120 GPM; this was done utilizing an external piping system as diagramed in the plumbing schematic (Attachment 4). Then the water was diverted into the testing tank where it was allowed to stabilize at a constant head height and thus creating constant flow through the filter cartridge. After 60 seconds the lead screw auger and propeller mixer were activated and the testing tank was left to mix for an additional 60 to 90 seconds. A total of eight samples were then collected, four at the influent and four at the effluent of the filter cartridge, by a trained Long Island Analytical Laboratories technician. All sampling and preservation techniques were done in strict compliance with NYSDOH ELAP protocols. [5]



6 Sample Analysis Method

The eight samples, each approximately 500 mL, were analyzed at Long Island Analytical Laboratories using the Standard Test Methods for Determining Sediment Concentration in Water Samples, ASTM Designation: D3977-97. From the ASTM specification Test Method B – Filtration was found to be most suitable for analyzing the samples. Test Method B “can be used only on samples containing sand concentrations less than about 10,000 ppm and clay concentrations less than about 200 ppm. The sediment need not be settleable because filters are used to separate water from the sediment.” Then “the sample consisting of water, sediment and dissolved solids were weighed and then filtered through a glass-fiber disk. The disk and sediment were dried and weighed” then the sediment concentration was calculated. [6]

7 Laboratory Results

$$P_{Removal} = \frac{S_{Before} - S_{After}}{S_{Before}}$$

Sample #	Influent [mg/L]	Effluent [mg/L]	Efficiency (%)
1	954	232	75.7
2	2060	217	89.5
3	1150	258	77.6
4	1970	266	86.5
Mean	1533.50	243.25	82.3

Table 3: Sediment Removal Efficiency Results.

8 References

- [1] Fabco Industries, Inc., *Cartridge, Standard*, Farmingdale, New York, 2007.
- [2] Fabco Industries, Inc., *TSS Testing Fabco Cartridge*, Farmingdale, NY, 2014.
- [3] Fabco Industries, Inc., *Testing Plumbing Schematic*, Farmingdale, NY, 2014.
- [4] U.S. Silica Company, "Product Data OK-85 Unground Silica," U.S. Silica Company, [Online]. Available: <http://www.ussilica.com>. [Accessed 18 June 2015].
- [5] Fabco Industries, Inc., *Total Suspended Solids (TSS) - Outline*, Farmingville, NY, 2014.
- [6] ASTM International, "Standard Test Methods for Determining Sediment Concentration in Water Samples," 2013. [Online]. Available: <http://www.ASTM.org>. [Accessed 2 March 2015].

9 Appendix

Table 1: Equipment used for sediment removal testing.	2
Table 2: Typical physical properties of OK-85 Silica sand. [4]	3
Table 3: Sediment Removal Efficiency Results.	5



9.1 Attachment 1: Fabco Industries, Inc. Standard Cartridge

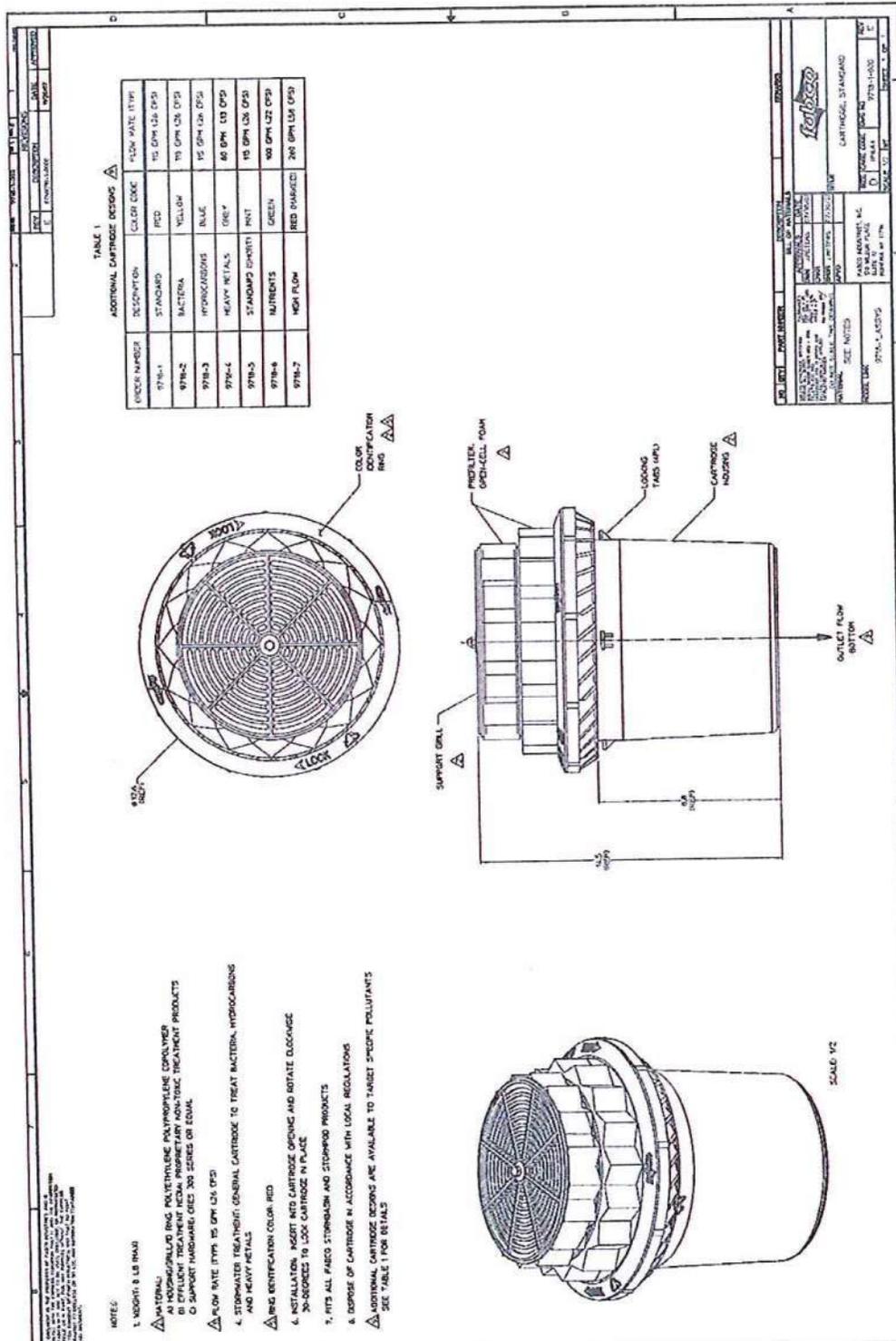


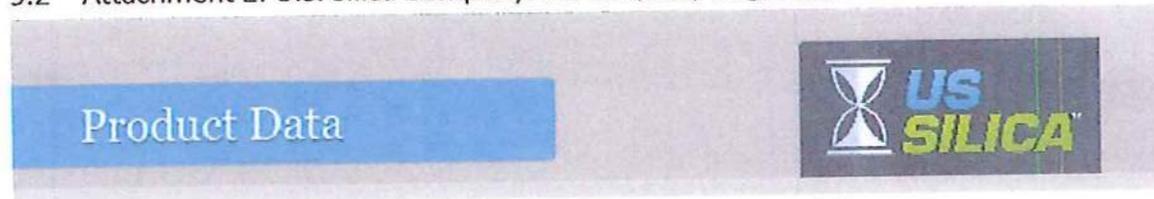
Figure 2: Fabco Industries, Inc. - Cartridge, Standard (Red Ring Identifier) [1]



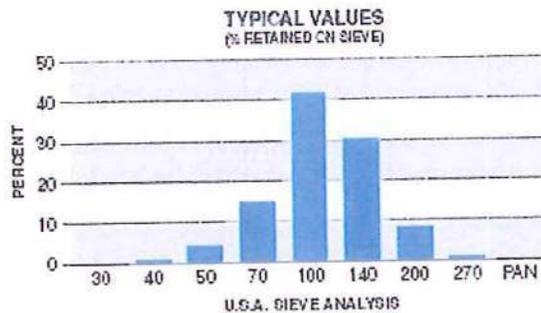
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9.2 Attachment 2: U.S. Silica Company: OK-85 Silica, Unground



OK-85
UNGROUND SILICA
 PLANT: MILL CREEK, OKLAHOMA



USA STD SIEVE SIZE		TYPICAL VALUES		
MESH	MILLIMETERS	% RETAINED		% PASSING
		INDIVIDUAL	CUMULATIVE	CUMULATIVE
30	0.600	0.0	0.0	100.0
40	0.425	0.8	0.8	99.2
50	0.300	4.0	4.8	95.2
70	0.212	14.8	19.6	80.4
100	0.150	41.0	60.6	59.4
140	0.106	30.0	90.6	9.4
200	0.075	8.4	99.0	1.0
270	0.053	0.9	99.9	0.1
Pan		0.1	100.0	0.0

TYPICAL PHYSICAL PROPERTIES

AFS TM Acid Demand (@pH7)	0.4
AFS TM Grain Fineness	61.8
Color	White
Grain Shape	Round
Hardness (Mohs)	7
Melting Point (Degrees F)	3100
Mineral	Quartz
Moisture Content (%)	<0.50
pH	6.7
Specific Gravity	2.65

TYPICAL CHEMICAL ANALYSIS, %

SiO ₂ (Silicon Dioxide)	99.8
Fe ₂ O ₃ (Iron Oxide)	0.017
Al ₂ O ₃ (Aluminum Oxide)	0.09
TiO ₂ (Titanium Dioxide)	<0.01
CaO (Calcium Oxide)	<0.01
MgO (Magnesium Oxide)	<0.01
Na ₂ O (Sodium Oxide)	<0.01
K ₂ O (Potassium Oxide)	0.04
LOI (Loss On Ignition)	0.1

(1) American Foundrymen's Society

U.S. Silica Company
 8490 Progress Drive, Suite 300
 Frederick, MD 21701
 (301) 692-0600 (phone)
 (800) 243-7500 (toll-free)
us silica.com

DISCLAIMER: The information set forth in this Product Data Sheet represents typical properties of the product described; the information and the typical values are not specifications. U.S. Silica Company makes no representation or warranty concerning the Products, expressed or implied, by this Product Data Sheet.

WARNING: The product contains crystalline silica – quartz, which can cause silicosis (an occupational lung disease) and lung cancer. For detailed information on the potential health effect of crystalline silica – quartz, see the U.S. Silica Company Material Safety Data Sheet.

