Appendix 4.17-C

Layover Facility Stormwater !yl·fëäŜå

Stormwater Report

Weaver's Cove East Layover Facility

City of Fall River,
Massachusetts

Prepared for

massDOT

Massachusetts Department of Transportation
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Boston, Massachusetts

Prepared by

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June 2012

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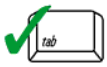
Checklist for Stormwater Report

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

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): _____

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.

1

Stormwater Report Narrative

This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00).

1.1 Project Description

The Applicant, MassDOT, is proposing to construct a commuter rail overnight layover facility at the Weaver's Cove East site, located adjacent to 2804 North Main Street in Fall River, Massachusetts along the Fall River Secondary Line (the Project). The Project will include six layover tracks, a paved driveway and access aisle around the layover tracks, ancillary landscape improvements, 41 parking spaces, two operation and maintenance buildings, and utility improvements to support this use. The Project involves demolishing concrete pads and multiple bituminous driveways that currently exist on the site.

The site will be considered a Land Use with Higher Potential Pollutant Loads (LUHPPL) as defined in 3.10 CMR 10.04 and 314 CMR 9.02 because the use is regulated under the NPDES Multi-Sector General Permit.

1.2 Site Description

The Project site consists of approximately 18 acres of land (the Site) located adjacent to 2804 North Main Street in Fall River, Massachusetts (Figures 1 and 2). The Site is northeast of Weaver's Cove Energy, LCC located at 1 New Street in Fall River, adjacent to residential buildings to the north, south and east and the MBTA railroad right-of-way to the west.

There are no Wetland Resource Areas located on the Site.

According to the National Resources Conservation Service (NRCS), surface soils on the Site include Paxton Fine Sandy Loam, smoothed Udorthents, and Urban land classified as Hydrologic Soil Groups (HSG) C, B and D respectively.

The Site is not located within the 100-year flood plain as shown on the FEMA Floodway Map, City of Fall River, Massachusetts Bristol County, Community Panel Number 25005C0332F dated July 7, 2009. The 100-year flood elevation is lower than the finished grade elevation of the layover yard. The FEMA map is included in Appendix B. This site is also located within the Massachusetts Coastal Zone.

1.3 Existing Drainage Conditions

The Site is currently almost entirely undeveloped land with a small portion that was previously developed at the southern end. For the existing conditions hydrologic analysis, the Site was divided into seven drainage areas that contribute to four separate design points. The following paragraphs summarize each drainage area.

Drainage Area 1

This 3.21-acre area in the southwest portion of the Site consists of predominantly impervious concrete pads with a small portion of grassy pasture urban land. This grassy area sheet flows to a catch basin to the north of the concrete pads where it is captured by the closed drainage system that drains to the Taunton River.

Drainage Area 2

This 3.83-acre area in the southern portion of the Site, north of Drainage Area 1, consists of mainly open space with a small portion of impervious area that sheet flows to a vegetated depression in the center of Drainage Area 2 where it infiltrates or overflows to Drainage Area 3 in larger storm events.

Drainage Area 3

This 7.14-acre area in the center of the Site consists predominantly of open space areas with small patches of paved area that sheet flows to a catch basin in the center of the Site. The catch basin is part of a closed drainage system that drains to the Taunton River.

Drainage Area 4

This 1.34-acre area in the northern portion of the Site consists predominantly of open space with small patches of paved area that sheet flows to a vegetated depression adjacent to North Main Street where it infiltrates.

Drainage Area 5

This 1.62-acre area in the northern portion of the Site consists of open space with multiple concrete pads and some paved area that sheet flows to a vegetated depression south of the property at 2990 North Main Street where it infiltrates.

Drainage Area 6

This 0.43-acre area in the southwest portion of the Site consists of partially open space and partially paved area that sheet flows to a culvert underneath the railroad ROW, ultimately discharging to the Taunton River.

Drainage Area 7

This 0.63-acre area in the northwest portion of the Site consists of open space that sheet flows towards a ditch along the railroad ROW, ultimately discharging to the Taunton River.

Figure 3 illustrates the existing drainage patterns on the Site. Table 1 provides a summary of the existing conditions hydrologic data.

Table 1 Existing Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (acres)	Curve Number	Time of Concentration (min)
1	Taunton River	1	3.21	98	5.0
2	Taunton River	1	3.83	72	7.8
3	Taunton River	1	7.14	71	19.4
4	Depression 2	3	1.34	73	7.7
5	Depression 3	4	1.62	75	21.4
6	Taunton River	1	0.43	89	5.0
7	Taunton River	1	0.63	69	5.0

1.4 Proposed Drainage Conditions

Figure 4 illustrates the proposed "post-construction" drainage conditions for the Project. As shown, the Site would be divided into nine drainage areas that discharge treated stormwater to three existing Design Points and one new design point. Existing drainage and grading patterns were maintained to the maximum extent possible in proposed conditions. Low impact development stormwater management techniques have been incorporated into the design. These practices are focused on decentralizing stormwater management techniques into the design that will reduce peak runoff rates, maximize groundwater recharge and treat for water quality. The following is a summary of each drainage area in the post-construction condition.

Drainage Area 1

This 3.68-acre area in the southwest portion of the Site consists of primarily open space with small patches of gravel. In the proposed condition the stormwater would be directed from the east and west to a grass channel that enters a culvert underneath the paved access driveway and outlets to a sediment forebay before entering an infiltration basin. An outlet control structure manages the water level in the basin and directs stormwater to the existing closed drainage system that discharges to the Taunton River.

Drainage Area 2

This 1.67-acre area in the eastern portion of the Site consists of predominantly landscaped area. In the proposed condition the stormwater would sheet flow to a depression on the eastern side of the proposed parking area. Runoff from the driveway sheet flows through a gravel and grass filter strip for pretreatment then into the depression. This depression is designed to infiltrate all stormwater from Drainage Area 2 that is collected during a 100-year storm.

Drainage Area 3

This 0.77-acre area in the southern portion of the Site consists of paved parking areas for the operation and maintenance buildings and landscaped islands. The paved parking areas would be pitched to the west to allow the stormwater to drain into the grass channel in Drainage Area 1 and discharge into a sediment forebay for treatment and then into an infiltration basin. An outlet control structure manages the water level in the basin and directs stormwater to the existing closed drainage system that discharges to the Taunton River.

Drainage Area 4

This 3.60-acre area in the eastern portion of the Site consists of existing landscaped areas and that would be slightly re-graded to allow for the installation of two sediment forebays and an infiltration basin. Runoff from the grass area would sheet flow to the infiltration basin. Stormwater from the driveway would sheet flow through a gravel and grass filter strip for pretreatment then into the infiltration basin. An outlet control structure manages the water level in the basin and directs stormwater to the existing closed drainage system that discharges to the Taunton River. The Best Management Practices (BMPs) in Drainage Area 4 manage the runoff from Drainage Areas 1, 3, 4 and 5.

Drainage Area 5

This 4.83-acre area in the western portion of the Site consists of a paved driveway for access to the site, layover tracks, and access aisles around the layover tracks. In the proposed condition, stormwater from the layover tracks would drain to underdrains that would be fed into an oil grit separator and then outlet into a sediment forebay before entering an infiltration basin. An outlet control structure manages the water

level in the basin and directs stormwater to the existing closed drainage system that discharges to the Taunton River.

Drainage Area 6

This 0.73-acre area in the northeast portion of the Site consists of predominantly landscaped area maintained from the existing condition. Stormwater would sheet flow to a depression adjacent to the access aisle around the layover tracks. This depression is designed to infiltrate all stormwater from Drainage Area 6 that is collected during a 100-year storm.

Drainage Area 7

This 1.38-acre area in the northern portion of the Site consists of predominantly landscape areas with small patches of impervious concrete pads. In the proposed condition this drainage area would be regraded to incorporate a depression. This depression is designed to infiltrate all stormwater from Drainage Area 7 that is collected during a 100-year storm.

Drainage Area 8

This 0.61-acre area in the western portion of the Site consists of unpaved area for the track ladder entering the layover yard. Under existing conditions this drainage area sheet flows to a culvert underneath the railroad right-of-way. In the proposed condition this drainage area would sheet flow untreated to the same culvert underneath the railroad ROW.

Drainage Area 9

This 0.94-acre area in the western portion of the Site consists of all grass area which would sheet flow to the ditch adjacent to the railroad ROW and ultimately discharge to the Taunton River.

Table 2 provides a summary of the proposed conditions hydrologic data.

Table 2 Proposed Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (acres)	Curve Number	Time of Concentration (min)
1	Taunton River	1	3.68	84	20.9
2	Depression 1	2	1.67	78	5.0
3	Taunton River	1	0.77	93	5.0
4	Taunton River	1	3.60	72	12.1
5	Taunton River	1	4.83	98	5.0
6	Depression 2	3	0.73	83	5.0
7	Depression 3	4	1.38	77	5.0
8	Taunton River	1	0.61	92	5.0
9	Taunton River	1	0.94	69	5.0

The Site has been designed with a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook. The proposed stormwater management system has been designed to treat the 1.0 inch Water Quality Volume.

1.5 Environmentally Sensitive and Low Impact Development (LID) Techniques

Low Impact Development (LID) techniques and stormwater Best Management Practices (BMPs) implemented into the Project design include:

- Grassed Channel
- Gravel and Grass Filter Strip
- Infiltration Basin
- Sediment Forebays

In general, stormwater runoff from all impervious surfaces in proposed conditions would receive some form of treatment for stormwater quality prior to discharge to the existing design points. Under existing conditions no such treatment is provided for stormwater runoff.

1.6 Hydraulic Analysis

The closed drainage system was designed for the 25-year storm event, in accordance with the Massachusetts Bay Transportation Authority *Railroad Operations, Commuter Rail Design Standards Manual*, Volume 1.

Drainage pipes were sized using Manning's Equation for full-flow capacity and the Rational Method. Pipe sizing calculations are included in Appendix A of this report.

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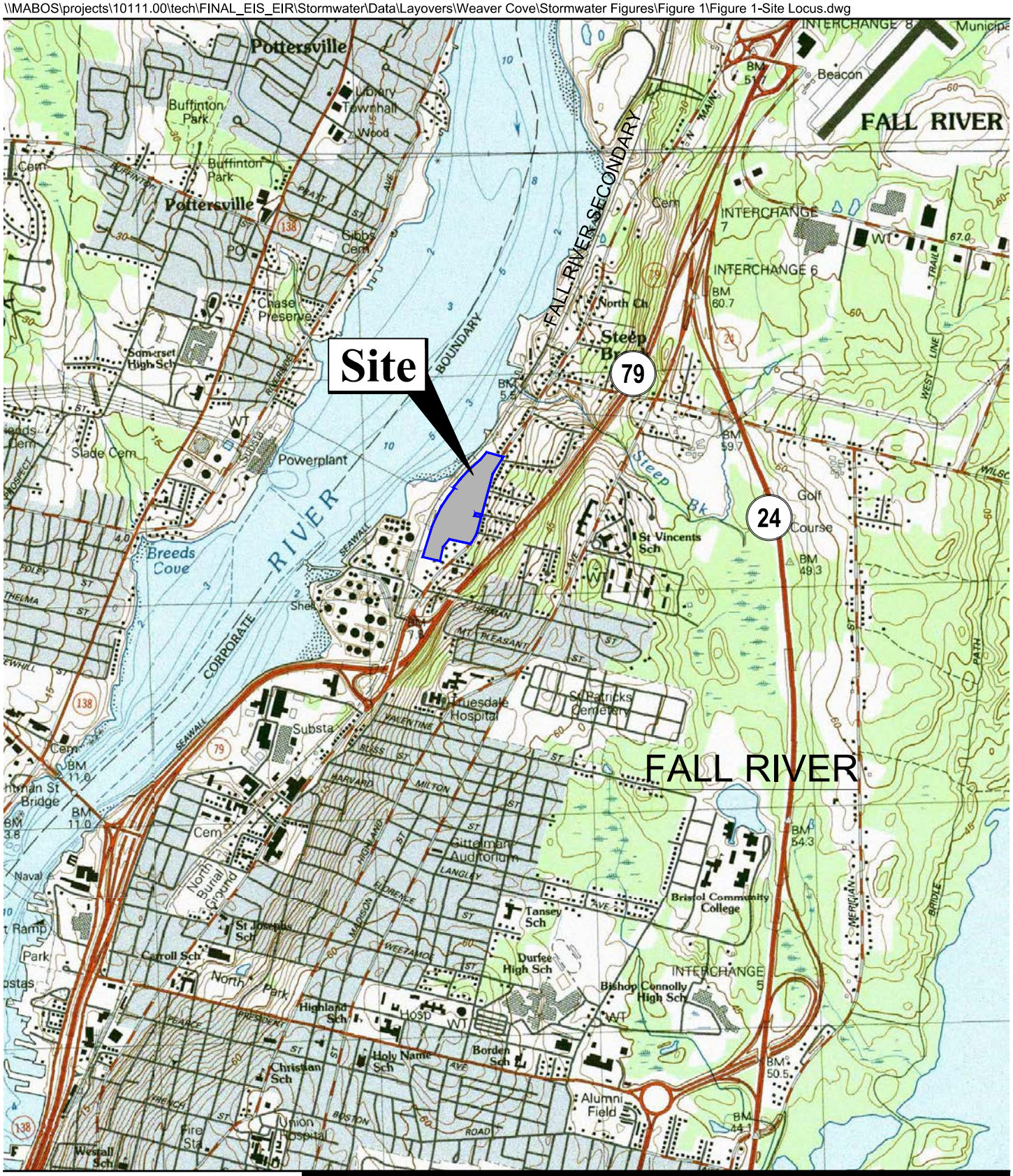

Vanasse Hangen Brustlin, Inc.

0 1000 2000 Feet

USGS Locus Map

Weaver's Cove Layover
South Coast Rail
Fall River, Massachusetts

Figure 1
May 2012

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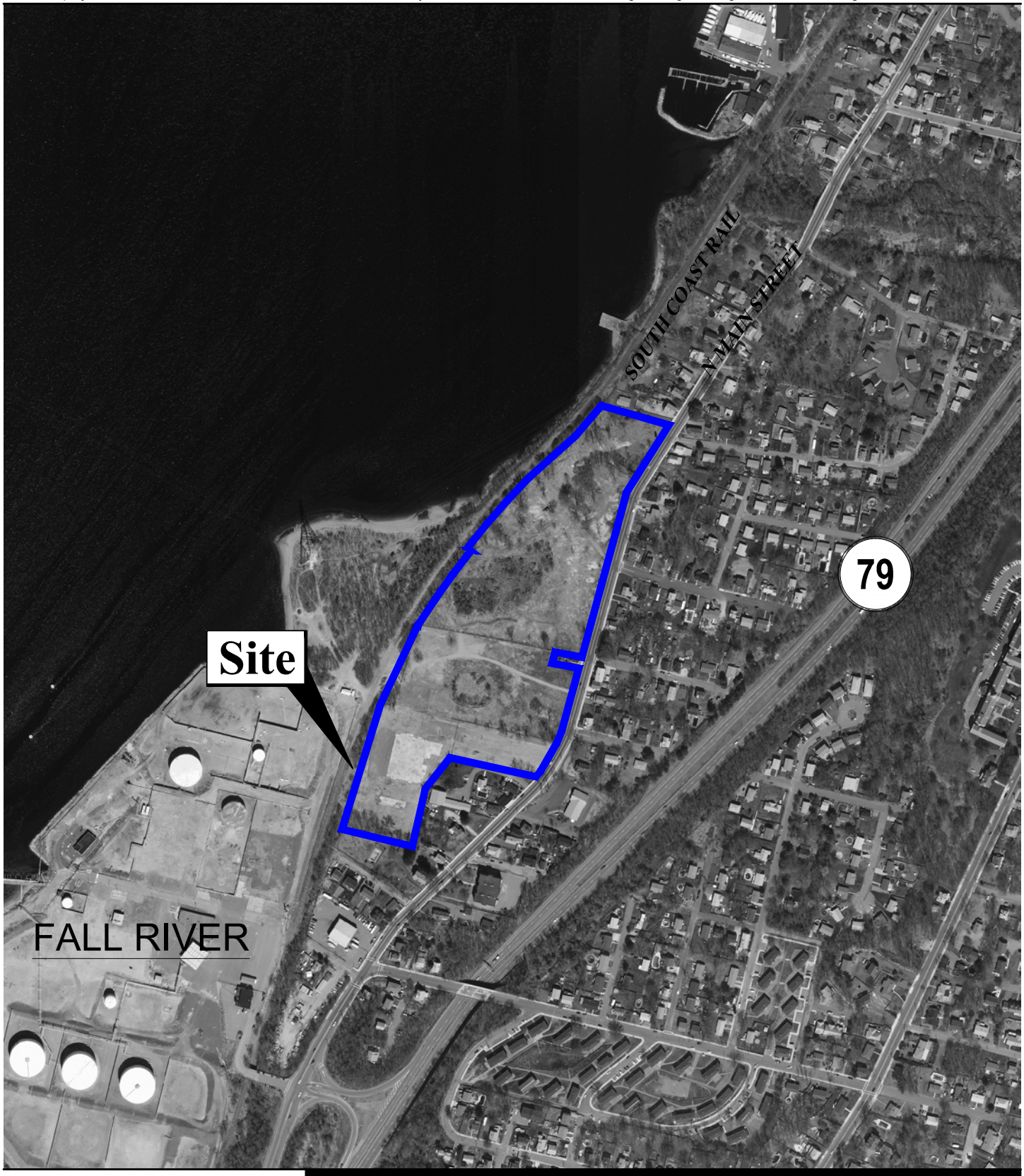

Vanasse Hangen Brustlin, Inc.

