

# **DRAINAGE REPORT**

*For*



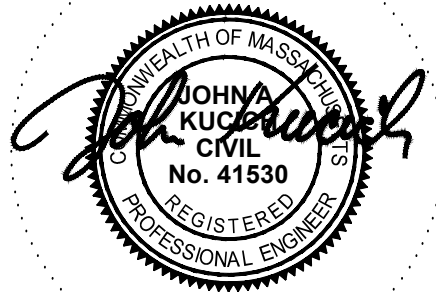
MARCUS PARTNERS

**PROPOSED  
“RESIDENTIAL DEVELOPMENT”**

**582 Kelley Boulevard  
North Attleborough, Massachusetts  
Bristol County**

Prepared by:

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**BOHLER //**

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#W211244

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## I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the proposed residential development located on the South and West side of Kelley Blvd near the intersection with Plain Street. The site, which contains approximately 13.679 acres of land, contains an existing fun center with driving range, mini golf, and batting cages with surface parking lots.

The proposed project includes the construction of new residential apartment buildings and amenities with new paved parking areas, landscaping, storm water management components and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at four (4) "design points" where stormwater runoff currently drains to under existing conditions. These design points are described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates and volumes for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** and **Table 1.2** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards as detailed herein.

**Table 1.1: Design Point Peak Runoff Rate Summary**

| Peak Flow Discharge in cubic feet per second (cfs) |        |       |       |         |       |       |         |       |       |          |       |       |
|----------------------------------------------------|--------|-------|-------|---------|-------|-------|---------|-------|-------|----------|-------|-------|
|                                                    | 2-year |       |       | 10-year |       |       | 25-year |       |       | 100-year |       |       |
|                                                    | Pre-   | Post- | Delta | Pre-    | Post- | Delta | Pre-    | Post- | Delta | Pre-     | Post- | Delta |
| DP1                                                | 1.47   | 0.00  | -1.47 | 2.35    | 0.01  | -2.34 | 3.74    | 0.05  | -3.69 | 7.37     | 0.17  | -7.20 |
| DP2                                                | 0.00   | 0.00  | 0.00  | 0.00    | 0.00  | 0.00  | 0.00    | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  |
| DP3                                                | 0.19   | 0.02  | -0.17 | 0.30    | 0.03  | -0.27 | 0.39    | 0.07  | -0.32 | 0.73     | 0.47  | -0.26 |
| DP4                                                | 0.10   | 0.00  | -0.10 | 0.16    | 0.00  | -0.16 | 0.20    | 0.02  | -0.18 | 0.28     | 0.07  | -0.21 |

**Table 1.2: Design Point Volume Summary**

| Volume Discharge in acre-ft (ac-ft) from 72-hr Time Span |        |       |        |         |       |        |         |       |        |          |       |        |
|----------------------------------------------------------|--------|-------|--------|---------|-------|--------|---------|-------|--------|----------|-------|--------|
|                                                          | 2-year |       |        | 10-year |       |        | 25-year |       |        | 100-year |       |        |
|                                                          | Pre-   | Post- | Delta  | Pre-    | Post- | Delta  | Pre-    | Post- | Delta  | Pre-     | Post- | Delta  |
| DP1                                                      | 0.250  | 0.000 | -0.250 | 0.567   | 0.004 | -0.563 | 0.887   | 0.009 | -0.878 | 1.521    | 0.019 | -1.502 |
| DP2                                                      | 0.000  | 0.000 | 0.000  | 0.000   | 0.000 | 0.000  | 0.000   | 0.000 | 0.000  | 0.000    | 0.000 | 0.000  |
| DP3                                                      | 0.015  | 0.002 | -0.013 | 0.030   | 0.007 | -0.023 | 0.044   | 0.013 | -0.031 | 0.069    | 0.072 | 0.003  |
| DP4                                                      | 0.008  | 0.000 | -0.008 | 0.014   | 0.002 | -0.012 | 0.022   | 0.005 | -0.017 | 0.042    | 0.016 | -0.026 |

## II. EXISTING SITE CONDITIONS

### **Existing Site Description**

The site consists of approximately 13.679 acres of land located on the South and West side of Kelley Blvd near the intersection with Plain Street in North Attleborough. Most of the site is cleared for the existing driving range use. Other areas of the site are developed by parking and vehicular access. Near the western property line is a densely wooded area with delineated wetlands. Slopes on the site range from 1%-15% with a mean slope of 4% and on-site elevations ranging from 194 to 207.

### **On-Site Soil Information**

The Natural Resource Conservation Service (NRCS) maps multiple on-site soils classified as Hydrologic Soil Group (HSG) 'A'. On-site test pits and monitoring wells at the locations of the proposed stormwater management basins were performed by Whitestone Associates, Inc. on several visits as documented in the *Comprehensive Stormwater Management Area Evaluation*. Refer to **Appendix C** for additional information.

Wetlands exist along the western property line per the Order of Resource Area Delineation DEP File No SE 243-0963.

### **Existing Collection and Conveyance**

Throughout the parking and access areas there are few catch basins that discharge into unknown sized drywells. Existing municipal storm drainage infrastructure exists within Kelley Blvd and George Leven Road, but none of the existing site drains to the municipal system.

### **Existing Watersheds and Design Point Information**

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at four (4) "design points" as described below where stormwater runoff currently drains to under existing conditions. The existing site was subdivided into seven (7) separate sub catchments to analyze existing and proposed flow rates at each design point. Refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

Design Point #1 (DP1) represents the flow to the southern abutters at Map Lots 35-217 and 35-3A. Flow from the lots fronting on Kelley Blvd is captured by catch basins and infiltrated into drywells so these flow are discarded and not realized at DP1.

Design Point #2 (DP2) represents area directed to a drywell in the access drive south of the batting cages. This point assumes no offsite runoff to the abutter and that all stormwater runoff volume infiltrates.

Design Point #3 (DP3) represents the flow to George Leven Drive.

Design Point #4 (DP4) represents the flow to the Map Lot 35-218 and the existing wetland near the west property line. The wetlands receive offsite flow from the west which flows overland to the south adjacent to Map 35-218.

Refer to **Table 1.1 and 1.2** for the existing conditions peak rates of runoff and volumes.

### III. PROPOSED SITE CONDITIONS

#### **Proposed Development Description**

The proposed project consists of the construction of new residential apartments with associated paved parking areas, landscaping, utilities, and stormwater management systems. The site has been designed to drain to deep-sump, hooded catch basins and/or filtering bioretention areas before entering either an underground infiltration basin or one of two above ground infiltration basins. Pretreatment of stormwater runoff prior to infiltration is achieved by combination of the deep-sump, hooded catch basins, filtered bioretention, and/or proprietary water quality units.

#### **Proposed Development Collection and Conveyance**

Deep sump hooded catch basins are proposed to collect and route runoff from the paved parking areas to the existing surface basins. Pipes have been designed for the 25-year storm using Storm Sewers by Hydraflow Software/Rational Method. Pipe, inlet, and outlet protection sizing calculations are included in **Appendix F**.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet, or exceed, the standards set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards. Refer to **Section V** for additional information.

#### **Proposed Watersheds and Design Point Information**

The project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same design points described in **Section II** above. The site was subdivided

into sixteen (16) separate sub catchments for the proposed conditions as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP1 receives stormwater flows from watershed “PD1.0” representing grassed areas that are not captured by the stormwater management system.

Under proposed conditions DP2 ends at the above ground infiltration basin “P2.1” which receives stormwater flows from the lots fronting on Kelley Blvd and the access drive from George Leven Road. The emergency overflow for P2.1 is directed to the same existing condition drywell. Matching existing conditions, this point assumes no offsite runoff to the abutter and that all stormwater runoff volume infiltrates.

Under proposed conditions DP3 receives stormwater flows from basin P1.10 and a portion of the southern access drive that cannot be directed to the stormwater management system.

Under proposed conditions DP4 receives stormwater flows from watershed “PD4” representing grassed and wooded areas that are not captured by the stormwater management system.

Refer to **Table 1.1, 1.2, 6.1, and 6.2** for the calculated proposed conditions peak rates of runoff and volumes. For additional hydrologic information, refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

#### IV. METHODOLOGY

##### Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of the Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in table 4.1 below for stormwater calculations is based on NOAA Atlas 14, Volume 10, Version 3 from July 16, 2024 at the site location. Refer to **Appendix F** for more information.

**Table 4.1: Rainfall Depths**

| Frequency         | 2 year | 10 year | 25 year | 100 year |
|-------------------|--------|---------|---------|----------|
| Rainfall (inches) | 3.40   | 5.19    | 6.31    | 8.03     |

The proposed stormwater management as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year design storm events. Additionally, the proposed project meets, or exceeds, the MADEP Stormwater Management standards. Compliance with these standards is described further below.

## **V. STORMWATER MANAGEMENT STANDARDS**

### **Standard #1: No New Untreated Discharges**

The project has been designed so that proposed impervious areas (including the building roof and paved parking/driveway areas) shall be collected and passed through the proposed drainage system for treatment prior to discharge.

### **Standard #2: Peak Rate Attenuation**

As outlined in **Table 1.1** and **Table 6.1**, the development of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points.

### **Standard #3: Recharge**

The stormwater runoff from the project will be collected and diverted to either above or below ground infiltration basins. The project as proposed will involve the creation of 5.494 acres of new impervious area and is required to infiltrate 11,966 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed infiltration basins will collectively provide 82,208 cubic feet of volume below the respective lowest outlets for groundwater recharge. Refer to **Appendix F** of this report for calculations documenting required and provided recharge volumes.

The DEP Stormwater Standards require that the infiltration BMP drains completely within 72 hours of the end of the storm event. Calculations showing adequate drawdown are included in **Appendix F** of this report.

A groundwater mounding analysis has been provided in **Appendix F** of this report. The analysis shows that the groundwater mound will have no effect on the proposed system.

#### **Standard #4: Water Quality**

Water quality treatment is provided via a combination of some or all of the following: deep sump catch basins, water quality units, filtered bioretention, and infiltration basin. TSS removal calculations are included in **Appendix F** of this report. The project as proposed will involve the creation of 5.494 acres of new impervious area and is required to treat 39,324 cubic feet of water quality volume as defined in Stormwater Standard 4. The proposed infiltration basins and bioretention collectively provide 90,347 cubic feet of water quality volume below the respective lowest outlets for water quality treatment. Refer to **Appendix F** of this report for calculations documenting required and provided water quality volumes.

#### **Standard #5: Land Use with Higher Potential Pollutant Loads**

The proposed project involves “Land Uses with Higher Potential Pollutant Loads”. Accordingly, the stormwater management system includes water quality units in lieu of an oil/grit separators and filtered bioretention prior to discharge. In addition, the project will provide 44% TSS removal prior to infiltration and treat the 1.0 in water quality depth, as further illustrated in **Appendix E** of this report.

#### **Standard #6: Critical Areas**

A Zone II and interim wellhead protection area has been established covers the development. The proposed stormwater management system has been designed to provide at least eighty percent (80%) removal of Total Suspended Solids (TSS) through the use of several Best Management Practices (BMPs), including deep-sump hooded catch basins, filtering bioretention areas, water quality units, and infiltration basins. The deep-sump hooded catch basins, filtering bioretention, and water quality units will provide a minimum of 44% TSS removal prior to all infiltration basins. Refer to **Appendix F** for TSS removal calculations.

#### **Standard #7: Redevelopment**

This project is a partial redevelopment but is treated as a new development.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stock piles and various

other techniques as outlined on the erosion and sediment control sheets. Additionally, the project is required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during the construction period. The SWPPP will be prepared prior to the start of construction and will be implemented by the site contractor under the guidance and responsibility of the project's proponent. Refer to **Appendix H**.

**Standard #9: Operation and Maintenance Plan (O&M Plan)**

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included in **Appendix G** of this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties.

**Standard #10: Prohibition of Illicit Discharges**

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in **Appendix G** of this report.

## VI. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development stormwater discharge comparisons are contained in **Table 6.1** and **Table 6.2** below.

As outlined in the tables, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year storm events. Additionally, the project meets or exceeds the MADEP Stormwater Management Standards as described further herein.

**Table 6.1: Design Point Peak Runoff Rate Summary**

| Peak Flow Discharge in cubic feet per second (cfs) |        |       |       |         |       |       |         |       |       |          |       |       |
|----------------------------------------------------|--------|-------|-------|---------|-------|-------|---------|-------|-------|----------|-------|-------|
|                                                    | 2-year |       |       | 10-year |       |       | 25-year |       |       | 100-year |       |       |
|                                                    | Pre-   | Post- | Delta | Pre-    | Post- | Delta | Pre-    | Post- | Delta | Pre-     | Post- | Delta |
| DP1                                                | 1.47   | 0.00  | -1.47 | 2.35    | 0.01  | -2.34 | 3.74    | 0.05  | -3.69 | 7.37     | 0.17  | -7.20 |
| DP2                                                | 0.00   | 0.00  | 0.00  | 0.00    | 0.00  | 0.00  | 0.00    | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  |
| DP3                                                | 0.19   | 0.02  | -0.17 | 0.30    | 0.03  | -0.27 | 0.39    | 0.07  | -0.32 | 0.73     | 0.47  | -0.26 |
| DP4                                                | 0.10   | 0.00  | -0.10 | 0.16    | 0.00  | -0.16 | 0.20    | 0.02  | -0.18 | 0.28     | 0.07  | -0.21 |

**Table 6.2: Design Point Volume Summary**

| Volume Discharge in acre-ft (ac-ft) from 72-hr Time Span |        |       |        |         |       |        |         |       |        |          |       |        |
|----------------------------------------------------------|--------|-------|--------|---------|-------|--------|---------|-------|--------|----------|-------|--------|
|                                                          | 2-year |       |        | 10-year |       |        | 25-year |       |        | 100-year |       |        |
|                                                          | Pre-   | Post- | Delta  | Pre-    | Post- | Delta  | Pre-    | Post- | Delta  | Pre-     | Post- | Delta  |
| DP1                                                      | 0.250  | 0.000 | -0.250 | 0.567   | 0.004 | -0.563 | 0.887   | 0.009 | -0.878 | 1.521    | 0.019 | -1.502 |
| DP2                                                      | 0.000  | 0.000 | 0.000  | 0.000   | 0.000 | 0.000  | 0.000   | 0.000 | 0.000  | 0.000    | 0.000 | 0.000  |
| DP3                                                      | 0.015  | 0.002 | -0.013 | 0.030   | 0.007 | -0.023 | 0.044   | 0.013 | -0.031 | 0.069    | 0.072 | 0.003  |
| DP4                                                      | 0.008  | 0.000 | -0.008 | 0.014   | 0.002 | -0.012 | 0.022   | 0.005 | -0.017 | 0.042    | 0.016 | -0.026 |

**APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST**



# 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.<sup>1</sup> 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<sup>2</sup>
- 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.

<sup>1</sup> 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.

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



# Checklist for Stormwater Report

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## 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.

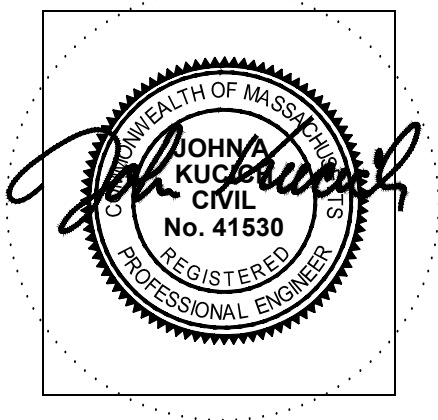
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

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### 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



9/18/2024

Signature and Date

---

## Checklist

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

- ☐ New development
- ☐ Redevelopment
- ☒ Mix of New Development and Redevelopment



# Checklist for Stormwater Report

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## Checklist (continued)

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

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

### 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

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## 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<sup>1</sup>
- ☐ 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.

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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

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## 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

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## 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

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## 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

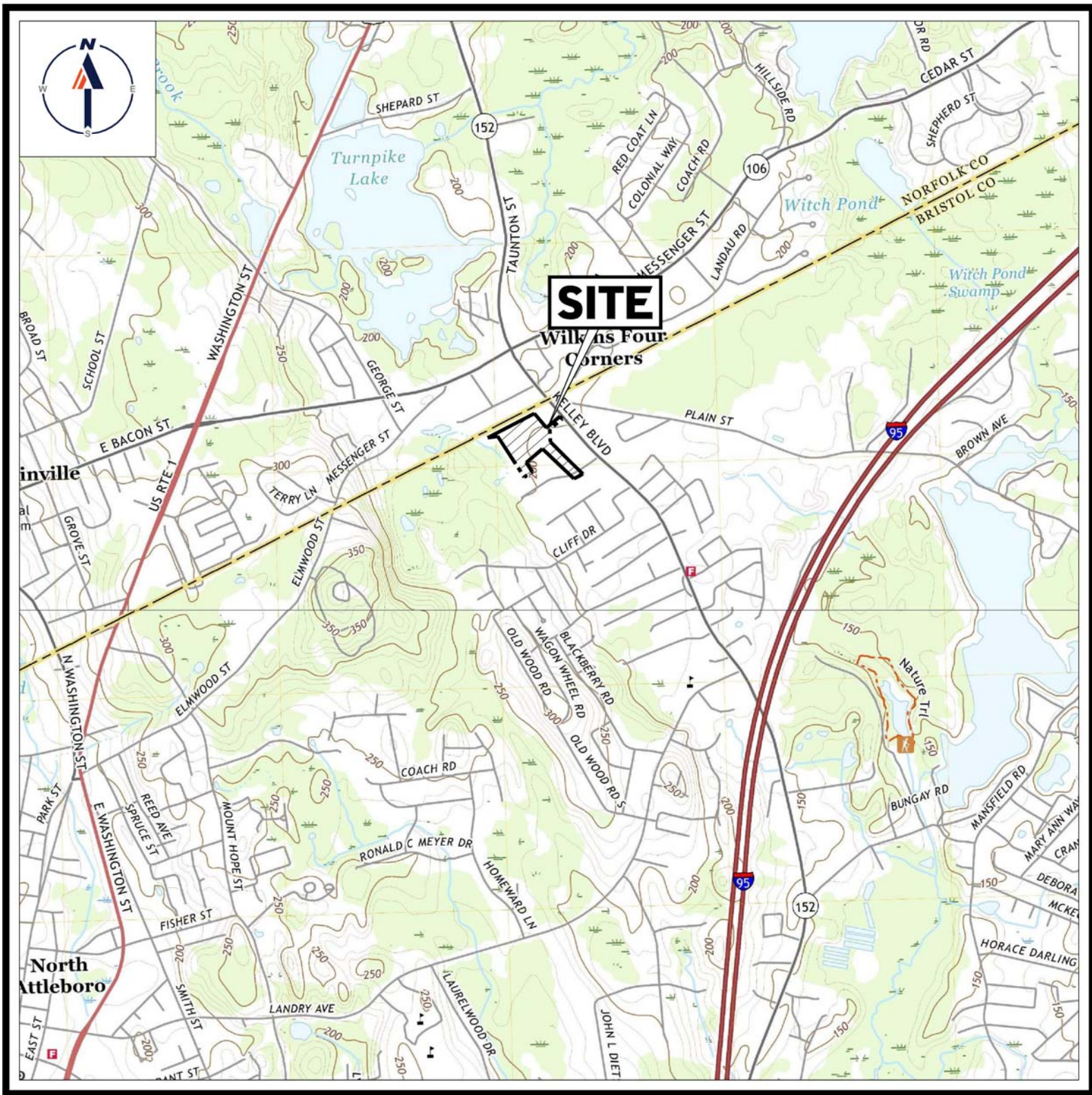
- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - ☒ Name of the stormwater management system owners;
  - ☒ Party responsible for operation and maintenance;
  - ☒ Schedule for implementation of routine and non-routine 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.

## **APPENDIX B: PROJECT LOCATION MAPS**

- USGS MAP
- FEMA FIRMETTE
- NORTH ATTLEBOROUGH GIS – WELLHEAD ZONE II



## USGS MAP

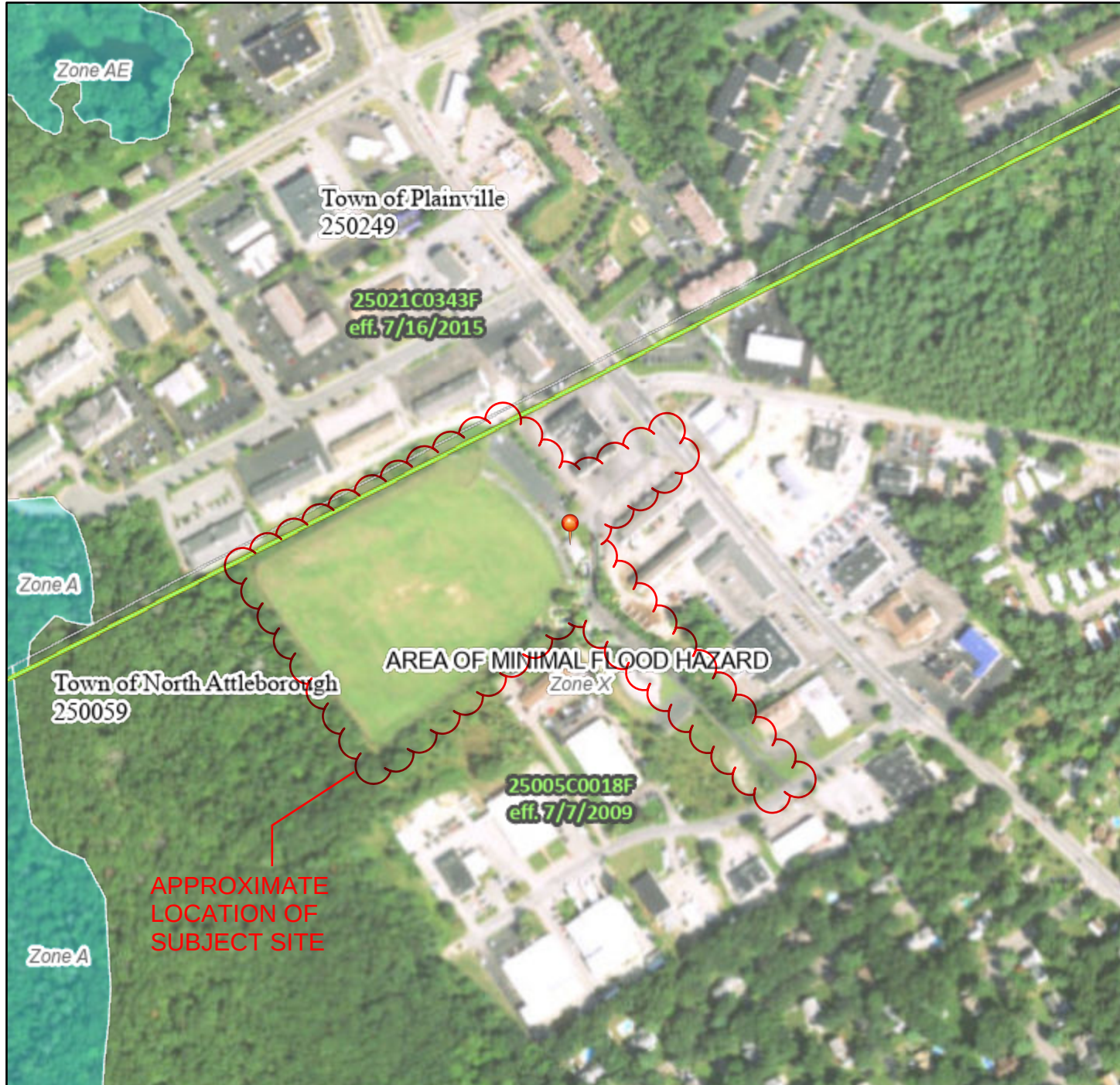
SCALE: 1" = 2,000'

SOURCE: WRENTHAM AND ATTLEBORO MASSACHUSETTS USGS QUADRANGLE

# National Flood Hazard Layer FIRMette



71°18'33"W 42°0'40"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

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

## Legend

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

|                             |  |                                                                                                                                                                   |
|-----------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SPECIAL FLOOD HAZARD AREAS  |  | Without Base Flood Elevation (BFE)<br>Zone A, V, A99                                                                                                              |
|                             |  | With BFE or Depth Zone AE, AO, AH, VE, AR                                                                                                                         |
|                             |  | Regulatory Floodway                                                                                                                                               |
| OTHER AREAS OF FLOOD HAZARD |  | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X |
|                             |  | Future Conditions 1% Annual Chance Flood Hazard Zone X                                                                                                            |
|                             |  | Area with Reduced Flood Risk due to Levee. See Notes. Zone X                                                                                                      |
|                             |  | Area with Flood Risk due to Levee Zone D                                                                                                                          |
| OTHER AREAS                 |  | NO SCREEN Area of Minimal Flood Hazard Zone X                                                                                                                     |
|                             |  | Effective LOMRs                                                                                                                                                   |
| GENERAL STRUCTURES          |  | Area of Undetermined Flood Hazard Zone D                                                                                                                          |
|                             |  | Channel, Culvert, or Storm Sewer                                                                                                                                  |
|                             |  | Levee, Dike, or Floodwall                                                                                                                                         |
| OTHER FEATURES              |  | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation                                                                                                 |
|                             |  | 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation                                                                                                 |
|                             |  | Coastal Transect                                                                                                                                                  |
|                             |  | Base Flood Elevation Line (BFE)                                                                                                                                   |
|                             |  | Limit of Study                                                                                                                                                    |
|                             |  | Jurisdiction Boundary                                                                                                                                             |
| MAP PANELS                  |  | Coastal Transect Baseline                                                                                                                                         |
|                             |  | Profile Baseline                                                                                                                                                  |
|                             |  | Hydrographic Feature                                                                                                                                              |
|                             |  | Digital Data Available                                                                                                                                            |
|                             |  | No Digital Data Available                                                                                                                                         |
|                             |  | Unmapped                                                                                                                                                          |



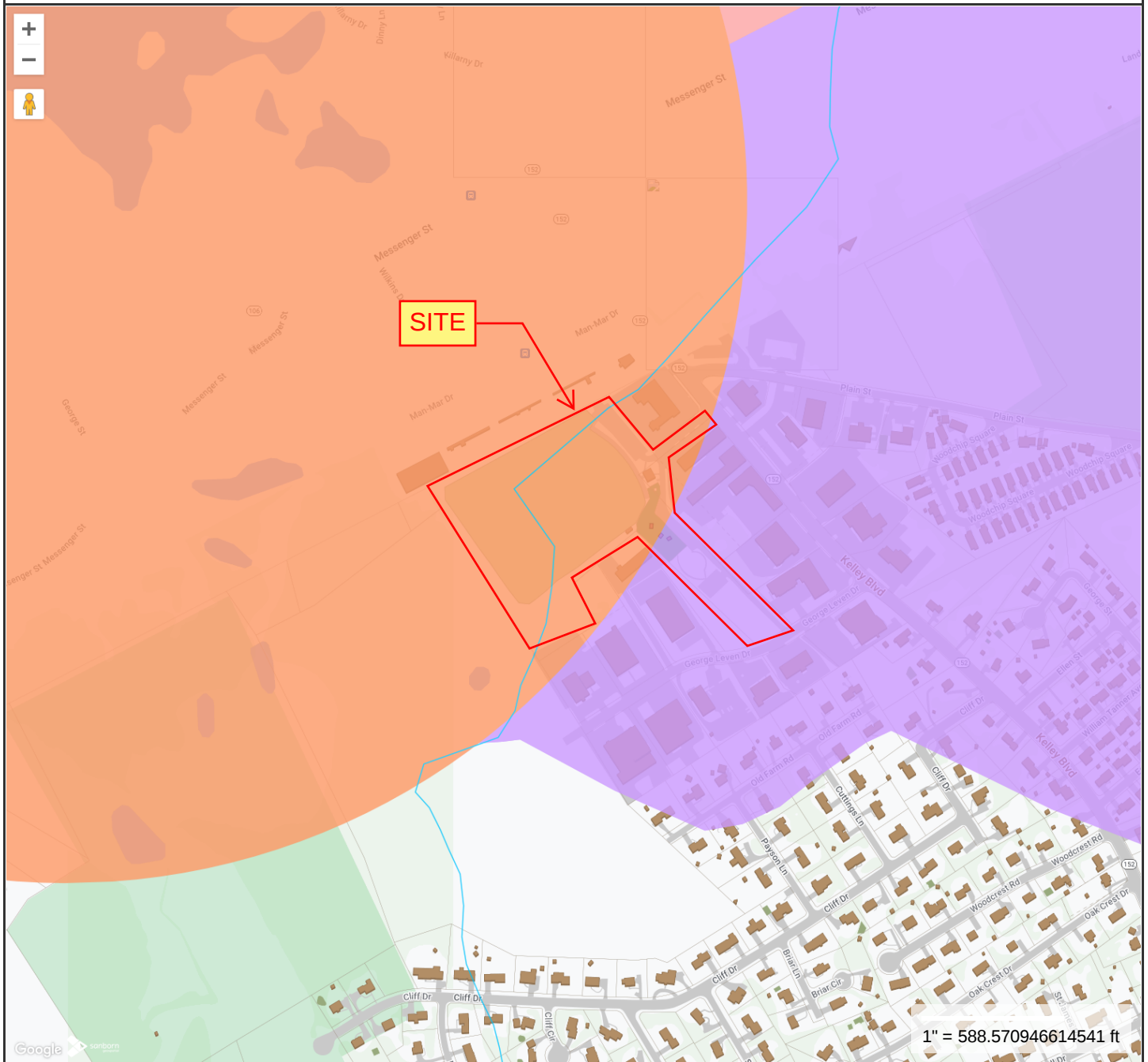
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **2/11/2022 at 2:43 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

## Water Resource Protection

**MAP FOR REFERENCE ONLY  
NOT A LEGAL DOCUMENT**

Town of North Attleborough, MA makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 07/01/2024  
Data updated 07/01/2024

Print map scale is approximate.  
Critical layout or measurement  
activities should not be done using  
this resource.

Map Theme Legends

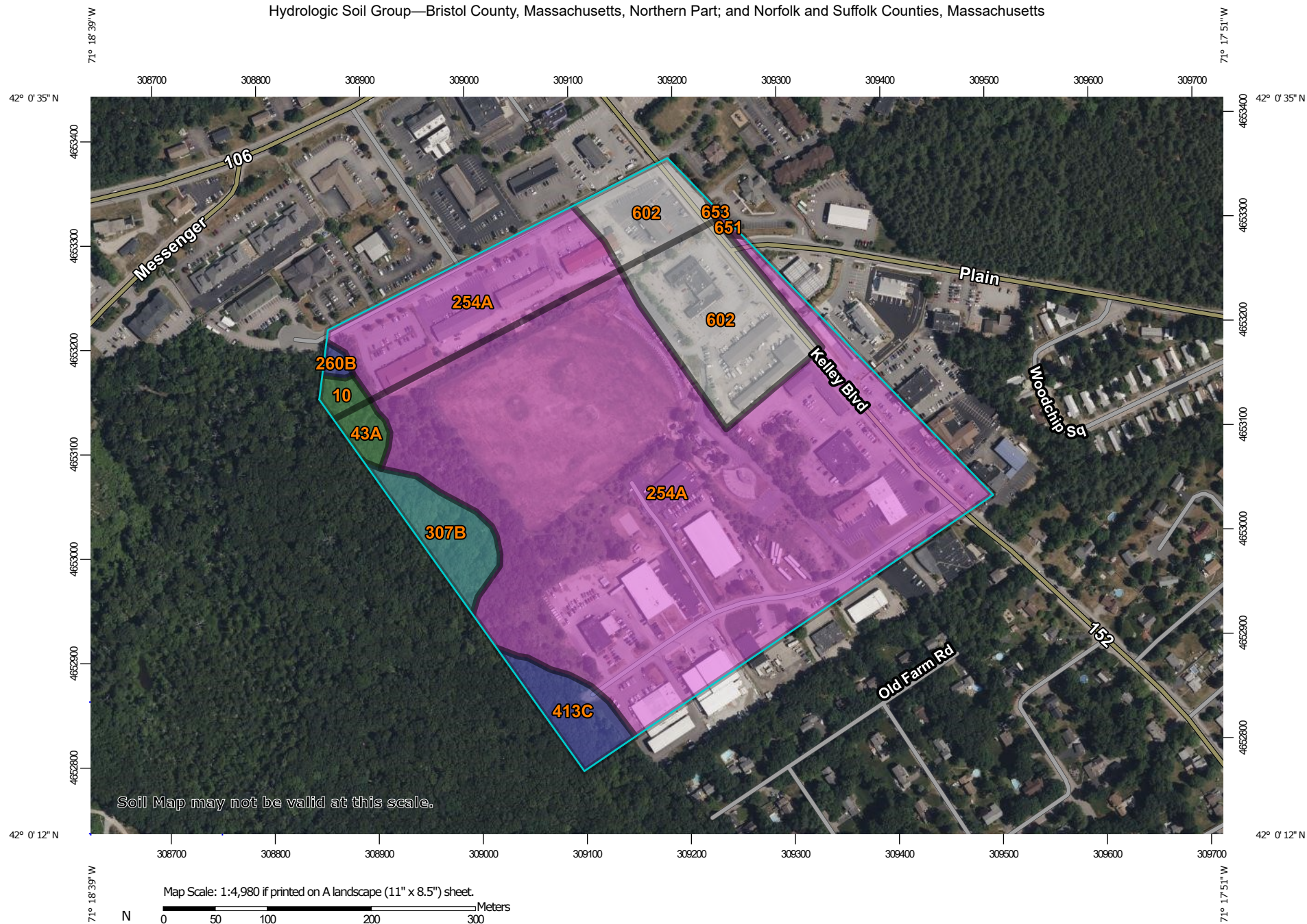
Water Resource Protection

- Watershed
  - 
- Zone II Wellhead Protection Areas
  - 
- Interim Wellhead Protection Area
  - 
- Surface Water Protection Zones
  -  ZONE A
  -  ZONE B
  -  ZONE C

## **APPENDIX C: SOIL AND WETLAND INFORMATION**

- NCRS CUSTOM SOIL RESOURCE REPORT
- REPORT OF GEOTECHNICAL INVESTIGATION - COMPREHENSIVE  
STORMWATER MANAGEMENT AREA EVALUATION

# Hydrologic Soil Group—Bristol County, Massachusetts, Northern Part; and Norfolk and Suffolk Counties, Massachusetts



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

7/8/2024  
Page 1 of 5

## 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 scales ranging from 1:20,000 to 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

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: Bristol County, Massachusetts, Northern Part  
 Survey Area Data: Version 16, Sep 10, 2023

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts  
 Survey Area Data: Version 19, Sep 10, 2023

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jun 14, 2022—Jul 1, 2022

## MAP LEGEND

## MAP INFORMATION

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

| Map unit symbol                       | Map unit name                                                        | Rating | Acres in AOI | Percent of AOI |
|---------------------------------------|----------------------------------------------------------------------|--------|--------------|----------------|
| 43A                                   | Scarboro mucky fine sandy loam, 0 to 3 percent slopes                | A/D    | 0.5          | 1.0%           |
| 254A                                  | Merrimac fine sandy loam, 0 to 3 percent slopes                      | A      | 34.4         | 68.0%          |
| 307B                                  | Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony       | C      | 1.8          | 3.5%           |
| 413C                                  | Charlton-Paxton fine sandy loams, 8 to 15 percent slopes, very stony | B      | 1.5          | 2.9%           |
| 602                                   | Urban land                                                           |        | 4.8          | 9.5%           |
| 651                                   | Udorthents, smoothed                                                 | A      | 0.0          | 0.1%           |
| <b>Subtotals for Soil Survey Area</b> |                                                                      |        | <b>43.0</b>  | <b>85.0%</b>   |
| <b>Totals for Area of Interest</b>    |                                                                      |        | <b>50.6</b>  | <b>100.0%</b>  |

| Map unit symbol                       | Map unit name                                      | Rating | Acres in AOI | Percent of AOI |
|---------------------------------------|----------------------------------------------------|--------|--------------|----------------|
| 10                                    | Scarboro and Birdsall soils, 0 to 3 percent slopes | A/D    | 0.3          | 0.7%           |
| 254A                                  | Merrimac fine sandy loam, 0 to 3 percent slopes    | A      | 5.2          | 10.2%          |
| 260B                                  | Sudbury fine sandy loam, 2 to 8 percent slopes     | B      | 0.2          | 0.3%           |
| 602                                   | Urban land, 0 to 15 percent slopes                 |        | 1.9          | 3.8%           |
| 653                                   | Udorthents, sandy                                  | A      | 0.0          | 0.0%           |
| <b>Subtotals for Soil Survey Area</b> |                                                    |        | <b>7.6</b>   | <b>15.0%</b>   |
| <b>Totals for Area of Interest</b>    |                                                    |        | <b>50.6</b>  | <b>100.0%</b>  |

## 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

August 21, 2024

*via email*

**MCP 582 KELLEY, LLC**  
3401 Columbia Pike  
Suite 410  
Arlington, Virginia 22204

Attention: Ms. Caitlin Walker  
Senior Development Manager

**Regarding: COMPREHENSIVE STORMWATER MANAGEMENT AREA EVALUATION  
PROPOSED RESIDENTIAL DEVELOPMENT  
582 KELLEY BOULEVARD  
MAP 35, LOT 3  
NORTH ATTLEBOROUGH, BRISTOL COUNTY, MASSACHUSETTS  
WHITESTONE PROJECT NO.: GM2118635.002**

Dear Ms. Walker:

Whitestone Associates, Inc. (Whitestone) has completed a comprehensive stormwater management (SWM) area evaluation at the above-referenced site. Whitestone previously completed March 23, May 23, and November 29, 2022 *Limited SWM Area Evaluation* reports for the site. The purpose of these evaluations were to assess subsurface conditions, groundwater depths, estimate seasonal groundwater high (SGWH), and water infiltration rates at the site. Multiple evaluations were completed at the client's request to further assess subsurface conditions including in areas that could not be accessed during previous investigations.

## ***1.0 PROJECT DESCRIPTION***

### ***1.1 Site Location & Existing Conditions***

The approximately 18-acre subject property is located at 582 Kelley Boulevard in North Attleborough, Bristol County, Massachusetts. The site is developed with the *Stix Fun Center* golf driving range and associated structures. Wetlands and a shallow stream are located at the southwest site property boundary.

### ***1.2 Site Geology***

Based on a review of the U.S. Geological Survey *Surficial Geologic Map of the Wrentham Quadrangle, Massachusetts (2008)*, the site is underlain by coarse glacial stratified (glaciofluvial) deposits. The *Geologic Map of Massachusetts*, prepared by U.S. Geological Survey, indicates that the subject property is underlain by the Upper and Middle Pennsylvanian-aged Rhode Island Formation, consisting of sandstone and graywacke, with minor conglomerate, shale, and anthracite, part of the Milford-Dedham Zone.

### ***1.3 Proposed Construction***

Based on the February 23, 2022 *Grading and Drainage Plan* prepared by Bohler Engineering MA, LLC, the proposed redevelopment will include removal of the *Stix Fun Center* facility and construction of approximately 300 residential units, including three multi-story apartment buildings with footprints ranging

*Office Locations:*

from approximately 24,210 square feet to 31,025 square feet, a pool, associated paved parking and landscaped areas. Stormwater management is proposed to consist of an infiltration system in the northwestern portion of the site and three detention ponds in the eastern portion of the site.

## **2.0 FIELD EXPLORATION & TESTING**

### **2.1 Field Exploration**

Field exploration at the project site consisted of advancing 24 test pits (identified as TP-1 through TP-10, TP-101 through TP-105, and TP-201 through TP-209) and three borings (identified as B-101/MW through B-103/MW). Groundwater monitoring wells were installed in the boring locations. Whitestone representatives including a Title 5 System Inspector and Soil Evaluator (SE #14233) and a Professional Engineer licensed in the Commonwealth of Massachusetts (PE# 477440) evaluated soil and groundwater conditions within the test pits. The test pits and borings subsequently were backfilled to the surface with excavated soils from the investigation after conducting percolation testing. The locations of the explorations are shown on the accompanying *Test Location Plan* included as Figure 1. *Records of Subsurface Exploration* are provided in Appendix A.

The subsurface tests were conducted in the presence of a Whitestone engineer, who conducted field tests, recorded visual classifications, and collected samples of the various strata encountered. Test locations were established in the field by taping from existing site features noted on the plan. These locations are presumed to be accurate to the degree implied by the method used.

Groundwater level observations, where encountered, were recorded during and immediately after the completion of field operations prior to backfilling the test pits. Seasonal variations, temperature effects, man-made effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitor wells may not be representative of true groundwater levels.

### **2.2 Infiltration/Percolation Testing**

#### **March 23, 2022 Infiltration Testing**

Field infiltration testing was conducted in the test pits and is summarized in the following table.

| <b>SUMMARY OF INFILTRATION TESTING</b> |                                            |                                                       |                                                |                                                    |                                  |
|----------------------------------------|--------------------------------------------|-------------------------------------------------------|------------------------------------------------|----------------------------------------------------|----------------------------------|
| <b>Location</b>                        | <b>Ground Elevation (feet above NAVD)*</b> | <b>Groundwater Depth/Elevation (fbgs/feet NAVD)**</b> | <b>Test Depth/Elevation (fbgs/feet NAVD)**</b> | <b>Estimated SGWH/Elevation (fbgs/feet NAVD)**</b> | <b>Infiltration Rate (in/hr)</b> |
| TP-1                                   | 198                                        | 5.4 / 192.6                                           | 2 / 196                                        | 3.2 / 194.8                                        | >30                              |
| TP-2                                   | 204                                        | NE                                                    | 4 / 200                                        | -                                                  | >30                              |
| TP-3                                   | 202                                        | 4.75 / 197.25                                         | 2 / 200                                        | 2 / 200                                            | 2                                |
| TP-4                                   | 203                                        | 6.8 / 196.2                                           | 2 / 201                                        | 3.3 / 199.7                                        | 5                                |
| TP-5                                   | 204                                        | NE                                                    | 4 / 200                                        | 5 / 199                                            | >30                              |

\*Elevations are interpolated based on the contour lines on the February 23, 2022 *Grading and Drainage Plan* prepared by Bohler Engineering MA, LLC

\*\*NE: Not encountered; fbgs: feet below ground surface

### ***May 23, 2022 Guelph Permeameter Infiltration Testing***

Field infiltration testing was conducted with a Guelph permeameter, which has an applicable permeability range of about 0.01 inches per hour (in/hr) to 15 in/hr. Hydraulic conductivities,  $k_{fs}$ , documented by the Guelph are tabulated below and ranged from 11.5 in/hr to greater than 30 in/hr. The measured hydraulic conductivities, except for infiltration test I-9, are outside the applicable range for the Guelph permeameter. However, the measured hydraulic conductivities in infiltration tests I-6, I-7, I-8, and I-10 are still considered indicative of the higher permeability of the soil tested.

| <b>SUMMARY OF GUELPH PERMEAMETER TESTING</b> |                                            |                                                       |                                                |                                                     |                                                                            |
|----------------------------------------------|--------------------------------------------|-------------------------------------------------------|------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------|
| <b>Location</b>                              | <b>Ground Elevation (feet above NAVD)*</b> | <b>Groundwater Depth/Elevation (fbgs/feet NAVD)**</b> | <b>Test Depth/Elevation (fbgs/feet NAVD)**</b> | <b>Estimated SGWH/ Elevation (fbgs/feet NAVD)**</b> | <b>Field Saturated Hydraulic Conductivity, <math>k_{fs}</math> (in/hr)</b> |
| I-6 (TP-6)                                   | 203                                        | NE                                                    | 2.7 / 200.3                                    | 4.8 / 198.2                                         | 25.1                                                                       |
| I-7 (TP-7)                                   | 200                                        | NE                                                    | 2 / 198                                        | 4 / 196                                             | >30                                                                        |
| I-8 (TP-8)                                   | 201                                        | NE                                                    | 2 / 199                                        | 4.2 / 196.8                                         | >30                                                                        |
| I-9 (TP-9)                                   | 203                                        | NE                                                    | 2 / 201                                        | 3.7 / 199.3                                         | 11.5                                                                       |
| I-10 (TP-10)                                 | 202                                        | NE                                                    | 2 / 200                                        | 3.7 / 198.3                                         | >30                                                                        |

\*Elevations are interpolated based on contour lines on Bohler February 23, 2022 *Grading and Drainage Plan*

\*\*NE: Not encountered; fbgs: feet below ground surface

Typically, Whitestone recommends at least a Factor of Safety (FoS) of two be applied to field infiltration rates to account for siltation and consolidation of systems over time. Safety factors are dependent on how critical the systems are to the development. If the system is critical, a greater FoS should be applied. Infiltration rates are variable and dependent on test depth and stratification. An appropriate Factor of Safety should be selected and applied to the values above based on how critical the functionality of the systems will be.

### ***November 29, 2022 Percolation Testing***

Percolation tests were conducted in approximate 12-inch diameter and 12-inch deep holes excavated from a shelf at the side of the test pits. Water infiltrated at a rate greater than 15 inches per hour.

| <b>SUMMARY OF PERCOLATION TESTING</b> |                                    |                                                    |                                             |                                                  |                                 |
|---------------------------------------|------------------------------------|----------------------------------------------------|---------------------------------------------|--------------------------------------------------|---------------------------------|
| <b>Location</b>                       | <b>Ground Elevation (ft NAVD)*</b> | <b>Groundwater Depth/Elevation (fbgs/ft NAVD)*</b> | <b>Test Depth/Elevation (fbgs/ft NAVD)*</b> | <b>Estimated SGWH/ Elevation (fbgs/ft NAVD)*</b> | <b>Percolation Rate (in/hr)</b> |
| PERC-1 (TP-101)                       | 197                                | NE                                                 | 3.5 / 193.5                                 | 4.8 / 191.2                                      | >15                             |
| PERC-5 (TP-102)                       | 198                                | NE                                                 | 3 / 195                                     | 3.9 / 194.1                                      | >15                             |
| PERC-2 (TP-103)                       | 201                                | NE                                                 | 4.5 / 196.5                                 | 7.8 / 193.2                                      | >15                             |

| SUMMARY OF PERCOLATION TESTING |                             |                                             |                                      |                                          |                          |
|--------------------------------|-----------------------------|---------------------------------------------|--------------------------------------|------------------------------------------|--------------------------|
| Location                       | Ground Elevation (ft NAVD)* | Groundwater Depth/Elevation (fbgs/ft NAVD)* | Test Depth/Elevation (fbgs/ft NAVD)* | Estimated SGWH/Elevation (fbgs/ft NAVD)* | Percolation Rate (in/hr) |
| PERC-3 (TP-104)                | 201.5                       | NE                                          | 4 / 197.5                            | 4.5 / 197                                | >15                      |
| PERC-4 (TP-105)                | 198                         | NE                                          | 3 / 195                              | 4.8 / 191.3                              | >15                      |

\*Elevations are interpolated based on contour lines on Bohler February 23, 2022 *Grading and Drainage Plan*  
NE: Not encountered; fbgs: feet below ground surface

### ***August 5, 2024 Groundwater Data***

On July 31, 2024, Whitestone installed monitoring wells within borings B-101/MW through B-103/MW. Where encountered, groundwater readings were recorded immediately following well installation. Whitestone returned to the site on August 5, 2024 to record stabilized groundwater within wells. Stabilized groundwater readings can be found below.

| SUMMARY OF GROUNDWATER DEPTH |                                    |                                                         |
|------------------------------|------------------------------------|---------------------------------------------------------|
| Location                     | Ground Elevation (feet above NAVD) | Stabilized Groundwater Depth/Elevation (fbgs/feet NAVD) |
| B-101/MW                     | 203                                | 14 / 189                                                |
| B-102/MW                     | 200                                | 18 / 182                                                |
| B-103/MW                     | 199                                | 17 / 182                                                |

NE: Not encountered; fbgs: feet below ground surface

### ***3.0 SUBSURFACE CONDITIONS***

The subsurface soil conditions encountered within the subsurface test locations conducted by Whitestone consisted of the following generalized strata in order of increasing depth. *Records of Subsurface Exploration* are provided in Appendix A.