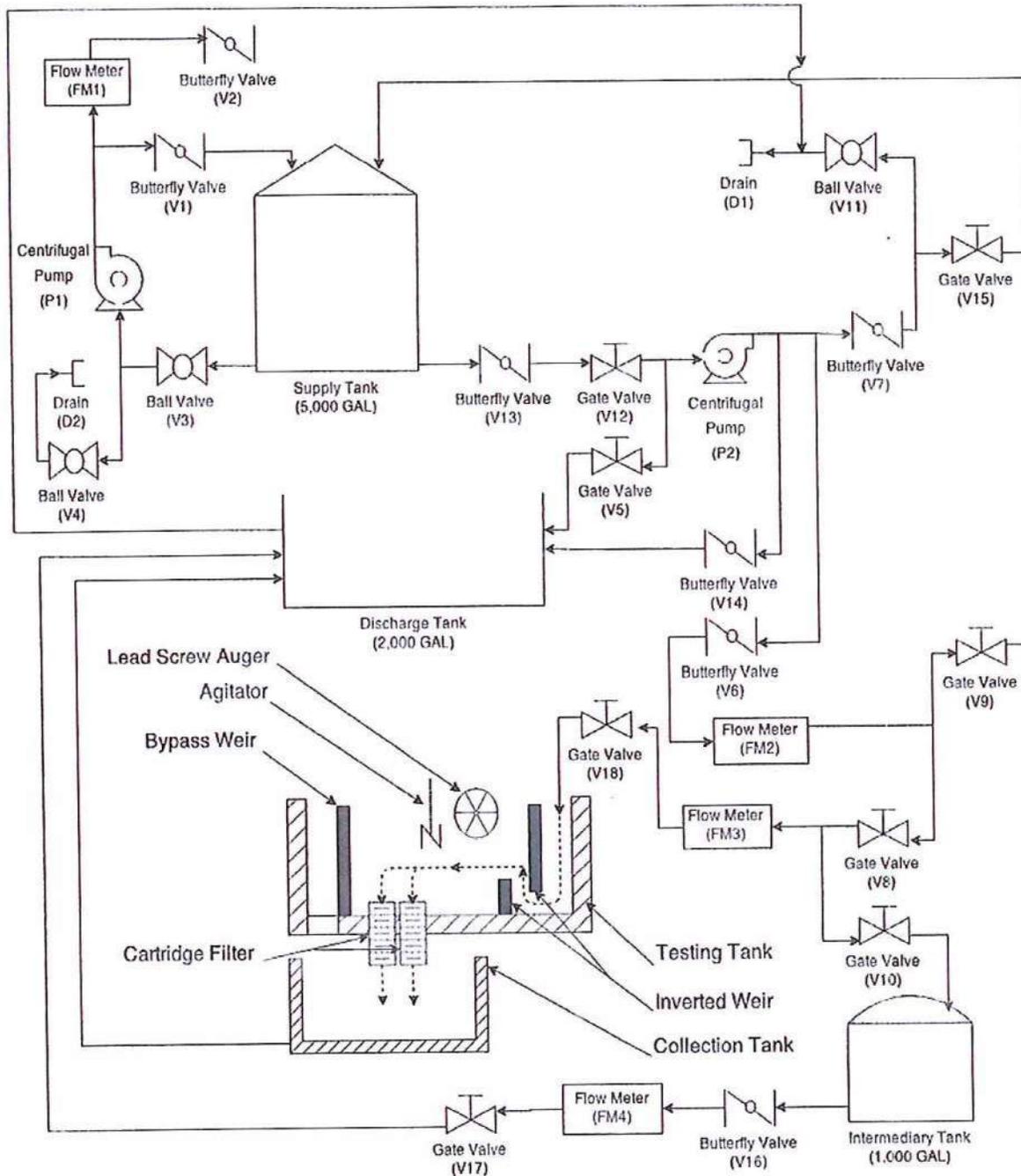


Figure 3: U.S. Silica Company - MSDS for OK-85, unground [4]



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9.4 Attachment 4: Fabco Industries, Inc. Testing Fixture Plumbing Schematic



Notes:

- FM1: GPI, TM Series, Water Meter, Great Plains Industries, Inc. Wichita, KS.
- FM2, FM3, FM4: Blue-White Industries, F-2000, Flow Monitoring System
- P1: US Motors, SN: C55CXJZB-4757, Power: 1 HP, Speed: 3450 RPM
- P2: Burks Pumps, SN: 0305, CAT: 469-4, Power: 7.5 HP, Speed: 1760 RPM

Figure 5: Fabco Industries, Inc. Plumbing Schematic. [3]



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9.5 Attachment 5: Fabco Industries, Inc. Total Suspended Solids (TSS) – Outline

Figure 6: Fabco Industries, Inc. Testing Procedure. [5]



Total Suspended Solids (TSS)- Outline

Written by:

Kevin C. Peters

Prior to Sampling:

- 1st.: The testing setup was constructed to the TSS Plumbing Schematic featured at the conclusion of this document. (Figure 1)
- 2nd.: The cartridge test fixture (Figure 1) was cleaned and rinsed of all sediment and particulates.
- 3rd.: The 5,000 gallon supply tank (Figure 1) was filled with clean water to the 4,500 gallon mark. (Previous sediment testing for a single cartridge assembly has been shown to use no more than 2,000 gallons)
- 4th.: The water level in the 2,000 gallon discharge tank (Figure 1) was drained to readily accommodate the total volume of water used during the experiment.
- 5th.: Calibration of the lead screw auger was conducted through timed trials of sediment expulsion and collection. The lead screw auger was run for one minute and the sediment excreted from the auger was collected in a beaker and massed using a digital balance.
- 6th.: Calibration of flow meter 3 (Figure 1) was conducted through a timed volume displacement trial. The flow meter was held at a constant flow rate of 60 gallons per minute for one minute to stabilize and then a 30 gallon, marked, drum was used to collect the dispensed water. A stop watch was used to measure the required time to fill the drum to the 30 gallon marker.

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Concurrent to Sampling:

- 1st.: A new Standard Fabco Cartridge was inserted into the Testing Tank as shown in Figure 1.
- 2nd.: The testing setup was configured to the valve positions specified in the table Valve Positioning -- Sediment Testing, Start column (Table 1).
- 3rd.: The centrifugal pump, P2, (Figure 1) was started. With the valves in the Start position this allows the water to be recirculated through the 5,000 gallon Supply Tank (Figure 1).
- 4th.: Using flow meter FM2 (Figure 1) and butterfly valves V6 and V7, (Figure 1), here forth referred to as the control valves, the flow rate is adjusted roughly 15 to 20 gallons per minute higher than the desired flow rate. For sediment testing the desired flow rate was 120 gallons per minute, thus the flow rate obtained by the control valves was roughly 145 gallons per minute.
- 5th.: Once the flow rate was maintained, the valve positions were reconfigured to correspond with the Test column of the Valve Position -- Sediment Testing Table (Table 1). This configuration redirects the flow of water that was passing though the flow meter, FM2, (Figure 1) away from the 5,000 gallon Supply Tank and into the Testing Tank (Figure 1).
- 6th.: Using flow meter FM3 and gate valve V18 (Figure 1), thus forth referred to as the regulatory valve, the flow rate was readjusted to the desired rate. For the total suspended solids (TSS) testing the desired flow rate was 120 gallons per minute.
- 7th.: Once the desired flow rate was obtained, the lead screw auger filled with OK-85 sand and the water agitator were turned on. The water and sediment was then allowed to mix in the testing for between 60 and 90 seconds.

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- 8th.: A total of ten samples were taken during testing, five inlet and five outlet. The inlet and outlet samples were taken concurrently at 20 second intervals between samples. The inlet samples were taken at the invert of a half pipe which was placed so that both the inlet water and OK-85 sediment would thoroughly mix. The outlet samples were taken at the exit of the standard cartridge filter (Figure 1) which was between the testing Tank and the Collection Tank (Figure 1).
- 9th.: Once all samples had been taken the centrifugal pump P2 was turned off and the valves were reconfigured to the positions specified in the End column of the Valve Positioning – Sediment Testing table (Table 1).



VALVE POSITION - SEDIMENT TESTING				
VALVE #	START	TEST	DRAIN	END
V1	OPEN	OPEN	N/A	N/A
V2	CLOSED	CLOSED	CLOSED	CLOSED
V3	OPEN	OPEN	CLOSED	CLOSED
V4	CLOSED	CLOSED	CLOSED	CLOSED
V5	CLOSED	CLOSED	OPEN IF DRAINING POOL	N/A
V6	CLOSED	ADJ. W/ V7 TO OBT. FL. RT.	CLOSED	CLOSED
V7	OPEN	ADJ. W/ V6 TO OBT. FL. RT.	OPEN	OPEN
V8	CLOSED	OPEN AT CORRECT FL. RT.	N/A	N/A
V9	OPEN	CLOSE AT CORRECT FL. RT.	N/A	N/A
V10	CLOSED	CLOSED	N/A	N/A
V11	CLOSED	CLOSED	OPEN	N/A
V14	CLOSED	CLOSED	OPEN	OPEN
V15	OPEN	OPEN	CLOSED	CLOSED
V12	OPEN	OPEN	OPEN IF DRAINING CIELO	N/A
V13	OPEN	OPEN	OPEN IF DRAINING CIELO	CLOSED

Table 1: Valve positioning for sediment testing to be used in cognizance with TSS Plumbing Schematic (Figure 1)

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9.6 Attachment 6: Standard Test Methods for Determining Sediment Concentration in Water Samples, ASTM Designation D3977-97

ASTM D3977 - 97 (2013)⁵¹

TEST METHOD B—FILTRATION

14. Scope

14.1 Test Method B can be used only on samples containing sand concentrations less than about 10 000 ppm and clay concentrations less than about 200 ppm. The sediment need not be settleable because filters are used to separate water from the sediment. Correction factors for dissolved solids are not required.

14.2 Even though a high-concentration sample may filter slowly, users should not divide the sample and use two or more filters. Instead, the entire sample should be filtered through one disk.

15. Summary of Test Method

15.1 The sample consisting of river water, sediment, and dissolved solids is weighed and then filtered through a glass-fiber disk. The disk and sediment are dried and weighed, then the sediment concentration is calculated in accordance with Section 18.

16. Apparatus

16.1 *Gooch Crucibles*—Porcelain or borosilicate glass crucibles with fritted glass bases are required for holding the filters. Capacities of the crucibles are optional; sizes in the 25 to 130-mL range work best with 1-L samples. Small crucibles have the advantage of requiring less oven space during drying and absorbing less moisture during weighing; large crucibles are needed if filtering proceeds slowly.

16.2 *Glass-fiber Filter Disks*—Filter diameter and filter retention rating, sometimes referred to as filter pore size, are critical to this analysis. The sediment that accumulates on a filter traps some particles that are smaller than the filter's retention rating. As filtration proceeds and the sediment layer thickens, the retention rating of the sediment and filter acting as a unit gradually decreases. Users should use filters with retention ratings of 1.5 μm to agree with practices in many sediment laboratories.⁸ Filter diameters should equal or exceed 24 mm. Filters as large as 42 mm may be required to avoid filter plugging at high concentrations. Record filter retention rating in micrometres and filter diameter in millimetres at a convenient place on the laboratory form.

16.3 *Vacuum System*—See 10.2.

16.4 *Drying Oven*—See 10.3.

16.5 *Desiccator*—See 10.4.

16.6 *Laboratory Balances*—See 10.5 and 10.6.

17. Procedure

17.1 Wash the filter with water to remove soluble compounds; then dry the filter and its crucible at 105°C for at least 1 h.

⁸ The sole source of supply of the apparatus known to the committee at this time is Whatman type 934-AH Whatman Lab Sales Inc., Hillsboro, OR. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

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17.2 Transfer the crucible and filter to the desiccator, then, after the parts have cooled to room temperature, weigh them to the nearest 0.0001 g and record the reading on the laboratory form under the heading Weight of Sediment—Tare.

17.3 While a vacuum is being applied to the bottom of the crucible, decant supernate from the sample into the crucible. Flush the inner surfaces of the sample bottle with water to complete the transfer.

17.4 As filtering proceeds, inspect the filtrate. If it is turbid, pour the filtrate back through the filter a second and possibly a third time. If the filtrate is still turbid, the filter may be leaking. In this case, substitute a new filter and repeat the process. If the filtrate is transparent but discolored, a natural dye is present; refiltration is not necessary.

17.5 When filtration is complete, place the crucible and its contents in the drying oven set for 105°C.

17.6 When the crucible and its contents are dry, transfer to a desiccator. After the crucible has cooled, weigh to the nearest 0.0001 g and record the reading on the laboratory form under the heading Weight of Sediment—Gross.

17.7 Refer to 11.6 for a discussion of multiple drying and weighing cycles.

18. Calculation

18.1 Subtract Weight of Sediment—Tare from Weight of Sediment—Gross and record the difference under the heading Weight of Sediment—Net. No dissolved-solids correction is required.

18.2 Refer to 12.3 and 12.4 for computations.

19. Precision and Bias for Test Method B (Filtration)

19.1 These precision and bias data meet requirements of Practice D2777.

19.2 Samples for collaborative testing were prepared by dispersing a specially prepared dry powder in approximately 350 mL of water. Mixtures were shipped in sealed glass containers to the nine participating laboratories where three Youden pairs at each of three concentrations were tested.

19.3 Bias was influenced not only by analytical procedures such as filtering, drying, and weighing but also by failure to remove all sediment from the containers and by losing particles through dissolution.

