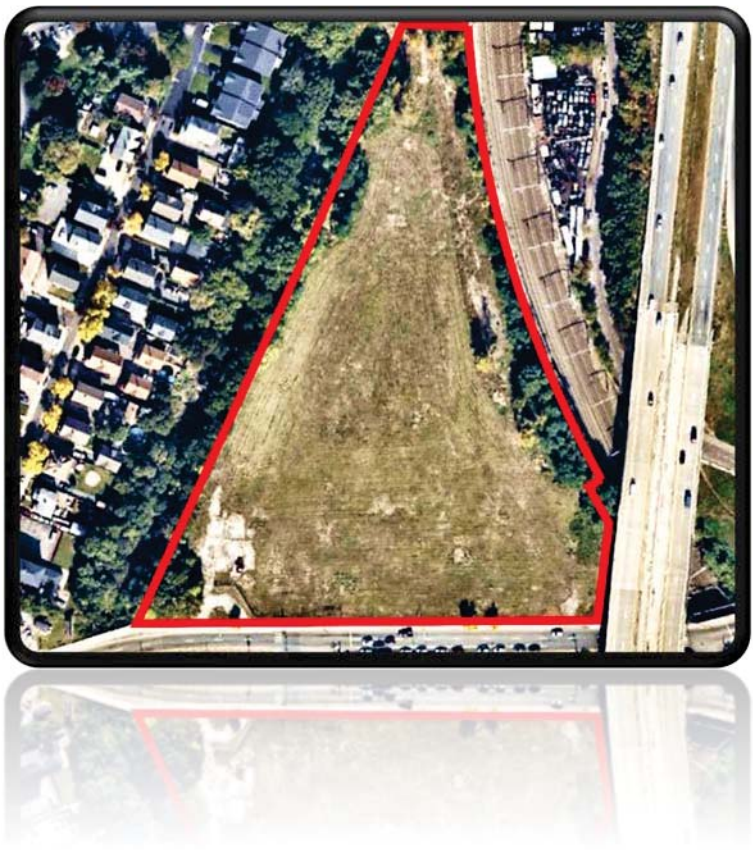
DiPrete Engineering

Stormwater Management Report



DANA R. NISBET
STATE OF RHODE ISLAND
No. 11876
04/08/2022
REGISTERED
PROFESSIONAL ENGINEER
CIVIL

Trolley Barn Plaza

Located in Cranston, RI

Applicant: Trolley Barn Associates, LLC c/o
First Hartford Realty Corp.

3-14-2022

Revised 4-8-2020

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Executive Summary

On behalf of the Client, we are submitting drainage calculations for the proposed development at 777 Cranston Street, Cranston, RI. The site is located on Assessors' Plat 7 Lot 1. The site exists today as mostly over-grown grass with some existing pavement and some woods. The client proposes to construct a car wash, a gas station with drive-thru, a fast food restaurant with drive-thru, and an auto parts store with a warehouse component. The post development stormwater will be treated for water quality using Best Management Practices (BMPs). The Site has been designed to meet the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM).

To mitigate post development flows on site, a closed pipe network, oil/grit separators, proprietary separator devices, a FocalPoint biofiltration system, and underground sand filters are proposed to capture and treat runoff before being discharged to an infiltration pond located at the northern end of the site. The underground sand filters and FocalPoint biofiltration system are sized to accept and treat the site's water quality volume. These practices will remove 80% or more of TSS (total suspended solids) generated by the proposed parking areas and access roads.

This report details how the site will show no net increase in stormwater runoff from pre-development to post development conditions, and how the proposed BMPs will provide water quality treatment for stormwater runoff.

Pre-Development Conditions versus Post-Development Conditions for each watershed are summarized below:

Subwatershed (design point)	1.2" Peak Flow		1-yr Peak Flow		10-yr Peak Flow		25-yr Peak Flow		100-yr Peak Flow	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
DL-1: Cranston Street	0.02	0.00	0.00	0.00	0.02	0.00	0.09	0.00	0.33	0.02
DP-2: Active Rail Corridor	0.00	0.12	0.00	0.00	0.11	0.27	0.79	0.65	4.38	1.73
DP-3: Abandoned Rail Corridor	0.17	0.01	0.00	0.00	0.24	0.02	0.80	0.08	3.30	0.41
Totals:	0.19	0.13	0.00	0.00	0.37	0.29	1.68	0.73	8.01	2.16

All flows in cubic feet per second (cfs)

APPENDIX A: STORMWATER MANAGEMENT PLAN CHECKLIST AND LID PLANNING REPORT – STORMWATER DESIGN SUMMARY

PROJECT NAME **Trolley Barn Plaza**	(RIDEM USE ONLY) STW/WQC File #: Date Received:
TOWN **Cranston, RI**	
BRIEF PROJECT DESCRIPTION: Construction of a car wash, gas station, fast food with drive-thru, and auto parts store/warehouse with associated infrastructure.	

Stormwater Management Plan (SMP) Elements – Minimum Standards

When submitting a SMP,[1] submit four separately bound documents: Appendix A Checklist; Stormwater Site Planning, Analysis and Design Report with Plan Set/Drawings; Soil Erosion and Sediment Control (SESC) Plan, and Post Construction Operations and Maintenance (O&M) Plan. Please refer to Suggestions to Promote Brevity.

Note: **All stormwater construction projects must create a Stormwater Management Plan (SMP). However, not every element listed below is required per the RIDEM Stormwater Rules and the RIPDES Construction General Permit (CGP). This checklist will help identify the required elements to be submitted with an Application for Stormwater Construction Permit & Water Quality Certification.**

PART 1. PROJECT AND SITE INFORMATION

PROJECT TYPE (Check all that apply)

☐ Residential	☒ Commercial	☐ Federal	☐ Retrofit	☐ Restoration
☐ Road	☐ Utility	☐ Fill	☐ Dredge	☐ Mine
☐ Other (specify):				

SITE INFORMATION

☒ Vicinity Map

INITIAL DISCHARGE LOCATION(S): The WQv discharges to: (You may choose more than one answer if several discharge points are associated with the project.)

☒ **Groundwater**	☐ **Surface Water**	☐ **MS4**
☐ GAA	☐ Isolated Wetland	☐ RIDOT
☐ GA	☐ Named Waterbody	☐ RIDOT Alteration Permit is Approved
☒ GB	☐ Unnamed Waterbody Connected to Named Waterbody	☐ Town
		☐ Other (specify):

ULTIMATE RECEIVING WATERBODY LOCATION(S): Include pertinent information that applies to both WQ_v and flow from larger storm events including overflows. Choose all that apply, and repeat table for each waterbody.

☒ Groundwater or Disconnected Wetland	☐ SRWP		
☐ Waterbody Name: Woonasquatucket River	☐ Coldwater	☒ Warmwater	☐ Unassessed
☐ Waterbody ID: RI0002007R-10D	☐ 4th order stream of pond 50 acres or more		
☐ TMDL for: Zinc; Lead; Copper	☐ Watershed of flood prone river (e.g., Pocasset River)		
☐ Contributes to a priority outfall listed in the TMDL	☐ Contributes stormwater to a public beach		
☐ 303(d) list – Impairment(s) for: Zinc; Lead; Copper; Mercury; Dioxin; Non-Native Aquatic Plants; Enterococcus; PCBs, Dissolved Oxygen	☐ Contributes to shellfishing grounds		

[1] Applications for a Construction General Permit that do not require any other permits from RIDEM and will disturb less than 5 acres over the entire course of the project do not need to submit a SMP. The Appendix A checklist must still be submitted.

PROJECT HISTORY		
☐ RIDEM Pre- Application Meeting	Meeting Date:	☐ Minutes Attached
☒ Municipal Master Plan Approval	Approval Date: 12/8/2021	☐ Minutes Attached
☐ Subdivision Suitability Required	Approval #:	
☐ Previous Enforcement Action has been taken on the property	Enforcement #:	

FLOODPLAIN & FLOODWAY See Guidance Pertaining to Floodplain and Floodways	
☐ Riverine 100-year floodplain: **FEMA FLOODPLAIN FIRMETTE** has been reviewed and the 100-year floodplain is on site	
☐ Delineated from FEMA Maps	
NOTE: Per Rule 250-RICR-150-10-8-1.1(B)(5)(d)(3), provide volumetric floodplain compensation calculations for cut and fill/displacement calculated by qualified professional	
☐ Calculated by Professional Engineer	
☐ Calculations are provided for cut vs. fill/displacement volumes proposed within the 100-year floodplain	Amount of Fill (CY): Amount of Cut (CY):
☐ Restrictions or modifications are proposed to the flow path or velocities in a floodway	
☐ Floodplain storage capacity is impacted	
☒ Project area is not within 100-year floodplain as defined by RIDEM	

CRMC JURISDICTION -N/A
☐ CRMC Assent required
☐ Property subject to a Special Area Management Plan (SAMP). If so, specify which SAMP:
☐ Sea level rise mitigation has been designed into this project

LUHPPL IDENTIFICATION - MINIMUM STANDARD 8:		
1. OFFICE OF Land Revitalization and Sustainable Materials Management (OLRSMM)		
	☐ Known or suspected releases of HAZARDOUS MATERIAL are present at the site (Hazardous Material is defined in Rule 1.4(A)(33) of 250-140-30-1 of the RIDEM Rules and Regulations for Investigation and Remediation of Hazardous Materials (the Remediation Regulations))	**RIDEM CONTACT:**
	☐ Known or suspected releases of PETROLEUM PRODUCT are present at the site (Petroleum Product as defined in Rule 1.5(A)(84) of 250-140-25-1 of the RIDEM Rules and Regulations for Underground Storage Facilities Used for Regulated Substances and Hazardous Materials)	
	☐ This site is identified on the RIDEM Environmental Resources Map as one of the following regulated facilities	**SITE ID#:**
	☐ CERCLIS/Superfund (NPL)	
	☐ State Hazardous Waste Site (SHWS)	
	☐ Environmental Land Usage Restriction (ELUR)	
	☐ Leaking Underground Storage Tank (LUST)	
	☐ Closed Landfill	
Note: If any boxes in 1 above are checked, the applicant must contact the RIDEM OLRSMM Project Manager associated with the Site to determine if subsurface infiltration of stormwater is allowable for the project. Indicate if the infiltration corresponds to "Red," "Yellow" or "Green" as described in Section 3.2.8 of the RISDISM Guidance (Subsurface Contamination Guidance). Also, note and reference approval in PART 3, Minimum Standard 2: Groundwater Recharge/Infiltration.		
2. PER MINIMUM STANDARD 8 of RICR 8.14.C.1-6 "LUHPPLS," THE SITE IS/HAS:		
	☐ Industrial Site with RIPDES MSGP, except where No Exposure Certification exists. http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/status.php	
	☐ Auto Fueling Facility (e.g., gas station)	
	☐ Exterior Vehicles Service, Maintenance, or Equipment Cleaning Area	

	☐ Road Salt Storage and Loading Areas (exposed to rainwater)	
	☐ Outdoor Storage and Loading/Unloading of Hazardous Substances	
3.	**STORMWATER INDUSTRIAL PERMITTING**	
	☒ The site is associated with existing or proposed activities that are considered Land Uses with Higher Potential Pollutant Loads (LUHPPLS) (see RICR 8.14.C)	Activities: Auto Fueling Facilities Sector:
	☐ Construction is proposed on a site that is subject to THE MULTI-SECTOR GENERAL PERMIT (MSGP) UNDER RULE 31(B)15 OF THE RIPDES REGULATIONS.	MSGP permit #
	☐ Additional stormwater treatment is required by the MSGP Explain:	

REDEVELOPMENT STANDARD – MINIMUM STANDARD 6		
☒ Pre Construction Impervious Area		
	☒ Total Pre-Construction Impervious Area (**TIA**) = 0.204 ac	
	☒ Total Site Area (**TSA**) = 6.605 ac	
	☐ Jurisdictional Wetlands (**JW**) N/A	
	☐ Conservation Land (**CL**) N/A	
☒ Calculate the Site Size (defined as contiguous properties under same ownership)		
	☐ Site Size (**SS**) = (**TSA**) – (**JW**) – (**CL**) = (6.605) – (0) – (0) = 6.605 ac	
	☒ (**TIA**) / (**SS**) = (0.204) / (6.605) = 0.0308	☒ (**TIA**) / (**SS**) >**0.4**? No
☐ YES, Redevelopment		

PART 2. LOW IMPACT DEVELOPMENT ASSESSMENT – MINIMUM STANDARD 1

(NOT REQUIRED FOR REDEVELOPMENT OR RETROFITS)
This section may be deleted if not required.

Note: A written description must be provided specifying why each method is not being used or is not applicable at the Site. Appropriate answers may include:

- Town requires … (state the specific local requirement)
- Meets Town's dimensional requirement of …
- Not practical for site because …
- Applying for waiver/variance to achieve this (pending/approved/denied)
- Applying for wavier/variance to seek relief from this (pending/approved/denied)

A) PRESERVATION OF UNDISTURBED AREAS, BUFFERS, AND FLOODPLAINS	**IF NOT IMPLEMENTED, EXPLAIN HERE**
☒ Sensitive resource areas and site constraints are identified (required) ☒ Local development regulations have been reviewed (required) ☒ All vegetated buffers and coastal and freshwater wetlands will be protected during and after construction ☐ Conservation Development or another site design technique has been incorporated to protect open space and pre-development hydrology. **Note:** If Conservation Development has been used, check box and skip to Subpart C ☒ As much natural vegetation and pre-development hydrology as possible has been maintained	Site exists as mostly grass with some existing impervious and small amount of woods. Conservation of natural resources is N/A.

B) LOCATE DEVELOPMENT IN LESS SENSITIVE AREAS AND WORK WITH THE NATURAL LANDSCAPE CONDITIONS, HYDROLOGY, AND SOILS ☒ Development sites and building envelopes have been appropriately distanced from wetlands and waterbodies ☒ Development and stormwater systems have been located in areas with greatest infiltration capacity (e.g., soil groups A and B) ☐ Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPA's) ☒ Development sites and building envelopes have been positioned outside of floodplains ☒ Site design positions buildings, roadways and parking areas in a manner that avoids impacts to surface water features ☐ Development sites and building envelopes have been located to minimize impacts to steep slopes (≥15%) ☐ Other (describe):	No QPA's are proposed for this site. There are no nearby waterbodies adjacent to the site nor wetlands that will be impacted by the development. Steep slopes (33% [3:1] to 50% [2:1]) are proposed for the infiltration pond to be constructed towards the north end of the site.
C) MINIMIZE CLEARING AND GRADING ☒ Site clearing has been restricted to minimum area needed for building footprints, development activities, construction access, and safety. ☒ Site has been designed to position buildings, roadways, and parking areas in a manner that minimizes grading (cut and fill quantities) ☐ Protection for stands of trees and individual trees and their root zones to be preserved has been specified, and such protection extends at least to the tree canopy drip line(s) ☐ Plan notes specify that public trees removed or damaged during construction shall be replaced with equivalent	The site consists of mostly grassed area, with the entire site area having been cleared as recently as the year 2005. Fill will be brought into the site to raise portions of the site to promote proper drainage. Landscaping will be provided on this site.
D) REDUCE IMPERVIOUS COVER ☐ Reduced roadway widths (≤22 feet for ADT ≤ 400; ≤ 26 feet for ADT 400 - 2,000) ☐ Reduced driveway areas (length minimized via reduced ROW width (≤ 45 ft.) and/or reduced (or absolute minimum) front yard setback; width minimized to ≤ 9 ft. wide one lane; ≤ 18 ft. wide two lanes; shared driveways; pervious surface) ☐ Reduced building footprint: Explain approach: ☐ Reduced sidewalk area (≤ 4 ft. wide; one side of the street; unpaved path; pervious surface) ☐ Reduced cul-de-sacs (radius < 45 ft; vegetated island; alternative turn-around) ☐ Reduced parking lot area: Explain approach ☐ Use of pervious surfaces for driveways, sidewalks, parking areas/overflow parking areas, etc. ☒ Minimized impervious surfaces (project meets or is less than maximum specified by Zoning Ordinance) ☐ Other (describe):	
E) DISCONNECT IMPERVIOUS AREA ☐ Impervious surfaces have been disconnected, and runoff has been diverted to QPAs to the maximum extent possible ☐ Residential street edges allow side-of-the-road drainage into vegetated open swales ☐ Parking lot landscaping breaks up impervious expanse AND accepts runoff ☐ Other (describe):	All impervious will have pre-treatment provided by proprietary separator units, with primary treatment provided by lined underground sand filters.
F) MITIGATE RUNOFF AT THE POINT OF GENERATION ☒ Small-scale BMPs have been designated to treat runoff as close as possible to the source	

G) PROVIDE LOW-MAINTENANCE NATIVE VEGETATION ☒ Low-maintenance landscaping has been proposed using native species and cultivars ☐ Plantings of native trees and shrubs in areas previously cleared of native vegetation are shown on site plan ☐ Lawn areas have been limited/minimized, and yards have been kept undisturbed to the maximum extent practicable on residential lots	The existing site is mostly overgrown grass. Existing vegetation will remain where possible, and landscaping will be proposed accordingly.
H) RESTORE STREAMS/WETLANDS ☐ Historic drainage patterns have been restored by removing closed drainage systems, daylighting buried streams, and/or restoring degraded stream channels and/or wetlands ☐ Removal of invasive species ☐ Other	There are no streams or wetlands directly adjacent to the site. Pre-development hydrology has been preserved to the maximum extent practicable.

PART 3. SUMMARY OF REMAINING STANDARDS

GROUNDWATER RECHARGE – MINIMUM STANDARD 2		
YES	**NO**	
☒	☐	The project has been designed to meet the groundwater recharge standard.
☐	☐	If "No," the justification for groundwater recharge criterion waiver has been explained in the Narrative (e.g., threat of groundwater contamination or physical limitation), if applicable (see RICR 8.8.D);
☐	☐	Your waiver request has been explained in the Narrative, if applicable.
☒	☐	Is this site identified as a Regulated Facility in Part 1, Minimum Standard 8: LUHPPL Identification?
☐	☒	If "Yes," has approval for infiltration by the OLRSMM Site Project Manager, per Part 1, Minimum Standard 8, been requested?

TABLE 2-1: Summary of Recharge (see RISDISM Section 3.3.2)
(Add or Subtract Rows as Necessary)

Design Point	Impervious Area Treated (sq ft)	Total Re_v Required (cu ft)	LID Stormwater Credits (see RISDISM Section 4.6.1) Portion of Re_v directed to a QPA (cu ft)	Recharge Required by Remaining BMPs (cu ft)	Recharge Provided by BMPs (cu ft)
DP-1: Cranston Street	0	0	0	0	0
DP-2: Active Rail Corridor	4,704	235	0	235	0
DP-3: Abandoned Rail Corridor	190,793	9,540	0	9,540	15,594
TOTALS:	195,497	9,775	0	9,775	15,594

Notes:
1. Only BMPs listed in RISDISM Table 3-5 "List of BMPs Acceptable for Recharge" may be used to meet the recharge requirement.
2. Recharge requirement must be satisfied for each waterbody ID.

☒ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):

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WATER QUALITY – MINIMUM STANDARD 3		
YES	**NO**	
☒	☐	Does this project meet or exceed the required water quality volume WQv (see RICR 8.9.E-I)?
☒	☐	Is the proposed final impervious cover greater than 20% of the disturbed area (see RICR 8.9.E-I)?
☒	☐	If "Yes," either the Modified Curve Number Method or the Split Pervious/Impervious method in Hydro-CAD was used to calculate WQv; or,
☐	☐	If "Yes," either TR-55 or TR-20 was used to calculate WQv; and,
☐	☐	If "No," the project meets the minimum WQv of 0.2 watershed inches over the entire disturbed area.
☐	☐	Not Applicable
☒	☐	Does this project meet or exceed the ability to treat required water quality flow WQf (see RICR 8.9.I.1-3)?
☐	☒	Does this project propose an increase of impervious cover to a receiving water body with impairments? If "Yes," please indicate below the method that was used to address the water quality requirements of no further degradation to a low-quality water. All stormwater is infiltrated on site.
☐	☒	RICR 8.36. A Pollutant Loading Analysis is needed and has been completed.
☐	☒	The Water Quality Guidance Document (Water Quality Goals and Pollutant Loading Analysis Guidance for Discharges to Impaired Waters) has been followed as applicable. – N/A
☒	☐	BMPs are proposed that are on the approved technology list . If "Yes," please provide all required worksheets from the manufacturer.
☐	☒	Additional pollutant-specific requirements and/or pollutant removal efficiencies are applicable to the site as the result of a TMDL, SAMP, or other watershed-specific requirements. If "Yes," please describe:

TABLE 3-1: Summary of Water Quality (see RICR 8.9)

Design Point and WB ID	Impervious area treated (sq ft)	Total WQ_v Required (cu ft)	LID Stormwater Credits (see RICR 8.18) WQv directed to a QPA (cu ft)	Water Quality Treatment Remaining (cu ft)	Water Quality Provided by BMPs (cu ft)
DP-1: Cranston Street	0	0	0	0	0
DP-2: Active Rail Corridor	4,704	392	0	392	0
DP-3: Abandoned Rail Corridor	190,793	15,899	0	15,899	15,594*
TOTALS:	195,497	16,291	0	16,291	15,638

*All stormwater directed to the infiltration pond is infiltrated. Any discrepancies are due to HydroCAD rounding.

Notes:
1. Only BMPs listed in RICR 8.20 and 8.25 or the Approved Technologies List of BMPs is Acceptable for Water Quality treatment.
2. For each Design Point, the Water Quality Volume Standard must be met for each Waterbody ID.

☒ YES ☐ NO	This project has met the setback requirements for each BMP. If "No," please explain:

☒ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):
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CONVEYANCE AND NATURAL CHANNEL PROTECTION (RICR 8.10) – MINIMUM STANDARD 4		
YES	**NO**	
☐	☒	Is this standard waived? If "Yes," please indicate one or more of the reasons below:
		☐ The project directs discharge to a large river (i.e., 4th-order stream or larger. See RISDISM Appendix I for State-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters. ☐ The project is a small facility with impervious cover of less than or equal to 1 acre. ☐ The project has a post-development peak discharge rate from the facility that is less than 2 cfs for the 1-year, 24-hour Type III design storm event (prior to any attenuation). (Note: LID design strategies can greatly reduce the peak discharge rate).
☒	☐	Conveyance and natural channel protection for the site have been met. If "No,' explain why: * The 1 year storm event is fully infiltrated. This meets the Channel Protection Requirement

TABLE 4-1: Summary of Channel Protection Volumes (see RICR 8.10)					
Design Point	**Receiving Water Body Name**	**Coldwater Fishery? (Y/N)**	**Total CPv Required (cu ft)**	**Total CPv Provided (cu ft)**	**Average Release Rate Modeled in the 1-yr storm (cfs)**
DP-1: Cranston Street	N/A	N/A	N/A	N/A*	N/A
DP-2: Active Rail Corridor	N/A	N/A	N/A	N/A*	N/A
DP-3: Abandoned Rail Corridor	N/A	N/A	N/A	N/A*	N/A
TOTALS:	N/A	N/A	N/A	N/A*	N/A
Note: The Channel Protection Volume Standard must be met in each waterbody ID.					
☒ YES ☐ NO	The CPv is released at roughly a uniform rate over a 24-hour duration (see examples of sizing calculations in Appendix D of the RISDISM).				
☐ YES ☒ NO	Do additional design restrictions apply resulting from any discharge to cold-water fisheries; If "Yes," please indicate restrictions and solutions below.				
☒ Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.). Stormwater Report Prepared by DiPrete Engineering					

OVERBANK FLOOD PROTECTION (RICR 8.11) AND OTHER POTENTIAL HIGH FLOWS – MINIMUM STANDARD 5			
YES	**NO**		
☐	☒	Is this standard waived? If yes, please indicate one or more of the reasons below:	
		☐	The project directs discharge to a large river (i.e., 4th-order stream or larger. See Appendix I for state-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters.
		☐	A Downstream Analysis (see RICR 8.11.D and E) indicates that peak discharge control would not be beneficial or would exacerbate peak flows in a downstream tributary of a particular site (e.g., through coincident peaks).
☐	☒	Does the project flow to an MS4 system or subject to other stormwater requirements? If "Yes," indicate as follows:	
		☐	RIDOT
		☐	Other (specify):
Note: The project could be approved by RIDEM but not meet RIDOT or Town standards. RIDOT's regulations indicate that post-volumes must be **less** than pre-volumes for the 10-yr storm at the design point entering the RIDOT system. If you have not already received approval for the discharge to an MS4, please explain below your strategy to comply with RIDEM and the MS4.			
		Indicate below which model was used for your analysis. ☐ TR-55 ☐ TR-20 ☒ HydroCAD ☐ Bentley/Haestad ☐ Intellisolve ☐ Other (Specify):	
YES	**NO**		
☒	☐	Does the drainage design demonstrate that flows from the 100-year storm event through a BMP will safely manage and convey the 100-year storm? If "No," please explain briefly below and reference where in the application further documentation can be found (i.e., name of report/document, page numbers, appendices, etc.):	
☒	☐	Do off-site areas contribute to the sub-watersheds and design points? If "Yes,"	
☒	☐	Are the areas modeled as "present condition" for both pre- and post-development analysis?	
☒	☐	Are the off-site areas shown on the subwatershed maps?	
☒	☐	Does the drainage design confirm safe passage of the 100-year flow through the site for off-site runoff?	
☐	☒	Is a Downstream Analysis required (see RICR 8.11.E.1)?	
☒	☐	Calculate the following:	
		☒	Area of disturbance within the sub-watershed (areas) = 6.658 ac
		☒	Impervious cover (%) = 67%
☐	☒	Is a dam breach analysis required (earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and contributes to a significant or high hazard dam)?	
☒	☐	Does this project meet the overbank flood protection standard?	