**Surface Cover Materials** The test pits encountered 10 inches to 24 inches of topsoil at the ground surface, typically underlain by six inches to 12 inches of subsoil.

**Alluvial Deposit (Intermittent):** Beneath the topsoil and subsoil layers in TP-3 the former subsoil layer in TP-7 a three-inch to six inch-thick layer of an alluvial deposit was encountered which included organics. The alluvial deposit is likely associated with a historic stream to the southwest where the low-flow intermittent stream was observed.

**Existing Fill (Intermittent):** At the ground surface, test pits TP-101, TP-102, and TP-103 encountered existing fill, consisting of brown to dark brown, silty sand with gravel, brick and asphalt pieces. The existing fill extended to depths of 1.8 fbgs to 4.1 fbgs. In test pit TP-101, a former subsoil layer seven inches thick was encountered directly under the existing fill. In test pit TP-102, three inches of former topsoil and five inches of former subsoil were encountered directly under the existing fill.

**Glaciofluvial Deposit:** Beneath the surface cover materials, former topsoil/subsoil, or existing fill, the test pits encountered a glaciofluvial deposit, generally consisting of brown to gray, coarse to fine sand, some gravel, trace silt with cobbles. This stratum has significant amounts of gravel and cobbles. The test pits terminated in this stratum at depths of 5.7 fbgs to 8.7 fbgs.

**Groundwater:** Groundwater was encountered during the test pits at depth ranging from 4.8 fbgs to 6.8 fbgs and in the monitoring wells in the borings from 14.0 fbgs to 18.5 fbgs. Indications of the seasonal high-water level were noted in the test pits at depths ranging from two fbgs to greater than 10 fbgs. Groundwater levels should be expected to fluctuate seasonally and following periods of precipitation.

#### **4.0 CONCLUSION**

The site hydrogeological conditions are complex as result of both natural and existing development-related conditions. These complex conditions include pervious corridors of gravel, pavement surface runoff, existing infiltration systems, and the water course to the north of the site. This has caused irregular mottling and resulted in observed seasonal groundwater high elevations that vary across the site. As such, Whitestone considers that not all seasonal groundwater high elevations identified during the investigations are appropriate for use when considering the final condition of the site following redevelopment. The stratification of gravel at the site and pervious corridors result in the temporarily surge of groundwater that may change on the order of 10 feet for brief periods of time following heavy precipitation. This is demonstrated empirically through the periodic and static groundwater readings within some of the wells compared to the observed seasonal groundwater high elevations.

Locations at the site are expected to have artificial seasonal groundwater high elevations or conditions resulting in seasonal groundwater high elevations that are not relevant for the proposed development. These locations are described below:

- ▶ TP-9 and TP-10 – These locations have been influenced by a stratified soil layer within the grass area of the driving range where water is very briefly delayed during infiltration. Because of this brief delay in infiltration slight mottling occurs. The seasonal groundwater high in this area can easily be mistaken to be at a higher elevation and should not be relied upon for design.
- ▶ TP-1, TP-6, and TP-104 – Observed seasonal groundwater high in these areas is artificially high as a result of significant surface water infiltration and temporary mounding condition associated with sheet flow from impervious surfaces. This condition will change following redevelopment and likely be several feet lower at these locations.

During the latest round of investigation Whitestone carefully examined the locations of previous explorations in the field. Some locations of the site were found to not be accurately represented on the survey that was previously used to establish ground surface elevations at test locations. Discrepancies were identified at TP-101, TP-102, and TP-105 where actual ground surfaces are about one foot to two feet lower than originally shown on plans. The ground surface and estimated seasonal groundwater high elevations have been adjusted on Whitestone's logs, plan, and herein to be representative of actual conditions.

#### **4.0 CLOSING**

Whitestone's Geotechnical Division appreciates the opportunity to be of continuing service to MCP 582 Kelley, LLC. Please contact us with any questions regarding this report.



Sincerely,

**WHITESTONE ASSOCIATES, INC.**

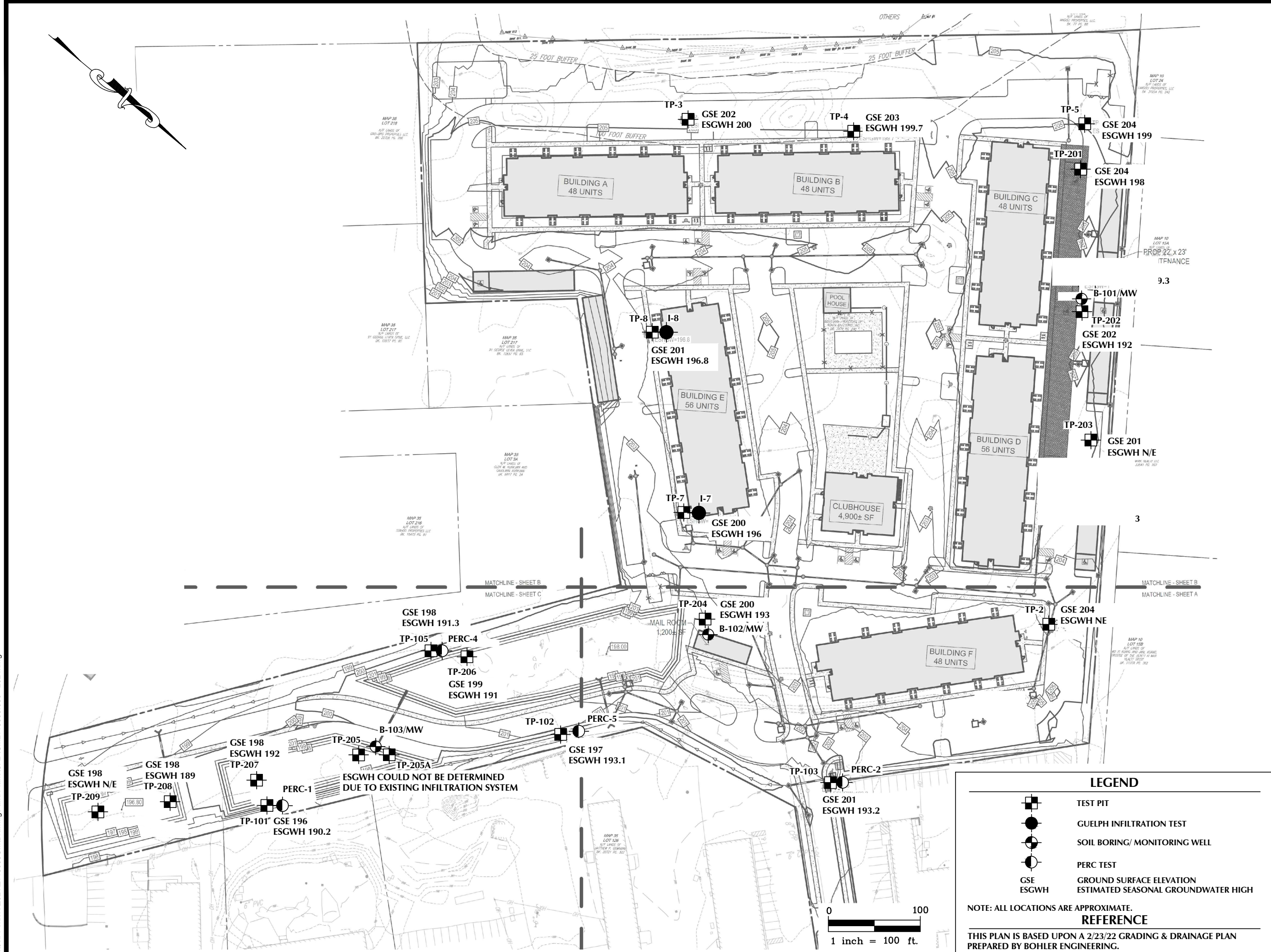
Jason R. Landry  
Senior Project Manager

Ryan R. Roy, P.E.  
Vice President

RWM/lc N:\Job Folders\2021\2118635GM\Reports and Submittals\Marcus Residential N Attleboro MA GM 2118635.002 Comprehensive SWM 08-21-24.docx



**FIGURE 1**  
**Test Location Plan**



*An Employee-Owned Company*

352 TURNPIKE ROAD, SUITE 320, SOUTHBOROUGH, MA 01772  
508.485.0755 WHITESTONEASSOC.COM

**DRAWING TITLE:**  
**TEST LOCATION PLAN**

**CLIENT:**  
**MARCUS PARTNERS, INC.**

**PROJECT:**  
PROPOSED RESIDENTIAL DEVELOPMENT  
582 KELLEY BOULEVARD  
NORTH ATTLEBOROUGH, BRISTOL COUNTY, MASSACHUSETTS

PROJECT #:  
**GM2118635.000**

|                           |                         |
|---------------------------|-------------------------|
| DESIGNED BY:<br><b>MR</b> | PROJ. MGR:<br><b>RE</b> |
|---------------------------|-------------------------|

PROJ. MGR  
RE

|         |         |
|---------|---------|
| DATE:   | FIGURE: |
| 8/20/24 |         |

**FIGURE:**

SCALE:  
 $1'' = 100'$

## LEGEND

- |                                                                                       |                                     |
|---------------------------------------------------------------------------------------|-------------------------------------|
|  | TEST PIT                            |
|  | GUELPH INFILTRATION TEST            |
|  | SOIL BORING/ MONITORING WELL        |
|  | PERC TEST                           |
| GSE                                                                                   | GROUND SURFACE ELEVATION            |
| ESGWH                                                                                 | ESTIMATED SEASONAL GROUNDWATER HIGH |

**NOTE: ALL LOCATIONS ARE APPROXIMATE**

## REFERENCE

THIS PLAN IS BASED UPON A 2/23/22 GRADING & DRAINAGE PLAN  
PREPARED BY BOHLER ENGINEERING.



# **APPENDIX A**

## **Records of Subsurface Exploration**



# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: **TP-3**

Page 1 of 1

|                                                                                          |                                  |                                                            |                                                              |
|------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------------------|--------------------------------------------------------------|
| <b>Project:</b> Proposed Residential Development                                         |                                  | <b>WAI Project No.:</b> GM2118635.001                      |                                                              |
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |                                  | <b>Client:</b> MCP 582 Kelley, LLC                         |                                                              |
| <b>Surface Elevation:</b> ± 202.0 feet NAVD88                                            | <b>Date Started:</b> 3/17/2022   | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |
| <b>Termination Depth:</b> 6.5 feet bgs                                                   | <b>Date Completed:</b> 3/17/2022 | <b>During:</b> 4.8   --                                    | <b>At Completion:</b> --   --                                |
| <b>Location:</b>                                                                         | <b>Logged By:</b> JR             | <b>At Completion:</b> --   --                              | <b>At Completion:</b> --   --                                |
| <b>Excavating Method:</b> Compact Excavator                                              | <b>Contractor:</b> BC            | <b>24 Hours:</b> --   --                                   |                                                              |
| <b>Test Method:</b> Visual Observation                                                   | <b>Rig Type:</b> Mini Excavator  |                                                            |                                                              |

| SAMPLE INFORMATION |        |      | DEPTH  | STRATA                        | DESCRIPTION OF MATERIALS<br>(Classification)                                              | REMARKS             |
|--------------------|--------|------|--------|-------------------------------|-------------------------------------------------------------------------------------------|---------------------|
| Depth (ft.)        | Number | Type | (feet) |                               |                                                                                           |                     |
|                    |        |      | 0.0    |                               |                                                                                           |                     |
|                    |        |      | 0.8    | TS                            | 10" Topsoil - Dark Brown, Medium to Fine Sand, Some Silt with Trace Organics              |                     |
|                    |        |      | 1.8    | SUBSOIL                       | Subsoil, Orange-Brown, Medium to Fine Sand, Some Silt, Little Gravel                      |                     |
|                    |        |      | 2.1    | ALLUVIAL                      | Grey, Fine Sand and Silt, Trace Gravel                                                    | Estimated SGWH = 2' |
|                    |        |      | 5.0    | GLACIO-<br>FLUVIAL<br>DEPOSIT | Brown, Coarse to Fine Sand, Some Gravel, Little Silt with Cobbles and occasional Boulders |                     |
|                    |        |      | 6.5    |                               |                                                                                           |                     |
|                    |        |      |        |                               | Test Pit TP-3 Terminated at Depth of 6.5 Feet Below Ground Surface.                       |                     |
|                    |        |      | 10.0   |                               |                                                                                           |                     |
|                    |        |      | 15.0   |                               |                                                                                           |                     |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched





# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: **TP-5**  
Page 1 of 1

|                                                                                          |                                  |                                                            |                                                              |
|------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------------------|--------------------------------------------------------------|
| <b>Project:</b> Proposed Residential Development                                         |                                  | <b>WAI Project No.:</b> GM2118635.001                      |                                                              |
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |                                  | <b>Client:</b> MCP 582 Kelley, LLC                         |                                                              |
| <b>Surface Elevation:</b> ± 204.0 feet NAVD88                                            | <b>Date Started:</b> 3/17/2022   | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |
| <b>Termination Depth:</b> 8.0 feet bgs                                                   | <b>Date Completed:</b> 3/17/2022 | <b>During:</b> --   --                                     | <b>At Completion:</b> --   --                                |
| <b>Location:</b>                                                                         | <b>Logged By:</b> JR             | <b>24 Hours:</b> --   --                                   | <b>At Completion:</b> --   --                                |
| <b>Excavating Method:</b> Compact Excavator                                              | <b>Contractor:</b> BC            |                                                            |                                                              |
| <b>Test Method:</b> Visual Observation                                                   | <b>Rig Type:</b> Mini Excavator  |                                                            |                                                              |

| SAMPLE INFORMATION |        |      | DEPTH  | STRATA                        | DESCRIPTION OF MATERIALS<br>(Classification)                                           | REMARKS             |
|--------------------|--------|------|--------|-------------------------------|----------------------------------------------------------------------------------------|---------------------|
| Depth (ft.)        | Number | Type | (feet) |                               |                                                                                        |                     |
|                    |        |      | 0.0    |                               |                                                                                        |                     |
|                    |        |      |        | TS                            | 12" Topsoil - Dark Brown, Medium to Fine Sand, Some Silt with Trace Organics           |                     |
|                    |        |      | 1.0    |                               |                                                                                        |                     |
|                    |        |      |        | SUBSOIL                       | Orange-Brown, Medium to Fine Sand, Little Gravel and Silt with Cobbles                 |                     |
|                    |        |      | 2.0    |                               |                                                                                        |                     |
|                    |        |      |        |                               | Brown, Coarse to Fine Sand and Gravel, Trace Silt with Cobbles and occasional Boulders |                     |
|                    |        |      |        | GLACIO-<br>FLUVIAL<br>DEPOSIT |                                                                                        | Estimated SGWH = 5' |
|                    |        |      | 8.0    |                               |                                                                                        |                     |
|                    |        |      |        |                               | Test Pit TP-5 Terminated at Depth of 8.0 Feet Below Ground Surface.                    |                     |
|                    |        |      | 10.0   |                               |                                                                                        |                     |
|                    |        |      | 15.0   |                               |                                                                                        |                     |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched











# RECORD OF SUBSURFACE EXPLORATION

|                                                                                          |                                   |                                                                   |                                                                     |
|------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Project:</b> Proposed Residential Development                                         |                                   | <b>WAI Project No.:</b> GM2118635.002                             |                                                                     |
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |                                   | <b>Client:</b> MCP 582 Kelley, LLC                                |                                                                     |
| <b>Surface Elevation:</b> ± 198.0 feet NAVD88                                            | <b>Date Started:</b> 10/31/2022   | <b>Water Depth</b>   <b>Elevation</b><br>(feet bgs)   (ft NAVD88) | <b>Cave-In Depth</b>   <b>Elevation</b><br>(feet bgs)   (ft NAVD88) |
| <b>Termination Depth:</b> 7.5 feet bgs                                                   | <b>Date Completed:</b> 10/31/2022 | <b>During:</b> --   --                                            | <b>At Completion:</b> --   --                                       |
| <b>Location:</b> SWM Area                                                                | <b>Logged By:</b> RK              | <b>At Completion:</b> --   --                                     |                                                                     |
| <b>Excavating Method:</b> Compact Excavator                                              | <b>Contractor:</b> DE             | <b>24 Hours:</b> --   --                                          |                                                                     |
| <b>Test Method:</b> Visual Observation                                                   | <b>Rig Type:</b> Bobcat E35       |                                                                   |                                                                     |

| SAMPLE INFORMATION |        |      | DEPTH  | STRATA                        | DESCRIPTION OF MATERIALS<br>(Classification)                          | REMARKS                   |
|--------------------|--------|------|--------|-------------------------------|-----------------------------------------------------------------------|---------------------------|
| Depth (ft.)        | Number | Type | (feet) |                               |                                                                       |                           |
|                    |        |      | 0.0    |                               |                                                                       |                           |
|                    |        |      |        | TOPSOIL                       | 12" Topsoil                                                           |                           |
|                    |        |      |        | SUBSOIL                       | 9" Subsoil, Roots                                                     |                           |
|                    |        |      |        |                               |                                                                       | Percolation Test @ 3 fbgs |
|                    |        |      | 5.0    | GLACIO-<br>FLUVIAL<br>DEPOSIT | Brown, Coarse to Fine Sand, Some Gravel, Trace Silt with Cobbles      | Estimated SGWH = 4.8 fbgs |
|                    |        |      | 10.0   |                               |                                                                       |                           |
|                    |        |      | 15.0   |                               |                                                                       |                           |
|                    |        |      |        |                               | Test Pit TP-105 Terminated at Depth of 7.5 Feet Below Ground Surface. |                           |







# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: **TP-203**

Page 1 of 1

| <b>Project:</b> Proposed Retail Development                                              |        |                                   |        | <b>WAI Project No.:</b> GM2118635.003                      |  |                                                                        |  |                                                     |
|------------------------------------------------------------------------------------------|--------|-----------------------------------|--------|------------------------------------------------------------|--|------------------------------------------------------------------------|--|-----------------------------------------------------|
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |        |                                   |        | <b>Client:</b> MCP 582 Kelley, LLC                         |  |                                                                        |  |                                                     |
| <b>Surface Elevation:</b> ± 201.0 feet NAVD88                                            |        | <b>Date Started:</b> 8/2/2024     |        | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88)           |  |                                                     |
| <b>Termination Depth:</b> 10.0 feet bgs                                                  |        | <b>Date Completed:</b> 8/2/2024   |        |                                                            |  |                                                                        |  |                                                     |
| <b>Proposed Location:</b> SWM Area                                                       |        | <b>Logged By:</b> TG              |        | <b>During:</b> --   --                                     |  |                                                                        |  |                                                     |
| <b>Excavating Method:</b> Excavator                                                      |        | <b>Contractor:</b> Earthwork Ind. |        | <b>At Completion:</b> --   --                              |  | <b>At Completion:</b> --   --                                          |  |                                                     |
| <b>Test Method:</b> Visual Observation                                                   |        | <b>Rig Type:</b> DX 85R           |        | <b>24 Hours:</b> --   --                                   |  |                                                                        |  |                                                     |
| SAMPLE INFORMATION                                                                       |        |                                   | DEPTH  | STRATA                                                     |  | DESCRIPTION OF MATERIALS<br>(Classification)                           |  | REMARKS                                             |
| Depth (ft.)                                                                              | Number | Type                              | (feet) |                                                            |  |                                                                        |  |                                                     |
|                                                                                          |        |                                   | 0.0    |                                                            |  |                                                                        |  |                                                     |
|                                                                                          |        |                                   | 0.5    |                                                            |  | Topsoil                                                                |  |                                                     |
|                                                                                          |        |                                   | 1.5    |                                                            |  | Subsoil                                                                |  |                                                     |
|                                                                                          |        |                                   | 5.0    |                                                            |  | Well Graded Sand with Gravel, Occasional Cobbles and Boulders          |  |                                                     |
|                                                                                          |        |                                   | 10.0   |                                                            |  |                                                                        |  | Estimated Seasonal Groundwater High Not Encountered |
|                                                                                          |        |                                   | 15.0   |                                                            |  | Test Pit TP-203 Terminated at a depth of 10 Feet Below Ground Surface. |  |                                                     |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched



# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: **TP-204**

Page 1 of 1

| <b>Project:</b> Proposed Retail Development                                              |        |                                   |        | <b>WAI Project No.:</b> GM2118635.003                      |  |                                                                        |  |                                                  |
|------------------------------------------------------------------------------------------|--------|-----------------------------------|--------|------------------------------------------------------------|--|------------------------------------------------------------------------|--|--------------------------------------------------|
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |        |                                   |        | <b>Client:</b> MCP 582 Kelley, LLC                         |  |                                                                        |  |                                                  |
| <b>Surface Elevation:</b> ± 200.0 feet NAVD88                                            |        | <b>Date Started:</b> 8/2/2024     |        | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88)           |  |                                                  |
| <b>Termination Depth:</b> 10.0 feet bgs                                                  |        | <b>Date Completed:</b> 8/2/2024   |        |                                                            |  |                                                                        |  |                                                  |
| <b>Proposed Location:</b> SWM Area                                                       |        | <b>Logged By:</b> TG              |        | <b>During:</b> --   --                                     |  | <b>At Completion:</b> --   --                                          |  |                                                  |
| <b>Excavating Method:</b> Excavator                                                      |        | <b>Contractor:</b> Earthwork Ind. |        | <b>At Completion:</b> --   --                              |  | <b>At Completion:</b> --   --                                          |  |                                                  |
| <b>Test Method:</b> Visual Observation                                                   |        | <b>Rig Type:</b> DX 85R           |        | <b>24 Hours:</b> --   --                                   |  |                                                                        |  |                                                  |
| SAMPLE INFORMATION                                                                       |        |                                   | DEPTH  | STRATA                                                     |  | DESCRIPTION OF MATERIALS<br>(Classification)                           |  | REMARKS                                          |
| Depth (ft.)                                                                              | Number | Type                              | (feet) |                                                            |  |                                                                        |  |                                                  |
|                                                                                          |        |                                   | 0.0    |                                                            |  |                                                                        |  |                                                  |
|                                                                                          |        |                                   | 0.5    |                                                            |  | Topsoil                                                                |  |                                                  |
|                                                                                          |        |                                   |        |                                                            |  | Silty Sand with Gravel, Occasional Cobbles and Boulders                |  |                                                  |
|                                                                                          |        |                                   | 3.5    |                                                            |  |                                                                        |  |                                                  |
|                                                                                          |        |                                   | 5.0    |                                                            |  | Well Graded Sand with Gravel, Occasional Cobbles and Boulders          |  |                                                  |
|                                                                                          |        |                                   | 7.0    |                                                            |  |                                                                        |  |                                                  |
|                                                                                          |        |                                   | 10.0   |                                                            |  |                                                                        |  | Estimated Seasonal<br>Groundwater High at 7 Feet |
|                                                                                          |        |                                   | 15.0   |                                                            |  | Test Pit TP-204 Terminated at a depth of 10 Feet Below Ground Surface. |  |                                                  |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched



# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: TP-205/TP-205A

Page 1 of 1

|                                                                                          |  |                                   |                                       |                                 |  |                                  |  |
|------------------------------------------------------------------------------------------|--|-----------------------------------|---------------------------------------|---------------------------------|--|----------------------------------|--|
| <b>Project:</b> Proposed Retail Development                                              |  |                                   | <b>WAI Project No.:</b> GM2118635.003 |                                 |  |                                  |  |
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |  |                                   | <b>Client:</b> MCP 582 Kelley, LLC    |                                 |  |                                  |  |
| <b>Surface Elevation:</b> ± 199.0 feet NAVD88                                            |  | <b>Date Started:</b> 8/5/2024     |                                       | <b>Water Depth   Elevation</b>  |  | <b>Cave-In Depth   Elevation</b> |  |
| <b>Termination Depth:</b> 3.0 feet bgs                                                   |  | <b>Date Completed:</b> 8/5/2024   |                                       | <b>(feet bgs)   (ft NAVD88)</b> |  | <b>(feet bgs)   (ft NAVD88)</b>  |  |
| <b>Proposed Location:</b> SWM Area                                                       |  | <b>Logged By:</b> RR              |                                       | <b>During:</b> --   --          |  | <b>At Completion:</b> --   --    |  |
| <b>Excavating Method:</b> Excavator                                                      |  | <b>Contractor:</b> Earthwork Ind. |                                       | <b>At Completion:</b> --   --   |  | <b>At Completion:</b> --   --    |  |
| <b>Test Method:</b> Visual Observation                                                   |  | <b>Rig Type:</b> DX 85R           |                                       | <b>24 Hours:</b> --   --        |  |                                  |  |

| SAMPLE INFORMATION |        |      | DEPTH  | STRATA | DESCRIPTION OF MATERIALS<br>(Classification)                            | REMARKS                                |
|--------------------|--------|------|--------|--------|-------------------------------------------------------------------------|----------------------------------------|
| Depth (ft.)        | Number | Type | (feet) |        |                                                                         |                                        |
|                    |        |      | 0.0    |        |                                                                         |                                        |
|                    |        |      | 0.25   |        | Topsoil                                                                 |                                        |
|                    |        |      | 0.75   |        | Subsoil                                                                 |                                        |
|                    |        |      |        |        | Well Graded Sand and Gravel, Little Silt                                |                                        |
|                    |        |      | 3.0    |        |                                                                         | Possible Leach Field Stone Encountered |
|                    |        |      |        |        | Test Pit TP-205 Terminated at a depth of 3.0 Feet Below Ground Surface. |                                        |
|                    |        |      | 5.0    |        |                                                                         |                                        |
|                    |        |      | 10.0   |        |                                                                         |                                        |
|                    |        |      | 15.0   |        |                                                                         |                                        |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched



# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: **TP-206**

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|                                                                                          |  |                                   |                                       |                                                              |  |
|------------------------------------------------------------------------------------------|--|-----------------------------------|---------------------------------------|--------------------------------------------------------------|--|
| <b>Project:</b> Proposed Retail Development                                              |  |                                   | <b>WAI Project No.:</b> GM2118635.003 |                                                              |  |
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |  |                                   | <b>Client:</b> MCP 582 Kelley, LLC    |                                                              |  |
| <b>Surface Elevation:</b> ± 199.0 feet NAVD88                                            |  | <b>Date Started:</b> 8/5/2024     |                                       | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88)   |  |
| <b>Termination Depth:</b> 10.5 feet bgs                                                  |  | <b>Date Completed:</b> 8/5/2024   |                                       | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  |
| <b>Proposed Location:</b> SWM Area                                                       |  | <b>Logged By:</b> RR              |                                       | <b>During:</b> --   --                                       |  |
| <b>Excavating Method:</b> Excavator                                                      |  | <b>Contractor:</b> Earthwork Ind. |                                       | <b>At Completion:</b> --   --                                |  |
| <b>Test Method:</b> Visual Observation                                                   |  | <b>Rig Type:</b> DX 85R           |                                       | <b>At Completion:</b> --   --                                |  |

| SAMPLE INFORMATION |        |      | DEPTH  | STRATA | DESCRIPTION OF MATERIALS<br>(Classification)                             | REMARKS                                         |
|--------------------|--------|------|--------|--------|--------------------------------------------------------------------------|-------------------------------------------------|
| Depth (ft.)        | Number | Type | (feet) |        |                                                                          |                                                 |
|                    |        |      | 0.0    |        |                                                                          |                                                 |
|                    |        |      | 0.25   |        | Topsoil                                                                  |                                                 |
|                    |        |      | 0.75   |        | Subsoil                                                                  |                                                 |
|                    |        |      |        |        | Silty Sand with Gravel, Occasional Cobbles                               |                                                 |
|                    |        |      | 4.0    |        |                                                                          |                                                 |
|                    |        |      | 5.0    |        | Well Graded Sand and Gravel, Trace Silt, Occasional Cobbles              |                                                 |
|                    |        |      | 8.0    |        |                                                                          |                                                 |
|                    |        |      | 10.0   |        |                                                                          |                                                 |
|                    |        |      | 10.5   |        |                                                                          | Estimated Seasonal Groundwater High at 8.0 Feet |
|                    |        |      |        |        | Test Pit TP-206 Terminated at a depth of 10.5 Feet Below Ground Surface. |                                                 |
|                    |        |      | 15.0   |        |                                                                          |                                                 |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched



# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: **TP-207**

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|                                                                                          |  |                                   |  |                                                            |  |                                                              |  |
|------------------------------------------------------------------------------------------|--|-----------------------------------|--|------------------------------------------------------------|--|--------------------------------------------------------------|--|
| <b>Project:</b> Proposed Retail Development                                              |  |                                   |  | <b>WAI Project No.:</b> GM2118635.003                      |  |                                                              |  |
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |  |                                   |  | <b>Client:</b> MCP 582 Kelley, LLC                         |  |                                                              |  |
| <b>Surface Elevation:</b> ± 198.0 feet NAVD88                                            |  | <b>Date Started:</b> 8/5/2024     |  | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  |
| <b>Termination Depth:</b> 10.5 feet bgs                                                  |  | <b>Date Completed:</b> 8/5/2024   |  |                                                            |  |                                                              |  |
| <b>Proposed Location:</b> SWM Area                                                       |  | <b>Logged By:</b> RR              |  | <b>During:</b> --   --                                     |  | <b>At Completion:</b> --   --                                |  |
| <b>Excavating Method:</b> Excavator                                                      |  | <b>Contractor:</b> Earthwork Ind. |  | <b>At Completion:</b> --   --                              |  | <b>At Completion:</b> --   --                                |  |
| <b>Test Method:</b> Visual Observation                                                   |  | <b>Rig Type:</b> DX 85R           |  | <b>24 Hours:</b> --   --                                   |  |                                                              |  |

| SAMPLE INFORMATION |        |      | DEPTH  | STRATA | DESCRIPTION OF MATERIALS<br>(Classification)                             | REMARKS                                             |
|--------------------|--------|------|--------|--------|--------------------------------------------------------------------------|-----------------------------------------------------|
| Depth (ft.)        | Number | Type | (feet) |        |                                                                          |                                                     |
|                    |        |      | 0.0    |        |                                                                          |                                                     |
|                    |        |      | 0.25   |        | Topsoil                                                                  |                                                     |
|                    |        |      | 0.75   |        | Subsoil                                                                  |                                                     |
|                    |        |      |        |        | Well Graded Sand with Gravel, Occasional Cobbles                         |                                                     |
|                    |        |      | 5.0    |        |                                                                          |                                                     |
|                    |        |      | 6.0    |        |                                                                          | Estimeated Seasonal<br>Groundwater High at 5.8 Feet |
|                    |        |      |        |        | Poorly Graded Sand With Gravel                                           |                                                     |
|                    |        |      | 7.5    |        |                                                                          |                                                     |
|                    |        |      | 8.0    |        | Well Graded Sand with Gravel, Occasional Cobbles                         |                                                     |
|                    |        |      | 10.0   |        |                                                                          |                                                     |
|                    |        |      | 10.5   |        |                                                                          |                                                     |
|                    |        |      |        |        | Test Pit TP-207 Terminated at a depth of 10.5 Feet Below Ground Surface. |                                                     |
|                    |        |      | 15.0   |        |                                                                          |                                                     |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched



# RECORD OF SUBSURFACE EXPLORATION

Test Pit No.: TP-208

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| <b>Project:</b> Proposed Retail Development                                              |        |                                   |        | <b>WAI Project No.:</b> GM2118635.003                      |                                                                          |                                                              |  |
|------------------------------------------------------------------------------------------|--------|-----------------------------------|--------|------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------|--|
| <b>Location:</b> 582 Kelley Boulevard, North Attleborough, Bristol County, Massachusetts |        |                                   |        | <b>Client:</b> MCP 582 Kelley, LLC                         |                                                                          |                                                              |  |
| <b>Surface Elevation:</b> ± 198.0 feet NAVD88                                            |        | <b>Date Started:</b> 8/5/2024     |        | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |                                                                          | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  |
| <b>Termination Depth:</b> 10.0 feet bgs                                                  |        | <b>Date Completed:</b> 8/5/2024   |        | <b>During:</b> --   --                                     |                                                                          | <b>At Completion:</b> --   --                                |  |
| <b>Proposed Location:</b> SWM Area                                                       |        | <b>Logged By:</b> RR              |        | <b>At Completion:</b> --   --                              |                                                                          | <b>At Completion:</b> --   --                                |  |
| <b>Excavating Method:</b> Excavator                                                      |        | <b>Contractor:</b> Earthwork Ind. |        | <b>24 Hours:</b> --   --                                   |                                                                          |                                                              |  |
| <b>Test Method:</b> Visual Observation                                                   |        | <b>Rig Type:</b> DX 85R           |        |                                                            |                                                                          |                                                              |  |
| SAMPLE INFORMATION                                                                       |        |                                   | DEPTH  | STRATA                                                     | DESCRIPTION OF MATERIALS<br>(Classification)                             | REMARKS                                                      |  |
| Depth (ft.)                                                                              | Number | Type                              | (feet) |                                                            |                                                                          |                                                              |  |
|                                                                                          |        |                                   | 0.0    |                                                            |                                                                          |                                                              |  |
|                                                                                          |        |                                   | 0.25   |                                                            | Topsoil                                                                  |                                                              |  |
|                                                                                          |        |                                   | 1.0    |                                                            | Subsoil                                                                  |                                                              |  |
|                                                                                          |        |                                   |        |                                                            | Well Graded Sand with Gravel, Occasional Cobbles                         |                                                              |  |
|                                                                                          |        |                                   | 5.0    |                                                            |                                                                          |                                                              |  |
|                                                                                          |        |                                   | 9.0    |                                                            |                                                                          | Estimated Seasonal Groundwater High at 9.0 Feet              |  |
|                                                                                          |        |                                   | 10.0   |                                                            |                                                                          |                                                              |  |
|                                                                                          |        |                                   |        |                                                            | Test Pit TP-208 Terminated at a depth of 10.0 Feet Below Ground Surface. |                                                              |  |
|                                                                                          |        |                                   | 15.0   |                                                            |                                                                          |                                                              |  |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched





# RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-101/MW

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| <b>Project:</b> Proposed Residential Development                                              |     |      |                   |               |    | <b>WAI Project No.:</b> GM2118635.000 |                               |  |                                                                         |  |  |                                                              |                                                   |  |
|-----------------------------------------------------------------------------------------------|-----|------|-------------------|---------------|----|---------------------------------------|-------------------------------|--|-------------------------------------------------------------------------|--|--|--------------------------------------------------------------|---------------------------------------------------|--|
| <b>Location:</b> 582 Kelley Boulevard Rear, North Attleborough, Bristol County, Massachusetts |     |      |                   |               |    | <b>Client:</b> MP Properties III, LLC |                               |  |                                                                         |  |  |                                                              |                                                   |  |
| <b>Surface Elevation:</b> ± 203.0 feet above NAVD88                                           |     |      |                   |               |    | <b>Date Started:</b> 7/31/2024        |                               |  | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88)              |  |  | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |                                                   |  |
| <b>Termination Depth:</b> 21.0 feet bgs                                                       |     |      |                   |               |    | <b>Date Completed:</b> 7/31/2024      |                               |  | <b>During:</b> 14.0   --                                                |  |  | <b>At Completion:</b> --   --                                |                                                   |  |
| <b>Proposed Location:</b> Stormwater Area                                                     |     |      |                   |               |    | <b>Logged By:</b> TG                  |                               |  | <b>At Completion:</b> --   --                                           |  |  | <b>At Completion:</b> --   --                                |                                                   |  |
| <b>Drill / Test Method:</b> HSA / SPT (Autohammer)                                            |     |      |                   |               |    | <b>Contractor:</b> GL                 |                               |  | <b>24 Hours:</b> 14.0   --                                              |  |  | <b>24 Hours:</b> --   --                                     |                                                   |  |
| <b>Equipment:</b> 4" FWC & Roller Bit                                                         |     |      |                   |               |    | <b>Equipment:</b> CME 55              |                               |  |                                                                         |  |  |                                                              |                                                   |  |
| SAMPLE INFORMATION                                                                            |     |      |                   |               |    | DEPTH                                 | STRATA                        |  | DESCRIPTION OF MATERIALS<br>(Classification)                            |  |  |                                                              | REMARKS                                           |  |
| Depth<br>(feet)                                                                               | No  | Type | Blows Per 6"      | Rec.<br>(in.) | N  | (feet)                                |                               |  |                                                                         |  |  |                                                              |                                                   |  |
| 0 - 2                                                                                         | S-1 | X    | 3 - 7 - 13 - 26   | 12            | 20 | 0.0                                   | TS                            |  | 12" Topsoil                                                             |  |  |                                                              | Cobbles and boulders throughout boring            |  |
|                                                                                               |     |      |                   |               |    | 2.0                                   | SUBSOIL                       |  | 12" Subsoil                                                             |  |  |                                                              |                                                   |  |
| 2 - 3                                                                                         | S-2 | X    | 49 - 70           | 9             | -  |                                       |                               |  | Brown, Very Dense, Well-Graded Gravel with Silt and Sand (GW-GM)        |  |  |                                                              | Hollow Stem Auger Refusal at depth of 10 fbgs.    |  |
|                                                                                               |     |      |                   |               |    | 5.0                                   |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
| 5 - 5.8                                                                                       | S-3 | X    | 73 - 56/3"        | 6             | -  |                                       |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
|                                                                                               |     |      |                   |               |    |                                       |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
| 7 - 7.7                                                                                       | S-4 | X    | 53 - 70/2"        | 3             | -  |                                       |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
|                                                                                               |     |      |                   |               |    | 10.0                                  | GLACIO-<br>FLUVIAL<br>DEPOSIT |  | As Above (GW-GM)                                                        |  |  |                                                              | Installed Groundwater Monitoring Well in Borehole |  |
| 10 - 10.5                                                                                     | S-5 | X    | 90                | 2             | -  |                                       |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
|                                                                                               |     |      |                   |               |    |                                       |                               |  | As Above, Medium Dense (GW-GM)                                          |  |  |                                                              |                                                   |  |
| 14 - 16                                                                                       | S-6 | X    | 17 - 13 - 11 - 53 | 7             | 24 | 15.0                                  |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
|                                                                                               |     |      |                   |               |    |                                       |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
| 19 - 21                                                                                       | S-7 | X    | 31 - 38 - 41 - 28 | 8             | 79 | 20.0                                  |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
|                                                                                               |     |      |                   |               |    |                                       |                               |  | As Above (GW-GM)                                                        |  |  |                                                              |                                                   |  |
|                                                                                               |     |      |                   |               |    | 25.0                                  |                               |  | Boring Log B-101 Terminated at Depth of 21.0 feet below ground surface. |  |  |                                                              |                                                   |  |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

RECORD OF SUBSURFACE EXPLORATION  
MCP 582 Kelley LLC North Attleborough MA GM2118635.003 Boring Logs 08-24 (TOMS).xlsx 8/21/2024



# RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-102/MW

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|                                                                                        |                          |                                                     |                                                       |
|----------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------|-------------------------------------------------------|
| Project: Proposed Residential Development                                              |                          | WAI Project No.: GM2118635.000                      |                                                       |
| Location: 582 Kelley Boulevard Rear, North Attleborough, Bristol County, Massachusetts |                          | Client: MP Properties III, LLC                      |                                                       |
| Surface Elevation: ± 200.0 feet above NAVD88                                           | Date Started: 8/1/2024   | Water Depth   Elevation<br>(feet bgs)   (ft NAVD88) | Cave-In Depth   Elevation<br>(feet bgs)   (ft NAVD88) |
| Termination Depth: 29.0 feet bgs                                                       | Date Completed: 8/1/2024 | During: 18.0   --                                   | At Completion: --   --                                |
| Proposed Location: Stormwater Area                                                     | Logged By: TG            | At Completion: --   --                              | At Completion: --   --                                |
| Drill / Test Method: 4" FWC & Roller Bit                                               | Contractor: GL           | 24 Hours: 18.5   --                                 | 24 Hours: --   --                                     |
| SPT (Autohammer)                                                                       | Equipment: CME 55        |                                                     |                                                       |

| SAMPLE INFORMATION |     |      |                   |               |    | DEPTH  | STRATA                 | DESCRIPTION OF MATERIALS<br>(Classification)                       | REMARKS                                |
|--------------------|-----|------|-------------------|---------------|----|--------|------------------------|--------------------------------------------------------------------|----------------------------------------|
| Depth<br>(feet)    | No  | Type | Blows Per 6"      | Rec.<br>(in.) | N  | (feet) |                        |                                                                    |                                        |
|                    |     |      |                   |               |    | 0.0    | Subbase                | 8" Granular Subbase                                                |                                        |
| 0 - 2              | S-1 |      | 16 - 18 - 15 - 10 | 13            | 33 |        |                        | Brown, Dense, Silty Sand with Gravel (FILL)                        | Cobbles and boulders throughout boring |
| 2 - 4              | S-2 |      | 18 - 13 - 20 - 28 | 16            | 33 |        | FILL                   | As Above (FILL)                                                    |                                        |
| 5 - 5.4            | S-3 |      | 23 - 36 - 50/5"   | 10            | 72 |        |                        | Brown, Very Dense, Poorly Graded Sand with Silt and Gravel (SP-SM) |                                        |
|                    |     |      |                   |               |    | 5.0    |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
| 9 - 11             | S-4 |      | 23 - 27 - 29 - 22 | 10            | 56 | 10.0   | GLACIO-FLUVIAL DEPOSIT | As Above (S{-SM)                                                   |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
| 14 - 16            | S-5 |      | 21 - 23 - 28 - 41 | 0             | 51 | 15.0   |                        | Very Dense, No Recovery                                            |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
| 19 - 21            | S-6 |      | 13 - 10 - 8 - 9   | 12            | 18 | 20.0   |                        | Brown, Medium Dense, Well-Graded Gravel with Silt and Sand (GW-GM) |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    |        |                        |                                                                    |                                        |
|                    |     |      |                   |               |    | 25.0   |                        |                                                                    |                                        |

# RECORD OF SUBSURFACE EXPLORATION

Boring No.: **B-102/MW**

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|                                                                                               |  |  |  |  |  |                                       |  |  |                                                            |  |                                                              |  |
|-----------------------------------------------------------------------------------------------|--|--|--|--|--|---------------------------------------|--|--|------------------------------------------------------------|--|--------------------------------------------------------------|--|
| <b>Project:</b> Proposed Residential Development                                              |  |  |  |  |  | <b>WAI Project No.:</b> GM2118635.000 |  |  |                                                            |  |                                                              |  |
| <b>Location:</b> 582 Kelley Boulevard Rear, North Attleborough, Bristol County, Massachusetts |  |  |  |  |  |                                       |  |  |                                                            |  |                                                              |  |
| <b>Client:</b> MP Properties III, LLC                                                         |  |  |  |  |  |                                       |  |  |                                                            |  |                                                              |  |
| <b>Surface Elevation:</b> ± 200.0 feet above NAVD88                                           |  |  |  |  |  | <b>Date Started:</b> 8/1/2024         |  |  | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  |
| <b>Termination Depth:</b> 29.0 feet bgs                                                       |  |  |  |  |  | <b>Date Completed:</b> 8/1/2024       |  |  | <b>During:</b> 18.0   -- ▼                                 |  | <b>At Completion:</b> --   -- ▼                              |  |
| <b>Proposed Location:</b> Stormwater Area                                                     |  |  |  |  |  | <b>Logged By:</b> TG                  |  |  | <b>At Completion:</b> --   -- ▼                            |  | <b>At Completion:</b> --   -- ▼                              |  |
| <b>Drill / Test Method:</b> 4" FWC & Roller Bit                                               |  |  |  |  |  | <b>Contractor:</b> GL                 |  |  | <b>24 Hours:</b> 18.5   -- ▼                               |  | <b>24 Hours:</b> --   -- ▼                                   |  |
| <b>SPT (Autohammer)</b>                                                                       |  |  |  |  |  | <b>Equipment:</b> CME 55              |  |  |                                                            |  |                                                              |  |

| SAMPLE INFORMATION |    |      |              |               |   | DEPTH  | STRATA                        | DESCRIPTION OF MATERIALS<br>(Classification)                            | REMARKS                                                 |
|--------------------|----|------|--------------|---------------|---|--------|-------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------|
| Depth<br>(feet)    | No | Type | Blows Per 6" | Rec.<br>(in.) | N | (feet) |                               |                                                                         |                                                         |
|                    |    |      |              |               |   | 25.0   | GLACIO-<br>FLUVIAL<br>DEPOSIT |                                                                         | Installed Groundwater<br>Monitoring Well in<br>Borehole |
|                    |    |      |              |               |   | 30.0   |                               |                                                                         |                                                         |
|                    |    |      |              |               |   | 35.0   |                               | Boring Log B-102 Terminated at Depth of 29.0 feet below ground surface. |                                                         |
|                    |    |      |              |               |   | 40.0   |                               |                                                                         |                                                         |
|                    |    |      |              |               |   | 45.0   |                               |                                                                         |                                                         |
|                    |    |      |              |               |   |        |                               |                                                                         |                                                         |
|                    |    |      |              |               |   |        |                               |                                                                         |                                                         |
|                    |    |      |              |               |   |        |                               |                                                                         |                                                         |
|                    |    |      |              |               |   |        |                               |                                                                         |                                                         |
|                    |    |      |              |               |   |        |                               |                                                                         |                                                         |
|                    |    |      |              |               |   |        |                               |                                                                         |                                                         |
|                    |    |      |              |               |   | 50.0   |                               |                                                                         |                                                         |



# RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-103/MW

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|                                                                                               |           |             |                     |  |                      |                                       |               |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |
|-----------------------------------------------------------------------------------------------|-----------|-------------|---------------------|--|----------------------|---------------------------------------|---------------|------------------------|------------------------------------------------------------|-------------------------------------------------------------------------|--|--------------------------------------------------------------|--|----------------|---------------------------------------------------|
| <b>Project:</b> Proposed Residential Development                                              |           |             |                     |  |                      | <b>WAI Project No.:</b> GM2118635.000 |               |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |
| <b>Location:</b> 582 Kelley Boulevard Rear, North Attleborough, Bristol County, Massachusetts |           |             |                     |  |                      | <b>Client:</b> MP Properties III, LLC |               |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |
| <b>Surface Elevation:</b> ± 199.0 feet above NAVD88                                           |           |             |                     |  |                      | <b>Date Started:</b> 8/1/2024         |               |                        | <b>Water Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |                                                                         |  | <b>Cave-In Depth   Elevation</b><br>(feet bgs)   (ft NAVD88) |  |                |                                                   |
| <b>Termination Depth:</b> 19.0 feet bgs                                                       |           |             |                     |  |                      | <b>Date Completed:</b> 8/1/2024       |               |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |
| <b>Proposed Location:</b> Stormwater Area                                                     |           |             |                     |  |                      | <b>Logged By:</b> TG                  |               |                        | <b>During:</b> --   --                                     |                                                                         |  | <b>At Completion:</b> --   --                                |  |                |                                                   |
| <b>Drill / Test Method:</b> 4" FWC & Roller Bit                                               |           |             |                     |  |                      | <b>Contractor:</b> GL                 |               |                        | <b>At Completion:</b> --   --                              |                                                                         |  | <b>At Completion:</b> --   --                                |  |                |                                                   |
| <b>SPT (Autohammer)</b>                                                                       |           |             |                     |  |                      | <b>Equipment:</b> CME 55              |               |                        | <b>24 Hours:</b> 17.5   --                                 |                                                                         |  | <b>24 Hours:</b> --   --                                     |  |                |                                                   |
| <b>SAMPLE INFORMATION</b>                                                                     |           |             |                     |  |                      | <b>DEPTH</b>                          | <b>STRATA</b> |                        | <b>DESCRIPTION OF MATERIALS</b><br>(Classification)        |                                                                         |  |                                                              |  | <b>REMARKS</b> |                                                   |
| <b>Depth</b><br>(feet)                                                                        | <b>No</b> | <b>Type</b> | <b>Blows Per 6"</b> |  | <b>Rec.</b><br>(in.) | <b>N</b>                              | <b>(feet)</b> |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |
|                                                                                               |           |             |                     |  |                      |                                       | 0.0           | TS                     |                                                            | 5" Topsoil                                                              |  |                                                              |  |                |                                                   |
| 0 - 2                                                                                         | S-1       |             | 9 - 21 - 18 - 23    |  | 16                   | 39                                    |               |                        |                                                            | Brown, Medium Dense, Silty Sand with Gravel (FILL)                      |  |                                                              |  |                | Cobbles and boulders throughout boring            |
| 2 - 2.9                                                                                       | S-2       |             | 72 - 45/5"          |  | 7                    | -                                     |               | FILL                   |                                                            | As Above (FILL)                                                         |  |                                                              |  |                |                                                   |
|                                                                                               |           |             |                     |  |                      |                                       | 4.0           |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |
| 4 - 6                                                                                         | S-3       |             | 26 - 39 - 60 - 58   |  | 18                   | 99                                    | 5.0           |                        |                                                            | Brown, Very Dense, Poorly Graded Sand with Silt and Gravel (SP-SM)      |  |                                                              |  |                |                                                   |
|                                                                                               |           |             |                     |  |                      |                                       | 10.0          | GLACIO-FLUVIAL DEPOSIT |                                                            |                                                                         |  |                                                              |  |                |                                                   |
|                                                                                               |           |             |                     |  |                      |                                       | 15.0          |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |
|                                                                                               |           |             |                     |  |                      |                                       |               |                        |                                                            |                                                                         |  |                                                              |  |                | Installed Groundwater Monitoring Well in Borehole |
|                                                                                               |           |             |                     |  |                      |                                       | 20.0          |                        |                                                            | Boring Log B-103 Terminated at Depth of 19.0 feet below ground surface. |  |                                                              |  |                |                                                   |
|                                                                                               |           |             |                     |  |                      |                                       | 25.0          |                        |                                                            |                                                                         |  |                                                              |  |                |                                                   |

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched



## **APPENDIX B**

### **Supplemental Information (USCS, Terms & Symbols)**

## UNIFIED SOIL CLASSIFICATION SYSTEM

### SOIL CLASSIFICATION CHART

| MAJOR DIVISIONS                                                     |                                                                 |                                                             | LETTER SYMBOL                                  | TYPICAL DESCRIPTIONS                                                                                               |
|---------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| COARSE GRAINED SOILS                                                | GRAVEL AND GRAVELLY SOILS                                       | CLEAN GRAVELS (LITTLE OR NO FINES)                          | GW                                             | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES                                                      |
|                                                                     | MORE THAN 50% OF COARSE FRACTION <u>RETAINED</u> ON NO. 4 SIEVE | GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)            | GP                                             | POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES                                                    |
|                                                                     |                                                                 | CLEAN SAND (LITTLE OR NO FINES)                             | GM                                             | SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES                                                                           |
|                                                                     | SAND AND SANDY SOILS                                            | MORE THAN 50% OF COARSE FRACTION <u>PASSING</u> NO. 4 SIEVE | SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES) | GC                                                                                                                 |
| CLEAN SAND (LITTLE OR NO FINES)                                     |                                                                 |                                                             | SW                                             | WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES                                                              |
| MORE THAN 50% OF MATERIAL IS <u>LARGER</u> THAN NO. 200 SIEVE SIZE  | MORE THAN 50% OF COARSE FRACTION <u>PASSING</u> NO. 4 SIEVE     | SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)              | SP                                             | POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES                                                            |
|                                                                     |                                                                 | CLEAN SAND (LITTLE OR NO FINES)                             | SM                                             | SILTY SANDS, SAND-SILT MIXTURES                                                                                    |
| FINE GRAINED SOILS                                                  | SILTS AND CLAYS                                                 | LIQUID LIMITS <u>LESS</u> THAN 50                           | SC                                             | CLAYEY SANDS, SAND-CLAY MIXTURES                                                                                   |
|                                                                     |                                                                 | LIQUID LIMITS <u>GREATER</u> THAN 50                        | ML                                             | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| MORE THAN 50% OF MATERIAL IS <u>SMALLER</u> THAN NO. 200 SIEVE SIZE | SILTS AND CLAYS                                                 | LIQUID LIMITS <u>GREATER</u> THAN 50                        | CL                                             | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS                  |
|                                                                     |                                                                 | LIQUID LIMITS <u>LESS</u> THAN 50                           | OL                                             | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY                                                            |
| HIGHLY ORGANIC SOILS                                                | SILTS AND CLAYS                                                 | LIQUID LIMITS <u>GREATER</u> THAN 50                        | MH                                             | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS                                                |
|                                                                     |                                                                 | LIQUID LIMITS <u>LESS</u> THAN 50                           | CH                                             | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS                                                                      |
| HIGHLY ORGANIC SOILS                                                | SILTS AND CLAYS                                                 | LIQUID LIMITS <u>GREATER</u> THAN 50                        | OH                                             | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS                                                          |
|                                                                     |                                                                 | LIQUID LIMITS <u>LESS</u> THAN 50                           | PT                                             | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS                                                                |

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

#### GRADATION\*

##### % FINER BY WEIGHT

TRACE..... 1% TO 10%  
LITTLE..... 10% TO 20%  
SOME..... 20% TO 35%  
AND..... 35% TO 50%

#### COMPACTNESS\*

##### Sand and/or Gravel

##### RELATIVE DENSITY

LOOSE..... 0% TO 40%  
MEDIUM DENSE..... 40% TO 70%  
DENSE..... 70% TO 90%  
VERY DENSE..... 90% TO 100%

#### CONSISTENCY\*

##### Clay and/or Silt

##### RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT

VERY SOFT..... LESS THAN 250  
SOFT..... 250 TO 500  
MEDIUM..... 500 TO 1000  
STIFF..... 1000 TO 2000  
VERY STIFF..... 2000 TO 4000  
HARD..... GREATER THAN 4000

\* VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE.  
WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.

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#### Other Office Locations:

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TAMPA, FL  
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*Environmental & Geotechnical Engineers & Consultants*

## GEOTECHNICAL TERMS AND SYMBOLS

### SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

### SOIL PROPERTY SYMBOLS

- N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.  
 Qu: Unconfined compressive strength, TSF.  
 Qp: Penetrometer value, unconfined compressive strength, TSF.  
 Mc: Moisture content, %.  
 LL: Liquid limit, %.  
 PI: Plasticity index, %.  
 δd: Natural dry density, PCF.  
 ▽: Apparent groundwater level at time noted after completion of boring.

### DRILLING AND SAMPLING SYMBOLS

- NE: Not Encountered (Groundwater was not encountered).  
 SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.  
 ST: Shelby Tube - 3" O.D., except where noted.  
 AU: Auger Sample.  
 OB: Diamond Bit.  
 CB: Carbide Bit  
 WS: Washed Sample.

### RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

| <u>Term (Non-Cohesive Soils)</u> | <u>Standard Penetration Resistance</u> |
|----------------------------------|----------------------------------------|
| Very Loose                       | 0-4                                    |
| Loose                            | 4-10                                   |
| Medium Dense                     | 10-30                                  |
| Dense                            | 30-50                                  |
| Very Dense                       | Over 50                                |

| <u>Term (Cohesive Soils)</u> | <u>Qu (TSF)</u> |
|------------------------------|-----------------|
| Very Soft                    | 0 - 0.25        |
| Soft                         | 0.25 - 0.50     |
| Firm (Medium)                | 0.50 - 1.00     |
| Stiff                        | 1.00 - 2.00     |
| Very Stiff                   | 2.00 - 4.00     |
| Hard                         | 4.00+           |

### PARTICLE SIZE

|          |             |             |               |      |                 |
|----------|-------------|-------------|---------------|------|-----------------|
| Boulders | 8 in.+      | Coarse Sand | 5mm-0.6mm     | Silt | 0.074mm-0.005mm |
| Cobbles  | 8 in.-3 in. | Medium Sand | 0.6mm-0.2mm   | Clay | -0.005mm        |
| Gravel   | 3 in.-5mm   | Fine Sand   | 0.2mm-0.074mm |      |                 |

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## **APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS**

- EXISTING CONDITIONS DRAINAGE MAP
- EXISTING CONDITIONS HYDROCAD COMPUTATIONS



# LEGEND

- WATERSHED BOUNDARY
- TIME OF CONCENTRATION
- DESIGN POINT
- SUBCATCHMENT

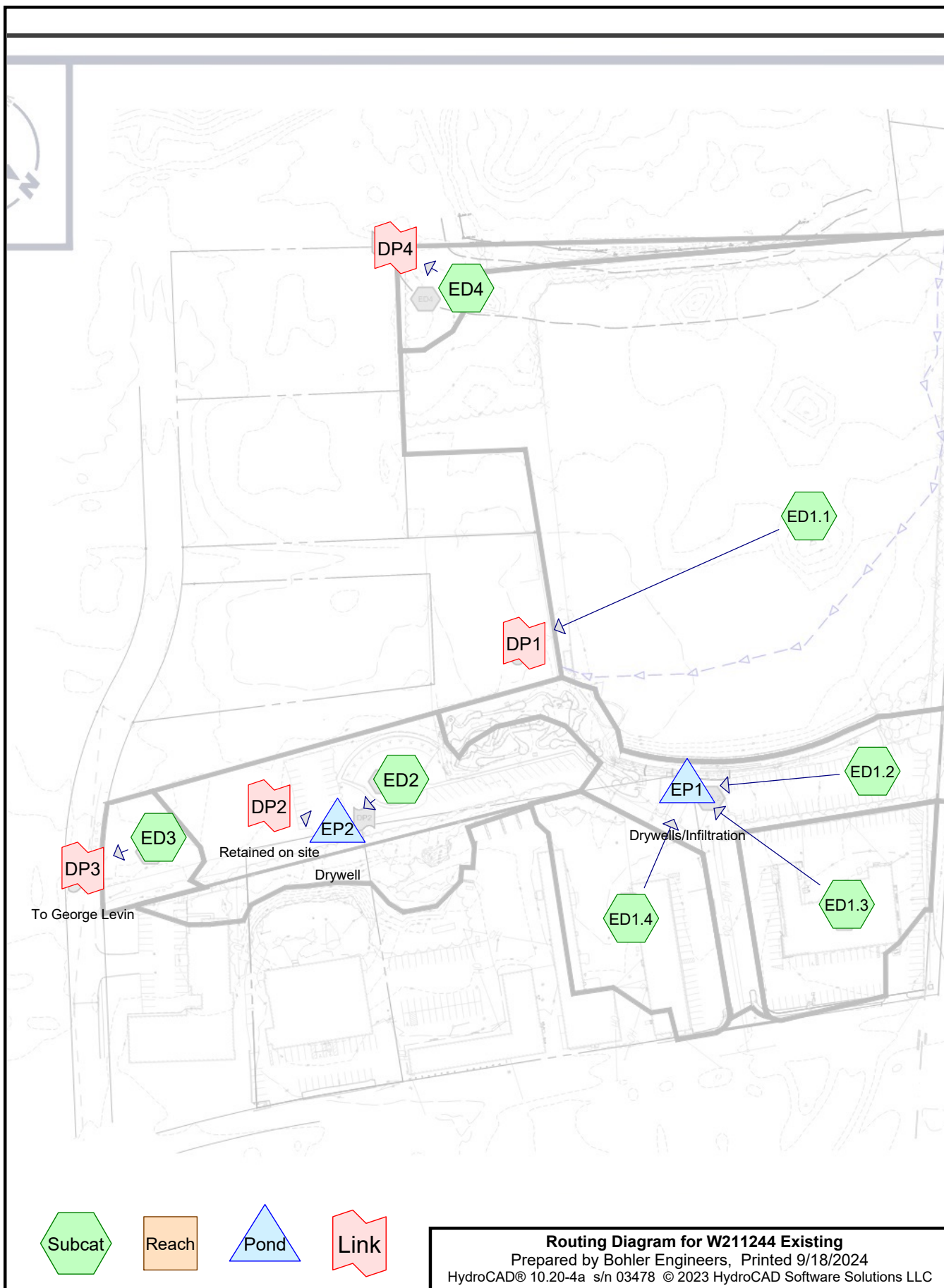
## EXISTING CONDITIONS WATERSHED MAP

582 KELLEY BOULEVARD,  
NORTH ATTELBOROUGH, MA

PREPARED BY

**BOHLER //**

SCALE: 1"=150'  
DATE: 9/17/2024



## W211244 Existing

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### Area Listing (all nodes)

| Area<br>(acres) | CN        | Description<br>(subcatchment-numbers)                                     |
|-----------------|-----------|---------------------------------------------------------------------------|
| 11.237          | 39        | >75% Grass cover, Good, HSG A (ED1.1, ED1.2, ED1.3, ED1.4, ED2, ED3, ED4) |
| 0.795           | 96        | Gravel surface, HSG A (ED1.2, ED1.4, ED2)                                 |
| 4.289           | 98        | Paved parking, HSG A (ED1.1, ED1.2, ED1.3, ED1.4, ED2, ED3, ED4)          |
| 1.055           | 98        | Roofs, HSG A (ED1.1, ED1.2, ED1.3, ED1.4)                                 |
| 1.363           | 30        | Woods, Good, HSG A (ED1.1, ED4)                                           |
| <b>18.739</b>   | <b>58</b> | <b>TOTAL AREA</b>                                                         |

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### Soil Listing (all nodes)

| Area<br>(acres) | Soil<br>Group | Subcatchment<br>Numbers                   |
|-----------------|---------------|-------------------------------------------|
| 18.739          | HSG A         | ED1.1, ED1.2, ED1.3, ED1.4, ED2, ED3, ED4 |
| 0.000           | HSG B         |                                           |
| 0.000           | HSG C         |                                           |
| 0.000           | HSG D         |                                           |
| 0.000           | Other         |                                           |
| <b>18.739</b>   |               | <b>TOTAL AREA</b>                         |

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

|                                        |                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentED1.1:</b>              | Runoff Area=10.885 ac 8.57% Impervious Runoff Depth=0.28"<br>Flow Length=970' Tc=44.0 min CN=WQ Runoff=1.47 cfs 0.250 af |
| <b>SubcatchmentED1.2:</b>              | Runoff Area=2.054 ac 69.28% Impervious Runoff Depth=2.37"<br>Tc=6.0 min CN=WQ Runoff=5.09 cfs 0.405 af                   |
| <b>SubcatchmentED1.3:</b>              | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=2.94"<br>Tc=6.0 min CN=WQ Runoff=4.07 cfs 0.325 af                   |
| <b>SubcatchmentED1.4:</b>              | Runoff Area=1.271 ac 54.62% Impervious Runoff Depth=2.92"<br>Tc=6.0 min CN=WQ Runoff=3.94 cfs 0.309 af                   |
| <b>SubcatchmentED2:</b>                | Runoff Area=2.272 ac 42.76% Impervious Runoff Depth=1.57"<br>Tc=6.0 min CN=WQ Runoff=3.73 cfs 0.297 af                   |
| <b>SubcatchmentED3:</b>                | Runoff Area=0.379 ac 15.37% Impervious Runoff Depth=0.49"<br>Tc=6.0 min CN=WQ Runoff=0.19 cfs 0.015 af                   |
| <b>SubcatchmentED4:</b>                | Runoff Area=0.554 ac 5.69% Impervious Runoff Depth=0.18"<br>Tc=6.0 min CN=WQ Runoff=0.10 cfs 0.008 af                    |
| <b>Pond EP1: Drywells/Infiltration</b> | Inflow=13.10 cfs 1.040 af<br>Primary=13.10 cfs 1.040 af                                                                  |
| <b>Pond EP2: Drywell</b>               | Inflow=3.73 cfs 0.297 af<br>Primary=3.73 cfs 0.297 af                                                                    |
| <b>Link DP1:</b>                       | Inflow=1.47 cfs 0.250 af<br>Primary=1.47 cfs 0.250 af                                                                    |
| <b>Link DP2: Retained on site</b>      | Inflow=3.73 cfs 0.297 af<br>Primary=3.73 cfs 0.297 af                                                                    |
| <b>Link DP3: To George Levin</b>       | Inflow=0.19 cfs 0.015 af<br>Primary=0.19 cfs 0.015 af                                                                    |
| <b>Link DP4:</b>                       | Inflow=0.10 cfs 0.008 af<br>Primary=0.10 cfs 0.008 af                                                                    |

**Total Runoff Area = 18.739 ac Runoff Volume = 1.610 af Average Runoff Depth = 1.03"**  
**71.48% Pervious = 13.395 ac 28.52% Impervious = 5.344 ac**

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Type III 24-hr 2-Year Rainfall=3.40"

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**Summary for Subcatchment ED1.1:**

Runoff = 1.47 cfs @ 12.57 hrs, Volume= 0.250 af, Depth= 0.28"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 9.068     | 39 | >75% Grass cover, Good, HSG A |
| 0.586     | 98 | Paved parking, HSG A          |
| 0.347     | 98 | Roofs, HSG A                  |
| 0.884     | 30 | Woods, Good, HSG A            |
| 10.885    |    | Weighted Average              |
| 9.952     |    | 91.43% Pervious Area          |
| 0.933     |    | 8.57% Impervious Area         |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                                              |
|----------|---------------|---------------|-------------------|----------------|--------------------------------------------------------------------------|
| 8.5      | 20            | 0.0300        | 0.04              |                | <b>Sheet Flow, A-B</b><br>Woods: Dense underbrush n= 0.800 P2= 3.40"     |
| 4.5      | 30            | 0.0300        | 0.11              |                | <b>Sheet Flow, B-C</b><br>Grass: Dense n= 0.240 P2= 3.40"                |
| 31.0     | 920           | 0.0050        | 0.49              |                | <b>Shallow Concentrated Flow, B-C</b><br>Short Grass Pasture Kv= 7.0 fps |
| 44.0     | 970           | Total         |                   |                |                                                                          |

**Summary for Subcatchment ED1.2:**

Runoff = 5.09 cfs @ 12.08 hrs, Volume= 0.405 af, Depth= 2.37"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.511     | 39 | >75% Grass cover, Good, HSG A |
| 0.120     | 96 | Gravel surface, HSG A         |
| 1.313     | 98 | Paved parking, HSG A          |
| 0.110     | 98 | Roofs, HSG A                  |
| 2.054     |    | Weighted Average              |
| 0.631     |    | 30.72% Pervious Area          |
| 1.423     |    | 69.28% Impervious Area        |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description          |
|----------|---------------|---------------|-------------------|----------------|----------------------|
| 6.0      |               |               |                   |                | <b>Direct Entry,</b> |

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Type III 24-hr 2-Year Rainfall=3.40"

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**Summary for Subcatchment ED1.3:**

Runoff = 4.07 cfs @ 12.08 hrs, Volume= 0.325 af, Depth= 2.94"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED1.4:**

Runoff = 3.94 cfs @ 12.08 hrs, Volume= 0.309 af, Depth= 2.92"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.063     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.408     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.577     |    | 45.38% Pervious Area          |
| 0.694     |    | 54.62% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED2:**

Runoff = 3.73 cfs @ 12.08 hrs, Volume= 0.297 af, Depth= 1.57"  
 Routed to Pond EP2 : Drywell

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

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Type III 24-hr 2-Year Rainfall=3.40"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.138     | 39 | >75% Grass cover, Good, HSG A |
| 0.162     | 96 | Gravel surface, HSG A         |
| 0.971     | 98 | Paved parking, HSG A          |
| 2.272     |    | Weighted Average              |
| 1.300     |    | 57.24% Pervious Area          |
| 0.971     |    | 42.76% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED3:**

Runoff = 0.19 cfs @ 12.08 hrs, Volume= 0.015 af, Depth= 0.49"  
 Routed to Link DP3 : To George Levin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.321     | 39 | >75% Grass cover, Good, HSG A |
| 0.058     | 98 | Paved parking, HSG A          |
| 0.379     |    | Weighted Average              |
| 0.321     |    | 84.63% Pervious Area          |
| 0.058     |    | 15.37% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED4:**

Runoff = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 0.18"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.043     | 39 | >75% Grass cover, Good, HSG A |
| 0.032     | 98 | Paved parking, HSG A          |
| 0.479     | 30 | Woods, Good, HSG A            |
| 0.554     |    | Weighted Average              |
| 0.522     |    | 94.31% Pervious Area          |
| 0.032     |    | 5.69% Impervious Area         |

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Type III 24-hr 2-Year Rainfall=3.40"

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Pond EP1: Drywells/Infiltration**

Inflow Area = 4.650 ac, 72.04% Impervious, Inflow Depth = 2.68" for 2-Year event  
 Inflow = 13.10 cfs @ 12.08 hrs, Volume= 1.040 af  
 Primary = 13.10 cfs @ 12.08 hrs, Volume= 1.040 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Pond EP2: Drywell**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 1.57" for 2-Year event  
 Inflow = 3.73 cfs @ 12.08 hrs, Volume= 0.297 af  
 Primary = 3.73 cfs @ 12.08 hrs, Volume= 0.297 af, Atten= 0%, Lag= 0.0 min  
 Routed to Link DP2 : Retained on site

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

**Summary for Link DP1:**

Inflow Area = 10.885 ac, 8.57% Impervious, Inflow Depth = 0.28" for 2-Year event  
 Inflow = 1.47 cfs @ 12.57 hrs, Volume= 0.250 af  
 Primary = 1.47 cfs @ 12.57 hrs, Volume= 0.250 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP2: Retained on site**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 1.57" for 2-Year event  
 Inflow = 3.73 cfs @ 12.08 hrs, Volume= 0.297 af  
 Primary = 3.73 cfs @ 12.08 hrs, Volume= 0.297 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP3: To George Levin**

Inflow Area = 0.379 ac, 15.37% Impervious, Inflow Depth = 0.49" for 2-Year event  
 Inflow = 0.19 cfs @ 12.08 hrs, Volume= 0.015 af  
 Primary = 0.19 cfs @ 12.08 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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*Type III 24-hr 2-Year Rainfall=3.40"*

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**Summary for Link DP4:**

Inflow Area = 0.554 ac, 5.69% Impervious, Inflow Depth = 0.18" for 2-Year event  
Inflow = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af  
Primary = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 10-Year Rainfall=5.19"

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

|                                        |                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentED1.1:</b>              | Runoff Area=10.885 ac 8.57% Impervious Runoff Depth=0.63"<br>Flow Length=970' Tc=44.0 min CN=WQ Runoff=2.35 cfs 0.567 af |
| <b>SubcatchmentED1.2:</b>              | Runoff Area=2.054 ac 69.28% Impervious Runoff Depth=3.77"<br>Tc=6.0 min CN=WQ Runoff=7.83 cfs 0.645 af                   |
| <b>SubcatchmentED1.3:</b>              | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=4.62"<br>Tc=6.0 min CN=WQ Runoff=6.26 cfs 0.511 af                   |
| <b>SubcatchmentED1.4:</b>              | Runoff Area=1.271 ac 54.62% Impervious Runoff Depth=4.63"<br>Tc=6.0 min CN=WQ Runoff=6.10 cfs 0.490 af                   |
| <b>SubcatchmentED2:</b>                | Runoff Area=2.272 ac 42.76% Impervious Runoff Depth=2.57"<br>Tc=6.0 min CN=WQ Runoff=5.74 cfs 0.487 af                   |
| <b>SubcatchmentED3:</b>                | Runoff Area=0.379 ac 15.37% Impervious Runoff Depth=0.96"<br>Tc=6.0 min CN=WQ Runoff=0.30 cfs 0.030 af                   |
| <b>SubcatchmentED4:</b>                | Runoff Area=0.554 ac 5.69% Impervious Runoff Depth=0.31"<br>Tc=6.0 min CN=WQ Runoff=0.16 cfs 0.014 af                    |
| <b>Pond EP1: Drywells/Infiltration</b> | Inflow=20.18 cfs 1.645 af<br>Primary=20.18 cfs 1.645 af                                                                  |
| <b>Pond EP2: Drywell</b>               | Inflow=5.74 cfs 0.487 af<br>Primary=5.74 cfs 0.487 af                                                                    |
| <b>Link DP1:</b>                       | Inflow=2.35 cfs 0.567 af<br>Primary=2.35 cfs 0.567 af                                                                    |
| <b>Link DP2: Retained on site</b>      | Inflow=5.74 cfs 0.487 af<br>Primary=5.74 cfs 0.487 af                                                                    |
| <b>Link DP3: To George Levin</b>       | Inflow=0.30 cfs 0.030 af<br>Primary=0.30 cfs 0.030 af                                                                    |
| <b>Link DP4:</b>                       | Inflow=0.16 cfs 0.014 af<br>Primary=0.16 cfs 0.014 af                                                                    |

**Total Runoff Area = 18.739 ac Runoff Volume = 2.745 af Average Runoff Depth = 1.76"**  
**71.48% Pervious = 13.395 ac 28.52% Impervious = 5.344 ac**

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Type III 24-hr 10-Year Rainfall=5.19"

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**Summary for Subcatchment ED1.1:**

Runoff = 2.35 cfs @ 12.61 hrs, Volume= 0.567 af, Depth= 0.63"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 9.068     | 39 | >75% Grass cover, Good, HSG A |
| 0.586     | 98 | Paved parking, HSG A          |
| 0.347     | 98 | Roofs, HSG A                  |
| 0.884     | 30 | Woods, Good, HSG A            |
| 10.885    |    | Weighted Average              |
| 9.952     |    | 91.43% Pervious Area          |
| 0.933     |    | 8.57% Impervious Area         |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                                              |
|----------|---------------|---------------|-------------------|----------------|--------------------------------------------------------------------------|
| 8.5      | 20            | 0.0300        | 0.04              |                | <b>Sheet Flow, A-B</b><br>Woods: Dense underbrush n= 0.800 P2= 3.40"     |
| 4.5      | 30            | 0.0300        | 0.11              |                | <b>Sheet Flow, B-C</b><br>Grass: Dense n= 0.240 P2= 3.40"                |
| 31.0     | 920           | 0.0050        | 0.49              |                | <b>Shallow Concentrated Flow, B-C</b><br>Short Grass Pasture Kv= 7.0 fps |
| 44.0     | 970           | Total         |                   |                |                                                                          |

**Summary for Subcatchment ED1.2:**

Runoff = 7.83 cfs @ 12.08 hrs, Volume= 0.645 af, Depth= 3.77"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.511     | 39 | >75% Grass cover, Good, HSG A |
| 0.120     | 96 | Gravel surface, HSG A         |
| 1.313     | 98 | Paved parking, HSG A          |
| 0.110     | 98 | Roofs, HSG A                  |
| 2.054     |    | Weighted Average              |
| 0.631     |    | 30.72% Pervious Area          |
| 1.423     |    | 69.28% Impervious Area        |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description          |
|----------|---------------|---------------|-------------------|----------------|----------------------|
| 6.0      |               |               |                   |                | <b>Direct Entry,</b> |

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Type III 24-hr 10-Year Rainfall=5.19"

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**Summary for Subcatchment ED1.3:**

Runoff = 6.26 cfs @ 12.08 hrs, Volume= 0.511 af, Depth= 4.62"

Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED1.4:**

Runoff = 6.10 cfs @ 12.08 hrs, Volume= 0.490 af, Depth= 4.63"

Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.063     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.408     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.577     |    | 45.38% Pervious Area          |
| 0.694     |    | 54.62% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED2:**

Runoff = 5.74 cfs @ 12.08 hrs, Volume= 0.487 af, Depth= 2.57"

Routed to Pond EP2 : Drywell

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Type III 24-hr 10-Year Rainfall=5.19"

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Type III 24-hr 10-Year Rainfall=5.19"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.138     | 39 | >75% Grass cover, Good, HSG A |
| 0.162     | 96 | Gravel surface, HSG A         |
| 0.971     | 98 | Paved parking, HSG A          |
| 2.272     |    | Weighted Average              |
| 1.300     |    | 57.24% Pervious Area          |
| 0.971     |    | 42.76% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED3:**

Runoff = 0.30 cfs @ 12.08 hrs, Volume= 0.030 af, Depth= 0.96"  
 Routed to Link DP3 : To George Levin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.321     | 39 | >75% Grass cover, Good, HSG A |
| 0.058     | 98 | Paved parking, HSG A          |
| 0.379     |    | Weighted Average              |
| 0.321     |    | 84.63% Pervious Area          |
| 0.058     |    | 15.37% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED4:**

Runoff = 0.16 cfs @ 12.08 hrs, Volume= 0.014 af, Depth= 0.31"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.043     | 39 | >75% Grass cover, Good, HSG A |
| 0.032     | 98 | Paved parking, HSG A          |
| 0.479     | 30 | Woods, Good, HSG A            |
| 0.554     |    | Weighted Average              |
| 0.522     |    | 94.31% Pervious Area          |
| 0.032     |    | 5.69% Impervious Area         |

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Type III 24-hr 10-Year Rainfall=5.19"

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Pond EP1: Drywells/Infiltration**

Inflow Area = 4.650 ac, 72.04% Impervious, Inflow Depth = 4.25" for 10-Year event  
 Inflow = 20.18 cfs @ 12.08 hrs, Volume= 1.645 af  
 Primary = 20.18 cfs @ 12.08 hrs, Volume= 1.645 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Pond EP2: Drywell**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 2.57" for 10-Year event  
 Inflow = 5.74 cfs @ 12.08 hrs, Volume= 0.487 af  
 Primary = 5.74 cfs @ 12.08 hrs, Volume= 0.487 af, Atten= 0%, Lag= 0.0 min  
 Routed to Link DP2 : Retained on site

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

**Summary for Link DP1:**

Inflow Area = 10.885 ac, 8.57% Impervious, Inflow Depth = 0.63" for 10-Year event  
 Inflow = 2.35 cfs @ 12.61 hrs, Volume= 0.567 af  
 Primary = 2.35 cfs @ 12.61 hrs, Volume= 0.567 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP2: Retained on site**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 2.57" for 10-Year event  
 Inflow = 5.74 cfs @ 12.08 hrs, Volume= 0.487 af  
 Primary = 5.74 cfs @ 12.08 hrs, Volume= 0.487 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP3: To George Levin**

Inflow Area = 0.379 ac, 15.37% Impervious, Inflow Depth = 0.96" for 10-Year event  
 Inflow = 0.30 cfs @ 12.08 hrs, Volume= 0.030 af  
 Primary = 0.30 cfs @ 12.08 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**W211244 Existing***Type III 24-hr 10-Year Rainfall=5.19"*

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**Summary for Link DP4:**

Inflow Area = 0.554 ac, 5.69% Impervious, Inflow Depth = 0.31" for 10-Year event  
Inflow = 0.16 cfs @ 12.08 hrs, Volume= 0.014 af  
Primary = 0.16 cfs @ 12.08 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 25-Year Rainfall=6.31"

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

|                                        |                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentED1.1:</b>              | Runoff Area=10.885 ac 8.57% Impervious Runoff Depth=0.98"<br>Flow Length=970' Tc=44.0 min CN=WQ Runoff=3.74 cfs 0.887 af |
| <b>SubcatchmentED1.2:</b>              | Runoff Area=2.054 ac 69.28% Impervious Runoff Depth=4.68"<br>Tc=6.0 min CN=WQ Runoff=9.57 cfs 0.801 af                   |
| <b>SubcatchmentED1.3:</b>              | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=5.68"<br>Tc=6.0 min CN=WQ Runoff=7.63 cfs 0.628 af                   |
| <b>SubcatchmentED1.4:</b>              | Runoff Area=1.271 ac 54.62% Impervious Runoff Depth=5.70"<br>Tc=6.0 min CN=WQ Runoff=7.44 cfs 0.604 af                   |
| <b>SubcatchmentED2:</b>                | Runoff Area=2.272 ac 42.76% Impervious Runoff Depth=3.28"<br>Tc=6.0 min CN=WQ Runoff=7.09 cfs 0.621 af                   |
| <b>SubcatchmentED3:</b>                | Runoff Area=0.379 ac 15.37% Impervious Runoff Depth=1.39"<br>Tc=6.0 min CN=WQ Runoff=0.39 cfs 0.044 af                   |
| <b>SubcatchmentED4:</b>                | Runoff Area=0.554 ac 5.69% Impervious Runoff Depth=0.48"<br>Tc=6.0 min CN=WQ Runoff=0.20 cfs 0.022 af                    |
| <b>Pond EP1: Drywells/Infiltration</b> | Inflow=24.65 cfs 2.033 af<br>Primary=24.65 cfs 2.033 af                                                                  |
| <b>Pond EP2: Drywell</b>               | Inflow=7.09 cfs 0.621 af<br>Primary=7.09 cfs 0.621 af                                                                    |
| <b>Link DP1:</b>                       | Inflow=3.74 cfs 0.887 af<br>Primary=3.74 cfs 0.887 af                                                                    |
| <b>Link DP2: Retained on site</b>      | Inflow=7.09 cfs 0.621 af<br>Primary=7.09 cfs 0.621 af                                                                    |
| <b>Link DP3: To George Levin</b>       | Inflow=0.39 cfs 0.044 af<br>Primary=0.39 cfs 0.044 af                                                                    |
| <b>Link DP4:</b>                       | Inflow=0.20 cfs 0.022 af<br>Primary=0.20 cfs 0.022 af                                                                    |

**Total Runoff Area = 18.739 ac Runoff Volume = 3.607 af Average Runoff Depth = 2.31"**  
**71.48% Pervious = 13.395 ac 28.52% Impervious = 5.344 ac**

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Type III 24-hr 25-Year Rainfall=6.31"

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**Summary for Subcatchment ED1.1:**

Runoff = 3.74 cfs @ 12.67 hrs, Volume= 0.887 af, Depth= 0.98"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 9.068     | 39 | >75% Grass cover, Good, HSG A |
| 0.586     | 98 | Paved parking, HSG A          |
| 0.347     | 98 | Roofs, HSG A                  |
| 0.884     | 30 | Woods, Good, HSG A            |
| 10.885    |    | Weighted Average              |
| 9.952     |    | 91.43% Pervious Area          |
| 0.933     |    | 8.57% Impervious Area         |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                                              |
|----------|---------------|---------------|-------------------|----------------|--------------------------------------------------------------------------|
| 8.5      | 20            | 0.0300        | 0.04              |                | <b>Sheet Flow, A-B</b><br>Woods: Dense underbrush n= 0.800 P2= 3.40"     |
| 4.5      | 30            | 0.0300        | 0.11              |                | <b>Sheet Flow, B-C</b><br>Grass: Dense n= 0.240 P2= 3.40"                |
| 31.0     | 920           | 0.0050        | 0.49              |                | <b>Shallow Concentrated Flow, B-C</b><br>Short Grass Pasture Kv= 7.0 fps |
| 44.0     | 970           | Total         |                   |                |                                                                          |

**Summary for Subcatchment ED1.2:**

Runoff = 9.57 cfs @ 12.08 hrs, Volume= 0.801 af, Depth= 4.68"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.511     | 39 | >75% Grass cover, Good, HSG A |
| 0.120     | 96 | Gravel surface, HSG A         |
| 1.313     | 98 | Paved parking, HSG A          |
| 0.110     | 98 | Roofs, HSG A                  |
| 2.054     |    | Weighted Average              |
| 0.631     |    | 30.72% Pervious Area          |
| 1.423     |    | 69.28% Impervious Area        |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description          |
|----------|---------------|---------------|-------------------|----------------|----------------------|
| 6.0      |               |               |                   |                | <b>Direct Entry,</b> |

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Type III 24-hr 25-Year Rainfall=6.31"

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**Summary for Subcatchment ED1.3:**

Runoff = 7.63 cfs @ 12.08 hrs, Volume= 0.628 af, Depth= 5.68"

Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED1.4:**

Runoff = 7.44 cfs @ 12.08 hrs, Volume= 0.604 af, Depth= 5.70"

Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.063     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.408     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.577     |    | 45.38% Pervious Area          |
| 0.694     |    | 54.62% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED2:**

Runoff = 7.09 cfs @ 12.09 hrs, Volume= 0.621 af, Depth= 3.28"

Routed to Pond EP2 : Drywell

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Type III 24-hr 25-Year Rainfall=6.31"

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Type III 24-hr 25-Year Rainfall=6.31"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.138     | 39 | >75% Grass cover, Good, HSG A |
| 0.162     | 96 | Gravel surface, HSG A         |
| 0.971     | 98 | Paved parking, HSG A          |
| 2.272     |    | Weighted Average              |
| 1.300     |    | 57.24% Pervious Area          |
| 0.971     |    | 42.76% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED3:**

Runoff = 0.39 cfs @ 12.10 hrs, Volume= 0.044 af, Depth= 1.39"  
 Routed to Link DP3 : To George Levin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.321     | 39 | >75% Grass cover, Good, HSG A |
| 0.058     | 98 | Paved parking, HSG A          |
| 0.379     |    | Weighted Average              |
| 0.321     |    | 84.63% Pervious Area          |
| 0.058     |    | 15.37% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED4:**

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 0.022 af, Depth= 0.48"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.043     | 39 | >75% Grass cover, Good, HSG A |
| 0.032     | 98 | Paved parking, HSG A          |
| 0.479     | 30 | Woods, Good, HSG A            |
| 0.554     |    | Weighted Average              |
| 0.522     |    | 94.31% Pervious Area          |
| 0.032     |    | 5.69% Impervious Area         |

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Type III 24-hr 25-Year Rainfall=6.31"

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Pond EP1: Drywells/Infiltration**

Inflow Area = 4.650 ac, 72.04% Impervious, Inflow Depth = 5.25" for 25-Year event  
 Inflow = 24.65 cfs @ 12.08 hrs, Volume= 2.033 af  
 Primary = 24.65 cfs @ 12.08 hrs, Volume= 2.033 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Pond EP2: Drywell**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 3.28" for 25-Year event  
 Inflow = 7.09 cfs @ 12.09 hrs, Volume= 0.621 af  
 Primary = 7.09 cfs @ 12.09 hrs, Volume= 0.621 af, Atten= 0%, Lag= 0.0 min  
 Routed to Link DP2 : Retained on site

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

**Summary for Link DP1:**

Inflow Area = 10.885 ac, 8.57% Impervious, Inflow Depth = 0.98" for 25-Year event  
 Inflow = 3.74 cfs @ 12.67 hrs, Volume= 0.887 af  
 Primary = 3.74 cfs @ 12.67 hrs, Volume= 0.887 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP2: Retained on site**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 3.28" for 25-Year event  
 Inflow = 7.09 cfs @ 12.09 hrs, Volume= 0.621 af  
 Primary = 7.09 cfs @ 12.09 hrs, Volume= 0.621 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP3: To George Levin**

Inflow Area = 0.379 ac, 15.37% Impervious, Inflow Depth = 1.39" for 25-Year event  
 Inflow = 0.39 cfs @ 12.10 hrs, Volume= 0.044 af  
 Primary = 0.39 cfs @ 12.10 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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*Type III 24-hr 25-Year Rainfall=6.31"*

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**Summary for Link DP4:**

Inflow Area = 0.554 ac, 5.69% Impervious, Inflow Depth = 0.48" for 25-Year event  
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 0.022 af  
Primary = 0.20 cfs @ 12.09 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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

|                                        |                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentED1.1:</b>              | Runoff Area=10.885 ac 8.57% Impervious Runoff Depth=1.68"<br>Flow Length=970' Tc=44.0 min CN=WQ Runoff=7.37 cfs 1.521 af |
| <b>SubcatchmentED1.2:</b>              | Runoff Area=2.054 ac 69.28% Impervious Runoff Depth=6.13"<br>Tc=6.0 min CN=WQ Runoff=12.57 cfs 1.049 af                  |
| <b>SubcatchmentED1.3:</b>              | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=7.33"<br>Tc=6.0 min CN=WQ Runoff=9.79 cfs 0.809 af                   |
| <b>SubcatchmentED1.4:</b>              | Runoff Area=1.271 ac 54.62% Impervious Runoff Depth=7.37"<br>Tc=6.0 min CN=WQ Runoff=9.54 cfs 0.780 af                   |
| <b>SubcatchmentED2:</b>                | Runoff Area=2.272 ac 42.76% Impervious Runoff Depth=4.46"<br>Tc=6.0 min CN=WQ Runoff=9.85 cfs 0.843 af                   |
| <b>SubcatchmentED3:</b>                | Runoff Area=0.379 ac 15.37% Impervious Runoff Depth=2.19"<br>Tc=6.0 min CN=WQ Runoff=0.73 cfs 0.069 af                   |
| <b>SubcatchmentED4:</b>                | Runoff Area=0.554 ac 5.69% Impervious Runoff Depth=0.90"<br>Tc=6.0 min CN=WQ Runoff=0.28 cfs 0.042 af                    |
| <b>Pond EP1: Drywells/Infiltration</b> | Inflow=31.90 cfs 2.638 af<br>Primary=31.90 cfs 2.638 af                                                                  |
| <b>Pond EP2: Drywell</b>               | Inflow=9.85 cfs 0.843 af<br>Primary=9.85 cfs 0.843 af                                                                    |
| <b>Link DP1:</b>                       | Inflow=7.37 cfs 1.521 af<br>Primary=7.37 cfs 1.521 af                                                                    |
| <b>Link DP2: Retained on site</b>      | Inflow=9.85 cfs 0.843 af<br>Primary=9.85 cfs 0.843 af                                                                    |
| <b>Link DP3: To George Levin</b>       | Inflow=0.73 cfs 0.069 af<br>Primary=0.73 cfs 0.069 af                                                                    |
| <b>Link DP4:</b>                       | Inflow=0.28 cfs 0.042 af<br>Primary=0.28 cfs 0.042 af                                                                    |

**Total Runoff Area = 18.739 ac Runoff Volume = 5.113 af Average Runoff Depth = 3.27"**  
**71.48% Pervious = 13.395 ac 28.52% Impervious = 5.344 ac**

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Type III 24-hr 100-Year Rainfall=8.03"

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**Summary for Subcatchment ED1.1:**

Runoff = 7.37 cfs @ 12.67 hrs, Volume= 1.521 af, Depth= 1.68"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 9.068     | 39 | >75% Grass cover, Good, HSG A |
| 0.586     | 98 | Paved parking, HSG A          |
| 0.347     | 98 | Roofs, HSG A                  |
| 0.884     | 30 | Woods, Good, HSG A            |
| 10.885    |    | Weighted Average              |
| 9.952     |    | 91.43% Pervious Area          |
| 0.933     |    | 8.57% Impervious Area         |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                                              |
|----------|---------------|---------------|-------------------|----------------|--------------------------------------------------------------------------|
| 8.5      | 20            | 0.0300        | 0.04              |                | <b>Sheet Flow, A-B</b><br>Woods: Dense underbrush n= 0.800 P2= 3.40"     |
| 4.5      | 30            | 0.0300        | 0.11              |                | <b>Sheet Flow, B-C</b><br>Grass: Dense n= 0.240 P2= 3.40"                |
| 31.0     | 920           | 0.0050        | 0.49              |                | <b>Shallow Concentrated Flow, B-C</b><br>Short Grass Pasture Kv= 7.0 fps |
| 44.0     | 970           | Total         |                   |                |                                                                          |

**Summary for Subcatchment ED1.2:**

Runoff = 12.57 cfs @ 12.08 hrs, Volume= 1.049 af, Depth= 6.13"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.511     | 39 | >75% Grass cover, Good, HSG A |
| 0.120     | 96 | Gravel surface, HSG A         |
| 1.313     | 98 | Paved parking, HSG A          |
| 0.110     | 98 | Roofs, HSG A                  |
| 2.054     |    | Weighted Average              |
| 0.631     |    | 30.72% Pervious Area          |
| 1.423     |    | 69.28% Impervious Area        |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description          |
|----------|---------------|---------------|-------------------|----------------|----------------------|
| 6.0      |               |               |                   |                | <b>Direct Entry,</b> |

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**Summary for Subcatchment ED1.3:**

Runoff = 9.79 cfs @ 12.08 hrs, Volume= 0.809 af, Depth= 7.33"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED1.4:**

Runoff = 9.54 cfs @ 12.08 hrs, Volume= 0.780 af, Depth= 7.37"  
 Routed to Pond EP1 : Drywells/Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.063     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.408     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.577     |    | 45.38% Pervious Area          |
| 0.694     |    | 54.62% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment ED2:**

Runoff = 9.85 cfs @ 12.09 hrs, Volume= 0.843 af, Depth= 4.46"  
 Routed to Pond EP2 : Drywell

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

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Type III 24-hr 100-Year Rainfall=8.03"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.138     | 39 | >75% Grass cover, Good, HSG A |
| 0.162     | 96 | Gravel surface, HSG A         |
| 0.971     | 98 | Paved parking, HSG A          |
| 2.272     |    | Weighted Average              |
| 1.300     |    | 57.24% Pervious Area          |
| 0.971     |    | 42.76% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED3:**

Runoff = 0.73 cfs @ 12.10 hrs, Volume= 0.069 af, Depth= 2.19"  
 Routed to Link DP3 : To George Levin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.321     | 39 | >75% Grass cover, Good, HSG A |
| 0.058     | 98 | Paved parking, HSG A          |
| 0.379     |    | Weighted Average              |
| 0.321     |    | 84.63% Pervious Area          |
| 0.058     |    | 15.37% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment ED4:**

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 0.042 af, Depth= 0.90"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.043     | 39 | >75% Grass cover, Good, HSG A |
| 0.032     | 98 | Paved parking, HSG A          |
| 0.479     | 30 | Woods, Good, HSG A            |
| 0.554     |    | Weighted Average              |
| 0.522     |    | 94.31% Pervious Area          |
| 0.032     |    | 5.69% Impervious Area         |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Pond EP1: Drywells/Infiltration**