19.4 The following table shows precision and bias for Test Method B:

Concentration Added, mg/L	Concentration Recovered, mg/L	Standard Deviation of Test Method (S)	Standard Deviation of Single Operator (So)	Bias, %
10	8	2.6	2	-20
100	91	5.3	5.1	-9
1000	951	20.4	14.1	-3.9

TEST METHOD C—WET-SIEVING-FILTRATION

20. Scope

20.1 This test method covers concentration measurements of two particle-size fractions. The term fine fraction refers to



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Figure 7: Test Method B - Filtration from ASTM Designation D3977-97. [6]

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Storm Drainage Computations

Name: Delanson Circle
 Wellesley, MA
 Client: Delanson Realty Partners. LLC

Proj. No.: **216-194**
 Date: **21-Feb-20**
 Computed by: **SBS**
 Checked by: **BCM**

Design Parameters:
 REV **10-Jul-20 25** Year Storm
 REV **12-Aug-20**
 k_s= **0.5**

NOTE:

FD=First Defense Unit

DESCRIPTION	LOCATION		AREA (AC.)	C	C x A	SUM C x A	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PROFILE						
	FROM	TO					PIPE	CONC TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft ³ /s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER	W.S.E. ft	Freeboard ft
	OCS	DMH 1	---	---	0.07	0.07	0.09	6.0	5.7	0.4	2.1	0.013	8	0.0060	0.9	2.7	12	0.07	187.50	179.40	179.32	180.6	6.9
	RD 1	DMH 2	0.138	0.90	0.12	0.15	0.20	6.0	5.7	0.9	3.3	0.013	8	0.0100	1.2	3.5	40	0.40	173.00	169.40	169.00	170.7	2.3
	DMH 2	DMH 3	0.193	0.72	0.14	0.14	0.36	6.2	5.7	0.8	3.0	0.013	12	0.0100	3.6	4.5	66	0.66	172.50	169.00	168.34	169.6	2.9
	DMH 1	DMH 3	---	---	---	0.36	0.12	6.6	5.6	2.0	3.3	0.013	12	0.0060	2.8	3.5	23	0.14	182.00	170.47	170.33	171.1	10.9
	DMH 3	DMH 4	---	---	---	0.36	0.14	6.7	5.6	2.0	3.9	0.013	12	0.0100	3.6	4.5	34	0.34	173.25	168.34	168.00	168.9	4.4
	DMH 4	P-1	---	---	---	0.36	0.40	6.7	5.6	2.0	4.0	0.013	12	0.0103	3.6	4.6	97	1.00	173.25	168.00	167.00	169.6	3.7
	RD 2	P-1	0.266	0.80	0.21	0.21	0.07	6.0	5.7	1.2	3.5	0.013	10	0.0100	2.2	4.0	14	0.14	173.00	167.14	167.00	168.7	4.3
	CB 2	DMH 5	0.181	0.64	0.12	0.12	0.01	6.0	5.7	0.7	2.9	0.013	12	0.0100	3.6	4.5	1	0.01	170.26	167.09	167.08	167.7	2.6
	DMH 5	P-1	---	---	---	0.12	0.03	6.0	5.7	0.7	3.3	0.013	12	0.0160	4.5	5.7	5	0.08	170.40	167.08	167.00	168.1	2.3
	P-1	DMH 6	---	---	---	1.10	0.02	7.1	5.5	6.0	9.7	0.013	12	0.0500	8.0	10.1	14	0.70	171.00	167.50	166.80	166.5	4.5
	DMH 6	DMH 7	---	---	---	1.10	0.08	7.1	5.5	6.0	7.8	0.013	12	0.0270	5.9	7.5	35	0.95	170.40	165.00	164.05	164.6	5.8
	CB 3	DMH 7	0.020	0.84	0.02	0.02	0.06	6.0	5.7	0.1	1.4	0.013	12	0.0200	5.0	6.4	5	0.10	168.90	164.15	164.05	164.7	4.2
	DMH 7	DMH 8	---	---	---	1.11	0.09	7.2	5.5	6.1	9.6	0.013	12	0.0467	7.7	9.8	53	2.48	169.00	161.05	158.57	160.1	8.9
	DMH 8	DMH 9	---	---	---	1.11	0.22	7.3	5.4	6.1	8.2	0.013	12	0.0300	6.2	7.9	110	3.30	162.82	156.78	153.48	156.3	6.5
	DMH 9	DMH 10	---	---	---	1.11	0.02	7.5	5.4	6.0	8.2	0.013	12	0.0300	6.2	7.9	9	0.27	158.00	153.48	153.21	153.0	5.0
	TD 1	DMH 12	0.044	0.55	0.02	0.02	0.13	6.0	5.7	0.1	1.9	0.013	12	0.0200	5.0	6.4	15	0.30	159.00	157.86	157.56	158.3	0.7
	RD 3	P-2	0.177	0.90	0.16	0.16	0.05	6.0	5.7	0.9	3.3	0.013	8	0.0100	1.2	3.5	10	0.10	164.00	157.60	157.50	158.1	5.9
	P-2	DMH 11	---	---	---	0.17	0.02	6.0	5.7	1.0	3.2	0.013	12	0.0100	3.6	4.5	3	0.03	161.00	157.40	157.37	159.0	2.0
	DMH 11	DMH 10	---	---	---	0.17	0.06	6.0	5.7	1.0	5.5	0.013	12	0.0500	8.0	10.1	20	1.00	160.50	156.00	155.00	157.4	3.2
	DMH 10	DMH 13	---	---	---	1.28	0.03	7.5	5.4	6.9	9.4	0.013	12	0.0400	7.1	9.1	18	0.72	158.00	153.21	152.50	154.6	3.4

A P P E N D I X E

Operation and Maintenance Plans

**Construction Phase Pollution Prevention and Erosion and
Sedimentation Control Plan
(Best Management Practices
Operation and Maintenance Plan)**

for

**Wellesley Square Residences
Wellesley, Massachusetts**

***Submitted to:*
Town of Wellesley**

***Prepared for:*
Delanson Realty Partners, LLC
20 Woodward Street
Newton, Massachusetts 02461**

Prepared by:



**Professional Civil Engineering • Project Management • Land Planning
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061
Tel.: (781) 792-3900 Facsimile: (781) 792-0333
www.mckeng.com**

**February 21, 2020
Revised July 10, 2020
August 12, 2020**

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**Construction Phase Pollution Prevention &
Erosion and Sedimentation Control Plan**

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled "Wellesley Square Residences, Delanson Circle, Wellesley, Massachusetts," dated February 21, 2020, revised August 12, 2020 and prepared by McKenzie Engineering Group, Inc., hereinafter referred to as the Site Plans.

Property Owner:

Delanson Realty Partners, LLC
20 Woodward Street
Newton, MA 02461

Developer Contact Information:

Delanson Realty Partners, LLC
20 Woodward Street
Newton, MA 02461

Town of Wellesley Contact Information:

Wellesley Department of Public Works – Engineering Division
David J. Hickey, Jr., P.E., Town Engineer
20 Municipal Way
Wellesley, MA 02481
Phone: 781-237-0047
Fax: 781-237-0047

Wellesley Protection Committee
Julie Meyer, Wetlands Administrator
525 Washington Street
Wellesley, MA 02482
Phone: 781-431-1019, ext. 2292

Wellesley Building Department
Michael T. Grant, Inspector of Buildings
525 Washington Street
Wellesley, MA 02482
Phone: 781-431-1019

Wellesley Zoning Board of Appeals
Lenore Mahoney, Executive Secretary
525 Washington Street
Wellesley, MA 02482
Phone: 781-431-1019, ext. 2208

Narrative:

Project Description:

The project proponent, Delanson Realty Partners, LLC, proposes to redevelop a 1.42-acre parcel of land located at Delanson Circle in Wellesley, Massachusetts. The proposed redevelopment will consist of 35 multi-family residential units and 4 existing multi-family residential units at 12-18 Hollis Street. The proposed development will involve the construction of a three (3) story plus one (1) basement level parking building, sidewalks, roof-top courtyard, retaining walls, access drive, stormwater management systems, utilities and other related infrastructure.

The project is comprised of seven (7) parcels which are shown on Assessors' Map 123 as Lots 9-14. The site is bounded by Hollis Street to the northeast, Linden Street to the southeast and developed residential property to the north and west as shown on Figure 1 - USGS Locus Map.

The project will access the existing utility infrastructure located on Linden Street, including sanitary sewer, water, gas, electric, telephone, and cable television. The stormwater management system will be designed to fully comply with all standards of the Department of Environment Protection's Stormwater Management Regulations and will utilize an existing closed drainage system on Linden Street as an overflow connection.

Site Description:

The property is located within the Residential Incentive Overlay Zoning District. The majority of the 1.42 acre-development area consists of the Delanson Circle cul-de-sac, five (5) single family homes, bituminous roadway and driveways, retaining walls, concrete walkways and associated landscaping. Currently, the site is comprised of approximately 22% impervious surfaces. The existing homes have either direct access to Delanson Circle or Hollis Street.

The existing topography generally ranges in elevation from approximately 200 ft. (Wellesley Vertical Datum) in the northwest portion of the site to an elevation of approximately 157 ft. (Wellesley Vertical Datum) in the southeast portion of the site. The parcel slopes in a southerly direction from its northern boundary towards Linden Street and an easterly direction towards Hollis Street.

Review of available environmental databases such as MassGIS reveals that the site is not located within a mapped Natural Heritage Area, a Zone II Groundwater Recharge Area, the Town of Wellesley Aquifer Protection District Zone, an Interim Wellhead Protection Area (IWPA), or a Contributing Watershed to Outstanding Resource Water (ORW).

The site is located within Zone X, Area of Minimal Flooding as shown on FEMA Flood Insurance Rate Map Panel No. 25021C0016E with an effective date of July 17, 2012. Refer to Figure 2 – FEMA Flood Map.

Soils:

The Natural Resources Conservation Service (NRCS) has identified the soil on the site as 602, Urban land, 0 to 15% slopes and does not further categorize the soil in terms of permeability or presence of groundwater, and 630C, Charlton-Hollis-Urban land

complex, 3 to 15% slopes with hydrologic soil group (HSG) B C/D. Refer to Figure 3 - NRCS Soils Map.

Erosion and Sedimentation Control Practices:

Structural Practices:

- 1) **Sediment Silt Sock Barrier Controls** – A sediment silt sock barrier will be constructed along downward slopes at the limit of work in locations shown on the plans. This control will be installed prior to major soil disturbance on the site. The sediment silt sock should be installed as shown on the Erosion Control Detail Plan.

Sediment Silt Sock Design/Installation Requirements

- a) Locate the silt sock where identified on the plans.
- b) The silt sock line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the silt sock should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.
- c) The silt sock shall be staked every 8 linear feet with 1-inch by 1-inch stakes.
- d) Sediment silt socks should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized through one growing season. Retained sediment must be removed and properly disposed of, or mulched and seeded.

Sediment Silt Sock Inspection/Maintenance

- a) Silt socks should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, and to see that the stakes are firmly in the ground. Repair or replace as necessary.
- b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the sock. Sediment will be removed from behind the silt sock when it becomes about ½ foot deep at the silt sock. Take care to avoid undermining the sock during cleanout.
- c) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.

Remove staking only after the contributing drainage areas have been properly stabilized. Sediment deposits and silt sock materials remaining after stakes have been removed should be graded to conform to the existing topography and vegetated.

- 2) **Stabilized Construction Entrance** – A stabilized construction entrances will be placed at the proposed entrances on Washington Street. The stabilized construction entrances will be installed immediately after the clearing and grubbing of the site entrance and associated roadway cut/fill to maintain access to the site are completed. The stormwater runoff from the entrance will be diverted to temporary sedimentation basins alongside the proposed driveway. The construction entrance will keep mud and sediment from being tracked off the construction site onto

Washington Street by vehicles leaving the site. The stabilized construction entrances shall be constructed as shown on the Erosion Control Detail Plan.