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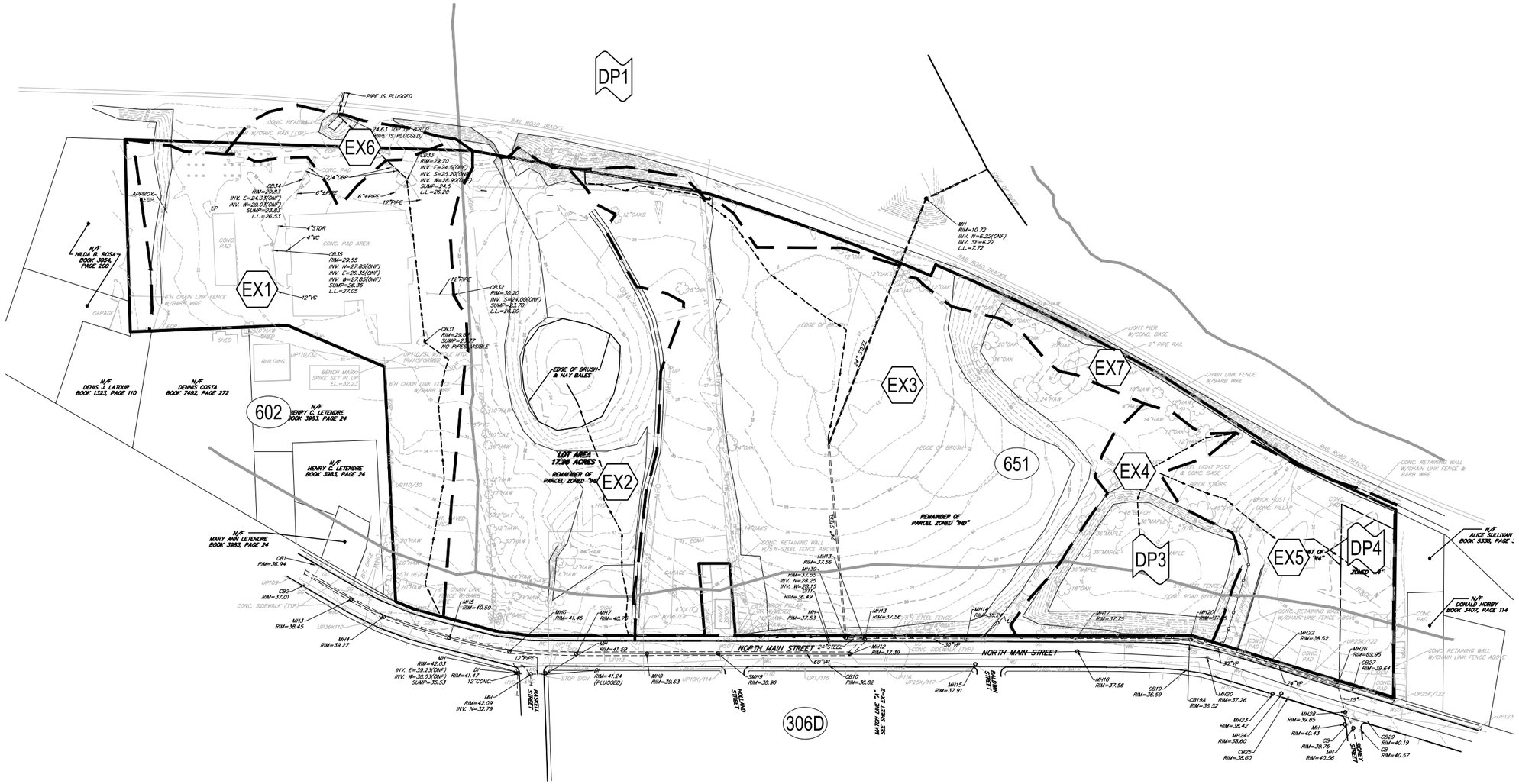
Site Aerial Map

Weaver's Cove Layover
South Coast Rail
Fall River, Massachusetts

Figure 2
May 2012



LEGEND

- SUBCATCHMENT DRAINAGE AREA DESIGNATION
- DESIGN POINT
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- SOIL TYPE BOUNDARY
- WETLAND BOUNDARY (WF1–300 to WF1–301)
- ACQUISITION LIMIT
- LIMIT OF WORK

NRCS SOIL CLASSIFICATIONS (HSG)

- 651 SMOOTHED UDORTHENTS (B)
- 306D PAXTON FINE SANDY LOAM (C)
- 602 URBAN LAND (D)

NOTES:

1. THE PREMISES SHOWN HEREON ARE THE SAME CONVEYED TO WEAVER'S COVE ENERGY, LLC AS DESCRIBED IN THE DEED RECORDED IN THE BRISTOL COUNTY REGISTRY OF DEEDS IN BOOK 6533, PAGE 225.
2. UNDERGROUND UTILITY LOCATIONS SHOWN HEREON WERE COMPILED UTILIZING FIELD SURVEY INFORMATION AND AVAILABLE RECORD INFORMATION FROM THE VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES, AND ARE APPROXIMATE ONLY. PRIOR TO ANY EXCAVATION, ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD.
3. ALL CATCH BASIN/DROP INLETS HAVE HOODS ON PIPE OUTLETS.
4. CATCH BASIN, DROP INLET AND MANHOLES WHERE NOT OPENED UNLESS INVERTS AND SUMPS ARE INDICATED ON THE PLAN.
5. HORIZONTAL DATUM SHOWN HEREON IS BASED ON NAD 83 AND VERTICAL DATUM SHOWN HEREON IS BASED ON NGVD 1929.
6. NO TELEPHONE, CATV OR FIBER OPTIC LINES WHERE OBSERVED IN THE SURVEY AREA.

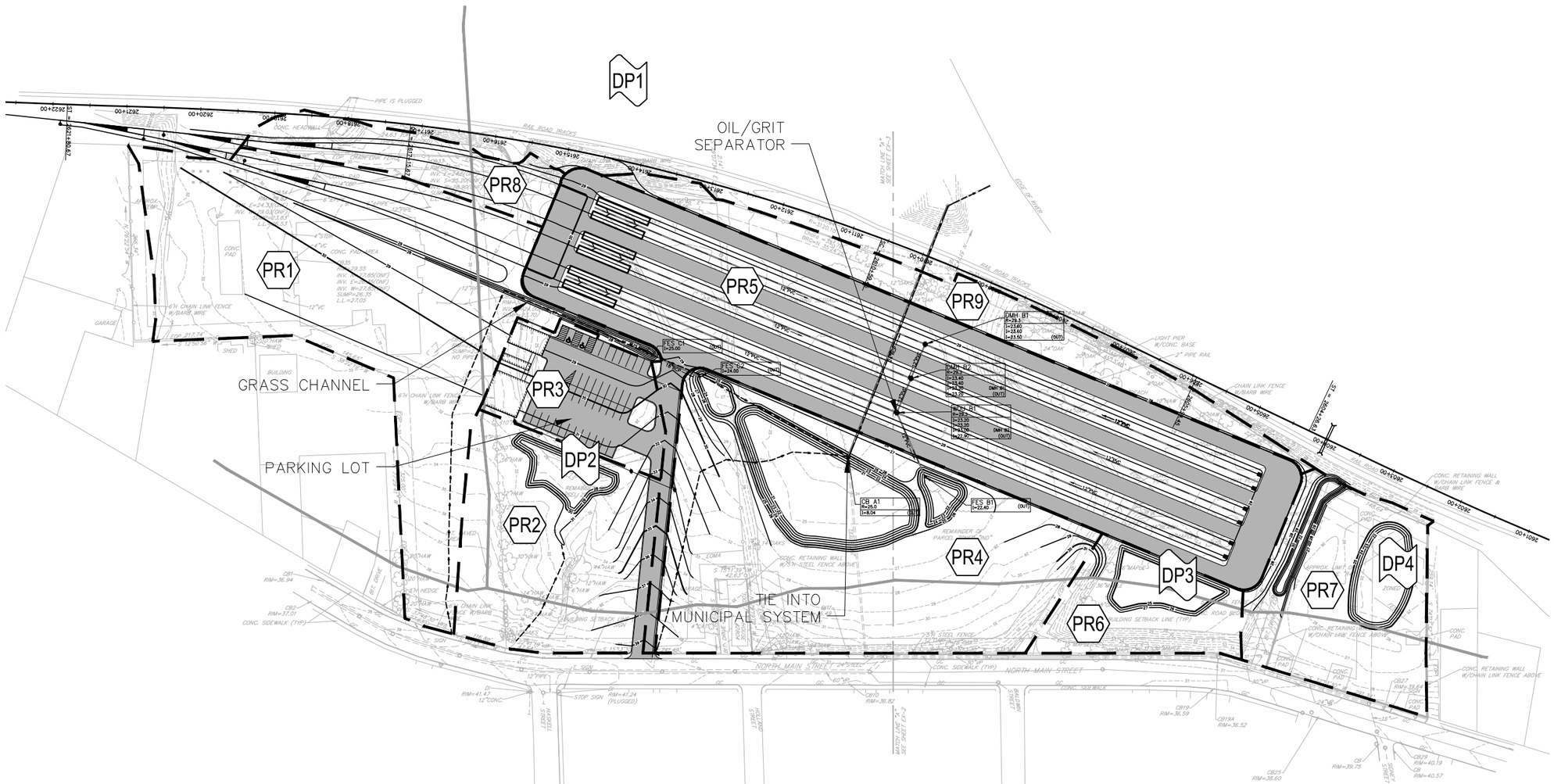
0 80 160 Feet

Vanasse Hangen Brustlin, Inc.

Figure 3 June 2012

Existing Conditions Drainage Areas

Weaver's Cove East Layover Facility
Fall River, Massachusetts



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6. NO TELEPHONE, CATV OR FIBER OPTIC LINES WHERE OBSERVED IN THE SURVEY AREA.

0 80 160 Feet

LEGEND

- 1 — SUBCATCHMENT DRAINAGE AREA DESIGNATION
- 1 — DESIGN POINT
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- SOIL TYPE BOUNDARY
- WETLAND BOUNDARY (WF1-300 to WF1-301)
- ACQUISITION LIMIT
- LIMIT OF WORK

Vanasse Hangen Brustlin, Inc.

Figure 4 June 2012

Proposed Conditions Drainage Areas

Weaver's Cove East Layover Facility
Fall River, Massachusetts

2

Regulatory Compliance

This Chapter describes the Project's compliance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards. The Project fully complies with the MassDEP Stormwater Management Standards at 310 CMR 10.05.

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project has been designed to fully comply with Standard 1.

No drainage from the Site discharges to wetlands. All drainage from the Site either infiltrates or discharges to the Taunton River after being treated.

The BMPs included in the proposed stormwater management system have been designed in accordance with the Massachusetts Stormwater Handbook. Supporting information and computations demonstrating that no new untreated discharges would result from the Project are presented through compliance with Standards 4 through 6.

All proposed Project stormwater outlets and conveyances have been designed to not cause erosion or scour to wetlands or receiving waters. Outlets from closed drainage systems have been designed with flared end sections and stone protection to dissipate discharge velocities. Overflows from BMPs that impound stormwater have been designed with stone to protect down gradient areas from erosion.

Standard 2: Peak Rate Attenuation

The Project has been designed to fully comply with Standard 2.

The rainfall-runoff response of the Site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, and 100 years. The results of the analysis, as summarized in Table 3, indicate that there is no increase in peak discharge rates between the existing and proposed conditions. The peak discharge for Design Points 2, 3 and 4 is 0.0 cfs because all of the stormwater is

infiltrated through new depressions and will not be discharging to the same point as in the existing conditions.

Computations and supporting information regarding the hydrologic modeling are included in Appendix B.

Table 3 Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	100-year
Design Point 1: Taunton River			
Existing	14.3	22.2	33.3
Proposed	2.7	4.6	14.7
Design Point 2: Depression 1			
Existing	-	-	-
Proposed	0.0	0.0	0.0
Design Point 3: Depression 2			
Existing	0.1	1.3	5.6
Proposed	0.0	0.0	0.0
Design Point 4: Depression 3			
Existing	0.0	0.06	1.2
Proposed	0.0	0.0	0.0

Standard 3: Stormwater Recharge

Since the Site is comprised of predominantly B soils, the Project has been designed to infiltrate the required recharge volume. The addition of pervious area in the proposed conditions from the removal of concrete pads on the south side of the Site would contribute to additional recharge to groundwater.

In accordance with the Stormwater Handbook, the Required Recharge Volume for the Project is 4,785 cubic feet. The Project proposes to exceed the standard of 4,785 cubic feet of recharge volume.

Recharge of stormwater has been provided through the use of four depressions. Each depression has been designed to provide the proper storage for recharge and the required square footage to ensure the depression drains completely within 72 hours.

Standard 4: Water Quality

The Project has been designed to fully comply with Standard 4.

The proposed stormwater management system implements a treatment train of BMPs that has been designed to provide 80 percent total suspended solids (TSS) removal of stormwater runoff from all proposed impervious surfaces.

Computations and supporting information, including the Long-Term Pollution Prevention Plan, are included in Appendix D.

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

The Project is considered a Land Use with Higher Potential Pollutant Loads (LUHPPL) as defined in 3.10 CMR 10.04 and 314 CMR 9.02. Due to the storage tracks, the layover facility would be classified as a LUHPPL and would require certain BMPs to prevent contamination of local wetlands and water resources such as the Taunton River. The storage tracks would have collection trays to catch any incidental drips, leaks, or spills of hazardous materials that may occur during storage or maintenance. The collection trays would be connected to an oil/water separator that would separate petroleum products from stormwater runoff prior to discharge, protecting the Taunton River and adjacent wetlands from contamination. Any oil or other hazardous materials stored at the Site would be secured with secondary containment structures to catch any spills. With the proposed containment measures in place, the layover facility would not pose a significant risk to the Taunton River or other surface or groundwater resources at this Site.

Standard 6: Critical Areas

The Project will not discharge stormwater near or to a critical area.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable

The Project is a partial redevelopment, but has still been designed to fully comply with all ten of the Stormwater Management Standards.

Refer directly to each Standard for applicable computations and supporting information demonstrating compliance with each.

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

The Project would disturb approximately 18.0 acres of land and is therefore required to obtain coverage under the US Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP). As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) would be developed and the Notice of Intent for the CGP would be submitted by the contractor and owner at least 14 days before land disturbance begins. Recommended construction period pollution prevention and erosion and sedimentation controls were discussed in the DEIS/DEIR. Appropriate controls will be prepared and implemented by the contractor and MassDOT (MBTA) during construction in accordance with the final design and NPDES SWPPP.

Standard 9: Operation and Maintenance Plan

In compliance with Standard 9, a Post Construction Stormwater Operation and Maintenance (O&M) Plan will be developed by the MBTA during the final design for the Project.

Standard 10: Prohibition of Illicit Discharges

Storm drainage structures remaining from the previous development that are part of the redevelopment area will be removed and replaced. The design plans submitted with this report have been developed so that the components included therein are in full compliance with current standards. No statement is made with regard to the drainage system in portions of the Site not included in the redevelopment project area. The Long-Term Pollution Prevention Plan will include measures to prevent illicit discharges.

Appendix A
Standard 1 Computations and Supporting Information

Vanasse Hangen Brustlin, Inc.
Transportation
Land Development
Environmental Services
101 Walnut St., Watertown, MA 02471
(617) 924-1770

Storm Drainage Computations

Name: Weaver's Cove East Layover Facility
Fall River, MA
Client: MassDOT

Proj. No.: **10111.00**
Date: **5/31/2012**
Computed by: **TJR**
Checked by:

Design Parameters:
25 **Year Storm**
k_e= **0.5**
Boston, MA **IDF Curve**

DESCRIPTION	LOCATION		AREA	C	C x A	SUM	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PROFILE						
	FROM	TO	(AC.)			C x A	PIPE	CONC TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER	W.S.E. ft	Freeboard ft
A SERIES	CB A1	FES A1	12.88	0.50	6.46	6.46	1.55	20.9	3.6	23.2	3.9	0.013	24	0.0027	11.9	3.8	364	1.00	25.5	7.2	6.2	7.0	18.5
B SERIES	UD CAP B1	DMH B1	4.83	0.90	4.34	4.34	2.40	5.0	6.0	26.1	3.3	0.013	12	0.0050	2.5	3.2	480	2.40	29.5	26.0	23.6	25.9	3.6
	UD CAP B2	DMH B1	4.83	0.90	4.34	4.34	2.44	5.0	6.0	26.1	3.3	0.013	12	0.0049	2.5	3.2	485	2.40	29.5	26.0	23.6	25.9	3.6
	UD CAP B3	DMH B2	4.83	0.90	4.34	4.34	2.30	5.0	6.0	26.1	3.5	0.013	12	0.0055	2.6	3.4	480	2.62	29.5	26.0	23.4	25.8	3.7
	UD CAP B4	DMH B2	4.83	0.90	4.34	4.34	2.33	5.0	6.0	26.1	3.5	0.013	12	0.0054	2.6	3.3	485	2.62	29.5	26.0	23.4	25.9	3.6
	UD CAP B5	WQU B1	4.83	0.90	4.34	4.34	2.20	5.0	6.0	26.1	3.6	0.013	12	0.0059	2.7	3.5	480	2.84	29.5	26.0	23.2	25.8	3.7
	UD CAP B6	WQU B1	4.83	0.90	4.34	4.34	2.24	5.0	6.0	26.1	3.6	0.013	12	0.0059	2.7	3.5	485	2.84	29.5	26.0	23.2	25.8	3.7
	DMH B1	DMH B2	4.83	0.90	4.34	4.34	0.23	5.0	6.0	26.1	3.2	0.013	12	0.0046	2.4	3.1	43	0.20	29.3	23.6	23.4	23.5	5.9
	DMH B2	WQU B1	4.83	0.90	4.34	4.34	0.21	5.0	6.0	26.1	3.5	0.013	12	0.0055	2.7	3.4	43	0.24	29.3	23.4	23.2	23.2	6.1
	WQU B1	FES B1	4.83	0.90	4.34	4.34	0.12	5.0	6.0	26.1	6.0	0.013	12	0.0162	4.5	5.8	43	0.70	29.3	23.2	22.5	22.8	6.6
C SERIES	FES C1	FES C2	4.46	0.30	1.33	1.33	0.22	20.9	3.6	4.8	5.4	0.013	18	0.0138	12.3	7.0	72	1.00	29.0	25.0	24.0	24.6	4.4