Inflow Area = 4.650 ac, 72.04% Impervious, Inflow Depth = 6.81" for 100-Year event  
 Inflow = 31.90 cfs @ 12.08 hrs, Volume= 2.638 af  
 Primary = 31.90 cfs @ 12.08 hrs, Volume= 2.638 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Pond EP2: Drywell**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 4.46" for 100-Year event  
 Inflow = 9.85 cfs @ 12.09 hrs, Volume= 0.843 af  
 Primary = 9.85 cfs @ 12.09 hrs, Volume= 0.843 af, Atten= 0%, Lag= 0.0 min  
 Routed to Link DP2 : Retained on site

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

**Summary for Link DP1:**

Inflow Area = 10.885 ac, 8.57% Impervious, Inflow Depth = 1.68" for 100-Year event  
 Inflow = 7.37 cfs @ 12.67 hrs, Volume= 1.521 af  
 Primary = 7.37 cfs @ 12.67 hrs, Volume= 1.521 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP2: Retained on site**

Inflow Area = 2.272 ac, 42.76% Impervious, Inflow Depth = 4.46" for 100-Year event  
 Inflow = 9.85 cfs @ 12.09 hrs, Volume= 0.843 af  
 Primary = 9.85 cfs @ 12.09 hrs, Volume= 0.843 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP3: To George Levin**

Inflow Area = 0.379 ac, 15.37% Impervious, Inflow Depth = 2.19" for 100-Year event  
 Inflow = 0.73 cfs @ 12.10 hrs, Volume= 0.069 af  
 Primary = 0.73 cfs @ 12.10 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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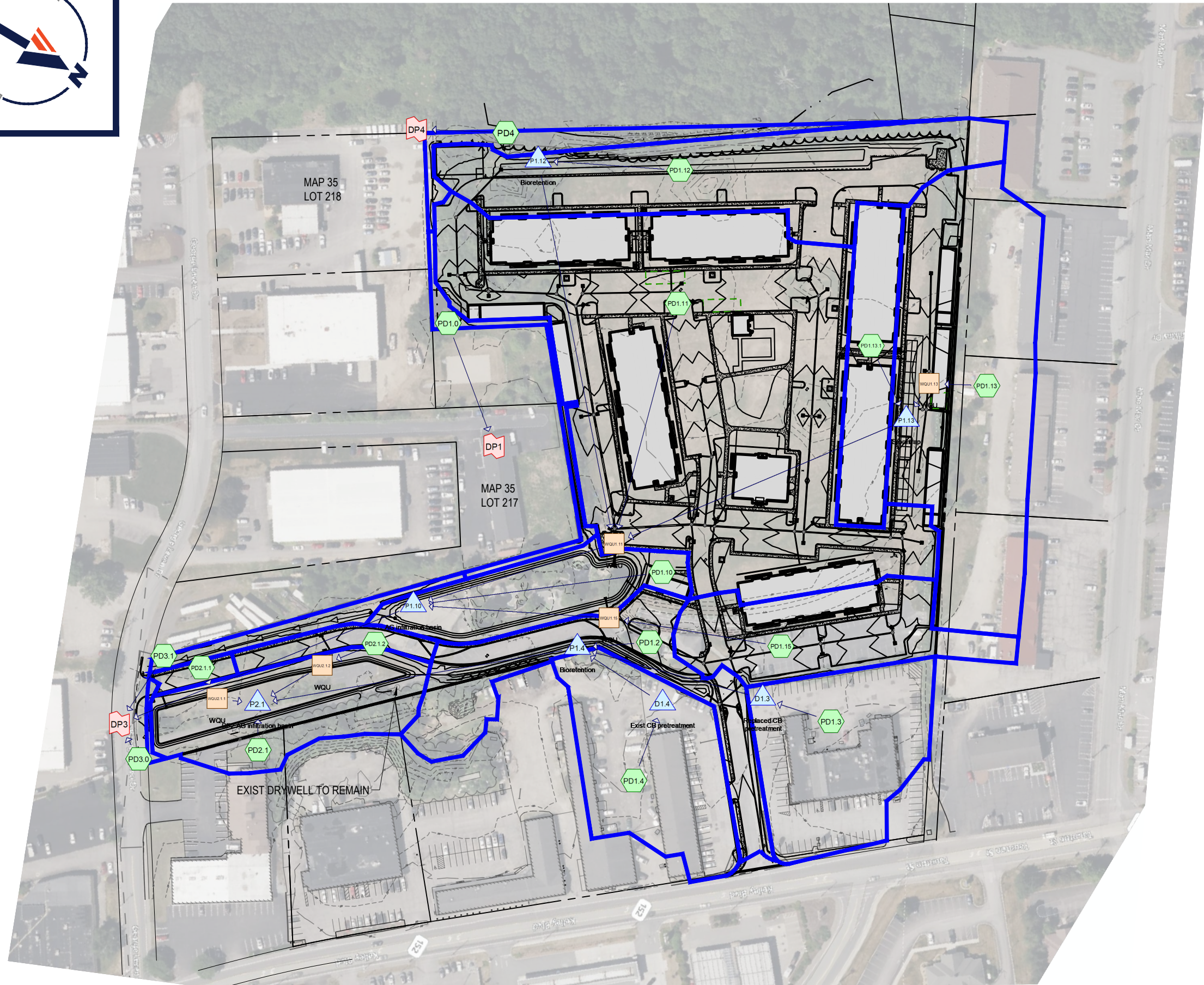
**Summary for Link DP4:**

Inflow Area = 0.554 ac, 5.69% Impervious, Inflow Depth = 0.90" for 100-Year event  
Inflow = 0.28 cfs @ 12.09 hrs, Volume= 0.042 af  
Primary = 0.28 cfs @ 12.09 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

## **APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS**

- PROPOSED CONDITIONS DRAINAGE MAP
- PROPOSED CONDITIONS HYDROCAD CALCULATIONS



## LEGEND

|                                                                                     |                       |                                                                                     |              |
|-------------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------|--------------|
|  | WATERSHED<br>BOUNDARY |  | DESIGN POINT |
|  | WATER<br>QUALITY UNIT |  | SUBCATCHMENT |

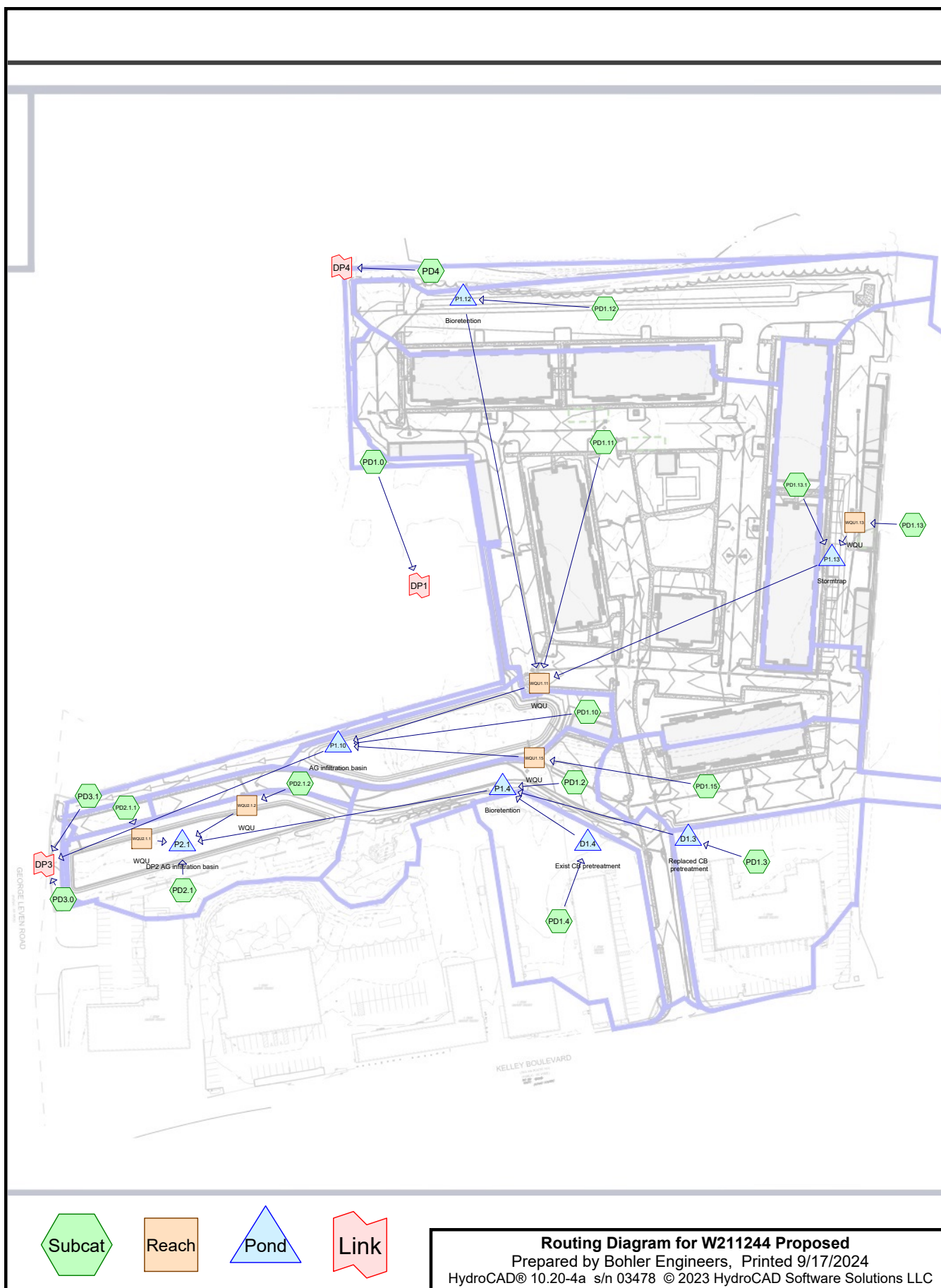
## PROPOSED CONDITIONS WATERSHED MAP

582 KELLEY BOULEVARD,  
NORTH ATTELBOROUGH, MA

PREPARED BY

**BOHLER //**

SCALE: 1"=150'  
DATE: 9/17/2024



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**Area Listing (all nodes)**

| Area<br>(acres) | CN        | Description<br>(subcatchment-numbers)                                                                                                                    |
|-----------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.838           | 39        | >75% Grass cover, Good, HSG A (PD1.0, PD1.10, PD1.11, PD1.12, PD1.13, PD1.13.1, PD1.15, PD1.2, PD1.3, PD1.4, PD2.1, PD2.1.1, PD2.1.2, PD3.0, PD3.1, PD4) |
| 0.572           | 96        | Gravel surface, HSG A (PD1.2, PD1.4)                                                                                                                     |
| 7.520           | 98        | Paved parking, HSG A (PD1.10, PD1.11, PD1.12, PD1.13, PD1.13.1, PD1.15, PD1.2, PD1.3, PD1.4, PD2.1, PD2.1.1, PD2.1.2, PD3.0, PD3.1)                      |
| 3.313           | 98        | Roofs, HSG A (PD1.0, PD1.10, PD1.11, PD1.12, PD1.13, PD1.13.1, PD1.15, PD1.3, PD1.4)                                                                     |
| 0.496           | 30        | Woods, Good, HSG A (PD1.12, PD4)                                                                                                                         |
| <b>18.740</b>   | <b>75</b> | <b>TOTAL AREA</b>                                                                                                                                        |

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**Soil Listing (all nodes)**

| Area<br>(acres) | Soil<br>Group | Subcatchment<br>Numbers                                                                                                     |
|-----------------|---------------|-----------------------------------------------------------------------------------------------------------------------------|
| 18.740          | HSG A         | PD1.0, PD1.10, PD1.11, PD1.12, PD1.13, PD1.13.1, PD1.15, PD1.2, PD1.3,<br>PD1.4, PD2.1, PD2.1.1, PD2.1.2, PD3.0, PD3.1, PD4 |
| 0.000           | HSG B         |                                                                                                                             |
| 0.000           | HSG C         |                                                                                                                             |
| 0.000           | HSG D         |                                                                                                                             |
| 0.000           | Other         |                                                                                                                             |
| <b>18.740</b>   |               | <b>TOTAL AREA</b>                                                                                                           |

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Type III 24-hr 2-Year Rainfall=3.40"

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

|                              |                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentPD1.0:</b>    | Runoff Area=0.189 ac 0.44% Impervious Runoff Depth=0.02"<br>Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.000 af   |
| <b>SubcatchmentPD1.10:</b>   | Runoff Area=0.826 ac 3.35% Impervious Runoff Depth=0.11"<br>Tc=6.0 min CN=WQ Runoff=0.09 cfs 0.008 af   |
| <b>SubcatchmentPD1.11:</b>   | Runoff Area=5.573 ac 74.07% Impervious Runoff Depth=2.35"<br>Tc=6.0 min CN=WQ Runoff=13.64 cfs 1.090 af |
| <b>SubcatchmentPD1.12:</b>   | Runoff Area=1.930 ac 41.19% Impervious Runoff Depth=1.31"<br>Tc=6.0 min CN=WQ Runoff=2.63 cfs 0.210 af  |
| <b>SubcatchmentPD1.13:</b>   | Runoff Area=2.676 ac 61.59% Impervious Runoff Depth=1.95"<br>Tc=6.0 min CN=WQ Runoff=5.45 cfs 0.435 af  |
| <b>SubcatchmentPD1.13.1:</b> | Runoff Area=0.720 ac 89.85% Impervious Runoff Depth=2.85"<br>Tc=6.0 min CN=WQ Runoff=2.14 cfs 0.171 af  |
| <b>SubcatchmentPD1.15:</b>   | Runoff Area=1.090 ac 72.34% Impervious Runoff Depth=2.29"<br>Tc=6.0 min CN=WQ Runoff=2.61 cfs 0.208 af  |
| <b>SubcatchmentPD1.2:</b>    | Runoff Area=1.159 ac 47.04% Impervious Runoff Depth=1.64"<br>Tc=6.0 min CN=WQ Runoff=1.99 cfs 0.158 af  |
| <b>SubcatchmentPD1.3:</b>    | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=2.95"<br>Tc=6.0 min CN=WQ Runoff=4.08 cfs 0.325 af  |
| <b>SubcatchmentPD1.4:</b>    | Runoff Area=1.271 ac 54.33% Impervious Runoff Depth=2.91"<br>Tc=6.0 min CN=WQ Runoff=3.93 cfs 0.308 af  |
| <b>SubcatchmentPD2.1:</b>    | Runoff Area=1.090 ac 4.39% Impervious Runoff Depth=0.14"<br>Tc=6.0 min CN=WQ Runoff=0.16 cfs 0.013 af   |
| <b>SubcatchmentPD2.1.1:</b>  | Runoff Area=0.091 ac 86.56% Impervious Runoff Depth=2.74"<br>Tc=6.0 min CN=WQ Runoff=0.26 cfs 0.021 af  |
| <b>SubcatchmentPD2.1.2:</b>  | Runoff Area=0.223 ac 88.12% Impervious Runoff Depth=2.79"<br>Tc=6.0 min CN=WQ Runoff=0.65 cfs 0.052 af  |
| <b>SubcatchmentPD3.0:</b>    | Runoff Area=0.025 ac 24.85% Impervious Runoff Depth=0.79"<br>Tc=6.0 min CN=WQ Runoff=0.02 cfs 0.002 af  |
| <b>SubcatchmentPD3.1:</b>    | Runoff Area=0.210 ac 0.00% Impervious Runoff Depth=0.00"<br>Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.000 af   |
| <b>SubcatchmentPD4:</b>      | Runoff Area=0.341 ac 0.00% Impervious Runoff Depth=0.00"<br>Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.000 af   |

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Type III 24-hr 2-Year Rainfall=3.40"

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|                                      |                                                                                                                                                  |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Reach WQU1.11: WQU                   | Inflow=14.14 cfs 1.300 af<br>Outflow=14.14 cfs 1.300 af                                                                                          |
| Reach WQU1.13: WQU                   | Inflow=5.45 cfs 0.435 af<br>Outflow=5.45 cfs 0.435 af                                                                                            |
| Reach WQU1.15: WQU                   | Inflow=2.61 cfs 0.208 af<br>Outflow=2.61 cfs 0.208 af                                                                                            |
| Reach WQU2.1.1: WQU                  | Inflow=0.26 cfs 0.021 af<br>Outflow=0.26 cfs 0.021 af                                                                                            |
| Reach WQU2.1.2: WQU                  | Inflow=0.65 cfs 0.052 af<br>Outflow=0.65 cfs 0.052 af                                                                                            |
| Pond D1.3: Replaced CB pretreatment  | Inflow=4.08 cfs 0.325 af<br>Primary=4.08 cfs 0.325 af                                                                                            |
| Pond D1.4: Exist CB pretreatment     | Inflow=3.93 cfs 0.308 af<br>Primary=3.93 cfs 0.308 af                                                                                            |
| Pond P1.10: AG infiltration basin    | Peak Elev=196.82' Storage=12,782 cf Inflow=16.84 cfs 1.516 af<br>Discarded=4.37 cfs 1.516 af Primary=0.00 cfs 0.000 af Outflow=4.37 cfs 1.516 af |
| Pond P1.12: Bioretention             | Peak Elev=201.66' Storage=3,016 cf Inflow=2.63 cfs 0.210 af<br>Outflow=0.64 cfs 0.210 af                                                         |
| Pond P1.13: Stormtrap                | Peak Elev=198.20' Storage=6,956 cf Inflow=7.59 cfs 0.606 af<br>Discarded=1.39 cfs 0.606 af Primary=0.00 cfs 0.000 af Outflow=1.39 cfs 0.606 af   |
| Pond P1.4: Bioretention              | Peak Elev=198.75' Storage=3,558 cf Inflow=9.99 cfs 0.792 af<br>Outflow=9.70 cfs 0.792 af                                                         |
| Pond P2.1: DP2 AG infiltration basin | Peak Elev=195.41' Storage=6,316 cf Inflow=10.74 cfs 0.878 af<br>Outflow=3.44 cfs 0.878 af                                                        |
| Link DP1:                            | Inflow=0.00 cfs 0.000 af<br>Primary=0.00 cfs 0.000 af                                                                                            |
| Link DP3:                            | Inflow=0.02 cfs 0.002 af<br>Primary=0.02 cfs 0.002 af                                                                                            |
| Link DP4:                            | Inflow=0.00 cfs 0.000 af<br>Primary=0.00 cfs 0.000 af                                                                                            |

Total Runoff Area = 18.740 ac Runoff Volume = 3.002 af Average Runoff Depth = 1.92"  
42.19% Pervious = 7.907 ac 57.81% Impervious = 10.833 ac

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Type III 24-hr 2-Year Rainfall=3.40"

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**Summary for Subcatchment PD1.0:**

Runoff = 0.00 cfs @ 12.08 hrs, Volume= 0.000 af, Depth= 0.02"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.188     | 39 | >75% Grass cover, Good, HSG A |
| 0.001     | 98 | Roofs, HSG A                  |
| 0.189     |    | Weighted Average              |
| 0.188     |    | 99.56% Pervious Area          |
| 0.001     |    | 0.44% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment PD1.10:**

Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 0.11"  
 Routed to Pond P1.10 : AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.798     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.028     | 98 | Roofs, HSG A                  |
| 0.826     |    | Weighted Average              |
| 0.798     |    | 96.65% Pervious Area          |
| 0.028     |    | 3.35% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment PD1.11:**

Runoff = 13.64 cfs @ 12.08 hrs, Volume= 1.090 af, Depth= 2.35"  
 Routed to Reach WQU1.11 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.445     | 39 | >75% Grass cover, Good, HSG A |
| 2.807     | 98 | Paved parking, HSG A          |
| 1.320     | 98 | Roofs, HSG A                  |
| 5.573     |    | Weighted Average              |
| 1.445     |    | 25.93% Pervious Area          |
| 4.128     |    | 74.07% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.12:**

Runoff = 2.63 cfs @ 12.08 hrs, Volume= 0.210 af, Depth= 1.31"  
 Routed to Pond P1.12 : Bioretention

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.916     | 39 | >75% Grass cover, Good, HSG A |
| 0.740     | 98 | Paved parking, HSG A          |
| 0.055     | 98 | Roofs, HSG A                  |
| 0.219     | 30 | Woods, Good, HSG A            |
| 1.930     |    | Weighted Average              |
| 1.135     |    | 58.81% Pervious Area          |
| 0.795     |    | 41.19% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13:**

Runoff = 5.45 cfs @ 12.08 hrs, Volume= 0.435 af, Depth= 1.95"  
 Routed to Reach WQU1.13 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.028     | 39 | >75% Grass cover, Good, HSG A |
| 1.143     | 98 | Paved parking, HSG A          |
| 0.506     | 98 | Roofs, HSG A                  |
| 2.676     |    | Weighted Average              |
| 1.028     |    | 38.41% Pervious Area          |
| 1.648     |    | 61.59% Impervious Area        |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13.1:**

Runoff = 2.14 cfs @ 12.08 hrs, Volume= 0.171 af, Depth= 2.85"  
 Routed to Pond P1.13 : Stormtrap

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.073     | 39 | >75% Grass cover, Good, HSG A |
| 0.023     | 98 | Paved parking, HSG A          |
| 0.624     | 98 | Roofs, HSG A                  |
| 0.720     |    | Weighted Average              |
| 0.073     |    | 10.15% Pervious Area          |
| 0.647     |    | 89.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.15:**

Runoff = 2.61 cfs @ 12.08 hrs, Volume= 0.208 af, Depth= 2.29"  
 Routed to Reach WQU1.15 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.302     | 39 | >75% Grass cover, Good, HSG A |
| 0.608     | 98 | Paved parking, HSG A          |
| 0.181     | 98 | Roofs, HSG A                  |
| 1.090     |    | Weighted Average              |
| 0.302     |    | 27.66% Pervious Area          |
| 0.789     |    | 72.34% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.2:**

Runoff = 1.99 cfs @ 12.08 hrs, Volume= 0.158 af, Depth= 1.64"  
 Routed to Pond P1.4 : Bioretention

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Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.555     | 39 | >75% Grass cover, Good, HSG A |
| 0.059     | 96 | Gravel surface, HSG A         |
| 0.545     | 98 | Paved parking, HSG A          |
| 1.159     |    | Weighted Average              |
| 0.614     |    | 52.96% Pervious Area          |
| 0.545     |    | 47.04% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.3:**

Runoff = 4.08 cfs @ 12.08 hrs, Volume= 0.325 af, Depth= 2.95"  
 Routed to Pond D1.3 : Replaced CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.4:**

Runoff = 3.93 cfs @ 12.08 hrs, Volume= 0.308 af, Depth= 2.91"  
 Routed to Pond D1.4 : Exist CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.066     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.405     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.580     |    | 45.67% Pervious Area          |
| 0.690     |    | 54.33% Impervious Area        |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1:**

Runoff = 0.16 cfs @ 12.08 hrs, Volume= 0.013 af, Depth= 0.14"  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.042     | 39 | >75% Grass cover, Good, HSG A |
| 0.048     | 98 | Paved parking, HSG A          |
| 1.090     |    | Weighted Average              |
| 1.042     |    | 95.61% Pervious Area          |
| 0.048     |    | 4.39% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.1:**

Runoff = 0.26 cfs @ 12.08 hrs, Volume= 0.021 af, Depth= 2.74"  
 Routed to Reach WQU2.1.1 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.012     | 39 | >75% Grass cover, Good, HSG A |
| 0.079     | 98 | Paved parking, HSG A          |
| 0.091     |    | Weighted Average              |
| 0.012     |    | 13.44% Pervious Area          |
| 0.079     |    | 86.56% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.2:**

Runoff = 0.65 cfs @ 12.08 hrs, Volume= 0.052 af, Depth= 2.79"  
 Routed to Reach WQU2.1.2 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.026     | 39 | >75% Grass cover, Good, HSG A |
| 0.196     | 98 | Paved parking, HSG A          |
| 0.223     |    | Weighted Average              |
| 0.026     |    | 11.88% Pervious Area          |
| 0.196     |    | 88.12% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.0:**

Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.002 af, Depth= 0.79"  
Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.019     | 39 | >75% Grass cover, Good, HSG A |
| 0.006     | 98 | Paved parking, HSG A          |
| 0.025     |    | Weighted Average              |
| 0.019     |    | 75.15% Pervious Area          |
| 0.006     |    | 24.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.1:**

Runoff = 0.00 cfs @ 23.42 hrs, Volume= 0.000 af, Depth= 0.00"  
Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.210     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.210     |    | Weighted Average              |
| 0.210     |    | 100.00% Pervious Area         |
| 0.000     |    | 0.00% Impervious Area         |

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Type III 24-hr 2-Year Rainfall=3.40"

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD4:**

Runoff = 0.00 cfs @ 23.42 hrs, Volume= 0.000 af, Depth= 0.00"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.40"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.064     | 39 | >75% Grass cover, Good, HSG A |
| 0.277     | 30 | Woods, Good, HSG A            |
| 0.341     |    | Weighted Average              |
| 0.341     |    | 100.00% Pervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Reach WQU1.11: WQU**

Inflow Area = 10.899 ac, 66.22% Impervious, Inflow Depth = 1.43" for 2-Year event  
 Inflow = 14.14 cfs @ 12.08 hrs, Volume= 1.300 af  
 Outflow = 14.14 cfs @ 12.08 hrs, Volume= 1.300 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU1.13: WQU**

Inflow Area = 2.676 ac, 61.59% Impervious, Inflow Depth = 1.95" for 2-Year event  
 Inflow = 5.45 cfs @ 12.08 hrs, Volume= 0.435 af  
 Outflow = 5.45 cfs @ 12.08 hrs, Volume= 0.435 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.13 : Stormtrap

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

**Summary for Reach WQU1.15: WQU**

Inflow Area = 1.090 ac, 72.34% Impervious, Inflow Depth = 2.29" for 2-Year event  
 Inflow = 2.61 cfs @ 12.08 hrs, Volume= 0.208 af  
 Outflow = 2.61 cfs @ 12.08 hrs, Volume= 0.208 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU2.1.1: WQU**

Inflow Area = 0.091 ac, 86.56% Impervious, Inflow Depth = 2.74" for 2-Year event  
Inflow = 0.26 cfs @ 12.08 hrs, Volume= 0.021 af  
Outflow = 0.26 cfs @ 12.08 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Reach WQU2.1.2: WQU**

Inflow Area = 0.223 ac, 88.12% Impervious, Inflow Depth = 2.79" for 2-Year event  
Inflow = 0.65 cfs @ 12.08 hrs, Volume= 0.052 af  
Outflow = 0.65 cfs @ 12.08 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Pond D1.3: Replaced CB pretreatment**

Inflow Area = 1.326 ac, 92.99% Impervious, Inflow Depth = 2.95" for 2-Year event  
Inflow = 4.08 cfs @ 12.08 hrs, Volume= 0.325 af  
Primary = 4.08 cfs @ 12.08 hrs, Volume= 0.325 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond D1.4: Exist CB pretreatment**

Inflow Area = 1.271 ac, 54.33% Impervious, Inflow Depth = 2.91" for 2-Year event  
Inflow = 3.93 cfs @ 12.08 hrs, Volume= 0.308 af  
Primary = 3.93 cfs @ 12.08 hrs, Volume= 0.308 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond P1.10: AG infiltration basin**

Inflow Area = 12.815 ac, 62.69% Impervious, Inflow Depth = 1.42" for 2-Year event  
Inflow = 16.84 cfs @ 12.08 hrs, Volume= 1.516 af  
Outflow = 4.37 cfs @ 12.48 hrs, Volume= 1.516 af, Atten= 74%, Lag= 23.6 min  
Discarded = 4.37 cfs @ 12.48 hrs, Volume= 1.516 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Routed to Link DP3 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Peak Elev= 196.82' @ 12.48 hrs Surf.Area= 18,708 sf Storage= 12,782 cf

Plug-Flow detention time= 15.8 min calculated for 1.516 af (100% of inflow)

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Center-of-Mass det. time= 15.8 min ( 783.3 - 767.4 )

| Volume | Invert  | Avail.Storage | Storage Description                                        |
|--------|---------|---------------|------------------------------------------------------------|
| #1     | 196.10' | 74,156 cf     | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 196.10              | 16,990               | 0                         | 0                         |
| 199.60              | 25,385               | 74,156                    | 74,156                    |

| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                                   |
|--------|-----------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary   | 198.60' | <b>10.0' long + 3.0 ' SideZ x 10.0' breadth Broad-Crested Rectangular Weir</b><br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |
| #2     | Discarded | 196.10' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'                                                                             |
| #3     | Primary   | 197.80' | <b>4.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads                                                                                                                              |

**Discarded OutFlow** Max=4.37 cfs @ 12.48 hrs HW=196.82' (Free Discharge)↑**2=Exfiltration** ( Controls 4.37 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=196.10' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)↑**3=Grate** ( Controls 0.00 cfs)**Summary for Pond P1.12: Bioretention**

Inflow Area = 1.930 ac, 41.19% Impervious, Inflow Depth = 1.31" for 2-Year event  
 Inflow = 2.63 cfs @ 12.08 hrs, Volume= 0.210 af  
 Outflow = 0.64 cfs @ 12.46 hrs, Volume= 0.210 af, Atten= 76%, Lag= 22.6 min  
 Primary = 0.64 cfs @ 12.46 hrs, Volume= 0.210 af  
 Routed to Reach WQU1.11 : WQU

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

Peak Elev= 201.66' @ 12.46 hrs Surf.Area= 6,093 sf Storage= 3,016 cf

Plug-Flow detention time= 85.0 min calculated for 0.210 af (100% of inflow)

Center-of-Mass det. time= 85.3 min ( 841.3 - 756.1 )

| Volume   | Invert  | Avail.Storage | Storage Description                                |
|----------|---------|---------------|----------------------------------------------------|
| #1       | 202.00' | 6,142 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2       | 200.01' | 3,638 cf      | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|          |         |               | 12,125 cf Overall x 30.0% Voids                    |
| 9,780 cf |         |               | Total Available Storage                            |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 202.00              | 6,093                | 0                         | 0                         |
| 202.80              | 9,263                | 6,142                     | 6,142                     |

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| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 200.01              | 6,093                | 0                         | 0                         |
| 202.00              | 6,093                | 12,125                    | 12,125                    |

| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                     |
|--------|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary  | 199.80' | <b>15.0" Round Culvert</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 199.80' / 199.75' S= 0.0050 '/' Cc= 0.900<br>n= 0.012, Flow Area= 1.23 sf    |
| #2     | Device 1 | 202.30' | <b>36.0" Horiz. Rim</b> C= 0.600 Limited to weir flow at low heads                                                                                                                 |
| #3     | Device 1 | 200.00' | <b>6.0" Round Underdrain</b><br>L= 100.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 200.00' / 199.80' S= 0.0020 '/' Cc= 0.900<br>n= 0.012, Flow Area= 0.20 sf |
| #4     | Device 3 | 200.01' | <b>0.500 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 200.00' Phase-In= 0.01'                                                               |

**Primary OutFlow** Max=0.64 cfs @ 12.46 hrs HW=201.66' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.64 cfs of 6.14 cfs potential flow)  
 2=Rim ( Controls 0.00 cfs)  
 3=Underdrain (Barrel Controls 0.64 cfs @ 3.26 fps)  
 4=Exfiltration (Passes 0.64 cfs of 11.71 cfs potential flow)

**Summary for Pond P1.13: Stormtrap**

Inflow Area = 3.396 ac, 67.58% Impervious, Inflow Depth = 2.14" for 2-Year event  
 Inflow = 7.59 cfs @ 12.08 hrs, Volume= 0.606 af  
 Outflow = 1.39 cfs @ 12.53 hrs, Volume= 0.606 af, Atten= 82%, Lag= 26.5 min  
 Discarded = 1.39 cfs @ 12.53 hrs, Volume= 0.606 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach WQU1.11 : WQU

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 198.20' @ 12.53 hrs Surf.Area= 7,860 sf Storage= 6,956 cf

Plug-Flow detention time= 29.5 min calculated for 0.606 af (100% of inflow)  
 Center-of-Mass det. time= 29.5 min ( 785.0 - 755.5 )

| Volume | Invert  | Avail.Storage | Storage Description                                                                                                                                                                                                                                                      |
|--------|---------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1A    | 197.20' | 0 cf          | <b>30.27'W x 259.65'L x 4.00'H Field A</b><br>31,439 cf Overall - 31,439 cf Embedded = 0 cf x 40.0% Voids                                                                                                                                                                |
| #2A    | 197.20' | 24,340 cf     | <b>StormTrap ST2 SingleTrap 3-6 x 32</b> Inside #1<br>Inside= 101.7"W x 42.0"H => 26.77 sf x 15.40'L = 412.1 cf<br>Outside= 101.7"W x 48.0"H => 33.92 sf x 15.40'L = 522.2 cf<br>32 Chambers in 2 Rows<br>16.96' x 246.33' Core + 6.66' Border = 30.27' x 259.65' System |
|        |         | 24,340 cf     | Total Available Storage                                                                                                                                                                                                                                                  |

Storage Group A created with Chamber Wizard

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| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                  |
|--------|-----------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 197.20' | <b>5.750 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 194.20' Phase-In= 0.01'                                                            |
| #2     | Primary   | 198.60' | <b>12.0" Round Culvert</b><br>L= 29.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 198.60' / 198.42' S= 0.0062 ' / Cc= 0.900<br>n= 0.012, Flow Area= 0.79 sf |
| #3     | Device 2  | 200.50' | <b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)                                                                                                            |

**Discarded OutFlow** Max=1.39 cfs @ 12.53 hrs HW=198.20' (Free Discharge)↑**1=Exfiltration** ( Controls 1.39 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** ( Controls 0.00 cfs)↑**3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)**Summary for Pond P1.4: Bioretention**

Inflow Area = 3.756 ac, 65.73% Impervious, Inflow Depth = 2.53" for 2-Year event  
 Inflow = 9.99 cfs @ 12.08 hrs, Volume= 0.792 af  
 Outflow = 9.70 cfs @ 12.10 hrs, Volume= 0.792 af, Atten= 3%, Lag= 1.2 min  
 Primary = 9.70 cfs @ 12.10 hrs, Volume= 0.792 af  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 198.75' @ 12.10 hrs Surf.Area= 4,212 sf Storage= 3,558 cf

Plug-Flow detention time= 111.9 min calculated for 0.792 af (100% of inflow)  
 Center-of-Mass det. time= 112.1 min ( 870.4 - 758.4 )

| Volume | Invert  | Avail.Storage | Storage Description                                |
|--------|---------|---------------|----------------------------------------------------|
| #1     | 197.30' | 3,952 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2     | 195.30' | 510 cf        | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|        |         |               | 1,700 cf Overall x 30.0% Voids                     |
|        |         | 4,462 cf      | Total Available Storage                            |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 197.30              | 850                  | 0                         | 0                         |
| 199.00              | 3,800                | 3,952                     | 3,952                     |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 195.30              | 850                  | 0                         | 0                         |
| 197.30              | 850                  | 1,700                     | 1,700                     |

| Device | Routing | Invert  | Outlet Devices                                                                                                                                                                    |
|--------|---------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary | 195.30' | <b>4.0" Round Underdrain</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 195.30' / 195.00' S= 0.0300 ' / Cc= 0.900<br>n= 0.012, Flow Area= 0.09 sf |

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Type III 24-hr 2-Year Rainfall=3.40"

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#2 Device 1 195.30' **0.500 in/hr Exfiltration over Surface area**  
 Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'  
 #3 Primary 198.40' **18.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir**  
 Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00  
 2.50 3.00 3.50 4.00 4.50 5.00 5.50  
 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66  
 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

**Primary OutFlow** Max=9.68 cfs @ 12.10 hrs HW=198.75' TW=195.21' (Dynamic Tailwater)

↑ **1=Underdrain** (Passes 0.07 cfs of 0.76 cfs potential flow)

↑ **2=Exfiltration** ( Controls 0.07 cfs)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 9.61 cfs @ 1.46 fps)

**Summary for Pond P2.1: DP2 AG infiltration basin**

Inflow Area = 5.159 ac, 54.11% Impervious, Inflow Depth = 2.04" for 2-Year event  
 Inflow = 10.74 cfs @ 12.10 hrs, Volume= 0.878 af  
 Outflow = 3.44 cfs @ 12.41 hrs, Volume= 0.878 af, Atten= 68%, Lag= 18.7 min  
 Discarded = 3.44 cfs @ 12.41 hrs, Volume= 0.878 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 195.41' @ 12.41 hrs Surf.Area= 15,868 sf Storage= 6,316 cf

Plug-Flow detention time= 8.9 min calculated for 0.878 af (100% of inflow)  
 Center-of-Mass det. time= 8.9 min ( 868.4 - 859.5 )

| Volume              | Invert               | Avail.Storage             | Storage Description                                        |
|---------------------|----------------------|---------------------------|------------------------------------------------------------|
| #1                  | 195.00'              | 34,616 cf                 | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |
| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet)                                  |
| 195.00              | 14,863               | 0                         | 0                                                          |
| 197.00              | 19,753               | 34,616                    | 34,616                                                     |

| Device | Routing   | Invert  | Outlet Devices                                                                                                       |
|--------|-----------|---------|----------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 195.00' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 192.00' Phase-In= 0.01' |

**Discarded OutFlow** Max=3.44 cfs @ 12.41 hrs HW=195.41' (Free Discharge)

↑ **1=Exfiltration** ( Controls 3.44 cfs)

**Summary for Link DP1:**

Inflow Area = 0.189 ac, 0.44% Impervious, Inflow Depth = 0.02" for 2-Year event  
 Inflow = 0.00 cfs @ 12.08 hrs, Volume= 0.000 af  
 Primary = 0.00 cfs @ 12.08 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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*Type III 24-hr 2-Year Rainfall=3.40"*

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**Summary for Link DP3:**

Inflow Area = 13.051 ac, 61.61% Impervious, Inflow Depth = 0.00" for 2-Year event  
Inflow = 0.02 cfs @ 12.08 hrs, Volume= 0.002 af  
Primary = 0.02 cfs @ 12.08 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP4:**

Inflow Area = 0.341 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event  
Inflow = 0.00 cfs @ 23.42 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 23.42 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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Type III 24-hr 10-Year Rainfall=5.19"

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

|                              |                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentPD1.0:</b>    | Runoff Area=0.189 ac 0.44% Impervious Runoff Depth=0.26"<br>Tc=6.0 min CN=WQ Runoff=0.01 cfs 0.004 af   |
| <b>SubcatchmentPD1.10:</b>   | Runoff Area=0.826 ac 3.35% Impervious Runoff Depth=0.40"<br>Tc=6.0 min CN=WQ Runoff=0.14 cfs 0.027 af   |
| <b>SubcatchmentPD1.11:</b>   | Runoff Area=5.573 ac 74.07% Impervious Runoff Depth=3.73"<br>Tc=6.0 min CN=WQ Runoff=20.97 cfs 1.733 af |
| <b>SubcatchmentPD1.12:</b>   | Runoff Area=1.930 ac 41.19% Impervious Runoff Depth=2.16"<br>Tc=6.0 min CN=WQ Runoff=4.04 cfs 0.347 af  |
| <b>SubcatchmentPD1.13:</b>   | Runoff Area=2.676 ac 61.59% Impervious Runoff Depth=3.14"<br>Tc=6.0 min CN=WQ Runoff=8.37 cfs 0.701 af  |
| <b>SubcatchmentPD1.13.1:</b> | Runoff Area=0.720 ac 89.85% Impervious Runoff Depth=4.47"<br>Tc=6.0 min CN=WQ Runoff=3.29 cfs 0.268 af  |
| <b>SubcatchmentPD1.15:</b>   | Runoff Area=1.090 ac 72.34% Impervious Runoff Depth=3.65"<br>Tc=6.0 min CN=WQ Runoff=4.01 cfs 0.332 af  |
| <b>SubcatchmentPD1.2:</b>    | Runoff Area=1.159 ac 47.04% Impervious Runoff Depth=2.68"<br>Tc=6.0 min CN=WQ Runoff=3.06 cfs 0.259 af  |
| <b>SubcatchmentPD1.3:</b>    | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=4.62"<br>Tc=6.0 min CN=WQ Runoff=6.26 cfs 0.511 af  |
| <b>SubcatchmentPD1.4:</b>    | Runoff Area=1.271 ac 54.33% Impervious Runoff Depth=4.61"<br>Tc=6.0 min CN=WQ Runoff=6.08 cfs 0.488 af  |
| <b>SubcatchmentPD2.1:</b>    | Runoff Area=1.090 ac 4.39% Impervious Runoff Depth=0.45"<br>Tc=6.0 min CN=WQ Runoff=0.24 cfs 0.041 af   |
| <b>SubcatchmentPD2.1.1:</b>  | Runoff Area=0.091 ac 86.56% Impervious Runoff Depth=4.32"<br>Tc=6.0 min CN=WQ Runoff=0.40 cfs 0.033 af  |
| <b>SubcatchmentPD2.1.2:</b>  | Runoff Area=0.223 ac 88.12% Impervious Runoff Depth=4.39"<br>Tc=6.0 min CN=WQ Runoff=1.00 cfs 0.081 af  |
| <b>SubcatchmentPD3.0:</b>    | Runoff Area=0.025 ac 24.85% Impervious Runoff Depth=1.41"<br>Tc=6.0 min CN=WQ Runoff=0.03 cfs 0.003 af  |
| <b>SubcatchmentPD3.1:</b>    | Runoff Area=0.210 ac 0.00% Impervious Runoff Depth=0.24"<br>Tc=6.0 min CN=WQ Runoff=0.01 cfs 0.004 af   |
| <b>SubcatchmentPD4:</b>      | Runoff Area=0.341 ac 0.00% Impervious Runoff Depth=0.05"<br>Tc=6.0 min CN=WQ Runoff=0.00 cfs 0.002 af   |

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|                                      |                                                                                                                                                  |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Reach WQU1.11: WQU                   | Inflow=21.62 cfs 2.079 af<br>Outflow=21.62 cfs 2.079 af                                                                                          |
| Reach WQU1.13: WQU                   | Inflow=8.37 cfs 0.701 af<br>Outflow=8.37 cfs 0.701 af                                                                                            |
| Reach WQU1.15: WQU                   | Inflow=4.01 cfs 0.332 af<br>Outflow=4.01 cfs 0.332 af                                                                                            |
| Reach WQU2.1.1: WQU                  | Inflow=0.40 cfs 0.033 af<br>Outflow=0.40 cfs 0.033 af                                                                                            |
| Reach WQU2.1.2: WQU                  | Inflow=1.00 cfs 0.081 af<br>Outflow=1.00 cfs 0.081 af                                                                                            |
| Pond D1.3: Replaced CB pretreatment  | Inflow=6.26 cfs 0.511 af<br>Primary=6.26 cfs 0.511 af                                                                                            |
| Pond D1.4: Exist CB pretreatment     | Inflow=6.08 cfs 0.488 af<br>Primary=6.08 cfs 0.488 af                                                                                            |
| Pond P1.10: AG infiltration basin    | Peak Elev=197.41' Storage=24,234 cf Inflow=25.77 cfs 2.438 af<br>Discarded=5.33 cfs 2.438 af Primary=0.00 cfs 0.000 af Outflow=5.33 cfs 2.438 af |
| Pond P1.12: Bioretention             | Peak Elev=202.20' Storage=4,968 cf Inflow=4.04 cfs 0.347 af<br>Outflow=0.76 cfs 0.347 af                                                         |
| Pond P1.13: Stormtrap                | Peak Elev=199.03' Storage=12,692 cf Inflow=11.66 cfs 0.969 af<br>Discarded=1.68 cfs 0.969 af Primary=0.00 cfs 0.000 af Outflow=1.68 cfs 0.969 af |
| Pond P1.4: Bioretention              | Peak Elev=198.85' Storage=3,921 cf Inflow=15.40 cfs 1.258 af<br>Outflow=15.06 cfs 1.258 af                                                       |
| Pond P2.1: DP2 AG infiltration basin | Peak Elev=195.84' Storage=13,346 cf Inflow=16.66 cfs 1.413 af<br>Outflow=4.08 cfs 1.413 af                                                       |
| Link DP1:                            | Inflow=0.01 cfs 0.004 af<br>Primary=0.01 cfs 0.004 af                                                                                            |
| Link DP3:                            | Inflow=0.03 cfs 0.007 af<br>Primary=0.03 cfs 0.007 af                                                                                            |
| Link DP4:                            | Inflow=0.00 cfs 0.002 af<br>Primary=0.00 cfs 0.002 af                                                                                            |

Total Runoff Area = 18.740 ac Runoff Volume = 4.834 af Average Runoff Depth = 3.10"  
42.19% Pervious = 7.907 ac 57.81% Impervious = 10.833 ac

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**Summary for Subcatchment PD1.0:**

Runoff = 0.01 cfs @ 12.43 hrs, Volume= 0.004 af, Depth= 0.26"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.188     | 39 | >75% Grass cover, Good, HSG A |
| 0.001     | 98 | Roofs, HSG A                  |
| 0.189     |    | Weighted Average              |
| 0.188     |    | 99.56% Pervious Area          |
| 0.001     |    | 0.44% Impervious Area         |

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

**Summary for Subcatchment PD1.10:**

Runoff = 0.14 cfs @ 12.08 hrs, Volume= 0.027 af, Depth= 0.40"  
 Routed to Pond P1.10 : AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.798     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.028     | 98 | Roofs, HSG A                  |
| 0.826     |    | Weighted Average              |
| 0.798     |    | 96.65% Pervious Area          |
| 0.028     |    | 3.35% Impervious Area         |

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

**Summary for Subcatchment PD1.11:**

Runoff = 20.97 cfs @ 12.08 hrs, Volume= 1.733 af, Depth= 3.73"  
 Routed to Reach WQU1.11 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.445     | 39 | >75% Grass cover, Good, HSG A |
| 2.807     | 98 | Paved parking, HSG A          |
| 1.320     | 98 | Roofs, HSG A                  |
| 5.573     |    | Weighted Average              |
| 1.445     |    | 25.93% Pervious Area          |
| 4.128     |    | 74.07% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.12:**

Runoff = 4.04 cfs @ 12.08 hrs, Volume= 0.347 af, Depth= 2.16"  
 Routed to Pond P1.12 : Bioretention

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.916     | 39 | >75% Grass cover, Good, HSG A |
| 0.740     | 98 | Paved parking, HSG A          |
| 0.055     | 98 | Roofs, HSG A                  |
| 0.219     | 30 | Woods, Good, HSG A            |
| 1.930     |    | Weighted Average              |
| 1.135     |    | 58.81% Pervious Area          |
| 0.795     |    | 41.19% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13:**

Runoff = 8.37 cfs @ 12.08 hrs, Volume= 0.701 af, Depth= 3.14"  
 Routed to Reach WQU1.13 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.028     | 39 | >75% Grass cover, Good, HSG A |
| 1.143     | 98 | Paved parking, HSG A          |
| 0.506     | 98 | Roofs, HSG A                  |
| 2.676     |    | Weighted Average              |
| 1.028     |    | 38.41% Pervious Area          |
| 1.648     |    | 61.59% Impervious Area        |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13.1:**