Table 5-1 Hydraulic Analysis Summary								
Subwatershed (Design Point)	**1.2" Peak Flow** (cfs) **		**1-yr Peak Flow** (cfs)		**10-yr Peak Flow** (cfs)		**100-yr Peak Flow** (cfs)	
	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
DP-1: Cranston Street	0.02	0.00	0.00	0.00	0.02	0.00	0.33	0.02
DP-2: Active Rail Corridor	0.00	0.12	0.00	0.00	0.11	0.27	4.38	1.73
DP-3: Abandoned Rail	0.17	0.01	0.00	0.00	0.24	0.02	3.30	0.41
TOTALS:	0.19	0.13	0.00	0.00	0.37	0.29	8.01	2.16

** Utilize modified curve number method or split pervious /impervious method in HydroCAD.

Note: The hydraulic analysis must demonstrate no impact to each individual subwatershed DP unless each DP discharges to the same wetland or water resource.

Indicate as follows where the pertinent calculations and/or information for the items above are provided	**Name of report/document, page numbers, appendices, etc.**
Existing conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, and water surface elevations showing methodologies used and supporting calculations.	Stormwater Report Prepared by DiPrete Engineering
Proposed conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, water surface elevations, and routing showing the methodologies used and supporting calculations.	Stormwater Report Prepared by DiPrete Engineering
Final sizing calculations for structural stormwater BMPs, including contributing drainage area, storage, and outlet configuration.	Stormwater Report Prepared by DiPrete Engineering
Stage-storage, inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).	Stormwater Report Prepared by DiPrete Engineering

Table 5-2 Summary of Best Management Practices											
BMP ID	**DP #**	**BMP Type** (e.g., bioretention, tree filter)	**BMP Functions**					**Bypass Type**	**Horizontal Setback Criteria are met per RICR 8.21.B.10, 8.22.D.11, and 8.35.B.4**		
			Pre-Treatment (Y/N/ NA)	Re_v	WQ_v	CP_v (Y/N/ NA)	Overbank Flood Reduction (Y/N/NA)	External (E) Internal (I) or NA	Yes/ No	Technical Justification (Design Report page number)	Distance Provided
USF A*	DP-3	Underground Sand Filter	Y	N	Y	N/A	N/A	I	Y	> 25' From Building Foundation**	81.3'
Focal Point B	DP-3	Bioretention	Y	N	Y	N/A	N/A	I	Y	> 25' From Building Foundation**	29.5'
USF C*	DP-3	Underground Sand Filter	Y	N	Y	N/A	N/A	I	Y	> 25' From Building Foundation**	21.6'
USF D*	DP-3	Underground Sand Filter	Y	N	Y	N/A	N/A	I	Y	> 25' From Building Foundation**	26.5'

Table 5-2 Summary of Best Management Practices											
BMP ID	**DP #**	**BMP Type** (e.g., bioretention, tree filter)	**BMP Functions**					**Bypass Type**	**Horizontal Setback Criteria are met per RICR 8.21.B.10, 8.22.D.11, and 8.35.B.4**		
			Pre-Treatment (Y/N/ NA)	Re_v	WQ_v	CP_v (Y/N/ NA)	Overbank Flood Reduction (Y/N/NA)	External (E) Internal (I) or NA	Yes/ No	Technical Justification (Design Report page number)	Distance Provided
USF E*	DP-3	Underground Sand Filter	Y	N	Y	N/A	N/A	I	Y	> 25' From Building Foundation**	32.0'
Infil. Pond F	DP-3	Infiltration Pond	N	Y	N	Y	N/A	E	Y	> 25' From Building Foundation	66.1'
		TOTALS:									

* All underground sand filters (USFs) are lined and sub-drained systems, and all buildings are proposed as slab on grade.
** Horizontal setback requirement applies to infiltration facilities. All proposed underground sand filters and bioretention basins do not infiltrate in-place.

Table 5.3 Summary of Soils to Evaluate Each BMP									
DP #	**BMP ID**	**BMP Type** (e.g., bioretention, tree filter)	**Soils Analysis for Each BMP**						
			Test Pit ID# and Ground Elevation		SHWT Elevation (ft)	Bottom of Practice Elevation* (ft)	Separation Distance Provided (ft)	Hydrologic Soil Group (A, B, C, D)	Exfiltration Rate Applied (in/hr)
			Primary	Secondary					
DP-3	USF-A	Sand Filter	TH-8	N/A	66.13 ±	67.00	0.87**	A	N/A
DP-3	FocalPoint B	Bioretention	TH-12	N/A	45.20 ±	62.00	16.80**	A	100
DP-3	USF-C	Sand Filter	TH-5	N/A	59.06 ±	64.50	5.44**	A	N/A
DP-3	USF-D	Sand Filter	TH-6	N/A	59.06 ±	62.50	3.44**	A	N/A
DP-3	USF-E	Sand Filter	TH-9	N/A	58.54 ±	63.00	4.46**	A	N/A
DP-3	Pond F	Infiltration Pond	TH-12	IT-1	45.20 ±	52.00	6.80	A	23.45***
		TOTALS:							

* For underground infiltration systems (UICs) bottom equals bottom of stone, for surface infiltration basins bottom equals bottom of basin, for filters bottom equals interface of storage and top of filter layer

** All proposed sand filters are lined underground sand filters with sub-drains. These underground sand filters do not infiltrate in-place; rather, they provide WQ treatment of stormwater before infiltrating in Infiltration Pond F. The proposed liners will be impermeable, so separation to groundwater is not critical.

***Established from Infiltrometer testing results. Using a factor of safety of 2.

LAND USES WITH HIGHER POTENTIAL POLLUTANTS LOADS (LUHPPLs) – MINIMUM STANDARD 8			
YES	**NO**	**N/A**	
☒	☐	☐	Describe any LUHPPLs identified in Part 1, Minimum Standard 8, Section 2. If not applicable, continue to Minimum Standard 9. Automotive refueling facility – underground storage tanks & tank mat.
☐	☒	☐	Are these activities already covered under an MSGP? If "No," please explain if you have applied for an MSGP or intend to do so?
☒	☐	☐	List the specific BMPs that are proposed for this project that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in RISDISM Table 3-3, "Acceptable BMPs for Use at LUHPPLs." Please list BMPs: Oil/water separator, Underground Lined Sand Filter
☒	☐	☐	Additional BMPs, or additional pretreatment BMP's if any, that meet RIPDES MSGP requirements; Please list BMPs: Sand filters are proposed in the treatment train after oil/water separator (where required) and Cascade separator (or approved equal)
			Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.). Stormwater Report Prepared by DiPrete Engineering

ILLICIT DISCHARGES – MINIMUM STANDARD 9			
Illicit discharges are defined as unpermitted discharges to Waters of the State that do not consist entirely of stormwater or uncontaminated groundwater, except for certain discharges identified in the RIPDES Phase II Stormwater General Permit.			
YES	**NO**	**N/A**	
☒	☐	☐	Have you checked for illicit discharges?
☐	☒	☐	Have any been found and/or corrected? If "Yes," please identify.
☒	☐	☐	Does your report explain preventative measures that keep non-stormwater discharges out of the Waters of the State (during and after construction)?

SOIL EROSION AND SEDIMENT CONTROL (SESC) – MINIMUM STANDARD 10				
YES	**NO**	**N/A**		
☒	☐	☐	Have you included a Soil Erosion and Sediment Control Plan Set and/or Complete Construction Plan Set?	
☒	☐	☐	Have you provided a **separately-bound** document based upon the SESC Template? If yes, proceed to Minimum Standard 11 (the following items can be assumed to be addressed).	
			If "No," include a document with your submittal that addresses the following elements of an SESC Plan:	
			☐	Soil Erosion and Sediment Control Plan Project Narrative, including a description of how the fifteen (15) Performance Criteria have been met:
			☐	Provide Natural Buffers and Maintain Existing Vegetation
			☐	Minimize Area of Disturbance
			☐	Minimize the Disturbance of Steep Slopes
			☐	Preserve Topsoil
			☐	Stabilize Soils
			☐	Protect Storm Drain Inlets
			☐	Protect Storm Drain Outlets
			☐	Establish Temporary Controls for the Protection of Post-Construction Stormwater Control Measures
			☐	Establish Perimeter Controls and Sediment Barriers
			☐	Divert or Manage Run-On from Up-Gradient Areas
			☐	Properly Design Constructed Stormwater Conveyance Channels
			☐	Retain Sediment On-Site
			☐	Control Temporary Increases in Stormwater Velocity, Volume, and Peak Flows
			☐	Apply Construction Activity Pollution Prevention Control Measures
			☐	Install, Inspect, and Maintain Control Measures and Take Corrective Actions
			☐	Qualified SESC Plan Preparer's Information and Certification
			☐	Operator's Information and Certification; if not known at the time of application, the Operator must certify the SESC Plan upon selection and prior to initiating site activities
			☐	Description of Control Measures, such as Temporary Sediment Trapping and Conveyance Practices, including design calculations and supporting documentation, as required

STORMWATER MANAGEMENT SYSTEM OPERATION, MAINTENANCE, AND POLLUTION PREVENTION PLAN – MINIMUM STANDARDS 7 AND 9		
Operation and Maintenance Section		
YES	**NO**	
☒	☐	Have you minimized all sources of pollutant contact with stormwater runoff, to the maximum extent practicable?
☒	☐	Have you provided a **separately-bound** Operation and Maintenance Plan for the site and for all of the BMPs, and does it address each element of RICR 8.17 and RISDISM Appendix C and E?
☒	☐	Lawn, Garden, and Landscape Management meet the requirements of RISDISM Section G.7? If "No," why not?

☒	☐	Is the property owner or homeowner's association responsible for the stormwater maintenance of all BMP's? If "No," you must provide a legally binding and enforceable maintenance agreement (see RISDISM Appendix E, page 26) that identifies the entity that will be responsible for maintenance of the stormwater. Indicate where this agreement can be found in your report (i.e., name of report/document, page numbers, appendices, etc.).
☐	☒	Do you anticipate that you will need legal agreements related to the stormwater structures? (e.g. off-site easements, deed restrictions, covenants, or ELUR per the Remediation Regulations). If "Yes," have you obtained them? Or please explain your plan to obtain them:
☐	☒	Is stormwater being directed from public areas to private property? If "Yes," note the following: Note: This is not allowed unless a funding mechanism is in place to provide the finances for the long-term maintenance of the BMP and drainage, or a funding mechanism is demonstrated that can guarantee the long-term maintenance of a stormwater BMP by an individual homeowner.
Pollution Prevention Section		
☒	☐	Designated snow stockpile locations?
☐	☒	Trash racks to prevent floatables, trash, and debris from discharging to Waters of the State?
☒	☐	Asphalt-only based sealants?
☐	☒	Pet waste stations? (Note: If a receiving water has a bacterial impairment, and the project involves housing units, then this could be an important part of your pollution prevention plan).
☒	☐	Regular sweeping? Please describe:
☒	☐	De-icing specifications, in accordance with RISDISM Appendix G. (NOTE: If the groundwater is GAA, or this area contributes to a drinking water supply, then this could be an important part of your pollution prevention plan).
☒	☐	A prohibition of phosphate-based fertilizers? (Note: If the site discharges to a phosphorus impaired waterbody, then this could be an important part of your pollution prevention plan).

PART 4. SUBWATERSHED MAPPING AND SITE-PLAN DETAILS

Existing and Proposed Subwatershed Mapping (REQUIRED)			
YES	**NO**		
☒	☐		Existing and proposed drainage area delineations
☒	☐		Locations of all streams and drainage swales
☒	☐		Drainage flow paths, mapped according to the DEM *Guidance for Preparation of Drainage Area Maps* (included in RISDISM Appendix K)
☒	☐		Complete drainage area boundaries; include off-site areas in both mapping and analyses, as applicable
☒	☐		Logs of borings and/or test pit investigations along with supporting soils/geotechnical report
☒	☐		Mapped seasonal high-water-table test pit locations
☒	☐		Mapped locations of the site-specific borings and/or test pits and soils information from the test pits at the locations of the BMPs
☒	☐		Mapped locations of the BMPs, with the BMPs consistently identified on the Site Construction Plans
☒	☐		Mapped bedrock outcrops adjacent to any infiltration BMP
☒	☐		Soils were logged by a:
		☒	DEM-licensed Class IV soil evaluator Name: Chris Sutter
		☐	RI-registered P.E.

		Name:

Subwatershed and Impervious Area Summary				
Subwatershed (area to each design point)	**First Receiving Water ID or MS4**	**Area Disturbed (acres)**	**Existing Impervious (acres)**	**Proposed Impervious (acres)**
DP-1: Cranston Street	N/A	0.017	0.014	0.000
DP-2: Active Rail Corridor	N/A	0.587	0.000	0.108
DP-3: Abandoned Rail Corridor	N/A	6.054	0.190	4.380
TOTALS:	N/A	6.658	0.204	4.488

Site Construction Plans (Indicate that the following applicable specifications are provided)		
YES	**NO**	
☒	☐	Existing and proposed plans (scale not greater than 1" = 40') with North arrow
☒	☐	Existing and proposed site topography (with 1 or 2-foot contours); 10-foot contours accepted for off-site areas
☒	☐	Boundaries of existing predominant vegetation and proposed limits of clearing
☒	☐	Site Location clarification
☒	☐	Location and field-verified boundaries of resource protection areas such as: ▸ freshwater and coastal wetlands, including lakes and ponds ▸ coastal shoreline features Perennial and intermittent streams, in addition to Areas Subject to Storm Flowage (ASSFs)
☒	☐	All required setbacks (e.g., buffers, water-supply wells, septic systems)
☒	☐	Representative cross-section and profile drawings, and notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include: ▸ Location and size of the stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) must have labels that correspond to RISDISM Table 5-2; ▸ Design water surface elevations (applicable storms); ▸ Structural details of outlet structures, embankments, spillways, stilling basins, grade-control structures, conveyance channels, etc.; ▸ Existing and proposed structural elevations (e.g., inverts of pipes, manholes, etc.); ▸ Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties or drainage that could be affected by work in the floodplain; ▸ Planting plans for structural stormwater BMPs, including species, size, planting methods, and maintenance requirements of proposed planting
☒	☐	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report and corresponding water tables
☒	☐	Mapping of any OLRSMM-approved remedial actions/systems (including ELURs)
☒	☐	Location of existing and proposed roads, buildings, and other structures including limits of disturbance; ▸ Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements; ▸ Location of existing and proposed conveyance systems, such as grass channels, swales, and storm drains, and location(s) of final discharge point(s) (wetland, waterbody, etc.); ▸ Cross sections of roadways, with edge details such as curbs and sidewalks; ▸ Location and dimensions of channel modifications, such as bridge or culvert crossings
☐	☒	Locations, cross sections, and profiles of all stream or wetland crossings and their method of stabilization – N/A

1.0 Project Description

The purpose of this report is to specify a Stormwater Management System to be implemented for the new development at 777 Cranston Street. The 6.605 acre triangular-shaped site is located on Assessor's Plat 7 Lot 1 in Cranston, Rhode Island. The site is located off Cranston Street near the intersection of Garfield Avenue. It is bound by an active rail corridor to the east and an abandoned rail corridor to the west. The proposed development will include a new 4,200 ± SF car wash, a 5,800 ± SF gas station with a drive-thru, a 1,600 ± SF fast food restaurant with a drive-thru, and a 35,000 ± SF combination warehouse and auto parts retail store. The site will be serviced by public water and sewer. Water is provided by Providence Water and Sewer is provided by City of Cranston and Veolia Water.

The stormwater quality will be improved by utilizing Best Management Practices (BMPs) as established by the RISDISM for the treatment of stormwater runoff from the proposed development. BMPs will consist of oil/grit separators, proprietary separators (Cascade separators or approved equal), a FocalPoint biofiltration system, and underground sand filters that will be constructed with liners and underdrains. The system has been designed to meet the RIDEM Stormwater Design and Installations Standards Manual.

2.0 Site Conditions

2.1 SOILS

There are the following soil types within the analyzed area of the Site as mapped by the NRCS USDA Soil Conservation service:

Soil Symbol	Description	Hydrologic Group
MU	Merrimac-Urban land complex	A
UD	Udorthents-Urban land complex	None
Ur	Urban land	None

The onsite soils are UD- Udorthents – Urban Land Complex which does not have a Hydrologic Group. Soils surrounding the site include Ur, which has no hydrologic group, and MU – Merrimac Urban Land Complex which is a Hydrologic Group A soil. Onsite test holes indicated sand and some silt onsite. Hydrologic Group A has been used for modeling the UD and Ur soils on this site.

Site specific soil evaluations can be found in Appendix A2.1.

2.2 EXISTING SITE CONDITIONS

Currently the site is predominately grass with some existing pavement and some woods. Most of the runoff generated on site flows towards the active rail corridor to the east, with the remainder either flowing towards the abandoned rail corridor to the west or Cranston Street towards the south. There is currently no treatment nor detainment provided for the site's stormwater runoff. Run-on from off-site is limited to a small area located towards the eastern edge of the lot. Run-on flows from a small area underneath Huntington Expressway and is conveyed through the site by a riprap swale and then flows

off-site to the active rail corridor. Design points for stormwater modeling include the active rail corridor, the abandoned rail corridor, and Cranston Street.

2.3 POST SITE CONDITIONS

The proposed drainage analysis uses stormwater management systems to control and treat runoff from the proposed development. The following BMP's are used on site and have been designed to include the following elements:

- Oil/Grit Separator (1,000 gallon capacity)
    - Equipped with an emergency shutoff valve in case of a larger spill
    - Accepts runoff from both LUHPPL areas consisting of the tank mat and fueling area
- Cascade Separator (or approved equivalent)
    - Hydrodynamic separator to remove sediment and other debris from runoff
- Underground Sand Filter (Lined)
    - Provides an underdrain and is lined with an impermeable poly liner
    - Fully filters the water quality stormwater event.
    - 1.5' of sand filter sand for stormwater infiltration
    - Closed pipe network provides conveyance of stormwater to the sand filters, with pre-treatment provided by proprietary separators and/or oil/grit separators.
- FocalPoint High Performance Modular Biofiltration System (HPBMS) and R-Tank Underground Storage System
    - Sized in accordance with the RIDEM Certification for the FocalPoint HPMBS, providing a filter bed of 220 sf and the approved infiltration rate of 100 in/hr
    - Lined with an impermeable liner to prevent infiltration due to treating LUHPPL areas.
    - 3" mulch layer and 18" high flow layer utilized to fully treat the water quality stormwater event.
    - Approved removal rates of the following pollutants:
        - 85% removal of total suspended solids (TSS)
        - 60% removal of pathogens
        - 30% removal of total phosphorus
    - R-Tank system wrapped with filter fabric
    - Setback to building foundation of 25' met (29.5' provided)
- Infiltration Pond
    - Fully infiltrates all storm events up to and including the 100-year storm

The above elements will used to meet the design standards of the Rhode Island Stormwater Design and Installation Standards.

The primary goal of increasing water quality treatment is accomplished by providing water quality BMPs. Stormwater runoff mitigation is provided through the use of an infiltration pond. By reducing post-development stormwater flow rate to a level no greater than the pre-development rate, the second goal of the proposed drainage system is achieved. Any potential impacts from the proposed development on the abutting properties have been mitigated.

3.0 Minimum Standards

The site has been designed to meet the minimum standards as outlined in the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM). The following sections outline how the site meets and exceeds the minimum required standards.

3.1 Minimum Standard 1: LID Site Planning and Design Strategies

See "Appendix A: Stormwater Management Checklist" from the RISDISM provided at the beginning of this report.

3.2 Minimum Standard 2: Groundwater Recharge

Groundwater is to be recharged per watershed based on impervious area coverage in accordance with section 3.2.2 of the RISDISM.
Groundwater recharge is determined from the following equation:
Re_v=1"*F*I/12
Where:
Re_v=Groundwater Recharge Volume (cf)
F=Recharge Factor based on Hydrologic Soil Groups (HSG) (see table below)
I=Impervious Area (sf)

HSG	Recharge Factor (F)
A	0.60
B	0.35
C	0.25
D	0.10

Recharge volume for the site is provided by Infiltration Pond F. See Table 2-1 of the Appendix A checklist for a summary of recharge values.

The required recharge volume is based on all impervious area, not just areas which are captured in the proposed BMPs.

See Appendix A3.2 for the water quality storm HydroCAD analysis. The water quality storm is calculated in HydroCAD using the 'calculate separate Pervious/Impervious runoff' option.

3.3 Minimum Standard 3: Water Quality

All stormwater is treated through an approved BMP before being discharged. This site has been designed to use oil/water separators, proprietary separators, a FocalPoint biofiltration system, and underground sand filters to treat stormwater before being infiltrated within the infiltration pond. There are no pollutant-specific requirements and/or pollutant removal efficiencies applicable to the site as the result of SAMP, TMDL, or other watershed-specific requirements.

Water Quality Underground Sand Filter System

The Underground Sand Filter Systems have been designed as water quality systems and have been sized per section 5.5 of the RISDISM. Pretreatment for the systems has been provided through the use of proprietary treatment devices. The pretreatment devices have been sized per the manufacturer's recommendations and the RIDEM Stormwater Proprietary Technologies List, using the water quality storm event. The water quality storm is calculated in HydroCAD using the 'calculate separate Pervious/Impervious runoff' option. Proprietary Max Water Quality Flow and Approximate Impervious Area obtained from the RIDEM Approved Alternative Stormwater Technology Certification.

Per section 5.5 of the RISDISM, sand filters are required to have a minimum filter Area (A_f) and are required to store 75% of the water quality volume. See the following calculation sheets. Stage storage tables for the underground systems can be found in appendix A3.3.

FocalPoint Water Quality Biofiltration System

The Water Quality System for the LUHPPL areas on this site has been designed as a FocalPoint High Performance Modular Biofiltration System (HPBMS). The system has been sized using FocalPoint design guidelines and HydroCAD. The filtration rate of 100 in/hr was used because of the high flow-rate engineered soil media. See Appendix A3.2 for the HydroCAD analysis of the water quality event. The Water Quality system has been designed to fully treat the water quality storm event.

The FocalPoint HPBMS system has been designed in accordance with RIDEM requirements. Please see Appendix A3.2.1 for a copy of a certification of design compliance from Ferguson Waterworks and the RIDEM certification. Per the above mentioned RIDEM Certification, the filter bed of the FocalPoint must be sized to provide 192 sf of filter bed area per acre of impervious cover. Of the 1.201 acres tributary to the FocalPoint, 1.019 acres are impervious for a requirement minimum size of 210 sf. The provided filter bed area is 220 sf.

