PROJECT NARRATIVE AND STORMWATER ANALYSIS

18 Boyd Drive

Newburyport, MA
May 22, 2017
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Submitted to:
Newburyport Planning Board & Conservation Commission
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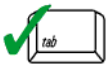
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

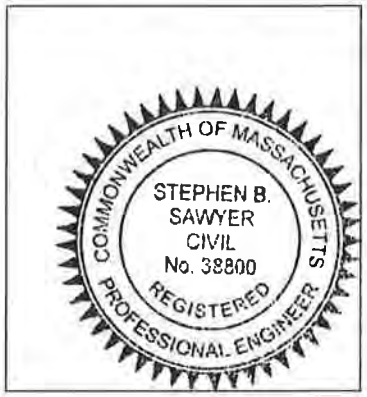
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Signature and Date MAR 22, 2017

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☒ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

2. Project Overview

Introduction

The project proposes a Definitive Plan pursuant to the approval of the Open Space Residential Design (OSRD) Special Permit which authorized a OSRD consisting of thirty-eight (38) lots on approximately thirty-six acres, (36.84 +/- acres) (the "Property"). The Property is located off of Boyd Drive and Brown Avenue and is currently operated as a golf course. The Brown Avenue lot is currently a single-family home. The Property lies within the R-1 and R-2 zoning district as well as the Water Resource Protection Overlay District ("WRPD") and is a Zone II designation for that purpose. The portion of the Property on which homes and roadways would be constructed includes 13.36 +/- acres and the remaining 22.816 +/- acres will be preserved for conservation and recreational uses – open to the public but owned and maintained by the home-owner's association

Existing Conditions

The existing site is comprised of City of Newburyport Assessors tax map, Map 110 Parcel 20 for 18 Boyd Drive and Map 111 Parcel 13 for the 5 Brown Avenue parcel. The majority of the existing land proposed for development was originally used as a gravel pit creating a low flat area with relatively steep slopes surrounding the lot area. It is currently utilized as a 9 hole golf course. After advancing 13 deep hole tests and 8 test holes for the hydrological study it has been determined that there is a loam surface with underlying soils consisting of well drained sands and gravels.

This low area is classified as Isolated Land Subject to Flooding. Additionally, one of the low areas has been delineated is isolated wetland under the local Newburyport Wetland Regulations. The Conservation Commission issued an Order of Resource Area Delineation(ORAD) confirming the isolated wetland area and a peak ILSF flood elevation of 55.60 based upon 7 inches of rain per the MA DEP regulations. The drainage system from Boyd Drive currently discharges untreated stormwater onto the property.

Project Description

The proposed redevelopment will consist of 38 new homes and approximately 3,100 linear feet of new roads. Consistent with section XIV of the Newburyport Zoning Ordinance ("OSRD") the proposed development maximizes the amount of preserved open space and protects local resources while not impacting the number of units permitted by a conventional plan. The Proposed Development has received an OSRD Special Permit and is therefore in conformance with the OSRD zoning requirements.

Specifically, the land within the project site resides within the R1 zoning district with lot areas of 20,000 square feet and minimum lot frontage of 125 feet. As provided in the OSRD approval the development provides 10,000 square foot minimum lots with at least 50% minimum setbacks as is required in the underlying district – All front yard setbacks are a minimum of 15 feet and side yards are a minimum of 10 feet as required.

Further, as required in the OSRD, at least 60% of the total lot area is Open Space and will include a restriction assuring the open space in perpetuity. The Open Space is specifically designed to be maintained for wildlife habitat, conservation, outdoor education, passive and active recreation. The Open Space is programed as shown on the site plans and includes the requisite long term operation and maintenance plan.

The project proposes to improve the Boyd Drive drainage outfall to current DEP treatment standards for a Zone II watershed. This will be accomplished by constructing a new Constructed Stormwater Wetland. Five biorention areas or rain gardens will provide water quality treatment for the new development. The 22.8 Acres of open space including the expanded and improved Isolated Wetland and a new expansive pollinator meadow. This will provide new wildlife habitat and new diverse natural plant species replacing much of the current golf fairways and greens. This change in land use from the current golf course fairway and greens to a naturally vegetated open space area provides a substantial benefit in regards to the Zone II watershed quality.

Utilities

The new building is proposed to be serviced with new water, sewer, gas services, electric and communications conduits from Boyd Drive and Brown Avenue. Public and private utilities are all available along the property frontage. The project will replace the existing sewerage pump station at the bottom of Boyd Drive.

3. Stormwater Management

Introduction

The project is located within a Zone II wellhead protection area. This will require added water quality treatment measures including a 1" water quality volume for all paved areas. Currently the Boyd Drive drainage system discharges onto the property and does not meet the current DEP design standards. Included in this project, the stormwater treatment for Boyd Drive will be brought up to Current DEP treatment standards. The project proposes for the Boyd Drive stormwater flow be directed to a new Constructed Stormwater Wetland designed in accordance with the Massachusetts Stormwater Handbook published by the Massachusetts Department of Environmental Protection (DEP). The new subdivision will utilize Low Impact Design techniques designed in accordance with the Massachusetts Stormwater Handbook with the development divided up into five smaller drainage areas where the stormwater will be directed to Bioretention areas for final treatment prior to discharging to the improved isolated wetland area. These systems will be landscaped and visually appealing. These systems will be maintained by the new homeowners association with no maintenance responsibility to the Newburyport Department of Public Services. Pre-treatment is provided with deep sump catch basins followed by hydrodynamic separation prior to the stormwater flowing into the Bioretention areas. Additionally, a detailed study was completed during the OSRD permit process to determine the impact of the new subdivision on the Newburyport Well located over 700' from the proposed development.

Consistency with the DEP Stormwater Management Policy

The project is a new development and therefore must meet all ten of the Stormwater Management Standards. Each of the standards of the DEP Stormwater Handbook and how the project meets or exceeds them is discussed below.

Standard 1 – Untreated Stormwater

Standard 1 states that "*No new stormwater conveyances (e.g. outfalls) will discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth*."

The proposed drainage system does not include new conveyances that discharge directly without pre-treatment. Several BMP's are proposed to treat stormwater and to prevent any erosion to the surrounding Resource Areas. Since no new conveyances will directly discharge untreated stormwater, the project meets this standard. The project proposes to bring the off-site Boyd Drive drainage system into compliance with DEP Stormwater Standards

Standard 2 – Post Development Peak Discharge Rates

Standard 2 states that "*Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates*."

The site was analyzed under both the existing and proposed conditions to compare the pre and post development peak discharge rates at two design points leaving the property. The analysis divides the site into several subcatchments that discharge at the borders of the site. The discharge points were analyzed to ensure that there is no impact on abutting properties as a result of the project. Most of the runoff remains on the property area designated as Isolated Land Subject to Flooding (ILSF). This area is analyzed to confirm the proposed ILSF elevation on the property with the new development. A detailed description of both the existing and proposed conditions hydrology is described below. A copy of the HydroCAD printouts for the ILSF calculation, existing and proposed conditions is included in Appendix B.

Existing Conditions Hydrology

The majority of the site runoff is directed to a large Isolated Land Subject to Flooding area on the property. There are two small portions of the property that flow off site, one area is directed to Brown Avenue and the other onto Boyd Drive. These design points have been analyzed for Standard 2 compliance. The main drainage area does not require compliance to Standard 2 where no runoff leaves the property. Alternately this drainage area had been evaluated as Isolated Land Subject to Flooding to determine the new 100 year flood elevation and confirm it has no negative impact to the proposed development. This analysis is provided below under Standard 2.

Proposed Conditions Hydrology

Proposed Subcatchment PR 2: This subcatchment located northern side of the property, it consists of a new access road and landscaped areas. The new catch basins here divert stormwater runoff back to the ILSF area on the property reducing the flow off property at this location.

Proposed Subcatchment PR 3: This subcatchment located on the eastern side directing water onto Boyd Drive consists new access drive, 3 new homes, driveways and new landscaped lawn areas. This area eventually flows back onto the property and into the ILSF area.

Summary

The project does not increase flow rate for 2, 10 & 100 year design storm off the property. The calculations are based upon the rainfall rates in the City of Newburyport Drainage regulations. A summary of the pre and post development discharge rates is shown on Table 1 below.

Table 2: Existing and Proposed Peak Discharge Rate Comparison at Design Points

DESIGN POINT 2 & 3 – To Brown Ave., & Boyd Drive Offsite

	2 Year Storm - (3.10 in)		10 Year Storm - (4.70 in)		100 Year Storm - (8.30 in)	
Design Point	Existing (cfs)	Proposed (cfs)	Existing (cfs)	Proposed (cfs)	Existing (cfs)	Proposed (cfs)
2 Brown Ave.	0.17	0.03	0.26	0.05	0.71	0.15
3 Boyd Dr	2.07	1.16	3.16	1.77	5.80	4.24

Since the proposed project is designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates, the project is in compliance with Standard 2.

Design Point 1 – Isolated Land Subject to Flooding.

This low area is classified as Isolated Land Subject to Flooding meaning the water ponds at the bottom low areas during large storm events. Additionally, one of the low areas has been delineated is isolated wetland under the local Newburyport Wetland Regulations. The Conservation Commission issued an Order of Resource Area Delineation(ORAD) confirming a the isolated wetland area and a peak ILSF flood elevation of 55.60 based upon 7 inches of rain per the MA DEP regulations. The project proposes to improve the Isolated Wetland area by expanding the area and excavating the bottom down to interface with the spring high ground water elevation of 52 as determined by numerous observations taken this April and May in the observation wells installed throughout the property. The ILSF calculations do not take credit for any volume below elevation 52.0 due to estimated seasonal high groundwater elevation as determined by averaging numerous test pits completed within and adjacent to the ILSF area. With the improved Isolated Wetland area and New Constructed Stormwater Wetland, the proposed ILSF flood elevation is lowered to elevation 55.25. This lower elevation accounts for the increased impervious surface with the proposed development and using 8.3 inches of rainfall, the 100 year rainfall amount from the Newburyport Wetland Regulations verses the 7 inch rainfall depth as defined the DEP regulations and used in the existing ORAD for the property. The ILSF elevation based upon using the DEP requirement of 7" rainfall event is lowered to elevation 54.70.

Numerous groundwater observation wells have been installed on the property with wells #'s 2, 3 & 6 located with the areas of the improved Isolated Wetland and Constructed Stormwater Wetland. The peak readings this spring ranged from elevation 51.1 in well no 2 in the northwest corner of the site to 49.6 adjacent to the Isolated Wetlands. These reading were taken on or before May 19th prior to any pumping of groundwater by City Well #2, the golf course irrigation system, or the city pump testing program. Based

on these reading the Isolated Wetland and Constructed Stormwater Wetland will be excavated down to between elevations 50.25 to 51.25 providing high and low marsh zones in these features. However, for our ILSF calculation volume we have not taken credit for storage volume below elevation 52.0. This takes into account potential for any standing groundwater during seasonal high periods as determined by the test pit evaluations.

Please refer to Appendix B for the proposed ILSF hydoCAD hydrology model for the proposed conditions using the City's 8.3" 100 year rainfall depth versus the 7" rainfall as standardly used for this calculation per Massachusetts DEP regulations. Refer to Appendix D for the drainage areas contributing to this ILSF areas and location of the ILSF areas. This calculation rendered a required volume of 617,774 cubic feet for storage. Based upon the proposed grading plan, the peak ILSF elevation is 55.25. This only takes credit for the volume above elevation 52.0. This volume is calculated by a Gird volume analysis using Carlson Software with the proposed site grading. The report summary is provided on the Proposed ILSF Drainage Plan in Appendix D. The project proposes the lowest new home basement elevation at 57.50. This gives 2.25 feet of freeboard above the potential ILSF elevation.

The city completed a well pump test on the property pumping 200 gpm for 72 hours. This operation pumped a total of 864,000 gallons or 115,508 cubic feet water that was discharged into the Isolated Vegetated Wetland. During this pump test the water never accumulated more than 12" of depth within an area of 28,430 square feet. Approximately 95,000 cubic feet of the pumped water was infiltrated over a 72 hour period covering the 28,430 square feet. Based on this data the infiltration rate within the Isolated Vegetated Wetland is 0.56" per hour. Using this infiltration rate, the time projected for the ILSf area to drain from an elevation of 54.70 down to elevation 52.0 is approximately 58 hours. This does not take into account the infiltration rate in the proposed meadow area should be double the rate of the IVW area. Based on a Rawl's table, an infiltration rate of 1.02 inches per hour should applied over the meadow area given the proposed sandy loam soils. Using the 0.56" calculated from the pump test gives a conservative estimate of time for the ILSF area to drain.

Standard 3 – Recharge to Groundwater

Standard 3 states that "*Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This condition is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook*."

The volume of the recharge system was calculated according to the Massachusetts Stormwater Handbook. The proposed site design increases impervious area by 141,262 square feet. For this calculation, all impervious areas will be counted as being on Hydrologic Group A soils having a volume requirement of 0.60 inches multiplied by the new area of impervious cover. The additional impervious surfaces requires 7,063 cubic feet (0.6" x 141,262 cubic feet)

The project proposes five biorentention areas with a minimum sump depth of 8 inches. The bottom of these areas are greater than 2 feet above seasonal high groundwater so can be utilized for groundwater recharge. The sumps of the five bioretention areas provides 11,076 cubic feet of recharge satisfying the groundwater recharge standard.

Basin “B” – 2,104 cubic feet / Basin “C” – 1,780 cubic feet / Basin “D” – 2,938 cubic feet
Basin “E” – 1,388 cubic feet / Basin “E” – 2,866 cubic feet

See the stage storage volume tables for the five basins.

Additionally, drip edge infiltration trenches will be provided for infiltration of roof runoff. A minimum of 50 linear feet, 18” x 18” stone trench will be provided for each home. With 38 homes, this will provide an additional 1,410 cubic feet of recharge.

Volume Calculation: (1.5’x1.5’x 50’x 38 homes x 0.33) = 1,410 Cubic Feet.

Along the on the northern side of the property (4) 500 gallon drywells have been provided to prevent potential ponding. Each drywells and stone will provide 138 cubic feet of volume with another 552 cubic feet.

TOTAL RECHARGE VOLLUME = 13,038 CUBIC FEET

Drawdown Calculation: 8” depth drains at 0.52” per hour ; 8”/0.52’per hr= 15.4 hours

Stage-Area-Storage for Pond B: POND B BR

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
55.55	2,765	0	56.08	3,130	1,563
55.56	2,772	28	56.09	3,137	1,594
55.57	2,779	55	56.10	3,143	1,625
55.58	2,786	83	56.11	3,150	1,657
55.59	2,793	111	56.12	3,157	1,688
55.60	2,800	139	56.13	3,163	1,720
55.61	2,807	167	56.14	3,170	1,752
55.62	2,814	195	56.15	3,177	1,783
55.63	2,820	223	56.16	3,183	1,815
55.64	2,827	252	56.17	3,190	1,847
55.65	2,834	280	56.18	3,197	1,879
55.66	2,841	308	56.19	3,203	1,911
55.67	2,848	337	56.20	3,210	1,943
55.68	2,855	365	56.21	3,217	1,975
55.69	2,862	394	56.22	3,223	2,007
55.70	2,869	423	56.23	3,230	2,040
55.71	2,876	451	56.24	3,237	2,072
55.72	2,883	480	56.25	3,243	2,104
55.73	2,890	509	56.26	3,250	2,137
55.74	2,897	538	56.27	3,257	2,169
55.75	2,904	567	56.28	3,263	2,202
55.76	2,911	596	56.29	3,270	2,235
55.77	2,918	625	56.30	3,276	2,267
55.78	2,924	654	56.31	3,283	2,300
55.79	2,931	684	56.32	3,290	2,333
55.80	2,938	713	56.33	3,296	2,366
55.81	2,945	742	56.34	3,303	2,399
55.82	2,952	772	56.35	3,310	2,432
55.83	2,959	801	56.36	3,316	2,465
55.84	2,966	831	56.37	3,323	2,498
55.85	2,973	861	56.38	3,330	2,532
55.86	2,980	890	56.39	3,336	2,565
55.87	2,987	920	56.40	3,343	2,598
55.88	2,994	950	56.41	3,350	2,632
55.89	3,001	980	56.42	3,356	2,665
55.90	3,008	1,010	56.43	3,363	2,699
55.91	3,015	1,040	56.44	3,370	2,733
55.92	3,022	1,071	56.45	3,376	2,766
55.93	3,028	1,101	56.46	3,383	2,800
55.94	3,035	1,131	56.47	3,390	2,834
55.95	3,042	1,161	56.48	3,396	2,868
55.96	3,049	1,192	56.49	3,403	2,902
55.97	3,056	1,222	56.50	3,410	2,936
55.98	3,063	1,253	56.51	3,416	2,970
55.99	3,070	1,284	56.52	3,423	3,004
56.00	3,077	1,314	56.53	3,429	3,039
56.01	3,084	1,345	56.54	3,436	3,073
56.02	3,090	1,376	56.55	3,443	3,107
56.03	3,097	1,407	56.56	3,449	3,142
56.04	3,104	1,438	56.57	3,456	3,176
56.05	3,110	1,469	56.58	3,463	3,211
56.06	3,117	1,500	56.59	3,469	3,246
56.07	3,124	1,531	56.60	3,476	3,280

Stage-Area-Storage for Pond C: POND C BR

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
55.50	2,273	0	56.03	2,677	1,309
55.51	2,280	23	56.04	2,687	1,336
55.52	2,288	46	56.05	2,698	1,363
55.53	2,295	69	56.06	2,709	1,390
55.54	2,303	92	56.07	2,719	1,417
55.55	2,310	115	56.08	2,730	1,444
55.56	2,318	138	56.09	2,740	1,472
55.57	2,325	161	56.10	2,751	1,499
55.58	2,333	184	56.11	2,762	1,527
55.59	2,340	208	56.12	2,772	1,555
55.60	2,347	231	56.13	2,783	1,582
55.61	2,355	255	56.14	2,793	1,610
55.62	2,362	278	56.15	2,804	1,638
55.63	2,370	302	56.16	2,815	1,666
55.64	2,377	326	56.17	2,825	1,694
55.65	2,385	349	56.18	2,836	1,723
55.66	2,392	373	56.19	2,846	1,751
55.67	2,399	397	56.20	2,857	1,780
55.68	2,407	421	56.21	2,868	1,808
55.69	2,414	445	56.22	2,878	1,837
55.70	2,422	469	56.23	2,889	1,866
55.71	2,429	494	56.24	2,899	1,895
55.72	2,437	518	56.25	2,910	1,924
55.73	2,444	542	56.26	2,921	1,953
55.74	2,452	567	56.27	2,931	1,982
55.75	2,459	592	56.28	2,942	2,012
55.76	2,466	616	56.29	2,952	2,041
55.77	2,474	641	56.30	2,963	2,071
55.78	2,481	666	56.31	2,974	2,100
55.79	2,489	690	56.32	2,984	2,130
55.80	2,496	715	56.33	2,995	2,160
55.81	2,504	740	56.34	3,005	2,190
55.82	2,511	765	56.35	3,016	2,220
55.83	2,519	791	56.36	3,027	2,250
55.84	2,526	816	56.37	3,037	2,281
55.85	2,533	841	56.38	3,048	2,311
55.86	2,541	866	56.39	3,058	2,342
55.87	2,548	892	56.40	3,069	2,372
55.88	2,556	917	56.41	3,080	2,403
55.89	2,563	943	56.42	3,090	2,434
55.90	2,571	969	56.43	3,101	2,465
55.91	2,578	994	56.44	3,111	2,496
55.92	2,585	1,020	56.45	3,122	2,527
55.93	2,593	1,046	56.46	3,133	2,558
55.94	2,600	1,072	56.47	3,143	2,590
55.95	2,608	1,098	56.48	3,154	2,621
55.96	2,615	1,124	56.49	3,164	2,653
55.97	2,623	1,150	56.50	3,175	2,685
55.98	2,630	1,177	56.51	3,186	2,716
55.99	2,638	1,203	56.52	3,196	2,748
56.00	2,645	1,230	56.53	3,207	2,780
56.01	2,656	1,256	56.54	3,217	2,812
56.02	2,666	1,283	56.55	3,228	2,845

Stage-Area-Storage for Pond D: POND D BR

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
54.55	3,607	0	55.08	4,047	2,029
54.56	3,615	36	55.09	4,055	2,069
54.57	3,624	72	55.10	4,062	2,110
54.58	3,632	109	55.11	4,070	2,151
54.59	3,640	145	55.12	4,078	2,191
54.60	3,649	181	55.13	4,086	2,232
54.61	3,657	218	55.14	4,094	2,273
54.62	3,665	255	55.15	4,102	2,314
54.63	3,674	291	55.16	4,110	2,355
54.64	3,682	328	55.17	4,118	2,396
54.65	3,691	365	55.18	4,126	2,438
54.66	3,699	402	55.19	4,134	2,479
54.67	3,707	439	55.20	4,142	2,520
54.68	3,716	476	55.21	4,150	2,562
54.69	3,724	513	55.22	4,158	2,603
54.70	3,732	550	55.23	4,166	2,645
54.71	3,741	588	55.24	4,174	2,687
54.72	3,749	625	55.25	4,182	2,728
54.73	3,757	663	55.26	4,190	2,770
54.74	3,766	700	55.27	4,198	2,812
54.75	3,774	738	55.28	4,206	2,854
54.76	3,782	776	55.29	4,214	2,896
54.77	3,791	814	55.30	4,221	2,938
54.78	3,799	852	55.31	4,229	2,981
54.79	3,808	890	55.32	4,237	3,023
54.80	3,816	928	55.33	4,245	3,065
54.81	3,824	966	55.34	4,253	3,108
54.82	3,833	1,004	55.35	4,261	3,150
54.83	3,841	1,043	55.36	4,269	3,193
54.84	3,849	1,081	55.37	4,277	3,236
54.85	3,858	1,120	55.38	4,285	3,279
54.86	3,866	1,158	55.39	4,293	3,322
54.87	3,874	1,197	55.40	4,301	3,365
54.88	3,883	1,236	55.41	4,309	3,408
54.89	3,891	1,275	55.42	4,317	3,451
54.90	3,899	1,314	55.43	4,325	3,494
54.91	3,908	1,353	55.44	4,333	3,537
54.92	3,916	1,392	55.45	4,341	3,581
54.93	3,925	1,431	55.46	4,349	3,624
54.94	3,933	1,470	55.47	4,357	3,668
54.95	3,941	1,510	55.48	4,365	3,711
54.96	3,950	1,549	55.49	4,373	3,755
54.97	3,958	1,589	55.50	4,381	3,799
54.98	3,966	1,628	55.51	4,388	3,842
54.99	3,975	1,668	55.52	4,396	3,886
55.00	3,983	1,708	55.53	4,404	3,930
55.01	3,991	1,748	55.54	4,412	3,974
55.02	3,999	1,788	55.55	4,420	4,019
55.03	4,007	1,828	55.56	4,428	4,063
55.04	4,015	1,868	55.57	4,436	4,107
55.05	4,023	1,908	55.58	4,444	4,152
55.06	4,031	1,948	55.59	4,452	4,196
55.07	4,039	1,989	55.60	4,460	4,241

Stage-Area-Storage for Pond E: POND E BR

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
56.05	1,718	0
56.06	1,726	17
56.07	1,733	35
56.08	1,741	52
56.09	1,748	69
56.10	1,756	87
56.11	1,763	104
56.12	1,771	122
56.13	1,779	140
56.14	1,786	158
56.15	1,794	176
56.16	1,801	194
56.17	1,809	212
56.18	1,816	230
56.19	1,824	248
56.20	1,832	266
56.21	1,839	285
56.22	1,847	303
56.23	1,854	322
56.24	1,862	340
56.25	1,869	359
56.26	1,877	377
56.27	1,885	396
56.28	1,892	415
56.29	1,900	434
56.30	1,907	453
56.31	1,915	472
56.32	1,922	491
56.33	1,930	511
56.34	1,938	530
56.35	1,945	549
56.36	1,953	569
56.37	1,960	589
56.38	1,968	608
56.39	1,975	628
56.40	1,983	648
56.41	1,991	668
56.42	1,998	687
56.43	2,006	708
56.44	2,013	728
56.45	2,021	748
56.46	2,028	768
56.47	2,036	788
56.48	2,044	809
56.49	2,051	829
56.50	2,059	850
56.51	2,066	870
56.52	2,074	891
56.53	2,081	912
56.54	2,089	933
56.55	2,097	954
56.56	2,104	975
56.57	2,112	996
56.58	2,119	1,017
56.59	2,127	1,038
56.60	2,134	1,059
56.61	2,142	1,081
56.62	2,150	1,102
56.63	2,157	1,124
56.64	2,165	1,145
56.65	2,172	1,167
56.66	2,180	1,189
56.67	2,187	1,211
56.68	2,195	1,233
56.69	2,203	1,255
56.70	2,210	1,277
56.71	2,218	1,299
56.72	2,225	1,321
56.73	2,233	1,343
56.74	2,240	1,366
56.75	2,248	1,388
56.76	2,291	1,411
56.77	2,335	1,434
56.78	2,378	1,457
56.79	2,422	1,481
56.80	2,465	1,506
56.81	2,509	1,531
56.82	2,552	1,556
56.83	2,596	1,582
56.84	2,639	1,608
56.85	2,683	1,635
56.86	2,726	1,662
56.87	2,770	1,689
56.88	2,813	1,717
56.89	2,857	1,745
56.90	**2,900**	**1,774**

Stage-Area-Storage for Pond F: POND F BR

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
55.55	3,463	0
55.56	3,473	35
55.57	3,482	69
55.58	3,492	104
55.59	3,501	139
55.60	3,511	174
55.61	3,520	210
55.62	3,530	245
55.63	3,539	280
55.64	3,549	316
55.65	3,559	351
55.66	3,568	387
55.67	3,578	422
55.68	3,587	458
55.69	3,597	494
55.70	3,606	530
55.71	3,616	566
55.72	3,626	603
55.73	3,635	639
55.74	3,645	675
55.75	3,654	712
55.76	3,664	748
55.77	3,673	785
55.78	3,683	822
55.79	3,693	859
55.80	3,702	896
55.81	3,712	933
55.82	3,721	970
55.83	3,731	1,007
55.84	3,740	1,044
55.85	3,750	1,082
55.86	3,759	1,119
55.87	3,769	1,157
55.88	3,779	1,195
55.89	3,788	1,233
55.90	3,798	1,271
55.91	3,807	1,309
55.92	3,817	1,347
55.93	3,826	1,385
55.94	3,836	1,423
55.95	3,845	1,462
55.96	3,855	1,500
55.97	3,865	1,539
55.98	3,874	1,577
55.99	3,884	1,616
56.00	3,893	1,655
56.01	3,903	1,694
56.02	3,912	1,733
56.03	3,922	1,772
56.04	3,932	1,812
56.05	3,941	1,851
56.06	3,951	1,890
56.07	3,960	1,930
56.08	3,970	1,970
56.09	3,979	2,009
56.10	3,989	2,049
56.11	3,998	2,089
56.12	4,008	2,129
56.13	4,018	2,169
56.14	4,027	2,210
56.15	4,037	2,250
56.16	4,046	2,290
56.17	4,056	2,331
56.18	4,065	2,371
56.19	4,075	2,412
56.20	4,085	2,453
56.21	4,094	2,494
56.22	4,104	2,535
56.23	4,113	2,576
56.24	4,123	2,617
56.25	4,132	2,658
56.26	4,142	2,700
56.27	4,151	2,741
56.28	4,161	2,783
56.29	4,171	2,824
56.30	4,180	2,866
56.31	4,190	2,908
56.32	4,199	2,950
56.33	4,209	2,992
56.34	4,218	3,034
56.35	4,228	3,076
56.36	**4,228**	**3,076**
56.37	4,228	3,076
56.38	4,228	3,076
56.39	4,228	3,076
56.40	4,228	3,076
56.41	4,228	3,076
56.42	4,228	3,076
56.43	4,228	3,076

Standard 4 – Removal of 80% Total Suspended Solids (TSS)

Standard 4 states that "*Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when: (a) Suitable practices for source control and pollution prevention are identified in long-term pollution prevention plan, and thereafter implemented and maintained; (b) Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and (c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook*."

Removal of Total Suspended Solids (TSS) is proposed for the developed areas of the site. TSS removal is accomplished by the combination of the following structural and non-structural BMPs:

- Five Bio retention Areas and a Constructed Stormwater Wetland

Below is a summary of each discharge point analyzed and the provided stormwater treatment. The TSS Removal worksheets are also provided in the section.

Extended Detention Constructed Stormwater Wetland "A" – The runoff to this basin is passed a sediment forebay prior to entering the stormwater wetland. *85% TSS removal is provided for this drainage area. See the TSS removal Table below.* This area requires 1" water quality volume (WQV) over the new and existing impervious surfaces. The total paved and sidewalk impervious surfaces including (Off Site Drainage Area 3 - 90,953) + (Drainage Area 3A – 13,358) contributing to this basin is 104,311 sf with a required WQV of 8,693 cubic feet.

Basin #A provides 11,505 cubic feet of water quality volume. Refer to details provided in the drawings for a detailed breakdown of the water quality volumes. The required pretreatment is provided in the sediment forebay with 0.1" rendering a required volume of 869 cubic feet and 4,487 cubic feet is provided.

For the following five Bio retention areas pretreatment is provided for each. Deep sump catch basins provide 25% TSS removal followed by hydrodynamic separators providing another 25% TSS removal. This provides the required 44% TSS pretreatment requirement. See The TSS removal spreadsheet below for the treatment train for these five basins

Bio retention Area "B"– The runoff to this basin is passed thru a deep sump catch basin and particle separator providing pretreatment prior to entering the rain garden. *94% TSS removal is provided for this drainage area, see the TSS removal spreadsheet below.* This area requires 1" water quality volume (WQV) over the new impervious surfaces. The total paved impervious surface contributing to this basin (Drainage

Area 1B) is 20,740 sf with a required WQV of 1,728 cubic feet. Bio retention Area "B" provides 2,104 cubic feet of water quality volume in the 8" deep sump. See stage/storage table above.

Bio retention Area "C"– The runoff to this basin is passed thru a deep sump catch basin and particle separator providing pretreatment prior to entering the rain garden. *94% TSS removal is provided for this drainage area, see the TSS removal spreadsheet below.* This area requires 1" water quality volume (WQV) over the new impervious surfaces. The total paved impervious surface contributing to this basin (Drainage Area 1C) is 20,099 sf with a required WQV of 1,675 cubic feet. Bio retention Area "C" provides 1,780 cubic feet of water quality volume in the 8" deep sump. See stage/storage table above.

Bio retention Area "D"– The runoff to this basin is passed thru a deep sump catch basin and particle separator providing pretreatment prior to entering the rain garden. *94% TSS removal is provided for this drainage area, see the TSS removal spreadsheet below.* This area requires 1" water quality volume (WQV) over the new impervious surfaces. The total paved impervious surface contributing to this basin (Drainage Area 1B0 is 34,791 sf with a required WQV of 2,899 cubic feet. Bio retention Area "B" provides 2,938 cubic feet of water quality volume in the 8" deep sump. See stage/storage table above.

Bio retention Area "E"– The runoff to this basin is passed thru a deep sump catch basin and particle separator providing pretreatment prior to entering the rain garden. *94% TSS removal is provided for this drainage area, see the TSS removal spreadsheet below.* This area requires 1" water quality volume (WQV) over the new impervious surfaces. The total impervious surface contributing to this basin (Drainage Area 1E) is 12,988 sf with a required WQV of 1,082 cubic feet. Bio retention Area "B" provides 1,388 cubic feet of water quality volume in the 8" deep sump. See stage/storage table above.

Bio retention Area "F"– The runoff to this basin is passed thru a deep sump catch basin and particle separator providing pretreatment prior to entering the rain garden. *94% TSS removal is provided for this drainage area, see the TSS removal spreadsheet below.* This area requires 1" water quality volume (WQV) over the new paved impervious surfaces. The total impervious surface contributing to this basin (Drainage Area 1E) is 30,381 sf with a required WQV of 2,532 cubic feet. Bio retention Area "B" provides 2.866 cubic feet of water quality volume in the 8" deep sump. . See stage/storage table above.

See Appendix D for breakdown of the proposed subcatchment drainage areas.

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Constrcuted Stormwater Wetland - Basin "A"

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 0%	**0.00**	**1.00**	**0.00**	**1.00**
Sediment Forebay	**0.25**	**1.00**	**0.25**	**0.75**
Constructed Stormwater Wetland	**0.80**	**0.75**	**0.60**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**

Total TSS Removal = **85%**

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

Project: **Port Place Newburyport**

Prepared By: **S. Sawyer**

Date: **11/1/2017**

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

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

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Bio Retention Basins "B" - "F"

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 0%	**0.00**	**1.00**	**0.00**	**1.00**
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
** **Deep Sump and Hooded Catch Basin**	**0.25**	**0.75**	**0.19**	**0.56**
Bioretention Area	**0.90**	**0.56**	**0.51**	**0.06**
	0.00	**0.06**	**0.00**	**0.06**

** HYDRO-GUARD PARTICLE SEPARATOR PRETRAETMENT - 25% TSS REMOVAL

Total TSS Removal = **94%**

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

Project: **Port Place Newburyport**

Prepared By: **S. Sawyer**

Date: **11/1/2017**

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

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

1. From MassDEP Stormwater Handbook Vol. 1

Standard 5 – Land Uses with Higher Potential Pollutant Loads

Standard 5 states that "*For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook*."

The project use is not a Land Use with Higher Potential Pollutant Loads. Therefore, Standard 5 is not applicable to this project.

Standard 6 – Critical Areas

Standard 6 states that "*Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook*."

The project located in a Zone II wellhead protection area. The Water Quality Volume of 1" x Contributing Impervious Area has been used for sizing all of the bio-retention areas and constructed stormwater wetland. Refer to Standard 4 for detailed water quality calculations.

The project's is not located in estimated habitat or any critical area.

Standard 7 - Redevelopment

Standard 7 states that "*A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5 and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions*."

The proposed project is currently a 9-hole golf course with associated structures and paved parking area. The project fully complies with all DEP Stormwater Standards and additionally brings the existing Boyd Drive drainage system into full compliance with Zone II water quality requirements.

Standard 8 – Erosion and Sedimentation Controls

Standard 8 states that "*A plan to control construction related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented*."

A Stormwater Pollution Prevention Plan for the Project will be submitted prior to any land disturbance on the site.

Standard 9 – Operation and Maintenance Plans

Standard 9 states: "A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed. "

A long-term operation and maintenance plan is included in Appendix C. The Plan includes provisions for Construction-Phase measures, as well as long term maintenance and inspections. Therefore the Project complies with Standard 9.

Standard 10 – Illicit Discharges to Drainage System

Standard 10 states: "All illicit discharges to the stormwater management system are prohibited."

There are no known or suspected illicit discharges to the stormwater management system at the project site. Therefore the Project complies with Standard 10.

Appendix A

USDA NRCS Soil Map, Deep Observation Hole Logs, Observation Well Readings & Test Pit/OW Well Location Figure


70° 55' 10" W
70° 54' 14" W
42° 49' 41" N
42° 49' 14" N
343100
343200
343300
343400
343500
343600
343700
343800
343900
344000
344100
344200
344300
4743500
4743400
4743300
4743200
4743100
4743000
4742900
4742800
4742700
257E
254B
1
255B
651
600
254A
253A
Brown Ave
Spofford
Harding Ave
Pine Hill
Hallisey Dr
Honeydew Ln
Noble St
95
113
Map Scale: 1:5,860 if printed on A landscape (11" x 8.5") sheet.
Meters
0 50 100 200 300
Feet
0 250 500 1000 1500
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 11, Sep 28, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2011—Apr 8, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Essex County, Massachusetts, Northern Part (MA605)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1	Water		1.8	2.2%
253A	Hinckley loamy sand, 0 to 3 percent slopes	A	8.6	10.4%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	2.5	3.1%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	3.9	4.7%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	2.5	3.0%
257E	Hinckley and Windsor soils, 25 to 35 percent slopes	A	10.3	12.4%
600	Pits, gravel		36.2	43.7%
651	Udorthents, smoothed	A	16.9	20.4%
Totals for Area of Interest			**82.8**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SOIL SUITABILITY ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS

NEWBURYPORT, MASSACHUSETTS

SOIL SUITABILITY ASSESSMENT FOR ON-SITE STORMWATER MANAGEMENT

SITE INFORMATION

Map 110 & Lot 20

Street Address: 18 Boyd Drive Town: Newburyport State: Massachusetts Zip Code: 01950 County: Essex

Land Use: Recreational; Evergreen Golf Course Latitude: ~42º 49' 27.3" N Longitude: ~70º 54' 46.4" W

PUBLISHED SOIL DATA AND MAP UNIT DESCRIPTION

Physiographic Division: Appalachian Highlands Physio. Province: New England Physio. Section: Seaboard lowland section

Soil map unit: 254A – Merrimac fine sandy loam (sandy, mixed, mesic, Typic Dystrochrepts), 0-3% slopes

NRCS/USDA web soil survey: Essex County, Massachusetts, Northern part. Map Scale: 1:500'

Hydric or upland soil: Upland soil Average depth to water table: >120" Depth to restrictive feature: >120"

Frequency of flooding: None Frequency of ponding: None Available water capacity: Low (~4.6")

Drainage Class: Somewhat excessively drained Hydrologic Soil Group: A Ksat: High (1.42 – 99.00 in/hr)

Soil limitations: High permeability, deep seasonal and apparent groundwater elevations, loose & unstable substratum.

WETLAND AREA & USGS WELL MEASUREMENTS

National Wetland Inventory Map: NA Wetlands Conservancy Program: NA Bordering vegetative wetland: >100 feet

Current Water Resource Condition (USGS): Well Site # 424841071004101- MA-HLW 23 Haverhill, MA.,

Well completed in Sand and gravel aquifers and ice-contact deposits, including kames and eskers.

Well depth: 15.10 feet Land surface altitude: 100.00 feet above NGVD29 Latitude: ~42º48'41.8" N Longitude: ~71º00'41.7"

Most recent data value: 13.01' on 2/03/16 (depth to water level in feet below land surface). Range: Below normal

SURFICIAL & BEDROCK GEOLOGY:

Surficial geology: Qsu: Late Pleistocene, Wisconsin Stage – undifferentiated sandy glaciofluvial deposits

Geologic parent material: Sandy proglacial outwash deposits Geomorphic landform: Outwash terrace

Slope aspect: Westerly Landform position (2D): footslope Landform position (3D): tread

Slope gradient: ~03-05% Down slope shape: Convex Across slope shape: Convex Slope complexity: Simple

Bedrock outcropping in vicinity: Not observed Glacial erratics in vicinity: None observed

Bedrock Type: Newburyport Volcanic Complex: Lower Devonian, Porphyritic andesite, includes tuffaceous mudstone beds containing fossils of Late Silurian through Early Devonian age.