Runoff = 3.29 cfs @ 12.08 hrs, Volume= 0.268 af, Depth= 4.47"  
 Routed to Pond P1.13 : Stormtrap

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.073     | 39 | >75% Grass cover, Good, HSG A |
| 0.023     | 98 | Paved parking, HSG A          |
| 0.624     | 98 | Roofs, HSG A                  |
| 0.720     |    | Weighted Average              |
| 0.073     |    | 10.15% Pervious Area          |
| 0.647     |    | 89.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.15:**

Runoff = 4.01 cfs @ 12.08 hrs, Volume= 0.332 af, Depth= 3.65"  
 Routed to Reach WQU1.15 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.302     | 39 | >75% Grass cover, Good, HSG A |
| 0.608     | 98 | Paved parking, HSG A          |
| 0.181     | 98 | Roofs, HSG A                  |
| 1.090     |    | Weighted Average              |
| 0.302     |    | 27.66% Pervious Area          |
| 0.789     |    | 72.34% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.2:**

Runoff = 3.06 cfs @ 12.08 hrs, Volume= 0.259 af, Depth= 2.68"  
 Routed to Pond P1.4 : Bioretention

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Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.555     | 39 | >75% Grass cover, Good, HSG A |
| 0.059     | 96 | Gravel surface, HSG A         |
| 0.545     | 98 | Paved parking, HSG A          |
| 1.159     |    | Weighted Average              |
| 0.614     |    | 52.96% Pervious Area          |
| 0.545     |    | 47.04% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.3:**

Runoff = 6.26 cfs @ 12.08 hrs, Volume= 0.511 af, Depth= 4.62"  
 Routed to Pond D1.3 : Replaced CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.4:**

Runoff = 6.08 cfs @ 12.08 hrs, Volume= 0.488 af, Depth= 4.61"  
 Routed to Pond D1.4 : Exist CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.066     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.405     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.580     |    | 45.67% Pervious Area          |
| 0.690     |    | 54.33% Impervious Area        |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1:**

Runoff = 0.24 cfs @ 12.08 hrs, Volume= 0.041 af, Depth= 0.45"  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.042     | 39 | >75% Grass cover, Good, HSG A |
| 0.048     | 98 | Paved parking, HSG A          |
| 1.090     |    | Weighted Average              |
| 1.042     |    | 95.61% Pervious Area          |
| 0.048     |    | 4.39% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.1:**

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 0.033 af, Depth= 4.32"  
 Routed to Reach WQU2.1.1 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.012     | 39 | >75% Grass cover, Good, HSG A |
| 0.079     | 98 | Paved parking, HSG A          |
| 0.091     |    | Weighted Average              |
| 0.012     |    | 13.44% Pervious Area          |
| 0.079     |    | 86.56% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.2:**

Runoff = 1.00 cfs @ 12.08 hrs, Volume= 0.081 af, Depth= 4.39"  
 Routed to Reach WQU2.1.2 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.026     | 39 | >75% Grass cover, Good, HSG A |
| 0.196     | 98 | Paved parking, HSG A          |
| 0.223     |    | Weighted Average              |
| 0.026     |    | 11.88% Pervious Area          |
| 0.196     |    | 88.12% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.0:**

Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af, Depth= 1.41"  
Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.019     | 39 | >75% Grass cover, Good, HSG A |
| 0.006     | 98 | Paved parking, HSG A          |
| 0.025     |    | Weighted Average              |
| 0.019     |    | 75.15% Pervious Area          |
| 0.006     |    | 24.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.1:**

Runoff = 0.01 cfs @ 12.44 hrs, Volume= 0.004 af, Depth= 0.24"  
Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.210     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.210     |    | Weighted Average              |
| 0.210     |    | 100.00% Pervious Area         |
| 0.000     |    | 0.00% Impervious Area         |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD4:**

Runoff = 0.00 cfs @ 12.44 hrs, Volume= 0.002 af, Depth= 0.05"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.19"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.064     | 39 | >75% Grass cover, Good, HSG A |
| 0.277     | 30 | Woods, Good, HSG A            |
| 0.341     |    | Weighted Average              |
| 0.341     |    | 100.00% Pervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Reach WQU1.11: WQU**

Inflow Area = 10.899 ac, 66.22% Impervious, Inflow Depth = 2.29" for 10-Year event  
 Inflow = 21.62 cfs @ 12.08 hrs, Volume= 2.079 af  
 Outflow = 21.62 cfs @ 12.08 hrs, Volume= 2.079 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU1.13: WQU**

Inflow Area = 2.676 ac, 61.59% Impervious, Inflow Depth = 3.14" for 10-Year event  
 Inflow = 8.37 cfs @ 12.08 hrs, Volume= 0.701 af  
 Outflow = 8.37 cfs @ 12.08 hrs, Volume= 0.701 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.13 : Stormtrap

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

**Summary for Reach WQU1.15: WQU**

Inflow Area = 1.090 ac, 72.34% Impervious, Inflow Depth = 3.65" for 10-Year event  
 Inflow = 4.01 cfs @ 12.08 hrs, Volume= 0.332 af  
 Outflow = 4.01 cfs @ 12.08 hrs, Volume= 0.332 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU2.1.1: WQU**

Inflow Area = 0.091 ac, 86.56% Impervious, Inflow Depth = 4.32" for 10-Year event  
Inflow = 0.40 cfs @ 12.08 hrs, Volume= 0.033 af  
Outflow = 0.40 cfs @ 12.08 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Reach WQU2.1.2: WQU**

Inflow Area = 0.223 ac, 88.12% Impervious, Inflow Depth = 4.39" for 10-Year event  
Inflow = 1.00 cfs @ 12.08 hrs, Volume= 0.081 af  
Outflow = 1.00 cfs @ 12.08 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Pond D1.3: Replaced CB pretreatment**

Inflow Area = 1.326 ac, 92.99% Impervious, Inflow Depth = 4.62" for 10-Year event  
Inflow = 6.26 cfs @ 12.08 hrs, Volume= 0.511 af  
Primary = 6.26 cfs @ 12.08 hrs, Volume= 0.511 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond D1.4: Exist CB pretreatment**

Inflow Area = 1.271 ac, 54.33% Impervious, Inflow Depth = 4.61" for 10-Year event  
Inflow = 6.08 cfs @ 12.08 hrs, Volume= 0.488 af  
Primary = 6.08 cfs @ 12.08 hrs, Volume= 0.488 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond P1.10: AG infiltration basin**

Inflow Area = 12.815 ac, 62.69% Impervious, Inflow Depth = 2.28" for 10-Year event  
Inflow = 25.77 cfs @ 12.08 hrs, Volume= 2.438 af  
Outflow = 5.33 cfs @ 12.53 hrs, Volume= 2.438 af, Atten= 79%, Lag= 26.9 min  
Discarded = 5.33 cfs @ 12.53 hrs, Volume= 2.438 af  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Routed to Link DP3 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Peak Elev= 197.41' @ 12.53 hrs Surf.Area= 20,122 sf Storage= 24,234 cf

Plug-Flow detention time= 28.7 min calculated for 2.438 af (100% of inflow)

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Center-of-Mass det. time= 28.7 min ( 795.4 - 766.7 )

| Volume | Invert  | Avail.Storage | Storage Description                                        |
|--------|---------|---------------|------------------------------------------------------------|
| #1     | 196.10' | 74,156 cf     | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 196.10              | 16,990               | 0                         | 0                         |
| 199.60              | 25,385               | 74,156                    | 74,156                    |

| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                                   |
|--------|-----------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary   | 198.60' | <b>10.0' long + 3.0 ' SideZ x 10.0' breadth Broad-Crested Rectangular Weir</b><br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |
| #2     | Discarded | 196.10' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'                                                                             |
| #3     | Primary   | 197.80' | <b>4.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads                                                                                                                              |

**Discarded OutFlow** Max=5.33 cfs @ 12.53 hrs HW=197.41' (Free Discharge)↑**2=Exfiltration** ( Controls 5.33 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=196.10' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)↑**3=Grate** ( Controls 0.00 cfs)**Summary for Pond P1.12: Bioretention**

Inflow Area = 1.930 ac, 41.19% Impervious, Inflow Depth = 2.16" for 10-Year event  
 Inflow = 4.04 cfs @ 12.08 hrs, Volume= 0.347 af  
 Outflow = 0.76 cfs @ 12.53 hrs, Volume= 0.347 af, Atten= 81%, Lag= 27.0 min  
 Primary = 0.76 cfs @ 12.53 hrs, Volume= 0.347 af  
 Routed to Reach WQU1.11 : WQU

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 202.20' @ 12.53 hrs Surf.Area= 12,997 sf Storage= 4,968 cf

Plug-Flow detention time= 85.1 min calculated for 0.347 af (100% of inflow)  
 Center-of-Mass det. time= 85.4 min ( 846.4 - 761.0 )

| Volume   | Invert  | Avail.Storage | Storage Description                                |
|----------|---------|---------------|----------------------------------------------------|
| #1       | 202.00' | 6,142 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2       | 200.01' | 3,638 cf      | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|          |         |               | 12,125 cf Overall x 30.0% Voids                    |
| 9,780 cf |         |               | Total Available Storage                            |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 202.00              | 6,093                | 0                         | 0                         |
| 202.80              | 9,263                | 6,142                     | 6,142                     |

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| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 200.01              | 6,093                | 0                         | 0                         |
| 202.00              | 6,093                | 12,125                    | 12,125                    |

| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                     |
|--------|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary  | 199.80' | <b>15.0" Round Culvert</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 199.80' / 199.75' S= 0.0050 '/' Cc= 0.900<br>n= 0.012, Flow Area= 1.23 sf    |
| #2     | Device 1 | 202.30' | <b>36.0" Horiz. Rim</b> C= 0.600 Limited to weir flow at low heads                                                                                                                 |
| #3     | Device 1 | 200.00' | <b>6.0" Round Underdrain</b><br>L= 100.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 200.00' / 199.80' S= 0.0020 '/' Cc= 0.900<br>n= 0.012, Flow Area= 0.20 sf |
| #4     | Device 3 | 200.01' | <b>0.500 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 200.00' Phase-In= 0.01'                                                               |

**Primary OutFlow** Max=0.76 cfs @ 12.53 hrs HW=202.20' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.76 cfs of 7.88 cfs potential flow)  
 2=Rim ( Controls 0.00 cfs)  
 3=Underdrain (Barrel Controls 0.76 cfs @ 3.86 fps)  
 4=Exfiltration (Passes 0.76 cfs of 15.64 cfs potential flow)

**Summary for Pond P1.13: Stormtrap**

Inflow Area = 3.396 ac, 67.58% Impervious, Inflow Depth = 3.42" for 10-Year event  
 Inflow = 11.66 cfs @ 12.08 hrs, Volume= 0.969 af  
 Outflow = 1.68 cfs @ 12.58 hrs, Volume= 0.969 af, Atten= 86%, Lag= 30.0 min  
 Discarded = 1.68 cfs @ 12.58 hrs, Volume= 0.969 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach WQU1.11 : WQU

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 199.03' @ 12.58 hrs Surf.Area= 7,860 sf Storage= 12,692 cf

Plug-Flow detention time= 52.2 min calculated for 0.969 af (100% of inflow)  
 Center-of-Mass det. time= 52.2 min ( 805.3 - 753.1 )

| Volume | Invert  | Avail.Storage | Storage Description                                                                                                                                                                                                                                                      |
|--------|---------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1A    | 197.20' | 0 cf          | <b>30.27'W x 259.65'L x 4.00'H Field A</b><br>31,439 cf Overall - 31,439 cf Embedded = 0 cf x 40.0% Voids                                                                                                                                                                |
| #2A    | 197.20' | 24,340 cf     | <b>StormTrap ST2 SingleTrap 3-6 x 32</b> Inside #1<br>Inside= 101.7"W x 42.0"H => 26.77 sf x 15.40'L = 412.1 cf<br>Outside= 101.7"W x 48.0"H => 33.92 sf x 15.40'L = 522.2 cf<br>32 Chambers in 2 Rows<br>16.96' x 246.33' Core + 6.66' Border = 30.27' x 259.65' System |
|        |         | 24,340 cf     | Total Available Storage                                                                                                                                                                                                                                                  |

Storage Group A created with Chamber Wizard

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| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                  |
|--------|-----------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 197.20' | <b>5.750 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 194.20' Phase-In= 0.01'                                                            |
| #2     | Primary   | 198.60' | <b>12.0" Round Culvert</b><br>L= 29.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 198.60' / 198.42' S= 0.0062 ' / Cc= 0.900<br>n= 0.012, Flow Area= 0.79 sf |
| #3     | Device 2  | 200.50' | <b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)                                                                                                            |

**Discarded OutFlow** Max=1.68 cfs @ 12.58 hrs HW=199.03' (Free Discharge)↑**1=Exfiltration** ( Controls 1.68 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** ( Controls 0.00 cfs)↑**3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)**Summary for Pond P1.4: Bioretention**

Inflow Area = 3.756 ac, 65.73% Impervious, Inflow Depth = 4.02" for 10-Year event  
 Inflow = 15.40 cfs @ 12.08 hrs, Volume= 1.258 af  
 Outflow = 15.06 cfs @ 12.10 hrs, Volume= 1.258 af, Atten= 2%, Lag= 1.1 min  
 Primary = 15.06 cfs @ 12.10 hrs, Volume= 1.258 af  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 198.85' @ 12.10 hrs Surf.Area= 4,394 sf Storage= 3,921 cf

Plug-Flow detention time= 76.4 min calculated for 1.258 af (100% of inflow)  
 Center-of-Mass det. time= 76.6 min ( 829.4 - 752.8 )

| Volume | Invert  | Avail.Storage | Storage Description                                |
|--------|---------|---------------|----------------------------------------------------|
| #1     | 197.30' | 3,952 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2     | 195.30' | 510 cf        | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|        |         |               | 1,700 cf Overall x 30.0% Voids                     |
|        |         | 4,462 cf      | Total Available Storage                            |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 197.30              | 850                  | 0                         | 0                         |
| 199.00              | 3,800                | 3,952                     | 3,952                     |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 195.30              | 850                  | 0                         | 0                         |
| 197.30              | 850                  | 1,700                     | 1,700                     |

| Device | Routing | Invert  | Outlet Devices                                                                                                                                                                    |
|--------|---------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary | 195.30' | <b>4.0" Round Underdrain</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 195.30' / 195.00' S= 0.0300 ' / Cc= 0.900<br>n= 0.012, Flow Area= 0.09 sf |

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#2 Device 1 195.30' **0.500 in/hr Exfiltration over Surface area**  
 Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'  
 #3 Primary 198.40' **18.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir**  
 Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00  
 2.50 3.00 3.50 4.00 4.50 5.00 5.50  
 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66  
 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

**Primary OutFlow** Max=15.05 cfs @ 12.10 hrs HW=198.85' TW=195.45' (Dynamic Tailwater)

↑ **1=Underdrain** (Passes 0.07 cfs of 0.77 cfs potential flow)

↑ **2=Exfiltration** ( Controls 0.07 cfs)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 14.97 cfs @ 1.71 fps)

**Summary for Pond P2.1: DP2 AG infiltration basin**

Inflow Area = 5.159 ac, 54.11% Impervious, Inflow Depth = 3.29" for 10-Year event  
 Inflow = 16.66 cfs @ 12.10 hrs, Volume= 1.413 af  
 Outflow = 4.08 cfs @ 12.49 hrs, Volume= 1.413 af, Atten= 75%, Lag= 23.7 min  
 Discarded = 4.08 cfs @ 12.49 hrs, Volume= 1.413 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 195.84' @ 12.49 hrs Surf.Area= 16,917 sf Storage= 13,346 cf

Plug-Flow detention time= 17.9 min calculated for 1.413 af (100% of inflow)  
 Center-of-Mass det. time= 17.9 min ( 842.1 - 824.2 )

| Volume              | Invert               | Avail.Storage             | Storage Description                                        |
|---------------------|----------------------|---------------------------|------------------------------------------------------------|
| #1                  | 195.00'              | 34,616 cf                 | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |
| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet)                                  |
| 195.00              | 14,863               | 0                         | 0                                                          |
| 197.00              | 19,753               | 34,616                    | 34,616                                                     |

| Device | Routing   | Invert  | Outlet Devices                                                                                                       |
|--------|-----------|---------|----------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 195.00' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 192.00' Phase-In= 0.01' |

**Discarded OutFlow** Max=4.08 cfs @ 12.49 hrs HW=195.84' (Free Discharge)

↑ **1=Exfiltration** ( Controls 4.08 cfs)

**Summary for Link DP1:**

Inflow Area = 0.189 ac, 0.44% Impervious, Inflow Depth = 0.26" for 10-Year event  
 Inflow = 0.01 cfs @ 12.43 hrs, Volume= 0.004 af  
 Primary = 0.01 cfs @ 12.43 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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**Summary for Link DP3:**

Inflow Area = 13.051 ac, 61.61% Impervious, Inflow Depth = 0.01" for 10-Year event  
Inflow = 0.03 cfs @ 12.08 hrs, Volume= 0.007 af  
Primary = 0.03 cfs @ 12.08 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP4:**

Inflow Area = 0.341 ac, 0.00% Impervious, Inflow Depth = 0.05" for 10-Year event  
Inflow = 0.00 cfs @ 12.44 hrs, Volume= 0.002 af  
Primary = 0.00 cfs @ 12.44 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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

|                              |                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentPD1.0:</b>    | Runoff Area=0.189 ac 0.44% Impervious Runoff Depth=0.56"<br>Tc=6.0 min CN=WQ Runoff=0.05 cfs 0.009 af   |
| <b>SubcatchmentPD1.10:</b>   | Runoff Area=0.826 ac 3.35% Impervious Runoff Depth=0.72"<br>Tc=6.0 min CN=WQ Runoff=0.28 cfs 0.050 af   |
| <b>SubcatchmentPD1.11:</b>   | Runoff Area=5.573 ac 74.07% Impervious Runoff Depth=4.64"<br>Tc=6.0 min CN=WQ Runoff=25.64 cfs 2.153 af |
| <b>SubcatchmentPD1.12:</b>   | Runoff Area=1.930 ac 41.19% Impervious Runoff Depth=2.77"<br>Tc=6.0 min CN=WQ Runoff=4.99 cfs 0.445 af  |
| <b>SubcatchmentPD1.13:</b>   | Runoff Area=2.676 ac 61.59% Impervious Runoff Depth=3.95"<br>Tc=6.0 min CN=WQ Runoff=10.27 cfs 0.880 af |
| <b>SubcatchmentPD1.13.1:</b> | Runoff Area=0.720 ac 89.85% Impervious Runoff Depth=5.51"<br>Tc=6.0 min CN=WQ Runoff=4.01 cfs 0.331 af  |
| <b>SubcatchmentPD1.15:</b>   | Runoff Area=1.090 ac 72.34% Impervious Runoff Depth=4.54"<br>Tc=6.0 min CN=WQ Runoff=4.90 cfs 0.413 af  |
| <b>SubcatchmentPD1.2:</b>    | Runoff Area=1.159 ac 47.04% Impervious Runoff Depth=3.41"<br>Tc=6.0 min CN=WQ Runoff=3.77 cfs 0.329 af  |
| <b>SubcatchmentPD1.3:</b>    | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=5.68"<br>Tc=6.0 min CN=WQ Runoff=7.63 cfs 0.628 af  |
| <b>SubcatchmentPD1.4:</b>    | Runoff Area=1.271 ac 54.33% Impervious Runoff Depth=5.69"<br>Tc=6.0 min CN=WQ Runoff=7.42 cfs 0.602 af  |
| <b>SubcatchmentPD2.1:</b>    | Runoff Area=1.090 ac 4.39% Impervious Runoff Depth=0.78"<br>Tc=6.0 min CN=WQ Runoff=0.43 cfs 0.071 af   |
| <b>SubcatchmentPD2.1.1:</b>  | Runoff Area=0.091 ac 86.56% Impervious Runoff Depth=5.33"<br>Tc=6.0 min CN=WQ Runoff=0.49 cfs 0.040 af  |
| <b>SubcatchmentPD2.1.2:</b>  | Runoff Area=0.223 ac 88.12% Impervious Runoff Depth=5.41"<br>Tc=6.0 min CN=WQ Runoff=1.21 cfs 0.100 af  |
| <b>SubcatchmentPD3.0:</b>    | Runoff Area=0.025 ac 24.85% Impervious Runoff Depth=1.91"<br>Tc=6.0 min CN=WQ Runoff=0.04 cfs 0.004 af  |
| <b>SubcatchmentPD3.1:</b>    | Runoff Area=0.210 ac 0.00% Impervious Runoff Depth=0.54"<br>Tc=6.0 min CN=WQ Runoff=0.05 cfs 0.009 af   |
| <b>SubcatchmentPD4:</b>      | Runoff Area=0.341 ac 0.00% Impervious Runoff Depth=0.19"<br>Tc=6.0 min CN=WQ Runoff=0.02 cfs 0.005 af   |

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|                                      |                                                                                                                                                  |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Reach WQU1.11: WQU                   | Inflow=26.37 cfs 2.599 af<br>Outflow=26.37 cfs 2.599 af                                                                                          |
| Reach WQU1.13: WQU                   | Inflow=10.27 cfs 0.880 af<br>Outflow=10.27 cfs 0.880 af                                                                                          |
| Reach WQU1.15: WQU                   | Inflow=4.90 cfs 0.413 af<br>Outflow=4.90 cfs 0.413 af                                                                                            |
| Reach WQU2.1.1: WQU                  | Inflow=0.49 cfs 0.040 af<br>Outflow=0.49 cfs 0.040 af                                                                                            |
| Reach WQU2.1.2: WQU                  | Inflow=1.21 cfs 0.100 af<br>Outflow=1.21 cfs 0.100 af                                                                                            |
| Pond D1.3: Replaced CB pretreatment  | Inflow=7.63 cfs 0.628 af<br>Primary=7.63 cfs 0.628 af                                                                                            |
| Pond D1.4: Exist CB pretreatment     | Inflow=7.42 cfs 0.602 af<br>Primary=7.42 cfs 0.602 af                                                                                            |
| Pond P1.10: AG infiltration basin    | Peak Elev=197.82' Storage=32,755 cf Inflow=31.50 cfs 3.061 af<br>Discarded=6.03 cfs 3.061 af Primary=0.01 cfs 0.000 af Outflow=6.04 cfs 3.061 af |
| Pond P1.12: Bioretention             | Peak Elev=202.37' Storage=6,173 cf Inflow=4.99 cfs 0.445 af<br>Outflow=1.38 cfs 0.445 af                                                         |
| Pond P1.13: Stormtrap                | Peak Elev=199.61' Storage=16,794 cf Inflow=14.28 cfs 1.211 af<br>Discarded=1.89 cfs 1.211 af Primary=0.00 cfs 0.000 af Outflow=1.89 cfs 1.211 af |
| Pond P1.4: Bioretention              | Peak Elev=198.91' Storage=4,129 cf Inflow=18.83 cfs 1.559 af<br>Outflow=18.46 cfs 1.559 af                                                       |
| Pond P2.1: DP2 AG infiltration basin | Peak Elev=196.13' Storage=18,388 cf Inflow=20.53 cfs 1.771 af<br>Outflow=4.54 cfs 1.771 af                                                       |
| Link DP1:                            | Inflow=0.05 cfs 0.009 af<br>Primary=0.05 cfs 0.009 af                                                                                            |
| Link DP3:                            | Inflow=0.07 cfs 0.013 af<br>Primary=0.07 cfs 0.013 af                                                                                            |
| Link DP4:                            | Inflow=0.02 cfs 0.005 af<br>Primary=0.02 cfs 0.005 af                                                                                            |

Total Runoff Area = 18.740 ac Runoff Volume = 6.070 af Average Runoff Depth = 3.89"  
42.19% Pervious = 7.907 ac 57.81% Impervious = 10.833 ac

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**Summary for Subcatchment PD1.0:**

Runoff = 0.05 cfs @ 12.31 hrs, Volume= 0.009 af, Depth= 0.56"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.188     | 39 | >75% Grass cover, Good, HSG A |
| 0.001     | 98 | Roofs, HSG A                  |
| 0.189     |    | Weighted Average              |
| 0.188     |    | 99.56% Pervious Area          |
| 0.001     |    | 0.44% Impervious Area         |

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

**Summary for Subcatchment PD1.10:**

Runoff = 0.28 cfs @ 12.14 hrs, Volume= 0.050 af, Depth= 0.72"  
 Routed to Pond P1.10 : AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.798     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.028     | 98 | Roofs, HSG A                  |
| 0.826     |    | Weighted Average              |
| 0.798     |    | 96.65% Pervious Area          |
| 0.028     |    | 3.35% Impervious Area         |

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

**Summary for Subcatchment PD1.11:**

Runoff = 25.64 cfs @ 12.08 hrs, Volume= 2.153 af, Depth= 4.64"  
 Routed to Reach WQU1.11 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.445     | 39 | >75% Grass cover, Good, HSG A |
| 2.807     | 98 | Paved parking, HSG A          |
| 1.320     | 98 | Roofs, HSG A                  |
| 5.573     |    | Weighted Average              |
| 1.445     |    | 25.93% Pervious Area          |
| 4.128     |    | 74.07% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.12:**

Runoff = 4.99 cfs @ 12.09 hrs, Volume= 0.445 af, Depth= 2.77"  
 Routed to Pond P1.12 : Bioretention

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.916     | 39 | >75% Grass cover, Good, HSG A |
| 0.740     | 98 | Paved parking, HSG A          |
| 0.055     | 98 | Roofs, HSG A                  |
| 0.219     | 30 | Woods, Good, HSG A            |
| 1.930     |    | Weighted Average              |
| 1.135     |    | 58.81% Pervious Area          |
| 0.795     |    | 41.19% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13:**

Runoff = 10.27 cfs @ 12.08 hrs, Volume= 0.880 af, Depth= 3.95"  
 Routed to Reach WQU1.13 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.028     | 39 | >75% Grass cover, Good, HSG A |
| 1.143     | 98 | Paved parking, HSG A          |
| 0.506     | 98 | Roofs, HSG A                  |
| 2.676     |    | Weighted Average              |
| 1.028     |    | 38.41% Pervious Area          |
| 1.648     |    | 61.59% Impervious Area        |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13.1:**

Runoff = 4.01 cfs @ 12.08 hrs, Volume= 0.331 af, Depth= 5.51"  
 Routed to Pond P1.13 : Stormtrap

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.073     | 39 | >75% Grass cover, Good, HSG A |
| 0.023     | 98 | Paved parking, HSG A          |
| 0.624     | 98 | Roofs, HSG A                  |
| 0.720     |    | Weighted Average              |
| 0.073     |    | 10.15% Pervious Area          |
| 0.647     |    | 89.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.15:**

Runoff = 4.90 cfs @ 12.08 hrs, Volume= 0.413 af, Depth= 4.54"  
 Routed to Reach WQU1.15 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.302     | 39 | >75% Grass cover, Good, HSG A |
| 0.608     | 98 | Paved parking, HSG A          |
| 0.181     | 98 | Roofs, HSG A                  |
| 1.090     |    | Weighted Average              |
| 0.302     |    | 27.66% Pervious Area          |
| 0.789     |    | 72.34% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.2:**

Runoff = 3.77 cfs @ 12.09 hrs, Volume= 0.329 af, Depth= 3.41"  
 Routed to Pond P1.4 : Bioretention

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Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.555     | 39 | >75% Grass cover, Good, HSG A |
| 0.059     | 96 | Gravel surface, HSG A         |
| 0.545     | 98 | Paved parking, HSG A          |
| 1.159     |    | Weighted Average              |
| 0.614     |    | 52.96% Pervious Area          |
| 0.545     |    | 47.04% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.3:**

Runoff = 7.63 cfs @ 12.08 hrs, Volume= 0.628 af, Depth= 5.68"  
 Routed to Pond D1.3 : Replaced CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.4:**

Runoff = 7.42 cfs @ 12.08 hrs, Volume= 0.602 af, Depth= 5.69"  
 Routed to Pond D1.4 : Exist CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.066     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.405     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.580     |    | 45.67% Pervious Area          |
| 0.690     |    | 54.33% Impervious Area        |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1:**

Runoff = 0.43 cfs @ 12.13 hrs, Volume= 0.071 af, Depth= 0.78"  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.042     | 39 | >75% Grass cover, Good, HSG A |
| 0.048     | 98 | Paved parking, HSG A          |
| 1.090     |    | Weighted Average              |
| 1.042     |    | 95.61% Pervious Area          |
| 0.048     |    | 4.39% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.1:**

Runoff = 0.49 cfs @ 12.08 hrs, Volume= 0.040 af, Depth= 5.33"  
 Routed to Reach WQU2.1.1 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.012     | 39 | >75% Grass cover, Good, HSG A |
| 0.079     | 98 | Paved parking, HSG A          |
| 0.091     |    | Weighted Average              |
| 0.012     |    | 13.44% Pervious Area          |
| 0.079     |    | 86.56% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.2:**

Runoff = 1.21 cfs @ 12.08 hrs, Volume= 0.100 af, Depth= 5.41"  
 Routed to Reach WQU2.1.2 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.026     | 39 | >75% Grass cover, Good, HSG A |
| 0.196     | 98 | Paved parking, HSG A          |
| 0.223     |    | Weighted Average              |
| 0.026     |    | 11.88% Pervious Area          |
| 0.196     |    | 88.12% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.0:**

Runoff = 0.04 cfs @ 12.09 hrs, Volume= 0.004 af, Depth= 1.91"  
Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.019     | 39 | >75% Grass cover, Good, HSG A |
| 0.006     | 98 | Paved parking, HSG A          |
| 0.025     |    | Weighted Average              |
| 0.019     |    | 75.15% Pervious Area          |
| 0.006     |    | 24.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.1:**

Runoff = 0.05 cfs @ 12.31 hrs, Volume= 0.009 af, Depth= 0.54"  
Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.210     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.210     |    | Weighted Average              |
| 0.210     |    | 100.00% Pervious Area         |
| 0.000     |    | 0.00% Impervious Area         |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD4:**

Runoff = 0.02 cfs @ 12.31 hrs, Volume= 0.005 af, Depth= 0.19"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.31"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.064     | 39 | >75% Grass cover, Good, HSG A |
| 0.277     | 30 | Woods, Good, HSG A            |
| 0.341     |    | Weighted Average              |
| 0.341     |    | 100.00% Pervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Reach WQU1.11: WQU**

Inflow Area = 10.899 ac, 66.22% Impervious, Inflow Depth = 2.86" for 25-Year event  
 Inflow = 26.37 cfs @ 12.08 hrs, Volume= 2.599 af  
 Outflow = 26.37 cfs @ 12.08 hrs, Volume= 2.599 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU1.13: WQU**

Inflow Area = 2.676 ac, 61.59% Impervious, Inflow Depth = 3.95" for 25-Year event  
 Inflow = 10.27 cfs @ 12.08 hrs, Volume= 0.880 af  
 Outflow = 10.27 cfs @ 12.08 hrs, Volume= 0.880 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.13 : Stormtrap

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

**Summary for Reach WQU1.15: WQU**

Inflow Area = 1.090 ac, 72.34% Impervious, Inflow Depth = 4.54" for 25-Year event  
 Inflow = 4.90 cfs @ 12.08 hrs, Volume= 0.413 af  
 Outflow = 4.90 cfs @ 12.08 hrs, Volume= 0.413 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU2.1.1: WQU**

Inflow Area = 0.091 ac, 86.56% Impervious, Inflow Depth = 5.33" for 25-Year event  
Inflow = 0.49 cfs @ 12.08 hrs, Volume= 0.040 af  
Outflow = 0.49 cfs @ 12.08 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Reach WQU2.1.2: WQU**

Inflow Area = 0.223 ac, 88.12% Impervious, Inflow Depth = 5.41" for 25-Year event  
Inflow = 1.21 cfs @ 12.08 hrs, Volume= 0.100 af  
Outflow = 1.21 cfs @ 12.08 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Pond D1.3: Replaced CB pretreatment**

Inflow Area = 1.326 ac, 92.99% Impervious, Inflow Depth = 5.68" for 25-Year event  
Inflow = 7.63 cfs @ 12.08 hrs, Volume= 0.628 af  
Primary = 7.63 cfs @ 12.08 hrs, Volume= 0.628 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond D1.4: Exist CB pretreatment**

Inflow Area = 1.271 ac, 54.33% Impervious, Inflow Depth = 5.69" for 25-Year event  
Inflow = 7.42 cfs @ 12.08 hrs, Volume= 0.602 af  
Primary = 7.42 cfs @ 12.08 hrs, Volume= 0.602 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond P1.10: AG infiltration basin**

Inflow Area = 12.815 ac, 62.69% Impervious, Inflow Depth = 2.87" for 25-Year event  
Inflow = 31.50 cfs @ 12.08 hrs, Volume= 3.061 af  
Outflow = 6.04 cfs @ 12.57 hrs, Volume= 3.061 af, Atten= 81%, Lag= 29.3 min  
Discarded = 6.03 cfs @ 12.57 hrs, Volume= 3.061 af  
Primary = 0.01 cfs @ 12.57 hrs, Volume= 0.000 af  
Routed to Link DP3 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Peak Elev= 197.82' @ 12.57 hrs Surf.Area= 21,114 sf Storage= 32,755 cf

Plug-Flow detention time= 37.4 min calculated for 3.061 af (100% of inflow)

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Center-of-Mass det. time= 37.4 min ( 804.9 - 767.5 )

| Volume | Invert  | Avail.Storage | Storage Description                                        |
|--------|---------|---------------|------------------------------------------------------------|
| #1     | 196.10' | 74,156 cf     | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 196.10              | 16,990               | 0                         | 0                         |
| 199.60              | 25,385               | 74,156                    | 74,156                    |

| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                                   |
|--------|-----------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary   | 198.60' | <b>10.0' long + 3.0 ' SideZ x 10.0' breadth Broad-Crested Rectangular Weir</b><br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |
| #2     | Discarded | 196.10' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'                                                                             |
| #3     | Primary   | 197.80' | <b>4.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads                                                                                                                              |

**Discarded OutFlow** Max=6.03 cfs @ 12.57 hrs HW=197.82' (Free Discharge)↑**2=Exfiltration** ( Controls 6.03 cfs)**Primary OutFlow** Max=0.01 cfs @ 12.57 hrs HW=197.82' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)↑**3=Grate** (Weir Controls 0.01 cfs @ 0.45 fps)**Summary for Pond P1.12: Bioretention**

Inflow Area = 1.930 ac, 41.19% Impervious, Inflow Depth = 2.77" for 25-Year event  
 Inflow = 4.99 cfs @ 12.09 hrs, Volume= 0.445 af  
 Outflow = 1.38 cfs @ 12.46 hrs, Volume= 0.445 af, Atten= 72%, Lag= 22.4 min  
 Primary = 1.38 cfs @ 12.46 hrs, Volume= 0.445 af  
 Routed to Reach WQU1.11 : WQU

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 202.37' @ 12.46 hrs Surf.Area= 13,657 sf Storage= 6,173 cf

Plug-Flow detention time= 85.8 min calculated for 0.445 af (100% of inflow)  
 Center-of-Mass det. time= 86.1 min ( 850.9 - 764.8 )

| Volume   | Invert  | Avail.Storage | Storage Description                                |
|----------|---------|---------------|----------------------------------------------------|
| #1       | 202.00' | 6,142 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2       | 200.01' | 3,638 cf      | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|          |         |               | 12,125 cf Overall x 30.0% Voids                    |
| 9,780 cf |         |               | Total Available Storage                            |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 202.00              | 6,093                | 0                         | 0                         |
| 202.80              | 9,263                | 6,142                     | 6,142                     |

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Type III 24-hr 25-Year Rainfall=6.31"

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| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 200.01              | 6,093                | 0                         | 0                         |
| 202.00              | 6,093                | 12,125                    | 12,125                    |

| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                     |
|--------|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary  | 199.80' | <b>15.0" Round Culvert</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 199.80' / 199.75' S= 0.0050 '/' Cc= 0.900<br>n= 0.012, Flow Area= 1.23 sf    |
| #2     | Device 1 | 202.30' | <b>36.0" Horiz. Rim</b> C= 0.600 Limited to weir flow at low heads                                                                                                                 |
| #3     | Device 1 | 200.00' | <b>6.0" Round Underdrain</b><br>L= 100.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 200.00' / 199.80' S= 0.0020 '/' Cc= 0.900<br>n= 0.012, Flow Area= 0.20 sf |
| #4     | Device 3 | 200.01' | <b>0.500 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 200.00' Phase-In= 0.01'                                                               |

**Primary OutFlow** Max=1.38 cfs @ 12.46 hrs HW=202.37' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 1.38 cfs of 8.24 cfs potential flow)  
 2=Rim (Weir Controls 0.59 cfs @ 0.87 fps)  
 3=Underdrain (Barrel Controls 0.79 cfs @ 4.02 fps)  
 4=Exfiltration (Passes 0.79 cfs of 16.82 cfs potential flow)

**Summary for Pond P1.13: Stormtrap**

Inflow Area = 3.396 ac, 67.58% Impervious, Inflow Depth = 4.28" for 25-Year event  
 Inflow = 14.28 cfs @ 12.08 hrs, Volume= 1.211 af  
 Outflow = 1.89 cfs @ 12.63 hrs, Volume= 1.211 af, Atten= 87%, Lag= 32.7 min  
 Discarded = 1.89 cfs @ 12.63 hrs, Volume= 1.211 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach WQU1.11 : WQU

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 199.61' @ 12.63 hrs Surf.Area= 7,860 sf Storage= 16,794 cf

Plug-Flow detention time= 66.9 min calculated for 1.210 af (100% of inflow)  
 Center-of-Mass det. time= 66.9 min ( 819.6 - 752.7 )

| Volume | Invert  | Avail.Storage | Storage Description                                                                                                                                                                                                                                                      |
|--------|---------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1A    | 197.20' | 0 cf          | <b>30.27'W x 259.65'L x 4.00'H Field A</b><br>31,439 cf Overall - 31,439 cf Embedded = 0 cf x 40.0% Voids                                                                                                                                                                |
| #2A    | 197.20' | 24,340 cf     | <b>StormTrap ST2 SingleTrap 3-6 x 32</b> Inside #1<br>Inside= 101.7"W x 42.0"H => 26.77 sf x 15.40'L = 412.1 cf<br>Outside= 101.7"W x 48.0"H => 33.92 sf x 15.40'L = 522.2 cf<br>32 Chambers in 2 Rows<br>16.96' x 246.33' Core + 6.66' Border = 30.27' x 259.65' System |
|        |         | 24,340 cf     | Total Available Storage                                                                                                                                                                                                                                                  |

Storage Group A created with Chamber Wizard

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| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                            |
|--------|-----------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 197.20' | <b>5.750 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 194.20' Phase-In= 0.01'                                                                      |
| #2     | Primary   | 198.60' | <b>12.0" Round Culvert</b><br>L= 29.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 198.60' / 198.42' S= 0.0062 ' S= 0.0062 ' Cc= 0.900<br>n= 0.012, Flow Area= 0.79 sf |
| #3     | Device 2  | 200.50' | <b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)                                                                                                                      |

**Discarded OutFlow** Max=1.89 cfs @ 12.63 hrs HW=199.61' (Free Discharge)↑**1=Exfiltration** ( Controls 1.89 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=197.20' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** ( Controls 0.00 cfs)↑**3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)**Summary for Pond P1.4: Bioretention**

Inflow Area = 3.756 ac, 65.73% Impervious, Inflow Depth = 4.98" for 25-Year event  
 Inflow = 18.83 cfs @ 12.08 hrs, Volume= 1.559 af  
 Outflow = 18.46 cfs @ 12.10 hrs, Volume= 1.559 af, Atten= 2%, Lag= 1.0 min  
 Primary = 18.46 cfs @ 12.10 hrs, Volume= 1.559 af  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 198.91' @ 12.10 hrs Surf.Area= 4,494 sf Storage= 4,129 cf

Plug-Flow detention time= 63.8 min calculated for 1.559 af (100% of inflow)  
 Center-of-Mass det. time= 64.0 min ( 814.9 - 750.9 )

| Volume | Invert  | Avail.Storage | Storage Description                                |
|--------|---------|---------------|----------------------------------------------------|
| #1     | 197.30' | 3,952 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2     | 195.30' | 510 cf        | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|        |         |               | 1,700 cf Overall x 30.0% Voids                     |
|        |         | 4,462 cf      | Total Available Storage                            |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 197.30              | 850                  | 0                         | 0                         |
| 199.00              | 3,800                | 3,952                     | 3,952                     |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 195.30              | 850                  | 0                         | 0                         |
| 197.30              | 850                  | 1,700                     | 1,700                     |

| Device | Routing | Invert  | Outlet Devices                                                                                                                                                                              |
|--------|---------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary | 195.30' | <b>4.0" Round Underdrain</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 195.30' / 195.00' S= 0.0300 ' S= 0.0300 ' Cc= 0.900<br>n= 0.012, Flow Area= 0.09 sf |

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#2 Device 1 195.30' **0.500 in/hr Exfiltration over Surface area**  
 Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'  
 #3 Primary 198.40' **18.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir**  
 Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00  
 2.50 3.00 3.50 4.00 4.50 5.00 5.50  
 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66  
 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

**Primary OutFlow** Max=18.45 cfs @ 12.10 hrs HW=198.91' TW=195.60' (Dynamic Tailwater)

1=Underdrain (Passes 0.08 cfs of 0.76 cfs potential flow)

2=Exfiltration ( Controls 0.08 cfs)

3=Broad-Crested Rectangular Weir (Weir Controls 18.37 cfs @ 1.84 fps)

**Summary for Pond P2.1: DP2 AG infiltration basin**

Inflow Area = 5.159 ac, 54.11% Impervious, Inflow Depth = 4.12" for 25-Year event  
 Inflow = 20.53 cfs @ 12.10 hrs, Volume= 1.771 af  
 Outflow = 4.54 cfs @ 12.53 hrs, Volume= 1.771 af, Atten= 78%, Lag= 25.6 min  
 Discarded = 4.54 cfs @ 12.53 hrs, Volume= 1.771 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 196.13' @ 12.53 hrs Surf.Area= 17,630 sf Storage= 18,388 cf

Plug-Flow detention time= 24.0 min calculated for 1.771 af (100% of inflow)  
 Center-of-Mass det. time= 24.0 min ( 836.0 - 812.1 )

| Volume              | Invert               | Avail.Storage             | Storage Description                                        |
|---------------------|----------------------|---------------------------|------------------------------------------------------------|
| #1                  | 195.00'              | 34,616 cf                 | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |
| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet)                                  |
| 195.00              | 14,863               | 0                         | 0                                                          |
| 197.00              | 19,753               | 34,616                    | 34,616                                                     |

| Device | Routing   | Invert  | Outlet Devices                                                                                                       |
|--------|-----------|---------|----------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 195.00' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 192.00' Phase-In= 0.01' |

**Discarded OutFlow** Max=4.54 cfs @ 12.53 hrs HW=196.13' (Free Discharge)

1=Exfiltration ( Controls 4.54 cfs)

**Summary for Link DP1:**

Inflow Area = 0.189 ac, 0.44% Impervious, Inflow Depth = 0.56" for 25-Year event  
 Inflow = 0.05 cfs @ 12.31 hrs, Volume= 0.009 af  
 Primary = 0.05 cfs @ 12.31 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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**Summary for Link DP3:**

Inflow Area = 13.051 ac, 61.61% Impervious, Inflow Depth = 0.01" for 25-Year event  
Inflow = 0.07 cfs @ 12.14 hrs, Volume= 0.013 af  
Primary = 0.07 cfs @ 12.14 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP4:**

Inflow Area = 0.341 ac, 0.00% Impervious, Inflow Depth = 0.19" for 25-Year event  
Inflow = 0.02 cfs @ 12.31 hrs, Volume= 0.005 af  
Primary = 0.02 cfs @ 12.31 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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

|                              |                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>SubcatchmentPD1.0:</b>    | Runoff Area=0.189 ac 0.44% Impervious Runoff Depth=1.20"<br>Tc=6.0 min CN=WQ Runoff=0.17 cfs 0.019 af   |
| <b>SubcatchmentPD1.10:</b>   | Runoff Area=0.826 ac 3.35% Impervious Runoff Depth=1.39"<br>Tc=6.0 min CN=WQ Runoff=0.92 cfs 0.096 af   |
| <b>SubcatchmentPD1.11:</b>   | Runoff Area=5.573 ac 74.07% Impervious Runoff Depth=6.07"<br>Tc=6.0 min CN=WQ Runoff=33.71 cfs 2.821 af |
| <b>SubcatchmentPD1.12:</b>   | Runoff Area=1.930 ac 41.19% Impervious Runoff Depth=3.81"<br>Tc=6.0 min CN=WQ Runoff=7.01 cfs 0.613 af  |
| <b>SubcatchmentPD1.13:</b>   | Runoff Area=2.676 ac 61.59% Impervious Runoff Depth=5.25"<br>Tc=6.0 min CN=WQ Runoff=13.82 cfs 1.170 af |
| <b>SubcatchmentPD1.13.1:</b> | Runoff Area=0.720 ac 89.85% Impervious Runoff Depth=7.12"<br>Tc=6.0 min CN=WQ Runoff=5.16 cfs 0.427 af  |
| <b>SubcatchmentPD1.15:</b>   | Runoff Area=1.090 ac 72.34% Impervious Runoff Depth=5.96"<br>Tc=6.0 min CN=WQ Runoff=6.46 cfs 0.541 af  |
| <b>SubcatchmentPD1.2:</b>    | Runoff Area=1.159 ac 47.04% Impervious Runoff Depth=4.61"<br>Tc=6.0 min CN=WQ Runoff=5.21 cfs 0.445 af  |
| <b>SubcatchmentPD1.3:</b>    | Runoff Area=1.326 ac 92.99% Impervious Runoff Depth=7.33"<br>Tc=6.0 min CN=WQ Runoff=9.79 cfs 0.809 af  |
| <b>SubcatchmentPD1.4:</b>    | Runoff Area=1.271 ac 54.33% Impervious Runoff Depth=7.35"<br>Tc=6.0 min CN=WQ Runoff=9.52 cfs 0.778 af  |
| <b>SubcatchmentPD2.1:</b>    | Runoff Area=1.090 ac 4.39% Impervious Runoff Depth=1.46"<br>Tc=6.0 min CN=WQ Runoff=1.29 cfs 0.133 af   |
| <b>SubcatchmentPD2.1.1:</b>  | Runoff Area=0.091 ac 86.56% Impervious Runoff Depth=6.90"<br>Tc=6.0 min CN=WQ Runoff=0.63 cfs 0.052 af  |
| <b>SubcatchmentPD2.1.2:</b>  | Runoff Area=0.223 ac 88.12% Impervious Runoff Depth=7.00"<br>Tc=6.0 min CN=WQ Runoff=1.57 cfs 0.130 af  |
| <b>SubcatchmentPD3.0:</b>    | Runoff Area=0.025 ac 24.85% Impervious Runoff Depth=2.81"<br>Tc=6.0 min CN=WQ Runoff=0.06 cfs 0.006 af  |
| <b>SubcatchmentPD3.1:</b>    | Runoff Area=0.210 ac 0.00% Impervious Runoff Depth=1.17"<br>Tc=6.0 min CN=WQ Runoff=0.19 cfs 0.021 af   |
| <b>SubcatchmentPD4:</b>      | Runoff Area=0.341 ac 0.00% Impervious Runoff Depth=0.56"<br>Tc=6.0 min CN=WQ Runoff=0.07 cfs 0.016 af   |