Sand Filter Sizing

Name of Sand Filter: USF-A

Sand Filter Parameters		
At,Total Area to Sand Filter	0.832	(Acres)
Impervious Area To Sand Filter	0.635	(Acres)
d_f, Filter Bed Depth	1.50	(feet)
k, Coefficient of Permeability	3.5	(ft/day)
h_f, Average Height of Water	1.38	(ft)
t_f, Design Filter Bed Drain Time	2.00	(days)
WQ Storage Depth	33	(in)

Water Quality Calculations

WQ_v= 1inch x Impervious Area

WQ_v= 2,305 (Cubic Feet)

Minimum Size of Sand Filter Filter Area

$A_f=(WQ_v)x(d_f)/[(k)x(h_f+d_f)(t_f)]$

Required Af= 172 (Square Feet) Where A_f is the required filter bed area

Provided Af= 804 (Square Feet)

Sand Filter Pre Treatment

Type of Pre Treatment: Proprietary Device

Water Quailty Storm Flow 0.7 (CFS)
Proprietary Device Max Treatment Flow Rate 1.02 (CFS)

Impervious Area to BMP .635 (Acres)
Proprietary Device Max Treatment Impevious Area 0.93 (Acres)

Required Water Quality Volume

75% of the WQv must be held within system

Required WQ_v 1,729 (Cubic Feet)

Provided WQv 1,736 (Cubic Feet)

WQv Provided at Elevation: 71.25

DiPrete Engineering
Engineers • Planners • Surveyors

Sand Filter Sizing

Name of Sand Filter: USF-C

Sand Filter Parameters		
At,Total Area to Sand Filter	0.626	(Acres)
Impervious Area To Sand Filter	0.527	(Acres)
d_f, Filter Bed Depth	1.50	(feet)
k, Coefficient of Permeability	3.5	(ft/day)
h_f, Average Height of Water	0.95	(ft)
t_f, Design Filter Bed Drain Time	2.00	(days)
WQ Storage Depth	23	(in)

Water Quality Calculations

WQ_v= 1inch x Impervious Area

WQ_v= 1,913 (Cubic Feet)

Minimum Size of Sand Filter Filter Area

$A_f=(WQ_v)x(d_f)/[(k)x(h_f+d_f)(t_f)]$

Required Af= 167 (Square Feet) Where A_f is the required filter bed area

Provided Af= 842 (Square Feet)

Sand Filter Pre Treatment

Type of Pre Treatment: Proprietary Device

Water Quailty Storm Flow 0.58 (CFS)
Proprietary Device Max Treatment Flow Rate 1.02 (CFS)

Impervious Area to BMP .527 (Acres)
Proprietary Device Max Treatment Impevious Area 0.93 (Acres)

Required Water Quality Volume

75% of the WQv must be held within system

Required WQ_v 1,435 (Cubic Feet)

Provided WQv 1,477 (Cubic Feet)

WQv Provided at Elevation: 67.40

Sand Filter Sizing

Name of Sand Filter: USF-D

Sand Filter Parameters		
At,Total Area to Sand Filter	1.166	(Acres)
Impervious Area To Sand Filter	1.026	(Acres)
d_f, Filter Bed Depth	1.50	(feet)
k, Coefficient of Permeability	3.5	(ft/day)
h_f, Average Height of Water	1.30	(ft)
t_f, Design Filter Bed Drain Time	2.00	(days)
WQ Storage Depth	31	(in)

Water Quality Calculations

WQ_v= 1inch x Impervious Area

WQ_v= 3,724 (Cubic Feet)

Minimum Size of Sand Filter Filter Area

$A_f=(WQ_v)x(d_f)/[(k)x(h_f+d_f)(t_f)]$

Required Af= 285 (Square Feet) Where A_f is the required filter bed area

Provided Af= 1,350 (Square Feet)

Sand Filter Pre Treatment

Type of Pre Treatment: Proprietary Device

Water Quailty Storm Flow 1.12 (CFS)
Proprietary Device Max Treatment Flow Rate 1.8 (CFS)

Impervious Area to BMP 1.026 (Acres)
Proprietary Device Max Treatment Impevious Area 1.68 (Acres)

Required Water Quality Volume

75% of the WQv must be held within system

Required WQ_v 2,793 (Cubic Feet)

Provided WQv 2,863 (Cubic Feet)

WQv Provided at Elevation: 66.60

Sand Filter Sizing

Name of Sand Filter: USF-E

Sand Filter Parameters		
At,Total Area to Sand Filter	1.319	(Acres)
Impervious Area To Sand Filter	1.201	(Acres)
d_f, Filter Bed Depth	1.50	(feet)
k, Coefficient of Permeability	3.5	(ft/day)
h_f, Average Height of Water	1.35	(ft)
t_f, Design Filter Bed Drain Time	2.00	(days)
WQ Storage Depth	32	(in)

Water Quality Calculations

WQ_v= 1inch x Impervious Area

WQ_v= 4,360 (Cubic Feet)

Minimum Size of Sand Filter Filter Area

$A_f=(WQ_v)x(d_f)/[(k)x(h_f+d_f)(t_f)]$

Required Af= 328 (Square Feet) Where A_f is the required filter bed area

Provided Af= 1,530 (Square Feet)

Sand Filter Pre Treatment

Type of Pre Treatment: Proprietary Device

Water Quailty Storm Flow 1.31 (CFS)
Proprietary Device Max Treatment Flow Rate 1.8 (CFS)

Impervious Area to BMP 1.201 (Acres)
Proprietary Device Max Treatment Impevious Area 1.68 (Acres)

Required Water Quality Volume

75% of the WQv must be held within system

Required WQ_v 3,270 (Cubic Feet)

Provided WQv 3,328 (Cubic Feet)

WQv Provided at Elevation: 66.70

FERGUSON WATERWORKS

FOCALPOINT DESIGN SHEET

RHODE ISLAND DEM CERTIFIED

DESIGNING WITH FOCALPOINT IN RHODE ISLAND

FocalPoint (High Performance Modular Biofiltration System) is recognized by the Rhode Island Department of Environmental Management (DEM) and Coastal Resources Management Council (CRMC) for use as a water quality BMP or pretreatment device for site development projects and as a retrofit device for redevelopment projects.

The FocalPoint is approved in Rhode Island for the following pollutant removals when designed with the maximum infiltration rate of 100 inches per hour: 85% removal of total suspended solids (TSS), 60% removal of pathogens, 30% removal of total phosphorus (TP) for discharges to freshwaters, and 30% removal of total nitrogen (TN) for discharges to tidal waters.

1. **Determine FocalPoint bed area (minimum 192 sf/acre of impervious area - ex: 0.2 acres = 39 sf)**
   See step 2 to determine if minimum size is appropriate.
   - Tributary impervious area: = 1.019 ac **(A)**
   - Tributary pervious area: = 0.182 ac **(B)**
   - Minimum FocalPoint bed area required: **= ((A x 1.0) + (B x 0.4)) * 192** = 209.6 sf
   - FocalPoint bed area provided*: = 220 sf
   - Dimensions of proposed FocalPoint: = 22 ft x 10 ft

2. **Model a Type III 24-hr rainfall event that generates the water quality volume to demonstrate that the entire storm volume is treated prior to activation of the overflow (typically set at 6 - 12 in above the mulch). Note: a 1.2 - 1.3" rainfall event usually generates 1.0" of runoff.**
   Contact Ferguson Waterworks for a sample HydroCAD node.
   - Water quality volume (WQv) goal: = 3,699 ft^3
   - Type III 24-hr rainfall depth to generate WQv: = 1.2 in
   - Temporary storage depth provided: = 8.4 in
     (typically 6 - 12 in)
   - Temporary storage volume provided at above depth: = 322 ft^3
   - Peak ponding depth from Type III 24 hr WQv event: = 7.2 in

3. **Size the Harco PVC domed overflow riser.**
   Note: Ferguson recommends installation of a Fabco domed overflow filter kit for overflow protection.
   - Domed overflow riser diameter: = 12 in
   - Rim elevation of overflow riser: = 62.70
   - Pipe size and pipe invert IN elevation: = N/A in = N/A
   - Pipe size and pipe invert OUT elevation: = 12 in = 59.00

Contact Loren Joyce - Stormwater Engineer
Cell: 207.272.9743 | Email: loren.joyce@ferguson.com

FERGUSON WATERWORKS

DESIGNING WITH FOCALPOINT IN RHODE ISLAND (CONTINUED)

4. **Pretreatment Device: System must incorporate pretreatment device based on drainage area (select one):**
   - Rain Guardian (drainage area of 0.25 acres or less) ☐
   - Upstream water quality manhole (drainage area of 0.50 acres or less) ☐
   - PRETX Unit (drainage area of 1 acre or less) ☐
   - `Oil/water separator for pretreatment before bypass structure` ☑
5. **Recharge, channel protection and over-bank flood protection of major storms.**
   The R-Tank modular underdrain can be expanded beyond the footprint of the FocalPoint treatment area to meet groundwater recharge volume, conveyance, natural channel protection and over-bank flood protection requirements per the Rhode Island Stormwater Design & Installation Standards Manual. Contact Ferguson for additional information on designing expanded R-Tank systems.
6. **Prepare a landscape plan including approved plantings for the FocalPoint system (per RIDEM approval letter)**
7. **Ensure manufacturer's representative verifies the design of each FocalPoint system with a signed letter as required in the applicant's submission to the RIDEM**
8. **Coordinate installation oversight provided by manufacturer's representative**

Approved Plant List by Common Name/Species

- American Beach Grass / Ammophila Breviligulata
- Switchgrass / Pancium Virgatum
- Day Lily / Hemerocallis
- Black Eyed Susan / Rudbeckia Hirta
- Cone Flower / Echinacea

FOCALPOINT SYSTEMS:




FOCALPOINT ACCESSORIES:


Pretreatment - Rain Guardian Turret


Pretreatment - Rain Guardian Foxhole


Pretreatment - PreTx


Bypass protection - Domed overflow with filter insert

For additional information please visit: acfenvironmental.com

Contact Loren Joyce - Stormwater Engineer
Cell: 207.272.9743 | Email: loren.joyce@ferguson.com

3.4 Minimum Standard 4: Conveyance and Natural Channel Protection

3.4.1 Drainage Network Design Parameters:

A. PIPES

- All drainage pipes are HDPE or equivalent unless otherwise noted.
- Manning's coefficient = 0.012 for HDPE Pipe
- Diameters & lengths as specified
- The 100-year design storm is utilized for the drainage pipe design to ensure that the drainage system contains and channels water to the BMP areas as shown on the plans.
- The rational method has been used for the closed drainage system.

B. STRUCTURES

- Catch basins – Pre-cast concrete with 3' sump unless otherwise noted and inverts as specified
- Manholes – Pre-cast concrete with inverts as specified.

3.4.2 Channel Protection Volume:

The site has been designed to fully infiltrate the channel protection volume. The channel protection required has been met.

See Table 4-1 of the Appendix A Checklist for a Summary of Channel Protection Volumes. See Appendix A3.5.4.2 for the 1-year storm event HydroCAD analysis.

3.5 Minimum Standard 5: Overbank Flood Protection & Downstream Analysis

3.5.1 Method of Analysis

USDA Soil Conservation Service Method as defined by Technical Release No. 20 (TR-20) determines Stormwater runoff rate and volume. Type III rainfall distribution is utilized. Time of concentration is determined using Technical Release No 55 (TR-55) methodology, through the computer program *HydroCAD ver. 10.0* by HydroCAD Software Solutions LLC.

Infiltrometer testing has been performed within the footprint of the proposed infiltration pond. The test results yield infiltration rates of 46.9 and 73.8 inches per hour at this location. A conservative infiltration rate equal to half the lowest rate (23.45 inches per hour) has been used to model the infiltration pond. The drainage system has been designed to mitigate all stormwater flows for the 10 and 100 year storm events. The overflow outlet has been sized to handle the 100 year storm event.

3.5.2 Design Storm

Analysis of 1-year, 10-year, 25-year, and 100-year frequency storms are included. The following 24-hour rainfall intensities are obtained from the Rhode Island Stormwater Design and Installation Standards Manual,

Table 3-1 for Providence County.

1 year =	2.7 inches
10 year =	4.9 inches
25 year =	6.1 inches
100 year=	8.7 inches

3.5.3 Design Point Breakdown

The site is analyzed as 3 watershed areas. In the pre-development stage, there are 3 subcatchments. In the post development stage, there are 11 subcatchments. Each watershed will demonstrate zero increase of runoff due to the proposed development. A description of each watershed and associated subcatchments are summarized as follows; for cover types see color watershed maps located in the back of this report. Numbers in parentheses ( ) indicate the HydroCAD Node Number.

Design Line 1:

Design Line 1 (DL-1) represents Cranston Street.

In pre-development conditions, there is only one watershed to DL-1. Pre-1 (11) contains a small area consisting of mostly grass and some pavement. Stormwater reaches DL-1 (12) via overland flow.

In post-development conditions there is one sub-watershed: Post-1 (101) consists of a small area of grass. Stormwater reaches DL-1 (102) via overland flow.

Below is a summary of the hydrologic parameters for the pre and post development sub-areas in DL-1:

Node Name	Node Number	Area (acres)	CN	Tc (min)
Pre-1	11	0.164	44	6.0
Post-1	101	0.017	39	6.0

Design Point 2:

Design Point 2 (DP-2) represents the active rail corridor located along the eastern edge of the lot.

In pre-development conditions, there is only one watershed to DP-2. Pre-2 (21) contains a large portion of the site that consists of mostly grass with some woods and gravel. Stormwater reaches DP-2 (22) via overland flow.

In post-development conditions there is one sub-watershed: Post-2 (201) consists of mostly grass with some impervious associated with the bike path that runs along the eastern edge of the property. Stormwater reaches DP-2 (202) via overland flow.

Below is a summary of the hydrologic parameters for the pre and post development sub-areas in DP-2:

Node Name	Node Number	Area (acres)	CN	Tc (min)
Pre-2	21	4.290	39	11.7
Post-2	201	0.587	50	6.0

Design Point 3:

Design Point 3 (DP-3) represents the abandoned rail corridor located along the western edge of the lot.

In pre-development conditions, there is only one watershed to DP-3. Pre-3 (31) contains a portion of the site that consists of mostly grass with some woods and some existing pavement. Stormwater reaches DP-3 (32) via overland flow.

In post-development conditions there are nine sub-watersheds:

Post-3 (305) consists of the proposed car wash building and its associated parking, drive aisles, and landscaped areas. Pre-treatment of runoff is provided by a proprietary separator and WQ treatment is provided by a lined underground sand filter (USF-A) (307) designed to filter the water quality volume. Overflows from USF-A and larger storm events are bypassed to Infiltration Pond F (327) on the northern end of the site which would overflow to DP-3 in storm events larger than the 100-year storm.

Post-4 (301) consists of the proposed gas station and its associated parking, drive aisles, and landscaped areas as well as the tank mat area. Pre-treatment of runoff is provided by an oil/grit separator that has a storage capacity of 1,000 gallons. WQ treatment is provided by the FocalPoint biofiltration system (304) and overflows are bypassed to Infiltration Pond F (327).

Post-5 (309) consists of the proposed fast food restaurant and its associated parking, drive aisles, and landscaped areas. Pre-treatment of runoff is provided by a proprietary separator and WQ treatment is provided by USF-C (311). Overflows are bypassed to Infiltration Pond F (327).

Post-6 (314) consists of the eastern drive aisle, half of the proposed warehouse/store roof area, and adjacent parking and landscaped areas. Pre-treatment of runoff is provided by a proprietary separator. WQ treatment is provided by USF-D (316) and overflows are bypassed to Infiltration Pond F (327).

Post-7 (319) and Post-8 (320) consist of the western drive aisle, half of the proposed warehouse/store roof area, and adjacent parking and landscaped areas. Pre-treatment of runoff is provided by a proprietary separator. WQ treatment is provided by USF-E (322) and overflows are bypassed to Infiltration Pond F (327).

Post-9 (326) consists mostly of grassed area with a portion of the proposed bike path that contributes runoff directly to the proposed infiltration pond, which would overflow to DP-3 in storm events larger than the 100-year storm.

Post-10 (328) consists almost entirely of grass area with a small impervious area associated with the bike path. Runoff from this subcatchment area is not captured or detained and reaches DP-3 via overland flow.

Post-11 (303) consists almost entirely of grass area with a small impervious area associated with the bike path. Runoff from this subcatchment area flows to the FocalPoint biofiltration system, which overflows to Infiltration Pond F (327) during storm events larger than the water quality storm.

Below is a summary of the hydrologic parameters for the pre and post development sub-areas in DP-3:

Node Name	Node Number	Area (acres)	CN	Tc (min)
Pre-3	31	2.204	43	12.4
Post-3	305	0.832	84	6.0
Post-4	301	1.121	92	6.0
Post-5	309	0.627	89	6.0
Post-6	314	1.071	91	6.0
Post-7	319	0.610	87	6.0
Post-8	320	0.709	98	6.0
Post-9	326	0.764	42	6.0
Post-10	328	0.241	42	6.0
Post-11	303	0.080	41	6.0

3.5.4 Q_p BMP Calculations

The emergency outlet has been sized to safely pass the 100-year storm and beyond without erosion to the embankment. The infiltration pond has been sized to fully infiltrate the 100 year storm event; thus no erosion will take place on the embankment or downstream. See attached HydroCAD.

Outlet Protection

Rip rap aprons are designed at the drainage pipe discharges into the infiltration pond. The rip rap aprons are designed to prevent scour at the storm water outlet and to minimize the potential for downstream erosion by reducing the velocity of concentrated storm water flows.

Outlet Protection Calculations
Pond F

DiPrete Engineering
Engineers • Planners • Surveyors

$$La = \frac{1.7*Q}{Do^{3/2}} + 8*Do$$

La = length of apron
Do = diameter of outlet pipe
W = width of apron
d-50 = median stone diameter
TW = tailwater depth

For discharges where Tailwater < 0.5*Do

$$W = 3*Do + La$$

For discharges where Tailwater >= 0.5*Do

$$W = 3*Do + 0.4*La$$

d-50 is determined by the following formula

$$d\text{-}50 = \frac{0.02}{TW} * \left(\frac{Q}{Do}\right)^{4/3}$$

Outlet Protection Table (Sized for 100 Year Storm Event)

Outlet	Discharge (cfs)	Do (ft)	La (ft)	TW* (ft)	W (ft)	d-50 (in)	Riprap Class
FES-54	37.83	2.50	37	2.50	23.00	4	R-4

* TW assumed to be depth of flow in pipe

3.5.5 Downstream Analysis

A downstream analysis is required under the following conditions:

Area of Disturbance (Acres)	Impervious Cover (%)
>5 to 10	>75
>10 to 25	>50
>25 to 50	>25
>50	All Projects

The proposed project disturbs 6.658 acres and is 4.487 acres of impervious. This is approximately 67% impervious cover. A downstream analysis is not required.

3.5.6 Overbank Flood Protection Conclusion

The table below presents a summary of the pre-development flows vs. the mitigated post-development flows. The table shows a decrease in the rate of runoff for all storms included in the analysis.

Pre Development Flows vs. Post Development Flows Mitigated

Subwatershed (design point)	1.2" Peak Flow		1-yr Peak Flow		10-yr Peak Flow		25-yr Peak Flow		100-yr Peak Flow	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
DL-1: Cranston Street	0.02	0.00	0.00	0.00	0.02	0.00	0.09	0.00	0.33	0.02
DP-2: Active Rail Corridor	0.00	0.12	0.00	0.00	0.11	0.27	0.79	0.65	4.38	1.73
DP-3: Abandoned Rail Corridor	0.17	0.01	0.00	0.00	0.24	0.02	0.80	0.08	3.30	0.41
Totals:	0.19	0.13	0.00	0.00	0.37	0.29	1.68	0.73	8.01	2.16

All flows in cubic feet per second (cfs)

As shown in the table above, no net increase in stormwater runoff flow will occur following the proposed construction during the 1 through 100 year storm events for the entire site. There is a slight increase in post-development runoff to DP-2 for the water quality and 10-year storm events due to the higher curve number and reduced time of concentration for its contributing watershed area. However, peak flows are reduced for all other storm events and this isolated peak flow increase is small enough to be negligible.

3.6 Minimum Standard 6: Redevelopment and Infill Projects.

The site is not classified as a redevelopment or infill project.

3.7 Minimum Standard 7: Pollution Prevention

A Soil Erosion and Sediment Control Plan (SESC) for this development can be found under a separate document. See the Soil Erosion and Sediment Control Plan for the development prepared by DiPrete Engineering. The SESC contains information for construction pollution prevention. For post construction pollution prevention see the Operations and Maintenance (O&M) document prepared for this development by DiPrete Engineering.

3.8 Minimum Standard 8: Land Uses with High Potential Pollutant Loads (LUHPPLs)

Per RISDISM SECTION 3.2.8 Guidance for Infiltration at Auto Fueling Facilities, auto fueling is characterized as a LUHPPL. The LUHPPL portion of an auto fueling facility is the fuel dispensing area and the tank filling area (tank traffic mat). Stormwater runoff from these areas will be pre-treated by an oil/ water separator, in compliance with the Guidance document. In the event of a large spill, the oil/water separator is equipped with an emergency shutoff valve that will be able to prevent the spill from flowing to downstream treatment practices. The site has also been graded to isolate stormwater runoff from these areas to the maximum extent practicable, in order to isolate that section of the drainage network in the event of a spill. The water quality volume from the LUHPPL areas is treated by a FocalPoint biofiltration system that has a liner to prevent infiltration.

3.9 Minimum Standard 9: Illicit Discharges

There are no proposed Illicit Discharges on site. The site will be serviced by public water and sewer.

3.10 Minimum Standard 10: Construction Activity Soil Erosion, Runoff and Sedimentation and Pollution Prevention Control Measure Requirements

See the SESC for this development prepared by DiPrete Engineering.

3.11 Minimum Standard 11: Stormwater Management System Operation and Maintenance

See the O&M for this development prepared by DiPrete Engineering.