TP16-1 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 12:01 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 15”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
15 → 18”	B_w	Loamy Sand	10YR5/6 yellowish brown	none observed	Very friable; moderate-grade fine to medium angular blocky structure; cohesive matrix; mixed medium to mostly fine grained mineral content; damp; ~5% subrounded gravel content; clear smooth boundary.
18 → 101”	C	Sand gravelly	2.5Y5/3 lite olive brown	@ 93” (c,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~20% rounded to subrounded gravel & ~15% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no redoximorphic features nor apparent water observed and no refusal at test hole depth.

Depth to bedrock: >101” Seasonal High Groundwater Table: 93” Phreatic water table (weep) : >101”

TP16-1 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 93" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 93" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 7.16 feet

Depth of naturally occurring pervious material in TP16-1 Upper boundary: 15"
Lower boundary: 101"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-2 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 12:14 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 05”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
05 → 47”	C^	Sandy Loam	10YR2/1 black	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~15% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
47 → 102”	C	Sand very gravelly	2.5Y5/3 lite olive brown	@ 91” (c,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~40% rounded to subrounded gravel & ~20% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >102” Seasonal High Groundwater Table: 91” Phreatic water table (weep) : >102”

TP16-2 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 91" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 91" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 4.58 feet

Depth of naturally occurring pervious material in TP16-2 Upper boundary: 47"
Lower boundary: 102"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-3 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 12:43 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 06”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
06 → 42”	C^	Sandy Loam	10YR2/1 black	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~15% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
42 → 108”	C	Sand very gravelly	2.5Y5/6 lite olive brown	@ 91” (c,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~40% rounded to subrounded gravel & ~20% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >108” Seasonal High Groundwater Table: 91” Phreatic water table (weep) : >108”

TP16-3 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 91" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 91" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 4.58 feet

Depth of naturally occurring pervious material in TP16-3 Upper boundary: 47"
Lower boundary: 102"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-4 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 12:26 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-4

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 11”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
11 → 52”	C_1	Sand gravelly	2.5Y5/3 lite olive brown	none observed	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~20% rounded to subrounded gravel & ~15% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; clear smooth boundary.
52 → 103”	C_2	Sand	2.5Y5/6 lite olive brown	@ 93” (c,2,p) 7.5R5/8 10Y7/1	Loose; massive angular structure; unstable; mixed very fine to fine grained mineral content; slightly damp matrix; stratified and well graded; ~5% rounded to subrounded content of mixed lithology; stratified beds dipping gently to the North-Northeast; no apparent water observed and no refusal at test hole depth.

Depth to bedrock: >103” Seasonal High Groundwater Table: 93” Phreatic water table (weep) : >103”

TP16-4 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 93" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C2 matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 93" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 7.66 feet

Depth of naturally occurring pervious material in TP16-4 Upper boundary: 11"
Lower boundary: 103"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-5 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 12:57 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-5

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 06”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
06 → 42”	C^	Sandy Loam gravelly	10YR2/2 very dark brown	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~15% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
42 → 110”	C	Sand very gravelly	2.5Y5/6 lite olive brown	@ 89” (c,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed medium to coarse grained mineral content; slightly damp matrix; stratified and well graded; ~40% rounded to subrounded gravel & ~20% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >110” Seasonal High Groundwater Table: 89” Phreatic water table (weep) : >110”

TP16-5 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 89" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 89" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 5.66 feet

Depth of naturally occurring pervious material in TP16-5 Upper boundary: 42"
Lower boundary: 110"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-6 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 13:07 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-6

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 08”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
08 → 65”	C_1	Sand gravelly	2.5Y5/3 lite olive brown	none observed	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~20% rounded to subrounded gravel & ~15% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; clear smooth boundary.
65 → 109”	C_2	Sand	2.5Y6/4 lite yellowish brown	@ 90” (c,2,p) 7.5R5/8 10Y7/1	Loose; massive angular structure; unstable; mixed medium to coarse grained mineral content; slightly damp matrix; stratified and well graded; ~5% rounded to subrounded content of mixed lithology; stratified beds dipping gently to the North-Northeast; no apparent water observed and no refusal at test hole depth.

Depth to bedrock: >109” Seasonal High Groundwater Table: 90” Phreatic water table (weep) : >109”

TP16-6 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 90" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C2 matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 90" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 8.42 feet

Depth of naturally occurring pervious material in TP16-6 Upper boundary: 08"
Lower boundary: 109"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-7 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 13:16 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-7

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 62”	C^	Sandy Loam gravelly	10YR2/2 very dark brown	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~15% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
62 → 110”	C	Sand very gravelly	2.5Y6/4 lite yellowish brown	@ 89” (c,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed medium to coarse grained mineral content; slightly damp matrix; stratified and well graded; ~40% rounded to subrounded gravel & ~20% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >110” Seasonal High Groundwater Table: 89” Phreatic water table (weep) : >110”

TP16-7 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 89" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 89" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 5.66 feet

Depth of naturally occurring pervious material in TP16-7 Upper boundary: 42"
Lower boundary: 110"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-8 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 13:45 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-8

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 08”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
08 → 61”	C^	Loamy Sand	2.5Y5/2 grayish brown	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~5% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
61 → 112”	C	Sand gravelly	2.5Y7/3 pale yellow	@ 92” (c,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~20% rounded to subrounded gravel & ~5% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >112” Seasonal High Groundwater Table: 92” Phreatic water table (weep) : >112”

TP16-8 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 92" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 92" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 4.25 feet

Depth of naturally occurring pervious material in TP16-8 Upper boundary: 61"
Lower boundary: 112"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-9 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 13:21 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-9

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 12”	C^	Sandy Loam	10YR2/2 very dark brown	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~5% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
12 → 98”	C	Sand very gravelly	2.5Y6/4 lite yellowish brown	@ 66” (m,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed medium to coarse grained mineral content; slightly damp matrix; stratified and well graded; ~40% rounded to subrounded gravel & ~20% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >98” Seasonal High Groundwater Table: 66” Phreatic water table (weep) : >98”

TP16-9 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 66" (below land surface)

Type: Masses on sand grains Abundance: Many Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 66" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 7.16 feet

Depth of naturally occurring pervious material in TP16-9 Upper boundary: 12"
Lower boundary: 98"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-10 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 13:15 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-10

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 06”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
06 → 25”	C^	Loamy Sand	2.5Y5/2 grayish brown	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~5% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
25 → 100”	C	Sand gravelly	2.5Y7/3 pale yellow	@ 70” (c,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~20% rounded to subrounded gravel & ~5% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >100” Seasonal High Groundwater Table: 70” Phreatic water table (weep) : >100”

TP16-10 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 70" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 70" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.25 feet

Depth of naturally occurring pervious material in TP16-10 Upper boundary: 25"
Lower boundary: 100"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-11 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 13:24 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-11

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 09”	A_p	Sandy Loam	10YR3/2 very dark grayish brown	none observed	Very friable; moderate-grade fine to medium subangular granular structure; cohesive matrix; fine grained mineral content; slightly damp; common grass roots; free of clasts; clear wavy boundary.
09 → 70”	C_1	Sand gravelly	2.5Y5/3 lite olive brown	none observed	Loose; structurless; very unstable; mixed fine to medium grained mineral content; slightly damp matrix; stratified and well graded; ~20% rounded to subrounded gravel & ~15% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; clear smooth boundary.
70 → 100”	C_2	Sand	2.5Y6/4 lite yellowish brown	@ 93” (c,2,p) 7.5R5/8 10Y7/1	Loose; massive angular structure; unstable; mixed medium to coarse grained mineral content; slightly damp matrix; stratified and well graded; ~5% rounded to subrounded content of mixed lithology; stratified beds dipping gently to the North-Northeast; no apparent water observed and no refusal at test hole depth.

Depth to bedrock: >100” Seasonal High Groundwater Table: 93” Phreatic water table (weep) : >100”

TP16-11 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 93" (below land surface)

Type: Masses on sand grains Abundance: Common Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C2 matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 93" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 7.58 feet

Depth of naturally occurring pervious material in TP16-11 Upper boundary: 09"
Lower boundary: 100"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-12 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 13:55 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-12

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 41”	C^	Sandy Loam	10YR2/2 very dark brown	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~5% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
41 → 98”	C	Sand very gravelly	2.5Y6/4 lite yellowish brown	@ 85” (m,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed medium to coarse grained mineral content; slightly damp matrix; stratified and well graded; ~40% rounded to subrounded gravel & ~20% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >98” Seasonal High Groundwater Table: 85” Phreatic water table (weep) : >98”

TP16-12 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 85" (below land surface)

Type: Masses on sand grains Abundance: Many Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 85" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 4.75 feet

Depth of naturally occurring pervious material in TP16-12 Upper boundary: 41"
Lower boundary: 98"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

TP16-13 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

Date: January 28, 2016 Time: 12:37 Weather: Clear, cool, ~45°F, light East wind

Position on landscape: Terrace tread Slope aspect: Westerly Land Cover: Grass

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet

Wetlands: 100^{+} feet Open water body: 400^{+} feet Abutting septic system: NA

SOIL PROFILE ► TP16-13

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00 → 24”	C^	Sandy Loam	10YR2/2 very dark brown	none observed	Human transported material; Anthropogenic layer; loose; structurless; mixed very fine to medium grained mineral content in a sandy loam matrix; damp; ~5% angular to subangular gravel content of mixed lithology; ash and shells within matrix; clear wavy boundary.
24 → 100”	C	Sand very gravelly	2.5Y6/4 lite yellowish brown	@ 70” (m,2,p) 7.5R5/8 10Y7/1	Loose; structurless; very unstable; mixed medium to coarse grained mineral content; slightly damp matrix; stratified and well graded; ~40% rounded to subrounded gravel & ~20% rounded to subrounded cobble content of mixed lithology; stratified beds dipping gently to the North-Northeast; no refusal at test hole depth.

Depth to bedrock: >100” Seasonal High Groundwater Table: 70” Phreatic water table (weep) : >100”

TP16-13 DEEP OBSERVATION HOLE

18 Boyd Drive, Newburyport, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE: None Observed

Apparent water seeping from pit face:____ (Below land surface) Depth to stabilized apparent water: ____ (Below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE:

Depth of Estimated Seasonal High Groundwater Table: 70" (below land surface)

Type: Masses on sand grains Abundance: Many Size: Medium Contrast: Prominent

Shape: Irregular; laminar to spheroidal Moisture state: Damp Location: C matrix

Hardness: Soft Boundary: Diffuse Concentration color: 7.5R 5/8 (red) Reduction color: 10Y 7/1 (bluish gray)

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to stabilized phreatic water: ____ inches below grade

Observed water weeping from side of deep hole: ____ inches below grade

Observed depth to redoximorphic features: 70" inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL: ► 6.33 feet

Depth of naturally occurring pervious material in TP16-13 Upper boundary: 24"
Lower boundary: 100"

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.017.

Alexander F. Parker *License #1848* — June 1998

Printed name of evaluator & license number — Date of Soil Evaluator Certification

Unofficial soil evaluation for drainage — 01/28/16

Town of Newburyport witness — Date of soil testing

HAVERHILL USGS WELL (HLW) 23

Well No.	S_c	S_r	OW_c	OW_{max}	OW_r	S_h	Ground Elev	Frimpter GW Elev	GW Elev on 5/19/17
1	9.50	10	6.09	4.75	9.5	8.09	60.50	52.41	51.00
2	10.90	10	6.09	4.75	9.5	9.49	62.00	52.51	51.10
3	5.30	10	6.09	4.75	9.5	3.89	55.10	51.21	49.80
5	7.90	10	6.09	4.75	9.5	6.49	57.00	50.51	49.10
6	6.70	10	6.09	4.75	9.5	5.29	56.80	51.51	50.10
7	11.00	10	6.09	4.75	9.5	9.59	61.10	51.51	50.10

S_c measured depth to water at the site

S_h estimated depth to probable high water level at site

OW_c measured depth to water in the observation well which is used to correlate with the water levels at the site, reading if 6.09 is actual real time value for date of 5/19

OW_{max} depth to recorded maximum water level at the observation well which is used to correlate with the water levels at the site

S_r range of water level where the site is located. Values range with varying exceedance probabilities may be selected from figures 8, 11 or 12. For example, a range of 10 feet would be expected to be exceeded at 5 percent of sites in sand and gravel on terraces

OW_r recorded upper limit of annual range of water level at the observation well which is used to correlate with the water levels at the site

Lithology - SAND
Topographic setting - HILLSIDE
Remarks - Water level affected by Halfway Brook
Period of record - HIGH (OWmax) 2.43, LOW 9.04, (OWr) 6.55

GREAT BARRINGTON (GMW) 2
Start year of record - 1951
Land-surface elevation 732 ft, well depth 16.0 ft
Lithology - TILL
Topographic setting - VALLEY
Remarks - Water level affected by stream
Period of record - HIGH (OWmax) 3.99, LOW Dry, (OWr) 9.07

HANSON (HGW) 76
Start year of record - 1964
Land-surface elevation 71 ft, well depth 26.6 ft
Lithology - SAND
Topographic setting - VALLEY
Remarks - Water level affected by Wampatuck Pond
Period of record - HIGH (OWmax) 2.50, LOW 6.53, (OWr) 3.23

HARDWICK (HHW) 1
Start year of record - 1965
Land-surface elevation 580 ft, well depth 33.2 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 9.17, LOW 18.00, (OWr) 7.71

HAVERHILL (HLW) 23 (real-time data since March 2014)
Start year of record - 1960 (daily water-level record October 1984 to present)
Land-surface elevation 105 ft, well depth 15.10 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 4.75, LOW 15.02 (from daily record), (OWr) 9.50

HAWLEY (HMW) 8
Start year of record - 1986
Land-surface elevation 1,700 ft, well depth 17.0 ft
Lithology - TILL
Topographic setting - HILLSIDE
Remarks - none
Period of record - HIGH (OWmax) 1.87, LOW 6.92, (OWr) 4.22

LAKEVILLE (LKW) 14 (real-time data since September 2001)
Start year of record - 1964 (daily water-level record July 1986 to present)
Land-surface elevation 105 ft, well depth 41.0 ft
Lithology - SAND
Topographic setting - TERRACE

Boating safety tips

This station managed by the Northborough MA Field Office.

Available Parameters	Period of Record
☐ All 1 Available Parameters for this site	
☑ 00065 Gage height(Mean)	2006-06-27 2017-10-09

Output format

- ○ Graph
- ○ Graph w/ stats
- ○ Graph w/ (up to 3) parms
- ◉ Table
- ○ Tab-separated

Days (365) **Summary of all available data for this site** GO

Instantaneous-data availability statement

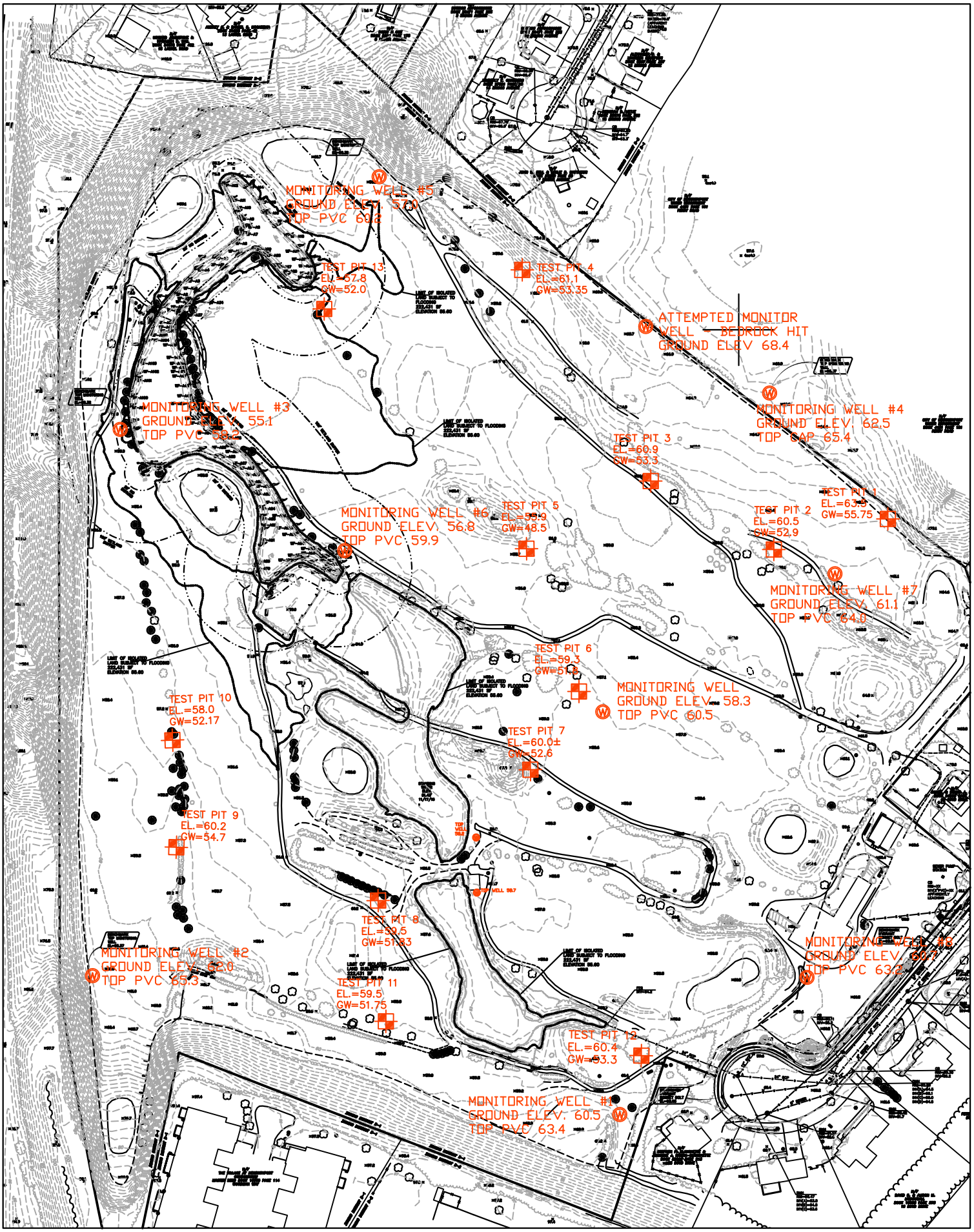
-- or --

Begin date 2016-10-09

End date 2017-10-09

Daily Mean Gage height, feet

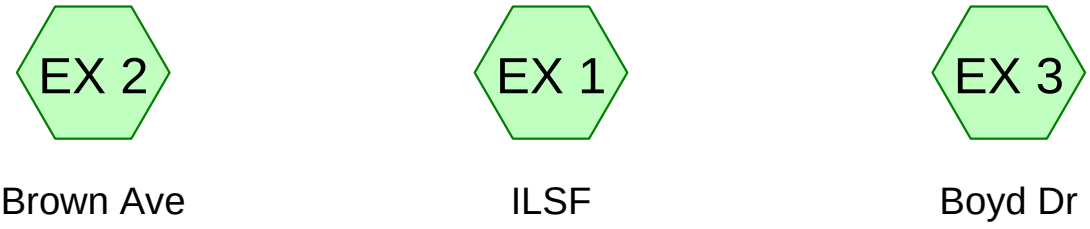
DATE	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017	Sep 2017	Oct 2017
1		3.07P	4.04P	3.12P	3.52P	7.35P	6.37P	5.87P	5.30P	---	2.02P	1.69P	1.73P
2		2.72P	4.00P	2.81P	3.21P	6.48P	5.88P	5.80P	5.40P	---	2.04P	1.52P	1.82P
3		2.72P	4.47P	3.39P	3.00P	6.13P	5.90P	5.87P	5.18P	4.94P	2.05P	2.01P	1.83P
4		2.53P	4.14P	4.32P	2.71P	5.76P	6.59P	5.81P	4.80P	---	2.23P	2.09P	1.61P
5		2.68P	3.86P	3.52P	2.73P	4.99P	7.37P	5.83P	4.76P	---	2.35P	2.40P	1.87P
6		2.73P	3.33P	3.84P	2.54P	4.60P	8.15P	6.36P	5.38P	---	2.27P	2.83P	2.15P
7		2.48P	3.38P	3.91P	2.95P	4.50P	8.98P	6.76P	6.75P	---	2.24P	3.62P	2.37P
8		2.38P	3.20P	3.60P	3.47P	4.35P	9.40P	6.93P	7.91P	---	2.47P	3.77P	2.41P
9	1.92P	2.45P	2.81P	3.45P	3.57P	4.03P	9.28P	6.78P	7.76P	---	2.46P	3.71P	2.49P
10	1.75P	2.30P	2.66P	4.03P	3.13P	4.15P	8.65P	6.36P	6.74P	---	2.42P	3.18P	
11	1.68P	2.01P	2.46P	3.60P	3.53P	3.94P	8.12P	5.76P	5.78P	2.97P	2.36P	2.93P	
12	1.77P	1.99P	3.06P	3.59P	4.02P	3.14P	8.32P	5.12P	5.04P	3.05P	2.51P	3.03P	
13	2.08P	1.89P	2.87P	3.68P	4.27P	3.30P	8.67P	4.89P	4.66P	3.35P	2.43P	2.81P	
14	2.09P	2.33P	3.24P	3.79P	4.34P	4.40P	8.82P	5.35P	4.28P	3.20P	2.27P	2.77P	
15	2.22P	2.73P	3.05P	3.96P	4.12P	3.54P	8.40P	6.56P	3.95P	3.42P	2.36P	2.41P	
16	2.36P	3.51P	2.52P	3.68P	4.00P	3.16P	7.51P	7.55P	3.58P	3.51P	2.31P	2.13P	
17	2.48P	3.56P	3.20P	3.32P	2.79P	3.37P	6.78P	7.60P	3.77P	3.26P	2.14P	2.39P	
18	2.84P	3.40P	3.49P	3.76P	2.78P	3.28P	6.53P	6.98P	3.73P	3.02P	2.35P	2.33P	
19	2.72P	3.22P	2.28P	3.38P	2.73P	3.39P	6.26P	6.09P	3.75P	3.12P	2.74P	2.55P	
20	2.46P	3.02P	2.57P	3.13P	2.76P	3.26P	5.81P	5.44P	3.84P	3.21P	2.92P	2.70P	
21	2.82P	2.51P	2.81P	3.15P	2.84P	3.12P	5.46P	4.86P	4.19P	3.19P	2.94P	3.03P	
22	3.74P	2.17P	2.70P	3.31P	2.99P	2.81P	5.58P	4.74P	4.40P	3.09P	2.91P	3.08P	
23	2.34P	1.78P	2.40P	3.78P	3.27P	2.51P	5.86P	4.68P	4.42P	3.25P	3.05P	2.63P	



OBSERVATION WELL & TEST PIT LOCATIONS

Appendix B

HydroCAD Hydrology Printouts, Proposed ILSF, Existing & Proposed Drainage Areas



Subcat Reach Pond Link

Drainage Diagram for 15-063 Hyd-Ex
Prepared by Microsoft, Printed 8/7/2017

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
159,103	30	Woods, Good, HSG A (EX 1, EX 2)
1,158,318	39	>75% Grass cover, Good, HSG A (EX 1, EX 2, EX 3)
70,710	98	Bdg & Pavement HSG A (EX 1)
32,748	98	Bldg & Pavement, HSG A (EX 2, EX 3)
222,431	98	Wetlands, HSG A (EX 1)

Summary for Subcatchment EX 1: ILSF

Runoff = 20.23 cfs @ 12.08 hrs, Volume= 69,964 cf, Depth> 0.54"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.10"

	Area (sf)	CN	Description
*	222,431	98	Wetlands, HSG A
	137,550	30	Woods, Good, HSG A
*	70,710	98	Bdg & Pavement HSG A
	1,131,723	39	>75% Grass cover, Good, HSG A
	1,562,414	49	Weighted Average
	1,269,273	38	81.24% Pervious Area
	293,141	98	18.76% Impervious Area

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

Summary for Subcatchment EX 2: Brown Ave

Runoff = 0.17 cfs @ 12.13 hrs, Volume= 659 cf, Depth> 0.19"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.10"

	Area (sf)	CN	Description
	21,553	30	Woods, Good, HSG A
*	2,761	98	Bldg & Pavement, HSG A
	18,010	39	>75% Grass cover, Good, HSG A
	42,324	38	Weighted Average
	39,563	34	93.48% Pervious Area
	2,761	98	6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.1800	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
0.8	160	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.7	210	Total			

Summary for Subcatchment EX 3: Boyd Dr

Runoff = 2.07 cfs @ 12.08 hrs, Volume= 7,157 cf, Depth> 2.23"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.10"

	Area (sf)	CN	Description
*	29,987	98	Bldg & Pavement, HSG A
	8,585	39	>75% Grass cover, Good, HSG A
	38,572	85	Weighted Average
	8,585	39	22.26% Pervious Area
	29,987	98	77.74% Impervious Area

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

Summary for Subcatchment EX 1: ILSF

Runoff = 30.92 cfs @ 12.08 hrs, Volume= 120,968 cf, Depth> 0.93"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.70"

	Area (sf)	CN	Description
*	222,431	98	Wetlands, HSG A
	137,550	30	Woods, Good, HSG A
*	70,710	98	Bdg & Pavement HSG A
	1,131,723	39	>75% Grass cover, Good, HSG A
	1,562,414	49	Weighted Average
	1,269,273	38	81.24% Pervious Area
	293,141	98	18.76% Impervious Area

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

Summary for Subcatchment EX 2: Brown Ave

Runoff = 0.26 cfs @ 12.13 hrs, Volume= 1,131 cf, Depth> 0.32"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.70"

	Area (sf)	CN	Description
	21,553	30	Woods, Good, HSG A
*	2,761	98	Bldg & Pavement, HSG A
	18,010	39	>75% Grass cover, Good, HSG A
	42,324	38	Weighted Average
	39,563	34	93.48% Pervious Area
	2,761	98	6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.1800	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
0.8	160	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.7	210	Total			

Summary for Subcatchment EX 3: Boyd Dr

Runoff = 3.16 cfs @ 12.08 hrs, Volume= 11,224 cf, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.70"

	Area (sf)	CN	Description
*	29,987	98	Bldg & Pavement, HSG A
	8,585	39	>75% Grass cover, Good, HSG A
	38,572	85	Weighted Average
	8,585	39	22.26% Pervious Area
	29,987	98	77.74% Impervious Area

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

Summary for Subcatchment EX 1: ILSF

Runoff = 79.04 cfs @ 12.10 hrs, Volume= 321,096 cf, Depth> 2.47"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

	Area (sf)	CN	Description
*	222,431	98	Wetlands, HSG A
	137,550	30	Woods, Good, HSG A
*	70,710	98	Bdg & Pavement HSG A
	1,131,723	39	>75% Grass cover, Good, HSG A
	1,562,414	49	Weighted Average
	1,269,273	38	81.24% Pervious Area
	293,141	98	18.76% Impervious Area

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

Summary for Subcatchment EX 2: Brown Ave

Runoff = 0.71 cfs @ 12.17 hrs, Volume= 4,532 cf, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

	Area (sf)	CN	Description
	21,553	30	Woods, Good, HSG A
*	2,761	98	Bldg & Pavement, HSG A
	18,010	39	>75% Grass cover, Good, HSG A
	42,324	38	Weighted Average
	39,563	34	93.48% Pervious Area
	2,761	98	6.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.1800	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.20"
0.8	160	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.7	210	Total			

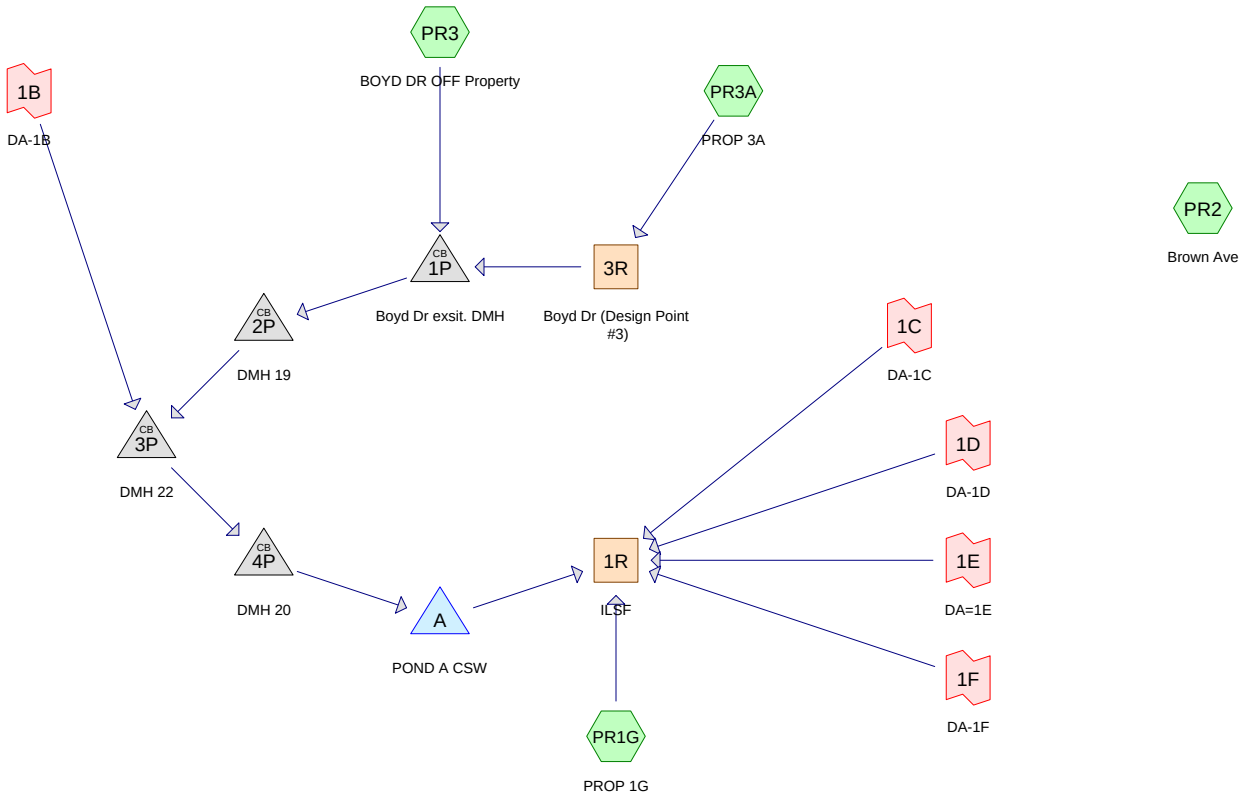
Summary for Subcatchment EX 3: Boyd Dr

Runoff = 5.80 cfs @ 12.08 hrs, Volume= 20,937 cf, Depth> 6.51"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.30"

	Area (sf)	CN	Description
*	29,987	98	Bldg & Pavement, HSG A
	8,585	39	>75% Grass cover, Good, HSG A
	38,572	85	Weighted Average
	8,585	39	22.26% Pervious Area
	29,987	98	77.74% Impervious Area

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



Subcat Reach Pond Link

Drainage Diagram for 15-063 Hyd-Prop Boyd and ILSF
Prepared by Microsoft, Printed 1/7/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
400,927	30	Meadow, non-grazed, HSG A (PR1G, PR2)
256,844	30	Woods, Good, HSG A (PR1G, PR2, PR3)
486,802	39	>75% Grass cover, Good, HSG A (PR1G, PR3, PR3A)
18,183	76	Gravel roads, HSG A (PR1G)
90,970	98	Bdg & Pavement HSG A (PR3)
480	98	Bldg & Pavement, HSG A (PR2)
13,358	98	Paved parking, HSG A (PR3A)
53,303	98	Roofs, HSG A (PR1G, PR3, PR3A)
278,856	98	Wetlands, HSG A (PR1G)
1,599,723		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1P: Boyd Dr exsit. DMH Peak Elev=55.70' Inflow=8.31 cfs 34,749 cf
30.0" Round Culvert n=0.013 L=110.0' S=0.0030 '/' Outflow=8.31 cfs 34,749 cf

Pond 2P: DMH 19 Peak Elev=55.32' Inflow=8.31 cfs 34,749 cf
30.0" Round Culvert n=0.013 L=84.0' S=0.0030 '/' Outflow=8.31 cfs 34,749 cf

Pond 3P: DMH 22 Peak Elev=55.17' Inflow=8.47 cfs 37,812 cf
30.0" Round Culvert n=0.013 L=188.0' S=0.0015 '/' Outflow=8.47 cfs 37,812 cf

Pond 4P: DMH 20 Peak Elev=54.88' Inflow=8.47 cfs 37,812 cf
30.0" Round Culvert n=0.013 L=490.0' S=0.0015 '/' Outflow=8.47 cfs 37,812 cf

Pond A: POND A CSW Peak Elev=50.91' Storage=27,488 cf Inflow=8.47 cfs 37,812 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=0.57 cfs 13,921 cf

Summary for Pond 1P: Boyd Dr exsit. DMH

Inflow Area = 701,430 sf, 20.76% Impervious, Inflow Depth > 0.59" for 2 Year event
Inflow = 8.31 cfs @ 12.16 hrs, Volume= 34,749 cf
Outflow = 8.31 cfs @ 12.16 hrs, Volume= 34,749 cf, Atten= 0%, Lag= 0.0 min
Primary = 8.31 cfs @ 12.16 hrs, Volume= 34,749 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.70' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	54.20'	**30.0" Round Culvert** L= 110.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 54.20' / 53.87' S= 0.0030 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=8.30 cfs @ 12.16 hrs HW=55.70' (Free Discharge)
1=Culvert (Barrel Controls 8.30 cfs @ 3.88 fps)

Summary for Pond 2P: DMH 19

Inflow Area = 701,430 sf, 20.76% Impervious, Inflow Depth > 0.59" for 2 Year event
Inflow = 8.31 cfs @ 12.16 hrs, Volume= 34,749 cf
Outflow = 8.31 cfs @ 12.16 hrs, Volume= 34,749 cf, Atten= 0%, Lag= 0.0 min
Primary = 8.31 cfs @ 12.16 hrs, Volume= 34,749 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.32' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.81'	**30.0" Round Culvert** L= 84.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 53.81' / 53.56' S= 0.0030 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=8.30 cfs @ 12.16 hrs HW=55.32' (Free Discharge)
1=Culvert (Barrel Controls 8.30 cfs @ 3.84 fps)

Summary for Pond 3P: DMH 22

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 0.56" for 2 Year event
Inflow = 8.47 cfs @ 12.16 hrs, Volume= 37,812 cf
Outflow = 8.47 cfs @ 12.16 hrs, Volume= 37,812 cf, Atten= 0%, Lag= 0.0 min
Primary = 8.47 cfs @ 12.16 hrs, Volume= 37,812 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.17' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.52'	**30.0" Round Culvert** L= 188.0' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 53.52' / 53.24' S= 0.0015 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=8.46 cfs @ 12.16 hrs HW=55.17' (Free Discharge)
└**1=Culvert** (Barrel Controls 8.46 cfs @ 3.49 fps)

Summary for Pond 4P: DMH 20

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 0.56" for 2 Year event
Inflow = 8.47 cfs @ 12.16 hrs, Volume= 37,812 cf
Outflow = 8.47 cfs @ 12.16 hrs, Volume= 37,812 cf, Atten= 0%, Lag= 0.0 min
Primary = 8.47 cfs @ 12.16 hrs, Volume= 37,812 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 54.88' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.20'	**30.0" Round Culvert** L= 490.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 53.20' / 52.47' S= 0.0015 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=8.46 cfs @ 12.16 hrs HW=54.88' (Free Discharge)
└**1=Culvert** (Barrel Controls 8.46 cfs @ 3.40 fps)

Summary for Pond A: POND A CSW

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 0.56" for 2 Year event
Inflow = 8.47 cfs @ 12.16 hrs, Volume= 37,812 cf
Outflow = 0.57 cfs @ 14.47 hrs, Volume= 13,921 cf, Atten= 93%, Lag= 138.6 min
Primary = 0.57 cfs @ 14.47 hrs, Volume= 13,921 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 50.91' @ 14.47 hrs Surf.Area= 16,677 sf Storage= 27,488 cf

Plug-Flow detention time= 408.7 min calculated for 13,915 cf (37% of inflow)
Center-of-Mass det. time= 257.6 min (1,023.7 - 766.2)

Volume	Invert	Avail.Storage	Storage Description
#1	49.00'	85,079 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
49.00	7,000	0	0
49.50	14,335	5,334	5,334
50.00	15,550	7,471	12,805
51.00	16,787	16,169	28,974
52.00	18,050	17,419	46,392
53.00	19,337	18,694	65,086
54.00	20,649	19,993	85,079

Device	Routing	Invert	Outlet Devices
#1	Primary	50.50'	**12.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 50.50' / 50.30' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.57 cfs @ 14.47 hrs HW=50.91' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.57 cfs @ 2.79 fps)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1P: Boyd Dr exsit. DMH Peak Elev=56.13' Inflow=12.69 cfs 57,632 cf
30.0" Round Culvert n=0.013 L=110.0' S=0.0030 '/' Outflow=12.69 cfs 57,632 cf

Pond 2P: DMH 19 Peak Elev=55.75' Inflow=12.69 cfs 57,632 cf
30.0" Round Culvert n=0.013 L=84.0' S=0.0030 '/' Outflow=12.69 cfs 57,632 cf

Pond 3P: DMH 22 Peak Elev=55.74' Inflow=14.02 cfs 65,309 cf
30.0" Round Culvert n=0.013 L=188.0' S=0.0015 '/' Outflow=14.02 cfs 65,309 cf

Pond 4P: DMH 20 Peak Elev=55.49' Inflow=14.02 cfs 65,309 cf
30.0" Round Culvert n=0.013 L=490.0' S=0.0015 '/' Outflow=14.02 cfs 65,309 cf

Pond A: POND A CSW Peak Elev=51.50' Storage=37,453 cf Inflow=14.02 cfs 65,309 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=2.40 cfs 39,961 cf

Summary for Pond 1P: Boyd Dr exsit. DMH

Inflow Area = 701,430 sf, 20.76% Impervious, Inflow Depth > 0.99" for 10 Year event
Inflow = 12.69 cfs @ 12.16 hrs, Volume= 57,632 cf
Outflow = 12.69 cfs @ 12.16 hrs, Volume= 57,632 cf, Atten= 0%, Lag= 0.0 min
Primary = 12.69 cfs @ 12.16 hrs, Volume= 57,632 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.13' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	54.20'	**30.0" Round Culvert** L= 110.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 54.20' / 53.87' S= 0.0030 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=12.69 cfs @ 12.16 hrs HW=56.13' (Free Discharge)
1=Culvert (Barrel Controls 12.69 cfs @ 4.31 fps)

Summary for Pond 2P: DMH 19

Inflow Area = 701,430 sf, 20.76% Impervious, Inflow Depth > 0.99" for 10 Year event
Inflow = 12.69 cfs @ 12.16 hrs, Volume= 57,632 cf
Outflow = 12.69 cfs @ 12.16 hrs, Volume= 57,632 cf, Atten= 0%, Lag= 0.0 min
Primary = 12.69 cfs @ 12.16 hrs, Volume= 57,632 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.75' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.81'	**30.0" Round Culvert** L= 84.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 53.81' / 53.56' S= 0.0030 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=12.69 cfs @ 12.16 hrs HW=55.75' (Free Discharge)
1=Culvert (Barrel Controls 12.69 cfs @ 4.28 fps)

Summary for Pond 3P: DMH 22

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 0.97" for 10 Year event
Inflow = 14.02 cfs @ 12.17 hrs, Volume= 65,309 cf
Outflow = 14.02 cfs @ 12.17 hrs, Volume= 65,309 cf, Atten= 0%, Lag= 0.0 min
Primary = 14.02 cfs @ 12.17 hrs, Volume= 65,309 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.74' @ 12.17 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.52'	**30.0" Round Culvert** L= 188.0' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 53.52' / 53.24' S= 0.0015 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=14.01 cfs @ 12.17 hrs HW=55.74' (Free Discharge)
└**1=Culvert** (Barrel Controls 14.01 cfs @ 4.03 fps)

Summary for Pond 4P: DMH 20

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 0.97" for 10 Year event
Inflow = 14.02 cfs @ 12.17 hrs, Volume= 65,309 cf
Outflow = 14.02 cfs @ 12.17 hrs, Volume= 65,309 cf, Atten= 0%, Lag= 0.0 min
Primary = 14.02 cfs @ 12.17 hrs, Volume= 65,309 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.49' @ 12.17 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.20'	**30.0" Round Culvert**
			L= 490.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 53.20' / 52.47' S= 0.0015 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=14.01 cfs @ 12.17 hrs HW=55.49' (Free Discharge)
└**1=Culvert** (Barrel Controls 14.01 cfs @ 3.89 fps)

Summary for Pond A: POND A CSW

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 0.97" for 10 Year event
Inflow = 14.02 cfs @ 12.17 hrs, Volume= 65,309 cf
Outflow = 2.40 cfs @ 12.85 hrs, Volume= 39,961 cf, Atten= 83%, Lag= 41.4 min
Primary = 2.40 cfs @ 12.85 hrs, Volume= 39,961 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 51.50' @ 12.85 hrs Surf.Area= 17,413 sf Storage= 37,453 cf

Plug-Flow detention time= 294.4 min calculated for 39,961 cf (61% of inflow)
Center-of-Mass det. time= 176.1 min (957.5 - 781.3)

Volume	Invert	Avail.Storage	Storage Description
#1	49.00'	85,079 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
49.00	7,000	0	0
49.50	14,335	5,334	5,334
50.00	15,550	7,471	12,805
51.00	16,787	16,169	28,974
52.00	18,050	17,419	46,392
53.00	19,337	18,694	65,086
54.00	20,649	19,993	85,079

Device	Routing	Invert	Outlet Devices
#1	Primary	50.50'	**12.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 50.50' / 50.30' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.40 cfs @ 12.85 hrs HW=51.50' (Free Discharge)
1=Culvert (Barrel Controls 2.40 cfs @ 3.81 fps)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1P: Boyd Dr exsit. DMH Peak Elev=57.89' Inflow=28.46 cfs 145,191 cf
30.0" Round Culvert n=0.013 L=110.0' S=0.0030 '/' Outflow=28.46 cfs 145,191 cf

Pond 2P: DMH 19 Peak Elev=57.46' Inflow=28.46 cfs 145,191 cf
30.0" Round Culvert n=0.013 L=84.0' S=0.0030 '/' Outflow=28.46 cfs 145,191 cf

Pond 3P: DMH 22 Peak Elev=58.18' Inflow=32.24 cfs 169,277 cf
30.0" Round Culvert n=0.013 L=188.0' S=0.0015 '/' Outflow=32.24 cfs 169,277 cf

Pond 4P: DMH 20 Peak Elev=59.28' Inflow=32.24 cfs 169,277 cf
30.0" Round Culvert n=0.013 L=490.0' S=0.0015 '/' Outflow=32.24 cfs 169,277 cf

Pond A: POND A CSW Peak Elev=53.69' Storage=78,755 cf Inflow=32.24 cfs 169,277 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0100 '/' Outflow=6.20 cfs 140,078 cf

Summary for Pond 1P: Boyd Dr exsit. DMH

Inflow Area = 701,430 sf, 20.76% Impervious, Inflow Depth > 2.48" for 100 Year event
Inflow = 28.46 cfs @ 12.18 hrs, Volume= 145,191 cf
Outflow = 28.46 cfs @ 12.18 hrs, Volume= 145,191 cf, Atten= 0%, Lag= 0.0 min
Primary = 28.46 cfs @ 12.18 hrs, Volume= 145,191 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.89' @ 12.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	54.20'	**30.0" Round Culvert** L= 110.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 54.20' / 53.87' S= 0.0030 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=28.44 cfs @ 12.18 hrs HW=57.89' (Free Discharge)
1=Culvert (Barrel Controls 28.44 cfs @ 5.79 fps)

Summary for Pond 2P: DMH 19

Inflow Area = 701,430 sf, 20.76% Impervious, Inflow Depth > 2.48" for 100 Year event
Inflow = 28.46 cfs @ 12.18 hrs, Volume= 145,191 cf
Outflow = 28.46 cfs @ 12.18 hrs, Volume= 145,191 cf, Atten= 0%, Lag= 0.0 min
Primary = 28.46 cfs @ 12.18 hrs, Volume= 145,191 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.46' @ 12.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.81'	**30.0" Round Culvert** L= 84.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 53.81' / 53.56' S= 0.0030 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=28.44 cfs @ 12.18 hrs HW=57.46' (Free Discharge)
1=Culvert (Barrel Controls 28.44 cfs @ 5.79 fps)

Summary for Pond 3P: DMH 22

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 2.50" for 100 Year event
Inflow = 32.24 cfs @ 12.18 hrs, Volume= 169,277 cf
Outflow = 32.24 cfs @ 12.18 hrs, Volume= 169,277 cf, Atten= 0%, Lag= 0.0 min
Primary = 32.24 cfs @ 12.18 hrs, Volume= 169,277 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.18' @ 12.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.52'	**30.0" Round Culvert** L= 188.0' CPP, projecting, no headwall, Ke= 0.900

Inlet / Outlet Invert= 53.52' / 53.24' S= 0.0015 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=32.22 cfs @ 12.18 hrs HW=58.18' (Free Discharge)
└**1=Culvert** (Barrel Controls 32.22 cfs @ 6.56 fps)

Summary for Pond 4P: DMH 20

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 2.50" for 100 Year event
Inflow = 32.24 cfs @ 12.18 hrs, Volume= 169,277 cf
Outflow = 32.24 cfs @ 12.18 hrs, Volume= 169,277 cf, Atten= 0%, Lag= 0.0 min
Primary = 32.24 cfs @ 12.18 hrs, Volume= 169,277 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.28' @ 12.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	53.20'	**30.0" Round Culvert**
			L= 490.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 53.20' / 52.47' S= 0.0015 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=32.22 cfs @ 12.18 hrs HW=59.28' (Free Discharge)
└**1=Culvert** (Barrel Controls 32.22 cfs @ 6.56 fps)

Summary for Pond A: POND A CSW

Inflow Area = 811,786 sf, 21.87% Impervious, Inflow Depth > 2.50" for 100 Year event
Inflow = 32.24 cfs @ 12.18 hrs, Volume= 169,277 cf
Outflow = 6.20 cfs @ 13.00 hrs, Volume= 140,078 cf, Atten= 81%, Lag= 49.3 min
Primary = 6.20 cfs @ 13.00 hrs, Volume= 140,078 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 53.69' @ 13.00 hrs Surf.Area= 20,243 sf Storage= 78,755 cf

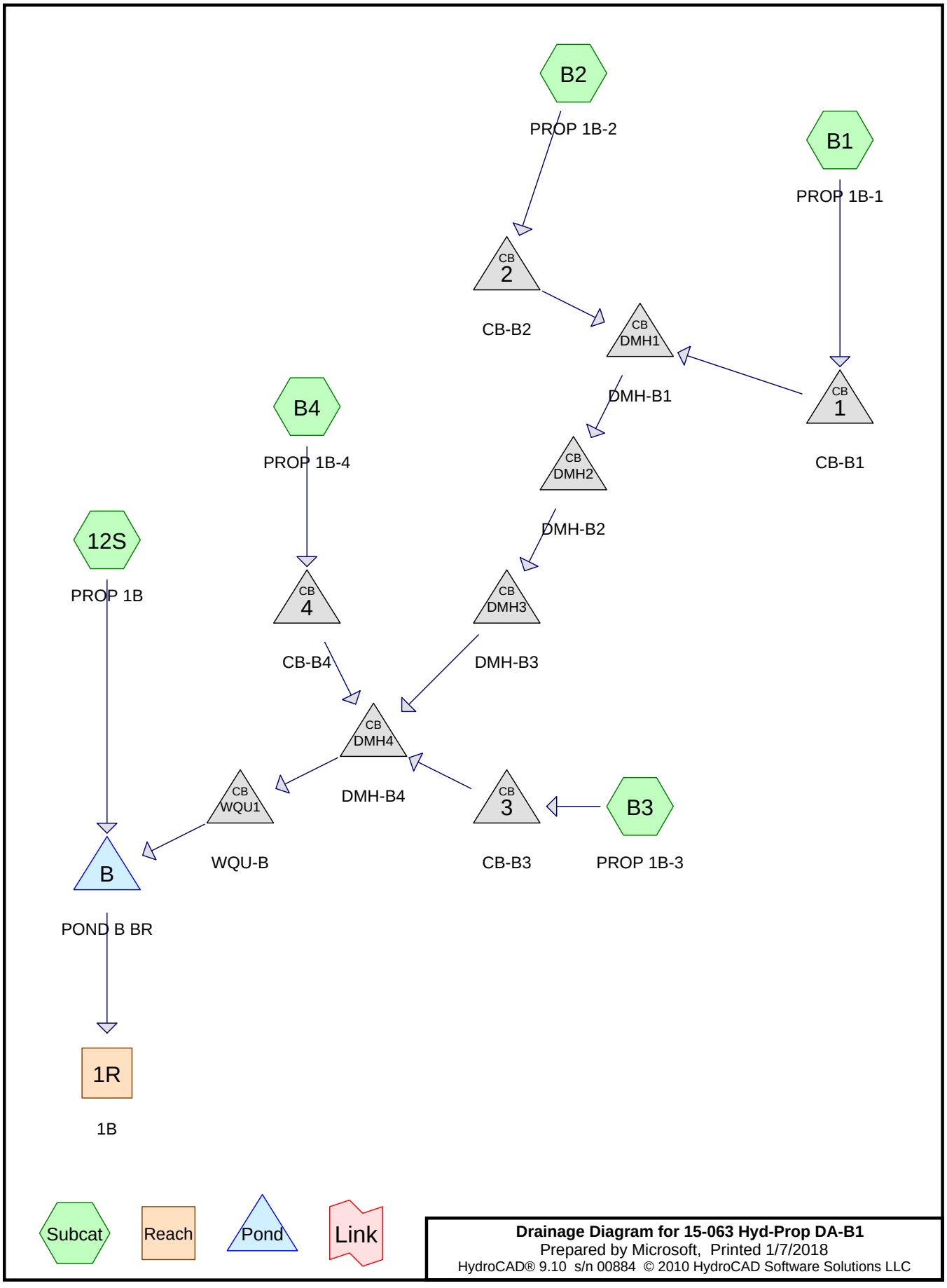
Plug-Flow detention time= 225.5 min calculated for 140,078 cf (83% of inflow)
Center-of-Mass det. time= 148.7 min (958.3 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1	49.00'	85,079 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
49.00	7,000	0	0
49.50	14,335	5,334	5,334
50.00	15,550	7,471	12,805
51.00	16,787	16,169	28,974
52.00	18,050	17,419	46,392
53.00	19,337	18,694	65,086
54.00	20,649	19,993	85,079

Device	Routing	Invert	Outlet Devices
#1	Primary	50.50'	**12.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 50.50' / 50.30' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=6.20 cfs @ 13.00 hrs HW=53.69' (Free Discharge)
1=Culvert (Inlet Controls 6.20 cfs @ 7.90 fps)



Drainage Diagram for 15-063 Hyd-Prop DA-B1
Prepared by Microsoft, Printed 1/7/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
78,484	39	>75% Grass cover, Good, HSG A (12S, B1, B3, B4)
21,565	98	Paved parking, HSG A (B1, B2, B3, B4)
10,307	98	Roofs, HSG A (12S, B1, B3)
110,356		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-B1 Peak Elev=60.73' Inflow=0.26 cfs 979 cf
12.0" Round Culvert n=0.013 L=53.0' S=0.0051 '/' Outflow=0.26 cfs 979 cf

Pond 2: CB-B2 Peak Elev=60.82' Inflow=0.30 cfs 880 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0100 '/' Outflow=0.30 cfs 880 cf

Pond 3: CB-B3 Peak Elev=58.71' Inflow=0.83 cfs 3,246 cf
12.0" Round Culvert n=0.013 L=8.0' S=0.0100 '/' Outflow=0.83 cfs 3,246 cf

Pond 4: CB-B4 Peak Elev=58.47' Inflow=0.34 cfs 1,309 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.34 cfs 1,309 cf

Pond B: POND B BR Peak Elev=56.62' Storage=3,349 cf Inflow=1.74 cfs 7,606 cf
Discarded=0.04 cfs 2,573 cf Primary=0.62 cfs 3,062 cf Outflow=0.66 cfs 5,636 cf

Pond DMH1: DMH-B1 Peak Elev=60.46' Inflow=0.47 cfs 1,859 cf
12.0" Round Culvert n=0.013 L=105.0' S=0.0100 '/' Outflow=0.47 cfs 1,859 cf

Pond DMH2: DMH-B2 Peak Elev=59.30' Inflow=0.47 cfs 1,859 cf
12.0" Round Culvert n=0.013 L=96.0' S=0.0100 '/' Outflow=0.47 cfs 1,859 cf

Pond DMH3: DMH-B3 Peak Elev=58.24' Inflow=0.47 cfs 1,859 cf
12.0" Round Culvert n=0.013 L=44.0' S=0.0100 '/' Outflow=0.47 cfs 1,859 cf

Pond DMH4: DMH-B4 Peak Elev=57.82' Inflow=1.56 cfs 6,414 cf
15.0" Round Culvert n=0.013 L=31.0' S=0.0048 '/' Outflow=1.56 cfs 6,414 cf

Pond WQU1: WQU-B Peak Elev=57.46' Inflow=1.56 cfs 6,414 cf
18.0" Round Culvert n=0.013 L=115.0' S=0.0050 '/' Outflow=1.56 cfs 6,414 cf

Summary for Pond 1: CB-B1

Inflow Area = 8,603 sf, 47.68% Impervious, Inflow Depth > 1.37" for 2 Year event
Inflow = 0.26 cfs @ 12.12 hrs, Volume= 979 cf
Outflow = 0.26 cfs @ 12.12 hrs, Volume= 979 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.26 cfs @ 12.12 hrs, Volume= 979 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.73' @ 12.12 hrs
Flood Elev= 63.43'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.43'	**12.0" Round Culvert** L= 53.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.43' / 60.16' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.26 cfs @ 12.12 hrs HW=60.73' (Free Discharge)
1=Culvert (Barrel Controls 0.26 cfs @ 1.96 fps)

Summary for Pond 2: CB-B2

Inflow Area = 3,683 sf,100.00% Impervious, Inflow Depth > 2.87" for 2 Year event
Inflow = 0.30 cfs @ 12.02 hrs, Volume= 880 cf
Outflow = 0.30 cfs @ 12.02 hrs, Volume= 880 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.30 cfs @ 12.02 hrs, Volume= 880 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.82' @ 12.02 hrs
Flood Elev= 63.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.50'	**12.0" Round Culvert** L= 9.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.50' / 60.41' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.29 cfs @ 12.02 hrs HW=60.81' (Free Discharge)
1=Culvert (Barrel Controls 0.29 cfs @ 2.08 fps)

Summary for Pond 3: CB-B3

Inflow Area = 25,005 sf, 54.39% Impervious, Inflow Depth > 1.56" for 2 Year event
Inflow = 0.83 cfs @ 12.13 hrs, Volume= 3,246 cf
Outflow = 0.83 cfs @ 12.13 hrs, Volume= 3,246 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.83 cfs @ 12.13 hrs, Volume= 3,246 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.71' @ 12.13 hrs
Flood Elev= 61.14'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.14'	**12.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.14' / 58.06' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.83 cfs @ 12.13 hrs HW=58.71' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.83 cfs @ 2.57 fps)

Summary for Pond 4: CB-B4

Inflow Area = 32,646 sf, 16.80% Impervious, Inflow Depth > 0.48" for 2 Year event
Inflow = 0.34 cfs @ 12.13 hrs, Volume= 1,309 cf
Outflow = 0.34 cfs @ 12.13 hrs, Volume= 1,309 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.34 cfs @ 12.13 hrs, Volume= 1,309 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.47' @ 12.13 hrs
Flood Elev= 61.14'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.14'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.14' / 58.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.34 cfs @ 12.13 hrs HW=58.47' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.34 cfs @ 2.25 fps)

Summary for Pond B: POND B BR

Inflow Area = 110,356 sf, 28.88% Impervious, Inflow Depth > 0.83" for 2 Year event
Inflow = 1.74 cfs @ 12.13 hrs, Volume= 7,606 cf
Outflow = 0.66 cfs @ 12.47 hrs, Volume= 5,636 cf, Atten= 62%, Lag= 20.6 min
Discarded = 0.04 cfs @ 12.47 hrs, Volume= 2,573 cf
Primary = 0.62 cfs @ 12.47 hrs, Volume= 3,062 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.62' @ 12.47 hrs Surf.Area= 3,489 sf Storage= 3,349 cf

Plug-Flow detention time= 175.9 min calculated for 5,636 cf (74% of inflow)
Center-of-Mass det. time= 89.2 min (849.2 - 759.9)

Volume	Invert	Avail.Storage	Storage Description
#1	55.55'	13,682 cf	**BioRentention Area (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.55	2,765	0	0
56.00	3,077	1,314	1,314
57.00	3,742	3,410	4,724
58.00	4,465	4,104	8,827
59.00	5,244	4,855	13,682

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.25'	**18.0" Round Culvert** L= 74.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 56.25' / 54.50' S= 0.0236 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.04 cfs @ 12.47 hrs HW=56.62' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.62 cfs @ 12.47 hrs HW=56.62' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.62 cfs @ 1.83 fps)

Summary for Pond DMH1: DMH-B1

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 1.82" for 2 Year event
Inflow = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf
Outflow = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.46' @ 12.04 hrs
Flood Elev= 63.66'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.07'	**12.0" Round Culvert** L= 105.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.07' / 59.02' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.47 cfs @ 12.04 hrs HW=60.46' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.47 cfs @ 1.67 fps)

Summary for Pond DMH2: DMH-B2

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 1.82" for 2 Year event
Inflow = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf
Outflow = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 59.30' @ 12.04 hrs
Flood Elev= 62.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.91'	**12.0" Round Culvert** L= 96.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.91' / 57.95' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.47 cfs @ 12.04 hrs HW=59.30' (Free Discharge)
1=Culvert (Inlet Controls 0.47 cfs @ 1.67 fps)

Summary for Pond DMH3: DMH-B3

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 1.82" for 2 Year event
Inflow = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf
Outflow = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.47 cfs @ 12.04 hrs, Volume= 1,859 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.24' @ 12.04 hrs
Flood Elev= 61.63'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.85'	**12.0" Round Culvert** L= 44.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.85' / 57.41' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.47 cfs @ 12.04 hrs HW=58.24' (Free Discharge)
1=Culvert (Inlet Controls 0.47 cfs @ 1.67 fps)

Summary for Pond DMH4: DMH-B4

Inflow Area = 69,937 sf, 38.42% Impervious, Inflow Depth > 1.10" for 2 Year event
Inflow = 1.56 cfs @ 12.12 hrs, Volume= 6,414 cf
Outflow = 1.56 cfs @ 12.12 hrs, Volume= 6,414 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.56 cfs @ 12.12 hrs, Volume= 6,414 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.82' @ 12.12 hrs
Flood Elev= 62.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.06'	**15.0" Round Culvert** L= 31.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.06' / 56.91' S= 0.0048 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.56 cfs @ 12.12 hrs HW=57.82' (Free Discharge)
1=Culvert (Barrel Controls 1.56 cfs @ 2.86 fps)

Summary for Pond WQU1: WQU-B

Inflow Area = 69,937 sf, 38.42% Impervious, Inflow Depth > 1.10" for 2 Year event
Inflow = 1.56 cfs @ 12.12 hrs, Volume= 6,414 cf
Outflow = 1.56 cfs @ 12.12 hrs, Volume= 6,414 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.56 cfs @ 12.12 hrs, Volume= 6,414 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.46' @ 12.12 hrs
Flood Elev= 61.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.80'	**18.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.80' / 56.23' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.56 cfs @ 12.12 hrs HW=57.46' (Free Discharge)
1=Culvert (Barrel Controls 1.56 cfs @ 3.06 fps)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-B1 Peak Elev=60.80' Inflow=0.39 cfs 1,577 cf
12.0" Round Culvert n=0.013 L=53.0' S=0.0051 '/' Outflow=0.39 cfs 1,577 cf

Pond 2: CB-B2 Peak Elev=60.90' Inflow=0.45 cfs 1,370 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0100 '/' Outflow=0.45 cfs 1,370 cf

Pond 3: CB-B3 Peak Elev=58.88' Inflow=1.27 cfs 5,188 cf
12.0" Round Culvert n=0.013 L=8.0' S=0.0100 '/' Outflow=1.27 cfs 5,188 cf

Pond 4: CB-B4 Peak Elev=58.55' Inflow=0.51 cfs 2,360 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.51 cfs 2,360 cf

Pond B: POND B BR Peak Elev=56.87' Storage=4,246 cf Inflow=2.66 cfs 12,768 cf
Discarded=0.04 cfs 2,831 cf Primary=1.64 cfs 7,677 cf Outflow=1.68 cfs 10,508 cf

Pond DMH1: DMH-B1 Peak Elev=60.56' Inflow=0.71 cfs 2,947 cf
12.0" Round Culvert n=0.013 L=105.0' S=0.0100 '/' Outflow=0.71 cfs 2,947 cf

Pond DMH2: DMH-B2 Peak Elev=59.40' Inflow=0.71 cfs 2,947 cf
12.0" Round Culvert n=0.013 L=96.0' S=0.0100 '/' Outflow=0.71 cfs 2,947 cf

Pond DMH3: DMH-B3 Peak Elev=58.34' Inflow=0.71 cfs 2,947 cf
12.0" Round Culvert n=0.013 L=44.0' S=0.0100 '/' Outflow=0.71 cfs 2,947 cf

Pond DMH4: DMH-B4 Peak Elev=58.04' Inflow=2.38 cfs 10,495 cf
15.0" Round Culvert n=0.013 L=31.0' S=0.0048 '/' Outflow=2.38 cfs 10,495 cf

Pond WQU1: WQU-B Peak Elev=57.64' Inflow=2.38 cfs 10,495 cf
18.0" Round Culvert n=0.013 L=115.0' S=0.0050 '/' Outflow=2.38 cfs 10,495 cf

Summary for Pond 1: CB-B1

Inflow Area = 8,603 sf, 47.68% Impervious, Inflow Depth > 2.20" for 10 Year event
Inflow = 0.39 cfs @ 12.12 hrs, Volume= 1,577 cf
Outflow = 0.39 cfs @ 12.12 hrs, Volume= 1,577 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.39 cfs @ 12.12 hrs, Volume= 1,577 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.80' @ 12.12 hrs
Flood Elev= 63.43'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.43'	**12.0" Round Culvert** L= 53.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.43' / 60.16' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.39 cfs @ 12.12 hrs HW=60.80' (Free Discharge)
1=Culvert (Barrel Controls 0.39 cfs @ 2.19 fps)

Summary for Pond 2: CB-B2

Inflow Area = 3,683 sf,100.00% Impervious, Inflow Depth > 4.46" for 10 Year event
Inflow = 0.45 cfs @ 12.02 hrs, Volume= 1,370 cf
Outflow = 0.45 cfs @ 12.02 hrs, Volume= 1,370 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.45 cfs @ 12.02 hrs, Volume= 1,370 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.90' @ 12.02 hrs
Flood Elev= 63.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.50'	**12.0" Round Culvert** L= 9.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.50' / 60.41' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.45 cfs @ 12.02 hrs HW=60.90' (Free Discharge)
1=Culvert (Barrel Controls 0.45 cfs @ 2.27 fps)

Summary for Pond 3: CB-B3

Inflow Area = 25,005 sf, 54.39% Impervious, Inflow Depth > 2.49" for 10 Year event
Inflow = 1.27 cfs @ 12.13 hrs, Volume= 5,188 cf
Outflow = 1.27 cfs @ 12.13 hrs, Volume= 5,188 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.27 cfs @ 12.13 hrs, Volume= 5,188 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.88' @ 12.13 hrs
Flood Elev= 61.14'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.14'	**12.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.14' / 58.06' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.27 cfs @ 12.13 hrs HW=58.88' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.27 cfs @ 2.83 fps)

Summary for Pond 4: CB-B4

Inflow Area = 32,646 sf, 16.80% Impervious, Inflow Depth > 0.87" for 10 Year event
Inflow = 0.51 cfs @ 12.13 hrs, Volume= 2,360 cf
Outflow = 0.51 cfs @ 12.13 hrs, Volume= 2,360 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.51 cfs @ 12.13 hrs, Volume= 2,360 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.55' @ 12.13 hrs
Flood Elev= 61.14'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.14'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.14' / 58.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.51 cfs @ 12.13 hrs HW=58.55' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.51 cfs @ 2.46 fps)

Summary for Pond B: POND B BR

Inflow Area = 110,356 sf, 28.88% Impervious, Inflow Depth > 1.39" for 10 Year event
Inflow = 2.66 cfs @ 12.13 hrs, Volume= 12,768 cf
Outflow = 1.68 cfs @ 12.30 hrs, Volume= 10,508 cf, Atten= 37%, Lag= 10.2 min
Discarded = 0.04 cfs @ 12.30 hrs, Volume= 2,831 cf
Primary = 1.64 cfs @ 12.30 hrs, Volume= 7,677 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.87' @ 12.30 hrs Surf.Area= 3,656 sf Storage= 4,246 cf

Plug-Flow detention time= 141.7 min calculated for 10,508 cf (82% of inflow)
Center-of-Mass det. time= 63.8 min (836.5 - 772.7)

Volume	Invert	Avail.Storage	Storage Description
#1	55.55'	13,682 cf	**BioRentention Area (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.55	2,765	0	0
56.00	3,077	1,314	1,314
57.00	3,742	3,410	4,724
58.00	4,465	4,104	8,827
59.00	5,244	4,855	13,682

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.25'	**18.0" Round Culvert** L= 74.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 56.25' / 54.50' S= 0.0236 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.04 cfs @ 12.30 hrs HW=56.87' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.63 cfs @ 12.30 hrs HW=56.87' (Free Discharge)
└**2=Culvert** (Inlet Controls 1.63 cfs @ 2.37 fps)

Summary for Pond DMH1: DMH-B1

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 2.88" for 10 Year event
Inflow = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf
Outflow = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.56' @ 12.04 hrs
Flood Elev= 63.66'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.07'	**12.0" Round Culvert** L= 105.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.07' / 59.02' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.71 cfs @ 12.04 hrs HW=60.56' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.71 cfs @ 1.88 fps)

Summary for Pond DMH2: DMH-B2

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 2.88" for 10 Year event
Inflow = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf
Outflow = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 59.40' @ 12.04 hrs
Flood Elev= 62.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.91'	**12.0" Round Culvert** L= 96.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.91' / 57.95' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.71 cfs @ 12.04 hrs HW=59.40' (Free Discharge)
1=Culvert (Inlet Controls 0.71 cfs @ 1.88 fps)

Summary for Pond DMH3: DMH-B3

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 2.88" for 10 Year event
Inflow = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf
Outflow = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.71 cfs @ 12.04 hrs, Volume= 2,947 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.34' @ 12.04 hrs
Flood Elev= 61.63'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.85'	**12.0" Round Culvert** L= 44.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.85' / 57.41' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.71 cfs @ 12.04 hrs HW=58.34' (Free Discharge)
1=Culvert (Inlet Controls 0.71 cfs @ 1.88 fps)

Summary for Pond DMH4: DMH-B4

Inflow Area = 69,937 sf, 38.42% Impervious, Inflow Depth > 1.80" for 10 Year event
Inflow = 2.38 cfs @ 12.12 hrs, Volume= 10,495 cf
Outflow = 2.38 cfs @ 12.12 hrs, Volume= 10,495 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.38 cfs @ 12.12 hrs, Volume= 10,495 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.04' @ 12.12 hrs
Flood Elev= 62.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.06'	**15.0" Round Culvert** L= 31.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.06' / 56.91' S= 0.0048 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.38 cfs @ 12.12 hrs HW=58.04' (Free Discharge)
1=Culvert (Barrel Controls 2.38 cfs @ 3.17 fps)

Summary for Pond WQU1: WQU-B

Inflow Area = 69,937 sf, 38.42% Impervious, Inflow Depth > 1.80" for 10 Year event
Inflow = 2.38 cfs @ 12.12 hrs, Volume= 10,495 cf
Outflow = 2.38 cfs @ 12.12 hrs, Volume= 10,495 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.38 cfs @ 12.12 hrs, Volume= 10,495 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.64' @ 12.12 hrs
Flood Elev= 61.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.80'	**18.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.80' / 56.23' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.38 cfs @ 12.12 hrs HW=57.64' (Free Discharge)
1=Culvert (Barrel Controls 2.38 cfs @ 3.39 fps)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-B1 Peak Elev=60.98' Inflow=0.78 cfs 3,232 cf
12.0" Round Culvert n=0.013 L=53.0' S=0.0051 '/' Outflow=0.78 cfs 3,232 cf

Pond 2: CB-B2 Peak Elev=61.06' Inflow=0.80 cfs 2,473 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0100 '/' Outflow=0.80 cfs 2,473 cf

Pond 3: CB-B3 Peak Elev=59.32' Inflow=2.47 cfs 10,340 cf
12.0" Round Culvert n=0.013 L=8.0' S=0.0100 '/' Outflow=2.47 cfs 10,340 cf

Pond 4: CB-B4 Peak Elev=58.91' Inflow=1.44 cfs 6,577 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=1.44 cfs 6,577 cf

Pond B: POND B BR Peak Elev=57.33' Storage=6,002 cf Inflow=5.78 cfs 29,741 cf
Discarded=0.05 cfs 3,127 cf Primary=4.26 cfs 24,086 cf Outflow=4.31 cfs 27,213 cf

Pond DMH1: DMH-B1 Peak Elev=60.76' Inflow=1.30 cfs 5,706 cf
12.0" Round Culvert n=0.013 L=105.0' S=0.0100 '/' Outflow=1.30 cfs 5,706 cf

Pond DMH2: DMH-B2 Peak Elev=59.60' Inflow=1.30 cfs 5,706 cf
12.0" Round Culvert n=0.013 L=96.0' S=0.0100 '/' Outflow=1.30 cfs 5,706 cf

Pond DMH3: DMH-B3 Peak Elev=58.54' Inflow=1.30 cfs 5,706 cf
12.0" Round Culvert n=0.013 L=44.0' S=0.0100 '/' Outflow=1.30 cfs 5,706 cf

Pond DMH4: DMH-B4 Peak Elev=58.85' Inflow=5.02 cfs 22,623 cf
15.0" Round Culvert n=0.013 L=31.0' S=0.0048 '/' Outflow=5.02 cfs 22,623 cf

Pond WQU1: WQU-B Peak Elev=58.13' Inflow=5.02 cfs 22,623 cf
18.0" Round Culvert n=0.013 L=115.0' S=0.0050 '/' Outflow=5.02 cfs 22,623 cf

Summary for Pond 1: CB-B1

Inflow Area = 8,603 sf, 47.68% Impervious, Inflow Depth > 4.51" for 100 Year event
Inflow = 0.78 cfs @ 12.13 hrs, Volume= 3,232 cf
Outflow = 0.78 cfs @ 12.13 hrs, Volume= 3,232 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.78 cfs @ 12.13 hrs, Volume= 3,232 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.98' @ 12.13 hrs
Flood Elev= 63.43'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.43'	**12.0" Round Culvert** L= 53.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.43' / 60.16' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.78 cfs @ 12.13 hrs HW=60.97' (Free Discharge)
1=Culvert (Barrel Controls 0.78 cfs @ 2.59 fps)

Summary for Pond 2: CB-B2

Inflow Area = 3,683 sf,100.00% Impervious, Inflow Depth > 8.06" for 100 Year event
Inflow = 0.80 cfs @ 12.02 hrs, Volume= 2,473 cf
Outflow = 0.80 cfs @ 12.02 hrs, Volume= 2,473 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.80 cfs @ 12.02 hrs, Volume= 2,473 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 61.06' @ 12.02 hrs
Flood Elev= 63.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.50'	**12.0" Round Culvert** L= 9.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.50' / 60.41' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.80 cfs @ 12.02 hrs HW=61.06' (Free Discharge)
1=Culvert (Barrel Controls 0.80 cfs @ 2.57 fps)

Summary for Pond 3: CB-B3

Inflow Area = 25,005 sf, 54.39% Impervious, Inflow Depth > 4.96" for 100 Year event
Inflow = 2.47 cfs @ 12.13 hrs, Volume= 10,340 cf
Outflow = 2.47 cfs @ 12.13 hrs, Volume= 10,340 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.47 cfs @ 12.13 hrs, Volume= 10,340 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.32' @ 12.13 hrs
Flood Elev= 61.14'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.14'	**12.0" Round Culvert** L= 8.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.14' / 58.06' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.47 cfs @ 12.13 hrs HW=59.32' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.47 cfs @ 3.14 fps)

Summary for Pond 4: CB-B4

Inflow Area = 32,646 sf, 16.80% Impervious, Inflow Depth > 2.42" for 100 Year event
Inflow = 1.44 cfs @ 12.15 hrs, Volume= 6,577 cf
Outflow = 1.44 cfs @ 12.15 hrs, Volume= 6,577 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.44 cfs @ 12.15 hrs, Volume= 6,577 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.91' @ 12.15 hrs
Flood Elev= 61.14'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.14'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.14' / 58.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.44 cfs @ 12.15 hrs HW=58.91' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.44 cfs @ 3.06 fps)

Summary for Pond B: POND B BR

Inflow Area = 110,356 sf, 28.88% Impervious, Inflow Depth > 3.23" for 100 Year event
Inflow = 5.78 cfs @ 12.15 hrs, Volume= 29,741 cf
Outflow = 4.31 cfs @ 12.29 hrs, Volume= 27,213 cf, Atten= 25%, Lag= 8.9 min
Discarded = 0.05 cfs @ 12.29 hrs, Volume= 3,127 cf
Primary = 4.26 cfs @ 12.29 hrs, Volume= 24,086 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.33' @ 12.29 hrs Surf.Area= 3,981 sf Storage= 6,002 cf

Plug-Flow detention time= 91.9 min calculated for 27,213 cf (92% of inflow)
Center-of-Mass det. time= 46.3 min (837.3 - 791.0)

Volume	Invert	Avail.Storage	Storage Description
#1	55.55'	13,682 cf	**BioRentention Area (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.55	2,765	0	0
56.00	3,077	1,314	1,314
57.00	3,742	3,410	4,724
58.00	4,465	4,104	8,827
59.00	5,244	4,855	13,682

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.25'	**18.0" Round Culvert** L= 74.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 56.25' / 54.50' S= 0.0236 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Discarded OutFlow Max=0.05 cfs @ 12.29 hrs HW=57.33' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=4.26 cfs @ 12.29 hrs HW=57.33' (Free Discharge)
└**2=Culvert** (Inlet Controls 4.26 cfs @ 3.12 fps)

Summary for Pond DMH1: DMH-B1

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 5.57" for 100 Year event
Inflow = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf
Outflow = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.76' @ 12.04 hrs
Flood Elev= 63.66'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.07'	**12.0" Round Culvert** L= 105.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.07' / 59.02' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.30 cfs @ 12.04 hrs HW=60.76' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.30 cfs @ 2.24 fps)

Summary for Pond DMH2: DMH-B2

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 5.57" for 100 Year event
Inflow = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf
Outflow = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 59.60' @ 12.04 hrs
Flood Elev= 62.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.91'	**12.0" Round Culvert** L= 96.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.91' / 57.95' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.30 cfs @ 12.04 hrs HW=59.60' (Free Discharge)
1=Culvert (Inlet Controls 1.30 cfs @ 2.24 fps)

Summary for Pond DMH3: DMH-B3

Inflow Area = 12,286 sf, 63.36% Impervious, Inflow Depth > 5.57" for 100 Year event
Inflow = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf
Outflow = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.30 cfs @ 12.04 hrs, Volume= 5,706 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.54' @ 12.04 hrs
Flood Elev= 61.63'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.85'	**12.0" Round Culvert** L= 44.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.85' / 57.41' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.30 cfs @ 12.04 hrs HW=58.54' (Free Discharge)
1=Culvert (Inlet Controls 1.30 cfs @ 2.24 fps)

Summary for Pond DMH4: DMH-B4

Inflow Area = 69,937 sf, 38.42% Impervious, Inflow Depth > 3.88" for 100 Year event
Inflow = 5.02 cfs @ 12.13 hrs, Volume= 22,623 cf
Outflow = 5.02 cfs @ 12.13 hrs, Volume= 22,623 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.02 cfs @ 12.13 hrs, Volume= 22,623 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.85' @ 12.13 hrs
Flood Elev= 62.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.06'	**15.0" Round Culvert** L= 31.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.06' / 56.91' S= 0.0048 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=5.03 cfs @ 12.13 hrs HW=58.85' (Free Discharge)
1=Culvert (Inlet Controls 5.03 cfs @ 4.09 fps)

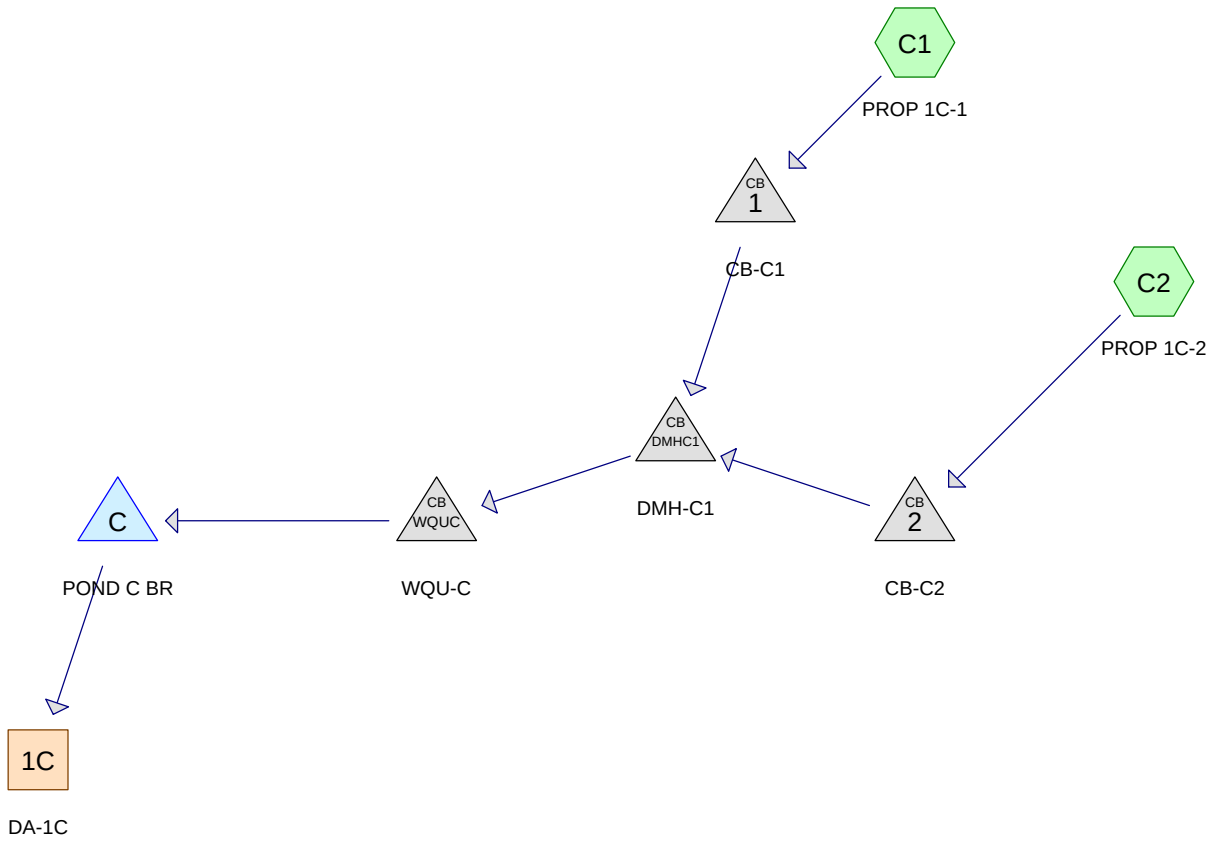
Summary for Pond WQU1: WQU-B

Inflow Area = 69,937 sf, 38.42% Impervious, Inflow Depth > 3.88" for 100 Year event
Inflow = 5.02 cfs @ 12.13 hrs, Volume= 22,623 cf
Outflow = 5.02 cfs @ 12.13 hrs, Volume= 22,623 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.02 cfs @ 12.13 hrs, Volume= 22,623 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.13' @ 12.13 hrs
Flood Elev= 61.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.80'	**18.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.80' / 56.23' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=5.01 cfs @ 12.13 hrs HW=58.13' (Free Discharge)
1=Culvert (Barrel Controls 5.01 cfs @ 4.01 fps)



Subcat Reach Pond Link

Drainage Diagram for 15-063 Hyd-Prop DA-C1
Prepared by Microsoft, Printed 1/7/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
24,410	39	>75% Grass cover, Good, HSG A (C1, C2)
20,099	98	Paved parking, HSG A (C1, C2)
8,489	98	Roofs, HSG A (C1, C2)
52,998		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-C1 Peak Elev=57.89' Inflow=0.77 cfs 3,003 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=0.77 cfs 3,003 cf

Pond 2: CB-C2 Peak Elev=56.95' Inflow=0.98 cfs 3,820 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0100 '/' Outflow=0.98 cfs 3,820 cf

Pond C: POND C BR Peak Elev=56.34' Storage=2,192 cf Inflow=1.75 cfs 6,823 cf
Discarded=0.04 cfs 2,258 cf Primary=1.42 cfs 2,981 cf Outflow=1.46 cfs 5,239 cf

Pond DMHC1: DMH-C1 Peak Elev=57.78' Inflow=1.75 cfs 6,823 cf
15.0" Round Culvert n=0.013 L=25.0' S=0.0052 '/' Outflow=1.75 cfs 6,823 cf

Pond WQUC: WQU-C Peak Elev=57.50' Inflow=1.75 cfs 6,823 cf
15.0" Round Culvert n=0.013 L=114.0' S=0.0050 '/' Outflow=1.75 cfs 6,823 cf

Summary for Pond 1: CB-C1

Inflow Area = 23,229 sf, 54.16% Impervious, Inflow Depth > 1.55" for 2 Year event
Inflow = 0.77 cfs @ 12.13 hrs, Volume= 3,003 cf
Outflow = 0.77 cfs @ 12.13 hrs, Volume= 3,003 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.77 cfs @ 12.13 hrs, Volume= 3,003 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.89' @ 12.13 hrs
Flood Elev= 60.32'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.32'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.32' / 57.22' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.77 cfs @ 12.13 hrs HW=57.89' (Free Discharge)
1=Culvert (Barrel Controls 0.77 cfs @ 2.43 fps)

Summary for Pond 2: CB-C2

Inflow Area = 29,769 sf, 53.77% Impervious, Inflow Depth > 1.54" for 2 Year event
Inflow = 0.98 cfs @ 12.13 hrs, Volume= 3,820 cf
Outflow = 0.98 cfs @ 12.13 hrs, Volume= 3,820 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.98 cfs @ 12.13 hrs, Volume= 3,820 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.95' @ 12.13 hrs
Flood Elev= 60.32'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.32'	**12.0" Round Culvert** L= 9.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.32' / 56.23' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.98 cfs @ 12.13 hrs HW=56.95' (Free Discharge)
1=Culvert (Barrel Controls 0.98 cfs @ 2.69 fps)

Summary for Pond C: POND C BR

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 1.54" for 2 Year event
Inflow = 1.75 cfs @ 12.13 hrs, Volume= 6,823 cf
Outflow = 1.46 cfs @ 12.20 hrs, Volume= 5,239 cf, Atten= 17%, Lag= 4.1 min
Discarded = 0.04 cfs @ 12.20 hrs, Volume= 2,258 cf
Primary = 1.42 cfs @ 12.20 hrs, Volume= 2,981 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 56.34' @ 12.20 hrs Surf.Area= 3,006 sf Storage= 2,192 cf

Plug-Flow detention time= 142.3 min calculated for 5,237 cf (77% of inflow)
Center-of-Mass det. time= 60.5 min (820.0 - 759.5)

Volume	Invert	Avail.Storage	Storage Description
#1	55.50'	4,405 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.50	2,273	0	0
56.00	2,645	1,230	1,230
57.00	3,705	3,175	4,405

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.50'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.20'	**10.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.04 cfs @ 12.20 hrs HW=56.34' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.42 cfs @ 12.20 hrs HW=56.34' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 1.42 cfs @ 1.01 fps)

Summary for Pond DMHC1: DMH-C1

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 1.54" for 2 Year event
Inflow = 1.75 cfs @ 12.13 hrs, Volume= 6,823 cf
Outflow = 1.75 cfs @ 12.13 hrs, Volume= 6,823 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.75 cfs @ 12.13 hrs, Volume= 6,823 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.78' @ 12.13 hrs
Flood Elev= 60.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.97'	**15.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.97' / 56.84' S= 0.0052 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.75 cfs @ 12.13 hrs HW=57.78' (Free Discharge)
1=Culvert (Barrel Controls 1.75 cfs @ 2.94 fps)

Summary for Pond WQUC: WQU-C

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 1.54" for 2 Year event
Inflow = 1.75 cfs @ 12.13 hrs, Volume= 6,823 cf
Outflow = 1.75 cfs @ 12.13 hrs, Volume= 6,823 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.75 cfs @ 12.13 hrs, Volume= 6,823 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.50' @ 12.13 hrs
Flood Elev= 62.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.74'	**15.0" Round Culvert** L= 114.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.74' / 56.17' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.75 cfs @ 12.13 hrs HW=57.50' (Free Discharge)
1=Culvert (Barrel Controls 1.75 cfs @ 3.20 fps)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-C1 Peak Elev=58.05' Inflow=1.18 cfs 4,800 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=1.18 cfs 4,800 cf

Pond 2: CB-C2 Peak Elev=57.14' Inflow=1.50 cfs 6,110 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0100 '/' Outflow=1.50 cfs 6,110 cf

Pond C: POND C BR Peak Elev=56.40' Storage=2,377 cf Inflow=2.68 cfs 10,910 cf
Discarded=0.04 cfs 2,466 cf Primary=2.43 cfs 6,669 cf Outflow=2.47 cfs 9,135 cf

Pond DMHC1: DMH-C1 Peak Elev=58.03' Inflow=2.68 cfs 10,910 cf
15.0" Round Culvert n=0.013 L=25.0' S=0.0052 '/' Outflow=2.68 cfs 10,910 cf

Pond WQUC: WQU-C Peak Elev=57.73' Inflow=2.68 cfs 10,910 cf
15.0" Round Culvert n=0.013 L=114.0' S=0.0050 '/' Outflow=2.68 cfs 10,910 cf

Summary for Pond 1: CB-C1

Inflow Area = 23,229 sf, 54.16% Impervious, Inflow Depth > 2.48" for 10 Year event
Inflow = 1.18 cfs @ 12.13 hrs, Volume= 4,800 cf
Outflow = 1.18 cfs @ 12.13 hrs, Volume= 4,800 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.18 cfs @ 12.13 hrs, Volume= 4,800 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.05' @ 12.13 hrs
Flood Elev= 60.32'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.32'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.32' / 57.22' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.18 cfs @ 12.13 hrs HW=58.05' (Free Discharge)
1=Culvert (Barrel Controls 1.18 cfs @ 2.70 fps)

Summary for Pond 2: CB-C2

Inflow Area = 29,769 sf, 53.77% Impervious, Inflow Depth > 2.46" for 10 Year event
Inflow = 1.50 cfs @ 12.13 hrs, Volume= 6,110 cf
Outflow = 1.50 cfs @ 12.13 hrs, Volume= 6,110 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.50 cfs @ 12.13 hrs, Volume= 6,110 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.14' @ 12.13 hrs
Flood Elev= 60.32'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.32'	**12.0" Round Culvert** L= 9.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.32' / 56.23' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.50 cfs @ 12.13 hrs HW=57.14' (Free Discharge)
1=Culvert (Barrel Controls 1.50 cfs @ 2.97 fps)

Summary for Pond C: POND C BR

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 2.47" for 10 Year event
Inflow = 2.68 cfs @ 12.13 hrs, Volume= 10,910 cf
Outflow = 2.47 cfs @ 12.17 hrs, Volume= 9,135 cf, Atten= 8%, Lag= 2.6 min
Discarded = 0.04 cfs @ 12.17 hrs, Volume= 2,466 cf
Primary = 2.43 cfs @ 12.17 hrs, Volume= 6,669 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 56.40' @ 12.17 hrs Surf.Area= 3,071 sf Storage= 2,377 cf

Plug-Flow detention time= 110.7 min calculated for 9,135 cf (84% of inflow)
Center-of-Mass det. time= 40.5 min (799.6 - 759.1)

Volume	Invert	Avail.Storage	Storage Description
#1	55.50'	4,405 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.50	2,273	0	0
56.00	2,645	1,230	1,230
57.00	3,705	3,175	4,405

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.50'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.20'	**10.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.04 cfs @ 12.17 hrs HW=56.40' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=2.43 cfs @ 12.17 hrs HW=56.40' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.43 cfs @ 1.21 fps)

Summary for Pond DMHC1: DMH-C1

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 2.47" for 10 Year event
Inflow = 2.68 cfs @ 12.13 hrs, Volume= 10,910 cf
Outflow = 2.68 cfs @ 12.13 hrs, Volume= 10,910 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.68 cfs @ 12.13 hrs, Volume= 10,910 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.03' @ 12.13 hrs
Flood Elev= 60.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.97'	**15.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.97' / 56.84' S= 0.0052 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.67 cfs @ 12.13 hrs HW=58.03' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.67 cfs @ 3.26 fps)

Summary for Pond WQUC: WQU-C

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 2.47" for 10 Year event
Inflow = 2.68 cfs @ 12.13 hrs, Volume= 10,910 cf
Outflow = 2.68 cfs @ 12.13 hrs, Volume= 10,910 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.68 cfs @ 12.13 hrs, Volume= 10,910 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.73' @ 12.13 hrs
Flood Elev= 62.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.74'	**15.0" Round Culvert** L= 114.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.74' / 56.17' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.67 cfs @ 12.13 hrs HW=57.73' (Free Discharge)
1=Culvert (Barrel Controls 2.67 cfs @ 3.53 fps)

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-C1 Peak Elev=58.46' Inflow=2.30 cfs 9,576 cf
12.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=2.30 cfs 9,576 cf

Pond 2: CB-C2 Peak Elev=57.77' Inflow=2.91 cfs 12,206 cf
12.0" Round Culvert n=0.013 L=9.0' S=0.0100 '/' Outflow=2.91 cfs 12,206 cf

Pond C: POND C BR Peak Elev=56.52' Storage=2,744 cf Inflow=5.21 cfs 21,782 cf
Discarded=0.04 cfs 2,683 cf Primary=4.87 cfs 17,290 cf Outflow=4.91 cfs 19,974 cf

Pond DMHC1: DMH-C1 Peak Elev=58.84' Inflow=5.21 cfs 21,782 cf
15.0" Round Culvert n=0.013 L=25.0' S=0.0052 '/' Outflow=5.21 cfs 21,782 cf

Pond WQUC: WQU-C Peak Elev=58.70' Inflow=5.21 cfs 21,782 cf
15.0" Round Culvert n=0.013 L=114.0' S=0.0050 '/' Outflow=5.21 cfs 21,782 cf

Summary for Pond 1: CB-C1

Inflow Area = 23,229 sf, 54.16% Impervious, Inflow Depth > 4.95" for 100 Year event
Inflow = 2.30 cfs @ 12.13 hrs, Volume= 9,576 cf
Outflow = 2.30 cfs @ 12.13 hrs, Volume= 9,576 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.30 cfs @ 12.13 hrs, Volume= 9,576 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.46' @ 12.13 hrs
Flood Elev= 60.32'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.32'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.32' / 57.22' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.29 cfs @ 12.13 hrs HW=58.46' (Free Discharge)
1=Culvert (Barrel Controls 2.29 cfs @ 3.22 fps)

Summary for Pond 2: CB-C2

Inflow Area = 29,769 sf, 53.77% Impervious, Inflow Depth > 4.92" for 100 Year event
Inflow = 2.91 cfs @ 12.13 hrs, Volume= 12,206 cf
Outflow = 2.91 cfs @ 12.13 hrs, Volume= 12,206 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.91 cfs @ 12.13 hrs, Volume= 12,206 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.77' @ 12.13 hrs
Flood Elev= 60.32'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.32'	**12.0" Round Culvert** L= 9.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.32' / 56.23' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.91 cfs @ 12.13 hrs HW=57.77' (Free Discharge)
1=Culvert (Inlet Controls 2.91 cfs @ 3.71 fps)

Summary for Pond C: POND C BR

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 4.93" for 100 Year event
Inflow = 5.21 cfs @ 12.13 hrs, Volume= 21,782 cf
Outflow = 4.91 cfs @ 12.17 hrs, Volume= 19,974 cf, Atten= 6%, Lag= 2.2 min
Discarded = 0.04 cfs @ 12.17 hrs, Volume= 2,683 cf
Primary = 4.87 cfs @ 12.17 hrs, Volume= 17,290 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 56.52' @ 12.17 hrs Surf.Area= 3,195 sf Storage= 2,744 cf

Plug-Flow detention time= 79.0 min calculated for 19,974 cf (92% of inflow)
Center-of-Mass det. time= 34.4 min (797.5 - 763.1)

Volume	Invert	Avail.Storage	Storage Description
#1	55.50'	4,405 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.50	2,273	0	0
56.00	2,645	1,230	1,230
57.00	3,705	3,175	4,405

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.50'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.20'	**10.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.04 cfs @ 12.17 hrs HW=56.52' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=4.87 cfs @ 12.17 hrs HW=56.52' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 4.87 cfs @ 1.53 fps)

Summary for Pond DMHC1: DMH-C1

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 4.93" for 100 Year event
Inflow = 5.21 cfs @ 12.13 hrs, Volume= 21,782 cf
Outflow = 5.21 cfs @ 12.13 hrs, Volume= 21,782 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.21 cfs @ 12.13 hrs, Volume= 21,782 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.84' @ 12.13 hrs
Flood Elev= 60.58'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.97'	**15.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.97' / 56.84' S= 0.0052 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=5.20 cfs @ 12.13 hrs HW=58.84' (Free Discharge)
↑**1=Culvert** (Inlet Controls 5.20 cfs @ 4.24 fps)

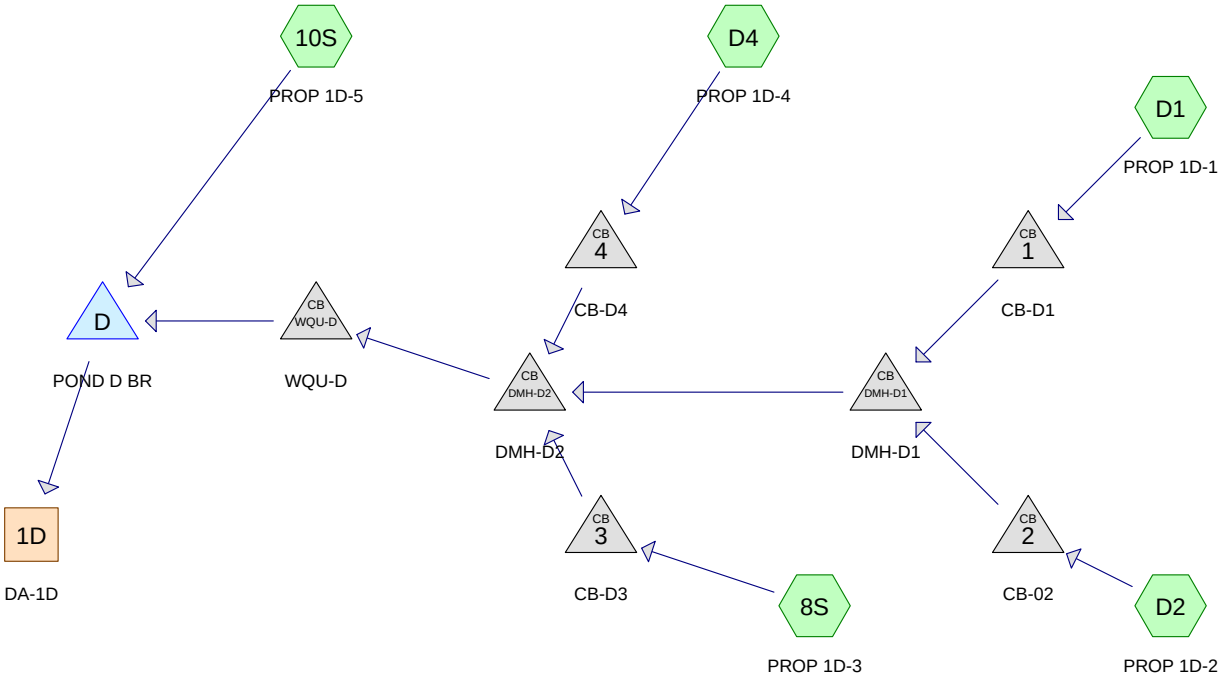
Summary for Pond WQUC: WQU-C

Inflow Area = 52,998 sf, 53.94% Impervious, Inflow Depth > 4.93" for 100 Year event
Inflow = 5.21 cfs @ 12.13 hrs, Volume= 21,782 cf
Outflow = 5.21 cfs @ 12.13 hrs, Volume= 21,782 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.21 cfs @ 12.13 hrs, Volume= 21,782 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.70' @ 12.13 hrs
Flood Elev= 62.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.74'	**15.0" Round Culvert** L= 114.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.74' / 56.17' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=5.20 cfs @ 12.13 hrs HW=58.69' (Free Discharge)
1=Culvert (Barrel Controls 5.20 cfs @ 4.24 fps)



Subcat Reach Pond Link

Drainage Diagram for 15-063 Hyd-Prop DA-D1

Prepared by Microsoft, Printed 1/7/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
114,355	39	>75% Grass cover, Good, HSG A (8S, 10S, D1, D2, D4)
34,791	98	Paved parking, HSG A (8S, D1, D2, D4)
12,969	98	Roofs, HSG A (10S, D1, D4)
162,115		**TOTAL AREA**

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-D1 Peak Elev=59.35' Inflow=0.88 cfs 3,519 cf
12.0" Round Culvert n=0.013 L=6.0' S=0.0100 '/' Outflow=0.88 cfs 3,519 cf

Pond 2: CB-02 Peak Elev=59.07' Inflow=0.28 cfs 1,156 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0053 '/' Outflow=0.28 cfs 1,156 cf

Pond 3: CB-D3 Peak Elev=57.35' Inflow=0.39 cfs 1,644 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0047 '/' Outflow=0.39 cfs 1,644 cf

Pond 4: CB-D4 Peak Elev=57.69' Inflow=1.23 cfs 4,679 cf
12.0" Round Culvert n=0.013 L=7.0' S=0.0100 '/' Outflow=1.23 cfs 4,679 cf

Pond D: POND D BR Peak Elev=55.39' Storage=3,303 cf Inflow=2.86 cfs 11,398 cf
Discarded=0.05 cfs 3,431 cf Primary=2.70 cfs 5,231 cf Outflow=2.75 cfs 8,663 cf

Pond DMH-D1: DMH-D1 Peak Elev=59.20' Inflow=1.16 cfs 4,675 cf
12.0" Round Culvert n=0.013 L=189.0' S=0.0100 '/' Outflow=1.16 cfs 4,675 cf

Pond DMH-D2: DMH-D2 Peak Elev=57.16' Inflow=2.75 cfs 10,998 cf
18.0" Round Culvert n=0.013 L=22.0' S=0.0050 '/' Outflow=2.75 cfs 10,998 cf

Pond WQU-D: WQU-D Peak Elev=56.86' Inflow=2.75 cfs 10,998 cf
18.0" Round Culvert n=0.013 L=148.0' S=0.0050 '/' Outflow=2.75 cfs 10,998 cf

Summary for Pond 1: CB-D1

Inflow Area = 26,985 sf, 54.65% Impervious, Inflow Depth > 1.56" for 2 Year event
Inflow = 0.88 cfs @ 12.14 hrs, Volume= 3,519 cf
Outflow = 0.88 cfs @ 12.14 hrs, Volume= 3,519 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.88 cfs @ 12.14 hrs, Volume= 3,519 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.35' @ 12.14 hrs
Flood Elev= 61.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.75'	**12.0" Round Culvert** L= 6.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.75' / 58.69' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.87 cfs @ 12.14 hrs HW=59.35' (Free Discharge)
1=Culvert (Barrel Controls 0.87 cfs @ 2.54 fps)

Summary for Pond 2: CB-02

Inflow Area = 14,630 sf, 33.11% Impervious, Inflow Depth > 0.95" for 2 Year event
Inflow = 0.28 cfs @ 12.15 hrs, Volume= 1,156 cf
Outflow = 0.28 cfs @ 12.15 hrs, Volume= 1,156 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.28 cfs @ 12.15 hrs, Volume= 1,156 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.07' @ 12.15 hrs
Flood Elev= 61.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.75'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.75' / 58.66' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.28 cfs @ 12.15 hrs HW=59.07' (Free Discharge)
1=Culvert (Barrel Controls 0.28 cfs @ 1.91 fps)

Summary for Pond 3: CB-D3

Inflow Area = 61,661 sf, 11.18% Impervious, Inflow Depth > 0.32" for 2 Year event
Inflow = 0.39 cfs @ 12.16 hrs, Volume= 1,644 cf
Outflow = 0.39 cfs @ 12.16 hrs, Volume= 1,644 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.39 cfs @ 12.16 hrs, Volume= 1,644 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.35' @ 12.16 hrs
Flood Elev= 59.96'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.96'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.96' / 56.88' S= 0.0047 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.39 cfs @ 12.16 hrs HW=57.35' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.39 cfs @ 2.02 fps)

Summary for Pond 4: CB-D4

Inflow Area = 40,034 sf, 48.96% Impervious, Inflow Depth > 1.40" for 2 Year event
Inflow = 1.23 cfs @ 12.12 hrs, Volume= 4,679 cf
Outflow = 1.23 cfs @ 12.12 hrs, Volume= 4,679 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.23 cfs @ 12.12 hrs, Volume= 4,679 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.69' @ 12.12 hrs
Flood Elev= 59.96'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.96'	**12.0" Round Culvert** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.96' / 56.89' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.23 cfs @ 12.12 hrs HW=57.69' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.23 cfs @ 2.78 fps)

Summary for Pond D: POND D BR

Inflow Area = 162,115 sf, 29.46% Impervious, Inflow Depth > 0.84" for 2 Year event
Inflow = 2.86 cfs @ 12.13 hrs, Volume= 11,398 cf
Outflow = 2.75 cfs @ 12.16 hrs, Volume= 8,663 cf, Atten= 4%, Lag= 1.8 min
Discarded = 0.05 cfs @ 12.16 hrs, Volume= 3,431 cf
Primary = 2.70 cfs @ 12.16 hrs, Volume= 5,231 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.39' @ 12.16 hrs Surf.Area= 4,290 sf Storage= 3,303 cf

Plug-Flow detention time= 135.3 min calculated for 8,659 cf (76% of inflow)
Center-of-Mass det. time= 52.1 min (812.1 - 759.9)

Volume	Invert	Avail.Storage	Storage Description
#1	54.55'	6,088 cf	**STORM WATER WETLAND (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.55	3,607	0	0
55.00	3,983	1,708	1,708
56.00	4,778	4,381	6,088

Device	Routing	Invert	Outlet Devices
#1	Discarded	54.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	55.30'	**40.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.05 cfs @ 12.16 hrs HW=55.39' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=2.69 cfs @ 12.16 hrs HW=55.39' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.69 cfs @ 0.79 fps)

Summary for Pond DMH-D1: DMH-D1

Inflow Area = 41,615 sf, 47.08% Impervious, Inflow Depth > 1.35" for 2 Year event
Inflow = 1.16 cfs @ 12.14 hrs, Volume= 4,675 cf
Outflow = 1.16 cfs @ 12.14 hrs, Volume= 4,675 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.16 cfs @ 12.14 hrs, Volume= 4,675 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.20' @ 12.14 hrs
Flood Elev= 61.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.56'	**12.0" Round Culvert** L= 189.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.56' / 56.67' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.15 cfs @ 12.14 hrs HW=59.20' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.15 cfs @ 2.16 fps)

Summary for Pond DMH-D2: DMH-D2

Inflow Area = 143,310 sf, 32.16% Impervious, Inflow Depth > 0.92" for 2 Year event
Inflow = 2.75 cfs @ 12.13 hrs, Volume= 10,998 cf
Outflow = 2.75 cfs @ 12.13 hrs, Volume= 10,998 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.75 cfs @ 12.13 hrs, Volume= 10,998 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.16' @ 12.13 hrs
Flood Elev= 60.08'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.17'	**18.0" Round Culvert** L= 22.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.17' / 56.06' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.75 cfs @ 12.13 hrs HW=57.16' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.75 cfs @ 3.16 fps)

Summary for Pond WQU-D: WQU-D

Inflow Area = 143,310 sf, 32.16% Impervious, Inflow Depth > 0.92" for 2 Year event
Inflow = 2.75 cfs @ 12.13 hrs, Volume= 10,998 cf
Outflow = 2.75 cfs @ 12.13 hrs, Volume= 10,998 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.75 cfs @ 12.13 hrs, Volume= 10,998 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.86' @ 12.13 hrs
Flood Elev= 61.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	55.96'	**18.0" Round Culvert** L= 148.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 55.96' / 55.22' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.75 cfs @ 12.13 hrs HW=56.86' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.75 cfs @ 3.57 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-D1 Peak Elev=59.53' Inflow=1.34 cfs 5,623 cf
12.0" Round Culvert n=0.013 L=6.0' S=0.0100 '/' Outflow=1.34 cfs 5,623 cf

Pond 2: CB-02 Peak Elev=59.16' Inflow=0.43 cfs 1,915 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0053 '/' Outflow=0.43 cfs 1,915 cf

Pond 3: CB-D3 Peak Elev=57.46' Inflow=0.60 cfs 3,209 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0047 '/' Outflow=0.60 cfs 3,209 cf

Pond 4: CB-D4 Peak Elev=57.92' Inflow=1.88 cfs 7,526 cf
12.0" Round Culvert n=0.013 L=7.0' S=0.0100 '/' Outflow=1.88 cfs 7,526 cf

Pond D: POND D BR Peak Elev=55.42' Storage=3,431 cf Inflow=4.36 cfs 19,098 cf
Discarded=0.05 cfs 3,727 cf Primary=4.22 cfs 12,423 cf Outflow=4.28 cfs 16,151 cf

Pond DMH-D1: DMH-D1 Peak Elev=59.41' Inflow=1.77 cfs 7,538 cf
12.0" Round Culvert n=0.013 L=189.0' S=0.0100 '/' Outflow=1.77 cfs 7,538 cf

Pond DMH-D2: DMH-D2 Peak Elev=57.45' Inflow=4.21 cfs 18,272 cf
18.0" Round Culvert n=0.013 L=22.0' S=0.0050 '/' Outflow=4.21 cfs 18,272 cf

Pond WQU-D: WQU-D Peak Elev=57.13' Inflow=4.21 cfs 18,272 cf
18.0" Round Culvert n=0.013 L=148.0' S=0.0050 '/' Outflow=4.21 cfs 18,272 cf

Summary for Pond 1: CB-D1

Inflow Area = 26,985 sf, 54.65% Impervious, Inflow Depth > 2.50" for 10 Year event
Inflow = 1.34 cfs @ 12.14 hrs, Volume= 5,623 cf
Outflow = 1.34 cfs @ 12.14 hrs, Volume= 5,623 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.34 cfs @ 12.14 hrs, Volume= 5,623 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.53' @ 12.14 hrs
Flood Elev= 61.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.75'	**12.0" Round Culvert** L= 6.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.75' / 58.69' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.34 cfs @ 12.14 hrs HW=59.53' (Free Discharge)
1=Culvert (Barrel Controls 1.34 cfs @ 2.81 fps)

Summary for Pond 2: CB-02

Inflow Area = 14,630 sf, 33.11% Impervious, Inflow Depth > 1.57" for 10 Year event
Inflow = 0.43 cfs @ 12.15 hrs, Volume= 1,915 cf
Outflow = 0.43 cfs @ 12.15 hrs, Volume= 1,915 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.43 cfs @ 12.15 hrs, Volume= 1,915 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.16' @ 12.15 hrs
Flood Elev= 61.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.75'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.75' / 58.66' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.43 cfs @ 12.15 hrs HW=59.16' (Free Discharge)
1=Culvert (Barrel Controls 0.43 cfs @ 2.11 fps)

Summary for Pond 3: CB-D3

Inflow Area = 61,661 sf, 11.18% Impervious, Inflow Depth > 0.62" for 10 Year event
Inflow = 0.60 cfs @ 12.16 hrs, Volume= 3,209 cf
Outflow = 0.60 cfs @ 12.16 hrs, Volume= 3,209 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.60 cfs @ 12.16 hrs, Volume= 3,209 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.46' @ 12.16 hrs
Flood Elev= 59.96'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.96'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.96' / 56.88' S= 0.0047 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.60 cfs @ 12.16 hrs HW=57.46' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.60 cfs @ 2.25 fps)

Summary for Pond 4: CB-D4

Inflow Area = 40,034 sf, 48.96% Impervious, Inflow Depth > 2.26" for 10 Year event
Inflow = 1.88 cfs @ 12.12 hrs, Volume= 7,526 cf
Outflow = 1.88 cfs @ 12.12 hrs, Volume= 7,526 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.88 cfs @ 12.12 hrs, Volume= 7,526 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.92' @ 12.12 hrs
Flood Elev= 59.96'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.96'	**12.0" Round Culvert** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.96' / 56.89' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.88 cfs @ 12.12 hrs HW=57.92' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.88 cfs @ 3.10 fps)

Summary for Pond D: POND D BR

Inflow Area = 162,115 sf, 29.46% Impervious, Inflow Depth > 1.41" for 10 Year event
Inflow = 4.36 cfs @ 12.13 hrs, Volume= 19,098 cf
Outflow = 4.28 cfs @ 12.15 hrs, Volume= 16,151 cf, Atten= 2%, Lag= 1.3 min
Discarded = 0.05 cfs @ 12.15 hrs, Volume= 3,727 cf
Primary = 4.22 cfs @ 12.15 hrs, Volume= 12,423 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.42' @ 12.15 hrs Surf.Area= 4,313 sf Storage= 3,431 cf

Plug-Flow detention time= 109.4 min calculated for 16,151 cf (85% of inflow)
Center-of-Mass det. time= 38.4 min (810.4 - 772.1)

Volume	Invert	Avail.Storage	Storage Description
#1	54.55'	6,088 cf	**STORM WATER WETLAND (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.55	3,607	0	0
55.00	3,983	1,708	1,708
56.00	4,778	4,381	6,088

Device	Routing	Invert	Outlet Devices
#1	Discarded	54.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	55.30'	**40.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.05 cfs @ 12.15 hrs HW=55.42' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=4.21 cfs @ 12.15 hrs HW=55.42' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.21 cfs @ 0.91 fps)

Summary for Pond DMH-D1: DMH-D1

Inflow Area = 41,615 sf, 47.08% Impervious, Inflow Depth > 2.17" for 10 Year event
Inflow = 1.77 cfs @ 12.14 hrs, Volume= 7,538 cf
Outflow = 1.77 cfs @ 12.14 hrs, Volume= 7,538 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.77 cfs @ 12.14 hrs, Volume= 7,538 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.41' @ 12.14 hrs
Flood Elev= 61.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.56'	**12.0" Round Culvert** L= 189.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.56' / 56.67' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.77 cfs @ 12.14 hrs HW=59.41' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.77 cfs @ 2.48 fps)

Summary for Pond DMH-D2: DMH-D2

Inflow Area = 143,310 sf, 32.16% Impervious, Inflow Depth > 1.53" for 10 Year event
Inflow = 4.21 cfs @ 12.13 hrs, Volume= 18,272 cf
Outflow = 4.21 cfs @ 12.13 hrs, Volume= 18,272 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.21 cfs @ 12.13 hrs, Volume= 18,272 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.45' @ 12.13 hrs
Flood Elev= 60.08'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.17'	**18.0" Round Culvert** L= 22.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.17' / 56.06' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=4.20 cfs @ 12.13 hrs HW=57.45' (Free Discharge)
└**1=Culvert** (Barrel Controls 4.20 cfs @ 3.52 fps)

Summary for Pond WQU-D: WQU-D

Inflow Area = 143,310 sf, 32.16% Impervious, Inflow Depth > 1.53" for 10 Year event
Inflow = 4.21 cfs @ 12.13 hrs, Volume= 18,272 cf
Outflow = 4.21 cfs @ 12.13 hrs, Volume= 18,272 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.21 cfs @ 12.13 hrs, Volume= 18,272 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.13' @ 12.13 hrs
Flood Elev= 61.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	55.96'	**18.0" Round Culvert** L= 148.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 55.96' / 55.22' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=4.20 cfs @ 12.13 hrs HW=57.13' (Free Discharge)
└**1=Culvert** (Barrel Controls 4.20 cfs @ 3.93 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-D1 Peak Elev=60.01' Inflow=2.60 cfs 11,192 cf
12.0" Round Culvert n=0.013 L=6.0' S=0.0100 '/' Outflow=2.60 cfs 11,192 cf

Pond 2: CB-02 Peak Elev=59.38' Inflow=0.94 cfs 4,291 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0053 '/' Outflow=0.94 cfs 4,291 cf

Pond 3: CB-D3 Peak Elev=58.01' Inflow=2.06 cfs 10,459 cf
12.0" Round Culvert n=0.013 L=17.0' S=0.0047 '/' Outflow=2.06 cfs 10,459 cf

Pond 4: CB-D4 Peak Elev=59.03' Inflow=3.74 cfs 15,325 cf
12.0" Round Culvert n=0.013 L=7.0' S=0.0100 '/' Outflow=3.74 cfs 15,325 cf

Pond D: POND D BR Peak Elev=55.50' Storage=3,795 cf Inflow=9.75 cfs 44,220 cf
Discarded=0.05 cfs 4,000 cf Primary=9.58 cfs 37,243 cf Outflow=9.63 cfs 41,243 cf

Pond DMH-D1: DMH-D1 Peak Elev=60.46' Inflow=3.53 cfs 15,483 cf
12.0" Round Culvert n=0.013 L=189.0' S=0.0100 '/' Outflow=3.53 cfs 15,483 cf

Pond DMH-D2: DMH-D2 Peak Elev=58.76' Inflow=9.11 cfs 41,268 cf
18.0" Round Culvert n=0.013 L=22.0' S=0.0050 '/' Outflow=9.11 cfs 41,268 cf

Pond WQU-D: WQU-D Peak Elev=58.62' Inflow=9.11 cfs 41,268 cf
18.0" Round Culvert n=0.013 L=148.0' S=0.0050 '/' Outflow=9.11 cfs 41,268 cf

Summary for Pond 1: CB-D1

Inflow Area = 26,985 sf, 54.65% Impervious, Inflow Depth > 4.98" for 100 Year event
Inflow = 2.60 cfs @ 12.14 hrs, Volume= 11,192 cf
Outflow = 2.60 cfs @ 12.14 hrs, Volume= 11,192 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.60 cfs @ 12.14 hrs, Volume= 11,192 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.01' @ 12.14 hrs
Flood Elev= 61.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.75'	**12.0" Round Culvert** L= 6.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.75' / 58.69' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.59 cfs @ 12.14 hrs HW=60.00' (Free Discharge)
1=Culvert (Inlet Controls 2.59 cfs @ 3.30 fps)

Summary for Pond 2: CB-02

Inflow Area = 14,630 sf, 33.11% Impervious, Inflow Depth > 3.52" for 100 Year event
Inflow = 0.94 cfs @ 12.16 hrs, Volume= 4,291 cf
Outflow = 0.94 cfs @ 12.16 hrs, Volume= 4,291 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.94 cfs @ 12.16 hrs, Volume= 4,291 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.38' @ 12.16 hrs
Flood Elev= 61.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.75'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.75' / 58.66' S= 0.0053 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.94 cfs @ 12.16 hrs HW=59.38' (Free Discharge)
1=Culvert (Barrel Controls 0.94 cfs @ 2.55 fps)

Summary for Pond 3: CB-D3

Inflow Area = 61,661 sf, 11.18% Impervious, Inflow Depth > 2.04" for 100 Year event
Inflow = 2.06 cfs @ 12.19 hrs, Volume= 10,459 cf
Outflow = 2.06 cfs @ 12.19 hrs, Volume= 10,459 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.06 cfs @ 12.19 hrs, Volume= 10,459 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.01' @ 12.19 hrs
Flood Elev= 59.96'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.96'	**12.0" Round Culvert** L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.96' / 56.88' S= 0.0047 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.06 cfs @ 12.19 hrs HW=58.01' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.06 cfs @ 3.09 fps)

Summary for Pond 4: CB-D4

Inflow Area = 40,034 sf, 48.96% Impervious, Inflow Depth > 4.59" for 100 Year event
Inflow = 3.74 cfs @ 12.12 hrs, Volume= 15,325 cf
Outflow = 3.74 cfs @ 12.12 hrs, Volume= 15,325 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.74 cfs @ 12.12 hrs, Volume= 15,325 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.03' @ 12.12 hrs
Flood Elev= 59.96'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.96'	**12.0" Round Culvert** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.96' / 56.89' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.74 cfs @ 12.12 hrs HW=59.03' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.74 cfs @ 4.76 fps)

Summary for Pond D: POND D BR

Inflow Area = 162,115 sf, 29.46% Impervious, Inflow Depth > 3.27" for 100 Year event
Inflow = 9.75 cfs @ 12.14 hrs, Volume= 44,220 cf
Outflow = 9.63 cfs @ 12.16 hrs, Volume= 41,243 cf, Atten= 1%, Lag= 1.1 min
Discarded = 0.05 cfs @ 12.16 hrs, Volume= 4,000 cf
Primary = 9.58 cfs @ 12.16 hrs, Volume= 37,243 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 55.50' @ 12.16 hrs Surf.Area= 4,380 sf Storage= 3,795 cf

Plug-Flow detention time= 65.8 min calculated for 41,243 cf (93% of inflow)
Center-of-Mass det. time= 28.3 min (818.0 - 789.7)

Volume	Invert	Avail.Storage	Storage Description
#1	54.55'	6,088 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.55	3,607	0	0
55.00	3,983	1,708	1,708
56.00	4,778	4,381	6,088

Device	Routing	Invert	Outlet Devices
#1	Discarded	54.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	55.30'	**40.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.05 cfs @ 12.16 hrs HW=55.50' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=9.57 cfs @ 12.16 hrs HW=55.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 9.57 cfs @ 1.20 fps)

Summary for Pond DMH-D1: DMH-D1

Inflow Area = 41,615 sf, 47.08% Impervious, Inflow Depth > 4.46" for 100 Year event
Inflow = 3.53 cfs @ 12.15 hrs, Volume= 15,483 cf
Outflow = 3.53 cfs @ 12.15 hrs, Volume= 15,483 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.53 cfs @ 12.15 hrs, Volume= 15,483 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.46' @ 12.15 hrs
Flood Elev= 61.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.56'	**12.0" Round Culvert** L= 189.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.56' / 56.67' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.53 cfs @ 12.15 hrs HW=60.46' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.53 cfs @ 4.49 fps)

Summary for Pond DMH-D2: DMH-D2

Inflow Area = 143,310 sf, 32.16% Impervious, Inflow Depth > 3.46" for 100 Year event
Inflow = 9.11 cfs @ 12.14 hrs, Volume= 41,268 cf
Outflow = 9.11 cfs @ 12.14 hrs, Volume= 41,268 cf, Atten= 0%, Lag= 0.0 min
Primary = 9.11 cfs @ 12.14 hrs, Volume= 41,268 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.76' @ 12.14 hrs
Flood Elev= 60.08'

Device	Routing	Invert	Outlet Devices
#1	Primary	56.17'	**18.0" Round Culvert** L= 22.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 56.17' / 56.06' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=9.10 cfs @ 12.14 hrs HW=58.75' (Free Discharge)
└**1=Culvert** (Inlet Controls 9.10 cfs @ 5.15 fps)

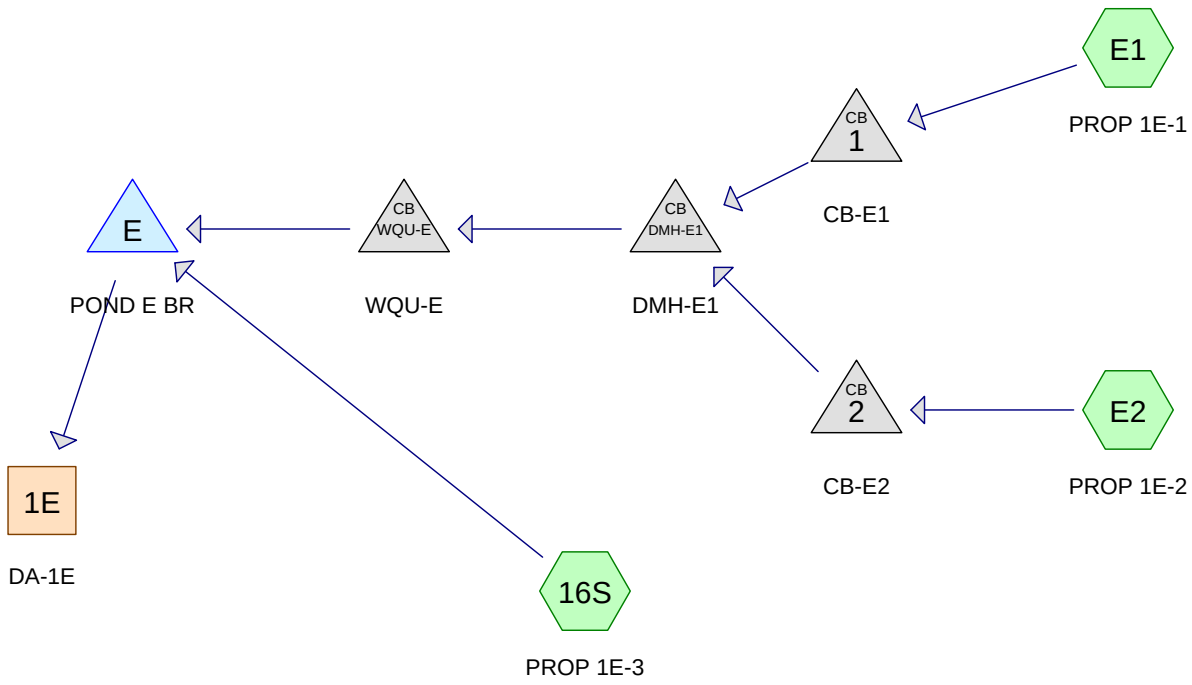
Summary for Pond WQU-D: WQU-D

Inflow Area = 143,310 sf, 32.16% Impervious, Inflow Depth > 3.46" for 100 Year event
Inflow = 9.11 cfs @ 12.14 hrs, Volume= 41,268 cf
Outflow = 9.11 cfs @ 12.14 hrs, Volume= 41,268 cf, Atten= 0%, Lag= 0.0 min
Primary = 9.11 cfs @ 12.14 hrs, Volume= 41,268 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.62' @ 12.14 hrs
Flood Elev= 61.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	55.96'	**18.0" Round Culvert** L= 148.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 55.96' / 55.22' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=9.10 cfs @ 12.14 hrs HW=58.62' (Free Discharge)
└**1=Culvert** (Barrel Controls 9.10 cfs @ 5.15 fps)



Subcat Reach Pond Link

Drainage Diagram for 15-063 Hyd-Prop DA-E1
Prepared by Microsoft, Printed 1/7/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
17,130	39	>75% Grass cover, Good, HSG A (16S)
20,342	76	Gravel roads, HSG A (E1, E2)
12,988	98	Paved parking, HSG A (E1, E2)
8,369	98	Roofs, HSG A (16S, E1, E2)
58,829		**TOTAL AREA**

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-E1 Peak Elev=58.55' Inflow=0.85 cfs 3,228 cf
12.0" Round Culvert n=0.013 L=14.5' S=0.0103 '/' Outflow=0.85 cfs 3,228 cf

Pond 2: CB-E2 Peak Elev=58.57' Inflow=0.87 cfs 3,301 cf
12.0" Round Culvert n=0.013 L=11.5' S=0.0104 '/' Outflow=0.87 cfs 3,301 cf

Pond DMH-E1: DMH-E1 Peak Elev=58.32' Inflow=1.72 cfs 6,529 cf
15.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=1.72 cfs 6,529 cf

Pond E: POND E BR Peak Elev=56.80' Storage=1,504 cf Inflow=1.81 cfs 6,929 cf
Discarded=0.03 cfs 1,777 cf Primary=1.76 cfs 3,782 cf Outflow=1.79 cfs 5,558 cf

Pond WQU-E: WQU-E Peak Elev=58.05' Inflow=1.72 cfs 6,529 cf
15.0" Round Culvert n=0.013 L=130.0' S=0.0050 '/' Outflow=1.72 cfs 6,529 cf

Summary for Pond 1: CB-E1

Inflow Area = 19,492 sf, 50.84% Impervious, Inflow Depth > 1.99" for 2 Year event
Inflow = 0.85 cfs @ 12.13 hrs, Volume= 3,228 cf
Outflow = 0.85 cfs @ 12.13 hrs, Volume= 3,228 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.85 cfs @ 12.13 hrs, Volume= 3,228 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.55' @ 12.13 hrs
Flood Elev= 61.06'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	**12.0" Round Culvert** L= 14.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.00' / 57.85' S= 0.0103 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.85 cfs @ 12.13 hrs HW=58.55' (Free Discharge)
1=Culvert (Barrel Controls 0.85 cfs @ 2.76 fps)

Summary for Pond 2: CB-E2

Inflow Area = 20,532 sf, 47.60% Impervious, Inflow Depth > 1.93" for 2 Year event
Inflow = 0.87 cfs @ 12.13 hrs, Volume= 3,301 cf
Outflow = 0.87 cfs @ 12.13 hrs, Volume= 3,301 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.87 cfs @ 12.13 hrs, Volume= 3,301 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.57' @ 12.13 hrs
Flood Elev= 61.06'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	**12.0" Round Culvert** L= 11.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.00' / 57.88' S= 0.0104 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.87 cfs @ 12.13 hrs HW=58.57' (Free Discharge)
1=Culvert (Barrel Controls 0.87 cfs @ 2.70 fps)

Summary for Pond DMH-E1: DMH-E1

Inflow Area = 40,024 sf, 49.18% Impervious, Inflow Depth > 1.96" for 2 Year event
Inflow = 1.72 cfs @ 12.13 hrs, Volume= 6,529 cf
Outflow = 1.72 cfs @ 12.13 hrs, Volume= 6,529 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.72 cfs @ 12.13 hrs, Volume= 6,529 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.32' @ 12.13 hrs
Flood Elev= 61.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.50'	**15.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.50' / 57.40' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.72 cfs @ 12.13 hrs HW=58.32' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.72 cfs @ 2.87 fps)

Summary for Pond E: POND E BR

Inflow Area = 58,829 sf, 36.30% Impervious, Inflow Depth > 1.41" for 2 Year event
Inflow = 1.81 cfs @ 12.12 hrs, Volume= 6,929 cf
Outflow = 1.79 cfs @ 12.14 hrs, Volume= 5,558 cf, Atten= 1%, Lag= 0.8 min
Discarded = 0.03 cfs @ 12.14 hrs, Volume= 1,777 cf
Primary = 1.76 cfs @ 12.14 hrs, Volume= 3,782 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.80' @ 12.14 hrs Surf.Area= 2,462 sf Storage= 1,504 cf

Plug-Flow detention time= 113.0 min calculated for 5,558 cf (80% of inflow)
Center-of-Mass det. time= 34.6 min (820.1 - 785.5)

Volume	Invert	Avail.Storage	Storage Description
#1	56.05'	1,774 cf	**STORM WATER WETLAND (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.05	1,718	0	0
56.75	2,248	1,388	1,388
56.90	2,900	386	1,774

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.05'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.75'	**60.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.03 cfs @ 12.14 hrs HW=56.80' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.76 cfs @ 12.14 hrs HW=56.80' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.76 cfs @ 0.60 fps)

Summary for Pond WQU-E: WQU-E

Inflow Area = 40,024 sf, 49.18% Impervious, Inflow Depth > 1.96" for 2 Year event
Inflow = 1.72 cfs @ 12.13 hrs, Volume= 6,529 cf
Outflow = 1.72 cfs @ 12.13 hrs, Volume= 6,529 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.72 cfs @ 12.13 hrs, Volume= 6,529 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.05' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	57.30'	**15.0" Round Culvert** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.30' / 56.65' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.72 cfs @ 12.13 hrs HW=58.05' (Free Discharge)
1=Culvert (Barrel Controls 1.72 cfs @ 3.21 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-E1 Peak Elev=58.77' Inflow=1.46 cfs 5,507 cf
12.0" Round Culvert n=0.013 L=14.5' S=0.0103 '/' Outflow=1.46 cfs 5,507 cf

Pond 2: CB-E2 Peak Elev=58.80' Inflow=1.51 cfs 5,680 cf
12.0" Round Culvert n=0.013 L=11.5' S=0.0104 '/' Outflow=1.51 cfs 5,680 cf

Pond DMH-E1: DMH-E1 Peak Elev=58.64' Inflow=2.97 cfs 11,187 cf
15.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=2.97 cfs 11,187 cf

Pond E: POND E BR Peak Elev=56.82' Storage=1,559 cf Inflow=3.11 cfs 12,014 cf
Discarded=0.03 cfs 1,942 cf Primary=3.06 cfs 8,682 cf Outflow=3.09 cfs 10,624 cf

Pond WQU-E: WQU-E Peak Elev=58.35' Inflow=2.97 cfs 11,187 cf
15.0" Round Culvert n=0.013 L=130.0' S=0.0050 '/' Outflow=2.97 cfs 11,187 cf

Summary for Pond 1: CB-E1

Inflow Area = 19,492 sf, 50.84% Impervious, Inflow Depth > 3.39" for 10 Year event
Inflow = 1.46 cfs @ 12.13 hrs, Volume= 5,507 cf
Outflow = 1.46 cfs @ 12.13 hrs, Volume= 5,507 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.46 cfs @ 12.13 hrs, Volume= 5,507 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.77' @ 12.13 hrs
Flood Elev= 61.06'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	**12.0" Round Culvert** L= 14.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.00' / 57.85' S= 0.0103 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.46 cfs @ 12.13 hrs HW=58.77' (Free Discharge)
1=Culvert (Barrel Controls 1.46 cfs @ 3.09 fps)

Summary for Pond 2: CB-E2

Inflow Area = 20,532 sf, 47.60% Impervious, Inflow Depth > 3.32" for 10 Year event
Inflow = 1.51 cfs @ 12.13 hrs, Volume= 5,680 cf
Outflow = 1.51 cfs @ 12.13 hrs, Volume= 5,680 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.51 cfs @ 12.13 hrs, Volume= 5,680 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.80' @ 12.13 hrs
Flood Elev= 61.06'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	**12.0" Round Culvert** L= 11.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.00' / 57.88' S= 0.0104 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.51 cfs @ 12.13 hrs HW=58.80' (Free Discharge)
1=Culvert (Barrel Controls 1.51 cfs @ 3.06 fps)

Summary for Pond DMH-E1: DMH-E1

Inflow Area = 40,024 sf, 49.18% Impervious, Inflow Depth > 3.35" for 10 Year event
Inflow = 2.97 cfs @ 12.13 hrs, Volume= 11,187 cf
Outflow = 2.97 cfs @ 12.13 hrs, Volume= 11,187 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.97 cfs @ 12.13 hrs, Volume= 11,187 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.64' @ 12.13 hrs
Flood Elev= 61.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.50'	**15.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.50' / 57.40' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.97 cfs @ 12.13 hrs HW=58.64' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.97 cfs @ 3.31 fps)

Summary for Pond E: POND E BR

Inflow Area = 58,829 sf, 36.30% Impervious, Inflow Depth > 2.45" for 10 Year event
Inflow = 3.11 cfs @ 12.12 hrs, Volume= 12,014 cf
Outflow = 3.09 cfs @ 12.14 hrs, Volume= 10,624 cf, Atten= 1%, Lag= 0.7 min
Discarded = 0.03 cfs @ 12.14 hrs, Volume= 1,942 cf
Primary = 3.06 cfs @ 12.14 hrs, Volume= 8,682 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.82' @ 12.14 hrs Surf.Area= 2,557 sf Storage= 1,559 cf

Plug-Flow detention time= 83.1 min calculated for 10,619 cf (88% of inflow)
Center-of-Mass det. time= 27.4 min (811.0 - 783.5)

Volume	Invert	Avail.Storage	Storage Description
#1	56.05'	1,774 cf	**STORM WATER WETLAND (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.05	1,718	0	0
56.75	2,248	1,388	1,388
56.90	2,900	386	1,774

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.05'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.75'	**60.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.03 cfs @ 12.14 hrs HW=56.82' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=3.05 cfs @ 12.14 hrs HW=56.82' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 3.05 cfs @ 0.72 fps)

Summary for Pond WQU-E: WQU-E

Inflow Area = 40,024 sf, 49.18% Impervious, Inflow Depth > 3.35" for 10 Year event
Inflow = 2.97 cfs @ 12.13 hrs, Volume= 11,187 cf
Outflow = 2.97 cfs @ 12.13 hrs, Volume= 11,187 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.97 cfs @ 12.13 hrs, Volume= 11,187 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.35' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	57.30'	**15.0" Round Culvert** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.30' / 56.65' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.97 cfs @ 12.13 hrs HW=58.35' (Free Discharge)
1=Culvert (Barrel Controls 2.97 cfs @ 3.63 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-E1 Peak Elev=59.44' Inflow=2.90 cfs 10,974 cf
12.0" Round Culvert n=0.013 L=14.5' S=0.0103 '/' Outflow=2.90 cfs 10,974 cf

Pond 2: CB-E2 Peak Elev=59.53' Inflow=3.04 cfs 11,415 cf
12.0" Round Culvert n=0.013 L=11.5' S=0.0104 '/' Outflow=3.04 cfs 11,415 cf

Pond DMH-E1: DMH-E1 Peak Elev=59.74' Inflow=5.93 cfs 22,389 cf
15.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=5.93 cfs 22,389 cf

Pond E: POND E BR Peak Elev=56.87' Storage=1,683 cf Inflow=6.58 cfs 25,345 cf
Discarded=0.03 cfs 2,119 cf Primary=6.52 cfs 21,827 cf Outflow=6.55 cfs 23,947 cf

Pond WQU-E: WQU-E Peak Elev=59.69' Inflow=5.93 cfs 22,389 cf
15.0" Round Culvert n=0.013 L=130.0' S=0.0050 '/' Outflow=5.93 cfs 22,389 cf

Summary for Pond 1: CB-E1

Inflow Area = 19,492 sf, 50.84% Impervious, Inflow Depth > 6.76" for 100 Year event
Inflow = 2.90 cfs @ 12.13 hrs, Volume= 10,974 cf
Outflow = 2.90 cfs @ 12.13 hrs, Volume= 10,974 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.90 cfs @ 12.13 hrs, Volume= 10,974 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.44' @ 12.13 hrs
Flood Elev= 61.06'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	**12.0" Round Culvert** L= 14.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.00' / 57.85' S= 0.0103 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.90 cfs @ 12.13 hrs HW=59.44' (Free Discharge)
1=Culvert (Inlet Controls 2.90 cfs @ 3.69 fps)

Summary for Pond 2: CB-E2

Inflow Area = 20,532 sf, 47.60% Impervious, Inflow Depth > 6.67" for 100 Year event
Inflow = 3.04 cfs @ 12.13 hrs, Volume= 11,415 cf
Outflow = 3.04 cfs @ 12.13 hrs, Volume= 11,415 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.04 cfs @ 12.13 hrs, Volume= 11,415 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.53' @ 12.13 hrs
Flood Elev= 61.06'

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	**12.0" Round Culvert** L= 11.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.00' / 57.88' S= 0.0104 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.03 cfs @ 12.13 hrs HW=59.53' (Free Discharge)
1=Culvert (Inlet Controls 3.03 cfs @ 3.86 fps)

Summary for Pond DMH-E1: DMH-E1

Inflow Area = 40,024 sf, 49.18% Impervious, Inflow Depth > 6.71" for 100 Year event
Inflow = 5.93 cfs @ 12.13 hrs, Volume= 22,389 cf
Outflow = 5.93 cfs @ 12.13 hrs, Volume= 22,389 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.93 cfs @ 12.13 hrs, Volume= 22,389 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.74' @ 12.13 hrs
Flood Elev= 61.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.50'	**15.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.50' / 57.40' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=5.93 cfs @ 12.13 hrs HW=59.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.93 cfs @ 4.83 fps)

Summary for Pond E: POND E BR

Inflow Area = 58,829 sf, 36.30% Impervious, Inflow Depth > 5.17" for 100 Year event
Inflow = 6.58 cfs @ 12.12 hrs, Volume= 25,345 cf
Outflow = 6.55 cfs @ 12.13 hrs, Volume= 23,947 cf, Atten= 0%, Lag= 0.6 min
Discarded = 0.03 cfs @ 12.13 hrs, Volume= 2,119 cf
Primary = 6.52 cfs @ 12.13 hrs, Volume= 21,827 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.87' @ 12.13 hrs Surf.Area= 2,760 sf Storage= 1,683 cf

Plug-Flow detention time= 52.4 min calculated for 23,947 cf (94% of inflow)
Center-of-Mass det. time= 21.3 min (801.2 - 779.9)

Volume	Invert	Avail.Storage	Storage Description
#1	56.05'	1,774 cf	**STORM WATER WETLAND (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.05	1,718	0	0
56.75	2,248	1,388	1,388
56.90	2,900	386	1,774

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.05'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.75'	**60.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.03 cfs @ 12.13 hrs HW=56.87' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=6.52 cfs @ 12.13 hrs HW=56.87' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 6.52 cfs @ 0.92 fps)

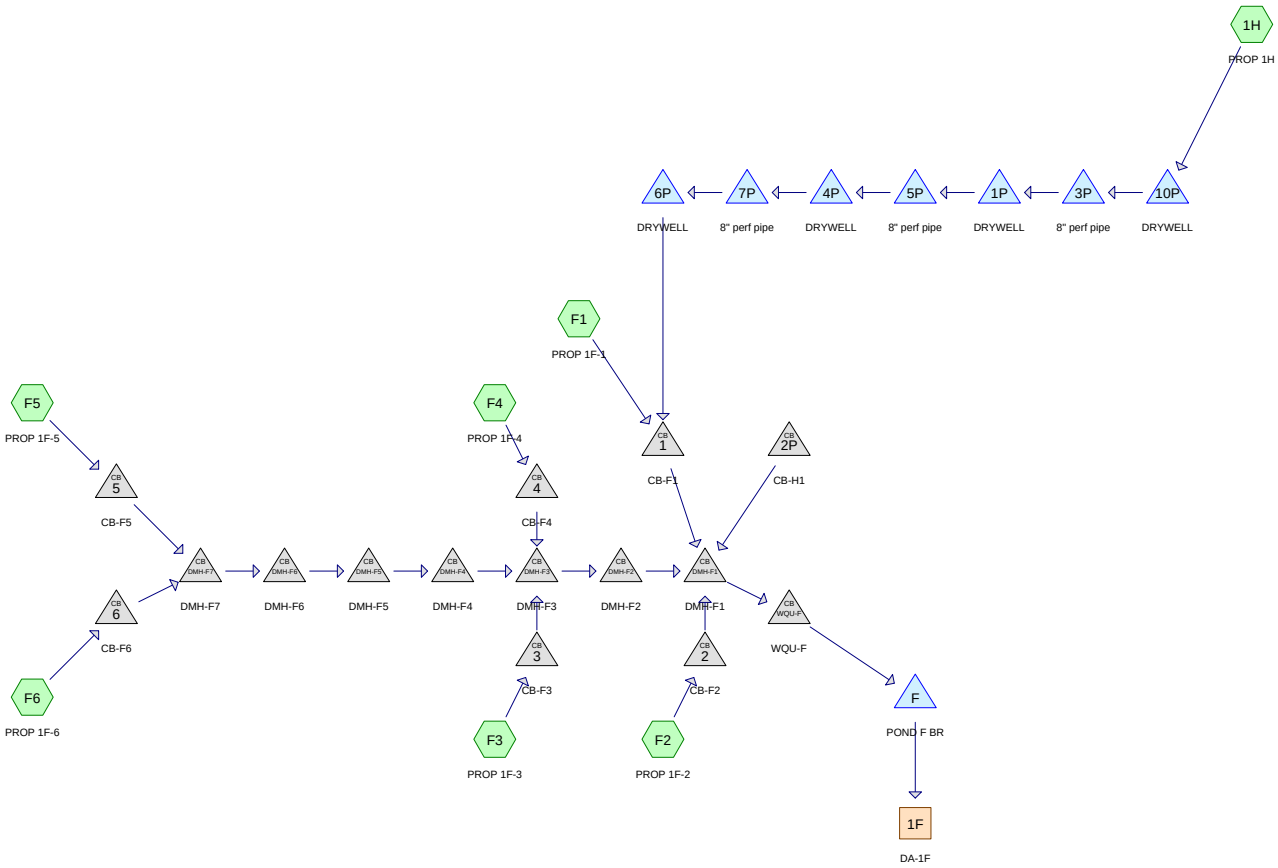
Summary for Pond WQU-E: WQU-E

Inflow Area = 40,024 sf, 49.18% Impervious, Inflow Depth > 6.71" for 100 Year event
Inflow = 5.93 cfs @ 12.13 hrs, Volume= 22,389 cf
Outflow = 5.93 cfs @ 12.13 hrs, Volume= 22,389 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.93 cfs @ 12.13 hrs, Volume= 22,389 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.69' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	57.30'	**15.0" Round Culvert** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.30' / 56.65' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=5.93 cfs @ 12.13 hrs HW=59.69' (Free Discharge)
1=Culvert (Barrel Controls 5.93 cfs @ 4.83 fps)



Subcat Reach Pond Link

Drainage Diagram for 15-063 Hyd-Prop DA-F1

Prepared by Microsoft, Printed 1/7/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
79,755	30	Meadow, non-grazed, HSG A (1H)
17,860	30	Woods, Good, HSG A (1H)
128,521	39	>75% Grass cover, Good, HSG A (1H, F1, F2, F4, F5, F6)
2,750	98	Patios, HSG A (1H)
30,381	98	Paved parking, HSG A (F1, F2, F3, F4, F5, F6)
20,742	98	Roofs, HSG A (1H, F1, F2)
280,009		**TOTAL AREA**

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-F1 Peak Elev=58.17' Inflow=1.11 cfs 4,444 cf
12.0" Round Culvert n=0.013 L=16.0' S=0.0050 '/' Outflow=1.11 cfs 4,444 cf

Pond 1P: DRYWELL Peak Elev=58.46' Storage=105 cf Inflow=0.60 cfs 1,917 cf
Discarded=0.01 cfs 429 cf Primary=0.59 cfs 1,488 cf Outflow=0.60 cfs 1,917 cf

Pond 2: CB-F2 Peak Elev=58.01' Inflow=0.71 cfs 2,746 cf
12.0" Round Culvert n=0.013 L=12.5' S=0.0048 '/' Outflow=0.71 cfs 2,746 cf

Pond 2P: CB-H1 Peak Elev=0.00'
10.0" Round Culvert n=0.013 L=115.0' S=0.0052 '/' Primary=0.00 cfs 0 cf

Pond 3: CB-F3 Peak Elev=60.55' Inflow=0.26 cfs 786 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0100 '/' Outflow=0.26 cfs 786 cf

Pond 3P: 8" perf pipe Peak Elev=58.46' Storage=36 cf Inflow=0.64 cfs 2,322 cf
Discarded=0.03 cfs 405 cf Primary=0.60 cfs 1,917 cf Outflow=0.64 cfs 2,322 cf

Pond 4: CB-F4 Peak Elev=60.49' Inflow=0.21 cfs 696 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0100 '/' Outflow=0.21 cfs 696 cf

Pond 4P: DRYWELL Peak Elev=58.43' Storage=104 cf Inflow=0.56 cfs 1,351 cf
Discarded=0.01 cfs 226 cf Primary=0.54 cfs 1,126 cf Outflow=0.56 cfs 1,351 cf

Pond 5: CB-F5 Peak Elev=66.95' Inflow=0.25 cfs 800 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.25 cfs 800 cf

Pond 5P: 8" perf pipe Peak Elev=58.60' Storage=19 cf Inflow=0.59 cfs 1,488 cf
Discarded=0.03 cfs 136 cf Primary=0.56 cfs 1,351 cf Outflow=0.59 cfs 1,488 cf

Pond 6: CB-F6 Peak Elev=66.96' Inflow=0.27 cfs 800 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.27 cfs 800 cf

Pond 6P: DRYWELL Peak Elev=58.40' Storage=103 cf Inflow=0.49 cfs 980 cf
Discarded=0.01 cfs 159 cf Primary=0.47 cfs 821 cf Outflow=0.49 cfs 980 cf

Pond 7P: 8" perf pipe Peak Elev=58.52' Storage=34 cf Inflow=0.54 cfs 1,126 cf
Discarded=0.05 cfs 145 cf Primary=0.49 cfs 980 cf Outflow=0.54 cfs 1,126 cf

Pond 10P: DRYWELL Peak Elev=58.48' Storage=106 cf Inflow=0.65 cfs 3,403 cf
Discarded=0.01 cfs 1,051 cf Primary=0.64 cfs 2,322 cf Outflow=0.65 cfs 3,373 cf

Pond DMH-F1: DMH-F1 Peak Elev=57.94' Inflow=2.31 cfs 10,273 cf
18.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=2.31 cfs 10,273 cf

Pond DMH-F2: DMH-F2 Peak Elev=58.37' Inflow=0.95 cfs 3,083 cf
15.0" Round Culvert n=0.013 L=56.0' S=0.0100 '/' Outflow=0.95 cfs 3,083 cf

Pond DMH-F3: DMH-F3 Peak Elev=59.99' Inflow=0.95 cfs 3,083 cf
15.0" Round Culvert n=0.013 L=152.5' S=0.0100 '/' Outflow=0.95 cfs 3,083 cf

Pond DMH-F4: DMH-F4 Peak Elev=65.05' Inflow=0.50 cfs 1,601 cf
12.0" Round Culvert n=0.013 L=91.0' S=0.0468 '/' Outflow=0.50 cfs 1,601 cf

Pond DMH-F5: DMH-F5 Peak Elev=65.63' Inflow=0.50 cfs 1,601 cf
12.0" Round Culvert n=0.013 L=91.0' S=0.0049 '/' Outflow=0.50 cfs 1,601 cf

Pond DMH-F6: DMH-F6 Peak Elev=66.39' Inflow=0.50 cfs 1,601 cf
12.0" Round Culvert n=0.013 L=133.0' S=0.0050 '/' Outflow=0.50 cfs 1,601 cf

Pond DMH-F7: DMH-F7 Peak Elev=66.84' Inflow=0.50 cfs 1,601 cf
12.0" Round Culvert n=0.013 L=67.0' S=0.0049 '/' Outflow=0.50 cfs 1,601 cf

Pond F: POND F BR Peak Elev=56.43' Storage=3,076 cf Inflow=2.31 cfs 10,273 cf
Discarded=0.05 cfs 3,348 cf Primary=2.84 cfs 4,199 cf Outflow=2.89 cfs 7,548 cf

Pond WQU-F: WQU-F Peak Elev=57.66' Inflow=2.31 cfs 10,273 cf
18.0" Round Culvert n=0.013 L=120.0' S=0.0050 '/' Outflow=2.31 cfs 10,273 cf

Summary for Pond 1: CB-F1

Inflow Area = 232,146 sf, 12.69% Impervious, Inflow Depth > 0.23" for 2 Year event
Inflow = 1.11 cfs @ 12.19 hrs, Volume= 4,444 cf
Outflow = 1.11 cfs @ 12.19 hrs, Volume= 4,444 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.11 cfs @ 12.19 hrs, Volume= 4,444 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.17' @ 12.19 hrs
Flood Elev= 60.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.46'	**12.0" Round Culvert** L= 16.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.46' / 57.38' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.11 cfs @ 12.19 hrs HW=58.17' (Free Discharge)
1=Culvert (Barrel Controls 1.11 cfs @ 2.63 fps)

Summary for Pond 1P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.12" for 2 Year event
Inflow = 0.60 cfs @ 12.30 hrs, Volume= 1,917 cf
Outflow = 0.60 cfs @ 12.30 hrs, Volume= 1,917 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.01 cfs @ 9.98 hrs, Volume= 429 cf
Primary = 0.59 cfs @ 12.30 hrs, Volume= 1,488 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.46' @ 12.30 hrs Surf.Area= 79 sf Storage= 105 cf

Plug-Flow detention time= 15.7 min calculated for 1,917 cf (100% of inflow)
Center-of-Mass det. time= 15.7 min (764.6 - 748.9)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 9.98 hrs HW=56.05' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.59 cfs @ 12.30 hrs HW=58.46' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.59 cfs @ 2.30 fps)

Summary for Pond 2: CB-F2

Inflow Area = 20,326 sf, 56.61% Impervious, Inflow Depth > 1.62" for 2 Year event
Inflow = 0.71 cfs @ 12.13 hrs, Volume= 2,746 cf
Outflow = 0.71 cfs @ 12.13 hrs, Volume= 2,746 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.71 cfs @ 12.13 hrs, Volume= 2,746 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.01' @ 12.13 hrs
Flood Elev= 60.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.46'	**12.0" Round Culvert** L= 12.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.46' / 57.40' S= 0.0048 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.71 cfs @ 12.13 hrs HW=58.01' (Free Discharge)
1=Culvert (Barrel Controls 0.71 cfs @ 2.32 fps)

Summary for Pond 2P: CB-H1

Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	57.50'	**10.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.50' / 56.90' S= 0.0052 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 3: CB-F3

Inflow Area = 3,290 sf,100.00% Impervious, Inflow Depth > 2.87" for 2 Year event
Inflow = 0.26 cfs @ 12.03 hrs, Volume= 786 cf
Outflow = 0.26 cfs @ 12.03 hrs, Volume= 786 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.26 cfs @ 12.03 hrs, Volume= 786 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.55' @ 12.03 hrs
Flood Elev= 63.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.26'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.26' / 60.16' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.26 cfs @ 12.03 hrs HW=60.55' (Free Discharge)
1=Culvert (Barrel Controls 0.26 cfs @ 2.05 fps)

Summary for Pond 3P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.14" for 2 Year event
Inflow = 0.64 cfs @ 12.29 hrs, Volume= 2,322 cf
Outflow = 0.64 cfs @ 12.30 hrs, Volume= 2,322 cf, Atten= 0%, Lag= 0.7 min
Discarded = 0.03 cfs @ 12.30 hrs, Volume= 405 cf
Primary = 0.60 cfs @ 12.30 hrs, Volume= 1,917 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.46' @ 12.30 hrs Surf.Area= 85 sf Storage= 36 cf

Plug-Flow detention time= 1.2 min calculated for 2,321 cf (100% of inflow)
Center-of-Mass det. time= 1.2 min (756.7 - 755.5)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	48 cf	**8.0" D x 138.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.03 cfs @ 12.30 hrs HW=58.46' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.60 cfs @ 12.30 hrs HW=58.46' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.60 cfs @ 2.32 fps)

Summary for Pond 4: CB-F4

Inflow Area = 12,577 sf, 23.17% Impervious, Inflow Depth > 0.66" for 2 Year event
Inflow = 0.21 cfs @ 12.07 hrs, Volume= 696 cf
Outflow = 0.21 cfs @ 12.07 hrs, Volume= 696 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.21 cfs @ 12.07 hrs, Volume= 696 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.49' @ 12.07 hrs
Flood Elev= 63.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.23'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.23' / 60.13' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.21 cfs @ 12.07 hrs HW=60.49' (Free Discharge)
1=Culvert (Barrel Controls 0.21 cfs @ 1.96 fps)

Summary for Pond 4P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.08" for 2 Year event
Inflow = 0.56 cfs @ 12.30 hrs, Volume= 1,351 cf
Outflow = 0.56 cfs @ 12.31 hrs, Volume= 1,351 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.01 cfs @ 11.62 hrs, Volume= 226 cf
Primary = 0.54 cfs @ 12.31 hrs, Volume= 1,126 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.43' @ 12.31 hrs Surf.Area= 79 sf Storage= 104 cf

Plug-Flow detention time= 12.4 min calculated for 1,351 cf (100% of inflow)
Center-of-Mass det. time= 12.3 min (759.4 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 11.62 hrs HW=56.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.54 cfs @ 12.31 hrs HW=58.43' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.54 cfs @ 2.25 fps)

Summary for Pond 5: CB-F5

Inflow Area = 6,800 sf, 49.26% Impervious, Inflow Depth > 1.41" for 2 Year event
Inflow = 0.25 cfs @ 12.06 hrs, Volume= 800 cf
Outflow = 0.25 cfs @ 12.06 hrs, Volume= 800 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.25 cfs @ 12.06 hrs, Volume= 800 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.95' @ 12.06 hrs
Flood Elev= 69.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.67'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.67' / 66.53' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.25 cfs @ 12.06 hrs HW=66.95' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.25 cfs @ 2.11 fps)

Summary for Pond 5P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.09" for 2 Year event
Inflow = 0.59 cfs @ 12.30 hrs, Volume= 1,488 cf
Outflow = 0.59 cfs @ 12.30 hrs, Volume= 1,488 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.03 cfs @ 12.21 hrs, Volume= 136 cf
Primary = 0.56 cfs @ 12.30 hrs, Volume= 1,351 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.60' @ 12.30 hrs Surf.Area= 0 sf Storage= 19 cf

Plug-Flow detention time= 0.8 min calculated for 1,487 cf (100% of inflow)
Center-of-Mass det. time= 0.8 min (749.2 - 748.4)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	19 cf	**6.0" D x 98.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.03 cfs @ 12.21 hrs HW=58.50' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.56 cfs @ 12.30 hrs HW=58.60' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 2.86 fps)

Summary for Pond 6: CB-F6

Inflow Area = 4,870 sf, 68.79% Impervious, Inflow Depth > 1.97" for 2 Year event
Inflow = 0.27 cfs @ 12.02 hrs, Volume= 800 cf
Outflow = 0.27 cfs @ 12.02 hrs, Volume= 800 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.27 cfs @ 12.02 hrs, Volume= 800 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.96' @ 12.02 hrs
Flood Elev= 69.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.67'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.67' / 66.53' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.27 cfs @ 12.02 hrs HW=66.96' (Free Discharge)
↑**1=Culvert** (Barrel Controls 0.27 cfs @ 2.15 fps)

Summary for Pond 6P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.06" for 2 Year event
Inflow = 0.49 cfs @ 12.32 hrs, Volume= 980 cf
Outflow = 0.49 cfs @ 12.32 hrs, Volume= 980 cf, Atten= 1%, Lag= 0.0 min
Discarded = 0.01 cfs @ 12.02 hrs, Volume= 159 cf
Primary = 0.47 cfs @ 12.32 hrs, Volume= 821 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.40' @ 12.32 hrs Surf.Area= 79 sf Storage= 103 cf

Plug-Flow detention time= 11.4 min calculated for 980 cf (100% of inflow)
Center-of-Mass det. time= 11.4 min (758.5 - 747.0)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 12.02 hrs HW=56.07' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.47 cfs @ 12.32 hrs HW=58.40' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.47 cfs @ 2.16 fps)

Summary for Pond 7P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.07" for 2 Year event
Inflow = 0.54 cfs @ 12.31 hrs, Volume= 1,126 cf
Outflow = 0.54 cfs @ 12.32 hrs, Volume= 1,126 cf, Atten= 0%, Lag= 0.6 min
Discarded = 0.05 cfs @ 12.28 hrs, Volume= 145 cf
Primary = 0.49 cfs @ 12.32 hrs, Volume= 980 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.52' @ 12.32 hrs Surf.Area= 0 sf Storage= 34 cf

Plug-Flow detention time= 1.3 min calculated for 1,125 cf (100% of inflow)
Center-of-Mass det. time= 1.3 min (748.3 - 747.0)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	34 cf	**6.0" D x 175.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 12.28 hrs HW=58.51' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.49 cfs @ 12.32 hrs HW=58.52' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.49 cfs @ 2.51 fps)

Summary for Pond 10P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 0.21" for 2 Year event
Inflow = 0.65 cfs @ 12.28 hrs, Volume= 3,403 cf
Outflow = 0.65 cfs @ 12.29 hrs, Volume= 3,373 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.01 cfs @ 6.99 hrs, Volume= 1,051 cf
Primary = 0.64 cfs @ 12.29 hrs, Volume= 2,322 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.48' @ 12.29 hrs Surf.Area= 79 sf Storage= 106 cf

Plug-Flow detention time= 22.0 min calculated for 3,373 cf (99% of inflow)
Center-of-Mass det. time= 16.2 min (785.5 - 769.3)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 6.99 hrs HW=56.05' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.64 cfs @ 12.29 hrs HW=58.48' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.64 cfs @ 2.36 fps)

Summary for Pond DMH-F1: DMH-F1

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 0.44" for 2 Year event
Inflow = 2.31 cfs @ 12.09 hrs, Volume= 10,273 cf
Outflow = 2.31 cfs @ 12.09 hrs, Volume= 10,273 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.31 cfs @ 12.09 hrs, Volume= 10,273 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.94' @ 12.09 hrs
Flood Elev= 60.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.04'	**18.0" Round Culvert**

L= 20.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 57.04' / 56.94' S= 0.0050 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.30 cfs @ 12.09 hrs HW=57.94' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.30 cfs @ 3.01 fps)

Summary for Pond DMH-F2: DMH-F2

Inflow Area = 27,537 sf, 46.86% Impervious, Inflow Depth > 1.34" for 2 Year event
Inflow = 0.95 cfs @ 12.04 hrs, Volume= 3,083 cf
Outflow = 0.95 cfs @ 12.04 hrs, Volume= 3,083 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.95 cfs @ 12.04 hrs, Volume= 3,083 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.37' @ 12.04 hrs
Flood Elev= 62.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.85'	**15.0" Round Culvert** L= 56.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.85' / 57.29' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.94 cfs @ 12.04 hrs HW=58.37' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.94 cfs @ 1.94 fps)

Summary for Pond DMH-F3: DMH-F3

Inflow Area = 27,537 sf, 46.86% Impervious, Inflow Depth > 1.34" for 2 Year event
Inflow = 0.95 cfs @ 12.04 hrs, Volume= 3,083 cf
Outflow = 0.95 cfs @ 12.04 hrs, Volume= 3,083 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.95 cfs @ 12.04 hrs, Volume= 3,083 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.99' @ 12.04 hrs
Flood Elev= 63.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	59.47'	**15.0" Round Culvert** L= 152.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 59.47' / 57.95' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.94 cfs @ 12.04 hrs HW=59.99' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.94 cfs @ 1.94 fps)

Summary for Pond DMH-F4: DMH-F4

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 1.65" for 2 Year event
Inflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf
Outflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.05' @ 12.03 hrs
Flood Elev= 69.49'

Device	Routing	Invert	Outlet Devices
#1	Primary	64.65'	**12.0" Round Culvert** L= 91.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 64.65' / 60.39' S= 0.0468 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.49 cfs @ 12.03 hrs HW=65.05' (Free Discharge)
1=Culvert (Inlet Controls 0.49 cfs @ 1.70 fps)

Summary for Pond DMH-F5: DMH-F5

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 1.65" for 2 Year event
Inflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf
Outflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.63' @ 12.03 hrs
Flood Elev= 75.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	65.21'	**12.0" Round Culvert** L= 91.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.21' / 64.76' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.49 cfs @ 12.03 hrs HW=65.63' (Free Discharge)
1=Culvert (Barrel Controls 0.49 cfs @ 2.36 fps)

Summary for Pond DMH-F6: DMH-F6

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 1.65" for 2 Year event
Inflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf
Outflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.39' @ 12.03 hrs
Flood Elev= 72.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	65.98'	**12.0" Round Culvert** L= 133.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.98' / 65.31' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.49 cfs @ 12.03 hrs HW=66.39' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.49 cfs @ 2.40 fps)

Summary for Pond DMH-F7: DMH-F7

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 1.65" for 2 Year event
Inflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf
Outflow = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 12.03 hrs, Volume= 1,601 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.84' @ 12.03 hrs
Flood Elev= 70.21'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.42'	**12.0" Round Culvert** L= 67.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.42' / 66.09' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.50 cfs @ 12.03 hrs HW=66.84' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.50 cfs @ 2.32 fps)

Summary for Pond F: POND F BR

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 0.44" for 2 Year event
Inflow = 2.31 cfs @ 12.09 hrs, Volume= 10,273 cf
Outflow = 2.89 cfs @ 12.10 hrs, Volume= 7,548 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.05 cfs @ 12.10 hrs, Volume= 3,348 cf
Primary = 2.84 cfs @ 12.10 hrs, Volume= 4,199 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.43' @ 12.10 hrs Surf.Area= 4,228 sf Storage= 3,076 cf

Plug-Flow detention time= 140.7 min calculated for 7,544 cf (73% of inflow)
Center-of-Mass det. time= 59.1 min (816.1 - 757.0)

Volume	Invert	Avail.Storage	Storage Description
#1	55.55'	3,076 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.55	3,463	0	0
56.35	4,228	3,076	3,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.35'	**50.0' long x 1.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00
			Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.05 cfs @ 12.10 hrs HW=56.43' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=2.84 cfs @ 12.10 hrs HW=56.43' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.84 cfs @ 0.74 fps)

Summary for Pond WQU-F: WQU-F

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 0.44" for 2 Year event
Inflow = 2.31 cfs @ 12.09 hrs, Volume= 10,273 cf
Outflow = 2.31 cfs @ 12.09 hrs, Volume= 10,273 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.31 cfs @ 12.09 hrs, Volume= 10,273 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.66' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.84'	**18.0" Round Culvert**
			L= 120.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 56.84' / 56.24' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.30 cfs @ 12.09 hrs HW=57.66' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 2.30 cfs @ 3.38 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-F1 Peak Elev=58.45' Inflow=1.89 cfs 7,637 cf
12.0" Round Culvert n=0.013 L=16.0' S=0.0050 '/' Outflow=1.89 cfs 7,637 cf

Pond 1P: DRYWELL Peak Elev=58.63' Storage=113 cf Inflow=0.93 cfs 3,735 cf
Discarded=0.01 cfs 823 cf Primary=0.92 cfs 2,912 cf Outflow=0.93 cfs 3,734 cf

Pond 2: CB-F2 Peak Elev=58.16' Inflow=1.09 cfs 4,379 cf
12.0" Round Culvert n=0.013 L=12.5' S=0.0048 '/' Outflow=1.09 cfs 4,379 cf

Pond 2P: CB-H1 Peak Elev=0.00'
10.0" Round Culvert n=0.013 L=115.0' S=0.0052 '/' Primary=0.00 cfs 0 cf

Pond 3: CB-F3 Peak Elev=60.63' Inflow=0.40 cfs 1,223 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0100 '/' Outflow=0.40 cfs 1,223 cf

Pond 3P: 8" perf pipe Peak Elev=58.64' Storage=47 cf Inflow=0.98 cfs 4,542 cf
Discarded=0.05 cfs 806 cf Primary=0.93 cfs 3,735 cf Outflow=0.98 cfs 4,541 cf

Pond 4: CB-F4 Peak Elev=60.56' Inflow=0.32 cfs 1,198 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0100 '/' Outflow=0.32 cfs 1,198 cf

Pond 4P: DRYWELL Peak Elev=58.60' Storage=112 cf Inflow=0.89 cfs 2,632 cf
Discarded=0.01 cfs 416 cf Primary=0.87 cfs 2,216 cf Outflow=0.89 cfs 2,632 cf

Pond 5: CB-F5 Peak Elev=67.02' Inflow=0.38 cfs 1,287 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.38 cfs 1,287 cf

Pond 5P: 8" perf pipe Peak Elev=59.14' Storage=19 cf Inflow=0.92 cfs 2,912 cf
Discarded=0.03 cfs 279 cf Primary=0.89 cfs 2,632 cf Outflow=0.92 cfs 2,912 cf

Pond 6: CB-F6 Peak Elev=67.04' Inflow=0.41 cfs 1,264 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.41 cfs 1,264 cf

Pond 6P: DRYWELL Peak Elev=58.56' Storage=110 cf Inflow=0.82 cfs 1,940 cf
Discarded=0.01 cfs 231 cf Primary=0.81 cfs 1,710 cf Outflow=0.82 cfs 1,940 cf

Pond 7P: 8" perf pipe Peak Elev=59.00' Storage=34 cf Inflow=0.87 cfs 2,216 cf
Discarded=0.05 cfs 276 cf Primary=0.82 cfs 1,940 cf Outflow=0.87 cfs 2,216 cf

Pond 10P: DRYWELL Peak Elev=58.67' Storage=115 cf Inflow=1.00 cfs 5,773 cf
Discarded=0.01 cfs 1,144 cf Primary=0.98 cfs 4,542 cf Outflow=1.00 cfs 5,686 cf

Pond DMH-F1: DMH-F1 Peak Elev=58.26' Inflow=3.87 cfs 16,989 cf
18.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=3.87 cfs 16,989 cf

Pond DMH-F2: DMH-F2 Peak Elev=58.51' Inflow=1.44 cfs 4,973 cf
15.0" Round Culvert n=0.013 L=56.0' S=0.0100 '/' Outflow=1.44 cfs 4,973 cf

Pond DMH-F3: DMH-F3 Peak Elev=60.13' Inflow=1.44 cfs 4,973 cf
15.0" Round Culvert n=0.013 L=152.5' S=0.0100 '/' Outflow=1.44 cfs 4,973 cf

Pond DMH-F4: DMH-F4 Peak Elev=65.15' Inflow=0.76 cfs 2,551 cf
12.0" Round Culvert n=0.013 L=91.0' S=0.0468 '/' Outflow=0.76 cfs 2,551 cf

Pond DMH-F5: DMH-F5 Peak Elev=65.74' Inflow=0.76 cfs 2,551 cf
12.0" Round Culvert n=0.013 L=91.0' S=0.0049 '/' Outflow=0.76 cfs 2,551 cf

Pond DMH-F6: DMH-F6 Peak Elev=66.50' Inflow=0.76 cfs 2,551 cf
12.0" Round Culvert n=0.013 L=133.0' S=0.0050 '/' Outflow=0.76 cfs 2,551 cf

Pond DMH-F7: DMH-F7 Peak Elev=66.95' Inflow=0.76 cfs 2,551 cf
12.0" Round Culvert n=0.013 L=67.0' S=0.0049 '/' Outflow=0.76 cfs 2,551 cf

Pond F: POND F BR Peak Elev=56.45' Storage=3,076 cf Inflow=3.87 cfs 16,989 cf
Discarded=0.05 cfs 3,651 cf Primary=4.04 cfs 10,273 cf Outflow=4.09 cfs 13,924 cf

Pond WQU-F: WQU-F Peak Elev=57.96' Inflow=3.87 cfs 16,989 cf
18.0" Round Culvert n=0.013 L=120.0' S=0.0050 '/' Outflow=3.87 cfs 16,989 cf

Summary for Pond 1: CB-F1

Inflow Area = 232,146 sf, 12.69% Impervious, Inflow Depth > 0.39" for 10 Year event
Inflow = 1.89 cfs @ 12.15 hrs, Volume= 7,637 cf
Outflow = 1.89 cfs @ 12.15 hrs, Volume= 7,637 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.89 cfs @ 12.15 hrs, Volume= 7,637 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.45' @ 12.15 hrs
Flood Elev= 60.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.46'	**12.0" Round Culvert** L= 16.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.46' / 57.38' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.89 cfs @ 12.15 hrs HW=58.45' (Free Discharge)
1=Culvert (Barrel Controls 1.89 cfs @ 3.03 fps)

Summary for Pond 1P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 0.23" for 10 Year event
Inflow = 0.93 cfs @ 12.30 hrs, Volume= 3,735 cf
Outflow = 0.93 cfs @ 12.30 hrs, Volume= 3,734 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.01 cfs @ 8.64 hrs, Volume= 823 cf
Primary = 0.92 cfs @ 12.30 hrs, Volume= 2,912 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.63' @ 12.30 hrs Surf.Area= 79 sf Storage= 113 cf

Plug-Flow detention time= 16.5 min calculated for 3,733 cf (100% of inflow)
Center-of-Mass det. time= 16.4 min (798.3 - 781.8)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 8.64 hrs HW=56.05' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.92 cfs @ 12.30 hrs HW=58.63' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.92 cfs @ 2.70 fps)

Summary for Pond 2: CB-F2

Inflow Area = 20,326 sf, 56.61% Impervious, Inflow Depth > 2.59" for 10 Year event
Inflow = 1.09 cfs @ 12.13 hrs, Volume= 4,379 cf
Outflow = 1.09 cfs @ 12.13 hrs, Volume= 4,379 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.09 cfs @ 12.13 hrs, Volume= 4,379 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.16' @ 12.13 hrs
Flood Elev= 60.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.46'	**12.0" Round Culvert** L= 12.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.46' / 57.40' S= 0.0048 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.08 cfs @ 12.13 hrs HW=58.16' (Free Discharge)
1=Culvert (Barrel Controls 1.08 cfs @ 2.58 fps)

Summary for Pond 2P: CB-H1

Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	57.50'	**10.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.50' / 56.90' S= 0.0052 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 3: CB-F3

Inflow Area = 3,290 sf,100.00% Impervious, Inflow Depth > 4.46" for 10 Year event
Inflow = 0.40 cfs @ 12.03 hrs, Volume= 1,223 cf
Outflow = 0.40 cfs @ 12.03 hrs, Volume= 1,223 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.40 cfs @ 12.03 hrs, Volume= 1,223 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.63' @ 12.03 hrs
Flood Elev= 63.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.26'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.26' / 60.16' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.40 cfs @ 12.03 hrs HW=60.63' (Free Discharge)
1=Culvert (Barrel Controls 0.40 cfs @ 2.24 fps)

Summary for Pond 3P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 0.28" for 10 Year event
Inflow = 0.98 cfs @ 12.29 hrs, Volume= 4,542 cf
Outflow = 0.98 cfs @ 12.30 hrs, Volume= 4,541 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.05 cfs @ 12.30 hrs, Volume= 806 cf
Primary = 0.93 cfs @ 12.30 hrs, Volume= 3,735 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.64' @ 12.30 hrs Surf.Area= 38 sf Storage= 47 cf

Plug-Flow detention time= 1.2 min calculated for 4,541 cf (100% of inflow)
Center-of-Mass det. time= 1.1 min (802.5 - 801.5)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	48 cf	**8.0" D x 138.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 12.30 hrs HW=58.64' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.93 cfs @ 12.30 hrs HW=58.64' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.93 cfs @ 2.72 fps)

Summary for Pond 4: CB-F4

Inflow Area = 12,577 sf, 23.17% Impervious, Inflow Depth > 1.14" for 10 Year event
Inflow = 0.32 cfs @ 12.07 hrs, Volume= 1,198 cf
Outflow = 0.32 cfs @ 12.07 hrs, Volume= 1,198 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.32 cfs @ 12.07 hrs, Volume= 1,198 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.56' @ 12.07 hrs
Flood Elev= 63.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.23'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.23' / 60.13' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.32 cfs @ 12.07 hrs HW=60.56' (Free Discharge)
1=Culvert (Barrel Controls 0.32 cfs @ 2.14 fps)

Summary for Pond 4P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.16" for 10 Year event
Inflow = 0.89 cfs @ 12.31 hrs, Volume= 2,632 cf
Outflow = 0.89 cfs @ 12.31 hrs, Volume= 2,632 cf, Atten= 1%, Lag= 0.1 min
Discarded = 0.01 cfs @ 10.43 hrs, Volume= 416 cf
Primary = 0.87 cfs @ 12.31 hrs, Volume= 2,216 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.60' @ 12.31 hrs Surf.Area= 79 sf Storage= 112 cf

Plug-Flow detention time= 12.5 min calculated for 2,631 cf (100% of inflow)
Center-of-Mass det. time= 12.5 min (764.7 - 752.2)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 10.43 hrs HW=56.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.87 cfs @ 12.31 hrs HW=58.60' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.87 cfs @ 2.64 fps)

Summary for Pond 5: CB-F5

Inflow Area = 6,800 sf, 49.26% Impervious, Inflow Depth > 2.27" for 10 Year event
Inflow = 0.38 cfs @ 12.06 hrs, Volume= 1,287 cf
Outflow = 0.38 cfs @ 12.06 hrs, Volume= 1,287 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.38 cfs @ 12.06 hrs, Volume= 1,287 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 67.02' @ 12.06 hrs
Flood Elev= 69.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.67'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.67' / 66.53' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.38 cfs @ 12.06 hrs HW=67.02' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.38 cfs @ 2.31 fps)

Summary for Pond 5P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.18" for 10 Year event
Inflow = 0.92 cfs @ 12.30 hrs, Volume= 2,912 cf
Outflow = 0.92 cfs @ 12.31 hrs, Volume= 2,912 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.03 cfs @ 12.10 hrs, Volume= 279 cf
Primary = 0.89 cfs @ 12.31 hrs, Volume= 2,632 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.14' @ 12.31 hrs Surf.Area= 0 sf Storage= 19 cf

Plug-Flow detention time= 0.7 min calculated for 2,910 cf (100% of inflow)
Center-of-Mass det. time= 0.7 min (757.2 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	19 cf	**6.0" D x 98.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.03 cfs @ 12.10 hrs HW=58.51' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.89 cfs @ 12.31 hrs HW=59.14' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.89 cfs @ 4.55 fps)

Summary for Pond 6: CB-F6

Inflow Area = 4,870 sf, 68.79% Impervious, Inflow Depth > 3.11" for 10 Year event
Inflow = 0.41 cfs @ 12.02 hrs, Volume= 1,264 cf
Outflow = 0.41 cfs @ 12.02 hrs, Volume= 1,264 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.41 cfs @ 12.02 hrs, Volume= 1,264 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 67.04' @ 12.02 hrs
Flood Elev= 69.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.67'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.67' / 66.53' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.41 cfs @ 12.02 hrs HW=67.04' (Free Discharge)
1=Culvert (Barrel Controls 0.41 cfs @ 2.35 fps)

Summary for Pond 6P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.12" for 10 Year event
Inflow = 0.82 cfs @ 12.31 hrs, Volume= 1,940 cf
Outflow = 0.82 cfs @ 12.32 hrs, Volume= 1,940 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.01 cfs @ 11.51 hrs, Volume= 231 cf
Primary = 0.81 cfs @ 12.32 hrs, Volume= 1,710 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.56' @ 12.32 hrs Surf.Area= 79 sf Storage= 110 cf

Plug-Flow detention time= 8.9 min calculated for 1,940 cf (100% of inflow)
Center-of-Mass det. time= 8.9 min (755.2 - 746.3)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 11.51 hrs HW=56.06' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.81 cfs @ 12.32 hrs HW=58.56' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.81 cfs @ 2.56 fps)

Summary for Pond 7P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth = 0.14" for 10 Year event
Inflow = 0.87 cfs @ 12.31 hrs, Volume= 2,216 cf
Outflow = 0.87 cfs @ 12.31 hrs, Volume= 2,216 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.05 cfs @ 12.14 hrs, Volume= 276 cf
Primary = 0.82 cfs @ 12.31 hrs, Volume= 1,940 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.00' @ 12.31 hrs Surf.Area= 0 sf Storage= 34 cf

Plug-Flow detention time= 1.1 min calculated for 2,216 cf (100% of inflow)
Center-of-Mass det. time= 1.1 min (748.9 - 747.8)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	34 cf	**6.0" D x 175.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 12.14 hrs HW=58.53' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.82 cfs @ 12.31 hrs HW=59.00' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.82 cfs @ 4.18 fps)

Summary for Pond 10P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 0.36" for 10 Year event
Inflow = 1.00 cfs @ 12.28 hrs, Volume= 5,773 cf
Outflow = 1.00 cfs @ 12.29 hrs, Volume= 5,686 cf, Atten= 0%, Lag= 0.6 min
Discarded = 0.01 cfs @ 4.66 hrs, Volume= 1,144 cf
Primary = 0.98 cfs @ 12.29 hrs, Volume= 4,542 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.67' @ 12.29 hrs Surf.Area= 79 sf Storage= 115 cf

Plug-Flow detention time= 15.9 min calculated for 5,683 cf (98% of inflow)
Center-of-Mass det. time= 6.4 min (801.7 - 795.3)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 4.66 hrs HW=56.05' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.98 cfs @ 12.29 hrs HW=58.67' (Free Discharge)
2=Orifice/Grate (Orifice Controls 0.98 cfs @ 2.80 fps)

Summary for Pond DMH-F1: DMH-F1

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 0.73" for 10 Year event
Inflow = 3.87 cfs @ 12.10 hrs, Volume= 16,989 cf
Outflow = 3.87 cfs @ 12.10 hrs, Volume= 16,989 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.87 cfs @ 12.10 hrs, Volume= 16,989 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.26' @ 12.10 hrs
Flood Elev= 60.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.04'	**18.0" Round Culvert**

L= 20.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 57.04' / 56.94' S= 0.0050 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.87 cfs @ 12.10 hrs HW=58.26' (Free Discharge)
└**1=Culvert** (Barrel Controls 3.87 cfs @ 3.43 fps)

Summary for Pond DMH-F2: DMH-F2

Inflow Area = 27,537 sf, 46.86% Impervious, Inflow Depth > 2.17" for 10 Year event
Inflow = 1.44 cfs @ 12.04 hrs, Volume= 4,973 cf
Outflow = 1.44 cfs @ 12.04 hrs, Volume= 4,973 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.44 cfs @ 12.04 hrs, Volume= 4,973 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.51' @ 12.04 hrs
Flood Elev= 62.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.85'	**15.0" Round Culvert** L= 56.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.85' / 57.29' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.44 cfs @ 12.04 hrs HW=58.51' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.44 cfs @ 2.19 fps)

Summary for Pond DMH-F3: DMH-F3

Inflow Area = 27,537 sf, 46.86% Impervious, Inflow Depth > 2.17" for 10 Year event
Inflow = 1.44 cfs @ 12.04 hrs, Volume= 4,973 cf
Outflow = 1.44 cfs @ 12.04 hrs, Volume= 4,973 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.44 cfs @ 12.04 hrs, Volume= 4,973 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.13' @ 12.04 hrs
Flood Elev= 63.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	59.47'	**15.0" Round Culvert** L= 152.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 59.47' / 57.95' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.44 cfs @ 12.04 hrs HW=60.13' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.44 cfs @ 2.19 fps)

Summary for Pond DMH-F4: DMH-F4

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 2.62" for 10 Year event
Inflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf
Outflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.15' @ 12.03 hrs
Flood Elev= 69.49'

Device	Routing	Invert	Outlet Devices
#1	Primary	64.65'	**12.0" Round Culvert** L= 91.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 64.65' / 60.39' S= 0.0468 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.76 cfs @ 12.03 hrs HW=65.15' (Free Discharge)
1=Culvert (Inlet Controls 0.76 cfs @ 1.91 fps)

Summary for Pond DMH-F5: DMH-F5

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 2.62" for 10 Year event
Inflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf
Outflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.74' @ 12.03 hrs
Flood Elev= 75.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	65.21'	**12.0" Round Culvert** L= 91.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.21' / 64.76' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.76 cfs @ 12.03 hrs HW=65.74' (Free Discharge)
1=Culvert (Barrel Controls 0.76 cfs @ 2.62 fps)

Summary for Pond DMH-F6: DMH-F6

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 2.62" for 10 Year event
Inflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf
Outflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.50' @ 12.03 hrs
Flood Elev= 72.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	65.98'	**12.0" Round Culvert** L= 133.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.98' / 65.31' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.76 cfs @ 12.03 hrs HW=66.50' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.76 cfs @ 2.68 fps)

Summary for Pond DMH-F7: DMH-F7

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 2.62" for 10 Year event
Inflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf
Outflow = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.03 hrs, Volume= 2,551 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.95' @ 12.03 hrs
Flood Elev= 70.21'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.42'	**12.0" Round Culvert** L= 67.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.42' / 66.09' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.76 cfs @ 12.03 hrs HW=66.95' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.76 cfs @ 2.58 fps)

Summary for Pond F: POND F BR

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 0.73" for 10 Year event
Inflow = 3.87 cfs @ 12.10 hrs, Volume= 16,989 cf
Outflow = 4.09 cfs @ 12.09 hrs, Volume= 13,924 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.05 cfs @ 11.80 hrs, Volume= 3,651 cf
Primary = 4.04 cfs @ 12.09 hrs, Volume= 10,273 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.45' @ 12.09 hrs Surf.Area= 4,228 sf Storage= 3,076 cf

Plug-Flow detention time= 104.1 min calculated for 13,918 cf (82% of inflow)
Center-of-Mass det. time= 33.0 min (791.9 - 758.9)

Volume	Invert	Avail.Storage	Storage Description
#1	55.55'	3,076 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.55	3,463	0	0
56.35	4,228	3,076	3,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.35'	**50.0' long x 1.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00
			Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.05 cfs @ 11.80 hrs HW=56.39' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=4.04 cfs @ 12.09 hrs HW=56.45' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.04 cfs @ 0.84 fps)

Summary for Pond WQU-F: WQU-F

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 0.73" for 10 Year event
Inflow = 3.87 cfs @ 12.10 hrs, Volume= 16,989 cf
Outflow = 3.87 cfs @ 12.10 hrs, Volume= 16,989 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.87 cfs @ 12.10 hrs, Volume= 16,989 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 57.96' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.84'	**18.0" Round Culvert**
			L= 120.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 56.84' / 56.24' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.87 cfs @ 12.10 hrs HW=57.96' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 3.87 cfs @ 3.81 fps)

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1: CB-F1 Peak Elev=59.77' Inflow=4.02 cfs 26,236 cf
12.0" Round Culvert n=0.013 L=16.0' S=0.0050 '/' Outflow=4.02 cfs 26,236 cf

Pond 1P: DRYWELL Peak Elev=60.86' Storage=203 cf Inflow=2.71 cfs 18,732 cf
Discarded=0.01 cfs 1,017 cf Primary=2.67 cfs 17,624 cf Outflow=2.68 cfs 18,640 cf

Pond 2: CB-F2 Peak Elev=58.53' Inflow=2.09 cfs 8,656 cf
12.0" Round Culvert n=0.013 L=12.5' S=0.0048 '/' Outflow=2.09 cfs 8,656 cf

Pond 2P: CB-H1 Peak Elev=0.00'
10.0" Round Culvert n=0.013 L=115.0' S=0.0052 '/' Primary=0.00 cfs 0 cf

Pond 3: CB-F3 Peak Elev=60.77' Inflow=0.71 cfs 2,208 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0100 '/' Outflow=0.71 cfs 2,208 cf

Pond 3P: 8" perf pipe Peak Elev=60.93' Storage=48 cf Inflow=2.75 cfs 20,310 cf
Discarded=0.06 cfs 1,569 cf Primary=2.71 cfs 18,732 cf Outflow=2.77 cfs 20,301 cf

Pond 4: CB-F4 Peak Elev=60.78' Inflow=0.79 cfs 2,988 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0100 '/' Outflow=0.79 cfs 2,988 cf

Pond 4P: DRYWELL Peak Elev=60.76' Storage=200 cf Inflow=2.64 cfs 16,702 cf
Discarded=0.01 cfs 841 cf Primary=2.62 cfs 15,771 cf Outflow=2.63 cfs 16,612 cf

Pond 5: CB-F5 Peak Elev=67.19' Inflow=0.75 cfs 2,616 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.75 cfs 2,616 cf

Pond 5P: 8" perf pipe Peak Elev=66.05' Storage=19 cf Inflow=2.67 cfs 17,624 cf
Discarded=0.03 cfs 917 cf Primary=2.64 cfs 16,702 cf Outflow=2.67 cfs 17,619 cf

Pond 6: CB-F6 Peak Elev=67.20' Inflow=0.78 cfs 2,411 cf
12.0" Round Culvert n=0.013 L=14.0' S=0.0100 '/' Outflow=0.78 cfs 2,411 cf

Pond 6P: DRYWELL Peak Elev=60.63' Storage=196 cf Inflow=2.58 cfs 14,331 cf
Discarded=0.01 cfs 772 cf Primary=2.55 cfs 13,471 cf Outflow=2.56 cfs 14,243 cf

Pond 7P: 8" perf pipe Peak Elev=65.68' Storage=34 cf Inflow=2.62 cfs 15,771 cf
Discarded=0.05 cfs 1,434 cf Primary=2.58 cfs 14,331 cf Outflow=2.63 cfs 15,765 cf

Pond 10P: DRYWELL Peak Elev=61.00' Storage=207 cf Inflow=2.76 cfs 21,624 cf
Discarded=0.01 cfs 1,221 cf Primary=2.75 cfs 20,310 cf Outflow=2.76 cfs 21,531 cf

Pond DMH-F1: DMH-F1 Peak Elev=59.19' Inflow=7.94 cfs 45,114 cf
18.0" Round Culvert n=0.013 L=20.0' S=0.0050 '/' Outflow=7.94 cfs 45,114 cf

Pond DMH-F2: DMH-F2 Peak Elev=58.85' Inflow=2.84 cfs 10,222 cf
15.0" Round Culvert n=0.013 L=56.0' S=0.0100 '/' Outflow=2.84 cfs 10,222 cf

Pond DMH-F3: DMH-F3 Peak Elev=60.47' Inflow=2.84 cfs 10,222 cf
15.0" Round Culvert n=0.013 L=152.5' S=0.0100 '/' Outflow=2.84 cfs 10,222 cf

Pond DMH-F4: DMH-F4 Peak Elev=65.39' Inflow=1.45 cfs 5,027 cf
12.0" Round Culvert n=0.013 L=91.0' S=0.0468 '/' Outflow=1.45 cfs 5,027 cf

Pond DMH-F5: DMH-F5 Peak Elev=65.99' Inflow=1.45 cfs 5,027 cf
12.0" Round Culvert n=0.013 L=91.0' S=0.0049 '/' Outflow=1.45 cfs 5,027 cf

Pond DMH-F6: DMH-F6 Peak Elev=66.74' Inflow=1.45 cfs 5,027 cf
12.0" Round Culvert n=0.013 L=133.0' S=0.0050 '/' Outflow=1.45 cfs 5,027 cf

Pond DMH-F7: DMH-F7 Peak Elev=67.21' Inflow=1.45 cfs 5,027 cf
12.0" Round Culvert n=0.013 L=67.0' S=0.0049 '/' Outflow=1.45 cfs 5,027 cf

Pond F: POND F BR Peak Elev=56.50' Storage=3,076 cf Inflow=7.94 cfs 45,114 cf
Discarded=0.05 cfs 3,938 cf Primary=7.94 cfs 38,101 cf Outflow=7.99 cfs 42,039 cf

Pond WQU-F: WQU-F Peak Elev=59.02' Inflow=7.94 cfs 45,114 cf
18.0" Round Culvert n=0.013 L=120.0' S=0.0050 '/' Outflow=7.94 cfs 45,114 cf

Summary for Pond 1: CB-F1

Inflow Area = 232,146 sf, 12.69% Impervious, Inflow Depth > 1.36" for 100 Year event
Inflow = 4.02 cfs @ 12.16 hrs, Volume= 26,236 cf
Outflow = 4.02 cfs @ 12.16 hrs, Volume= 26,236 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.02 cfs @ 12.16 hrs, Volume= 26,236 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.77' @ 12.16 hrs
Flood Elev= 60.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.46'	**12.0" Round Culvert** L= 16.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.46' / 57.38' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=4.02 cfs @ 12.16 hrs HW=59.77' (Free Discharge)
1=Culvert (Inlet Controls 4.02 cfs @ 5.12 fps)

Summary for Pond 1P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 1.17" for 100 Year event
Inflow = 2.71 cfs @ 12.40 hrs, Volume= 18,732 cf
Outflow = 2.68 cfs @ 12.41 hrs, Volume= 18,640 cf, Atten= 1%, Lag= 0.8 min
Discarded = 0.01 cfs @ 6.38 hrs, Volume= 1,017 cf
Primary = 2.67 cfs @ 12.41 hrs, Volume= 17,624 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.86' @ 12.41 hrs Surf.Area= 79 sf Storage= 203 cf

Plug-Flow detention time= 5.1 min calculated for 18,640 cf (100% of inflow)
Center-of-Mass det. time= 2.4 min (872.3 - 870.0)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 6.38 hrs HW=56.05' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=2.67 cfs @ 12.41 hrs HW=60.86' (Free Discharge)
2=Orifice/Grate (Orifice Controls 2.67 cfs @ 7.65 fps)

Summary for Pond 2: CB-F2

Inflow Area = 20,326 sf, 56.61% Impervious, Inflow Depth > 5.11" for 100 Year event
Inflow = 2.09 cfs @ 12.13 hrs, Volume= 8,656 cf
Outflow = 2.09 cfs @ 12.13 hrs, Volume= 8,656 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.09 cfs @ 12.13 hrs, Volume= 8,656 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.53' @ 12.13 hrs
Flood Elev= 60.46'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.46'	**12.0" Round Culvert** L= 12.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.46' / 57.40' S= 0.0048 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.09 cfs @ 12.13 hrs HW=58.53' (Free Discharge)
1=Culvert (Barrel Controls 2.09 cfs @ 3.10 fps)

Summary for Pond 2P: CB-H1

Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	57.50'	**10.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.50' / 56.90' S= 0.0052 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=0.00' (Free Discharge)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 3: CB-F3

Inflow Area = 3,290 sf,100.00% Impervious, Inflow Depth > 8.05" for 100 Year event
Inflow = 0.71 cfs @ 12.03 hrs, Volume= 2,208 cf
Outflow = 0.71 cfs @ 12.03 hrs, Volume= 2,208 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.71 cfs @ 12.03 hrs, Volume= 2,208 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.77' @ 12.03 hrs
Flood Elev= 63.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.26'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.26' / 60.16' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.71 cfs @ 12.03 hrs HW=60.77' (Free Discharge)
1=Culvert (Barrel Controls 0.71 cfs @ 2.53 fps)

Summary for Pond 3P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 1.26" for 100 Year event
Inflow = 2.75 cfs @ 12.40 hrs, Volume= 20,310 cf
Outflow = 2.77 cfs @ 12.40 hrs, Volume= 20,301 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.06 cfs @ 12.09 hrs, Volume= 1,569 cf
Primary = 2.71 cfs @ 12.40 hrs, Volume= 18,732 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.93' @ 12.40 hrs Surf.Area= 0 sf Storage= 48 cf

Plug-Flow detention time= 0.9 min calculated for 20,301 cf (100% of inflow)
Center-of-Mass det. time= 0.6 min (871.7 - 871.0)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	48 cf	**8.0" D x 138.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.06 cfs @ 12.09 hrs HW=58.67' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=2.71 cfs @ 12.40 hrs HW=60.93' (Free Discharge)
2=Orifice/Grate (Orifice Controls 2.71 cfs @ 7.76 fps)

Summary for Pond 4: CB-F4

Inflow Area = 12,577 sf, 23.17% Impervious, Inflow Depth > 2.85" for 100 Year event
Inflow = 0.79 cfs @ 12.08 hrs, Volume= 2,988 cf
Outflow = 0.79 cfs @ 12.08 hrs, Volume= 2,988 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.79 cfs @ 12.08 hrs, Volume= 2,988 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.78' @ 12.08 hrs
Flood Elev= 63.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	60.23'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 60.23' / 60.13' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.79 cfs @ 12.08 hrs HW=60.78' (Free Discharge)
1=Culvert (Barrel Controls 0.79 cfs @ 2.59 fps)

Summary for Pond 4P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 1.04" for 100 Year event
Inflow = 2.64 cfs @ 12.41 hrs, Volume= 16,702 cf
Outflow = 2.63 cfs @ 12.43 hrs, Volume= 16,612 cf, Atten= 0%, Lag= 1.0 min
Discarded = 0.01 cfs @ 8.46 hrs, Volume= 841 cf
Primary = 2.62 cfs @ 12.43 hrs, Volume= 15,771 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.76' @ 12.43 hrs Surf.Area= 79 sf Storage= 200 cf

Plug-Flow detention time= 5.2 min calculated for 16,605 cf (99% of inflow)
Center-of-Mass det. time= 2.2 min (870.8 - 868.6)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 8.46 hrs HW=56.05' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=2.62 cfs @ 12.43 hrs HW=60.76' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 2.62 cfs @ 7.51 fps)

Summary for Pond 5: CB-F5

Inflow Area = 6,800 sf, 49.26% Impervious, Inflow Depth > 4.62" for 100 Year event
Inflow = 0.75 cfs @ 12.06 hrs, Volume= 2,616 cf
Outflow = 0.75 cfs @ 12.06 hrs, Volume= 2,616 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.75 cfs @ 12.06 hrs, Volume= 2,616 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 67.19' @ 12.06 hrs
Flood Elev= 69.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.67'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.67' / 66.53' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.75 cfs @ 12.06 hrs HW=67.19' (Free Discharge)
↑**1=Culvert** (Barrel Controls 0.75 cfs @ 2.66 fps)

Summary for Pond 5P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 1.10" for 100 Year event
Inflow = 2.67 cfs @ 12.41 hrs, Volume= 17,624 cf
Outflow = 2.67 cfs @ 12.41 hrs, Volume= 17,619 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.93 hrs, Volume= 917 cf
Primary = 2.64 cfs @ 12.41 hrs, Volume= 16,702 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.05' @ 12.41 hrs Surf.Area= 0 sf Storage= 19 cf

Plug-Flow detention time= 0.5 min calculated for 17,611 cf (100% of inflow)
Center-of-Mass det. time= 0.4 min (872.6 - 872.2)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	19 cf	**6.0" D x 98.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.03 cfs @ 11.93 hrs HW=58.52' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=2.64 cfs @ 12.41 hrs HW=66.05' (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 2.64 cfs @ 13.44 fps)

Summary for Pond 6: CB-F6

Inflow Area = 4,870 sf, 68.79% Impervious, Inflow Depth > 5.94" for 100 Year event
Inflow = 0.78 cfs @ 12.02 hrs, Volume= 2,411 cf
Outflow = 0.78 cfs @ 12.02 hrs, Volume= 2,411 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.78 cfs @ 12.02 hrs, Volume= 2,411 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 67.20' @ 12.02 hrs
Flood Elev= 69.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.67'	**12.0" Round Culvert** L= 14.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.67' / 66.53' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.77 cfs @ 12.02 hrs HW=67.20' (Free Discharge)
↑**1=Culvert** (Barrel Controls 0.77 cfs @ 2.67 fps)

Summary for Pond 6P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 0.89" for 100 Year event
Inflow = 2.58 cfs @ 12.42 hrs, Volume= 14,331 cf
Outflow = 2.56 cfs @ 12.45 hrs, Volume= 14,243 cf, Atten= 1%, Lag= 1.5 min
Discarded = 0.01 cfs @ 9.74 hrs, Volume= 772 cf
Primary = 2.55 cfs @ 12.45 hrs, Volume= 13,471 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.63' @ 12.45 hrs Surf.Area= 79 sf Storage= 196 cf

Plug-Flow detention time= 5.5 min calculated for 14,237 cf (99% of inflow)
Center-of-Mass det. time= 2.0 min (858.8 - 856.8)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 9.74 hrs HW=56.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=2.55 cfs @ 12.45 hrs HW=60.63' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 2.55 cfs @ 7.30 fps)

Summary for Pond 7P: 8" perf pipe

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 0.98" for 100 Year event
Inflow = 2.62 cfs @ 12.43 hrs, Volume= 15,771 cf
Outflow = 2.63 cfs @ 12.42 hrs, Volume= 15,765 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.05 cfs @ 11.98 hrs, Volume= 1,434 cf
Primary = 2.58 cfs @ 12.42 hrs, Volume= 14,331 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.68' @ 12.42 hrs Surf.Area= 0 sf Storage= 34 cf

Plug-Flow detention time= 0.9 min calculated for 15,765 cf (100% of inflow)
Center-of-Mass det. time= 0.7 min (866.1 - 865.4)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	34 cf	**6.0" D x 175.0'L Pipe Storage**

Device	Routing	Invert	Outlet Devices
#1	Discarded	58.00'	**8.240 in/hr Exfiltration over Wetted area**
#2	Primary	58.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.05 cfs @ 11.98 hrs HW=58.55' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=2.58 cfs @ 12.42 hrs HW=65.68' (Free Discharge)
↑└**2=Orifice/Grate** (Orifice Controls 2.58 cfs @ 13.12 fps)

Summary for Pond 10P: DRYWELL

Inflow Area = 192,734 sf, 7.41% Impervious, Inflow Depth > 1.35" for 100 Year event
Inflow = 2.76 cfs @ 12.38 hrs, Volume= 21,624 cf
Outflow = 2.76 cfs @ 12.40 hrs, Volume= 21,531 cf, Atten= 0%, Lag= 1.1 min
Discarded = 0.01 cfs @ 2.06 hrs, Volume= 1,221 cf
Primary = 2.75 cfs @ 12.40 hrs, Volume= 20,310 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 61.00' @ 12.40 hrs Surf.Area= 79 sf Storage= 207 cf

Plug-Flow detention time= 5.5 min calculated for 21,531 cf (100% of inflow)
Center-of-Mass det. time= 3.0 min (864.8 - 861.7)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	108 cf	**10.00'D x 5.00'H Vertical Cone/Cylinder** 393 cf Overall - 122 cf Embedded = 271 cf x 40.0% Voids
#2	56.50'	99 cf	**6.00'D x 3.50'H Vertical Cone/Cylinder** Inside #1 122 cf Overall - 4.0" Wall Thickness = 99 cf
		207 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.240 in/hr Exfiltration over Surface area**
#2	Primary	58.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.01 cfs @ 2.06 hrs HW=56.05' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=2.75 cfs @ 12.40 hrs HW=61.00' (Free Discharge)
↑└**2=Orifice/Grate** (Orifice Controls 2.75 cfs @ 7.86 fps)

Summary for Pond DMH-F1: DMH-F1

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 1.93" for 100 Year event
Inflow = 7.94 cfs @ 12.11 hrs, Volume= 45,114 cf
Outflow = 7.94 cfs @ 12.11 hrs, Volume= 45,114 cf, Atten= 0%, Lag= 0.0 min
Primary = 7.94 cfs @ 12.11 hrs, Volume= 45,114 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.19' @ 12.11 hrs
Flood Elev= 60.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.04'	**18.0" Round Culvert**

L= 20.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 57.04' / 56.94' S= 0.0050 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=7.94 cfs @ 12.11 hrs HW=59.19' (Free Discharge)
└**1=Culvert** (Inlet Controls 7.94 cfs @ 4.49 fps)

Summary for Pond DMH-F2: DMH-F2

Inflow Area = 27,537 sf, 46.86% Impervious, Inflow Depth > 4.45" for 100 Year event
Inflow = 2.84 cfs @ 12.04 hrs, Volume= 10,222 cf
Outflow = 2.84 cfs @ 12.04 hrs, Volume= 10,222 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.84 cfs @ 12.04 hrs, Volume= 10,222 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.85' @ 12.04 hrs
Flood Elev= 62.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	57.85'	**15.0" Round Culvert** L= 56.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 57.85' / 57.29' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.84 cfs @ 12.04 hrs HW=58.85' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.84 cfs @ 2.69 fps)

Summary for Pond DMH-F3: DMH-F3

Inflow Area = 27,537 sf, 46.86% Impervious, Inflow Depth > 4.45" for 100 Year event
Inflow = 2.84 cfs @ 12.04 hrs, Volume= 10,222 cf
Outflow = 2.84 cfs @ 12.04 hrs, Volume= 10,222 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.84 cfs @ 12.04 hrs, Volume= 10,222 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 60.47' @ 12.04 hrs
Flood Elev= 63.39'

Device	Routing	Invert	Outlet Devices
#1	Primary	59.47'	**15.0" Round Culvert** L= 152.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 59.47' / 57.95' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.84 cfs @ 12.04 hrs HW=60.47' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.84 cfs @ 2.69 fps)

Summary for Pond DMH-F4: DMH-F4

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 5.17" for 100 Year event
Inflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf
Outflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.39' @ 12.04 hrs
Flood Elev= 69.49'

Device	Routing	Invert	Outlet Devices
#1	Primary	64.65'	**12.0" Round Culvert** L= 91.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 64.65' / 60.39' S= 0.0468 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.45 cfs @ 12.04 hrs HW=65.39' (Free Discharge)
1=Culvert (Inlet Controls 1.45 cfs @ 2.32 fps)

Summary for Pond DMH-F5: DMH-F5

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 5.17" for 100 Year event
Inflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf
Outflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.99' @ 12.04 hrs
Flood Elev= 75.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	65.21'	**12.0" Round Culvert** L= 91.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.21' / 64.76' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.45 cfs @ 12.04 hrs HW=65.99' (Free Discharge)
1=Culvert (Barrel Controls 1.45 cfs @ 3.06 fps)

Summary for Pond DMH-F6: DMH-F6

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 5.17" for 100 Year event
Inflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf
Outflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 66.74' @ 12.04 hrs
Flood Elev= 72.23'

Device	Routing	Invert	Outlet Devices
#1	Primary	65.98'	**12.0" Round Culvert** L= 133.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 65.98' / 65.31' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.45 cfs @ 12.04 hrs HW=66.74' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.45 cfs @ 3.13 fps)

Summary for Pond DMH-F7: DMH-F7

Inflow Area = 11,670 sf, 57.41% Impervious, Inflow Depth > 5.17" for 100 Year event
Inflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf
Outflow = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.04 hrs, Volume= 5,027 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 67.21' @ 12.04 hrs
Flood Elev= 70.21'

Device	Routing	Invert	Outlet Devices
#1	Primary	66.42'	**12.0" Round Culvert** L= 67.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.42' / 66.09' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.45 cfs @ 12.04 hrs HW=67.21' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.45 cfs @ 3.01 fps)

Summary for Pond F: POND F BR

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 1.93" for 100 Year event
Inflow = 7.94 cfs @ 12.11 hrs, Volume= 45,114 cf
Outflow = 7.99 cfs @ 12.12 hrs, Volume= 42,039 cf, Atten= 0%, Lag= 0.6 min
Discarded = 0.05 cfs @ 10.15 hrs, Volume= 3,938 cf
Primary = 7.94 cfs @ 12.12 hrs, Volume= 38,101 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 56.50' @ 12.12 hrs Surf.Area= 4,228 sf Storage= 3,076 cf

Plug-Flow detention time= 59.5 min calculated for 42,021 cf (93% of inflow)
Center-of-Mass det. time= 23.7 min (816.6 - 792.9)

Volume	Invert	Avail.Storage	Storage Description
#1	55.55'	3,076 cf	**STORM WATER WETLAND (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
55.55	3,463	0	0
56.35	4,228	3,076	3,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	55.55'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	56.35'	**50.0' long x 1.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00
			Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.05 cfs @ 10.15 hrs HW=56.37' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=7.94 cfs @ 12.12 hrs HW=56.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 7.94 cfs @ 1.05 fps)

Summary for Pond WQU-F: WQU-F

Inflow Area = 280,009 sf, 19.24% Impervious, Inflow Depth > 1.93" for 100 Year event
Inflow = 7.94 cfs @ 12.11 hrs, Volume= 45,114 cf
Outflow = 7.94 cfs @ 12.11 hrs, Volume= 45,114 cf, Atten= 0%, Lag= 0.0 min
Primary = 7.94 cfs @ 12.11 hrs, Volume= 45,114 cf

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.02' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	56.84'	**18.0" Round Culvert**
			L= 120.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 56.84' / 56.24' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=7.94 cfs @ 12.11 hrs HW=59.02' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 7.94 cfs @ 4.49 fps)

Appendix C

Operation & Maintenance Plan

STORMWATER MANAGEMENT
OPERATION AND MAINTENANCE PLAN
CONSTRUCTION PHASE

Port Place
Newburyport, Massachusetts

The following Stormwater Management Operation and Maintenance (O&M) Plan has been prepared to operate and maintain the stormwater management system during the Construction Phase of the proposed development by Evergreen Commons LLC. Construction Phase is defined as the duration between the start of construction until the last lot is conveyed.

Owner/Operator: During the Construction Phase, Evergreen Commons, LLC will be responsible for the operation and maintenance of the stormwater management system, erosion control measures, the swirl particle separators, biorentention areas and the constructed stormwater wetland.

Inspection and Maintenance – Construction Phase

Erosion and Sediment Controls

All construction erosion control measures shall be installed in accordance to the project plan and specifications. Control measures shall be inspected at least once per week and immediately after each rain event of 0.5 inches or greater. A maintenance inspection report will be made after each inspection. The Contractor's site superintendent shall be responsible for inspections, maintenance and repair activities, as well as, for filling out the inspection reports. Any necessary repairs needed to the erosion control barriers shall be made immediately to keep them in good working order. If there are any signs of undercutting or impounding of water behind the barrier, a temporary check dam should replace the section of barrier.

Stabilization of any swales, ditches and ponds is required prior to directing any flow to them. Construction stormwater shall be diverted away from all infiltration facilities, and sediment control barriers shall be installed around the facilities to filter any potential sheet flow. See Erosion Control Notes in the Project plans and specifications for construction phase stabilization methods and vegetative practices. All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of report. Remove any built up sediment found inside measures and dispose of properly. Refer to the project plans and specifications for installation details for the following construction erosion and sediment controls.

Stabilized Construction Entrance –

- The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This will require periodic top dressing with additional stone or additional length as conditions demand and repair and/or cleanout of any measures used to trap sediment.
- All sediment spilled, washed, dropped or tracked onto public rights-of-way must be removed immediately.

Catch Basins and Particle Separators –

- Install erosion control measures in these structures as described on the Site Plans.

- Structures shall be inspected at least once a week and immediately after every rain event of 0.5 inches or greater storm. Remove any accumulated sediment and dispose off site properly.
- Measures shall remain in place until after permanent stabilization of grassed areas has been achieved and road paving has been completed.

Bioretention Areas & Constructed Stormwater Wetland

- Install erosion control barrier around perimeter of rain gardens, and maintain to prevent any tracking of sediments into these areas.
- Contractor to implement measures to divert any runoff from storms away from rain garden areas during construction and planting phases.
- Erosion control measures to remain in place until surrounding grassed areas have been stabilized.
- Remove any accumulated sediment from perimeter of erosion control barriers.
- For the Wetlands, aggressively provide erosion controls during the standing and planting periods. Stabilize the vegetation in all areas above the normal pool elevation during the standing period (typically by hydroseeding).

Constructed Wetland: Inspect the wetland four times a year during both the growing and non-growing seasons. During these inspections, record and map the following information:

- The types and distribution of the dominant wetland plants
- The presence and distribution of planted wetland species
- The presence and distribution of invasive wetland species (must be removed)
- Indications that other species are replacing the planted wetland species
- Percentage of standing water that is unvegetated (excluding the deep water cells)
- The maximum elevation and the vegetative condition in this zone
- Stability of the original depth zones and the micro-topographic features
- Accumulation of sediment in the forebay and micropool; and survival rate of plants (cells with dead plants must be replanted.

Construction Phase Dewatering – Pumped Filter Bags

Dewater the constructed wetlands at least three days prior to planting, because a dry wetland is easier to plant than a wet one.

Filter Bags may be used to filter water pumped from disturbed areas prior to discharging into any surrounding resource areas. They may also be used to filter water pumped from the sediment storage areas of sediment basins.

Filter bags shall be installed according to the detail shown on the Site Plans.

Filter bags shall be made from non-woven geotextile material sewn with high-strength, double stitched "J" type seams. They shall be capable of trapping particles larger than 150 microns.

Filter bags shall be replaced when they become ½ full. Spare bags shall be kept available for replacement of those that have failed or are filled.

Bags shall be located in well-vegetated (grassy) area, and discharge onto stable, erosion resistant areas. Where this is not possible, a geotextile flow path shall be provided. Bags shall not be placed on slopes greater than 5%.

The pump discharge hose shall be inserted into the bags in the manner specified by the manufacturer and securely clamped.

The pumping rate shall be no greater than 750 gpm or ½ the maximum specified manufacturer, whichever is less. Pump intake hoses should be floating and screened.

Filter bags shall be inspected daily. If any problem is detected, pumping shall cease immediately and not resume until the problem is corrected.

Interim Long Term Inspection and Maintenance

After completion of the roadways and infrastructure, during the phased construction of the homes, the stormwater management systems shall be maintained on a routine basis not less than once per month. Refer to the Grading & Drainage Plans, for drainage structure locations. Inspection and maintenance shall be performed as follows:

1. Street Sweeping – Completed monthly or more frequently if tracked sediment from home construction is evident in roadways. Removed sediment will be disposed off site by a qualified waste disposal contractor in accordance with all applicable local and state regulations.

3. Catch Basins & Particle Separators – See attached maintenance procedures for Hydroworks proprietary particle separators. Inspect on a monthly basis. All sediments removed must be disposed of in accordance with all applicable local and state regulations.

3. Snow Removal and Storage: During the winter months, snow shall be plowed from the roadway and not stored or piled in or near the stormwater basins.

4. Bioretention Areas – Inspect the bioretention areas, and repair any eroded areas and remove trash on a monthly basis year round. Prune and remove any dead vegetation each spring and fall. Replace any dead vegetation and mulch the area each spring as needed. If the soil media fails and infiltration no longer occurs, the entire media and all vegetation must be replaced in either late spring or early summer with similar plantings. Soil media and plants must be in accordance with Massachusetts DEP Stormwater Handbook guidelines.

5. Constructed Stormwater Wetlands- Inspect the wetlands twice a year during both the growing and non-growing seasons. During these inspections, record and map the following information:
    - The types and distribution of the dominant wetland plants
    - The presence and distribution of planted wetland species
    - The presence and distribution of invasive wetland species (must be removed)
    - Indications that other species are replacing the planted wetland species
    - Percentage of standing water that is unvegetated (excluding the deep water cells)
    - The maximum elevation and the vegetative condition in this zone

    - Stability of the original depth zones and the micro-topographic features
    - Accumulation of sediment in the forebay and micropool; and survival rate of plants (cells with dead plants must be replanted)

6. Sediment Forebay: Sediment forebays are to be cleaned twice per year.
    - Forebays to be cleaned each spring prior to growing season
    - Remove any potential accumulated trash from forebay.
    - Remove sediment from splash pad and sump
    - Replace any dislodged stones from splash pad.
    - Remove any invasive vegetation.
    - Trim and remove overgrown vegetation.
    - Confirm weir berm is not clogged or overgrown, remove debris as required.

Stormwater System Inspection Report

General Information			
Location: Port Place, Newburyport MA			
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Purpose of Inspection			
Weather Information			
Has it rained since the last inspection? ❑Yes ❑No			
Weather at time of this inspection?			

Site-Specific Stormwater Devices

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
1		❑Yes ❑No		
2		❑Yes ❑No		
3		❑Yes ❑No		
4		❑Yes ❑No		
5		❑Yes ❑No		
6		❑Yes ❑No		
7		❑Yes ❑No		
8		❑Yes ❑No		
9		❑Yes ❑No		

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
10		❑Yes ❑No		
11		❑Yes ❑No		
12		❑Yes ❑No		
13		❑Yes ❑No		
14		❑Yes ❑No		
15		❑Yes ❑No		

	Description		Corrective Action	Date for Corrective Action/Responsible Person
1	Are all slopes properly stabilized?	❑Yes ❑No		
2	Are natural resource areas (e.g., streams, wetlands, etc.) being subjected to erosion?	❑Yes ❑No		
3	Are discharge points free of sediment deposits?	❑Yes ❑No		

Certification Statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name: _____

Signature: _____

Date: _____

Hydroworks® Hydroguard

Operations & Maintenance Manual

Version 1.5

Introduction

The Hydroguard is a state of the art hydrodynamic separator. Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The Hydroguard is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their Hydroguard.

Hydroworks® HG Operation

The Hydroworks HG separator is unique since it treats both high and low flows in one device, but maintains separate flow paths for low and high flows. Accordingly, high flows do not scour out the fines that are settled in the low flow path since they are treated in a separate area of the device as shown in Figure 1.

The HG separator consists of three chambers:

1. an inner chamber that treats low or normal flows
2. a middle chamber that treats high flows
3. an outlet chamber where water is discharged to the downstream storm system

Under normal or low flows, water enters the middle chamber and is conveyed into the inner chamber by momentum. Since the inner chamber is offset to one side of the structure the water strikes the wall of the inner chamber at a tangent creating a vortex within the inner chamber. The vortex motion forces solids and floatables to the middle of the inner chamber. The water spirals down the inner chamber to the outlet of the inner chamber which is located below the inlet of the inner chamber and adjacent to the wall of the structure but above the floor of the structure. Floatables are trapped since the outlet of the inner chamber is submerged. The design maximizes the retention of settled solids since solids are forced to the center of the inner chamber by the vortex motion of water while the outlet of the inner chamber draws water from the wall of the inner chamber.

The water leaving the inner chamber continues into the middle chamber, again at a tangent to the wall of the structure. The water is then conveyed through an outlet baffle wall (high and low baffle). This enhances the collection of any floatables or solids not removed by the inner chamber. Water flowing through the baffles then enters the outlet chamber and is discharged into the downstream storm drain.

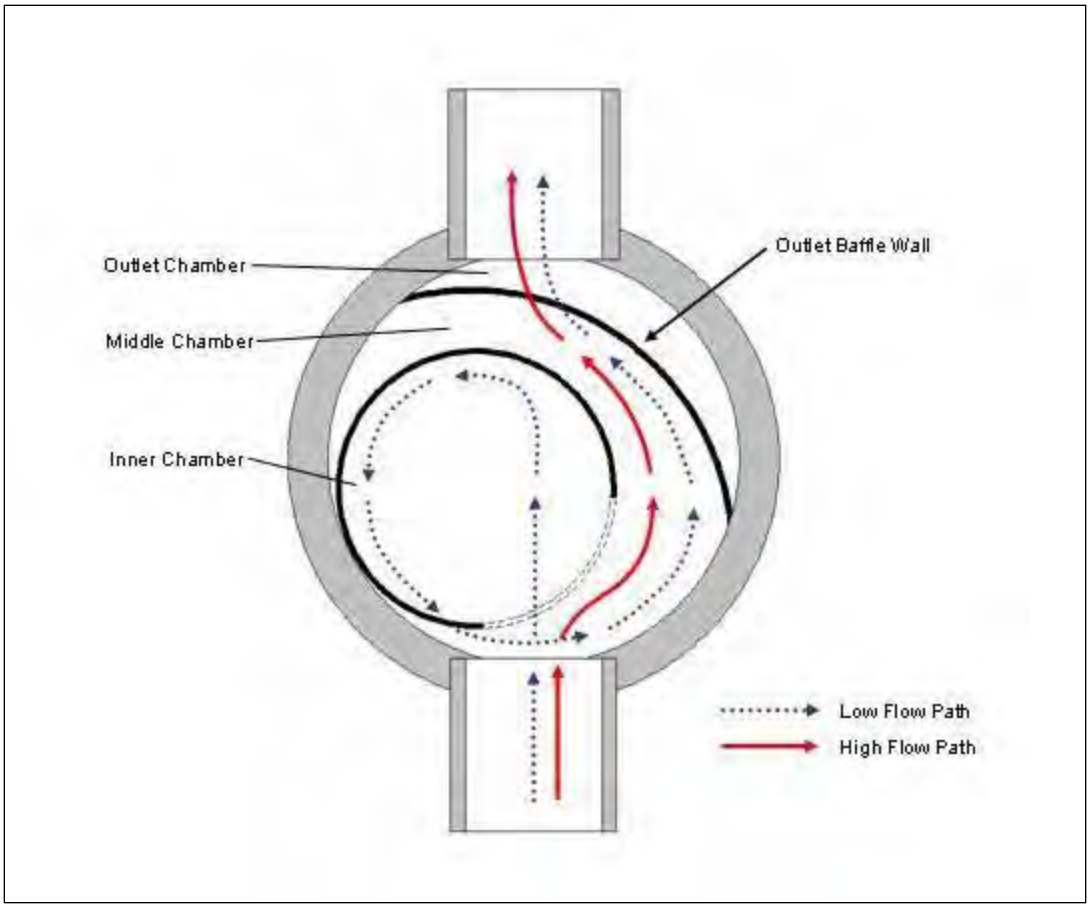


Figure 1. Hydroworks HG Operation – Plan View

During high flows, the flow rate entering the inner chamber is restricted by the size of the inlet opening to the inner chamber. This restriction of flow rate into the inner chamber prevents scour and re-suspension of solids from the inner chamber during periods of high flow. This is important since fines, which are typically considered highly polluted, are conveyed during low/normal flows.

The excess flow is conveyed directly into the middle chamber where it receives treatment for floatables and solids via the baffle system. This treatment of the higher flow rates is important since trash and heavier solids are typically conveyed during periods of higher flow rates. The Hydroworks HG separator is revolutionary since it incorporates low and high flow treatment in one device while maintaining separate low and high flow paths to prevent the scour and re-suspension of fines.

Figure 2 is a profile view of the HG separator showing the flow patterns for low and high flows.

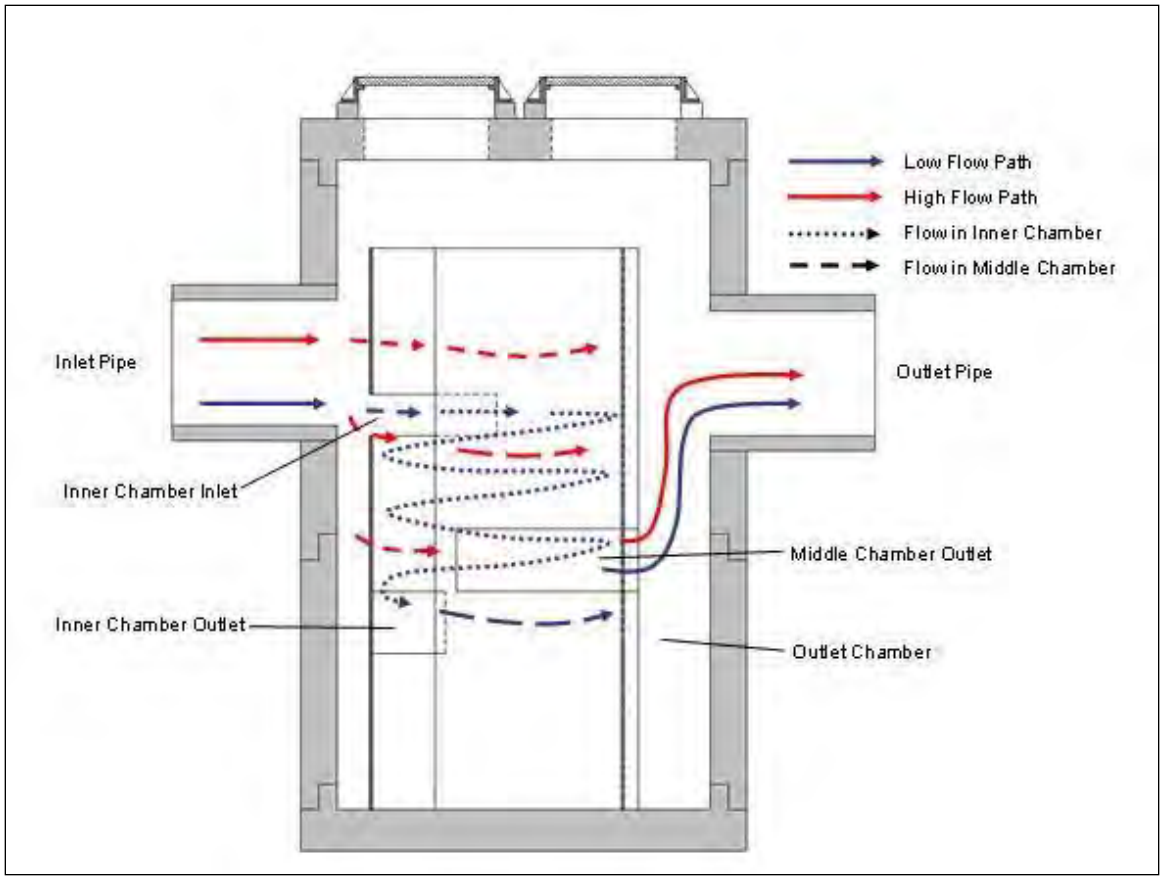
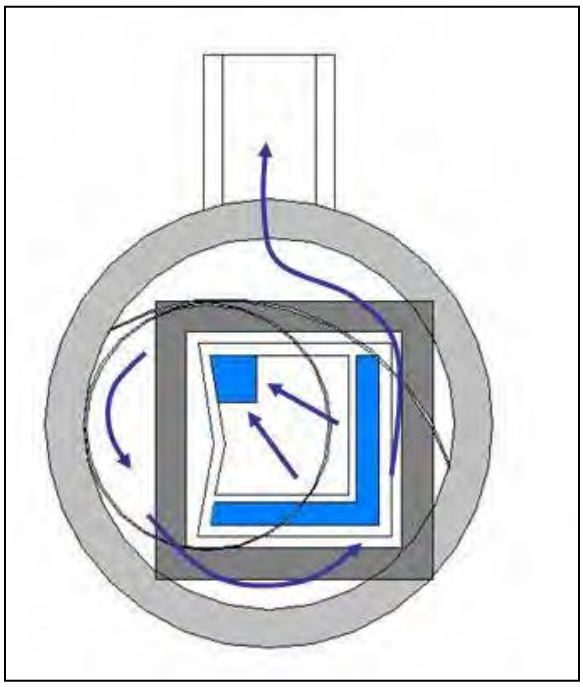


Figure 2. Hydroworks HG Operation – Profile View

The HG 4i is an inlet version of the HG 4 separator. There is a catch-basin grate on top of the HG 4i. Water flows directly into the inner chamber of the HG 4i through the catch-basin grate on top of the structure. The grate is oversized to allow maintenance of the entire structure. A funnel that sits underneath the grate on the top cap of the concrete itself directs the water into the inner chamber during normal flows and the middle chamber during high flows. Figures 3 and 4 show the flow paths for the HG 4i separator.

The inlet funnel is sloped towards the corner inlet and hence the wall of the inner chamber. Water moves in a circular direction in the inner chamber since water enters tangentially along the wall of the inner chamber due to the sloping funnel.

Water continues moving in a circular motion (vortex) through the rest of the structure (through the middle chamber and baffle wall) until it is discharged from the separator.



During periods of peak flow the water will back up from the corner inlet and overflow into two side overflow troughs which discharge directly into the middle chamber. These overflow troughs are covered from the surface such that water cannot directly fall through them (i.e. water must back up to enter the overflow troughs).

Accordingly this funnel provides the same separate flow paths for low and high flow as the other Hydroguard separators.

The whole funnel is removed for inspection and cleaning providing.

Figure 3. Hydroworks HG 4i Normal Flow Path

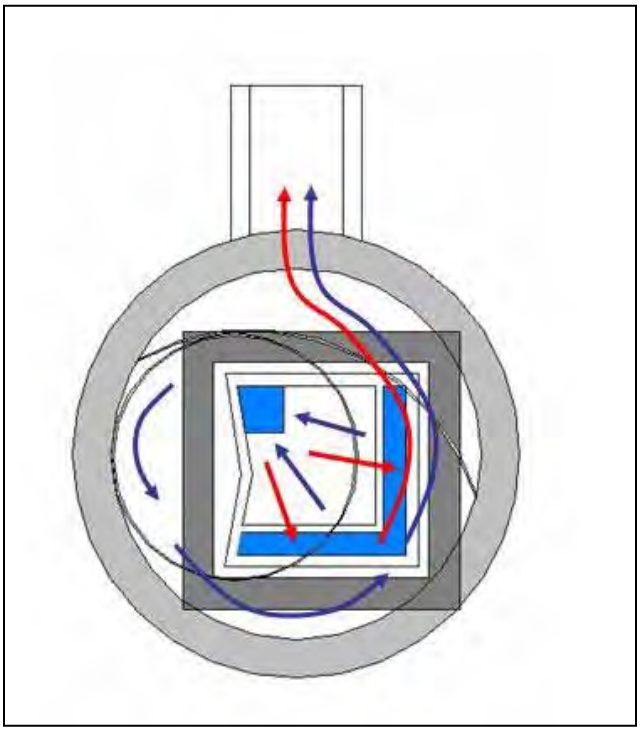


Figure 4. Hydroworks HG 4i Peak Flow Path

Inspection

Procedure

Although all parts of the Hydroguard should be inspected, inspection and maintenance should focus on the inner and middle chambers since this is where the pollutants (floatable and sinking) will accumulate.

Floatables

A visual inspection can be conducted for floatables by removing the covers and looking down into the separator. Multiple covers are provided on Hydroworks HG units to access all areas of the separator (The HG 4 may have a single larger 32” (800mm) cover due to the lack of space for multiple 24” (600mm) covers). Separators with an inlet grate (HG4i or custom separator) will have a plastic funnel located under the grate or on the top cap of the concrete that must be removed through the frame prior to inspection or maintenance. If you are missing a funnel please contact Hydroworks at the numbers provided at the end of this document.

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

Frequency

Construction Period

The HG separator should be inspected every two weeks and after every large storm (over 0.5” (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HG separator should be inspected once per year for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized (storage piles, exposed soils) areas the HG separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required future frequency of maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HG unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HG separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature. Disposal of the water will depend on local requirements. Disposal options for the decanted water may include:

1. Discharge into a nearby sanitary sewer manhole
2. Discharge into a nearby LID practice (grassed swale, bioretention)
3. Discharge through a filter bag into a downstream storm drain connection

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Disposal of the contents of the separator depend on local requirements. Maintenance of a Hydroworks HG unit will typically take 1 to 2 hours based on a vacuum truck and longer for other cleaning methods (i.e. clamshell bucket).

Frequency

Construction Period

A HG separator can fill with construction sediment quickly during the construction period. The Hydroguard must be maintained during the construction period when the depth of TSS/sediment reaches 30" (750 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the open water surface on the inlet side of the outlet baffle wall.

The HG separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The Hydroguard was independently tested by Alden Research Laboratory in 2008. A HG6 was tested for scour with initial sediment loads of 4.6 ft^3 and 9.3 ft^3. The results from these tests were almost identical. Therefore, the 9.3 ft^3 sediment load was used as 50% of the maximum sediment depth for maintenance in the calculation of the maintenance interval for the HG6 separator based on the NJDEP maintenance equation.

Maintenance Interval (months) = 3.565 x (Sediment Storage) / (MTFR x TSS Removal)

Maintenance Interval (HG6) = 3.565 x 9.3 / (1.81x 0.60) = 30 months

All values (flow, sediment storage) can be scaled by the surface area making the sediment depths and maintenance intervals equal for all separators.

The separator was loaded with the sediment in the inner chamber and middle chamber with the majority of sediment (80%) located in the inner chamber. The inner chamber for area represents approximately 44% of the separator surface area. The inner chamber is 4 ft (1200 mm) in diameter in the HG6. Therefore the 50% sediment depth for the HG6 in the inner chamber would be:

9.3 ft^3 x 0.80 / (3.14 x 4 ft^2) x 12 in/ft = 7.1 inches (175 mm)

Accordingly the 100% sediment volume would represent 14.2" (350 mm) of sediment depth in the inner chamber.

The HG separator must be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the open water surface on the inlet side of the outlet baffle wall. It should also be maintained once the accumulated TSS/sediment depths are greater than 14" (350 mm) in the inner chamber. For typical stabilized post-construction sites (parking lots, streets) it is anticipated that maintenance will be required annually or once every two years. More frequent or less frequent maintenance will be required depending on individual site conditions (traffic use, stabilization, storage piles, etc.). The long term maintenance frequency can be established based on the maintenance requirements during the first several years of operation if site conditions do not change.

HYDROGUARD INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

Hydroguard	**Yes**	**No**
Incorrect access orientation	☐ ***	☐
Obstructions in the inlet or outlet	☐ *	☐
Missing internal components	☐ **	☐
Improperly installed internal components	☐ **	☐
Improperly installed inlet or outlet pipes	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____"

Routine Measurements

Floating debris depth	**< 0.5" (13mm)**	☐	**>0.5" 13mm)**	☐ *
Floating debris coverage	**< 25% of surface area**	☐	**> 25% surface area**	☐ *
Sludge depth	**< 14" (350mm)**	☐	**> 14" (350mm)**	☐ *

* Maintenance required
** Repairs required
*** Further investigation is required

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please fax a copy of the completed checklist to Hydroworks at 888-783-7271 for our records.

Other Comments:

Hydroworks® Hydroguard

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks Hydroguard to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks Hydroguard are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Hydroguard, or the cost of other goods or services related to the purchase and installation of the Hydroguard. For this Limited Warranty to apply, the Hydroguard must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the Hydroguard arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the Hydroguard, whether the claim is based upon contract, tort, or other legal basis.

STORMWATER MANAGEMENT
OPERATION AND MAINTENANCE PLAN

Port Place
Newburyport, Massachusetts

The following Stormwater Management Operation and Maintenance (O&M) Plan has been prepared for the operation and maintenance of the stormwater management system for the development by Evergreen Commons LLC known as Port Place. The maintenance to be completed in perpetuity including repairs or replacement of systems to provide stormwater treatment as per the approved design as recorded in the South Essex County Registry of Deeds.

Owner/Operator: The Port Place Subdivision Homeowners Association, will be responsible for the operation and maintenance of the stormwater management systems and open space area and will be responsible for the operation and maintenance of all facilities within the Right of Ways, including but not limited to; Roadways, Curbing. Sidewalks, Catch Basins, Drain Manholes and piping within the roadway until such time as the City of Newburyport accepts the roadway as a public way. After the City of Newburyport accepts the roadways as public ways, the City of Newburyport will be responsible for the operation and maintenance of all facilities within the Right of Ways, including but not limited to; Roadways, Curbing. Sidewalks, Catch Basins, Drain Manholes and piping within the roadway. After roadway acceptance, the Port Place Homeowners Associations will maintain all facilities outside of the roadway Right of Way's including but not limited to; drainage piping, particle separators, biorentention areas and the constructed stormwater wetland. Refer to the Stormwater Management Facilities Location Figure for locations of the stormwater systems to be maintained.

Long Term Inspection and Maintenance

Upon acceptance of the roadways and completion of homes, maintenance shall be performed as recommended below. Refer to the Grading & Drainage Plans, for drainage structure locations. Inspection and maintenance shall be performed as follows:

1. Snow Removal and Storage: During the winter months, snow shall be plowed from the driveways and walks and not stored or piled in or near the stormwater basins.

2. Particle Separators – See attached maintenance procedures for Hydroworks proprietary particle separators. All sediments removed must be disposed of in accordance with all applicable local and state regulations. At a minimum clean each spring on a yearly basis.

3. Bioretention Areas – Inspect the bioretention areas, and repair any eroded areas and remove trash on a monthly basis. Prune and remove any dead vegetation each spring and fall. Replace any dead vegetation and mulch the area each spring. If the soil media fails and infiltration no longer occurs, the entire media and all vegetation must be replaced in either late spring or early summer with similar plantings. Soil media and plants must be in accordance with Massachusetts DEP Stormwater Handbook guidelines.

4. Constructed Stormwater Wetlands- Inspect the wetlands twice a year during both the growing and non-growing seasons. During these inspections, record and map the following information:
    - The types and distribution of the dominant wetland plants
    - The presence and distribution of planted wetland species
    - The presence and distribution of invasive wetland species (must be removed)
    - Indications that other species are replacing the planted wetland species
    - Percentage of standing water that is unvegetated (excluding the deep water cells)
    - The maximum elevation and the vegetative condition in this zone

    - Stability of the original depth zones and the micro-topographic features
    - Accumulation of sediment in the forebay and micropool; and survival rate of plants (cells with dead plants must be replanted)

5. Sediment Forebay: Sediment forebays are to be cleaned twice per year.
    - Forebays to be cleaned each spring prior to growing season
    - Remove any potential accumulated trash from forebay.
    - Remove sediment from splash pad and sump
    - Replace any dislodged stones from splash pad.
    - Remove any invasive vegetation.
    - Trim and remove overgrown vegetation.
    - Confirm weir berm is not clogged or overgrown, remove debris as required.

6. Drywells: Inspect drywells twice per year and at the end of foliage and snow seasons. Remove any debris from top and area surrounding grate. Remove drywell grate and inspect bottom of drywell for any sediment or debris. Remove any accumulated sediment or debris from bottom of drywall. Inspect drywell inlet and outlet pipes for any debris blocking openings. Remove any debris or sticks from pipe openings.

7. Roof Infiltration Trench: Inspect for accumulation of silt, sediment, vegetation, or debris twice per year at end of foliage and snow seasons. Keep stone clean of any vegetation or sediment. If required remove the top layer of stone wash stone clean away from edge trench and replace clean stone into trench. In the event of an infiltration trench failure, the crushed stone shall be removed and washed clean. The non-woven filter fabric that surrounds the trench will need to be disposed of and replaced. Place clean stone on top of the new filter fabric.

Stormwater System Inspection Report

General Information			
Location: Port Place, Newburyport MA			
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Purpose of Inspection			
Weather Information			
Has it rained since the last inspection? ❑Yes ❑No			
Weather at time of this inspection?			

Site-Specific Stormwater Devices

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
1		❑Yes ❑No		
2		❑Yes ❑No		
3		❑Yes ❑No		
4		❑Yes ❑No		
5		❑Yes ❑No		
6		❑Yes ❑No		
7		❑Yes ❑No		
8		❑Yes ❑No		
9		❑Yes ❑No		

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
10		❑Yes ❑No		
11		❑Yes ❑No		
12		❑Yes ❑No		
13		❑Yes ❑No		
14		❑Yes ❑No		
15		❑Yes ❑No		

	Description		Corrective Action	Date for Corrective Action/Responsible Person
1	Are all slopes properly stabilized?	❑Yes ❑No		
2	Are natural resource areas (e.g., streams, wetlands, etc.) being subjected to erosion?	❑Yes ❑No		
3	Are discharge points free of sediment deposits?	❑Yes ❑No		

Certification Statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name: _____

Signature: _____

Date: _____

Hydroworks® Hydroguard

Operations & Maintenance Manual

Version 1.5

Introduction

The Hydroguard is a state of the art hydrodynamic separator. Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The Hydroguard is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their Hydroguard.

Hydroworks® HG Operation

The Hydroworks HG separator is unique since it treats both high and low flows in one device, but maintains separate flow paths for low and high flows. Accordingly, high flows do not scour out the fines that are settled in the low flow path since they are treated in a separate area of the device as shown in Figure 1.

The HG separator consists of three chambers:

1. an inner chamber that treats low or normal flows
2. a middle chamber that treats high flows
3. an outlet chamber where water is discharged to the downstream storm system

Under normal or low flows, water enters the middle chamber and is conveyed into the inner chamber by momentum. Since the inner chamber is offset to one side of the structure the water strikes the wall of the inner chamber at a tangent creating a vortex within the inner chamber. The vortex motion forces solids and floatables to the middle of the inner chamber. The water spirals down the inner chamber to the outlet of the inner chamber which is located below the inlet of the inner chamber and adjacent to the wall of the structure but above the floor of the structure. Floatables are trapped since the outlet of the inner chamber is submerged. The design maximizes the retention of settled solids since solids are forced to the center of the inner chamber by the vortex motion of water while the outlet of the inner chamber draws water from the wall of the inner chamber.

The water leaving the inner chamber continues into the middle chamber, again at a tangent to the wall of the structure. The water is then conveyed through an outlet baffle wall (high and low baffle). This enhances the collection of any floatables or solids not removed by the inner chamber. Water flowing through the baffles then enters the outlet chamber and is discharged into the downstream storm drain.

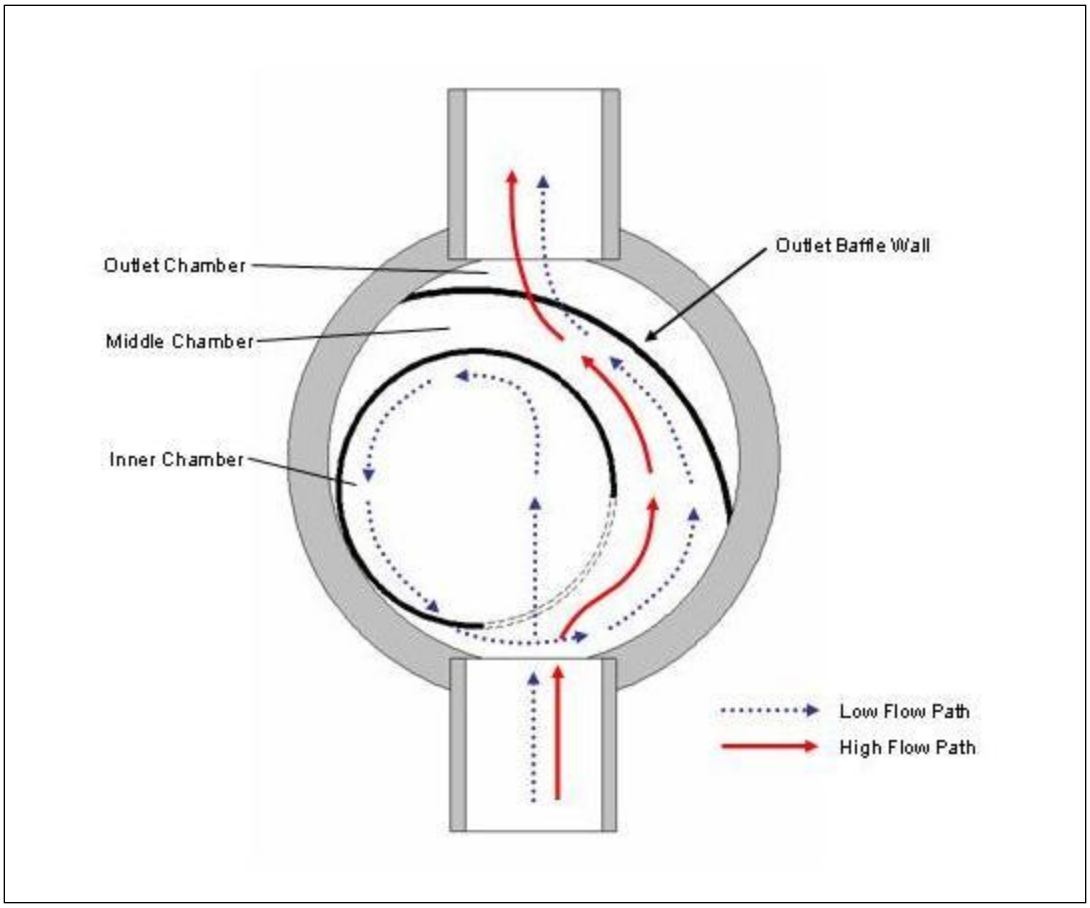


Figure 1. Hydroworks HG Operation – Plan View

During high flows, the flow rate entering the inner chamber is restricted by the size of the inlet opening to the inner chamber. This restriction of flow rate into the inner chamber prevents scour and re-suspension of solids from the inner chamber during periods of high flow. This is important since fines, which are typically considered highly polluted, are conveyed during low/normal flows.

The excess flow is conveyed directly into the middle chamber where it receives treatment for floatables and solids via the baffle system. This treatment of the higher flow rates is important since trash and heavier solids are typically conveyed during periods of higher flow rates. The Hydroworks HG separator is revolutionary since it incorporates low and high flow treatment in one device while maintaining separate low and high flow paths to prevent the scour and re-suspension of fines.

Figure 2 is a profile view of the HG separator showing the flow patterns for low and high flows.

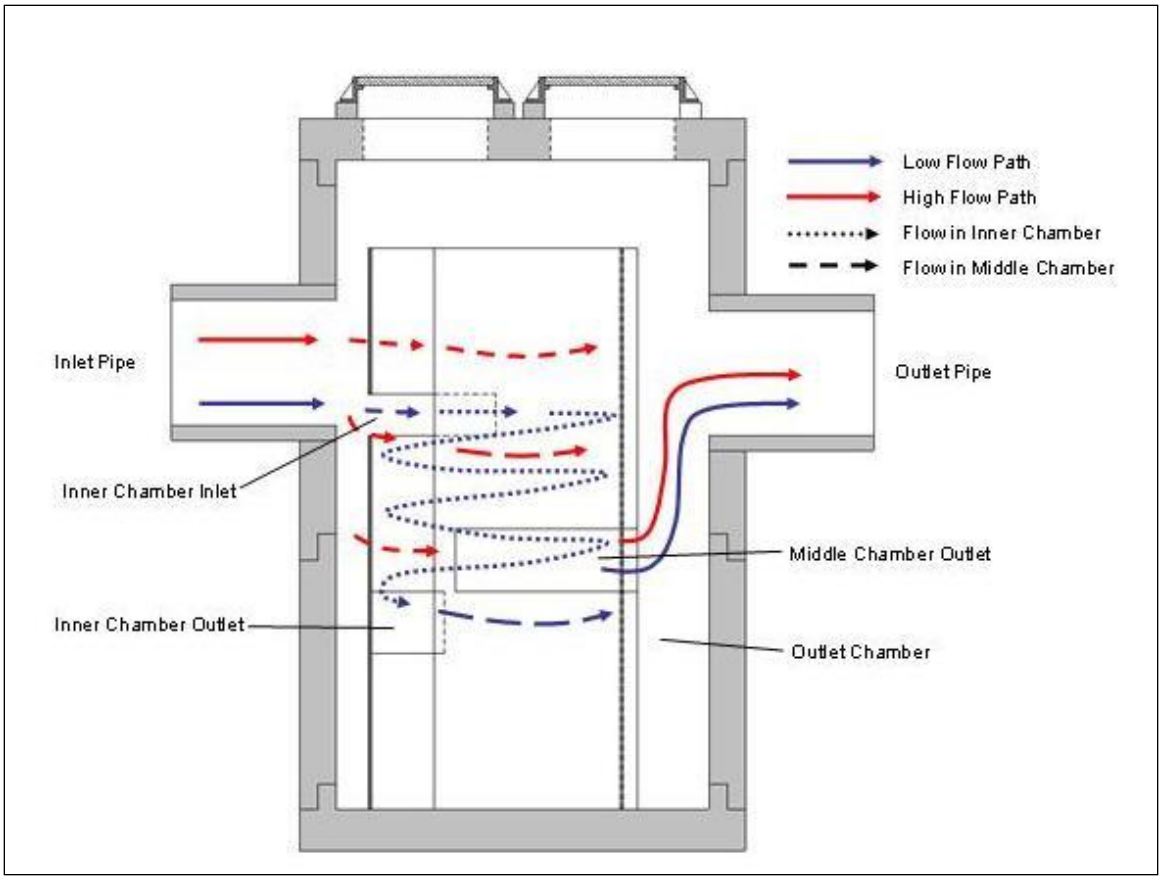
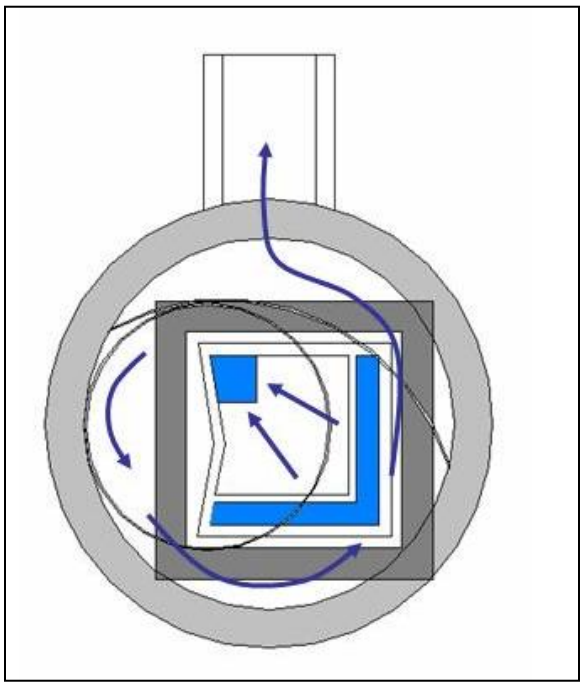


Figure 2. Hydroworks HG Operation – Profile View

The HG 4i is an inlet version of the HG 4 separator. There is a catch-basin grate on top of the HG 4i. Water flows directly into the inner chamber of the HG 4i through the catch-basin grate on top of the structure. The grate is oversized to allow maintenance of the entire structure. A funnel that sits underneath the grate on the top cap of the concrete itself directs the water into the inner chamber during normal flows and the middle chamber during high flows. Figures 3 and 4 show the flow paths for the HG 4i separator.

The inlet funnel is sloped towards the corner inlet and hence the wall of the inner chamber. Water moves in a circular direction in the inner chamber since water enters tangentially along the wall of the inner chamber due to the sloping funnel.

Water continues moving in a circular motion (vortex) through the rest of the structure (through the middle chamber and baffle wall) until it is discharged from the separator.



During periods of peak flow the water will back up from the corner inlet and overflow into two side overflow troughs which discharge directly into the middle chamber. These overflow troughs are covered from the surface such that water cannot directly fall through them (i.e. water must back up to enter the overflow troughs).

Accordingly this funnel provides the same separate flow paths for low and high flow as the other Hydroguard separators.

The whole funnel is removed for inspection and cleaning providing.

Figure 3. Hydroworks HG 4i Normal Flow Path

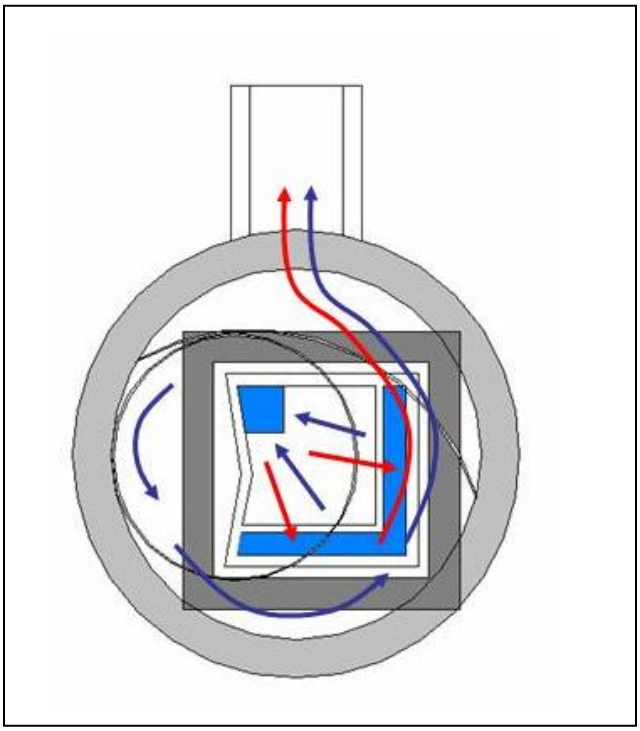


Figure 4. Hydroworks HG 4i Peak Flow Path

Inspection

Procedure

Although all parts of the Hydroguard should be inspected, inspection and maintenance should focus on the inner and middle chambers since this is where the pollutants (floatable and sinking) will accumulate.

Floatables

A visual inspection can be conducted for floatables by removing the covers and looking down into the separator. Multiple covers are provided on Hydroworks HG units to access all areas of the separator (The HG 4 may have a single larger 32” (800mm) cover due to the lack of space for multiple 24” (600mm) covers). Separators with an inlet grate (HG4i or custom separator) will have a plastic funnel located under the grate or on the top cap of the concrete that must be removed through the frame prior to inspection or maintenance. If you are missing a funnel please contact Hydroworks at the numbers provided at the end of this document.

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

Frequency

Construction Period

The HG separator should be inspected every two weeks and after every large storm (over 0.5” (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HG separator should be inspected once per year for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized (storage piles, exposed soils) areas the HG separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required future frequency of maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HG unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HG separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature. Disposal of the water will depend on local requirements. Disposal options for the decanted water may include:

1. Discharge into a nearby sanitary sewer manhole
2. Discharge into a nearby LID practice (grassed swale, bioretention)
3. Discharge through a filter bag into a downstream storm drain connection

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Disposal of the contents of the separator depend on local requirements. Maintenance of a Hydroworks HG unit will typically take 1 to 2 hours based on a vacuum truck and longer for other cleaning methods (i.e. clamshell bucket).

Frequency

Construction Period

A HG separator can fill with construction sediment quickly during the construction period. The Hydroguard must be maintained during the construction period when the depth of TSS/sediment reaches 30" (750 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the open water surface on the inlet side of the outlet baffle wall.

The HG separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The Hydroguard was independently tested by Alden Research Laboratory in 2008. A HG6 was tested for scour with initial sediment loads of 4.6 ft^3 and 9.3 ft^3. The results from these tests were almost identical. Therefore, the 9.3 ft^3 sediment load was used as 50% of the maximum sediment depth for maintenance in the calculation of the maintenance interval for the HG6 separator based on the NJDEP maintenance equation.

Maintenance Interval (months) = 3.565 x (Sediment Storage) / (MTFR x TSS Removal)

Maintenance Interval (HG6) = 3.565 x 9.3 / (1.81x 0.60) = 30 months

All values (flow, sediment storage) can be scaled by the surface area making the sediment depths and maintenance intervals equal for all separators.

The separator was loaded with the sediment in the inner chamber and middle chamber with the majority of sediment (80%) located in the inner chamber. The inner chamber for area represents approximately 44% of the separator surface area. The inner chamber is 4 ft (1200 mm) in diameter in the HG6. Therefore the 50% sediment depth for the HG6 in the inner chamber would be:

9.3 ft^3 x 0.80 / (3.14 x 4 ft^2) x 12 in/ft = 7.1 inches (175 mm)

Accordingly the 100% sediment volume would represent 14.2" (350 mm) of sediment depth in the inner chamber.

The HG separator must be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the open water surface on the inlet side of the outlet baffle wall. It should also be maintained once the accumulated TSS/sediment depths are greater than 14" (350 mm) in the inner chamber. For typical stabilized post-construction sites (parking lots, streets) it is anticipated that maintenance will be required annually or once every two years. More frequent or less frequent maintenance will be required depending on individual site conditions (traffic use, stabilization, storage piles, etc.). The long term maintenance frequency can be established based on the maintenance requirements during the first several years of operation if site conditions do not change.

HYDROGUARD INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

Hydroguard	**Yes**	**No**
Incorrect access orientation	☐ ***	☐
Obstructions in the inlet or outlet	☐ *	☐
Missing internal components	☐ **	☐
Improperly installed internal components	☐ **	☐
Improperly installed inlet or outlet pipes	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____"

Routine Measurements

Floating debris depth	**< 0.5" (13mm)**	☐	**>0.5" 13mm)**	☐ *
Floating debris coverage	**< 25% of surface area**	☐	**> 25% surface area**	☐ *
Sludge depth	**< 14" (350mm)**	☐	**> 14" (350mm)**	☐ *****

* Maintenance required
** Repairs required
*** Further investigation is required

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please fax a copy of the completed checklist to Hydroworks at 888-783-7271 for our records.

Other Comments:

Hydroworks® Hydroguard

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks Hydroguard to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

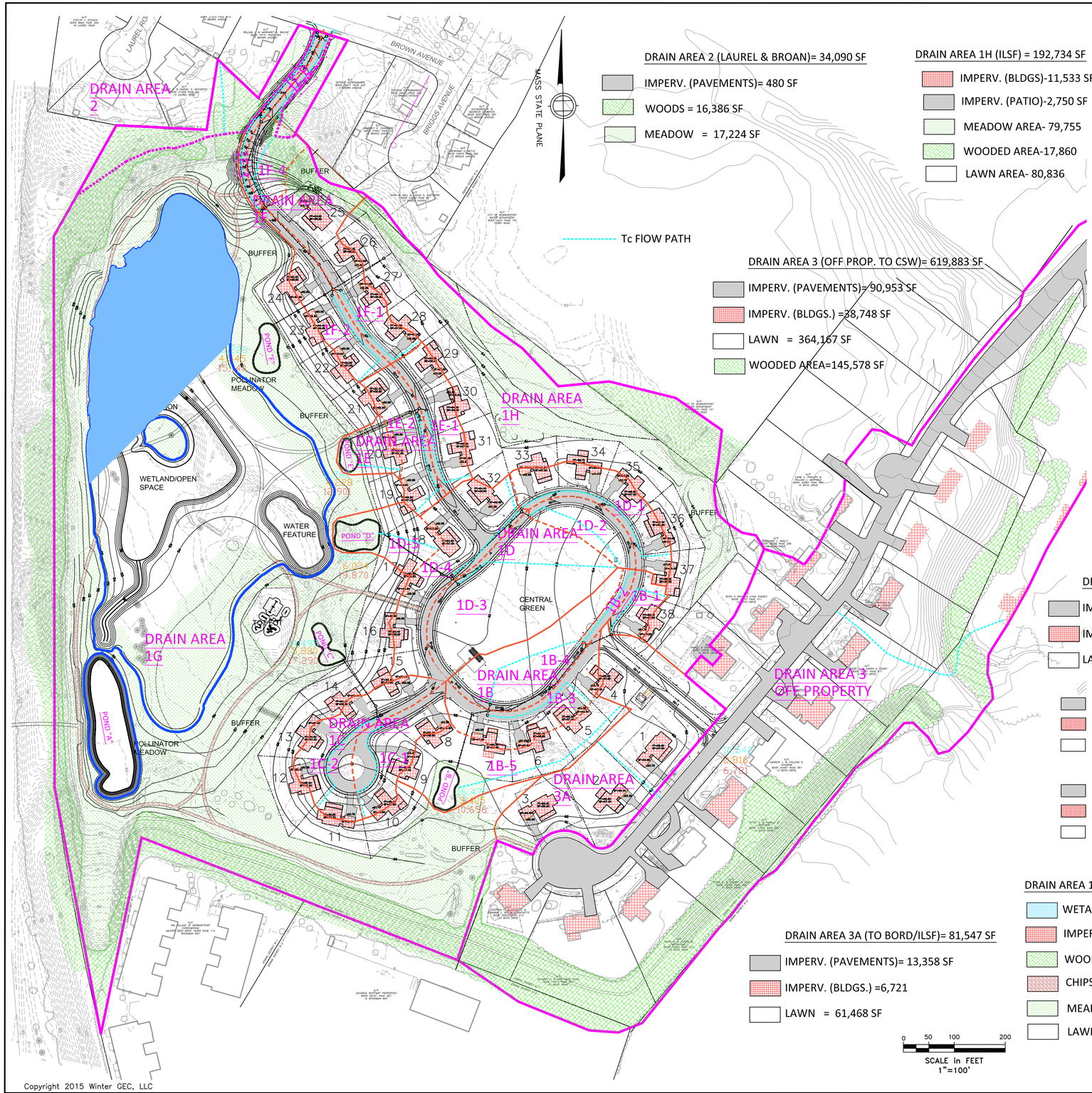
The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks Hydroguard are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Hydroguard, or the cost of other goods or services related to the purchase and installation of the Hydroguard. For this Limited Warranty to apply, the Hydroguard must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the Hydroguard arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the Hydroguard, whether the claim is based upon contract, tort, or other legal basis.

PORT PLACE HOMEOWNERS ASSOCIATION
STORMWATER MANAGEMENT FACILITIES LOCATION FIGURE



DRAIN AREA 2 (LAUREL & BROAN)= 34,090 SF

IMPERV. (PAVEMENTS)= 480 SF

WOODS = 16,386 SF

MEADOW = 17,224 SF

DRAIN AREA 1H (ILSF) = 192,734 SF

IMPERV. (BLDGS)-11,533 SF

IMPERV. (PATIO)-2,750 SF

MEADOW AREA- 79,755

WOODED AREA-17,860

LAWN AREA- 80,836

DRAIN AREA 3 (OFF PROP. TO CSW)= 619,883 SF

IMPERV. (PAVEMENTS)= 90,953 SF

IMPERV. (BLDGS.) =38,748 SF

LAWN = 364,167 SF

WOODED AREA=145,578 SF

DRAIN AREA 1B (ILSF) 110,356= SF

IMPERV. (PAVEMENTS)= 20,740 SF

IMPERV. (BLDGS.) =10,696 SF

LAWN = 38,501 SF

DRAIN AREA 1B-1 8,603= SF

IMPERV. (PAVEMENTS)= 3,006 SF

IMPERV. (BLDGS.) =1,096 SF

LAWN = 4,501 SF

DRAIN AREA 1B-2 3,683= SF

IMPERV. (PAVEMENTS)= 3,683 SF

IMPERV. (BLDGS.) =0 SF

LAWN = 0 SF

DRAIN AREA 1B-3 25,005= SF

IMPERV. (PAVEMENTS)= 9,392 SF

IMPERV. (BLDGS.) =4,208 SF

LAWN = 11,405 SF

DRAIN AREA 1B-4 32,646= SF

IMPERV. (PAVEMENTS)= 5,484SF

IMPERV. (BLDGS.) =0 SF

LAWN = 27,162 SF

DRAIN AREA 1B-5 40,419= SF

IMPERV. (PAVEMENTS)= 0 SF

IMPERV. (BLDGS.) = 5,003 SF

LAWN = 35,416 SF

DRAIN AREA 1E (ILSF) 58,829 = SF

IMPERV. (PAVEMENTS)= 12,988 SF

IMPERV. (BLDGS.) =8,369 SF

LAWN = 37,472 SF

DRAIN AREA 1E-1 19,492= SF

IMPERV. (PAVEMENTS)= 6,487 SF

IMPERV. (BLDGS.) =3,422 SF

LAWN = 9,583 SF

DRAIN AREA 1E-2 20,532= SF

IMPERV. (PAVEMENTS)= 6,501SF

IMPERV. (BLDGS.) =3,272 SF

LAWN = 10,759 SF

DRAIN AREA 1E-3 18,805= SF

IMPERV. (PAVEMENTS)= 0 SF

IMPERV. (BLDGS.) =1,675 SF

LAWN = 17,130 SF

DRAIN AREA 1F (ILSF) 87,275= SF

IMPERV. (PAVEMENTS)= 30,381 SF

IMPERV. (BLDGS.) =9,209 SF

LAWN = 47,685 SF

DRAIN AREA 1F-1 39,412= SF

IMPERV. (PAVEMENTS)= 9,051 SF

IMPERV. (BLDGS.) =6,129 SF

LAWN = 24,232 SF

DRAIN AREA 1F-2 20,326= SF

IMPERV. (PAVEMENTS)= 8,426 SF

IMPERV. (BLDGS.) =3,080 SF

LAWN = 8,820 SF

DRAIN AREA 1F-3 3,290 = SF

IMPERV. (PAVEMENTS)= 3,290 SF

IMPERV. (BLDGS.) =0 SF

LAWN = 0 SF

DRAIN AREA 1F-4 12,577 = SF

IMPERV. (PAVEMENTS)= 2,914 SF

IMPERV. (BLDGS.) =0 SF

LAWN = 9,663 SF

DRAIN AREA 1F-5 6,800 = SF

IMPERV. (PAVEMENTS)= 3,350 SF

IMPERV. (BLDGS.) =0 SF

LAWN = 3,450 SF

DRAIN AREA 1F-6 4,870 = SF

IMPERV. (PAVEMENTS)= 3,350 SF

IMPERV. (BLDGS.) =0 SF

LAWN = 1,520 SF

DRAIN AREA 1D (ILSF) 162,115= SF

IMPERV. (PAVEMENTS)= 34,791 SF

IMPERV. (BLDGS.) = 12,969 SF

LAWN = 114,355 SF

DRAIN AREA 1D-1 26,985= SF

IMPERV. (PAVEMENTS)= 9,083 SF

IMPERV. (BLDGS.) =5,664 SF

LAWN = 12,238 SF

DRAIN AREA 1D-2 14,630= SF

IMPERV. (PAVEMENTS)= 4,844 SF

IMPERV. (BLDGS.) =0 SF

LAWN = 9,786 SF

DRAIN AREA 1D-3 61,661= SF

IMPERV. (PAVEMENTS)= 6,892 SF

IMPERV. (BLDGS.) =0 SF

LAWN = 54,769 SF

DRAIN AREA 1D-4 40,034= SF

IMPERV. (PAVEMENTS)= 13,972 SF

IMPERV. (BLDGS.) =5,630 SF

LAWN = 20,432 SF

DRAIN AREA 1B-5 18,805= SF

IMPERV. (PAVEMENTS)= 0 SF

IMPERV. (BLDGS.) = 1,675 SF

LAWN = 17,130 SF

DRAIN AREA 1C (ILSF) 52,998= SF

IMPERV. (PAVEMENTS)= 20,099 SF

IMPERV. (BLDGS.) =8,489SF

LAWN = 24,410 SF

DRAIN AREA 1C-1 23,229= SF

IMPERV. (PAVEMENTS)= 9,184 SF

IMPERV. (BLDGS.) =3,397 SF

LAWN = 10,648 SF

DRAIN AREA 1C-2 29,769= SF

IMPERV. (PAVEMENTS)= 10,915 SF

IMPERV. (BLDGS.) =5,092 SF

LAWN = 13,762 SF

DRAIN AREA 1G (ILSF)= 864,203 SF

WETAND & ILSF AREA-278,856 SF

IMPERV. (BLDGS)-11,985 SF

WOODED AREA - 94,866 SF

CHIPSTONE PATHS-18,183 SF

MEADOW AREA- 383,703

LAWN AREA- 76,610

DRAIN AREA 3A (TO BORD/ILSF)= 81,547 SF

IMPERV. (PAVEMENTS)= 13,358 SF

IMPERV. (BLDGS.) =6,721

LAWN = 61,468 SF

0 50 100 200

SCALE in FEET
1"=100'

Design Consultants, Inc.
Consulting Engineers and Surveyors
68 PLEASANT STREET
NEWBURYPORT MA
(617) 776-3350

SCALE:
HORIZ: 1"= 100'
VERT: _____

NO.	DATE	BY	REVISIONS
2.	11/16/17	SBS	Review Commnets
1.	8/8/17	SBS	Review Commnets

FIELD: EC
CALCS: EC
CHECKED: SBS
APPROVED: SBS

PROPOSED
DRAINAGE AREAS

PORT PLACE
BY EVERGREEN COMMONS LLC

PLAN OF LAND
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS
SURVEYED FOR
GALE FORCE DEVELOPMENT, LLC

PROJECT NO.
2015-063

DATE: MAY 22, 2017

SHEET NO.
1 OF 1

Appendix D

Figure 1,2 & 3 – ILSF, Pre & Post Development Drainage Areas

ILSF STAGE STORAGE ANALYSIS

REFERENCE ELEVATION: 52.00 – VOLUME: 0.0 C.F.
REFERENCE ELEVATION: 52.50 – VOLUME: 62,928 C.F. / AREA: 132,087 S.F.
REFERENCE ELEVATION: 53.00. – VOLUME: 131,685 C.F. / AREA 143,058 S.F.
REFERENCE ELEVATION: 53.50 – VOLUME: 209,178 C.F. / AREA: 167,859 S.F.
REFERENCE ELEVATION: 54.00 – VOLUME: 299,260 C.F. / AREA: 192,145 S.F.
REFERENCE ELEVATION: 54.50 – VOLUME: 408,342 C.F. / AREA: 246,089 S.F.
REFERENCE ELEVATION: 55.00 – VOLUME: 547,163 C.F. / AREA: 306,838 S.F.
*REFERENCE ELEVATION: 55.25 – VOLUME: 625,874 C.F. / AREA: 322,589 S.F.
REFERENCE ELEVATION: 55.50 – VOLUME: 708,443 C.F. / AREA: 337,960 S.F.
REFERENCE ELEVATION: 56.00 – VOLUME: 885,024 C.F. / AREA: 369,601 S.F.
**REFERENCE ELEVATION: 56.50 – VOLUME: 1,081,185 C.F. / AREA: 415,264 S.F.

*ILSF VOLUME BASED UPON NEWBURYPORT LOCAL REGULATIONS
100 YEAR STORM (8.3" 24HR RAINFALL EVENT)

**TOTAL AVAILAILBLE STORAGE VOLUME PER OSRD SPECIAL PERMIT CONISTIONS OF MAXIMUM ILSF ELVATION 1 FT BELOW LOWEST FOUNDATION ELEVATION.

15-063 Hyd-pr ilsf *Type III 24-hr Rainfall=8.30"*
Prepared by Microsoft Printed 10/23/2017
HydroCAD® 9.10 s/n 00884 © 2010 HydroCAD Software Solutions LLC Page 2

Summary for Subcatchment PR1: PROP ILSF

Runoff = 158.23 cfs @ 12.09 hrs, Volume= 617,774 cf, Depth> 3.15"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 2.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr Rainfall=8.30"

	Area (sf)	CN	Description
*	322,589	98	Wetlands, HSG A
	351,703	30	Woods, Good, HSG A
*	130,466	98	Bldg, HSG A
*	224,140	98	Impervious path, roads, HSG A
	19,050	76	Gravel roads, HSG A
	1,306,301	39	>75% Grass cover, Good, HSG A
	2,354,249	55	Weighted Average
	1,677,054	38	71.24% Pervious Area
	677,195	98	28.76% Impervious Area

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

DRAINAGE AREA - 2,354,249 SF

LEGEND

- WETAND & ILSF AREA-322,589 SF
- WOODED AREA - 351,703 SF
- BUILDING AREA -130,466 SF
- PAVEMENT AREA-224,140 SF
- CHIPSTONE PATHS-19,050 SF
- MEADOW / LAWN AREA- 1,306,301

0 50 100 200
SCALE in FEET
1"=100'

Design Consultants, Inc.
Consulting Engineers and Surveyors
68 PLEASANT STREET
NEWBURYPORT MA
(617) 776-3350

SCALE:
HORIZ: 1"= 100'
VERT:

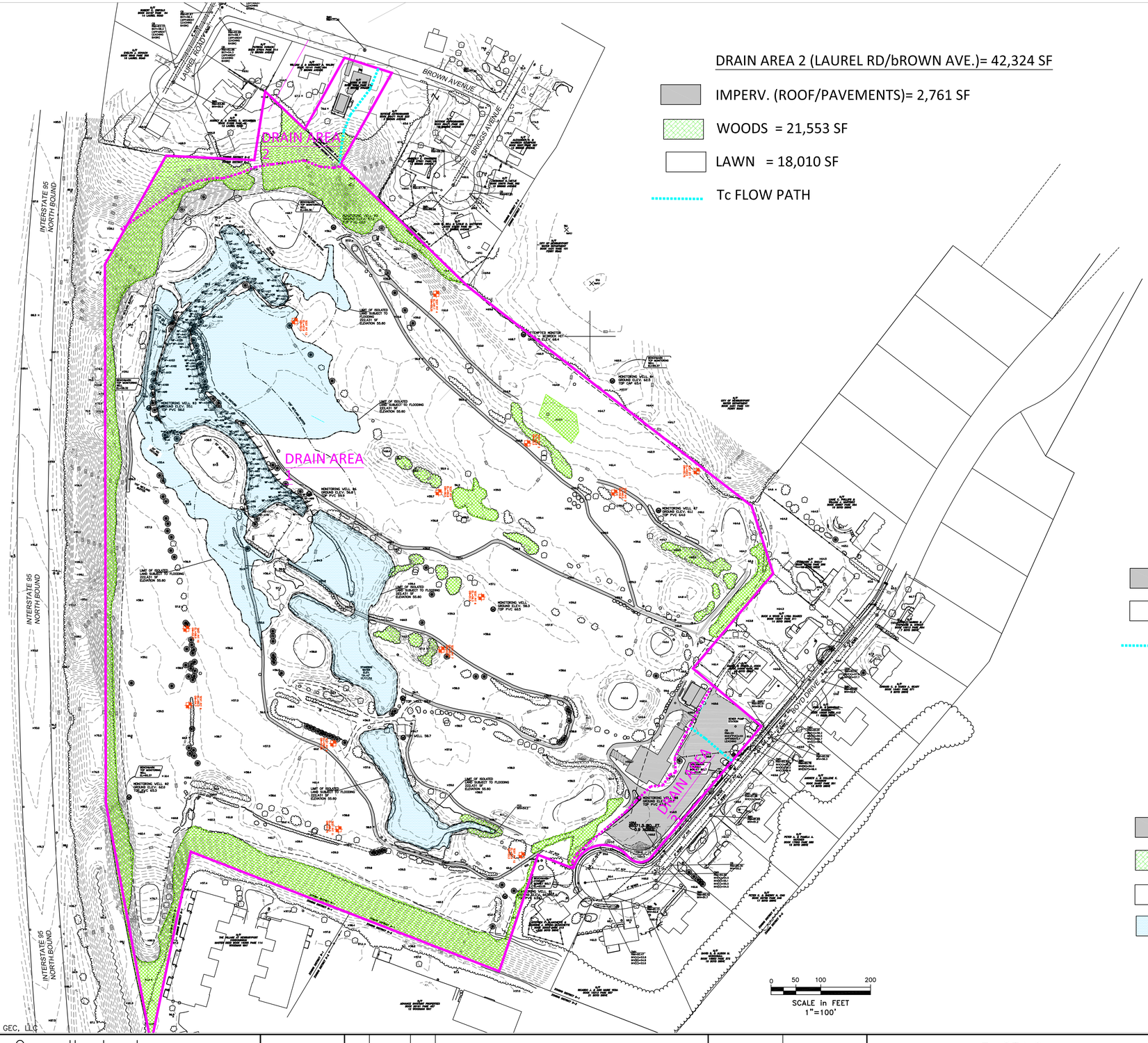
NO.	DATE	BY	REVISIONS

FIELD: EC
CALCS: EC
CHECKED: SBS
APPROVED: SBS

PROPOSED ILSF ELEVATION/VOLUME CORRELATED TO 8.3" 24 HOUR RAIN EVENT
PORT PLACE
BY EVERGREEN COMMONS LLC

PLAN OF LAND
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS
PREPARED FOR
EVERGREEN COMMONS, LLC

PROJECT NO. 18BOYD
DATE: OCT. 23, 2017
SHEET NO. 1 OF 1



DRAIN AREA 2 (LAUREL RD/bROWN AVE.)= 42,324 SF

- IMPERV. (ROOF/PAVEMENTS)= 2,761 SF
- WOODS = 21,553 SF
- LAWN = 18,010 SF
- Tc FLOW PATH

MASS STATE PLANE

DRAIN AREA 3 (BOYD DR)= 38,572 SF

- IMPERV. (ROOF/PAVEMENTS)= 29,987 SF
- LAWN = 8,585
- Tc Flow Path

DRAIN AREA 1 (ILSF)= 1,523,843 SF

- IMPERV. (ROOF/PAVEMENTS)= 40,723 SF
- WOODS = 137,550 SF
- LAWN = 1,123,138 SF
- ILSF AREA= 222,432 SF

Design Consultants, Inc.
Consulting Engineers and Surveyors
68 PLEASANT STREET
NEWBURYPORT MA
(617) 776-3350

SCALE:
HORIZ: 1"= 100'
VERT: _____

NO.	DATE	BY	REVISIONS
1.	8/8/17	sbs	Review comments

FIELD: EC
CALCS: EC
CHECKED: SBS
APPROVED: SBS

EXISTING
DRAINAGE AREAS

PORT PLACE
BY EVERGREEN COMMONS LLC

PLAN OF LAND
18 BOYD DRIVE
NEWBURYPORT, MASSACHUSETTS
SURVEYED FOR
EVERGREEN COMMONS, LLC

PROJECT NO. 2015-063
DATE: MAY 22, 2017
SHEET NO. 1 OF 1