Construction Entrance Design/Construction Requirements *

- a) Grade foundation for positive drainage towards the temporary sedimentation basin along the side of the roadway.
- b) Stone for a stabilized construction entrance shall consist of 1 to 3-inch stone placed on a stable foundation.
- c) Pad dimensions: The minimum length of the gravel pad should be 50 feet. The pad should extend the full width of the proposed roadway, or wide enough so that the largest construction vehicle will fit in the entrance with room to spare; whichever is greater. If a large amount of traffic is expected at the entrance, then the stabilized construction entrance should be wide enough to fit two vehicles across with room to spare.
- d) A geotextile filter fabric shall be placed between the stone fill and the earth surface below the pad to reduce the migration of soil particles from the underlying soil into the stone and vice versa. The filter fabric should be Amoco woven polypropylene 1198 or equivalent.
- e) Washing: If the site conditions are such that the majority of mud is not removed from the vehicle tires by the gravel pad, then the tires should be washed before the vehicle enters the street. The wash area should be a level area with 3-inch washed stone minimum, or a commercial rack.
- f) Water employed in the washing process shall be directed to a sediment trap or approved sediment-trapping device prior to discharge to a temporary sedimentation basin along side the site entrance drive. Sediment should be prevented from entering any watercourses.

Construction Entrance Inspection/Maintenance *

- a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto Washington Street. This may require periodic topdressing with additional stone
- b) The construction entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.
- c) Mud and sediment tracked or washed onto public road shall be immediately removed by sweeping.
- d) Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.

- e) If washing facilities are used, the sediment traps should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available.
 - f) The pad shall be reshaped as needed for drainage and runoff control.
 - g) Broken road pavement on Washington Street shall be repaired immediately.
 - h) All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.
- 3) **Inlet Protection** – Inlet Protection will be utilized around the catch basin grates. The inlet protection will allow the storm drain inlets to be used before final stabilization. This structural practice will allow early use of the drainage system if the detention basin is already stabilized. Siltsack or equivalent will be utilized for the inlet protection. Siltsack is manufactured by ACF Environmental. The telephone number is 1-800-437-6746. Regular flow siltsack will be utilized, and if it does not allow enough storm water flow, hi-flow siltsack will be utilized.

Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance Requirements *

- a) All trapping devices and the structures they protect should be inspected after every rain storm and repairs made as necessary.
- b) Sediment should be removed from the trapping devices after the sediment has reached a maximum depth of one-half the depth of the trap.
- c) Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Sediment removed shall be disposed of in accordance with all applicable local, state, and federal regulations.
- d) The silt sack must be replaced if it is ripped or torn in any way.
- e) Temporary traps should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.
- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that

construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

- 1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

Temporary Seeding Planting Procedures *

- a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.
- b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.
- c) The seedbed should be firm with a fairly fine surface. Perform all cultural operations across or at right angles to the slope. A minimum of 2 to 4-inches of tilled topsoil is required. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content.
- d) Apply uniformly 2 tons of ground limestone per acre (100 lbs. Per 1,000 sq.ft.) or according to soil test. Apply uniformly 10-10-10 analysis fertilizer at the rate of 400 lbs. per acre (14 lbs. per 1,000 sq.ft.) or as indicated by soil test. Forty percent of the nitrogen should be in organic form. Work in lime and fertilizer to a depth of 4-inches using any suitable equipment.
- e) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs/1,000 sq.ft.)	Seeding Rate (lbs/acre)	Recommended Seeding Dates	Seed Cover required
Annual Ryegrass	1	40	April 1 st to June 1 st August 15 th to Sept. 15 th	¼ inch
Foxtail Millet	0.7	30	May 1 st to June 30 th	½ to ¾ inch
Oats	2	80	April 1 st to July 1 st August 15 th to Sept. 15 th	1 to 1-½ inch
Winter Rye	3	120	August 15 th to Oct. 15 th	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

- f) Use an effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance *

- a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four-hour period). Stands should be uniform and dense. Fertilize, reseed, and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.
 - b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.
- 2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	Manufacturer	Product	Remarks
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening
Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening

Amoco may be reached at (800) 445-7732

Geotextile Installation

- a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance *

- a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.
- 3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw.

Mulch (Hay or Straw) Materials and Installation

- a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be

appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

Mulch Maintenance *

- a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.
 - b) Straw or grass mulches that blow or wash away should be repaired promptly.
 - c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.
 - d) Continue inspections until vegetation is well established.
- 4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

- a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. All brush, tree limbs, tree trunk and stump disposal shall take place off site and within 30 days of cutting. All disposal shall be in accordance with federal, state and local regulations. Any temporary stockpiling of brush, tree limbs, tree trunks or stumps shall be surrounded with an erosion control barrier. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.
- b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.
- c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.

- d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.
- e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

Land Grading Stabilization Inspection/Maintenance *

- a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.
 - b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.
 - c) Areas requiring revegetation should be repaired immediately. Slopes should be limed and fertilized as necessary to keep vegetation healthy. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.
- 5) **Topsoiling** * – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

Topsoiling Placement

- a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.
 - b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.
 - c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- 6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

Permanent Seeding Seedbed Preparation

- a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and respread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed.

- b) The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.
- c) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.
- d) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

Permanent Seeding Grass Selection/Application

- a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydroseeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.
- b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100 foot buffer zone to a wetland resource area.
- c) Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding Inspection/Maintenance *

- a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.
- b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.
- c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.
- d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

Dust Control *:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective

control measure, especially for construction haul roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

Non-Stormwater Discharges:

During construction activities at the site, some water from the site will be suitable for discharge to the detention areas and/or temporary sediment basin areas. Non-stormwater discharges will be directed to recharge groundwater and to replenish wetland resource areas.

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges.

Soil Stockpiling *:

Topsoil and subsoil from the driveway and parking area grading will be stockpiled in locations shown on the plans.

Stockpile Material Construction Procedure

- 1) Topsoil and subsoil that are stripped will be stockpiled for later distribution on disturbed areas.
- 2) The stockpiles will be located as shown on the plans. These locations will allow them to not interfere with work on the site.
- 3) Seed the stockpiles with a temporary erosion control mix if the stockpile is to remain undisturbed for more than 30 days. The stockpiles must be stable and the side slopes should not exceed 2:1.
- 4) Sediment silt sock or hay bale barrier erosion control measure should be placed surrounding each stockpile.
- 5) As needed, the stockpiled topsoil and subsoil are redistributed throughout the site.

Pollution Prevention:

Fueling and Maintenance of Equipment or Vehicles

Refueling/maintenance Rules – The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. This document shall include language that shall permit the maintenance of vehicles only in designated locations on the job site. In the event of mechanical failure of a vehicle, the vehicle shall be moved to the designated maintenance area on the site to perform maintenance. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. Refueling for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

1. Fueling operations shall take place in designated area(s) as shown on site maps. Provide temporary drip protection during fueling operations which take place outside of designated area(s). Materials necessary to address a spill shall be made readily available in a location known to the site supervisor or his/her designee.
2. Fueling operation procedures shall be in effect throughout the project duration.

Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Washing of Equipment and Vehicles

Vehicle Washing Rules - The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. This document shall include language that shall not permit vehicle washing on the job site. Concrete trucks shall be exempt from this rule. Concrete truck cleaning shall be confined within the work area and conducted in a manner to prevent water drainage beyond the specified area of work.

Concrete truck washout shall be conducted in designated areas and shall not be discharged in areas which would allow wash water to leave the site or enter protected areas.

Maintenance Requirements

1. The site supervisor shall maintain a log of individuals receiving these instructions.

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

Building Products - Building products are not anticipated during this phase of construction.

Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

The use of pesticides and herbicides is not currently anticipated for this site. Fertilizers and landscape materials will be used to stabilize slopes and other disturbed areas.

1. Store all fertilizers and landscape materials in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.

Maintenance Requirements

1. The site supervisor shall regularly inspect the designated storage areas as well as any portions of the site under construction to ensure that all materials are properly stored. The site supervisor shall immediately address any issues and instruct personnel to secure and properly store all materials.

Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

Refueling and maintenance for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

Refueling and maintenance of equipment shall take place in designated areas whenever possible. Refueling or maintenance of equipment in locations other than those designated for such activity shall be performed under the supervision of the site supervisor or his/her designee and shall employ drip pans or other suitable means of preventing fuel, hydraulic fluid, etc. from spilling or being otherwise carried offsite or into protected areas.

Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

Hazardous or toxic waste associated with paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations.

Hazardous or toxic waste shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations. Hazardous and toxic waste shall not be disposed of in solid waste containers intended for non-hazardous construction debris.

Maintenance Requirements

1. The site supervisor shall regularly inspect all portions of the project under construction and ensure that all hazardous or toxic materials are disposed of in accordance with the practices detailed above and shall immediately correct any improper disposal practices.

Construction and Domestic Waste

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.)

Construction and domestic waste shall be disposed of in a trash receptacle (dumpster) which shall be removed and disposed of at an approved land fill.

Recyclable waste material shall be stored in an appropriate container or in a designated location on site until it can be removed.

1. Trash receptacles (dumpsters) and recyclable waste material containers shall be located as needed throughout the site.

Maintenance Requirements

1. The site supervisor shall inspect all trash receptacles and containers to confirm that construction and domestic waste is properly contained and shall also ascertain that waste is being picked up in a timely manner to ensure that no receptacles are overflowing. Pick-up schedules shall be modified or the number of receptacles shall be increased as needed.

Sanitary Waste

During the construction process, portable toilets will be provided in an appropriate location during the construction process.

Maintenance Requirements

1. The site supervisor shall execute a contract with a vendor to supply and maintain portable toilets throughout the site for the project duration. The site supervisor shall determine if a sufficient number of toilets are present to meet staffing levels and shall ensure that the toilets are regularly and properly maintained.

Washing of Applicators and Containers used for Paint, Concrete or Other Materials

Concrete washout shall be restricted to designated areas. Paints, form release oils, curing compounds, etc. shall be recycled and/or disposed of utilizing appropriate containers in accordance with manufacturer's recommendations and EPA guidelines.

1. Install straw bale and plastic liner washout pit at the designated location on site. Concrete trucks shall wash out only at washout pit or other similar acceptable facility such as a portable roll-off washout pit.
2. Provide suitable containers for recycling or disposal for cleanup of paints, form release oils, curing compounds, etc.

Maintenance Requirements

1. The site supervisor shall inspect concrete washout pits (or other acceptable facility) to ensure that they are properly maintained. If necessary, wash water in a concrete washout pit shall be vacuumed off and the hardened concrete broken up and recycled. Wash water and broken up concrete shall be properly disposed of at a suitable facility. If necessary, the wash out pit shall be repaired and relined with plastic prior to continued use.
2. Containers for waste paint, form release oil, curing compounds, etc. shall be sealed and removed from the site and properly disposed of at a suitable facility. Empty containers shall replace those being removed for disposal.

Fertilizers

Fertilizers shall be used only as necessary to establish vegetative stabilized slopes and disturbed areas. Apply at recommended rates. Use only slow release fertilizers to minimize discharge of nitrogen or phosphorous.

1. Store all fertilizers in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.
2. To prevent accidental release of fertilizers, the site supervisor shall attempt to coordinate delivery of fertilizers to coincide with application and reduce the need to warehouse large quantities on-site.

Maintenance Requirements

1. Site supervisor shall make regular inspections to ensure that fertilizer is being applied at proper rates and that all perimeter controls are in place and properly maintained to control runoff which may contain fertilizer. Stored fertilizer shall be properly covered or enclosed in a designated location to prevent introduction into stormwater runoff.

Spill Prevention and Response

The site supervisor or their representative shall be present on the job site at all times during the course of work and shall be present during the delivery, removal of any liquid/chemical materials to or from the job site. They will also be present during any refueling practices. All subcontractors will be notified of their responsibilities in writing. In the event a spill occurs, the site supervisor shall be notified immediately.

The site supervisor shall have in place a spill prevention plan and resources to contain and clean up any potential spills in a timely manner. Refer to the following Spill Containment & Management Plan, including Spill Report, Emergency Response Equipment Inventory, and Emergency Notification and phone numbers.

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a licensed engineer or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete the Stormwater Management Construction Phase BMP Inspection Schedule and Evaluation Checklist, as attached, for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective.

The inspector should notify the appropriate person to make the changes and submit copies of the form to the Wellesley Department of Public Works – Engineering Division – Town Engineer upon request.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed. The forms list each of the measures to be inspected on the site, the inspector's name, the date of the inspection, the condition of the measure/area inspected, maintenance or repair performed and any changes which should be made to the Pollution Prevention & Erosion and Sedimentation Control Plan to control or eliminate unforeseen pollution of storm water.