Appendix A

A2.1 Soil Evaluations

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

Site Evaluation Form
Part A – Soil Profile Description **Application Number** N/A

Property Owner: Trolley Barn Associates LLC
Property Location: Cranston Street (AP 7 Lot 1) Cranston, RI
Date of Test Hole: May 3, 2021
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 70's Shaded: Yes ☐ No ☑ Time: 8:00 AM

TH 1 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM	0-40"	C	S				sandy			Fill
Ab	40-46"	C	S	10YR 3/4			ls	1-sbk	fri	3
Bw	46-64"	C	S	10YR 4/6			ls	1-sbk	fri	3
C	64-120"			2.5Y 5/4			gs	0-sg	L	1

TH 2 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM*	0-120"	C	S				mixed			Fill
C	120-126"			2.5Y 5/4			s	0-sg	L	1

TH 1 Soil Class HTM/Outwash Total Depth 120" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 120" (og)
TH 2 Soil Class HTM/Outwash Total Depth 126" Impervious/Limiting Layer Depth N/A (og) GW Seepage Depth N/A SHWT 120" (og)

Comments:
*TH 2: HTM contains abundant brick and concrete fragments

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

Site Evaluation Form
Part A – Soil Profile Description **Application Number** N/A

Property Owner: Trolley Barn Associates LLC
Property Location: Cranston Street (AP 7 Lot 1) Cranston, RI
Date of Test Hole: May 3, 2021
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 70's Shaded: Yes ☐ No ☑ Time: 8:00 AM

TH 3 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1*	0-36"	C	S				mixed			Fill
HTM 2	36-108"	C	S				sandy			Fill
C	108-120"			2.5Y 5/4			gcos	0-sg	L	1

TH 4 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1	0-40"	C	S				mixed			Fill
HTM 2**	40-50"	C	S				ash/mixed			Fill
HTM 3	50-60"	C	S				mixed			Fill
Ab	60-70"	C	S	10YR 3/2			ls	1-sbk	fri	3
Bw	70-100"	C	S	10YR 4/6			ls	1-sbk	fri	3
C	100-137"			2.5Y 5/4			gs	0-sg	L	1

TH 3 Soil Class HTM/Outwash Total Depth 120" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 120" (og)
TH 4 Soil Class HTM/Outwash Total Depth 137" Impervious/Limiting Layer Depth N/A (og) GW Seepage Depth N/A SHWT 120" (og)

Comments:
*TH 3: HTM 1 contains abundant brick and concrete fragments
**TH 4: HTM 2 appears to consist of ash and mixed fill

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

Site Evaluation Form
Part A – Soil Profile Description **Application Number** N/A

Property Owner: Trolley Barn Associates LLC
Property Location: Cranston Street (AP 7 Lot 1) Cranston, RI
Date of Test Hole: May 3, 2021
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 70's Shaded: Yes ☐ No ☑ Time: 8:00 AM

TH 5 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM*	0-120"	C	S				mixed			Fill
TH 6 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1	0-60"	C	S				mixed			Fill
C	60-120"			2.5Y 5/4			gs	0-sg	L	1

TH 5 Soil Class HTM/Outwash Total Depth 120" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 120" (og)
TH 6 Soil Class HTM/Outwash Total Depth 120" Impervious/Limiting Layer Depth N/A (og) GW Seepage Depth N/A SHWT 120" (og)

Comments:
*TH 5: HTM 1 contains abundant brick and concrete fragments

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

Site Evaluation Form
Part A – Soil Profile Description **Application Number** N/A

Property Owner: Trolley Barn Associates LLC
Property Location: Cranston Street (AP 7 Lot 1) Cranston, RI
Date of Test Hole: May 3, 2021
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 70's Shaded: Yes ☐ No ☑ Time: 8:00 AM

TH 7 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1	0-12"	C	S				loamy			Fill
HTM 2*	12-72"	C	S				silty			Fill
HTM 3	72-108"	C	S				sandy			Fill
R**	108"									

TH 8 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1	0-120"	C	S				sand			Fill
R***	120"									

TH 7 Soil Class HTM/Outwash Total Depth 108" Impervious/Limiting Layer Depth 108" (og) GW Seepage Depth NA SHWT >108" (og)
TH 8 Soil Class HTM/Outwash Total Depth 120" Impervious/Limiting Layer Depth 120" (og) GW Seepage Depth N/A SHWT 120" (og)

Comments:
*TH 7: HTM 2 is likely impacted fill which has been capped. Liner material encountered at 12" from existing grade
**TH 7: Refusal at 108" appears to concrete slab
***TH 8: Refusal at 120" appears to be concrete slab. Vertical foundation walls encountered at this location

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

Site Evaluation Form
Part A – Soil Profile Description **Application Number** N/A

Property Owner: Trolley Barn Associates LLC
Property Location: Cranston Street (AP 7 Lot 1) Cranston, RI
Date of Test Hole: May 3, 2021
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 70's Shaded: Yes ☐ No ☑ Time: 8:00 AM

TH 9 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1	0-40"	C	S				mixed			Fill
C1	40-50"	C	S	2.5Y 5/3			fs	0-sg	L	1
C2	50-126"	C	S	2.5Y 5/4			gcos	0-sg	L	1

TH 10 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1	0-12"	C	S				sandy			Fill
HTM 2*	12-36"	C	S				silty			Fill
HTM 3**	36-96						sandy			Fill

TH 9 Soil Class HTM/Outwash Total Depth 126" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 120" (og)
TH 10 Soil Class HTM/Outwash Total Depth 96" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth N/A SHWT >96 (og)

Comments:
*TH 10: HTM 2 is likely impacted fill which has been capped. Liner material encountered at 12" from existing grade
**TH 10: HTM 3 contains abundant concrete, brick, rebar, etc

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

Site Evaluation Form
Part A – Soil Profile Description **Application Number** N/A

Property Owner: Trolley Barn Associates LLC
Property Location: Cranston Street (AP 7 Lot 1) Cranston, RI
Date of Test Hole: May 3, 2021
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 70's Shaded: Yes ☐ No ☑ Time: 8:00 AM

TH 11 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM 1	0-32"	C	S				mixed			Fill
HTM 2	32-80"	C	S				sandy			Fill
Bw	80-105"	C	S	10YR 4/6			ls	1-sbk	fri	3
C	105-132"			2.5Y 5/4			gs	0-sg	L	1

TH 12 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
HTM	0-36"	C	S				sandy			Fill
C	36-120"			2.5Y 5/4			gs	0-sg	L	1

TH 11 Soil Class HTM/Outwash Total Depth 132" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 120" (og)
TH 12 Soil Class HTM/Outwash Total Depth 120" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth N/A SHWT 120" (og)

Comments:

Double Ring Infiltrometer Field Data Sheet

Project Name: 2928-001 Cranston St. #777	**Date:**	10/18/21		**Diameter**	**H2O depth**
Test Location: IT #1 (rear of lot)			**Inner Ring**	12"	6"
Water Source: Supplied Tank			**Outer Ring**	24"	6"
Field Personnel: Chris Sutter, Allison Drake					
Ring Depth (in.): Inner: 5" **Outer:** 6"					
Depth to WT: +/- 120"					

Presoak Data

Start Time	End Time	Starting Water Level/Ending Water Level
10:15 am	10:45 am	10"/0" (40+ gal used)

*Reading interval determined based on water level drop during presoak period

				Flow Reading				Liquid	Remarks
Trial #	IT1	Time	Elapsed	Inner Ring		Outer Ring		Temp	Weather Cond., etc
		HR:MIN	Time	in.	Δ in.	in	Δ in.	(F)	
1	START	10:46	-	6.0	1.75	6.0	1.5	50°	Clear, 60°
	END	10:48	2.0	4.25		4.5			
2	START	10:49	-	6.0	2.0	6.0	1.5	-	
	END	10:51	2.0	4.0		4.5			
3	START	10:52	-	6.0	1.75	6.0	1.5	-	
	END	10:54	2.0	4.25		4.5			
4	START	10:56	-	6.0	1.5	6.0	1.5	-	
	END	10:58	2.0	4.5		4.5			
5	START	11:00	-	6.0	1.5	6.0	1.5	-	
	END	11:02	2.0	4.5		4.5			
6	START	11:42	-	6.0	1.25	6.0	1.5	-	
	END	11:44	2.0	4.75		4.5			
7	START	11:45	-	6.0	1.5	6.0	1.5	-	
	END	11:47	2.0	4.5		4.5			
8	START	11:48	-	6.0	1.5	6.0	1.5	-	
	END	11:50	2.0	4.5		4.5			
9	START	11:51	-	6.0	1.5	6.0	1.5	-	
	END	11:53	2.0	4.5		4.5			
10	START	11:54	-	6.0	1.5	6.0	1.5	-	
	END	11:56	2.0	4.5		4.5			
11	START	11:57	-	6.0	1.5	6.0	1.5	-	
	END	11:59	2.0	4.5		4.5			
12	START	12:00	-	6.0	1.5	6.0	1.5	-	
	END	12:02	2.0	4.5		4.5			
13	START								
	END								
14	START								
	END								
15	START								
	END								

refill tank

Infiltration Rate: 18.75 in/24 min = 0.78 in/min = 46.9 in/hr

Double Ring Infiltrometer Field Data Sheet

Project Name: 2928-001 Cranston St. #777	**Date:**	10/18/21		**Diameter**	**H2O depth**
Test Location: IT #2 (front of lot)			**Inner Ring**	12"	5"
Water Source: Supplied Tank			**Outer Ring**	24"	5"
Field Personnel: Chris Sutter, Allison Drake					
Ring Depth (in.): Inner: 5" **Outer:** 6"					
Depth to WT: +/- 120"					

Presoak Data

Start Time	End Time	Starting Water Level/Ending Water Level
12:15 pm	12:40 pm	10"/0" (40+ gal used)

*Reading interval determined based on water level drop during presoak period

				Flow Reading				Liquid	Remarks
Trial #	IT1	Time	Elapsed	Inner Ring		Outer Ring		Temp	Weather Cond., etc
		HR:MIN	Time	in.	Δ in.	in	Δ in.	(F)	
1	START	12:50	-	5.0	2.5	5.0	2.5	58°	Clear, 60°
	END	12:52	2.0	2.5		2.5			
2	START	12:53	-	5.0	2.0	5.0	2.5	-	
	END	12:55	2.0	3.0		2.5			
3	START	12:56	-	5.0	2.5	5.0	2.5	-	
	END	12:58	2.0	2.5		2.5			
4	START	1:00	-	5.0	2.5	5.0	2.5	-	
	END	1:02	2.0	2.5		2.5			
5	START	1:04	-	5.0	2.5	5.0	2.5	-	
	END	1:06	2.0	2.5		2.5			
6	START	1:07	-	5.0	2.5	5.0	2.5	-	
	END	1:09	2.0	2.5		2.5			
7	START	1:10	-	5.0	2.5	5.0	2.5	-	
	END	1:12	2.0	2.5		2.5			
8	START	1:13	-	5.0	2.5	5.0	2.5	-	
	END	1:15	2.0	2.5		2.5			
9	START	1:17	-	5.0	2.5	5.0	2.5	-	
	END	1:19	2.0	2.5		2.5			
10	START	1:20	-	5.0	2.5	5.0	2.5	-	
	END	1:22	2.0	2.5		2.5			
11	START	1:23	-	5.0	2.5	5.0	2.5	-	
	END	1:25	2.0	2.5		2.5			
12	START								
	END								
13	START								
	END								
14	START								
	END								
15	START								
	END								

Infiltration Rate: 27.0 in/24 min = 1.23 in/min = 73.8 in/hr

A3.2 Water Quality HydroCAD Storm Analysis

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 11: Pre-1 Runoff Area=0.164 ac 8.75% Impervious Runoff Depth=0.09"
Tc=6.0 min CN=39/98 Runoff=0.02 cfs 0.001 af

Subcatchment 21: Pre-2 Runoff Area=4.290 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=755' Tc=11.7 min CN=39/98 Runoff=0.00 cfs 0.000 af

Subcatchment 31: Pre-3 Runoff Area=2.204 ac 8.62% Impervious Runoff Depth=0.08"
Flow Length=441' Tc=12.4 min CN=38/98 Runoff=0.17 cfs 0.016 af

Reach 12: DL-1 Cranston Street Inflow=0.02 cfs 0.001 af
Outflow=0.02 cfs 0.001 af

Reach 22: DP-2 Active Rail Corridor Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 32: DP-3 Abandoned Rail Corridor Inflow=0.17 cfs 0.016 af
Outflow=0.17 cfs 0.016 af

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 101: Post-1 Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39/0 Runoff=0.00 cfs 0.000 af

Subcatchment 201: Post-2 Runoff Area=0.587 ac 18.43% Impervious Runoff Depth=0.18"
Tc=6.0 min CN=39/98 Runoff=0.12 cfs 0.009 af

Subcatchment 301: Post-4 Runoff Area=1.121 ac 90.63% Impervious Runoff Depth=0.89"
Tc=6.0 min CN=39/98 Runoff=1.11 cfs 0.083 af

Subcatchment 303: Post-11 Runoff Area=0.080 ac 3.72% Impervious Runoff Depth=0.04"
Tc=6.0 min CN=39/98 Runoff=0.00 cfs 0.000 af

Subcatchment 305: Post-3 Runoff Area=0.832 ac 76.07% Impervious Runoff Depth=0.75"
Tc=6.0 min CN=39/98 Runoff=0.69 cfs 0.052 af

Subcatchment 309: Post-5 Runoff Area=0.626 ac 84.26% Impervious Runoff Depth=0.83"
Tc=6.0 min CN=39/98 Runoff=0.58 cfs 0.043 af

Subcatchment 314: Post-6 Runoff Area=1.071 ac 88.13% Impervious Runoff Depth=0.87"
Tc=6.0 min CN=39/98 Runoff=1.03 cfs 0.078 af

Subcatchment 319: Post-7 Runoff Area=0.610 ac 80.64% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=39/98 Runoff=0.54 cfs 0.040 af

Subcatchment 320: Post-8 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=0/98 Runoff=0.78 cfs 0.058 af

Subcatchment 326: Post-9 Runoff Area=0.764 ac 5.78% Impervious Runoff Depth=0.06"
Tc=6.0 min CN=39/98 Runoff=0.05 cfs 0.004 af

Subcatchment 328: Post-10 Runoff Area=0.242 ac 5.15% Impervious Runoff Depth=0.05"
Tc=6.0 min CN=39/98 Runoff=0.01 cfs 0.001 af

Reach 102: DL-1 Cranston Street Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 202: DP-2 Active Rail Corridor Inflow=0.12 cfs 0.009 af
Outflow=0.12 cfs 0.009 af

Reach DP-3: DP-3 Abandoned Rail Corridor Inflow=0.01 cfs 0.001 af
Outflow=0.01 cfs 0.001 af

Pond 302: Bypass (DMH-12) Peak Elev=63.92' Inflow=1.11 cfs 0.083 af
Primary=1.11 cfs 0.083 af Secondary=0.00 cfs 0.000 af Outflow=1.11 cfs 0.083 af

Pond 304: FocalPoint-B Peak Elev=62.69' Storage=319 cf Inflow=1.12 cfs 0.084 af
Outflow=0.51 cfs 0.084 af

Pond 306: Bypass (DMH-21) Peak Elev=69.78' Inflow=0.69 cfs 0.052 af
Primary=0.69 cfs 0.052 af Secondary=0.00 cfs 0.000 af Outflow=0.69 cfs 0.052 af

Pond 307: USF A (740s) Peak Elev=68.88' Storage=500 cf Inflow=0.69 cfs 0.052 af
Outflow=0.15 cfs 0.052 af

Pond 307P: Pipe 21-23 Peak Elev=66.32' Inflow=0.15 cfs 0.052 af
18.00" Round Culvert n=0.012 L=63.6' S=0.0050 '/' Outflow=0.15 cfs 0.052 af

Pond 308: DMH-23 Peak Elev=61.66' Inflow=0.15 cfs 0.052 af
15.00" Round Culvert n=0.012 L=106.2' S=0.0050 '/' Outflow=0.15 cfs 0.052 af

Pond 310: Bypass (DMH-30) Peak Elev=66.91' Inflow=0.58 cfs 0.043 af
Primary=0.58 cfs 0.043 af Secondary=0.00 cfs 0.000 af Outflow=0.58 cfs 0.043 af

Pond 311: USF C (740s) Peak Elev=65.20' Storage=334 cf Inflow=0.58 cfs 0.043 af
Outflow=0.16 cfs 0.043 af

Pond 312: DMH-32 Peak Elev=66.36' Inflow=0.00 cfs 0.000 af
15.00" Round Culvert n=0.012 L=74.7' S=0.0100 '/' Outflow=0.00 cfs 0.000 af

Pond 313: DMH-33 Peak Elev=63.38' Inflow=0.16 cfs 0.043 af
18.00" Round Culvert n=0.012 L=108.1' S=0.0100 '/' Outflow=0.16 cfs 0.043 af

Pond 315: Bypass (DMH-39) Peak Elev=65.49' Inflow=1.03 cfs 0.078 af
Primary=1.03 cfs 0.078 af Secondary=0.00 cfs 0.000 af Outflow=1.03 cfs 0.078 af

Pond 316: USF-D (740s) Peak Elev=64.00' Storage=669 cf Inflow=1.03 cfs 0.078 af
Outflow=0.26 cfs 0.078 af

Pond 317: DMH-41 Peak Elev=61.87' Inflow=0.42 cfs 0.121 af
Outflow=0.42 cfs 0.121 af

Pond 318: DMH-43 Peak Elev=60.37' Inflow=0.57 cfs 0.173 af
24.00" Round Culvert n=0.012 L=39.0' S=0.0051 '/' Outflow=0.57 cfs 0.173 af

Pond 321: Bypass (DMH-49) Peak Elev=65.74' Inflow=1.31 cfs 0.099 af
Primary=1.31 cfs 0.099 af Secondary=0.00 cfs 0.000 af Outflow=1.31 cfs 0.099 af

Pond 322: USF-E (740s) Peak Elev=64.37' Storage=946 cf Inflow=1.31 cfs 0.099 af
Outflow=0.29 cfs 0.099 af

Pond 323: DMH-44 Peak Elev=60.19' Inflow=0.87 cfs 0.271 af
24.00" Round Culvert n=0.012 L=83.7' S=0.0050 '/' Outflow=0.87 cfs 0.271 af

Pond 324: DMH-51 Peak Elev=59.21' Inflow=0.87 cfs 0.271 af
Outflow=0.87 cfs 0.271 af

Pond 325: DMH-53 Peak Elev=55.93' Inflow=0.87 cfs 0.271 af
30.00" Round Culvert n=0.012 L=60.9' S=0.0586 '/' Outflow=0.87 cfs 0.271 af

Pond 327: Infiltration Pond E Peak Elev=52.00' Storage=26 cf Inflow=1.42 cfs 0.359 af
Discarded=1.42 cfs 0.359 af Primary=0.00 cfs 0.000 af Outflow=1.42 cfs 0.359 af

Stage-Area-Storage for Pond 304: FocalPoint-B

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
59.75	**220**	0
59.80	220	2
59.85	220	4
59.90	220	7
59.95	220	9
60.00	220	11
60.05	220	13
60.10	220	15
60.15	220	18
60.20	220	20
60.25	220	22
60.30	220	24
60.35	220	26
60.40	220	29
60.45	220	31
60.50	220	33
60.55	220	35
60.60	220	37
60.65	220	40
60.70	220	42
60.75	220	44
60.80	220	46
60.85	220	48
60.90	220	51
60.95	220	53
61.00	220	55
61.05	220	57
61.10	220	59
61.15	220	62
61.20	220	64
61.25	220	66
61.30	220	68
61.35	220	70
61.40	220	73
61.45	220	75
61.50	220	77
61.55	220	79
61.60	220	81
61.65	220	84
61.70	220	86
61.75	220	88
61.80	220	90
61.85	220	92
61.90	220	95
61.95	220	97
62.00	220	99
62.05	220	111
62.10	220	124
62.15	220	137
62.20	220	151
62.25	220	165
62.30	220	180
62.35	220	196
62.40	220	212
62.45	220	229
62.50	220	246
62.55	220	264
62.60	220	283
62.65	220	302
62.70	220	322
62.75	220	343
62.80	220	364
62.85	220	386
62.90	220	409
62.95	220	432
63.00	220	**456**

Stage-Area-Storage for Pond 307: USF A (740s)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
67.00	**804**	0
67.05	804	13
67.10	804	27
67.15	804	40
67.20	804	53
67.25	804	66
67.30	804	80
67.35	804	93
67.40	804	106
67.45	804	119
67.50	804	133
67.55	804	146
67.60	804	159
67.65	804	172
67.70	804	186
67.75	804	199
67.80	804	212
67.85	804	226
67.90	804	239
67.95	804	252
68.00	804	265
68.05	804	279
68.10	804	292
68.15	804	305
68.20	804	318
68.25	804	332
68.30	804	345
68.35	804	358
68.40	804	371
68.45	804	385
68.50	804	398
68.55	804	411
68.60	804	425
68.65	804	438
68.70	804	451
68.75	804	464
68.80	804	478
68.85	804	491
68.90	804	504
68.95	804	517
69.00	804	531
69.05	804	562
69.10	804	593
69.15	804	624
69.20	804	654
69.25	804	685
69.30	804	716
69.35	804	746
69.40	804	777
69.45	804	807
69.50	804	837
69.55	804	867
69.60	804	897
69.65	804	927
69.70	804	956
69.75	804	985
69.80	804	1,015
69.85	804	1,044
69.90	804	1,072
69.95	804	1,101
70.00	804	1,130
70.05	804	1,158
70.10	804	1,186
70.15	804	1,214
70.20	804	1,241
70.25	804	1,268
70.30	804	1,295
70.35	804	1,322
70.40	804	1,349
70.45	804	1,375
70.50	804	1,401
70.55	804	1,426
70.60	804	1,452
70.65	804	1,476
70.70	804	1,501
70.75	804	1,525
70.80	804	1,548
70.85	804	1,572
70.90	804	1,594
70.95	804	1,617
71.00	804	1,638
71.05	804	1,659
71.10	804	1,680
71.15	804	1,699
71.20	804	1,718
71.25	804	1,736
71.30	804	1,752
71.35	804	1,767
71.40	804	1,782
71.45	804	1,796
71.50	804	1,809
71.55	804	1,823
71.60	804	1,836
71.65	804	1,849
71.70	804	1,863
71.75	804	1,876
71.80	804	1,889
71.85	804	1,902
71.90	804	1,916
71.95	804	1,929
72.00	804	**1,942**

Stage-Area-Storage for Pond 311: USF C (740s)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
64.00	**842**	0
64.05	842	14
64.10	842	28
64.15	842	42
64.20	842	56
64.25	842	69
64.30	842	83
64.35	842	97
64.40	842	111
64.45	842	125
64.50	842	139
64.55	842	153
64.60	842	167
64.65	842	181
64.70	842	195
64.75	842	208
64.80	842	222
64.85	842	236
64.90	842	250
64.95	842	264
65.00	842	278
65.05	842	292
65.10	842	306
65.15	842	320
65.20	842	333
65.25	842	347
65.30	842	361
65.35	842	375
65.40	842	389
65.45	842	403
65.50	842	417
65.55	842	434
65.60	842	450
65.65	842	467
65.70	842	484
65.75	842	501
65.80	842	518
65.85	842	535
65.90	842	552
65.95	842	568
66.00	842	585
66.05	842	619
66.10	842	652
66.15	842	686
66.20	842	719
66.25	842	752
66.30	842	785
66.35	842	819
66.40	842	851
66.45	842	884
66.50	842	917
66.55	842	950
66.60	842	982
66.65	842	1,014
66.70	842	1,046
66.75	842	1,078
66.80	842	1,110
66.85	842	1,142
66.90	842	1,173
66.95	842	1,205
67.00	842	1,236
67.05	842	1,267
67.10	842	1,297
67.15	842	1,328
67.20	842	1,358
67.25	842	1,388
67.30	842	1,418
67.35	842	1,447
67.40	842	1,477
67.45	842	1,506
67.50	842	1,534
67.55	842	1,563
67.60	842	1,591
67.65	842	1,619
67.70	842	1,646
67.75	842	1,673
67.80	842	1,699
67.85	842	1,726
67.90	842	1,751
67.95	842	1,777
68.00	842	1,801
68.05	842	1,826
68.10	842	1,849
68.15	842	1,872
68.20	842	1,894
68.25	842	1,915
68.30	842	1,934
68.35	842	1,953
68.40	842	1,971
68.45	842	1,989
68.50	842	2,006
68.55	842	2,023
68.60	842	2,040
68.65	842	2,056
68.70	842	2,073
68.75	842	2,090
68.80	842	2,107
68.85	842	2,124
68.90	842	2,141
68.95	842	2,158
69.00	842	**2,174**

Stage-Area-Storage for Pond 316: USF-D (740s)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
62.50	**1,350**	0
62.55	1,350	22
62.60	1,350	45
62.65	1,350	67
62.70	1,350	89
62.75	1,350	111
62.80	1,350	134
62.85	1,350	156
62.90	1,350	178
62.95	1,350	200
63.00	1,350	223
63.05	1,350	245
63.10	1,350	267
63.15	1,350	290
63.20	1,350	312
63.25	1,350	334
63.30	1,350	356
63.35	1,350	379
63.40	1,350	401
63.45	1,350	423
63.50	1,350	446
63.55	1,350	468
63.60	1,350	490
63.65	1,350	512
63.70	1,350	535
63.75	1,350	557
63.80	1,350	579
63.85	1,350	601
63.90	1,350	624
63.95	1,350	646
64.00	1,350	668
64.05	1,350	691
64.10	1,350	713
64.15	1,350	735
64.20	1,350	757
64.25	1,350	780
64.30	1,350	802
64.35	1,350	824
64.40	1,350	846
64.45	1,350	869
64.50	1,350	891
64.55	1,350	944
64.60	1,350	998
64.65	1,350	1,051
64.70	1,350	1,104
64.75	1,350	1,157
64.80	1,350	1,209
64.85	1,350	1,262
64.90	1,350	1,314
64.95	1,350	1,366
65.00	1,350	1,418
65.05	1,350	1,469
65.10	1,350	1,521
65.15	1,350	1,572
65.20	1,350	1,622
65.25	1,350	1,673
65.30	1,350	1,723
65.35	1,350	1,773
65.40	1,350	1,822
65.45	1,350	1,871
65.50	1,350	1,920
65.55	1,350	1,969
65.60	1,350	2,017
65.65	1,350	2,064
65.70	1,350	2,112
65.75	1,350	2,158
65.80	1,350	2,205
65.85	1,350	2,251
65.90	1,350	2,296
65.95	1,350	2,341
66.00	1,350	2,385
66.05	1,350	2,429
66.10	1,350	2,472
66.15	1,350	2,515
66.20	1,350	2,557
66.25	1,350	2,598
66.30	1,350	2,638
66.35	1,350	2,678
66.40	1,350	2,717
66.45	1,350	2,755
66.50	1,350	2,792
66.55	1,350	2,828
66.60	1,350	2,863
66.65	1,350	2,896
66.70	1,350	2,928
66.75	1,350	2,957
66.80	1,350	2,985
66.85	1,350	3,011
66.90	1,350	3,035
66.95	1,350	3,059
67.00	1,350	3,082
67.05	1,350	3,104
67.10	1,350	3,126
67.15	1,350	3,149
67.20	1,350	3,171
67.25	1,350	3,193
67.30	1,350	3,215
67.35	1,350	3,238
67.40	1,350	3,260
67.45	1,350	3,282
67.50	1,350	**3,305**

