CIVIL DESIGN
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DRAINAGE REPORT

269 Broadway & 2 Osgood Street
Methuen, Massachusetts

APPLICANT:

Jowamar Companies, LLC
300 Broadway
Methuen, MA 01844

SUBMITTED TO:

City of Methuen
Searles Building
41 Pleasant Street
Methuen, MA 01844

ISSUED:

October 5, 2022

CDCI FILE #: 21-10314

DRAINAGE REPORT

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TAB 1

DRAINAGE REPORT

269 Broadway & 2 Osgood Street
Methuen, Massachusetts

PROJECT DESCRIPTION

The applicant proposes a mixed-use development located at 269 Broadway and 2 Osgood Street (Parcel ID 612-52-2 & 612-52-3) in Methuen, Massachusetts. The project includes the construction of a four-story, 8,400-SF building containing commercial space on the first level and eighteen (18) residential units on the upper levels. Other site improvement includes driveways, associated parking, utilities, landscaping, and provisions for stormwater. Project plans entitled *Site Development Plans for 269 Broadway & 2 Osgood Street*, have been prepared by this office and provided for your review. These plans illustrate the proposal in detail including zoning, construction details, utilities, and stormwater BMP's.

SITE DESCRIPTION

The total lot area of the project site is approximately 13,200-SF and provides approximately 82-FT of frontage on Broadway (Rt. 28) and 178-FT on Osgood Street. Both parcels are currently vacant. A 3000-SF single story building was previously located at 2 Osgood Street and has since been demolished. Under current conditions, the site has remnants of broken pavement and hardpan gravel areas. Elevations range from a high of approximately 87-FT at the northwestern corner of the site, at the intersection of Broadway and Osgood Street, to a low of approximately 83-FT at the southeastern corner of property. There are no on-site or nearby wetland resource areas.

According to the Natural Resource Conservation Service Soil Survey for Middlesex County, Massachusetts on-site soils consist of a Udorthents, smoothed (Hydrologic Soils Group (HSG) A) and Hinckley Loamy Sand (HSG A). Test pits were conducted by this office in May 2022 to determine soil texture and estimated seasonal high groundwater elevations. Test pit logs are provided under Tab 5 of this report. Finally, according to the Flood Insurance Rate Map for Middlesex County, Massachusetts Map Number 25009C0206F, no part of this site is located within the 100-year base flood elevation.

SURFACE DRAINAGE

Pre-Development Condition

The pre-development condition consists of two (2) watershed area contributing to two (2) design points. Design Point #1 (DP-1) receives runoff from drainage area EWA-1 and consists of overland flow discharging towards Broadway, towards the west.

Post-Development Condition

The proposed project consists of a four-story, 8,400-SF building with associated parking area. On-site infrastructure includes driveways, landscaping, drainage facilities and utilities. Drainage will be collected and routed through a series of best management practices sized to address the MADEP Stormwater Management Standards as well as the local stormwater regulations. Approximately 0.34-AC of area is anticipated to be disturbed during construction. Impervious area will include driveways, sidewalk, parking areas and roof tops which totals approximately 0.27-AC.

The proposed construction results in four (4) individual sub-watersheds contributing to two (2) design points. DP-1 receives overland flow from PWA-1 which consists of the proposed walkways and landscaped areas adjacent to Broadway.

DP-2 receives flow from PWA-2A and PWA-2B which consists of overland flow from landscaped areas, portion of the pavement area, and overflows from the infiltration trench located along the eastern edge of the parking lot.

The entire roof area is proposed to be routed into a subsurface infiltration trench located below the walkway, between the western property line and the building. The subsurface infiltration trench will store and infiltrate the entire roof runoff up to and including the 100-year, 24-hour storm event. No overflows

are anticipated for the system; however, an outlet pipe is proposed to connect to the City's drainage system in the event that a storm greater than the 100-year storm event occurs.

Peak Discharge Comparison

As illustrated in the following tables, the impact of the proposed improvements has been mitigated through the use of best management practices including the use of infiltration trenches for up to and including the 100-year, 24-hour storm event.

Design Point #1

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	50-YR (5.9-IN)	100-YR (6.5-IN)
	CFS	CFS	CFS	CFS	CFS
Pre-Development	0.06	0.11	0.13	0.15	0.17
Post-Development	0.01	0.04	0.05	0.06	0.07

Design Point #2

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	50-YR (5.9-IN)	100-YR (6.5-IN)
	CFS	CFS	CFS	CFS	CFS
Pre-Development	0.57	0.95	1.17	1.33	1.49
Post-Development	0.05	0.11	0.15	0.18	0.21

METHODOLOGY

Drainage calculations were performed using the computer program HydroCAD by HydroCAD Software Solutions, LLC based upon Technical Release 20 (TR-20), developed by the NRCS, formerly the Soils Conservation Service. Drainage calculations were prepared for the 2-YR, 10-YR, 25-YR, 50-YR, and 100-YR Type III 24-hour storm events. Rainfall data corresponds with National Weather Service Technical Paper 40 (TP-40) used in Technical Release 55 (TR-55). Curve numbers were generated using the information provided in TR-55 and the SCS Soils Survey.

TAB 2

CIVIL DESIGN
Consultants, Inc.
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PROJECT:

269 BROADWAY
& 2 OSGOOD STREET
METHUEN, MA 01844

PREPARED FOR:

JOWAMAR COMPANIES, LLC
300 BROADWAY
METHUEN, MA 01876

FIGURE 1: ORTHO

PREPARED BY: MAC
SCALE: 1"=250'
CDCI FILE #: 21-10314
DATE: JULY, 2022

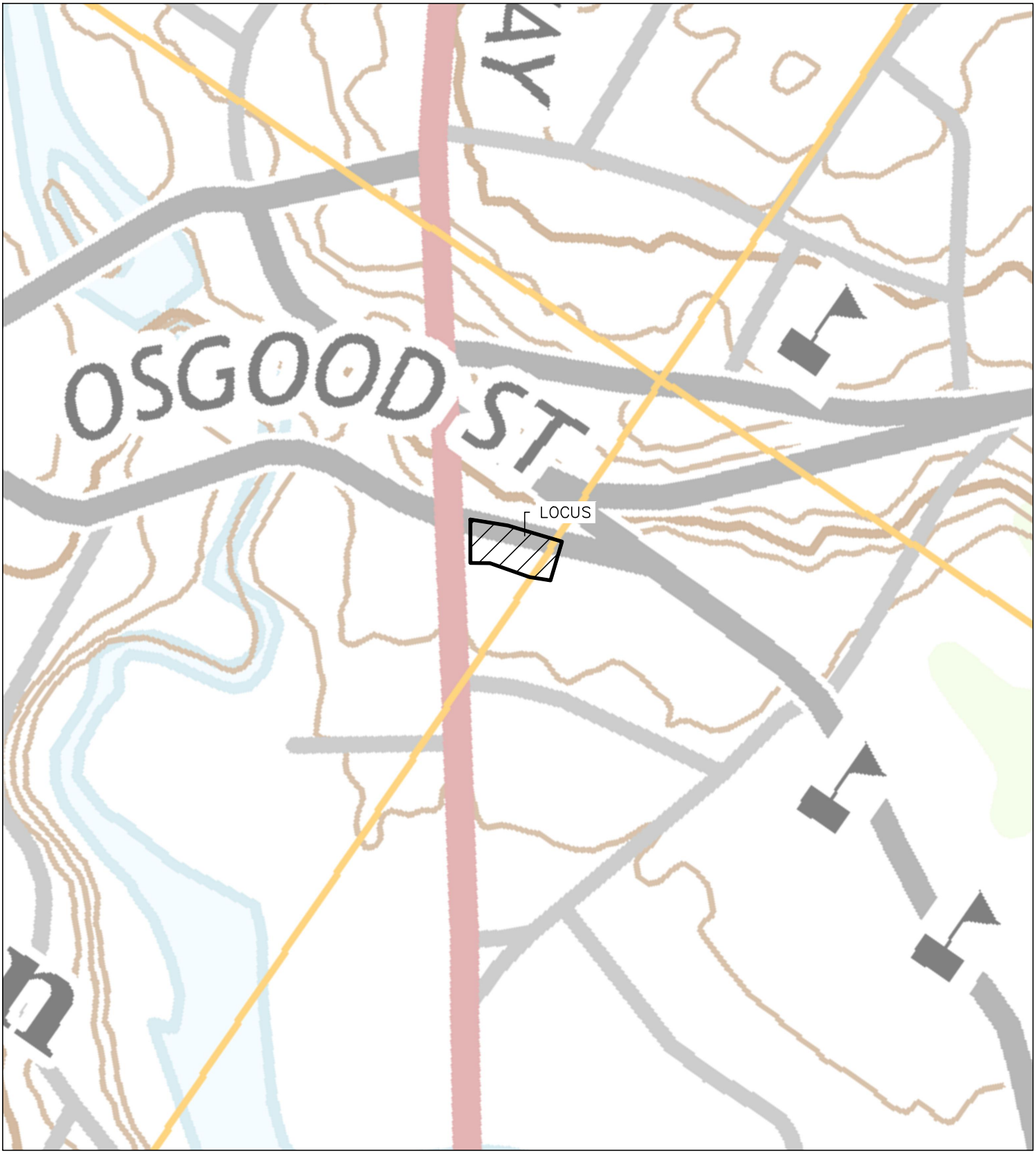

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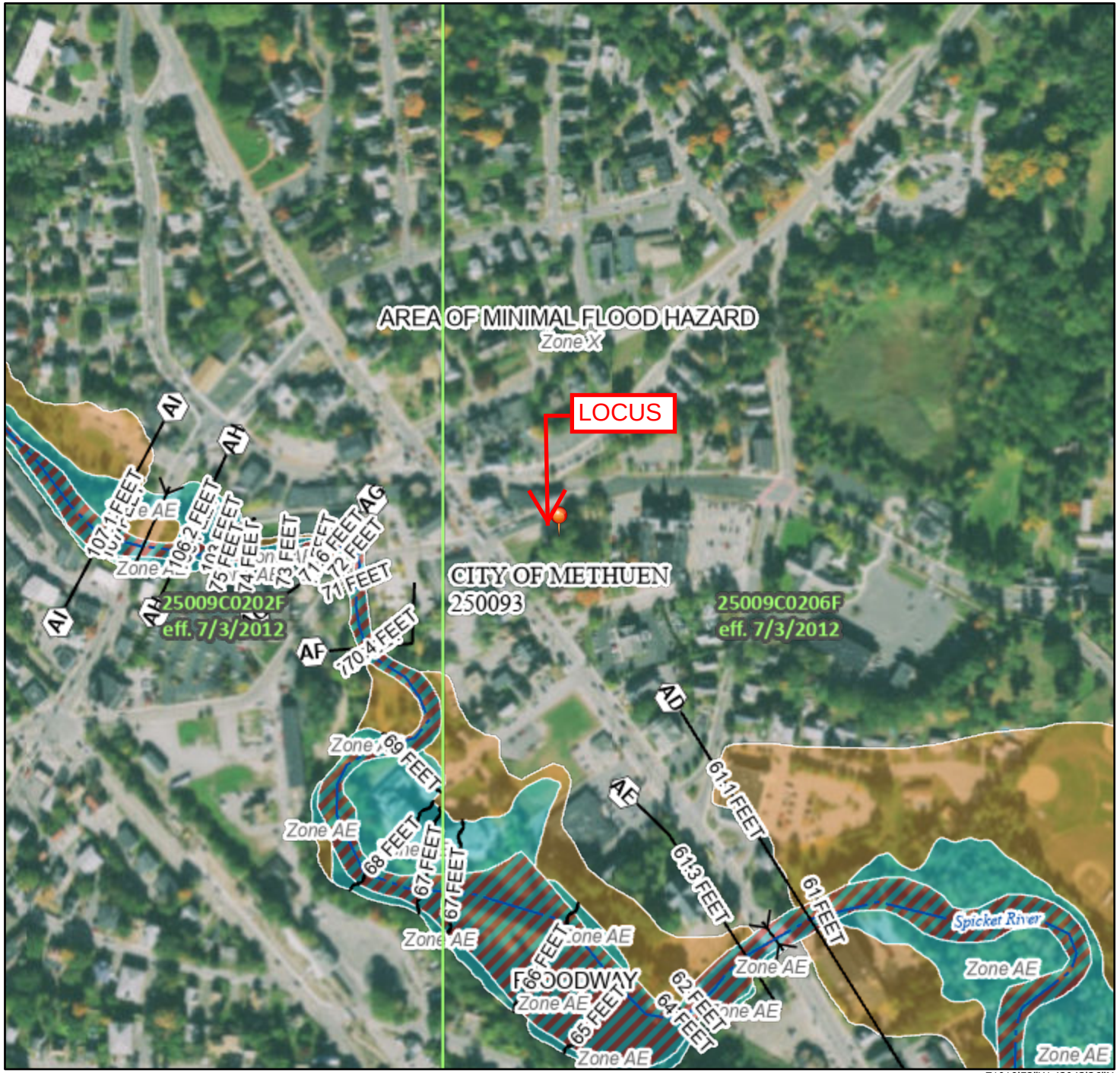
FIGURE 2: USGS MAP

PREPARED BY: MAC
SCALE: 1"=250'
CDCI FILE #: 21-10314
DATE: JULY, 2022

National Flood Hazard Layer FIRMette

FEMA

71°11'30"W 42°43'52"N



71°10'52"W 42°43'26"N

Feet

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/1/2022 at 9:49 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Map Scale: 1:3,110 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