Project Location: Wellesley Square Residences – Delanson Circle, Wellesley, MA

Date:

Stormwater Management – Construction Phase

Best Management Practices – Inspection Schedule and Evaluation Checklist

Construction Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/Repair	Performed by
Siltsock Erosion Control Barrier	After heavy rainfall events (minimum weekly)			1. Sediment level 2. Material tears or repairs	<input type="checkbox"/> yes <input type="checkbox"/> no		
Stabilized Construction Entrance	After heavy rainfall events (minimum weekly)			1. Sediment build-up or clogging	<input type="checkbox"/> yes <input type="checkbox"/> no		
Inlet Protection	After heavy rainfall events (minimum weekly)			1. Sediment level 2. Sack tears or damage	<input type="checkbox"/> yes <input type="checkbox"/> no		
Temporary Seeding	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		
Geotextiles	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		
Mulching & Netting	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		
Land Grading	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		

Topsoiling	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		
Permanent Seeding	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		
Dust Control	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

Notes (Include deviations from : Site Plan Approval or Order of Conditions, Construction Sequence and Approved Plan):

Stormwater Control Manager _____

Spill Containment and Management Plan

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) _____

Facility Manager (phone) _____

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact: _____ Phone Number: _____

Fire Department: 911 _____

Police Department: 911 _____

Department of Public Works: (781) 235-7600 _____

Board of Health Phone: (781) 235-0135 _____

Conservation Commission Phone: (781) 431 1019, ext. 2292 _____

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

EMERGENCY RESPONSE EQUIPMENT INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	SQUARE END SHOVELS	1
--	PRY BAR	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
NAME: _____ BEEPER: _____
PHONE: _____ CELL PHONE: _____

ALTERNATE:
NAME: _____ BEEPER: N/A _____
PHONE: _____ CEL PHONE: _____
2. FIRE DEPARTMENT
EMERGENCY: 911
BUSINESS: (781) 235-1300

POLICE DEPARTMENT
EMERGENCY: 911
BUSINESS: (781) 235-1212
3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
EMERGENCY: (617) 556-1133
NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200
4. NATIONAL RESPONSE CENTER
PHONE: (800) 424-8802

ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
EMERGENCY: (617) 223-7265
BUSINESS: (617) 860-4300
5. DEPARTMENT OF PUBLIC WORKS
CONTACT: Town Engineer, David J. Hickey, Jr., P.E.
PHONE: (781) 235-7600
6. WETLAND PROTECTION COMMITTEE
CONTACT: Wetlands Administrator, Julie Meyer
PHONE: (781) 431 1019, Ext. 2292
7. BOARD OF HEALTH
CONTACT: Director. Community and Public Health Leonard Izzo, MS, RS, CHO
PHONE: (781) 235-0135

**Post-Development Phase Best Management Practices Operation and
Maintenance Plan /
Long-Term Pollution Prevention Plan**

for

**Wellesley Square Residences
Wellesley, Massachusetts**

***Submitted to:*
Town of Wellesley**

***Prepared for:*
Delanson Realty Partners, LLC
20 Woodward Street
Newton, Massachusetts 02461**

Prepared by:



**Professional Civil Engineering • Project Management • Land Planning
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061
Tel.: (781) 792-3900 Facsimile: (781) 792-0333
www.mckeng.com**

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August 12, 2020**

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**Post-Development Best Management Practice
Operation and Maintenance Plan &
Long-Term Pollution Prevention Plan**

**Post-Development Best Management Practices (BMPs)
Operation and Maintenance Plan**

Responsible Party/Property Owner/Developer contact information:

Property Owner:

Delanson Realty Partners, LLC
20 Woodward Street
Newton, MA 02461

Developer Contact Information:

Delanson Realty Partners, LLC
20 Woodward Street
Newton, MA 02461

Town of Wellesley Contact Information:

Wellesley Department of Public Works – Engineering Division
David J. Hickey, Jr., P.E., Town Engineer
20 Municipal Way
Wellesley, MA 02481
Phone: 781-237-0047
Fax: 781-237-0047

Wellesley Protection Committee
Julie Meyer, Wetlands Administrator
525 Washington Street
Wellesley, MA 02482
Phone: 781-431-1019, ext. 2292

Wellesley Building Department
Michael T. Grant, Inspector of Buildings
525 Washington Street
Wellesley, MA 02482
Phone: 781-431-1019

**Long-Term Operations and Maintenance
General Conditions**

1. The property owner shall be responsible for scheduling regular inspections and maintenance of the stormwater BMP's as illustrated on the design plans and detailed in the following long-term operations and maintenance plan.

2. All Stormwater BMP's shall be operated and maintained in accordance with the design plans and the following Long-Term Operations and Maintenance Plan.

3. The owner shall:
 - a. Maintain an Operation and Maintenance Log (see Attachment A) for the last three years. The Log shall include all BMP inspections, repairs, replacement activities and disposal activities (disposal material and disposal location shall be included in the Log);
 - b. Make the log available to the Wellesley Department of Public Works - Town Engineer on an annual basis;
 - c. Allow members and agents of the Wellesley Department of Public Works to enter the premises and ensure that the Owner has complied with the Operation and Maintenance Plan requirements for each BMP.
4. A recommended inspection and maintenance schedule is outlined below based on statewide averages. This inspection and maintenance schedule should be adhered to at a minimum for the first year of service of all BMP's referenced in this document. At the commencement of the first year of service, a more accurate inspection/maintenance schedule should be determined based on the level of service for this site.

Best Management Practices Operations and Maintenance

1. **Paved Areas** –Sweepers shall sweep paved areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15th and November 15th. Special attention should be made to sweeping paved surfaces in March and April before spring rains wash residual sand into the drainage system.

The frequency of sweeping shall average:

- Monthly if by a high-efficiency vacuum sweeper
- Bi-weekly if by a regenerative air sweeper
- Weekly if by a mechanical sweeper

Salt used for de-icing on the parking lot during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

Cost: The property owner should consult local sweeping contractors for detailed cost estimates.

2. **Catch Basins** - Catch basin grates shall be checked quarterly and following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of properly. Deep sump catch basins shall be inspected and cleaned bi-annually of all accumulated sediments. Catch basins with hoods shall be inspected annually to check oil build-up and outlet obstructions. Material shall be removed from catch basins and disposed of in accordance with all applicable regulations.

Cost: Estimated \$50 - \$100 per cleaning as needed. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 3. Proprietary Pretreatment Units** – The proprietary pretreatment units shall be inspected and maintained by qualified personnel only at a minimum of at least two (2) times per year and following heavy rain events with NO rainfall for at least 24 hours. Visually inspect both chambers for heavy sediment, trash, and debris loading that may limit or prevent water flow into the filter housing. Signs that cleaning or filter replacement is necessary are as follows:
- i. Waterline marks less than 12-inch below the top of the bypass weir.
 - ii. Water level differential between the influent chamber and effluent chamber.
 - iii. Obvious heaving loading of leaves, sticks or construction debris.

The requirements for the disposal from the units should be in compliance with all local, state and federal regulations. Consult the Wellesley Board of Health for transfer station locations prior to disposing the separator contents. Please refer to the Manufacturer's Manual for additional detail on proper inspection and maintenance of the Fabco Stormsafe structure.

Cost: Cleaning should be included along with the routine maintenance of the catch basins. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 4. Subsurface Infiltration Chamber System** - Proper maintenance of the subsurface infiltration system is essential to the long-term effectiveness of the infiltration function. The subsurface infiltration system shall have inspection ports and additional inspections should be scheduled during the first few months to ensure proper stabilization and function. Thereafter, they shall be checked semiannually and following heavy rainfalls, defined as a 1-year storm event exceeding 2.5 inches of rainfall within a twenty-four-hour period. Water levels in the chambers shall be checked to verify proper drainage. Ponding water in a chamber indicates failure from the bottom. If water remains within the chambers after 48-hours following a storm event, steps to restore the infiltration function shall be taken, as directed by a qualified stormwater management professional. In order to rectify the problem, accumulated sediment must be removed from the bottom of the chamber. The stone aggregate and filter fabric must be removed and replaced and the underlying soil layer must be scarified to encourage proper infiltration. Material removed from the system shall be disposed of in accordance with all applicable local, state, and federal regulations. Please refer to the Manufacturer's Manual for additional detail on proper inspection and maintenance of the ACF-R Tank chambers.

Cost: The property owner should consult local landscape contractors for a detailed cost estimate.

- 5. Trench Drains** - Trench drain grates shall be checked quarterly and following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of in accordance with all applicable regulations.

Cost: Estimated \$50 - \$100 per cleaning as needed. The Owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 6. Pesticides, Herbicides, and Fertilizers** - Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.

All structural BMP's as identified on the site plans will be owned and maintained by the homeowner's association of the development and shall run with the title of the property.

Cost: Included in the routine landscaping maintenance schedule. The Owner should consult local landscaping contractors for details.

- 7. Snow Removal** - Snow accumulations removed from driveway, fire lane and parking area should be placed in upland areas only, where sand and other debris will remain after snowmelt for later removal. Excess snow should be removed from the site and properly disposed of in an approved snow disposal facility.

Cost: The owner should consult local snow removal contractors for a detailed cost estimate.

Maintenance Responsibilities

All post construction maintenance activities should be documented and kept on file and made available to the Wellesley Department of Public Works – Town Engineer on an annual basis.

To develop and implement an operation and maintenance program with the goal of preventing or reducing pollutant runoff by keeping potential pollutants from coming into contact with stormwater or being transported off site without treatment, the following efforts will be made:

- Property Management awareness and training on how to incorporate pollution prevention techniques into maintenance operations.
- Follow appropriate best management practices (BMPs) by proper maintenance and inspection procedures.

Long-Term Pollution Prevention Plan

Good Housekeeping:

Storage and Disposal of Waste and Toxics:

Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts.

The exterior storage of hazardous materials on site shall be prohibited.

The following is a list of management considerations for hazardous materials as outlined by the EPA:

- Ensuring sufficient aisle space to provide access for inspections and to improve the ease of material transport;

- Storing materials well away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags, or containers.
- Stacking containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself;
- Storing containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests.

Landscape Maintenance:

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. These practices can benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife. The following lawn and landscaping management practices will be encouraged:

- Mow lawn areas at the highest recommended height.
- Minimize lawn size and maintain existing native vegetation.
- Abide by water restrictions and other conservation measures implemented by the Town of Wellesley.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

Integrated Pest Management (IPM):

This management measure seeks to limit the adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests.

The presence of pesticides in stormwater runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chloropyrifos, which even at very low levels can be harmful to aquatic life.

The following IPM practices will be encouraged:

- Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.
- Lawn care and landscaping management programs including appropriate pesticide use management as part of program.

Illicit Discharges:

Illicit discharges are non-stormwater discharges to the storm drain system which typically contain bacteria and other pollutants. All illicit discharges are prohibited. Any illicit discharges should be reported to the Wellesley Department of Public Works to be addressed in accordance with their respective policies.

The following is a list of EPA allowed non-stormwater discharges. If the non-stormwater discharge is not listed, it is prohibited.

1. Water line flushing,
2. Landscape irrigation,
3. Diverted stream flows,
4. Rising ground waters,
5. Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
6. Uncontaminated pumped ground water,
7. Discharge from potable water sources,
8. Foundation drains,
9. Air conditioning condensation,
10. Irrigation water, springs,
11. Water from crawl space pumps,
12. Footing drains,
13. Lawn watering,
14. Flows from riparian habitats and wetlands,
15. Street wash water,
16. Discharges or flows from firefighting activities occur during emergency conditions.