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|                                      |                                                                                                                                                  |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Reach WQU1.11: WQU                   | Inflow=34.47 cfs 3.448 af<br>Outflow=34.47 cfs 3.448 af                                                                                          |
| Reach WQU1.13: WQU                   | Inflow=13.82 cfs 1.170 af<br>Outflow=13.82 cfs 1.170 af                                                                                          |
| Reach WQU1.15: WQU                   | Inflow=6.46 cfs 0.541 af<br>Outflow=6.46 cfs 0.541 af                                                                                            |
| Reach WQU2.1.1: WQU                  | Inflow=0.63 cfs 0.052 af<br>Outflow=0.63 cfs 0.052 af                                                                                            |
| Reach WQU2.1.2: WQU                  | Inflow=1.57 cfs 0.130 af<br>Outflow=1.57 cfs 0.130 af                                                                                            |
| Pond D1.3: Replaced CB pretreatment  | Inflow=9.79 cfs 0.809 af<br>Primary=9.79 cfs 0.809 af                                                                                            |
| Pond D1.4: Exist CB pretreatment     | Inflow=9.52 cfs 0.778 af<br>Primary=9.52 cfs 0.778 af                                                                                            |
| Pond P1.10: AG infiltration basin    | Peak Elev=198.55' Storage=48,897 cf Inflow=41.80 cfs 4.085 af<br>Discarded=7.31 cfs 4.039 af Primary=0.36 cfs 0.045 af Outflow=7.67 cfs 4.085 af |
| Pond P1.12: Bioretention             | Peak Elev=202.48' Storage=7,047 cf Inflow=7.01 cfs 0.613 af<br>Outflow=3.23 cfs 0.613 af                                                         |
| Pond P1.13: Stormtrap                | Peak Elev=200.60' Storage=23,648 cf Inflow=18.98 cfs 1.597 af<br>Discarded=2.23 cfs 1.583 af Primary=0.52 cfs 0.014 af Outflow=2.75 cfs 1.597 af |
| Pond P1.4: Bioretention              | Peak Elev=199.00' Storage=4,447 cf Inflow=24.52 cfs 2.032 af<br>Outflow=24.10 cfs 2.032 af                                                       |
| Pond P2.1: DP2 AG infiltration basin | Peak Elev=196.61' Storage=27,041 cf Inflow=27.54 cfs 2.347 af<br>Outflow=5.29 cfs 2.347 af                                                       |
| Link DP1:                            | Inflow=0.17 cfs 0.019 af<br>Primary=0.17 cfs 0.019 af                                                                                            |
| Link DP3:                            | Inflow=0.47 cfs 0.072 af<br>Primary=0.47 cfs 0.072 af                                                                                            |
| Link DP4:                            | Inflow=0.07 cfs 0.016 af<br>Primary=0.07 cfs 0.016 af                                                                                            |

Total Runoff Area = 18.740 ac Runoff Volume = 8.077 af Average Runoff Depth = 5.17"  
42.19% Pervious = 7.907 ac 57.81% Impervious = 10.833 ac

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**Summary for Subcatchment PD1.0:**

Runoff = 0.17 cfs @ 12.12 hrs, Volume= 0.019 af, Depth= 1.20"  
 Routed to Link DP1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.188     | 39 | >75% Grass cover, Good, HSG A |
| 0.001     | 98 | Roofs, HSG A                  |
| 0.189     |    | Weighted Average              |
| 0.188     |    | 99.56% Pervious Area          |
| 0.001     |    | 0.44% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment PD1.10:**

Runoff = 0.92 cfs @ 12.11 hrs, Volume= 0.096 af, Depth= 1.39"  
 Routed to Pond P1.10 : AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.798     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.028     | 98 | Roofs, HSG A                  |
| 0.826     |    | Weighted Average              |
| 0.798     |    | 96.65% Pervious Area          |
| 0.028     |    | 3.35% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment PD1.11:**

Runoff = 33.71 cfs @ 12.08 hrs, Volume= 2.821 af, Depth= 6.07"  
 Routed to Reach WQU1.11 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.445     | 39 | >75% Grass cover, Good, HSG A |
| 2.807     | 98 | Paved parking, HSG A          |
| 1.320     | 98 | Roofs, HSG A                  |
| 5.573     |    | Weighted Average              |
| 1.445     |    | 25.93% Pervious Area          |
| 4.128     |    | 74.07% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.12:**

Runoff = 7.01 cfs @ 12.09 hrs, Volume= 0.613 af, Depth= 3.81"  
 Routed to Pond P1.12 : Bioretention

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.916     | 39 | >75% Grass cover, Good, HSG A |
| 0.740     | 98 | Paved parking, HSG A          |
| 0.055     | 98 | Roofs, HSG A                  |
| 0.219     | 30 | Woods, Good, HSG A            |
| 1.930     |    | Weighted Average              |
| 1.135     |    | 58.81% Pervious Area          |
| 0.795     |    | 41.19% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13:**

Runoff = 13.82 cfs @ 12.09 hrs, Volume= 1.170 af, Depth= 5.25"  
 Routed to Reach WQU1.13 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.028     | 39 | >75% Grass cover, Good, HSG A |
| 1.143     | 98 | Paved parking, HSG A          |
| 0.506     | 98 | Roofs, HSG A                  |
| 2.676     |    | Weighted Average              |
| 1.028     |    | 38.41% Pervious Area          |
| 1.648     |    | 61.59% Impervious Area        |

**W211244 Proposed**

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Type III 24-hr 100-Year Rainfall=8.03"

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.13.1:**

Runoff = 5.16 cfs @ 12.08 hrs, Volume= 0.427 af, Depth= 7.12"  
 Routed to Pond P1.13 : Stormtrap

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.073     | 39 | >75% Grass cover, Good, HSG A |
| 0.023     | 98 | Paved parking, HSG A          |
| 0.624     | 98 | Roofs, HSG A                  |
| 0.720     |    | Weighted Average              |
| 0.073     |    | 10.15% Pervious Area          |
| 0.647     |    | 89.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.15:**

Runoff = 6.46 cfs @ 12.08 hrs, Volume= 0.541 af, Depth= 5.96"  
 Routed to Reach WQU1.15 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.302     | 39 | >75% Grass cover, Good, HSG A |
| 0.608     | 98 | Paved parking, HSG A          |
| 0.181     | 98 | Roofs, HSG A                  |
| 1.090     |    | Weighted Average              |
| 0.302     |    | 27.66% Pervious Area          |
| 0.789     |    | 72.34% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD1.2:**

Runoff = 5.21 cfs @ 12.09 hrs, Volume= 0.445 af, Depth= 4.61"  
 Routed to Pond P1.4 : Bioretention

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Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.555     | 39 | >75% Grass cover, Good, HSG A |
| 0.059     | 96 | Gravel surface, HSG A         |
| 0.545     | 98 | Paved parking, HSG A          |
| 1.159     |    | Weighted Average              |
| 0.614     |    | 52.96% Pervious Area          |
| 0.545     |    | 47.04% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment PD1.3:**

Runoff = 9.79 cfs @ 12.08 hrs, Volume= 0.809 af, Depth= 7.33"  
Routed to Pond D1.3 : Replaced CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.093     | 39 | >75% Grass cover, Good, HSG A |
| 0.921     | 98 | Paved parking, HSG A          |
| 0.312     | 98 | Roofs, HSG A                  |
| 1.326     |    | Weighted Average              |
| 0.093     |    | 7.01% Pervious Area           |
| 1.233     |    | 92.99% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description   |
|-------------|------------------|------------------|----------------------|-------------------|---------------|
| 6.0         |                  |                  |                      |                   | Direct Entry, |

**Summary for Subcatchment PD1.4:**

Runoff = 9.52 cfs @ 12.08 hrs, Volume= 0.778 af, Depth= 7.35"  
Routed to Pond D1.4 : Exist CB pretreatment

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.066     | 39 | >75% Grass cover, Good, HSG A |
| 0.514     | 96 | Gravel surface, HSG A         |
| 0.405     | 98 | Paved parking, HSG A          |
| 0.286     | 98 | Roofs, HSG A                  |
| 1.271     |    | Weighted Average              |
| 0.580     |    | 45.67% Pervious Area          |
| 0.690     |    | 54.33% Impervious Area        |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1:**

Runoff = 1.29 cfs @ 12.11 hrs, Volume= 0.133 af, Depth= 1.46"  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 1.042     | 39 | >75% Grass cover, Good, HSG A |
| 0.048     | 98 | Paved parking, HSG A          |
| 1.090     |    | Weighted Average              |
| 1.042     |    | 95.61% Pervious Area          |
| 0.048     |    | 4.39% Impervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.1:**

Runoff = 0.63 cfs @ 12.08 hrs, Volume= 0.052 af, Depth= 6.90"  
 Routed to Reach WQU2.1.1 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.012     | 39 | >75% Grass cover, Good, HSG A |
| 0.079     | 98 | Paved parking, HSG A          |
| 0.091     |    | Weighted Average              |
| 0.012     |    | 13.44% Pervious Area          |
| 0.079     |    | 86.56% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD2.1.2:**

Runoff = 1.57 cfs @ 12.08 hrs, Volume= 0.130 af, Depth= 7.00"  
 Routed to Reach WQU2.1.2 : WQU

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
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| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.026     | 39 | >75% Grass cover, Good, HSG A |
| 0.196     | 98 | Paved parking, HSG A          |
| 0.223     |    | Weighted Average              |
| 0.026     |    | 11.88% Pervious Area          |
| 0.196     |    | 88.12% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.0:**

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.006 af, Depth= 2.81"  
 Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.019     | 39 | >75% Grass cover, Good, HSG A |
| 0.006     | 98 | Paved parking, HSG A          |
| 0.025     |    | Weighted Average              |
| 0.019     |    | 75.15% Pervious Area          |
| 0.006     |    | 24.85% Impervious Area        |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD3.1:**

Runoff = 0.19 cfs @ 12.12 hrs, Volume= 0.021 af, Depth= 1.17"  
 Routed to Link DP3 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.210     | 39 | >75% Grass cover, Good, HSG A |
| 0.000     | 98 | Paved parking, HSG A          |
| 0.210     |    | Weighted Average              |
| 0.210     |    | 100.00% Pervious Area         |
| 0.000     |    | 0.00% Impervious Area         |

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| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Subcatchment PD4:**

Runoff = 0.07 cfs @ 12.36 hrs, Volume= 0.016 af, Depth= 0.56"  
 Routed to Link DP4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.03"

| Area (ac) | CN | Description                   |
|-----------|----|-------------------------------|
| 0.064     | 39 | >75% Grass cover, Good, HSG A |
| 0.277     | 30 | Woods, Good, HSG A            |
| 0.341     |    | Weighted Average              |
| 0.341     |    | 100.00% Pervious Area         |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description          |
|-------------|------------------|------------------|----------------------|-------------------|----------------------|
| 6.0         |                  |                  |                      |                   | <b>Direct Entry,</b> |

**Summary for Reach WQU1.11: WQU**

Inflow Area = 10.899 ac, 66.22% Impervious, Inflow Depth = 3.80" for 100-Year event  
 Inflow = 34.47 cfs @ 12.08 hrs, Volume= 3.448 af  
 Outflow = 34.47 cfs @ 12.08 hrs, Volume= 3.448 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU1.13: WQU**

Inflow Area = 2.676 ac, 61.59% Impervious, Inflow Depth = 5.25" for 100-Year event  
 Inflow = 13.82 cfs @ 12.09 hrs, Volume= 1.170 af  
 Outflow = 13.82 cfs @ 12.09 hrs, Volume= 1.170 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.13 : Stormtrap

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

**Summary for Reach WQU1.15: WQU**

Inflow Area = 1.090 ac, 72.34% Impervious, Inflow Depth = 5.96" for 100-Year event  
 Inflow = 6.46 cfs @ 12.08 hrs, Volume= 0.541 af  
 Outflow = 6.46 cfs @ 12.08 hrs, Volume= 0.541 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond P1.10 : AG infiltration basin

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

**Summary for Reach WQU2.1.1: WQU**

Inflow Area = 0.091 ac, 86.56% Impervious, Inflow Depth = 6.90" for 100-Year event  
Inflow = 0.63 cfs @ 12.08 hrs, Volume= 0.052 af  
Outflow = 0.63 cfs @ 12.08 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Reach WQU2.1.2: WQU**

Inflow Area = 0.223 ac, 88.12% Impervious, Inflow Depth = 7.00" for 100-Year event  
Inflow = 1.57 cfs @ 12.08 hrs, Volume= 0.130 af  
Outflow = 1.57 cfs @ 12.08 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P2.1 : DP2 AG infiltration basin

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

**Summary for Pond D1.3: Replaced CB pretreatment**

Inflow Area = 1.326 ac, 92.99% Impervious, Inflow Depth = 7.33" for 100-Year event  
Inflow = 9.79 cfs @ 12.08 hrs, Volume= 0.809 af  
Primary = 9.79 cfs @ 12.08 hrs, Volume= 0.809 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond D1.4: Exist CB pretreatment**

Inflow Area = 1.271 ac, 54.33% Impervious, Inflow Depth = 7.35" for 100-Year event  
Inflow = 9.52 cfs @ 12.08 hrs, Volume= 0.778 af  
Primary = 9.52 cfs @ 12.08 hrs, Volume= 0.778 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond P1.4 : Bioretention

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

**Summary for Pond P1.10: AG infiltration basin**

Inflow Area = 12.815 ac, 62.69% Impervious, Inflow Depth = 3.82" for 100-Year event  
Inflow = 41.80 cfs @ 12.09 hrs, Volume= 4.085 af  
Outflow = 7.67 cfs @ 12.63 hrs, Volume= 4.085 af, Atten= 82%, Lag= 32.6 min  
Discarded = 7.31 cfs @ 12.63 hrs, Volume= 4.039 af  
Primary = 0.36 cfs @ 12.63 hrs, Volume= 0.045 af  
Routed to Link DP3 :

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Peak Elev= 198.55' @ 12.63 hrs Surf.Area= 22,874 sf Storage= 48,897 cf

Plug-Flow detention time= 50.1 min calculated for 4.084 af (100% of inflow)

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Center-of-Mass det. time= 50.1 min ( 817.4 - 767.3 )

| Volume | Invert  | Avail.Storage | Storage Description                                        |
|--------|---------|---------------|------------------------------------------------------------|
| #1     | 196.10' | 74,156 cf     | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 196.10              | 16,990               | 0                         | 0                         |
| 199.60              | 25,385               | 74,156                    | 74,156                    |

| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                                   |
|--------|-----------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary   | 198.60' | <b>10.0' long + 3.0 ' SideZ x 10.0' breadth Broad-Crested Rectangular Weir</b><br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |
| #2     | Discarded | 196.10' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'                                                                             |
| #3     | Primary   | 197.80' | <b>4.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads                                                                                                                              |

**Discarded OutFlow** Max=7.31 cfs @ 12.63 hrs HW=198.55' (Free Discharge)↑**2=Exfiltration** ( Controls 7.31 cfs)**Primary OutFlow** Max=0.36 cfs @ 12.63 hrs HW=198.55' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)↑**3=Grate** (Orifice Controls 0.36 cfs @ 4.18 fps)**Summary for Pond P1.12: Bioretention**

Inflow Area = 1.930 ac, 41.19% Impervious, Inflow Depth = 3.81" for 100-Year event

Inflow = 7.01 cfs @ 12.09 hrs, Volume= 0.613 af

Outflow = 3.23 cfs @ 12.28 hrs, Volume= 0.613 af, Atten= 54%, Lag= 11.4 min

Primary = 3.23 cfs @ 12.28 hrs, Volume= 0.613 af

Routed to Reach WQU1.11 : WQU

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

Peak Elev= 202.48' @ 12.28 hrs Surf.Area= 14,102 sf Storage= 7,047 cf

Plug-Flow detention time= 76.6 min calculated for 0.613 af (100% of inflow)

Center-of-Mass det. time= 76.9 min ( 846.0 - 769.1 )

| Volume | Invert  | Avail.Storage | Storage Description                                |
|--------|---------|---------------|----------------------------------------------------|
| #1     | 202.00' | 6,142 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2     | 200.01' | 3,638 cf      | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|        |         |               | 12,125 cf Overall x 30.0% Voids                    |

9,780 cf Total Available Storage

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 202.00              | 6,093                | 0                         | 0                         |
| 202.80              | 9,263                | 6,142                     | 6,142                     |

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| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 200.01              | 6,093                | 0                         | 0                         |
| 202.00              | 6,093                | 12,125                    | 12,125                    |

| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                     |
|--------|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary  | 199.80' | <b>15.0" Round Culvert</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 199.80' / 199.75' S= 0.0050 '/' Cc= 0.900<br>n= 0.012, Flow Area= 1.23 sf    |
| #2     | Device 1 | 202.30' | <b>36.0" Horiz. Rim</b> C= 0.600 Limited to weir flow at low heads                                                                                                                 |
| #3     | Device 1 | 200.00' | <b>6.0" Round Underdrain</b><br>L= 100.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 200.00' / 199.80' S= 0.0020 '/' Cc= 0.900<br>n= 0.012, Flow Area= 0.20 sf |
| #4     | Device 3 | 200.01' | <b>0.500 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 200.00' Phase-In= 0.01'                                                               |

**Primary OutFlow** Max=3.23 cfs @ 12.28 hrs HW=202.48' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 3.23 cfs of 8.48 cfs potential flow)  
 2=Rim (Weir Controls 2.42 cfs @ 1.40 fps)  
 3=Underdrain (Barrel Controls 0.81 cfs @ 4.13 fps)  
 4=Exfiltration (Passes 0.81 cfs of 17.63 cfs potential flow)

**Summary for Pond P1.13: Stormtrap**

Inflow Area = 3.396 ac, 67.58% Impervious, Inflow Depth = 5.64" for 100-Year event  
 Inflow = 18.98 cfs @ 12.09 hrs, Volume= 1.597 af  
 Outflow = 2.75 cfs @ 12.59 hrs, Volume= 1.597 af, Atten= 86%, Lag= 30.5 min  
 Discarded = 2.23 cfs @ 12.59 hrs, Volume= 1.583 af  
 Primary = 0.52 cfs @ 12.59 hrs, Volume= 0.014 af  
 Routed to Reach WQU1.11 : WQU

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 200.60' @ 12.59 hrs Surf.Area= 7,860 sf Storage= 23,648 cf

Plug-Flow detention time= 86.8 min calculated for 1.597 af (100% of inflow)  
 Center-of-Mass det. time= 86.8 min ( 839.4 - 752.6 )

| Volume | Invert  | Avail.Storage | Storage Description                                                                                                                                                                                                                                                      |
|--------|---------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1A    | 197.20' | 0 cf          | <b>30.27'W x 259.65'L x 4.00'H Field A</b><br>31,439 cf Overall - 31,439 cf Embedded = 0 cf x 40.0% Voids                                                                                                                                                                |
| #2A    | 197.20' | 24,340 cf     | <b>StormTrap ST2 SingleTrap 3-6 x 32</b> Inside #1<br>Inside= 101.7"W x 42.0"H => 26.77 sf x 15.40'L = 412.1 cf<br>Outside= 101.7"W x 48.0"H => 33.92 sf x 15.40'L = 522.2 cf<br>32 Chambers in 2 Rows<br>16.96' x 246.33' Core + 6.66' Border = 30.27' x 259.65' System |
|        |         | 24,340 cf     | Total Available Storage                                                                                                                                                                                                                                                  |

Storage Group A created with Chamber Wizard

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| Device | Routing   | Invert  | Outlet Devices                                                                                                                                                                   |
|--------|-----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 197.20' | <b>5.750 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 194.20' Phase-In= 0.01'                                                             |
| #2     | Primary   | 198.60' | <b>12.0" Round Culvert</b><br>L= 29.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 198.60' / 198.42' S= 0.0062 ' /' Cc= 0.900<br>n= 0.012, Flow Area= 0.79 sf |
| #3     | Device 2  | 200.50' | <b>5.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)                                                                                                             |

**Discarded OutFlow** Max=2.23 cfs @ 12.59 hrs HW=200.60' (Free Discharge)↑**1=Exfiltration** ( Controls 2.23 cfs)**Primary OutFlow** Max=0.52 cfs @ 12.59 hrs HW=200.60' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** (Passes 0.52 cfs of 4.54 cfs potential flow)↑**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.52 cfs @ 1.04 fps)**Summary for Pond P1.4: Bioretention**

Inflow Area = 3.756 ac, 65.73% Impervious, Inflow Depth = 6.49" for 100-Year event  
 Inflow = 24.52 cfs @ 12.08 hrs, Volume= 2.032 af  
 Outflow = 24.10 cfs @ 12.10 hrs, Volume= 2.032 af, Atten= 2%, Lag= 0.9 min  
 Primary = 24.10 cfs @ 12.10 hrs, Volume= 2.032 af  
 Routed to Pond P2.1 : DP2 AG infiltration basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 199.00' @ 12.10 hrs Surf.Area= 4,643 sf Storage= 4,447 cf

Plug-Flow detention time= 51.2 min calculated for 2.032 af (100% of inflow)  
 Center-of-Mass det. time= 51.1 min ( 800.1 - 749.0 )

| Volume | Invert  | Avail.Storage | Storage Description                                |
|--------|---------|---------------|----------------------------------------------------|
| #1     | 197.30' | 3,952 cf      | <b>Surface V (Prismatic)</b> Listed below (Recalc) |
| #2     | 195.30' | 510 cf        | <b>Media (Prismatic)</b> Listed below (Recalc)     |
|        |         |               | 1,700 cf Overall x 30.0% Voids                     |
|        |         | 4,462 cf      | Total Available Storage                            |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 197.30              | 850                  | 0                         | 0                         |
| 199.00              | 3,800                | 3,952                     | 3,952                     |

| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 195.30              | 850                  | 0                         | 0                         |
| 197.30              | 850                  | 1,700                     | 1,700                     |

| Device | Routing | Invert  | Outlet Devices                                                                                                                                                                     |
|--------|---------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary | 195.30' | <b>4.0" Round Underdrain</b><br>L= 10.0' CPP, square edge headwall, Ke= 0.500<br>Inlet / Outlet Invert= 195.30' / 195.00' S= 0.0300 ' /' Cc= 0.900<br>n= 0.012, Flow Area= 0.09 sf |

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#2 Device 1 195.30' **0.500 in/hr Exfiltration over Surface area**  
 Conductivity to Groundwater Elevation = 193.00' Phase-In= 0.01'  
 #3 Primary 198.40' **18.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir**  
 Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00  
 2.50 3.00 3.50 4.00 4.50 5.00 5.50  
 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66  
 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

**Primary OutFlow** Max=24.09 cfs @ 12.10 hrs HW=199.00' TW=195.86' (Dynamic Tailwater)

↑ **1=Underdrain** (Passes 0.08 cfs of 0.74 cfs potential flow)

↑ **2=Exfiltration** ( Controls 0.08 cfs)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 24.02 cfs @ 2.04 fps)

**Summary for Pond P2.1: DP2 AG infiltration basin**

Inflow Area = 5.159 ac, 54.11% Impervious, Inflow Depth = 5.46" for 100-Year event  
 Inflow = 27.54 cfs @ 12.10 hrs, Volume= 2.347 af  
 Outflow = 5.29 cfs @ 12.56 hrs, Volume= 2.347 af, Atten= 81%, Lag= 27.4 min  
 Discarded = 5.29 cfs @ 12.56 hrs, Volume= 2.347 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 196.61' @ 12.56 hrs Surf.Area= 18,792 sf Storage= 27,041 cf

Plug-Flow detention time= 33.6 min calculated for 2.347 af (100% of inflow)  
 Center-of-Mass det. time= 33.6 min ( 833.5 - 799.8 )

| Volume              | Invert               | Avail.Storage             | Storage Description                                        |
|---------------------|----------------------|---------------------------|------------------------------------------------------------|
| #1                  | 195.00'              | 34,616 cf                 | <b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) |
| Elevation<br>(feet) | Surf.Area<br>(sq-ft) | Inc.Store<br>(cubic-feet) | Cum.Store<br>(cubic-feet)                                  |
| 195.00              | 14,863               | 0                         | 0                                                          |
| 197.00              | 19,753               | 34,616                    | 34,616                                                     |

| Device | Routing   | Invert  | Outlet Devices                                                                                                       |
|--------|-----------|---------|----------------------------------------------------------------------------------------------------------------------|
| #1     | Discarded | 195.00' | <b>8.270 in/hr Exfiltration over Surface area</b><br>Conductivity to Groundwater Elevation = 192.00' Phase-In= 0.01' |

**Discarded OutFlow** Max=5.29 cfs @ 12.56 hrs HW=196.61' (Free Discharge)

↑ **1=Exfiltration** ( Controls 5.29 cfs)

**Summary for Link DP1:**

Inflow Area = 0.189 ac, 0.44% Impervious, Inflow Depth = 1.20" for 100-Year event  
 Inflow = 0.17 cfs @ 12.12 hrs, Volume= 0.019 af  
 Primary = 0.17 cfs @ 12.12 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min  
 Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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**Summary for Link DP3:**

Inflow Area = 13.051 ac, 61.61% Impervious, Inflow Depth = 0.07" for 100-Year event  
Inflow = 0.47 cfs @ 12.41 hrs, Volume= 0.072 af  
Primary = 0.47 cfs @ 12.41 hrs, Volume= 0.072 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

**Summary for Link DP4:**

Inflow Area = 0.341 ac, 0.00% Impervious, Inflow Depth = 0.56" for 100-Year event  
Inflow = 0.07 cfs @ 12.36 hrs, Volume= 0.016 af  
Primary = 0.07 cfs @ 12.36 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min  
Routed to nonexistent node POA-3

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

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**Stage-Area-Storage for Pond P1.10: AG infiltration basin**

| Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) | Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 196.10              | 16,990             | 0                       | 198.75              | 23,346             | 53,445                  |
| 196.15              | 17,110             | 852                     | 198.80              | 23,466             | 54,616                  |
| 196.20              | 17,230             | 1,711                   | 198.85              | 23,586             | 55,792                  |
| 196.25              | 17,350             | 2,575                   | 198.90              | 23,706             | 56,974                  |
| 196.30              | 17,470             | 3,446                   | 198.95              | 23,826             | 58,163                  |
| 196.35              | 17,590             | 4,322                   | 199.00              | 23,946             | 59,357                  |
| 196.40              | 17,710             | 5,205                   | 199.05              | 24,066             | 60,557                  |
| 196.45              | 17,829             | 6,093                   | 199.10              | 24,186             | 61,764                  |
| 196.50              | 17,949             | 6,988                   | 199.15              | 24,306             | 62,976                  |
| 196.55              | 18,069             | 7,888                   | 199.20              | 24,426             | 64,194                  |
| 196.60              | 18,189             | 8,795                   | 199.25              | 24,546             | 65,418                  |
| 196.65              | 18,309             | 9,707                   | 199.30              | 24,665             | 66,649                  |
| 196.70              | 18,429             | 10,626                  | 199.35              | 24,785             | 67,885                  |
| 196.75              | 18,549             | 11,550                  | 199.40              | 24,905             | 69,127                  |
| 196.80              | 18,669             | 12,481                  | 199.45              | 25,025             | 70,375                  |
| 196.85              | 18,789             | 13,417                  | 199.50              | 25,145             | 71,630                  |
| 196.90              | 18,909             | 14,360                  | 199.55              | 25,265             | 72,890                  |
| 196.95              | 19,029             | 15,308                  | 199.60              | <b>25,385</b>      | <b>74,156</b>           |
| 197.00              | 19,149             | 16,262                  |                     |                    |                         |
| 197.05              | 19,269             | 17,223                  |                     |                    |                         |
| 197.10              | 19,389             | 18,189                  |                     |                    |                         |
| 197.15              | 19,509             | 19,162                  |                     |                    |                         |
| 197.20              | 19,628             | 20,140                  |                     |                    |                         |
| 197.25              | 19,748             | 21,125                  |                     |                    |                         |
| 197.30              | 19,868             | 22,115                  |                     |                    |                         |
| 197.35              | 19,988             | 23,111                  |                     |                    |                         |
| 197.40              | 20,108             | 24,114                  |                     |                    |                         |
| 197.45              | 20,228             | 25,122                  |                     |                    |                         |
| 197.50              | 20,348             | 26,137                  |                     |                    |                         |
| 197.55              | 20,468             | 27,157                  |                     |                    |                         |
| 197.60              | 20,588             | 28,183                  |                     |                    |                         |
| 197.65              | 20,708             | 29,216                  |                     |                    |                         |
| 197.70              | 20,828             | 30,254                  |                     |                    |                         |
| 197.75              | 20,948             | 31,299                  |                     |                    |                         |
| 197.80              | 21,068             | 32,349                  |                     |                    |                         |
| 197.85              | 21,188             | 33,405                  |                     |                    |                         |
| 197.90              | 21,307             | 34,468                  |                     |                    |                         |
| 197.95              | 21,427             | 35,536                  |                     |                    |                         |
| 198.00              | 21,547             | 36,610                  |                     |                    |                         |
| 198.05              | 21,667             | 37,691                  |                     |                    |                         |
| 198.10              | 21,787             | 38,777                  |                     |                    |                         |
| 198.15              | 21,907             | 39,869                  |                     |                    |                         |
| 198.20              | 22,027             | 40,968                  |                     |                    |                         |
| 198.25              | 22,147             | 42,072                  |                     |                    |                         |
| 198.30              | 22,267             | 43,183                  |                     |                    |                         |
| 198.35              | 22,387             | 44,299                  |                     |                    |                         |
| 198.40              | 22,507             | 45,421                  |                     |                    |                         |
| 198.45              | 22,627             | 46,550                  |                     |                    |                         |
| 198.50              | 22,747             | 47,684                  |                     |                    |                         |
| 198.55              | 22,866             | 48,824                  |                     |                    |                         |
| 198.60              | 22,986             | 49,971                  |                     |                    |                         |
| 198.65              | 23,106             | 51,123                  |                     |                    |                         |
| 198.70              | 23,226             | 52,281                  |                     |                    |                         |

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**Stage-Area-Storage for Pond P1.12: Bioretention**

| Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) | Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 200.01              | 6,093              | 0                       | 202.66              | 14,801             | 8,522                   |
| 200.06              | 6,093              | 91                      | 202.71              | 14,999             | 8,962                   |
| 200.11              | 6,093              | 183                     | 202.76              | <b>15,197</b>      | <b>9,413</b>            |
| 200.16              | 6,093              | 274                     |                     |                    |                         |
| 200.21              | 6,093              | 366                     |                     |                    |                         |
| 200.26              | 6,093              | 457                     |                     |                    |                         |
| 200.31              | 6,093              | 548                     |                     |                    |                         |
| 200.36              | 6,093              | 640                     |                     |                    |                         |
| 200.41              | 6,093              | 731                     |                     |                    |                         |
| 200.46              | 6,093              | 823                     |                     |                    |                         |
| 200.51              | 6,093              | 914                     |                     |                    |                         |
| 200.56              | 6,093              | 1,005                   |                     |                    |                         |
| 200.61              | 6,093              | 1,097                   |                     |                    |                         |
| 200.66              | 6,093              | 1,188                   |                     |                    |                         |
| 200.71              | 6,093              | 1,280                   |                     |                    |                         |
| 200.76              | 6,093              | 1,371                   |                     |                    |                         |
| 200.81              | 6,093              | 1,462                   |                     |                    |                         |
| 200.86              | 6,093              | 1,554                   |                     |                    |                         |
| 200.91              | 6,093              | 1,645                   |                     |                    |                         |
| 200.96              | 6,093              | 1,737                   |                     |                    |                         |
| 201.01              | 6,093              | 1,828                   |                     |                    |                         |
| 201.06              | 6,093              | 1,919                   |                     |                    |                         |
| 201.11              | 6,093              | 2,011                   |                     |                    |                         |
| 201.16              | 6,093              | 2,102                   |                     |                    |                         |
| 201.21              | 6,093              | 2,193                   |                     |                    |                         |
| 201.26              | 6,093              | 2,285                   |                     |                    |                         |
| 201.31              | 6,093              | 2,376                   |                     |                    |                         |
| 201.36              | 6,093              | 2,468                   |                     |                    |                         |
| 201.41              | 6,093              | 2,559                   |                     |                    |                         |
| 201.46              | 6,093              | 2,650                   |                     |                    |                         |
| 201.51              | 6,093              | 2,742                   |                     |                    |                         |
| 201.56              | 6,093              | 2,833                   |                     |                    |                         |
| 201.61              | 6,093              | 2,925                   |                     |                    |                         |
| 201.66              | 6,093              | 3,016                   |                     |                    |                         |
| 201.71              | 6,093              | 3,107                   |                     |                    |                         |
| 201.76              | 6,093              | 3,199                   |                     |                    |                         |
| 201.81              | 6,093              | 3,290                   |                     |                    |                         |
| 201.86              | 6,093              | 3,382                   |                     |                    |                         |
| 201.91              | 6,093              | 3,473                   |                     |                    |                         |
| 201.96              | 6,093              | 3,564                   |                     |                    |                         |
| 202.01              | 12,226             | 3,699                   |                     |                    |                         |
| 202.06              | 12,424             | 4,010                   |                     |                    |                         |
| 202.11              | 12,622             | 4,332                   |                     |                    |                         |
| 202.16              | 12,820             | 4,663                   |                     |                    |                         |
| 202.21              | 13,018             | 5,004                   |                     |                    |                         |
| 202.26              | 13,216             | 5,356                   |                     |                    |                         |
| 202.31              | 13,414             | 5,717                   |                     |                    |                         |
| 202.36              | 13,612             | 6,088                   |                     |                    |                         |
| 202.41              | 13,811             | 6,469                   |                     |                    |                         |
| 202.46              | 14,009             | 6,860                   |                     |                    |                         |
| 202.51              | 14,207             | 7,260                   |                     |                    |                         |
| 202.56              | 14,405             | 7,671                   |                     |                    |                         |
| 202.61              | 14,603             | 8,091                   |                     |                    |                         |

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### Pond P1.13: Stormtrap - Chamber Wizard Field A

**Chamber Model = StormTrap ST2 SingleTrap 3-6 (StormTrap ST2 SingleTrap® Type II+IV)**

Inside= 101.7"W x 42.0"H => 26.77 sf x 15.40'L = 412.1 cf

Outside= 101.7"W x 48.0"H => 33.92 sf x 15.40'L = 522.2 cf

16 Chambers/Row x 15.40' Long = 246.33' Row Length +79.9" Border x 2 = 259.65' Base Length

2 Rows x 101.7" Wide + 79.9" Side Border x 2 = 30.27' Base Width

48.0" Chamber Height = 4.00' Field Height

32 Chambers x 412.1 cf + 11,152.0 cf Border = 24,340.2 cf Chamber Storage

32 Chambers x 522.2 cf + 14,729.2 cf Border = 31,438.8 cf Displacement

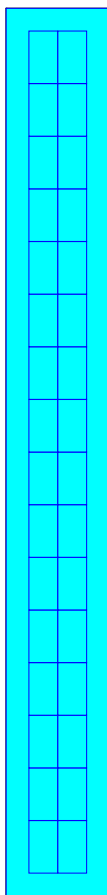
Chamber Storage = 24,340.2 cf = 0.559 af

Overall Storage Efficiency = 77.4%

Overall System Size = 259.65' x 30.27' x 4.00'

32 Chambers (plus border)

1,164.4 cy Field



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**Stage-Area-Storage for Pond P1.13: Stormtrap**

| Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) | Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 197.20              | <b>7,860</b>       | 0                       | 199.85              | 7,860              | 18,429                  |
| 197.25              | 7,860              | 348                     | 199.90              | 7,860              | 18,777                  |
| 197.30              | 7,860              | 695                     | 199.95              | 7,860              | 19,124                  |
| 197.35              | 7,860              | 1,043                   | 200.00              | 7,860              | 19,472                  |
| 197.40              | 7,860              | 1,391                   | 200.05              | 7,860              | 19,820                  |
| 197.45              | 7,860              | 1,739                   | 200.10              | 7,860              | 20,168                  |
| 197.50              | 7,860              | 2,086                   | 200.15              | 7,860              | 20,515                  |
| 197.55              | 7,860              | 2,434                   | 200.20              | 7,860              | 20,863                  |
| 197.60              | 7,860              | 2,782                   | 200.25              | 7,860              | 21,211                  |
| 197.65              | 7,860              | 3,129                   | 200.30              | 7,860              | 21,558                  |
| 197.70              | 7,860              | 3,477                   | 200.35              | 7,860              | 21,906                  |
| 197.75              | 7,860              | 3,825                   | 200.40              | 7,860              | 22,254                  |
| 197.80              | 7,860              | 4,173                   | 200.45              | 7,860              | 22,602                  |
| 197.85              | 7,860              | 4,520                   | 200.50              | 7,860              | 22,949                  |
| 197.90              | 7,860              | 4,868                   | 200.55              | 7,860              | 23,297                  |
| 197.95              | 7,860              | 5,216                   | 200.60              | 7,860              | 23,645                  |
| 198.00              | 7,860              | 5,563                   | 200.65              | 7,860              | 23,992                  |
| 198.05              | 7,860              | 5,911                   | 200.70              | 7,860              | 24,340                  |
| 198.10              | 7,860              | 6,259                   | 200.75              | 7,860              | 24,340                  |
| 198.15              | 7,860              | 6,607                   | 200.80              | 7,860              | 24,340                  |
| 198.20              | 7,860              | 6,954                   | 200.85              | 7,860              | 24,340                  |
| 198.25              | 7,860              | 7,302                   | 200.90              | 7,860              | 24,340                  |
| 198.30              | 7,860              | 7,650                   | 200.95              | 7,860              | 24,340                  |
| 198.35              | 7,860              | 7,997                   | 201.00              | 7,860              | 24,340                  |
| 198.40              | 7,860              | 8,345                   | 201.05              | 7,860              | 24,340                  |
| 198.45              | 7,860              | 8,693                   | 201.10              | 7,860              | <b>24,340</b>           |
| 198.50              | 7,860              | 9,041                   | 201.15              | 7,860              | <b>24,340</b>           |
| 198.55              | 7,860              | 9,388                   | 201.20              | 7,860              | 24,340                  |
| 198.60              | 7,860              | 9,736                   |                     |                    |                         |
| 198.65              | 7,860              | 10,084                  |                     |                    |                         |
| 198.70              | 7,860              | 10,432                  |                     |                    |                         |
| 198.75              | 7,860              | 10,779                  |                     |                    |                         |
| 198.80              | 7,860              | 11,127                  |                     |                    |                         |
| 198.85              | 7,860              | 11,475                  |                     |                    |                         |
| 198.90              | 7,860              | 11,822                  |                     |                    |                         |
| 198.95              | 7,860              | 12,170                  |                     |                    |                         |
| 199.00              | 7,860              | 12,518                  |                     |                    |                         |
| 199.05              | 7,860              | 12,866                  |                     |                    |                         |
| 199.10              | 7,860              | 13,213                  |                     |                    |                         |
| 199.15              | 7,860              | 13,561                  |                     |                    |                         |
| 199.20              | 7,860              | 13,909                  |                     |                    |                         |
| 199.25              | 7,860              | 14,256                  |                     |                    |                         |
| 199.30              | 7,860              | 14,604                  |                     |                    |                         |
| 199.35              | 7,860              | 14,952                  |                     |                    |                         |
| 199.40              | 7,860              | 15,300                  |                     |                    |                         |
| 199.45              | 7,860              | 15,647                  |                     |                    |                         |
| 199.50              | 7,860              | 15,995                  |                     |                    |                         |
| 199.55              | 7,860              | 16,343                  |                     |                    |                         |
| 199.60              | 7,860              | 16,690                  |                     |                    |                         |
| 199.65              | 7,860              | 17,038                  |                     |                    |                         |
| 199.70              | 7,860              | 17,386                  |                     |                    |                         |
| 199.75              | 7,860              | 17,734                  |                     |                    |                         |
| 199.80              | 7,860              | 18,081                  |                     |                    |                         |

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**Stage-Area-Storage for Pond P1.4: Bioretention**

| Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) | Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 195.30              | 850                | 0                       | 197.95              | 2,828              | 1,429                   |
| 195.35              | 850                | 13                      | 198.00              | 2,915              | 1,530                   |
| 195.40              | 850                | 25                      | 198.05              | 3,001              | 1,636                   |
| 195.45              | 850                | 38                      | 198.10              | 3,088              | 1,745                   |
| 195.50              | 850                | 51                      | 198.15              | 3,175              | 1,859                   |
| 195.55              | 850                | 64                      | 198.20              | 3,262              | 1,978                   |
| 195.60              | 850                | 77                      | 198.25              | 3,349              | 2,101                   |
| 195.65              | 850                | 89                      | 198.30              | 3,435              | 2,228                   |
| 195.70              | 850                | 102                     | 198.35              | 3,522              | 2,359                   |
| 195.75              | 850                | 115                     | 198.40              | 3,609              | 2,495                   |
| 195.80              | 850                | 128                     | 198.45              | 3,696              | 2,635                   |
| 195.85              | 850                | 140                     | 198.50              | 3,782              | 2,779                   |
| 195.90              | 850                | 153                     | 198.55              | 3,869              | 2,928                   |
| 195.95              | 850                | 166                     | 198.60              | 3,956              | 3,081                   |
| 196.00              | 850                | 178                     | 198.65              | 4,043              | 3,239                   |
| 196.05              | 850                | 191                     | 198.70              | 4,129              | 3,401                   |
| 196.10              | 850                | 204                     | 198.75              | 4,216              | 3,567                   |
| 196.15              | 850                | 217                     | 198.80              | 4,303              | 3,737                   |
| 196.20              | 850                | 230                     | 198.85              | 4,390              | 3,912                   |
| 196.25              | 850                | 242                     | 198.90              | 4,476              | 4,091                   |
| 196.30              | 850                | 255                     | 198.95              | 4,563              | 4,275                   |
| 196.35              | 850                | 268                     | 199.00              | <b>4,650</b>       | <b>4,462</b>            |
| 196.40              | 850                | 280                     |                     |                    |                         |
| 196.45              | 850                | 293                     |                     |                    |                         |
| 196.50              | 850                | 306                     |                     |                    |                         |
| 196.55              | 850                | 319                     |                     |                    |                         |
| 196.60              | 850                | 332                     |                     |                    |                         |
| 196.65              | 850                | 344                     |                     |                    |                         |
| 196.70              | 850                | 357                     |                     |                    |                         |
| 196.75              | 850                | 370                     |                     |                    |                         |
| 196.80              | 850                | 383                     |                     |                    |                         |
| 196.85              | 850                | 395                     |                     |                    |                         |
| 196.90              | 850                | 408                     |                     |                    |                         |
| 196.95              | 850                | 421                     |                     |                    |                         |
| 197.00              | 850                | 433                     |                     |                    |                         |
| 197.05              | 850                | 446                     |                     |                    |                         |
| 197.10              | 850                | 459                     |                     |                    |                         |
| 197.15              | 850                | 472                     |                     |                    |                         |
| 197.20              | 850                | 485                     |                     |                    |                         |
| 197.25              | 850                | 497                     |                     |                    |                         |
| 197.30              | 1,700              | 510                     |                     |                    |                         |
| 197.35              | 1,787              | 555                     |                     |                    |                         |
| 197.40              | 1,874              | 604                     |                     |                    |                         |
| 197.45              | 1,960              | 657                     |                     |                    |                         |
| 197.50              | 2,047              | 715                     |                     |                    |                         |
| 197.55              | 2,134              | 777                     |                     |                    |                         |
| 197.60              | 2,221              | 843                     |                     |                    |                         |
| 197.65              | 2,307              | 914                     |                     |                    |                         |
| 197.70              | 2,394              | 989                     |                     |                    |                         |
| 197.75              | 2,481              | 1,068                   |                     |                    |                         |
| 197.80              | 2,568              | 1,152                   |                     |                    |                         |
| 197.85              | 2,654              | 1,240                   |                     |                    |                         |
| 197.90              | 2,741              | 1,332                   |                     |                    |                         |

lowest outlet

**W211244 Proposed**

Prepared by Bohler Engineers

HydroCAD® 10.20-4a s/n 03478 © 2023 HydroCAD Software Solutions LLC

Type III 24-hr 100-Year Rainfall=8.03"