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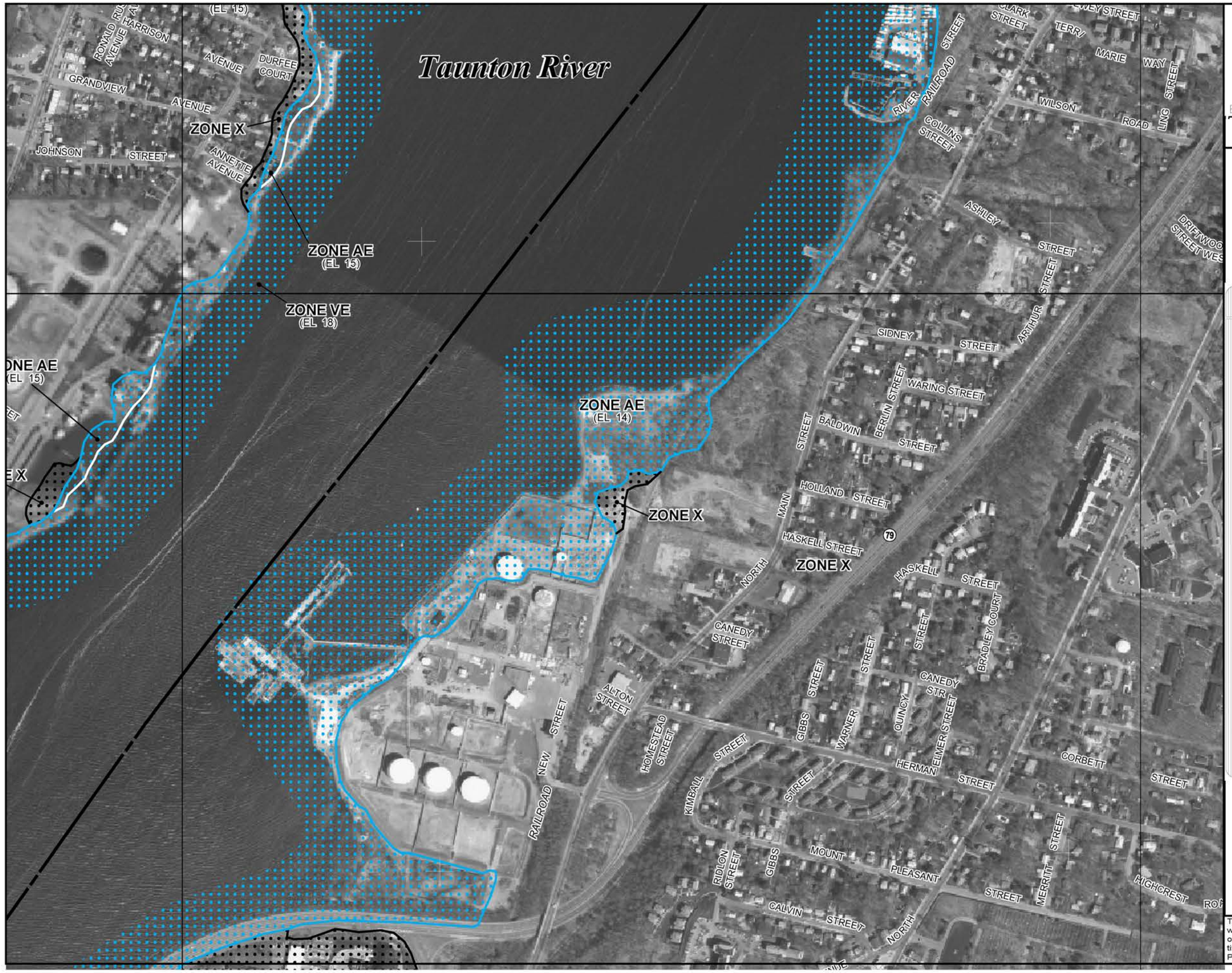
Appendix B
Standard 2 Computations and Supporting Information

Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm event for Bristol County. Runoff coefficients for the existing and proposed conditions, as previously shown in Tables 1 and 2 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology.

FEMA Flood Maps



MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0332F

FIRM

FLOOD INSURANCE RATE MAP

BRISTOL COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

PANEL 332 OF 550

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FALL RIVER, CITY OF	250055	0332	F
SOMERSET, TOWN OF	255220	0332	F
SWANSEA, TOWN OF	255221	0332	F

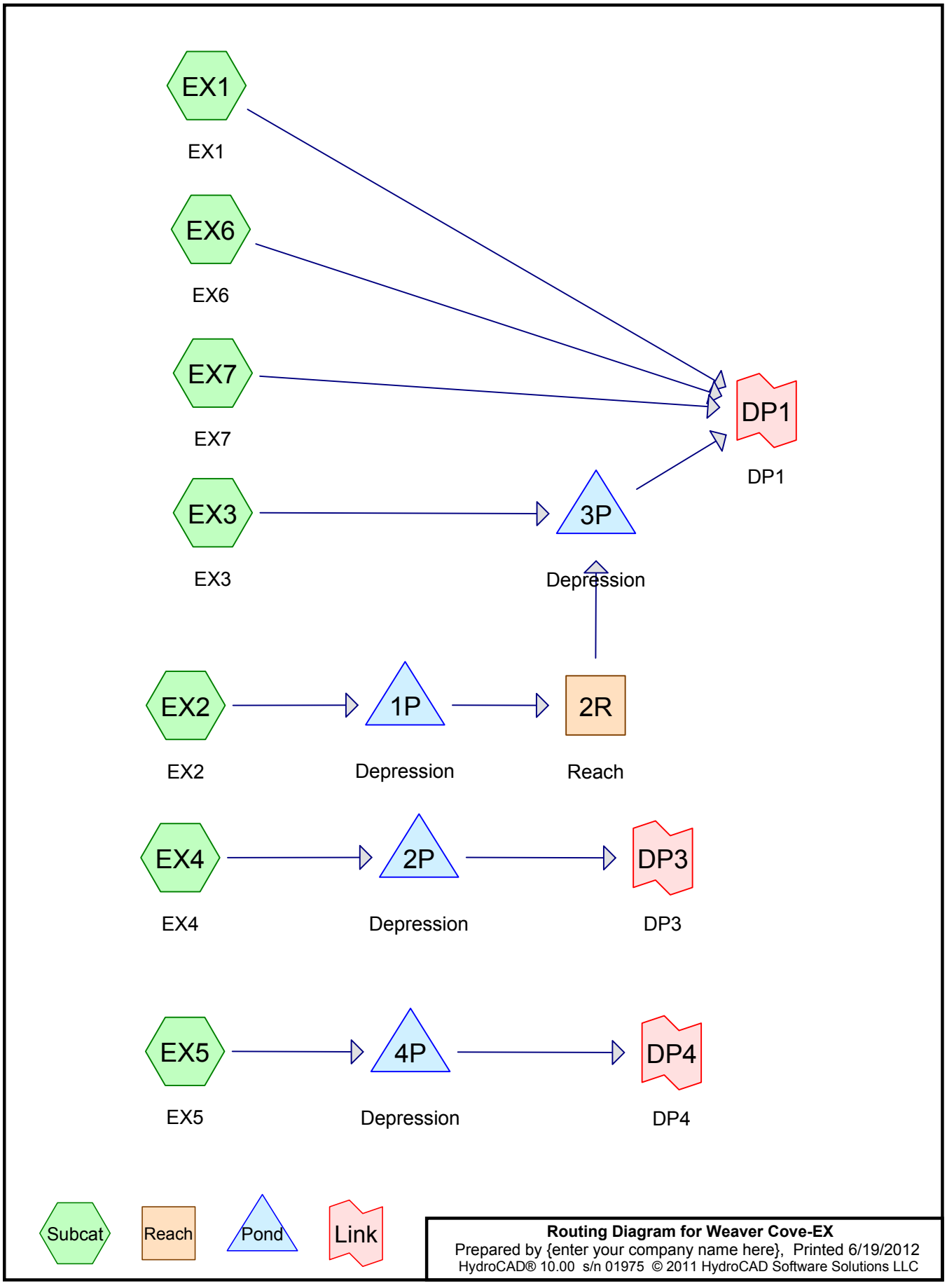
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25005C0332F

EFFECTIVE DATE
JULY 7, 2009

Federal Emergency Management Agency

HydroCAD Analysis: Existing Conditions



Routing Diagram for Weaver Cove-EX

Prepared by {enter your company name here}, Printed 6/19/2012

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
11.105	69	50-75% Grass cover, Fair, HSG B (EX1, EX2, EX3, EX4, EX5, EX7)
2.163	79	50-75% Grass cover, Fair, HSG C (EX2, EX3, EX4, EX5)
0.274	84	50-75% Grass cover, Fair, HSG D (EX1, EX6)
0.131	85	Gravel roads, HSG B (EX2, EX3)
0.009	89	Gravel roads, HSG C (EX3)
3.079	98	Paved parking, HSG B (EX1)
0.722	98	Unconnected pavement, HSG B (EX1, EX2, EX3, EX4, EX5)
0.296	98	Unconnected pavement, HSG C (EX2, EX3, EX5)
0.419	98	Unconnected pavement, HSG D (EX2, EX6)
18.198	**78**	**TOTAL AREA**

2-Year Storm Event - Existing

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX1 Runoff Area=3.212 ac 99.63% Impervious Runoff Depth>3.17"
Flow Length=813' Tc=5.0 min CN=98 Runoff=10.68 cfs 0.847 af

SubcatchmentEX2: EX2 Runoff Area=3.831 ac 14.54% Impervious Runoff Depth>1.05"
Flow Length=366' Tc=7.8 min UI Adjusted CN=72 Runoff=4.12 cfs 0.337 af

SubcatchmentEX3: EX3 Runoff Area=7.145 ac 2.67% Impervious Runoff Depth>1.00"
Flow Length=929' Tc=19.4 min CN=71 Runoff=5.25 cfs 0.593 af

SubcatchmentEX4: EX4 Runoff Area=1.336 ac 2.10% Impervious Runoff Depth>1.11"
Flow Length=227' Tc=7.7 min UI Adjusted CN=73 Runoff=1.54 cfs 0.124 af

SubcatchmentEX5: EX5 Runoff Area=1.621 ac 23.32% Impervious Runoff Depth>1.23"
Flow Length=331' Tc=21.4 min UI Adjusted CN=75 Runoff=1.47 cfs 0.166 af

SubcatchmentEX6: EX6 Runoff Area=0.427 ac 37.94% Impervious Runoff Depth>2.26"
Tc=5.0 min CN=89 Runoff=1.13 cfs 0.081 af

SubcatchmentEX7: EX7 Runoff Area=0.626 ac 0.00% Impervious Runoff Depth>0.89"
Tc=5.0 min CN=69 Runoff=0.60 cfs 0.047 af

Reach 2R: Reach Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.035 L=600.0' S=0.0037 '/' Capacity=2.03 cfs Outflow=0.00 cfs 0.000 af

Pond 1P: Depression Peak Elev=24.45' Storage=14,654 cf Inflow=4.12 cfs 0.337 af
Outflow=0.00 cfs 0.000 af

Pond 2P: Depression Peak Elev=27.51' Storage=3,798 cf Inflow=1.54 cfs 0.124 af
Outflow=0.09 cfs 0.038 af

Pond 3P: Depression Peak Elev=22.73' Storage=609 cf Inflow=5.25 cfs 0.593 af
Outflow=4.72 cfs 0.593 af

Pond 4P: Depression Peak Elev=25.64' Storage=7,206 cf Inflow=1.47 cfs 0.166 af
Outflow=0.00 cfs 0.000 af

Link DP1: DP1 Inflow=14.32 cfs 1.567 af
Primary=14.32 cfs 1.567 af

Link DP3: DP3 Inflow=0.09 cfs 0.038 af
Primary=0.09 cfs 0.038 af

Link DP4: DP4 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 18.198 ac Runoff Volume = 2.193 af Average Runoff Depth = 1.45"
75.18% Pervious = 13.682 ac 24.82% Impervious = 4.516 ac

Summary for Subcatchment EX1: EX1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 10.68 cfs @ 12.07 hrs, Volume= 0.847 af, Depth> 3.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.013	98	Unconnected pavement, HSG B
0.108	98	Unconnected pavement, HSG B
3.079	98	Paved parking, HSG B
0.003	69	50-75% Grass cover, Fair, HSG B
0.009	84	50-75% Grass cover, Fair, HSG D
3.212	98	Weighted Average
0.012		0.37% Pervious Area
3.200		99.63% Impervious Area
0.121		3.78% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0240	1.33		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.6	308	0.0263	3.29		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	57	0.0175	2.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.1	398	0.0100	5.90	4.63	**Pipe Channel, assume pipe goes with 1% slope** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
1.3					**Direct Entry, dirct entry to 5 min time concentration**
5.0	813	Total			

Summary for Subcatchment EX2: EX2

Runoff = 4.12 cfs @ 12.12 hrs, Volume= 0.337 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.193	98	Unconnected pavement, HSG B
0.107	98	Unconnected pavement, HSG C
0.257	98	Unconnected pavement, HSG D
2.933	69	50-75% Grass cover, Fair, HSG B
0.278	79	50-75% Grass cover, Fair, HSG C
0.063	85	Gravel roads, HSG B
3.831	74	Weighted Average, UI Adjusted CN = 72
3.274		85.46% Pervious Area
0.557		14.54% Impervious Area
0.557		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0340	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
2.4	209	0.0430	1.45		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	107	0.0634	1.76		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	366	Total			

Summary for Subcatchment EX3: EX3

Runoff = 5.25 cfs @ 12.30 hrs, Volume= 0.593 af, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.086	98	Unconnected pavement, HSG B
0.105	98	Unconnected pavement, HSG C
5.931	69	50-75% Grass cover, Fair, HSG B
0.946	79	50-75% Grass cover, Fair, HSG C
0.068	85	Gravel roads, HSG B
0.009	89	Gravel roads, HSG C
7.145	71	Weighted Average
6.954		97.33% Pervious Area
0.191		2.67% Impervious Area
0.191		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	17	0.4819	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
5.5	219	0.0091	0.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.4	221	0.0050	0.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.4	107	0.0034	0.41		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	365	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
19.4	929	Total			

Summary for Subcatchment EX4: EX4

Runoff = 1.54 cfs @ 12.12 hrs, Volume= 0.124 af, Depth> 1.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.028	98	Unconnected pavement, HSG B
0.000	98	Unconnected pavement, HSG C
0.782	69	50-75% Grass cover, Fair, HSG B
0.526	79	50-75% Grass cover, Fair, HSG C
1.336	74	Weighted Average, UI Adjusted CN = 73
1.308		97.90% Pervious Area
0.028		2.10% Impervious Area
0.028		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	43	0.0384	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
3.3	123	0.0081	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.2780	3.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	43	0.0282	1.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.7	227	Total			

Summary for Subcatchment EX5: EX5

Runoff = 1.47 cfs @ 12.32 hrs, Volume= 0.166 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.294	98	Unconnected pavement, HSG B
0.084	98	Unconnected pavement, HSG C
0.830	69	50-75% Grass cover, Fair, HSG B
0.413	79	50-75% Grass cover, Fair, HSG C
1.621	78	Weighted Average, UI Adjusted CN = 75
1.243		76.68% Pervious Area
0.378		23.32% Impervious Area
0.378		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	50	0.0012	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.6	45	0.0378	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	97	0.0515	1.59		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	139	0.0120	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	331	Total			

Summary for Subcatchment EX6: EX6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.13 cfs @ 12.07 hrs, Volume= 0.081 af, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.162	98	Unconnected pavement, HSG D
0.265	84	50-75% Grass cover, Fair, HSG D
0.427	89	Weighted Average
0.265		62.06% Pervious Area
0.162		37.94% Impervious Area
0.162		100.00% Unconnected

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

Summary for Subcatchment EX7: EX7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.047 af, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.626	69	50-75% Grass cover, Fair, HSG B
0.626		100.00% Pervious Area

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

Summary for Reach 2R: Reach

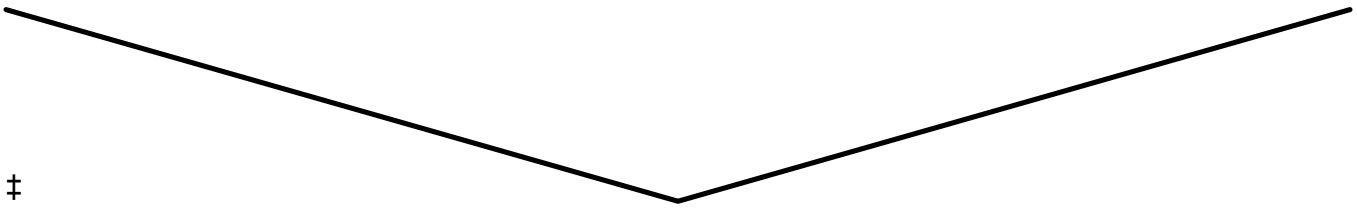
Assumed

Inflow Area = 3.831 ac, 14.54% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 2.0 sf, Capacity= 2.03 cfs

0.00' x 0.50' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 8.0 '/' Top Width= 8.00'
Length= 600.0' Slope= 0.0037 '/'
Inlet Invert= 24.50', Outlet Invert= 22.30'



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Summary for Pond 1P: Depression

Inflow Area = 3.831 ac, 14.54% Impervious, Inflow Depth > 1.05" for 2-Year event
Inflow = 4.12 cfs @ 12.12 hrs, Volume= 0.337 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 24.45' @ 24.00 hrs Surf.Area= 17,313 sf Storage= 14,654 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	23.00'	54,543 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
23.00	3,560	227.0	0	0	3,560
24.00	13,186	521.0	7,866	7,866	21,064
25.00	23,209	669.0	17,963	25,829	35,092
26.00	34,597	756.0	28,714	54,543	44,983

Device	Routing	Invert	Outlet Devices
#1	Primary	25.00'	**174.6 deg x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=23.00' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Depression

Inflow Area = 1.336 ac, 2.10% Impervious, Inflow Depth > 1.11" for 2-Year event
Inflow = 1.54 cfs @ 12.12 hrs, Volume= 0.124 af
Outflow = 0.09 cfs @ 15.55 hrs, Volume= 0.038 af, Atten= 94%, Lag= 205.7 min
Primary = 0.09 cfs @ 15.55 hrs, Volume= 0.038 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 27.51' @ 15.55 hrs Surf.Area= 10,954 sf Storage= 3,798 cf

Plug-Flow detention time= 383.4 min calculated for 0.038 af (31% of inflow)
Center-of-Mass det. time= 244.0 min (1,106.1 - 862.1)

Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	13,008 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
26.00	531	116.5	0	0	531
27.00	1,512	533.3	980	980	22,086
28.00	28,059	659.5	12,028	13,008	34,080

Device	Routing	Invert	Outlet Devices
#1	Primary	27.50'	**179.9 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=0.04 cfs @ 15.55 hrs HW=27.51' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.04 cfs @ 0.26 fps)

Summary for Pond 3P: Depression

[62] Hint: Exceeded Reach 2R OUTLET depth by 0.43' @ 12.40 hrs

Inflow Area = 10.976 ac, 6.81% Impervious, Inflow Depth > 0.65" for 2-Year event
Inflow = 5.25 cfs @ 12.30 hrs, Volume= 0.593 af
Outflow = 4.72 cfs @ 12.40 hrs, Volume= 0.593 af, Atten= 10%, Lag= 6.3 min
Primary = 4.72 cfs @ 12.40 hrs, Volume= 0.593 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 22.73' @ 12.40 hrs Surf.Area= 4,270 sf Storage= 609 cf

Plug-Flow detention time= 0.6 min calculated for 0.593 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (878.1 - 877.5)