Stage-Area-Storage for Pond 322: USF-E (740s)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
62.50	**1,530**	0
62.55	1,530	25
62.60	1,530	50
62.65	1,530	76
62.70	1,530	101
62.75	1,530	126
62.80	1,530	151
62.85	1,530	177
62.90	1,530	202
62.95	1,530	227
63.00	1,530	252
63.05	1,530	278
63.10	1,530	303
63.15	1,530	328
63.20	1,530	353
63.25	1,530	379
63.30	1,530	404
63.35	1,530	429
63.40	1,530	454
63.45	1,530	480
63.50	1,530	505
63.55	1,530	530
63.60	1,530	555
63.65	1,530	581
63.70	1,530	606
63.75	1,530	631
63.80	1,530	656
63.85	1,530	682
63.90	1,530	707
63.95	1,530	732
64.00	1,530	757
64.05	1,530	783
64.10	1,530	808
64.15	1,530	833
64.20	1,530	858
64.25	1,530	884
64.30	1,530	909
64.35	1,530	934
64.40	1,530	959
64.45	1,530	984
64.50	1,530	1,010
64.55	1,530	1,070
64.60	1,530	1,131
64.65	1,530	1,192
64.70	1,530	1,252
64.75	1,530	1,312
64.80	1,530	1,372
64.85	1,530	1,432
64.90	1,530	1,491
64.95	1,530	1,551
65.00	1,530	1,610
65.05	1,530	1,668
65.10	1,530	1,727
65.15	1,530	1,785
65.20	1,530	1,843
65.25	1,530	1,900
65.30	1,530	1,957
65.35	1,530	2,014
65.40	1,530	2,070
65.45	1,530	2,126
65.50	1,530	2,182
65.55	1,530	2,237
65.60	1,530	2,292
65.65	1,530	2,346
65.70	1,530	2,400
65.75	1,530	2,453
65.80	1,530	2,506
65.85	1,530	2,558
65.90	1,530	2,609
65.95	1,530	2,661
66.00	1,530	2,711
66.05	1,530	2,761
66.10	1,530	2,810
66.15	1,530	2,859
66.20	1,530	2,906
66.25	1,530	2,953
66.30	1,530	2,999
66.35	1,530	3,044
66.40	1,530	3,088
66.45	1,530	3,131
66.50	1,530	3,173
66.55	1,530	3,214
66.60	1,530	3,254
66.65	1,530	3,292
66.70	1,530	3,328
66.75	1,530	3,362
66.80	1,530	3,393
66.85	1,530	3,422
66.90	1,530	3,450
66.95	1,530	3,477
67.00	1,530	3,503
67.05	1,530	3,528
67.10	1,530	3,553
67.15	1,530	3,579
67.20	1,530	3,604
67.25	1,530	3,629
67.30	1,530	3,654
67.35	1,530	3,679
67.40	1,530	3,705
67.45	1,530	3,730
67.50	1,530	**3,755**

A3.2.1 FocalPoint RIDEM Certification

Rhode Island Department of Environmental Management

Office of Water Resources – Stormwater Technology Review Committee
235 Promenade St. Providence, RI 02908 Ph: 401-222-4700

Alternative Stormwater Technology Program

Vendor Information:
Convergent Water Technologies
13810 Hollister Road
Houston, TX 77086

Contact:
W. Scott Gorneau, P.E.
Vice President
Email: sgorneau@convergentwater.com
Web: www.convergentwater.com
Phone: 207-885-6174

Technology Name:
FocalPoint High Performance Modular Biofiltration System (HPMBS)

Approval Type:
WQBMP, Retrofits, Pre-Treatment

Certification Dates:
Issued: October 4, 2021
Expires: October 4, 2026

CERTIFICATION:

The Rhode Island Stormwater Technology Review Committee which consists of members from the Department of Environmental Management (DEM), Department of Transportation (DOT) and the Coastal Resources Management Council (CRMC) have reviewed the **FocalPoint** High Performance Modular Biofiltration System (HPMBS) application for Technology Approval and accepted use for Stormwater Treatment in the State of Rhode Island.

In accordance with Stormwater Rule 250-RICR-150-10-8.9B, **Convergent Water Technologies** has petitioned the permitting agencies to add the **FocalPoint** HPMBS to the list of acceptable structural stormwater controls described in Sections 8.19 through 8.25 of Stormwater Rule 250-RICR-150-10. They have submitted monitoring results and supporting information developed in accordance with the provisions of the Technology Assessment Protocol for Innovate and Emerging Technologies as described in Stormwater Rule 250-RICR-150-10 Sections 8.39 and 8.40.

The **FocalPoint** HPMBS is granted reciprocity in Rhode Island as a proprietary stormwater treatment technology, given that it has been certified by other State agencies which are members of the Technology Acceptance Reciprocity Partnership. The device was certified by the Maryland Department of Environment as a micro-bioretention practice in September of 2018. The Pennsylvania Department of Environmental Protection has also certified the device as a constructed filter approved for stand-alone treatment on new construction projects. Additionally, the Virginia Department of Environmental Quality certified the **FocalPoint** as a manufactured treatment device (MTD) in June 2016. These approvals/certifications issued by TARP member States were granted as a result of the multiple field studies of the **FocalPoint** which were conducted in accordance with the protocol specified by the Washington Department of Ecology's Technology Assessment Protocol – Ecology (TAPE). The first TAPE field study was conducted by Civil and Environmental Consultants, Inc. at a parking lot on Campbell Run Road in Pittsburgh, Pennsylvania during the period of July 2015 to May 2016. Another TAPE field study was conducted by the NAVFAC Engineering and Expeditionary Warfare Center at the Navy Fleet Readiness Center Metal Finishing Complex located on Naval Base Point Loma in San Diego, California during the period of February 2018 to May 2019. A third field study was also conducted in accordance with the North Carolina Department of Environmental Quality and University Field Monitoring Protocols to determine total suspended solids (TSS) and pathogen removal. This study was conducted by North Carolina State University's Department of Biological and Agricultural Engineering on a roadside swale South of US Route 17 in Brunswick County, North Carolina during the period of February 2014 to February 2015.

The **FocalPoint** HPMBS is a structural stormwater treatment system developed by **Convergent Water Technologies**. The system utilizes regionally acceptable vegetation housed in an open-bed style without the use of

a pre-cast concrete container. The system contains energy dissipator stones at the inlet, a mulch layer to capture debris, a layer of engineered soil media, an overflow/bypass outlet, and a modular underdrain system.

This device varies from the design guidance for filtering systems described in Stormwater Rule 250-RICR-150-10-8.23 because of the device's atypically high flow-rate engineered soil media in lieu of traditional filter low flow medias such as: ASTM C33 concrete sand, USDA loamy sand or USDA sandy loam. Additionally, the device in and of itself does not meet minimum requirements for filter bed area or minimum temporary water quality storage. However, the increased infiltration rate compensates for the device's smaller filter bed area and temporary storage. The manufacturer has demonstrated through the provided field studies that the device provides the minimum water quality pollutant removal rates specified in Stormwater Rule 250-RICR-150-10-8.9B. It is approved in Rhode Island for the following pollutant removals when designed with a maximum infiltration rate of 100 inches per hour: **85%** removal of total suspended solids (TSS), **60%** removal of pathogens, **30%** removal of total phosphorus (TP) for discharges to freshwaters, and **30%** removal of total nitrogen (TN) for discharges to tidal waters. This device may be used as an approved water quality BMP provided that the design, installation, and maintenance are conducted in accordance with the following terms and conditions:

I. GENERAL CERTIFICATION REQUIREMENTS

1. The system must be designed and installed to adhere to the manufacturer's specifications titled "SPECIFICATION: HIGH PERFORMANCE MODULAR BIOFILTRATION SYSTEM (HPMBS) Material, Performance and Installation Specification". https://acfenvironmental.com/wp-content/uploads/2015/09/S.1FocalPoint_Specification.pdf

2. The system must be designed to incorporate a PRETX, Rain Guardian or water quality manhole upstream of the filter bed so as to provide a sump to capture and store sediment.
    a. The maximum drainage area that can be directed to each PRETX unit is 1 acre.
    b. The maximum drainage area that can be directed to each upstream water quality manhole is 0.5 acres.
    c. The maximum drainage area that can be directed to each Rain Guardian unit is 0.25 acres.

3. The system must utilize a minimum 3 inch layer of hardwood mulch, a minimum 18 inch layer of the engineered soil media as defined by the device's specification.

4. Systems designed with a modular underdrain must utilize a minimum 6 inch layer of washed 3/8" bridging stone and a high-tenacity monofilament polypropylene yarn, open mesh, woven geotextile to separate the soil media and the underdrain.

5. The system must utilize a plant or plants listed in *Table 2: Approved List of Plants for FocalPoint Systems in Rhode Island***.**

6. The **FocalPoint** HPMBS is **certified as a pretreatment device** in accordance with Stormwater Rule 250-RICR-150-10-8.31, provided the device treats the first inch of runoff from the capture area, unless waived by the state permitting agency.

7. The vendor must provide applicants with a signed letter which verifies that the design for each proprietary device meets the requirements set forth in this certification letter and the device's specification. The applicant must include this verification letter as part of their application.

8. A representative from the vendor must be on site during the installation of systems to ensure that the system is installed in accordance with the manufacturer's specifications and the approved design.

9. The **FocalPoint** HPMBS is **certified as a retrofit device** in accordance with Stormwater Rule 250-RICR-150-10-8.6A. Retrofits are allowed flexibility with regards to the eleven minimum standards described in Sections 8.6 through 8.17 of Stormwater Rule 250-RICR-150-10, but in general they are considered effective if they capture at least 50% of the catchment and meet the target water quality treatment of at least the first 0.5 inches of the water quality volume.

10. This device is **certified as a Water Quality BMP** in accordance with pollutant removal requirements specified in Stormwater Rule 250-RICR-150-10-8.9B, provided that:

    a. The unit is sized to treat the water quality volume and the water quality flow. The filter bed area must be sized to be at least 0.44% of the impervious area that drains into it (this equates to approximately 192 square feet of filter bed area per acre of impervious cover). Pre-detention practices may be utilized as long as the first inch of runoff is treated. Should the permitting agency waive or relieve the applicant from treatment of the full water quality volume (i.e., retrofits or redevelopments), the applicant is granted relief and may design the system to treat a smaller volume, as required by the permitting agency.

    b. This product meets recharge volume requirements, as specified in Stormwater Rule 250-RICR-150-10-8.8, only if designed with a modular underdrain that meets all requirements of a water quality stormwater infiltration practice (excluding standard storage sizing requirements), as specified in Stormwater Rule 250-RICR-150-10-8.21. However, use of **FocalPoint** HPMBS products not designed to infiltrate into in-situ soils are not prohibited so long as the applicant can demonstrate to the permitting agency that the required recharge is met within the sub-watershed, unless waived by the state permitting agency on a case-by-case basis (i.e., LUHHPLs, retrofits or redevelopments).

II. **MAINTENANCE REQUIREMENTS**

1. The device must be maintained in accordance with the manufacturer's specifications provided in the **FocalPoint** HPMBS Operation & Maintenance Manual, which can be found on the manufacturer's website. https://convergewater.wpengine.com/wp-content/uploads/2021/06/focalpoint-operations-maintenance-guide.pdf

2. The entire device (mulch, soil media, underdrain, etc.) must be maintained in accordance with the requirements for filtering system water quality BMPs, as stated in Stormwater Rule 250-RICR-150-10-8.23-F.3 which requires that the entire device must be inspected on at least an annual basis and after storms equal to or greater than the 1-year Type-III 24-hour design storm.

3. The device must be maintained in accordance with Stormwater Rule 250-RICR-150-10-8.23-F.1b which requires that "silt/sediment shall be removed from the filter bed when the accumulation exceeds one inch. When the filtering capacity of the device diminishes substantially (water ponds on the surface of the filter bed for more than 48 hours), the top few inches of discolored material shall be removed and shall be replaced with fresh material" (where "fresh material" means the engineered soil media described in the manufacturer's specification). If it is determined that replacing the top few inches of discolored material (or other restoration methods) does not restore the device's filtering capacity (water is still ponding on the filter bed for more than 48 hours), then the entirety of the device's filtering media must be replaced with fresh material.

4. The device's sump (i.e., PRETX, Rain Guardian, or upstream manhole) must be maintained in accordance with the requirements for proprietary pre-treatment devices, as stated in Stormwater Rule 250-RICR-150-10-8.31-C, which requires the sump to be inspected a minimum of 2 times per year. Additionally, the sump must be cleaned out when 50% or more of the pollutant storage capacity is filled or displaced.

5. All material removed from the unit must be properly disposed of and is the responsibility of the owner.

6. The applicant must provide evidence of a maintenance contract which extends for a minimum of two years. The contracted maintenance provider must receive training by **Convergent Water Technologies** on how to properly maintain **FocalPoint** HPMBS devices. This requirement excludes maintenance providers recognized by the RIDEM to be qualified in the maintenance of **FocalPoint** HPMBS devices.

7. The applicant must include a copy of the **FocalPoint** HPMBS Operation & Maintenance Manual in their project specific long term operation and maintenance plan.

III.**REPORTING REQUIREMENTS**

1. Upon request from the owner of any **FocalPoint** HPMBS system installed in the State of Rhode Island, the vendor shall provide the owner with a recommended maintenance schedule after the first year of operation. If a recommended maintenance schedule is requested by the owner after the first year of the device's operation, then the owner is responsible for notifying the vendor of any additional pollutant loads on sites where contributing drainage areas may be subject to further development (i.e., strip malls).

2. The Vendor shall provide a listing to the RIDEM Office of Water Resources of all systems installed within the State of Rhode Island on an annual basis. This list shall also include the name of the Vendor representative who was on-site to verify proper installation of each system.

3. The Vendor shall provide an annual listing to the RIDEM Office of Water Resources of all Rhode Island maintenance providers that they trained in **FocalPoint** HPMBS maintenance.

4. The Vendor shall immediately notify the RIDEM Office of Water Resources if and when any changes are made to the model name or number of any **FocalPoint** HPMBS device applicable to this certification.

5. The Vendor shall immediately notify the RIDEM Office of Water Resources if and when any revisions are made to the design, installation or operation and maintenance manuals for all models applicable to this certification.

6. The Vendor shall notify the RIDEM within at least thirty (30) days following any proposed transfer of ownership of the Component technology. Notification shall include the name and address of the new owner and a written agreement between the existing and new owner specifying a date for transfer of ownership, responsibility, and liability for the Component. All provisions of this Certification shall be applicable to any new owners.

IV. **RIGHTS OF THE RIDEM AND CRMC**

1. The RIDEM may suspend, modify or revoke this approval for cause, including but not limited to non-compliance with any of the conditions or provisions of this approval, mis-representation or failure to fully disclose all relevant data, or receipt of new information indicating that the use of the **FocalPoint** HPMBS system is contrary to the public interest, public health or the environment.

2. This approval does not represent an endorsement of the **FocalPoint** HPMBS system by the RIDEM, RIDOT or CRMC. This letter of approval may be reproduced only in its entirety.

3. The **FocalPoint** HPMBS Bioretention System Standard Specification and **FocalPoint** HPMBS operation and maintenance manual referenced herein are approved upon the date of approval of this Certification.

4. The RIDEM reserves the right to suspend or revoke this Certification if updated design, installation, and O&M manuals are not provided to the RIDEM within thirty (30) days of RIDEM request or one hundred and eighty (180) days prior to the expiration date of this Certification. All revisions must be reviewed and approved by the RIDEM prior to re-certification.

Eric A. Beck, P.E. Date
Administrator of Groundwater and Wetlands Protection
RIDEM – Office of Water Resources

ATTACHMENTS:

Table 2: Approved List of Plants for FocalPoint Systems in Rhode Island

Common Name/Species	*Spacing*	*Exposure*	*Comments*
American Beach Grass/ Ammophila breviligulata	*24" on center*	*Full and high high temperatures*	*Tolerates wet to well-drained soil; flowers appear to float; high wildlife value.*
Switchgrass/Pancium virgatum	*24" on center*	*Full sun, high temperatures*	*Tolerates wet to well-drained soil; flowers appear to float; high wildlife value.*
Day Lily/ Hemerocallis	*24" on center*	*Full sun, tolerate shade*	*Yellow, Red and Pink colors available. Many red and purple varieties benefit from partial shade in the hottest part of the day since dark colors absorb heat and do not withstand the sun as well as lighter colors.*
Black Eyed Susan/Rudbeckia hirta	*24" on center*	*Full sun, tolerate shade*	*Widely cultivated in parks and gardens, for summer bedding schemes, borders, containers, wildflower gardens, prairie-style plantings and cut flowers.*
Cone Flower/Echinacea	*24" on center*	*Full sun, tolerate shade*	*Herbaceous flowering plant in the daisy family. Grows in moist to dry prairies and open wooded areas.*

A3.4.2 Drainage Network Hydraulic Calculations

DiPrete Engineering
Engineers • Planners • Surveyors

Project Name: Trolley Barn Plaza
Project Number: 2928-001

10-Year Storm
Date: 3/29/2022

Structure	Area	Inlet Time	Intensity	Runoff C	Q=Cia	Q Carry over	Q Captured	Q Bypassed	Bypass Structure	Inlet Type	Curb Opening	Curb Opening	Grate Length	Grate Width	Depth	Spread
	(sf)	(min)	(in/hr)	(C)	(cfs)	(cfs)	(cfs)	(cfs)			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
26	3,404	6	6.94	0.81	0.44	0	0.35	0.09	---	Grate inlet	---	---	2	2	0.098	4.913
24	5,551	6	6.938	0.69	0.62	0	0.46	0.16	---	Grate inlet	---	---	2	2	0.111	5.558
27	2,635	6	6.938	0.85	0.36	0	0.30	0.06	---	Grate inlet	---	---	2	2	0.091	4.544
28	5,801	6	6.938	0.85	0.79	0	0.56	0.24	---	Grate inlet	---	---	2	2	0.122	6.109
46	8,704	6	6.938	0.77	1.08	0	1.08	0.00	---	Grate inlet	---	---	2	2	0.173	8.646
45	4,371	6	6.938	0.71	0.50	0	0.50	0.00	---	Grate inlet	---	---	2	2	0.112	5.577
34	27,610	6	6.938	0.89	3.95	0	1.79	2.15	---	Grate inlet	---	---	2	2	0.223	11.158
14	16,336	6	6.938	0.68	1.78	0	1.78	0.00	---	Grate inlet	---	---	2	2	0.234	11.708
15	2,190	6	6.938	0.64	0.23	0	0.23	0.00	---	Grate inlet	---	---	2	2	0.074	3.694
16	5,809	6	6.938	0.62	0.58	0	0.58	0.00	---	Grate inlet	---	---	2	2	0.121	6.054
17	8,119	6	6.938	0.88	1.15	0	1.15	0.00	---	Grate inlet	---	---	2	2	0.18	8.979
19	4,425	6	6.938	0.81	0.58	0	0.58	0.00	---	Grate inlet	---	---	2	2	0.121	6.038
48	30,066	6	6.938	0.9	4.35	0	4.35	0.00	---	Grate inlet	---	---	2	2	0.408	20.386
35	12,488	6	6.938	0.9	1.81	0	1.03	0.78	---	Grate inlet	---	---	2	2	0.166	8.321
37	6,212	6	6.938	0.82	0.82	0	0.57	0.25	---	Grate inlet	---	---	2	2	0.124	6.185
25	12,871	6	6.938	0.7	1.45	0	0.88	0.57	---	Grate inlet	---	---	2	2	0.153	7.659
47	14,305	6	6.938	0.81	1.86	0	1.86	0.00	---	Grate inlet	---	---	2	2	0.24	12.014

DiPrete Engineering
Engineers • Planners • Surveyors

Project Name: Trolley Barn Plaza
Project Number: 2928-001

25-Year Storm
Date: 3/29/2022

Pipe Analysis

Pipe ID	Pipe Length	Pipe Size	Pipe Slope	Flow Rate	Capacity Full	Velocity	Invert Down	Invert Up
	(ft)	(in)	(%)	(cfs)	(cfs)	(ft/s)	(Ft)	(ft)
53-54	60.94	30	5.87%	24.0	107.78	17.7	52.00	55.57
52-53	24.11	30	3.00%	24.0	77.04	13.9	55.57	56.30
51-52	85.29	30	3.00%	24.2	77.04	13.9	56.30	58.85
44-51	83.75	24	0.50%	15.9	17.35	6.3	59.35	59.77
43-44	39.02	24	0.50%	16.0	17.35	6.3	59.77	59.97
42-43	273.08	24	0.50%	11.7	17.35	5.9	59.97	61.33
41-42	27.22	24	1.00%	11.7	24.53	7.7	61.33	61.60
33-40	108.09	18	1.00%	4.3	11.39	6.0	62.13	63.21
32-33	74.69	15	1.00%	4.3	7.01	6.0	65.61	66.36
30-32	9.88	15	1.00%	4.3	7.01	6.0	66.36	66.46
29-30	12.77	15	1.00%	4.3	7.01	6.0	66.46	66.59
25-29	50.22	15	0.50%	2.5	4.95	4.0	67.70	67.95
24-25	74.15	12	0.50%	0.8	2.73	3.0	68.20	68.57
28-29	84.04	15	1.00%	1.9	7.01	4.9	66.59	67.43
27-28	56.72	15	1.00%	0.4	7.01	3.2	67.43	67.99
26-28	71.94	12	0.50%	0.5	2.73	2.7	67.68	68.04
46-48	13.33	24	1.00%	7.9	24.53	7.0	64.62	64.75
38-39	10.46	24	0.50%	7.9	17.35	5.4	65.05	65.10
37-38	37.28	24	0.50%	8.0	17.35	5.4	65.10	65.29
36-37	35.73	24	0.50%	7.0	17.35	5.2	65.29	65.47
35-36	24.00	15	0.50%	2.2	4.95	3.9	66.29	66.41
34-36	24.00	24	0.56%	4.8	18.40	4.9	65.47	65.60
23-43	106.23	15	0.50%	5.0	4.95	4.6	60.93	61.46
21-23	63.61	15	0.50%	5.1	4.95	4.6	65.81	66.13
20-21	10.40	15	1.00%	5.1	7.01	6.2	69.21	69.32
15-20	66.90	15	0.50%	2.4	4.95	4.0	69.66	69.99
14-15	127.29	15	0.50%	2.2	4.95	3.9	69.99	70.63
19-20	39.08	12	0.78%	2.7	3.42	4.8	69.57	69.87
18-19	29.55	12	1.00%	2.1	3.86	5.0	69.87	70.17
17-18	62.53	12	1.00%	2.1	3.86	5.0	70.17	70.79
16-17	71.48	12	1.00%	0.7	3.86	3.7	70.79	71.51
49-51	18.26	18	1.00%	8.9	11.39	7.1	64.54	64.72
48-49	11.77	18	1.00%	8.9	11.39	7.1	64.72	64.84
47-48	181.90	18	0.50%	4.1	8.05	4.6	64.84	65.75
46-47	113.03	15	0.50%	1.9	4.95	3.8	66.00	66.57
45-46	31.64	12	0.50%	0.6	2.73	2.8	66.82	66.97