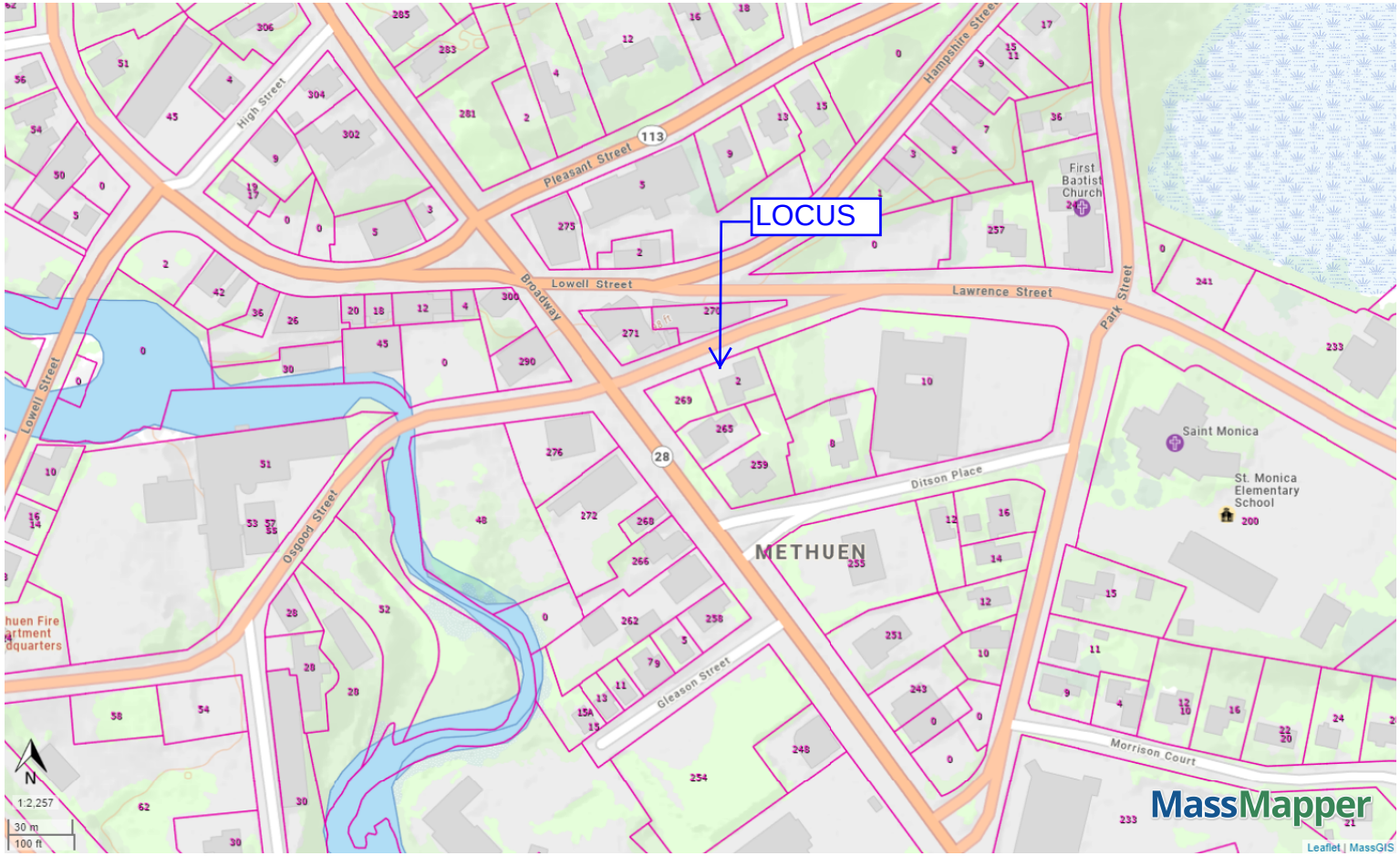
Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		0.2	0.5%
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	3.2	6.5%
67B	Leicester fine sandy loam, 3 to 8 percent slopes	A/D	0.8	1.7%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	19.1	39.3%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	1.8	3.6%
602	Urban land		1.0	2.1%
651	Udorthents, smoothed	A	11.2	23.1%
711C	Charlton-Rock outcrop-Hollis complex, 8 to 15 percent slopes	A	11.3	23.2%
Totals for Area of Interest			**48.6**	**100.0%**

Broadway/Osgood

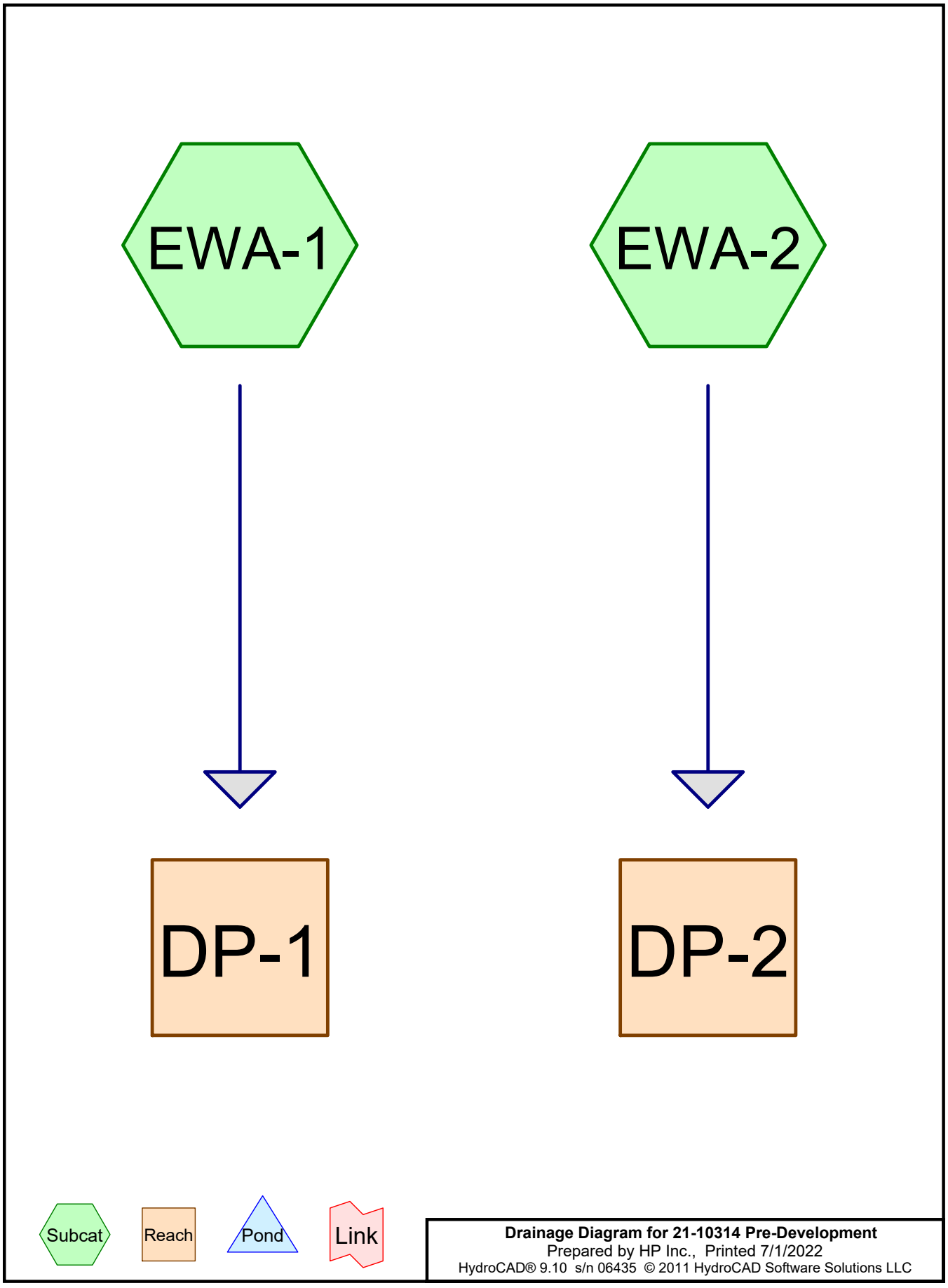


NHESP Priority Habitats of Rare Species

NHESP Estimated Habitats of Rare Wildlife

Property Tax Parcels

TAB 3



Drainage Diagram for 21-10314 Pre-Development
Prepared by HP Inc., Printed 7/1/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.30	87	Hardpan Gravel, HSG A (EWA-1, EWA-2)
0.30	87	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.30	HSG A	EWA-1, EWA-2
0.00	HSG B	
0.00	HSG C	
0.00	HSG D	
0.00	Other	
0.30		**TOTAL AREA**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: Runoff Area=0.03 ac 0.00% Impervious Runoff Depth>1.71"
Tc=6.0 min CN=87 Runoff=0.06 cfs 0.004 af

Subcatchment EWA-2: Runoff Area=0.27 ac 0.00% Impervious Runoff Depth>1.71"
Tc=6.0 min CN=87 Runoff=0.57 cfs 0.038 af

Reach DP-1: Inflow=0.06 cfs 0.004 af
Outflow=0.06 cfs 0.004 af

Reach DP-2: Inflow=0.57 cfs 0.038 af
Outflow=0.57 cfs 0.038 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.043 af Average Runoff Depth = 1.71"
100.00% Pervious = 0.30 ac 0.00% Impervious = 0.00 ac

Summary for Subcatchment EWA-1:

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af, Depth> 1.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (ac)	CN	Description
*	0.03	87	Hardpan Gravel, HSG A
	0.03		100.00% Pervious Area

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

Summary for Subcatchment EWA-2:

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.038 af, Depth> 1.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (ac)	CN	Description
*	0.27	87	Hardpan Gravel, HSG A
	0.27		100.00% Pervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.03 ac, 0.00% Impervious, Inflow Depth > 1.71" for 2-Year event
Inflow = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af
Outflow = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.27 ac, 0.00% Impervious, Inflow Depth > 1.71" for 2-Year event
Inflow = 0.57 cfs @ 12.09 hrs, Volume= 0.038 af
Outflow = 0.57 cfs @ 12.09 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: Runoff Area=0.03 ac 0.00% Impervious Runoff Depth>2.92"
Tc=6.0 min CN=87 Runoff=0.11 cfs 0.007 af

Subcatchment EWA-2: Runoff Area=0.27 ac 0.00% Impervious Runoff Depth>2.92"
Tc=6.0 min CN=87 Runoff=0.95 cfs 0.066 af

Reach DP-1: Inflow=0.11 cfs 0.007 af
Outflow=0.11 cfs 0.007 af

Reach DP-2: Inflow=0.95 cfs 0.066 af
Outflow=0.95 cfs 0.066 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.073 af Average Runoff Depth = 2.92"
100.00% Pervious = 0.30 ac 0.00% Impervious = 0.00 ac

Summary for Subcatchment EWA-1:

Runoff = 0.11 cfs @ 12.09 hrs, Volume= 0.007 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (ac)	CN	Description
*	0.03	87	Hardpan Gravel, HSG A
	0.03		100.00% Pervious Area

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

Summary for Subcatchment EWA-2:

Runoff = 0.95 cfs @ 12.09 hrs, Volume= 0.066 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (ac)	CN	Description
*	0.27	87	Hardpan Gravel, HSG A
	0.27		100.00% Pervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.03 ac, 0.00% Impervious, Inflow Depth > 2.92" for 10-Year event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 0.007 af
Outflow = 0.11 cfs @ 12.09 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.27 ac, 0.00% Impervious, Inflow Depth > 2.92" for 10-Year event
Inflow = 0.95 cfs @ 12.09 hrs, Volume= 0.066 af
Outflow = 0.95 cfs @ 12.09 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: Runoff Area=0.03 ac 0.00% Impervious Runoff Depth>3.63"
Tc=6.0 min CN=87 Runoff=0.13 cfs 0.009 af

Subcatchment EWA-2: Runoff Area=0.27 ac 0.00% Impervious Runoff Depth>3.63"
Tc=6.0 min CN=87 Runoff=1.17 cfs 0.082 af

Reach DP-1: Inflow=0.13 cfs 0.009 af
Outflow=0.13 cfs 0.009 af

Reach DP-2: Inflow=1.17 cfs 0.082 af
Outflow=1.17 cfs 0.082 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.091 af Average Runoff Depth = 3.63"
100.00% Pervious = 0.30 ac 0.00% Impervious = 0.00 ac

Summary for Subcatchment EWA-1:

Runoff = 0.13 cfs @ 12.09 hrs, Volume= 0.009 af, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (ac)	CN	Description
*	0.03	87	Hardpan Gravel, HSG A
	0.03		100.00% Pervious Area

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

Summary for Subcatchment EWA-2:

Runoff = 1.17 cfs @ 12.09 hrs, Volume= 0.082 af, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

	Area (ac)	CN	Description
*	0.27	87	Hardpan Gravel, HSG A
	0.27		100.00% Pervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.03 ac, 0.00% Impervious, Inflow Depth > 3.63" for 25-Year event
Inflow = 0.13 cfs @ 12.09 hrs, Volume= 0.009 af
Outflow = 0.13 cfs @ 12.09 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.27 ac, 0.00% Impervious, Inflow Depth > 3.63" for 25-Year event
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 0.082 af
Outflow = 1.17 cfs @ 12.09 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: Runoff Area=0.03 ac 0.00% Impervious Runoff Depth>4.17"
Tc=6.0 min CN=87 Runoff=0.15 cfs 0.010 af

Subcatchment EWA-2: Runoff Area=0.27 ac 0.00% Impervious Runoff Depth>4.17"
Tc=6.0 min CN=87 Runoff=1.33 cfs 0.094 af

Reach DP-1: Inflow=0.15 cfs 0.010 af
Outflow=0.15 cfs 0.010 af

Reach DP-2: Inflow=1.33 cfs 0.094 af
Outflow=1.33 cfs 0.094 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.104 af Average Runoff Depth = 4.17"
100.00% Pervious = 0.30 ac 0.00% Impervious = 0.00 ac

Summary for Subcatchment EWA-1:

Runoff = 0.15 cfs @ 12.09 hrs, Volume= 0.010 af, Depth> 4.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=5.90"

	Area (ac)	CN	Description
*	0.03	87	Hardpan Gravel, HSG A
	0.03		100.00% Pervious Area

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

Summary for Subcatchment EWA-2:

Runoff = 1.33 cfs @ 12.09 hrs, Volume= 0.094 af, Depth> 4.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=5.90"

	Area (ac)	CN	Description
*	0.27	87	Hardpan Gravel, HSG A
	0.27		100.00% Pervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.03 ac, 0.00% Impervious, Inflow Depth > 4.17" for 50-Year event
Inflow = 0.15 cfs @ 12.09 hrs, Volume= 0.010 af
Outflow = 0.15 cfs @ 12.09 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.27 ac, 0.00% Impervious, Inflow Depth > 4.17" for 50-Year event
Inflow = 1.33 cfs @ 12.09 hrs, Volume= 0.094 af
Outflow = 1.33 cfs @ 12.09 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWA-1: Runoff Area=0.03 ac 0.00% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=87 Runoff=0.17 cfs 0.012 af

Subcatchment EWA-2: Runoff Area=0.27 ac 0.00% Impervious Runoff Depth>4.72"
Tc=6.0 min CN=87 Runoff=1.49 cfs 0.106 af

Reach DP-1: Inflow=0.17 cfs 0.012 af
Outflow=0.17 cfs 0.012 af

Reach DP-2: Inflow=1.49 cfs 0.106 af
Outflow=1.49 cfs 0.106 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.118 af Average Runoff Depth = 4.72"
100.00% Pervious = 0.30 ac 0.00% Impervious = 0.00 ac

Summary for Subcatchment EWA-1:

Runoff = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (ac)	CN	Description
*	0.03	87	Hardpan Gravel, HSG A
	0.03		100.00% Pervious Area

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

Summary for Subcatchment EWA-2:

Runoff = 1.49 cfs @ 12.09 hrs, Volume= 0.106 af, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (ac)	CN	Description
*	0.27	87	Hardpan Gravel, HSG A
	0.27		100.00% Pervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.03 ac, 0.00% Impervious, Inflow Depth > 4.72" for 100-Year event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af
Outflow = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

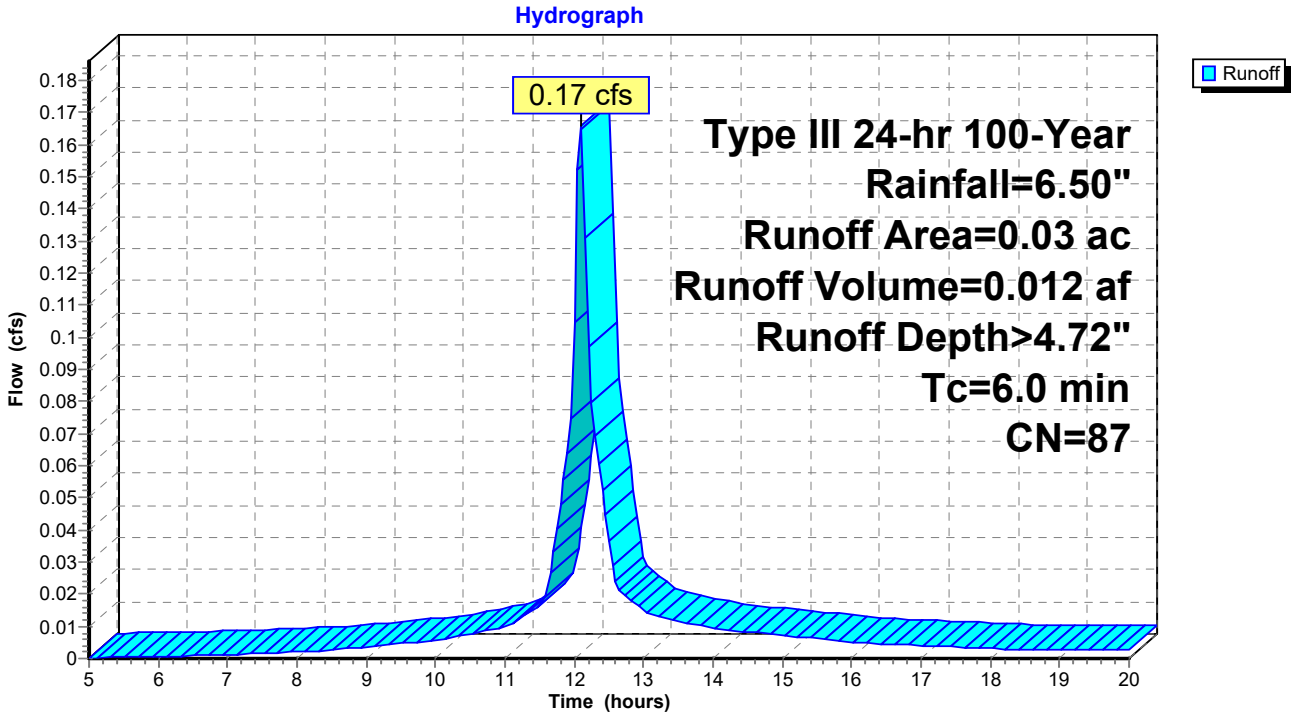
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

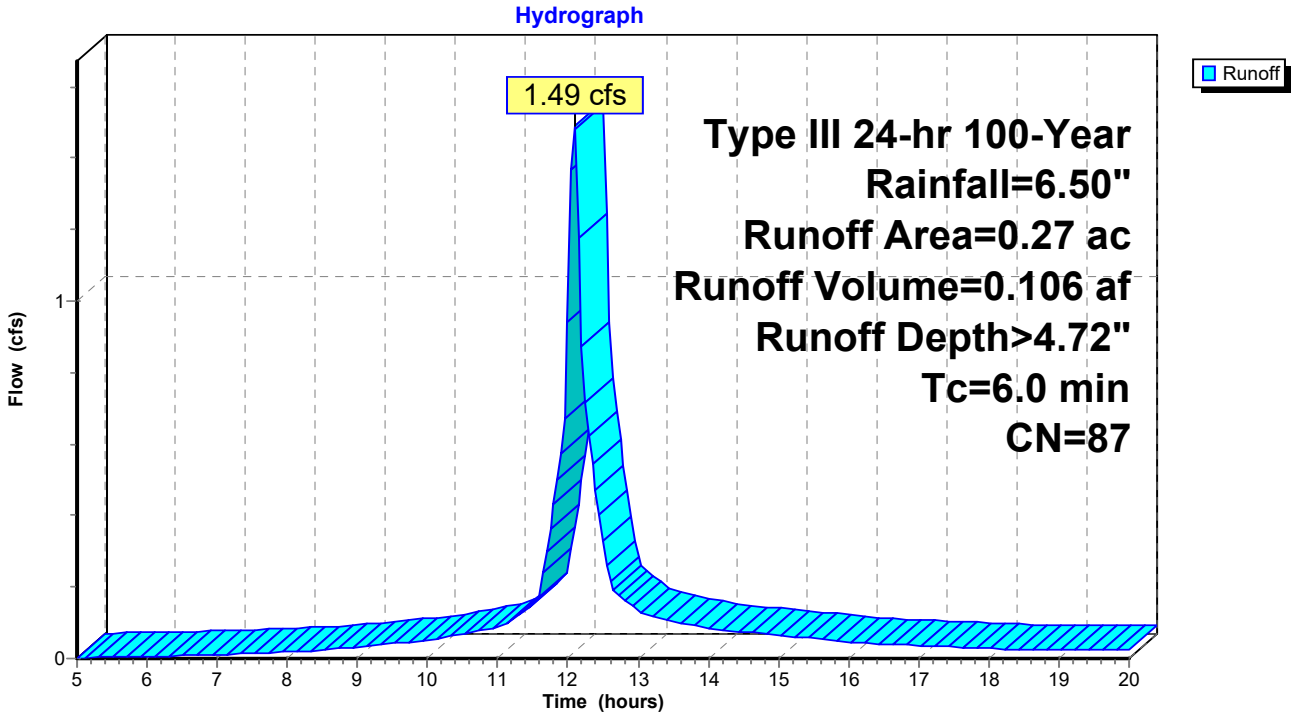
Inflow Area = 0.27 ac, 0.00% Impervious, Inflow Depth > 4.72" for 100-Year event
Inflow = 1.49 cfs @ 12.09 hrs, Volume= 0.106 af
Outflow = 1.49 cfs @ 12.09 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

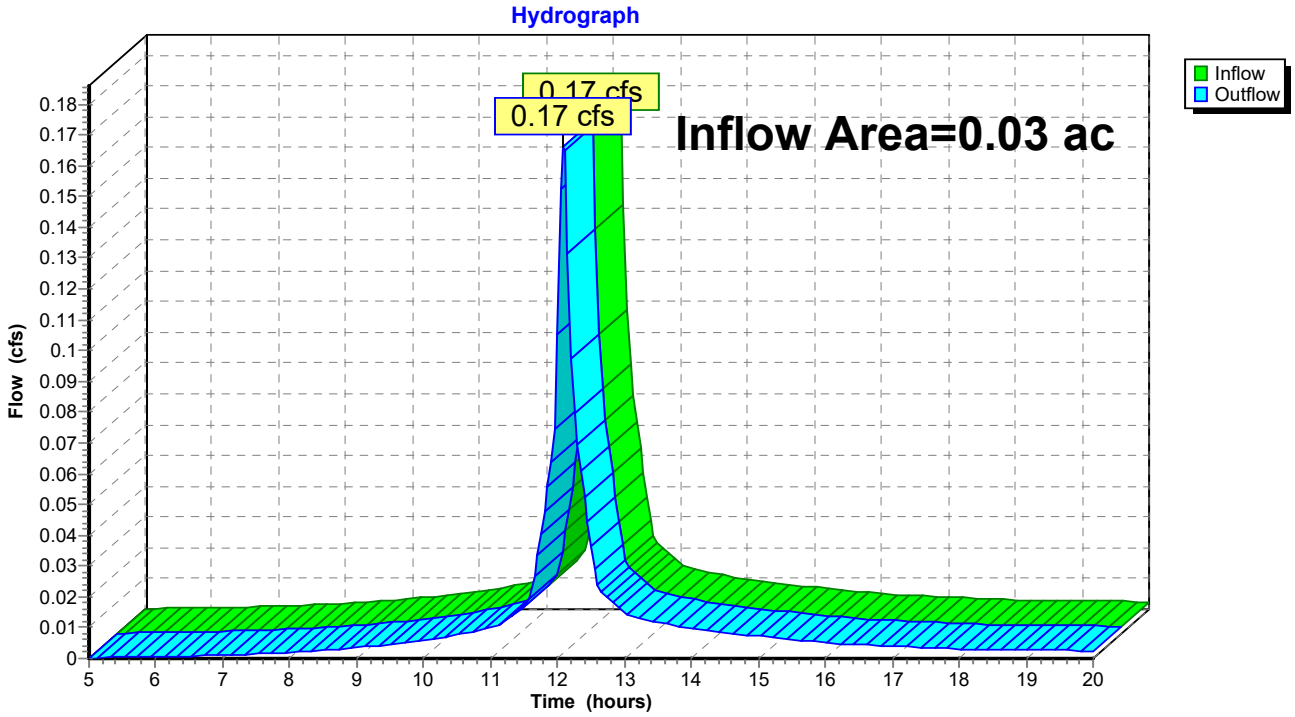
Subcatchment EWA-1:



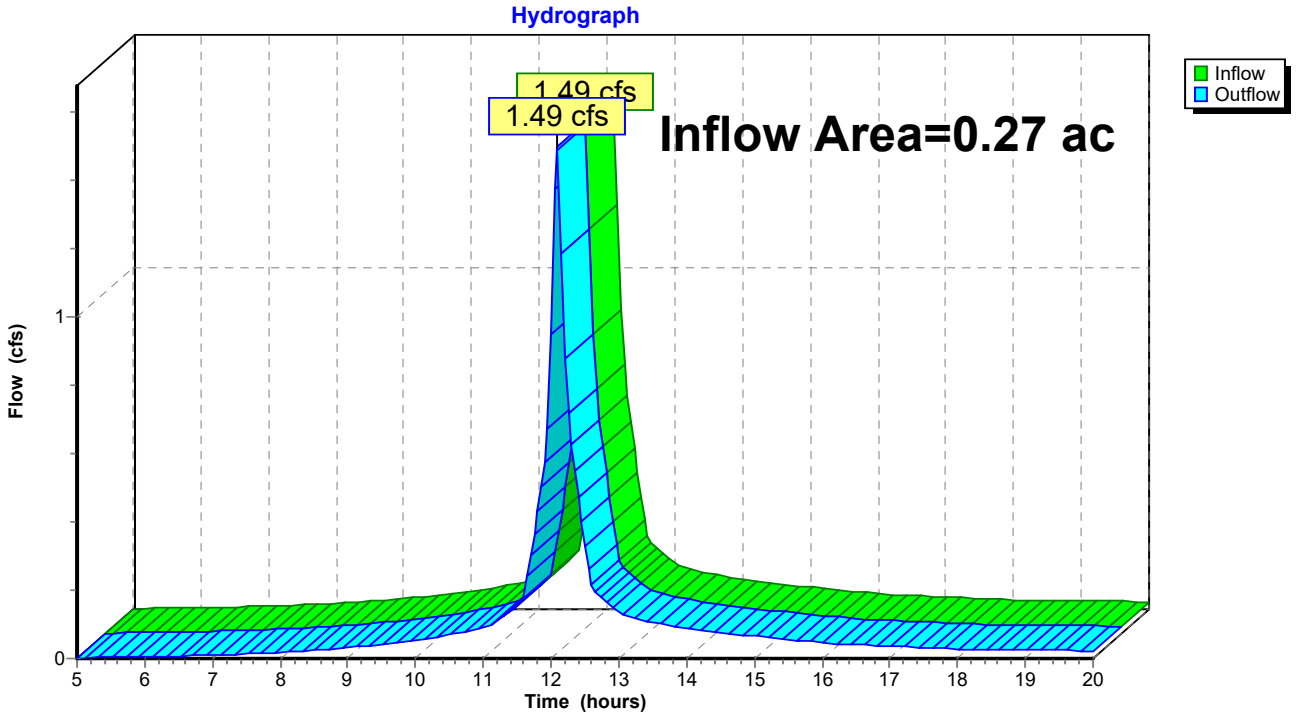
Subcatchment EWA-2:



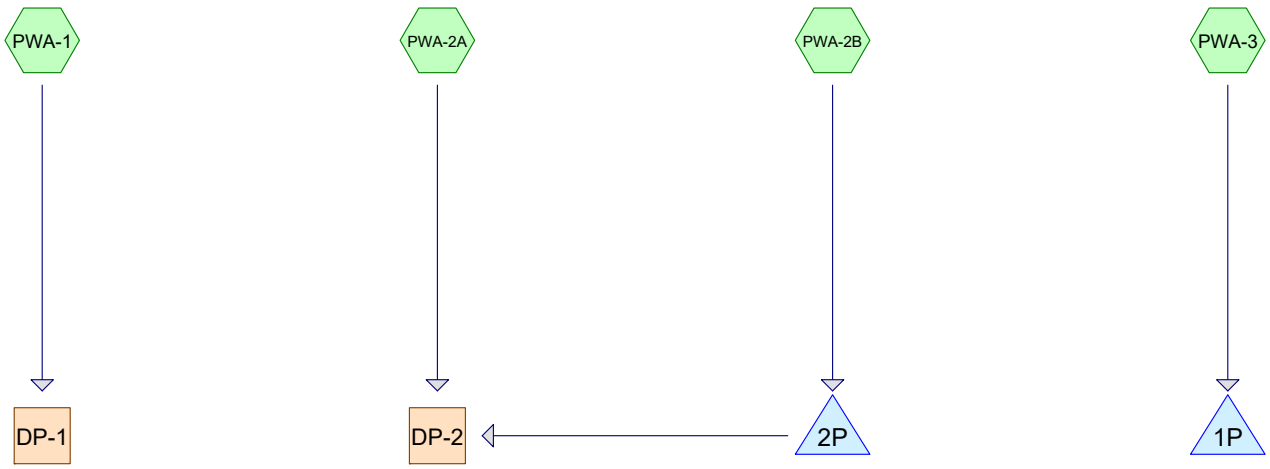
Reach DP-1:


Hydrograph
0.17 cfs
0.17 cfs
Inflow Area=0.03 ac
Inflow
Outflow
Flow (cfs)
Time (hours)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Reach DP-2:


Hydrograph
1.49 cfs
1.49 cfs
Inflow Area=0.27 ac
Inflow
Outflow
Flow (cfs)
0
1
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Time (hours)

TAB 4



Subcat Reach Pond Link

Drainage Diagram for 21-10314 Post-Development
Prepared by HP Inc., Printed 7/1/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.03	39	>75% Grass cover, Good, HSG A (PWA-1, PWA-2A)
0.08	98	Paved parking, HSG A (PWA-1, PWA-2A, PWA-2B)
0.19	98	Roofs, HSG A (PWA-3)
0.30	92	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.30	HSG A	PWA-1, PWA-2A, PWA-2B, PWA-3
0.00	HSG B	
0.00	HSG C	
0.00	HSG D	
0.00	Other	
0.30		**TOTAL AREA**

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	1P	83.30	82.70	14.0	0.0429	0.013	12.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWA-1: (new Subcat) Runoff Area=0.02 ac 50.00% Impervious Runoff Depth>0.65"
Tc=6.0 min CN=69 Runoff=0.01 cfs 0.001 af

Subcatchment PWA-2A: (new Subcat) Runoff Area=0.05 ac 60.00% Impervious Runoff Depth>0.89"
Tc=6.0 min CN=74 Runoff=0.05 cfs 0.004 af

Subcatchment PWA-2B: (new Subcat) Runoff Area=0.04 ac 100.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.009 af

Subcatchment PWA-3: (new Subcat) Runoff Area=0.19 ac 100.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=0.56 cfs 0.042 af

Reach DP-1: Inflow=0.01 cfs 0.001 af
Outflow=0.01 cfs 0.001 af

Reach DP-2: Inflow=0.05 cfs 0.004 af
Outflow=0.05 cfs 0.004 af

Pond 1P: (new Pond) Peak Elev=77.97' Storage=500 cf Inflow=0.56 cfs 0.042 af
Discarded=0.12 cfs 0.042 af Primary=0.00 cfs 0.000 af Outflow=0.12 cfs 0.042 af

Pond 2P: (new Pond) Peak Elev=81.46' Storage=69 cf Inflow=0.12 cfs 0.009 af
Discarded=0.05 cfs 0.009 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.009 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.056 af Average Runoff Depth = 2.25"
10.00% Pervious = 0.03 ac 90.00% Impervious = 0.27 ac

Summary for Subcatchment PWA-1: (new Subcat)

Runoff = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.01	98	Paved parking, HSG A
0.01	39	>75% Grass cover, Good, HSG A
0.02	69	Weighted Average
0.01		50.00% Pervious Area
0.01		50.00% Impervious Area

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

Summary for Subcatchment PWA-2A: (new Subcat)

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.03	98	Paved parking, HSG A
0.02	39	>75% Grass cover, Good, HSG A
0.05	74	Weighted Average
0.02		40.00% Pervious Area
0.03		60.00% Impervious Area

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

Summary for Subcatchment PWA-2B: (new Subcat)

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.009 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.04	98	Paved parking, HSG A
0.04		100.00% Impervious Area

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

Summary for Subcatchment PWA-3: (new Subcat)

Runoff = 0.56 cfs @ 12.09 hrs, Volume= 0.042 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (ac)	CN	Description
0.19	98	Roofs, HSG A
0.19		100.00% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.02 ac, 50.00% Impervious, Inflow Depth > 0.65" for 2-Year event
Inflow = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af
Outflow = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.09 ac, 77.78% Impervious, Inflow Depth > 0.49" for 2-Year event
Inflow = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af
Outflow = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 0.19 ac,100.00% Impervious, Inflow Depth > 2.68" for 2-Year event
Inflow = 0.56 cfs @ 12.09 hrs, Volume= 0.042 af
Outflow = 0.12 cfs @ 12.49 hrs, Volume= 0.042 af, Atten= 78%, Lag= 24.4 min
Discarded = 0.12 cfs @ 12.49 hrs, Volume= 0.042 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 77.97' @ 12.49 hrs Surf.Area= 421 sf Storage= 500 cf

Plug-Flow detention time= 27.3 min calculated for 0.042 af (100% of inflow)
Center-of-Mass det. time= 26.8 min (765.7 - 738.9)

Volume	Invert	Avail.Storage	Storage Description
#1	75.00'	1,215 cf	**Gravel (Conic)** Listed below (Recalc) 3,368 cf Overall - 329 cf Embedded = 3,039 cf x 40.0% Voids
#2	80.33'	242 cf	**24.0" D x 77.0'L Pipe Storage** Inside #1 329 cf Overall - 2.0" Wall Thickness = 242 cf
		1,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.00	421	0	0	421
76.00	421	421	421	494
77.00	421	421	842	566
78.00	421	421	1,263	639
79.00	421	421	1,684	712
80.00	421	421	2,105	785
81.00	421	421	2,526	857
82.00	421	421	2,947	930
83.00	421	421	3,368	1,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	83.30'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.30' / 82.70' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.12 cfs @ 12.49 hrs HW=77.97' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=75.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: (new Pond)

Inflow Area = 0.04 ac,100.00% Impervious, Inflow Depth > 2.68" for 2-Year event
Inflow = 0.12 cfs @ 12.09 hrs, Volume= 0.009 af
Outflow = 0.05 cfs @ 12.31 hrs, Volume= 0.009 af, Atten= 60%, Lag= 13.1 min
Discarded = 0.05 cfs @ 12.31 hrs, Volume= 0.009 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 81.46' @ 12.31 hrs Surf.Area= 99 sf Storage= 69 cf

Plug-Flow detention time= 9.4 min calculated for 0.009 af (100% of inflow)
Center-of-Mass det. time= 9.1 min (748.0 - 738.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	79.90'	151 cf	**2.21'W x 45.00'L x 4.21'H Field A** 418 cf Overall - 42 cf Embedded = 376 cf x 40.0% Voids
#2A	80.90'	32 cf	**ADS N-12 12** x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

183 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.90'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	84.10'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.05 cfs @ 12.31 hrs HW=81.46' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=79.90' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWA-1: (new Subcat) Runoff Area=0.02 ac 50.00% Impervious Runoff Depth>1.47"
Tc=6.0 min CN=69 Runoff=0.04 cfs 0.002 af

Subcatchment PWA-2A: (new Subcat) Runoff Area=0.05 ac 60.00% Impervious Runoff Depth>1.82"
Tc=6.0 min CN=74 Runoff=0.11 cfs 0.008 af

Subcatchment PWA-2B: (new Subcat) Runoff Area=0.04 ac 100.00% Impervious Runoff Depth>3.96"
Tc=6.0 min CN=98 Runoff=0.17 cfs 0.013 af

Subcatchment PWA-3: (new Subcat) Runoff Area=0.19 ac 100.00% Impervious Runoff Depth>3.96"
Tc=6.0 min CN=98 Runoff=0.82 cfs 0.063 af

Reach DP-1: Inflow=0.04 cfs 0.002 af
Outflow=0.04 cfs 0.002 af

Reach DP-2: Inflow=0.11 cfs 0.008 af
Outflow=0.11 cfs 0.008 af

Pond 1P: (new Pond) Peak Elev=80.00' Storage=842 cf Inflow=0.82 cfs 0.063 af
Discarded=0.15 cfs 0.063 af Primary=0.00 cfs 0.000 af Outflow=0.15 cfs 0.063 af

Pond 2P: (new Pond) Peak Elev=82.45' Storage=117 cf Inflow=0.17 cfs 0.013 af
Discarded=0.07 cfs 0.013 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.013 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.086 af Average Runoff Depth = 3.44"
10.00% Pervious = 0.03 ac 90.00% Impervious = 0.27 ac

Summary for Subcatchment PWA-1: (new Subcat)

Runoff = 0.04 cfs @ 12.10 hrs, Volume= 0.002 af, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.01	98	Paved parking, HSG A
0.01	39	>75% Grass cover, Good, HSG A
0.02	69	Weighted Average
0.01		50.00% Pervious Area
0.01		50.00% Impervious Area

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

Summary for Subcatchment PWA-2A: (new Subcat)

Runoff = 0.11 cfs @ 12.10 hrs, Volume= 0.008 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.03	98	Paved parking, HSG A
0.02	39	>75% Grass cover, Good, HSG A
0.05	74	Weighted Average
0.02		40.00% Pervious Area
0.03		60.00% Impervious Area

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

Summary for Subcatchment PWA-2B: (new Subcat)

Runoff = 0.17 cfs @ 12.09 hrs, Volume= 0.013 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.04	98	Paved parking, HSG A
0.04		100.00% Impervious Area

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

Summary for Subcatchment PWA-3: (new Subcat)

Runoff = 0.82 cfs @ 12.09 hrs, Volume= 0.063 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (ac)	CN	Description
0.19	98	Roofs, HSG A
0.19		100.00% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.02 ac, 50.00% Impervious, Inflow Depth > 1.47" for 10-Year event
Inflow = 0.04 cfs @ 12.10 hrs, Volume= 0.002 af
Outflow = 0.04 cfs @ 12.10 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.09 ac, 77.78% Impervious, Inflow Depth > 1.01" for 10-Year event
Inflow = 0.11 cfs @ 12.10 hrs, Volume= 0.008 af
Outflow = 0.11 cfs @ 12.10 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 0.19 ac,100.00% Impervious, Inflow Depth > 3.96" for 10-Year event
Inflow = 0.82 cfs @ 12.09 hrs, Volume= 0.063 af
Outflow = 0.15 cfs @ 12.53 hrs, Volume= 0.063 af, Atten= 82%, Lag= 26.7 min
Discarded = 0.15 cfs @ 12.53 hrs, Volume= 0.063 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 80.00' @ 12.53 hrs Surf.Area= 421 sf Storage= 842 cf

Plug-Flow detention time= 42.0 min calculated for 0.062 af (100% of inflow)
Center-of-Mass det. time= 41.3 min (777.1 - 735.8)

Volume	Invert	Avail.Storage	Storage Description
#1	75.00'	1,215 cf	**Gravel (Conic)** Listed below (Recalc) 3,368 cf Overall - 329 cf Embedded = 3,039 cf x 40.0% Voids
#2	80.33'	242 cf	**24.0" D x 77.0'L Pipe Storage** Inside #1 329 cf Overall - 2.0" Wall Thickness = 242 cf
		1,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.00	421	0	0	421
76.00	421	421	421	494
77.00	421	421	842	566
78.00	421	421	1,263	639
79.00	421	421	1,684	712
80.00	421	421	2,105	785
81.00	421	421	2,526	857
82.00	421	421	2,947	930
83.00	421	421	3,368	1,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	83.30'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.30' / 82.70' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.15 cfs @ 12.53 hrs HW=80.00' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=75.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: (new Pond)

Inflow Area = 0.04 ac,100.00% Impervious, Inflow Depth > 3.96" for 10-Year event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 0.013 af
Outflow = 0.07 cfs @ 12.32 hrs, Volume= 0.013 af, Atten= 62%, Lag= 14.3 min
Discarded = 0.07 cfs @ 12.32 hrs, Volume= 0.013 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 82.45' @ 12.32 hrs Surf.Area= 99 sf Storage= 117 cf

Plug-Flow detention time= 12.9 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 12.6 min (748.4 - 735.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	79.90'	151 cf	**2.21'W x 45.00'L x 4.21'H Field A** 418 cf Overall - 42 cf Embedded = 376 cf x 40.0% Voids
#2A	80.90'	32 cf	**ADS N-12 12** x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

183 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.90'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	84.10'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.06 cfs @ 12.32 hrs HW=82.44' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=79.90' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWA-1: (new Subcat) Runoff Area=0.02 ac 50.00% Impervious Runoff Depth>2.01"
Tc=6.0 min CN=69 Runoff=0.05 cfs 0.003 af

Subcatchment PWA-2A: (new Subcat) Runoff Area=0.05 ac 60.00% Impervious Runoff Depth>2.42"
Tc=6.0 min CN=74 Runoff=0.15 cfs 0.010 af

Subcatchment PWA-2B: (new Subcat) Runoff Area=0.04 ac 100.00% Impervious Runoff Depth>4.69"
Tc=6.0 min CN=98 Runoff=0.20 cfs 0.016 af

Subcatchment PWA-3: (new Subcat) Runoff Area=0.19 ac 100.00% Impervious Runoff Depth>4.69"
Tc=6.0 min CN=98 Runoff=0.96 cfs 0.074 af

Reach DP-1: Inflow=0.05 cfs 0.003 af
Outflow=0.05 cfs 0.003 af

Reach DP-2: Inflow=0.15 cfs 0.010 af
Outflow=0.15 cfs 0.010 af

Pond 1P: (new Pond) Peak Elev=81.04' Storage=1,049 cf Inflow=0.96 cfs 0.074 af
Discarded=0.16 cfs 0.074 af Primary=0.00 cfs 0.000 af Outflow=0.16 cfs 0.074 af

Pond 2P: (new Pond) Peak Elev=83.11' Storage=143 cf Inflow=0.20 cfs 0.016 af
Discarded=0.08 cfs 0.016 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.016 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.103 af Average Runoff Depth = 4.13"
10.00% Pervious = 0.03 ac 90.00% Impervious = 0.27 ac

Summary for Subcatchment PWA-1: (new Subcat)

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.003 af, Depth> 2.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.01	98	Paved parking, HSG A
0.01	39	>75% Grass cover, Good, HSG A
0.02	69	Weighted Average
0.01		50.00% Pervious Area
0.01		50.00% Impervious Area

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

Summary for Subcatchment PWA-2A: (new Subcat)

Runoff = 0.15 cfs @ 12.09 hrs, Volume= 0.010 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.03	98	Paved parking, HSG A
0.02	39	>75% Grass cover, Good, HSG A
0.05	74	Weighted Average
0.02		40.00% Pervious Area
0.03		60.00% Impervious Area

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

Summary for Subcatchment PWA-2B: (new Subcat)

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 0.016 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.04	98	Paved parking, HSG A
0.04		100.00% Impervious Area

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

Summary for Subcatchment PWA-3: (new Subcat)

Runoff = 0.96 cfs @ 12.09 hrs, Volume= 0.074 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
0.19	98	Roofs, HSG A
0.19		100.00% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.02 ac, 50.00% Impervious, Inflow Depth > 2.01" for 25-Year event
Inflow = 0.05 cfs @ 12.10 hrs, Volume= 0.003 af
Outflow = 0.05 cfs @ 12.10 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.09 ac, 77.78% Impervious, Inflow Depth > 1.34" for 25-Year event
Inflow = 0.15 cfs @ 12.09 hrs, Volume= 0.010 af
Outflow = 0.15 cfs @ 12.09 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 0.19 ac,100.00% Impervious, Inflow Depth > 4.69" for 25-Year event
Inflow = 0.96 cfs @ 12.09 hrs, Volume= 0.074 af
Outflow = 0.16 cfs @ 12.55 hrs, Volume= 0.074 af, Atten= 83%, Lag= 27.8 min
Discarded = 0.16 cfs @ 12.55 hrs, Volume= 0.074 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 81.04' @ 12.55 hrs Surf.Area= 421 sf Storage= 1,049 cf

Plug-Flow detention time= 49.6 min calculated for 0.074 af (100% of inflow)
Center-of-Mass det. time= 49.0 min (783.8 - 734.8)

Volume	Invert	Avail.Storage	Storage Description
#1	75.00'	1,215 cf	**Gravel (Conic)** Listed below (Recalc) 3,368 cf Overall - 329 cf Embedded = 3,039 cf x 40.0% Voids
#2	80.33'	242 cf	**24.0" D x 77.0'L Pipe Storage** Inside #1 329 cf Overall - 2.0" Wall Thickness = 242 cf
		1,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.00	421	0	0	421
76.00	421	421	421	494
77.00	421	421	842	566
78.00	421	421	1,263	639
79.00	421	421	1,684	712
80.00	421	421	2,105	785
81.00	421	421	2,526	857
82.00	421	421	2,947	930
83.00	421	421	3,368	1,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	83.30'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.30' / 82.70' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.16 cfs @ 12.55 hrs HW=81.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=75.00' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: (new Pond)

Inflow Area = 0.04 ac,100.00% Impervious, Inflow Depth > 4.69" for 25-Year event
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 0.016 af
Outflow = 0.08 cfs @ 12.32 hrs, Volume= 0.016 af, Atten= 62%, Lag= 14.2 min
Discarded = 0.08 cfs @ 12.32 hrs, Volume= 0.016 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 83.11' @ 12.32 hrs Surf.Area= 99 sf Storage= 143 cf

Plug-Flow detention time= 14.2 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 13.9 min (748.7 - 734.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	79.90'	151 cf	**2.21'W x 45.00'L x 4.21'H Field A** 418 cf Overall - 42 cf Embedded = 376 cf x 40.0% Voids
#2A	80.90'	32 cf	**ADS N-12 12** x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

183 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.90'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	84.10'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.08 cfs @ 12.32 hrs HW=83.11' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=79.90' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWA-1: (new Subcat) Runoff Area=0.02 ac 50.00% Impervious Runoff Depth>2.44"
Tc=6.0 min CN=69 Runoff=0.06 cfs 0.004 af

Subcatchment PWA-2A: (new Subcat) Runoff Area=0.05 ac 60.00% Impervious Runoff Depth>2.89"
Tc=6.0 min CN=74 Runoff=0.18 cfs 0.012 af

Subcatchment PWA-2B: (new Subcat) Runoff Area=0.04 ac 100.00% Impervious Runoff Depth>5.24"
Tc=6.0 min CN=98 Runoff=0.23 cfs 0.017 af

Subcatchment PWA-3: (new Subcat) Runoff Area=0.19 ac 100.00% Impervious Runoff Depth>5.24"
Tc=6.0 min CN=98 Runoff=1.07 cfs 0.083 af

Reach DP-1: Inflow=0.06 cfs 0.004 af
Outflow=0.06 cfs 0.004 af

Reach DP-2: Inflow=0.18 cfs 0.012 af
Outflow=0.18 cfs 0.012 af

Pond 1P: (new Pond) Peak Elev=81.69' Storage=1,211 cf Inflow=1.07 cfs 0.083 af
Discarded=0.17 cfs 0.083 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.083 af

Pond 2P: (new Pond) Peak Elev=83.62' Storage=164 cf Inflow=0.23 cfs 0.017 af
Discarded=0.09 cfs 0.017 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.017 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.116 af Average Runoff Depth = 4.66"
10.00% Pervious = 0.03 ac 90.00% Impervious = 0.27 ac

Summary for Subcatchment PWA-1: (new Subcat)

Runoff = 0.06 cfs @ 12.10 hrs, Volume= 0.004 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=5.90"

Area (ac)	CN	Description
0.01	98	Paved parking, HSG A
0.01	39	>75% Grass cover, Good, HSG A
0.02	69	Weighted Average
0.01		50.00% Pervious Area
0.01		50.00% Impervious Area

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

Summary for Subcatchment PWA-2A: (new Subcat)

Runoff = 0.18 cfs @ 12.09 hrs, Volume= 0.012 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=5.90"

Area (ac)	CN	Description
0.03	98	Paved parking, HSG A
0.02	39	>75% Grass cover, Good, HSG A
0.05	74	Weighted Average
0.02		40.00% Pervious Area
0.03		60.00% Impervious Area

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

Summary for Subcatchment PWA-2B: (new Subcat)

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 0.017 af, Depth> 5.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=5.90"

Area (ac)	CN	Description
0.04	98	Paved parking, HSG A
0.04		100.00% Impervious Area

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

Summary for Subcatchment PWA-3: (new Subcat)

Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.083 af, Depth> 5.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=5.90"

Area (ac)	CN	Description
0.19	98	Roofs, HSG A
0.19		100.00% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.02 ac, 50.00% Impervious, Inflow Depth > 2.44" for 50-Year event
Inflow = 0.06 cfs @ 12.10 hrs, Volume= 0.004 af
Outflow = 0.06 cfs @ 12.10 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.09 ac, 77.78% Impervious, Inflow Depth > 1.60" for 50-Year event
Inflow = 0.18 cfs @ 12.09 hrs, Volume= 0.012 af
Outflow = 0.18 cfs @ 12.09 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 0.19 ac,100.00% Impervious, Inflow Depth > 5.24" for 50-Year event
Inflow = 1.07 cfs @ 12.09 hrs, Volume= 0.083 af
Outflow = 0.17 cfs @ 12.56 hrs, Volume= 0.083 af, Atten= 84%, Lag= 28.5 min
Discarded = 0.17 cfs @ 12.56 hrs, Volume= 0.083 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 81.69' @ 12.56 hrs Surf.Area= 421 sf Storage= 1,211 cf

Plug-Flow detention time= 55.5 min calculated for 0.083 af (100% of inflow)
Center-of-Mass det. time= 54.9 min (789.2 - 734.2)

Volume	Invert	Avail.Storage	Storage Description
#1	75.00'	1,215 cf	**Gravel (Conic)** Listed below (Recalc) 3,368 cf Overall - 329 cf Embedded = 3,039 cf x 40.0% Voids
#2	80.33'	242 cf	**24.0" D x 77.0'L Pipe Storage** Inside #1 329 cf Overall - 2.0" Wall Thickness = 242 cf
		1,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.00	421	0	0	421
76.00	421	421	421	494
77.00	421	421	842	566
78.00	421	421	1,263	639
79.00	421	421	1,684	712
80.00	421	421	2,105	785
81.00	421	421	2,526	857
82.00	421	421	2,947	930
83.00	421	421	3,368	1,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	83.30'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.30' / 82.70' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.17 cfs @ 12.56 hrs HW=81.69' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=75.00' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: (new Pond)

Inflow Area = 0.04 ac,100.00% Impervious, Inflow Depth > 5.24" for 50-Year event
Inflow = 0.23 cfs @ 12.09 hrs, Volume= 0.017 af
Outflow = 0.09 cfs @ 12.32 hrs, Volume= 0.017 af, Atten= 62%, Lag= 14.1 min
Discarded = 0.09 cfs @ 12.32 hrs, Volume= 0.017 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 83.62' @ 12.32 hrs Surf.Area= 99 sf Storage= 164 cf

Plug-Flow detention time= 15.1 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 14.7 min (749.0 - 734.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	79.90'	151 cf	**2.21'W x 45.00'L x 4.21'H Field A** 418 cf Overall - 42 cf Embedded = 376 cf x 40.0% Voids
#2A	80.90'	32 cf	**ADS N-12 12** x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

183 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.90'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	84.10'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.09 cfs @ 12.32 hrs HW=83.61' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=79.90' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWA-1: (new Subcat) Runoff Area=0.02 ac 50.00% Impervious Runoff Depth>2.88"
Tc=6.0 min CN=69 Runoff=0.07 cfs 0.005 af

Subcatchment PWA-2A: (new Subcat) Runoff Area=0.05 ac 60.00% Impervious Runoff Depth>3.37"
Tc=6.0 min CN=74 Runoff=0.21 cfs 0.014 af

Subcatchment PWA-2B: (new Subcat) Runoff Area=0.04 ac 100.00% Impervious Runoff Depth>5.78"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.019 af

Subcatchment PWA-3: (new Subcat) Runoff Area=0.19 ac 100.00% Impervious Runoff Depth>5.78"
Tc=6.0 min CN=98 Runoff=1.18 cfs 0.092 af

Reach DP-1: Inflow=0.07 cfs 0.005 af
Outflow=0.07 cfs 0.005 af

Reach DP-2: Inflow=0.21 cfs 0.014 af
Outflow=0.21 cfs 0.014 af

Pond 1P: (new Pond) Peak Elev=82.52' Storage=1,376 cf Inflow=1.18 cfs 0.092 af
Discarded=0.19 cfs 0.091 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.091 af

Pond 2P: (new Pond) Peak Elev=84.10' Storage=183 cf Inflow=0.25 cfs 0.019 af
Discarded=0.10 cfs 0.019 af Primary=0.01 cfs 0.000 af Outflow=0.10 cfs 0.019 af

Total Runoff Area = 0.30 ac Runoff Volume = 0.130 af Average Runoff Depth = 5.19"
10.00% Pervious = 0.03 ac 90.00% Impervious = 0.27 ac

Summary for Subcatchment PWA-1: (new Subcat)

Runoff = 0.07 cfs @ 12.09 hrs, Volume= 0.005 af, Depth> 2.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.01	98	Paved parking, HSG A
0.01	39	>75% Grass cover, Good, HSG A
0.02	69	Weighted Average
0.01		50.00% Pervious Area
0.01		50.00% Impervious Area

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

Summary for Subcatchment PWA-2A: (new Subcat)

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 0.014 af, Depth> 3.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.03	98	Paved parking, HSG A
0.02	39	>75% Grass cover, Good, HSG A
0.05	74	Weighted Average
0.02		40.00% Pervious Area
0.03		60.00% Impervious Area

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

Summary for Subcatchment PWA-2B: (new Subcat)

Runoff = 0.25 cfs @ 12.09 hrs, Volume= 0.019 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.04	98	Paved parking, HSG A
0.04		100.00% Impervious Area

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

Summary for Subcatchment PWA-3: (new Subcat)

Runoff = 1.18 cfs @ 12.09 hrs, Volume= 0.092 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
0.19	98	Roofs, HSG A
0.19		100.00% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.02 ac, 50.00% Impervious, Inflow Depth > 2.88" for 100-Year event
Inflow = 0.07 cfs @ 12.09 hrs, Volume= 0.005 af
Outflow = 0.07 cfs @ 12.09 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.09 ac, 77.78% Impervious, Inflow Depth > 1.87" for 100-Year event
Inflow = 0.21 cfs @ 12.09 hrs, Volume= 0.014 af
Outflow = 0.21 cfs @ 12.09 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: (new Pond)

Inflow Area = 0.19 ac,100.00% Impervious, Inflow Depth > 5.78" for 100-Year event
Inflow = 1.18 cfs @ 12.09 hrs, Volume= 0.092 af
Outflow = 0.19 cfs @ 12.57 hrs, Volume= 0.091 af, Atten= 84%, Lag= 28.9 min
Discarded = 0.19 cfs @ 12.57 hrs, Volume= 0.091 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 82.52' @ 12.57 hrs Surf.Area= 421 sf Storage= 1,376 cf

Plug-Flow detention time= 61.3 min calculated for 0.091 af (100% of inflow)
Center-of-Mass det. time= 60.7 min (794.5 - 733.8)

Volume	Invert	Avail.Storage	Storage Description
#1	75.00'	1,215 cf	**Gravel (Conic)** Listed below (Recalc) 3,368 cf Overall - 329 cf Embedded = 3,039 cf x 40.0% Voids
#2	80.33'	242 cf	**24.0" D x 77.0'L Pipe Storage** Inside #1 329 cf Overall - 2.0" Wall Thickness = 242 cf
		1,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.00	421	0	0	421
76.00	421	421	421	494
77.00	421	421	842	566
78.00	421	421	1,263	639
79.00	421	421	1,684	712
80.00	421	421	2,105	785
81.00	421	421	2,526	857
82.00	421	421	2,947	930
83.00	421	421	3,368	1,003

Device	Routing	Invert	Outlet Devices
#1	Discarded	75.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	83.30'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 83.30' / 82.70' S= 0.0429 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.19 cfs @ 12.57 hrs HW=82.51' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=75.01' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: (new Pond)

Inflow Area = 0.04 ac,100.00% Impervious, Inflow Depth > 5.78" for 100-Year event
Inflow = 0.25 cfs @ 12.09 hrs, Volume= 0.019 af
Outflow = 0.10 cfs @ 12.30 hrs, Volume= 0.019 af, Atten= 58%, Lag= 12.8 min
Discarded = 0.10 cfs @ 12.31 hrs, Volume= 0.019 af
Primary = 0.01 cfs @ 12.30 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 84.10' @ 12.31 hrs Surf.Area= 99 sf Storage= 183 cf

Plug-Flow detention time= 15.8 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 15.4 min (749.2 - 733.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	79.90'	151 cf	**2.21'W x 45.00'L x 4.21'H Field A** 418 cf Overall - 42 cf Embedded = 376 cf x 40.0% Voids
#2A	80.90'	32 cf	**ADS N-12 12** x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

183 cf Total Available Storage

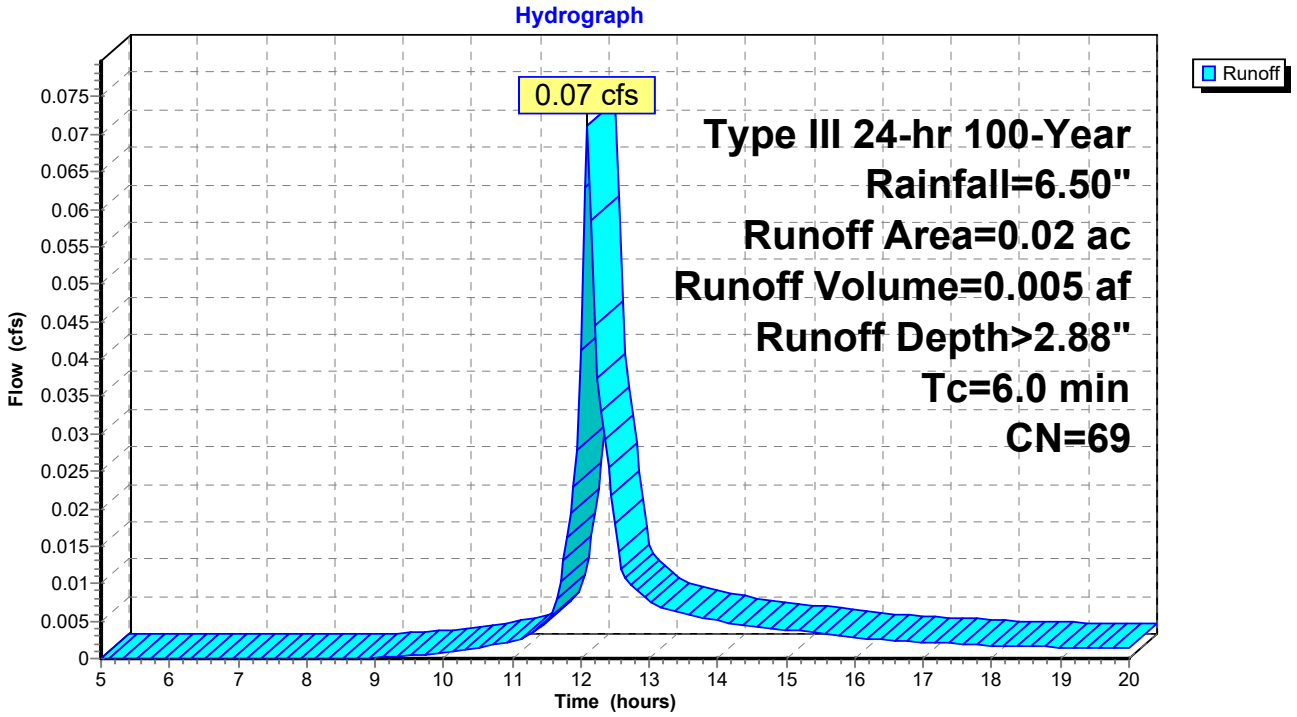
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.90'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	84.10'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

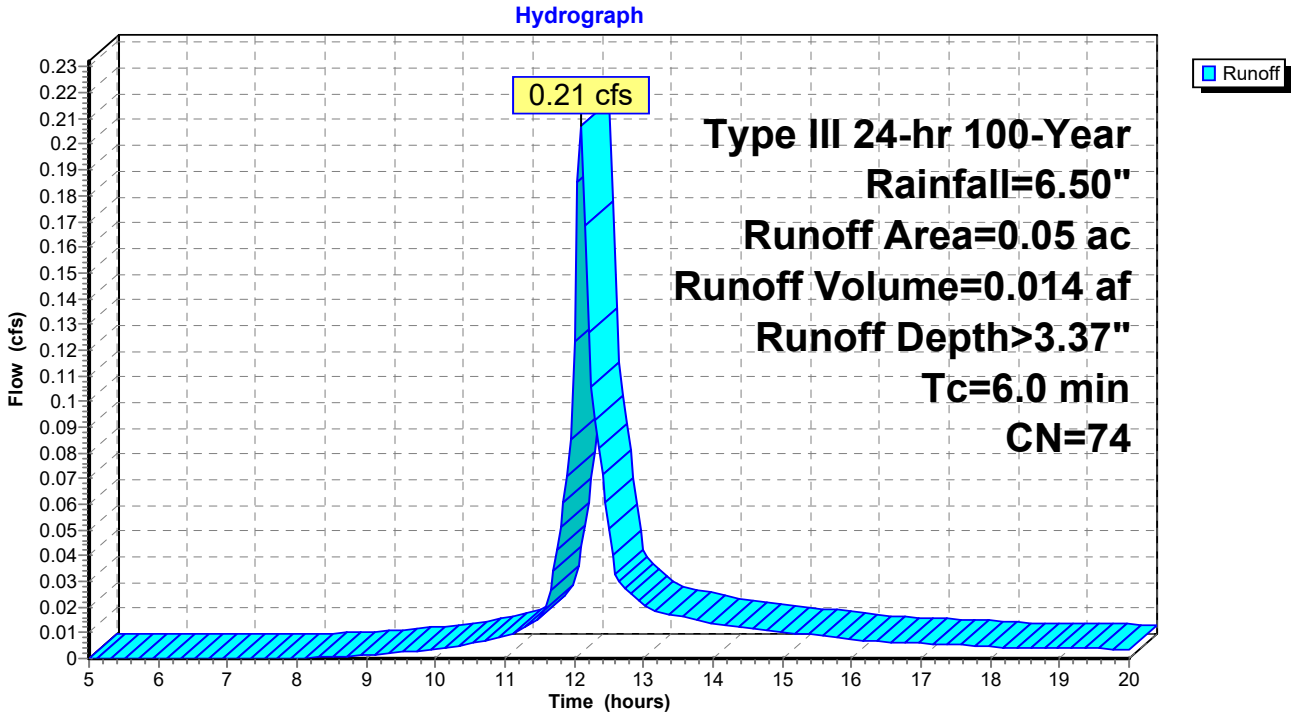
Discarded OutFlow Max=0.09 cfs @ 12.31 hrs HW=84.10' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.01 cfs @ 12.30 hrs HW=84.10' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.15 fps)

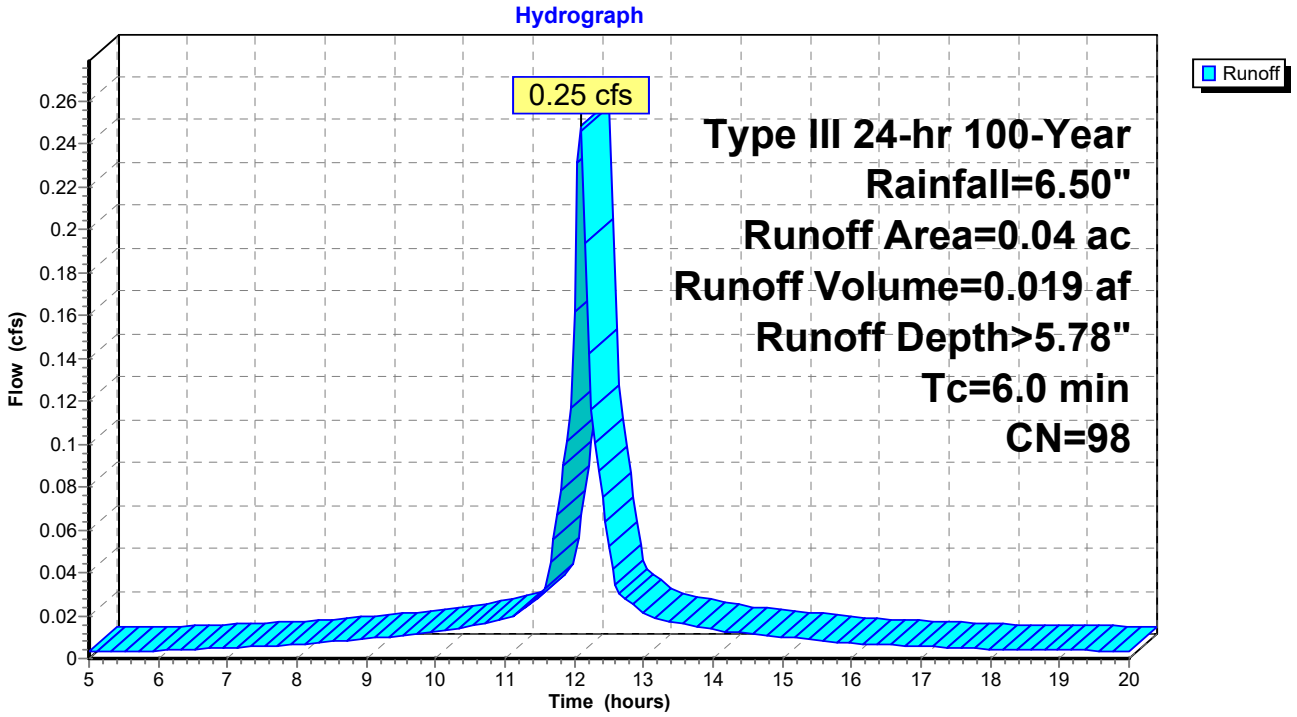
Subcatchment PWA-1: (new Subcat)



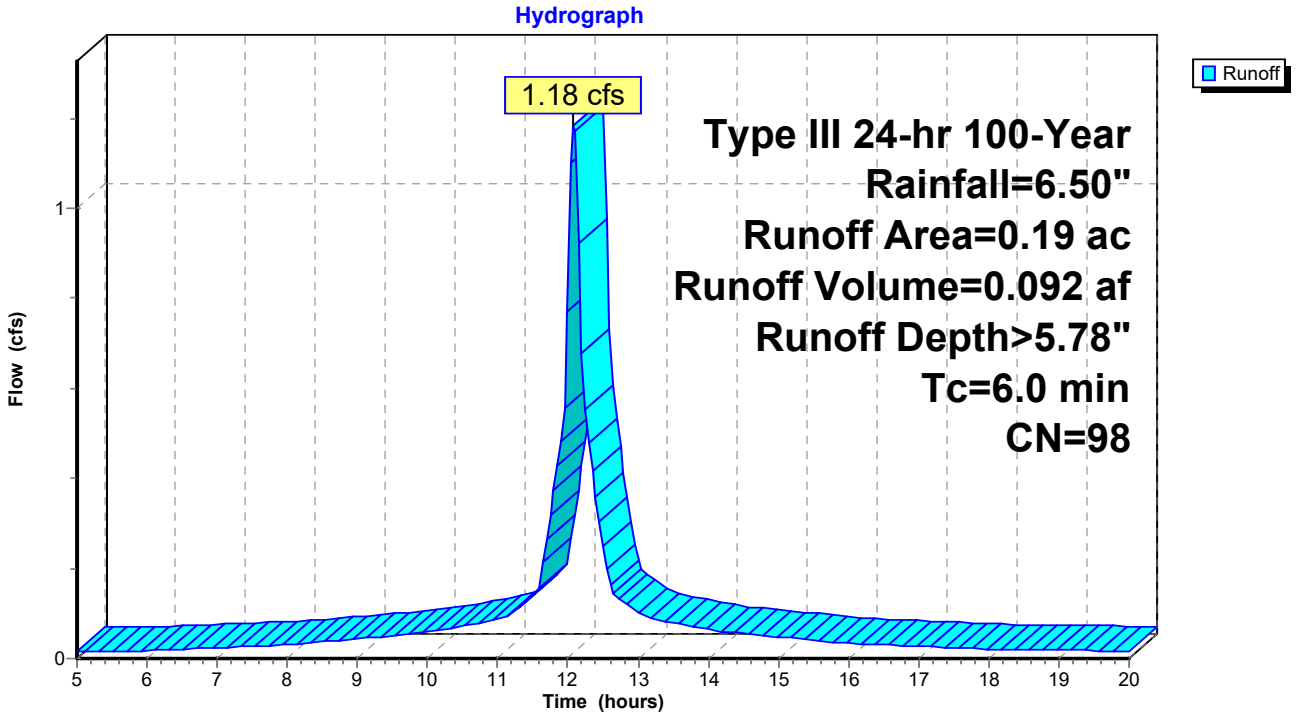
Subcatchment PWA-2A: (new Subcat)



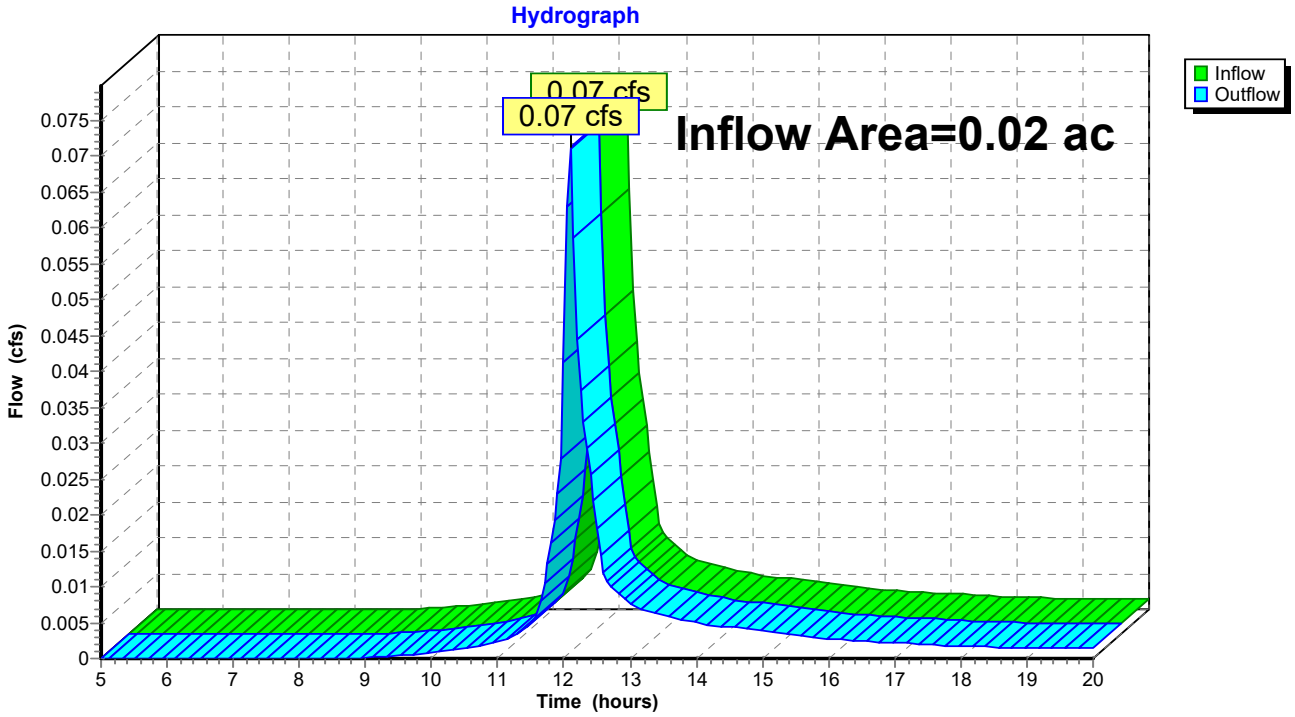
Subcatchment PWA-2B: (new Subcat)



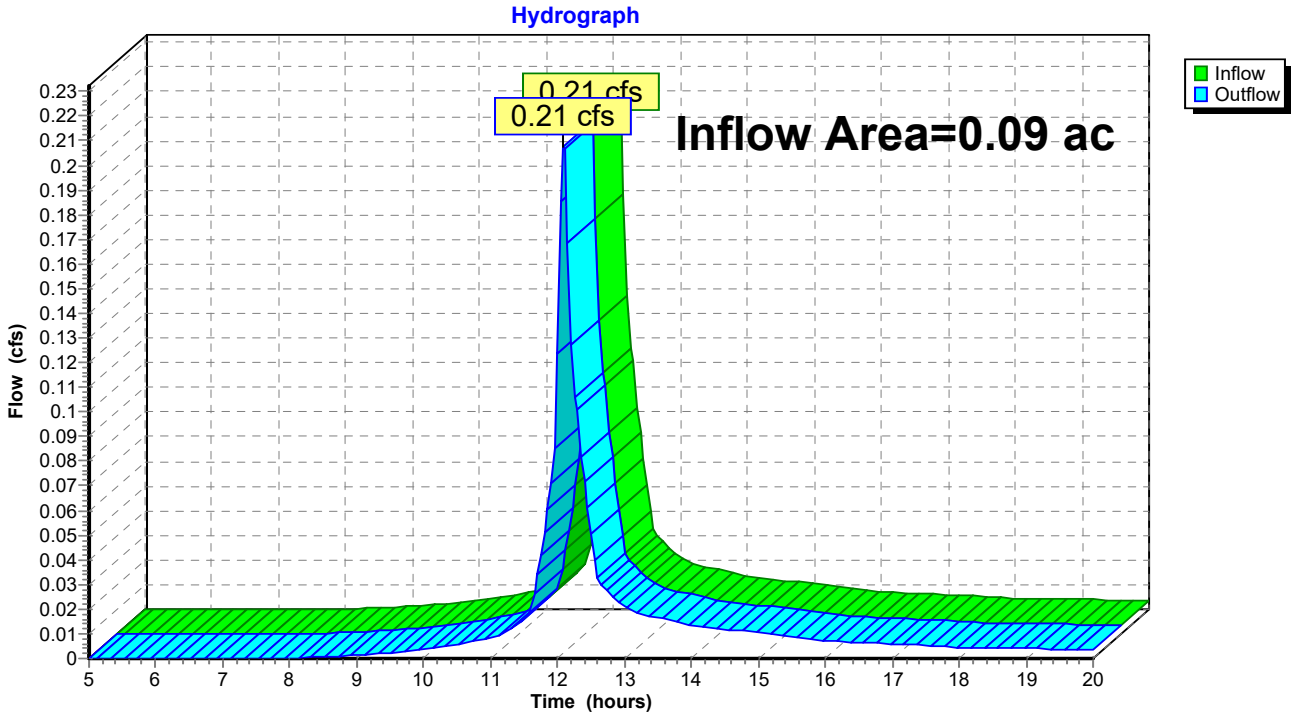
Subcatchment PWA-3: (new Subcat)



Reach DP-1:


Hydrograph
Inflow
Outflow
0.07 cfs
0.07 cfs
Inflow Area=0.02 ac
Flow (cfs)
0.075
0.07
0.065
0.06
0.055
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Time (hours)

Reach DP-2:


Hydrograph
Inflow
Outflow
0.21 cfs
0.21 cfs
Inflow Area=0.09 ac
Flow (cfs)
Time (hours)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
0.19
0.2
0.21
0.22
0.23
5
6
7
8
9
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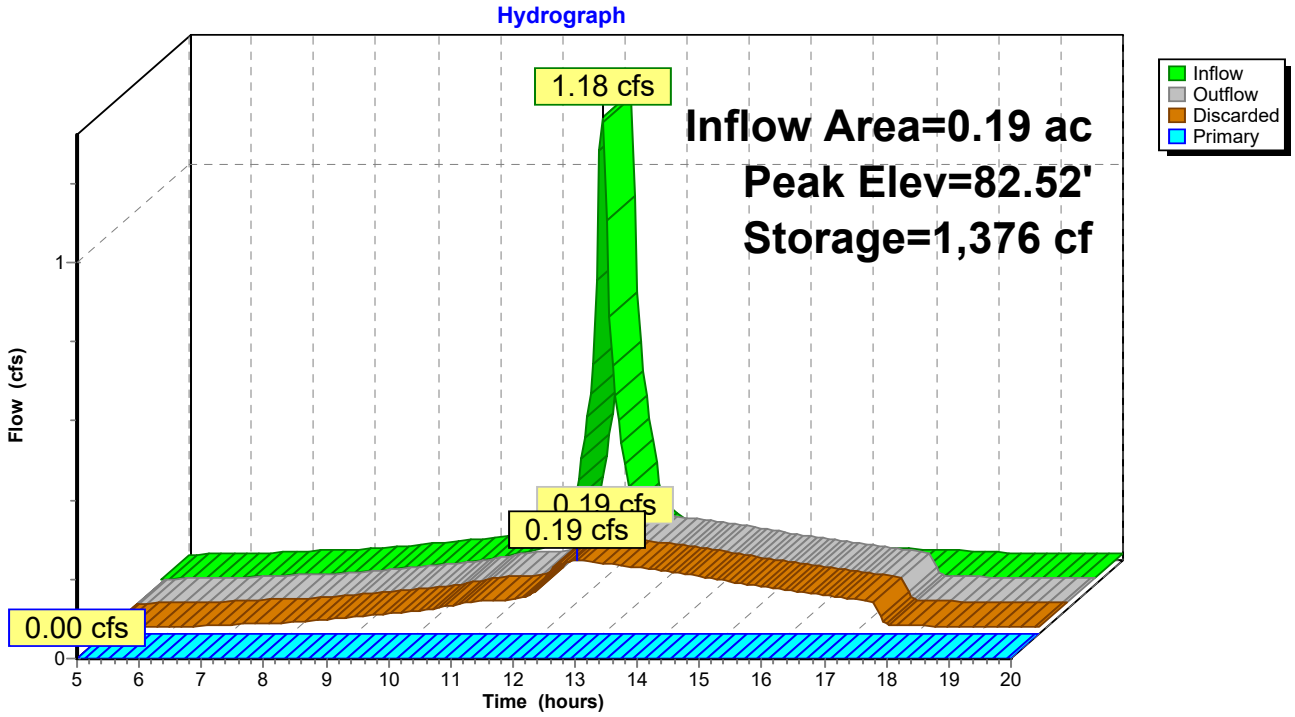
19
20

Pond 1P: (new Pond)



Pond 2P: (new Pond) - Chamber Wizard Field A

Chamber Model = ADS N-12 12
Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf
Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 0.0" Spacing = 14.5" C-C

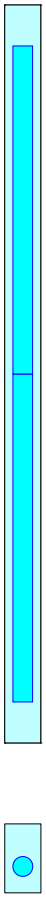
2 Chambers/Row x 20.00' Long = 40.00' + 30.0" End Stone x 2 = 45.00' Base Length
1 Rows x 14.5" Wide + 6.0" Side Stone x 2 = 2.21' Base Width
12.0" Base + 14.5" Chamber Height + 24.0" Cover = 4.21' Field Height

2 Chambers x 16.2 cf = 32.4 cf Chamber Storage
2 Chambers x 20.9 cf = 41.9 cf Displacement

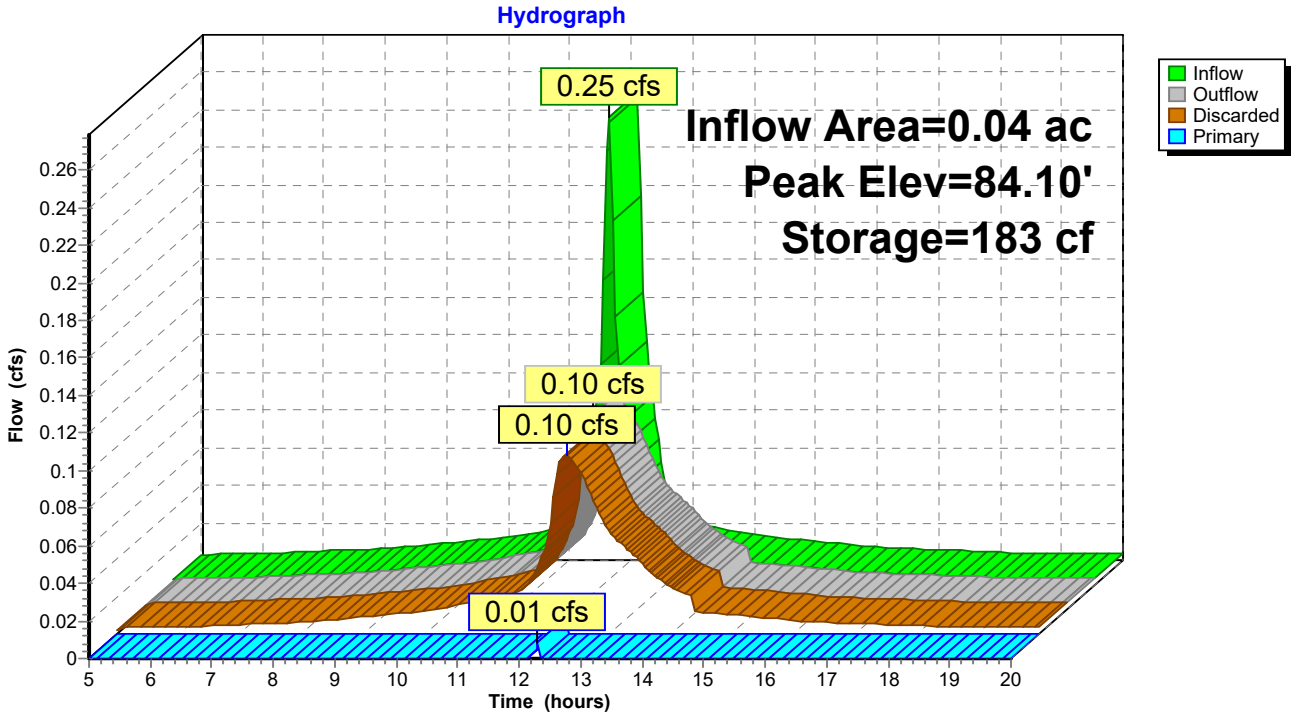
418.4 cf Field - 41.9 cf Chambers = 376.5 cf Stone x 40.0% Voids = 150.6 cf Stone Storage

Stone + Chamber Storage = 183.0 cf = 0.004 af

2 Chambers
15.5 cy Field
13.9 cy Stone



Pond 2P: (new Pond)



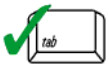
TAB 5

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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 8[2]
- 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.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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.

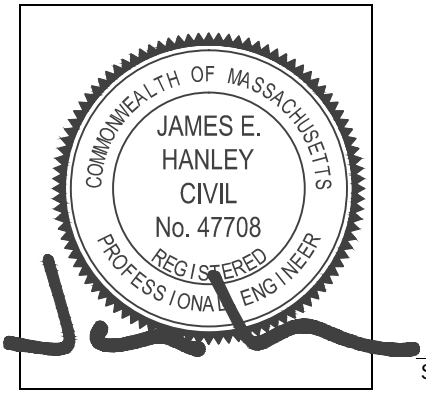
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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



7-1-22

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 Trench

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Project: 269 Broadway/2 Osgood
Location: Methuen, MA
Client: Jowamar Companies

Project Number: 21-10314
Prepared By: MAC
Date: July 1, 2022

STORMWATER MANAGEMENT STANDARDS CALCULATIONS

Standard 1: Stormwater Discharge

Conclusion: This project does not propose any new untreated stormwater discharges. The Stormwater Management System conforms to Standard 1.

Standard 2: Peak Discharge Summary

Design Point 1 (To Boardway)	2-Year (3.2-IN)	10-Year (4.5-IN)	25-Year (5.3-IN)	50-Year (5.9-IN)	100-Year (6.5-IN)
Pre-Development Conditions:	0.06	0.11	0.13	0.15	0.17
Post Development Conditions:	0.01	0.04	0.05	0.06	0.07

Design Point 2 (Off-Site)	2-Year (3.2-IN)	10-Year (4.5-IN)	25-Year (5.3-IN)	50-Year (5.9-IN)	100-Year (6.5-IN)
Pre-Development Conditions:	0.57	0.95	1.17	1.33	1.49
Post Development Conditions:	0.05	0.11	0.15	0.18	0.21

Conclusion: The Stormwater Management System conforms to Standard 2.

Standard 3: Recharge Calculations (Static Method)

Infiltration Trench (24" Perf. Pipe)

Hydrologic Soils Group:	A	B	C	D	
Total Proposed Impervious Area:	0.19	0.00	0.00	0.00	0.19 AC
Target Factor:	0.60	0.35	0.25	0.10	
Required Recharge Volume:	414	0	0	0	414 CF

Volume Below Lowest Outlet:	**1,457**	CF
Elevation of Lowest Invert:	83.30	FT

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate):	8.27	IN/HR
Bottom Area of Infiltration Trench:	421	SF
Drawdown Time:	**5.0**	HRS

Standard 6: Critical Areas

Conclusion: The proposal is not located within a Critical Area. This Standard is NOT Applicable.

Standard 7: Redevelopment

Conclusion: The project is not considered a redevelopment project. This Standard is NOT Applicable.

Standard 8: Construction Period Controls

Conclusion: An Operation and Maintenance Plan addressing construction period pollution prevention measures to reduce the potential for erosion and sedimentation is attached to this report. The Stormwater Management System Conforms to Standard 8.

Standard 9: Operations and Maintenance Plan

Conclusion: An Operations and Maintenance Plan has been prepared and provided with this summary. The Stormwater Management System Conforms to Standard 9.

Standard 10: Illicit Discharges to Drainage System

Conclusion: All off-site discharges are comprised entirely of stormwater. The Stormwater Management System Conforms to Standard 10.

Infiltration Trench (12" Perf. Pipe)

Hydrologic Soils Group:	A	B	C	D		
Total Proposed Impervious Area:	0.04	0.00	0.00	0.00	0.04	AC
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	87	0	0	0	87	CF

Volume Below Lowest Outlet:	**183**	CF
Elevation of Lowest Invert:	84.10	FT

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate):	8.27	IN/HR
Bottom Area of Infiltration Basin:	100	SF
Drawdown Time:	**2.7**	HRS

Conclusion: The volume provided below the lowest invert in the infiltration systems exceed the minimum recharge volume required for the pond. In addition, each system drains within 72-HRS. The Stormwater Management System conforms to Standard 3.

Standard 4: Water Quality Volume Calculations

Infiltration Trench (24" Perf. Pipe)

Water Quality Depth:	1.0	IN
Total Proposed Impervious Area:	0.19	AC
Required Water Quality Volume:	690	CF
Provided Water Quality Volume:	**1,457**	CF

Infiltration Trench (12" Perf. Pipe)

Water Quality Depth:	1.0	IN
Total Proposed Impervious Area:	0.04	AC
Required Water Quality Volume:	145	CF
Provided Water Quality Volume:	**183**	CF

TSS Removal Rate Calculations

Treatment Provided From Infiltration Trench

	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Street Sweeping:	5%	1.00	0.05	0.95
Infiltration Trench	80%	0.95	0.76	0.19
TSS Removed:				81.0%

Conclusion: The volume provided within all proposed stormwater systems exceeds the Water Quality Volume, and the Weighted Average TSS Removal Rate exceeds 80%.

Standard 5: Land Uses With Higher Potential Pollutant Loads

Conclusion: The proposed use is not considered a Land Use with Higher Potential Pollutant Loads. This Standard is NOT Applicable.

Stage-Area-Storage for Pond 1P: (new Pond)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
75.00	421	0
75.10	428	17
75.20	436	34
75.30	443	51
75.40	450	67
75.50	457	84
75.60	465	101
75.70	472	118
75.80	479	135
75.90	486	152
76.00	494	168
76.10	501	185
76.20	508	202
76.30	516	219
76.40	523	236
76.50	530	253
76.60	537	269
76.70	545	286
76.80	552	303
76.90	559	320
77.00	566	337
77.10	574	354
77.20	581	370
77.30	588	387
77.40	596	404
77.50	603	421
77.60	610	438
77.70	617	455
77.80	625	472
77.90	632	488
78.00	639	505
78.10	646	522
78.20	654	539
78.30	661	556
78.40	668	573
78.50	676	589
78.60	683	606
78.70	690	623
78.80	697	640
78.90	705	657
79.00	712	674
79.10	719	690
79.20	726	707
79.30	734	724
79.40	741	741
79.50	748	758
79.60	756	775
79.70	763	791
79.80	770	808
79.90	777	825
80.00	785	842
80.10	792	859
80.20	799	875
80.30	806	889
80.40	814	905
80.50	821	924
80.60	828	946
80.70	836	968
80.80	843	991
80.90	850	1,015
81.00	857	1,039
81.10	865	1,064
81.20	872	1,089
81.30	879	1,114
81.40	887	1,139
81.50	894	1,164
81.60	901	1,188
81.70	908	1,213
81.80	916	1,237
81.90	923	1,261
82.00	930	1,283
82.10	937	1,305
82.20	945	1,326
82.30	952	1,344
82.40	959	1,358
82.50	967	1,373
82.60	974	1,390
82.70	981	1,407
82.80	988	1,424
82.90	996	1,441
83.00	**1,003**	**1,457**
83.10	1,003	1,457
83.20	1,003	1,457
83.30	1,003	1,457
83.40	1,003	1,457
83.50	1,003	1,457
83.60	1,003	1,457
83.70	1,003	1,457
83.80	1,003	1,457
83.90	1,003	1,457
84.00	1,003	1,457
84.10	1,003	1,457
84.20	1,003	1,457
84.30	1,003	1,457

Stage-Area-Storage for Pond 2P: (new Pond)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
79.90	99	0
79.95	104	2
80.00	109	4
80.05	114	6
80.10	118	8
80.15	123	10
80.20	128	12
80.25	132	14
80.30	137	16
80.35	142	18
80.40	147	20
80.45	151	22
80.50	156	24
80.55	161	26
80.60	165	28
80.65	170	30
80.70	175	32
80.75	180	34
80.80	184	36
80.85	189	38
80.90	194	40
80.95	199	42
81.00	203	43
81.05	208	45
81.10	213	48
81.15	217	50
81.20	222	53
81.25	227	56
81.30	232	59
81.35	236	62
81.40	241	65
81.45	246	68
81.50	250	71
81.55	255	74
81.60	260	78
81.65	265	81
81.70	269	84
81.75	274	87
81.80	279	90
81.85	284	92
81.90	288	95
81.95	293	98
82.00	298	100
82.05	302	101
82.10	307	103
82.15	312	105
82.20	317	107
82.25	321	109
82.30	326	111
82.35	331	113
82.40	335	115
82.45	340	117
82.50	345	119

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
82.55	350	121
82.60	354	123
82.65	359	125
82.70	364	127
82.75	368	129
82.80	373	131
82.85	378	133
82.90	383	135
82.95	387	137
83.00	392	139
83.05	397	141
83.10	402	143
83.15	406	145
83.20	411	147
83.25	416	149
83.30	420	151
83.35	425	153
83.40	430	155
83.45	435	157
83.50	439	159
83.55	444	161
83.60	449	163
83.65	453	165
83.70	458	167
83.75	463	169
83.80	468	171
83.85	472	173
83.90	477	175
83.95	482	177
84.00	487	179
84.05	491	181
84.10	**496**	**183**

269 BROADWAY

Commonwealth of Massachusetts
City/Town of METHUEN

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-1 (Hole #) | 5/25/22 (Date) | ____ (Time) | 70 - CLEAR (Weather) | ____ (Latitude) | ____ (Longitude)

1. Land Use: VACANT LOT (e.g., woodland, agricultural field, vacant lot, etc.) | NONE (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5 (Slope (%))

Description of Location: ____

2. Soil Parent Material: OUTWASH | ____ (Landform) | ____ (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body ____ feet | Drainage Way ____ feet | Wetlands ____ feet | Property Line >10 feet | Drinking Water Well ____ feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ____ Depth to Weeping in Hole ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-48	FILL				Cnc : Dpl:						
48-84	C	SAND	10YR 6/4	—	Cnc : Dpl:	—	—	—	SINGLE GRAIN	LOOSE	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: TEST PITS FOR DRAINAGE ANALYSIS ONLY - NO MOTTLING OBS.

Commonwealth of Massachusetts
City/Town of METHUEN

269 BROADWAY

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-2 (Hole #) | 5/25/22 (Date) | Time | 70- CLEAR (Weather) | Latitude | Longitude

1. Land Use: VACANT LOT (e.g., woodland, agricultural field, vacant lot, etc.) | NONE (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5 (Slope (%))

Description of Location:

2. Soil Parent Material: OUTWASH | Landform | Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from: Open Water Body — feet | Drainage Way — feet | Wetlands — feet
Property Line >10 feet | Drinking Water Well — feet | Other — feet

4. Unsuitable Materials Present: [X] Yes [ ] No If Yes: [X] Disturbed Soil/Fill Material [ ] Weathered/Fractured Rock [ ] Bedrock

5. Groundwater Observed: [ ] Yes [X] No If yes: — Depth to Weeping in Hole ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-96	FILL	—	—	—	Cnc : Dpl:	—	—	—	—	—	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: EXCAVATOR COULD NOT DIG PAST 96"

Commonwealth of Massachusetts
City/Town of METHUEN

269 BROADWAY

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-3 (Hole #) | 5/25/22 (Date) | ____ (Time) | 70 - CLEAR (Weather) | ____ (Latitude) | ____ (Longitude)

1. Land Use: VACANT LOT (e.g., woodland, agricultural field, vacant lot, etc.) | NONE (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5 (Slope (%))

Description of Location: ____

2. Soil Parent Material: OUTWASH | ____ (Landform) | ____ (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body ____ feet | Drainage Way ____ feet | Wetlands ____ feet
Property Line >10 feet | Drinking Water Well ____ feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ____ Depth to Weeping in Hole ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-96	FILL				Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: EXCAVATOR COULD NOT DIG PAST 96"

LONG TERM OPERATIONS AND MAINTENANCE PROGRAM

July 6, 2022

This Long-Term Operations and Maintenance Program Plan has been prepared in accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (DEP) for the proposed mixed-use development located at 269 Broadway and 2 Osgood Street (Parcel ID 612-52-2 & 612-52-3) in Methuen, Massachusetts. Upon a period beginning twelve months after the completion of the parking lot, all structural BMP's shall be inspected twice annually, once in April and once in November. The inspection shall be performed as indicated below:

Street Sweeping

Street sweeping can be an effective method to reduce pollutant loading in runoff generated from pavement. Street sweeping shall be performed quarterly, using a high frequency vacuum sweeper or regenerative air sweeper, with sweeping scheduled primarily in the spring and fall.

Snow Storage / Removal

Snow shall be plowed from the roadway/parking area, and if conditions arise where snow storage areas are at capacity, the Operator is required to remove and dispose of snow off site in conformance with all local, state and federal regulations.

Infiltration Trench

Infiltration trenches are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Inspections and preventive maintenance must be performed at least twice a year. Remove accumulated sediment, trash, debris, leaves and grass clippings from mowing. Inspect the infiltration trench after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months. To address surface clogging, remove and replace the topsoil or first layer of stone aggregate and the filter fabric.

Owner / Responsible Party (During and After Construction):

JoWaMar Companies LLC (c/o Johan Lopez)
300 Broadway
Methuen, MA 01844

System Map:

See Site Development Plans for 269 Broadway and 2 Osgood Street, TMethuen, MA, for the location of all stormwater management facilities.

Estimated Operations and Maintenance Budget

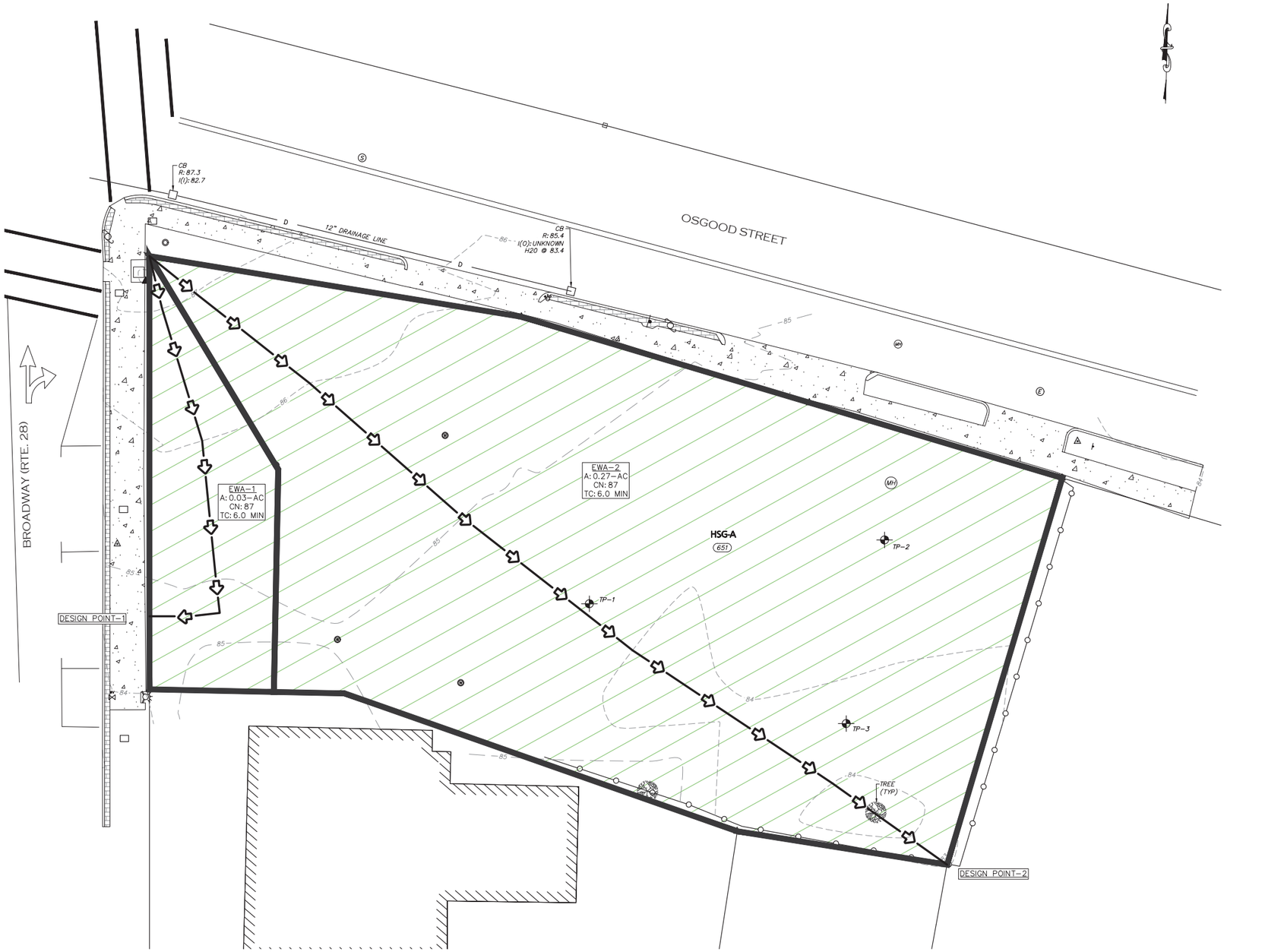
It is anticipated that the stormwater management system will require an annual budget of $5,000 to maintain.

LEGEND

PROPERTY LINE	
ABUTTERS PROPERTY LINE	
EXISTING EDGE OF PAVEMENT	
LIMIT OF BORDERING VEGETATED WETLAND (BVW)	
WETLAND FLAG	WF 8D
WETLAND	
50 FT BUFFER ZONE TO BVW	
100 FT BUFFER ZONE TO BVW	
EXISTING CONTOUR	
EXISTING WATERSHED BOUNDARY	
EXISTING TC	
HYDROLOGIC SOILS GROUP A	
HYDROLOGIC SOILS GROUP B	
HYDROLOGIC SOILS GROUP C	
HYDROLOGIC SOILS GROUP D	

SOILS SUMMARY:

SYMBOL	DESCRIPTION	HSG
651	UDORTHENTS, SMOOTHED	A



HORIZONTAL SCALE

10 0 5 10 20 40

(IN FEET)
1"=10'

DATE	DESCRIPTION
REVISIONS	

OWNER / APPLICANT:

JOWAMAR COMPANIES, LLC
300 BROADWAY
METHUEN, MA 01876

PROJECT:

296 BROADWAY & 2 OSGOOD ST
METHUEN, MA 01844

DATE ISSUED:	JUNE 1, 2022
PROJECT #:	21-10314
PREPARED BY:	MAC

06/01/22

PROFESSIONAL ENGINEER FOR CIVIL DESIGN CONSULTANTS, INC.

CIVIL DESIGN Consultants, Inc.
SURVEY • DESIGN • PERMITTING • CONSTRUCTION ADMINISTRATION
344 North Main Street
Andover, MA 01810
Tel: (978) 416-0920
Fax: (978) 416-7865

DRAWING TITLE:

EXISTING WATERSHED PLAN

DRAWING #:

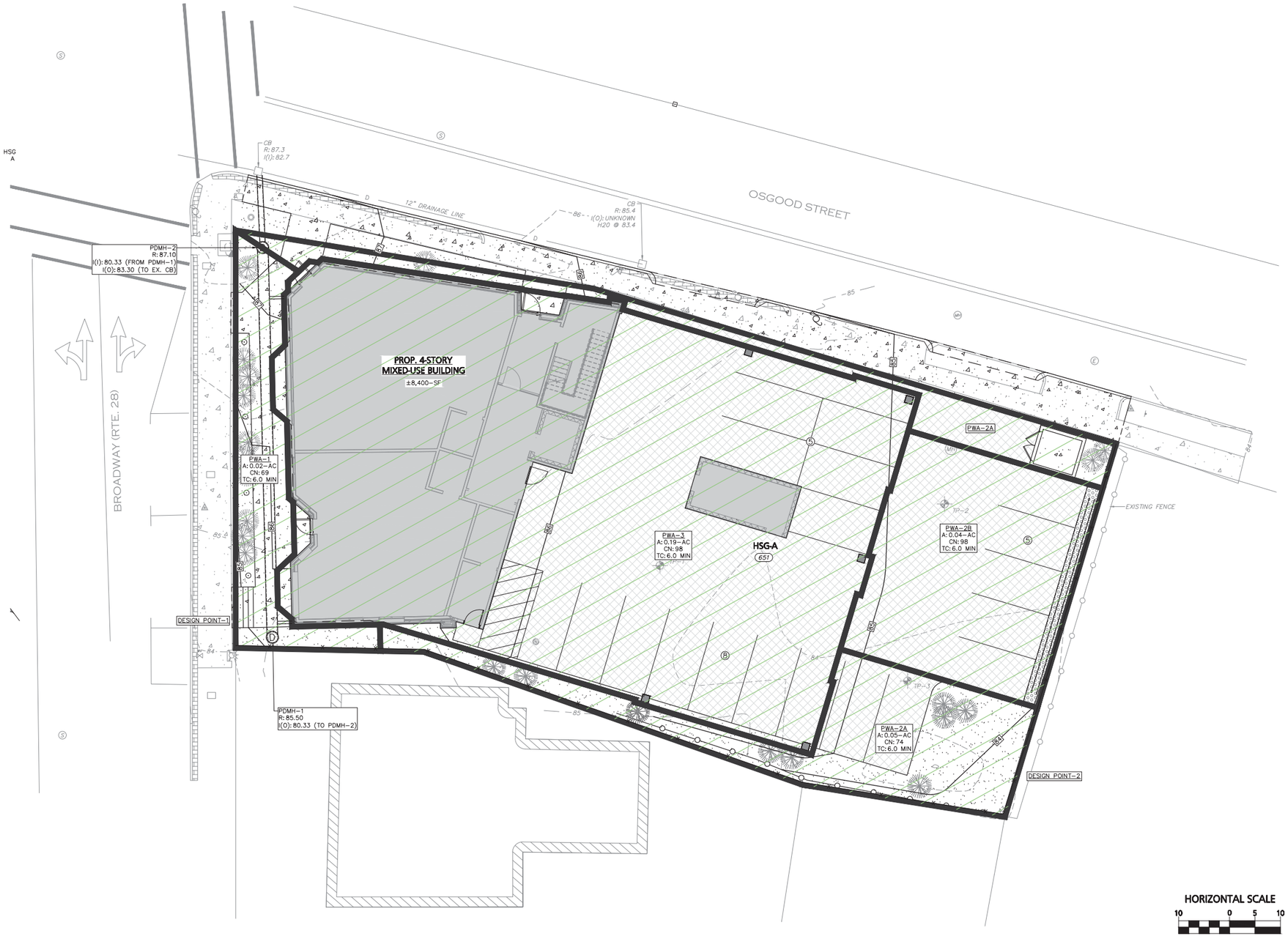
EWP

LEGEND

PROPERTY LINE	
PROPOSED BUILDING	
PROPOSED CONTOUR	142
PROPOSED SPOT GRADE	161.00
PROPOSED SPOT GRADE (TW/BW)	TW: 159.57 BW: 155.67
PROPOSED DRAIN	
PROPOSED CATCH BASIN	
PROPOSED DRAIN MANHOLE	
PROPOSED RETAINING WALL	
PROPOSED WATERSHED BOUNDARY	
PROPOSED TC	
PROPOSED IMPERVIOUS SURFACE	
HYDROLOGIC SOILS GROUP A	
HYDROLOGIC SOILS GROUP B	
HYDROLOGIC SOILS GROUP C	
HYDROLOGIC SOILS GROUP D	

SOILS SUMMARY:

SYMBOL	DESCRIPTION	HSG
651	UDORTHENTS, SMOOTHED	A



HORIZONTAL SCALE

10 0 5 10

(IN FEET)

1"=10'

DATE	DESCRIPTION
REVISIONS	

OWNER / APPLICANT:

JOWAMAR COMPANIES, LLC

300 BROADWAY
METHUEN, MA 01876

PROJECT:

296 BROADWAY & 2 OSGOOD ST

METHUEN, MA 01844

DATE ISSUED:	JULY 6, 2022
PROJECT #:	21-10314
PREPARED BY:	MAC

7/6/22

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SURVEY • DESIGN • PERMITTING • CONSTRUCTION ADMINISTRATION

344 North Main Street
Andover, MA 01810

Tel: (978) 416-0920
Fax: (978) 416-7865

DRAWING TITLE:

PROPOSED WATERSHED PLAN

DRAWING #:

PWP