Volume	Invert	Avail.Storage	Storage Description
#1	22.30'	36,053 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
22.30	0	0.0	0	0	0
23.00	11,429	748.0	2,667	2,667	44,525
24.00	62,091	1,002.0	33,386	36,053	79,908

Device	Routing	Invert	Outlet Devices
#1	Primary	7.22'	**24.0" Round Culvert** L= 365.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.22' / 6.22' S= 0.0027 '/' Cc= 0.900 n= 0.012 Steel, smooth, Flow Area= 3.14 sf
#2	Device 1	22.30'	**6.0" x 1.5" Horiz. Orifice/Grate X 3.00 columns** X 8 rows C= 0.600 in 24.0" x 24.0" Grate Limited to weir flow at low heads
#3	Primary	23.09'	**178.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=4.72 cfs @ 12.40 hrs HW=22.73' (Free Discharge)
└─**1=Culvert** (Passes 4.72 cfs of 41.41 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 4.72 cfs @ 3.15 fps)
└─**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 4P: Depression

Inflow Area = 1.621 ac, 23.32% Impervious, Inflow Depth > 1.23" for 2-Year event
Inflow = 1.47 cfs @ 12.32 hrs, Volume= 0.166 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.64' @ 24.00 hrs Surf.Area= 15,389 sf Storage= 7,206 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	13,753 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
25.00	7,632	406.6	0	0	7,632
26.00	20,975	659.9	13,753	13,753	29,136

Device	Routing	Invert	Outlet Devices
#1	Primary	25.95'	**179.9 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Link DP1: DP1

Inflow Area = 15.241 ac, 26.97% Impervious, Inflow Depth > 1.23" for 2-Year event
Inflow = 14.32 cfs @ 12.08 hrs, Volume= 1.567 af
Primary = 14.32 cfs @ 12.08 hrs, Volume= 1.567 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP3: DP3

Inflow Area = 1.336 ac, 2.10% Impervious, Inflow Depth > 0.35" for 2-Year event
Inflow = 0.09 cfs @ 15.55 hrs, Volume= 0.038 af
Primary = 0.09 cfs @ 15.55 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP4: DP4

Inflow Area = 1.621 ac, 23.32% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10-Year Storm Event - Existing

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX1: EX1 Runoff Area=3.212 ac 99.63% Impervious Runoff Depth>4.56"
Flow Length=813' Tc=5.0 min CN=98 Runoff=15.17 cfs 1.221 af

Subcatchment EX2: EX2 Runoff Area=3.831 ac 14.54% Impervious Runoff Depth>2.04"
Flow Length=366' Tc=7.8 min UI Adjusted CN=72 Runoff=8.40 cfs 0.652 af

Subcatchment EX3: EX3 Runoff Area=7.145 ac 2.67% Impervious Runoff Depth>1.96"
Flow Length=929' Tc=19.4 min CN=71 Runoff=10.95 cfs 1.166 af

Subcatchment EX4: EX4 Runoff Area=1.336 ac 2.10% Impervious Runoff Depth>2.12"
Flow Length=227' Tc=7.7 min UI Adjusted CN=73 Runoff=3.07 cfs 0.236 af

Subcatchment EX5: EX5 Runoff Area=1.621 ac 23.32% Impervious Runoff Depth>2.28"
Flow Length=331' Tc=21.4 min UI Adjusted CN=75 Runoff=2.82 cfs 0.308 af

Subcatchment EX6: EX6 Runoff Area=0.427 ac 37.94% Impervious Runoff Depth>3.58"
Tc=5.0 min CN=89 Runoff=1.76 cfs 0.127 af

Subcatchment EX7: EX7 Runoff Area=0.626 ac 0.00% Impervious Runoff Depth>1.81"
Tc=5.0 min CN=69 Runoff=1.30 cfs 0.095 af

Reach 2R: Reach Avg. Flow Depth=0.16' Max Vel=0.47 fps Inflow=0.10 cfs 0.016 af
n=0.035 L=600.0' S=0.0037 '/' Capacity=2.03 cfs Outflow=0.08 cfs 0.011 af

Pond 1P: Depression Peak Elev=25.08' Storage=27,684 cf Inflow=8.40 cfs 0.652 af
Outflow=0.10 cfs 0.016 af

Pond 2P: Depression Peak Elev=27.54' Storage=4,181 cf Inflow=3.07 cfs 0.236 af
Outflow=1.29 cfs 0.150 af

Pond 3P: Depression Peak Elev=23.18' Storage=5,252 cf Inflow=10.95 cfs 1.177 af
Outflow=7.12 cfs 1.177 af

Pond 4P: Depression Peak Elev=25.96' Storage=12,977 cf Inflow=2.82 cfs 0.308 af
Outflow=0.06 cfs 0.010 af

Link DP1: DP1 Inflow=22.23 cfs 2.620 af
Primary=22.23 cfs 2.620 af

Link DP3: DP3 Inflow=1.29 cfs 0.150 af
Primary=1.29 cfs 0.150 af

Link DP4: DP4 Inflow=0.06 cfs 0.010 af
Primary=0.06 cfs 0.010 af

Total Runoff Area = 18.198 ac Runoff Volume = 3.804 af Average Runoff Depth = 2.51"
75.18% Pervious = 13.682 ac 24.82% Impervious = 4.516 ac

Summary for Subcatchment EX1: EX1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 15.17 cfs @ 12.07 hrs, Volume= 1.221 af, Depth> 4.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.013	98	Unconnected pavement, HSG B
0.108	98	Unconnected pavement, HSG B
3.079	98	Paved parking, HSG B
0.003	69	50-75% Grass cover, Fair, HSG B
0.009	84	50-75% Grass cover, Fair, HSG D
3.212	98	Weighted Average
0.012		0.37% Pervious Area
3.200		99.63% Impervious Area
0.121		3.78% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0240	1.33		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.6	308	0.0263	3.29		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	57	0.0175	2.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.1	398	0.0100	5.90	4.63	**Pipe Channel, assume pipe goes with 1% slope** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
1.3					**Direct Entry, dirct entry to 5 min time concentration**
5.0	813	Total			

Summary for Subcatchment EX2: EX2

Runoff = 8.40 cfs @ 12.12 hrs, Volume= 0.652 af, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.193	98	Unconnected pavement, HSG B
0.107	98	Unconnected pavement, HSG C
0.257	98	Unconnected pavement, HSG D
2.933	69	50-75% Grass cover, Fair, HSG B
0.278	79	50-75% Grass cover, Fair, HSG C
0.063	85	Gravel roads, HSG B
3.831	74	Weighted Average, UI Adjusted CN = 72
3.274		85.46% Pervious Area
0.557		14.54% Impervious Area
0.557		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0340	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
2.4	209	0.0430	1.45		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	107	0.0634	1.76		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	366	Total			

Summary for Subcatchment EX3: EX3

Runoff = 10.95 cfs @ 12.28 hrs, Volume= 1.166 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.086	98	Unconnected pavement, HSG B
0.105	98	Unconnected pavement, HSG C
5.931	69	50-75% Grass cover, Fair, HSG B
0.946	79	50-75% Grass cover, Fair, HSG C
0.068	85	Gravel roads, HSG B
0.009	89	Gravel roads, HSG C
7.145	71	Weighted Average
6.954		97.33% Pervious Area
0.191		2.67% Impervious Area
0.191		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	17	0.4819	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
5.5	219	0.0091	0.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.4	221	0.0050	0.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.4	107	0.0034	0.41		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	365	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
19.4	929	Total			

Summary for Subcatchment EX4: EX4

Runoff = 3.07 cfs @ 12.12 hrs, Volume= 0.236 af, Depth> 2.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.028	98	Unconnected pavement, HSG B
0.000	98	Unconnected pavement, HSG C
0.782	69	50-75% Grass cover, Fair, HSG B
0.526	79	50-75% Grass cover, Fair, HSG C
1.336	74	Weighted Average, UI Adjusted CN = 73
1.308		97.90% Pervious Area
0.028		2.10% Impervious Area
0.028		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	43	0.0384	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
3.3	123	0.0081	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.2780	3.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	43	0.0282	1.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.7	227	Total			

Summary for Subcatchment EX5: EX5

Runoff = 2.82 cfs @ 12.30 hrs, Volume= 0.308 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.294	98	Unconnected pavement, HSG B
0.084	98	Unconnected pavement, HSG C
0.830	69	50-75% Grass cover, Fair, HSG B
0.413	79	50-75% Grass cover, Fair, HSG C
1.621	78	Weighted Average, UI Adjusted CN = 75
1.243		76.68% Pervious Area
0.378		23.32% Impervious Area
0.378		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	50	0.0012	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.6	45	0.0378	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	97	0.0515	1.59		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	139	0.0120	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	331	Total			

Summary for Subcatchment EX6: EX6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.76 cfs @ 12.07 hrs, Volume= 0.127 af, Depth> 3.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.162	98	Unconnected pavement, HSG D
0.265	84	50-75% Grass cover, Fair, HSG D
0.427	89	Weighted Average
0.265		62.06% Pervious Area
0.162		37.94% Impervious Area
0.162		100.00% Unconnected

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

Summary for Subcatchment EX7: EX7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.30 cfs @ 12.08 hrs, Volume= 0.095 af, Depth> 1.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.626	69	50-75% Grass cover, Fair, HSG B
0.626		100.00% Pervious Area

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

Summary for Reach 2R: Reach

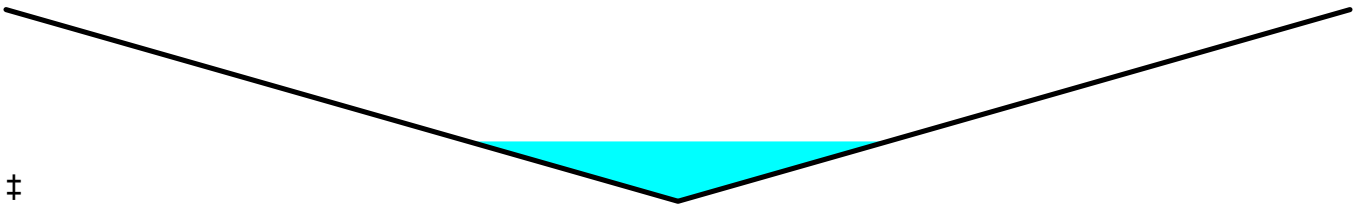
Assumed

Inflow Area = 3.831 ac, 14.54% Impervious, Inflow Depth > 0.05" for 10-Year event
Inflow = 0.10 cfs @ 24.00 hrs, Volume= 0.016 af
Outflow = 0.08 cfs @ 24.00 hrs, Volume= 0.011 af, Atten= 12%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.47 fps, Min. Travel Time= 21.4 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 30.8 min

Peak Storage= 117 cf @ 24.00 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 0.50' Flow Area= 2.0 sf, Capacity= 2.03 cfs

0.00' x 0.50' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 8.0 '/' Top Width= 8.00'
Length= 600.0' Slope= 0.0037 '/'
Inlet Invert= 24.50', Outlet Invert= 22.30'



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Summary for Pond 1P: Depression

Inflow Area = 3.831 ac, 14.54% Impervious, Inflow Depth > 2.04" for 10-Year event
Inflow = 8.40 cfs @ 12.12 hrs, Volume= 0.652 af
Outflow = 0.10 cfs @ 24.00 hrs, Volume= 0.016 af, Atten= 99%, Lag= 713.0 min
Primary = 0.10 cfs @ 24.00 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.08' @ 24.00 hrs Surf.Area= 24,021 sf Storage= 27,684 cf

Plug-Flow detention time= 716.2 min calculated for 0.016 af (3% of inflow)
Center-of-Mass det. time= 516.5 min (1,362.0 - 845.4)

Volume	Invert	Avail.Storage	Storage Description
#1	23.00'	54,543 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
23.00	3,560	227.0	0	0	3,560
24.00	13,186	521.0	7,866	7,866	21,064
25.00	23,209	669.0	17,963	25,829	35,092
26.00	34,597	756.0	28,714	54,543	44,983

Device	Routing	Invert	Outlet Devices
#1	Primary	25.00'	**174.6 deg x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=0.09 cfs @ 24.00 hrs HW=25.08' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.09 cfs @ 0.69 fps)

Summary for Pond 2P: Depression

Inflow Area = 1.336 ac, 2.10% Impervious, Inflow Depth > 2.12" for 10-Year event
Inflow = 3.07 cfs @ 12.12 hrs, Volume= 0.236 af
Outflow = 1.29 cfs @ 12.42 hrs, Volume= 0.150 af, Atten= 58%, Lag= 18.0 min
Primary = 1.29 cfs @ 12.42 hrs, Volume= 0.150 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 27.54' @ 12.42 hrs Surf.Area= 11,875 sf Storage= 4,181 cf

Plug-Flow detention time= 191.7 min calculated for 0.150 af (64% of inflow)
Center-of-Mass det. time= 83.5 min (926.3 - 842.8)

Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	13,008 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
26.00	531	116.5	0	0	531
27.00	1,512	533.3	980	980	22,086
28.00	28,059	659.5	12,028	13,008	34,080

Device	Routing	Invert	Outlet Devices
#1	Primary	27.50'	**179.9 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=1.17 cfs @ 12.42 hrs HW=27.54' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.17 cfs @ 0.52 fps)

Summary for Pond 3P: Depression

[62] Hint: Exceeded Reach 2R OUTLET depth by 0.88' @ 12.55 hrs

Inflow Area = 10.976 ac, 6.81% Impervious, Inflow Depth > 1.29" for 10-Year event
Inflow = 10.95 cfs @ 12.28 hrs, Volume= 1.177 af
Outflow = 7.12 cfs @ 12.54 hrs, Volume= 1.177 af, Atten= 35%, Lag= 15.5 min
Primary = 7.12 cfs @ 12.54 hrs, Volume= 1.177 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 23.18' @ 12.54 hrs Surf.Area= 17,552 sf Storage= 5,252 cf

Plug-Flow detention time= 3.9 min calculated for 1.174 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (865.9 - 862.0)

Volume	Invert	Avail.Storage	Storage Description
#1	22.30'	36,053 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
22.30	0	0.0	0	0	0
23.00	11,429	748.0	2,667	2,667	44,525
24.00	62,091	1,002.0	33,386	36,053	79,908

Device	Routing	Invert	Outlet Devices
#1	Primary	7.22'	**24.0" Round Culvert** L= 365.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.22' / 6.22' S= 0.0027 '/' Cc= 0.900 n= 0.012 Steel, smooth, Flow Area= 3.14 sf
#2	Device 1	22.30'	**6.0" x 1.5" Horiz. Orifice/Grate X 3.00 columns** X 8 rows C= 0.600 in 24.0" x 24.0" Grate Limited to weir flow at low heads
#3	Primary	23.09'	**178.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=7.11 cfs @ 12.54 hrs HW=23.18' (Free Discharge)
- **1=Culvert** (Passes 6.77 cfs of 42.05 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 6.77 cfs @ 4.51 fps)
- **3=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.33 cfs @ 0.73 fps)

Summary for Pond 4P: Depression

Inflow Area = 1.621 ac, 23.32% Impervious, Inflow Depth > 2.28" for 10-Year event
Inflow = 2.82 cfs @ 12.30 hrs, Volume= 0.308 af
Outflow = 0.06 cfs @ 23.30 hrs, Volume= 0.010 af, Atten= 98%, Lag= 659.8 min
Primary = 0.06 cfs @ 23.30 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.96' @ 23.30 hrs Surf.Area= 20,355 sf Storage= 12,977 cf

Plug-Flow detention time= 735.9 min calculated for 0.010 af (3% of inflow)
Center-of-Mass det. time= 529.5 min (1,378.0 - 848.4)

Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	13,753 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
25.00	7,632	406.6	0	0	7,632
26.00	20,975	659.9	13,753	13,753	29,136

Device	Routing	Invert	Outlet Devices
#1	Primary	25.95'	**179.9 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=0.05 cfs @ 23.30 hrs HW=25.96' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.05 cfs @ 0.27 fps)

Summary for Link DP1: DP1

Inflow Area = 15.241 ac, 26.97% Impervious, Inflow Depth > 2.06" for 10-Year event
Inflow = 22.23 cfs @ 12.08 hrs, Volume= 2.620 af
Primary = 22.23 cfs @ 12.08 hrs, Volume= 2.620 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP3: DP3

Inflow Area = 1.336 ac, 2.10% Impervious, Inflow Depth > 1.35" for 10-Year event
Inflow = 1.29 cfs @ 12.42 hrs, Volume= 0.150 af
Primary = 1.29 cfs @ 12.42 hrs, Volume= 0.150 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP4: DP4

Inflow Area = 1.621 ac, 23.32% Impervious, Inflow Depth > 0.07" for 10-Year event
Inflow = 0.06 cfs @ 23.30 hrs, Volume= 0.010 af
Primary = 0.06 cfs @ 23.30 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

100-Year Storm Event - Existing

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEX1: EX1 Runoff Area=3.212 ac 99.63% Impervious Runoff Depth>6.76"
Flow Length=813' Tc=5.0 min CN=98 Runoff=22.20 cfs 1.809 af

SubcatchmentEX2: EX2 Runoff Area=3.831 ac 14.54% Impervious Runoff Depth>3.82"
Flow Length=366' Tc=7.8 min UI Adjusted CN=72 Runoff=15.96 cfs 1.221 af

SubcatchmentEX3: EX3 Runoff Area=7.145 ac 2.67% Impervious Runoff Depth>3.71"
Flow Length=929' Tc=19.4 min CN=71 Runoff=21.23 cfs 2.209 af

SubcatchmentEX4: EX4 Runoff Area=1.336 ac 2.10% Impervious Runoff Depth>3.93"
Flow Length=227' Tc=7.7 min UI Adjusted CN=73 Runoff=5.74 cfs 0.438 af

SubcatchmentEX5: EX5 Runoff Area=1.621 ac 23.32% Impervious Runoff Depth>4.13"
Flow Length=331' Tc=21.4 min UI Adjusted CN=75 Runoff=5.15 cfs 0.558 af

SubcatchmentEX6: EX6 Runoff Area=0.427 ac 37.94% Impervious Runoff Depth>5.71"
Tc=5.0 min CN=89 Runoff=2.73 cfs 0.203 af

SubcatchmentEX7: EX7 Runoff Area=0.626 ac 0.00% Impervious Runoff Depth>3.51"
Tc=5.0 min CN=69 Runoff=2.58 cfs 0.183 af

Reach 2R: Reach Avg. Flow Depth=0.43' Max Vel=0.92 fps Inflow=1.38 cfs 0.566 af
n=0.035 L=600.0' S=0.0037 '/' Capacity=2.03 cfs Outflow=1.37 cfs 0.557 af