Project Location: Wellesley Square Residences – Delanson Circle, Wellesley, MA

Date:

Stormwater Management – Long Term

Best Management Practices – Inspection Schedule and Evaluation Checklist

Long Term Practices

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/Repair	Performed by
Parking Lot Maintenance	4-times annually - specifically in Spring and Fall			1. Sediment build-up 2. Trash and debris 3. Minor Spills (vehicular)	<input type="checkbox"/> yes <input type="checkbox"/> no		
Catch Basins	After heavy rainfall events (minimum quarterly)			1. Sediment level exceeds 8" 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Grate or outlet blockages	<input type="checkbox"/> yes <input type="checkbox"/> no		
Proprietary Stormwater Treatment Units	After heavy rainfall events (minimum twice per year)			1. Sediment level exceeds Manufacturer's specification 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Outlet blockages	<input type="checkbox"/> yes <input type="checkbox"/> no		
Subsurface Infiltration Chambers System	After heavy rainfall events (minimum semi-annually)			1. Sediment build-up 2. Standing Water greater than 48 hours	<input type="checkbox"/> yes <input type="checkbox"/> no		
Trench Drains	After heavy rainfall events (minimum quarterly)			1. Sediment level exceeds 8" 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Grate or outlet blockages	<input type="checkbox"/> yes <input type="checkbox"/> no		

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

Notes (Include deviations from: Site Plan Approval and Order of Conditions and Approved Plans):

1. Limited or no use of sodium chloride slats, fertilizers or pesticides recommended. Slow release fertilizer recommended if necessary.

Stormwater Control Manager _____

Spill Containment and Management Plan

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) _____

Facility Manager (phone) _____

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact: _____ Phone Number: _____

Fire Department: 911 _____

Police Department: 911 _____

Department of Public Works: (781) 235-7600 _____

Board of Health Phone: (781) 235-0135 _____

Conservation Commission Phone: (781) 431 1019, ext. 2292 _____

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date ___ / ___ / ___

Time _____ AM / PM

Exact location (Transformer #) _____

Type of equipment _____ Make _____ Size _____

S / N _____ Weather Conditions _____

On or near water Yes If yes, name of body of water _____
 No

Type of chemical / oil spilled _____

Amount of chemical / oil spilled _____

Cause of spill _____

Measures taken to contain or clean up spill _____

Amount of chemical / oil recovered _____ Method _____

Material collected as a result of clean up

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal _____

Name and address of any person, firm, or corporation suffering damages _____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring _____

Spill reported to General Office by _____ Time _____ AM / PM

Spill reported to DEP / National Response Center by _____

DEP Date ___ / ___ / ___ Time _____ AM / PM Inspector _____

NRC Date ___ / ___ / ___ Time _____ AM / PM Inspector _____

Additional comments _____

EMERGENCY RESPONSE EQUIPMENT INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	SQUARE END SHOVELS	1
--	PRY BAR	1

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
NAME: _____ BEEPER: _____
PHONE: _____ CELL PHONE: _____

ALTERNATE:
NAME: _____ BEEPER: N/A _____
PHONE: _____ CEL PHONE: _____
2. FIRE DEPARTMENT
EMERGENCY: 911
BUSINESS: (781) 235-1300

POLICE DEPARTMENT
EMERGENCY: 911
BUSINESS: (781) 235-1212
3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
EMERGENCY: (617) 556-1133
NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200
4. NATIONAL RESPONSE CENTER
PHONE: (800) 424-8802

ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
EMERGENCY: (617) 223-7265
BUSINESS: (617) 860-4300
5. DEPARTMENT OF PUBLIC WORKS
CONTACT: Town Engineer, David J. Hickey, Jr., P.E.
PHONE: (781) 235-7600
6. WETLAND PROTECTION COMMITTEE
CONTACT: Wetlands Administrator, Julie Meyer
PHONE: (781) 431 1019, Ext. 2292
7. BOARD OF HEALTH
CONTACT: Director. Community and Public Health Leonard Izzo, MS, RS, CHO
PHONE: (781) 235-0135



StormSafe 4C

Storm water Filtration Chamber

Inspection And Maintenance Guide

Important:

- Inspection and maintenance to be performed by qualified personnel only.
- Helical filter replacement may require personnel properly trained for confined space activity in accordance with local and OSHA regulations.

66 Central Ave • Farmingdale New York 11735
Tel: (631) 393-6024 • Fax: (631) 501-5528 • Web: www.fabco-industries.com

Inspection and Cleaning Overview

The StormSafe-4C, like any other storm water remediation device, requires regular maintenance intervals to remain effective as a storm water filter. Since maintenance requirements and frequency are dependent on the pollutant load characteristics of each site, Fabco recommends a regular inspection and maintenance regime to maintain peak performance of the cartridge filters. As required, both the influent and effluent chambers should be cleaned of any collected oil, trash, debris and sediment that may inhibit filter performance.

Recommended Cleaning Frequency

Site conditions will determine the required cleaning frequency to maintain peak performance of the StormSafe-4C treatment chamber. There is no universal rule to predict the optimal cleanout cycle for storm water filter systems; however locations with stabilized surface conditions will require less frequent cleaning than areas exposed to erosion or construction. Over a short period of time, regular inspection by maintenance personnel will dictate the appropriate cleaning frequency. For new installations, Fabco recommends at least two (2) inspections per year. Additional inspections are recommended following major rain events. Cleaning and filter replacement should be "as needed" based on these inspections. Fabco recommends an initial filter replacement frequency of once per year until sufficient historical data predicts otherwise.

In Case of Spills

In the event of a spill, all inspection and cleaning operations should be aborted until trained HAZMAT personnel secure the jobsite.

Included Reference Material

StormSafe-4C Detail (Figure 1), Maintenance Log Sheet

Visual Inspection Procedure

Inspection and cleaning should be performed only after NO rainfall for at least 24 hours.
If working in the street, wear proper safety equipment and follow the local road safety rules & regulations.
Begin by removing both the 36" manhole access cover located over the influent and effluent chambers of the StormSafe-4C. Allow several minutes for the system to vent.
CAUTION: Grates are extremely heavy. Some type of lifting mechanism is high recommended.

Visually inspect both chambers for heavy sediment, trash and debris loading that may limit or prevent water flow into the filter housing. A battery powered flashlight or droplight is recommended for thorough inspection.
Some telltale signs that cleaning or filter replacement is necessary are as follows:
Waterline marks less than 12-in below the top of the bypass weir.
Water level differential between the influent chamber and effluent chamber.
Obvious heavy loading of leaves, sticks or construction debris.
Record observations and comments on the maintenance log sheet. In addition, the use of digital photographs and/or sketches may be warranted to maintain the most accurate historical records.

Cleaning and Filter Replacement

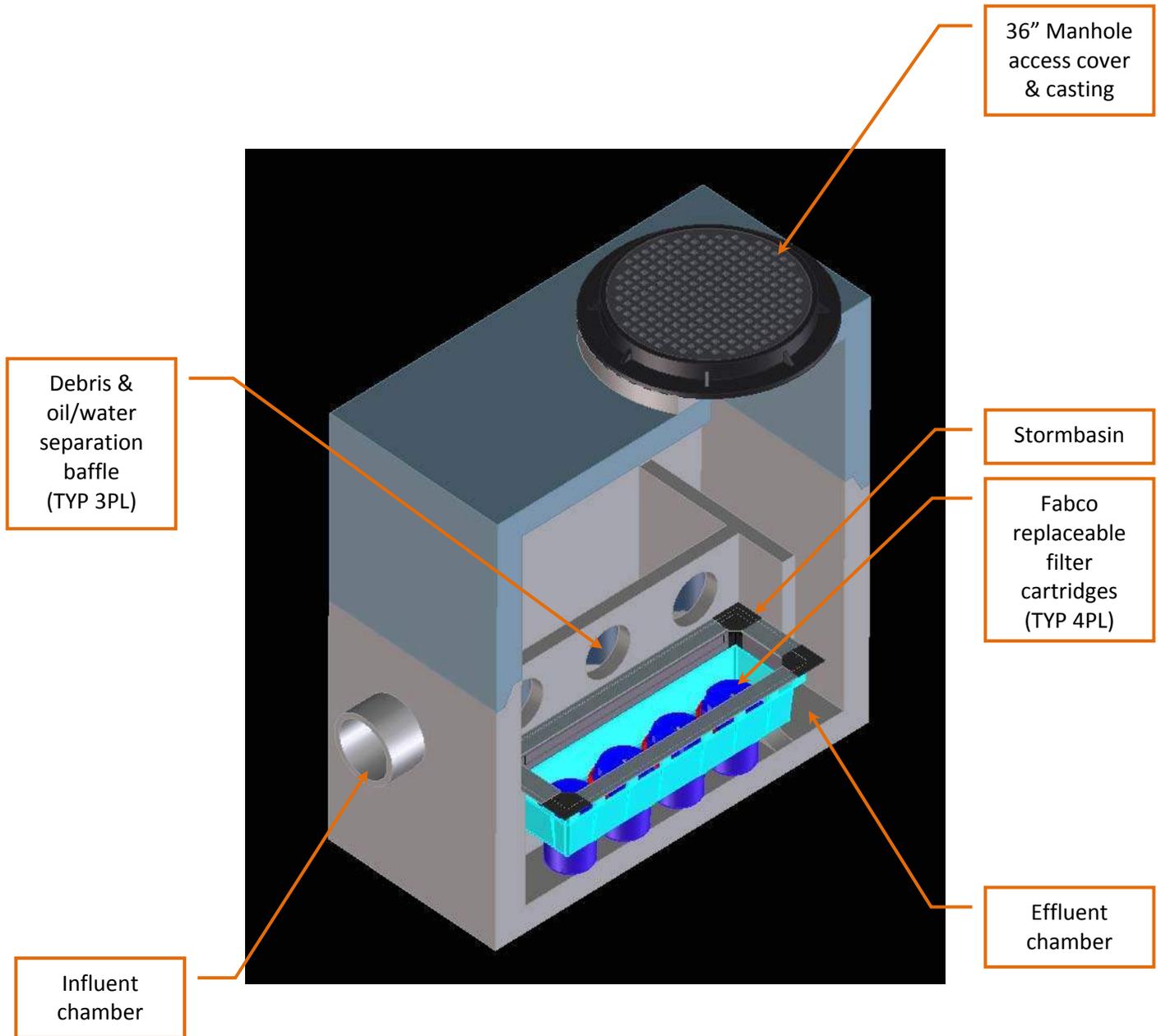
If cleaning or replacing a filter is deemed necessary, the following procedure is recommended:

1. Secure the worksite with the appropriate safety equipment in accordance with local and OSHA regulations.
2. Remove the 36" manhole access cover located over the influent and effluent chambers of the StormSafe-4C. Allow several minutes for the chambers to vent.
3. Perform an internal and external visual inspection of the vault's general condition including the access manhole cover and casting, as well as any exposed concrete surfaces. Record any visual anomalies such as cracks, gouges, hollows, excess wear and settling.
4. Without entering the vault, both the influent and effluent chambers can be cleaned using a typical vacuum truck or similar vacuum equipment with sufficient storage capacity.
5. Both the influent and effluent chambers are designed to accommodate standard suction hoses typical to vacuum equipment. Thoroughly vacuum liquids, debris sediment from both chambers.
6. If filter replacement is deemed unnecessary, reinstall the 36" manhole access cover. Clean the jobsite as necessary and record pertinent information on the attached "Maintenance Log Sheet" to complete the job.
7. If filter replacement is deemed necessary, vault entry is required and OSHA rules for confined space entry may be required. Check local regulations and proceed accordingly.
8. Removal of the filters is done from the influent chamber. Due to possible slippery floor conditions, care should be taken to avoid falls.
9. Use a ladder if necessary, enter the influent chamber and start by twisting and lifting one of the four cartridge filters in a **counter-clockwise** direction.
10. Repeat until all four filters have been removed, proceed to inspect and clean the cartridge openings to ensure correct fit for the new set of cartridge filters.

Disposal

All removed water, oils, sediment, debris, trash and other accumulates collected in the StormSafe must be handled and disposed of in accordance with local, state and federal regulations.

Disposal considerations must be part of a well-planned and scheduled vault maintenance regime. Solid waste disposal can typically be coordinated with a local landfill, whereas liquid waste can be disposed of at either a wastewater treatment plant, or a municipal vacuum truck decant facility.