Printed 9/17/2024

Page 6

**Stage-Area-Storage for Pond P2.1: DP2 AG infiltration basin**

| Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) | Elevation<br>(feet) | Surface<br>(sq-ft) | Storage<br>(cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 195.00              | 14,863             | 0                       | 196.06              | 17,455             | 17,128                  |
| 195.02              | 14,912             | 298                     | 196.08              | 17,504             | 17,478                  |
| 195.04              | 14,961             | 596                     | 196.10              | 17,552             | 17,829                  |
| 195.06              | 15,010             | 896                     | 196.12              | 17,601             | 18,180                  |
| 195.08              | 15,059             | 1,197                   | 196.14              | 17,650             | 18,533                  |
| 195.10              | 15,107             | 1,499                   | 196.16              | 17,699             | 18,886                  |
| 195.12              | 15,156             | 1,801                   | 196.18              | 17,748             | 19,241                  |
| 195.14              | 15,205             | 2,105                   | 196.20              | 17,797             | 19,596                  |
| 195.16              | 15,254             | 2,409                   | 196.22              | 17,846             | 19,952                  |
| 195.18              | 15,303             | 2,715                   | 196.24              | 17,895             | 20,310                  |
| 195.20              | 15,352             | 3,021                   | 196.26              | 17,944             | 20,668                  |
| 195.22              | 15,401             | 3,329                   | 196.28              | 17,993             | 21,028                  |
| 195.24              | 15,450             | 3,638                   | 196.30              | 18,042             | 21,388                  |
| 195.26              | 15,499             | 3,947                   | 196.32              | 18,090             | 21,749                  |
| 195.28              | 15,548             | 4,257                   | 196.34              | 18,139             | 22,112                  |
| 195.30              | 15,597             | 4,569                   | 196.36              | 18,188             | 22,475                  |
| 195.32              | 15,645             | 4,881                   | 196.38              | 18,237             | 22,839                  |
| 195.34              | 15,694             | 5,195                   | 196.40              | 18,286             | 23,204                  |
| 195.36              | 15,743             | 5,509                   | 196.42              | 18,335             | 23,571                  |
| 195.38              | 15,792             | 5,824                   | 196.44              | 18,384             | 23,938                  |
| 195.40              | 15,841             | 6,141                   | 196.46              | 18,433             | 24,306                  |
| 195.42              | 15,890             | 6,458                   | 196.48              | 18,482             | 24,675                  |
| 195.44              | 15,939             | 6,776                   | 196.50              | 18,531             | 25,045                  |
| 195.46              | 15,988             | 7,096                   | 196.52              | 18,579             | 25,416                  |
| 195.48              | 16,037             | 7,416                   | 196.54              | 18,628             | 25,788                  |
| 195.50              | 16,086             | 7,737                   | 196.56              | 18,677             | 26,161                  |
| 195.52              | 16,134             | 8,059                   | 196.58              | 18,726             | 26,535                  |
| 195.54              | 16,183             | 8,383                   | 196.60              | 18,775             | 26,910                  |
| 195.56              | 16,232             | 8,707                   | 196.62              | 18,824             | 27,286                  |
| 195.58              | 16,281             | 9,032                   | 196.64              | 18,873             | 27,663                  |
| 195.60              | 16,330             | 9,358                   | 196.66              | 18,922             | 28,041                  |
| 195.62              | 16,379             | 9,685                   | 196.68              | 18,971             | 28,420                  |
| 195.64              | 16,428             | 10,013                  | 196.70              | 19,019             | 28,800                  |
| 195.66              | 16,477             | 10,342                  | 196.72              | 19,068             | 29,181                  |
| 195.68              | 16,526             | 10,672                  | 196.74              | 19,117             | 29,563                  |
| 195.70              | 16,574             | 11,003                  | 196.76              | 19,166             | 29,946                  |
| 195.72              | 16,623             | 11,335                  | 196.78              | 19,215             | 30,330                  |
| 195.74              | 16,672             | 11,668                  | 196.80              | 19,264             | 30,714                  |
| 195.76              | 16,721             | 12,002                  | 196.82              | 19,313             | 31,100                  |
| 195.78              | 16,770             | 12,337                  | 196.84              | 19,362             | 31,487                  |
| 195.80              | 16,819             | 12,673                  | 196.86              | 19,411             | 31,875                  |
| 195.82              | 16,868             | 13,010                  | 196.88              | 19,460             | 32,263                  |
| 195.84              | 16,917             | 13,348                  | 196.90              | 19,509             | 32,653                  |
| 195.86              | 16,966             | 13,686                  | 196.92              | 19,557             | 33,044                  |
| 195.88              | 17,015             | 14,026                  | 196.94              | 19,606             | 33,435                  |
| 195.90              | 17,064             | 14,367                  | 196.96              | 19,655             | 33,828                  |
| 195.92              | 17,112             | 14,709                  | 196.98              | 19,704             | 34,221                  |
| 195.94              | 17,161             | 15,051                  | 197.00              | <b>19,753</b>      | <b>34,616</b>           |
| 195.96              | 17,210             | 15,395                  |                     |                    |                         |
| 195.98              | 17,259             | 15,740                  |                     |                    |                         |
| 196.00              | 17,308             | 16,086                  |                     |                    |                         |
| 196.02              | 17,357             | 16,432                  |                     |                    |                         |
| 196.04              | 17,406             | 16,780                  |                     |                    |                         |

lowest outlet

## **APPENDIX F: STORMWATER CALCULATIONS**

- NOAA RAINFALL DATA
- MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME
- MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL
- OUTLET PROTECTION SIZING
- MOUNDING ANALYSIS AND NARRATIVE



NOAA Atlas 14, Volume 10, Version 3  
Location name: North Attleboro, Massachusetts,  
USA\*

Latitude: 42.0074°, Longitude: -71.304°

Elevation: 201 ft\*\*

\* source: ESRI Maps

\*\* source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup> |                                     |                        |                        |                        |                        |                       |                       |                      |                      |                      |
|----------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|----------------------|----------------------|----------------------|
| Duration                                                                                                 | Average recurrence interval (years) |                        |                        |                        |                        |                       |                       |                      |                      |                      |
|                                                                                                          | 1                                   | 2                      | 5                      | 10                     | 25                     | 50                    | 100                   | 200                  | 500                  | 1000                 |
| 5-min                                                                                                    | 0.313<br>(0.248-0.391)              | 0.385<br>(0.305-0.481) | 0.502<br>(0.397-0.630) | 0.599<br>(0.470-0.756) | 0.733<br>(0.556-0.969) | 0.833<br>(0.619-1.12) | 0.940<br>(0.678-1.32) | 1.06<br>(0.720-1.52) | 1.25<br>(0.811-1.84) | 1.40<br>(0.889-2.11) |
| 10-min                                                                                                   | 0.443<br>(0.352-0.554)              | 0.545<br>(0.432-0.682) | 0.711<br>(0.562-0.893) | 0.849<br>(0.666-1.07)  | 1.04<br>(0.788-1.37)   | 1.18<br>(0.876-1.59)  | 1.33<br>(0.960-1.87)  | 1.51<br>(1.02-2.15)  | 1.77<br>(1.15-2.61)  | 1.99<br>(1.26-2.99)  |
| 15-min                                                                                                   | 0.521<br>(0.414-0.652)              | 0.641<br>(0.508-0.802) | 0.837<br>(0.661-1.05)  | 0.999<br>(0.784-1.26)  | 1.22<br>(0.927-1.62)   | 1.39<br>(1.03-1.88)   | 1.57<br>(1.13-2.20)   | 1.77<br>(1.20-2.53)  | 2.08<br>(1.35-3.07)  | 2.34<br>(1.48-3.52)  |
| 30-min                                                                                                   | 0.721<br>(0.573-0.901)              | 0.890<br>(0.706-1.11)  | 1.17<br>(0.921-1.46)   | 1.40<br>(1.10-1.76)    | 1.71<br>(1.30-2.26)    | 1.94<br>(1.44-2.63)   | 2.20<br>(1.58-3.08)   | 2.49<br>(1.68-3.55)  | 2.93<br>(1.90-4.31)  | 3.29<br>(2.08-4.95)  |
| 60-min                                                                                                   | 0.921<br>(0.731-1.15)               | 1.14<br>(0.903-1.42)   | 1.50<br>(1.18-1.88)    | 1.79<br>(1.41-2.26)    | 2.20<br>(1.67-2.90)    | 2.50<br>(1.86-3.38)   | 2.82<br>(2.04-3.97)   | 3.20<br>(2.17-4.57)  | 3.77<br>(2.45-5.56)  | 4.25<br>(2.69-6.38)  |
| 2-hr                                                                                                     | 1.18<br>(0.941-1.46)                | 1.47<br>(1.18-1.83)    | 1.96<br>(1.56-2.44)    | 2.36<br>(1.87-2.96)    | 2.92<br>(2.23-3.83)    | 3.33<br>(2.50-4.47)   | 3.78<br>(2.75-5.28)   | 4.31<br>(2.93-6.09)  | 5.13<br>(3.34-7.49)  | 5.82<br>(3.70-8.66)  |
| 3-hr                                                                                                     | 1.36<br>(1.10-1.68)                 | 1.71<br>(1.37-2.11)    | 2.28<br>(1.82-2.82)    | 2.75<br>(2.18-3.42)    | 3.40<br>(2.61-4.44)    | 3.87<br>(2.92-5.18)   | 4.39<br>(3.22-6.12)   | 5.02<br>(3.43-7.06)  | 5.98<br>(3.91-8.69)  | 6.81<br>(4.34-10.1)  |
| 6-hr                                                                                                     | 1.78<br>(1.44-2.18)                 | 2.21<br>(1.79-2.70)    | 2.91<br>(2.34-3.57)    | 3.49<br>(2.79-4.30)    | 4.28<br>(3.32-5.55)    | 4.87<br>(3.69-6.45)   | 5.51<br>(4.06-7.60)   | 6.28<br>(4.31-8.74)  | 7.44<br>(4.90-10.7)  | 8.44<br>(5.41-12.4)  |
| 12-hr                                                                                                    | 2.32<br>(1.89-2.81)                 | 2.82<br>(2.30-3.42)    | 3.63<br>(2.95-4.43)    | 4.31<br>(3.48-5.28)    | 5.25<br>(4.09-6.72)    | 5.94<br>(4.53-7.78)   | 6.69<br>(4.94-9.09)   | 7.56<br>(5.23-10.4)  | 8.87<br>(5.87-12.6)  | 9.97<br>(6.43-14.5)  |
| 24-hr                                                                                                    | 2.81<br>(2.31-3.38)                 | 3.40<br>(2.80-4.10)    | 4.38<br>(3.59-5.29)    | 5.19<br>(4.23-6.31)    | 6.31<br>(4.96-8.01)    | 7.14<br>(5.48-9.27)   | 8.03<br>(5.98-10.8)   | 9.09<br>(6.32-12.4)  | 10.7<br>(7.09-15.0)  | 12.0<br>(7.77-17.2)  |
| 2-day                                                                                                    | 3.17<br>(2.63-3.78)                 | 3.90<br>(3.23-4.65)    | 5.09<br>(4.20-6.09)    | 6.08<br>(4.98-7.32)    | 7.44<br>(5.89-9.38)    | 8.44<br>(6.54-10.9)   | 9.53<br>(7.17-12.8)   | 10.9<br>(7.59-14.7)  | 12.9<br>(8.63-18.0)  | 14.7<br>(9.55-20.9)  |
| 3-day                                                                                                    | 3.45<br>(2.88-4.09)                 | 4.23<br>(3.52-5.02)    | 5.51<br>(4.57-6.56)    | 6.57<br>(5.41-7.87)    | 8.02<br>(6.39-10.1)    | 9.10<br>(7.09-11.7)   | 10.3<br>(7.76-13.7)   | 11.7<br>(8.21-15.8)  | 13.9<br>(9.33-19.3)  | 15.8<br>(10.3-22.4)  |
| 4-day                                                                                                    | 3.71<br>(3.11-4.39)                 | 4.52<br>(3.78-5.35)    | 5.84<br>(4.86-6.94)    | 6.94<br>(5.74-8.28)    | 8.44<br>(6.74-10.6)    | 9.56<br>(7.46-12.2)   | 10.8<br>(8.15-14.3)   | 12.2<br>(8.61-16.4)  | 14.5<br>(9.75-20.1)  | 16.4<br>(10.8-23.2)  |
| 7-day                                                                                                    | 4.45<br>(3.75-5.22)                 | 5.30<br>(4.46-6.23)    | 6.68<br>(5.60-7.88)    | 7.84<br>(6.52-9.29)    | 9.42<br>(7.56-11.7)    | 10.6<br>(8.31-13.4)   | 11.9<br>(9.00-15.6)   | 13.4<br>(9.45-17.8)  | 15.6<br>(10.6-21.4)  | 17.5<br>(11.5-24.5)  |
| 10-day                                                                                                   | 5.16<br>(4.36-6.03)                 | 6.03<br>(5.10-7.06)    | 7.46<br>(6.28-8.76)    | 8.65<br>(7.23-10.2)    | 10.3<br>(8.28-12.6)    | 11.5<br>(9.04-14.4)   | 12.8<br>(9.70-16.6)   | 14.3<br>(10.2-18.9)  | 16.5<br>(11.2-22.5)  | 18.3<br>(12.1-25.4)  |
| 20-day                                                                                                   | 7.29<br>(6.22-8.45)                 | 8.23<br>(7.02-9.55)    | 9.77<br>(8.30-11.4)    | 11.0<br>(9.31-12.9)    | 12.8<br>(10.4-15.5)    | 14.2<br>(11.1-17.4)   | 15.5<br>(11.7-19.7)   | 16.9<br>(12.1-22.1)  | 18.9<br>(12.9-25.5)  | 20.4<br>(13.5-28.1)  |
| 30-day                                                                                                   | 9.06<br>(7.77-10.5)                 | 10.1<br>(8.61-11.6)    | 11.7<br>(9.96-13.5)    | 13.0<br>(11.0-15.2)    | 14.9<br>(12.1-17.9)    | 16.3<br>(12.9-19.9)   | 17.7<br>(13.4-22.2)   | 19.1<br>(13.8-24.8)  | 20.9<br>(14.4-28.0)  | 22.2<br>(14.8-30.4)  |
| 45-day                                                                                                   | 11.3<br>(9.70-12.9)                 | 12.3<br>(10.6-14.1)    | 14.0<br>(12.0-16.2)    | 15.5<br>(13.2-17.9)    | 17.4<br>(14.2-20.8)    | 19.0<br>(15.0-23.0)   | 20.5<br>(15.5-25.4)   | 21.8<br>(15.8-28.1)  | 23.5<br>(16.2-31.3)  | 24.6<br>(16.4-33.4)  |
| 60-day                                                                                                   | 13.1<br>(11.3-15.0)                 | 14.2<br>(12.3-16.2)    | 16.0<br>(13.8-18.4)    | 17.5<br>(15.0-20.2)    | 19.6<br>(16.0-23.2)    | 21.2<br>(16.9-25.6)   | 22.8<br>(17.2-28.1)   | 24.1<br>(17.5-30.9)  | 25.7<br>(17.8-34.0)  | 26.7<br>(17.9-36.1)  |

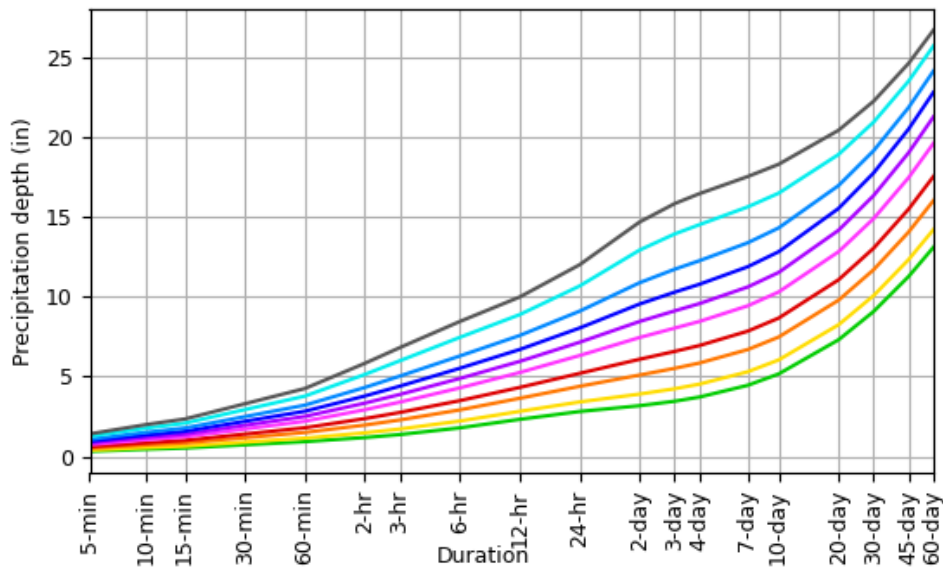
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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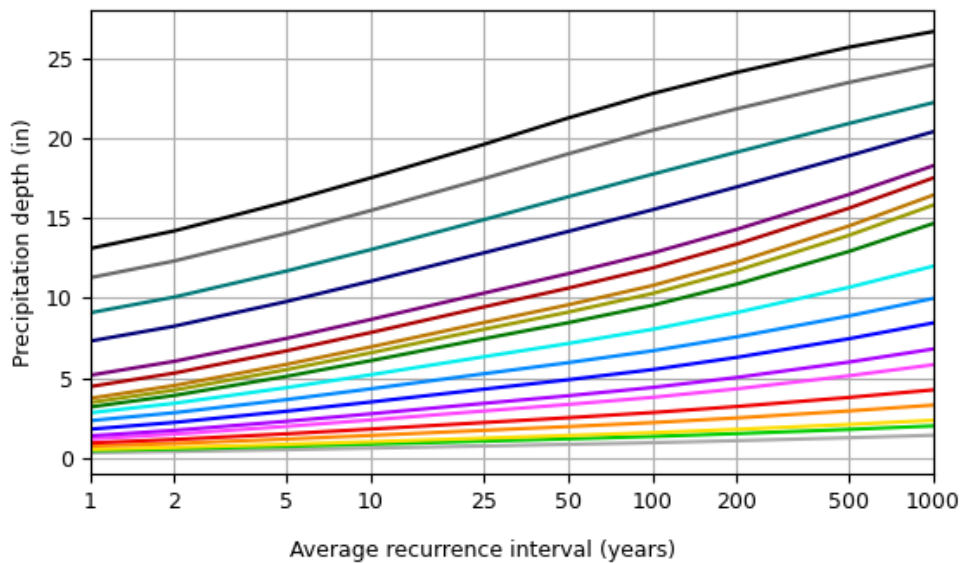
PF graphical

## PDS-based depth-duration-frequency (DDF) curves

Latitude: 42.0074°, Longitude: -71.3040°



| Average recurrence interval (years) |
|-------------------------------------|
| 1                                   |
| 2                                   |
| 5                                   |
| 10                                  |
| 25                                  |
| 50                                  |
| 100                                 |
| 200                                 |
| 500                                 |
| 1000                                |

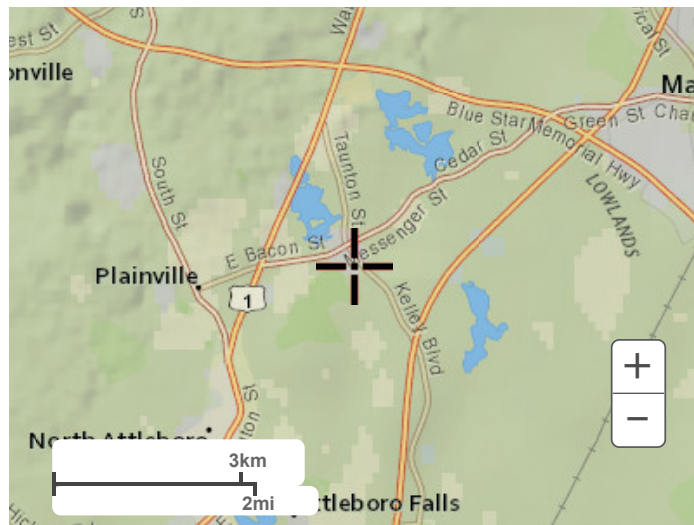


| Duration |        |
|----------|--------|
| 5-min    | 2-day  |
| 10-min   | 3-day  |
| 15-min   | 4-day  |
| 30-min   | 7-day  |
| 60-min   | 10-day |
| 2-hr     | 20-day |
| 3-hr     | 30-day |
| 6-hr     | 45-day |
| 12-hr    | 60-day |
| 24-hr    |        |

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## Maps & aerials

Small scale terrain



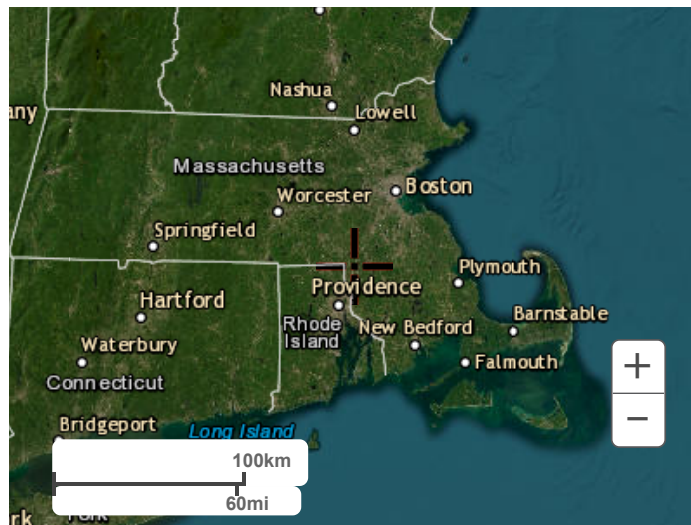
Large scale terrain



Large scale map



Large scale aerial



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[National Water Center](#)  
1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

[Disclaimer](#)

**Proposed Residential Development**  
**582 Kelley Blvd**  
**Town of North Attleborough, MA**  
**Bohler Job Number: W211244**  
**9/19/2024**

**MA DEP Standard 3: Recharge Volume Calculations**

| <b>Required Recharge Volume - A Soils (0.60 in.)</b> |               |
|------------------------------------------------------|---------------|
| Existing Site Impervious Area (ac)                   | 5.339         |
| Proposed Site Impervious Area (ac)                   | 10.833        |
| Proposed Increase in Site Impervious Area (ac)       | 5.494         |
| <b>Recharge Volume Required (cf)</b>                 | <b>11,966</b> |

| <b>Required Recharge Volume - B Soils (0.35 in.)</b> |          |
|------------------------------------------------------|----------|
| Existing Site Impervious Area (ac)                   | 0.000    |
| Proposed Site Impervious Area (ac)                   | 0.000    |
| Proposed Increase in Site Impervious Area (ac)       | 0.000    |
| <b>Recharge Volume Required (cf)</b>                 | <b>0</b> |

| <b>Required Recharge Volume - C Soils (0.25 in.)</b> |          |
|------------------------------------------------------|----------|
| Existing Site Impervious Area (ac)                   | 0.000    |
| Proposed Site Impervious Area (ac)                   | 0.000    |
| Proposed Increase in Site Impervious Area (ac)       | 0.000    |
| <b>Recharge Volume Required (cf)</b>                 | <b>0</b> |

| <b>Required Recharge Volume - D Soils (0.10 in.)</b> |          |
|------------------------------------------------------|----------|
| Existing Site Impervious Area (ac)                   | 0.000    |
| Proposed Site Impervious Area (ac)                   | 0.000    |
| Proposed Increase in Site Impervious Area (ac)       | 0.000    |
| <b>Recharge Volume Required (cf)</b>                 | <b>0</b> |

|                                            |               |
|--------------------------------------------|---------------|
| <b>Total Recharge Volume Required (cf)</b> | <b>11,966</b> |
|--------------------------------------------|---------------|

| <b>Recharge Volume Adjustment Factor</b>            |               |
|-----------------------------------------------------|---------------|
| Impervious Area Directed to Infiltration BMP (ac)   | <b>10.833</b> |
| %Impervious Directed to Infiltration BMP            | 100%          |
| Adjustment Factor                                   | 1.00          |
| <b>Adjusted Total Recharge Volume Required (cf)</b> | <b>11,966</b> |

| <b>Provided Recharge Volume*</b>           |               |
|--------------------------------------------|---------------|
| P1.10                                      | 32,349        |
| P1.13                                      | 22,949        |
| P2.1                                       | 26,910        |
|                                            |               |
| <b>Total Recharge Volume Provided (cf)</b> | <b>82,208</b> |

**Provided greater than or Equal to Required**

\*Volume provided below lowest outlet in cubic feet (cf)

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

MA DEP Standard 3: Drawdown Time Calculations

|                                    |             |
|------------------------------------|-------------|
| <b>P1.10</b>                       |             |
| Volume below outlet pipe (Rv) (cf) | 32,349      |
| Soil Type                          | Sand - A    |
| Infiltration rate (K)*             | 8.27        |
| Bottom Area (sf)                   | 16,990      |
| <b>Drawdown time (Hours)*</b>      | <b>2.8</b>  |
| <b>P1.13</b>                       |             |
| Volume below outlet pipe (Rv) (cf) | 22,949      |
| Soil Type                          | Sand - A    |
| Infiltration rate (K)*             | 5.75        |
| Bottom Area (sf)                   | 7,860       |
| <b>Drawdown time (Hours)**</b>     | <b>6.1</b>  |
| <b>P2.1</b>                        |             |
| Volume below outlet pipe (Rv) (cf) | 26,910      |
| Soil Type                          | Sand - A    |
| Infiltration rate (K)*             | 8.27        |
| Bottom Area (sf)                   | 3,062       |
| <b>Drawdown time (Hours)**</b>     | <b>12.8</b> |

\*Infiltration Rates from lesser of (1) in-situ tests with FS of 2 applied or (2) Rawls rate

\*\*Drawdown time =  $R_v / (K \times (\text{bottom area}))$

Prepared By:

**BOHLER** //

352 Turnpike Road  
Southborough, MA 01772  
(508) 480-9900

9/17/2024

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

MA DEP Standard 4: Water Quality Volume Calculations

| Water Quality Volume Required                                                                                                       |               |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Water Quality Volume runoff (in.)*                                                                                                  | 1.0           |
| Total Post Development Impervious Area (sf)                                                                                         | 471,885       |
| <b>Required Water Quality Volume (cf)</b>                                                                                           | <b>39,324</b> |
| *Water Quality volume runoff is equal to 1.0 inches of runoff times the total impervious area of the post development project site. |               |

| Water Quality Volume Provided*                  |               |
|-------------------------------------------------|---------------|
| P1.10                                           | 32,349        |
| P1.13                                           | 22,949        |
| P2.1                                            | 26,910        |
| P1.12                                           | 5,644         |
| P1.4                                            | 2,495         |
|                                                 |               |
|                                                 |               |
|                                                 |               |
| <b>Total Provided Water Quality Volume (cf)</b> | <b>90,347</b> |

Required WQV Provided

\*Volume provided below lowest outlet pipe in cubic feet (cf)

Prepared By:

**BOHLER //**

352 Turnpike Road  
Southborough, MA 01772  
(508) 480-9900

9/17/2024

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

1" Water Quality Volume to Flow Rate Calculation Sheet

**Compute Water Quality Flow with the following Equation**

$$WQF = (qu)(A)(WQV)$$

| Site Plan Callout |   | qu<br>(from 1" - qu Table) | Impervious<br>Area (SF) | Ai<br>(sq/mi) | WQV<br>(inches) |   | WQF (cfs) | Unit<br>provided | Configuration | WQF treatment<br>rate (cfs) |
|-------------------|---|----------------------------|-------------------------|---------------|-----------------|---|-----------|------------------|---------------|-----------------------------|
| WQU1.11           | = | 774                        | 179812                  | 0.006450      | 1               | = | 4.99      | CS-6             | Offline       | 5.60                        |
| WQU1.13           | = | 774                        | 71793                   | 0.002575      | 1               | = | 1.99      | CS-4             | Online        | 2.00                        |
| WQU1.15           | = | 774                        | 34347                   | 0.001232      | 1               | = | 0.95      | CDS1515          | Online        | 1.00                        |
| WQU2.1.1          | = | 774                        | 3828                    | 0.000137      | 1               | = | 0.11      | CDS1515          | Online        | 1.00                        |
| WQU2.1.2          | = | 774                        | 8560                    | 0.000307      | 1               | = | 0.24      | CDS1515          | Online        | 1.00                        |

Water Quality Flow Rate = WQF  
Water Quality Volume = WQV\*  
Unit peak discharge (csm/in) = qu\*\*  
Impervious Area in watershed (square miles) = Ai

\*WQV is expressed in watershed inches (you must use 1.0-inches in all cases with this method and not 0.5-inches)

\*\* calculate the qu based on the time of concentration (see 1" - qu Table)

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment train for 44% - Deep Sump CBs to Oil/Grit separator

| A<br>BMP            | B<br>TSS Removal<br>Rate | C<br>Starting TSS<br>Load* | D<br>Amount<br>Removed (B*C) | E<br>Remaining<br>Load (C-D) |
|---------------------|--------------------------|----------------------------|------------------------------|------------------------------|
| Deep Sump CBs       | 0.25                     | 1.00                       | 0.25                         | 0.75                         |
| Water Quality Unit  | 0.80                     | 0.75                       | 0.60                         | 0.15                         |
|                     |                          |                            |                              |                              |
|                     |                          |                            |                              |                              |
| Total TSS Removal = |                          |                            | 85%                          |                              |

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

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Pretreatment train for 44% - Filtered Bioretention

| A<br>BMP              | B<br>TSS Removal<br>Rate | C<br>Starting TSS<br>Load* | D<br>Amount<br>Removed (B*C) | E<br>Remaining<br>Load (C-D) |
|-----------------------|--------------------------|----------------------------|------------------------------|------------------------------|
| Filtered Bioretention | 0.80                     | 1.00                       | 0.80                         | 0.20                         |
|                       |                          |                            |                              |                              |
|                       |                          |                            |                              |                              |
|                       |                          |                            |                              |                              |
| Total TSS Removal =   |                          |                            | 80%                          |                              |

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

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Offline Deep Sump CBs to Oil/Grit separator to Infiltration Basin

| A<br>BMP            | B<br>TSS Removal<br>Rate | C<br>Starting TSS<br>Load* | D<br>Amount<br>Removed (B*C) | E<br>Remaining<br>Load (C-D) |
|---------------------|--------------------------|----------------------------|------------------------------|------------------------------|
| Deep Sump CBs       | 0.25                     | 1.00                       | 0.25                         | 0.75                         |
| Water Quality Unit  | 0.80                     | 0.75                       | 0.60                         | 0.15                         |
| Infiltration Basin  | 0.80                     | 0.15                       | 0.12                         | 0.03                         |
|                     |                          |                            |                              |                              |
| Total TSS Removal = |                          |                            | 97%                          |                              |

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

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Filtered Bioretention to Infiltration Basin

| A<br>BMP              | B<br>TSS Removal<br>Rate | C<br>Starting TSS<br>Load* | D<br>Amount<br>Removed (B*C) | E<br>Remaining<br>Load (C-D) |
|-----------------------|--------------------------|----------------------------|------------------------------|------------------------------|
| Filtered Bioretention | 0.80                     | 1.00                       | 0.80                         | 0.20                         |
| Infiltration Basin    | 0.80                     | 0.20                       | 0.16                         | 0.04                         |
|                       |                          |                            |                              |                              |
|                       |                          |                            |                              |                              |
| Total TSS Removal =   |                          |                            | 96%                          |                              |

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

Estimated Net Annual Solids Load Reduction  
Based on the Rational Rainfall Method



Proposed Development  
North Attleboro, MA  
WQU 1.11



AREA 4.13 acres CASCADE MODEL CS-6  
WEIGHTED C 0.90  
TC 6.00 minutes

| Rainfall Intensity <sup>1</sup><br>(in/hr)     | Percent Rainfall<br>Volume <sup>1</sup> | Hydraulic Loading Rate<br>(gpm/ft <sup>2</sup> ) | Removal Efficiency<br>(%) | Incremental Removal<br>(%) |
|------------------------------------------------|-----------------------------------------|--------------------------------------------------|---------------------------|----------------------------|
| 0.02                                           | 9.1%                                    | 1.18                                             | 100.0                     | 9.1                        |
| 0.04                                           | 8.9%                                    | 2.36                                             | 100.0                     | 8.9                        |
| 0.06                                           | 9.8%                                    | 3.54                                             | 100.0                     | 9.8                        |
| 0.08                                           | 8.2%                                    | 4.72                                             | 100.0                     | 8.2                        |
| 0.10                                           | 7.7%                                    | 5.90                                             | 100.0                     | 7.7                        |
| 0.12                                           | 5.5%                                    | 7.08                                             | 100.0                     | 5.5                        |
| 0.14                                           | 5.0%                                    | 8.26                                             | 100.0                     | 5.0                        |
| 0.16                                           | 4.9%                                    | 9.44                                             | 100.0                     | 4.9                        |
| 0.18                                           | 4.3%                                    | 10.62                                            | 100.0                     | 4.3                        |
| 0.20                                           | 4.8%                                    | 11.80                                            | 100.0                     | 4.8                        |
| 0.25                                           | 7.4%                                    | 14.74                                            | 98.0                      | 7.3                        |
| 0.30                                           | 5.8%                                    | 17.69                                            | 95.3                      | 5.6                        |
| 0.35                                           | 4.5%                                    | 20.64                                            | 92.5                      | 4.1                        |
| 0.40                                           | 2.4%                                    | 23.59                                            | 89.7                      | 2.2                        |
| 0.45                                           | 2.0%                                    | 26.54                                            | 87.0                      | 1.7                        |
| 0.50                                           | 1.9%                                    | 29.49                                            | 84.2                      | 1.6                        |
| 0.75                                           | 5.0%                                    | 44.23                                            | 70.3                      | 3.5                        |
| 1.00                                           | 1.6%                                    | 58.98                                            | 56.5                      | 0.9                        |
| 1.50                                           | 0.8%                                    | 88.46                                            | 28.7                      | 0.2                        |
| 2.00                                           | 0.0%                                    | 115.09                                           | 3.6                       | 0.0                        |
| 2.50                                           | 0.5%                                    | 115.09                                           | 2.9                       | 0.0                        |
|                                                |                                         |                                                  |                           | 95.2                       |
| Removal Efficiency Adjustment <sup>2</sup> =   |                                         |                                                  |                           | 6.5%                       |
| Predicted % Annual Rainfall Treated =          |                                         |                                                  |                           | 93.4%                      |
| Predicted Net Annual Load Removal Efficiency = |                                         |                                                  |                           | 88.8%                      |

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Estimated Net Annual Solids Load Reduction  
Based on the Rational Rainfall Method



Proposed Development  
North Attleboro, MA  
WQU 1.13



AREA 1.65 acres CASCADE MODEL CS-4  
WEIGHTED C 0.90  
TC 6.00 minutes

| Rainfall Intensity <sup>1</sup><br>(in/hr)     | Percent Rainfall<br>Volume <sup>1</sup> | Hydraulic Loading Rate<br>(gpm/ft <sup>2</sup> ) | Removal Efficiency<br>(%) | Incremental Removal<br>(%) |
|------------------------------------------------|-----------------------------------------|--------------------------------------------------|---------------------------|----------------------------|
| 0.02                                           | 9.1%                                    | 1.06                                             | 100.0                     | 9.1                        |
| 0.04                                           | 8.9%                                    | 2.12                                             | 100.0                     | 8.9                        |
| 0.06                                           | 9.8%                                    | 3.18                                             | 100.0                     | 9.8                        |
| 0.08                                           | 8.2%                                    | 4.24                                             | 100.0                     | 8.2                        |
| 0.10                                           | 7.7%                                    | 5.30                                             | 100.0                     | 7.7                        |
| 0.12                                           | 5.5%                                    | 6.36                                             | 100.0                     | 5.5                        |
| 0.14                                           | 5.0%                                    | 7.43                                             | 100.0                     | 5.0                        |
| 0.16                                           | 4.9%                                    | 8.49                                             | 100.0                     | 4.9                        |
| 0.18                                           | 4.3%                                    | 9.55                                             | 100.0                     | 4.3                        |
| 0.20                                           | 4.8%                                    | 10.61                                            | 100.0                     | 4.8                        |
| 0.25                                           | 7.4%                                    | 13.26                                            | 99.4                      | 7.4                        |
| 0.30                                           | 5.8%                                    | 15.91                                            | 96.9                      | 5.6                        |
| 0.35                                           | 4.5%                                    | 18.56                                            | 94.5                      | 4.2                        |
| 0.40                                           | 2.4%                                    | 21.22                                            | 92.0                      | 2.2                        |
| 0.45                                           | 2.0%                                    | 23.87                                            | 89.5                      | 1.8                        |
| 0.50                                           | 1.9%                                    | 26.52                                            | 87.0                      | 1.6                        |
| 0.75                                           | 5.0%                                    | 39.78                                            | 74.5                      | 3.7                        |
| 1.00                                           | 1.6%                                    | 53.04                                            | 62.0                      | 1.0                        |
| 1.50                                           | 0.8%                                    | 76.08                                            | 38.6                      | 0.3                        |
| 2.00                                           | 0.0%                                    | 76.08                                            | 29.0                      | 0.0                        |
| 2.50                                           | 0.5%                                    | 76.08                                            | 23.2                      | 0.1                        |
|                                                |                                         |                                                  |                           | 96.1                       |
| Removal Efficiency Adjustment <sup>2</sup> =   |                                         |                                                  |                           | 6.5%                       |
| Predicted % Annual Rainfall Treated =          |                                         |                                                  |                           | 93.3%                      |
| Predicted Net Annual Load Removal Efficiency = |                                         |                                                  |                           | 89.7%                      |

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

### PROPOSED DEVELOPMENT N ATTLEBORO, MA

Area **0.79 ac**  
Weighted C **0.9**  
 $t_c$  **6 min**  
CDS Model **1515-3**

Unit Site Designation **WQU 1.15**  
Rainfall Station # **146**

CDS Treatment Capacity **1.0 cfs**

| <u>Rainfall Intensity<sup>1</sup></u><br><u>(in/hr)</u> | <u>Percent Rainfall Volume<sup>1</sup></u> | <u>Cumulative Rainfall Volume</u> | <u>Total Flowrate (cfs)</u> | <u>Treated Flowrate (cfs)</u> | <u>Incremental Removal (%)</u> |
|---------------------------------------------------------|--------------------------------------------|-----------------------------------|-----------------------------|-------------------------------|--------------------------------|
| 0.02                                                    | 9.1%                                       | 9.1%                              | 0.01                        | 0.01                          | 8.7                            |
| 0.04                                                    | 8.9%                                       | 18.0%                             | 0.03                        | 0.03                          | 8.5                            |
| 0.06                                                    | 9.8%                                       | 27.7%                             | 0.04                        | 0.04                          | 9.2                            |
| 0.08                                                    | 8.2%                                       | 35.9%                             | 0.06                        | 0.06                          | 7.6                            |
| 0.10                                                    | 7.7%                                       | 43.6%                             | 0.07                        | 0.07                          | 7.1                            |
| 0.12                                                    | 5.5%                                       | 49.1%                             | 0.09                        | 0.09                          | 5.1                            |
| 0.14                                                    | 5.0%                                       | 54.2%                             | 0.10                        | 0.10                          | 4.6                            |
| 0.16                                                    | 4.9%                                       | 59.1%                             | 0.11                        | 0.11                          | 4.4                            |
| 0.18                                                    | 4.3%                                       | 63.4%                             | 0.13                        | 0.13                          | 3.8                            |
| 0.20                                                    | 4.8%                                       | 68.2%                             | 0.14                        | 0.14                          | 4.2                            |
| 0.25                                                    | 7.4%                                       | 75.6%                             | 0.18                        | 0.18                          | 6.3                            |
| 0.30                                                    | 5.8%                                       | 81.5%                             | 0.21                        | 0.21                          | 4.8                            |
| 0.35                                                    | 4.5%                                       | 85.9%                             | 0.25                        | 0.25                          | 3.6                            |
| 0.40                                                    | 2.4%                                       | 88.3%                             | 0.28                        | 0.28                          | 1.9                            |
| 0.45                                                    | 2.0%                                       | 90.3%                             | 0.32                        | 0.32                          | 1.5                            |
| 0.50                                                    | 1.9%                                       | 92.1%                             | 0.36                        | 0.36                          | 1.4                            |
| 0.75                                                    | 5.0%                                       | 97.1%                             | 0.53                        | 0.53                          | 3.0                            |
| 1.00                                                    | 1.6%                                       | 98.7%                             | 0.71                        | 0.71                          | 0.8                            |
| 1.50                                                    | 0.8%                                       | 99.5%                             | 1.07                        | 1.00                          | 0.2                            |
| 2.00                                                    | 0.0%                                       | 99.5%                             | 1.42                        | 1.00                          | 0.0                            |
| 2.50                                                    | 0.5%                                       | 100.0%                            | 1.78                        | 1.00                          | 0.1                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
|                                                         |                                            |                                   |                             |                               | 86.7                           |
| Removal Efficiency Adjustment <sup>2</sup> =            |                                            |                                   |                             |                               | 6.5%                           |
| Predicted % Annual Rainfall Treated =                   |                                            |                                   |                             |                               | 93.3%                          |
| <b>Predicted Net Annual Load Removal Efficiency =</b>   |                                            |                                   |                             |                               | <b>80.3%</b>                   |

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

### PROPOSED DEVELOPMENT N ATTLEBORO, MA

Area **0.09 ac**  
Weighted C **0.9**  
 $t_c$  **6 min**  
CDS Model **1515-3**

Unit Site Designation **WQU 2.1.1**  
Rainfall Station # **146**

CDS Treatment Capacity **1.0 cfs**

| <u>Rainfall Intensity<sup>1</sup></u><br><u>(in/hr)</u> | <u>Percent Rainfall Volume<sup>1</sup></u> | <u>Cumulative Rainfall Volume</u> | <u>Total Flowrate (cfs)</u> | <u>Treated Flowrate (cfs)</u> | <u>Incremental Removal (%)</u> |
|---------------------------------------------------------|--------------------------------------------|-----------------------------------|-----------------------------|-------------------------------|--------------------------------|
| 0.02                                                    | 9.1%                                       | 9.1%                              | 0.00                        | 0.00                          | 8.8                            |
| 0.04                                                    | 8.9%                                       | 18.0%                             | 0.00                        | 0.00                          | 8.6                            |
| 0.06                                                    | 9.8%                                       | 27.7%                             | 0.00                        | 0.00                          | 9.5                            |
| 0.08                                                    | 8.2%                                       | 35.9%                             | 0.01                        | 0.01                          | 7.9                            |
| 0.10                                                    | 7.7%                                       | 43.6%                             | 0.01                        | 0.01                          | 7.4                            |
| 0.12                                                    | 5.5%                                       | 49.1%                             | 0.01                        | 0.01                          | 5.4                            |
| 0.14                                                    | 5.0%                                       | 54.2%                             | 0.01                        | 0.01                          | 4.9                            |
| 0.16                                                    | 4.9%                                       | 59.1%                             | 0.01                        | 0.01                          | 4.8                            |
| 0.18                                                    | 4.3%                                       | 63.4%                             | 0.01                        | 0.01                          | 4.1                            |
| 0.20                                                    | 4.8%                                       | 68.2%                             | 0.02                        | 0.02                          | 4.6                            |
| 0.25                                                    | 7.4%                                       | 75.6%                             | 0.02                        | 0.02                          | 7.1                            |
| 0.30                                                    | 5.8%                                       | 81.5%                             | 0.02                        | 0.02                          | 5.6                            |
| 0.35                                                    | 4.5%                                       | 85.9%                             | 0.03                        | 0.03                          | 4.3                            |
| 0.40                                                    | 2.4%                                       | 88.3%                             | 0.03                        | 0.03                          | 2.3                            |
| 0.45                                                    | 2.0%                                       | 90.3%                             | 0.04                        | 0.04                          | 1.9                            |
| 0.50                                                    | 1.9%                                       | 92.1%                             | 0.04                        | 0.04                          | 1.8                            |
| 0.75                                                    | 5.0%                                       | 97.1%                             | 0.06                        | 0.06                          | 4.6                            |
| 1.00                                                    | 1.6%                                       | 98.7%                             | 0.08                        | 0.08                          | 1.5                            |
| 1.50                                                    | 0.8%                                       | 99.5%                             | 0.12                        | 0.12                          | 0.7                            |
| 2.00                                                    | 0.0%                                       | 99.5%                             | 0.16                        | 0.16                          | 0.0                            |
| 2.50                                                    | 0.5%                                       | 100.0%                            | 0.20                        | 0.20                          | 0.4                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
|                                                         |                                            |                                   |                             |                               | 96.0                           |
| Removal Efficiency Adjustment <sup>2</sup> =            |                                            |                                   |                             |                               | 6.5%                           |
| Predicted % Annual Rainfall Treated =                   |                                            |                                   |                             |                               | 93.5%                          |
| <b>Predicted Net Annual Load Removal Efficiency =</b>   |                                            |                                   |                             |                               | <b>89.6%</b>                   |

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

### PROPOSED DEVELOPMENT N ATTLEBORO, MA

Area **0.20 ac**  
Weighted C **0.9**  
 $t_c$  **6 min**  
CDS Model **1515-3**

Unit Site Designation **WQU 2.1.2**  
Rainfall Station # **146**

CDS Treatment Capacity **1.0 cfs**

| <u>Rainfall Intensity<sup>1</sup></u><br><u>(in/hr)</u> | <u>Percent Rainfall Volume<sup>1</sup></u> | <u>Cumulative Rainfall Volume</u> | <u>Total Flowrate (cfs)</u> | <u>Treated Flowrate (cfs)</u> | <u>Incremental Removal (%)</u> |
|---------------------------------------------------------|--------------------------------------------|-----------------------------------|-----------------------------|-------------------------------|--------------------------------|
| 0.02                                                    | 9.1%                                       | 9.1%                              | 0.00                        | 0.00                          | 8.8                            |
| 0.04                                                    | 8.9%                                       | 18.0%                             | 0.01                        | 0.01                          | 8.6                            |
| 0.06                                                    | 9.8%                                       | 27.7%                             | 0.01                        | 0.01                          | 9.4                            |
| 0.08                                                    | 8.2%                                       | 35.9%                             | 0.01                        | 0.01                          | 7.9                            |
| 0.10                                                    | 7.7%                                       | 43.6%                             | 0.02                        | 0.02                          | 7.4                            |
| 0.12                                                    | 5.5%                                       | 49.1%                             | 0.02                        | 0.02                          | 5.3                            |
| 0.14                                                    | 5.0%                                       | 54.2%                             | 0.02                        | 0.02                          | 4.8                            |
| 0.16                                                    | 4.9%                                       | 59.1%                             | 0.03                        | 0.03                          | 4.7                            |
| 0.18                                                    | 4.3%                                       | 63.4%                             | 0.03                        | 0.03                          | 4.1                            |
| 0.20                                                    | 4.8%                                       | 68.2%                             | 0.04                        | 0.04                          | 4.5                            |
| 0.25                                                    | 7.4%                                       | 75.6%                             | 0.04                        | 0.04                          | 7.0                            |
| 0.30                                                    | 5.8%                                       | 81.5%                             | 0.05                        | 0.05                          | 5.5                            |
| 0.35                                                    | 4.5%                                       | 85.9%                             | 0.06                        | 0.06                          | 4.2                            |
| 0.40                                                    | 2.4%                                       | 88.3%                             | 0.07                        | 0.07                          | 2.2                            |
| 0.45                                                    | 2.0%                                       | 90.3%                             | 0.08                        | 0.08                          | 1.8                            |
| 0.50                                                    | 1.9%                                       | 92.1%                             | 0.09                        | 0.09                          | 1.7                            |
| 0.75                                                    | 5.0%                                       | 97.1%                             | 0.13                        | 0.13                          | 4.4                            |
| 1.00                                                    | 1.6%                                       | 98.7%                             | 0.18                        | 0.18                          | 1.4                            |
| 1.50                                                    | 0.8%                                       | 99.5%                             | 0.27                        | 0.27                          | 0.7                            |
| 2.00                                                    | 0.0%                                       | 99.5%                             | 0.35                        | 0.35                          | 0.0                            |
| 2.50                                                    | 0.5%                                       | 100.0%                            | 0.44                        | 0.44                          | 0.3                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
| 0.00                                                    | 0.0%                                       | 100.0%                            | 0.00                        | 0.00                          | 0.0                            |
|                                                         |                                            |                                   |                             |                               | 94.5                           |
| Removal Efficiency Adjustment <sup>2</sup> =            |                                            |                                   |                             |                               | 6.5%                           |
| Predicted % Annual Rainfall Treated =                   |                                            |                                   |                             |                               | 93.5%                          |
| <b>Predicted Net Annual Load Removal Efficiency =</b>   |                                            |                                   |                             |                               | <b>88.1%</b>                   |

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Proposed Residential Development  
582 Kelley Blvd  
Town of North Attleborough, MA  
Bohler Job Number: W211244  
9/19/2024

Rip Rap Sizing Calculations

Design Period Storm: 25 Year

| Rip Rap Apron Sizing Calculations |                 |                 |         |          |         |          |          |          |          |            |              |
|-----------------------------------|-----------------|-----------------|---------|----------|---------|----------|----------|----------|----------|------------|--------------|
| Location                          | Pipe Size (in.) | Pipe Size (ft.) | Q (cfs) | TW (ft.) | V (fps) | W1 (ft.) | La (ft.) | W2 (ft.) | W3 (ft.) | Apron Type | Rip Rap Type |
| From WQU1.15                      | 15              | 1.3             | 4.90    | 1.72     | 4.57    | 3.75     | 10       | 8        | NA       | B          | Modified     |
| From WQU2.1.1                     | 15              | 1.3             | 0.49    | 1.34     | 2.49    | 3.75     | 10       | 8        | NA       | B          | Modified     |
| From WQU2.1.2                     | 15              | 1.3             | 1.21    | 1.14     | 4.26    | 3.75     | 10       | 8        | NA       | B          | Modified     |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |
|                                   |                 |                 |         |          |         |          |          |          |          |            |              |

Based ConnDOT Drainage Manual - Type A, B, and C Riprap Aprons

Outlet Velocity (fps)  
0-8 - Modified  
8-10 - Intermediate  
10-14 - Standard

| Scour Hole Sizing Calculations |                      |                      |         |          |                 |                      |        |        |        |              |
|--------------------------------|----------------------|----------------------|---------|----------|-----------------|----------------------|--------|--------|--------|--------------|
| Location                       | Pipe Size/ Span (in) | Pipe Size/ Span (ft) | Q (cfs) | TW (ft.) | Scour Hole Type | D <sub>50</sub> (ft) | F (ft) | C (ft) | B (ft) | Rip Rap Type |
| From WQU1.11                   | 30                   | 2.5                  | 26.37   | 1.72     | Type 1          | 0.17                 | 1.25   | 15     | 13     | Modified     |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |
|                                |                      |                      |         |          |                 |                      |        |        |        |              |

Based on ConnDOT Drainage Manual - Type 1 and 2 Scour Holes

D<sub>50</sub> < 0.42 ft - Modified  
0.42 ft < D<sub>50</sub> < 0.67 ft - Intermediate  
0.67 ft < D<sub>50</sub> < 1.25 ft - Standard  
1.25 ft < D<sub>50</sub> - Special Design

Riprap Type D<sub>50</sub> (inches)  
Modified - 5  
Intermediate - 8  
Standard - 15

## **GROUNDWATER MOUNDING CALCULATIONS**

**“Proposed Residential Development”**

**582 Kelley Boulevard |**

**North Attleborough, MA**

**Bohler Job Number: W211244**

### **Methodology**

Basins P1.10, P1.13, and P2.1 for this project are designed with less than 4 feet of groundwater separation. They are also designed to attenuate the 10-year storm event or larger. Therefore, groundwater mounding calculations are required according to MA DEP Stormwater Management Guidelines. The purpose of the calculations is to ensure that the mound will not prevent the full draining of the basin. The mounding analysis must show that the recharge volume will exfiltrate within seventy-two (72) hours. Additionally, it should be verified that the mounding effect will not cause stormwater to surge above the lowest discharge point out of a basin (during the 72-hour period) or raise the water elevation in a nearby resource area.

The groundwater mounding analysis was performed by a proprietary program using the Hantush Method with Glover's Solution. Input parameters are site specific and determined based on existing and proposed conditions. The required input parameters are the following: application rate; duration of application; fillable porosity; hydraulic conductivity; initial saturated thickness; length of application area; width of application area; and distance to closest resource area (constant head boundary).

Calculations using the Hantush Method are considered conservative due to the fact that the unsaturated soil zone is not incorporated. In practice, this zone will have a significant positive effect on reducing the groundwater mounding under an infiltration basin by allowing horizontal migration. Please refer to the table below where all values are in feet:

| <b>Stormwater Basin</b> | <b>(A)<br/>Unsaturated Zone (Basin bottom to ESHGW)</b> | <b>(B)<br/>Depth Below Lowest Outlet to Basin Bottom</b> | <b>(C)<br/>Mounding Storage Provided (A)+(B)</b> | <b>(D)<br/>Groundwater Mounding - <math>\Delta h</math> (D must be &lt;C)</b> | <b>(E)<br/>Groundwater Mounding at 72 hrs. (E must be &lt;A)</b> |
|-------------------------|---------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------|
| <b>P1.10</b>            | <b>3.1</b>                                              | <b>1.7</b>                                               | <b>4.8</b>                                       | <b>4.676</b>                                                                  | <b>0.772</b>                                                     |
| <b>P1.13</b>            | <b>3.0</b>                                              | <b>3.3</b>                                               | <b>6.3</b>                                       | <b>3.578</b>                                                                  | <b>0.797</b>                                                     |
| <b>P2.1</b>             | <b>3.0</b>                                              | <b>1.6</b>                                               | <b>4.6</b>                                       | <b>3.852</b>                                                                  | <b>0.645</b>                                                     |

Additionally, if the mound exceeds the unsaturated zone thickness, we must check the mound after 72 hours to verify that it is less than the unsaturated zone thickness to ensure that the basin can exfiltrate within that period of time.

The application rate used is converted from the Rawls value selected for an exfiltration rate in HydroCAD. The duration of application used for the analysis is the 24-hour based duration of the storm event. The fillable porosity, hydraulic conductivity, and initial saturated thickness used for the analysis are based on the existing soil conditions.

### **Results**

Based on the criteria mentioned above, the analysis (see attached) indicates the mound in each stormwater basin falls below the mounding storage provided. Additionally, the mounding effect at the end of Day 3 is less than the unsaturated zone thickness for all basins. Given these results, we feel as though the basins recharge the stormwater volume within 72 hours as required.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate ( $R$ ), specific yield ( $S_y$ ), horizontal hydraulic conductivity ( $K_h$ ), basin dimensions ( $x$ ,  $y$ ), duration of infiltration period ( $t$ ), and the initial thickness of the saturated zone ( $h_i(0)$ ), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length ( $x = y$ ). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify  $x$  as the short dimension and  $y$  as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify  $y$  as the short dimension,  $x$  as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

| Input Values |          | use consistent units (e.g. feet & days <b>or</b> inches & hours) |
|--------------|----------|------------------------------------------------------------------|
| 16.5400      | $R$      | Recharge (infiltration) rate (feet/day)                          |
| 0.200        | $S_y$    | Specific yield, $S_y$ (dimensionless, between 0 and 1)           |
| 165.40       | $K$      | Horizontal hydraulic conductivity, $K_h$ (feet/day)*             |
| 160.000      | $x$      | 1/2 length of basin (x direction, in feet)                       |
| 31.000       | $y$      | 1/2 width of basin (y direction, in feet)                        |
| 0.099        | $t$      | duration of infiltration period (days)                           |
| 22.000       | $h_i(0)$ | initial thickness of saturated zone (feet)                       |

| Conversion Table |          |
|------------------|----------|
| inch/hour        | feet/day |
| 0.67             | 1.33     |
| 2.00             | 4.00     |
| hours            | days     |
| 36               | 1.50     |

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

|        |                  |                                                                                             |
|--------|------------------|---------------------------------------------------------------------------------------------|
| 26.676 | $h(\max)$        | maximum thickness of saturated zone (beneath center of basin at end of infiltration period) |
| 4.676  | $\Delta h(\max)$ | maximum groundwater mounding (beneath center of basin at end of infiltration period)        |

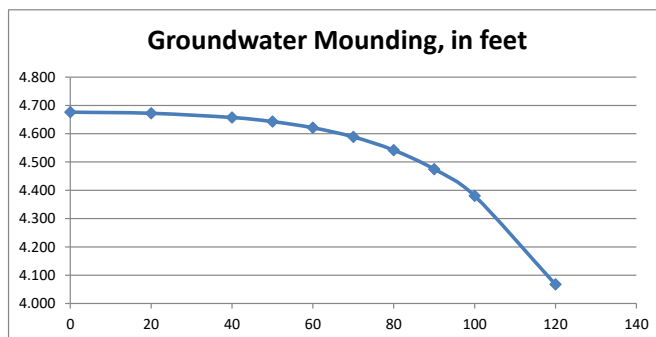
Ground-water Mounding, in feet

Distance from center of basin in x direction, in feet

|       |     |
|-------|-----|
| 4.676 | 0   |
| 4.672 | 20  |
| 4.657 | 40  |
| 4.643 | 50  |
| 4.621 | 60  |
| 4.589 | 70  |
| 4.542 | 80  |
| 4.475 | 90  |
| 4.380 | 100 |
| 4.067 | 120 |



Re-Calculate Now



### Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate ( $R$ ), specific yield ( $S_y$ ), horizontal hydraulic conductivity ( $K_h$ ), basin dimensions ( $x$ ,  $y$ ), duration of infiltration period ( $t$ ), and the initial thickness of the saturated zone ( $h_i(0)$ , height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length ( $x = y$ ). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify  $x$  as the short dimension and  $y$  as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify  $y$  as the short dimension,  $x$  as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

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| Input Values |          | use consistent units (e.g. feet & days <b>or</b> inches & hours) |
|--------------|----------|------------------------------------------------------------------|
| 0.5435       | $R$      | Recharge (infiltration) rate (feet/day)                          |
| 0.200        | $S_y$    | Specific yield, $S_y$ (dimensionless, between 0 and 1)           |
| 165.40       | $K$      | Horizontal hydraulic conductivity, $K_h$ (feet/day)*             |
| 160.000      | $x$      | 1/2 length of basin ( $x$ direction, in feet)                    |
| 31.000       | $y$      | 1/2 width of basin ( $y$ direction, in feet)                     |
| 3.000        | $t$      | duration of infiltration period (days)                           |
| 22.000       | $h_i(0)$ | initial thickness of saturated zone (feet)                       |

| Conversion Table |          |
|------------------|----------|
| inch/hour        | feet/day |
| 0.67             | 1.33     |
| 2.00             | 4.00     |
| hours            | days     |
| 36               | 1.50     |

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

|        |                  |                                                                                             |
|--------|------------------|---------------------------------------------------------------------------------------------|
| 22.772 | $h(\max)$        | maximum thickness of saturated zone (beneath center of basin at end of infiltration period) |
| 0.772  | $\Delta h(\max)$ | maximum groundwater mounding (beneath center of basin at end of infiltration period)        |

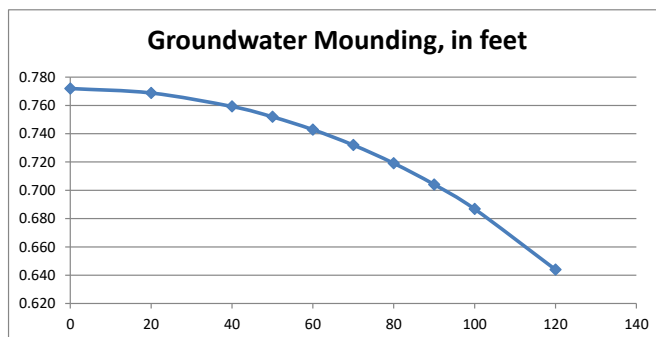
Ground-water Mounding, in feet

Distance from center of basin in  $x$  direction, in feet

|       |     |
|-------|-----|
| 0.772 | 0   |
| 0.769 | 20  |
| 0.759 | 40  |
| 0.752 | 50  |
| 0.743 | 60  |
| 0.732 | 70  |
| 0.719 | 80  |
| 0.704 | 90  |
| 0.687 | 100 |
| 0.644 | 120 |



Re-Calculate Now



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This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate ( $R$ ), specific yield ( $S_y$ ), horizontal hydraulic conductivity ( $K_h$ ), basin dimensions ( $x$ ,  $y$ ), duration of infiltration period ( $t$ ), and the initial thickness of the saturated zone ( $h_i(0)$ ), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length ( $x = y$ ). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify  $x$  as the short dimension and  $y$  as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify  $y$  as the short dimension,  $x$  as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

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| Input Values |                  | use consistent units (e.g. feet & days <b>or</b> inches & hours)                            | Conversion Table |          |  |
|--------------|------------------|---------------------------------------------------------------------------------------------|------------------|----------|--|
|              |                  |                                                                                             | inch/hour        | feet/day |  |
| 11.5000      | $R$              | Recharge (infiltration) rate (feet/day)                                                     | 0.67             | 1.33     |  |
| 0.200        | $S_y$            | Specific yield, $S_y$ (dimensionless, between 0 and 1)                                      |                  |          |  |
| 115.00       | $K$              | Horizontal hydraulic conductivity, $K_h$ (feet/day)*                                        | 2.00             | 4.00     |  |
| 129.500      | $x$              | 1/2 length of basin (x direction, in feet)                                                  |                  |          |  |
| 15.000       | $y$              | 1/2 width of basin (y direction, in feet)                                                   | hours            | days     |  |
| 0.257        | $t$              | duration of infiltration period (days)                                                      | 36               | 1.50     |  |
| 23.200       | $h_i(0)$         | initial thickness of saturated zone (feet)                                                  |                  |          |  |
| 26.778       | $h(\max)$        | maximum thickness of saturated zone (beneath center of basin at end of infiltration period) |                  |          |  |
| 3.578        | $\Delta h(\max)$ | maximum groundwater mounding (beneath center of basin at end of infiltration period)        |                  |          |  |

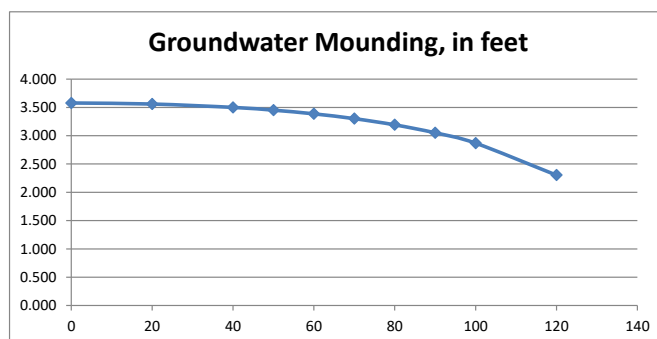
Ground-water Mounding, in feet

Distance from center of basin in x direction, in feet

|       |     |
|-------|-----|
| 3.578 | 0   |
| 3.560 | 20  |
| 3.500 | 40  |
| 3.451 | 50  |
| 3.386 | 60  |
| 3.301 | 70  |
| 3.192 | 80  |
| 3.051 | 90  |
| 2.868 | 100 |
| 2.303 | 120 |



Re-Calculate Now



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The user must specify infiltration rate ( $R$ ), specific yield ( $S_y$ ), horizontal hydraulic conductivity ( $K_h$ ), basin dimensions ( $x$ ,  $y$ ), duration of infiltration period ( $t$ ), and the initial thickness of the saturated zone ( $h_i(0)$ ), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length ( $x = y$ ). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify  $x$  as the short dimension and  $y$  as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify  $y$  as the short dimension,  $x$  as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

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| Input Values |          | use consistent units (e.g. feet & days <b>or</b> inches & hours) |
|--------------|----------|------------------------------------------------------------------|
| 0.9845       | $R$      | Recharge (infiltration) rate (feet/day)                          |
| 0.200        | $S_y$    | Specific yield, $S_y$ (dimensionless, between 0 and 1)           |
| 115.00       | $K$      | Horizontal hydraulic conductivity, $K_h$ (feet/day)*             |
| 129.500      | $x$      | 1/2 length of basin ( $x$ direction, in feet)                    |
| 15.000       | $y$      | 1/2 width of basin ( $y$ direction, in feet)                     |
| 3.000        | $t$      | duration of infiltration period (days)                           |
| 23.200       | $h_i(0)$ | initial thickness of saturated zone (feet)                       |

| Conversion Table |          |
|------------------|----------|
| inch/hour        | feet/day |
| 0.67             | 1.33     |
| 2.00             | 4.00     |
| hours            | days     |
| 36               | 1.50     |

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

|        |                  |                                                                                             |
|--------|------------------|---------------------------------------------------------------------------------------------|
| 23.997 | $h(\max)$        | maximum thickness of saturated zone (beneath center of basin at end of infiltration period) |
| 0.797  | $\Delta h(\max)$ | maximum groundwater mounding (beneath center of basin at end of infiltration period)        |

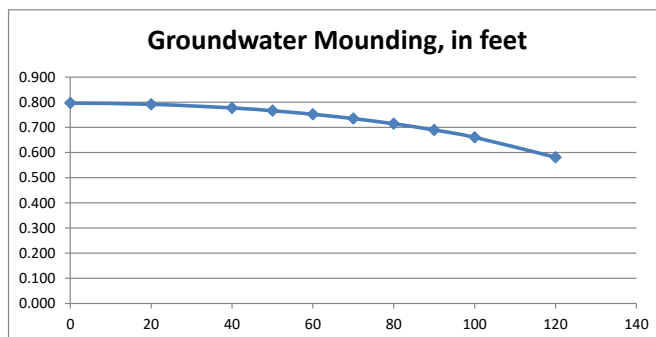
Ground-water Mounding, in feet

Distance from center of basin in  $x$  direction, in feet

|       |     |
|-------|-----|
| 0.797 | 0   |
| 0.792 | 20  |
| 0.777 | 40  |
| 0.766 | 50  |
| 0.752 | 60  |
| 0.735 | 70  |
| 0.714 | 80  |
| 0.690 | 90  |
| 0.661 | 100 |
| 0.581 | 120 |



Re-Calculate Now



### Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate ( $R$ ), specific yield ( $S_y$ ), horizontal hydraulic conductivity ( $K_h$ ), basin dimensions ( $x$ ,  $y$ ), duration of infiltration period ( $t$ ), and the initial thickness of the saturated zone ( $h_i(0)$ ), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length ( $x = y$ ). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify  $x$  as the short dimension and  $y$  as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify  $y$  as the short dimension,  $x$  as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

| Input Values |                  | use consistent units (e.g. feet & days <b>or</b> inches & hours)                            | Conversion Table |          |  |
|--------------|------------------|---------------------------------------------------------------------------------------------|------------------|----------|--|
|              |                  |                                                                                             | inch/hour        | feet/day |  |
| 16.5400      | $R$              | Recharge (infiltration) rate (feet/day)                                                     | 0.67             | 1.33     |  |
| 0.200        | $S_y$            | Specific yield, $S_y$ (dimensionless, between 0 and 1)                                      |                  |          |  |
| 165.40       | $K$              | Horizontal hydraulic conductivity, $K_h$ (feet/day)*                                        | 2.00             | 4.00     |  |
| 177.500      | $x$              | 1/2 length of basin (x direction, in feet)                                                  |                  |          |  |
| 22.000       | $y$              | 1/2 width of basin (y direction, in feet)                                                   | hours            | days     |  |
| 0.104        | $t$              | duration of infiltration period (days)                                                      | 36               | 1.50     |  |
| 21.000       | $h_i(0)$         | initial thickness of saturated zone (feet)                                                  |                  |          |  |
| 24.852       | $h(\max)$        | maximum thickness of saturated zone (beneath center of basin at end of infiltration period) |                  |          |  |
| 3.852        | $\Delta h(\max)$ | maximum groundwater mounding (beneath center of basin at end of infiltration period)        |                  |          |  |

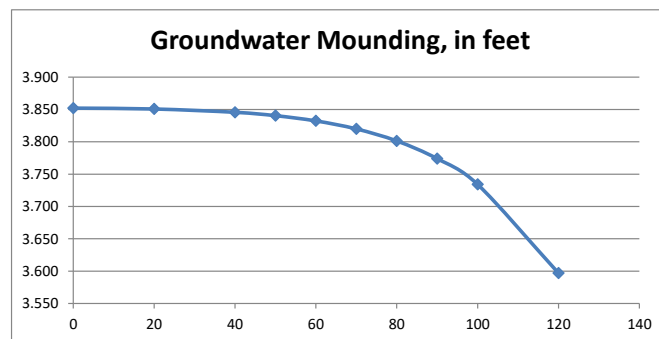
Ground-water Mounding, in feet

Distance from center of basin in x direction, in feet

|       |     |
|-------|-----|
| 3.852 | 0   |
| 3.851 | 20  |
| 3.846 | 40  |
| 3.840 | 50  |
| 3.832 | 60  |
| 3.820 | 70  |
| 3.801 | 80  |
| 3.774 | 90  |
| 3.734 | 100 |
| 3.597 | 120 |



Re-Calculate Now



### Disclaimer

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The user must specify infiltration rate ( $R$ ), specific yield ( $S_y$ ), horizontal hydraulic conductivity ( $K_h$ ), basin dimensions ( $x$ ,  $y$ ), duration of infiltration period ( $t$ ), and the initial thickness of the saturated zone ( $h_i(0)$ , height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length ( $x = y$ ). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify  $x$  as the short dimension and  $y$  as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify  $y$  as the short dimension,  $x$  as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

| Input Values |          | use consistent units (e.g. feet & days <b>or</b> inches & hours) |
|--------------|----------|------------------------------------------------------------------|
| 0.5743       | $R$      | Recharge (infiltration) rate (feet/day)                          |
| 0.200        | $S_y$    | Specific yield, $S_y$ (dimensionless, between 0 and 1)           |
| 165.40       | $K$      | Horizontal hydraulic conductivity, $K_h$ (feet/day)*             |
| 177.500      | $x$      | 1/2 length of basin ( $x$ direction, in feet)                    |
| 22.000       | $y$      | 1/2 width of basin ( $y$ direction, in feet)                     |
| 3.000        | $t$      | duration of infiltration period (days)                           |
| 21.000       | $h_i(0)$ | initial thickness of saturated zone (feet)                       |

| Conversion Table |          |
|------------------|----------|
| inch/hour        | feet/day |
| 0.67             | 1.33     |
| 2.00             | 4.00     |
| hours            | days     |
| 36               | 1.50     |

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

|        |                  |                                                                                             |
|--------|------------------|---------------------------------------------------------------------------------------------|
| 21.645 | $h(\max)$        | maximum thickness of saturated zone (beneath center of basin at end of infiltration period) |
| 0.645  | $\Delta h(\max)$ | maximum groundwater mounding (beneath center of basin at end of infiltration period)        |

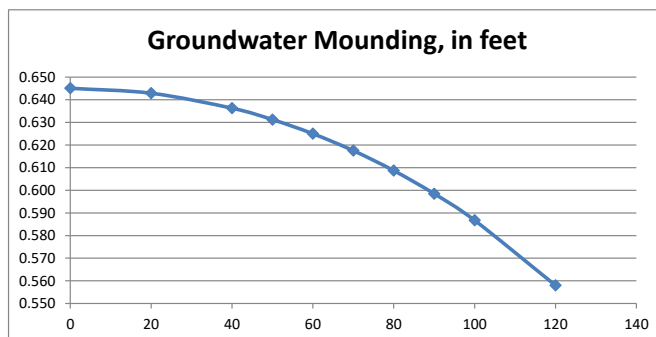
Ground-water Mounding, in feet

Distance from center of basin in  $x$  direction, in feet

|       |     |
|-------|-----|
| 0.645 | 0   |
| 0.643 | 20  |
| 0.636 | 40  |
| 0.631 | 50  |
| 0.625 | 60  |
| 0.618 | 70  |
| 0.609 | 80  |
| 0.598 | 90  |
| 0.587 | 100 |
| 0.558 | 120 |



Re-Calculate Now



### Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

## **APPENDIX G: OPERATION AND MAINTENANCE**

- STORMWATER OPERATION AND MAINTENANCE PLAN
- INSPECTION REPORT
- INSPECTION AND MAINTENANCE LOG FORM
- LONG-TERM POLLUTION PREVENTION PLAN
- ILLICIT DISCHARGE STATEMENT
- SPILL PREVENTION
- PROPOSED OPERATION AND MAINTENANCE MAP
- MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS

# **STORMWATER OPERATION AND MAINTENANCE PLAN**

*Proposed Residential Development  
582 Kelley Boulevard  
North Attleborough, Massachusetts*

## **RESPONSIBLE PARTY DURING CONSTRUCTION:**

*Contractor - TBD*

## **RESPONSIBLE PARTY POST CONSTRUCTION:**

*Owner*

### **Construction Phase**

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP) if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

### **Post Development Controls**

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots and Roadways: Sweep at least two (2) times per year and on a more frequent basis depending on sanding operations. Swept areas shall include all parking, drive aisles, and access aisles. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.
2. Catch basins, yard drains, trench drains, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off-site in accordance with MADEP and other applicable requirements.
3. Riprap apron / Scour Hole: Riprap and scour holes should be checked at least annually and after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for displaced stones, slumping, and erosion at edges, especially downstream or downslope. If the riprap is damaged, it should be repaired before further damage can take place. Note and

repair any erosion, stone displacement or low spots in the areas. Woody vegetation should be removed from the riprap annually.

4. Water Quality Unit (Proprietary Separator): Follow manufacturer's recommendations (attached).
5. Infiltration Basin: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. Mow the buffer area, side slopes and basin bottom if grassed floor, rake if stone or sand bottom, remove trash and debris, remove grass clippings and accumulated organic matter. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.
6. Underground Infiltration Basins: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. The outlet of the basin, if any, shall be inspected for erosion and sedimentation, and rip-rap shall be promptly repaired in the case of erosion. Sediment collecting in the bottom of the basin shall be inspected twice annually, and removal shall commence any time the sediment reaches a depth of six inches anywhere in the basin. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.
7. Bioretention Areas: shall be inspected and cleared of trashed monthly; mowed 2 to 12 times per year; mulched annually; fertilized annually; dead vegetation removed annually; pruned annually; replace entire media and all vegetation as needed. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.
8. Dry Well: Dry wells shall be inspected a minimum of once a year to ensure they are operating as intended and in working order. To determine if the dry well is functioning, measure the depth of water at 24 and 48 hour intervals after a storm. Calculate clearance rates by dividing the drop in water level (inches) by the time elapsed (hours). Inspections shall be by qualified personnel assigned by the property owner. Sediment collecting in the bottom of the basin shall be inspected once annually, and shall be removed any time the sediment reaches a depth of six inches. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

**STORMWATER MANAGEMENT SYSTEM**  
**POST-CONSTRUCTION INSPECTION REPORT**

**LOCATION:**

***Proposed Residential Development  
582 Kelley Boulevard  
North Attleborough, Massachusetts***

**RESPONSIBLE PARTY:**

***Owner***

|                                                                                         |                  |
|-----------------------------------------------------------------------------------------|------------------|
| NAME OF INSPECTOR:                                                                      | INSPECTION DATE: |
| Note Condition of the Following (sediment depth, debris, standing water, damage, etc.): |                  |
| Catch Basins:                                                                           |                  |
|                                                                                         |                  |
| Discharge Points/ Flared End Sections / Rip Rap:                                        |                  |
|                                                                                         |                  |
| Infiltration Basin:                                                                     |                  |
|                                                                                         |                  |
| Water Quality Units:                                                                    |                  |
|                                                                                         |                  |
| Other:                                                                                  |                  |
|                                                                                         |                  |

Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):

Catch Basins:

Discharge Points / Flared End Sections / Rip Rap:

Infiltration Basin:

Water Quality Units:

Other:

Comments:

***Proposed Residential Development  
582 Kelley Boulevard  
North Attleborough, Massachusetts***

[illegible]

# **LONG-TERM POLLUTION PREVENTION PLAN**

*Proposed Residential Development  
582 Kelley Boulevard  
North Attleborough, Massachusetts*

## **RESPONSIBLE PARTY DURING CONSTRUCTION:**

*Contractor - TBD*

## **RESPONSIBLE PARTY POST CONSTRUCTION:**

*Owner*

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- The property owner shall be responsible for “good housekeeping” including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Sweeping of roadways a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the “O&M Plan”.
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.
- No outdoor maintenance or washing of vehicles allowed.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.

- Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system.
- Grass shall be maintained at a minimum blade height of two to three inches and only 1/3 of the plant height shall be removed at a time. Clippings shall not be disposed of within stormwater management areas or adjacent resource areas.
- Plants shall be pruned as necessary.
- Pet waste shall be disposed of in accordance with local regulations. Pet waste shall not be disposed of in a storm drain or catch basin.
- Homeowners will be encouraged to implement the following methods when washing vehicles: Use soap sparingly, use a hose nozzle with a trigger to save water, and pour the bucket of soapy water down the sink when done and not in the street or when possible use a commercial car wash.
- Snow piles shall be located adjacent to or on pervious surfaces in upland areas. This will allow snow melt water to filter into the soil, leaving behind sand and debris which can be removed in the springtime.
- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams, or other water bodies).
- In no case shall snow be disposed of or stored in the detention basins, infiltration basins or bioretention areas.
- If necessary, stockpiled snow will be removed from the Site and disposed of at an off-site location in accordance with all local, state and federal regulations.
- The amount of sand and deicing chemicals shall be kept at the minimum amount required to provide safe pedestrian and vehicle travel.
- Deicing chemicals are recommended as a pretreatment to storm events to minimize the amount of applied sand.
- Sand and deicing chemicals should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials. Stockpile areas shall be located outside resource areas.
- The primary agents used for deicing at parking lots, sidewalks and the access roads shall consist of salt alternatives such as calcium carbonate ( $\text{CaCO}_3$ ) or potassium chloride (KCl).

- Deliveries shall be monitored by owner or owner's representative to ensure proper delivery and in the event that a spillage occurs it shall be contained and cleaned up immediately in accordance with the spill prevention program for the project.
- Recycle materials whenever possible. Provide separate containers for recycle materials. Recycling products will be removed by a certified waste hauler.

## **OPERATON AND MAINTENANCE TRAINING PROGRAM**

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

### Discuss the Operations and Maintenance Plan

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

### Discuss the Spill Prevention and Response Procedures

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.

## **ILLICIT DISCHARGE STATEMENT**

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

---

Name & Title

Date

## **SPILL PREVENTION AND RESPONSE PROCEDURES** **(POST CONSTRUCTION)**

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.
2. The minimum practical quantity of all such materials will be kept on site.
3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.
4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.
5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)
2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.
3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).
4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

## SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

### ***Proposed Residential Development***

**582 Kelley Boulevard**

## North Attleborough, Massachusetts

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Town Fire Department (at **9-1-1**)
2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.
3. Notify the Town Health Department at 508-699-0100 Ext. 2560 and the Town Conservation Commission at 508-699-0100 Ext. 2584.
4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Town Health Department and Conservation Commission.

Date of spill: \_\_\_\_\_ Time: \_\_\_\_\_ Reported By: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

[illegible]

Cause of Spill: \_\_\_\_\_  
\_\_\_\_\_

Measures Taken to Clean up Spill: \_\_\_\_\_  
\_\_\_\_\_

Type of equipment: \_\_\_\_\_ Make: \_\_\_\_\_ Size: \_\_\_\_\_

License or S/N: \_\_\_\_\_

Location and Method of Disposal \_\_\_\_\_  
\_\_\_\_\_

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY  
PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCY PHONE: (888) 372-7341



- 

## CATCH BASIN



WATER QUALITY UNIT

 INFILTRATION BASIN BIORETENTION BASIN UNDERGROUND INFILTRATION BASIN

RIP RAP APRON / SCOUR HOLE

DRYWELL



**ALWAYS CALL 811**

**fast. It's free. It's the**

---

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY  
REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION  
DOCUMENT UNLESS INDICATED OTHERWISE.

|              |                |
|--------------|----------------|
| PROJECT No.: | W211244-UTIL-1 |
| DRAWN BY:    | VEH/AO/        |
| CHECKED BY:  | KV             |
| DATE:        | 8/22/20        |
| CAD I.D.:    | W211244-UTIL-1 |

PROJECT:

\_\_\_\_\_ FOR \_\_\_\_\_

**PROPOSED  
DEVELOPMENT**

MAP: 35 LOT: 3  
582 KELLEY BOULEVARD  
TOWN OF NORTH ATTLEBOROUGH  
BRISTOL COUNTY,  
MASSACHUSETTS

**3 EXECUTIVE PARK DRIVE, FLOOR**  
**BEDFORD, NH 03110**  
Phone: (603) 441-2900

***www.BohlerEngineering.com***

**SHEET TITLE:**

**OPERATION  
AND  
MAINTENANCE  
PLAN**

RG. DATE - 9/17/2024

## Cascade Separator® Inspection and Maintenance Guide



## Maintenance

The Cascade Separator® system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects sediment and debris will depend upon on-site activities and site pollutant characteristics. For example, unstable soils or heavy winter sanding will cause the sediment storage sump to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

## Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall). However, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment wash-down areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

A visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet chamber, flumes or outlet channel. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided in this Inspection and Maintenance Guide.

Access to the Cascade Separator unit is typically achieved through one manhole access cover. The opening allows for inspection and cleanout of the center chamber (cylinder) and sediment storage sump, as well as inspection of the inlet chamber and slanted skirt. For large units, multiple manhole covers allow access to the chambers and sump.

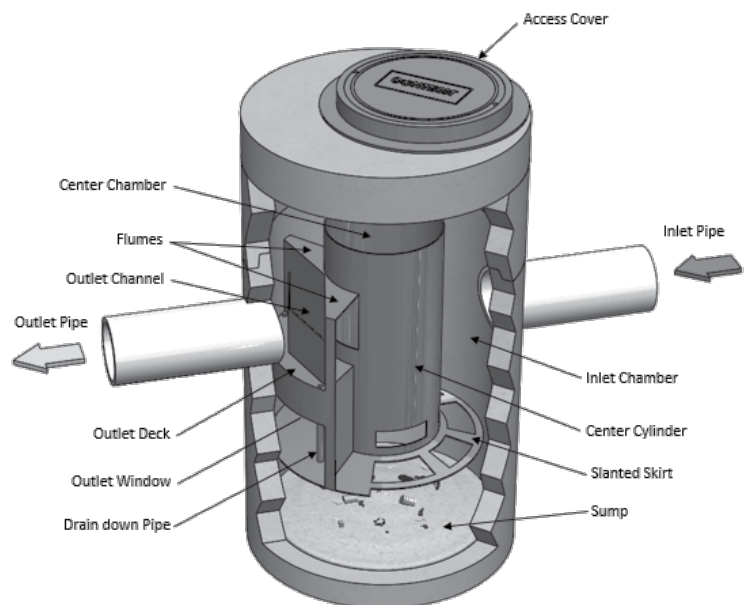
The Cascade Separator system should be cleaned before the level of sediment in the sump reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it must be replaced when significant discoloration has occurred. Performance may be impacted when maximum sediment storage capacity is exceeded. Contech recommends maintaining the system when sediment level reaches 50% of maximum storage volume. The level of sediment is easily determined by measuring the distance from the system outlet invert (standing water level) to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the chart in this document to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage.

## Cleaning

Cleaning of a Cascade Separator system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum tube down through the center chamber and into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The areas outside the center chamber and the slanted skirt should also be washed off if pollutant build-up exists in these areas.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. Then the system should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and to ensure proper safety precautions. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the Cascade Separator system must be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal. If any components are damaged, replacement parts can be ordered from the manufacturer.



## Cascade Separator® Maintenance Indicators and Sediment Storage Capacities

| Model Number | Diameter |     | Distance from Water Surface to Top of Sediment Pile |     | Sediment Storage Capacity |                |
|--------------|----------|-----|-----------------------------------------------------|-----|---------------------------|----------------|
|              | ft       | m   | ft                                                  | m   | y <sup>3</sup>            | m <sup>3</sup> |
| CS-3         | 3        | 0.9 | 1.5                                                 | 0.5 | 0.4                       | 0.3            |
| CS-4         | 4        | 1.2 | 2.5                                                 | 0.8 | 0.7                       | 0.5            |
| CS-5         | 5        | 1.3 | 3                                                   | 0.9 | 1.1                       | 0.8            |
| CS-6         | 6        | 1.8 | 3.5                                                 | 1   | 1.6                       | 1.2            |
| CS-8         | 8        | 2.4 | 4.8                                                 | 1.4 | 2.8                       | 2.1            |
| CS-10        | 10       | 3.0 | 6.2                                                 | 1.9 | 4.4                       | 3.3            |
| CS-12        | 12       | 3.6 | 7.5                                                 | 2.3 | 6.3                       | 4.8            |

Note: The information in the chart is for standard units. Units may have been designed with non-standard sediment storage depth.



A Cascade Separator unit can be easily cleaned in less than 30 minutes.



A vacuum truck excavates pollutants from the systems.

## Cascade Separator® Inspection & Maintenance Log

[illegible]

1. The depth to sediment is determined by taking a measurement from the manhole outlet invert (standing water level) to the top of the sediment pile. Once this measurement is recorded, it should be compared to the chart in the maintenance guide to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

## SUPPORT

- Drawings and specifications are available at [www.ContechES.com](http://www.ContechES.com).
- Site-specific design support is available from our engineers.

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## CDS Guide Operation, Design, Performance and Maintenance



## CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

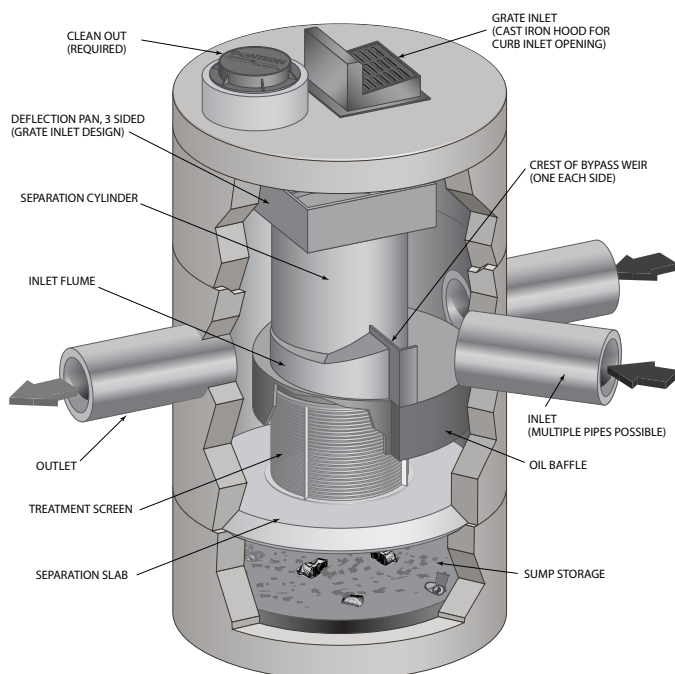
## Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



## Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the United States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

### Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

### Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

### Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

### Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

### Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

## Performance

### Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation ( $d_{50} = 20$  to  $30 \mu\text{m}$ ) covering a wide size range (Coefficient of Uniformity,  $C_u$  averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer  $d_{50}$  ( $d_{50}$  for NJDEP is approximately  $50 \mu\text{m}$ ) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size ( $d_{50}$ ) of 106 microns. The PSDs for the test material are shown in Figure 1.

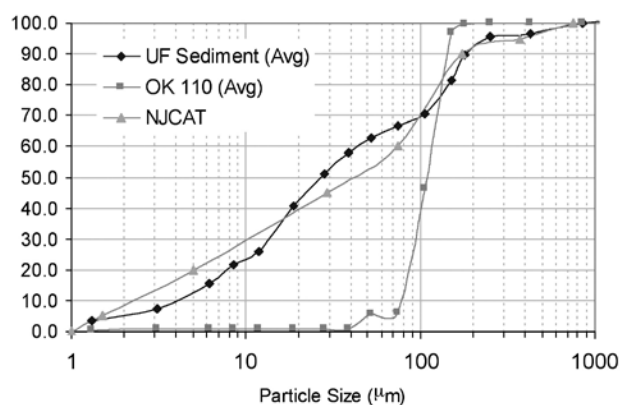


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

## Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

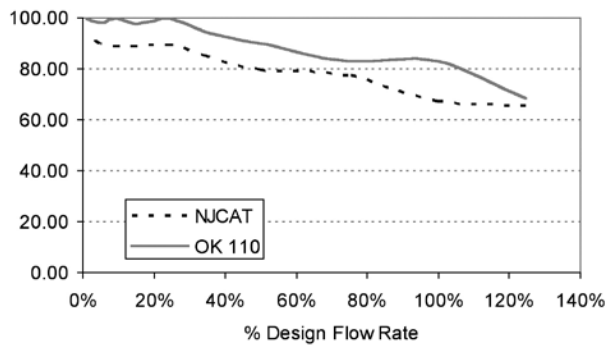


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size ( $d_{50}$ ) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution ( $d_{50} = 125 \mu m$ ).

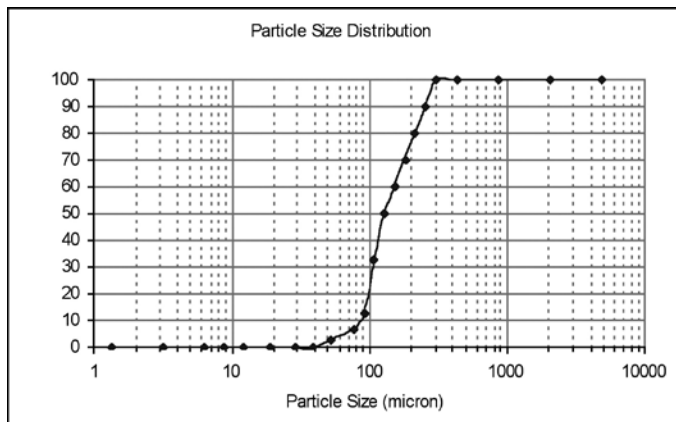


Figure 3. WASDOE PSD

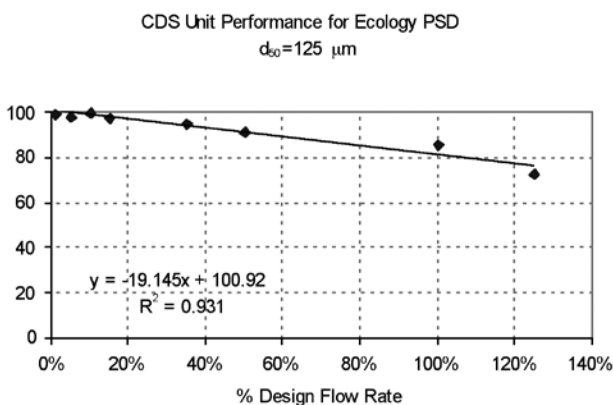


Figure 4. Modeled performance for WASDOE PSD.

## Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

## Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified



during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allow both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded; however, it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine whether the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

## Cleaning

Cleaning of a CDS system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

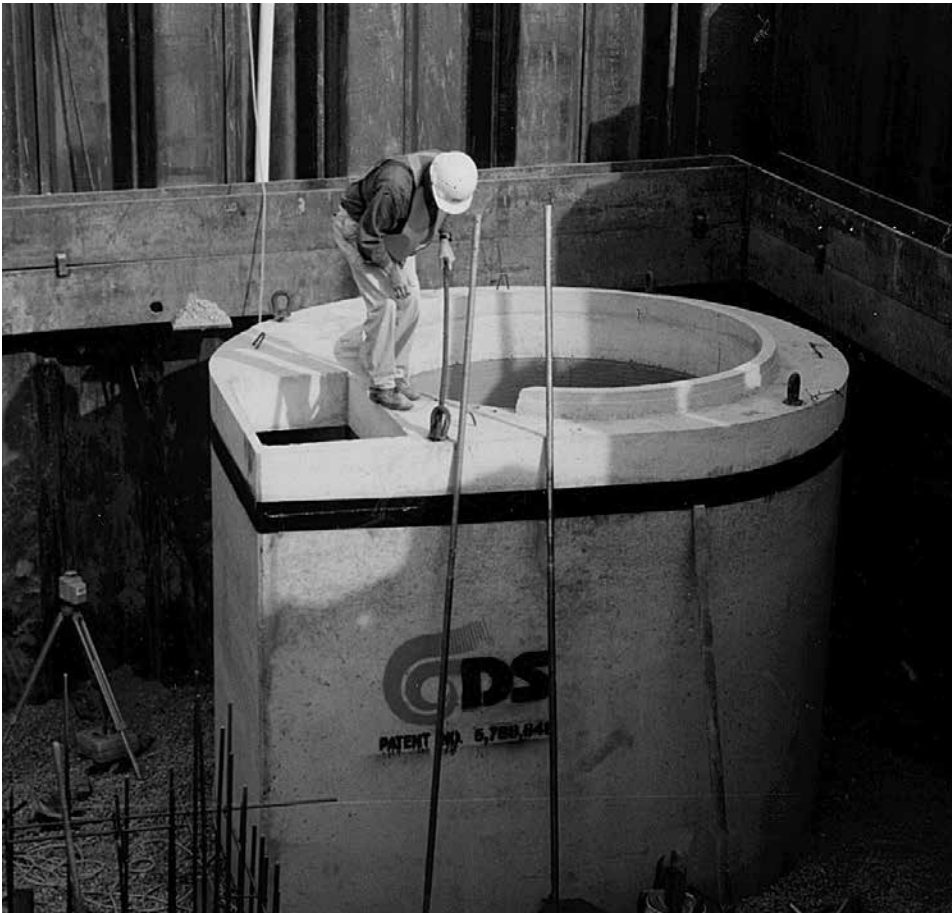
Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.



| CDS Model | Diameter |     | Distance from Water Surface to Top of Sediment Pile |     | Sediment Storage Capacity |                |
|-----------|----------|-----|-----------------------------------------------------|-----|---------------------------|----------------|
|           | ft       | m   | ft                                                  | m   | y <sup>3</sup>            | m <sup>3</sup> |
| CDS1515   | 3        | 0.9 | 3.0                                                 | 0.9 | 0.5                       | 0.4            |
| CDS2015   | 4        | 1.2 | 3.0                                                 | 0.9 | 0.9                       | 0.7            |
| CDS2015   | 5        | 1.5 | 3.0                                                 | 0.9 | 1.3                       | 1.0            |
| CDS2020   | 5        | 1.5 | 3.5                                                 | 1.1 | 1.3                       | 1.0            |
| CDS2025   | 5        | 1.5 | 4.0                                                 | 1.2 | 1.3                       | 1.0            |
| CDS3020   | 6        | 1.8 | 4.0                                                 | 1.2 | 2.1                       | 1.6            |
| CDS3025   | 6        | 1.8 | 4.0                                                 | 1.2 | 2.1                       | 1.6            |
| CDS3030   | 6        | 1.8 | 4.6                                                 | 1.4 | 2.1                       | 1.6            |
| CDS3035   | 6        | 1.8 | 5.0                                                 | 1.5 | 2.1                       | 1.6            |
| CDS4030   | 8        | 2.4 | 4.6                                                 | 1.4 | 5.6                       | 4.3            |
| CDS4040   | 8        | 2.4 | 5.7                                                 | 1.7 | 5.6                       | 4.3            |
| CDS4045   | 8        | 2.4 | 6.2                                                 | 1.9 | 5.6                       | 4.3            |
| CDS5640   | 10       | 3.0 | 6.3                                                 | 1.9 | 8.7                       | 6.7            |
| CDS5653   | 10       | 3.0 | 7.7                                                 | 2.3 | 8.7                       | 6.7            |
| CDS5668   | 10       | 3.0 | 9.3                                                 | 2.8 | 8.7                       | 6.7            |
| CDS5678   | 10       | 3.0 | 10.3                                                | 3.1 | 8.7                       | 6.7            |

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



# CDS Inspection & Maintenance Log

CDS Model: \_\_\_\_\_ Location: \_\_\_\_\_

[illegible]

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

## SUPPORT

- Drawings and specifications are available at [www.ContechES.com](http://www.ContechES.com).
- Site-specific design support is available from our engineers.



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