Pond 1P: Depression Peak Elev=25.23' Storage=31,524 cf Inflow=15.96 cfs 1.221 af
Outflow=1.38 cfs 0.566 af

Pond 2P: Depression Peak Elev=27.58' Storage=4,645 cf Inflow=5.74 cfs 0.438 af
Outflow=5.55 cfs 0.351 af

Pond 3P: Depression Peak Elev=23.43' Storage=10,939 cf Inflow=21.23 cfs 2.766 af
Outflow=17.21 cfs 2.766 af

Pond 4P: Depression Peak Elev=25.99' Storage=13,641 cf Inflow=5.15 cfs 0.558 af
Outflow=1.22 cfs 0.259 af

Link DP1: DP1 Inflow=33.27 cfs 4.961 af
Primary=33.27 cfs 4.961 af

Link DP3: DP3 Inflow=5.55 cfs 0.351 af
Primary=5.55 cfs 0.351 af

Link DP4: DP4 Inflow=1.22 cfs 0.259 af
Primary=1.22 cfs 0.259 af

Total Runoff Area = 18.198 ac Runoff Volume = 6.620 af Average Runoff Depth = 4.37"
75.18% Pervious = 13.682 ac 24.82% Impervious = 4.516 ac

Summary for Subcatchment EX1: EX1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 22.20 cfs @ 12.07 hrs, Volume= 1.809 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.013	98	Unconnected pavement, HSG B
0.108	98	Unconnected pavement, HSG B
3.079	98	Paved parking, HSG B
0.003	69	50-75% Grass cover, Fair, HSG B
0.009	84	50-75% Grass cover, Fair, HSG D
3.212	98	Weighted Average
0.012		0.37% Pervious Area
3.200		99.63% Impervious Area
0.121		3.78% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	50	0.0240	1.33		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
1.6	308	0.0263	3.29		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	57	0.0175	2.69		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.1	398	0.0100	5.90	4.63	**Pipe Channel, assume pipe goes with 1% slope** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
1.3					**Direct Entry, dirct entry to 5 min time concentration**
5.0	813	Total			

Summary for Subcatchment EX2: EX2

Runoff = 15.96 cfs @ 12.11 hrs, Volume= 1.221 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.193	98	Unconnected pavement, HSG B
0.107	98	Unconnected pavement, HSG C
0.257	98	Unconnected pavement, HSG D
2.933	69	50-75% Grass cover, Fair, HSG B
0.278	79	50-75% Grass cover, Fair, HSG C
0.063	85	Gravel roads, HSG B
3.831	74	Weighted Average, UI Adjusted CN = 72
3.274		85.46% Pervious Area
0.557		14.54% Impervious Area
0.557		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0340	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
2.4	209	0.0430	1.45		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	107	0.0634	1.76		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	366	Total			

Summary for Subcatchment EX3: EX3

Runoff = 21.23 cfs @ 12.27 hrs, Volume= 2.209 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.086	98	Unconnected pavement, HSG B
0.105	98	Unconnected pavement, HSG C
5.931	69	50-75% Grass cover, Fair, HSG B
0.946	79	50-75% Grass cover, Fair, HSG C
0.068	85	Gravel roads, HSG B
0.009	89	Gravel roads, HSG C
7.145	71	Weighted Average
6.954		97.33% Pervious Area
0.191		2.67% Impervious Area
0.191		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	17	0.4819	0.44		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
5.5	219	0.0091	0.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.4	221	0.0050	0.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.4	107	0.0034	0.41		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	365	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
19.4	929	Total			

Summary for Subcatchment EX4: EX4

Runoff = 5.74 cfs @ 12.11 hrs, Volume= 0.438 af, Depth> 3.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.028	98	Unconnected pavement, HSG B
0.000	98	Unconnected pavement, HSG C
0.782	69	50-75% Grass cover, Fair, HSG B
0.526	79	50-75% Grass cover, Fair, HSG C
1.336	74	Weighted Average, UI Adjusted CN = 73
1.308		97.90% Pervious Area
0.028		2.10% Impervious Area
0.028		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	43	0.0384	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
3.3	123	0.0081	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	18	0.2780	3.69		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	43	0.0282	1.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.7	227	Total			

Summary for Subcatchment EX5: EX5

Runoff = 5.15 cfs @ 12.30 hrs, Volume= 0.558 af, Depth> 4.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.294	98	Unconnected pavement, HSG B
0.084	98	Unconnected pavement, HSG C
0.830	69	50-75% Grass cover, Fair, HSG B
0.413	79	50-75% Grass cover, Fair, HSG C
1.621	78	Weighted Average, UI Adjusted CN = 75
1.243		76.68% Pervious Area
0.378		23.32% Impervious Area
0.378		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	50	0.0012	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.6	45	0.0378	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	97	0.0515	1.59		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	139	0.0120	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	331	Total			

Summary for Subcatchment EX6: EX6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.73 cfs @ 12.07 hrs, Volume= 0.203 af, Depth> 5.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.162	98	Unconnected pavement, HSG D
0.265	84	50-75% Grass cover, Fair, HSG D
0.427	89	Weighted Average
0.265		62.06% Pervious Area
0.162		37.94% Impervious Area
0.162		100.00% Unconnected

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

Summary for Subcatchment EX7: EX7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.58 cfs @ 12.08 hrs, Volume= 0.183 af, Depth> 3.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.626	69	50-75% Grass cover, Fair, HSG B
0.626		100.00% Pervious Area

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

Summary for Reach 2R: Reach

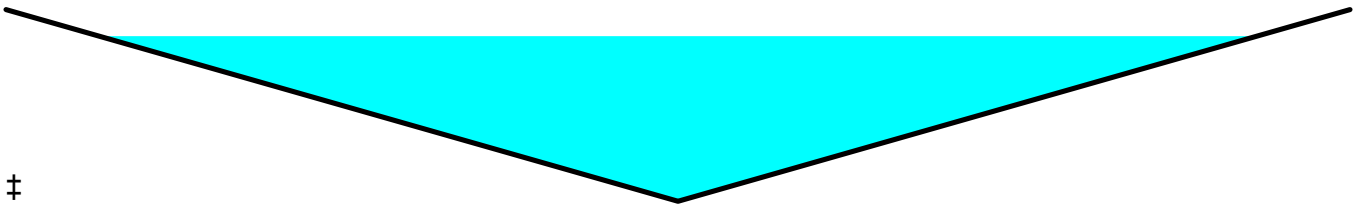
Assumed

Inflow Area = 3.831 ac, 14.54% Impervious, Inflow Depth > 1.77" for 100-Year event
Inflow = 1.38 cfs @ 13.48 hrs, Volume= 0.566 af
Outflow = 1.37 cfs @ 13.83 hrs, Volume= 0.557 af, Atten= 1%, Lag= 21.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.92 fps, Min. Travel Time= 10.9 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 14.0 min

Peak Storage= 892 cf @ 13.65 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 0.50' Flow Area= 2.0 sf, Capacity= 2.03 cfs

0.00' x 0.50' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 8.0 '/' Top Width= 8.00'
Length= 600.0' Slope= 0.0037 '/'
Inlet Invert= 24.50', Outlet Invert= 22.30'



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Summary for Pond 1P: Depression

Inflow Area = 3.831 ac, 14.54% Impervious, Inflow Depth > 3.82" for 100-Year event
Inflow = 15.96 cfs @ 12.11 hrs, Volume= 1.221 af
Outflow = 1.38 cfs @ 13.48 hrs, Volume= 0.566 af, Atten= 91%, Lag= 81.9 min
Primary = 1.38 cfs @ 13.48 hrs, Volume= 0.566 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.23' @ 13.48 hrs Surf.Area= 25,662 sf Storage= 31,524 cf

Plug-Flow detention time= 280.4 min calculated for 0.566 af (46% of inflow)
Center-of-Mass det. time= 162.9 min (990.2 - 827.3)

Volume	Invert	Avail.Storage	Storage Description
#1	23.00'	54,543 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
23.00	3,560	227.0	0	0	3,560
24.00	13,186	521.0	7,866	7,866	21,064
25.00	23,209	669.0	17,963	25,829	35,092
26.00	34,597	756.0	28,714	54,543	44,983

Device	Routing	Invert	Outlet Devices
#1	Primary	25.00'	**174.6 deg x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=1.37 cfs @ 13.48 hrs HW=25.23' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.37 cfs @ 1.19 fps)

Summary for Pond 2P: Depression

Inflow Area = 1.336 ac, 2.10% Impervious, Inflow Depth > 3.93" for 100-Year event
Inflow = 5.74 cfs @ 12.11 hrs, Volume= 0.438 af
Outflow = 5.55 cfs @ 12.15 hrs, Volume= 0.351 af, Atten= 3%, Lag= 2.1 min
Primary = 5.55 cfs @ 12.15 hrs, Volume= 0.351 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 27.58' @ 12.15 hrs Surf.Area= 12,948 sf Storage= 4,645 cf

Plug-Flow detention time= 117.7 min calculated for 0.350 af (80% of inflow)
Center-of-Mass det. time= 42.1 min (867.1 - 825.0)

Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	13,008 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
26.00	531	116.5	0	0	531
27.00	1,512	533.3	980	980	22,086
28.00	28,059	659.5	12,028	13,008	34,080

Device	Routing	Invert	Outlet Devices
#1	Primary	27.50'	**179.9 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=5.44 cfs @ 12.15 hrs HW=27.58' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 5.44 cfs @ 0.70 fps)

Summary for Pond 3P: Depression

[62] Hint: Exceeded Reach 2R OUTLET depth by 1.13' @ 12.40 hrs

Inflow Area = 10.976 ac, 6.81% Impervious, Inflow Depth > 3.02" for 100-Year event
Inflow = 21.23 cfs @ 12.27 hrs, Volume= 2.766 af
Outflow = 17.21 cfs @ 12.42 hrs, Volume= 2.766 af, Atten= 19%, Lag= 9.0 min
Primary = 17.21 cfs @ 12.42 hrs, Volume= 2.766 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 23.43' @ 12.42 hrs Surf.Area= 28,268 sf Storage= 10,939 cf

Plug-Flow detention time= 4.9 min calculated for 2.760 af (100% of inflow)
Center-of-Mass det. time= 4.9 min (877.5 - 872.6)

Volume	Invert	Avail.Storage	Storage Description
#1	22.30'	36,053 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
22.30	0	0.0	0	0	0
23.00	11,429	748.0	2,667	2,667	44,525
24.00	62,091	1,002.0	33,386	36,053	79,908

Device	Routing	Invert	Outlet Devices
#1	Primary	7.22'	**24.0" Round Culvert** L= 365.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.22' / 6.22' S= 0.0027 '/' Cc= 0.900 n= 0.012 Steel, smooth, Flow Area= 3.14 sf
#2	Device 1	22.30'	**6.0" x 1.5" Horiz. Orifice/Grate X 3.00 columns** X 8 rows C= 0.600 in 24.0" x 24.0" Grate Limited to weir flow at low heads
#3	Primary	23.09'	**178.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=17.07 cfs @ 12.42 hrs HW=23.43' (Free Discharge)
└─**1=Culvert** (Passes 7.67 cfs of 42.40 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 7.67 cfs @ 5.12 fps)
└─**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 9.40 cfs @ 1.43 fps)

Summary for Pond 4P: Depression

Inflow Area = 1.621 ac, 23.32% Impervious, Inflow Depth > 4.13" for 100-Year event
Inflow = 5.15 cfs @ 12.30 hrs, Volume= 0.558 af
Outflow = 1.22 cfs @ 12.95 hrs, Volume= 0.259 af, Atten= 76%, Lag= 39.3 min
Primary = 1.22 cfs @ 12.95 hrs, Volume= 0.259 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.99' @ 12.95 hrs Surf.Area= 20,886 sf Storage= 13,641 cf

Plug-Flow detention time= 251.2 min calculated for 0.259 af (46% of inflow)
Center-of-Mass det. time= 136.8 min (968.3 - 831.5)

Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	13,753 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
25.00	7,632	406.6	0	0	7,632
26.00	20,975	659.9	13,753	13,753	29,136

Device	Routing	Invert	Outlet Devices
#1	Primary	25.95'	**179.9 deg Sharp-Crested Vee/Trap Weir** Cv= 2.46 (C= 3.08)

Primary OutFlow Max=1.19 cfs @ 12.95 hrs HW=25.99' (Free Discharge)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.19 cfs @ 0.52 fps)

Summary for Link DP1: DP1

Inflow Area = 15.241 ac, 26.97% Impervious, Inflow Depth > 3.91" for 100-Year event
Inflow = 33.27 cfs @ 12.07 hrs, Volume= 4.961 af
Primary = 33.27 cfs @ 12.07 hrs, Volume= 4.961 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP3: DP3

Inflow Area = 1.336 ac, 2.10% Impervious, Inflow Depth > 3.15" for 100-Year event
Inflow = 5.55 cfs @ 12.15 hrs, Volume= 0.351 af
Primary = 5.55 cfs @ 12.15 hrs, Volume= 0.351 af, Atten= 0%, Lag= 0.0 min

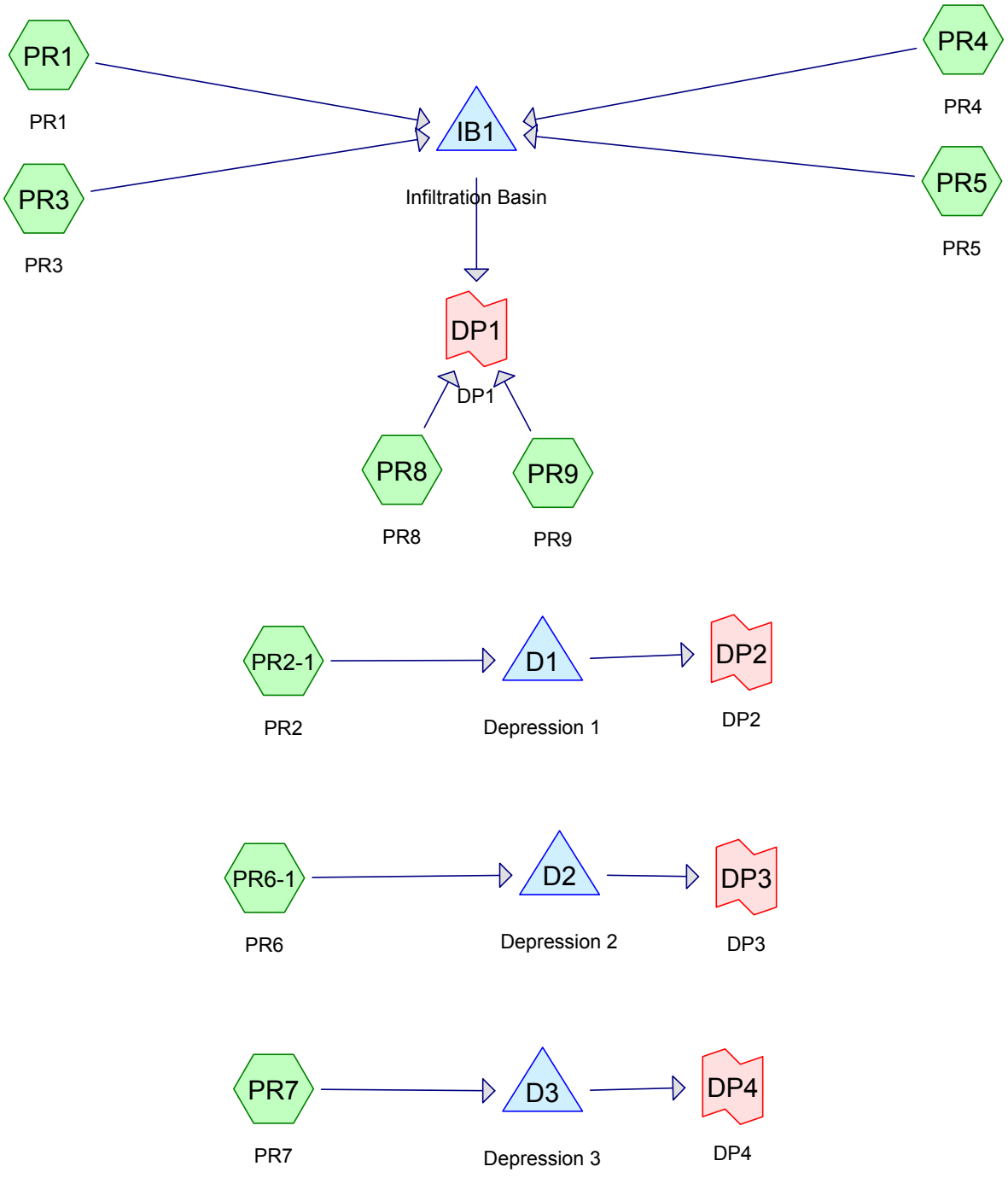
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP4: DP4

Inflow Area = 1.621 ac, 23.32% Impervious, Inflow Depth > 1.92" for 100-Year event
Inflow = 1.22 cfs @ 12.95 hrs, Volume= 0.259 af
Primary = 1.22 cfs @ 12.95 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

HydroCAD Analysis: Proposed Conditions



Routing Diagram for Weaver Cove-PR
Prepared by Vanasse Hangen Brustlin, Printed 6/18/2012

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.471	69	50-75% Grass cover, Fair, HSG B (PR1, PR2-1, PR3, PR4, PR5, PR6-1, PR7, PR8, PR9)
2.384	79	50-75% Grass cover, Fair, HSG C (PR1, PR2-1, PR4, PR6-1, PR7)
3.116	84	50-75% Grass cover, Fair, HSG D (PR1, PR2-1, PR8)
0.298	96	Gravel surface, HSG B (PR1, PR8)
0.655	96	Gravel surface, HSG D (PR1, PR8)
5.530	98	Paved parking, HSG B (PR2-1, PR3, PR4, PR5)
0.104	98	Paved parking, HSG C (PR2-1, PR4, PR5)
0.554	98	Water Surface, 0% imp, HSG B (PR2-1, PR6-1, PR7)
0.093	98	Water Surface, 0% imp, HSG C (PR6-1)
18.205	**84**	**TOTAL AREA**

2-Year Storm Event - Proposed

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1: PR1 Runoff Area=3.686 ac 0.00% Impervious Runoff Depth>1.84"
Flow Length=1,302' Tc=20.9 min CN=84 Runoff=5.28 cfs 0.566 af

Subcatchment PR2-1: PR2 Runoff Area=1.667 ac 5.28% Impervious Runoff Depth>1.42"
Tc=5.0 min CN=78 Runoff=2.75 cfs 0.197 af