DiPrete Engineering
Engineers • Planners • Surveyors

Project Name: Trolley Barn Plaza
Project Number: 2928-001

100-Year Storm
Date: 3/29/2022

Pipe Analysis

Pipe ID	Pipe Length	Pipe Size	Pipe Slope	Flow Rate	Capacity Full	Velocity	Invert Down	Invert Up
	(ft)	(in)	(%)	(cfs)	(cfs)	(ft/s)	(Ft)	(ft)
53-54	60.94	30	5.87%	31.0	107.78	19.0	52.00	55.57
52-53	24.11	30	3.00%	31.1	77.04	14.8	55.57	56.30
51-52	85.29	30	3.00%	31.2	77.04	14.9	56.30	58.85
44-51	83.75	24	0.50%	20.6	17.35	6.6	59.35	59.77
43-44	39.02	24	0.50%	20.7	17.35	6.6	59.77	59.97
42-43	273.08	24	0.50%	15.1	17.35	6.2	59.97	61.33
41-42	27.22	24	1.00%	15.1	24.53	8.2	61.33	61.60
33-40	108.09	18	1.00%	5.5	11.39	6.4	62.13	63.21
32-33	74.69	15	1.00%	5.5	7.01	6.3	65.61	66.36
30-32	9.88	15	1.00%	5.5	7.01	6.3	66.36	66.46
29-30	12.77	15	1.00%	5.6	7.01	6.3	66.46	66.59
25-29	50.22	15	0.50%	3.2	4.95	4.3	67.70	67.95
24-25	74.15	12	0.50%	1.0	2.73	3.2	68.20	68.57
28-29	84.04	15	1.00%	2.5	7.01	5.2	66.59	67.43
27-28	56.72	15	1.00%	0.6	7.01	3.4	67.43	67.99
26-28	71.94	12	0.50%	0.7	2.73	2.9	67.68	68.04
46-48	13.33	24	1.00%	10.1	24.53	7.4	64.62	64.75
38-39	10.46	24	0.50%	10.2	17.35	5.7	65.05	65.10
37-38	37.28	24	0.50%	10.2	17.35	5.7	65.10	65.29
36-37	35.73	24	0.50%	9.0	17.35	5.6	65.29	65.47
35-36	24.00	15	0.50%	2.8	4.95	4.2	66.29	66.41
34-36	24.00	24	0.56%	6.2	18.40	5.3	65.47	65.60
23-43	106.23	15	0.50%	6.5	4.95	5.3	60.93	61.46
21-23	63.61	15	0.50%	6.5	4.95	5.3	65.81	66.13
20-21	10.40	15	1.00%	6.5	7.01	6.5	69.21	69.32
15-20	66.90	15	0.50%	3.1	4.95	4.3	69.66	69.99
14-15	127.29	15	0.50%	2.8	4.95	4.2	69.99	70.63
19-20	39.08	12	0.78%	3.5	3.42	4.9	69.57	69.87
18-19	29.55	12	1.00%	2.6	3.86	5.3	69.87	70.17
17-18	62.53	12	1.00%	2.7	3.86	5.3	70.17	70.79
16-17	71.48	12	1.00%	0.9	3.86	4.0	70.79	71.51
49-51	18.26	18	1.00%	11.5	11.39	7.3	64.54	64.72
48-49	11.77	18	1.00%	11.5	11.39	7.3	64.72	64.84
47-48	181.90	18	0.50%	5.2	8.05	4.8	64.84	65.75
46-47	113.03	15	0.50%	2.5	4.95	4.0	66.00	66.57
45-46	31.64	12	0.50%	0.8	2.73	3.0	66.82	66.97

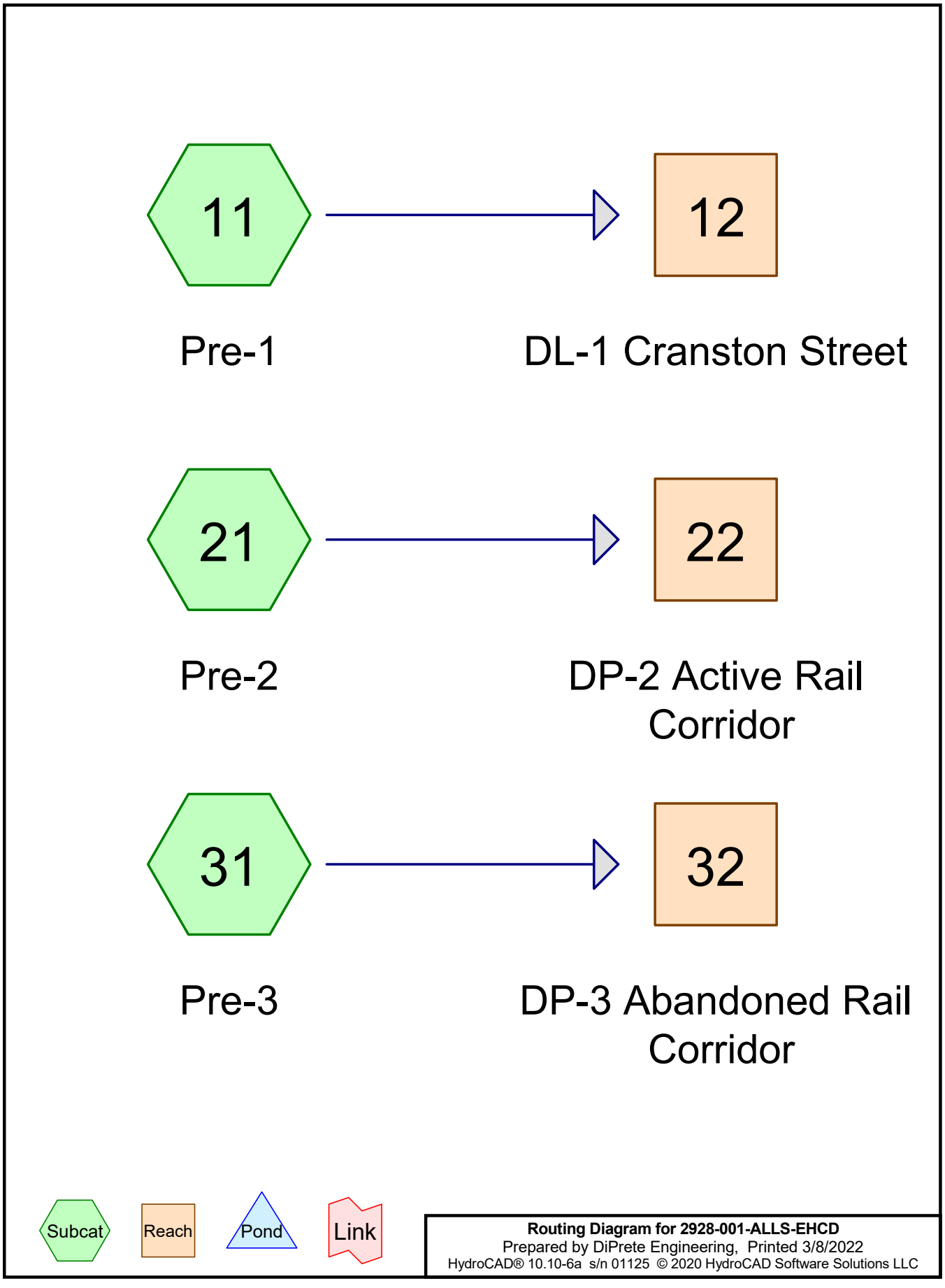
DiPrete Engineering
Engineers • Planners • Surveyors

Project Name: Trolley Barn Plaza — 100-Year Storm
Project Number: 2928-001 — Date: 3/29/2022

HGL at Structure

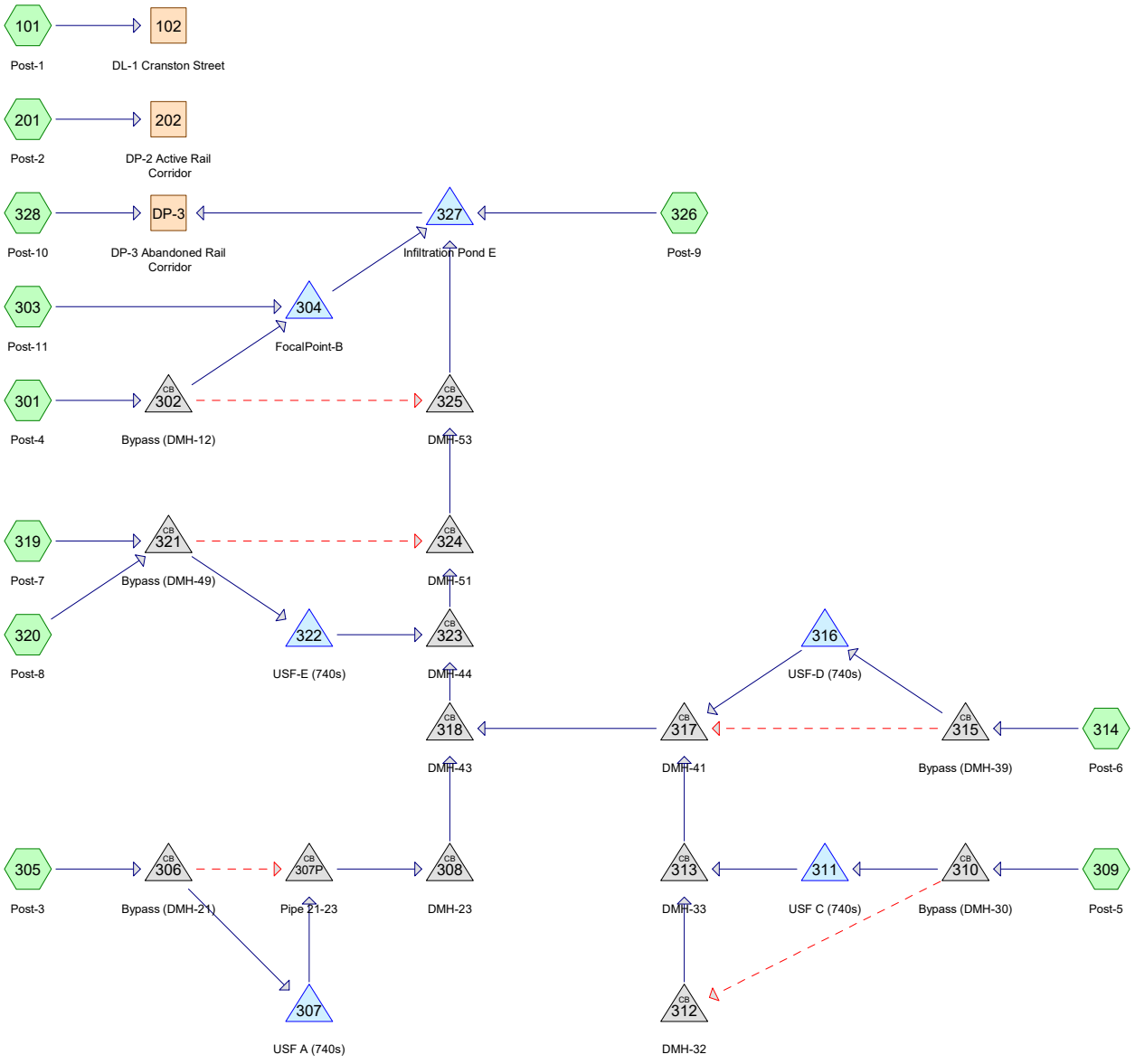
Structure	Rim Elevation (ft)	HGL Elevation (ft)	Rim-HGL (ft)
54	54.92	0.00	N/A
53	69.04	56.49	12.55
52	71.73	61.83	9.91
51	71.00	62.81	8.20
44	71.20	63.77	7.43
43	70.79	64.48	6.31
42 (5' DIA)	71.40	66.46	4.95
41 (5' DIA)	71.50	66.97	4.54
33	71.96	67.70	4.26
32	72.47	68.19	4.29
30	72.32	68.64	3.68
29	72.13	68.91	3.22
25	71.63	69.54	2.09
24	71.79	69.75	2.05
28	71.46	69.57	1.90
27	71.11	69.67	1.45
26	71.56	69.68	1.87
39	70.74	67.47	3.27
38	70.62	67.66	2.97
37	69.88	67.92	1.95
36	70.42	68.09	2.33
35	70.30	68.26	2.04
34	69.94	68.25	1.69
23	71.64	66.28	5.35
21	73.92	67.38	6.54
20	73.77	70.27	3.50
15	73.60	71.79	1.81
14	73.83	72.11	1.72
19	72.93	71.86	1.07
18	74.49	72.43	2.06
17	74.38	72.89	1.50
16	74.71	73.16	1.55
49	70.42	65.97	4.45
48	70.05	66.75	3.30
47	69.34	68.11	1.23
46	70.16	68.43	1.74
45	70.17	68.52	1.65

A3.5.4.1 HydroCAD Node Diagram


11
12
Pre-1
DL-1 Cranston Street
21
22
Pre-2
DP-2 Active Rail Corridor
31
32
Pre-3
DP-3 Abandoned Rail Corridor
Subcat
Reach
Pond
Link
Routing Diagram for 2928-001-ALLS-EHCD
Prepared by DiPrete Engineering, Printed 3/8/2022
HydroCAD® 10.10-6a s/n 01125 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.815	39	>75% Grass cover, Good, HSG A (11, 21, 31)
0.073	96	Gravel surface, HSG A (21)
0.204	98	Impervious, HSG A (11, 21, 31)
0.565	30	Woods, Good, HSG A (21, 31)
6.658	**41**	**TOTAL AREA**



Subcat Reach Pond Link

Routing Diagram for RESTORED-2928-001-ALLS-PHCD
Prepared by DiPrete Engineering, Printed 4/1/2022
HydroCAD® 10.10-6a s/n 01125 © 2020 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.170	39	>75% Grass cover, Good, HSG A (101, 201, 301, 303, 305, 309, 314, 319, 326, 328)
4.488	98	Impervious, HSG A (201, 301, 303, 305, 309, 314, 319, 320, 326, 328)
6.658	**79**	**TOTAL AREA**

A3.5.4.2 HydroCAD 1-Year Storm Analysis

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

Subcatchment 11: Pre-1 Runoff Area=0.164 ac 8.75% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=44 Runoff=0.00 cfs 0.000 af

Subcatchment 21: Pre-2 Runoff Area=4.290 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=755' Tc=11.7 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 31: Pre-3 Runoff Area=2.204 ac 8.62% Impervious Runoff Depth=0.00"
Flow Length=441' Tc=12.4 min CN=43 Runoff=0.00 cfs 0.000 af

Reach 12: DL-1 Cranston Street Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 22: DP-2 Active Rail Corridor Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 32: DP-3 Abandoned Rail Corridor Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

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

Subcatchment 101: Post-1 Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 201: Post-2 Runoff Area=0.587 ac 18.43% Impervious Runoff Depth=0.05"
Tc=6.0 min CN=50 Runoff=0.00 cfs 0.002 af

Subcatchment 301: Post-4 Runoff Area=1.121 ac 90.63% Impervious Runoff Depth=1.88"
Tc=6.0 min CN=92 Runoff=2.43 cfs 0.175 af

Subcatchment 303: Post-11 Runoff Area=0.080 ac 3.72% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=41 Runoff=0.00 cfs 0.000 af

Subcatchment 305: Post-3 Runoff Area=0.832 ac 76.07% Impervious Runoff Depth=1.27"
Tc=6.0 min CN=84 Runoff=1.24 cfs 0.088 af

Subcatchment 309: Post-5 Runoff Area=0.626 ac 84.26% Impervious Runoff Depth=1.63"
Tc=6.0 min CN=89 Runoff=1.20 cfs 0.085 af

Subcatchment 314: Post-6 Runoff Area=1.071 ac 88.13% Impervious Runoff Depth=1.79"
Tc=6.0 min CN=91 Runoff=2.23 cfs 0.160 af

Subcatchment 319: Post-7 Runoff Area=0.610 ac 80.64% Impervious Runoff Depth=1.48"
Tc=6.0 min CN=87 Runoff=1.06 cfs 0.075 af

Subcatchment 320: Post-8 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=2.47"
Tc=6.0 min CN=98 Runoff=1.85 cfs 0.146 af

Subcatchment 326: Post-9 Runoff Area=0.764 ac 5.78% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=42 Runoff=0.00 cfs 0.000 af

Subcatchment 328: Post-10 Runoff Area=0.242 ac 5.15% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=42 Runoff=0.00 cfs 0.000 af

Reach 102: DL-1 Cranston Street Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 202: DP-2 Active Rail Corridor Inflow=0.00 cfs 0.002 af
Outflow=0.00 cfs 0.002 af

Reach DP-3: DP-3 Abandoned Rail Corridor Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 302: Bypass (DMH-12) Peak Elev=64.00' Inflow=2.43 cfs 0.175 af
Outflow=2.43 cfs 0.175 af

Pond 304: FocalPoint-B Peak Elev=63.04' Storage=456 cf Inflow=2.43 cfs 0.175 af
Outflow=2.58 cfs 0.175 af

Pond 306: Bypass (DMH-21) Peak Elev=70.25' Inflow=1.24 cfs 0.088 af
Primary=1.24 cfs 0.088 af Secondary=0.00 cfs 0.000 af Outflow=1.24 cfs 0.088 af

Pond 307: USF A (740s) Peak Elev=70.24' Storage=1,263 cf Inflow=1.24 cfs 0.088 af
Outflow=0.15 cfs 0.088 af

Pond 307P: Pipe 21-23 Peak Elev=66.32' Inflow=0.15 cfs 0.088 af
18.00" Round Culvert n=0.012 L=63.6' S=0.0050 '/' Outflow=0.15 cfs 0.088 af

Pond 308: DMH-23 Peak Elev=61.66' Inflow=0.15 cfs 0.088 af
15.00" Round Culvert n=0.012 L=106.2' S=0.0050 '/' Outflow=0.15 cfs 0.088 af

Pond 310: Bypass (DMH-30) Peak Elev=67.30' Inflow=1.20 cfs 0.085 af
Primary=1.20 cfs 0.085 af Secondary=0.00 cfs 0.000 af Outflow=1.20 cfs 0.085 af

Pond 311: USF C (740s) Peak Elev=66.90' Storage=1,173 cf Inflow=1.20 cfs 0.085 af
Outflow=0.16 cfs 0.085 af

Pond 312: DMH-32 Peak Elev=66.36' Inflow=0.00 cfs 0.000 af
15.00" Round Culvert n=0.012 L=74.7' S=0.0100 '/' Outflow=0.00 cfs 0.000 af

Pond 313: DMH-33 Peak Elev=63.38' Inflow=0.16 cfs 0.085 af
18.00" Round Culvert n=0.012 L=108.1' S=0.0100 '/' Outflow=0.16 cfs 0.085 af

Pond 315: Bypass (DMH-39) Peak Elev=66.65' Inflow=2.23 cfs 0.160 af
Primary=2.10 cfs 0.160 af Secondary=0.13 cfs 0.000 af Outflow=2.23 cfs 0.160 af

Pond 316: USF-D (740s) Peak Elev=65.95' Storage=2,339 cf Inflow=2.10 cfs 0.160 af
Outflow=0.26 cfs 0.160 af

Pond 317: DMH-41 Peak Elev=61.91' Inflow=0.55 cfs 0.245 af
Outflow=0.55 cfs 0.245 af

Pond 318: DMH-43 Peak Elev=60.41' Inflow=0.70 cfs 0.333 af
24.00" Round Culvert n=0.012 L=39.0' S=0.0051 '/' Outflow=0.70 cfs 0.333 af

Pond 321: Bypass (DMH-49) Peak Elev=66.84' Inflow=2.91 cfs 0.221 af
Primary=2.24 cfs 0.216 af Secondary=0.66 cfs 0.005 af Outflow=2.91 cfs 0.221 af

Pond 322: USF-E (740s) Peak Elev=66.40' Storage=3,084 cf Inflow=2.24 cfs 0.216 af
Outflow=0.29 cfs 0.216 af

Pond 323: DMH-44 Peak Elev=60.22' Inflow=1.00 cfs 0.550 af
24.00" Round Culvert n=0.012 L=83.7' S=0.0050 '/' Outflow=1.00 cfs 0.550 af

Pond 324: DMH-51 Peak Elev=59.35' Inflow=1.66 cfs 0.555 af
Outflow=1.66 cfs 0.555 af

Pond 325: DMH-53 Peak Elev=56.07' Inflow=1.66 cfs 0.555 af
30.00" Round Culvert n=0.012 L=60.9' S=0.0586 '/' Outflow=1.66 cfs 0.555 af

Pond 327: Infiltration Pond E Peak Elev=52.01' Storage=75 cf Inflow=4.23 cfs 0.730 af
Discarded=4.08 cfs 0.730 af Primary=0.00 cfs 0.000 af Outflow=4.08 cfs 0.730 af

A3.5.4.3 HydroCAD 10-Year Storm Analysis

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

Subcatchment 101: Post-1 Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.18"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 201: Post-2 Runoff Area=0.587 ac 18.43% Impervious Runoff Depth=0.65"
Tc=6.0 min CN=50 Runoff=0.27 cfs 0.032 af

Subcatchment 301: Post-4 Runoff Area=1.121 ac 90.63% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=92 Runoff=4.98 cfs 0.373 af

Subcatchment 303: Post-11 Runoff Area=0.080 ac 3.72% Impervious Runoff Depth=0.25"
Tc=6.0 min CN=41 Runoff=0.01 cfs 0.002 af

Subcatchment 305: Post-3 Runoff Area=0.832 ac 76.07% Impervious Runoff Depth=3.18"
Tc=6.0 min CN=84 Runoff=3.08 cfs 0.220 af

Subcatchment 309: Post-5 Runoff Area=0.626 ac 84.26% Impervious Runoff Depth=3.68"
Tc=6.0 min CN=89 Runoff=2.63 cfs 0.192 af

Subcatchment 314: Post-6 Runoff Area=1.071 ac 88.13% Impervious Runoff Depth=3.89"
Tc=6.0 min CN=91 Runoff=4.68 cfs 0.347 af

Subcatchment 319: Post-7 Runoff Area=0.610 ac 80.64% Impervious Runoff Depth=3.47"
Tc=6.0 min CN=87 Runoff=2.44 cfs 0.177 af

Subcatchment 320: Post-8 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=4.66"
Tc=6.0 min CN=98 Runoff=3.40 cfs 0.275 af

Subcatchment 326: Post-9 Runoff Area=0.764 ac 5.78% Impervious Runoff Depth=0.29"
Tc=6.0 min CN=42 Runoff=0.07 cfs 0.018 af

Subcatchment 328: Post-10 Runoff Area=0.242 ac 5.15% Impervious Runoff Depth=0.29"
Tc=6.0 min CN=42 Runoff=0.02 cfs 0.006 af

Reach 102: DL-1 Cranston Street Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 202: DP-2 Active Rail Corridor Inflow=0.27 cfs 0.032 af
Outflow=0.27 cfs 0.032 af

Reach DP-3: DP-3 Abandoned Rail Corridor Inflow=0.02 cfs 0.006 af
Outflow=0.02 cfs 0.006 af

Pond 302: Bypass (DMH-12) Peak Elev=64.43' Inflow=4.98 cfs 0.373 af
Primary=1.29 cfs 0.296 af Secondary=3.70 cfs 0.076 af Outflow=4.98 cfs 0.373 af

Pond 304: FocalPoint-B Peak Elev=62.88' Storage=399 cf Inflow=1.29 cfs 0.298 af
Outflow=1.28 cfs 0.298 af

Pond 306: Bypass (DMH-21) Peak Elev=71.52' Inflow=3.08 cfs 0.220 af
Primary=1.84 cfs 0.153 af Secondary=1.87 cfs 0.067 af Outflow=3.08 cfs 0.220 af

Pond 307: USF A (740s) Peak Elev=71.50' Storage=1,809 cf Inflow=1.84 cfs 0.153 af
Outflow=0.15 cfs 0.153 af

Pond 307P: Pipe 21-23 Peak Elev=66.87' Inflow=2.03 cfs 0.220 af
18.00" Round Culvert n=0.012 L=63.6' S=0.0050 '/' Outflow=2.03 cfs 0.220 af

Pond 308: DMH-23 Peak Elev=62.25' Inflow=2.03 cfs 0.220 af
15.00" Round Culvert n=0.012 L=106.2' S=0.0050 '/' Outflow=2.03 cfs 0.220 af

Pond 310: Bypass (DMH-30) Peak Elev=67.64' Inflow=2.63 cfs 0.192 af
Primary=1.44 cfs 0.142 af Secondary=1.52 cfs 0.050 af Outflow=2.63 cfs 0.192 af

Pond 311: USF C (740s) Peak Elev=67.58' Storage=1,581 cf Inflow=1.44 cfs 0.142 af
Outflow=0.16 cfs 0.142 af

Pond 312: DMH-32 Peak Elev=66.96' Inflow=1.52 cfs 0.050 af
15.00" Round Culvert n=0.012 L=74.7' S=0.0100 '/' Outflow=1.52 cfs 0.050 af

Pond 313: DMH-33 Peak Elev=63.80' Inflow=1.69 cfs 0.192 af
18.00" Round Culvert n=0.012 L=108.1' S=0.0100 '/' Outflow=1.69 cfs 0.192 af

Pond 315: Bypass (DMH-39) Peak Elev=66.97' Inflow=4.68 cfs 0.347 af
Primary=2.05 cfs 0.255 af Secondary=2.99 cfs 0.091 af Outflow=4.68 cfs 0.347 af

Pond 316: USF-D (740s) Peak Elev=66.79' Storage=2,981 cf Inflow=2.05 cfs 0.255 af
Outflow=0.26 cfs 0.255 af

Pond 317: DMH-41 Peak Elev=62.65' Inflow=4.91 cfs 0.539 af
Outflow=4.91 cfs 0.539 af

Pond 318: DMH-43 Peak Elev=61.51' Inflow=6.90 cfs 0.759 af
24.00" Round Culvert n=0.012 L=39.0' S=0.0051 '/' Outflow=6.90 cfs 0.759 af

Pond 321: Bypass (DMH-49) Peak Elev=67.17' Inflow=5.84 cfs 0.452 af
Primary=2.14 cfs 0.322 af Secondary=4.16 cfs 0.130 af Outflow=5.84 cfs 0.452 af

Pond 322: USF-E (740s) Peak Elev=66.93' Storage=3,466 cf Inflow=2.14 cfs 0.322 af
Outflow=0.29 cfs 0.322 af

Pond 323: DMH-44 Peak Elev=61.12' Inflow=7.20 cfs 1.081 af
24.00" Round Culvert n=0.012 L=83.7' S=0.0050 '/' Outflow=7.20 cfs 1.081 af

Pond 324: DMH-51 Peak Elev=60.25' Inflow=11.32 cfs 1.211 af
Outflow=11.32 cfs 1.211 af

Pond 325: DMH-53 Peak Elev=57.22' Inflow=14.99 cfs 1.287 af
30.00" Round Culvert n=0.012 L=60.9' S=0.0586 '/' Outflow=14.99 cfs 1.287 af

Pond 327: Infiltration Pond E Peak Elev=52.67' Storage=7,177 cf Inflow=16.27 cfs 1.604 af
Discarded=6.09 cfs 1.604 af Primary=0.00 cfs 0.000 af Outflow=6.09 cfs 1.604 af

A3.5.4.4 HydroCAD 25-Year Storm Analysis

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

Subcatchment 11: Pre-1 Runoff Area=0.164 ac 8.75% Impervious Runoff Depth=0.78"
Tc=6.0 min CN=44 Runoff=0.09 cfs 0.011 af

Subcatchment 21: Pre-2 Runoff Area=4.290 ac 0.00% Impervious Runoff Depth=0.47"
Flow Length=755' Tc=11.7 min CN=39 Runoff=0.79 cfs 0.170 af

Subcatchment 31: Pre-3 Runoff Area=2.204 ac 8.62% Impervious Runoff Depth=0.71"
Flow Length=441' Tc=12.4 min CN=43 Runoff=0.80 cfs 0.131 af

Reach 12: DL-1 Cranston Street Inflow=0.09 cfs 0.011 af
Outflow=0.09 cfs 0.011 af

Reach 22: DP-2 Active Rail Corridor Inflow=0.79 cfs 0.170 af
Outflow=0.79 cfs 0.170 af

Reach 32: DP-3 Abandoned Rail Corridor Inflow=0.80 cfs 0.131 af
Outflow=0.80 cfs 0.131 af

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

Subcatchment 101: Post-1 Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.47"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.001 af

Subcatchment 201: Post-2 Runoff Area=0.587 ac 18.43% Impervious Runoff Depth=1.19"
Tc=6.0 min CN=50 Runoff=0.65 cfs 0.058 af

Subcatchment 301: Post-4 Runoff Area=1.121 ac 90.63% Impervious Runoff Depth=5.17"
Tc=6.0 min CN=92 Runoff=6.36 cfs 0.483 af

Subcatchment 303: Post-11 Runoff Area=0.080 ac 3.72% Impervious Runoff Depth=0.59"
Tc=6.0 min CN=41 Runoff=0.02 cfs 0.004 af

Subcatchment 305: Post-3 Runoff Area=0.832 ac 76.07% Impervious Runoff Depth=4.29"
Tc=6.0 min CN=84 Runoff=4.12 cfs 0.297 af

Subcatchment 309: Post-5 Runoff Area=0.626 ac 84.26% Impervious Runoff Depth=4.83"
Tc=6.0 min CN=89 Runoff=3.40 cfs 0.252 af

Subcatchment 314: Post-6 Runoff Area=1.071 ac 88.13% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=91 Runoff=6.00 cfs 0.451 af

Subcatchment 319: Post-7 Runoff Area=0.610 ac 80.64% Impervious Runoff Depth=4.61"
Tc=6.0 min CN=87 Runoff=3.20 cfs 0.235 af

Subcatchment 320: Post-8 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=98 Runoff=4.24 cfs 0.346 af

Subcatchment 326: Post-9 Runoff Area=0.764 ac 5.78% Impervious Runoff Depth=0.65"
Tc=6.0 min CN=42 Runoff=0.27 cfs 0.041 af

Subcatchment 328: Post-10 Runoff Area=0.242 ac 5.15% Impervious Runoff Depth=0.65"
Tc=6.0 min CN=42 Runoff=0.08 cfs 0.013 af

Reach 102: DL-1 Cranston Street Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Reach 202: DP-2 Active Rail Corridor Inflow=0.65 cfs 0.058 af
Outflow=0.65 cfs 0.058 af

Reach DP-3: DP-3 Abandoned Rail Corridor Inflow=0.08 cfs 0.013 af
Outflow=0.08 cfs 0.013 af

Pond 302: Bypass (DMH-12) Peak Elev=64.53' Inflow=6.36 cfs 0.483 af
Primary=1.32 cfs 0.364 af Secondary=5.04 cfs 0.118 af Outflow=6.36 cfs 0.483 af

Pond 304: FocalPoint-B Peak Elev=62.89' Storage=402 cf Inflow=1.34 cfs 0.368 af
Outflow=1.33 cfs 0.368 af

Pond 306: Bypass (DMH-21) Peak Elev=71.69' Inflow=4.12 cfs 0.297 af
Primary=1.56 cfs 0.175 af Secondary=3.83 cfs 0.122 af Outflow=4.12 cfs 0.297 af

Pond 307: USF A (740s) Peak Elev=71.68' Storage=1,857 cf Inflow=1.56 cfs 0.175 af
Outflow=0.15 cfs 0.175 af

Pond 307P: Pipe 21-23 Peak Elev=67.23' Inflow=3.98 cfs 0.297 af
18.00" Round Culvert n=0.012 L=63.6' S=0.0050 '/' Outflow=3.98 cfs 0.297 af

Pond 308: DMH-23 Peak Elev=62.89' Inflow=3.98 cfs 0.297 af
15.00" Round Culvert n=0.012 L=106.2' S=0.0050 '/' Outflow=3.98 cfs 0.297 af

Pond 310: Bypass (DMH-30) Peak Elev=67.76' Inflow=3.40 cfs 0.252 af
Primary=1.33 cfs 0.164 af Secondary=2.79 cfs 0.088 af Outflow=3.40 cfs 0.252 af

Pond 311: USF C (740s) Peak Elev=67.72' Storage=1,655 cf Inflow=1.33 cfs 0.164 af
Outflow=0.16 cfs 0.164 af

Pond 312: DMH-32 Peak Elev=67.21' Inflow=2.79 cfs 0.088 af
15.00" Round Culvert n=0.012 L=74.7' S=0.0100 '/' Outflow=2.79 cfs 0.088 af

Pond 313: DMH-33 Peak Elev=64.04' Inflow=2.95 cfs 0.252 af
18.00" Round Culvert n=0.012 L=108.1' S=0.0100 '/' Outflow=2.95 cfs 0.252 af

Pond 315: Bypass (DMH-39) Peak Elev=67.11' Inflow=6.00 cfs 0.451 af
Primary=1.97 cfs 0.291 af Secondary=4.77 cfs 0.160 af Outflow=6.00 cfs 0.451 af

Pond 316: USF-D (740s) Peak Elev=66.95' Storage=3,059 cf Inflow=1.97 cfs 0.291 af
Outflow=0.26 cfs 0.291 af

Pond 317: DMH-41 Peak Elev=63.08' Inflow=7.98 cfs 0.703 af
Outflow=7.98 cfs 0.703 af

Pond 318: DMH-43 Peak Elev=62.30' Inflow=11.96 cfs 1.001 af
24.00" Round Culvert n=0.012 L=39.0' S=0.0051 '/' Outflow=11.96 cfs 1.001 af

Pond 321: Bypass (DMH-49) Peak Elev=67.31' Inflow=7.44 cfs 0.581 af
Primary=2.02 cfs 0.363 af Secondary=6.23 cfs 0.217 af Outflow=7.44 cfs 0.581 af

Pond 322: USF-E (740s) Peak Elev=67.13' Storage=3,566 cf Inflow=2.02 cfs 0.363 af
Outflow=0.29 cfs 0.363 af

Pond 323: DMH-44 Peak Elev=61.67' Inflow=12.25 cfs 1.364 af
24.00" Round Culvert n=0.012 L=83.7' S=0.0050 '/' Outflow=12.25 cfs 1.364 af

Pond 324: DMH-51 Peak Elev=60.73' Inflow=18.48 cfs 1.582 af
Outflow=18.48 cfs 1.582 af

Pond 325: DMH-53 Peak Elev=57.80' Inflow=23.49 cfs 1.700 af
30.00" Round Culvert n=0.012 L=60.9' S=0.0586 '/' Outflow=23.49 cfs 1.700 af

Pond 327: Infiltration Pond E Peak Elev=53.38' Storage=15,559 cf Inflow=25.02 cfs 2.109 af
Discarded=6.64 cfs 2.109 af Primary=0.00 cfs 0.000 af Outflow=6.64 cfs 2.109 af

A3.5.4.5 HydroCAD 100-Year Storm Analysis

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

Subcatchment 11: Pre-1 Runoff Area=0.164 ac 8.75% Impervious Runoff Depth=2.01"
Tc=6.0 min CN=44 Runoff=0.33 cfs 0.027 af

Subcatchment 21: Pre-2 Runoff Area=4.290 ac 0.00% Impervious Runoff Depth=1.46"
Flow Length=755' Tc=11.7 min CN=39 Runoff=4.38 cfs 0.523 af

Subcatchment 31: Pre-3 Runoff Area=2.204 ac 8.62% Impervious Runoff Depth=1.90"
Flow Length=441' Tc=12.4 min CN=43 Runoff=3.30 cfs 0.348 af

Reach 12: DL-1 Cranston Street Inflow=0.33 cfs 0.027 af
Outflow=0.33 cfs 0.027 af

Reach 22: DP-2 Active Rail Corridor Inflow=4.38 cfs 0.523 af
Outflow=4.38 cfs 0.523 af

Reach 32: DP-3 Abandoned Rail Corridor Inflow=3.30 cfs 0.348 af
Outflow=3.30 cfs 0.348 af

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

Subcatchment 101: Post-1 Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=1.46"
Tc=6.0 min CN=39 Runoff=0.02 cfs 0.002 af

Subcatchment 201: Post-2 Runoff Area=0.587 ac 18.43% Impervious Runoff Depth=2.69"
Tc=6.0 min CN=50 Runoff=1.73 cfs 0.131 af

Subcatchment 301: Post-4 Runoff Area=1.121 ac 90.63% Impervious Runoff Depth=7.74"
Tc=6.0 min CN=92 Runoff=9.30 cfs 0.723 af

Subcatchment 303: Post-11 Runoff Area=0.080 ac 3.72% Impervious Runoff Depth=1.68"
Tc=6.0 min CN=41 Runoff=0.12 cfs 0.011 af

Subcatchment 305: Post-3 Runoff Area=0.832 ac 76.07% Impervious Runoff Depth=6.77"
Tc=6.0 min CN=84 Runoff=6.36 cfs 0.469 af

Subcatchment 309: Post-5 Runoff Area=0.626 ac 84.26% Impervious Runoff Depth=7.37"
Tc=6.0 min CN=89 Runoff=5.07 cfs 0.385 af

Subcatchment 314: Post-6 Runoff Area=1.071 ac 88.13% Impervious Runoff Depth=7.62"
Tc=6.0 min CN=91 Runoff=8.82 cfs 0.680 af

Subcatchment 319: Post-7 Runoff Area=0.610 ac 80.64% Impervious Runoff Depth=7.13"
Tc=6.0 min CN=87 Runoff=4.84 cfs 0.363 af

Subcatchment 320: Post-8 Runoff Area=0.709 ac 100.00% Impervious Runoff Depth=8.46"
Tc=6.0 min CN=98 Runoff=6.05 cfs 0.500 af

Subcatchment 326: Post-9 Runoff Area=0.764 ac 5.78% Impervious Runoff Depth=1.79"
Tc=6.0 min CN=42 Runoff=1.31 cfs 0.114 af

Subcatchment 328: Post-10 Runoff Area=0.242 ac 5.15% Impervious Runoff Depth=1.79"
Tc=6.0 min CN=42 Runoff=0.41 cfs 0.036 af

Reach 102: DL-1 Cranston Street Inflow=0.02 cfs 0.002 af
Outflow=0.02 cfs 0.002 af

Reach 202: DP-2 Active Rail Corridor Inflow=1.73 cfs 0.131 af
Outflow=1.73 cfs 0.131 af

Reach DP-3: DP-3 Abandoned Rail Corridor Inflow=0.41 cfs 0.036 af
Outflow=0.41 cfs 0.036 af

Pond 302: Bypass (DMH-12) Peak Elev=64.97' Inflow=9.30 cfs 0.723 af
Primary=1.48 cfs 0.509 af Secondary=7.83 cfs 0.214 af Outflow=9.30 cfs 0.723 af

Pond 304: FocalPoint-B Peak Elev=62.92' Storage=419 cf Inflow=1.60 cfs 0.520 af
Outflow=1.58 cfs 0.520 af

Pond 306: Bypass (DMH-21) Peak Elev=71.85' Inflow=6.36 cfs 0.469 af
Primary=1.07 cfs 0.213 af Secondary=6.14 cfs 0.256 af Outflow=6.36 cfs 0.469 af

Pond 307: USF A (740s) Peak Elev=71.84' Storage=1,901 cf Inflow=1.07 cfs 0.213 af
Outflow=0.15 cfs 0.213 af

Pond 307P: Pipe 21-23 Peak Elev=67.63' Inflow=6.30 cfs 0.469 af
18.00" Round Culvert n=0.012 L=63.6' S=0.0050 '/' Outflow=6.30 cfs 0.469 af

Pond 308: DMH-23 Peak Elev=66.51' Inflow=6.30 cfs 0.469 af
15.00" Round Culvert n=0.012 L=106.2' S=0.0050 '/' Outflow=6.30 cfs 0.469 af

Pond 310: Bypass (DMH-30) Peak Elev=68.09' Inflow=5.07 cfs 0.385 af
Primary=1.02 cfs 0.201 af Secondary=4.41 cfs 0.183 af Outflow=5.07 cfs 0.385 af

Pond 311: USF C (740s) Peak Elev=68.02' Storage=1,812 cf Inflow=1.02 cfs 0.201 af
Outflow=0.16 cfs 0.201 af

Pond 312: DMH-32 Peak Elev=67.53' Inflow=4.41 cfs 0.183 af
15.00" Round Culvert n=0.012 L=74.7' S=0.0100 '/' Outflow=4.41 cfs 0.183 af

Pond 313: DMH-33 Peak Elev=66.56' Inflow=4.57 cfs 0.385 af
18.00" Round Culvert n=0.012 L=108.1' S=0.0100 '/' Outflow=4.57 cfs 0.385 af

Pond 315: Bypass (DMH-39) Peak Elev=67.34' Inflow=8.82 cfs 0.680 af
Primary=1.42 cfs 0.352 af Secondary=8.31 cfs 0.328 af Outflow=8.82 cfs 0.680 af

Pond 316: USF-D (740s) Peak Elev=67.28' Storage=3,208 cf Inflow=1.42 cfs 0.352 af
Outflow=0.26 cfs 0.352 af

Pond 317: DMH-41 Peak Elev=66.23' Inflow=13.14 cfs 1.065 af
Outflow=13.14 cfs 1.065 af

Pond 318: DMH-43 Peak Elev=65.05' Inflow=19.43 cfs 1.534 af
24.00" Round Culvert n=0.012 L=39.0' S=0.0051 '/' Outflow=19.43 cfs 1.534 af

Pond 321: Bypass (DMH-49) Peak Elev=67.55' Inflow=10.89 cfs 0.862 af
Primary=1.23 cfs 0.433 af Secondary=10.28 cfs 0.429 af Outflow=10.89 cfs 0.862 af

Pond 322: USF-E (740s) Peak Elev=67.47' Storage=3,739 cf Inflow=1.23 cfs 0.433 af
Outflow=0.29 cfs 0.433 af

Pond 323: DMH-44 Peak Elev=63.42' Inflow=19.72 cfs 1.967 af
24.00" Round Culvert n=0.012 L=83.7' S=0.0050 '/' Outflow=19.72 cfs 1.967 af

Pond 324: DMH-51 Peak Elev=61.71' Inflow=30.00 cfs 2.396 af
Outflow=30.00 cfs 2.396 af

Pond 325: DMH-53 Peak Elev=59.38' Inflow=37.81 cfs 2.610 af
30.00" Round Culvert n=0.012 L=60.9' S=0.0586 '/' Outflow=37.81 cfs 2.610 af

Pond 327: Infiltration Pond E Peak Elev=54.95' Storage=36,462 cf Inflow=40.66 cfs 3.244 af
Discarded=7.85 cfs 3.244 af Primary=0.00 cfs 0.000 af Outflow=7.85 cfs 3.244 af

Summary for Subcatchment 101: Post-1

Runoff = 0.02 cfs @ 12.11 hrs, Volume= 0.002 af, Depth= 1.46"
Routed to Reach 102 : DL-1 Cranston Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.017	39	>75% Grass cover, Good, HSG A
0.017	39	100.00% Pervious Area

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

Summary for Subcatchment 201: Post-2

Runoff = 1.73 cfs @ 12.10 hrs, Volume= 0.131 af, Depth= 2.69"
Routed to Reach 202 : DP-2 Active Rail Corridor

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.479	39	>75% Grass cover, Good, HSG A
0.108	98	Impervious, HSG A
0.587	50	Weighted Average
0.479	39	81.57% Pervious Area
0.108	98	18.43% Impervious Area

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

Summary for Subcatchment 301: Post-4

Runoff = 9.30 cfs @ 12.08 hrs, Volume= 0.723 af, Depth= 7.74"
Routed to Pond 302 : Bypass (DMH-12)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.105	39	>75% Grass cover, Good, HSG A
1.016	98	Impervious, HSG A
1.121	92	Weighted Average
0.105	39	9.37% Pervious Area
1.016	98	90.63% Impervious Area

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

Summary for Subcatchment 303: Post-11

Runoff = 0.12 cfs @ 12.11 hrs, Volume= 0.011 af, Depth= 1.68"
Routed to Pond 304 : FocalPoint-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.077	39	>75% Grass cover, Good, HSG A
0.003	98	Impervious, HSG A
0.080	41	Weighted Average
0.077	39	96.28% Pervious Area
0.003	98	3.72% Impervious Area

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

Summary for Subcatchment 305: Post-3

Runoff = 6.36 cfs @ 12.09 hrs, Volume= 0.469 af, Depth= 6.77"
Routed to Pond 306 : Bypass (DMH-21)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.199	39	>75% Grass cover, Good, HSG A
0.633	98	Impervious, HSG A
0.832	84	Weighted Average
0.199	39	23.93% Pervious Area
0.633	98	76.07% Impervious Area

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

Summary for Subcatchment 309: Post-5

Runoff = 5.07 cfs @ 12.08 hrs, Volume= 0.385 af, Depth= 7.37"
Routed to Pond 310 : Bypass (DMH-30)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.099	39	>75% Grass cover, Good, HSG A
0.528	98	Impervious, HSG A
0.626	89	Weighted Average
0.099	39	15.74% Pervious Area
0.528	98	84.26% Impervious Area

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

Summary for Subcatchment 314: Post-6

Runoff = 8.82 cfs @ 12.08 hrs, Volume= 0.680 af, Depth= 7.62"
Routed to Pond 315 : Bypass (DMH-39)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.127	39	>75% Grass cover, Good, HSG A
0.944	98	Impervious, HSG A
1.071	91	Weighted Average
0.127	39	11.87% Pervious Area
0.944	98	88.13% Impervious Area

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

Summary for Subcatchment 319: Post-7

Runoff = 4.84 cfs @ 12.08 hrs, Volume= 0.363 af, Depth= 7.13"
Routed to Pond 321 : Bypass (DMH-49)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.118	39	>75% Grass cover, Good, HSG A
0.492	98	Impervious, HSG A
0.610	87	Weighted Average
0.118	39	19.36% Pervious Area
0.492	98	80.64% Impervious Area

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

Summary for Subcatchment 320: Post-8

Runoff = 6.05 cfs @ 12.08 hrs, Volume= 0.500 af, Depth= 8.46"
Routed to Pond 321 : Bypass (DMH-49)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.709	98	Impervious, HSG A
0.709	98	100.00% Impervious Area

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

Summary for Subcatchment 326: Post-9

Runoff = 1.31 cfs @ 12.11 hrs, Volume= 0.114 af, Depth= 1.79"
Routed to Pond 327 : Infiltration Pond E

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.720	39	>75% Grass cover, Good, HSG A
0.044	98	Impervious, HSG A
0.764	42	Weighted Average
0.720	39	94.22% Pervious Area
0.044	98	5.78% Impervious Area

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

Summary for Subcatchment 328: Post-10

Runoff = 0.41 cfs @ 12.11 hrs, Volume= 0.036 af, Depth= 1.79"
Routed to Reach DP-3 : DP-3 Abandoned Rail Corridor

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (ac)	CN	Description
0.229	39	>75% Grass cover, Good, HSG A
0.012	98	Impervious, HSG A
0.242	42	Weighted Average
0.229	39	94.85% Pervious Area
0.012	98	5.15% Impervious Area

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

Summary for Reach 102: DL-1 Cranston Street

Inflow Area = 0.017 ac, 0.00% Impervious, Inflow Depth = 1.46" for 100-Year event
Inflow = 0.02 cfs @ 12.11 hrs, Volume= 0.002 af
Outflow = 0.02 cfs @ 12.11 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

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

Summary for Reach 202: DP-2 Active Rail Corridor

Inflow Area = 0.587 ac, 18.43% Impervious, Inflow Depth = 2.69" for 100-Year event
Inflow = 1.73 cfs @ 12.10 hrs, Volume= 0.131 af
Outflow = 1.73 cfs @ 12.10 hrs, Volume= 0.131 af, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: DP-3 Abandoned Rail Corridor

Inflow Area = 6.054 ac, 72.35% Impervious, Inflow Depth = 0.07" for 100-Year event
Inflow = 0.41 cfs @ 12.11 hrs, Volume= 0.036 af
Outflow = 0.41 cfs @ 12.11 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min

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

Summary for Pond 302: Bypass (DMH-12)

Inflow Area = 1.121 ac, 90.63% Impervious, Inflow Depth = 7.74" for 100-Year event
Inflow = 9.30 cfs @ 12.08 hrs, Volume= 0.723 af
Outflow = 9.30 cfs @ 12.08 hrs, Volume= 0.723 af, Atten= 0%, Lag= 0.0 min
Primary = 1.48 cfs @ 12.08 hrs, Volume= 0.509 af
Routed to Pond 304 : FocalPoint-B
Secondary = 7.83 cfs @ 12.08 hrs, Volume= 0.214 af
Routed to Pond 325 : DMH-53

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 64.97' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	63.15'	**8.00" Round WQ Trunk Line** L= 127.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 63.15' / 62.00' S= 0.0090 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#2	Device 3	64.00'	**4.0' long Weir Plate** Cv= 2.62 (C= 3.28)
#3	Secondary	63.15'	**18.00" Round QP Line** L= 8.3' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 63.15' / 63.07' S= 0.0096 '/' Cc= 0.900

n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=1.48 cfs @ 12.08 hrs HW=64.97' TW=62.92' (Dynamic Tailwater)
└**1=WQ Trunk Line** (Outlet Controls 1.48 cfs @ 4.23 fps)

Secondary OutFlow Max=7.81 cfs @ 12.08 hrs HW=64.97' TW=59.37' (Dynamic Tailwater)
└**3=QP Line** (Barrel Controls 7.81 cfs @ 4.63 fps)
└**2=Weir Plate** (Passes 7.81 cfs of 12.45 cfs potential flow)

Summary for Pond 304: FocalPoint-B

Inflow Area = 1.201 ac, 84.85% Impervious, Inflow Depth = 5.20" for 100-Year event
Inflow = 1.60 cfs @ 12.09 hrs, Volume= 0.520 af
Outflow = 1.58 cfs @ 12.10 hrs, Volume= 0.520 af, Atten= 1%, Lag= 1.0 min
Primary = 1.58 cfs @ 12.10 hrs, Volume= 0.520 af
Routed to Pond 327 : Infiltration Pond E

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 62.92' @ 12.10 hrs Surf.Area= 220 sf Storage= 419 cf

Plug-Flow detention time= 3.6 min calculated for 0.520 af (100% of inflow)
Center-of-Mass det. time= 3.6 min (790.1 - 786.5)

Volume	Invert	Avail.Storage	Storage Description
#1	59.75'	99 cf	**10.00'W x 22.00'L x 2.25'H FocalPoint** 495 cf Overall x 20.0% Voids
#2	62.00'	357 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		456 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	236	0	0
62.50	353	147	147
63.00	485	210	357

Device	Routing	Invert	Outlet Devices
#1	Device 3	59.75'	**100.000 in/hr Exfiltration over Surface area** Phase-In= 0.10'
#2	Device 3	62.70'	**12.00" Horiz. Overflow grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	59.00'	**12.00" Round Culvert** L= 37.8' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 59.00' / 52.00' S= 0.1852 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=1.58 cfs @ 12.10 hrs HW=62.92' TW=53.65' (Dynamic Tailwater)
└**3=Culvert** (Passes 1.58 cfs of 7.00 cfs potential flow)
└**1=Exfiltration** (Exfiltration Controls 0.51 cfs)
└**2=Overflow grate** (Weir Controls 1.07 cfs @ 1.54 fps)

Summary for Pond 306: Bypass (DMH-21)

Inflow Area = 0.832 ac, 76.07% Impervious, Inflow Depth = 6.77" for 100-Year event
Inflow = 6.36 cfs @ 12.09 hrs, Volume= 0.469 af
Outflow = 6.36 cfs @ 12.09 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.0 min
Primary = 1.07 cfs @ 11.67 hrs, Volume= 0.213 af
Routed to Pond 307 : USF A (740s)
Secondary = 6.14 cfs @ 12.09 hrs, Volume= 0.256 af
Routed to Pond 307P : Pipe 21-23

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 71.85' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Secondary	71.25'	**4.0' long Weir Plate** Cv= 2.62 (C= 3.28)
#2	Primary	69.21'	**8.00" Round WQ Trunk Line** L= 11.3' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 69.21' / 69.10' S= 0.0097 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Primary OutFlow Max=1.07 cfs @ 11.67 hrs HW=71.25' TW=70.84' (Dynamic Tailwater)
↑—**2=WQ Trunk Line** (Inlet Controls 1.07 cfs @ 3.06 fps)

Secondary OutFlow Max=6.14 cfs @ 12.09 hrs HW=71.85' TW=67.63' (Dynamic Tailwater)
↑—**1=Weir Plate** (Weir Controls 6.14 cfs @ 2.54 fps)

Summary for Pond 307: USF A (740s)

Inflow Area = 0.832 ac, 76.07% Impervious, Inflow Depth = 3.08" for 100-Year event
Inflow = 1.07 cfs @ 11.67 hrs, Volume= 0.213 af
Outflow = 0.15 cfs @ 9.47 hrs, Volume= 0.213 af, Atten= 86%, Lag= 0.0 min
Primary = 0.15 cfs @ 9.47 hrs, Volume= 0.213 af
Routed to Pond 307P : Pipe 21-23

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 71.84' @ 12.10 hrs Surf.Area= 804 sf Storage= 1,901 cf

Plug-Flow detention time= 117.2 min calculated for 0.213 af (100% of inflow)
Center-of-Mass det. time= 117.2 min (954.1 - 837.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	68.50'	625 cf	**20.50'W x 39.22'L x 3.50'H Field A** -Impervious 2,814 cf Overall - 919 cf Embedded = 1,895 cf x 33.0% Voids
#2A	69.00'	919 cf	**ADS_StormTech SC-740 +Cap** x 20 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 20 Chambers in 4 Rows
#3	67.00'	398 cf	**18" Sand (Prismatic)** Listed below (Recalc) 1,206 cf Overall x 33.0% Voids
		1,942 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.00	804	0	0
68.50	804	1,206	1,206

Device	Routing	Invert	Outlet Devices
#1	Device 2	67.00'	**8.270 in/hr Sand Filtration to Subdrain over Surface area** Phase-In= 0.01'
#2	Primary	66.25'	**6.00" Round Culvert** L= 23.6' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.25' / 66.13' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Primary OutFlow Max=0.15 cfs @ 9.47 hrs HW=67.05' TW=66.32' (Dynamic Tailwater)
↑—**2=Culvert** (Passes 0.15 cfs of 0.58 cfs potential flow)
↑—**1=Sand Filtration to Subdrain** (Exfiltration Controls 0.15 cfs)

Summary for Pond 307P: Pipe 21-23

Inflow Area = 0.832 ac, 76.07% Impervious, Inflow Depth = 6.77" for 100-Year event
Inflow = 6.30 cfs @ 12.09 hrs, Volume= 0.469 af
Outflow = 6.30 cfs @ 12.09 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.0 min
Primary = 6.30 cfs @ 12.09 hrs, Volume= 0.469 af
Routed to Pond 308 : DMH-23

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 67.63' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	66.13'	**18.00" Round QP Trunk Line** L= 63.6' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.13' / 65.81' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=6.29 cfs @ 12.09 hrs HW=67.63' TW=66.51' (Dynamic Tailwater)
↑—**1=QP Trunk Line** (Barrel Controls 6.29 cfs @ 4.44 fps)

Summary for Pond 308: DMH-23

Inflow Area = 0.832 ac, 76.07% Impervious, Inflow Depth = 6.77" for 100-Year event
Inflow = 6.30 cfs @ 12.09 hrs, Volume= 0.469 af
Outflow = 6.30 cfs @ 12.09 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.0 min
Primary = 6.30 cfs @ 12.09 hrs, Volume= 0.469 af
Routed to Pond 318 : DMH-43

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 66.51' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	61.46'	**15.00" Round Culvert** L= 106.2' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.46' / 60.93' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=6.26 cfs @ 12.09 hrs HW=66.51' TW=65.05' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 6.26 cfs @ 5.10 fps)

Summary for Pond 310: Bypass (DMH-30)

Inflow Area = 0.626 ac, 84.26% Impervious, Inflow Depth = 7.37" for 100-Year event
Inflow = 5.07 cfs @ 12.08 hrs, Volume= 0.385 af
Outflow = 5.07 cfs @ 12.08 hrs, Volume= 0.385 af, Atten= 0%, Lag= 0.0 min
Primary = 1.02 cfs @ 11.70 hrs, Volume= 0.201 af
Routed to Pond 311 : USF C (740s)
Secondary = 4.41 cfs @ 12.09 hrs, Volume= 0.183 af
Routed to Pond 312 : DMH-32

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 68.09' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Device 2	67.40'	**4.0' long Weir Plate** Cv= 2.62 (C= 3.28)
#2	Secondary	66.46'	**15.00" Round QP Trunk Line** L= 9.9' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.46' / 66.36' S= 0.0101 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Primary	66.46'	**8.00" Round WQ Trunk Line** L= 17.2' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.46' / 66.10' S= 0.0209 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Primary OutFlow Max=1.01 cfs @ 11.70 hrs HW=67.40' TW=67.04' (Dynamic Tailwater)
↑**3=WQ Trunk Line** (Inlet Controls 1.01 cfs @ 2.91 fps)

Secondary OutFlow Max=4.42 cfs @ 12.09 hrs HW=68.09' TW=67.53' (Dynamic Tailwater)
↑**2=QP Trunk Line** (Inlet Controls 4.42 cfs @ 3.61 fps)
↑**1=Weir Plate** (Passes 4.42 cfs of 7.49 cfs potential flow)

Summary for Pond 311: USF C (740s)

Inflow Area = 0.626 ac, 84.26% Impervious, Inflow Depth = 3.86" for 100-Year event
Inflow = 1.02 cfs @ 11.70 hrs, Volume= 0.201 af
Outflow = 0.16 cfs @ 9.67 hrs, Volume= 0.201 af, Atten= 84%, Lag= 0.0 min
Primary = 0.16 cfs @ 9.67 hrs, Volume= 0.201 af
Routed to Pond 313 : DMH-33

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

Peak Elev= 68.02' @ 12.13 hrs Surf.Area= 842 sf Storage= 1,812 cf

Plug-Flow detention time= 82.8 min calculated for 0.201 af (100% of inflow)
Center-of-Mass det. time= 82.8 min (888.4 - 805.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	65.50'	793 cf	**15.75'W x 53.46'L x 3.50'H Field A** -Impervious 2,947 cf Overall - 965 cf Embedded = 1,982 cf x 40.0% Voids
#2A	66.00'	965 cf	**ADS_StormTech SC-740 +Cap** x 21 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 21 Chambers in 3 Rows
#3	64.00'	417 cf	**18" Sand (Prismatic)** Listed below (Recalc) 1,263 cf Overall x 33.0% Voids
		2,174 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.00	842	0	0
65.50	842	1,263	1,263

Device	Routing	Invert	Outlet Devices
#1	Device 2	64.00'	**8.270 in/hr Sand Filter to Subdrain over Surface area** Phase-In= 0.01'
#2	Primary	63.25'	**6.00" Round Subdrain** L= 7.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 63.25' / 63.21' S= 0.0053 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Primary OutFlow Max=0.16 cfs @ 9.67 hrs HW=64.05' TW=63.38' (Dynamic Tailwater)
↑└**2=Subdrain** (Passes 0.16 cfs of 0.65 cfs potential flow)
↑└**1=Sand Filter to Subdrain** (Exfiltration Controls 0.16 cfs)

Summary for Pond 312: DMH-32

Inflow = 4.41 cfs @ 12.09 hrs, Volume= 0.183 af
Outflow = 4.41 cfs @ 12.09 hrs, Volume= 0.183 af, Atten= 0%, Lag= 0.0 min
Primary = 4.41 cfs @ 12.09 hrs, Volume= 0.183 af
Routed to Pond 313 : DMH-33

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 67.53' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	66.36'	**15.00" Round Culvert** L= 74.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 66.36' / 65.61' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=4.40 cfs @ 12.09 hrs HW=67.53' TW=66.54' (Dynamic Tailwater)
1=Culvert (Inlet Controls 4.40 cfs @ 3.68 fps)

Summary for Pond 313: DMH-33

Inflow Area = 0.626 ac, 84.26% Impervious, Inflow Depth = 7.37" for 100-Year event
Inflow = 4.57 cfs @ 12.09 hrs, Volume= 0.385 af
Outflow = 4.57 cfs @ 12.09 hrs, Volume= 0.385 af, Atten= 0%, Lag= 0.0 min
Primary = 4.57 cfs @ 12.09 hrs, Volume= 0.385 af
Routed to Pond 317 : DMH-41

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 66.56' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	63.21'	**18.00" Round Culvert** L= 108.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 63.21' / 62.13' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=4.54 cfs @ 12.09 hrs HW=66.54' TW=66.21' (Dynamic Tailwater)
1=Culvert (Outlet Controls 4.54 cfs @ 2.57 fps)

Summary for Pond 315: Bypass (DMH-39)

Inflow Area = 1.071 ac, 88.13% Impervious, Inflow Depth = 7.62" for 100-Year event
Inflow = 8.82 cfs @ 12.08 hrs, Volume= 0.680 af
Outflow = 8.82 cfs @ 12.08 hrs, Volume= 0.680 af, Atten= 0%, Lag= 0.0 min
Primary = 1.42 cfs @ 11.64 hrs, Volume= 0.352 af
Routed to Pond 316 : USF-D (740s)
Secondary = 8.31 cfs @ 12.09 hrs, Volume= 0.328 af
Routed to Pond 317 : DMH-41

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 67.34' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Device 2	66.60'	**4.0' long Weir Plate** Cv= 2.62 (C= 3.28)
#2	Secondary	64.75'	**24.00" Round QP Trunk Line** L= 13.3' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.75' / 64.62' S= 0.0098 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#3	Primary	64.75'	**8.00" Round WQ Trunk Line** L= 12.4' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.75' / 64.60' S= 0.0121 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Primary OutFlow Max=1.41 cfs @ 11.64 hrs HW=66.61' TW=65.91' (Dynamic Tailwater)
└**3=WQ Trunk Line** (Inlet Controls 1.41 cfs @ 4.04 fps)

Secondary OutFlow Max=8.31 cfs @ 12.09 hrs HW=67.34' TW=66.20' (Dynamic Tailwater)
└**2=QP Trunk Line** (Passes 8.31 cfs of 16.10 cfs potential flow)
└**1=Weir Plate** (Weir Controls 8.31 cfs @ 2.81 fps)

Summary for Pond 316: USF-D (740s)

Inflow Area = 1.071 ac, 88.13% Impervious, Inflow Depth = 3.94" for 100-Year event
Inflow = 1.42 cfs @ 11.64 hrs, Volume= 0.352 af
Outflow = 0.26 cfs @ 9.28 hrs, Volume= 0.352 af, Atten= 82%, Lag= 0.0 min
Primary = 0.26 cfs @ 9.28 hrs, Volume= 0.352 af
Routed to Pond 317 : DMH-41

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 67.28' @ 12.12 hrs Surf.Area= 1,350 sf Storage= 3,208 cf

Plug-Flow detention time= 101.5 min calculated for 0.352 af (100% of inflow)
Center-of-Mass det. time= 101.5 min (895.0 - 793.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	64.00'	1,028 cf	**25.25'W x 53.46'L x 3.50'H Field A** -Impervious 4,724 cf Overall - 1,608 cf Embedded = 3,116 cf x 33.0% Voids
#2A	64.50'	1,608 cf	**ADS_StormTech SC-740 +Cap** x 35 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 35 Chambers in 5 Rows
#3	62.50'	668 cf	**18" Sand (Prismatic)** Listed below (Recalc) 2,025 cf Overall x 33.0% Voids
		3,305 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.50	1,350	0	0
64.00	1,350	2,025	2,025

Device	Routing	Invert	Outlet Devices
#1	Device 2	62.50'	**8.270 in/hr Sand Filtration to Subdrain over Surface area from 61.72' - 63.22'** Excluded Surface area = 0 sf Phase-In= 0.01'
#2	Primary	61.75'	**6.00" Round Culvert** L= 29.3' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.75' / 61.60' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Primary OutFlow Max=0.26 cfs @ 9.28 hrs HW=62.55' TW=61.86' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.26 cfs of 0.57 cfs potential flow)
└**1=Sand Filtration to Subdrain** (Exfiltration Controls 0.26 cfs)

Summary for Pond 317: DMH-41

Inflow Area = 1.697 ac, 86.70% Impervious, Inflow Depth = 7.53" for 100-Year event
Inflow = 13.14 cfs @ 12.09 hrs, Volume= 1.065 af
Outflow = 13.14 cfs @ 12.09 hrs, Volume= 1.065 af, Atten= 0%, Lag= 0.0 min
Primary = 13.14 cfs @ 12.09 hrs, Volume= 1.065 af
Routed to Pond 318 : DMH-43

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 66.23' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Device 2	61.60'	**24.00" Round Culvert** L= 27.2' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.60' / 61.33' S= 0.0099 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Primary	61.33'	**24.00" Round Culvert** L= 273.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.33' / 59.97' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=13.01 cfs @ 12.09 hrs HW=66.22' TW=65.05' (Dynamic Tailwater)
↑**2=Culvert** (Outlet Controls 13.01 cfs @ 4.14 fps)
↑**1=Culvert** (Passes 13.01 cfs of 16.38 cfs potential flow)

Summary for Pond 318: DMH-43

Inflow Area = 2.529 ac, 83.20% Impervious, Inflow Depth = 7.28" for 100-Year event
Inflow = 19.43 cfs @ 12.09 hrs, Volume= 1.534 af
Outflow = 19.43 cfs @ 12.09 hrs, Volume= 1.534 af, Atten= 0%, Lag= 0.0 min
Primary = 19.43 cfs @ 12.09 hrs, Volume= 1.534 af
Routed to Pond 323 : DMH-44

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 65.05' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	59.97'	**24.00" Round Culvert** L= 39.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 59.97' / 59.77' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=19.34 cfs @ 12.09 hrs HW=65.05' TW=63.41' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 19.34 cfs @ 6.16 fps)

Summary for Pond 321: Bypass (DMH-49)

Inflow Area = 1.319 ac, 91.04% Impervious, Inflow Depth = 7.85" for 100-Year event
Inflow = 10.89 cfs @ 12.08 hrs, Volume= 0.862 af
Outflow = 10.89 cfs @ 12.08 hrs, Volume= 0.862 af, Atten= 0%, Lag= 0.0 min
Primary = 1.23 cfs @ 11.55 hrs, Volume= 0.433 af
Routed to Pond 322 : USF-E (740s)
Secondary = 10.28 cfs @ 12.09 hrs, Volume= 0.429 af
Routed to Pond 324 : DMH-51

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 67.55' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Device 2	66.70'	**4.0' long Weir Plate** Cv= 2.62 (C= 3.28)
#2	Secondary	64.72'	**18.00" Round QP Trunk Line** L= 18.3' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.72' / 64.54' S= 0.0098 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#3	Primary	64.72'	**8.00" Round WQ Trunk Line** L= 14.2' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 64.72' / 64.60' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Primary OutFlow Max=1.23 cfs @ 11.55 hrs HW=66.70' TW=66.16' (Dynamic Tailwater)
└**3=WQ Trunk Line** (Inlet Controls 1.23 cfs @ 3.52 fps)

Secondary OutFlow Max=10.26 cfs @ 12.09 hrs HW=67.55' TW=61.71' (Dynamic Tailwater)
└**2=QP Trunk Line** (Passes 10.26 cfs of 12.27 cfs potential flow)
└**1=Weir Plate** (Weir Controls 10.26 cfs @ 3.02 fps)

Summary for Pond 322: USF-E (740s)

Inflow Area = 1.319 ac, 91.04% Impervious, Inflow Depth = 3.94" for 100-Year event
Inflow = 1.23 cfs @ 11.55 hrs, Volume= 0.433 af
Outflow = 0.29 cfs @ 8.91 hrs, Volume= 0.433 af, Atten= 76%, Lag= 0.0 min
Primary = 0.29 cfs @ 8.91 hrs, Volume= 0.433 af
Routed to Pond 323 : DMH-44

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 67.47' @ 12.13 hrs Surf.Area= 1,530 sf Storage= 3,739 cf

Plug-Flow detention time= 103.8 min calculated for 0.433 af (100% of inflow)
Center-of-Mass det. time= 103.8 min (873.7 - 769.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	64.00'	1,160 cf	**25.25'W x 60.58'L x 3.50'H Field A** -Impervious 5,353 cf Overall - 1,838 cf Embedded = 3,516 cf x 33.0% Voids
#2A	64.50'	1,838 cf	**ADS_StormTech SC-740 +Cap** x 40 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 5 Rows
#3	62.50'	757 cf	**18" Sand (Prismatic)** Listed below (Recalc) 2,295 cf Overall x 33.0% Voids
		3,755 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.50	1,530	0	0
64.00	1,530	2,295	2,295

Device	Routing	Invert	Outlet Devices
#1	Device 2	62.50'	**8.270 in/hr Sand Filtration to Subdrain over Surface area** Phase-In= 0.01'
#2	Primary	61.75'	**6.00" Round Culvert** L= 15.6' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 61.75' / 61.67' S= 0.0051 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Primary OutFlow Max=0.29 cfs @ 8.91 hrs HW=62.55' TW=60.18' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.29 cfs of 0.61 cfs potential flow)
└**1=Sand Filtration to Subdrain** (Exfiltration Controls 0.29 cfs)

Summary for Pond 323: DMH-44

Inflow Area = 3.848 ac, 85.89% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 19.72 cfs @ 12.09 hrs, Volume= 1.967 af
Outflow = 19.72 cfs @ 12.09 hrs, Volume= 1.967 af, Atten= 0%, Lag= 0.0 min
Primary = 19.72 cfs @ 12.09 hrs, Volume= 1.967 af
Routed to Pond 324 : DMH-51

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 63.42' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	59.77'	**24.00" Round Culvert** L= 83.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 59.77' / 59.35' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=19.75 cfs @ 12.09 hrs HW=63.41' TW=61.71' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 19.75 cfs @ 6.29 fps)

Summary for Pond 324: DMH-51

Inflow Area = 3.848 ac, 85.89% Impervious, Inflow Depth = 7.47" for 100-Year event
Inflow = 30.00 cfs @ 12.09 hrs, Volume= 2.396 af
Outflow = 30.00 cfs @ 12.09 hrs, Volume= 2.396 af, Atten= 0%, Lag= 0.0 min
Primary = 30.00 cfs @ 12.09 hrs, Volume= 2.396 af
Routed to Pond 325 : DMH-53

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 61.71' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Device 2	58.85'	**30.00" Round Culvert** L= 85.3' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 58.85' / 56.30' S= 0.0299 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Primary	56.30'	**30.00" Round Culvert** L= 24.1' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 56.30' / 55.57' S= 0.0303 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf

Primary OutFlow Max=29.97 cfs @ 12.09 hrs HW=61.71' TW=59.37' (Dynamic Tailwater)
2=Culvert (Passes 29.97 cfs of 36.11 cfs potential flow)
1=Culvert (Inlet Controls 29.97 cfs @ 6.11 fps)

Summary for Pond 325: DMH-53

Inflow Area = 3.848 ac, 85.89% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 37.81 cfs @ 12.09 hrs, Volume= 2.610 af
Outflow = 37.81 cfs @ 12.09 hrs, Volume= 2.610 af, Atten= 0%, Lag= 0.0 min
Primary = 37.81 cfs @ 12.09 hrs, Volume= 2.610 af
Routed to Pond 327 : Infiltration Pond E

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 59.38' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	55.57'	**30.00" Round Culvert** L= 60.9' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 55.57' / 52.00' S= 0.0586 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf

Primary OutFlow Max=37.76 cfs @ 12.09 hrs HW=59.37' TW=53.49' (Dynamic Tailwater)
1=Culvert (Inlet Controls 37.76 cfs @ 7.69 fps)

Summary for Pond 327: Infiltration Pond E

Inflow Area = 5.813 ac, 75.14% Impervious, Inflow Depth = 6.70" for 100-Year event
Inflow = 40.66 cfs @ 12.09 hrs, Volume= 3.244 af
Outflow = 7.85 cfs @ 12.54 hrs, Volume= 3.244 af, Atten= 81%, Lag= 27.2 min
Discarded = 7.85 cfs @ 12.54 hrs, Volume= 3.244 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP-3 : DP-3 Abandoned Rail Corridor

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 54.95' @ 12.54 hrs Surf.Area= 14,453 sf Storage= 36,462 cf

Plug-Flow detention time= 27.9 min calculated for 3.243 af (100% of inflow)
Center-of-Mass det. time= 27.9 min (840.7 - 812.8)

Volume	Invert	Avail.Storage	Storage Description
#1	52.00'	52,408 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
52.00	10,260	0	0
56.00	15,944	52,408	52,408

Device	Routing	Invert	Outlet Devices
#1	Discarded	52.00'	**23.450 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	55.00'	**20.0' long x 10.0' breadth Emergency Spillway** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=7.85 cfs @ 12.54 hrs HW=54.95' (Free Discharge)
1=Exfiltration (Exfiltration Controls 7.85 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=52.00' TW=0.00' (Dynamic Tailwater)
2=Emergency Spillway (Controls 0.00 cfs)

Watershed Maps


N
LEGEND
WOODS - A SOILS
WOODS - B SOILS
WOODS - C SOILS
WOODS - D SOILS
GRASS - A SOILS
GRASS - B SOILS
GRASS - C SOILS
GRASS - D SOILS
GRAVEL - A SOILS
GRAVEL - B SOILS
GRAVEL - C SOILS
GRAVEL - D SOILS
IMPERVIOUS
BRUSH - A SOILS
BRUSH - B SOILS
BRUSH - C SOILS
BRUSH - D SOILS
WATER
LEGEND
TC LINE WITH ELEVATIONS
37.5
A
32.5
B
SUBCATCHMENT AREA
SOIL BOUNDARY
REACH
SUBCATCHMENT
10
DRAINAGE POND/BIO RETENTION/SAND FILTER/INFILTRATING SWALE
10
DRAINAGE STRUCTURE/POND WITH INSIGNIFICANT STORAGE
10
REACH/SWALE
10
DESIGN POINT
10
DP-2
DP-3
DL-1
31
21
11
SCALE: 1"=40'
0
20'
40'
80'
PRE-DEVELOPMENT WATERSHED MAP
777 CRANSTON STREET
DiPrete Engineering
Two Stafford Court Cranston, RI 02920
tel 401-943-1000 fax 401-464-6006 www.diprete-eng.com
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POST-DEVELOPMENT WATERSHED MAP

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