StormSafe-4C Detail (Figure 1)

<u>Inspection and Maintenance Log-Sheet</u>	
StormSafe 4C – Stormwater Filtration Chamber	
Maintenance Company Information	
Company Name:	
Onsite Technician:	
Contact Phone No:	
StormSafe 4C - Vault Information	
Date of Maintenance:	Fabco Vault P/N:
Vault Location:	
Water Depth (prior to maintenance):	<u>Comments</u>
Sediment Depth (prior to maintenance):	
Structural Damage:	
Maintenance Performed:	
Water level differential between chambers:	
Additional Work Required:	
Structural Repairs:	



R-TANK OPERATION, INSPECTION & MAINTENANCE

Operation

Your ACF R-Tank System has been designed to function in conjunction with the engineered drainage system on your site, the existing municipal infrastructure, and/or the existing soils and geography of the receiving watershed. Unless your site included certain unique and rare features, the operation of your R-Tank System will be driven by naturally occurring systems and will function autonomously. However, upholding a proper schedule of Inspection & Maintenance is critical to ensuring continued functionality and optimum performance of the system.

Inspection

Both the R-Tank and all stormwater pre-treatment features incorporated into your site must be inspected regularly. Inspection frequency for your system must be determined based on the contributing drainage area, but should never exceed one year between inspections (six months during the first year of operation).

Inspections may be required more frequently for pre-treatment systems. You should refer to the manufacturer requirements for the proper inspection schedule.

With the right equipment your inspection and measurements can be accomplished from the surface without physically entering any confined spaces. If your inspection does require confined space entry, you **MUST** follow all local/regional requirements as well as OSHA standards.

R-Tank Systems may incorporate Inspection Ports, Maintenance Ports, and/or adjoining manholes. Each of these features are easily accessed by removing the lid at the surface. With the cover removed, a visual inspection can be performed to identify sediment deposits within the structure. Using a flashlight, ALL access points should be examined to complete a thorough inspection.

Inspection Ports

Usually located centrally in the R-Tank System, these perforated columns are designed to give the user a base-line sediment depth across the system floor.

Maintenance Ports

Usually located near the inlet and outlet connections, you'll likely find deeper deposits of heavier sediments when compared to the Inspection Ports.

Manholes

Most systems will include at least two manholes - one at the inlet and another at the outlet. There may be more than one location where stormwater enters the system, which would result in additional manholes to inspect.

Bear in mind that these manholes often include a sump below the invert of the pipe connecting to the R-Tank. These sumps are designed to capture sediment before it reaches the R-Tank, and they should be kept clean to ensure they function properly. However, existence of sediment in the sump does NOT necessarily mean sediment has accumulated in the R-Tank.

After inspecting the bottom of the structure, use a mirror on a pole (or some other device) to check for sediment or debris in the pipe connecting to the R-Tank.

R-TANK OPERATION INSPECTION & MAINTENANCE

If sediment or debris is observed in any of these structures, you should determine the depth of the material. This is typically accomplished with a stadia rod, but you should determine the best way to obtain the measurement.

All observations and measurements should be recorded on an Inspection Log kept on file. We've included a form you can use at the end of this guideline.

Maintenance

The R-Tank System should be back-flushed once sediment accumulation has reached 6" or 15% of the total system height. Use the chart below as a guideline to determine the point at which maintenance is required on your system.

R-Tank Unit	Height	Max Sediment Dept
Mini	9.5"	1.5"
Single	17"	3"
Double	34"	5"
Triple	50"	6"
Quad	67"	6"
Pent	84"	6"

Before any maintenance is performed on your system, be sure to plug the outlet pipe to prevent contamination of the adjacent systems.

To back-flush the R-Tank, water is pumped into the system through the Maintenance Ports as rapidly as possible. Water should be pumped into ALL Maintenance Ports. The turbulent action of the water moving through the R-Tank will suspend sediments which may then be pumped out.

If your system includes an Outlet Structure, this will be the ideal location to pump contaminated water out of the system. However, removal of back-flush water may be accomplished through the Maintenance Ports, as well.

For systems with large footprints that would require extensive volumes of water to properly flush the system, you should consider performing your maintenance within 24 hours of a rain event. Stormwater entering the system will aid in the suspension of sediments and reduce the volume of water required to properly flush the system.

Once removed, sediment-laden water may be captured for disposal or pumped through a Dirtbag™ (if permitted by the locality).



2831 Cardwell Road
Richmond, Virginia, 23234
800.448.3636
FAX 804.743.7779
acfenvironmental.com

Step-By-Step Inspection & Maintenance Routine

1) Inspection

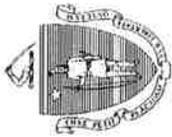
- a. Inspection Port
 - i. Remove Cap
 - ii. Use flashlight to detect sediment deposits
 - iii. If present, measure sediment depth with stadia rod
 - iv. Record results on Maintenance Log
 - v. Replace Cap
- b. Maintenance Port/s
 - i. Remove Cap
 - ii. Use flashlight to detect sediment deposits
 - iii. If present, measure sediment depth with stadia rod
 - iv. Record results on Maintenance Log
 - v. Replace Cap
 - vi. Repeat for ALL Maintenance Ports
- c. Adjacent Manholes
 - i. Remove Cover
 - ii. Use flashlight to detect sediment deposits
 - iii. If present, measure sediment depth with stadia rod, accounting for depth of sump (if present)
 - iv. Inspect pipes connecting to R-Tank
 - v. Record results on Maintenance Log
 - vi. Replace Cover
 - vii. Repeat for ALL Manholes that connect to the R-Tank

2) Maintenance

- a. Plug system outlet to prevent discharge of back-flush water
- b. Determine best location to pump out back-flush water
- c. Remove Cap from Maintenance Port
- d. Pump water as rapidly as possible (without over-topping port) into system until at least 1" of water covers system bottom
- e. Replace Cap
- f. Repeat at ALL Maintenance Ports
- g. Pump out back-flush water to complete back-flushing
- h. Vacuum all adjacent structures and any other structures or stormwater pre-treatment systems that require attention
- i. Sediment-laden water may be captured for disposal or pumped through a Dirtbag™.
- j. Replace any remaining Caps or Covers
- k. Record the back-flushing event in your Maintenance Log with any relevant specifics

APPENDIX F

Soil Testing Results



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

SLT Construction Corporation

Owner Name

South Street

Street Address

Kingston

City

MA

State

Map 62 Lots 14 & 14-1

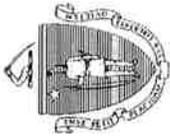
Map/Lot #

02364

Zip Code

B. Site Information

- New Construction Upgrade Repair
 Soil Survey Available? Yes No If yes: Web Soil Survey Source 259B Soil Map Unit
- Carver loamy coarse sand
 Soil Name
 Outwash
 Geologic/Parent Material
 Surficial Geological Report Available? Yes No Landform
 If yes: Year Published/Source Publication Scale Map Unit
- Flood Rate Insurance Map
 Above the 500-year flood boundary? Yes No Within the 100-year flood boundary? Yes No
 If Yes, continue to #5.
- Within a velocity zone? Yes No MassGIS Wetland Data Layer: Wetland Type
 Within a Mapped Wetland Area? Yes No Range: Above Normal Normal Below Normal
- Current Water Resource Conditions (USGS):
 June 2017 Month/Year
- Other references reviewed:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

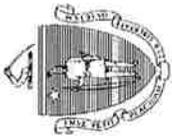
C. On-Site Review (continued)

Deep Observation Hole Number: TP 8-9-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features		Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color		Percent	Gravel			
0" -18"	F				FILL					
18" -26"	A	10YR3/3			Sandy Loan	5%	<5%	Granular	Friable	
26" -36"	Bw	10YR4/4			Loamy Sand	5-10%	<5%	Granular	Friable	Medium
36" -60"	C1	2.5YR6/3			Loamy Sand	5-10%	<5%	Granular	Moderate Friable	
60" -90"	C2	2.5YR6/3	62"	10YR4/6	Sandy Loan	5-10%	<5%	Granular	Firm in Place	Silty Slightly

Additional Notes: Variegated (Transitional Mottling) at 32 inches due to textural changes in the soil.

No weep or standing water was observed to 90 inches.



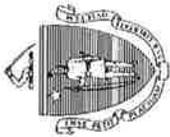
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP 8-9-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features		Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color		Percent	Gravel			
0"-24"	A	10YR3/3			Sandy Loam	5%	<5%	Granular	Friable	
24"-38"	Bw	10YR4/4			Loamy sand	5-10%	<5%	Granular	Friable	
38"-56"	C1	2.5YR6/3	44"	10YR4/6	Sandy Loam	5-10%	<5%	Granular	Firm in Place	
56"-80"	C2	10YR2/2			Loamy Sand	10-15%	<5%	Granular	Firm in Place	Loose w/broken M-C

Additional Notes: Portion of a horizon appear to be fill (different textures etc.). No weep or standing water was observed to 80inches.



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP 8-9-2 8/9/17 9:15 AM Sunny, 70 degrees
Date Time Weather

1. Location
Ground Elevation at Surface of Hole: 83.07+/- Latitude/Longitude: 41 58'55.1" / 70 45'21.1"

2. Land Use Gravel lot Few 3-5%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Pine & oak

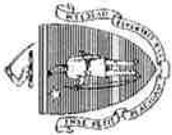
3. Distances from: Open Water Body >100' Drainage Way >100' Position on Landscape (SU, SH, BS, FS, Wetlands >100' feet
Property Line 40'+/- Drinking Water Well >100' Other Other feet
feet feet feet feet

4. Parent Material: Outwash Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 44" (Mottles) 79.4+/- elevation
inches



Commonwealth of Massachusetts
 City/Town of Kingston
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

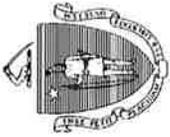
D. Determination of High Groundwater Elevation

1. Method Used:
- Depth observed standing water in observation hole
 - Depth weeping from side of observation hole
 - Depth to soil redoximorphic features (mottles)
 - Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)

Index Well Number	_____	Reading Date	_____
$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$			
Obs. Hole #	_____	S_c	_____
		S_r	_____
		OW_c	_____
		OW_{max}	_____
		OW_r	_____
		S_h	_____
Obs. Hole #	_____	S_c	_____
		S_r	_____
		OW_c	_____
		OW_{max}	_____
		OW_r	_____
		S_h	_____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material
- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?
- Yes No
- b. If yes, at what depth was it observed?
- Upper boundary: _____ inches Lower boundary: _____ inches
- c. If no, at what depth was impervious material observed?
- Upper boundary: _____ inches Lower boundary: _____ inches



Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Alan W. Loomis, Soil Evaluator #1405

Typed or Printed Name of Soil Evaluator / License #

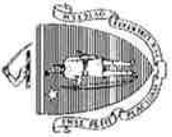
August 9, 2017

Date

June 30, 2019

Expiration Date of License

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

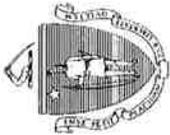


Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

SLT Construction Corporation
 Owner Name
 South Street
 Street Address
 Kingston
 City
 MA
 State
 Map 62 Lots 14 & 14-1
 Map/Lot #
 02364
 Zip Code

B. Site Information

1. (Check one) New Construction Upgrade Repair

2. Soil Survey Available? Yes No
 Carver loamy coarse sand
 Soil Name
 Outwash
 Geologic/Parent Material
 if yes: Web Soil Survey Source 259B
 Soil Map Unit
 Few for development
 Soil Limitations

3. Surficial Geological Report Available? Yes No
 Landform
 if yes: Year Published/Source Publication Scale Map Unit

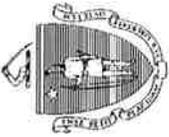
4. Flood Rate Insurance Map
 Above the 500-year flood boundary? Yes No
 If Yes, continue to #5. Within the 100-year flood boundary? Yes No

5. Within a velocity zone? Yes No
 MassGIS Wetland Data Layer: Wetland Type

6. Within a Mapped Wetland Area? Yes No
 Range: Above Normal Normal Below Normal

7. Current Water Resource Conditions (USGS):
 June 2017
 Month/Year

8. Other references reviewed:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed primary and reserve disposal area)

Deep Observation Hole Number: TP 8-9-3 08/09/17 9:45 AM Sunny, 70 Degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 84.1 +/- feet Latitude/Longitude: 41 58'54.9" / 70 45'21.2"

Description of Location:

2. Land Use Gravel lot Few 3-5%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Pine & oak

3. Distances from: Landform Position on Landscape (SU, SH, BS, FS, TS)

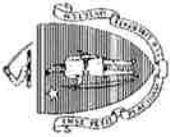
Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	>100' feet
Property Line	40'+/- feet	Drinking Water Well	>100' feet	Other	feet

4. Parent Material: Outwash Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 53" (Mottles) inches 79.7 +/- elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

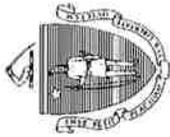
C. On-Site Review (continued)

Deep Observation Hole Number: TP 8-9-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features		Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color		Percent	Gravel			
0" -31"	F				Fill					
31" -38"	A	10YR3/3			Sandy Loam	5%	<5%	Granular	Friable	
38" -48"	Bw	10YR4/4			Loamy Sand	5-10%	<5%	Granular	Friable	
48" -68"	C1	2.5YR6/3	53"		Loamy Sand	5-10%	<5%	Granular	Friable	
68" -92"	C2	2.5YR6/3			Sandy Loam	5-10%	<5%	Granular	Firm in Place	

Additional Notes: Variegated color at Bw/C1 interface.