Subcatchment PR3: PR3 Runoff Area=0.770 ac 81.04% Impervious Runoff Depth>2.64"
Tc=5.0 min CN=93 Runoff=2.31 cfs 0.169 af

Subcatchment PR4: PR4 Runoff Area=3.597 ac 2.72% Impervious Runoff Depth>1.05"
Flow Length=836' Tc=12.1 min CN=72 Runoff=3.36 cfs 0.316 af

Subcatchment PR5: PR5 Runoff Area=4.828 ac 99.92% Impervious Runoff Depth>3.17"
Tc=5.0 min CN=98 Runoff=16.06 cfs 1.273 af

Subcatchment PR6-1: PR6 Runoff Area=0.729 ac 0.00% Impervious Runoff Depth>1.77"
Tc=5.0 min CN=83 Runoff=1.52 cfs 0.108 af

Subcatchment PR7: PR7 Runoff Area=1.377 ac 0.00% Impervious Runoff Depth>1.36"
Tc=5.0 min CN=77 Runoff=2.15 cfs 0.156 af

Subcatchment PR8: PR8 Runoff Area=0.612 ac 0.00% Impervious Runoff Depth>2.54"
Tc=5.0 min CN=92 Runoff=1.78 cfs 0.130 af

Subcatchment PR9: PR9 Runoff Area=0.939 ac 0.00% Impervious Runoff Depth>0.89"
Tc=5.0 min CN=69 Runoff=0.90 cfs 0.070 af

Pond D1: Depression 1 Peak Elev=28.64' Storage=0.112 af Inflow=2.75 cfs 0.197 af
Discarded=0.12 cfs 0.119 af Primary=0.00 cfs 0.000 af Outflow=0.12 cfs 0.119 af

Pond D2: Depression 2 Peak Elev=25.25' Storage=0.040 af Inflow=1.52 cfs 0.108 af
Discarded=0.17 cfs 0.107 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.107 af

Pond D3: Depression 3 Peak Elev=22.41' Storage=0.066 af Inflow=2.15 cfs 0.156 af
Discarded=0.17 cfs 0.155 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.155 af

Pond IB1: Infiltration Basin Peak Elev=23.87' Storage=1.492 af Inflow=23.21 cfs 2.325 af
Discarded=0.60 cfs 0.814 af Primary=0.36 cfs 0.186 af Outflow=0.96 cfs 1.000 af

Link DP1: DP1 Inflow=2.65 cfs 0.385 af
Primary=2.65 cfs 0.385 af

Link DP2: DP2 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP3: DP3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP4: DP4 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 18.205 ac Runoff Volume = 2.985 af Average Runoff Depth = 1.97"
69.05% Pervious = 12.571 ac 30.95% Impervious = 5.634 ac

Summary for Subcatchment PR1: PR1

Runoff = 5.28 cfs @ 12.29 hrs, Volume= 0.566 af, Depth> 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.123	96	Gravel surface, HSG B
0.376	96	Gravel surface, HSG D
0.267	69	50-75% Grass cover, Fair, HSG B
0.108	79	50-75% Grass cover, Fair, HSG C
2.812	84	50-75% Grass cover, Fair, HSG D
3.686	84	Weighted Average
3.686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
6.0	434	0.0299	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	220	0.0045	1.01		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.2	233	0.0116	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	365	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
20.9	1,302	Total			

Summary for Subcatchment PR2-1: PR2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.75 cfs @ 12.08 hrs, Volume= 0.197 af, Depth> 1.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.232	98	Water Surface, 0% imp, HSG B
0.068	98	Paved parking, HSG B
0.020	98	Paved parking, HSG C
0.818	69	50-75% Grass cover, Fair, HSG B
0.362	79	50-75% Grass cover, Fair, HSG C
0.167	84	50-75% Grass cover, Fair, HSG D
1.667	78	Weighted Average
1.579		94.72% Pervious Area
0.088		5.28% Impervious Area

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

Summary for Subcatchment PR3: PR3

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.31 cfs @ 12.07 hrs, Volume= 0.169 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.624	98	Paved parking, HSG B
0.000	98	Paved parking, HSG D
0.146	69	50-75% Grass cover, Fair, HSG B
0.770	93	Weighted Average
0.146		18.96% Pervious Area
0.624		81.04% Impervious Area

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

Summary for Subcatchment PR4: PR4

Runoff = 3.36 cfs @ 12.18 hrs, Volume= 0.316 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.035	98	Paved parking, HSG B
0.063	98	Paved parking, HSG C
2.535	69	50-75% Grass cover, Fair, HSG B
0.964	79	50-75% Grass cover, Fair, HSG C
3.597	72	Weighted Average
3.499		97.28% Pervious Area
0.098		2.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
2.5	207	0.0386	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.6	210	0.0367	1.34		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	369	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
12.1	836	Total			

Summary for Subcatchment PR5: PR5

[49] Hint: Tc<2dt may require smaller dt

Runoff = 16.06 cfs @ 12.07 hrs, Volume= 1.273 af, Depth> 3.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
4.803	98	Paved parking, HSG B
0.021	98	Paved parking, HSG C
0.004	69	50-75% Grass cover, Fair, HSG B
4.828	98	Weighted Average
0.004		0.08% Pervious Area
4.824		99.92% Impervious Area

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

Summary for Subcatchment PR6-1: PR6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.52 cfs @ 12.08 hrs, Volume= 0.108 af, Depth> 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.117	98	Water Surface, 0% imp, HSG B
0.093	98	Water Surface, 0% imp, HSG C
0.085	69	50-75% Grass cover, Fair, HSG B
0.434	79	50-75% Grass cover, Fair, HSG C
0.729	83	Weighted Average
0.729		100.00% Pervious Area

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

Summary for Subcatchment PR7: PR7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.15 cfs @ 12.08 hrs, Volume= 0.156 af, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.205	98	Water Surface, 0% imp, HSG B
0.656	69	50-75% Grass cover, Fair, HSG B
0.516	79	50-75% Grass cover, Fair, HSG C
1.377	77	Weighted Average
1.377		100.00% Pervious Area

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

Summary for Subcatchment PR8: PR8

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.78 cfs @ 12.07 hrs, Volume= 0.130 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.175	96	Gravel surface, HSG B
0.279	96	Gravel surface, HSG D
0.021	69	50-75% Grass cover, Fair, HSG B
0.137	84	50-75% Grass cover, Fair, HSG D
0.612	92	Weighted Average
0.612		100.00% Pervious Area

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

Summary for Subcatchment PR9: PR9

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.90 cfs @ 12.09 hrs, Volume= 0.070 af, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.939	69	50-75% Grass cover, Fair, HSG B
0.939		100.00% Pervious Area

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

Summary for Pond D1: Depression 1

Inflow Area = 1.667 ac, 5.28% Impervious, Inflow Depth > 1.42" for 2-Year event
Inflow = 2.75 cfs @ 12.08 hrs, Volume= 0.197 af
Outflow = 0.12 cfs @ 15.87 hrs, Volume= 0.119 af, Atten= 96%, Lag= 227.5 min
Discarded = 0.12 cfs @ 15.87 hrs, Volume= 0.119 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 28.64' @ 15.87 hrs Surf.Area= 0.112 ac Storage= 0.112 af

Plug-Flow detention time= 321.5 min calculated for 0.119 af (61% of inflow)
Center-of-Mass det. time= 207.8 min (1,052.3 - 844.5)

Volume	Invert	Avail.Storage	Storage Description
#1	27.50'	0.456 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
27.50	0.085	333.7	0.000	0.000	0.085
28.00	0.097	346.7	0.045	0.045	0.102
29.00	0.121	371.2	0.109	0.154	0.135
30.00	0.148	391.4	0.134	0.289	0.164
31.00	0.187	496.4	0.167	0.456	0.335

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	30.99'	**3.0' 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=0.12 cfs @ 15.87 hrs HW=28.64' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond D2: Depression 2

Inflow Area = 0.729 ac, 0.00% Impervious, Inflow Depth > 1.77" for 2-Year event
Inflow = 1.52 cfs @ 12.08 hrs, Volume= 0.108 af
Outflow = 0.17 cfs @ 12.91 hrs, Volume= 0.107 af, Atten= 89%, Lag= 50.1 min
Discarded = 0.17 cfs @ 12.91 hrs, Volume= 0.107 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.25' @ 12.91 hrs Surf.Area= 0.162 ac Storage= 0.040 af

Plug-Flow detention time= 91.8 min calculated for 0.107 af (100% of inflow)
Center-of-Mass det. time= 89.8 min (918.6 - 828.7)

Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	0.364 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
25.00	0.155	382.5	0.000	0.000	0.155
26.00	0.182	404.0	0.168	0.168	0.187
27.00	0.210	423.0	0.196	0.364	0.217

Device	Routing	Invert	Outlet Devices
#1	Discarded	25.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	26.99'	**3.0' 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=0.17 cfs @ 12.91 hrs HW=25.25' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond D3: Depression 3

Inflow Area = 1.377 ac, 0.00% Impervious, Inflow Depth > 1.36" for 2-Year event
Inflow = 2.15 cfs @ 12.08 hrs, Volume= 0.156 af
Outflow = 0.17 cfs @ 13.81 hrs, Volume= 0.155 af, Atten= 92%, Lag= 103.5 min
Discarded = 0.17 cfs @ 13.81 hrs, Volume= 0.155 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 22.41' @ 13.81 hrs Surf.Area= 0.167 ac Storage= 0.066 af

Plug-Flow detention time= 171.7 min calculated for 0.154 af (99% of inflow)
Center-of-Mass det. time= 167.9 min (1,015.5 - 847.6)

Volume	Invert	Avail.Storage	Storage Description
#1	22.00'	0.580 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
22.00	0.158	323.3	0.000	0.000	0.158
23.00	0.181	342.1	0.169	0.169	0.182
24.00	0.205	361.0	0.193	0.362	0.208
25.00	0.230	379.9	0.217	0.580	0.235

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	24.99'	**3.0' 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=0.17 cfs @ 13.81 hrs HW=22.41' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=22.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IB1: Infiltration Basin

Inflow Area = 12.881 ac, 43.06% Impervious, Inflow Depth > 2.17" for 2-Year event
Inflow = 23.21 cfs @ 12.09 hrs, Volume= 2.325 af
Outflow = 0.96 cfs @ 16.20 hrs, Volume= 1.000 af, Atten= 96%, Lag= 246.9 min
Discarded = 0.60 cfs @ 16.20 hrs, Volume= 0.814 af
Primary = 0.36 cfs @ 16.20 hrs, Volume= 0.186 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 23.87' @ 16.20 hrs Surf.Area= 0.585 ac Storage= 1.492 af

Plug-Flow detention time= 297.1 min calculated for 1.000 af (43% of inflow)
Center-of-Mass det. time= 160.7 min (953.2 - 792.6)

Volume	Invert	Avail.Storage	Storage Description
#1	21.00'	2.845 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
21.00	0.458	612.6	0.000	0.000	0.458
22.00	0.501	631.5	0.479	0.479	0.503
23.00	0.545	650.3	0.523	1.002	0.550
24.00	0.591	669.2	0.568	1.570	0.598
25.00	0.637	688.0	0.614	2.184	0.647
26.00	0.685	706.9	0.661	2.845	0.698

Device	Routing	Invert	Outlet Devices
#1	Primary	7.22'	**24.0" Round RCP 24"** L= 364.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 7.22' / 6.22' S= 0.0027 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Discarded	21.00'	**1.020 in/hr Exfiltration over Surface area**
#3	Device 1	23.50'	**6.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	24.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#5	Device 1	25.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 4.00 columns** X 4 rows C= 0.600 in 24.0" x 24.0" Grate

Discarded OutFlow Max=0.60 cfs @ 16.20 hrs HW=23.87' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.60 cfs)

Primary OutFlow Max=0.36 cfs @ 16.20 hrs HW=23.87' (Free Discharge)
└─**1=RCP 24"** (Passes 0.36 cfs of 40.59 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 0.36 cfs @ 1.95 fps)
  ├─**4=Orifice/Grate** (Controls 0.00 cfs)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP1: DP1

Inflow Area = 14.432 ac, 38.43% Impervious, Inflow Depth > 0.32" for 2-Year event
Inflow = 2.65 cfs @ 12.08 hrs, Volume= 0.385 af
Primary = 2.65 cfs @ 12.08 hrs, Volume= 0.385 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP2: DP2

Inflow Area = 1.667 ac, 5.28% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP3: DP3

Inflow Area = 0.729 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP4: DP4

Inflow Area = 1.377 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10-Year Storm Event- Proposed

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1: PR1 Runoff Area=3.686 ac 0.00% Impervious Runoff Depth>3.08"
Flow Length=1,302' Tc=20.9 min CN=84 Runoff=8.77 cfs 0.945 af

Subcatchment PR2-1: PR2 Runoff Area=1.667 ac 5.28% Impervious Runoff Depth>2.54"
Tc=5.0 min CN=78 Runoff=4.97 cfs 0.353 af

Subcatchment PR3: PR3 Runoff Area=0.770 ac 81.04% Impervious Runoff Depth>4.00"
Tc=5.0 min CN=93 Runoff=3.43 cfs 0.257 af

Subcatchment PR4: PR4 Runoff Area=3.597 ac 2.72% Impervious Runoff Depth>2.04"
Flow Length=836' Tc=12.1 min CN=72 Runoff=6.91 cfs 0.611 af

Subcatchment PR5: PR5 Runoff Area=4.828 ac 99.92% Impervious Runoff Depth>4.56"
Tc=5.0 min CN=98 Runoff=22.81 cfs 1.835 af

Subcatchment PR6-1: PR6 Runoff Area=0.729 ac 0.00% Impervious Runoff Depth>2.99"
Tc=5.0 min CN=83 Runoff=2.55 cfs 0.182 af

Subcatchment PR7: PR7 Runoff Area=1.377 ac 0.00% Impervious Runoff Depth>2.45"
Tc=5.0 min CN=77 Runoff=3.97 cfs 0.282 af

Subcatchment PR8: PR8 Runoff Area=0.612 ac 0.00% Impervious Runoff Depth>3.89"
Tc=5.0 min CN=92 Runoff=2.68 cfs 0.198 af

Subcatchment PR9: PR9 Runoff Area=0.939 ac 0.00% Impervious Runoff Depth>1.81"
Tc=5.0 min CN=69 Runoff=1.95 cfs 0.142 af

Pond D1: Depression 1 Peak Elev=29.58' Storage=0.229 af Inflow=4.97 cfs 0.353 af
Discarded=0.14 cfs 0.153 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.153 af

Pond D2: Depression 2 Peak Elev=25.50' Storage=0.081 af Inflow=2.55 cfs 0.182 af
Discarded=0.17 cfs 0.181 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.181 af

Pond D3: Depression 3 Peak Elev=22.90' Storage=0.151 af Inflow=3.97 cfs 0.282 af
Discarded=0.18 cfs 0.199 af Primary=0.00 cfs 0.000 af Outflow=0.18 cfs 0.199 af

Pond IB1: Infiltration Basin Peak Elev=24.73' Storage=2.016 af Inflow=35.83 cfs 3.648 af
Discarded=0.64 cfs 0.900 af Primary=2.85 cfs 1.297 af Outflow=3.49 cfs 2.196 af

Link DP1: DP1 Inflow=4.59 cfs 1.637 af
Primary=4.59 cfs 1.637 af

Link DP2: DP2 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP3: DP3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP4: DP4

Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 18.205 ac Runoff Volume = 4.805 af Average Runoff Depth = 3.17"
69.05% Pervious = 12.571 ac 30.95% Impervious = 5.634 ac

Summary for Subcatchment PR1: PR1

Runoff = 8.77 cfs @ 12.29 hrs, Volume= 0.945 af, Depth> 3.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.123	96	Gravel surface, HSG B
0.376	96	Gravel surface, HSG D
0.267	69	50-75% Grass cover, Fair, HSG B
0.108	79	50-75% Grass cover, Fair, HSG C
2.812	84	50-75% Grass cover, Fair, HSG D
3.686	84	Weighted Average
3.686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
6.0	434	0.0299	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	220	0.0045	1.01		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.2	233	0.0116	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	365	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
20.9	1,302	Total			

Summary for Subcatchment PR2-1: PR2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 4.97 cfs @ 12.08 hrs, Volume= 0.353 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.232	98	Water Surface, 0% imp, HSG B
0.068	98	Paved parking, HSG B
0.020	98	Paved parking, HSG C
0.818	69	50-75% Grass cover, Fair, HSG B
0.362	79	50-75% Grass cover, Fair, HSG C
0.167	84	50-75% Grass cover, Fair, HSG D
1.667	78	Weighted Average
1.579		94.72% Pervious Area
0.088		5.28% Impervious Area

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

Summary for Subcatchment PR3: PR3

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.43 cfs @ 12.07 hrs, Volume= 0.257 af, Depth> 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.624	98	Paved parking, HSG B
0.000	98	Paved parking, HSG D
0.146	69	50-75% Grass cover, Fair, HSG B
0.770	93	Weighted Average
0.146		18.96% Pervious Area
0.624		81.04% Impervious Area

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

Summary for Subcatchment PR4: PR4

Runoff = 6.91 cfs @ 12.17 hrs, Volume= 0.611 af, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.035	98	Paved parking, HSG B
0.063	98	Paved parking, HSG C
2.535	69	50-75% Grass cover, Fair, HSG B
0.964	79	50-75% Grass cover, Fair, HSG C
3.597	72	Weighted Average
3.499		97.28% Pervious Area
0.098		2.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
2.5	207	0.0386	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.6	210	0.0367	1.34		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	369	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
12.1	836	Total			

Summary for Subcatchment PR5: PR5

[49] Hint: Tc<2dt may require smaller dt

Runoff = 22.81 cfs @ 12.07 hrs, Volume= 1.835 af, Depth> 4.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
4.803	98	Paved parking, HSG B
0.021	98	Paved parking, HSG C
0.004	69	50-75% Grass cover, Fair, HSG B
4.828	98	Weighted Average
0.004		0.08% Pervious Area
4.824		99.92% Impervious Area

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

Summary for Subcatchment PR6-1: PR6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.55 cfs @ 12.08 hrs, Volume= 0.182 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.117	98	Water Surface, 0% imp, HSG B
0.093	98	Water Surface, 0% imp, HSG C
0.085	69	50-75% Grass cover, Fair, HSG B
0.434	79	50-75% Grass cover, Fair, HSG C
0.729	83	Weighted Average
0.729		100.00% Pervious Area

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

Summary for Subcatchment PR7: PR7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.97 cfs @ 12.08 hrs, Volume= 0.282 af, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.205	98	Water Surface, 0% imp, HSG B
0.656	69	50-75% Grass cover, Fair, HSG B
0.516	79	50-75% Grass cover, Fair, HSG C
1.377	77	Weighted Average
1.377		100.00% Pervious Area

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

Summary for Subcatchment PR8: PR8

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.68 cfs @ 12.07 hrs, Volume= 0.198 af, Depth> 3.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.175	96	Gravel surface, HSG B
0.279	96	Gravel surface, HSG D
0.021	69	50-75% Grass cover, Fair, HSG B
0.137	84	50-75% Grass cover, Fair, HSG D
0.612	92	Weighted Average
0.612		100.00% Pervious Area

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

Summary for Subcatchment PR9: PR9

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.95 cfs @ 12.08 hrs, Volume= 0.142 af, Depth> 1.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (ac)	CN	Description
0.939	69	50-75% Grass cover, Fair, HSG B
0.939		100.00% Pervious Area

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

Summary for Pond D1: Depression 1

Inflow Area = 1.667 ac, 5.28% Impervious, Inflow Depth > 2.54" for 10-Year event
Inflow = 4.97 cfs @ 12.08 hrs, Volume= 0.353 af
Outflow = 0.14 cfs @ 17.03 hrs, Volume= 0.153 af, Atten= 97%, Lag= 296.9 min
Discarded = 0.14 cfs @ 17.03 hrs, Volume= 0.153 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 29.58' @ 17.03 hrs Surf.Area= 0.136 ac Storage= 0.229 af

Plug-Flow detention time= 327.9 min calculated for 0.153 af (43% of inflow)
Center-of-Mass det. time= 207.1 min (1,034.7 - 827.6)

Volume	Invert	Avail.Storage	Storage Description
#1	27.50'	0.456 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
27.50	0.085	333.7	0.000	0.000	0.085
28.00	0.097	346.7	0.045	0.045	0.102
29.00	0.121	371.2	0.109	0.154	0.135
30.00	0.148	391.4	0.134	0.289	0.164
31.00	0.187	496.4	0.167	0.456	0.335

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	30.99'	**3.0' 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=0.14 cfs @ 17.03 hrs HW=29.58' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond D2: Depression 2

Inflow Area = 0.729 ac, 0.00% Impervious, Inflow Depth > 2.99" for 10-Year event
Inflow = 2.55 cfs @ 12.08 hrs, Volume= 0.182 af
Outflow = 0.17 cfs @ 13.74 hrs, Volume= 0.181 af, Atten= 93%, Lag= 99.7 min
Discarded = 0.17 cfs @ 13.74 hrs, Volume= 0.181 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.50' @ 13.74 hrs Surf.Area= 0.168 ac Storage= 0.081 af

Plug-Flow detention time= 195.2 min calculated for 0.181 af (100% of inflow)
Center-of-Mass det. time= 193.3 min (1,007.0 - 813.8)

Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	0.364 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
25.00	0.155	382.5	0.000	0.000	0.155
26.00	0.182	404.0	0.168	0.168	0.187
27.00	0.210	423.0	0.196	0.364	0.217

Device	Routing	Invert	Outlet Devices
#1	Discarded	25.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	26.99'	**3.0' 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=0.17 cfs @ 13.74 hrs HW=25.50' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond D3: Depression 3

Inflow Area = 1.377 ac, 0.00% Impervious, Inflow Depth > 2.45" for 10-Year event
Inflow = 3.97 cfs @ 12.08 hrs, Volume= 0.282 af
Outflow = 0.18 cfs @ 15.31 hrs, Volume= 0.199 af, Atten= 95%, Lag= 193.7 min
Discarded = 0.18 cfs @ 15.31 hrs, Volume= 0.199 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 22.90' @ 15.31 hrs Surf.Area= 0.179 ac Storage= 0.151 af

Plug-Flow detention time= 302.1 min calculated for 0.199 af (71% of inflow)
Center-of-Mass det. time= 206.6 min (1,036.8 - 830.2)

Volume	Invert	Avail.Storage	Storage Description
#1	22.00'	0.580 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
22.00	0.158	323.3	0.000	0.000	0.158
23.00	0.181	342.1	0.169	0.169	0.182
24.00	0.205	361.0	0.193	0.362	0.208
25.00	0.230	379.9	0.217	0.580	0.235

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	24.99'	**3.0' 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=0.18 cfs @ 15.31 hrs HW=22.90' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=22.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IB1: Infiltration Basin

Inflow Area = 12.881 ac, 43.06% Impervious, Inflow Depth > 3.40" for 10-Year event
Inflow = 35.83 cfs @ 12.09 hrs, Volume= 3.648 af
Outflow = 3.49 cfs @ 13.54 hrs, Volume= 2.196 af, Atten= 90%, Lag= 86.8 min
Discarded = 0.64 cfs @ 13.54 hrs, Volume= 0.900 af
Primary = 2.85 cfs @ 13.54 hrs, Volume= 1.297 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 24.73' @ 13.54 hrs Surf.Area= 0.625 ac Storage= 2.016 af

Plug-Flow detention time= 256.8 min calculated for 2.196 af (60% of inflow)
Center-of-Mass det. time= 146.8 min (933.1 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1	21.00'	2.845 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
21.00	0.458	612.6	0.000	0.000	0.458
22.00	0.501	631.5	0.479	0.479	0.503
23.00	0.545	650.3	0.523	1.002	0.550
24.00	0.591	669.2	0.568	1.570	0.598
25.00	0.637	688.0	0.614	2.184	0.647
26.00	0.685	706.9	0.661	2.845	0.698

Device	Routing	Invert	Outlet Devices
#1	Primary	7.22'	**24.0" Round RCP 24"** L= 364.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 7.22' / 6.22' S= 0.0027 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Discarded	21.00'	**1.020 in/hr Exfiltration over Surface area**
#3	Device 1	23.50'	**6.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	24.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#5	Device 1	25.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 4.00 columns** X 4 rows C= 0.600 in 24.0" x 24.0" Grate

Discarded OutFlow Max=0.64 cfs @ 13.54 hrs HW=24.73' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.64 cfs)

Primary OutFlow Max=2.85 cfs @ 13.54 hrs HW=24.73' (Free Discharge)
└─**1=RCP 24"** (Passes 2.85 cfs of 41.70 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 1.19 cfs @ 4.76 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 1.66 cfs @ 3.31 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP1: DP1

Inflow Area = 14.432 ac, 38.43% Impervious, Inflow Depth > 1.36" for 10-Year event
Inflow = 4.59 cfs @ 12.08 hrs, Volume= 1.637 af
Primary = 4.59 cfs @ 12.08 hrs, Volume= 1.637 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP2: DP2

Inflow Area = 1.667 ac, 5.28% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP3: DP3

Inflow Area = 0.729 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP4: DP4

Inflow Area = 1.377 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

100-Year Storm Event – Proposed

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR1: PR1 Runoff Area=3.686 ac 0.00% Impervious Runoff Depth>5.12"
Flow Length=1,302' Tc=20.9 min CN=84 Runoff=14.39 cfs 1.574 af

Subcatchment PR2-1: PR2 Runoff Area=1.667 ac 5.28% Impervious Runoff Depth>4.47"
Tc=5.0 min CN=78 Runoff=8.70 cfs 0.621 af

Subcatchment PR3: PR3 Runoff Area=0.770 ac 81.04% Impervious Runoff Depth>6.17"
Tc=5.0 min CN=93 Runoff=5.15 cfs 0.396 af

Subcatchment PR4: PR4 Runoff Area=3.597 ac 2.72% Impervious Runoff Depth>3.82"
Flow Length=836' Tc=12.1 min CN=72 Runoff=13.15 cfs 1.145 af

Subcatchment PR5: PR5 Runoff Area=4.828 ac 99.92% Impervious Runoff Depth>6.76"
Tc=5.0 min CN=98 Runoff=33.37 cfs 2.719 af

Subcatchment PR6-1: PR6 Runoff Area=0.729 ac 0.00% Impervious Runoff Depth>5.02"
Tc=5.0 min CN=83 Runoff=4.24 cfs 0.305 af

Subcatchment PR7: PR7 Runoff Area=1.377 ac 0.00% Impervious Runoff Depth>4.36"
Tc=5.0 min CN=77 Runoff=7.02 cfs 0.501 af

Subcatchment PR8: PR8 Runoff Area=0.612 ac 0.00% Impervious Runoff Depth>6.05"
Tc=5.0 min CN=92 Runoff=4.06 cfs 0.309 af

Subcatchment PR9: PR9 Runoff Area=0.939 ac 0.00% Impervious Runoff Depth>3.51"
Tc=5.0 min CN=69 Runoff=3.87 cfs 0.275 af

Pond D1: Depression 1 Peak Elev=30.92' Storage=0.440 af Inflow=8.70 cfs 0.621 af
Discarded=0.19 cfs 0.210 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.210 af

Pond D2: Depression 2 Peak Elev=25.96' Storage=0.161 af Inflow=4.24 cfs 0.305 af
Discarded=0.19 cfs 0.220 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.220 af

Pond D3: Depression 3 Peak Elev=23.76' Storage=0.314 af Inflow=7.02 cfs 0.501 af
Discarded=0.20 cfs 0.239 af Primary=0.00 cfs 0.000 af Outflow=0.20 cfs 0.239 af

Pond IB1: Infiltration Basin Peak Elev=25.99' Storage=2.835 af Inflow=56.46 cfs 5.833 af
Discarded=0.70 cfs 0.989 af Primary=13.46 cfs 3.293 af Outflow=14.17 cfs 4.281 af

Link DP1: DP1 Inflow=14.74 cfs 3.876 af
Primary=14.74 cfs 3.876 af

Link DP2: DP2 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP3: DP3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP4: DP4

Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 18.205 ac Runoff Volume = 7.844 af Average Runoff Depth = 5.17"
69.05% Pervious = 12.571 ac 30.95% Impervious = 5.634 ac

Summary for Subcatchment PR1: PR1

Runoff = 14.39 cfs @ 12.28 hrs, Volume= 1.574 af, Depth> 5.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.123	96	Gravel surface, HSG B
0.376	96	Gravel surface, HSG D
0.267	69	50-75% Grass cover, Fair, HSG B
0.108	79	50-75% Grass cover, Fair, HSG C
2.812	84	50-75% Grass cover, Fair, HSG D
3.686	84	Weighted Average
3.686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
6.0	434	0.0299	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	220	0.0045	1.01		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.2	233	0.0116	0.75		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	365	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
20.9	1,302	Total			

Summary for Subcatchment PR2-1: PR2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 8.70 cfs @ 12.08 hrs, Volume= 0.621 af, Depth> 4.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.232	98	Water Surface, 0% imp, HSG B
0.068	98	Paved parking, HSG B
0.020	98	Paved parking, HSG C
0.818	69	50-75% Grass cover, Fair, HSG B
0.362	79	50-75% Grass cover, Fair, HSG C
0.167	84	50-75% Grass cover, Fair, HSG D
1.667	78	Weighted Average
1.579		94.72% Pervious Area
0.088		5.28% Impervious Area

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

Summary for Subcatchment PR3: PR3

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.15 cfs @ 12.07 hrs, Volume= 0.396 af, Depth> 6.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.624	98	Paved parking, HSG B
0.000	98	Paved parking, HSG D
0.146	69	50-75% Grass cover, Fair, HSG B
0.770	93	Weighted Average
0.146		18.96% Pervious Area
0.624		81.04% Impervious Area

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

Summary for Subcatchment PR4: PR4

Runoff = 13.15 cfs @ 12.17 hrs, Volume= 1.145 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.035	98	Paved parking, HSG B
0.063	98	Paved parking, HSG C
2.535	69	50-75% Grass cover, Fair, HSG B
0.964	79	50-75% Grass cover, Fair, HSG C
3.597	72	Weighted Average
3.499		97.28% Pervious Area
0.098		2.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
2.5	207	0.0386	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.6	210	0.0367	1.34		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	369	0.0027	4.05	12.73	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Steel, smooth
12.1	836	Total			

Summary for Subcatchment PR5: PR5

[49] Hint: Tc<2dt may require smaller dt

Runoff = 33.37 cfs @ 12.07 hrs, Volume= 2.719 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
4.803	98	Paved parking, HSG B
0.021	98	Paved parking, HSG C
0.004	69	50-75% Grass cover, Fair, HSG B
4.828	98	Weighted Average
0.004		0.08% Pervious Area
4.824		99.92% Impervious Area

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

Summary for Subcatchment PR6-1: PR6

[49] Hint: Tc<2dt may require smaller dt

Runoff = 4.24 cfs @ 12.07 hrs, Volume= 0.305 af, Depth> 5.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.117	98	Water Surface, 0% imp, HSG B
0.093	98	Water Surface, 0% imp, HSG C
0.085	69	50-75% Grass cover, Fair, HSG B
0.434	79	50-75% Grass cover, Fair, HSG C
0.729	83	Weighted Average
0.729		100.00% Pervious Area

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

Summary for Subcatchment PR7: PR7

[49] Hint: Tc<2dt may require smaller dt

Runoff = 7.02 cfs @ 12.08 hrs, Volume= 0.501 af, Depth> 4.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.205	98	Water Surface, 0% imp, HSG B
0.656	69	50-75% Grass cover, Fair, HSG B
0.516	79	50-75% Grass cover, Fair, HSG C
1.377	77	Weighted Average
1.377		100.00% Pervious Area

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

Summary for Subcatchment PR8: PR8

[49] Hint: Tc<2dt may require smaller dt

Runoff = 4.06 cfs @ 12.07 hrs, Volume= 0.309 af, Depth> 6.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.175	96	Gravel surface, HSG B
0.279	96	Gravel surface, HSG D
0.021	69	50-75% Grass cover, Fair, HSG B
0.137	84	50-75% Grass cover, Fair, HSG D
0.612	92	Weighted Average
0.612		100.00% Pervious Area

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

Summary for Subcatchment PR9: PR9

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.87 cfs @ 12.08 hrs, Volume= 0.275 af, Depth> 3.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.939	69	50-75% Grass cover, Fair, HSG B
0.939		100.00% Pervious Area

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

Summary for Pond D1: Depression 1

Inflow Area = 1.667 ac, 5.28% Impervious, Inflow Depth > 4.47" for 100-Year event
Inflow = 8.70 cfs @ 12.08 hrs, Volume= 0.621 af
Outflow = 0.19 cfs @ 17.69 hrs, Volume= 0.210 af, Atten= 98%, Lag= 337.0 min
Discarded = 0.19 cfs @ 17.69 hrs, Volume= 0.210 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 30.92' @ 17.69 hrs Surf.Area= 0.184 ac Storage= 0.440 af

Plug-Flow detention time= 337.9 min calculated for 0.210 af (34% of inflow)
Center-of-Mass det. time= 209.9 min (1,021.3 - 811.4)

Volume	Invert	Avail.Storage	Storage Description
#1	27.50'	0.456 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
27.50	0.085	333.7	0.000	0.000	0.085
28.00	0.097	346.7	0.045	0.045	0.102
29.00	0.121	371.2	0.109	0.154	0.135
30.00	0.148	391.4	0.134	0.289	0.164
31.00	0.187	496.4	0.167	0.456	0.335

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	30.99'	**3.0' 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=0.19 cfs @ 17.69 hrs HW=30.92' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=27.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond D2: Depression 2

Inflow Area = 0.729 ac, 0.00% Impervious, Inflow Depth > 5.02" for 100-Year event
Inflow = 4.24 cfs @ 12.07 hrs, Volume= 0.305 af
Outflow = 0.19 cfs @ 14.95 hrs, Volume= 0.220 af, Atten= 96%, Lag= 172.4 min
Discarded = 0.19 cfs @ 14.95 hrs, Volume= 0.220 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 25.96' @ 14.95 hrs Surf.Area= 0.181 ac Storage= 0.161 af

Plug-Flow detention time= 284.1 min calculated for 0.220 af (72% of inflow)
Center-of-Mass det. time= 195.3 min (994.4 - 799.1)

Volume	Invert	Avail.Storage	Storage Description
#1	25.00'	0.364 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
25.00	0.155	382.5	0.000	0.000	0.155
26.00	0.182	404.0	0.168	0.168	0.187
27.00	0.210	423.0	0.196	0.364	0.217

Device	Routing	Invert	Outlet Devices
#1	Discarded	25.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	26.99'	**3.0' 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=0.19 cfs @ 14.95 hrs HW=25.96' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=25.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond D3: Depression 3

Inflow Area = 1.377 ac, 0.00% Impervious, Inflow Depth > 4.36" for 100-Year event
Inflow = 7.02 cfs @ 12.08 hrs, Volume= 0.501 af
Outflow = 0.20 cfs @ 16.49 hrs, Volume= 0.239 af, Atten= 97%, Lag= 265.1 min
Discarded = 0.20 cfs @ 16.49 hrs, Volume= 0.239 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 23.76' @ 16.49 hrs Surf.Area= 0.199 ac Storage= 0.314 af

Plug-Flow detention time= 309.1 min calculated for 0.238 af (48% of inflow)
Center-of-Mass det. time= 194.9 min (1,008.6 - 813.8)

Volume	Invert	Avail.Storage	Storage Description
#1	22.00'	0.580 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
22.00	0.158	323.3	0.000	0.000	0.158
23.00	0.181	342.1	0.169	0.169	0.182
24.00	0.205	361.0	0.193	0.362	0.208
25.00	0.230	379.9	0.217	0.580	0.235

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	24.99'	**3.0' 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=0.20 cfs @ 16.49 hrs HW=23.76' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=22.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IB1: Infiltration Basin

Inflow Area = 12.881 ac, 43.06% Impervious, Inflow Depth > 5.43" for 100-Year event
Inflow = 56.46 cfs @ 12.09 hrs, Volume= 5.833 af
Outflow = 14.17 cfs @ 12.66 hrs, Volume= 4.281 af, Atten= 75%, Lag= 33.7 min
Discarded = 0.70 cfs @ 12.66 hrs, Volume= 0.989 af
Primary = 13.46 cfs @ 12.66 hrs, Volume= 3.293 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 25.99' @ 12.66 hrs Surf.Area= 0.684 ac Storage= 2.835 af

Plug-Flow detention time= 201.8 min calculated for 4.281 af (73% of inflow)
Center-of-Mass det. time= 111.8 min (891.0 - 779.2)

Volume	Invert	Avail.Storage	Storage Description
#1	21.00'	2.845 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
21.00	0.458	612.6	0.000	0.000	0.458
22.00	0.501	631.5	0.479	0.479	0.503
23.00	0.545	650.3	0.523	1.002	0.550
24.00	0.591	669.2	0.568	1.570	0.598
25.00	0.637	688.0	0.614	2.184	0.647
26.00	0.685	706.9	0.661	2.845	0.698

Device	Routing	Invert	Outlet Devices
#1	Primary	7.22'	**24.0" Round RCP 24"** L= 364.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 7.22' / 6.22' S= 0.0027 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Discarded	21.00'	**1.020 in/hr Exfiltration over Surface area**
#3	Device 1	23.50'	**6.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	24.00'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#5	Device 1	25.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 4.00 columns** X 4 rows C= 0.600 in 24.0" x 24.0" Grate

Discarded OutFlow Max=0.70 cfs @ 12.66 hrs HW=25.98' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.70 cfs)

Primary OutFlow Max=13.46 cfs @ 12.66 hrs HW=25.98' (Free Discharge)
└─**1=RCP 24"** (Passes 13.46 cfs of 43.25 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 1.80 cfs @ 7.19 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 3.17 cfs @ 6.34 fps)
  └─**5=Orifice/Grate** (Orifice Controls 8.49 cfs @ 4.78 fps)

Summary for Link DP1: DP1

Inflow Area = 14.432 ac, 38.43% Impervious, Inflow Depth > 3.22" for 100-Year event
Inflow = 14.74 cfs @ 12.48 hrs, Volume= 3.876 af
Primary = 14.74 cfs @ 12.48 hrs, Volume= 3.876 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP2: DP2

Inflow Area = 1.667 ac, 5.28% Impervious, Inflow Depth = 0.00" for 100-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP3: DP3

Inflow Area = 0.729 ac, 0.00% Impervious, Inflow Depth = 0.00" for 100-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link DP4: DP4

Inflow Area = 1.377 ac, 0.00% Impervious, Inflow Depth = 0.00" for 100-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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Appendix C
Standard 3 Computations and Supporting Information

Soil Evaluation and Analysis

Hydrologic Soil Group—Bristol County, Massachusetts, Southern Part
(Weaver's Cove East - Hydrologic Soil Groups)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:3,520 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bristol County, Massachusetts, Southern Part
Survey Area Data: Version 6, Jul 23, 2010

Date(s) aerial images were photographed: 8/14/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Bristol County, Massachusetts, Southern Part (MA603)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	C	4.7	15.7%
602	Urban land		11.1	37.5%
651	Udorthents, smoothed	B	13.9	46.8%
Totals for Area of Interest			**29.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Required and Provided Recharge Volumes

Recharge Calculations

Project Name: Weaver's Cove East Layover **Proj. No.:** 10111.00
Project Location: Fall River, MA **Date:** 29-May-12
Calculated by: TJR
Checked by:

Proposed Impervious Surface Summary

Net Proposed Impervious Areas by Hydrologic Soil Group (HSG) in acres

Subcatchment	HSG A	HSG B	HSG C	HSG D	Total Area
1	0.0	-0.1	-0.1	-3.2	-3.4
2	0.0	0.0	-0.1	-0.1	-0.3
3	0.0	0.6	0.0	0.0	0.6
4	0.0	0.0	0.0	0.0	0.0
5	0.0	4.7	0.0	0.0	4.7
6	0.0	0.0	0.0	0.0	0.0
7	0.0	-0.3	-0.1	0.0	-0.4
8	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	-0.1	-0.1
TOTAL	**0.0**	**5.0**	**-0.3**	**-3.5**	**1.2**

Required Recharge Volume (Cubic Feet)

HSG	Area (acres)	Recharge Depth * (in.)	Volume (c.f.)
A	0.0	0.60	0
B	5.0	0.35	6,302
C	-0.3	0.25	-255
D	-3.5	0.10	-1,262
TOTAL			**4,785**

* Per 2008 Massachusetts DEP Recharge Requirement

Provided Recharge Volume (Cubic Feet)

Infiltration Volumes Provided in Infiltration Basins (below lowest overflow outlet)

Basin P1	55,792
Basin P2	21,625
Basin P3	15,879
Basin P4	25,229
Total	**118,525** c.f.

72-hour Drawdown Analysis

Drawdown Calculations

Project Name: Weaver's Cove East Layo\ **Proj. No.:** 10111.00

Date: 6/14/2012

Project Location: Fall River, MA **Calculated by:** TJR

Depression 1

Infiltration volumes provided in depression below Orifice A at elevation 24.0

Depression Volume Below Top of Depression

Elevation	Area (s.f.)	Incremental Volume (c.f.)
21.00	19,957	0
22.00	21,823	20,890
23.00	23,745	43,674
23.50	24,728	55,792
TOTAL		**55,792**

Assumptions:

Recharge Rate: 1.02 in/hr*

Drawdown Time:	**32.9 hours**

Depression 2

Infiltration volumes provided in depression below lowest outlet.

Depression Volume Below Top of Depression

Elevation	Area (s.f.)	Incremental Volume (c.f.)
27.50	3,702	0
28.00	4,212	1,978
29.00	5,289	6,729
30.00	6,433	12,590
31.00	8,166	19,889
TOTAL		**19,889**

Assumptions:

Recharge Rate: 1.02 in/hr

Drawdown Time:	**63.2 hours**

Drawdown Calculations

Project Name: Weaver's Cove East Layo\ **Proj. No.:** 10111.00

Date: 6/14/2012

Project Location: Fall River, MA **Calculated by:** TJR

Depression 3

Infiltration volumes provided in depression below lowest outlet.

Depression Volume Below Top of Depression

Elevation	Area (s.f.)	Incremental Volume (c.f.)
25.00	6,745	0
26.00	7,924	7,334
27.00	9,165	15,879
TOTAL		**15,879**

Assumptions:

Recharge Rate: 1.02 in/hr*

Drawdown Time:	**27.7 hours**

Depression 4

Infiltration volumes provided in depression below lowest outlet.

Depression Volume Below Top of Depression

Elevation	Area (s.f.)	Incremental Volume (c.f.)
22.00	6,865	0
23.00	7,863	7,364
24.00	8,918	15,755
25.00	10,029	25,229
TOTAL		**25,229**

Assumptions:

Recharge Rate: 1.02 in/hr*

Drawdown Time:	**43.2 hours**

Appendix D
Standard 4 Computations and Supporting Information

Water Quality Volume Calculations

VHB

Water Quality Volume Calculations

Project Name: Weaver's Cove Ea **Proj. No.:** 10111.0
Project Location: Fall River, MA **Date:** 6/14/2012
Calculated by: TJR

Depression 1
(runoff from Area PR-1, PR-3)

PR-1 Impervious Area =	0	Acres
PR-3 Impervious Area =	0.6246	Acres
Total Impervious Area =	0.62	Acres

Required:

	Runoff Depth to be Treated (in.)	Required Volume (c.f.)
Forebay Volume	0.1	227
Water Quality Volume	1	2,267

Provided:

	Elevation	Area (s.f.)	Cumulative Volume (c.f.)
Sediment Forebay	24.0	1,363	0
	25.0	1,844	1,604

Depression 1
(runoff from Area PR-5)

Total Impervious Area =	4.82	Acres

Required:

	Runoff Depth to be Treated (in.)	Required Volume (c.f.)
Forebay Volume	0.1	1,751
Water Quality Volume	1	17,509

Provided:

	Elevation	Area (s.f.)	Cumulative Volume (c.f.)
Sediment Forebay	24.0	2,360	0
	25.0	3,008	2,684

VHB

Water Quality Volume Calculations

Project Name: Weaver's Cove Ea **Proj. No.:** 10111.0

Project Location: Fall River, MA **Date:** 6/14/2012

Calculated by: TJR

Depression 1
(runoff from Area PR-4)

Total Impervious Area = 0.10 Acres

Required:

	Runoff Depth to be Treated (in.)	Required Volume (c.f.)
Forebay Volume	0.1	35
Water Quality Volume	1	355

Provided:

	Elevation	Area (s.f.)	Cumulative Volume (c.f.)
Infiltration Basin	21.00	19,957	0
	22.00	21,823	20,890
	23.00	23,745	43,674
	23.50	24,728	55,792

Depression 2
(runoff from Area PR-2)

Total Impervious Area = 0.09 Acres

Required:

	Runoff Depth to be Treated (in.)	Required Volume (c.f.)
Water Quality Volume	1	327

Provided:

	Elevation	Area (s.f.)	Cumulative Volume (c.f.)
Infiltration Basin	27.5	3,701	0
	28.0	4,212	1,978
	29.0	5,289	6,729
	30.0	6,433	12,590
	31.0	8,166	19,889

TSS Removal Worksheets

TSS Removal Calculation Worksheet

Vanasse Hangen Brustlin, Inc.
Consulting Engineers and Planners
101 Walnut Street
Watertown, MA 02471
(617) 924-1770

Project Name:	**Weaver's Cove East Layover**	Sheet:	**1 of 3**
Project Number:	**10111.00**	Date:	**14-Jun-2012**
Location:	**Fall River, MA**	Computed by:	**TJR**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR-1, PR-3**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (B*C)	Remaining Load (D-E)
Grass Channel	**50%**	**1.00**	**0.50**	**0.50**
Sediment Forebay	**25%**	**0.50**	**0.13**	**0.38**
Infiltration Basin	**80%**	**0.38**	**0.30**	**0.08**
	0%	**0.08**	**0.00**	**0.08**
	0%	**0.08**	**0.00**	**0.08**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).
** Equals remaining load from previous BMP (E)
*** Stormceptor sizing calculation gives a TSS removal rate of 87%. To be conservative, 75% removal is used for this calculation based upon the NJCAT study provided on the MA STEP website. (Change name of device and the claimed removal rate shown on the calc. sheet. ALSO provide backup documentation to support TSS removal rate from the MA STEP website. Remove this sentence if not applicable.)

Treatment Train TSS Removal = **93%**

TSS Removal Calculation Worksheet

Vanasse Hangen Brustlin, Inc.
Consulting Engineers and Planners
101 Walnut Street
Watertown, MA 02471
(617) 924-1770

Project Name:	**Weaver's Cove East Layover**	Sheet:	**2 of 3**
Project Number:	**10111.00**	Date:	**14-Jun-2012**
Location:	**Fall River, MA**	Computed by:	**TJR**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR-4**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (B*C)	Remaining Load (D-E)
Infiltration Basin	**80%**	**1.00**	**0.80**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).
** Equals remaining load from previous BMP (E)
*** Stormceptor sizing calculation gives a TSS removal rate of 87%. To be conservative, 75% removal is used for this calculation based upon the NJCAT study provided on the MA STEP website. (Change name of device and the claimed removal rate shown on the calc. sheet. ALSO provide backup documentation to support TSS removal rate from the MA STEP website. Remove this sentence if not applicable.)

Treatment Train TSS Removal = **80%**

TSS Removal Calculation Worksheet

Vanasse Hangen Brustlin, Inc.
Consulting Engineers and Planners
101 Walnut Street
Watertown, MA 02471
(617) 924-1770

Project Name:	**Weaver's Cove East Layover**	Sheet:	**3 of 3**
Project Number:	**10111.00**	Date:	**14-Jun-2012**
Location:	**Fall River, MA**	Computed by:	**TJR**
Discharge Point:	**DP1**	Checked by:	
Drainage Area(s):	**PR-5**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (B*C)	Remaining Load (D-E)
Oil Grit Separator	**25%**	**1.00**	**0.25**	**0.75**
Sediment Forebay	**25%**	**0.75**	**0.19**	**0.56**
Infiltration Basin	**80%**	**0.56**	**0.45**	**0.11**
	0%	**0.11**	**0.00**	**0.11**
	0%	**0.11**	**0.00**	**0.11**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).
** Equals remaining load from previous BMP (E)
*** Stormceptor sizing calculation gives a TSS removal rate of 87%. To be conservative, 75% removal is used for this calculation based upon the NJCAT study provided on the MA STEP website. (Change name of device and the claimed removal rate shown on the calc. sheet. ALSO provide backup documentation to support TSS removal rate from the MA STEP website. Remove this sentence if not applicable.)

Treatment Train TSS Removal = **89%**

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Stormwater Report

Wamsutta Layover Facility

City of New Bedford, Massachusetts

Prepared for

massDOT

Massachusetts Department of Transportation
10 Park Plaza
Boston, Massachusetts

Prepared by

Vanasse Hangen Brustlin, Inc.

Transportation, Land Development, Environmental Services
99 High Street
Boston, Massachusetts 02110
617 728 7777

June 2012

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Stormwater Report Narrative

This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and Water Quality Certification Regulations (314 CMR 9.00).

1.1 Project Description

MassDOT is proposing to construct an overnight commuter rail layover facility at a location known as Wamsutta, situated on a previously developed parcel adjacent to 216 Herman Melville Boulevard in New Bedford, Massachusetts along the New Bedford Main Line (the Project). The Project proposes six layover tracks, a paved driveway and access aisle around the layover tracks, ancillary landscape improvements, 39 parking spaces, one operation and maintenance building, one power substation, and one crew quarters building along with utility connections to support this use.

The Project is considered a Land Use with Higher Potential Pollutant Loads (LUHPPL) as defined in 3.10 CMR 10.04 and 314 CMR 9.02 because the use is regulated under the NPDES Multi-Sector General Permit.

1.2 Site Description

The Site is an approximately 11-acre parcel of land located at the end of the New Bedford Main Line in New Bedford, Massachusetts (Figure 1). It is located near the intersection of Wamsutta Street and Herman Melville Boulevard, near the southern terminus of the New Bedford Main Line, immediately north of the proposed Whale's Tooth Station. The Site is on the east side of the railroad right-of-way (ROW), opposite the proposed Whale's Tooth Station platform and adjacent to an existing freight rail yard. New Bedford Harbor lies to the east, just beyond the existing freight yard and Herman Melville Boulevard. The Site is ideally suited for a terminal

storage/ layover facility since it is located in an industrial area adjacent to a freight rail yard and is at the end of the railroad line, limiting deadhead moves.

The former Conrail Yard comprising the Site was managed as a voluntary "Brownfields" redevelopment site. Soils near the center of the Site contained elevated concentrations of polychlorinated biphenyls (PCB), arsenic, lead, and polycyclic aromatic hydrocarbons (PAHs) with the perimeter soils having lower concentrations of these contaminants. An agreement was reached with the Massachusetts Department of Environmental Protection (MassDEP) and US Environmental Protection Agency (EPA) based on the financial infeasibility of remediating contamination at the Site. The contamination was proposed to be left in place with proper engineering controls, such as a soil geotextile composition cap and land use restrictions consisting of an Activity and Use Limitation (AUL) in the areas exhibiting the highest concentrations of contamination above the Upper Concentration Limits. Since contaminated soil was left in place, there are potential human health impacts related to exposure during future soil disturbance at the Site during construction related to the South Coast Rail Project.

There is no Wetland Resource Area located on the Site, but the proposed layover facility is within the 100-foot buffer zone of a jurisdictional wetland just north of the Site, along Wamsutta Street. Hydrologic Soil Group (HSG) data is not available from National Resources Conservation Service (NRCS) for this site.

The project is not located within the 100-year flood plain as shown on the FEMA Floodway Map, City of New Bedford, Massachusetts Bristol County, Community Panel Number 25005C0393F dated July 7, 2009. This map is included in Appendix A. The proposed layover facility is located entirely within the coastal zone associated with New Bedford Inner Harbor but is not within the New Bedford/Fairhaven Designated Port Area (DPA).

1.3 Existing Drainage Conditions

The majority of the Site is currently situated on an engineered cap. The cap consists of a permeable geotextile material that is covered with a layer of soil and crushed stone, which varies in depth from 1 to 3 feet. Vegetation has grown in a swath along the easternmost freight yard track that was left without the crushed stone layer. When it rains, water seeps into the crushed stone layer and pools above the cap to a depth just a few inches below the top of the crushed stone. Some water flows through the crushed stone and to the vegetated area, where water also pools. In peak storm events, water flows off the Site, into the wetland/stream to the north of the Site and ultimately to the harbor.

1.4 Proposed Drainage Conditions

There has not been any ground survey taken of the Site, so the proposed drainage is conceptual. The Project is a redevelopment of the Site, so as stated in Standard 7 of the Massachusetts Stormwater Standards, it is subject to Standards 2, 3, 4, 5, and 6 to the maximum extent practicable. The Site is subject to coastal storm flowage as defined in 310 CMR 10.04, so it is not subject Standard 2. An overview of planned drainage is provided. Runoff would be split between three drainage areas.

The northern part of the Site, including the access roads and the body of the tracks, would drain into either one of two grass channels adjacent to the outermost tracks. On the east side of the Site, the grass channel would direct runoff towards the center of the facility to a concrete pipe that runs under the layover tracks to the west side. On the west side of the Site, the grass channel would direct runoff towards the center of the facility to a ballast inlet, tying the east and west sides together. From the ballast inlet, the stormwater flows through a concrete pipe under the main line to a water quality manhole. Finally, a concrete pipe connects the water quality manhole with the municipal drainage system in Acushnet Avenue.

The stormwater for the southern part of the Site would be captured by subdrains adjacent to the outermost tracks. Drip pans would be located in the track where locomotives will be tied-down overnight to collect higher potential pollution loads and channel any runoff into the closed drainage system. The subdrains and drip pans combine flows into a single water quality manhole located on the west side of the main line. From the water quality manhole, the stormwater flows through a concrete pipe south to tie into the municipal system near proposed Whales Tooth Station parking area.

The third drainage area includes the employee parking lot and support building footprints. There are limited options for managing the drainage due to the underlying cap. Pervious pavement will be used for the parking area to decrease runoff and provide maximum area for infiltration. Runoff from the roofs of the building will flow into a gutter and downspout system and will be collected in a rain barrel.

The Site has been designed with a comprehensive stormwater management system to the maximum extent practicable that has been developed in accordance with the Massachusetts Stormwater Standards.

1.5 Environmentally Sensitive and Low Impact Development (LID) Techniques

Low Impact Development (LID) techniques and stormwater Best Management Practices (BMPs) implemented into the site design include:

- Minimal disturbance to exiting trees and vegetation
- Grassed Channels
- Gravel and Grass Filter Strip
- Pervious Pavement

In general, stormwater runoff from all impervious surfaces in proposed conditions would receive some form of treatment for stormwater quality prior to discharge to the existing design points. Under existing conditions no such treatment is provided for stormwater runoff.

Appendix A
FEMA Flood Map

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MAP SCALE 1" = 500'

250 0 500 1000 FEET

METE

PANEL 0393F

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

BRISTOL COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

PANEL 393 OF 550

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FAIRHAVEN, TOWN OF	250054	0393	F
NEW BEDFORD, CITY OF	255216	0393	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25005C0393F

EFFECTIVE DATE
JULY 7, 2009

Federal Emergency Management Agency