No weep or standing water was observed to 92 inches.



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP 8-9-4 8/9/17 10:35 AM Sunny, 70 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 92.8+/- Latitude/Longitude: 41 58'50.5" / 70 45'31.3"

2. Land Use Gravel lot Few Surface Stones (e.g., cobbles, stones, boulders, etc.) 3-5%
(e.g., woodland, agricultural field, vacant lot, etc.) Slope (%)
Pine & oak

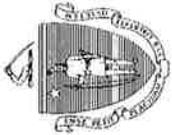
3. Distances from: Open Water Body >100' Drainage Way >100' Position on Landscape (SU, SH, BS, FS, Wetlands >100' feet
Property Line 40'+/- Drinking Water Well >100' Other Other feet
feet feet

4. Parent Material: Outwash Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 77" (Mottles) 86.8+/- elevation
inches



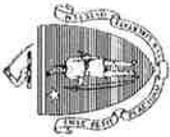
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP 8-9-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features		Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color		Percent	Gravel			
0"-48"	F				Unsorted Fill					
48"-110"	C1	2.5YR5/4	77"		Sand	10-15%	<5%	Single Grain	Loose	Medium

Additional Notes No weep or standing water was observed to 110 inches.



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

- Depth observed standing water in observation hole
- Depth weeping from side of observation hole
- Depth to soil redoximorphic features (mottles)
- Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)

Obs. Hole # TP 8-9-3	Obs. Hole # TP 8-9-4
inches	inches
inches	inches
53"	77"
inches	inches
inches	inches

Index Well Number _____ Reading Date _____

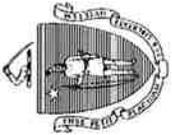
$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole #	_____	S_c	_____	S_r	_____	OW_c	_____	OW_{max}	_____	OW_r	_____	S_h	_____
Obs. Hole #	_____	S_c	_____	S_r	_____	OW_c	_____	OW_{max}	_____	OW_r	_____	S_h	_____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?
 Yes No
- b. If yes, at what depth was it observed?
 Upper boundary: _____ inches Lower boundary: _____ inches
- c. If no, at what depth was impervious material observed?
 Upper boundary: _____ inches Lower boundary: _____ inches



Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

August 9, 2017

Date

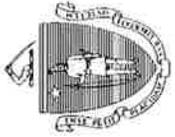
Alan W. Loomis, Soil Evaluator #1405

June 30, 2019

Expiration Date of License

Typed or Printed Name of Soil Evaluator / License #

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

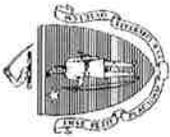


Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:



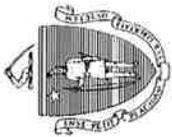
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

SLT Construction Corporation
 Owner Name
 South Street
 Street Address
 Kingston
 City
 MA
 State
 Map 62 Lots 14 & 14-1
 Map/Lot #
 02364
 Zip Code

B. Site Information

1. (Check one) New Construction Upgrade Repair
 2. Soil Survey Available? Yes No
 If yes: Web Soil Survey Source 259B
 Soil Map Unit
 Carver loamy coarse sand
 Soil Name
 Outwash
 Soil Limitations
 Few for development
 Geologic/Parent Material
 Landform
 3. Surficial Geological Report Available? Yes No
 If yes: Year Published/Source Publication Scale Map Unit
 4. Flood Rate Insurance Map
 Above the 500-year flood boundary? Yes No
 Within the 100-year flood boundary? Yes No
 If Yes, continue to #5.
 5. Within a velocity zone? Yes No
 6. Within a Mapped Wetland Area? Yes No
 MassGIS Wetland Data Layer: Wetland Type
 7. Current Water Resource Conditions (USGS):
 Range: Above Normal Normal Below Normal
 June 2017
 Month/Year
 8. Other references reviewed:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP 8-9-5 08/09/17 10:45 AM Sunny, 70 Degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 93.2+/- Latitude/Longitude: 41 58'50.8" / 70 45'32.7"

Description of Location:

2. Land Use Gravel lot Few 3-5%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Pine & oak

3. Distances from: Landform Position on Landscape (SU, SH, BS, FS, TS)

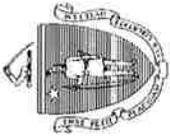
Vegetation	Open Water Body	>100'	Drainage Way	>100'	Wetlands	>100'
	Property Line	40'+/-	Drinking Water Well	>100'	Other	feet
	Outwash	feet				feet

4. Parent Material: Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: inches elevation



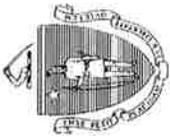
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP 8-9-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-48"	F					Fill					
48"-106"	C-1	2.5YR5/4			0	Sand	10-15%	<5%	Single Grain	Loose	Medium

Additional Notes: No mottles, weep or standing water was observed to 106"



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____ Date: _____ Time: _____ Weather: _____

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.) _____ Few Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%) _____

Vegetation

Landform

Position on Landscape (SU, SH, BS, FS, Wetlands _____ > _____ feet

3. Distances from:

Open Water Body _____ feet

Drainage Way _____ feet

_____ feet

Property Line _____ feet

Drinking Water Well _____ feet

_____ feet

4. Parent Material: _____

Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

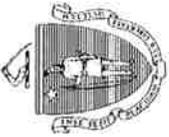
5. Groundwater Observed: Yes No

If yes: _____

Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

_____ inches _____ elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:
- Depth observed standing water in observation hole
inches
 - Depth weeping from side of observation hole
inches
 - Depth to soil redoximorphic features (mottles)
No Mottles Observed
inches
 - Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)
inches

- Obs. Hole # TP 8-9-5 Obs. Hole # _____
- inches inches
- inches inches
- inches inches
- inches inches

Index Well Number _____ Reading Date _____

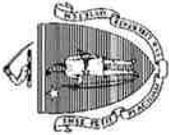
$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material
- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?
 Yes No
 - b. If yes, at what depth was it observed?
Upper boundary: 48" inches Lower boundary: 106" inches
 - c. If no, at what depth was impervious material observed?
Upper boundary: _____ inches Lower boundary: _____ inches



Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

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Signature of Soil Evaluator

Alan W. Loomis, Soil Evaluator #1405

Typed or Printed Name of Soil Evaluator / License #

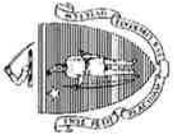
August 9, 2017

Date

June 30, 2019

Expiration Date of License

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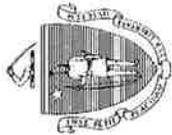


Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

SLT Construction Corporation

Owner Name

South Street

Street Address

Kingston

City

MA

State

Map 62 Lots 14 & 14-1

Map/Lot #

02364

Zip Code

B. Site Information

1. (Check one) New Construction Upgrade Repair

2. Soil Survey Available? Yes No

If yes: Web Soil Survey

Source

259B

Soil Map Unit

Carver loamy coarse sand

Soil Name

Outwash

Geologic/Parent Material

3. Surficial Geological Report Available? Yes No

Landform

If yes:

Year Published/Source

Publication Scale

Map Unit

4. Flood Rate Insurance Map

Above the 500-year flood boundary? Yes No
If Yes, continue to #5.

Within the 100-year flood boundary? Yes No

5. Within a velocity zone? Yes No

6. Within a Mapped Wetland Area? Yes No

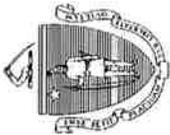
MassGIS Wetland Data Layer:

Wetland Type

7. Current Water Resource Conditions (USGS):
June 2017
Month/Year

Range: Above Normal Normal Below Normal

8. Other references reviewed:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed primary and reserve disposal area)

Deep Observation Hole Number: TP 6-7-1 Date: 6/7/17 Time: 9:30 AM Weather: Cloudy, 55 degrees

1. Location

Ground Elevation at Surface of Hole: 92.7 +/- feet Latitude/Longitude: 41 58'50.9" / 70 45'31.5"

Description of Location:

2. Land Use Gravel lot Few Surface Stones (e.g., cobbles, stones, boulders, etc.) 3-5%
(e.g., woodland, agricultural field, vacant lot, etc.)
Pine & oak

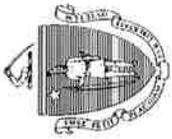
3. Distances from: Landform Position on Landscape (SU, SH, BS, FS, TS)
Vegetation Open Water Body >100' Drainage Way >100' Wetlands >100'
Property Line 40'+/- Drinking Water Well >100' Other Other
feet feet feet feet

4. Parent Material: Outwash Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 36" inches elevation 89.7 +/-



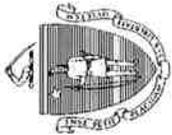
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP 6-7-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features		Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color		Percent	Gravel			
0"-6"	F/A	10YR3/3			Sandy loam	5-10%	<5%	Massive	Friable	
6"-30"	Bw	10YR4/6			Sandy loam	5-10%	<5%	Granular	Friable	
30"-108"	C1	2.5Y5/4	36"	10YR4/6 2.5Y6/2	Sand	5%	<5%	Single grain	Loose	Medium
108"-120"	C2	2.5Y5/3			Sandy loam	5%	<5%	Granular	Friable	

Additional Notes: Redoximorphic features were observed at 36" and below. Given topography and lithology and the fact that no weep or standing water was observed to a depth of 120", it is likely that the observed mottles were due to textural changes in the soil.



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____ Date: _____ Time: _____ Weather: _____

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.) _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%) _____

Vegetation

Landform

Position on Landscape (SU, SH, BS, FS, Wetlands _____)

3. Distances from:

Open Water Body _____ feet

Drainage Way _____ feet

Property Line _____ feet

Drinking Water Well _____ feet

Other _____ feet

4. Parent Material:

Unsuitable Materials Present: Yes No

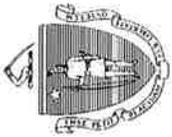
If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If yes:

Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____ inches _____ elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

- Depth observed standing water in observation hole
- Depth weeping from side of observation hole
- Depth to soil redoximorphic features (mottles)
- Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)

Obs. Hole # TP 6-7-1 _____ inches

Obs. Hole # _____ inches

Obs. Hole # _____ inches

Obs. Hole # _____ inches

Index Well Number _____ Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

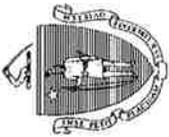
Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?
- Yes No
- b. If yes, at what depth was it observed?
- Upper boundary: _____ inches
- Lower boundary: _____ inches
- c. If no, at what depth was impervious material observed?
- Upper boundary: _____ inches
- Lower boundary: _____ inches



Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator Certification

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Signature of Soil Evaluator

June 7, 2017

Date

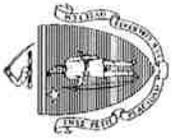
Alan W. Loomis, Soil Evaluator #1405

June 30, 2019

Expiration Date of License

Typed or Printed Name of Soil Evaluator / License #

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).



Commonwealth of Massachusetts
City/Town of Kingston

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams: